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A MONOGRAPH

OF THE

INFERIOR OOLITE GASTEROPODA.

BEING

PART I

OF THE

BRITISH JURASSIC GASTEROPODA.

BY

WILFRID H. HUDLESTON, M.A., F.R.S., &c.,
VICE-PRESIDENT OF THE PALÆONTOGRAPHICAL SOCIETY.

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BY

WILFRID H. HUDLESTON, M.A., F.R.S., Sec.G.S.

GENERAL INTRODUCTION.

Pages 1—15.

AND

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MONOGRAPH

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GENERAL INTRODUCTION.

Since the publication of the Supplement to the Great-Oolite Mollusca in 1863 no attempt has been made to deal with any portion of the Jurassic Gasteropoda in the works of the Palæontographical Society. It is true that the "British [Jurassic] Belemnites" formed the subject of a Monograph by the late Professor Phillips, whilst the Lias Ammonites have had ample justice done to them quite recently by the late Dr. Wright, and the Jurassic (as well as Cretaceous) *Trigoniæ* by the late Dr. Lycett. But the Mesozoic Gasteropoda have been singularly neglected, so that, in point of fact, there has been no Monograph dealing either with them or with the Pelecypoda "as a whole" since Lycett's last work, published four and twenty years; and to this long lapse of time we must add nine years since the date of the latest issues of the Great-Oolite Mollusca. One might almost imagine that this admirable Monograph, in conjunction with the no less valuable Supplement, had exhausted the subject of the Mollusca of the Lower Oolites, although professing to deal with the upper or Bathonian[1] division only.

Each age has its own speciality and its own way of looking at things. Thus the middle of the nineteenth century witnessed the appearance of the standard works of Deslongchamps, Goldfuss, D'Orbigny, Morris and Lycett, and many others. Those were the days when the discovery and naming of fossil Mollusca formed an exceedingly popular branch of science. But for some time past our biologists and palæontologists have been engaged in the more difficult task of working out the structure and affinities of the lower and obscurer classes. Thus, for nearly a quarter of a century, whilst the Sponges, Corals, Foraminifera, and

[1] It will be remembered that a few of the Gasteropoda figured in this work, such as "*Pterocera*" *Bentleyi*, and the shells in Plate XV (from Yorkshire), belong to the Bajocian or Inferior Oolite division of the Lower Oolites.

other Microzoa generally have received a large share of attention, the Mollusca seem to have been comparatively neglected. On the other hand, the Vertebrata have always had a number of eminent exponents, whose work has rendered the publications of the Palæontographical Society of peculiar value and interest.

On the whole, the great age of molluscan palæontology, as evinced by such works as those already quoted, preceded the announcement in England of the doctrine of Evolution by about ten years. It is true that this doctrine, now so universally accepted, had been most ably pre-figured by Lamarck and others; yet it had met with little favour from biologists or palæontologists previous to the appearance of Darwin's great book. Hence the age of Goldfuss, of D'Orbigny, and of Morris and Lycett, was an age when the general faith in distinct creations was at its height. This is what Professor Marsh calls the third period in palæontology,[1] when a species was regarded as a rigid entity, and he who "made" or described a species acquired a sort of prescriptive right therein. "So long as the bulk of naturalists really believed in the immutability of species there was something dangerously fascinating in the prospect of finding out and describing a *form-group*, which was destined to endure no change, which might indeed be destroyed or die out but could never be altered. The maker of a new species would thus come to look upon his offspring with almost parental solicitude, and having stood godfather to his own child would attach to the name given by him a peculiar interest."[2]

Perhaps the belief of that day was on the whole favourable to accurate definition, and there is no doubt that the practice adopted by some collectors of burking doubtful forms and varieties rendered it more easy to constitute and define "species." It must, however, be allowed that, when once the doctrine of Evolution is admitted in its entirety, the ideas attaching to such expressions as "genus" and "species" lose somewhat of their definition. Nevertheless they are necessities in classification; and even if they do not absolutely exist in nature, it becomes necessary as by a sort of legal fiction to presume that they do exist for purposes of scientific arrangement. But the palæontologist has to deal with the element of time in addition to his other difficulties, and thus for him, far more than for the malacologist, does it become necessary not to place too rigid a meaning on "genus" and "species."

I fear that this will appear somewhat heretical even in these days of belief in Evolution; but, as very justly observed by Professor Cope, the fact that all definitions which separate adjacent groups will be ultimately found to be fallible does not permit us to fall "into inexact and inconsistent methods of definition." Hence the work of definition need not be slovenly because we no longer believe

[1] "Address before the American Association for the Advancement of Science, 1879."

[2] W. H. Hudleston on the Yorkshire Oolites, 'Proc. Geol. Assoc.,' vol. v, p. 460.

it to be final. Nay, the more exact it is the easier will it be to trace the links which lead up to another group of forms.

At the same time the malacologist must not be hard on the fossil-conchologist because the latter cannot turn out such exact work as the stricter requirements of modern biology seem to demand. The malacologist has a wide grasp of space, but it is all on one plane as it were; there is no depth in it. The work lies on the surface and relates wholly to the present, whereas the work of the palæontologist lies in a series of perpetually receding planes, and bears the same relation, metaphorically speaking, to the study of existing life that solid geometry does to superficial. Of course it is admitted that palæontology, or rather that branch of it which may be called mineral conchology, is to a certain extent empirical in its methods, and these guesses at truth are not perhaps always of the happiest kind; still, it is more than probable that in the past there has not always been such sharp divisions as are required by the logical definition of "genus" and "species"; whilst the still more artificial "family" would be more difficult to outline the farther we go back in time.

Divisions of the Subject.

The Gasteropoda are usually regarded as dwellers in shallow water, and hence any notable accumulation of this class of shells would be looked upon as indicative of seas of moderate depth at the time that such accumulations were made. In the Jurassic rocks of England their distribution is very unequal; considerable thicknesses of rock are found to be almost devoid of Gasteropoda, and then again a few feet of beds may contain large quantities of them. They are, in fact, less sporadically distributed than the Brachiopoda or the Pelecypoda, and, on the whole, very much more difficult to procure in good condition. From their uncertain and unequal distribution, and also from the fact that Gasteropoda have been greatly influenced by the physical conditions that obtained during the period of deposition, it is probable that they are of less value as indicators of horizons than the Cephalopoda, the Ammonites especially. Moreover, with the exception of one or two groups, such as *Nerinæa*, their mutations have been much less rapid, so that forms have been more enduring, and thus sundry demoid types may be said to pervade nearly all the beds.

In dealing with our Jurassic Gasteropoda two alternative plans present themselves: (1) To carry each genus through from the lowest to the highest beds—the biological plan adopted both by Goldfuss and d'Orbigny; or, (2) to adopt the stratigraphical plan, and to take no more than a series of beds for complete description. The first method is the more philosophical of the two, but also the

one which involves the most trouble and preparation. The second method, besides being the most feasible, has, moreover, been already inaugurated by Morris and Lycett in their description of the Great-Oolite Mollusca. Hence there exists, as it were, a sort of prescription to describe the fossils according to their horizons, and it therefore only remains to determine what divisions shall be adopted. On the whole I am inclined to think that it would be the most advisable to complete the description of the Gasteropoda of the Lower Oolites, already so well begun. For this reason *the Gasteropoda of the Inferior Oolite* have been chosen to constitute the *first memoir* of the contemplated Monograph.

It does not appear that many important additions have been made to the Gasteropod Fauna of Bathonian beds in England since the date of Lycett's 'Supplement.' Hence with the completion of the proposed 'Memoir on the Gasteropoda of the Inferior Oolite,' the Gasteropod Fauna of the Lower Oolites will, in the main, have been exhausted. It would then become a question as to what should be the subject of the next memoir.

If the Middle and Upper Oolites, from the Kelloway Rock to the Portland-Purbeck inclusive, were made the subject of a second memoir, complete as regards the Gasteropoda, considerable advantages in the way of comparison would ensue. This course is the more to be recommended, since there is a disposition to regard the so-called Middle and Upper Oolites together as one great series of the Jurassic system. Nevertheless the difficulties which present themselves in having to grasp such a wide extent of beds are considerable; for the number of collections that have to be searched must be borne in mind, and how differently as regards synonymy the fossils are arranged in each. Nothing, it is true, can exceed the readiness with which the chief authorities of our public museums render all the facilities in their power; but in some cases the rules do not admit of more than an inspection, whereas everyone who has had any experience knows what an advantage it is to possess a fossil, even for a few weeks—to study it and to be thus enabled to determine its characters under various conditions of light. Hence the importance of making use of private collections.

The Gasteropoda of the Liassic Rocks might possibly form the subject of a third memoir, and in this connection it would be a subject of considerable interest to ascertain how far the Gasteropoda of the Lias, and especially of the Upper Lias, resemble those of the Inferior Oolite. My belief is that they would be found to do so to a much greater extent than is generally supposed, though the Gasteropod Fauna of the Inferior Oolite in our country is much fuller than that of the Lias; many of the genera which attain to such an important position in the Inferior Oolite are prefigured in the Lias. These remarks more especially apply to the south-west of England.

People who derive their impressions of the Faunas of two series of beds from

studying lists of fossils merely, can have very little idea of their true biological relations. This is owing to several causes, not the least of which is the unequal value of specific distinctions. This being so, it follows that under the present system of nomenclature comparisons by the percentage method are not of the highest order of merit; but such comparisons are still further weakened by mistakes in synonymy, which not seldom serve to aggravate the erroneous impressions as to alleged differences in two series under consideration. What shall we say, for instance, to a large and important group of fossils, characteristic alike of the Inferior Oolite and the Lias, being referred in one case to the genus *Amberleya*, and in the other case to the genus *Eucyclus?* Nay, more, in the very collection where this arrangement has been adopted, the genus *Amberleya* is placed under the Turbinidæ, whilst the genus *Eucyclus* is placed under the Littorinidæ. Yet the merest tyro in Jurassic palæontology knows that *Eucyclus* is a name given by Deslongchamps to a group of shells characterised, but not fully diagnosed, by Morris and Lycett nearly ten years before under the name of *Amberleya*. Whichever name we adopt the genus is the same; to call it by the first name in the Lias, and by the second name in the Inferior Oolite, is one way of making an artificial gap in the geological record. Doubtless comparative lists of fossils contained many such artificial gaps.

Nomenclature.

Like rates and taxes, Nomenclature is a necessary evil, but out of nomenclature has grown that fearful incubus, Synonymy, which threatens at some time to overwhelm us unless the Augean stable be cleansed. It is not intended in this Monograph to attempt anything more than a kind of selective synonymy in respect to the species described. No single individual nowadays can pretend thoroughly to cope with synonymy. Nothing short of an international commission of experts can ever do this, and we may well believe that matters are hardly ripe for such a consummation at present. The dread of having to deal with this horrible nightmare makes people rather shy of undertaking molluscan palæontology, which may be said to suffer from this disease more than any other branch of the tree of life.

But genuine nomenclature itself, even when free from its terrible parasite, is a subject full of difficulties. We are often and justly reminded that nomenclature is not science, and in fact many of our more philosophic biologists are rather hard upon nomenclature, because, as with liberty, much evil is done under its cover. Returning, however, to our original position that it is a necessary evil, we must endeavour to deal with it in a manner which we may hope will yield the most satisfactory results. Shall we continue to put new wine into old bottles? is the

essence of a question which has been frequently asked of late years. Those who ask such a question contend that, since the practical acceptance of the doctrine of Evolution by the scientific world, the old binomial system is insufficient for the requirements of biological knowledge.

It will be remembered that an important congress of naturalists was held some time ago at the British Museum under the presidency of Professor Flower, for the purpose of discussing the subject of zoological nomenclature. All parties were well represented—uncompromising binomialists, limited trinomialists, and thorough trinomialists. As far as the philosophy of the subject in dispute went, it appeared to me that the trinomialists had the best of it; but when it came to a matter of policy and practice, the more conservative side had much to say in favour of the old method. In summing up, Professor Flower, who declared himself a limited trinomialist, said that distinctly defined species undoubtedly exist in great numbers owing to the extinction of intermediate forms; for such the binomial system offers all that is needed in defining them. But infinite gradations are being traced, both of present and especially of past forms; in order to deal with these even a trinomial system would in many cases be inadequate. He considered that sooner or later far more radical changes would have to be introduced.

These remarks refer more especially to the higher classes of creatures, but they serve to show the danger of departing from the old course at present. It is not, therefore, because I consider the binomial system the most philosophic or the best, but because I consider it the least calculated to mislead under the circumstances that it has been adopted for this Monograph. We must jog on as well as we can with the help of sub-genera and var. *a* and var. *b*, and this no doubt can be done without any difficulty. Moreover, in the case of fossil mollusca, we must never lose sight of the fact that, biologically, we are walking somewhat in the dark, and also that mineralisation, by the changes it sometimes superinduces, adds to our uncertainty in these matters. Hence the fossil-conchologist, treading on somewhat doubtful ground, should not be over anxious to emphasise differences the precise value and meaning of which are not so very obvious in all cases. When we have to deal with a demoid group, such as some of the small *Cerithia* for example, the larger the collection and the fewer the specific names we should be disposed to give, whereas the varietal names would be numerous. It is, in fact, these demoid forms with their numerous links which most require the assistance of a third name. Of course these remarks have reference to the Jurassic Gasteropoda only. The Cephalopoda might perhaps require somewhat different treatment; in fact, the difficulty as regards the Ammonites is practically got over by splitting the genus, and even that method is hardly enough for such a sporting group.

Classification.

If it be true that too many cooks spoil the broth, the same may be said of the numerous systems of classification which have been put forward for the Mollusca. A friend of mine, who has a large collection under his charge, despairing of ever arriving at the right method, once said in the bitterness of his heart that he was thinking of adopting an alphabetical classification based upon genera. As one would fain believe that the main object of classification is arrangement according to affinities real or supposed, it is evident that such an act, if adopted for a collection and not for a catalogue, would be a piece of zoological suicide. It certainly may be argued with irresistible logic that, since the systems of classification are so numerous, they cannot all be right, and that the chances are against any one that may be selected.

But, after all, a collector would hardly like to store his fossils on principles which might very well commend themselves to a dealer; and rightly or wrongly it his duty to attempt some system of classification which shall be an aid to comparison as well as to differentiation. Then arises the question, for us more especially important, what is the best basis for a classification of the Gasteropoda? To many malacologists lingual dentition commends itself as the means whereby the most philosophic system of classification may be effected, whilst others incline to attach more weight to the shell itself. Hence, S. P. Woodward, in the 'Manual of the Mollusca,' divided the Prosobranchiata, with which we are mostly concerned, into Siphonostomata and Holostomata, the former including the bulk of the carnivorous Gasteropods—always excepting *Natica*. But the exception of this large and ancient genus is an awkward one, and it proves that the divisions adopted do not coincide with the divisions based on the modes of nutrition. There is also another difficulty in connection with the arrangement of the 'Manual of the Mollusca,' viz. placing *Cerithium* and *Aporrhais* amongst the Holostomata. It matters nothing whether these are vegetable feeders or not; clearly their shells are not holostomatous in the strict sense of the term, although on other grounds the affinities of the animal may be more with the Holostomes than with the Siphonostomes. This subject has been well discussed in the 'Palæontologica Indica' by Stoliczka, who arrived at the conclusion that such divisions as Siphonostomata and Holostomata might be accepted provisionally, but without giving such divisions any prominence.

Any system based mainly on lingual dentition cannot exactly commend itself to a palæontologist. The palæontology of the Gasteropoda is sufficiently empirical without importing this fresh element of uncertainty. Who can say what was the lingual dentition of *Nerinæa?* Hence, whilst admitting to the full the value of

this method as applied to existing creatures, we must fall back upon the shell as the basis of classification for our fossils, and accept such aid from zoology as is consistent with the material at our disposal.

It would seem as though the interest in the study of the Mollusca had been reviving lately. This may be inferred from the fact of the publication of three useful and important manuals since the beginning of 1880. I allude (1) to the fourth edition of Woodward's 'Manual,' with appendix by Prof. Ralph Tate; (2) to the work on 'Structural and Systematic Conchology,' by George W. Tryon, junr., published at Philadelphia; and (3) to the 'Manuel de Conchyliologie,' by Dr. Paul Fischer, of which the portion completing the Gasteropoda appeared in February, 1886. This work is being published in Paris. These authors, as also Stoliczka in the 'Palæontologica Indica,' bear testimony to the invaluable character of the original Manual by S. P. Woodward, which is indeed, both as regards text and illustrations, a work of the very highest character, published at a price which places it within the reach of all.

With some important exceptions I hope to follow in the main the classification of the 'Manual of the Mollusca.' The most important exceptions are (1) in the position assigned to the Aporrhaidæ and Cerithiidæ; (2) in adopting the family of the Pseudomelaniidæ, to include the quondam Chemnitzias and possibly some of the Phasianellas of the Jurassic Rocks. It should be noted that S. P. Woodward always regarded the application of the term *Chemnitzia* to the great *Melania*-like shells of the Jurassic Rocks as provisional, and many palæontologists besides that author have felt dissatisfied with the arrangement. Still, I should scarcely have ventured on such an innovation without the sanction of Dr. Paul Fischer, whose high authority I must quote in justification. I have long wished to do this, and now in such good company have no further hesitation.

There are certain genera, moreover, in the Jurassic Rocks whose position seems very doubtful. Most of those to which I allude are more or less characteristic of beds of that age. A few may be mentioned here, though each genus will of course be fully dealt with in the descriptive part of the text. Any observations now made must be regarded as preliminary and incomplete.

The first of these is *Purpurina*, a genus founded but abandoned by d'Orbigny, who makes no mention of it in the text of the 'Terrains Jurassiques.' From the name given we may judge that the author would have placed his genus in the same family as *Purpura*. The genus *Purpurina* were practically reconstituted by Piette and Deslongchamps, who regarded it as having relations on the one side with *Turbo*, and on the other with *Cerithium* and *Purpura*. If these views be correct its family relations are by no means clear, and this circumstance may account for the contradictory position assigned to it by the various authorities. Thus Tryon places *Purpurina*, with a query, under the sub-family Purpurinæ, and also under

"Cancellariidæ," in this way providing his bow with two strings. Tate, in the appendix to Woodward's 'Manual,' places it in the "Cancellaridæ;" Stoliczka, in the 'Palæontologia Indica,' places it with a query in the Trichotropidæ; whilst Fischer actually places *Purpurina* amongst the Littorinidæ. The latter author assigns no reason for his conclusion, merely observing that Stoliczka's approximation of the genus to *Trichotropis* appears to him a very doubtful determination. This subject has never been attentively studied by English palæontologists, partly owing to some of them having confounded *Purpurina* with Lycett's genus *Purpuroidea*, and partly perhaps from the difficulty hitherto experienced in obtaining good specimens from our English beds.

The results are that an extremely well-marked group, judging, of course, from the shell alone, has been regarded as having affinities with *Purpura*, with *Cancellaria*, with *Trichotropis*, with *Cerithium*, with *Littorina*, and with *Turbo*. In fact, in this short-lived genus *Purpurina* authors have noted features characteristic at once of the Siphonostomata and of the Holostomata, of the Tectibranchiata and of the Scutibranchiata, of the Toxoglossæ, Rhachiglossæ, Tænioglossæ, and Rhipidoglossæ.

From this very remarkable case we may draw the inference that probably it is not easy to lay down the law as to family affinities in respect of Mesozoic fossils, and for this reason we should deprecate the criticisms of certain zoological martinets, who are only too ready to find fault with the palæontologist. There is also a second lesson to be learnt, viz. that in all probability there was a greater blending of common elements in the Mollusca of the remoter past than there is at the present time, and that consequently the rules of classification applicable to existing creatures must not be too rigidly enforced. In fact we must use our system with a view to the circumstances of the case and not allow it to tyrannise over us.

But then comes the question, which must be faced by any one who has undertaken to deal with the Jurassic Gasteropoda, where are we going to place *Purpurina* in the forthcoming Memoir on the Gasteropoda of the Inferior Oolite, seeing that it occupies such an important position in that series? Although I have my doubts about its being a true Siphonostome any more than *Amberleya*, yet bearing in mind the idea of the original founder of the genus, and, moreover, justified by the authority of Prof. Tate, I have concluded to place this genus at the head of the list, though leaving the question of family in abeyance.

Another still more important genus, eminently characteristic of the Inferior Oolite, is *Amberleya*. The authors of the 'Great Oolite Mollusca,' when they placed *Amberleya nodosa* under the Littorinidæ and *Amberleya* (*Turbo*) *capitanea* amongst the Turbinidæ, gave unconscious expression to a doubt, never yet cleared up, as to which of these two great families the new Jurassic genus should be referred. Subsequently both Deslongchamps and Lycett had no doubt that *Amberleya*

(*Eucyclus*, Desl.) should be placed amongst the Littorinidæ, and it is in that family that most systematists have placed the genus. Nevertheless, Terquem and Jourdy, Zittel, and Fischer are opposed to this view, and replace *Amberleya* in its old position amongst the Turbos. The latter author observes, "The various forms grouped under the generic name *Amberleya* have the appearance of *Tectaria*, of *Echinella*, and of *Littorina*, but the existence of a nacreous layer, ascertained to exist in the Jurassic Amberleyas, has shown their affinity with the Turbinidæ and the Trochidæ." I am not aware that any traces of a nacreous layer have been found in our British Amberleyas, but such is stated to be the case in the Jurassic of Moscow (Fischer quoting Zittel). Whilst quite prepared to admit that neither the diagnosis of Lycett nor of Deslongchamps is quite satisfactory, I am at present content to follow Prof. Tate in retaining *Amberleya* amongst the Littorines, the more so as this classification has the sanction of Stoliczka. At the same time I must repeat my belief, already expressed with regard to *Purpurina*, that some of these old genera probably possessed characters which are now rarely, if ever, combined in the same group at the present day. Hence the impossibility of a classification which will satisfy everybody. In the meantime, should any more decided proofs of the existence of a nacreous layer in these very handsome shells become available, it is not too late to alter the position of the genus.

In some respects there are characters of resemblance between the Purpurines and the Amberleyas, which may be more nearly related than has hitherto been supposed. As I wish to act as far as possible on the principle of precedent no change should be made for which I cannot quote a good authority in justification. But it has occurred to me that d'Orbigny may not have been so far wrong in placing these shells amongst the Turbos, and that possibly they might be made to constitute a sub-family of the Turbinidæ.

But such changes are not to be lightly made, and I should, moreover, always desire to uphold the decision of Morris and Lycett in the majority of doubtful cases. It is satisfactory to believe that, on the whole, their genera find favour with systematists such as Tryon in America and Fischer in France, although not seldom the family position of these has been changed. Morris and Lycett represented an age in the history of molluscan palæontology, when numerous forms hitherto unknown had to be located as best might be under the exigencies of the case. In conjunction with their illustrious contemporaries on the Continent of Europe they succeeded in defining most of the generic groups required for the Lower Oolites, and it is a satisfaction to think that if it should be necessary to split up an inconveniently large genus into sub-genera or sections, for the Lower Oolites at any rate, few if any additional genera are likely to be required.

The following Table shows the systematic position of certain genera of the

Prosobranchiata according to (1) Fischer ('Manuel de Conchyliologie, &c.,' par le Dr. Paul Fischer, Paris. Gasteropoda concluded February, 1886). (2) Tryon ('Structural and Systematic Conchology,' by George W. Tryon, junr., Philadelphia, 1882-4). (3) Tate (Woodward's 'Manual of the Mollusca,' 4th edition, with appendix by Ralph Tate, A.L.S., F.G.S., London, 1880). (4) Stoliczka ('Palæontologia Indica,' "Cretaceous Gasteropoda," by Ferd. Stoliczka, Ph.D., F.G.S., Calcutta, 1868); and (5) Morris and Lycett (Palæontographical Society, 'Monograph of the Great-Oolite Mollusca,' by J. Morris, F.G.S., and John Lycett, London, 1850-4).

LIST OF SOME GENERA OF GASTEROPODS, CHIEFLY JURASSIC,

Provisionally arranged in alphabetical order. Family position according to five separate authorities, viz. *Fischer*, *Tryon*, *Tate* in Woodward's Manual, *Stoliczka*, *Morris and Lycett*.

	Fischer.	*Tryon.*	*Tate.*	*Stoliczka.*	*Morris and Lycett.*
1. Alaria	Alaria, *M. and L.*, 1854 [= Aporrhaidæ], Chenopodidæ	*M. and L.*, Strombidæ	*M. and L.*, 1854, Aporrhaidæ after Cerithiadæ	*M. and L.*, 1854, Alata, comprising Strombidæ and Aporrhaidæ	Strombidæ.
2. Amberleya	Amberleya, *M. and L.*, 1854, Turbinidæ	Eucyclus, *Desl.*, Littorinidæ	Eucyclus, *Desl.*, Littorinidæ	Amberleya, *M. and L.*, Sub-fam. Littorininæ	Pagodus, *Gray*, Sub-genus Amberleya, Littorinidæ.
3. Bourguetia	Bourguetia, *Desh.*, 1871, Pseudomelaniadæ	*Desh.*, Eulimidæ	—	—	—
4. Brachytrema ...	Brachytrema, *M. and L.*, 1850, ? Cerithiidæ	*M. and L.*, Littoriuidæ or Cerithiidæ	*M. and L.*, Cerithiadæ, provisionally	*M. and L.*, Cerithiidæ	Muricidæ.
5. Capulus= Pileopsis	Capulus, *Mont.*, Capulidæ	*Mont.*, Calyptræidæ	Calyptræidæ	Capulidæ	—
6. Cerithium	Cerithium, *Adan.*, 1757, Cerithiidæ. Between Struthiolaridæ and Modulidæ	*Brug.*, Cerithiidæ, between Littorinidæ and Melaniadæ	Cerithiadæ, between Pyramidellidæ and Aporrhaidæ	*Adan.*, Sub-fam. Cerithiinæ, between Pyramidellidæ and Melaniadæ	*Adan.*, 1757, Cerithiadæ, between Buccinidæ and Naticidæ.
7. Ceritella	Ceritella, *M. and L.*, Cerithiidæ	*M. and L.*, 1850, Cerithiidæ	*M. and L.*, Cerithiadæ, provisionally	*M. and L.*, Cerithiidæ	Cerithiadæ.
8. Chemnitzia(fossil only)	Pseudomelania, *P. and C.*, 1862, Pseudomelaniidæ	*D'Orb.*, Eulimidæ	Pyramidellidæ	Eulimidæ, Sub-fam. Chemnitzinæ	*D'Orb.*, 1839, Pyramidellidæ.
9. Chrysostoma ...	Chrysostoma, *Swain.*, Trochidæ	*Swain.*, Trochidæ	—	—	—
10. Cloughtonia	—	*Hudl.*, Naticidæ	—	—	—
11. Cirrus	Cirrus, *J. Sowerby*, 1816, Delphinulidæ	—	*Sow.*, Solaridæ	—	—
12. Crossostoma ...	Crossostoma, *M. and L.*, Delphinulidæ	*M. and L.*, Rotellidæ	Turbinidæ, see Delphinula	—	Turbinidæ. A sub-genus of *Delphinula*.
13. Cryptænia	Cryptænia, *Eug. Desl.*, 1865, section of Pleurotomaria, Pleurotomariidæ.	—	*Eug. Desl.*, Haliotidæ, Sub-fam. Scissurellinæ	—	—
14. Cryptoplocus ...	Cryptoplocus, *P. and C.*, 1854, Sub-genus of Nerinæa, Nerineidæ	*P. and C.*, Pyramidellidæ	*P. and C.*, Cerithiadæ	—	—
15. Delphinula	Delphinula, *Lam.*, 1803, Delphinulidæ	*Lam.*, Trochidæ	Turbinidæ	Trochidæ	*Lam.*, Turbinidæ.
16. Deslongchampsia	Deslongchampsia, *M'Coy*, 1850, Sub-genus of *Emarginula*. Fissurellidæ	—	*M'Coy*, Fissurellidæ	—	*M'Coy*, 1849, Patellidæ.
17. Diarthema	Diartema, *Piette*, 1864, Chenopodidæ	—	*Piette*, Aporrhaidæ	—	—

	Fischer.	*Tryon.*	*Tate.*	*Stoliczka.*	*Morris and Lycett.*
18. Discohelix	Discohelix, *Dunk.*, 1847, Sub-genus of Euomphalus, *Sow.*, Solariidæ	*Dunk.*, Solariidæ, between Onustidæ and Scalaridæ	*Dunk.*, Solaridæ, between Littorinidæ and Calyptræidæ	*Dunk.*, Solariidæ, between Onustidæ and Littorinidæ.	—
19. Ditremaria, *Deslong.* non *D'Orb.*	—	*Desl.*, Pleurotomaridæ	*Desl.*, Haliotidæ, Sub-fam. Scissurellinæ	—	—
20. Ditretus	—	*Piette*, 1874, Cerithiidæ	—	—	—
21. Emarginula.....	*Lam.*, Fissurellidæ	*Lam.*, Fissurellidæ	—	*Lam.*, Fissurellidæ	*Lam.*, 1801, Fissurellidæ.
22. Eucyclus = Amberleya	—	—	—	—	—
23. Eulima.....	Eulima, *Risso*, 1826, Eulimidæ	*Risso*, Eulimidæ	Pyramidellidæ	*Risso*, 1826, Eulimidæ, Sub-fam. Eulininæ	*Risso*, 1826, Pyramidellidæ.
24. Euspira	Euspira, *Ag.*, 1837, *M. and L.*, 1850, Sub-genus of Ampullina, *Lam.*, Naticidæ	*Ag.*, *M. and L.*, Naticidæ	Naticidæ, not mentioned by S. P. W.	*Ag.*, Sub-fam. Naticinæ	*Ag.*, Sub-genus Naticidæ.
25. Eustoma	Eustoma, *Piette*, 1855, Cerithiidæ	*Piette*, 1855, Cerithiidæ	*Piette*, Cerithiadæ	*Piette*, Sub-fam. Cerithiinæ.	—
26. Exelissa = Kilvertia, *Lyc.*	Exelissa, *Piette*, 1861, Cerithiidæ	—	*Piette*, Cerithiadæ	*Piette*, Sub-fam. Cerithiinæ.	—
27. Fibula	Fibula, *Piette*, 1851, Sub-genus of Ceritella, *M. and L.*, Cerithiidæ	*Piette*, 1857, Cerithiidæ	*Piette*, Cerithiadæ	*Piette*, Sub-fam. Cerithiioæ.	—
28. Fissurella.	Fissurella, *Brug.*, 1789, Fissurellidæ	*Lam.*, Fissurellidæ	—	—	*Lam.*, 1810, Fissurellidæ.
29. Fusus	Fusus, *Lam.*, 1801, Fasciolariidæ	*Lam.*, Sub-fam. Fusinæ	Muricidæ	Muricidæ, Sub-fam. Fusinæ	*Lam.*, 1801, Muricidæ.
30. Kilvertia = Exelissa, Piette					
31. Liotia	Liotia, *Gray*, 1842, Delphinulida	*Gray*, Liotridæ, between Neritidæ and Rotellidæ	—	Liotridæ, between Umbonidæ and Turbinidæ	—
32. Littorina (Tectaria)	Littorina, *Fér.*, 1821, Littorinidæ	*Fér.*, Littorinidæ	Littorinidæ, including Tectaria, &c.	*Fér.*, Sub.-fam. Littorinæ	—
33. Malaptera	Malaptera, *Piette*, 1876, ? Chenopodidæ	= Phyllocheilus, *Gabb*, 1868, Strombidæ	—	—	—
34. Mathilda	Mathilda, *Semper*, 1865, ? Turritellidæ	*Semp.*, Turritellidæ	Pyramidellidæ	—	—
35. Monodonta	Monodonta, *Lam.*, 1799, Trochidæ	*Lam.*, Trochidæ	Turbinidæ	Trochidæ (doubts *Monodonta* being Jurassic)	*Lam.*, 1801, Turbinidæ.
36. Natica	Natica, *Adanson*, 1757, Naticidæ	*Lam.*, Naticidæ	Naticidæ	Naticidæ, sub.-fam. Naticinæ	*Adan.*, 1757, Naticidæ.
37. Neridomus	Neridomus, *M. and L.*, 1850, Neritidæ	*M. and L.*, Neritidæ	—	—	Neritidæ.
38. Nerinæa	Nerinea, *Defrance*, 1825, Nerineidæ	*Defr.*, Pyramidellidæ	—	*Defr.*, 1825, Pyramidellidæ	*Defr.*, 1825, Cerithiadæ.
39. Nerita	Nerita, *Adans.*, 1757, Neritidæ	*Linn.*, Neritidæ	—	*Adan.*, 1757, Neritidæ	*Linn.*, 1758, Neritidæ.

	Fischer.	*Tryon.*	*Tate.*	*Stoliczka.*	*Morris and Lycett.*
40. Neritopsis	Neritopsis, *Grat.*, 1832, Neritopsidæ	*Grat.*, Neritidæ	Neritopsidæ, between Cancellaridæ and Pyramidellidæ	1832, Vanicoridæ (Neritopsidæ), between Naticidæ and Velutinidæ	*Grat.*, 1840, Neritidæ.
41. Onustus	Xenophora, *F. de W.*, 1807, Xenophoridæ	*H and A. Ad.*, Onustidæ	—	Onustidæ	—
42. Patella	Patella, *Linn.*, 1757, Patellidæ	*Linn.*, Patellidæ	Patellidæ	Patellidæ	*Linn.*, 1758, Patellidæ.
43. Pbasianella	"La plupart des prétendus *Phasianella* des T. J., sont des *Bourguetia*"	*Lam.*, Phasianellidæ	Turbinidæ	Phasianellinæ	*Lam.*, 1812, Turbinidæ.
44. Pileolus	Pileolus, *Cookson, G. B. Sow.*, 1823, Neritidæ	*Cooks.*, Neritidæ	—	*Cooks.*, Neritidæ	*G. B. Sow.*, 1823, Neritidæ.
45. Pileopsis = Capulus					
46. Pitonillus	Umbonium, *Link.*, 1807 = *Pitonillus*, Mont., and *Rotella*, Lam., Trochidæ	*Mont.*, Rotellidæ	Cyclostomidæ. *S. P. W.*, who says = *P. Helicina, Lam.*	Pitonillus—Umboniidæ	—
47. Pleurotomaria	Pleurotomaria, *Defr.*, 1821, Pleurotomariidæ	*Defr.*, Pleuromariidæ	Sub.-fam. Scissurellinæ	*Defr.*, 1821, Pleurotomariidæ	*Defr.*, 1825, Pleurotomaridæ.
48. Pseudomelania	Pseudomelania, *P. and C.*, 1862, Pseudomelaniidæ	*Pictet*, Eulimidæ	Pyramidellidæ	*P. and C.*, 1862, Eulimidæ	—
49. Pterocera	Pterocera, *Lam.*, 1799, Strombidæ	*Lam.*, Strombidæ	—	—	*Lam.*, 1801, Strombidæ.
50. Purpurina	Purpurina, *D'Orb.*, 1850, Littorinidæ	*D'Orb.*, ? Purpurinæ	Cancellaridæ	? Trichotropidæ	—
51. Purpuroidea	Purpuroidea, *Lyc.*, 1848, Muricidæ	*Lyc.*, Sub.-fam. Purpurinæ	—	*Lyc.*, 1848, Sub.-fam. Purpurinæ	*Lyc.*, 1848, Buccinidæ.
52. Rimula	Rimula, *Defr.*, 1819, sub.-genus of *Emarginula*, Fissurellidæ	*Defr.*, Fissurellidæ	See 'Man. of Mollusca,' p. 274, 4th edition	—	*Defr.*, 1827, Fissurellidæ.
53. Rissoa	—	Rissoidæ	*Frém.*, Rissoidæ	—	—
54. Rissoina	Rissoina, *D'Orb.*, 1840, Rissoidæ	*D'Orb.*, Sub.-fam. Rissoininæ	*D'Orb.*, Rissoidæ	*D'Orb.*, Sub-fam. Rissoininæ	*D'Orb.*, 1842, Littorinidæ.
55. Rotella	= Umbonium, *Link.*	*Lam.*, Rotellidæ	—	—	—
56. Solarium	"Les espèces indiquées dans les T. J. appt. prob. à *Straparollus ?*"	*Lam.*, Solariidæ	*Lam.*, Solaridæ	Solariidæ	*Lam.*, 1801, Turbinidæ.
57. Spinigera	Spinigera, *D'Orb.*, 1850, sub-genus of Alaria, *M. and L.*, Chenopodidæ	*D'Orb.*, Strombidæ	—	—	—
58. Stomatia	—	*Helb.*, Stomatellidæ	Haliotidæ	Stomatiadæ	*Lam.*, 1801, Pleurotomaridæ.
59. Straparollus	Straparollus, *Mont.*, 1810, p. 829, as a palæozoic genus only—? Delphinulidæ	*Mont.*, Solariidæ	= Enomphalus, *Sow.*, Solaridæ	= Enomphalus, *Sow.*, Solariidæ	—

	Fischer.	*Tryon.*	*Tate.*	*Stoliczka.*	*Morris and Lycett.*
60. Tessarolax	—	*Gabb*, Strombidæ	= Alaria, *M. and L.*	—	—
61. Trochotoma.....	Trochotoma, *Desl.*, 1842, Pleurotomariidæ	*Lyc.*, Pleurotomariidæ	Scissurellinæ	*Desl.*, 1841, Pleurotomariidæ	*Lyc.*, Pleurotomaridæ.
62. Trochus	—	—	—	—	—
63. Turbo	—	—	—	—	—
64. Turritella.....	Turritella, *Lam.*, 1799	*Lam.*, Turritellidæ	Turritellidæ	*Lam.*, Turritellidæ	
65. Umbrella	—	—	—	—	? Umbrella, Patellidæ.
66. Vermetus.....	Vermetus, *Adan.*, 1757, Vermetidæ	—	—	—	—
67. Vermicularia[1] ...	Vermicularia, *Lam.*, 1799, subgenus of Vermetus, Vermetidæ	Vermiculus, *Lister*, Vermetidæ	—	—	—

[1] Placed under Annelida in Morris' Catalogue, 1854; *e.g. V. compressa*, Y. and B. = *Vermetus tumidus* and *concinnus*, Sow., I. O. Blue Wick, Yorkshire; and *V. nodus*, Phil., I. O. Grey Limestone, Scarborough; Ponton, &c.

N.B.—The orthography of each author is preserved; hence the difference of spelling the same word. Moreover, it should be borne in mind that the above list must not be regarded as an absolutely complete generic list of all the British Jurassic Gasteropoda with the synonyms of each. On the other hand, such genera as *Fusus* and *Pterocera* are provisionally retained, though it is believed that no species belonging to them are found in our Jurassic rocks.

PART I.

GASTEROPODA OF THE INFERIOR OOLITE.

INTRODUCTION.

The vertical limits of the Inferior Oolite in England, as far as the Gasteropoda are concerned, lie between the Fuller's Earth, where that series is developed above, and the Upper Lias below. By some authorities the Fuller's Earth has been regarded as pertaining more to the Inferior than to the Great Oolite. Very little seems to be known of its Fauna, but its argillaceous character serves to connect it more with the Great Oolite than with the Inferior Oolite. Be this as it may, there are so few Gasteropoda that the inclusion or exclusion of the Fuller's Earth within the assigned limits is a matter of very little consequence. Further north, where the Fuller's Earth altogether fails, the upward boundary becomes a little indefinite for a time, especially in North Oxfordshire, &c.; but, fortunately, these doubtful beds contain very little bearing upon our subject. In Northamptonshire and Lincolnshire the uppermost beds of the Lincolnshire Limestone must be regarded as the upper limit of the Inferior Oolite in that direction, and this arrangement carries us to the Humber. In Yorkshire the Scarborough or Grey Limestone is the highest bed of Inferior Oolite age which is known to contain marine fossils.

Turning now to the lower boundary there seems to be a general opinion that the Sands of the Inferior Oolite should be restored to their old position as part of that series, which will, therefore, include the Cephalopoda-bed of the Cotteswolds and its Dorsetshire equivalents. As a matter of fact there are but few Gasteropoda in sufficiently good condition in these essentially transition beds between the Lias and the Oolites to make their acquisition of much value, and consequently but few specimens are likely to be selected for description from them.

The main mass of the Gasteropoda of the Inferior Oolite is to be found in the various limestones, more or less oolitic, and sometimes irony and arenaceous, which lie between the equivalents of the Gloucestershire Cephalopoda-bed and the base of the Fuller's Earth. Portions of this region constitute a really rich hunting ground, and, where the whole is fully developed, include three, if not four, well-known life zones, viz. the zone of *Am. Murchisonæ*, the sub-zone of *Am. Sowerbyi*, and the zones of *Am. Humphriesianus* and *Am. Parkinsoni*. These zones or life horizons are not made out with equal clearness in all places, partly, perhaps, from local causes of obscuration, but mainly, I am inclined to think, from the

absence or feeble development of beds representative of these zones in particular places. The zones of *Am. opalinus* and *Am. Sauzei* must be regarded as of subordinate importance in this country. Moreover, even if the Fauna of a particular zone is present, the Ammonite which gives its name to the zone may not be present. In Dorsetshire such an absence rarely happens, because there we are dealing with an essentially Cephalopod facies, but in such deposits as the Lincolnshire Limestone, usually referred to the *Sowerbyi* sub-zone, it is not always easy to ascertain the horizon of beds in particular quarries.

On the whole, I have concluded that the gaps which separate these four zones are of unequal value, and would propose to divide the Inferior Oolite into two main divisions. The lowest division includes the sub-zone of *Am. Sowerbyi*, the zone of *Am. Murchisonæ*, and the reputed zone of *Am. opalinus*, all characterised by a well-marked group of keeled Ammonites. As regards the Cephalopoda it has affinities with the Upper Lias, or Toarcian. This lower of the two grand divisions of the Inferior Oolite might be known generally as the zone of *Ammonites Murchisonæ* in its extended sense, or we might simply call it The Lower Division of the Inferior Oolite, and this is what I should propose to do in any tabular arrangement which may be ultimately adopted for illustrating the vertical distribution of the Gasteropoda.

Our upper division has a very different Ammonite Fauna. The allied groups (genera, according to some) of *Sphæroceras*, *Stephanoceras*, and *Cosmoceras* are the prevailing forms, though by no means to the exclusion of all others. Moreover this great change in the Ammonite Fauna appears to coincide with certain worn and bored surfaces, indicating a period when deposits ceased, and when, perhaps, a certain amount of destruction was effected, pointing to a change of physical condition and to a considerable lapse of time. I am not aware how far local geologists would bear me out in this assertion, but we shall have an opportunity for testing it more closely when we come to the details of the four main topographical divisions of the Inferior Oolite. The Upper Division of the Inferior Oolite, therefore, comprises what is usually known as the zones of *Am. Humphriesianus* and *Parkinsoni*, which may be separated in some cases, but which apparently inosculate to a very considerable extent. It so happens that some of the very richest shell beds in Dorsetshire occur at the junction of these two zones, and their fossils have been assigned by some to the *Humphriesianus*-zone, and by others to the *Parkinsoni*-zone. Hence the advantage of a classification which does not attempt, in all cases, a division between these two.

It will be remembered that in the Cotteswolds Dr. Lycett adopted certain species of Brachiopoda for his zonal arrangements, but, owing to the apparent absence of *T. fimbria* in Dorsetshire, this plan is not satisfactory. Roughly speaking our Lower Division would comprise the *fimbria*-stage of Lycett, with the addition of

the *cynocephala*-stage,[1] and our Upper Division the *spinosa*-stage. As a rule the Lower Division is much the thickest in the neighbourhood of the great escarpments, whilst in the West Midlands it fails altogether on the dip in many places, so that the Upper Division rests directly on the Lias in the absence of the Lower Division. In Dorsetshire it is sometimes the Upper and sometimes the Lower Division which is best developed in a particular quarry or limited neighbourhood, but I have failed hitherto in detecting any rule bearing on the point.

Indeed there is very considerable irregularity and uncertainty in the Inferior Oolite, though less, perhaps, than in beds of Corallian age. Yet the four great districts display a marvellous difference both in their Gasteropod Fauna, due, perhaps, to general difference of facies, and also in their composition. Two features are fairly common to the Inferior Oolite throughout England, viz. that the mechanical impurities of the limestones are sandy, and that there is a great tendency to ferruginous deposits, especially in the Lower Division, which is much more irony than the upper one. Fawn-coloured limestones prevail, but some beds of the Cotteswolds, and also of the Lincolnshire Limestone, are exceptions, being very pale in colour. The so-called "Oolite Marl" of the Cotteswolds is not usually a marl in a lithological sense, but simply a calcareous paste, which has very likely been derived from the waste of coral. The lithology of the beds of Inferior Oolite age in Yorkshire, excepting the Whitwell and Cave Oolites, is very exceptional in comparison with the usual types which prevail throughout the rest of England.

But if the lithology of the beds varies greatly, the difference in their development is still more extraordinary. Where the beds are thinnest there, as a rule, the fossils, especially the Gasteropoda, are the most numerous. We can easily understand some of the causes which have produced this result. Given, for instance, a certain length of time, during which a series of beds have been undergoing deposition, if the material of which they are constituted is thickened by large additions of mineral débris we could almost imagine a time might arrive when looking for a fossil would be like looking for a needle in a bundle of hay. In most places outside the Yorkshire area, instead of mineral débris the beds are thickened by calcareous débris, mainly secreted by organisms in the first instance. Such débris may appear in the form of comminuted shelly matter, or as a calcareous paste, or as an oolitic granule. It is thus that the beds of Inferior Oolite in the Cotteswold escarpments are, for the most part, thickened. More rarely, and never to any important extent, the beds are thickened by an actual growth of coral *in situ*. There are three such bands—the name "reef" is scarcely applicable—in the Cotteswolds, and there can be no doubt that such belts of coral have exercised

[1] The species of Gasteropoda in the *cynocephala*-stage of the Cotteswolds are so few in number that it is hardly worth while making a separate division for these.

an important influence on the Fauna. There appears to be a really large coral growth in the Upper or Ragstone division of the Inferior Oolite on Dundry Hill. So far as I know, this is the only accumulation in beds of this age throughout England to which the term "reef" could be fairly applicable.

But although the remains of actual coral growth now presented to us are scanty, there can be little doubt that the Inferior Oolite was deposited when a considerable growth of coral existed in some places, and mostly in the direction of the prolongation of the escarpment. It must of course be borne in mind that we merely see the truncated ends of the beds along the line of strike, and that these beds have all extended much further in a direction opposite to that of the prevailing dip. Taking the Cotteswold area, for instance, as an example, the westward prolongation of the Inferior Oolite from such a place as Leckhampton might, and most likely did, extend over what is now the vale of Gloucester, towards the high lands of the west, which would be the direction of the shore of that period. It was most probably on fringing reefs connected with a shore so situated that the main mass of actual coral was being accumulated. And this growing coral not only fostered a peculiar Fauna, but also furnished to the waves no small amount of the calcareous mud, which, in the form of paste or granules, constitutes a large proportion of the Inferior Oolite as it is now preserved to us. The long east and west axis of the Mendips would form an island in the Inferior Oolite sea of the south-west, whilst its axial prolongations would form shallows or submarine ridges such as that so well exposed at Vallis, near Frome, on which several feet of a rubbly variety of the upper beds of Inferior Oolite may be seen to repose. A little way off, on the north and south flanks of this Mendip island, are considerable accumulations of impure calcareous sediment of Inferior Oolite age, almost devoid of fossils, and yielding building stones (Freestone quarries). In Dorsetshire, on the other hand, with which South Somerset may be included to a certain extent, the signs of coral reef are small, and where Cephalopoda are very numerous the conditions must have been very different; but this will be seen more fully when the details of the several districts are given.

What I particularly wish to emphasize just now is the extraordinary irregularity and marked contrast in the several portions of the Inferior Oolite, and, by consequence, of its fossil contents. This peculiarity is on the whole favorable to variety in the forms of life, or, stated in other terms, the more varied the facies the more numerous will be the forms in a given series of beds. This, I think, especially affects Gasteropoda, which are easily influenced by change of physical conditions within a given area, such physical conditions being indicated by the nature and varying volume of the deposits.

Despite its variability and local attenuation the Inferior Oolite is nearly continuous in its outcrop from Bridport Harbour on the Channel to Blue Wyke on

the North Sea with the exception of a short break in Yorkshire. But about halfway between these two points, in the very centre of England, the deposits of this age are very meagre, and yield scarcely any Gasteropoda, indeed but few fossils of any sort. That portion of the outcrop which lies between Banbury and a little east of Blisworth represents this series in its most degraded condition, and at the point where the new railway to Northampton diverges from the old line (north of Roade station) a few feet of unfossiliferous sand is all that intervenes between Bathonian beds and the blue shales of the Upper Lias. I have very little doubt that if we could follow the beds for a short distance on the dip (*i. e.* to the south-south-east) it would be found that the Inferior Oolite had disappeared entirely. We are therefore prepared for the entire absence of the Inferior Oolite throughout the south-east of England, as proved by numerous borings, and we perceive that this south-easterly attenuation, which has been noted at several points in the midland and west midland districts, is but the prelude to entire extinction.

But to return to the outcrop, this extreme thinning and change of beds in the centre of England is no doubt due to the configuration of the old land surface at the time of the deposition of the Inferior Oolite. Into these physical details there is no need for us to enter on the present occasion; it is enough for our purpose that a markedly new phase of the Inferior Oolite is gradually attained in the country which lies to the east of the main line of the London and North-Western Railway. The line as thus indicated may be said roughly to divide the two great regions of the Inferior Oolite from each other, that on the north-east being on the whole of a less marine character than the more typical and better known region to the south-west. But, just as the Cotteswold type differs from that of Dorsetshire, so in the great north-eastern division does the Northampton-Lincoln type differ from that of Yorkshire.

Hence we may divide the Inferior Oolite of England geographically into four principal districts as follows:

No. 1. *The Dorset District*, including part of Somerset in the direction of the Mendips.

No. 2. *The Cotteswold District*, extending from the neighbourhood of the Mendips to a line across the centre of England approximately indicated by the London and North-Western Railway.

No. 3. *The East Midland District* representing the outcrop of beds of Inferior Oolite age in Northants (east of the above line), Rutland, Lincoln, and perhaps south-east Yorkshire as far as the Pocklington axis.

No. 4. *The Yorkshire Basin* constituting an isolated area and presenting many peculiar features.

Of course there may be some room for difference of opinion as to the boundaries of these four areas or districts, but generally speaking each of them is characterised

by the predominance of certain facies, and this peculiarity gradually loses its distinctive character, and frequently the beds their fossiliferous wealth, as the confines of the adjoining area are approached. Hence I do not feel called upon to indicate the boundaries too absolutely, as if one were defining the limits of a parish or a polling district, though something of the sort may be attempted in giving the details of the four great districts. As regards the name of the second district it certainly includes more, both to the north and to the south, than the actual Cotteswold Hills. Hence our second district is not precisely coterminous with the Inferior Oolite of the Cotteswolds. Moreover, there is another difficulty in this connection, viz. where to locate the very exceptional development at Dundry. Both the facies and lithology of those fossiliferous beds recall some of the most typical of the Dorsetshire sections, in spite of their lying well to the north of the Mendips. But on the other hand the large development of coral in the *Parkinsoni*-zone quite distinguishes this remarkable outlier, which topographically must be included within the second district, unless we are to regard it as sufficiently important to constitute a region by itself.

Now, the Dorset district possesses an essentially Cephalopod facies in the main with, as we have already seen, a thin development of sediment. These conditions seem to have been eminently favorable to the growth of Gasteropoda, and the subsequent mineral changes have also been favorable to their preservation as fossils. Hence it is to the collections from these beds that we must look, not only for the greatest number of species, but also for the best preserved specimens on which we must depend for the illustration of this Memoir. In fact, if all the available Gasteropods of the Inferior Oolite were as well preserved as are those from the best localities in Dorsetshire, the task I have undertaken would prove a much easier one than is likely to be the case. The essentially Cephalopod character of the facies is maintained as regards the Lower Division, even into South Somerset,[1] but the Upper Division, or equivalent of the Cotteswold Ragstones, already begins to fail in Ammonites; though the shell-beds swarm with Brachiopoda and *Trigoniæ* together with a moderate supply of the Gasteropoda peculiar to the Upper Division.

In the Cotteswold district the deposits are so bulky that it would be difficult to name any one facies as markedly predominant. The three thin "coral reefs," if indeed they are worthy of such a grandiose name, mark the more classical portion of the district which extends from the neighbourhood of Stroud to the neighbourhood of Cheltenham. Hence the facies is partly coralline; but there are also examples of the brachiopod and echinoderm facies in abundance. Ammonites are comparatively rare, and, as far as I can ascertain, above the Cephalopoda-bed (zone of *Am. radians*), of very few species. The Lower Division is better supplied with Gasteropoda than the Upper Division, or Ragstones, but these shells cannot be said

[1] The axis of the Mendips is taken as the division between North and South Somerset.

to be numerous as a class or particularly well preserved, many appearing in the condition of casts. The "Oolite Marl" yields a fairly respectable list of Gasteropoda, and some of these are really in good condition, well preserved in fine white calcite, so as to constitute a valuable acquisition to the cabinet. Mr. Brodie also has some good specimens of Gasteropoda, mostly small, from the freestones, which bear some resemblance to the Fauna and facies of the Lincolnshire Limestone. On the whole, however, the Cotteswold area of the Inferior Oolite is rather disappointing, and if it were not for the abundance of *Nerinæa* on certain lines in the "Oolite Marl" and associated beds, and the occurrence of this genus to a less extent in the "Pea-grit" below and the "*Clypeus*-grit" above, the ground would be somewhat poor hunting for those in search of Gasteropods. It has generally been held, and I think justly, that these shells are in some way associated with coral growth, and this seems all the more probable when we bear in mind that the No. 1, or Dorset district, notwithstanding its wealth of Gasteropods, has not yielded a single *Nerinæa* to collectors, so far as my experience goes. The genus *Nerinæa* has been traced as far as Radstock in the uppermost beds of the Inferior Oolite, but south of the Mendips it seems to be entirely absent, and this is also the case with beds on the same horizon in Normandy.

In the East Midland district, if we except the development of certain estuarine and ferruginous deposits, the Inferior Oolite is still mainly calcareous. The Lincolnshire Limestone is remarkably devoid of Cephalopoda, and the facies, where any abundance of fossils occurs, is described by Professor Judd as partly coralline and partly shelly. With few exceptions the Gasteropoda are small, but excessively numerous in certain places, and the genus *Nerinæa* is well represented throughout. It would be difficult to show a greater contrast than that which exists between the Lincolnshire Limestone, with its white Oolite, small shells, and total absence of Ammonites, and the Dorsetshire ironshot Oolites, so full of Ammonites and Belemnites that Mr. H. B. Woodward declares the entire Inferior Oolite of that region might be called a Cephalopoda-bed.[1] It is probable that the greater part of the Lincolnshire Limestone belongs to the Lower Division, though matters are more obscure here than in the south-west. The facies and general appearance of the upper beds of the Lincolnshire Limestone at Weldon, Wansford, Barnack, &c., has a strong resemblance to the Great Oolite as developed at Minchinhampton and elsewhere, but possibly this resemblance is in part superficial, and it may be that the freestones of the Inferior Oolite in the Cotteswolds, on a close comparison of species, may have more affinity with the Lincolnshire Limestone than is usually supposed.

[1] 'Proc. Geol. Assoc.,' vol. ix, p. 203, 1886.

Details of the Dorset-Somerset District (No. 1).

The Mendip axis serves approximately as the northern boundary.

Comparison with Normandy.

There can be very little doubt that both the Upper Lias and the Inferior Oolite of Dorsetshire present considerable analogies with beds of the same age in Normandy. This, indeed, has been pointed out by Oppel and Waagen, the latter of whom included Dorsetshire in the Parisian basin as distinct from the Inferior Oolite of the whole of the rest of England.

As regards the Upper Lias we have only to compare the general section at Ilminster, given by the late Charles Moore,[1] F.G.S., with the section at Evrécy, given by Prof. Eugène Deslongchamps[2] to perceive that above the *margaritatus*-beds (Marlstone), there come the *Leptæna*-beds, and then that remarkable zone of nodules, or doggers, with Saurians, Fish, and Crustacea, succeeded by certain beds containing Cephalopoda characteristic either of the Upper Lias proper, or of the *insignis*-zone. At Ilminster the whole of this, judging from the above-quoted section, is contained in about eight feet six inches, whilst at Evrécy the thickness of the corresponding beds does not exceed thirteen feet. But now supervenes an element of great physical difference in the Yeovil sands, over 100 feet thick, which separate the *bifrons*-beds from the regular Inferior Oolite of Dorsetshire. It is not a little singular that, whilst the life-zones remain almost identical in the two countries, there should be no adequate physical representative of these Yeovil Sands in the Department of Calvados.

But whilst the life-zones present such a singular resemblance, their arrangement and classification have been by no means uniform. Let us consult the work of Deslongchamps already quoted, in order to see how variously the Inferior Oolite may be divided or subtracted from according to the views of various authors. The learned Professor of Caen then wrote that the "*système oölithique inférieur*" consists of (1) Infra-oolitic Marls, (2) Inferior Oolite, (3) Fuller's Earth, (4) Great Oolite. His *système oölithique inférieur* is in fact the equivalent of the whole of our Lower Oolites *plus* the Upper Lias. I have drawn attention to the point mainly in order to show the development of the lower portion of the Inferior Oolite in Normandy, and its attachment to the Upper Lias, according to certain views. For this purpose it will be necessary to analyse the "Infra-oolitic Marls" to see

[1] 'Proc. Som. Arch. and Nat. Hist. Soc.,' vol. xiii (1865-6).

[2] 'Études sur les étages jurass. inf.,' p. 75, 1864.

what they are made of, and also the so-called Inferior Oolite, which latter we shall perceive has a much more restricted meaning than with us. The following is an outline of their development in Normandy, abstracted from the previously-quoted work. Starting below the Fuller's Earth :—

1. The "White Oolite." This is said to be the normal deposit of the Inferior Oolite; it is of considerable thickness, varying from twenty-eight feet to nearly fifty feet. The following are amongst the species quoted :—*Am. Parkinsoni, dimorphus, subradiatus, Martinsii, Natica Bajocensis, Trochus duplicatus, Pleurotomaria mutabilis, Terebratula carinata, T. Morieri, T. Phillipsii, T. globata, T. sphæroidalis, Rhynchonella plicatella.* This may be said to form the *Parkinsoni*-zone.

2. The "Ferruginous Oolite." This is the famous Oolite of Bayeux, or typical Bajocian. It is six feet thick, and divisible into three beds. The central bed is that in which *Am. Humphriesianus, Gervillei, Brongniarti*, and a crowd of Gasteropods occur. Above is a bed characterised by *Am. Niortensis* and large varieties of *Pl. mutabilis*, whilst *Ter. sphæroidalis* is more abundant than in the middle bed. Finally, at the base is a nodular bed, which contains the above-quoted Ammonites of the horizon of Bayeux, and along with these *Am. Sowerbyi, cycloides*, and even genuine specimens of *Murchisonæ*; most of the latter are believed to be *remanié*. This is in the main the *Humphriesianus*-zone, and perhaps includes in the lower bed the sub-zone of *Am. Sauzei*.[1]

3. "*Mâlière*," or highest group of the "Marnes Infra-oölithiques." Between this important series of beds and the "Ferruginous Oolite," or true Bajocian, there is, in Normandy, a considerable hiatus marked by eroded surfaces and other signs of a partial unconformity. The "Mâlière" is formed of a series of beds of marly limestone, frequently penetrated with "chlorite," sometimes sandy and siliceous. The thickness varies from nine to twenty-nine feet. It frequently contains dark siliceous concretions. The fossils are *Am. Murchisonæ*, and especially *Am.* "*aalensis*" or "*concavus*," which in Normandy occurs only on this horizon. Here also occur *Lima heteromorpha* and *Terebratula peroralis* along with *Rhynchonella ringens* and *R. quadriplicata*. The characteristic Gasteropods are *Eucyclus capitaneus* and *E. pinguis* along with *Pleurotomaria actinomphala* and *P. Baugieri*. The "Mâlière" constitutes a sort of transition between the "Marnes Infra-oölithiques" and the beds of Bayeux; and, according to Deslongchamps, the fossils of this horizon were sometimes cited by D'Orbigny in his Toarcian, sometimes in his Bajocian, varying with the locality observed.

It is not difficult to recognise in the "Mâlière" of the Norman geologists the *Murchisonæ*-zone of Dorsetshire *plus* the so-called *Sowerbyi*-zone, so well characterised by the innumerable varieties of *Am. concavus*. This forms the main mass of our Lower Division of the Inferior Oolite in Dorsetshire, is characterised

[1] See further on for a more detailed description.

throughout by sharp-keeled Ammonites, and contains an assemblage of Gasteropoda, which present considerable differences from those of the Upper Division. Such are its Liassic affinities that, as we have already seen, Eugène Deslongchamps formerly placed it at the head of his "marnes infra-oölithiques," whilst D'Orbigny assigned its fossils here to the Toarcian, there to the Bajocian, although in reality the species of the two horizons are for the most part distinct.

4. Zone of "*Am. primordialis*." In Normandy this is described as not usually much more than three feet thick, often less; it reposes conformably in most places on the marls with *Am. bifrons*. In some places occur a great quantity of Gasteropods and Bivalves having a facies thoroughly Oolitic; often in a poor state of preservation. *Rhynchonella cynocephala* is quoted from these beds.

In everything but thickness this horizon probably represents the Yeovil Sands with *Am. radians*, *Am. Moorei*, &c. (the Gloucestershire Cephalopoda-bed).

Locality and position of the principal beds containing Gasteropoda.

There are certain familiar names, well known to collectors of Inferior Oolite fossils, frequently to be seen on the specimens themselves in our museums, &c. As regards Cephalopoda, and especially Belemnites, these are so universally distributed, each group in its own order of succession, that in some places the entire section of the Inferior Oolite might be termed a Cephalopoda-bed. The same might almost be said of the Conchifera and Brachiopoda. The remains of the Gasteropoda, besides being much more difficult to procure, have rather a tendency to be confined to certain horizons; not absolutely, however, as a few specimens will, of course, be scattered throughout. The object of the present notice is simply to draw attention to the locality and position of certain beds remarkable for the number of Gasteropoda which they contain. In so doing the description of each section will be given with a view more especially to emphasize the geological position of such beds. Attention will be paid to the ordinary divisions where that is practicable, but without attempting any of those refinements of generalisation which have been deemed possible by Oppel, and still more so by his successor Waagen. I have already insisted on the fact that the Inferior Oolite, at all events in the Dorsetshire district, is capable of being placed under two well-marked divisions, and in each section the position of the dividing line will be indicated as carefully as the facts known to me may justify. For general purposes the following may be accepted as the zones of the Inferior Oolite, which have been traced, though never all in one place, throughout the Dorset district.

1. Parkinsoni-zone
2. Humphriesianus-zone } Upper Division.
3. Sauzei-zone

4. Concavus- or "Sowerbyi"-zone
5. Murchisonæ-zone
6. Opalinus-zone
7. Radians-zone (Sands)

} Lower Division.

The *Sauzei*-zone is an appendage of the *Humphriesianus*-zone, and both are often but feebly developed, except in the neighbourhood of Sherborne. The *concavus*-beds represent the upper part of the Mâlière of Normandy, and the true *Am. Sowerbyi* is hardly ever found in them. The most mixed Fauna occurs in the "*Sauzei*-bed" of Oborne, and some might class it with the Lower Division.

Burton Bradstock.—This name is very well known to collectors, and fossils so marked may come from shallow quarries and cuttings in the neighbourhood of the village, or from the cliff which overhangs the English Channel. Between Burton Castle and the neighbourhood of Bridport Harbour there is an isolated massif made up of the *Yeovil Sands*, capped by the *Inferior Oolite Limestone;* and in one place, where the sequence is very complete, these are succeeded by a fragment of the *Fuller's Earth*. This massif presents a bold front to the English Channel, and has a length of one and three quarter miles, by an average width of about half a mile. It is unequally divided by the River Bredy, which separates "Burton Cliff" from the area to the north-west. The Inferior Oolite Limestone of Burton Cliff, containing the fossiliferous beds presently to be detailed, is elevated out of reach by reason of the great thickness of the "Sands," and it is only where masses of this hard capping fall upon the beach that the fossils themselves come within reach of the hammer. Hence their relative position has not in all cases been determined with precision. Nevertheless, there is one horizon in Burton Cliff which is so pre-eminent above all others for the number and beauty of its Gasteropoda, that fossils marked "Burton Bradstock" are most likely to have been derived from it.

The portion of the cliff west of the River Bredy is sometimes known as the Bridport Cliff, but generally speaking the fossils from here are not well defined as to geological horizon, though they chiefly belong to the rich bed before mentioned. Some of the fossils marked "Bridport" come from here, but the term is applied rather loosely. The town of Bridport is at some distance from the coast, and is situated on the Middle Lias.

The sands of the Inferior Oolite, or, as Oppel calls them, the sands of the Lias, exposed in this noble sea-cliff, consist of yellow sands with numerous indurated layers of bluish calciferous grit, which are sometimes continuous and at other times occur as nodular masses. These beds contain but few Gasteropoda, and those for the most part so ill-preserved that they require but trifling notice. As is so often the case where sedimentary accumulations are of great vertical development, they are comparatively barren of life, partly, perhaps, because such areas were

unfavorable to its development, and partly because the mechanical sediments mask those of organic origin. I have before observed that the horizon may be roughly represented as the zone of *Am. radians*. The lower portions (not visible in this section) may probably be the equivalents in time of the *Jurensis*-beds, as identified by Tate and Blake in Yorkshire, whilst the upper portion may be taken to represent the *cynocephala*-stage of Lycett.

It so happens that in one place a complete section of the Inferior Oolite Limestone has slipped to the base of the cliff, and therefore we are fortunately able to effect an examination which would otherwise require a considerable, not to say dangerous, exertion. The following profile, therefore, though measured at the bottom, really represents the top of the cliff. It shows us the Inferior Oolite in a nutshell, and affords a clue to its development in this neighbourhood and to a certain extent throughout the Dorsetshire district. Its modest dimensions seem puny in comparison with the bulky Cotteswolds and the still thicker masses of the Yorkshire Oolites. Nevertheless, though small it is regular in sequence and the life-zones are fairly shown, better perhaps than in any one section of the Inferior Oolite throughout England. Doubtless there are deficiencies, and the *Parkinsoni*-zone is in preponderating force.

Profile No. 1, *see page* 31.—Taking these beds in ascending order and without too detailed a scrutiny, we perceive that above the main mass of "Yeovil Sands" there occur about seven feet of sand-rock and calciferous grits between two lines of very thin, smooth, sharply-keeled Ammonites. These, no doubt, are the beds referred to by Oppel, who says that he found here the beds of *Am. torulosus* in the form of sandy, light grey limestone charged with numerous organic remains, amongst which he collected *Am. torulosus*, *opalinus*, and *subinsignis*, *Turbo subduplicatus*, *Terebratula anglica*, and *Rhynchonella cynocephala*.[1]

Speaking from my own experience the fossils of this horizon are mainly confined to the vicinity of the upper line of *Am. opalinus*, which Oppel regards possibly as the equivalent of his zone of *Trigonia navis*. There is here a fossiliferous zone which teems with *Am. opalinus*, and I possess both the other species of Ammonites mentioned by Oppel from this place and most probably from the same horizon. *Rhynch. cynocephala* was also noted from here, and likewise a few species of Gasteropoda, but not enough to constitute what the local collectors call a "Univalve Bed."

The remainder of the section upwards consists of five blocks of limestone, which measure altogether about twelve feet in height. The most notable shell-bed in the lower portion is one in connection with the "irony nodule" bed, a well-marked physical horizon in this neighbourhood. Ammonites greatly resembling *Am. Murchisonæ* occur hereabouts, and there are a sufficient number of

[1] See Oppel, 'Juraformation,' p. 328, 1856-58.

Profile No. 1.—Burton Bradstock Cliff.

(Section complete.)

			Capping of Fuller's Earth.
UPPER DIVISION.	Parkinsoni-zone.	0′ 6″ P_3	Upper shell-bed with *Am. subradiatus*, &c.
		4′ 0″	Limestones with fossils of the *Parkinsoni*-zone sparingly distributed.
		1′ 0″ P_2	An ill-defined shell-bed with Brachiopoda and large *Am. Parkinsoni*.
		1′ 4″	Limestone.
		1′ 0″ P_1	*Terebratula sphæroidalis.* Chief shell-bed. Gasteropoda. *Astarte obliqua, Am. Parkinsoni.*
		1′ 0″	Limestone with few fossils.
LOWER DIVISION.	Murchisonæ-zone.	1′ 9″	Fossils becoming more numerous. Line of irony nodules: Gasteropoda. *Am. Murchisonæ.*
		1′ 6″	Impure Limestone with few fossils.
		0′ 3″	Brash and Rock with *Am. opalinus.* Gasteropoda.
		12′ 4″ Total.	Calciferous grits and brown sand-rock of the Yeovil Sands.

[1] In interpreting this and the following profiles the reader should bear in mind—(1) That the proportionate thickness of the beds is not observed any more than convenience allows; (2) the relative thickness of the beds must be judged by the measurements, which do not claim to be more than fairly accurate; (3) the divisions shown do not in all cases agree with existing divisional planes; (4) the main object in all cases has been to emphasize the position of the chief beds bearing Gasteropoda.

Gasteropoda on this line to entitle it to the dignity of an "Univalve Bed." The fossils are mainly those characteristic of the Lower Division, and more especially of the *Murchisonæ*-zone; *e.g. Cirrus*, usually a fossil of a low horizon. The other Gasteropoda from here will be named in their due places. The upper portion of this in all probability shades off into the *concavus*-beds, or so-called *Sowerbyi*-zone, but as there are no special traces of Gasteropoda here we need not go further into the inquiry. There are signs of the so-called "*Sowerbyi*"-zone in a quarry on the north side of the Bredy, but I found no Gasteropoda there of any consequence.

Again, the line between the Lower and Upper Divisions of the Inferior Oolite cannot be laid down to an inch or two with absolute certainty in the cliff section. This doubt arises mainly from the feeble and imperfect development of the *Humphriesianus*-zone, a failure very characteristic of South Dorsetshire. As far as an inspection of this section goes there seems to be no independent development of the *Humphriesianus*-zone at all otherwise than as an adjunct to the rich-shell at the base of the *Parkinsoni*-zone (P_1). This was noticed by Oppel, who, whilst alluding to the trifling thickness of the Inferior Oolite, speaks of the fossils of the *Humphriesianus*- and *Parkinsoni*-zones being found together in one and the same bed of Oolite. To a certain extent this is so, and if such a zonalist as Oppel admitted the fact the evidence in its favour must be very strong indeed.

We have then to consider the character of the shell-bed which I have distinguished as P_1. It is mainly situated towards the lower portion of the third block of limestone, and is by far the most important shell-bed in the Burton Bradstock Cliff. A portion of it also belongs to the next block, the split taking place through the midst. The result is that when the larger blocks break up there is a double surface presented to the collector's chisel. *Astarte obliqua* is very abundant, and there are also other species of *Astarte*, so that this is sometimes known as the *Astarte*-bed. The upper part of P_1 is crowded with *T. sphæroidalis*, whilst in the lower part the *Astarte* is most abundant. It is in this lower part that the Gasteropoda of this shell-bed principally occur. Specimens of moderate-sized *Am. Parkinsoni* are by no means uncommon in the *Astarte* division of P_1, and may be found quite down to the base of the shell-bed. Sometimes, however, in the very base of the bed, and in that portion which belongs to the lower block, fair-sized specimens of *Am. Humphriesianus*, or a very closely allied *Stephanoceras*, may be found. It is just possible that there may be a slight unconformity between the two lines so that, here and there, specimens belonging to an older and lower zone are sometimes adherent to the main mass. In this way an uncompromising zonalist might seek to explain the apparent admixture. However that may be, it is perfectly certain that specimens of *Am. Parkinsoni* are to be found quite as low as any of the Gasteropoda hereafter to be described, and therefore I have no hesi-

tation in assigning all specimens from P_1 of the Burton Bradstock Cliff to the lower division of that zone—which throughout this neighbourhood is richer than all the rest put together. *Am. Martinsii* is also abundant in this bed, and other Ammonites which are characteristic of this horizon.

According to my experience *Am. Martinsii* is a pretty faithful guide to the geological horizon of a particular bed when it occurs in any quantity. The position of this abundant development is low down in the *Parkinsoni*-zone, or in some cases we might say high up in the *Humphriesianus*-zone. If we accept for the moment the level of maximum development of *Am. Martinsii* for our datum line we shall find that here, at Burton Bradstock, *Am. Parkinsoni* descends rather lower than the former does, for instance, at Oborne, as we shall perceive subsequently. Hence we must brinq the *Parkinsoni*-zone a little lower down here, since, not only does the section *Cosmoceras* exceed all other sections of the unwieldy genus *Ammonites* in P_1, but the real *Am. Parkinsoni* is there in abundance quite to the base of the bed, but only of moderate dimensions. I have been somewhat precise in respect of this bed, not only because it is "the fossil-bed" of Burton Bradstock and the neighbourhood, but because, in the excellent section contributed by Mr. Etheridge to Damon's 'Geology of Weymouth,' it is evident that this bed is regarded as being in the *Humphriesianus*-zone. This misconception is probably due to an exaggerated notion of the importance of the *Humphriesianus*-zone in South Dorset, and may have its origin in the opinion expressed by the late Dr. Wright as to the position of the "fossil-bed" at Bradford Abbas.

Although there is considerable variety in the mineral composition of P_1, yet the matrix of a majority of the Gasteropoda is a pale grey marly limestone, which is very characteristic of this bed wherever it occurs between Burton Bradstock and Bridport Harbour. According to the degree to which this bed is ironshot, browner tints, more characteristic of the Dorset Inferior Oolite, are seen to prevail. On the whole, however, the bed as here developed seems to work rather more kindly than is often the case, and as the fossils are in good spathic condition, it has often been possible to develop them with a considerable degree of accuracy. My collector, Mr. Bloomfield, has been very successful in this respect, and specimens of *Spinigera recurva*, sp. n., with most of the spines attached, and other good fossils have rewarded his efforts. As we shall perceive in the sequel the Gasteropod Fauna of this bed is very distinct, and may be traced for some distance in South Dorset, nor is it difficult to see what are its approximate equivalents in other parts of No. 1 District. Moreover, its Gasteropoda are clearly those of the Bajocian (understanding this term to include the *Humphriesianus*- and *Parkinsoni*-zones only). They are fairly different from the much lower Bajocian beds at Oborne, and present a striking contrast to those of the infra-Bajocian "fossil-bed" of Bradford Abbas, which, as we have already seen, belongs to Deslongchamps' "Marnes Infra-oölithiques." I

might say here, whilst dealing with this subject, that, although the term "Bajocian" as applied by D'Orbigny was in the main confined to the "beds of Bayeux," it has since been so generally applied to the whole Inferior Oolite that we might well call the "horizon of Bayeux" Upper Bajocian and all the rest Lower Bajocian. At any rate this would sound better than "Upper Inferior Oolite" and "Lower Inferior Oolite." Still it is not strictly accurate, and martinets might grumble: we had best restrict ourselves to Upper Division and Lower Division.

Purpurina bellona, D'Orb., a somewhat elongate variety, is not uncommon in this bed, and *Onustus ornatissimus*, D'Orb., is also characteristic. Both these genera are represented by very different species in the "fossil-bed" of Bradford Abbas. *Purpurina bianor*, D'Orb., and varieties or allied species, are also characteristic; and *Purpurina inflata*, Tawney, likewise occurs. *Alaria hamus*, Desl., and *Alaria Lorieri*, D'Orb., or forms very near them, are fairly plentiful. On the whole, perhaps, the Normandy fossils are better represented in this bed than in any other, though in some respects the two Gasteropod horizons at Oborne may be still richer in forms identical or representative of those across the Channel.

P_2. This might be called the *Terebratula*-bed, from the abundance of what I take to be small varieties of *T. sphæroidalis; Terebratula Phillipsii* and *Waldheimia carinata* are also characteristic, or at any rate fossils that pass for such species. Conical forms of *Pleurotomaria* occur, and the specimens of *Am. Parkinsoni* are very large. Belemnites are very abundant. *Holectypus*, a small rounded species, is tolerably abundant. There are Gasteropoda here too, but not in sufficient numbers to call for any special notice. This shell-bed occurs about the base of the second limestone block, and within a very short distance vertically from P_1. Though well separated in the cliff section it is just possible that in some of the quarries hereabouts the two may coalesce.

P_3. A somewhat greater width of oolitic limestone separates this, the topmost bed of the *Parkinsoni*-zone, from the shell-bed last before detailed; it is about five inches thick and contains a narrow species of Belemnite in considerable abundance. *Am. Parkinsoni* is rare but *Am. subradiatus* is decidedly plentiful, and there occurs a very thin Ammonite just at the top, which perhaps, may be regarded as a variety of *Am. subradiatus*. *Serpulæ* and *Placunopsis* are adherent. Monomyaria are very abundant, especially *Lima pectiniformis* and *L. duplicata*. Many Myacids may be noted, and the little round *Holectypus* (*? H. depressus*) is to be found in great numbers. Very few Gasteropoda were noted. Upon the surface at the top the small *Ostreæ* and other shells of the *Fuller's Earth* above are adherent.

Comparison of the Dorsetshire and Yorkshire Coasts.

There is, perhaps, no portion of the Inferior Oolite throughout England which is so well illustrated as the *Parkinsoni*-zone of Burton Bradstock Cliff, even down to very minute details, and it is, of course, all the better for not being inflated with too much sedimentary matter. As this is the first glimpse of the Inferior Oolite in England, for one coming from the south it might perhaps produce an exaggerated notion of the importance of the *Parkinsoni*-zone.

One cannot help reflecting on the marvellous contrast presented by the section of the Inferior Oolite on the Yorkshire coast. Setting aside the enormous difference of physical development, we have in the *Nerinæa*-bed of the Yorkshire Dogger a fine development of the *Murchisonæ*-zone, and this is indeed the only bed of the Inferior Oolite which can be regarded as rich in Gasteropoda in that county. But owing to the difference of facies even the *Murchisonæ*-bed of Burton Bradstock Cliff has not much more resemblance to the Yorkshire Dogger than the beds of the *Parkinsoni*-zone have. It has many Ammonites and no Nerinæas, whereas the Yorkshire Dogger has many Nerinæas and hardly any Ammonites. If we carry the comparison a step higher we find the Cephalopoda of the *Humphriesianus*- or coronaten-zone abundant in certain portions of the Scarborough Limestone, whereas in Burton Bradstock Cliff this zone is aborted, or so overshadowed by the lower part of the *Parkinsoni*-zone as to produce no impression. Again, on the Yorkshire coast there is no palæontological representative of the *Parkinsoni*-zone, so that in all respects the contrast is most complete.

In every respect, therefore, the marine beds of the Inferior Oolite on the Yorkshire Coast differ surprisingly from those of Dorsetshire. Yet despite this difference the relative position of the life zones is always the same so far as the Cephalopoda afford the means for comparison. It remains to be seen how far this holds good for the Gasteropoda. The contrast between the species of Gasteropoda in our Lower and Upper Divisions is exceedingly marked throughout the Dorset District, where the abundance and excellent preservation of the Gasteropoda admit of the fact being proved to demonstration. Possibly the difference may be shown to a certain extent in the Cotteswold District (No. 2), but less clearly, I think, in the Yorkshire District (No. 4).

Reverting once more to the *Parkinsoni*-zone in Burton Bradstock Cliff, it seems to me that the Cotteswold divisions of the Ragstone are to a certain extent prefigured in this exposure. Making due allowance for geographical distance and difference of facies, I think that P_1 corresponds in the main to the Upper Trigonia Grit, though here fortunately the matrix is quite of a different character, hence lithologically there is no resemblance. Moreover, *Rhynchonella spinosa* does not

appear to make any show (I speak rather with hesitation on this point). There can be no doubt, however, that in most places throughout the Dorset-Somerset district, at all events from the sea coast as far as Castle Cary in south-east Somerset, wherever the Upper Division of the Inferior Oolite is at all well developed, a shell-bed rich in Gasteropoda is to be found about this horizon, and that in many cases it contains *Rhynch. spinosa*. We shall see this further on, and we shall also see that, in some places, there is a tendency to assume the lithological peculiarities of the Ragstone. If we grant that P_1 prefigures the Upper Trigonia Grit, we shall have no difficulty in believing that the succeeding beds, including P_2 and P_3, prefigure the *Clypeus*-grit, though not exactly corresponding as to details. Nevertheless, I consider that P_2 is somewhere about the horizon of the *globata*-bed, whilst P_3, in the abundance of its Myacids, reminds us of the name given by Lycett, viz. *Pholadomya*-grit, to the uppermost beds of the Inferior Oolite in the Cotteswolds. These two beds have not yielded me many species of Gasteropoda here—nothing, in fact, of importance—but if they were well worked the case might be different.

The section above detailed affords us the key to the remainder of the massif of Inferior Oolite on its pedestal of Yeovil Sands in this vicinity. Still, there are differences, and in one small quarry south of the village of Burton Bradstock, where there is an exposure of about five feet, better traces of the *Humphriesianus*-zone seem to exist. A recent road-cutting, leading from the village to the sea coast, displays a complete section of the Inferior Oolite Limestone with the underlying impure Siliceous Limestones. Mr. H. B. Woodward, who was resurveying this district in 1885, writes as follows :[1] "This excavation shows nearly the whole of the Inferior Oolite (here about fifteen feet in thickness), and the junction of it with the Sands beneath. . . . Many fossils were observed, although, owing to the difficulty of extracting them, if not to the fear of injuring the banks, few were collected. The entire Oolite is here a 'Cephalopoda-bed;' but the so-called Cephalopoda-bed of the Cotteswold Hills is no doubt represented by the upper portion of the Sands beneath. The lowest portion of this Oolite represents in a broad sense the zone of *Ammonites Murchisonæ* (including the beds with *A. concavus*); the highest portion represents the zone of *Ammonites Parkinsoni*. The zone of *Ammonites Humphriesianus*, which is to be found in some quarries east of Bridport, does not appear to be distinctly developed at Burton Bradstock, although the species is met with in the cliffs and road-cutting."

The above remarks will serve to afford an idea of those portions of the country away from the cliff. But, since many of the specimens procured by the most experienced collectors are obtained from old walls, or else from old disused quarries, where the fossiliferous blocks lie about in the midst of grass-grown sections, there will be a slight element of uncertainty as to the horizon of some of

[1] 'Proc. Geol. Assoc.,' vol. ix, p. 203, 1886.

the fossils marked "Burton Bradstock" and "Bridport." The majority, however, undoubtedly come from the horizon which I have distinguished as P_1.

Bridport.—The town itself is on the Middle Lias, but within a moderate distance are some important exposures of the Inferior Oolite. Burton Bradstock bears $2\frac{3}{4}$ miles S.E. The cliff between Bredymouth and Bridport Harbour 2 miles S. by E.; Vitney Cross Quarries 3 miles E.; Upper Loders Quarry $3\frac{1}{4}$ miles E.N.E.; quarry at Poorstock Station $3\frac{1}{2}$ miles N.N.E.; Outlier at Symondsbury $1\frac{1}{4}$ miles W. by N.; Outlier at Chideock 2 miles W. by N. Some of these may have had more importance formerly than at present, but two of them have yielded many interesting Gasteropoda quite lately, viz. *Vitney Cross* and *Upper Loders*.

Vitney Cross (see Profile No. 2, p. 38).—There are two quarries here, distinguished as the *Limekiln Quarry* and *Knight's Quarry*. Both afford good hunting ground for fossils, but in the Limekiln Quarry the section is more complete.

This quarry is extremely interesting, as it serves for comparison with the development of the Inferior Oolite in Burton Bradstock Cliff, a distance of three miles. We find that the physical conditions are mainly the same; the volume of the limestones has not at all increased, the Inferior Oolite is still "in a nutshell," and the *Parkinsoni*-zone maintains its preponderance in every way.

The lowest bed visible is somewhere about the *opalinus*-zone, but no palæontological traces of that horizon are forthcoming. The block with the line of Ammonites resembling *Am. Murchisonæ* is a hard blue stone with much pyrites, and is far from being a pure limestone; there is a line of a large *Astarte* along with the Ammonites. The irony nodules serve as an excellent physical feature to guide us on this horizon. The bed above the irony nodules contains numerous Belemnites; it is in many places a hard, calcitic, ironshot stone like the ordinary Dundry matrix. In position it may represent the *concavus*- or *Sowerbyi*-beds, and probably forms the top of the Lower Division in this quarry, most probably in contact, or nearly so, with the base of P_1.

The lower half of P_1, which we may distinguish as the *Astarte*-bed, constitutes the base of the upper portion of the quarry; it is well developed, and contains, both here and in the adjoining quarry, a fine suite of Gasteropoda, tallying extremely well with species from the same bed in Burton Bradstock Cliff. Fine specimens of *Spinigera recurva*, and many of the characteristic univalves of Burton Bradstock and the neighbourhood of Bridport, may be found here, but the matrix is rather harsher to work. In Knight's Quarry large specimens of *Am. Parkinsoni*, and a small species of *Stephanoceras* are abundant; *Ancyloceras* also occurs. The lower half of P_1 is separated from the upper half by about six inches of limestone without many fossils; it is rather thinly stocked, but contains a considerable number of *Ter. sphæroidalis*, or what passes for that species.

One of the more remarkable features of the quarry is the great development of

Profile No. 2.—Vitney Cross Quarry.

(Section complete.)

			Capping of Fuller's Earth.
UPPER DIVISION.	Parkinsoni-zone.	1′ 9″ P_3	Upper shell-bed. *Belemnites*, *Trigoniæ*, *&c.* *Brachytrema.* *Onustus.*
		3′ 3″	Calcareous rock with fewer fossils, chiefly Brachiopoda.
		1′ 6″ P_2	Crowded with Brachiopoda of many species. Some Gasteropoda.
		2′ 8″	Calcareous rock.
		1′ 9″ P_1	*Terebratula sphæroidalis* above. In two divisions. Gasteropoda. *Astarte obliqua* below.
LOWER DIVISION.	Murchisonæ-zone.	1′ 2″	Block containing in lower part a line of irony nodules.
		0′ 8″	Blue block containing *Am. Murchisonæ* atop.
		1′ 6″	Grey calciferous grits and hard brownish sand-rock.
		13′ 3″ Total.	Yeovil Sands.

It should be noted that not very far from here, in a southerly direction, traces of the *Humphriesianus*-zone have been found by Mr. H. B. Woodward; *i. e.* he obtained a fine specimen of *Am. Humphriesianus* in a certain quarry. See remarks on this point with reference to the Burton Bradstock section. Either a thin layer of an older rock is adherent to the shell-bed, or there is an admixture of forms.

P_2, or the Brachiopoda-bed, the upper portion of which is a complete arabesque or shell-entablature; large specimens of *Trigonia costata* and other *Trigoniæ* occur. Brachiopoda are very numerous; *Rhynchonella spinosa*, *Waldheimia carinata*, *Terebratula Phillipsii*, and a few *T. sphæroidalis* in the lower part. Several Gasteropoda were obtained from this bed in 1885. P_3, the upper shell-bed just under the Fuller's Earth, is nearly two feet thick, and contains one or two peculiar Gasteropoda, and notably the only species of *Brachytrema* I have succeeded in discovering from the Inferior Oolite of the Dorset district.

Loders.—An old quarry face at Upper Loders displays pretty much the same sequence as at Vitney Cross. At all events the *Astarte*-bed, P_1, is the main source of the Gasteropoda which come from here, as is the case almost everywhere east of Bridport. The irony nodule-bed with the *Murchisonæ*-like Ammonite just below is in its place about two feet underneath, then grey calciferous grits and brown sand-rock, showing the lithology of the *opalinus*-zone, though apparently without its fossils.

Beaminster.—This town is five and a half miles due north of Bridport. I do not know of any quarries in the town, but there are some in the neighbourhood. There are a few Gasteropoda marked "Beaminster" in the Buckman collection; and some have been sent to me from Mapperton, a village not far off. Judging from appearances, this is a neighbourhood where the *Parkinsoni*-zone has lost its predominance, and where such Gasteropoda as have been collected may be safely assumed to belong to the Lower Division, though to what stage of the Lower Division may not in all cases be clear. There is a quarry at Horn Park, one and a half miles north-west of Beaminster, showing nine feet six inches of limestone. The Lower Division here is five feet thick, and very full of Cephalopoda. The upper four feet six inches of this quarry consists of yellowish Oolite poor in fossils, which probably belongs to the Upper Division, though its rich shell-beds have disappeared. All this favours the supposition that "Beaminster" specimens may be set down either to the *concavus*- (*Sowerbyi*-) zone or to the *Murchisonæ*-zone. There is an exposure likewise at a place called Wadden Hill (marked Stoke Knap in the map) not far from Horn Park, where the *opalinus*-zone appears to be fossiliferous, since I have a specimen of the *Am. torulosus* from here, and two or three indifferent Gasteropoda.

Broadwinsor.—Three and a half miles north-west of Beaminster. This has been an important quarry for many years. The face of stone is about eight feet four inches thick, and presents no very definite shell-bed. There is abundance of *T. Phillipsii* in the upper beds, and of *T. sphæroidalis* lower down. The whole is in the Upper Division and probably in the *Parkinsoni*-zone, thus forming a marked exception to all other quarries in this neighbourhood.

Drympton, one and three quarter miles north of Broadwinsor.—Going still

northwards, this is the next exposure met with. It is a small quarry three miles south-west of Crewkerne Station. There is about six feet of stone in three blocks. The whole is probably in the *Murchisonæ*-zone, if not lower. *Waldheimia anglica* is very abundant, and the place is remarkable for very pretty species of *Trochus* or *Delphinula*. This is the most western point of any of the quarries noted.

Haselbury (see Profile No. 3, p. 41).—One and three quarter miles north-east of Crewkerne Station. This is a place of considerable importance as a quarry, but it is more remarkable for *Echini* and Conchifera than for Gasteropoda. *Isocardia cordata* is a noteworthy fossil here, since its occurrence in Dorsetshire has not often come under my notice.

It must be allowed that Profile No. 3 is very inferior in interest, for our purpose, to the two preceding, since but few Gasteropoda are noted from this quarry. I have introduced it mainly to show the preponderating importance of the Lower Division, and especially of the *Murchisonæ*-zone in this area. The "massive shell-bed with keeled Ammonites" certainly represents nothing higher than the *concavus*- (*Sowerbyi*-) zone, whilst all the rest must be in the *Murchisonæ*-zone or lower. The Gasteropoda are probably on the same line as at Drympton, which I conceive to be towards the base of the *Murchisonæ*-zone.

Résumé of the south-western half of the Dorset-Somerset District.

On the coast and for some miles inland the Lower Division of the Inferior Oolite is only feebly represented as a limestone, and, although there is an interesting shell-bed, associated with a line of irony nodules, which may be traced for some miles, containing the fossils of the *Murchisonæ*-zone, yet the development and also the fossils of the Upper Division, and notably of the *Parkinsoni*-zone, greatly preponderate. Near Beaminster, and north of that town as far as Haselbury, the very reverse of this state of things obtains. With the single exception of the quarry at Broadwinsor all the fossiliferous exposures known to me are in the Lower Division, and for the most part low down in that division, which is thicker than towards the coast.

It now remains to consider the *north-eastern half* of the Dorset-Somerset District, and we commence our researches in the vicinity of *Yeovil Junction*.

East Coker.—Two and three quarter miles south-west of Yeovil Junction. I have not been here myself, but am informed that there is only about three feet of limestone. The fossils are those of the *Murchisonæ*-zone, and especially *Cirrus*.

Stoford.—The limestone quarry is a few hundred yards west of Yeovil Junction. The Inferior Oolite Limestone is only a few feet thick, but affords a very complete section, which may be traced to the base of the Fuller's Earth. It is more

Profile No. 3.—Haselbury Quarry.

		Section incomplete.
LOWER DIVISION. Murchisonæ-zone.	1′ 0″	Top bed. No fossils noted.
	0′ 3″	Brash.
	2′ 4″	Massive shell-bed, with large Conchifera. Keeled Ammonites.
	2′ 0″	Massive creamy Limestones, with some shells. *Am. Murchisonæ*, *Lima Etheridgii*, and *Wald. anglica*, common.
	0′ 11″	Calcareous Rock.
	1′ 6″	Shelly towards the top with a few **Gasteropoda.**[1]
	1′ 4″	Base bed.
	9′ 4″ Total.	Water in bottom of quarry.

[1] It is not always easy to separate and distinguish between the fossils of the *opalinus*-zone and those of the *Murchisonæ*-zone

or less a repetition, on a reduced scale, of the Bradford Abbas section. Gasteropoda from more than one horizon are far from scarce. The Lower Division preponderates.

Stoford Sands Quarry.—No Gasteropoda are known to me from here, but it is interesting as containing a shell-bed about forty feet below the Inferior Oolite Limestone with *Am. radians*, *Am. Moorei*, &c., plainly showing where the horizon of the Gloucestershire Cephalopoda-bed must be sought. Mr. H. B. Woodward considers that these shell-beds occur at more than one level in the Yeovil Sands.

Bradford Abbas.—There has been more than one quarry worked in this parish; and it can hardly be doubted that many of the fossils from these quarries and from Stoford, &c., are labelled and quoted "Yeovil," which town happens to be on the Middle Lias.

Although there is only about twelve feet of limestone here, the life-history of the Inferior Oolite is well represented in this quarry, which may be compared with the cliff section at Burton Bradstock (Profile No. 1) of about the same thickness. I have no Gasteropoda from the lowest or *opalinus*-zone, if indeed it occurs here, but the Paving-stone bed is an excellent repository of the fossils of the *Murchisonæ*-zone, which may be also proved in the railway-cutting, a short distance to the south. Thirteen inches of stone in this quarry are the Dorsetshire representatives, in all probability, of most of the *fimbria*-stage of the Cotteswolds. This may be shown by the Ammonites. The resemblances between the Gasteropoda of the two regions is less obvious. Indeed, we are never so strongly reminded of the differences between the two districts as at Bradford Abbas, because it is here that the *Murchisonæ*-zone has been most successfully worked for fossils, so that comparisons are more possible than elsewhere.

The following is an extract from an Excursion Report of the Geologists' Association[1] with reference to this bed. "The 'Paving-stone bed' is a slabby ironshot Oolite, which comes off just above the 'Dew-bed,' and is used for gutters, &c. The true *Harpoceras*[2] *Murchisonæ* occurs here, as also the var. *Bradfordiensis*, S. S. Buckman. That author says of *H. Murchisonæ* that it marks a distinct zone which is just on the top of the Sands or passage-beds. This zone is about a foot thick at Bradford Abbas, but about three or four feet at Corton and Hawthorn Downs." At Bradford Abbas the Gasteropoda of this zone are in fairly good spathic condition, though not equal to the bed above. The matrix is a rather harsh calcareous rock, yellowish for the most part where the iron is peroxidised, and moderately ironshot. Sometimes the shells have perished considerably. It is not at all times certain that the fossils have not been mixed somewhat with those from the bed above, with which no doubt they are closely allied. Certain genera, however, are greatly predominant, such as *Cirrus*, though this is probably less

[1] 'Proceed.,' vol. ix, No. 4.

[2] Now called *Ludwigia*.

Profile No. 4.—East Hill Quarry, Bradford Abbas.

(Section complete.)

			Position of the Fuller's Earth.
UPPER DIVISION.	Parkinsoni-zone.	6′ 6″	Whitish Limestone in several beds, with occasional specimens of *Am. Parkinsoni*, Brachiopoda, &c., and a few **Gasteropoda**, but no definite shell-beds.
		0′ 6″	Marl-bed with *Terebratula Morieri* and *Rhynch. parvula*, and small Gasteropoda.
	? H.-zone.	0′ 6″	Rotten-bed with large *Astarte*.
		0′ 6″	Irony stone.
LOWER DIVISION.	Sowerbyi-zone.	2′ 0″	These blocks of stone contain the chief "fossil-bed" in the so-called *Sowerbyi*-zone, Gasteropoda. *Am. concavus*.
	Murchisonæ-zone.	1′ 1″	*Am. Murchisonæ*. Gasteropoda. Paving-stone bed.
		1′ 2″	"Dew-bed.
		12′ 3″ Total.	Yeovil Sands.

abundant than at Stoford and Coker. The species of *Amberleya*, too, are rather numerous, and differ somewhat from those of the *Sowerbyi*-bed; there are also species of *Onustus* allied to *O. pyramidatus*, Phil., which seem rather peculiar.

The real "fossil-bed" of Bradford Abbas occurs in two blocks. This stone when peroxidized is also a yellow ironshot Oolite, but it is much softer and more marly than the Paving-stone bed. Hence it is favorable for development, and few fossil-bearing rocks in the English Oolites work better. The fossils are in good spathic condition for the most part, but there is some variety in this, as also in the matrix, due probably to slight differences of position and possibly of horizon. As regards the name *Sowerbyi*-bed, since none but the initiated can pretend to know what the "true *Sowerbyi*" is like, it is difficult to say whether it occurs here. Mr. S. S. Buckman, if I remember rightly, once told me that it was very scarce. The most characteristic Ammonites of this bed, and indeed of this horizon throughout North Dorset, are those allied to *Am. concavus*, which we must regard as a near relative of *Am. Murchisonæ*. As far as my experience goes, if the "true *Sowerbyi*" has any resemblance to Sowerby's figure in the 'Mineral Conchology,' that form is far more common in the so-called *Sauzei*-bed of Oborne than in the so-called *Sowerbyi*-bed of Bradford Abbas. It may be that in that part of Germany whence Oppel, and after him Waagen came, the true *Sowerbyi* is plentiful in the bed that bears its name, but such is not the case with us. Now, there can be no doubt, as I hope has been already made clear, that the zone in question corresponds to a portion at least of the Norman "Mâlière;" indeed, this is shown to be the case by Waagen himself. Yet I cannot find in the works of M. Eugène Deslongchamps any evidence that the "true *Sowerbyi*" is in any way characteristic of the Norman "Mâlière," though *Am. concavus* is held to be so. As this is the most important bed for Gasteropoda hitherto discovered in the English Oolites, there should be as little obscurity as possible about its position in the geological scale, and we should endeavour, for the Dorsetshire District, to seek our parallels in Normandy rather than in Wurtemberg. Since it is recognised as the *Sowerbyi*-bed, let it be known that in this country the recognition can only be granted on the *lucus a non lucendo* principle, and that the name *concavus*-bed or beds would with us be far more appropriate.

It may interest some of the readers of the Palæontographical Society to know that this remarkable bed, which was sedulously worked for many years by the late Professor Buckman, attracted the attention of the late Dr. Wright. In the year 1856 the results of his impressions on North Dorset were published in the 'Quarterly Journal of the Geological Society' (vol. xiii, p. 309). Dr. Wright was then disposed to correlate the Bradford Abbas fossil-bed with the Frocester Cephalopoda-bed, or zone of *Am. radians*, and he named it *the* Cephalopoda-bed, which for him formed a portion of the Lias. Hence Professor Buckman complained

that he saw in some collections fossils from his own fossil-bed at Bradford Abbas marked "Lias." Now, if we regard the "Marnes Infra-oölithiques" of Eugène Deslongchamps as forming a portion of the Lias, then the *concavus*- or *Sowerbyi*-bed of Bradford Abbas will fall into that category; but in this case the greater part of the Inferior Oolite in England will have to be relegated to the Lias, a proposition which must not be entertained for a moment. At the same time it cannot be too often insisted on that our *Sowerbyi*-bed forms no portion of the Oolite of Bayeux. It distinctly belongs to the *Lower Division* of the Inferior Oolite, and constitutes its highest member. Hence we shall find that the Gasteropoda differ considerably from those of the Bayeux Oolite, and that is one reason why so many species hitherto unknown are found there. It follows from this that Dr. Wright was equally mistaken when, rushing from one extreme to the other, he afterwards placed the Bradford Abbas fossil-bed in the *Humphriesianus*-zone ('Quart. Journ. Geol. Soc.,' vol xv).

Amongst the Gasteropoda of the "fossil-bed" there are several species of *Purpurina*, some decidedly new. *Spinigera* is well represented, and that too by some new and curious forms. The species of *Alaria* are not without resemblance to those described by Schlumberger from the East of France. As regards *Cerithium*, the prevailing species in the beds of Bayeux are here represented by related rather than by identical forms, whilst the rarer and less widely distributed species would appear to be altogether different. Much the same may be said with regard to the other genera, and if we seek for a complete antithesis in England, it may be sought in the almost equally rich shell-bed (P_1) at Burton Bradstock, which contains extremely few species identical with those of the bed now under consideration. The exact equivalents of the "*Sowerbyi*-bed," as known in North Dorset, are by no means clear in the Cotteswolds, nor, for the matter of that, in any other part of England, so far as I am at present aware.

The two thin beds which succeed in the quarry are of but little interest for us. The "rotten-bed," which is so full of *Astarte obliqua*, may possibly be an attenuated representative of the *Humphriesianus*-zone. In point of thickness more than half the quarry belongs to the *Parkinsoni*-zone. Here we would fain institute a comparison with the same zone as developed at Burton Bradstock. The conditions are different, however, and we can hardly see in the marl-bed with *T. Morieri* the exact equivalents of P_1. Nevertheless, both here and in the white limestone above, the species of Gasteropoda which do occur are mostly identical with those noted from the same horizon on the coast.

Halfway-House Quarry is rather nearer to Bradford Abbas than to Sherborne, and to some extent partakes of its nature and characteristics. I do not know of many Gasteropoda having been obtained from here. The usual grey calciferous grit called the "Dew-bed" forms the base, and above this occur some four feet of

massive and partly ironshot limestone, full of keeled Ammonites, many of which belong to the *concavus* group. *Terebratula perovalis*, var. *ampla*, is characteristic of the higher block. Mr. Whidborne has obtained a few good Gasteropoda from here, which appear to me to have been procured from the *concavus*-bed or beds. These then belong to the Lower Division.

A few inches of rather fossiliferous brash, with many *Astarte obliqua*, separates the *concavus*-beds from the undoubted *Parkinsoni*-beds. Very large specimens of the var. *Dorsetensis* are obtained from the lowest beds, which also have yielded a few Gasteropoda. A great physical change comes on here in the thickening of the Upper Limestones above the main fossil-bed, the total thickness of limestone exceeding thirty feet, which is very different to anything hitherto noted, where the usual thickness of the Inferior Oolite Limestone has not much exceeded twelve feet.

Louse Hill.—This place is near Halfway House. I have not been to it myself, but there is said to be a thin ferruginous bed which yields fossils of the *Humphriesianus*-zone. I have a great many specimens of *Pleurotomaria* from here, but few if any are fit for figuring.

Sherborne.—Two and a half miles east of Halfway House. There are several quarries, especially towards the north-west of the town, where the Inferior Oolite has been worked. Immense numbers of Ammonites have been obtained from these, and from excavations for houses. More than one zone is well developed, but as I have few if any Gasteropoda from here, a detailed description would be superfluous. The fossils show that there is a rich development of the *Humphriesianus*-zone, but the bulk of the limestones, nearly forty feet thick altogether, are in the *Parkinsoni*-zone, which has yielded lately a splendid specimen of *Megalosaurus Bucklandi*, von Meyer. Speaking generally, however, the neighbourhood of Sherborne, especially Oborne and Milborne Wick, is famous for a good development of the *Humphriesianus*-zone. Indeed, this immediate neighbourhood is the only one in the Dorset-Somerset District where beds of that age occur to any extent.

Oborne (*Frogden Quarry*).—If Burton Bradstock gives us the Gasteropoda of the *Parkinsoni*-zone to perfection, if Bradford Abbas is still more famous for the Gasteropoda of the *Murchisonæ*- and *Sowerbyi*-zones, in this quarry we possess the best example which England affords of the beds of Bayeux—the "oölithe ferrugineuse," which is mainly characterised by *Stephanoceras* and *Sphæroceras*—in other words, the zone of *Am. Humphriesianus*. The traveller from Normandy by the route we have taken might well wonder what had become of D'Orbigny's typical Bajocian, but here it is at last.

Beginning from the base as usual, we note that the Lower Division of the Inferior Oolite is not represented by fossils in this quarry, though it is probably represented by some of the massive series of calciferous grits, which extend for a

Profile No. 5.—Frogden Quarry.

			Parkinsoni-zone, continued.
UPPER DIVISION.	Parkinsoni-zone.	3′ 0″	Pale fissile Limestones of the *Parkinsoni*-zone, with few fossils.
		5′ 6″	Alternations of brownish Limestone and brash, *Rhynch. spinosa*, &c. Lower down, small var. of *T. sphæroidalis*, peculiar form of *Cosmoceras*, &c.
	Humphriesianus-zone.	1′ 0″ H_3	The Cadomensis-bed. Gasteropoda. *Ter. sphæroidalis* abundant in the lower part.
		4′ 0″ H_2	Ironshot Oolites in strong blocks, especially characterised by large specimens of *Am. Humphriesianus* and *Blagdeni*. A few **Gasteropoda.**
		0′ 6″ H_1	The *Sauzei*-bed, or Marl with green grains. Gasteropoda.
LOWER DIVISION.		1′ 0″	Solid block of bluish-grey Limestone.
		15′ 0″ Total.	Calciferous grits, with fossils of the Lower Division.

considerable depth below the worked stone. The top of this series would be the "solid block of bluish-grey limestone," on which the so-called *Sauzei*-bed reposes. This *Sauzei*-bed is one of the most remarkable fossil-beds in Dorsetshire, and has mixed relations, no doubt, both with the Lower and Upper Divisions of the Inferior Oolite, though in drawing the line we must concede it to the Upper Division. This is another case of a misnomer, as far as Frogden Quarry is concerned, since it contains hardly any specimens of *Sphæroceras Sauzei*. Most of the Ammonites are keeled, which at first sight would militate against its being placed in the Upper Division. Again, what I conceive to be the "true *Sowerbyi*," or something very near to it, is far from being uncommon in this bed. All we can say, therefore, is that probably somewhere or other *Sphæroceras Sauzei* does characterise a bed which is about the same horizon, and contains a somewhat similar facies to this one.

The Gasteropoda in the *Sauzei*-bed are abundant and well preserved, and the matrix is on the whole favorable for extraction, being a soft, whitish limestone with green (? glauconitic) grains passing into the ironshot Oolite of the bed above. For the sake of distinction, and as indicating the position assigned to it, I call this bed H_1. The Gasteropoda seem to present forms that are intermediate between the "*Sowerbyi*-bed" of Bradford Abbas and the more recognised species of the *Humphriesianus*-zone. It is very rich in *Pleurotomariæ*, another characteristic which it shares with the beds of Bayeux; in some other respects it seems to possess features of its own.

At Milborne Wick the *Sauzei*-bed (H_1) seems more or less blended with the main *Humphriesianus*-bed (H_2), nor do I know of the distinctive development of this sub-stage anywhere else throughout the country.

The main mass of the *Humphriesianus*-zone (H_2) calls for few remarks. It is not particularly rich in Gasteropoda as far as my experience goes. Probably some of the specimens from H_1 in an ironshot matrix ought rather to be referred here.

The remaining sub-stage of the *Humphriesianus*-zone (H_3) deserves a little attention on our part. It is a thin bed of brown ironshot Oolite, mostly of a peculiar character, which lies just above a bed very full of *Terebratula sphæroidalis*. There is a most curious admixture of Ammonites. *Am. Martinsii* is common high up, and several species of *Cosmoceras* and *Oppelia* abound. *Cosmoceras Niortensis* and allied forms are especially numerous, and there occurs the curious little *Am. cadomensis*, which may well give its name to the bed, simply as a local name. Probably neither *Am. Humphriesianus*, nor *Am. Parkinsoni* properly so called occurs here, and it is evidently debateable ground between the two zones. It contains numerous species of *Astarte*, and many Gasteropoda. This horizon, or sub-stage, cannot be very far from that of P_1 at Burton Bradstock. However, this must be lower in the geological scale, though not much. The Gasteropoda occur for the

most part in a brown-coloured rock of very meagre touch, more or less charged with ironshot ova which have a great tendency to fly upon fracture, leaving cavities which give the rock a somewhat carious aspect. This bed has greater resemblance to the usual Dundry matrix than any fossiliferous bed with which I am acquainted in Dorsetshire, and its Gasteropoda are in a peculiar condition in many respects. A very characteristic fossil is *Pseudomelania coarctata* or *turris*, and this fossil shows the fine spiral lines in many cases to great perfection. This likewise is almost the only bed known to me in England where the wavy colour bands of *Pseudomelania* are preserved to any great extent, as in the Normandy beds. The species of Gasteropoda for the most part have strong affinities with those of H_1 and H_2, yet with certain differences which deserve to be recorded.

In order to show the degree of analogy, not to say of similarity, which exists between the remarkable exposure at Oborne and the "Oolithe ferrugineuse" of Normandy, I give an abstract of Eugène Deslongchamps' remarks with reference to its development in the Department of Calvados.[1] He observes that this formation, never more than two mètres in thickness, forms the base of what is for him the Inferior Oolite in the greater part of the Department. It is composed of a yellowish or greyish limestone, sometimes more or less siliceous, and contains a quantity of ironshot (ferruginous) Oolites which give it altogether a peculiar aspect. It is besides remarkable for the enormous quantity of Cephalopods, Gasteropods, and Bivalves which it contains. *It is possible to distinguish in most cases three beds.*

The lowest of these is a kind of conglomerate or rather nodular bed, which contains remanié fossils from the upper part of the "Marnes Infra-oolithiques," which, as we have already seen, corresponds in the main to the Lower Division of the Inferior Oolite. Hence in Normandy there is a break between the Lower and Upper Division, and this break is still more marked in the greater part of the Dorset District; since, in most places, only a doubtful fragment of the *Humphriesianus*-beds intervenes between the Lower Division and the *Parkinsoni*-zone. It may be a matter of doubt how far the lowest bed of the "Oolithe ferrugineuse" corresponds to the so-called *Sauzei*-bed of Oborne, except that it seems to contain a considerable mixture of Ammonites (*Am. Sowerbyi* amongst the number) and a crowd of Gasteropods, amongst others great Pleurotomarias so characteristic of the true "Oolithe ferrugineuse."

The second and thickest bed, says M. Deslongchamps, is the true ferruginous Oolite, the hardness of which is usually considerable, and which is pierced by small ironshot Oolites. This formation, the richest of all in fossils, appears to be characterised by *Am. Humphriesianus*, which here acquires a great size. We can scarcely fail to recognise in this the main mass of ironshot Oolite at Oborne (H_2),

[1] Op. cit., p. 105.

which is enormously rich in large Cephalopods, though not quite so good for Gasteropoda as the top and bottom beds of the series.

In the Department of Calvados there is a third bed where the ferruginous Oolites become scarce and less well defined. This is characterised by the abundance of *Am. Niortensis* and *Am. Parkinsoni interruptus*, by large varieties of *Pleurotomaria mutabilis*, by *Pl. bessina* and *Pl. scalaris*, and by "*Turbo*" *duplicatus*. Specimens of *Terebratula sphæroidalis* are more abundant than in the second bed, and *Ter. Phillipsii* may be noted. This description probably fits better with our *Cadomensis*-bed (H_3) than either of the other two with their presumed equivalents. The abundance of the peculiar group of *Cosmoceras* indicated by *Am. Niortensis* and *Am. Parkinsoni interruptus* is very suggestive, since this is exactly what we find in H_3 at Oborne. Just as coming events cast their shadows before, so did these precursors of the grand army of *Cosmoceras* prepare the way for the reign of *Am. Parkinsoni* which was shortly to set in.

Milborn Wick.—This is a roadside exposure, one and three quarter miles north-north-east of Frogden Quarry, where a peculiar phase of the *Humphriesianus*-zone presents itself. About nine feet of rock is exposed, of which the lower three feet are simply calciferous grits (Dew-beds). The "fossil-bed" is about eighteen inches thick, and consists for the most part of a softish white limestone, not unlike the marl with green grains at Oborne. In the upper part are numerous species of *Sphæroceras*, whilst in the lower part *Am. Humphriesianus* and *Am. Braikenridgii* are not uncommon. *Ter. sphæroidalis* occurs in the upper part of the fossil-bed. But few Gasteropoda are quoted from here.

Development of the Humphriesianus-*zone in Dorset–Somerset.*—A line drawn from near the town of Sherborne in a north-easterly direction to Milborn Wick (Somersetshire) is about three miles in length, and this line coincides with the principal development of these beds in No. 1 District, a development by far the most important in England, though the zone is very well represented at Dundry. Henceforth, as we pass northwards into Somersetshire, the character of No. 1 District undergoes considerable modification.

Corton Down Quarry.—Between three and four miles due north of Sherborne. The Lower Division is again well represented here, since many specimens of *Am. Murchisonæ* are quoted. No traces of the *Humphriesianus*-zone were observed by me.

Beyond this the exposures are lacking in interest from our point of view until we arrive in the neighbourhood of Castle Cary. To the south-east, east, and north-east of this town are three exposures in the Inferior Oolite, which have yielded a fair number of Gasteropoda. As this is a district but little known, the following particulars may be interesting.

Woolston Quarry.—Seven miles north by east of Sherborne, and three and a half miles south-east of Castle Cary. About seventeen feet of limestone are worked in this quarry, the whole of which is probably in the *Parkinsoni*-zone. It is noteworthy that the Cephalopod facies hitherto so characteristic of No. 1 District here begins to fail us, and immense quantities of Brachiopoda characterise the beds. As the same facies is still better shown in Grove Quarries, together with probably a more complete section, I will at once proceed to their description.

Grove Quarries (see *Profile*, p. 52).—One and three quarter miles east-south-east of Castle Cary. The South Quarry is nearer to Shotwell Farm than to Grove Farm. The face is not so well weathered, but here, as in the other quarry and also at Woolstone, the fossils are mainly obtained on fissure surfaces. The stone itself will not work so as to admit of the fossils being extracted along the partings, like the stone of Bradford Abbas and elsewhere. Hence, only those specimens which weather out are obtained. This peculiarity would seem to hold good throughout the same horizon in No. 2 District likewise.

This particular quarry has the advantage over the others that it seems to afford a tolerably complete section of the Inferior Oolite Limestone at this point. The basal bed, only a few inches thick, is most probably in the Lower Division resting directly on the sands. For palæontological purposes, therefore, everything outside the *Parkinsoni*-zone is atrophied in this immediate neighbourhood. The brown limestones in thick blocks, measuring about nine feet, constitute the most interesting feature, and if these beds require a name we might call them the Trigonia Grits. The rare presence of *Am. Parkinsoni* at the base is quite sufficient to make us feel safe as to the geological position. Roughly speaking, we may represent this fine mass of fossiliferous rock as being on the horizon of P_1 of the coast-section, and as the representative of the Upper Trigonia Grit of the Cotteswolds, which it does to a certain extent prefigure. It is, however, richer in Gasteropoda than the Upper Trigonia Grit and thus helps to maintain the character of the Dorset-Somerset District in spite of its poverty in Cephalopoda. In the north quarry, which is more properly speaking Grove Quarry, the Trigonia Grit is about the same thickness (nine feet), and the joint face of these beds was one mass of fossils before the chisels of collectors began to deface the entablature.

The species of Gasteropoda are clearly those which distinguish the lower beds of the *Parkinsoni*-zone throughout the district, and have certain affinities with some of those of the *Humphriesianus*-zone, but hardly any with the Gasteropoda of the Lower Division such as are obtained in abundance at Bradford Abbas. Owing to the rough nature of the matrix the specimens cannot be placed in the first rank as to condition. Varieties of *Cerithium sub-scalariforme* and the so-called *C. contortum* are plentiful. The latter is especially characteristic of this horizon, and may be traced even into the Cotteswolds.

Profile No. 6.—Grove or Shotwell Quarry.

		Position of the Fuller's Earth.
UPPER DIVISION. *Spinosa*-stage, or *Parkinsoni*-zone.	10′ 0″	Thin-bedded, whitish Limestones, much broken towards the top, with a sprinkling of Brachiopoda, and at base a bed of *Terebratula globata*.
	9′ 0″	Brownish earthy Limestones in large blocks, weathering dark brown. GASTEROPODA. *Trigoniæ*, *Rhynchonella spinosa* throughout. *Am. Parkinsoni* at base (rare).
	3′ 6″	Softer pale-coloured stone. The lowest bed contains *R. spinosa* and small *Stephanoceras*.
	0′ 6″	Calciferous grit with keeled Ammonites.
	23′ 0″ Total.	? Yeovil Sands.

The upper beds at Woolston, Shotwell, and Grove contain a scattering of Brachiopoda including *Rhynch. spinosa*, and in the two latter there is a distinct *Terebratula*-bed chiefly made up of a variety of *T. globata*. These beds then would seem to prefigure the *Clypeus*-grit; and on this horizon, if anywhere in the Dorset-Somerset District, specimens of *Nerinæa*, which has hitherto failed the collector, should be sought.

Pitcomb Road.—Two and a half miles east by north of Castle Cary. This is the last exposure in No. 1 District of beds containing any noteworthy quantity of Gasteropoda. It is a small roadside section. Reposing directly upon soft yellow sand-rock, believed to form part of the "Yeovil Sands," is (1) a calcareous or subcalcareous bed with shells, fourteen inches thick; (2) a rich shell-bed with many Cephalopoda and some Gasteropoda, thirty inches thick; and (3) pale-coloured limestones, of which three or four feet are exposed in the road cutting. After the experiences of Grove and Woolston this is certainly a surprise, since this "fossil-bed" is clearly not in the *Parkinsoni*-zone. The prevailing Ammonites are keeled, and may be on the horizon of those in the *Sowerbyi*-bed at Bradford Abbas. Perhaps we may obtain further evidence.

Résumé of the North-eastern half of the Dorset-Somerset District.

One very striking feature is the difficulty of predicating for any given neighbourhood on what horizon the main fossil-bed shall lie. All the zones, except perhaps the *opalinus*-zone, are well represented, and teem with most beautifully preserved Gasteropoda, some in one place and some in another. Consequently this has for years been the favourite hunting-ground of collectors. A very considerable proportion of the Gasteropoda selected for description in the accompanying Memoir are from this division of No. 1 District, and they are on the whole in by far the best state of preservation. Compared with these the Gasteropoda of the remaining districts are disappointing.

Border region of the Mendips.

If we allow, for purposes of delimitation, that the prolongation of the Mendip axis shall be considered to divide District No. 1 from District No. 2, yet there is a considerable portion of the Inferior Oolite outcrop on both sides of this axis which contains no shell-beds with Gasteropoda, and with which we need not trouble ourselves. The country from Brnton to Radstock, a distance of twelve miles if measured in an air-line, but more if we trace the edge of the outcrop in the neighbourhood of Frome, will be comprised in this border region. This presents many features of interest to the physical geologist, containing in some

places, and notably near Doulting and Cranmore, under the very shadow of the Mendips, thick beds of freestone of Inferior Oolite age, as also at Old Ford, near Frome. The well-known section at Vallis, where something like fifteen feet of Inferior Oolite rests on the Carboniferous Limestone, seems to show that only beds of the age of the *Clypeus*-grit were deposited upon the old ridge at that spot. Why the vicinity of the old reef should have been unfavorable to the accumulation of shell-beds with Gasteropoda is very difficult to say. But we find in all cases the border regions to be less rich than the central parts of the several districts or basins.

Details of the Cotteswold District. (No. 2.)

In a sense strictly topographical the country between Frome and Bath can scarcely be regarded as forming part of the Cotteswold Hills, though, to a certain extent, a physical continuation of that range. The exposures of Inferior Oolite throughout this portion of No. 2 District are neither numerous nor important in a palæontological sense. We have already seen that thick beds of pale-coloured oolitic rock (freestones) on both sides of the Mendips replace the rich shell-beds and ironshot Oolites of No. 1 District. This phase continues for some distance north of Frome. The evidences of Gasteropoda are slight, yet not devoid of interest; there is, however, one great drawback, viz. that most of these fossils are in the condition of casts. The high ground north of Radstock is capped by a sort of plateau of Inferior Oolite, and here the following exposures were examined.

Clan Down.—One and a half miles north-west of Radstock. There are several shallow pits on this down, where the upper beds of the Inferior Oolite have been worked. Of the general development of Inferior Oolite at this spot, and whether there is any representative of the Lower Division, I am ignorant. The unconformity must be considerable, since the Inferior Oolite is represented in the Survey map as resting on Lower Lias; in one pit, where seven feet of beds are exposed, the upper portion consists of a shivery whitish limestone with a variety of *Terebratula globata* scattered about, and containing a shell-bed with *Trigonia* and *Nerinæa* in casts, also *Natica Bajocensis* and a small *Trochus*. Below this is a much harder block of stone. *Nerinæa* occurs in casts, rather numerously at the top, and also in a shell-bed lower down. There is more than one species, but *Nerinæa Guisei* is most probably one of them. As we shall see subsequently, this is a very well-marked horizon in the *Clypeus*-grit, and it is extremely interesting to have obtained proofs of it thus early in our examination of the Cotteswold District. As far as we know at present, this is the most southern locality in England where *Nerinæa* has been found to occur in the Inferior Oolite, and abundantly too, since there are no less than three shell-beds traceable here.

Red Post Quarry.—Due north of Radstock on the Bath road. There are twenty-one feet of beds exposed here, made up of oolitic grains and comminuted shelly matter in small granules. It is pale in colour, but weathers brown, and may be regarded as an inferior freestone. There are a few fossils here and there, and low down occur traces of a *Trigonia*-bed, but the most interesting feature for us is a line of hardish stone, between three and four feet from the top, which contains casts of a *Nerinæa* with very complicated folds (*Ptygmatis*). We cannot help contrasting these thick and comparatively unfossiliferous exposures, entirely confined to one zone of the Inferior Oolite, with the dozen feet or so of Burton Bradstock or Bradford Abbas, full of organic remains, and exhibiting, if not the entire formation, yet most excellent representatives of both the Upper and Lower Divisions. There are a few other exposures in this neighbourhood of the same horizon containing *Nerinæa*, and notably one at Carnicot.

Twerton Hill.—We pass over a considerable extent of country without finding much of interest in the Inferior Oolite, until within one and three quarter miles west-south-west of Bath. At the Mission Chapel there are two exposures, one on either side of the road. In that on the east side the Fuller's Earth may be seen atop, and below this about fifteen feet of rough freestone is worked. The upper portion is very white and chalky. About ten feet down the stone becomes firmer, and here occurs a shell-bed in very fine Oolite, which contains *Nerinæa Guisei* and another species, also an *Alaria* and numerous *Trigoniæ*, *Ostreæ*, &c.

On the opposite side of the road is a disused quarry, where the face of rock is somewhat limited. Towards the top is a shell-bed with *Nerinæa* and corals, and hereabouts may be noted *Ceromya striata*, *Pholadomya Heraulti*, and several species of *Myacites*, some in a vertical position. This deposit rather reminds us of the *Pholadomya*-grit, a term given by Lycett to the series of beds usually known as the *Clypeus*-grit. The point to observe here is that, although there are fifteen feet of rock, only the very highest series of beds are exposed, and these contain *Nerinæa*, like their equivalents near Radstock.

Midford.—Three miles south-south-east of Bath. Owing to a cutting on the high road we obtain here a complete section of the Inferior Oolite Limestone—the first that we have seen in No. 2 District. There is probably about forty feet of rock, and the whole of this mass belongs to the Upper Division. Indeed, we may go closer than this, and regard it as mainly, if not wholly, within the *Parkinsoni*-zone, since *Ammonites Martinsii* occurs quite in the lower stage, which appears to me to represent the Upper Trigonia Grit of Stroud and Cheltenham. In that case the Inferior Oolite Limestone of this section would be the equivalent of the entire Upper, and part of the Lower, Ragstones of the Cotteswolds proper. There are but few Gasteropoda from here, and I should scarcely have ventured to say so much about it but for the fact that the *Midford Sands*, which underlie this limestone,

have been taken to represent the Sands of the Gloucestershire Cephalopoda-bed. In default of fossil evidence this is a dangerous assumption, since the whole of the Lower Division of the Inferior Oolite is absent as a limestone, and may possibly be represented by the upper portion of these same Midford Sands.

Freshford.—This is a section in the Avon valley about four miles south-south-east of Bath. Only a portion of the Upper Division of the Inferior Oolite is seen here. It contains a *Clypeus*-grit Fauna, and there are traces of the horizon of *Nerinæa Guisei*.

The sections above detailed, from Clan Down to Freshford inclusive, may be taken to give an idea of the general development of the Inferior Oolite in thelittle known country between the Mendips and the Avon valley. Whether the Lower Division is developed at all in that area is unknown to me. We should certainly expect to find it on the escarpment, where possibly it exists without being quarried. But opposite the escarpment, and about eight miles nearly due west of Twerton Hill, occurs the remarkable outlier of

Dundry Hill.—This place is one of the most classic in the annals of the Inferior Oolite, since so many of Sowerby's types come from here ; and it has also furnished the Bristol Museum with the greater part of the material so well elucidated by my lamented friend, Tawney, in the 'Dundry Gasteropoda.' I have already pointed out the anomalous character of this exposure of Inferior Oolite. It might be almost regarded as constituting a district by itself, so curiously does it combine the characters of No. 1 District with those of No. 2. Still, although it lies north of the Mendips, we must hold that its affinities with the Inferior Oolite of Dorset and Normandy far exceed any resemblance which it possesses to the main mass of the Cotteswold Oolite. Judging from the fossils, it is probable that more than one horizon has contributed its quota to this assemblage; though perhaps the highest beds are so loaded with massive *Thamnastræa* as not to have afforded much space for the accumulation of shells. In the present condition of the available exposures it is by no means easy to construct an intelligible section of the Inferior Oolite in this remarkable hill. Instead of going into the question of horizons we must be content to take the fossils as we find them in the various museums—at least for the present.

The Cotteswold Hills.

The range of the Cotteswolds may be said to commence north of the deep valley of the Avon, whence it continues in an almost unbroken escarpment for many miles. There are no exposures of any importance, as far as I am aware, until we reach the neighbourhood of Little Sodbury, some ten or twelve miles from Bath. This circumstance probably arises from the facility with which Carboniferous

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A MONOGRAPH

OF THE

BRITISH JURASSIC GASTEROPODA.

BY

WILFRID H. HUDLESTON, M.A., F.R.S., Sec.G.S.

PART I, No. 2.

GASTEROPODA OF THE INFERIOR OOLITE.

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Limestone can be obtained from the vicinity of Doynton, and also to the fact that there are several quarries on the plateau in the Great Oolite. The village of Little Sodbury is noteworthy as the place whence the Rev. Mr. Steinhauer supplied Sowerby with the types of *Trochus concavus*, *T. duplicatus*, and *T. dimidiatus* previous to the year 1818 ('Min. Conch.,' vol. 2, p. 180, pl. 181, figs. 3, 4, 5). As Little Sodbury itself is upon the Lias, these fossils must have been obtained from the Inferior Oolite quarries towards the top of the Cotteswold escarpment. The old parish pit in Mr. Steinhauer's time was situated at the very top of the road which leads straight up the hill, from the village, and is about half a mile south of the large quarry on Horton Hill.

Horton Hill Quarry.—This place is such a long distance from any convenient town, being about half way between Bath and Stroud, though somewhat nearer the latter, that it has always remained more or less a *terra incognita* to palæontologists. The exposure is an extremely interesting one, as affording us an insight into the development of the Inferior Oolite between the two points.

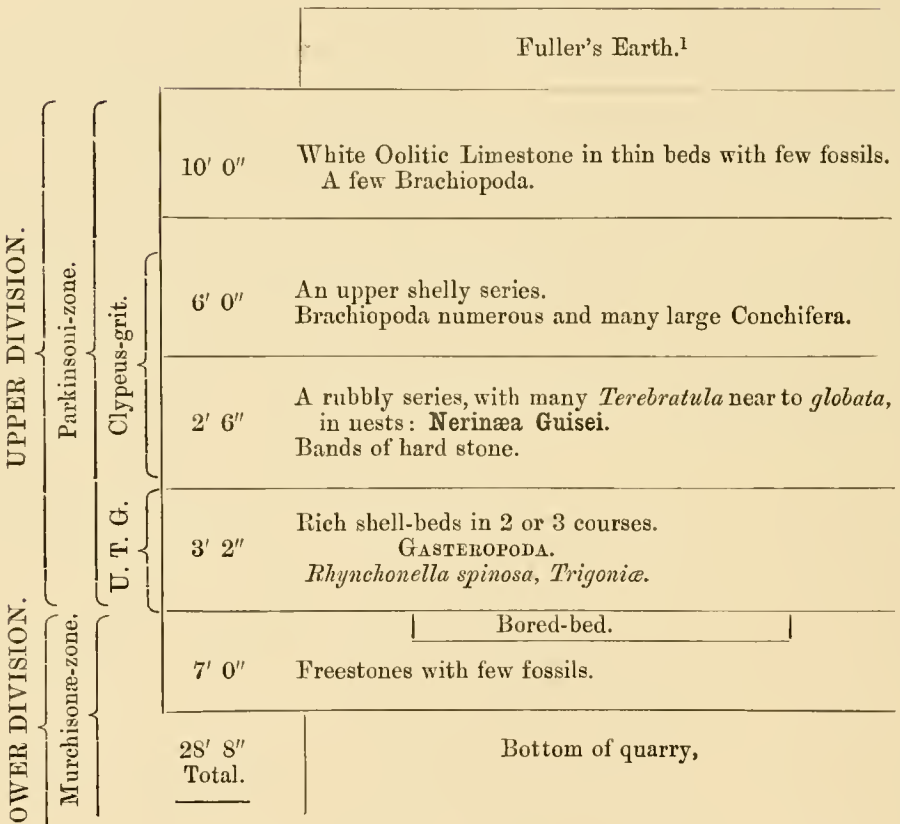
Commencing as usual at the base we find a somewhat variable thickness of poorly fossiliferous freestones. The top of this series is indurated and bored, affording evidence of a used surface, and thereby to a certain extent of uncomformity. The exact age of this series is not easy to determine, though it may be safely set down to some part of the *Murchisonæ*-zone, such as yields the greater part of the freestones or fine grained oolites of the Cotteswolds. Below Hawkesbury Upton not less than thirty feet of these beds are exposed.

The break between this and the rich shell-beds with Gasteropoda is most complete, lithologically and otherwise. There can be little doubt that these courses are the equivalents of the Upper Trigonia-grit of Stroud, &c. *T. costata* is very large and abundant, whilst the Clavellate species are less numerous. No Ammonites were found, but *Rhynch. spinosa* is not uncommon and often of considerable size. From this series, but especially from the lower course of stone, a considerable number of Gasteropods have been obtained. These fossils were associated with the large Conchifera in the ordinary way, but weathering for a long period had developed them to a considerable extent. Though fairly numerous, they are far less so than the Conchifera, &c. This horizon cannot fail to remind us of the one at Grove (see *Profile No.* 6), and there is one fossil here which has never yet been found by me, except in this instance, beyond No. 1 District, viz. *Cerithium? contortum*, Desl., so characteristic of the *Parkinsoni*-beds of the south. Once more, then, we gather a rich harvest of Gasteropods on the horizon of P_1 of Burton-Bradstock Cliff. The absence of any representative of the *Humphriesianus*-zone at Horton Hill seems to be complete. Sometimes these beds occur in three courses.

It is extremely interesting to obtain above this a horizon defined by abundance

Profile No. 7.—Horton Hill Quarry.

(Section incomplete.)



[1] In this and the succeeding Profiles it is not intended to imply that the Fuller's Earth is, in all cases, visible in the actual section.

of *Terebratula* near to *globata*, and especially by *Nerinæa Guisei*, which has never failed us since we entered No. 2 District. As we shall see presently, this certainly represents a portion of the *Clypeus*-grit. The upper shelly series, measured in the Profile as six feet, is in fact an accidental and extremely variable development, since towards the south end of the quarry the shells of this horizon have almost disappeared, whilst the highest beds of all represent a phase which is not uncommon in the Cotteswolds, but which would seem to possess but little palæontological interest. Altogether the Upper Ragstones are very fully developed in Horton Hill Quarry.

Travelling northwards we are able to obtain a nearly complete section of the entire Inferior Oolite in the ridge which forms a continuation of Symonds Hall Hill on the other side of Wootton-under-Edge. The Inferior Oolite limestones are now seen to attain a considerable thickness, and the Gloucestershire Cephalopoda-bed, or zone of *Am. radians*, is exceedingly well developed. Above it we perceive between thirty and forty feet of freestones (fine-grained oolite and broken-shell rock); towards the middle of this there is a slight unconformity in connection with a bed of *Nerinæa*. The top of the Freestone series is bored and hardened indicating unconformity to a marked extent. The whole of this Freestone series belongs in all probability to the *Murchisonæ*-zone. Above this we perceive a repetition of the Horton Hill sequence, viz. that a representative of the Upper Trigonia-grit rests directly on the freestones without any intervening Gryphite-grit. At this place, too, *Nerinæa Guisei* may be found in its usual position in the *Clypeus*-grit.

Nailsworth Hill.—The town is about six miles east-north-east of Wootton-under-Edge, and nearly twelve miles north-north-east of the exposure at Horton Hill previously described. Many of Lycett's specimens, now preserved in the Jermyn Street Museum, are labelled "I. O., Nailsworth Hill," though unfortunately the horizon is never indicated. As I have myself obtained a considerable number of Nerinæas from this locality, I append a complete profile of the Inferior Oolite of this district, mainly based upon the exposures on Scar Hill.

The lowest beds in this section partake of the Wootton and Frocester type. At the latter place Oppel[1] runs the Lias boundary (Lias-Grenze) between the *radians*- or *jurensis*-zone, and the *opalinus*- or *torulosus*-zone. A few Gasteropoda are obtained from this *opalinus*-zone in different parts of the Cotteswolds, but usually their condition is not favorable to accurate determination.

Considerable attention has been drawn to the small Gasteropods of the Lower Limestone, most of which, in addition to being extremely minute, are sadly rolled and defaced. *Cerithium* is the prevailing form. Mr. Witchell recently exhibited some of these at the Geological Society in illustration of a paper on the

[1] 'Juraformation,' p. 296.

Profile No. 8[1].—Nailsworth Hill and District.

(Section complete.)

			Fuller's Earth.
Upper Division.	Parkinsoni-zone.	3′ 0″	Oolite with few fossils.
		8′ 0″	*Clypeus*-grit series, with bed of *Terebratula globata* towards the top. **Nerinæa Guisei** below.
		4′ 0″	Upper Trigonia-grit.
		4′ 0″	Grit without gryphite.
Lower Division.	Murchisonæ-zone.	35′ 0″	Bored-bed. Thick-bedded Oolitic Freestones. *Nerinæa*-bed in upper part,[2] but no "Oolite marl" with *T. fimbria*.
		3′ 0″	Pea-grit, with several species of *Nerinæa*, especially at Longford's Mill.
		25′ 0″	Broken-shell Limestone and Oolite, with a few Gasteropods much rolled. (Lower Limestone of Mr. Witchell.)
	A	9′ 0″	Sandy, with a shell-bed towards the base. *Opalinus*-zone.
	B	5′ 0″	Gloucestershire Cephalopoda-bed, or zone of *Am. radians*.
		96′ 0″ Total.	Sands.

[1] Partly derived from observation, partly from other sources.

[2] Another bored-bed below the Nerinæas.

A *Opalinus-* or *torulosus*-zone. B *Radians-* or *jurensis*-zone. There is no intention here of entering into minute particulars as to the exact boundaries. The whole question of the *opalinus*-zone in the Cotteswolds is one of considerable obscurity. The Gasteropoda are scarce and in a bad state of preservation.

Lower Beds of the Inferior Oolite.[1] A list of those determined is given at p. 270. It was likewise, I believe, the opinion of Prof. R. Tate that several undescribed species of Gasteropods (minute) were to be found in this series. Hitherto I confess that my own researches have not been very successful. Moreover, if Mr. Witchell's specimens are to be taken as a sample, there are not many people who would venture to describe them. Whilst on the subject of these Micromorphs I may observe that the Pea-grit of Leckhampton, Crickley, &c., contains several small Gasteropods, many of which appear to be merely the young of well-known species. As such extremely small shells would require different artistic treatment from the bulk of the Gasteropoda to be described in this memoir, it might be convenient to place them in a separate category by way of supplement; that is to say, if they should prove to be of sufficient importance.

The Pea-grit is exposed on the flank of the hill, and on this horizon the earliest[2] Nerinæas in the Cotteswolds may be noticed. The same bed is well shown in a roadside cutting near Longford's mill, and has there afforded several species of *Nerinæa* usually distinct from those of the Oolite Marl. High up in the freestone series is another bed with *Nerinæa*, which may probably represent the extremely rich beds in connection with the Oolite Marl on the other side of Stroud. The third Nerinæan horizon is that in the *Clypeus*-grit, which we have now traced continuously through so many exposures.

The *Clypeus*-grit is characterised by *Nerinæa Guisei*, Witc.
The Freestones, Oolite Marl, &c., by *Nerinæa Cotteswoldiæ*, Lyc.
— *gracilis*, Lyc.
The Pea-grit by *Nerinæa producta*, Witc.
— *pisolitica*, Witc.

These three Nerinæan horizons, in the Pea-grit, the Oolite Marl, and the *Clypeus*-grit, respectively, have also yielded the bulk of the somewhat scanty collections of Gasteropoda which have been obtained from the more classical districts of the Cotteswolds. On the other hand, the Upper Trigonia-grit and the Gryphite-grit, well stored as they are with other fossils, seem to be deficient in this respect. Hence the Ragstones, though far more fossiliferous as a whole than the beds of the *Murchisonæ*-zone in this neighbourhood, contain fewer Gasteropoda.

Rodborough Common, about three miles north of Nailsworth Hill. This again is classic ground, many both of Dr. Lycett's and Mr. Witchell's specimens coming from here. I subjoin a profile, showing the upper or Ragstone-beds in some detail.

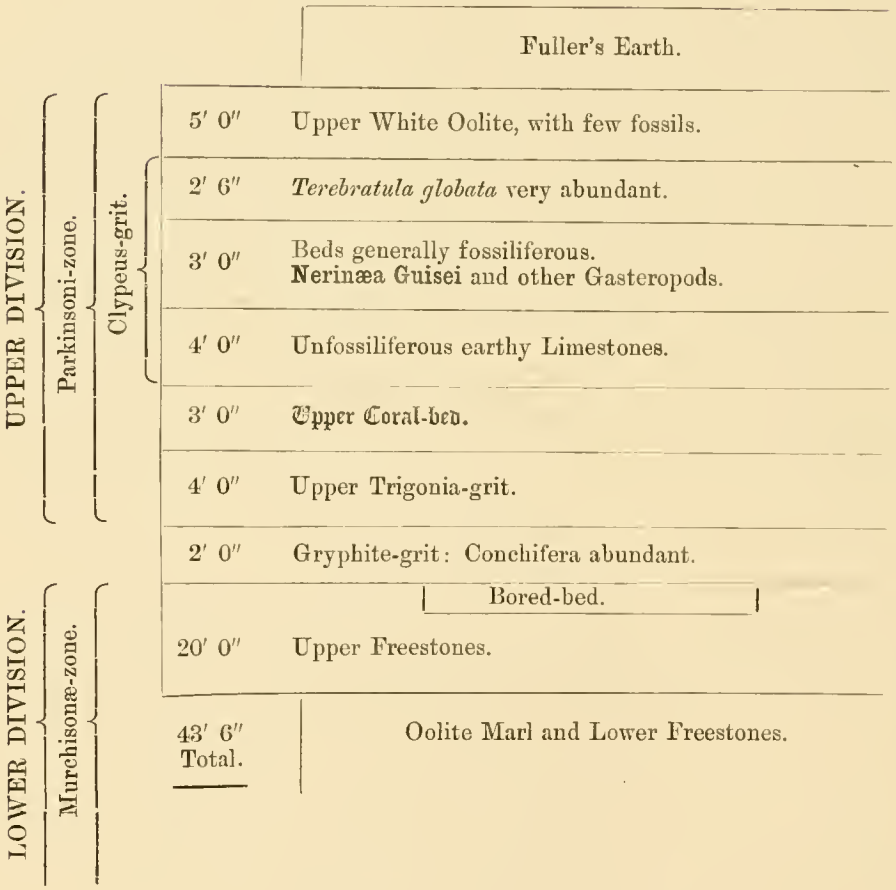
The Upper White Oolite is the bed we have generally met with hitherto in the Cotteswold Hills, usually forming the top of the Inferior Oolite. The next three

[1] 'Quart. Journ. Geol. Soc.,' vol. xlii (1886), p. 264, *et seq.*

[2] The Lower Limestone has hitherto yielded only imperfect fragments of *Nerinæa*.

Profile No. 9.—Rodborough Common.

(Section incomplete.)



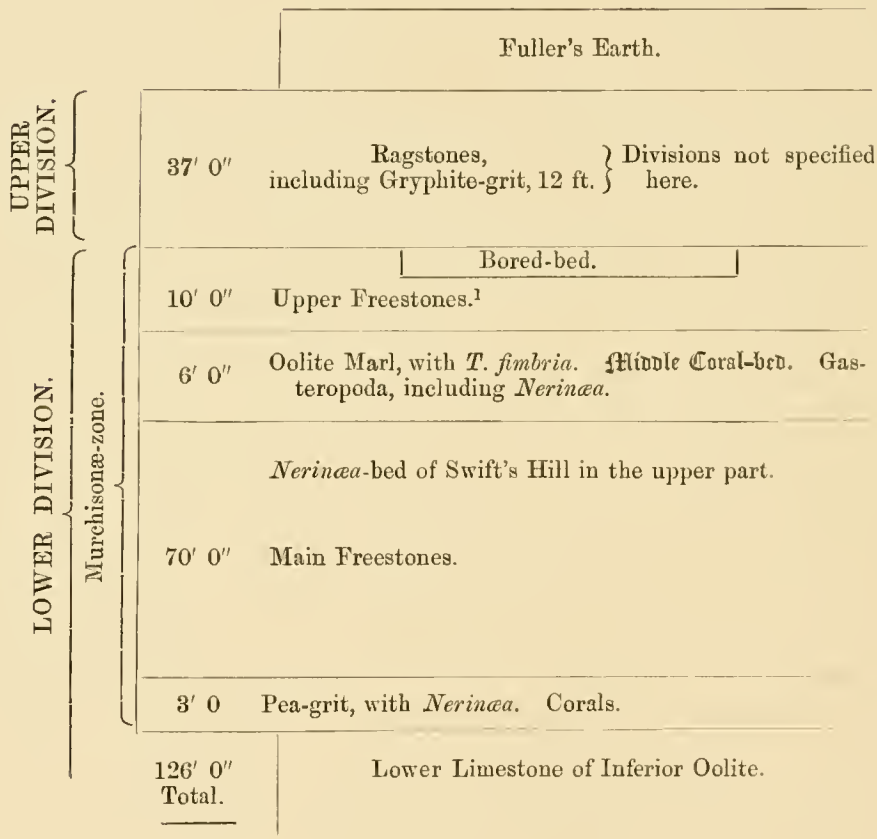
subdivisions may be taken to represent the *Clypeus*-grit. Here, as elsewhere, the great mass of *T. globata* occurs just above the *Guisei*-bed. This series has afforded Mr. Witchell several species of Gasteropoda, including the *Nerinæa* so often mentioned and some others. As a horizon therefore it is deserving of some notice. Mr. Witchell's types of *N. Guisei*, &c., are, I believe, from this very bed on Rodborough Common.

The next point worthy of notice is the Upper Coral-bed, which according to Mr. Witchell has its southward limits hereabouts. The Upper Trigonia-grit of this section calls for no special comment. This is the bed that we have seen continuously from the neighbourhood of Little Sodbury (Horton Hill). It appears to contain but few Gasteropoda here; at least I find no great number in Mr. Witchell's collection from this horizon. For all that, I have very little doubt of its being the representative of the rich shell-beds which, further south, have yielded such an abundance of Gasteropoda towards the base of the *Parkinsoni*-zone. There are also but few Gasteropoda from the Gryphite-grit, and consequently we need not take much trouble to discuss its geological position. Rodborough Common is about the last exposure where it contains the characteristic Gryphite, whilst further south (Wootton-under-Edge, Horton Hill, &c.) the beds of the *Parkinsoni*-zone rest directly on the Cotteswold Freestones. The Gryphite-grit has generally been regarded as belonging to the *Humphriesianus*-zone, but I leave this question to be discussed elsewhere. The entire Ragstone series, or Upper Division of the Inferior Oolite, on Rodborough Common measures about 23 feet, whilst the section on Stroud Hill, only just across the valley, has already increased to 37 feet (*teste* Witchell) partly owing to the expansion of the Gryphite-grit.

Stroud, Swift's Hill, and Longridge.—These are all on the north side of the deep valley which commences at Stonehouse; they may be taken together as constituting one section, so to say, of the Cotteswold District. *Swift's Hill Quarry* is about one and three quarter miles north-east of Stroud station near *Knapp Farm*. There is a fault in this quarry, which is mainly in the Freestone series. The *Nerinæa*-bed occurs several feet below the soft Oolite Marl. It forms part of two blocks, and the Nerinæas occupy a vertical space of about 2 feet 6 inches. The lower bed is a mixture of chalky stuff and oolite, and this is the best for fossils; sections of *Nerinæa* are extremely numerous. The quarry at *Longridge* is on very high ground two miles north of Swift's Hill, and about one mile east of the small town of Painswick. The quarry is in such a muddle that no section can be obtained; but the horizon whence the bulk of the fossils are obtained is probably a little below the Oolite Marl. A very fine series of Nerinæas have been procured from this place lately both by Mr. Witchell and myself. Taking *Stroud Hill* as the representative section of the region immediately north of the great valley, we obtain the following sequence. For further details I would refer to Witchell's Geology of Stroud, p. 5.

Profile No. 10.—Country more immediately north of Stroud Valley generalised.

(Section incomplete.)



[1] There are indications of a *Nerinæa*-bed in the Upper Freestones, which may be on the horizon of the bed, *p*, near Birdlip (see *postea*, p. 66). On the whole there are three distinct beds containing *Nerinæa* in the *Marl and Freestone Series*, though these beds cannot be made out at every point between Stroud and Cheltenham. These three beds constitute the Middle or Second Nerinæan horizon.

We observe here that the "Oolite Marl" has now a definite lithological development. Judging from the collections made by Lycett and Witchell in this district, the "Oolite Marl" has been the principal source of the Gasteropoda, few and scattered though they be. The fossils are preserved in a good spathic condition, and often beautifully white; but as the matrix is somewhat unkind, a great amount of scraping has in many cases materially injured the ornamentation. Hence these fossils, though undoubtedly the best afforded by the Inferior Oolite of the Cotteswolds, compare unfavorably with those of Dorsetshire. In consequence of this circumstance their correlation with the Dorsetshire fossils is by no means so satisfactory as could be wished. The Oolite Marl and part of the Freestones, probably, constitute one palæontological horizon, which must be referred to the upper part of the *Murchisonæ*-zone. For practical purposes, then, we may divide the *Murchisonæ*-zone of this part of the Cotteswolds into an Upper, or Oolite Marl horizon, and into a Lower, or Pea-grit horizon, without attempting to draw a strict divisional line between the two. The increasing thickness of the Inferior Oolite will be observed; we started at Burton Bradstock with about 12 feet of limestone, and here we have 126 feet without including the lowest beds.

Birdlip, Crickley Hill, Leckhampton Hill.—This group must be considered together and somewhat briefly. Birdlip is about four miles north-east by north of the *Nerinæa*-quarry at Longridge, and the main quarries on Leckhampton Hill are about three miles farther. Crickley Hill lies between, rather nearer to Birdlip. The development of the Ragstones continues to differ somewhat from that obtaining south; and hitherto we have failed to find the *Guisei*-bed in any exposure north of the Stroud valley. A deposit, known as the Lower Trigonia-grit, underlying the Gryphite-grit, contains a considerable number of casts of Gasteropoda. We must turn to the lower division of the Inferior Oolite—to the Freestones, Oolite Marl, and Pea-grit. Not that these are by any means rich in Gasteropoda. A most diligent search is necessary, and even then the specimens are often very small, little better than micromorphs. Mr. P. B. Brodie for many years collected from the Freestones of this neighbourhood, and without his aid I should know very little of their contents. Many extremely small Gasteropods have also been obtained by breaking open *Terebratulæ*, *Pholadomyæ*, &c., obtained between Birdlip and Crickley. Mr. George, of Northampton, has been kind enough to supply me with some of these micromorphs, and my own collector, Mr. Bloomfield, has procured several, mostly from the Pea-grit. But there is no notable assemblage of small Univalves between the Pea-grit and the Sands. A few are found in a thick-bedded stone, which probably corresponds to the horizon in the Lower Limestone at Stroud, already mentioned.

The lines where *Nerinæa* occurs in the Freestone series of this vicinity are somewhat obscure in consequence of the condition of the specimens. But some-

thing like the following sequence can be made out, commencing from the top. In a shallow quarry north of Birdlip is a *Nerinæa*-bed (*p*), immediately beneath the Ragstone. In the Birdlip Hill section *Nerinæa* occurs in the Oolite Marl (*q*), and the same may be seen in the Oolite Marl of Leckhampton Hill. Again, both at Leckhampton and Birdlip, a third *Nerinæa*-bed (*r*) occurs some twelve feet below the Oolite Marl. When it is borne in mind that each of these beds represents, usually, a slight line of erosion, and that probably other Gasteropoda have been procured from them, the fixing of these lines in the Freestone series becomes a point of some interest. The prevailing species on each of these three lines, or subhorizons, is somewhat different. The bed *r*, towards the top of the Lower Freestones, is distinguished by *N. Cotteswoldiæ*. These three beds belong to the Oolite Marl, or middle Nerinæan-zone of the Cotteswolds, including in this term the bulk of the Freestones.

We must now consider the lower or Pea-grit Nerinæan-zone, as developed in Crickley Hill.

The principal object of the Profile of Crickley Hill (p. 67) is to exhibit the relations of the Pea-grit to the beds above and below. There is no difficulty about the horizon, since *Am. Murchisonæ* is not uncommon in the Pea-grit. The "semipisolite," or equivalent of the Lower Limestone of Mr. Witchell, is very barren hunting ground. The shell-beds towards the base of the section have not yielded any notable quantity of Gasteropoda, but there are symptoms of a fauna similar to that at Drympton on the borders of Dorset and Somerset.

The really important bed in this Profile is the one containing long narrow forms of *Nerinæa*, of which sections are fairly numerous, and many smallish but rather well-preserved Gasteropoda; of these there are a few scattered throughout the Pea-grit and Freestones generally. Two species of *Nerita* are to be found in this bed. At the east end of the quarry face the line of the *Nerinæa*-bed is occupied by a small coral reef—the lower reef of the Cotteswolds. The great expansion of the Pea-grit from about three feet at Nailsworth and Stroud to upwards of thirty feet here is remarkable: in fact we are now entering on the region of maximum sedimentation of the Cotteswolds, and it is a matter of considerable interest for those who have traced the Inferior Oolite from its first appearance in the cliffs of the English Channel, to reflect that a subordinate series in the *Murchisonæ*-zone at Crickley is nearly three times thicker than the entire Inferior Oolite throughout some of the most fossiliferous exposures in Dorsetshire.

I will not dwell any further upon the Inferior Oolite as exhibited in the grand semicircular escarpment from Leckhampton to Cleeve and farther north, but will conclude this notice of its development in the Cotteswolds with a brief account

[1] This is probably the same as the Swift's Hill bed (see Profile, p. 64).

Profile No. 11.—Crickley Hill.

(Section incomplete.)

		Lower *Freestones* continued.
LOWER DIVISION. Opalinus-zone.		
Murchisonæ-zone. Pea-grit 33 ft. 6 in.	15′ 0″	White shivery oolites, constituting the base of the *Freestones*. Junction bed harder and darker.
	6′ 6″	Coarse pisolite, with some fossils.
	4′ 0″	*Nerinæa* and other Gasteropoda in the Pea-grit. Lower Coral-bed.
	23′ 0″	Main mass of the Pea-grit in thick beds of coarse pisolite. *Echini*, *Pentacrinus*, and a few Gasteropoda.
	15′ 6″	Semi-pisolite, with very few fossils.
	8′ 6″	Two rich shell-beds, with a few[1] Gasteropoda.
	3′ 0″	Continuation of the semi-pisolite.
	75′ 6″ Total.	No further exposure.

[1] An Ammonite related to *A. corrugatus* and *Rhynch. subdecorata*, juv., occur in this bed, which represents either a very low part of the *Murchisonæ*-zone, or, what is about the same thing, the so-called *Opalinus*-zone.

of the beds which have yielded Gasteropoda in the country between Cheltenham and Bourton, more especially near Notgrove Station and Aston Farm.

Notgrove, Aston.—The Gasteropoda obtained from this neighbourhood are from two distinct horizons, viz. the Oolite Marl and the Trigonia-grit. The annexed profile is not intended to grapple either with the stratigraphy or the actual development of the Inferior Oolite as displayed in the interesting cuttings and quarries between Notgrove and Bourton, but simply to show the relative positions of the beds containing Gasteropoda.

There is a very fine development of the Oolite Marl at Notgrove Station, indeed I am not aware of a finer one anywhere. The lowest beds visible swarm with Brachiopoda, *T. fimbria*, *T. curvifrons*, *Wald. Leckenbyi*, *Rhynch. Lycetti*, &c., The lowest hard bed associated with these contains an immense *Pseudomelania*, which at present I cannot differentiate from "*Chemnitzia*" *simplex*, M. and L. Then comes another soft bed swarming with Brachiopoda, and then another hard bed full of immense specimens of *Natica cincta*, nearly all as casts. This latter is, above all others, the "Leitfossil" of the Oolite Marl, and may be traced on the same horizon through the Lincolnshire Limestone into the Whitwell Oolite of Yorkshire, whence came the specimen figured by Phillips. It is interesting to find that both these great fossils are recorded by Mr. Walford from Combe Hill, an outlier of Inferior Oolite some four and twenty miles to the east-north-east of Notgrove Station, and close to the Cherwell Valley; but there the characteristic Brachiopods are scarce.

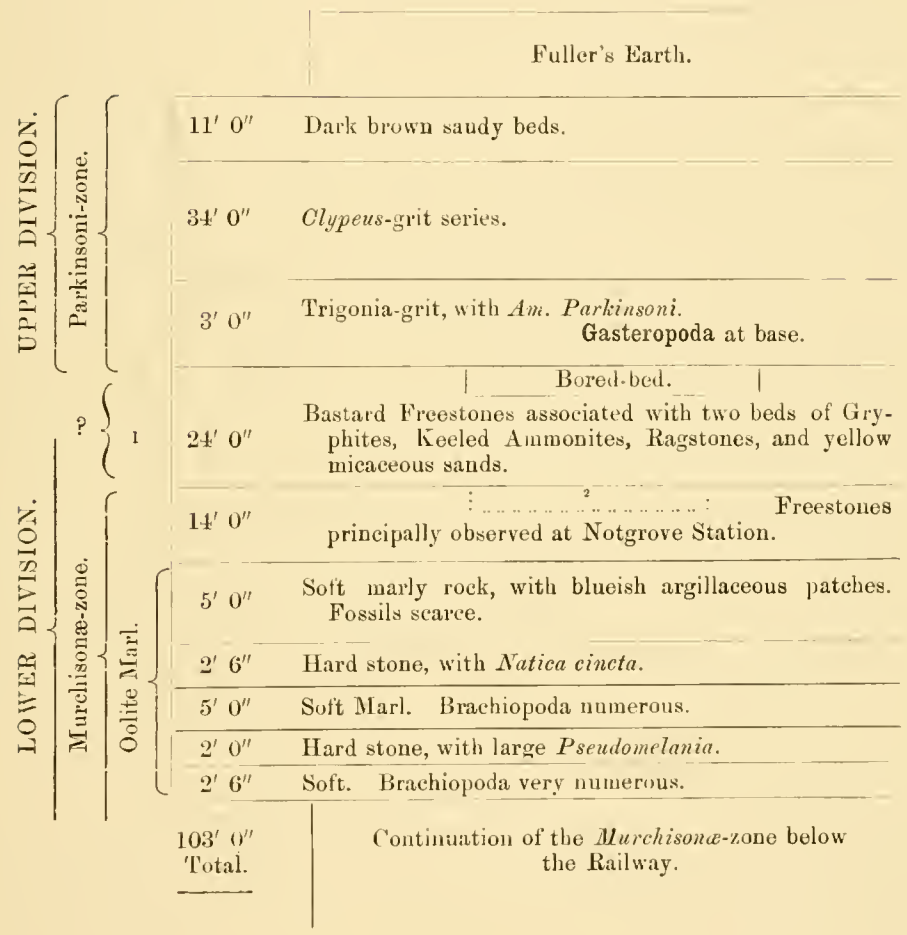
The upward sequence from this very fine development of the Oolite Marl is not precisely clear. We should naturally expect the Upper Freestones, but in the cutting near Aston Farm, whence the bulk of the Gasteropoda marked "Aston" are derived, a series of imperfect Freestones, associated with two beds of Gryphites, immediately underlies the Ragstones. Whatever these beds represent it is clear that the Gasteropoda found in this cutting and the neighbouring quarries lie at the base of the *Parkinsoni*-zone, or, it may be, in a thin band which is a little lower, since they are mostly found at the base. On the whole, however, I incline to the belief that they belong to the lower part of the *Parkinsoni*-zone, an horizon we have found so rich in Gasteropoda throughout both the Dorset and Cotteswold districts. Both in development and state of preservation they are far inferior to fossils from more favoured localities. A smooth *Cerithium* is one of the most abundant and characteristic Gasteropods.

Résumé of the Cotteswold Hills.

Considering the great development of the Inferior Oolite in this range the palæontological results on the whole are very inferior to those of No. 1 district,

Profile No. 12.—Notgrove—Aston, generalised.

(Section incomplete.)



[1] Mr. S. S. Buckman is of opinion that the beds associated with Gryphites are on the horizon of the Gryphite-grit of Leckhampton and Stroud, which for him represents the *Sowerbyi*-zone of Dorset.

[2] This is the horizon of the Bored Bed of the preceding profiles. The Freestone series here also is slightly bored on the top; but in this section the *main unconformity* is upon a higher horizon than that of Stroud, Horton Hill, &c.

more especially in Gasteropoda. When we bear in mind that some of the best collectors, and the most noted palæontologists, have been connected with the Cotteswolds for years, it must be clear that this inferiority cannot be due to want of research. In fact the country from Wootton-under-Edge to Cleeve Cloud is, above all others, the classic ground of the Inferior Oolite. It is true that in some portions of the range, and on some horizons, a considerable number of casts and badly preserved specimens of Gasteropoda may reward the labours of the collector. But how rare are really good fossils? If it were not for the Nerinæas, whose critical points are, perhaps, more internal than external, the show would be but a poor one, when we reflect on the many years that these beds have been under contribution.

There is another point, too, of some significance. Apart from mere specific names, such as help to make up a percentage comparison, there can be no doubt that the Gasteropod Fauna of the Great Oolite, as developed at Minchinhampton, has far more resemblance to that of the Inferior Oolite, which underlies it, than it has to the Gasteropod Fauna of the Inferior Oolite in the Dorset District. Greater similarity of facies may in parts account for this, but is there nothing due to the score of locality? Such questions are interesting, and, if taken up and worked out by younger palæontologists, may some day lead to conclusions of importance.

Lastly, it would seem that the Ammonite-zones are not quite so regular and well defined in the Cotteswolds as they are in Dorsetshire. When the question comes to be worked out, this may not prove to be the case; nor is it my business in the present instance to investigate it. But when we see such an anomalous assemblage of Ammonites as occurs for instance in the Gryphite-grit (*teste* Mr. Witchell's collection), we naturally wonder how this series can be made to fit in with the Dorsetshire sequence.

Remainder of the Cotteswold District.

East of the Vale of Moreton there is a mass of high ground constituting a sort of repetition of the Cotteswold Hills. This region extends as far as the Valley of the Cherwell. The Inferior Oolite is variously developed, but on the whole the *Clypeus*-grit is the main representative, at least near Chipping-Norton. The Gasteropoda in these beds of Inferior Oolite age are not sufficiently numerous or important to warrant many details being given here. The most important section is on the new railway near Hook Norton, where on both sides of a tunnel a more or less complete sequence of the Inferior Oolite may be seen. This has been fully described by Mr. Walford ('Quart. Journ. Geol. Soc.,' 1883, p. 224).

Hook Norton.—Though the Inferior Oolite is now verging towards the region where it undergoes further modification and a partial eclipse, before assuming

its East Midland character, the section at Hook Norton, read by the light of Mr. Walford's experience, is both interesting and instructive. Between the Upper Lias Clay and the Great Oolite are 31 feet of beds. These are divided into five groups. The *lowest group*, 4 feet 9 inches, is a sandy blue hearted limestone with corals. It has yielded *Rhynchonella cynocephala* and some few Gasteropoda characteristic of a low horizon. Since it is by no means easy to separate the *Opalinus-* from the *Murchisonæ-*zone, this group may be taken as representing the zone or zones usually characterised by those two Ammonites. The *second group*, 10 inches thick, contains an Ammonite-bed; the species being one of those smooth, flattish forms, similar to the prevailing types in the *concavus-* or so-called *Sowerbyi*-beds of Bradford Abbas. *Terebratula perovalis* likewise is quoted from here. Both the first and second group belong to the Lower Division of the Inferior Oolite. Next comes the usual hiatus, and then the *third group*, 2 feet 10 inches, has a shell-bed towards the top with undoubted fossils of the *Parkinsoni*-zone; and in this shell-bed are several species of Gasteropoda. If this group represents the Trigonia-grit, the Gasteropoda lie at the top, instead of at the bottom as in the Aston cutting. The *fourth* and *fifth groups* of this section call for no notice here. They are bulky and for the most part devoid of Mollusca, and serve to show the changeable nature of the uppermost beds of the Inferior Oolite hereabouts.

Details of the East Midland District (No. 3).

The first fossiliferous beds of Inferior Oolite age in this district which attract our attention are those at Blisworth and round the town of Northampton (Duston, &c.), which were regarded by Mr. Sharp as in the zones of *Am. opalinus* and *Am. Murchisonæ*. I see no reason to doubt Mr. Sharp's determination, the more so as there is a certain degree of resemblance between the Yorkshire Dogger and the *Northampton Sand*. Cephalopoda are not plentiful, but the Conchifera are large, especially *Lima*, and fairly numerous. The Gasteropoda are not particularly abundant, nor in a satisfactory condition for determination, occurring principally as impressions in the ironstone. Hence they are not very nice cabinet specimens. It is not probable, therefore, that many, if indeed any, of these specimens will be selected for figuring; but they will at all times be useful for correlation in those cases where the species can be made out with certainty. The best specimens are in the Sharp collection at the British Museum. At present I am informed by Mr. George and Mr. Beeby Thompson, that it is not easy to obtain many specimens of interest from these beds.

But the main feature of Inferior Oolite age in the East Midland District is the *Lincolnshire Limestone*. The chief characteristics of this important series are

given in 'Judd's Geology of Rutland,' and more recently in another Survey Memoir by Messrs. Jukes-Browne and Dalton. So extensive is this subject, that I may well be excused for not entering into particulars in an "Introduction to the Inferior Oolite Gasteropoda." As regards the position of the Lincolnshire Limestone in the geological scale, it has generally been referred to the *Sowerbyi*- subzone. But I am disposed to think that the greater portion of it belongs to the upper part of the *Murchisonæ*-zone. This would bring it on the level of the Oolite Marl of the Cotteswolds, simply as regards geological time. I think that there can be little doubt, from the abundance of *Nerinæa Cotteswoldiæ* in the compact limestones of so many localities, that such beds are on the horizon of the Oolite Marl, or just a little below, whilst the abundance of casts of *Natica cincta* (*Leckhamptonensis*) seem to point to the Oolite Marl itself. But it is apparently above these beds where we find that finely oolitic and broken shell-rock which swarms—though only at rare intervals—with Gasteropoda. Unfortunately they are much rolled, but now and then some really good specimens are obtained. Though the prevailing forms are decidedly small in these beds, yet some shells, especially those of *Nerinæa*, attain a considerable size.

By far the richest exposure of this class of beds is at Great Weldon, four and a half miles south-south-east of Rockingham, in Northamptonshire. As a section it is of no value, being a mere roadside opening near the village, about 8 feet in depth. The uppermost 4 feet consist of a shivery or platy kind of rock, with numerous small Oysters on the bedding planes. The lower half is a comminuted shell and oolite rock, and it is on the top of this that the richest accumulation of small Gasteropods may be noticed. A few hundred weights of well selected stuff will afford employment to the fossil hunter during many a winter's day. Innumerable small *Cerithia* of the *limæforma* group, some of them identical with *C. Beanii* of the Yorkshire Beds, are probably the most characteristic fossils. *Monodonta lævigata*, usually the typical form, but rather smaller than Dundry specimens, is on every block, and small species of *Trochus*, &c., are very numerous. The largest shells I have met with are the so-called "Phasianellas," which seem to occupy the place of *Natica*, here almost entirely unrepresented. The curious shell *Cloughtonia cincta* occurs here, and also at Ponton, but is rare. This constitutes another link with the Yorkshire Beds. I am not aware of its ever having been detected further south.

Another exposure is at Wansford, about eight miles west of Peterborough. This was more famous in former days, and is probably the locality "near Peterborough" of the Sharp collection. The Northampton collectors have obtained some good things from here, but the section is for the most part grass grown, and fine fossils are scarce.

The next best place is the railway cutting at Great Ponton. The depth of the cutting is about 20 feet. The beds which contain the Gasteropoda are very limited

in extent, and owing to the confusion and crushing of the rock, it is not easy to trace their relation to the *Terebratula*-beds, which are seen farther up the line (towards the south). It is by no means easy to say whether these beds are on precisely the same horizon as those at Weldon. The general character is the same, but each has its peculiarity. At Weldon, for instance, *Monodonta lævigata* swarms; here it seems almost absent. The species of *Nerinæa* too seem to differ, but where all, or nearly all, are so much rolled, the question of the Nerinæas of the Lincolnshire Limestone is not one calculated to give much peace of mind to a palæontologist.[1]

Barnack is another place which has yielded in former times a considerable number of these small Gasteropoda. At present what few fossils can be obtained are picked up on refuse heaps. There are many other quarries in Northamptonshire, Rutland, and South Lincolnshire which have yielded here and there a few good fossils. Some of these quarries are undoubtedly on the horizon of the Oolite Marl; as regards the others I have no evidence. One thing must strike the most casual observer, and that is the extraordinary difference between the Gasteropod Fauna of Dorsetshire, and of the Lincolnshire Limestone. Some forms, it is true, are merely micromorphs of species occurring elsewhere; but even granting that, the contrasts are enormous.

North of Grantham I have no knowledge of the Lincolnshire Limestone, or of its fossils, with the exception of a very few specimens now in the Jermyn Street Museum. Should I subsequently discover any notable quantity of Gasteropoda in the Inferior Oolite of this region, it may be necessary to deal with the subject by way of postscript.

Failing other evidence, we must regard the Northampton Sand, the Collyweston Slate, and, perhaps, the whole of the Lincolnshire Limestone, as belonging to the Lower Division of the Inferior Oolite.

[1] The cuttings known as Little and Great Ponton, on the Great Northern Railway, south of Grantham, were described by Prof. Morris ('Quart. Journ. Geol. Soc.,' ix, 324) with considerable detail, and these descriptions are quoted in Messrs. Jukes-Browne and Dalton's 'Geology of S.-W. Lincolnshire.' These authors consider the thickness of the Lincolnshire Limestone in South Lincolnshire to be fully 100 feet. They regard it as a lenticular mass between the Lower and Upper Estuarine, and further state that there is no constancy in the occurrence of the "coralline facies" as distinct from the "shelly facies;" since either may occur on any horizon. Mr. Brodie's observation is quoted that the more marly layers are particularly rich in corals, and recall the facies of the Oolite Marl at Crickley.

Details of the Yorkshire Basin (No. 4).

The beds of Inferior Oolite age in this region are completely separated from those to the south; and their present outcrop is nearly at right angles to that of the Cave Oolite and Lincolnshire Limestone. Although these arrangements are probably mere accidents of stratigraphy, the result is the complete isolation of all the Jurassic rocks of the basin of North-east Yorkshire. Since this is the case, there can be no harm in reversing our previous practice of proceeding from the south northwards, and in at once taking into consideration the important development at Blue Wyke. The following is in the main an extract from 'Contributions to the Palæontology of the Yorkshire Oolites,'[1] describing the marine horizons or zones of the Inferior Oolite, based chiefly upon the coast sections.

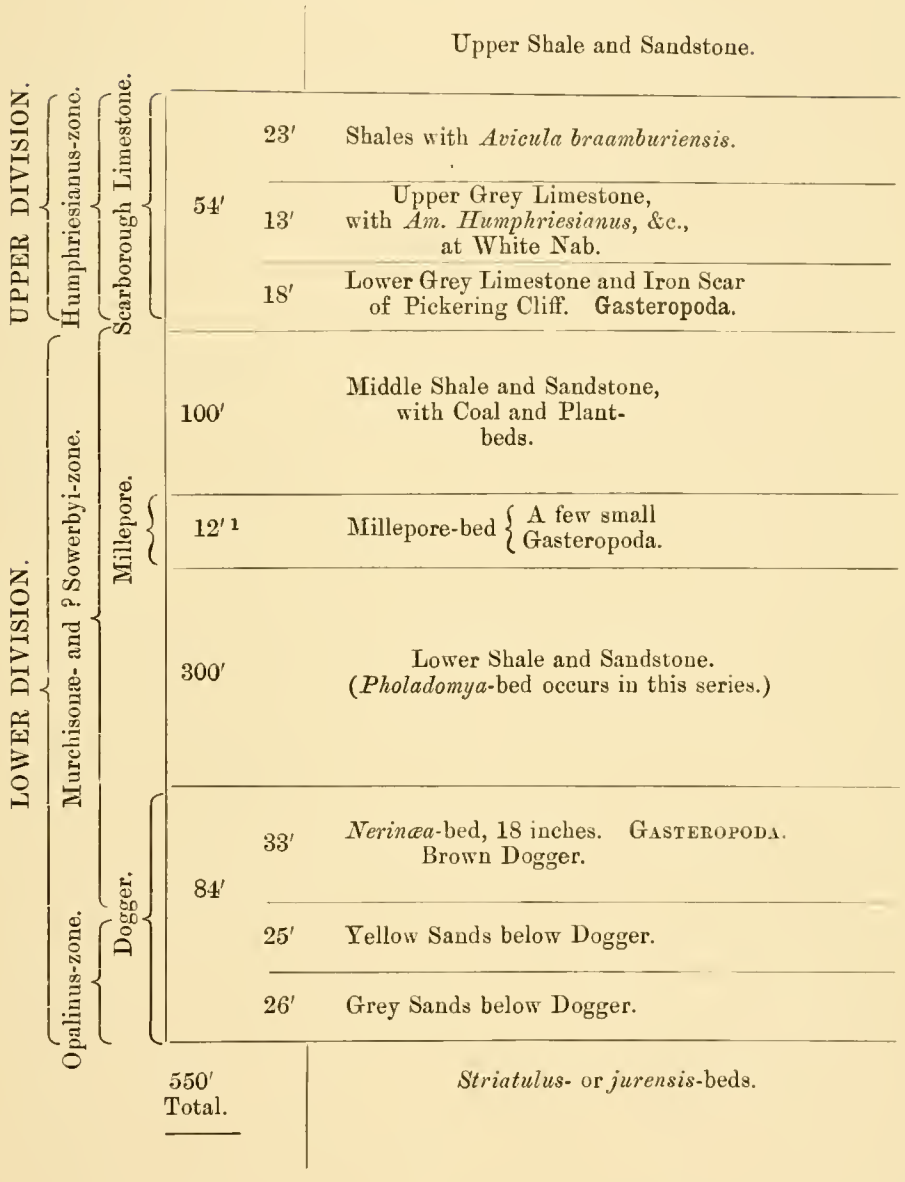
1. *First or lowest zone.*—This is known as the Dogger. Including the grey sands (*Lingula*-beds), the yellow sands, and the Dogger proper, a thickness of 80 feet may be assigned to the group, where most fully developed, as at Peak (Blue Wyke). The remains of Gasteropoda are almost wholly confined to a shell-bed 18 inches thick, which occurs about eight feet below the top of the series at Peak, but nowhere else in Yorkshire. The matrix is very characteristic. The substance of the shells has been largely replaced by spathic iron, whilst their exterior is lined with a thin skin of dark brown oxide. From the abundance of *Nerinæa cingenda* this band has been named the *Nerinæa*-bed, which is probably somewhere about the horizon of the Pea-grit of the Cotteswolds, though not improbably it contains species of a somewhat lower horizon. The Dogger in its totality may be placed in the *Opalinus*-zone and lowest part of the *Murchisonæ*-zone, and there can be little doubt that *Am. striatulus* (*radians*) crosses the boundary into the lower beds. Some 300 feet of "estuarine" sands and shales, with at best only irregular traces of marine shells, succeed the Dogger, and then we arrive at—

2. *The second zone*, known as the Millepore-bed, which is best seen on the north horn of Cloughton Wyke at Sycarham, where the thickness may be about 12 feet. This is also a kind of sandy ironstone, but more gritty and calcareous than the Dogger. The Gasteropoda are mostly limited to one bed, whilst Conchifera are abundant throughout. Some portions of the matrix contain more carbonate of iron than of lime, and there is just sufficient iron peroxidized to impart a reddish-brown tint to the mass, which is much flecked by a white substance allied to kaolin. This peculiarity is less noticeable in the bed where the univalves are mostly found. The Millepore-bed is well developed south of Scarborough, where it becomes thicker. It forms an important scar in Gristhorpe Bay. In the

[1] 'Geol. Mag.,' dec. ii, vol. ix (1882), p. 148.

Profile No. 13.—The Yorkshire Coast.

(Generalised Section, possibly complete.)



[1] Represented in the interior by the Whitwell Oolite, which yields *Natica cincta*, Phil.

interior the fawn-coloured sandy limestones of the Howardian Hills, worked in Whitwell parish and elsewhere, are referred to this horizon. North of Scarborough, on the coast, 100 feet of "estuarine" sands and shales, containing the principal moorland coal and the celebrated plant-bed, intervene between the Millepore-bed and—

3. *The third zone*, known as the Scarborough or Grey Limestone. South of Scarborough these two zones approach each other—the Millepore-bed, as we have seen, becoming thicker, whilst the Scarborough Limestone in Gristhorpe Bay is reduced to a few feet, with every indication of going out altogether. Thus it is the Millepore-bed which reappears further south as the Cave Oolite and the Lincolnshire Limestone. Near Scarborough, however, and especially north of that town, the uppermost of these two formations is far the most important. On the south horn of Cloughton Wyke, at Hundale, this group of beds has a thickness of nearly 60 feet, and contains a fine series of fossils, chiefly Conchifera. On the other side of Scarborough, at White Nab, the thickness has already fallen to 20 feet. It is here that specimens of *Am. Humphriesianus* and *Blagdeni* have been found together with casts of a large *Pseudomelania* and *Phasianella*. Lithologically this zone is composed for the most part of blue-grey limestones, more or less charged with dark-coloured mud, and in places is rich in iron. The fossils partake of this grey character, but there is a little difficulty sometimes in distinguishing specimens from certain varieties of the Millepore-bed or Cornbrash. This is the least oolitic in structure of all the four zones of the Lower Oolites.

The three zones enumerated above belong to the Inferior or Bajocian subdivision of the Lower Oolites. The two lowest (*i. e.* the Dogger and the Millepore) are probably both in the *Murchisonæ*-zone, though no Ammonite has ever been found to my knowledge in beds of this horizon on the coast. The Scarborough Limestone, which distiuctly dies out on the dip, must be regarded as on a level with the Coronaten-zone of the Germans. Above this comes a third "estuarine" series, which also thins considerably on the dip. As we have no palæontological indications in Yorkshire either of the *Parkinsoni*-zone or of the Great Oolite, it is not unreasonable to suppose that this third estuarine series may represent these formations in time. The gradual attenuation of the Great Oolite (Bathonian) in Lincolnshire as a marine formation prepares us for this change.

We have no difficulty in regarding both the Dogger and the Millepore-bed as belonging to the Lower Division of the Inferior Oolite, but with respect to the marine beds, known collectively as the Scarborough or Grey Limestone, the case is not quite so clear. It is perfectly true that south of Scarborough Castle Ammonites of the *Humphriesianus*-zone are found; but the fossiliferous exposures of Cloughton Wyke, both at Hundale Point, and also the one high up in the cliff on the opposite side, usually known as Pickering Cliff, have never to my knowledge

yielded these Ammonites. At any rate, if these beds do not belong to the *Humphriesianus*-zone they must be lower in the series, possibly about the level of the *Sauzei*-subzone.

In dealing with the Gasteropoda from these marine horizons of the Inferior Oolite in Yorkshire, it must be remembered that the majority of the species have been recently described and figured in the work referred to. The figures and descriptions there given will be incorporated, as far as may be convenient, with Part I of this Monograph. As a rule the Yorkshire specimens are not so well preserved that close specific determinations can always be given with certainty. This constitutes one great difficulty when instituting comparison with the beautiful fossils of Dorsetshire. So long as we are satisfied with lumping, the resemblances and analogies hold fairly good, but when we come to splitting, the case is different; and the difficulties are further enhanced by the difference of matrix. Under these circumstances an accurate comparison of the rare and difficultly preserved Gasteropoda of this district with those of the others, and especially of No. 1 district, is next to impossible.

Conclusion of the Introduction to the Inferior Oolite Gasteropoda.

In concluding this introduction to the Inferior Oolite Gasteropoda, I must acknowledge my obligations to many gentlemen who have kindly assisted me. To Prof. Eugène Deslongchamps of Caen my best thanks are due for the facilities afforded in studying his splendid collections from the Inferior Oolite of Normandy, and for much kind advice and sympathy. To him and to his father all students of Jurassic Palæontology are deeply indebted; and the curious resemblance existing between the development of the Inferior Oolite in Normandy and Dorsetshire makes us Englishmen all the more conscious of our obligations to these two illustrious *savants*, who have done so much in their day to render the publications of the Linnæan Society of Normandy famous. It has been my good fortune to have been enabled to purchase the collection of Inferior Oolite Gasteropoda formed by the late Prof. Buckman and his son Mr. S. S. Buckman. On the majority of these specimens the locality and horizon have been carefully indicated, and I am greatly obliged to Mr. S. S. Buckman for the readiness he has at all times shown in imparting any information required relative to the fossils and subdivisions of the Inferior Oolite. Mr. Witchell, of Stroud, has laid me under a deep obligation, not only by allowing me free access to his excellent collection of Inferior Oolite Gasteropoda from that part of the Cotteswolds, but also for his readiness in explaining the stratigraphy of the neighbourhood of Stroud. It is by the aid of his collection, in conjunction with that formed by the late Dr. Lycett, now preserved in the Jermyn Street Museum, that we may hope to increase our knowledge of the somewhat

obscure problem presented by the Inferior Oolite Gasteropoda in the Cotteswolds. Nor should I, when on the subject of Cotteswold fossils, forget the kindness of the Rev. P. B. Brodie. This veteran geologist, years ago, made it his business to collect specimens principally from the Freestones of Leckhampton and the neighbourhood. These he most generously permits me to examine and to retain for figuring when necessary. I have long been under obligations to Mr. Walford, of Banbury, whose intimate acquaintance with the Inferior Oolite of North Oxfordshire has been proved more than once in the pages of the 'Quarterly Journal of the Geological Society.' Nor must I forget to thank Mr. George and Mr. Beeby Thompson, of Northampton, for assistance and information in their own district.

The principal museums, whose collections have been consulted, are—the British Museum, the Museum of Practical Geology in Jermyn Street, the Bristol Museum, the Woodwardian Museum, and, for Yorkshire fossils only, the York Museum. Nothing could exceed the kindness and consideration of the officers in charge, and I tender them my heartfelt thanks.

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[1] Second edition published in 1856. This I have not seen.

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DESCRIPTION OF GENERA AND SPECIES.

Order—PROSOBRANCHIATA, *Milne Edwards*, 1848.

Note.—As already observed in the General Introduction there are certain genera of Gasteropods whose family position is yet doubtful, and which have been variously located by different authors. *Purpurina* and *Brachytrema* are noteworthy instances of such uncertainty. It is proposed to consider these in the first instance without attempting to refer either genus to any particular family.

Genus—Purpurina, *D'Orbigny*, 1850, Prod. i, p. 278.

Shell deeply and narrowly perforate, oval-elongate, tumid, thick; whorls rounded, rendered angular posteriorly by the sutural canaliculation; body-whorl large, ornamented with longitudinal ribs crossed by spiral striæ; aperture oval, sub-canaliculate in front; columella arched; lip simple.—Fischer.

Bibliography, &c.—Defined by Deslongchamps, 1860 ('Bull. Soc. Linn. Norm.,' vol. v, p. 136).

The history of *Purpurina* is rather singular. D'Orbigny gives a short diagnosis in the 'Prodrome,' and names several species from the Bajocian, Bathonian, Callovian, and Oxfordian; all of which perhaps belong to the genera *Brachytrema* and *Purpuroidea* of Lycett. In the 'Terrains Jurassiques,' as is well pointed out by Deslongchamps, numerous figures of *Purpurina* are given in the atlas, most of which belong to the genus *Eucyclus* (*Amberleya*). In the text D'Orbigny says nothing about the genus *Purpurina*, nor is there a word of description of any of the species figured. Fortunately there is just one figure of a most characteristic form, *P. bellona*, D'Orb. ('Ter. Jur.,' pl. 331, figs. 1 and 3), from the Inferior Oolite of Bayeux, and this has been accepted both by Piette ('Bull. Soc. Géol. de la France,' 2nd series, vol. xviii, p. 587) and by Deslongchamps for the type of a genus which, as defined by them, has relations on one side with *Turbo* and on the other with *Cerithium* and *Purpura*. "These shells," says Deslongchamps (vol. cit., p. 176; p. 24 of the separate 'Memoir on the Fossils of Montreuil-Bellay), "are characterised by a thick test, a small groove more or less pronounced in front of the mouth, especially in early life, by an umbilical slit of

very limited extent—by the whorls of the spire presenting longitudinal ribs more or less marked, cut by transverse striæ, a strong keel, or at least a very pronounced 'ressaut,' forming upon the whorl a 'meplat' towards the suture, which is deeply cut; finally a body-whorl much more developed than the others."

It is somewhat difficult to understand on what grounds Fischer places this genus under the Littorinidæ, and yet in the so-called *Purpurina bianor* and its allies there is a very strong resemblance to some sections of the numerously-represented genus *Amberleya* (*Eucyclus*). On the other hand, *Amberleya ornata*, D'Orb. (non Sow.), is very like a Purpurine, and was, in fact, recognised as such by Oppel ('Juraformation,' p. 387), who records it from the *Humphriesianus*-zone of Oeschingen, and also from the Bayeux beds. In well-preserved specimens of *Amberleya ornata*, D'Orb., the anterior groove or incipient canal is as well marked as in most Purpurines, and better perhaps than in the majority of specimens obtained by collectors. Thus there is certainly a link between *Purpurina* and *Amberleya*, though there may be no real affinity. Our difficulties are still further increased by the fact that Fischer classes *Amberleya* under the Turbinidæ. As regards the so-called canal in *Purpurina* it may be seen to vary from a very strong and well-defined channel with reflexed columella, such as those of *P. aspera* (Pl. I, fig. 11) and *P. calcar* (Pl. II, fig. 1), to the shallow, spoon-shaped grooves of *P. bellona* (Pl. I, fig. 5) and *P. inflata* (Pl. II, fig. 2). It should also be remembered that in the majority of specimens the anterior extremity has lost all original character from wear, so that we are only now and again permitted to see what the shell really was like.

Distribution, &c.—The duration of the genus appears to have been limited. The oldest form known to us in England is *P. ornatissima*, Moore, said to occur in the Marlstone of Ilminster (Moore, 'Middle and Upper Lias of S.-W. England,' p. 89, pl. v, figs. 20, 21), where it is described as being very rare. There is a somewhat similar form figured and described by Vacek (p. 53 (109), pl. 18, fig. 7) as *P. bellona*, D'Orb., from the *opalinus*-zone of the subalpine region. Nowhere are these pretty shells common, but in England they are the most abundant and best preserved in the Inferior Oolite of Dorsetshire, where the *Parkinsoni*-zone of Burton Bradstock yields for the most part different species to those characteristic of the *Sowerbyi*-bed of Bradford Abbas.

In the Inferior Oolite of the Cotteswolds *Purpurina* is rare, and usually in such indifferent preservation that the finer distinctions, held to constitute specific differences, can scarcely be made out. The same remarks apply for the most part to the Lincolnshire Limestone and Yorkshire Dogger. On higher geological horizons in England one species of *Purpurina* has been recognised in the Great Oolite (Bathonian), and another species in the Cornbrash and Kelloway Rock of

Yorkshire. Some of our Inferior Oolite species have very close representatives in the Callovian of Montreuil-Bellay in France.

Since the diagnosis of the genus given above will scarcely cover some of the extreme forms about to be included it will be necessary to constitute two sections, of which the first may be regarded as the normal or typical *Purpurina*, to which the above diagnosis may be fairly applied.

Section I.—Purpurina, *sensu stricto.*

Bellona Group.

1. Purpurina elaborata, *Lycett*, 1850. Plate I, figs. 1 *a*, *b*; 1 *c*, *d*, *e*; 1 *f*; 1 *g*.

1850. Turbo elaboratus, *Lycett*. Ann. Nat. Hist., vol. vi, p. 416, pl. ii, fig. 1.
1851–4. — — *Bean*. Morris, and Lycett, Gt. Ool. Moll., part 1, p. 64, pl. ix, fig. 27, and p. 116, pl. xv, fig. 2.
1854. — — — Morris, Catalogue, p. 282.
1869. Purpurina elaborata, *Bean*. Brauns, Mitl. Jura, p. 168.
1882. — — — var. Bajocensis, *Hudleston*. Geol. Mag., 1882, p. 195, pl. v, fig. 2.
Compare also *Purpurina bellona* of many Continental authors.

Bibliography, &c.—In addition to the above, "*Turbo elaboratus*" was described as a new species by Lycett, in a paper entitled "Tabular View of Fossil Shells from the Middle Division of the Inferior Oolite in Gloucestershire," published, 1853, in the 'Proceedings of the Cotteswold Naturalists' Field Club,' vol. i, p. 77.[1] There is certainly some difficulty in determining whether this species should be assigned to Lycett or to Bean, though it really makes very little difference. Morris and Lycett provide us with two types. One is from the Great Oolite of Minchinhampton or Bussage. This is in a good state of preservation, and may be seen at the Jermyn-Street Museum. The Yorkshire specimen (Pl. XV, fig. 2) is from the Scarborough Limestone (*Humphriesianus*-zone), and is in the Bean

[1] N.B.—No notice is taken of this paper by Morris in his 'Catalogue.' About 106 species of Gasteropods are tabulated, including some 56 new species, which are noted or briefly described. Two figures of Inferior-Oolite Gasteropoda are given. Several of the Inferior-Oolite species therein named and partially described by Lycett are preserved in the Jermyn Street Museum; some also have been described and figured in the "Great Oolite Mollusca." In those cases where the identification is certain, it will be convenient to adopt Lycett's name.

collection at the British Museum. Beyond the fact that it is a *Purpurina* very little else can be made out.

Morris and Lycett observe that *P. elaborata* has likewise been obtained from the Inferior Oolite (middle division) of the Minchinhampton district (p. 64), where specimens are said to be larger and more satisfactory (p. 117) than those from Scarborough. It has not been my lot to see any of these, though there are specimens of *Purpurinæ* from the Oolite-Marl devoid of any very distinctive features. Those authors speak of this species (p. 64) as occurring in the Inferior Oolite of Normandy, an allusion probably to *P. bellona*, which occurs on a higher horizon. On the whole *P. elaborata* must be regarded as a generalised form, which disputes with *P. bellona* the title to rank as the representative of the genus. In describing the really beautiful shells from the *Sowerbyi*-bed of Bradford Abbas under this title I have endeavoured to utilise an old name rather than invent a new one.

Description:

Length of a well-grown shell . . .	20 mm.
Ratio of width to length . . .	75 : 100.
Length of body-whorl to entire shell . .	66 : 100.
Spiral angle	76°.

Shell ovate-conoidal, apex acute. Whorls about five or six; posterior area tabulate, sides moderately tumid. The ornaments consist of about eighteen stout longitudinal costæ, which are feebly developed on the tabular area, rise up into spinous nodes on the keel, and are strong and regular in the flanks of the whorls. The costæ have a tendency to die out anteriorly on the body-whorl, a feature by no means confined to this species. The costæ decussate with regular and closely-set spirals, which extend down to the base of the shell; no spirals are seen on the flat area.

Aperture oval to subquadrate. Columella moderately reflexed so as to produce anteriorly a wide and shallow groove towards the point. Umbilical slit scarcely indicated.

Relations and Distribution.—The group of the Purpurinas to which *P. elaborata* belongs presents many features in common, and there can be no doubt that the several species run into each other to a very great extent. In fact, according to a lumping view of the case we might regard *P. elaborata-bellona* as one widely distributed species characteristic of the Inferior Oolite, and also represented in the Great Oolite of this country. When a badly preserved specimen turns up little more can be done than refer it thus. There is no doubt, however, that average specimens of D'Orbigny's *P. bellona*, which is fairly abundant in the "Oolithe ferrugineuse" of Normandy, present characters which on the whole differ constantly from average specimens obtained in the lower zones of the Inferior Oolite

in this country. In the typical *P. bellona* the spire is always higher, and the outline is more angular.

P. elaborata is somewhat scarce in the *Sowerbyi*-bed at Bradford Abbas. Most of the specimens found in the *Murchisonæ*-zone of the Cotteswolds must be referred here, as also the very stunted forms occasionally met with in the Lincolnshire Limestone. The *Nerinæa*-bed of the Yorkshire Dogger has yielded a very few characteristic specimens (N.B. The specimen from the Dogger, fig. 1 *g*, is very inferior to some since obtained). On the whole then, *P. elaborata* is the characteristic Purpurina of the Lower Division, whilst *P. bellona* is restricted to the Upper Division. One specimen from the *Murchisonæ*-zone of Normandy is in Prof. Deslongchamps' cabinet.

2. Purpurina: Species or Variety. Plate I, figs. 4 *a*, *b*.

1853. Cf. Turbo elaboratus, *Lycett*. Proc. Cotteswold Field Club, vol. i, p. 77, pl. ii, fig. 1.

Description.—Shell ovate; whorls about five, canaliculate towards the suture with subtumid flanks. The whorls of the spire are ornamented by stoutish longitudinal ribs, but these fail throughout the greater part of the body whorl. The spirals are moderately wide apart, and fine axial striæ may be noted in the interspaces.

The aperture is suborbicular, and the traces of the *Purpurina*-notch are very slight.

Relations and Distribution.—This species or variety possesses the flattened whorls of *P. elaborata* with much of the reticulate ornamentation of the species next described. The peculiar appearance of the aperture may be due to distortion, but it greatly resembles Lycett's figure in the 'Proc. Cotteswold Field Club.' The condition of the shell is such that no further comparisons can be made.

The specimen is from the Oolite-Marl. If a temporary name is required it might be known as Purpurina aperta.

3. Purpurina cancellata, sp. nov. Plate I, figs. 3 *a*, *b*.

Description:

Length	21 mm.
Ratio of width to length . . .	69 : 100.

Length of body whorl to entire shell	62 : 100.
Spiral angle	63°

Shell ovate-oblong, apex acute; spire about fourth tenths of the entire shell. Whorls five to six, angular, but the posterior area slopes outwards ; flanks scarcely tumid. There are about sixteen rather thin longitudinal costæ, which in the whorls of the spire are continuous, and form nodes at each of the keels; they also form nodes in the keel of the body-whorl, but die out anteriorly. The costæ decussate with spirals which are wide apart, wavy in outline, and about half the thickness of the longitudinals. This produces a regular network, of which the mesh is largest spirally. Spiral ornamentation of a fine character is also traceable on the posterior area.

Aperture very similar to that of *P. elaborata*, but with rather shorter columella. Very slight trace of the umbilical slit.

Relations and Distribution.—This pretty species has some resemblance to *Purpurina ornatissima*, Moore (*op. cit.*), from the Marlstone of Ilminster. But in Moore's species the shell is more ovate, the whorls are subtumid and very slightly tabulate. The ornamentation of Moore's species more resembles that of *P. elaborata*.

P. cancellata is described from a unique specimen in a very good state of preservation. It is stated to come from Stoford, and has much the appearance of a fossil from the *Sowerbyi*-bed.

4. Purpurina bellona, *D'Orbigny*, 1850. Plate I, figs. 5 *a*, *b* ; 5 *c*, *d* ; 5 *e*, *f*.

1850.	Purpurina bellona, *D'Orbigny*.			Prod. 1, p. 270.
1852.	—	—	—	T. J., 2, pl. 331, figs. 1—3.
1886.	Non —	—	—	Vacek, Fauna von Cap. S. Vigilio, p. 109, pl. 18, fig. 7.

Bibliography, &c.—This is the regulation name for most Purpurinas from the Inferior Oolite. I have already pointed out that D'Orbigny's type must have come from the "Oolithe ferrugineuse," and is therefore a fossil of the Upper Division. The species is capable of numerous subdivisions, some of which might almost be raised to the rank of species.

Description :

Length of a medium specimen	21 mm.
Ratio of width to length	66 : 100.
Length of body-whorl to entire shell	55 : 100.
Spiral angle	60°.

Shell ovate-oblong, turrited, apex acute. Spire nearly half the length of the

entire shell. Whorls about six, very angular. Posterior area flat, and forming a right angle with the sides, which are compressed and slightly undercut in the whorls of the spire. In the finer varieties (such as the specimen 5 *a*, *b*) there are from twenty-two to twenty-five longitudinal costæ on each whorl, but these only extend about half way down the body-whorl. These costæ form a circlet of slight spinous nodes on the keels, and are continuous over the flat area. The spiral ornamentation is similar to that of *P. elaborata*, and is not traceable over the flat area.

The aperture is ovate and relatively small; the pillar is short, and slightly reflexed, producing a broad and extremely shallow trough. Umbilical slit faint.

Specimens showing a bolder character of ornamentation are figs. 5 *c*, *d*, 5 *e*, *f*. Some of these have seven whorls. In the proportions and general shape of the whorls these do not differ materially from what has been already described; the ornamentation is simply coarser. In a large series every gradation may be seen.

Relations and Distribution.—In the character of its ornamentation, and in the rectangular outline of the whorls, there is considerable similarity between this species and *P. elaborata;* but the spire is higher, the shell less tumid, and the aperture somewhat more restricted.

In England *P. bellona* is most abundant in the *Parkinsoni*-zone of Burton Bradstock and that district, where some specimens occur with a higher spire than any shown on the accompanying plate. It also occurs in the *Cadomensis*-bed at Oborne. Specimens from the Upper Division in the Cotteswolds may, perhaps, belong here, but their condition is seldom good enough for specific determination.

5. Purpurina bellona, *D'Orbigny*, var. pagoda. Plate I, figs. 7 *a*, *b*, *c*.

1858. Cf. Quenstedt, Der Jura, *Turbo serratus*, p. 485, T. 65, fig. 7.

Description:

Length of a well-grown shell	25 mm.
Ratio of width to length	74 : 100.
Length of body-whorl to entire shell	60 : 100.
Spiral angle	68°.

The spiral angle is wider than in the more typical form. The posterior area of the whorls slopes outwards towards the keel, and then curves upwards before falling over, and the ornamentation on the keel is highly nodular.

Distribution.—P_1 of Burton Bradstock Cliff (p. 31) contains this form.

Another variety with sloping whorls (see Pl. I, fig. 9 *a*, *b*) is from the *Cadomensis*-bed at Oborne. This resembles the figure of a Dundry specimen given by Tawney

in the "Dundry Gasteropoda," pl. 3, fig. 8, and referred by him (p. 3) to *P. bellona*, D'Orb.

Another variety (Pl. I, fig. 8 *a*, *b*) resembles *P. Orbignyana*, Héb. and Desl. ('Bull. Soc. Linn. Norm.,' v., p. 176, pl. i, fig. 6), described by them from the Callovian of Montreuil-Bellay. This is a Dorsetshire specimen, but the horizon is unknown.

6. Purpurina curta, sp. nov. Plate I, fig. 6 *a*, *b*.

This is a very squat form, of which I have found one or two examples in the *Humphriesianus*-zone. The specimen figured is from Millborne Wick.

It is not quite safe to describe this form as a variety of *P. bellona*, whilst its title to the rank of species can scarcely be regarded as proved at present.

7. Purpurina parcicosta, sp. nov. Plate I, fig. 10 *a*, *b*.

Description :

Length	21 mm.
Ratio of width to length	80 : 100.
Ratio of body-whorl to shell	60 : 100.
Spiral angle	78°.

Shell conoidal; spire about four-tenths of the entire length. Whorls five to six, angular, and broadly tabulate. Keels coarsely crenulate, and scarcely upturned. Costæ of the spiral whorls wide apart, and not prominent; anterior two-thirds of body-whorl scarcely costated, though the costæ are continuous across the flat area. Spirals coarse and few in number.

Aperture ovate. Columella short, and slightly reflexed, with a very broad and shallow groove. Umbilicus sometimes well marked.

Relations and Distribution.—In the tabulate character of the whorls, and to a certain extent also in the height of the spire, this species approaches *P. bellona* of the type shown in figures 5 *a*—*f*, and the very ovate aperture, and wide and shallow canaliculation, still further connect it. I have, however, other specimens where the canaliculation is stronger, and more like that of the species next described.

Rare in the Inferior Oolite of Dorsetshire.

8. Purpurina aspera, sp. nov. Plate I, figs. 11 *a*, *b*; 11 *c*, *d*; 11 *e*.

Description:

Length of a well-grown specimen	26 mm.
Ratio of width to length	75 : 100.
Length of body-whorl to entire shell	60 : 100.
Spiral angle	70°.

Shell ovate-conoidal; spire rather more than four-tenths of the entire length. Whorls seven in number, angular; posterior area sloping outwards, anterior area sloping inwards. Keels submedian, and coarsely crenulate where the longitudinals or costæ cross over. Costæ few but prominent, and well-continued throughout the body-whorl except in the neigbourhood of the columella. The spirals on the posterior area of the whorls are fine and numerous, those on the anterior area are few in number (about three on the whorls of the spire), coarse and wavy. The spirals in the base are thicker and much striated longitudinally. Shell substance very thick.

Aperture subquadrate and rather restricted; columella encrusted and strongly reflexed, so that the anterior canaliculation is very pronounced. Umbilical slit narrowed and long.

Relations and Distribution.—This fine and characteristic Purpurine is, in many respects, widely removed from *P. elaborata*, and yet these two species are counected through the variety *pagoda*, and the numerous other varieties of *P. bellona*. Also, instead of the shallow anterior groove of that species, *P. aspera* is deeply canaliculate.

These very coarsely ornamented forms are characteristic of the *Sowerbyi*-bed of Bradford Abbas, where *P. aspera* is moderately abundant.

The specimen, Pl. I, fig. 2, is also from the *Sowerbyi*-bed of Bradford Abbas. It is an exceptional form, but I have not ventured to name it.

9. Purpurina calcar, sp. nov. Plate II, figs. 1 *a*, *b*.

Description:

Length	19 mm.
Ratio of width to length	80 : 100.
Length of body-whorl to entire shell	60 : 100.
Spiral angle	75°.

Shell conical. Whorls about six, very angular; posterior area slightly sloping outwards, anterior area slightly sloping inwards. Keels of the whorls of the spire

strongly crenulate, keel of the body-whorl enormously so. Costæ wide apart, scarcely traceable anteriorly, but strongly developed below the keel, though dying out towards the base of the shell. Spirals above the keel fine and numerous; few and wide apart (two or at most three) below the keel. The body-whorl, including the base, has ten spirals.

Aperture subquadrate with an extremely short columella, strongly reflexed, so as to produce a notch of considerable depth. Hardly any trace of umbilicus.

Relations and Distribution.—Evidently related to the last-named species, *P. calcar* is extremely rare in the *Sowerbyi*-bed of Bradford Abbas. In this form we perceive the coarsest ornamentation of any species of *Purpurina* known to me.

Inflata Group.

10. Purpurina inflata, *Tawney*, 1850. Plate II, figs. 2 *a*, *b*, *c*; 2 *d*, *e*; 2 *f*.

1873. Purpurina inflata, *Tawney*. Dundry Gasteropoda, p. 4, pl. iii, fig. 9.

Bibliography, &c.—Mr. Tawney need not have apologised for making this species, which is much nearer to *P. Sowerbyi*, Waagen, than to *P. coronata*, Héb. and Desl., with which he tried to identify it.

Description:

Length of a well-grown shell . . .	24 mm.
Ratio of width to length . . .	80 : 100.
Length of body-whorl to entire shell . .	72 : 100.
Spiral angle	93°.

Shell ovate-globose; spire about three-tenths of the entire length. Whorls five to six, tumid, but flattened posteriorly and markedly canaliculate. Body-whorl much inflated. The longitudinals or costæ are numerous, regular, of moderate force, and with a slight slope from left to right. On the shoulder of the whorls each rib terminates in a slight spinous projection, forming a closely crenulated keel; the costæ extend about half way down the body-whorl. The spirals are fine, numerous, and regular, but are not seen to extend over the flat area.

Aperture ovate to semilunar, with a short and scarcely inflexed columella in the more adult specimens. In younger specimens the anterior groove is better marked, and the umbilical slit is also more apparent.

Relations and Distribution.—This species may be regarded as typical of the more globular forms of *Purpurina*, which are found both in the Inferior Oolite of the Anglo-Norman basin, and also in the Callovian of Montreuil-Bellay. It is undoubtedly near to *P. Sowerbyi*, Waagen, but rather more tabulate.

P. inflata is characteristic of the *Parkinsoni*-zone of Burton Bradstock and the neighbourhood. The *Sauzei*-bed at Oborne also yields it, and specimens resembling this species are in Mr. Buckman's collection, said to come from East Coker, zone unknown. It also occurs at Dundry, and in the Inferior Oolite of Rodborough Hill, and Cold Comfort.

In Normandy it is fairly abundant in the "Oolithe ferrugineuse," whence many fine specimens are to be seen in Prof. Deslongchamps' collection.

11. Purpurina: Cf. Sowerbyi, *Waagen*, 1867. Not figured.

1867. Purpurina Sowerbyi, *Waagen*. Zone of *Am. Sowerbyi*, in Benecke, p. 105, pl. v, figs. 3, 4 *a*, *b*, *c*.

A globose *Purpurina* which differs from *P. inflata*, in having the shoulder of the whorl sloping, and scarcely canaliculate, is of rare occurrence in the *Sowerbyi*-bed of Bradford Abbas. The spire also is rather shorter, and the costæ have a more decided inclination from left to right.

12. Purpurina rotunda, sp. nov. Plate II, figs. 3 *a*, *b*, *c*; 3 *d*.

Description:

Length of well-grown shell	23 mm.
Ratio of width to length	82 : 100.
Length of body-whorl to entire shell	68 : 100.
Spiral angle	90°.

Shell ovate-globose, rather widely umbilicated. Whorls five to six, tumid and canaliculate near the suture; body-whorl much inflated. The costæ are feebly developed on the whorls of the spire, and more or less effaced on the body-whorl. The spirals are numerous and regular in their increase and relative distance.

Aperture widely ovate, with but slight traces of canaliculation.

Relations and Distribution.—Though not more tumid than *P. inflata* this is the most globose of all the Purpurines. It is further distinguished by a good sized, circular umbilicus. The aperture is, perhaps, the least canaliculate of any known species.

Rare in the *Sowerbyi*-bed of Bradford Abbas and Stoford.

13. Purpurina tabulata, sp. nov. Plate II, figs. 4 *a*, *b*, *c*.

Description:

Length of a large specimen	20 mm.
Ratio of width to length	80 : 100.
Length of body-whorl to entire shell	70 : 100.
Spiral angle	90°.

Shell conoidal, subglobose, almost imperforate. Whorls about six, angular and widely tabulate, slightly tumid on the flanks. The longitudinal ornament is very feeble, especially in the body-whorl; it is better shown on the tabular area, where the costæ are split by lines of growth. The keels are delicately crenulate. The spirals are regular, numerous, and rather fine; they do not extend over the tabular area.

Aperture ovate to subquadrate, wide, and bearing considerable resemblance to that of *P. elaborata*.

A less tumid variety (Pl. II, fig. 4 *d*, *e*), with better developed costæ, serves to connect this species with *P. curta* (Pl. I, fig. 6 *a*, *b*), which, however, has well-developed costæ and a somewhat longer spire. This variety might be called P. subcoronata.

Relations and Distribution.—*P. tabulata* is near to *P. coronata*, H. and D. ('Foss. Mont.-Bellay,' p. 25, pl. i, fig. 7), but that small and tabulate species is beautifully cancellated.

Rather rare in the *Sowerbyi*-bed of Bradford Abbas and Stoford.

The following list summarises the results as regards the Purpurines, strictly so called, of the Inferior Oolite in England.

Bellona Group.

Purpurina elaborata, *M. and L.*
— "aperta."
— cancellata, *sp. nov.*
— bellona, *D'Orb.*
— — — var. *pagoda*.

Purpurina curta, *sp. nov.*
— parcicosta, *sp. nov.*
— aspera, *sp. nov.*
— calcar, *sp. nov.*

Inflata Group.

Purpurina inflata, *Tawney.*
— cf. Sowerbyi, *Waagen.*

Purpurina rotunda, *sp. nov.*
— tabulata, *sp. nov.*

Section II.—Purpurina, *Auctorum nonnullorum.*

A considerable modification in the diagnosis of the genus is required to admit the following species; where the spire is longer, the body-whorl less tumid, and the whole shell angular and eucycloid. Indeed, I should prefer to distinguish this group as *Eucycloidea*—small shells with carinated whorls; carinæ median and crenulate; aperture rhomboidal, with a short and narrow anterior canaliculation.

14. Purpurina (Eucycloidea) bianor, *D'Orbigny*, 1850. Plate II, figs. 5 *a*, *b*, *c*; 5 *d*, *e*; 5 *f*, *g*, *h*.

1850. Turbo bianor, *D'Orbigny*. Prod. 1, Ét. 10, p. 266.
1852. Purpurina bianor, *D'Orbigny*. Ter. Jur. 2, pl. 331, figs. 14, 15.
1860. Cf. also Purpurina granulata, *Héb. and Desl.* Foss. de Montreuil-Bellay, p. 28, pl. 7, fig. 9.

Bibliography, &c.—I can find no adequate description of *P. bianor*. In the Prodrome, D'Orbigny merely says that *T. bianor* is near to *T. belia*, but more elongate, more carinate in the middle of the whorls, and without crenulations. Occurs at Port-en-Bessin. In the 'Terrains Jurassiques' no text accompanies the figure of *P. bianor*. On the other hand, our shell greatly resembles specimens from Normandy, which Prof. Deslongchamps and other palæontologists refer without hesitation to *P. bianor*, D'Orb. These occur in the beds of Bayeux.

P. granulata, H. and D., greatly resembles some of the larger specimens from Vitney Cross, but on the whole the ornamentation of *P. granulata* is richer, especially on the carinæ. But if the Vitney Cross specimens were as well preserved as those from the Callovian of Montreuil-Bellay, it might, perhaps, be more difficult to indicate the difference.

Description:

Length of a well-grown shell	13 mm.
Ratio of width to length	65 : 100.
Length of body-whorl to entire shell	55 : 100.
Spiral angle	55°.

Shell conical, eucycloid; spire nearly half the length of the shell, apex sharp. Whorls about seven in well-grown specimens, very angular, having a strong keel, which is median in the whorls of the spire; body-whorl with one strong keel, and showing no distinctive base. The keels are regularly and finely crenulate (differing

from D'Orbigny's description), and where this is not so, it would seem to be the result of wear. The spirals are often faint, except in the lower part of the body-whorl, where they are more prominent; but there is much variation in this respect. On the whole, the spirals are fewer and stronger in the anterior than in the posterior area of each whorl, and in well preserved specimens are seen to be decussated with fine longitudinal striæ.

Aperture subquadrate, inclining to rhomboidal; columella scarcely reflexed; anterior groove more marked in some specimens than in others. Umbilical slit variable.

Relations and Distributions.—The forms described below, viz. *P.* "*fusiformis*" and *P. carino-crenata*, are probably nothing more than varieties of the somewhat variable species identified as *P. bianor*. But this section of the genus *Purpurina*, as was noticed by Hébert and Deslongchamps in dealing with *P. granulata*, recalls the form of *Amberleya* (*Eucyclus*) with considerable force. It will be remembered that many species of eucycloid *Purpurinæ* were figured by D'Orbigny in the 'Terraines Jurassiques,' *e.g. P. ornata*, *P. bathis*, *P. belia*. Forms greatly resembling these our palæontologists have hitherto treated as belonging to the genus *Amberleya*. It is difficult to say where the line should be drawn, since many of the shells referred to *Amberleya* show considerable anterior grooving when well preserved. Altogether, the section of *Purpurina* which contains *P. bianor* is anomalous, and full of difficulty, as we shall perceive in the sequel.

In this country *P. bianor* is essentially a fossil of the *Parkinsoni*-zone, being fairly abundant in P_1, Burton Bradstock Cliff, and in the same horizon at Vitney Cross, and Upper Loders. In North Dorset it occurs sparingly in the *Parkinsoni*-beds at Halfway House and Bradford Abbas.

15. Purpurina (Eucycloidea): Species or Variety related to P. bianor. Plate II, figs. 6 *a*, *b*.

This shell differs from the preceding in having a somewhat smaller spiral angle, and in its more fusiform outline. The body-whorl presents a distinctly defined base, and the anterior portion of the whorls of the spire has less of an inward slope; consequently the whorls are less angular. The keels are richly crenulate; the spirals above the keel consist of a well-marked line near the suture, and two others which are fainter; the spirals below the keel are two in number and stronger; all are finely decussated by axial striæ.

Aperture imperfect, but probably like the preceding.

It is not impossible that this form may be a poor representative of *Turbo sub-*

angulatus, Münst. ('Goldf. Petref.,' t. 194, f. 5), a fossil of the *Murchisonæ*-zone identified by Oppel with *P. patroclus*, D'Orb. ('Ter. Jur.' 2, pl. 329, figs. 9—11). As a temporary name I propose that our shell be called "*Purpurina fusiformis*." It belongs to the Woodwardian Museum, and is marked "Yeovil." Hence I presume it is a fossil of the Lower Division of the Inferior Oolite.

16. Purpurina (Eucycloidea) carino-crenata, *Lycett*, 1853. Plate II, figs. 7 *a*, *b*.

1853. Fusus? carino-crenatus, *Lycett*. Proc. Cotteswold Nat. Field Club, vol. i, p. 81.

Description—"Shell small, fusiform; spire of four volutions, keeled and striated; an elevated carina encircles the middle of each whorl, its edge undulated or crenulated; encircling striæ cover the whole surface of the shell, and there is an indistinct circle of nodules upon the upper portion of each whorl near the junction."—Lycett.

The specimen now figured answers to the above description, except that possibly the spire may have had five whorls. It evidently belongs to the same section of *Purpurina* as *P. bianor*, but obviously differs in the smaller spiral angle, and in possessing a more defined base (not well shown in Fig. 7 *a*, *b*); in fact, the body-whorl may be regarded as distinctly bicarinate. The character, though not the details of the ornamentation, are similar. With "*P. fusiformis*" it has closer affinities, but the Cotteswold shell is much feebler.

This specimen is from the Lycett Collection in the Jermyn Street Museum, and is the only one known to me. The author quotes the species from the Inferior Oolite of Minchinhampton (*op. cit.*, p. 73).

Some other small fossils from the Inferior Oolite have lately turned up which may belong here, but at present it seems safer to reserve these to be dealt with subsequently, either by way of postscript or otherwise.

Genus—Brachytrema, *Morris and Lycett*, 1851, Great Ool. Moll., p. 24.

"*Shell small, twisted, turbinated, solid. Whorls nodular, costated or cancellated; the last whorl large and ventricose; columella smooth, rounded; twisted near to the base, and reflecting outwards, forming a short oblique canal; aperture moderately subovate, less frequently thickened, and externally subvaricose.*"—Fischer, 'Man. Conch.,' p. 685.

The above is in the main the original diagnosis of Morris and Lycett, which had to a certain extent been modified by Piette in 1856. To show the uncertainty which still prevails with regard to the family position of *Brachytrema*, I would refer to the partial list of genera, p. 12 of this Monograph. It will be seen that Fischer places the genus with a query under Cerithiidæ, Tryon places it under Littorinidæ or Cerithiidæ, Tate under Cerithiidæ provisionally, Stoliczka under Cerithiidæ. Morris and Lycett, on the other hand, originally regarded it as related to the Muricidæ.

These shells are very scarce and poorly preserved in the Inferior Oolite of England, so that our opportunities for adding to the knowledge we possess of the genus have not been great. Omitting the more fusiform shells which have occasionally been referred to *Brachytrema*, two distinct groups are apparent, one of which is like *Purpuroidea* in its aspect (*B. Wrightii*); the other might with more justice be regarded as related to the family of the Cerithiidæ (*B. subvaricosum*). Thus the genus is to be regarded as a composite one, which possibly may be broken up when the subject has been more fully ventilated.

17. Brachytrema subvaricosum, sp. nov. Plate II, figs. 9 *a*, *b*.

Description :

Length	6·25 mm.
Width	4·12 mm.
Length of body-whorl to entire shell, about	50 : 100
Spiral angle	50°

Shell small, subconical, apex pointed. Whorls six, nearly flat, and without strong sutural depressions. The ornaments consist of three stout, undulating spirals, which are wide apart, though somewhat fused together in the apical whorls. In the body-whorl a fourth spiral is developed; and in the base the spirals are fine and not numerous. The longitudinal ornamentation is irregular and not conspicuous, though slightly variciform in character.

Aperture subquadrate and somewhat restricted, canal short, columella curved, notch narrow.

Relations and Distribution.—Brachytrema brevis, Piette (‘Bull. Soc. Géol. France,’ 2me sér., vol. xiii, p. 564, pl. xv, figs. 21, 22), believed to be nearly the same as *Turbo pygmæus*, M. and L. (‘Great Ool. Moll.,’ p. 65, pl. ix, fig. 29), approaches this species very closely. *B. subvaricosum* is less depressed, and the longitudinal ornamentation is less sharply developed; the spirals are larger, wider apart, and less numerous than in *Turbo pygmæus*. *B. varicosa*, Lyc. (‘Suppl.,’

p. 5, pl. 44, fig. 27), approaches our shell still more closely, but the spiral ornamentation of Lycett's species is finer, more crowded, and more granulated. It is true that in all these cases the differences are chiefly connected with the ornamentation, and in this respect *B. subvaricosum* certainly differs from all known forms of *Brachytrema* in the Great Oolite of this country. It is possible that this may be the form described by Cossmann (p. 79, pl. xi, figs. 34 and 35) as *Brachytrema brevis*, Piette, said to be not uncommon in the Bajocian of the Meurthe-et-Moselle.

Brachytrema subvaricosum occurs sparingly in the upper part of the Lincolnshire Limestone at Great Ponton. There is also a wide-angled variety, with the spirals very wide apart, which has been found at Weldon.

18. Brachytrema binodosum, sp. nov. Pl. VII, fig. 12.

Description.—This little shell differs from all others of the *varicosum*-group in having two nodular spiral belts round the whorls, which give it an eucycloid aspect. A single specimen has been found at Great Ponton.

19. Brachytrema Wrightii, *Cotteau*, 1855, var. despecta. Plate II, figs. 8 *a*, *b*, *c*.

1860. Brachytrema Wrightii, *Cotteau*. Héb. and Desl., Foss. de Montreuil-Bellay, p. 21, pl. vii, figs. 7 *a*, *b*, *c*.

Description:

Length	7·5 mm.
Width	6 mm.
Body-whorl to entire shell, about	55 : 100
Spiral angle	65°

Shell conical; apex pointed. Whorls five, angular, and step-like; ornaments coarse; three strong nodulated spirals on the anterior area of each whorl; the longitudinals consist of tolerably numerous stout costæ which are very nodular over the angle of the whorl; base rather flattened and ornamented by five spiral lines.

Aperture subquadrate to circular; notch rather wide; scarcely any canal.

Relations and Distribution.—Owing to the indifferent preservation of the anterior margin of the only known specimen it is not easy fully to point out how the form now under consideration differs from Cotteau's species. It is not much

more than one-third the size, is wider-angled, and has a flatter base; the notch also is probably wider and more distinct. There is an undescribed species of *Brachytrema* in the Bajocian of Normandy (for a specimen of which I am indebted to the generosity of M. Deslongchamps), which greatly resembles this form, and also *B. Wrightii*, but yet has points of difference from both. These differences are probably not more than varietal. *B. Wrightii* and its allies represent the group of Brachytremas which are related to *Purpuroidea*. In the well-preserved specimens of the French Bajocian it is possible to note this relationship.

The variety *despecta* is founded on a unique specimen from P_3, Vitney Cross (see p. 38), and is the only *Brachytrema* that has hitherto to my knowledge been found in the Inferior Oolite of England outside of the Lincolnshire Limestone. If additional evidence as to its differing materially from *B. Wrightii* should be obtained, the species may be known as Brachytrema despectum.

Family APORRHAÏDÆ.

"*Shell turrited, aperture continued in front by an imperfect canal or a groove; lip expanded, aliform or digitate.*"—Fischer.

The Inferior Oolite, in England, contains three genera, which may be referred to this family, viz. *Malaptera*, Piette, *Spinigera*, D'Orbigny, and *Alaria*, Morris and Lycett. These genera are probably of unequal value, and it might perhaps be difficult to give a very rigorous and logical definition of any one of them, so linked are they to all appearance by connecting forms. Besides the three named genera there are one or two species of the Aporrhaïdæ, which seem rather difficult to place under any of the above.

The Cretaceous Aporrhaïdæ have received a considerable amount of attention from Mr. J. Starkie Gardner,[1] and, in common with some other conchologists, he failed to see any difference of generic value between *Alaria* and the existing *Aporrhais*. However, Fischer clearly endorses Piette's view as to the propriety of keeping *Aporrhais* distinct from at least the bulk of the shells usually referred to *Alaria*; and the farther we go back in time, the more the *Alaria*-group predominates over the others, until its origin is lost in the small and often obscure forms, which a minute and careful search is gradually revealing from the Lias.

[1] "On the Gault and Cretaceous Aporrhaïdæ," by J. Starkie Gardner, F.G.S., 'Geological Magazine,' 1875.

Genus—Malaptera, *Piette.*

"*Shell thin, fusiform or ovoid, wing very large, multidigitate, palmate, investing, bent back, extended on the columellar side, and sometimes on the posterior portion of the spire; anterior canal placed upon an expansion which forms part of the wing, and consisting of a wide furrow bent backwards as in* Aporrhais."—Fischer.

Such a genus as this possesses more resemblance to the existing *Aporrhais* than the average Jurassic *Alaria* does. Indeed, Cossmann ('Étage Bathonien,' p. 71) regards *Malaptera* as merely a subgenus of *Aporrhais*. Most of these shells were formerly referred to *Pterocera*, Lamarck.

20. Malaptera bentleyi, *Morris and Lycett*, 1851. Plate III, figs. 1 *a*, 1 *b*, 1 *c*.

1851.	Pterocera Bentleyi, *Morris and Lycett.*	Great Ool.-Moll., p. 15, pl. iii, figs. 15, 15 *a*.
1854.	— — —	Morris, Catalogue, p. 274.
Cf. also	Chenopus Pictaviensis, *D'Orbigny.*	Piette, Cont. de la Pal. Franç., pl. xiv, fig. 9, and pl. xix, figs. 10 and 11.

Bibliography, &c.—This is an Inferior-Oolite species described by Morris and Lycett as from the Great Oolite; but no similar form is known in the Great Oolite of this country.

Description:

Length of a full-sized specimen . . .	32 mm.
Ratio of width to length . . .	46 : 100.
Spiral angle	36°.

Shell turrited, spiral angle rather convex, apex blunt. Whorls angular and tumid; posterior third of each whorl marked with very fine spiral lines, for the most part scarcely visible; the anterior two-thirds carries four strong spiral lines. Body-whorl moderately large, and nearly equal to the length of the spire. It is ornamented by six strong spirals, from which the digitations of the wing arise. The wing embraces a very considerable portion of the spire. The posterior digitations are the strongest and also the widest apart, the first one being bent upwards, so as to form an angle of about 10° with the axis of the spire and nearly straight; the three anterior digitations are less strong, and project much less farther from the edge of the palmated portion of the wing; they are bent downwards in an

increasing ratio. The anterior portion of the wing is ornamented by numerous fine lines. The principal digitations are six, but a subordinate seventh occurs.

The aperture is short and nearly quadrate; the six or seven furrows of the wing, corresponding to the digitations, radiate from the outer lip, and the posterior furrows communicate directly with the aperture. The canal is very wide at first, but tapers gradually to a tolerably fine groove, as the anterior spine, or canal-sheath is bent back almost in the form of a sickle.

Relations and Distribution.—This species is of considerable interest as probably the oldest *Malaptera* known. The Collyweston Slate cannot well be higher than the middle part of the *Murchisonæ*-zone. Poor specimens are occasionally obtained from the neighbouring Lincolnshire Limestone, but the species has probably not been found out of the Stamford district. It is by no means uncommon at Collyweston.

21. Malaptera bentleyi, *M. and L.*, var. neglecta. Plate III, fig. 2.[1]

Cf. Morris and Lycett, Great-Ool. Moll., pl. iii, fig. 16.

This differs from the more usual form, (1) in being smaller, (2) the whorls of the spire being rather more angular and the ornamentation finer; (3) the posterior digitation more recurved upon the spire; (4) the anterior digitations scarcely perceptible.

Genus—Spinigera, *D'Orbigny*, 1850.

"*These are Rostellarias compressed and with successive lateral varices, like* Ranella, *but which have at each varix a long point.*" 'Prod.,' vol. i, p. 270. Étage Bajocien.'

Fischer ('Manuel,' p. 677) regards *Spinigera* as merely a subgenus of *Alaria*. He gives the following diagnosis. "Shell elongate, narrow, fusiform; anterior canal long, straight; varices continuous, aligned on one side or on both sides, as with *Ranella*, and provided with a long spine directed transversely." The compression of the shell, originally diagnosed by D'Orbigny, seems to me also an important feature, and helps to distinguish *Spinigera*, which represents a curious section of the Aporrhaïdæ, placed at the opposite extremity of the scale to that of *Malaptera* and its allies.

[1] N.B.—This figure and fig. 1 *c* were drawn from reversed casts in gutta-percha.

This genus is limited both vertically and horizontally. In England it is almost exclusively confined to the Inferior Oolite of Dorsetshire, with a stray specimen from Dundry. In France the type species, *Spinigera longispina*, Desl., is not uncommon in the beds of Bayeux. In the singular repetition of the Bayeux-beds on a Callovian horizon, which occurs at Montreuil-Bellay, two species of *Spinigera* are found, according to the determinations of MM. Hébert and Deslongchamps. The Bathonian beds in France have not yielded any, and this is also the case as regards our own Great Oolite.

The Dorsetshire beds of Inferior-Oolite age, and especially those of Bradford Abbas, provide us with some interesting forms. Five species may be noted, of which three are probably new. Like *Alaria* some are monodactyl, as *Sp. recurva*, where the last lateral spine appears to have the function of a wing-digitation; others, like *Sp. didactyla*, have two wing-digitations when adult. The spines are in many cases seen to be hollow in section, showing that they were channelled or perforated.

Owing to the compression, which appears characteristic of the genus, it would be useless to attempt any comparison by means of the spiral angle. In all cases the shell is more or less elongate, fusiform, and compressed.

22. Spinigera trinitatis, *Tawney*, 1873. Plate III, figs. 3 *a*, *b*; 3 *c*, *d*, *e*.

> 1873. Alaria trinitatis, *Tawney*. Dundry Gasteropoda, p. 12, pl. i, fig. 6.
> Cf. also Rostellaria spinosa, *Münster*. Goldfuss, iii, p. 15, pl. 170, fig. 2.

Bibliography, &c.—Mr. Tawney, in describing his species, admitted that the materials were very imperfect; and this we can easily believe, since it would be difficult to conjecture from the figure given in the 'Dundry Gasteropoda,' that the specimen was a *Spinigera*. However, there was enough to distinguish it from "*Alaria*" *longispina*, Desl.

Sp. trinitatis is probably closely related to *Rostellaria spinosa*, Münster. At any rate the species from the Jura-kalk of Pappenheim is evidently a *Spinigera*, and resembles this species rather than *Sp. longispina*, Desl.

Description:

Length[1]	18 mm.
Ratio of minor to major axis of width . .	53 : 100.

Shell elongate, fusiform. Whorls of spire extremely flattened, body-whorl less so; apical whorls smooth and tumid; next whorl has a median costated keel

[1] In all cases the canal is excluded.

(fig. 3 *b*); then comes a whorl with a keel nearly median and finely crenulated; each of these whorls presents a fine basal rim just above the suture. The four or five remaining whorls, including the body-whorl, have the keel almost at the anterior extremity; traces of the fine crenulation are seen on the keels of the two higher whorls, but this is almost obliterated on the penultimate and body-whorl. In the four or five last whorls there are two fine spiral lines above the keel, and one below; these are decussated by numerous fine radial lines, often indistinct. The four or five last whorls also develop a continuous chain of bilateral varices (fig. 3 *c*), each of which sends out a spine on crossing the keel (not always visible).

Aperture subovate, elongate; canal very long and straight. Without wing, except so far as the antero-lateral spine, originating in the varix, and not in the outer lip, represents one.

Relations and Distribution.—This species is extremely variable, especially as to the position of the keel in the anterior whorls. Occasionally the body-whorl is more angular, and in such cases specimens are not always to be distinguished from *Sp. didactyla*. Indeed, it is possible that *Sp. trinitatis* represents an incomplete stage of that very bizarre form.

Somewhat rare in the *Sowerbyi*-bed of Bradford Abbas, and quoted also from Dundry.

23. Spinigera longispina, *Deslongchamps*, 1842. Plate III, figs. 4 *a*, 4 *b*, 4 *c*.

1842. Ranella longispina, *Desl.* Mém. Soc. Linn. Norm., vol. vii, p. 152, pl. xi, fig. 29.

Bibliography.—This being the type of the genus, most forms of *Spinigera* hitherto found in the British Oolites have been thus referred to by collectors. Deslongchamps' species is, however, in reality almost unknown in our collections, and unless great pains be taken to show the spines it has so much the appearance of an *Alaria* that few would suspect its real nature.

Description:

Length	35 mm.
Ratio of minor to major axis of width . .	80 : 100

Shell elongate, fusiform. Whorls subventricose and only slightly compressed. Apical whorls subglobular; next succeeds an intermediate whorl, subangular, with a median keel, and traces of axial costæ anteriorly; the remaining six whorls, including the body-whorl, have the keel less and less median until its position is at about the lower third. The ornaments consist of numerous spiral lines, which have moderately wide interspaces, and are carried over the bilateral varices in undu-

lations. At the junction with each keel and the varices a spine is developed and generally nearly at right angles to the axis of the shell, sometimes with a slight anterior deflection. These spines are always situated about two-thirds down the whorl; above the base of each spine is a slight corrugation of the varix but no more than one spine on each side of the whorl.

Aperture ovate-oblong to subquadrate; no regular wing, since the anterior lateral spine springs from the varix and not from the outer lip; canal long and straight. N.B.—There seems a certain amount of irregularity in the development of the spines, but on the whole the arrangement is distinctly bilateral, though in some cases the spines appear better developed on one side than on the other.

Relations and Distribution.—Nearly related to the succeeding species, *Sp. longispina* is in this country eminently characteristic of the *Humphriesianus*-zone, where alone I have succeeded in finding it. The three figured specimens are all from the Sherborne district. The *Sauzei*-bed at Oborne contains a very inflated variety. Mr. Wilson has lately found a specimen in the iron-shot Oolite of Dundry, which seems to present features intermediate between this species and those of the one next described, though inclining towards *Sp. longispina.*

24. SPINIGERA RECURVA, sp. nov. Plate III, figs. 5 *a*, 5 *b*; 5 *c*, *d*, *e*; 5 *f*, *g*, *h*.

Description :

Length (full size) . .	22 mm
Ratio of minor to major axis of width . .	75 : 100

Shell rather short, fusiform, and moderately compressed. Apical whorls four, subglobular and plain (fig. 5 *h*), constituting the opening of a very convex spiral angle; next whorl angular and costated longitudinally; the succeeding whorls of the spire (three or four) have either no longitudinals or at best very faint ones, but are spirally ornamented throughout, and betray a tendency to bicarination which varies in different specimens but is generally well marked. The body-whorl exhibits a third carina, sometimes also visible in the penultimate. The chain of bilateral varices is more or less continuous, but a spine is always sent out on both sides where the varix crosses the lower keel (fig. 5 *e*). The direction of the spines is irregular, those on the body-whorl have mostly a tendency to curve upwards.

Aperture very nearly quadrate and graduating into a wide and straight canal. There is no actual wing, but in the well-preserved specimen, fig. 5 *a*, the spines are seen to be grooved, and the groove in the anterior lateral spine is seen distinctly to communicate through a notch in the outer lip with the aperture, hence it may also be said to have the function of a wing.

Relations and Distribution.—Distinguished from *Sp. longispina* in being much shorter, although with nearly the same number of whorls; also in the marked bicarination of the anterior whorls, and to a certain extent in the direction taken by the spines, some of which have a tendency to curve upwards. It is also more compressed and the whorls less tumid. *Spinigera compressa*, D'Orb. (Héb. and Desl., p. 18, pl. vi, fig. 8), from the Callovian of Montreuil-Bellay, which species is regarded by the authors as synonymous with *Muricida fragilissima*, Quenstedt ('Der Jura,' tab. 65, fig. 30), is a small form rather nearer to *Sp. longispina* than to this species.

Spinigera recurva is essentially a fossil of the lower part of the *Parkinsoni*-zone of South Dorset (P_1), being far from uncommon in the cliffs of Burton Bradstock and Bridport Harbour, likewise in the quarries of the interior, especially at Vitney Cross. I have also a stunted variety from Broadwinsor, showing more ornamentation than usual in the subapical whorls. The species has been recognised by M. Deslongchamps in the Bajocian of Normandy as one hitherto unnamed. Undoubtedly the differences which separate it from *Sp. longispina* are not very great, and some might be disposed to regard it as a variety. At the same time these differences are constant or nearly so, and are coincident with a change of horizon. When we feel sure that such is the case it seems only reasonable to "make a new species."

25. Spinigera didactyla, sp. nov. Plate III, figs. 6 *a*, 6 *b*, 6 *c*; 6 *d*, *e*, *f*, *g*.

Description.—This is a very variable shell, especially as to size and angular measurements; or, stated in other terms, several forms presenting considerable differences of size and outline are grouped under one specific distinction. The dimensions, therefore, must be given subsequently under the heading "varieties."

Shell elongate to sub-elongate, fusiform, and greatly compressed. Apex very blunt. The three apical whorls smooth and tumid; the whorls immediately succeeding have a median costated keel; the two costated whorls show a basal rim above the suture. The rest of the shell, consisting usually of five whorls in the longer varieties, and of four whorls in the shorter varieties, is nearly plain, or provided only with fine spiral lines. The keel is well developed, and ranges from submedian to anterior in position. These whorls develop the bilateral varices, which send out short spines on crossing the keel. The body-whorl is strongly bicarinate, sending out from each keel two long channelled bifurcating spines, which greatly resemble the double wing of the didactyl Alarias.

The aperture is subquadrate or trapezoidal, with the outer lip distended over

the wing and in communication with the channelled digitations. Canal long and straight, but no complete termination has been seen.

Varieties and Dimensions.—In the longer varieties, which constitute a considerable majority, the degree of compression, or ratio of minor to major axes of width, which might be called the index of compression, is as 57 to 100. In the shorter and wider varieties it is about as 50 to 100, *i. e.* one side of the shell is twice as wide as the other. From 15 to 20 mm. in length seems to be about an average for the narrower varieties. The large specimen (fig. 6 *a*) measures upwards of 30 mm., but this must be regarded as a megalomorph. The length in this case is gained not by an additional number of whorls, but by the greater height of each.

In the wide variety (fig. 6 *d*, and enlargements) the apical whorls resolve themselves into an almost undistinguishable nucleus, the two costated whorls are in their place, and the remainder of the shell appears in all cases to consist of four instead of five whorls. Hence this variety seems to have arrived at maturity earlier. The length of this variety may be taken at from 12 to 13 mm.

Relations and Distribution.—This curious species helps to show the analogy which exists between *Alaria* and *Spinigera*. Unless we are prepared to believe that *Sp. trinitatis* is a young or undeveloped form of *Sp. didactyla*, the latter stands almost alone. If *Spinigera trinitatis* be an undeveloped form, then the two species, though related, might be regarded as distinct. But if *Sp. trinitatis* be merely the young stage of the other, then it is clear that they only form one species. The point is a difficult one and not easy to decide. There is a considerable degree of resemblance in the more apical portions of the spire. On the whole the anterior whorls, which make up the bulk of the shell, are less angular in *Sp. trinitatis*, and show more spiral ornamentation.

Both forms are mainly confined to the *Sowerbyi*-bed at Bradford Abbas, and in my own collection *Sp. didactyla* is the most numerous. These species are apparently not known to occur in the Inferior Oolite of Normandy.

26. Spinigera crassa, sp. nov. Plate III, fig. 7.

Description.

Length about . . . . 25 mm.

Shell subelongate, fusiform. Apex unknown. Whorls stout and subangular (seven remain), with a strong keel placed towards the anterior extremity. No spiral ornament visible, but the whorls are rugose with axial lines, most probably of growth. The bilateral varices in the only available specimen are not well seen, and the spines are more or less broken off. Body-whorl sub-bicarinate,

with a stout diverging pair of spines, or didactyl wing. Other indications are wanting.

Relations and Distribution.—This species seems to be the descendant of the short variety of *Sp. didactyla*. A single specimen was found in the *Sauzei*-bed, or marl with green grains at Oborne.

Genus—Alaria, *Morris and Lycett*, June, 1851.

"*Shell fusiform, turrited; anterior canal straight or curved; lip dilated, digitate or palmate, formed by the prolongation of the last whorl; no posterior canal; no sinus properly so-called on the anterior margin of the lip; columellar margin not callous.*"—Fischer.

The above diagnosis is substantially that of Piette ('Cont. de la Pal. Franç.,' p. 16), who adopted Morris and Lycett's genus with modification. Piette further alludes to the nakedness of the first whorls, which are smooth and convex, and also to the power of developing varices, spurs, and protuberances at various periods of increase, evident traces of rudimentary wings, which appeared usually on the side opposite the actual (definitive) wing.

This very important genus has been variously subdivided into sections, to say nothing of sub-genera, such as *Spinigera* previously described. On the other hand, as already observed, there are not wanting those who fail to see any generic difference between *Alaria* and *Aporrhais* (*Chenopus*). Into these questions I do not feel disposed fully to enter, being on the whole satisfied that the genus *Alaria* may fairly be taken to cover the remainder of the wing-shells of the Inferior Oolite, with possibly one or two exceptions. It would not be difficult for a casuist to prove, almost to demonstration, that the family of the Aporrhaïdæ consists of little more than one genus. Thus Cossmann makes *Malaptera* (in part the old Jurassic *Pterocera*) co-generic with *Aporrhais*, which Gardner says does not differ from *Alaria*, of which *Spinigera*, according to Fischer, is merely a sub-genus. As was urged in the Introduction to this memoir, since the practical acceptance of the doctrine of evolution we no longer worship the fetish implied in such terms as "species," "genus," "family," &c. If no lawyer is able to draft an Act of Parliament through which some other lawyer cannot drive a coach-and-four, how much more applicable is this principle to the diagnosis of shells.

As far as the shell goes we need not, I think, have much difficulty in separating *Alaria* from *Aporrhais* in the majority of cases, since the wing in *Alaria* is barely or, at best, but scantily palmate, and does not envelope more of the spire than the anterior half of the penultimate. The monodactyl *Alariæ* are widely different from

Aporrhais, and, if we except certain obscure forms with no wing attached, the monodactyls seem to have been the earliest Aporrhaïds. Even the didactyl *Alariæ* have the wing but scantily palmate, and not embracing. In the Great Oolite, however, there are forms such as "*Pterocera*" *atractoides*, Desl., where the wing becomes more complex and embracing; and here the resemblance to *Aporrhais* becomes effective. Hence Piette places this species under *Aporrhais*. When we come to the malacology of the subject, attempts at comparison resolve themselves mainly into conjecture, as far as the Jurassic Aporrhaïds are concerned. These may have been the ancestors of part of the Strombidæ as well as of the modern Aporrhaïdæ, and probably differed from both to a certain extent. Piette divided the Jurassic *Alariæ* into five sections, viz. Varicifers, the Monodactyls, the Adactyls, the Longicaudes, and the Hamicaudes. To simplify matters these might be placed under *two grand divisions*. We do not, in this country, appear to have the section "Varicifer" developed, as far as I can understand it; the Monodactyls proper are numerous and important, whilst the Adactyls may owe their wingless appearance to various causes. All these I propose to place under the first grand division, assuming that they either have, or might have, no more than one digitation when there is no evidence of a second. Our *first grand division*, then, is constituted by the *Monodactyls*.

The Longicaudes, which are almost coextensive with the *mytirus*-group, and the Hamicaudes, which are almost coextensive with the *trifida*-group, make up the *second grand division*. The shells of both these groups, when mature, develop two digitations on the wing. These are *Didactyls*. There will still remain one or two forms somewhat difficult to place.

It is probably true that more species are made out of these fossils than would be the case if all the specimens could be obtained in a reasonably perfect condition, like the shells, for instance, of existing species of *Aporrhaïs*. But if we were to wait until none but perfect specimens of *Alaria* were accepted, the Jurassic Aporrhaïdæ might as well be left alone. Owing to the number of processes which many of these curious shells possessed, their preservation is rarely complete, and it thus happens that what ought to be recognised as the same species presents such a different aspect under the various conditions under which it is found as to make its recognition very difficult. To avoid error altogether under the circumstances is almost impossible. Too often we have to choose between the Scylla of a doubtful identification and the Charybdis of "species-making."

Thus the first forms described and figured in Pl. IV are wingless, and mostly without the canal-sheath. It becomes necessary to distinguish these in some way, yet such "species" are little more than tentative. The bulk of the species are described with some attempt at grouping.

Division I. The Monodactyls.

27. Alaria arenosa, *Hudleston*, 1884. Plate IV, fig. 1.

1884. Alaria arenosa, *Hudl.* Geol. Mag., dec. iii, vol. i, p. 198 (May), pl. vii, fig. 7.

Description:

Length[1]	20 mm.
Width of body-whorl to length of shell .	31 : 100.
Approximate spiral angle . . .	25°.

Shell fusiform, turrited. Number of whorls about ten, apical ones unknown. Each whorl has a median carina which is strongly tuberculated. In the upper whorls this tuberculation is extended axially so as almost to reach from suture to suture; but in the last two whorls it is confined to the region of the keels. The whorls are marked with rather strong spiral lines. The body-whorl carries two keels; the upper one is the strongest, and has tubercles very similar to those on the penult; the tuberculations of the lower keel are less strong. The nature of the wing is uncertain, there being no outer lip preserved.

Aperture ?; canal long and moderately curved.

Relations and Distribution.—Some of the peculiarities of the figured specimen are partly due to matrix and condition of the fossil. Piette (*op. cit.*, p. 23) alludes to a variety of *Rostellaria subpunctata*, Münst., figured by Terquem, which, as regards the tuberculations of the lower whorls, may have some resemblance. This was from the *Opalinus*-zone. From *Al. Phillipsii* this species differs in the position of the longitudinal costulæ, in the tuberculated keels of the body-whorl, and in the slightly narrower spiral angle.

Rare in the Dogger Sands (*Opalinus*-zone) this species is interesting as the earliest example of *Alaria* at present known from the Jurassic beds of Yorkshire.

[1] These measurements exclude the canal. Since all *Alariæ* possess a more or less blunt apex, with great convexity of the opening of the spiral angle, the "approximate spiral angle" of this and subsequent measurements is intended to denote the mean angle of the spire without reference to the apical whorls.

28. Alaria angusta, sp. nov. Plate IV, fig. 2.

Description:

Length	22 mm.
Width of body-whorl to length of shell	30 : 100.
Approximate spiral angle	21°.

Shell fusiform, turrited. Apex blunt. Whorls about ten, prominent and deeply divided by the suture on the principal whorls of the spire; the carina is very nearly median, and the slope of anterior and posterior moieties nearly equal. The longitudinal costæ are well developed, and especially prominent on the keels; they extend almost from suture to suture, but are strongest anteriorly. The spirals are close, undulating, and distinct; about seven fine ones in the posterior half of the whorls, and four or five stouter, and wider apart, below the keels. The last whorl is but slightly ventricose, and has ornaments nearly similar in character to those of the spire, except that the costæ are reduced to tubercles on the keel, and that there is a faint trace of an anterior keel at the base. The canal-sheath is broken off short; other indications wanting.

Relations and Distribution.—Although the specimen from which the above description is taken seems never to have carried a wing, the indications are clearly those of an *Alaria*. The blunt apex, and nearly smooth apical whorls, afford additional evidence in this direction. We may regard it either as an immature shell, or as a species of *Alaria* which had not developed a wing (Adactyl). In many cases the absence of a wing is due to mutilation, but hardly so in this. From the whole of the *hamus*-group it is separated by the ornamented character of the body-whorl, and by considerable differences in the ornaments of the spire and other features. It comes pretty near in many respects to *Alaria arenosa*.

The specimen is unique, and forms part of the Inferior-Oolite collection in the Bristol Museum. I have no note as to the horizon or locality. It is a well preserved spathic fossil in a fawn-coloured limestone, which is not iron-shot.

29. Alaria? sp. nov. Plate IV, fig. 3.

There is hardly enough of this fossil remaining to determine its true character. The whorls are very tumid and without much keel. The spiral ornaments are numerous and well cut; the longitudinal costæ are very thick and wide apart, and extend almost from suture to suture. The spiral angle appears to be rather wide.

The last whorl is somewhat inflated, and similarly ornamented. There are indications that possibly another whorl may have been broken off.

In the paucity and thickness of its longitudinals, this form bears some resemblance to *Al. rarispina*, Schlumb. In order to avoid a mistaken identification I would suggest the name CRASSICOSTATA as provisional. A single specimen in the Dogger.

30. ALARIA ? sp. nov. Plate IV, fig. 4.

The spiral angle is about 30°, the length of the specimen about 20 mm., and the number of whorls ten. The whorls of the spire are short and strongly turrited. The sculpture is rich, the longitudinals being numerous and stout, but somewhat irregular; they are mainly confined to the lower part of the whorls, and are extremely nodular at the junctions with the spirals. There is no very salient keel, but the anterior portion of each whorl is marked by three coarse spirals, the uppermost of which serves as a keel, and above this are from three to four fine wavy spirals. The body-whorl is similarly ornamented, but shows rather more irregularity. It shows no sudden increase.

Since the specimen is unique and imperfect as regards the aperture, but little can be said by way of comparison. The rich and nodular character of the sculpture seems to separate it from all forms of the *hamus*-group, and, supposing the shell to be complete in that case the body-whorl is totally different. It was found in the shell-bed of Horton Hill corresponding to the Upper Trigonia-grit (base of *Parkinsoni*-zone), and may be known temporarily as AL. HORTONENSIS.

The *Hamus*-Group.

A very considerable portion of the more strongly turrited and costate *Alariæ* belong to this important group, which is eminently characteristic of the Monodactyl section. They occur principally in the Upper Division of the Inferior Oolite, at least in the South of England. The forms which most nearly resemble the typical specimens of the Bayeux-beds are to be found chiefly in the *Parkinsoni*-zone of South Dorset, but micromorphs and varieties, such as *Al. Phillipsii*, occur in many parts of the Inferior Oolite. Also there are doubtful fossils such as *Al.* "*spinulosa*," which may be immature individuals of *Al. Phillipsii*, or, more probably, of *Al. unicarinata*.

31. Alaria. Variety, or immature form. Plate IV, figs. 5 *a*, 5 *b*.

1884. Alaria Phillipsii, spinulose variety. Hudleston in Geol. Mag., dec. iii, vol. i, p. 149, pl. vi, fig. 5.

Length from 18—25 mm., spiral angle rather over 30°, number of whorls nine. The apex, as is the case with nearly all *Alariæ*, consists of two and a half smooth, rather tumid whorls, but the apical angle as distinct from the spiral angle is only slightly convex. The remaining whorls of the spire are tumid and moderately angular. The longitudinal costæ, at first extending almost from suture to suture, become much shorter on the penultimate and last whorl, where they present the appearance of spinulose nodes. The spirals of the posterior area in each whorl are fine and numerous; the primary spirals on the anterior area are four, the uppermost one serving as keel. The body-whorl is moderately bicarinate, but the anterior carina probably dies out. The wing is formed on the posterior carina, but no prolonged digitation has been noted.

Aperture wide and triangular; canal straight, as far as known.

Originally it was considered that this form might be a variety of *Al. Phillipsii*; but, if it be not a distinct species, I am disposed to consider that it may be an immature form of *Al. unicarinata*. In order to avoid mistakes it may be distinguished for the present as Al. spinulosa. Rare in the Dogger of Blue Wyke.

32. Alaria hamus, *Deslongchamps*, 1842. Plate IV, figs. 6 *a*, 6 *b*, 6 *c*, 6 *d*; Plate VII, fig. 9.

1842. Rostellaria hamus, *Desl.* Mém. Soc. Linn. Norm., vol. vii, p. 173, pl. ix, figs. 32—36.

1850. Pterocera hamus, *D'Orbigny.* Prod., i, p. 270.

1864. Alaria hamus, *Eud. Desl.* Piette, Cont. de la Pal. Franç., p. 39, pl. v, figs. 1—11, &c., including several varieties.

Non Alaria hamus, *Desl.* In Morris and Lycett, Great-Ool. Moll., p. 16, pl. iii, figs. 2, 2 *a*, 2 *b*.

Bibliography, &c.—The identity of the Normandy fossil with the "*Rostellaria composita*" figured by Phillips (subsequently the *Pterocera Phillipsii* of the Prodrome) was evidently suspected by Deslongchamps. That author describes *Al. hamus* as a common fossil of the "Oolithe ferrugineuse." Only one example was known to him from the Great Oolite. The fact of its rarity in the Great

Oolite is endorsed by Piette and Cossmann. The former figures a variety (*op. cit.* pl. v, figs. 6 and 7) from the Fuller's Earth of Les Clappes, which is characterised by numerous slender longitudinals on each whorl. The same author (*op. cit.*, p. 46) points out the difference between *Al. hamus*, Desl., and the fossil so identified by Morris and Lycett.

Description :

Length of good-sized specimens	25 mm.
Width of body-whorl to length of shell	40 : 100
Approximate spiral angle	32°

Shell strongly turrited (muricated), fusiform ; apex blunt, but the apical angle only slightly convex, so that the general aspect of the spire is sharp. Number of whorls eleven ; two and a half smooth and convex; remainder of whorls of spire very angular, the keel being slightly above the middle; longitudinal costæ strong, regular, and numerous, for the most part sloping from right to left. In the majority of specimens from Burton Bradstock these costæ are confined to the anterior area of the whorl and fail to reach the suture, but in some cases (fig. 6 *a*) they extend across the keel. There are about five spirals above the keel and usually four below, exclusive of the keel. The body-whorl is bicarinate, with the keels plain, and the spiral ornamentation fainter in most cases; the posterior keel carries two spinous lumps, one situate half a turn above the wing and the other mid-way between these points.

The aperture is triangular to trapezoidal. The wing is constituted by the continuation of the posterior or principal keel, and consists of one stout digitation proceeding for some distance at right angles to the axis of the shell and suddenly curving upwards, somewhat after the fashion of a hook (the sharpness of this curve not sufficiently shown in fig. 6 *c*) ; see also Plate VII, fig. 9. The wing scarcely overlaps the base of the penultimate. The delicate spiral ornamentation is continued on the wing, base, and canal-sheath, being faintly decussated by fine longitudinal lines. Canal broad, moderately long, and curved anteriorly, though not to any great degree.

Relations and Distribution.—As the type of the Monodactyls *Alaria hamus* constitutes a standard of comparison both for varieties and species. The Dorsetshire specimens most nearly approach Deslongchamps' fig. 32. In the Normandy specimens which I have seen the wing appears to overlap the base of the penultimate somewhat more than in our English examples, and possibly the hook-like curve at the termination of the digitation is sharper, and the digitation itself shorter in the Normandy specimens. The individual figured (Pl. VII, fig. 9) is an unusually fine example.

This species is most abundant in the *Parkinsoni*-zone of South Dorset, and especially at Burton Bradstock, whence nearly all our best specimens are obtained

—mostly from P_1 (page 31). Specimens showing any of the processes (6 *c*, 6 *d*) are rare. The specimen 6 *d* differs somewhat from all the others, and approaches the var. *Phillipsii* in some respects, and still more reminds me of the form provisionally described as *Al. spinulosa*. I think that *Al. hamus*, as defined above, is mainly confined to the upper division of the Inferior Oolite, at any rate in Dorsetshire. Elsewhere in England, except perhaps at Dundry, it appears to be represented either by the variety *Phillipsii*, or else by dwarf forms, like those to which I now direct attention.

33. Dwarf varieties of Alaria hamus. Plate IV, figs. 7 *a*, 7 *b*, 7 *c*.

Specimens from the *Parkinsoni*-zone of Notgrove (fig. 7 *a*) and from the *Parkinsoni*-zone of Horton Hill (Upper Trigonia-grit) are fairly similar. The dwarfing extends to all the whorls, the whole shell is proportionally smaller, and the large spirals on the anterior portions of the whorls are always *three* in number. The keel of the body-whorl possesses the spinous lumps characteristic of *Al. hamus*, but they are better shown in specimens from Horton Hill than in the more slender ones from Notgrove, which might indeed be regarded with equal justice as dwarfs of the variety *Phillipsii*.

The specimen from Horton Hill (fig. 7 *b*) is sufficiently well preserved to show that it was possessed of a wing and "tail" in all respects, except as to size, identical with *Al. hamus*. The evidence of a wing in the case of the Notgrove specimens is less clear, but the plain and strongly-keeled body-whorls show that the specimens are mature shells.

The specimen (fig 7 *a*) from the Gryphite-grit of the neighbourhood of Stroud presents other differences. The shell is shorter in proportion to its width, and seems to have matured earlier; the whorls are strongly muricated. In this specimen the three spirals which occupy the anterior portion of the whorls of the spire are so conspicuous that, if a trivial name be required, I would suggest that of TRICINCTA.

The specimen (fig. 11), also from the Gryphite-grit, is most probably an immature form of *Al. Phillipsii*. Such forms are not uncommon in the Scarborough Limestone, and these of course are referred to *Al. Phillipsii* in default of better evidence.

It should be noted that, while the full-grown and typical forms of *Al. hamus* occur in the Dorset district, these dwarfed varieties seem to take its place in the Cotteswolds.

34. Alaria hamus, Desl., var. Phillipsii, D'Orbigny, 1850. Plate IV, figs. 8 *a*, 8 *b*, 8 *c*.

1829.	Rostellaria composita, *Sow.*			Phillips, G. Y., pp. 124, 129, 165, pl. ix, fig. 28.
1850.	Pterocera Phillipsii, *D'Orbigny.*			Prod., i, p. 270.
1853.	Alaria Phillipsii, *D'Orb.*			Morris and Lycett, Great-Ool. Moll., p. 111, pl. xv, figs. 15, 15 *a*.
1854.	—	—	—	Morris, Catalogue, p. 234.
1867.	—	—	*D'Orb.* = Al. hamus, *Desl.*	Laube, Gast. von Balin, p. 23.
1884.	—	hamus, *Desl.*, var. Phillipsii, *D'Orb.*		Hudleston, Geol. Mag., dec. iii, vol. i, p. 145, pl. vi, figs. 3 and 4.

Bibliography, &c.—It is noticeable that Morris regarded *Al. hamus* as a species of the Great Oolite only, and *Al. Phillipsii* as a species confined to the Inferior Oolite in England (Scarborough Limestone, &c.). It has already been shown that Morris and Lycett were incorrect in their identification of Deslongchamps' species, which can scarcely be said to occur in the Great Oolite in England. But it is evident that Morris, judging from the localities quoted in his "Catalogue," regarded *Al. Phillipsii* and the true *Al. hamus* as the same species. Laube takes the same view, but gives no figure.

If we could obtain perfect specimens of each, the point might be settled. Up to the present time I have never seen a Yorkshire specimen with the wing-digitation preserved. In fact I have never seen from any locality in England a specimen of the variety *Phillipsii* with the digitation.

Lately an unusually good specimen (fig. 8 *a*) was obtained from the Scarborough Limestone.

Description.—The points in which this differs from the Dorsetshire *Al. hamus* are that the spire is more slender, the costulæ are smaller, and the whorls are less boldly muricated; the aperture is subtriangular as in *Al. hamus*, and I think there are traces of the spinous swellings on the upper keel of the body-whorl. Imperfect specimens from the Dogger (fig. 8 *b*) and from the Millipore-bed (fig. 8 *c*) seem to bear out this view.

Relations and Distribution.—But little more need be said about the relations of this very doubtful species or variety. Most specimens of *Alaria* from the Inferior Oolite, which possess a moderately thin spire with longitudinal costulæ arranged in a circlet anteriorly on the whorls, and a plain bicarinate body-whorl are likely to be thus referred. The type is a very general one throughout the Oolites, and

is well exemplified in "*Rostellaria*" *composita*, Sow., a lower Oxfordian fossil, *Alaria seminuda*, Héb. and Desl., and probably others.

35. Alaria hamus, *Desl.*, var. nodosa. Plate IV, fig. 9.

A single specimen, said to come from Stoford, in the Buckman Collection, presents some curious analogies with, and yet some marked differences from, *Al. hamus*. It is a stouter and larger shell than the average of South-Dorset specimens. Number of whorls ten to eleven; not only are the apical whorls smooth and without ornament, but this peculiarity extends to the subapical whorls, so that the turrited character characteristic of the *hamus*-group is not developed until much later. The longitudinals are extremely thick and nodose. The wing overlaps the lower half of the penultimate, a feature not preserved in the Burton Bradstock specimens; there seems also to have been an anterior spine on the keel of the body-whorl instead of a mere spinous swelling.

36. Alaria pinguis, sp. nov. Plate IV, fig. 10; and Plate VII. fig. 11.

Description.—Since the available specimens are probably incomplete, dimensions cannot be given, but the spiral angle is about 45°. Spire wide-angled and conoidal, and consisting of eight whorls; the apical whorls, as usual, plain; subapical whorls convex and either plain or spirally striated; the anterior whorls possess coarse longitudinal tuberculation in addition to the spiral ornaments. Body-whorl bicarinate, keels plain or nearly so.

Relations and Distribution.—Through the var *nodosa* there seems to be some connection between these shells and the regular *Al. hamus*. Yet, omitting that possible intermediary, the differences are so great as to warrant a somewhat stronger distinction. Since none of the processes are known, the species must be regarded as tentative and incomplete.

Rare in the *Parkinsoni*-zone of Dorset. The specimen, Pl. IV, fig. 10, is from Stoford, horizon unknown; the specimen, Pl. VII, fig. 11, is from P_1, Vitney Cross.

37. Alaria: *Cf.* rarispina, *Schlumberger*, 1864. Plate IV, fig. 12.

1864. Alaria rarispina, *Schlumberger*. Bull. Soc. Linn. Norm., vol. ix, p. 225, pl. vi, figs. 7—9.
1867. — — — Piette, Continuat. Pal. Franç., p. 100, pl. xx, figs. 1—3.

This specimen sufficiently resembles the description given by Piette to warrant its comparison. The spire has an angle of about 26°; whorls angular, keel about one third distant from the posterior suture; costæ very wide apart, but extending almost from suture to suture; spirals fine and wavy. Part of the penultimate is devoid of costæ. Body-whorl scarcely bicarinate, and showing traces of a varix or spine on the keel.

Piette observes that Schlumberger's shell is very distinct from all other hamiform species; it was described from a single specimen in the *Sowerbyi-Murchisonæ*-zone of the Meurthe.

The specimen here figured is probably from the *Sowerbyi*-bed in Dorsetshire. It is certainly a more angular shell than the one figured by Piette, which, as regards the spire only, has more resemblance to the form (Pl. IV, 3) provisionally named "*crassicostata*." A specimen lately acquired for the York Museum, in a similar matrix, shows that the wing-digitation is more produced and less sharply curved than in *Al. hamus*. Rare.

The following species, viz. *Al. unicarinata*, *Al. unicornis*, and *Al. unicornis*, var., constitute a subgroup related to *Al. hamus*, but distinguished in possessing a somewhat different digitation, in the effete character of the anterior keels on the body-whorl, and especially in the possession of powerful curved spines on the keel instead of mere spinous protuberances. They belong also, as it seems to me, to a lower horizon. It may be, indeed, that these are only varieties of one species.

38. Alaria unicarinata, *Hudleston*, 1884. Plate IV, figs. 13 *a*, 13 *b*, 13 *c*.

1884. Alaria unicarinata, *Hudl.* Geol. Mag., dec. iii, vol. i, p. 149, pl. vi, figs. 1, 2, 2 *a*.

Bibliography, &c.—Two specimens of *Alaria*, one in the York Museum, the other in the British Museum, seemed to me sufficiently distinct from *Al. Phillipsii*, as recognised by Morris and Lycett, to warrant distinction. Since then I have ascertained that this is the more usual form in the Dogger. It is just possible

that Phillips' figure may have been meant for this one; for, although figured in the plate showing the Scarborough-Limestone fossils it has somewhat the look of a Dogger specimen.

Description:

Length	26 mm.
Width of body-whorl to length of shell . .	38 : 100
Approximate spiral angle . . .	31°

The spire is mainly on the type of *Alaria hamus*, but there is considerable variation in the several specimens; the whorls are more angular in some (fig. 13 *a*, fig. 13 *c*), more rounded in others (fig. 13 *b*); the position of the keel in the whorls of the spire also varies, being central in figs. 13 *a* and 13 *b*, and situate in the posterior third in fig. 13 *c*. The longitudinal costæ likewise show considerable difference. Part of this apparent difference is due to mal-preservation (fig. 13 *a*). The body-whorl is without costæ, and the anterior keel is so much aborted that the species is practically unicarinate. The keel gives birth to a very large spine a quarter of a turn above the base of the wing, and to another spine a quarter of a turn farther back, the latter being exactly opposite the wing.

The aperture is triangular, the wing being pretty full for a Monodactyl, and terminating in a stout digitation, the exact nature of which has not been ascertained. Canal straight at first, but the exact termination unknown.

Relations and Distribution.—The affinities of *Al. unicarinata* have already been partially indicated; when mere fragments of the spire alone are preserved, as is too often the case, it cannot well be distinguished from the mass of costated and turrited *Alariæ*. Not uncommon in the Yorkshire Dogger; it probably occurs in the Duston ironstone.

N.B.—It should be observed that fig. 13 *a* is not a back view, but just midway between a back view and a front view. The fracture on the keel represents the posterior spine broken off; the anterior spine is seen on the left.

39. Alaria unicornis, *Lycett*, 1853. Plate V, fig. 1.

1853. Rostellaria unicornis, *Lycett*. Proc. Cotteswold Nat. Field Club, vol. i, p. 80.

Description.—"Spire lengthened, composed of many whorls; whorls costated, the costæ terminating in knobs on their upper portions; costæ ten in a volution, indented by five encircling striæ, last whorl smooth with a single prominent carina, having an acute and elevated spine about a quarter the circumference posteriorly from the outer lip; the wing single, rounded, curved, slender, and produced; caudal extremity moderately long."—Lycett.

The specimen figured has a length of 26 mm. (exclusive of the fragment of the canal-sheath), and a spiral angle of about 30°.

Relations and Distribution.—It is only piecemeal, as it were, that we can hope to work out the true relations of the Jurassic *Alariæ*. Available specimens are generally wanting in some feature of importance. In the present case, if we were sure that *Al. unicornis* possessed a second spine, opposite the wing, this feature would serve still more closely to connect it with *Al. unicarinata*, notwithstanding certain differences in the spire which are increased by difference of matrix. Again, we are not certain of the true character of the digitation of *Al. unicarinata*.

Very rare in the Oolite-Marl of the Cotteswolds.

40. Alaria : *Cf.* unicornis, *Lycett.* Plate V, figs. 7 *a*, 7 *b*.

Description :

Length	26 mm.
Width of body-whorl to height of shell . .	42 : 100.
Spiral angle	28°.

Shell turrited, fusiform, elongate. Number of whorls about ten, excluding the apicals ; the whorls of the spire are very angular, and the keel placed rather far back, so as to make the anterior area twice as long as the posterior area. This peculiarity is less strong on the penultimate than on the other whorls of the spire. The costæ are regular, very straight, and rather strongly marked, though becoming less well-developed in the anterior whorls. The spirals are fine and crowded posteally, much coarser, about four in number, below the keel. The body-whorl is entirely without costæ, though marked by longitudinal striæ. It is practically unicarinate, since the lower keel becomes effete before reaching the margin. The keel is very salient and carries two large spines :—*a*, the anterior spine, a quarter of a turn above the wing ; *p*, the posterior spine, a quarter of a turn higher up, *i. e.* opposite the wing.

The aperture is rudely triangular, the wing consists of one digitation, which is stout at the base, but has not been observed further. Canal staight, as far as observed.

These shells occur rarely towards the junction of the *Sowerbyi*-bed and the paving-stone bed at Bradford Abbas, and may be regarded as belonging to the *Murchisonæ*-zone. If a varietal name is required I would suggest that of Bradfordiensis.

41. Alaria fusca, sp. nov. Plate V, fig. 3.

Description:

Approximate length	26 mm.
Width of body-whorl to length of shell . .	48 : 100.
Spiral angle	38°.

Shell turrited, subelongate, apex blunt. Number of whorls about 10; the two apicals rounded and without ornament; whorls of the spire tumid and subangular, keel median and becoming very prominent in the anterior whorls. Longitudinal costæ numerous, close, slightly curved, and extending nearly from suture to suture, being equally well-developed on the posterior as on the anterior area; spiral striæ regular, numerous, and nearly uniform; sutures distinct and bordered by a slightly raised rim. Body-whorl without costæ; posterior keel enormously developed, anterior keel barely perceptible.

Wing single, with a deep and strong digitation, extending at right angles to the axis of the spire for about three-fourths the length of the spire, where it forms a very thick elbow, and then turns up in the shape of a short hook; the digitation is finely marked by lines in continuation of the spiral ornament of the shell. Other indications wanting.

Relations and Distribution.—Differs from *Al. hamus* in the shape of the whorls, which are less mural, in the more median position of the keel, and in the fact that the costæ extend nearly from suture to suture. In this species the posterior keel is more salient, and the anterior keel less developed. The length of the digitation and its great thickness at the elbow are also differences, so far as we can judge, from the few specimens which have these processes preserved. On the other hand, the shell is by no means wanting in a general resemblance to *Al. Dundryensis*, though unfortunately we are ignorant of the character of the wing in Mr. Tawney's species.

Alaria fusca is extremely rare in the *Cadomensis*-bed at Oborne (upper part of the *Humphriesianus*-zone).

42. Alaria. Species or variety. Plate V, fig. 4.

There is hardly justification for burdening our lists with a fresh name in the present instance. This may possibly be the Dorsetshire representative of *Al. Dundryensis*, to which it bears considerable resemblance in the character of the

spire and its ornaments. The spire also has many points of resemblance to that of *Al. fusca*, but the digitation is more slender, and less abrupt in its upward curve.

A single specimen from the Inferior Oolite of North Dorset, horizon and locality unknown. As a mere name of convenience I would suggest that of AL. ALIENIGENA.

43. ALARIA DUNDRYENSIS, *Tawney*, 1873. Pl. V, fig. 2. *Type refigured.*

1873. ALARIA DUNDRYENSIS, *Tawney*. Dundry Gasteropoda, p. 12, pl. i, fig. 5.

Description.—"Shell fusiform, elongate. Whorls seven to nine, angular; the keel not quite in the middle of the whorl, but inferior thereto; on the keel is a series of tubercles, probably twelve to fourteen on a whorl, which do not form costæ in the [anterior] whorls, *i. e.* the last, but are vertically compressed; the surface shows faint [longitudinal] lines; there are fine [spiral] lines, which are stronger near the suture."—TAWNEY.

Description:

Length	30 mm.
Width of body-whorl to height of shell . .	44 : 100.
Spiral angle	36°.

The type is one of those shells preserved in crystalline calcite, where the ornamentation has probably undergone considerable modification, and this especially affects the length of the costæ. The body-whorl is almost unicarinate and without costæ; no spines are preserved, though there is good reason to suppose that a very prominent one existed a quarter of a turn above the wing. The base of the wing (which doubtless was monodactyl) is ornamented by fine cross-hatching, and it has a slight tendency to overlap the anterior portion of the penultimate. Other indications wanting.

Relations and Distribution.—The sub-median position of the keel, and its marked prominence, serve to separate this species from all members of the *hamus*-group; it is also much more unicarinate, and probably possessed a digitation of a very different character, which may have resembled that of *Al. fusca*, but which more probably resembled that of *Al. Roubaleti*, var. *Dorsetensis*, next to be described.

The type-specimen is from the Inferior Oolite of Dundry, and is the only one known to me which presents any describable features.

44. Alaria Roubaleti, *Schlumberger*, 1864, var. Dorsetensis. Plate V, figs. 5 *a*, 5 *b*, 5 *c*, 5 *d*, 5 *e*, 5 *f*; and Plate VII, fig. 10.

1864.	Alaria Roubaleti, *Schlumberger*.		Bull. Soc. Linn. Norm., vol. ix, p. 223, pl. vi, figs. 4—6.
1867.	—	—	Piette, Cont. de la Pal. Franç., p. 102, pl. xx, figs. 4—8.

Bibliography, &c.—The typical *Alaria Roubaleti*, Schlumb., is said to occur in the Department of the Meurthe (Lorraine), in a bed characterised by *Am. Sowerbyi* and *Am. cycloides*. The Dorsetshire fossil now under consideration is eminently characteristic of the so-called *Sowerbyi*-bed of Bradford Abbas, where it is rather abundant, and of course subject to considerable variety. In collections it is generally labelled *Al. Dundryensis*.

Description:

Length of large specimen . . .	32 mm.
Width of body-whorl to height of shell . .	44 : 100.
Spiral angle	36°.

Shell turrited, fusiform, subconical; apex very blunt. Whorls about ten; apicals globose and smooth, succeeding whorls convex, and becoming angular owing to the development of a strong keel, which is rather below the middle. The longitudinal costæ of the earlier whorls of the spire are very numerous, curved, and extend from the posterior almost to the anterior suture. These costæ disappear entirely on the posterior area of the ante-penultimate, and are only traceable as very faintly-cut serrations at wide intervals on the penultimate. The spiral lines are fine and very numerous; in the posterior areas they are closely set and of nearly equal strength; anteriorly the spiral lines are more irregular, so that a shallow sulcus is formed between each keel and the anterior suture.

In immature specimens, which have not developed a wing (fig. 5 *e*), the last whorl is strongly bicarinate, but the next half-turn, which developes the wing, presents a body-whorl with the anterior keel greatly diminishing in importance as it approaches the margin. In mature specimens the body-whorl is full, entirely without longitudinal ornament, and only slightly bicariuate; the spiral lines are fine and very numerous, and slightly cross-hatched by radial lines of growth. The posterior keel carries two very powerful spinous processes (see basal views of figs. 5 *a* and 5 *c*); the anterior spine, *a*, is a quarter of a turn above the wing; the posterior spine, *p*, is a quarter of a turn farther back, and, consequently, opposite the wing; both spines curve forwards.

The aperture (fig. 5 *a*) is widely triangular; the wing is constituted by the prolongation of the principal keel, and consists of one long and moderately stout digitation, which attains a length equal to the height of the spire before gradually curving backwards with a wide sweep towards its terminal point (see Pl. VII, fig. 10). Delicate lines, in continuation of the spirals, slightly cross-hatched by longitudinal lines, ornament the wing and digitation, and, in a less degree, the wing and canal-sheath. The canal is moderately wide, and extremely long, tapering gradually to a point; it has a slight anterior curve.

Relations and Distribution—It is probable that, in the presence of more perfect specimens of *Al. Roubaleti* and *Al. Dundryensis*, the differences which now seem to separate the var. *Dorsetensis* from both the other forms might be bridged over. At present we must be content to keep them apart, bearing in mind also that, in the type specimen of *Al. Dundryensis*, the processes of whatsoever nature, with the exception of the canal-sheath, are altogether wanting. Even granting that *Al. Dundryensis* was possessed of two spines on the keel, of which no mention is made in the diagnosis, there still remains a very considerable difference in the ornamentation of the spire, which is so very plain in the lower whorls of *Al. Dorsetensis*. On the other hand, the spire of Schlumberger's species has a very great resemblance to the Dorset fossil, but the latter differs in the development of two very important curving spines, which in *Al. Roubaleti* appear as mere spinous swellings. Moreover, we really know very little regarding the other processes of *Al. Roubaleti*.

Owing to the comparative abundance of *Al. Dorsetensis*, it is possible, from one specimen or another, to obtain a tolerably complete notion of the original shell, which must be accepted as typical of the group to which it belongs. From the *unicarinata*-group, which shares with it the possession of two similar and similarly situated spines, it differs entirely in the character of the spire. From the *hamus*-group it differs, still more widely, in the length and slight curvature of the "tail," and also in the length and moderate curvature of the wing-digitation, as well as in the character of the spire (see Pl. VII, figs. 9 and 10, where the two forms are well contrasted).

45. Alaria Roubaleti, *Schlumberger:* another variety. Plate V, fig. 6.

Spiral angle 28°. This form is at once distinguished from the numerous specimens of the far commoner *Al. Dorsetensis* by the comparative narrowness of the spiral angle and the greater delicacy of the ornamentation. A careful examination of the figured specimen renders it almost certain that it possessed the two spines characteristic of *Al. Dorsetensis*.

The aperture is triangular, and produced in a long and slender canal, somewhat more curved than in the preceding. In the figured specimen the callus of the inner lip extends to the upper keel.

Rare in the *concavus*- or *Sowerbyi*-bed of Halfway House. If a temporary name is required, I would distinguish this form as ALARIA DIMIDIATA.

46. ALARIA PSEUDO-ARMATA, *Hudleston*, 1884. Plate V, fig. 8.

1884. ALARIA PSEUDO-ARMATA, *Hudleston*. Geol. Mag., dec. iii, vol. i, p. 150, pl. vi, figs. 6 and 6 *a*.

Description :

Length	26 mm.
Width of last whorl to length of shell . .	48 : 100.
Spiral angle	34°.

Shell strongly turrited. Whorls about ten; those below the apicals are extremely angular, the dividing carina occurs about two-thirds down—a feature which is very marked in the penultimate. Each whorl has about eight short, tuberculated costulæ, which are straight and not developed in the anterior areas; spiral ornaments uncertain, apparently irregular. Body-whorl is largely developed, very angular, and without costæ. It carries a large median keel which supported one or two immense spines. Other indications wanting.

Relations and Distribution.—The peculiar character of the spire will serve to distinguish this species from any other *Alaria* in the Inferior Oolite. It evidently belongs to the section of unicarinate monodactyls, which carried powerful spines on the keel of the body-whorl. It may also have some relationship to *Al. armata*, M. and L., though that species is a difficult one to understand.

Extremely rare in the Yorkshire Dogger.

47. ALARIA LOTHARINGICA, *Schlumberger*, 1864. Plate V, fig. 9.

1864.	ALARIA LOTHARINGICA,	*Schlumb.*		Bull. Soc. Linn. Norm., vol. ix, p. 222, pl. vi, figs. 1—3.
1867.	—	—	—	Piette, Cont. de la Pal. Franç., p. 105, pl. xxi.
1873.	—	—	—	Tawney, Dundry Gasteropoda, p. 14.

Description:

Probable length . . .	40 mm.
Width of last whorl to length of shell	25 : 100.
Spiral angle . . .	14°.

Shell extremely elongate, slightly turrited. Whorls about ten (six visible in the figured specimen), convex, and scarcely angular, since the very slight keel or shoulder is close to the anterior suture. The longitudinals consist of regular and very straight ribs of considerable thickness, extending nearly from suture to suture; these decussate with a system of rather prominent spirals, which are continued in the base of the shell. The body-whorl shows a slight increase beyond the regular spiral angle, owing to the development of a strong median keel.

Piette observes that this keel, which becomes spinous on the side opposite the wing, forms in its prolongation a thick digitation bent upon itself, which twists towards the point of the spire.

Relations and Distribution.—This is a Monodactyl of peculiar form, which seems almost to stand by itself, or at least to have no near relations, except perhaps in some degree to the species next described. Piette describes several varieties.

It is said to be common in the zones of *Am. Sowerbyi* and *Am. Murchisonæ*, in the Department of the Meurthe. The Dundry specimen now figured, originally described by Tawney, is at present unique as a British example of this species.

48. Alaria prælonga, sp. nov. Plate V, fig. 10.

Description:

Probable length . . .	46 mm.
Width of body-whorl to length of shell	30 : 100.
Spiral angle . . .	17°.

Shell extremely elongate, turrited. Whorls ten or eleven in number, and moderately angular, the keel being situate rather more than one-third the distance from the anterior suture. The longitudinals are mainly confined to the anterior area of the whorls, and consist of very straight stout costæ, decussating with spirals which are more or less obliterated in the available specimens. In the penultimate the longitudinals fail entirely, the keel being plain and nearly median. There is a sharp rise of the keel in the body-whorl, which keel is also plain with indications of a spinous projection on the side opposite the outer lip; the position of the keel is irregular.

The aperture is triangular, and there is a considerable callous deposit on the columellar side. The indications of a wing and canal are not distinct.

Relations and Distribution.—Whether this curious species is a Monodactyl or an Adactyl cannot at present be decided. The condition of the available specimens is such as to lead to very grave suspicions. It is probably related to *Al. Lotharingica.*

Very rare in the *Murchisonæ*-zone of Halfway House.

We may fairly refer to these narrow-angled and elongate Alarias as the *Lotharingica*-group; and with this group terminates Section I, or the Monodactyls in the wider acceptation of the term.

Division II. The Didactyls.

Section 1.—*Imperfectly Didactyl.*

49. Alaria Doublieri, *D'Orbigny.* Plate V, fig. 11; Plate VI, figs 1 *a*, 1 *b*, 1 *c*.

1850.	Pterocera Doublieri, *D'Orbigny.*		Prod. i, p. 270.
1866.	Alaria	— —	Piette, Cont. de la Pal. Franç., p. 54, pl. vi, fig. 1; pl. vii, fig. 1.

Bibliography, &c.—D'Orbigny observes that this species is near to *Pterocera* (*Chenopus*) *Philippi*, K. and D., referred to by Piette as *Alaria bicarinata.* The type is said to have been derived from the Department of the Var. The specimens described and figured by Piette were so imperfect as to leave his determinations somewhat incomplete. But the semi-digitation, so to say, of the anterior portion of the wing, in addition to a considerable resemblance in the spire, helps to connect D'Orbigny's species with certain specimens found in the Inferior Oolite of Dorsetshire, which can scarcely all be referred to one species. These, however, for the present may be treated as varieties.

Var. A. (Plate VI, figs. 1 *a*, 1 *b*, 1 *c*).

Description.—Length of a full-grown specimen about 30 mm.; approximate spiral angle 36.° Shell conoidal, fusiform, apex of spire very blunt. Number of whorls about ten. The first five or six whorls[1] are convex and nearly smooth, or only marked by fine spiral lines; next succeeds a whorl with fine spiral lines and a faint submedian keel. The three remaining whorls of the spire, in addition to the fine spiral lines, develop a strong and rather blunt median keel, which at once

[1] None of the available specimens of this variety exhibit the extreme apicals in such a condition as to afford the means for a thoroughly accurate description.

makes the whorls angular instead of convex (see Pl. VI, fig. 1 *b*, and enlargement, where the successive stages of growth are very well shown). In the penultimate and antepenultimate the anterior area is excavated, and exposes a rim above the suture, prefiguring, as it were, the anterior keel. The body-whorl carries a prominent posterior keel in the middle, which gives rise to a stout digitation; this is connected by a slight palmation of the wing with a very short process, arising from the anterior keel, which has the appearance of an attempt to form an anterior digitation. The termination of the principal digitation is unknown. The spiral lines or striæ are continued on the wing and base of the shell, and slightly cross-hatched with axial lines. The posterior keel carries a short curved spine, half a turn above (*i. e.* opposite) the base of the wing; the existence of a spine between this one and the wing is not indicated in any of the specimens hitherto available.

The aperture is triangular to trapezoidal; the incrustation on the columellar side extended to the edge of the principal keel; canal rather narrow and nearly straight, so far as has been observed.

Relations and Distribution.—The specimens on which the above description is based are all from the Inferior Oolite of North Dorset, but the exact horizon is not known. In two of them the anterior "semidigitation" is well preserved. If we were desirous of obtaining any evidence as to the existence of an apparent link between the Monodactyls and the Didactyls these fossils seem to afford us a clue. The character of the spire, however, points to the latter rather than to the former, and the general affinities are perhaps almost as much with the *myurus*-group as with the *trifida*-group (*Chenopus Philippi*, *&c.*).

Though mainly confined to North Dorset there are some badly preserved specimens of *Alaria* from Dundry in the Bristol Museum, which might probably be classed under one or other of the varieties of *Al. Doublieri*.

Var. B. (Pl. V, fig. 11.)

A single specimen from the *Cadomensis*-bed of Oborne presents us with a spire in a very perfect condition but without processes of any kind. The spiral angle is nearly 40°, and very convex towards the apex. The apicals consist of two and a half whorls, perfectly smooth and convex; next succeeds a whorl convex and with regular longitudinal costæ, extending from suture to suture, and fine spiral striæ; the next whorl, though still very convex, developes a slight keel, whilst very fine spiral lines decussate with costæ which are more numerous and finer than in the preceding whorl. Remainder of the spire and body-whorl similar to those of Var. A.

It may be that the apical conditions of this specimen are really the same as those of Var. A. There are no certain signs of a spine but rather of a spinous swelling. On the whole there is probably no real difference between Var. A and Var. B, other than what may be due to the preservation of different features in each case.

50. Alaria: species or variety. (Pl. VI, fig. 2.)

Differs from the forms already described in the much coarser ornamentation of the higher whorls; the spiral lines, too, are stronger and wider apart and the keel more salient; the spiral angle is narrower, and there was an immense spine about one-quarter of a turn above the base of the chief digitation.

Founded on an imperfect specimen said to come from the *Humphriesianus*-zone of Dorset. This I think may prove to be a distinct species. It possibly belongs to the section of *Alaria* now under consideration, or it may be truly Didactyl, since the character of the penultimate and antepenultimate is greatly that of the *trifida*-group. Alaria dubia might do as a trivial name.

Section 2.—*Perfectly Didactyl.*

a. The *Myurus*-group = the "Longicaudes" of Piette.

51. Alaria sublævigata, sp. nov. Plate VI, figs. 3 *a*, 3 *b*; 3′ *a*, 3′ *b*.

Cf. Alaria myurus, *Deslongchamps*, narrow variety. Hudleston, Geol. Mag., dec. iii, vol. i, p. 196, pl. vii, fig. 6.

Description:

Length	28 mm.
Width of body-whorl to height of shell	44 : 100
Spiral angle.	34°

The points in which this species or variety differs from *Al. myurus*, Desl., are:—the general form is slightly more elongate in the majority of specimens, the whorls are less tumid, and the position of the spine on the posterior keel is differently placed; in this case being nearly three-quarters of a turn above the commencement of the wing; the anterior keel is also better defined on the side of the columella; the aperture is somewhat more triangular.

Relations and Distribution.—In some respects this species has more resemblance to *Al. lævigata*, M. and L., but the position of the principal spine, the comparative straightness of the canal, the keel in the penultimate, and the well-developed spiral lines, should, if Piette's description is to be accepted, distinguish *Al. sublævigata* from the Great-Oolite species.

Occurs sparingly in the Inferior Oolite of North Dorset, and chiefly in the *Sowerbyi*- or *concavus*-bed. The variety shown in figs. 3′ *a* and 3′ *b* from Bradford Abbas has a smooth outline, and but for the position of the spine might almost be referred to *Al. myurus*. The specimen, 3 *b*, is from the Yorkshire Dogger.

52. Alaria myurus, *Deslongchamps*, 1842. Plate VI, figs 4 *a*, 4 *b*, 4 *c*.

1842. Rostellaria myurus, *Deslongchamps*. Mém. Soc. Linn. Norm., vol. vii, p. 176, pl. ix, figs. 23—25.
1850. Pterocera — *D'Orbigny*. Prod., i, p. 270.
1864. Alaria myurus, *Eud. Desl.* Piette, Cont. de la Pal. Franç., p. 30, pl. ii, figs. 8—11, and pl. vi, figs. 11, 12.
? — — *Desl.* Lycett, Suppl., p. 122, pl. xli, fig. 13.
? — — — Tawney, Dundry Gasteropoda, p. 11.

Bibliography, &c.—Deslongchamps' species is a fossil of the "Oolithe ferrugineuse" (Calvados), and belongs consequently to the Upper Division of the Inferior Oolite. It was said to be rare, but Piette qualifies this by stating that it is tolerably numerous. *Al. myurus* is not quoted in Morris's Catalogue of British fossils. Mr. Tawney drew attention to some imperfect specimens from Dundry; none of these show very characteristic features.

The value of the difference between *Al. myurus*, Desl., and *Al. lævigata*, M. and L., is a question that has been much debated. In 1884 ('Geol. Mag.,' p. 196) I pointed out that the absence of striæ, on which alone Morris and Lycett based their distinction, was, under the circumstances, of no value whatever. This was written before I had read Lycett's note in the Supplement, where, in consequence of his having discovered striæ in *Al. lævigata*, he withdrew it as a distinct species. Laube ('Gast. von Balin,' p. 24) endorses this union of *Al. lævigata* and *Al. myurus*. Piette, on the other hand, says that, although *Al. myurus* is near to *Al. lævigata*, it has the spire more ventricose and less elongate, it is striated almost throughout and the penultimate is subangular. Cossmann ('L'Étage Bathonien en France,' p. 164), alluding to the remarks of Lycett in the Supplement, and of Laube, is disposed to agree with Piette, and separates them as distinct species. On the whole it seems to me that the differences are slight, but apparently constant according to horizon; hence, although the original difference noted by the authors of

Al. lævigata is admitted to be non-existent, there seem some grounds for distinction in other respects.

Description:

Length of largest specimen	35 mm.
Width of body-whorl to height of shell	54 : 100.
Spiral angle	40.°

Shell fusiform, elongate, about ten whorls; apicals unknown. The spire is composed mainly of about five very convex whorls, which are covered by fine spiral bands separated by regular furrows. Towards the centre of the penultimate one of these spiral bands becomes conspicuous and forms a slight keel. The body-whorl is bicarinated; the posterior keel, more salient than the other, gives rise to a strong spine a quarter of a turn above the base of the wing. The spiral ornamentation is very marked between the keels and in the base of the shell; as many as a dozen spiral bands may be counted between the keels, some of which are continued on the respective digitations; a system of finer lines intervenes. The wing consists chiefly of two long, diverging digitations, which are subtriangular in section. Piette says that the posterior digitation forms the arc of a circle of which the centre is situated towards the point of the spire.

The aperture is trapezoidal with a considerable callus on the columella; the canal is said to be long and almost straight, being barely curved at its extremity.

Relations and Distribution.—The relations of this, the type species, to such forms as *Al. lævigata* and *Al. sublævigata* have been already indicated. The possibility of some of these latter being immature specimens of *Al. myurus* has been intimated. It is very rare in the Inferior Oolite of England. One of the figured specimens (4 *a*) is from Dundry, and is by far the finest ever seen by me from English beds. Figs. 4 *b* and 4 *c* represent specimens from the *clypeus*-grit of the Stroud district, which already present some slight differences. The specimen fig. 4 *c* in many respects resembles one described by me ('Geol. Mag.' 1884, p. 197) from the Cornbrash of Scarborough as *Al. myurus* var. *teres*.

Some might prefer to regard *Al. lævigata*, *sublævigata*, &c., merely as varieties of Deslongchamps' species.

b. The *Trifida*-group = the "Hamicaudes" of Piette.

It is by no means easy to decide whether to admit as species the numerous forms of this widely spread group, which have received names from various authors. That its members vary considerably as to size and proportions in the same series of beds may be seen by inspecting the lower figures of Pl. VI. At present it is

by no means clear to me that the changes of form are coincident with change of horizon only, or that the differences which separate *Al. Lorieri* from *Al. cochleata* or *Al. trifida* are really of biological import. Piette seems to have more faith in the existence of these differences, and it is quite possible that the superior condition of the French fossils has justified the separation. In addition to any references which may be given the following general references should be noted :

1829 and 1835. Rostellaria trifida, *Bean*, MS. Phillips G. Y., p. 109, pl. v fig. 14.

Compare also

1836. Fusus curvicauda, *Roem.* Ool. Geb., p. 140, pl. xi, fig. 6.
1837. Chenopus Philippi, *Dunker and Koch.* Beitr., p. 34, pl. ii, fig. 13.
1844. Rostellaria bicarinata, *Münst.* Goldfuss, Pet., iii, p. 15, pl. 170, 1.
1867. Alaria cochleata, *Quenstedt.* Piette, Cont. de la Pal. Franç., p. 110, pl. xxii, figs. 1—6.

The *trifida*-group stands out tolerably distinct from all the others. In this country its earliest representative, *Al. Lorieri*, var. *gracilis*, appeared in the *Murchisonæ*-zone of the Cotteswolds. No traces of it are known to me in the Yorkshire Dogger, nor yet in the Lower Division of the Inferior Oolite in Dorsetshire.

53. Alaria Lorieri, *D'Orbigny*, 1850. Plate VI, figs. 6 *a*, 6 *b*, 6 *c*, 6 *d*; 6 *a'*, 6' *b*; 6'' *a*.

1850. Pterocera Lorieri, *D'Orbigny.* Prod., i, p. 270.
1867. Alaria — — Piette, Cont. de la Pal. Franç., p. 32; see plates ii, iii, iv, and vi.

Compare also

1842. Rostellaria trifida, *Phillips.* Deslongchamps, Mém. Soc. Linn. Norm., vol. vii, p. 171, pl. ix, ? figs. 27, 28.
1869. Chenopus Philippi, *Dunker and Koch.* Brauns, Mittlere Jura, p. 170.
1873. Alaria Lorieri, *D'Orbigny.* Tawney, Dundry Gasteropoda, p. 13.

Bibliography, &c.—Deslongchamps, who applied the name "*trifida*" to all forms of the group from the Lias to the Kimeridge Clay, traced the species back as far as the Upper Lias of Fontaine-Etoupe-Four. But I cannot find in Piette's work any allusion to the *hamicaudes* having been represented in the Lias.

The following is D'Orbigny's description of "*Pterocera*" *Lorieri*. "A small species near to *Pterocera* (*Chenopus*) *Philippi*, but much more elongate and slender; whorls strongly carinated, finely striated spirally." He does not mention any localities in Normandy but refers to the Department of the Sarthe. Piette

describes three varieties of *Al. Lorieri*. His third variety, which occurs in the "Oolithe ferrugineuse" of Bayeux (*op. cit.*, pl. ii, figs. 12—14, and pl. iii, figs. 11, 12), might be expected to have most resemblance to our Dorsetshire specimens. There are differences in the Dorset-beds but they do not correspond in all cases to the differences indicated by Piette. Viewed broadly we may say that the *trifida*-group is represented in the Inferior Oolite by a series of fossils which in France are recognised for the most part as *Al. Lorieri*, and in Germany as *Al.* (*Chenopus*) *Philippi*. Each of these has its own set of synonyms, and some English palæontologists would designate the whole as *Alaria trifida*.

Without doubt the Burton-Bradstock fossils must be regarded as representing the *Al. Lorieri* of common repute, though possibly not exactly the *Al. Lorieri* of D'Orbigny. Three varieties are shown in the accompanying plate, and these I proceed to describe.

Var. A. (Figs. 6 *a*, 6 *b*, 6 *c*.)

Description:

Length	20 mm.
Width of last whorl to height of shell	45 : 100
Spiral angle	35°

Shell fusiform, sub-turrited. Whorls nine; apex moderately blunt; apical whorls tumid without keel or ornament; the five succeeding whorls of the spire are strongly carinate; the carina is median, and in well-preserved specimens is seen to be characterised by a furrow. (This is one of the distinctive features of *Al. Lorieri* according to Piette). There are no longitudinal ornaments, but the spiral lines are regular and conspicuous, being most numerous on the posterior area of each whorl; in the anterior area is a sulcus immediately above the suture, and in the middle of this sulcus is a fine thread-like line, most obvious on the last three whorls; a rim is exposed at the base of the lower whorls, and the suture rather gapes in consequence. The body-whorl is strongly bicarinate, the posterior keel, representing the median carina of the spire-whorls, being the most salient. It gives rise to the posterior digitation (fig. 6 *b*) which rapidly attenuates in describing a curve, whose centre is a point some little way beyond the apex of the shell. The wing is slightly palmate, the intercarinal space being slightly excavated and spirally striated. The anterior digitation, although arising from the least salient keel, becomes wide and bayonet-shaped for a short distance, and after developing a broad, tongue-like process, curves slightly upwards to its blunt termination (fig. 6 *a*).

The aperture is trapezoidal, the outer lip considerably produced, and each of the wing-digitations deeply channelled; the canal is broad and comparatively short, since it curves sharply in a direction opposite to that of the anterior digitation, and to this circumstance much of the grotesque appearance of the shell (in common with other members of the *trifida*-group) is due. This also terminates in a slight expansion.

Var. B. (Figs 6′ *a*, 6′ *b*.)

Description:

Length	19—27 mm.
Spiral angle	28°

This form differs from the one last described in the comparative narrowness of the spiral angle and in the height of the whorls of the spire in proportion to their width. The slight differences of ornamentation are perhaps the result of accident. We may compare these forms in some respects to *Al. gracilis*, Lycett.

Var. C. (Fig. 6″ *a*.)

Description:

Spiral angle abont	40°

This specimen, which is deeply embedded in matrix, may be somewhat deceiving in appearance. It is shorter and more widely angled than the majority of specimens, and would do very well to represent the "*Chenopus*" *Philippi* of Dunker and Koch.

Relations and Distribution.—The *Parkinsoni*-zone of the neighbourhood of Burton Bradstock has yielded nearly all our specimens of *Al. Lorieri*. There is a specimen in the Bristol Museum (fig. 6 *d*), apparently a fragment of a large specimen of this species. Elsewhere it is very rare, small, and in poor preservation. Under such conditions *Al. Lorieri* or some member of the *trifida*-group may occasionally be recognised in the Upper Division of the Inferior Oolite in the Cotteswolds. Some specimens of the *trifida*-group occurring in the Lincolnshire Limestone may possibly belong here likewise, though not the forms from Great Ponton (see Pl. VII, figs 1 *a*, 1 *b*, and 2).

54. Alaria Lorieri, D'Orb., var. *gracilis*, Lycett, 1853. Plate VI, fig. 5.

1853. Rostellaria gracilis, *Lycett*. Proc. Cotteswold Nat. Field Club, vol. i, p. 80.

Description.—"Spire lengthened, smooth. Whorls six, lengthened, angulated, the angle being in the middle of the whorl, forming an acute and crenulated carina; body-whorl smooth, with two carinæ and large digital processes; caudal extremity slender and lengthened. The slender form, crenulated carina, and smooth surface distinguish it from *R. trifida*."—Lycett.

The figured specimen, which is believed to be Lycett's type, presents no crenulations other than the result of usage, and this is also the cause of the smoothness, the spiral lines having been rubbed down almost to obliteration. The appearance of smoothness in fossils obtained from oolitic freestones is in most cases merely due to rolling. The "caudal extremity" is not particularly lengthened, and there are indications in the specimen of the commencement of the hamicaudal curve. The mean spiral angle is about 28°.

Relations and Distribution.—This variety is more slender than the majority of the specimens referred to *Al. Lorieri* from the *Parkinsoni*-zone of Burton Bradstock. It may, in fact, represent the typical *Al. Lorieri* of D'Orbigny.

There is a particular interest attaching to the figured specimen, viz. that it is the earliest recorded example of the *trifida*-group in this country. It was obtained from the Freestones below the Oolite-Marl near Leckhampton, which are well within the *Murchisonæ*-zone. Such fossils must be extremely rare, since no species of the *trifida*-group is quoted from any horizon of the Inferior Oolite in Witchell's 'Geology of Stroud.' Since the few species of *Alariæ* hitherto discovered in the British Lias appear to belong to the Monodactyl section, this is the earliest Didactyl *Alaria* known in this country.

55. Alaria pontonis, sp. nov. Plate VII, figs. 1 *a*, 1 *b*, and var. *spinifera*, Plate VII, fig. 2.

Description:

Length	22 mm.
Width of body-whorl to height of shell . .	50 : 100
Spiral angle	42°

Shell fusiform, scarcely turrited, spire convex. Whorls about nine (only seven observed), tumid; the two sub-apical whorls have longitudinal costæ (rarely to be seen for lack of preservation); the two succeeding whorls are either smooth or marked with very fine spirals. Up to this point the increase of the shell is very slow. About the seventh whorl a change takes place, the shell begins to develop more rapidly, a sort of keel is formed somewhat above the middle of the whorl, which is spirally striated throughout; in the penultimate the keel is more pronounced; above the keel the spiral lines are fine and close, below the keel are three primary spirals with very fine intermediate lines. The body-whorl is ventricose, and bicarinate, the upper carina being the most prominent; the spiral ornamentation is continued throughout, and into the base of the shell; there are three principal spiral lines between the digitations. The wing rather broad and didactyl, each carina giving rise to a digitation; the posterior is somewhat the narrower, and sweeps upwards in a curve whose centre is situated near the apex of the shell. The anterior digitation has a tolerably sharp downward curve; it is short, thick, terminating in a sort of blunt point.

The aperture is trapezoidal, the outer lip projecting, the wing digitations being slightly channelled. The canal-sheath is thick and short, with a sharp upward curve.

The variety *Spinifera* differs from the shells previously described thus:—no longitudinal costæ have been detected on the sub-apical whorls (but this may arise from the accidents of preservation); the general outline is less smooth, whereby the anterior whorls are rendered somewhat more angular; the anterior digitation is directed more outwards, and with less of an anterior curve. But the chief difference lies in the tendency to develop spines; the upper carina of the body-whorl carries one or two spines, which are differently placed in different individuals, sometimes a quarter of a turn, sometimes half a turn, above the base of the posterior digitation. In some specimens there seems to have been some on the penultimate.

Strictly speaking, this form, which is the commoner of the two, should be regarded as more typical than the smooth specimens.

Relations and Distribution.—Always bearing in mind that this species is a member of the *trifida*-group, it may be separated from *Al. Lorieri* by the non-carinate character of the earlier portions of the spire, by the very different shape of the anterior digitation, by the proportional shortness of the highly curved "tail," and by the more pupoid aspect of the whole shell, besides minor points of ornamentation. The var. *Spinifera* still further differs in the development of spines.

It has much closer affinities with *Alaria pupæformis*, D'Archiac, a fossil of the Great Oolite of the East of France. Piette (*op. cit.*, p. 85, Pl. 13, figs. 1—8)

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A MONOGRAPH

OF THE

BRITISH JURASSIC GASTEROPODA.

BY

WILFRID H. HUDLESTON, M.A., F.R.S., Sec.G.S.

PART I, No. 3.

GASTEROPODA OF THE INFERIOR OOLITE.

Pages 137—192; Plates VII—XI.

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practically re-describes D'Archiac's species, and, doubtless, the points of resemblance with the Ponton fossil are tolerably close. In *Al. pupæformis* the shell is still more depressed, and the position of the spines is very different from that of the Ponton fossil. For all this we must hold that our var. *spinifera* closely approximates to *Al. pupæformis*, D'Arch., as defined by Piette. On the other hand, the smooth or non-spinous variety of *Al. pontonis* is further removed from it.

This species is rather characteristic of the Lincolnshire Limestone of Great Ponton, but I have not met with it elsewhere in the Inferior Oolite. On the other hand, it strongly resembles some of the Minchinhampton specimens of the *trifida*-group, and thus affords another link uniting the Gasteropod fauna of Great Ponton with that of the Great Oolite, both in the East of France and at Minchinhampton. (See 'Great-Oolite Moll.,' Pl. iii, fig. 11.)

56. Alaria primigenia, sp. nov. Plate VII, fig. 3.

Description :

Length	22 mm.
Width of body-whorl to height of shell . .	42 : 100.
Spiral angle about	34°

Shell fusiform, turrited. Opening of the spiral angle convex and obtuse. Number of whorls about eight; the apical and subapical whorls are without keel and apparently smooth; the last three whorls of the spire betray a very sudden increase, and are sharply carinated about the middle. There is no longitudinal ornamentation, and the spiral ornamentation, if ever it existed, is obliterated in the only available specimen. The keels of the spire-whorls develop pointed spinous swellings, which are very salient on the penult; these do not occur in axial order.

The body-whorl presents but a moderate increase; it is strongly bicarinate, and rather excavated; the base is very sharply marked off by the second carina. The wing is scarcely, if at all, palmate; the posterior keel produces a vigorous digitation, at first triangular in section, but becoming rounder, as it sweeps with a sharp upward curve considerably beyond the apex. The anterior digitation and canal-sheath are too much broken away for description. Other indications wanting.

Relations and Distribution.—This curious species, though founded on a unique specimen, presents characters which easily separate it from any others heretofore described. The uncompressed spire, and the unsymmetrical arrangement of the spinous nodes, exclude this species from *Spinigera*, to which it has a certain

superficial resemblance. It is a didactyl *Alaria*, which probably belongs to the *trifida*-group (Hamicandes). It differs from *Alaria Lorieri* in the excessive sharpness and salience of the keels, and in the numerous spinous processes on the keels of the spire-whorls; it further differs in the extreme recurvation of the posterior digitation, reminding one somewhat of the curve in the tusk of the mammoth.

Occurs in the *Parkinsoni*-zone (P_1) of Vitney Cross with *Alaria Lorieri* and *Spinigera recurva*.

With this species the list of didactyl *Alariæ* comes to an end. Some other Aporrhaïds remain to be described, which it will be convenient to classify under Section 3, as belonging to no group in particular, or whose position is somewhat doubtful.

Section 3.

57. Alaria spinigera, *Lycett*, 1853. Plate VII, fig. 4.

1853. Rostellaria spinigera, *Lycett*. Proc. Cotteswold Nat. Field Club, vol. i, p. 80.

Description by Author.—"Spire elevated, acute; whorls few, each with seven prominent spines or spinous ribs; body-whorl spined above, grooved beneath, wing not digitated and but moderately expanded; caudal extremity straight and moderately long."

The specimen (fig. 4) forms part of the Lycett collection in the Jermyn Street Museum, but, as Lycett gives no figure, strictly speaking there can be no type-specimen. The specimen now figured is marked "*R. spinigera*, Nailsworth," apparently in Lycett's handwriting.

The length is 15 mm. and the spiral angle about 45°. The shell is sub-elongate, thick, and rugose, body-whorl and spire about the same height, apex somewhat acute. There is one prominent and highly-spinous keel on the body-whorl, which gives rise to a sharp, stumpy, upcurved digitation after the manner of the Monodactyls (hence, if we may judge from this specimen, it is not quite correct to say that the wing is not digitated).

The aperture is wide-triangular to trapezoidal, and forms a sort of angle posteriorly in connection with the short process which represents the digitation. The columella is very straight, and probably the canal also. There is an indication in the figured specimen of an anterior digitation. This would relegate the

species to the section of didactyls. It is quite contrary to the original diagnosis of Lycett. Whether this really is an anterior digitation, or merely an accident in the development of the fossil, is a question awaiting further evidence.

Relations and Distribution.—The excessively rugose and spinous character of this shell, and the comparatively depressed spire, clearly separate this from all other *Alariæ* previously described in this Memoir. Hence there seems to be little danger of its being confounded with any one of them. But since a doubt yet remains as to whether the species is didactyl or monodactyl, and having regard also to the apparent scarcity of specimens, *Alaria spinigera* cannot be regarded as fully diagnosed at present.

Al. spinigera, Lycett, is quoted in Witchell's 'Geology of Stroud,' from the Oolite-Marl.

58. Alaria solida, *Lycett*, 1853. Plate IV, fig. 5.

1853. Alaria solida, *Lyc.* Proc. Cotteswold Nat. Field Club, vol. i, p. ? 80.

Description by Author.—"Spire turrited; whorls few, angulated by a circle of elevated, longitudinal, spinous ribs crossed by lines; body-whorl with a single *carina*, beneath which are several encircling grooves; wing simple, small, proceeding from the carina, caudal extremity short."

The specimen from which, apparently, the above description was taken, is in the Lycett collection at Jermyn Street, and has the word "*solida*" still legible upon the reverse. The spiral angle is about 38°. Certain variciform swellings may be traced across the whorls, presenting a feature not often observed, but the specimen is too imperfectly preserved for further description.

Relations and Distribution.—Though the character of the spire is somewhat similar to that of the last-named species, the ornamentation is less spiny, and what appear to be the variciform lines or swellings seem still further to distinguish it; the spiral angle, also, is considerably less. On the other hand, the short, upturned digitation greatly resembles that which appears to be the posterior digitation of *Al. spinigera*. The fossil also reminds us somewhat of the form of *Alaria* (*Diartema*) *hamulus* of the Great Oolite and appears to have been derived from the Inferior Oolite of the Cotteswolds.

Alaria solida is not quoted in Witchell's 'Geology of Stroud.'

59. Alaria solida, *Lycett*, var. Plate VII, fig. 6.

Description :

Length	. 17 mm.
Width of body-whorl to height of shell .	. 40 : 100.
Spiral angle	. 36°.

The apical whorls, conjectured to be about three in number, are wanting ; the four remaining whorls of the spire are angular, the keel being rather above the middle ; a series of nodular costæ, wide apart, originate upon the keels and extend for some distance below : in the penult these assume considerable proportions, and are seen to decussate with strong spiral lines. The body-whorl is rather shorter than the spire, moderately ventricose, and carries one very prominent and spinous posterior keel, from which a short upturned digitation emanates ; beneath the posterior keel is a strong system of spirals (the several "encircling grooves" of Lycett), one of which functions as an anterior keel. From this proceeds an imperfect anterior digitation. The whole of the body-whorl and short upturned canal-sheath are richly chased with fine spiral ornament. Other indications wanting.

Relations and Distribution.—A single specimen from Crickley—most probably from the Oolite-Marl—is all I have seen. This belongs to Mr. Brodie, and is marked "*Rostellaria solida*, n. sp.," in Lycett's handwriting. It is less rugose and less variciform than the Jermyn Street specimen, which I assume to be the type, and it possesses, moreover, an incipient anterior digitation, like that of *Alaria Doublieri*. This, however, may have existed in the Jermyn Street specimen, but destroyed or obliterated subsequently.

N.B.—It is to be regretted that the interesting forms described as *Alaria spinigera*, *Al. solida*, and *Al. solida*, var. are so scarce that we are very much in the dark as to their true nature. Whilst exhibiting important differences, they possess several features in common, such as a comparatively short spire, spinous or rugose ornamentation, and a short, upturned principal digitation.

60. Alaria hamoides, sp. nov. Plate VII, figs. 7 *a*, 7 *b*.

Description :

Length	. 24 mm.
Width of body-whorl to length of shell .	. 42 : 100
Spiral angle	. 26°.

Shell turrited, fusiform. Probable number of whorls ten to eleven (apical ones

unknown); these are very angular, with the keel slightly above the middle; anterior portion of each whorl marked by straight regular longitudinal costæ, close set, not less than a dozen in number, with a marked slope from right to left. The spiral lines are fine and numerous in the posterior areas, which are entirely devoid of longitudinal ornament, the spirals in the anterior areas are coarser and wider apart, decussating visibly with the longitudinals. Spiral lines may also be detected on the body-whorl, but no costæ. There is one prominent median keel, armed with a short spur, rather more than a quarter of a turn above the base of the wing, which is short. The nature of the digitation, if any, is unknown.

Aperture apparently trapezoidal, the outer lip enveloping the anterior half of the penult. Other indications wanting.

Relations and Distribution.—The character of the spire is not unlike that of *Al. hamus*, the turriting being distinctly mural. It somewhat resembles a figure given by Piette (op. cit., p. 44, pl. v, fig. 6) of a variety of *Al. hamus* from the Fuller's Earth of Les Clappes, which that author considered might be a distinct species; but his description does not tally quite so well, since he indicates only eight or nine costæ on the whorls of the spire. Only one specimen of *Al. hamoides* has yet been found with the body-whorl preserved, and the indications are not altogether reliable. At present it is only known to occur in the Lincolnshire Limestone at Great Ponton, where portions of the spire have been found from time to time.

61. Alaria (? Diartema[1]) varicifera, sp. nov. Plate II, figs. 10 *a*, 10 *b*; Plate VII, figs. 8 *a*, 8 *b*; figs. 8′ *a*, 8′ *b*.

Description.—The specimens found in the Lincolnshire Limestone at Great Ponton (fig. 8 *a*, and fig. 8 *b*) differ to a certain extent from those occurring at Weldon (figs. 8′ *a*, 8′ *b*), and these again present some differences between themselves. Amongst the specimens figured we recognise three different forms, which have certain features in common, but which differ in the final development. These forms may represent varieties or different stages of the same species. Describing the common features—

The shell is turrited and fusiform, apical portion of the spire blunt, with a convex angle and smooth whorls. The whorls of the remainder of the spire are angular and carinated, the carina being nearly median. The longitudinal orna-

[1] Piette, 1864. The forms now under consideration differ so widely from *Alaria* that they are only placed under that genus provisionally. They do not correspond exactly with *Diartema*. Beyond the obvious fact that they belong to the Aporrhäidæ it is not very clear to what genus we should refer them.

ments consist of stout costæ distributed at wide intervals in the form of varices, not usually in alignment, chiefly on the posterior area of each whorl, and very nodose in passing over the keels. Below the keels one, and sometimes two strong spiral bands may be noted, almost giving the appearance of bicarination; the lesser spirals are fine and numerous throughout the shell.

The Ponton variety presents the most interest, since here alone have I been able to find a specimen with the wing developed (or preserved), fig. 8 *b*.

Length	22 mm.
Width of body-whorl to height of shell	45 : 100.
Spiral angle about	30°.

Probable number of whorls seven or eight. Ornamentation of the spire-whorls as already described. Body-whorl tumid, sub-bicarinate, with two or three coarse nodular varices, and traces of numerous diverging spiral lines. Wing wide and short, and enveloping nearly half of the penult, apparently without digitation. Aperture wide and subquadrate, with an expanding lip, anterior margin slightly excavated; columella curved and but slightly encrusted; canal apparently almost as short as in *Brachytrema*.

The Weldon variety, which is presumed to be an immature form, and which might almost be regarded as a distinct species, is most characteristically represented by fig. 8′ *a*, a well-preserved specimen of the more usual form. See also Pl. II, figs. 10 *a*, 10 *b*.

Length	10—12 mm.
Width of body-whorl to height of shell	55 : 100.
Spiral angle about	40°.

A wide-angled, stumpy little shell of about six whorls. Body-whorl tumid, sub-bicarinate, spirally striated, and carrying three or four varices. There is no wing. Aperture wide, with a simple lip, and very short anterior canal, almost like *Brachytrema*.

A sub-variety of the Weldon fossil is shown in fig. 8′ *b*.

Probable length	14 mm
Width of body whorl to height of shell	42 : 100.
Spiral angle about	30°.

Probable number of whorls six or seven; ornamentation similar to the last upon a narrower and more turrited spire. Body-whorl keeled and spirally ornamented, but entirely without varices. Other indications wanting. This is rare.

Relations and Distribution.—Accepting the adult specimen from Great Ponton (fig. 8 *b*), for the moment, as the type of the group, there is nothing like this known from the Inferior Oolite of the other districts. The form of the wing and the character of the aperture remind us of certain specimens of *Alaria* (*Diartema*) *paradoxa*, M. & L., a well-known fossil of the Great Oolite, but the spire is very

different. If the diagnosis of *Diartema* were somewhat altered, it might be made to include the species here described as *varicifera*.

This is another instance where the Aporrhaïdæ of the Lincolnshire Limestone at Great Ponton show their affinity with Bathonian forms.

Family—CERITHIIDÆ.

"*Shell spiral, elongated, many-whorled, frequently varicose; aperture channeled in front, with a less distinct posterior canal; lip generally expanded in the adult.*"—S. P. Woodward.

The above diagnosis was no doubt formed so as to include both *Nerinæa* and *Aporrhais*, both of which are now excluded. Fischer observes that the shell is very variable; the canal, generally short, becomes rudimentary and even disappears completely, as though to show in some sort the impossibility of separating the Siphonostomes and the Holostomes. He observes that the same modifications of the canal are observed in the Melaniidæ. I would here remark on the possibility of the more recent Melaniidæ having originated from some of the old Jurassic Cerithiidæ, or at least from molluscs of that age, which we group with the Cerithiidæ. Most freshwater Gasteropoda are probably descended from genera which were once marine.

In the Inferior Oolite the Cerithiidæ are well represented, though some genera are placed here with a query—*Brachytrema*, already described, is thus classified by many. The following genera are referred to this family. *Cerithium*, Adanson, *Fibula*, Piette, *Ceritella*, Morris and Lycett, *Exelissa*, Piette, *Cryptaulax*, Tate, and *Cerithinella*, Gemmellaro. Of these *Cerithinella*, and possibly even *Cryptaulax*, might almost claim relationship with the Turritellidæ.

Genus—Cerithium, *Adanson*, 1757.

"*Shell imperforate, turrited; whorls numerous, narrow; the last always shorter than those of the spire; aperture oblong, semioval; anterior canal short, oblique, well-marked; lip more or less thickened.*"—Abridged from Fischer.

The Jurassic *Cerithia* cannot be judged by the same strict diagnosis as may be applied to existing species. A considerable group of fossil shells, many of them small, occur in our Liassic and Oolitic strata, to which the generic name *Cerithium* is applied. Some of these fossils are, perhaps, more like *Bittium*, where

the anterior canal is short, indistinct, and scarcely reflexed. M. Cossmann observes that out of forty-one species of *Cerithia* recorded from Bathonian beds in France, probably not more than half really present the characters of *Cerithium*. We might almost say the same of many species in our Inferior Oolite. But if we were to remove them from that genus it would be necessary to make a number of allied genera in order to receive each species. In the case of forms now existing where the shell is well preserved and the animal can be put in evidence, such multiplication of genera is justifiable, and is even necessitated by the enforcement of the binomial system of nomenclature. To adopt this method where imperfectly preserved shells are alone obtainable is scarcely to be recommended. The result is that *Cerithium*, as a Jurassic genus, is not exactly the same thing as the recent genus, especially as now restricted. The Jurassic *Cerithia* have not the anterior canal so well developed or so strongly reflexed, and in some cases the canal is very poorly developed indeed, a defect which is aggravated by imperfect preservation.

It thus happens that species have been ranged under "*Chemnitzia*" which ought to be classified under *Cerithium*. This leads to the consideration of a question which is best discussed at the present stage, viz. what is to become of "*Chemnitzia*." It is scarcely necessary to point out that D'Orbigny's "*Chemnitzia*" of 1850 and his "*Chemnitzia*" of 1839 refer to distinct groups of shells. The "*Chemnitzia*" of 1850 is now very generally referred to *Pseudomelania*, Pictet and Campiche, a genus well represented in the Inferior Oolite, which will be dealt with subsequently. D'Orbigny's original "*Chemnitzia*" is now held to be a synonym of *Turbonilla*, Leach (*vide* Fischer, p. 789), a name applied to a group of shells which are elongate, narrow, and many-whorled, the whorls being slightly convex and usually costulated; the aperture is simple, and oval or subquadrangular. This genus is said to extend no farther back than the Tertiaries. In the Bathonian of France, Cossmann refers no species to "*Chemnitzia*." On the other hand, Gemmellaro, and after him Tryon, accept *Chemnitzia*, D'Orb., as a genus of fossil shells, divisible into the sub-genera *Chemnitzia*, *Rhabdoconcha*, *Pseudomelania*, *Oonia*, and *Microschiza*. The four last sub-genera evidently belong to the Pseudomelaniadæ, and need not be discussed here. There remains, then, *Chemnitzia*, D'Orb., as restricted, of which one of the types is *Chemnitzia* (*Turritella*) *undulata*, Benz. The following is Gemmellaro's diagnosis: "Shell elongate, composed of a great number of whorls transversely (axially) plicated. Mouth oval, rounded or angular in front, confined posteriorly. Columella straight or sometimes curved, and slightly incrusted. Lip thin and sharp." I do not think that there are any species in our Inferior Oolite which come within the above diagnosis. There are one or two cases where *Cerithia*, of the section originally grouped by Deslongchamps under *Melania*, have the anterior

canal almost effete, a feature always accentuated by wear. But the connection of these forms with others, where the anterior canal is fairly well developed, is so obvious that we cannot fail to place them under *Cerithium*.

It must be borne in mind that mineralization has, in many cases, so affected the ornaments of *Cerithia*, especially of those preserved in calcareous rocks, as to produce more confusion than in any other class of shells. When to this is added the sporting or variation of an abundant group, the difficulties of nomenclature become very serious. For these reasons the common or demoid forms have given rise to more names than may be absolutely necessary. There are two of these demoid groups of *Cerithium* which more or less pervade the Oolites, at least as high as the Corallian-rocks. These are the *muricatum*-group, including the quondam "*Chemnitzia*" *vetusta* and its allies, and the *limæforme*-group. An attempt has been made to arrange the several species in something like the order of their apparent relationship. The last group included under *Cerithium* comprises four species, which might almost be constituted into a subgenus, if indeed they are not allied to one already constituted. Externally the species of this group have considerable resemblance to *Nerinæa*, but their internal structure is quite different.

As regards the possible origin of the Cerithia of the Inferior Oolite, we may suppose that some of them are the modified descendants of species occurring in the Lias. The intermediate sands, whether belonging to the *opalinus*-zone or to the *jurensis*-zone, seem to oppose a barrier, usually not very fossiliferous, between the abundant fauna of the *bifrons*-beds, and the more calcareous beds of the Inferior Oolite. Some small Liassic species, such as *Cerithium armatum*, *C. quadrilineatum*, and *Cryptaulax scobina*, still linger in the lower part of these sands. Somewhere in the *opalinus*-zone, as is well exemplified in the Yorkshire Dogger, *Cerithia* became both larger and more plentiful, whilst the fauna of the Inferior Oolite now presents itself to the collector in abundance.

62. Cerithium quadrilineatum, *Römer*, 1836. Plate VIII, fig. 1.

1836.	Turritella quadrilineata,		*Römer.*	Ool. Geb., p. 154.
1850.	Cerithium quadrilineatum,		*D'Orb.*	Prod., i, 250, Étage Toarcien.
1869.	—	—	*Römer.*	Brauns, Mittl. Jura, p. 171, pl. ii, figs. 7 and 8.
1876	—	—	—	Tate and Blake, York. Lias, p. 351.

Description of a Dogger Specimen.—Length 6 mm., width 2 mm. Shell elongate, subturrited. The spiral angle is regular; whorls seven or eight, nearly flat, well-divided by the suture. The ornaments consist of from four to five spirals, which reticulate with slightly arcuate longitudinals of about equal strength, producing a

perfectly reticulate pattern. The longitudinal ornament becomes slightly weaker in the body-whorl. The upper row of spirals is rather more nodular and salient than the others. Other indications wanting.

Relations and Distribution.—This little shell seems to contain the germ of the *muricatum*-group. It is met with sparingly in the Blue-Wyke Sand-rock, which may be regarded as mainly in the *opalinus*-zone.[1] It is also quoted from the *jurensis*-zone by Tate and Blake.

The *Muricatum*-Group.

63. Cerithium muricatum, *Sowerby*, 1825 (Dogger variety). Plate VIII, figs. 2 *a*, 2 *b*.

1825.	Turritella muricata, *Sowerby*.	Min. Conch., vol. v, p. 159, pl. 499, figs. 1 and 2.
1829.	— — —	Phillips, Geol. Yorkshire, 1st ed., vol. i, p. 135, pl. iv, fig. 8.
1844.	Cerithium granulato-costatum, *Münst.* (pars).	Goldf., Petrefact. Germ., vol. iii, p. 32, pl. clxxiii, fig. 10.
1884.	— muricatum, *Sow.*	Hudleston Geol. Mag., dec. iii, vol. i, p. 51, pl. iii, figs. 1 and 2.

Bibliography, &c.—Speaking in general terms *C. muricatum*, Sow., represents a group rather than a species, nevertheless fig. 2 *a* is taken from one of Sowerby's types. I have discussed this question at considerable length in the "Palæontology of the Yorkshire Oolites" and will merely repeat my conclusions, viz. that in the Yorkshire Dogger there are many varieties of *Cerithia*, such as those now figured and others not figured, which are so plainly connected that they cannot be separated specifically. Some of these, especially Sowerby's type, cannot be separated from certain varieties in the Coralline Oolite of Pickering.

Description.—Length 18—25 mm., spiral angle about 18°. Shell elongate, strongly turrited; whorls numerous, very slightly convex and rather constricted anteriorly. Width of whorl to height as 5 : 3·5. Suture distinct; ornaments conspicuous, consisting of granulated spiral bands usually four and sometimes five in number,[2] which decussate with more or less numerous longitudinal ribs, which latter usually have a slight inclination from left to right, and are sometimes slightly arcuate. The nodes or spinous granulations at the points of intersection are drawn out spirally, the upper band being somewhat the strongest. The body-whorl is short relatively to the spire and similarly ornamented, but the spiral

[1] Ammonites of the section, *Oxynoticeras*, are most characteristic of the Blue-Wyke beds.

[2] The variety "*sex-lineatum*" probably belongs to another species.

lines in the base, though very strong, are not granulated. Specimens showing the full character of the aperture are not available.

Relations and Distribution.—Differs from *C. vetustum* and its varieties in a less marked tendency to longitudinal ornament, *i. e.* that costæ, as a rule, do not predominate over the spiral ornamentation. Nevertheless I am scarcely prepared to say that these forms do not inosculate. The Yorkshire beds contain *C. muricatum*, more especially the lower portions of the Dogger proper. The variety named *trilineatum* is almost worthy of being regarded as a distinct species (fig. 3). This is a unique specimen from the Scarborough Limestone.

64. Cerithium gemmatum, *Morris and Lycett*, 1853. Plate VIII, fig. 4.

1853.	Cerithium gemmatum,	*Morris and Lycett.*		Great Ool. Moll., p. 11 pl. xv, fig. 6.
1884.	—	—	—	Hudleston, Geol. Mag., dec. iii, vol. i, p. 58, pl. iii, fig. 9.

Bibliography, &c.—The type was from the Scarborough Limestone. The specimen now figured is from the Bean collection.

Description.—Length 15 mm., width 4·5 mm., spiral angle 20°. Shell turrited; whorls about ten, rather convex, encircled with five rows of nodules; nodules ovate, twenty-four in a whorl; the rows of nodules are slightly curved; they are oval, their longer diameter being in the axis of the shell, and they are distant from each other about their own diameter. The body-whorl shows five rows of nodules on the side; the base is ornamented with spiral bands, the granules of which are drawn out spirally, and less deeply cut. Other indications wanting.

Relations and Distribution.—Differs from *C. muricatum* in the fact that the granules are drawn out axially rather than spirally. The beaded character of the granulations may be partly the result of mineralization. It occurs in the grey marly Oolite of White Nab (Scarborough Limestone Series), and appears to be a local form. It may have some relationship to *Cerithium vetustum*, inasmuch as there is a tendency to axial rather than to spiral ornamentation.

The *Vetustum*-Subgroup, *partly included under* Chemnitzia *by some authors.*

This group may to a certain extent be said to inosculate with the *muricatum*-group, but its ramifications in the Inferior Oolite are much more extensive.

The numerous varieties and species which I refer to the *vetustum*-group have a tendency to longitudinal ornament, and even when their ornaments are markedly granular, the granules are usually drawn out axially rather than spirally. *Cerithium flexuosum*, Münst., as it seems to me, represents the immature condition of some varieties, where arcuate longitudinal costæ prevail before any turriting has commenced, whilst *C. muricato-costatum* represents robust varieties, where the granules have been more or less fused into continuous longitudinal costæ. This tendency to longitudinal ornamentation, so conspicuous in corroded specimens, has caused the original *Terebra vetusta* of Phillips to be classed under "*Chemnitzia*" even by D'Orbigny, although the representative species in the Bajocian of Normandy (Nos. 172 and 188 of the 10th stage) are classed under *Cerithium* in the 'Prodrome.'

As regards nomenclature, the difficulties which beset all demoid forms are aggravated in this case. Firstly, the prior name was given to a corroded specimen of the stunted species which occurs in the Millepore- and Scarborough-Limestone. Secondly, the whole group is peculiarly liable to have its ornaments affected by variations in conditions of mineralization, and this is particularly the case in the beds whence the type was derived. Münster's names, though very useful, and no doubt applicable to the German beds, represent conditions of mineralization, and in the case of *C. flexuosum* (only 10 mm. in length) even a stage of growth in all probability. Without in any way asserting, that the method adopted in this Monograph for dealing with such an extensive group is the best, it possesses the merit of exhibiting the facts of the case as they occur in the Inferior Oolite of this country. Some dubious forms, presumably belonging to this group, have not been noticed, but Münster's names would cover the majority of them.

65. Cerithium vetustum, Phillips, 1829. Plate VIII, figs. 5 *a*, 5 *b*, 5 *c*, 5 *d*.

1829. Terebra vetusta, *Phil.* Geol. York., Pt. I, vol. i, p. 152, pl. ix, fig. 27.
1844. Cerithium muricato-costatum, *Münst.* Goldfuss, t. 173, fig. 12.
1844. — granulato-costatum, *Münst.* Goldfuss, t. 173, fig. 10.
1844. — ? flexuosum, *Münst.* Goldfuss, t. 173, fig. 15.
1850. Chemnitzia vetusta, *D'Orb.* (*Phil.*). Prod., vol. i, p. 263.
1851. — ? — *Phil.* Morris and Lycett, p. 114, pl. xv, fig. 7.
1869. Cerithium vetustum, *Williamson.* Brauns, Mittl. Jura, p. 172.
1882. "Chemnitzia" vetusta, *Phil.* Hudleston, Geol. Mag., dec. ii, vol. ix, p. 247, pl. vi, figs. 9—11.

Bibliography, &c.—Brauns, in sweeping up the muricato- and granulato-costate *Cerithia* of North-west Germany into this net, included *Cerithium armatum*,

Goldfuss, and *Cerithium* (*Cryptaulax*) *tortile*, Héb. and Desl., which was clearly a mistake, as these two are totally different species. He was not so far wrong in including *Melania undulata*, Deslong., as this is certainly in part a representative species. The same author also regarded *Chemnitzia? vetusta*, Morris and Lycett, as a species distinct from that of Phillips, and already included under *C. flexuosum*, Münster.

Description.—Size variable; 15 mm. is the length of a fair-sized specimen. The spiral angle is about 18°. Shell elongate to elongate-ovate. Spiral angle regular; whorls ten to twelve, flat to subconvex, anterior whorls turrited, suture close. The posterior whorls are very flat, with longitudinal costæ, which are straight and extend from suture to suture, almost without spiral decussation. By degrees the whorls become more convex, the costæ becoming arcuate, and in very well-preserved specimens decussated by fine spiral lines, which cause the costæ to be granular.

In full-sized specimens the body-whorl is slightly ventricose, and, if well preserved, the spiral decussations are shown; in this case the uppermost row of spirals assumes a slightly muricated character. Base full and spirally striated, with sometimes a slight prolongation of the axial costæ. Aperture broadly ovate, with a sharp angle at the posterior extremity; inner lip somewhat expanded on the columella; anterior canal fairly developed (in all available specimens the end of the canal has been broken off).

Varieties.—The original figure of *Terebra vetusta*, Phil., represents a specimen, either from the Millepore or Grey Limestone, which is in that condition where all the fine spiral lines are obliterated. This is perhaps the most usual condition for specimens. It is partly on account of this appearance that *Terebra vetusta* has been so often referred to "*Chemnitzia*."

Chemnitzia? vetusta, Phil., of Morris and Lycett, represents a more perfect specimen from one or other of the same beds. The spiral ornaments are faintly distinguishable, more especially in the anterior whorls, and the longitudinals are somewhat more arcuate. Hence Braun's reference to *Cerith. flexuosum*. In the Dogger this stage of *C. vetustum* is not uncommon.

So much as regards Yorkshire varieties. Elsewhere in the Inferior Oolite of England there are specimens, some with granular, some with continuous costæ, straight or flexed, which may be referred to *C. vetustum*. I have several such from the *Parkinsoni*-zone of the Cotteswolds. When in bad condition *C. vetustum* is the most suitable name.

Relations and Distribution.—Under the head of relations little more need be said. As regards distribution, *C. vetustum* occurs in the Dogger, where it probably represents an incomplete stage of the next species. The best specimens, as regards condition, are obtained from the Lower Division of the Scarborough

Limestone series (Pickering Cliff, &c). It is doubtfully quoted from the Lincolnshire Limestone in Judd's 'Geology of Rutland.' Specimens from the Cotteswolds may be referred to *C. vetustum* or to *C. granulato-costatum* according to condition.

66. Cerithium vetustum-majus, *Hudleston*, 1882. Plate VIII, figs. 6 *a*, 6 *b*.

1882. "Chemnitzia" vetusta-major, *Hudl.* Geol. Mag., dec. ii, vol. ix, p. 248, pl. vi, fig. 12.

Description:

Length (large size)	43 mm.
Width	10 mm.
Spiral angle	18°.

Shell elongate, turrited; whorls flat to subconvex, and only turrited anteriorly; about twelve in number; suture distinct. Strong longitudinal ribs, having a crescentic curve, characterise the spine. The precise apical conditions are unknown. The anterior whorls have the longitudinal ribbing decussated by about six spirals, producing nodes at the points of intersection. In the larger specimens the last two whorls have the longitudinal ribbing less strongly marked, whilst the spiral ribbing towards the posterior margin becomes more pronounced, presenting somewhat the appearance of a nodular varix, which much increases the turrited aspect of the shell.

The base is strongly ribbed spirally. The aperture is somewhat widely ovate; and some specimens give evidence of a tolerably long anterior canal, but slightly reflexed.

Relations and Distribution.—It is by no means improbable that *Cerithium flexuosum*, Münst., represents the apical conditions of this species. It is closely allied to the larger varieties of *Melania undulata*, Deslong., whilst the typical *Cerithium vetustum* of the Scarborough Limestone, &c., is its attenuated representative on a higher horizon.

In Yorkshire the larger shells are confined for the most part to the principal shell-bed of the Dogger, but it is seldom that the ornaments are in a good state of preservation. In some of the other parts of the Dogger these are better preserved, but on the whole smaller.

67. Cerithium vetustum, var. *seminuda*, Hudl. Plate VIII, fig. 7.

1882. "Chemnitzia" vetusta, var. seminuda, *Hudl.* Geol. Mag., dec. ii, vol. ix, p. 249, pl. vi, fig. 13.

Description.—This is a subulate variety, about 23 mm. in length, and with a spiral angle of 14°. The spire is composed of about a dozen whorls, which are flat to subconvex, increasing with perfect regularity. The subapical whorls are ornamented with numerous delicate longitudinal ribs, very slightly curved. Lower down this ornament becomes very faint, and expires in the body-whorl or is merely represented by obscure sinuous lines.

Base rounded and smooth; aperture ovate: other indications wanting.

Relations and Distribution.—Differs from *C. vetustum* in being more slender and in the failure of ornamentation on the anterior whorls. Rare in the Yorkshire Dogger.

68. Cerithium subscalariforme, D'Orb., var. *spinicostata*, Wright, MS. Plate VIII, figs. 8 *a*, 8 *b*, 8 *c*, 8 *d*, 8 *e*, 8 *f*.

1850. Cerithium subscalariforme, *D'Orb.* Prod., vol. i, p. 271.
Compare also
1842. Melania scalariformis, var. a, *Desl.* Mém. Soc. Linn. Norm., vol. vii, p. 218, pl. xi, fig. 63.
1842. — undulata, var. b, *Desl.* Vol. cit., p. 217, pl. xi, figs. 59—62.

Bibliography, &c.—This species may be regarded as the principal representative of the *vetustum*-group in Dorsetshire. There are, it would seem, objections to both Deslongchamps' names, hence collectors usually fall back upon *Cerithium subscalariforme*, D'Orb., for a set of fossils which are well known in the Bayeux-beds. Although we cannot use Deslongchamps' names, we can at least apply his generalizations as follows:

"*Melania undulata*, var. b. Testâ longiori, costis striisque frequentioribus. *Lias supérieur.*" His Upper Lias I take to comprehend the Mâlière (see Introduction to the present Monograph), which is included in our Lower Division of the Inferior Oolite.

"*Melania undulata*, var. a. Testâ breviori, costis et striis crassioribus varioribusque. *Oolite ferrugineuse*," *i. e.* our Upper Division.

Deslongchamps' generalisation, as above stated, holds good throughout the Dorsetshire-beds, the varieties of *C. subscalariforme* having a tendency to become

shorter, and to be more coarsely ornamented in the zones of *Am. Humphriesianus* and *Parkinsoni*.

Description of var. spinicostata :

Length of a fair-sized specimen . .	35 mm.
Width	7·5 mm.
Ratio of body-whorl to entire length . .	31 : 100.
Spiral angle	15°.

Shell elongate, strongly turrited. Spiral angle nearly regular; whorls about fifteen in number, subconvex in the apical region, but becoming flatter and somewhat pinched anteriorly so as to increase the turriting of the shells. The ornaments consist of about eight fine spiral lines, which in the latter whorls assume the character of spiral belts, with a considerable interspace; subordinate spiral lines may be detected, especially in the more mature whorls. The uppermost one is strongly tuberculate at the points of intersection with the costæ, which are numerous. The costæ are rather fine, and extend from suture to suture, decussating with the spirals so as to present a somewhat granular appearance at the points of intersection.

The body-whorl is less than one third the entire length of the shell, the shape and ornamentation are similar in character to the whorls of the spire, with, however, a tendency for the costæ to become more arcuate. The base is tolerably full and marked with strong spiral striæ, which are partially decussated by a faint continuation of the costæ. The aperture is ovate-elongate; the outer lip thin (always broken away). There exists a kind of rudimentary posterior canal. Columella excavated and but slightly encrusted. Anterior canal considerably produced, but slightly reflexed.

The following sub-varieties may be noted. Fig. 8 *b* is less subulate, and shorter. The specimen figured has suffered slightly from wear or solvents, so that the spiral lines are less distinct. The costæ are scarcely decussated in consequence. This is a medium-sized specimen and greatly resembles some of the larger forms of *C. subscalariforme* from the Bayeux-beds. Fig. 8 *c* represents a very elongate form, with fine ornamentation. In Fig. 8 *d* the proportions are as usual, but that which constitutes some difference is the twist in the costæ, and their marked inclination from right to left. In this specimen the spiral lines on the costæ are entirely obliterated. In Fig. 8 *e* the costæ are stouter and less numerous than usual, with great salience of the spinous row of nodules on the shoulder of each whorl. The traces of spiral ornamentation are still more difficult to find. This sub-variety leads up to *Cerithium subglabrum*.

Relations and Distribution.—The most typical forms of *C. spinicostatum* are to be met with in the *Sowerbyi*-bed of Bradford Abbas, where it is one of the most abundant fossils, though not always in the best state of preservation. It is

related to *Cerithium costellatum*, Münst. (non Deslong.), as that fossil occurs in the Upper Lias of Compton, and some of the Bradford-Abbas specimens are scarcely to be distinguished from the Lias species, where, however, the costæ are somewhat straighter—a very unimportant difference. Taken as a whole, with all its varieties, this species is eminently characteristic of the Lower Division of the Inferior Oolite, but seldom so well preserved or of such large size as in Dorsetshire. Though the ornaments are considerably modified by conditions of preservation, it may be recognised in a granulato-costate condition in other places, as, for instance, in B of Mr. Walford's Hook Norton section. *Cerithium vetustum-majus* of the Dogger is probably its local representative in the Yorkshire-beds.

69. Cerithium subscalariforme, D'Orb., variety in the *Humphriesianus*-zone. Plate VIII, fig. 9.

This form is very near to *C. subscalariforme* as it occurs in the beds of Bayeux; it is somewhat smaller, and in the figured specimen the body-whorl appears unusually short. The costæ also happen to be somewhat more granular as in *granulato-costatum*, Münst. Occurs in the *Sauzei*-bed at Oborne.

70. Cerithium subscalariforme, D'Orb., variety in the *Parkinsoni*-zone. Plate VIII, figs. 10 *a*, 10 *b*.

Cf. Melania undulata, var. a, *Deslongchamps*, vol. cit., p. 217, pl. xi, fig. 58.

Description.—As compared with the previous variety, or varietal group, there can be no better description than "testâ breviori; costis et striis crassioribus rariori-busque." This is a much shorter form, it is more widely angled, and when in the granulato-costate condition the spirals are not usually more than four or sometimes, in well-developed specimens, five. Corresponding to the greater width of the shell the aperture is widely ovate, and it so happens that in the majority of the available specimens the anterior canal is by no means distinct (probably the result of wear).

Relations and Distribution.—This variety possibly represents rather than resembles the *C. vetustum* of the Yorkshire-beds. It is essentially a fossil of the Upper Division, and is moderately common. The specimen from Grove (fig. 10 *a*) greatly resembles the figure in Deslongchamps' work (xi, 58), and is exceptionally fine. Away from the Dorset-beds the specimens become poorer, worse preserved, and may be variously described as *C. granulato-costatum*, *C. muricato-costatum*, and even *C. vetustum* according to local circumstances.

71. Cerithium subabbreviatum, D'Orb., 1850. Plate VIII, fig. 11.

1850. Cerithium subabbreviatum, *D'Orb.* Prod., vol. i, p. 271.
1842. Melania abbreviata, *Desl.* Mém. Soc. Linn. Norm., p. 219, pl. xi, fig. 67.

Bibliography, &c.—The most natural course, in this case, would be to retain the specific name given by Deslongchamps, by whom the species was originally described. But the specific term *abbreviatum* has already been bespoken by Mr. Leckenby for a *Cerithium* described by him.

Description :

Length	16 mm.
Width	6 mm.
Ratio of body-whorl to entire shell	35 : 100.
Spiral angle	28°.

Shell ovate, turrited. Spiral angle scarcely if at all convex. Number of whorls about twelve; these are narrow and subtumid; suture close and but little inclined. The spiral lines are very fine and numerous, and extend over the entire shell (in the figured specimen the faintness of this ornament is in part due to wear). The longitudinals are extremely numerous, extending with regularity, in the form of slightly arcuate costæ, from suture to suture.

Body-whorl subventricose. Aperture ovate with a considerable callus on the columella; canal short, small, and slightly reflexed.

Relations and Distribution.—Deslongchamps pointed out the relationship of this rare shell to "*Melania scalariformis.*" The shortness of the whorls of the spire and the ventricose character of the body-whorl constitute its principal difference.

A single specimen from P_1, Burton Bradstock.

72. (?) Cerithium obesum, sp. nov. Plate VIII, fig. 12.

Description :

Length	8 mm.
Width	5 mm.
Ratio of body-whorl to entire shell, about	50 : 100.
Spiral angle, about	50°.

Shell short, ovate, turrited. Number of whorls about six, convex, and increasing very rapidly. The ornaments consist of three or four spirals which decussate with

a straight longitudinal system, thus producing straight granular costæ, the nodes of which are drawn out axially.

The body-whorl is ventricose and with similar ornamentation; base full and ornamented with granular spiral lines. Aperture ovate with some traces of an anterior canal. Other indications wanting.

Relations and Distribution.—The generic position of this curious shell is open to doubt, but it seems to be fulfilling the dictum of Deslongchamps with regard to the "Melaniæ" of the Inferior Oolite, viz. that they become shorter and stouter in the higher beds. The sudden increase in the body-whorl, however, carries it far beyond even *Cerithium subabbreviatum*, or the remarkable variety of *C. subscalariforme* from Grove (see fig. 10 *a*).

A single specimen from P_1, Vitney Cross.

73. Cerithium subglabrum, sp. nov. Plate VIII, fig. 13.

Description.—Shell elongate, turrited; spiral angle nearly regular. Whorls about eighteen in number, short, slightly curved to nearly flat; sutures rather close. But little trace of spiral ornamentation beyond a faint line on each whorl at a short distance from the posterior margin. The longitudinals are well-developed in the apical and subapical regions, but with a tendency to become wide apart. These gradually fail in the last two whorls, though the terminal tubercles are retained. The lines of growth between the costæ are visible.

Body-whorl short, and with but little trace of ornament; base spirally striated. Aperture ovate. Other indications wanting.

Relations and Distribution.—Evidently related to *C. subscalariforme*, but the differences are so marked as to almost exceed the limits of a mere variety. Rare in the *Sowerbyi*-bed of Bradford Abbas.

This terminates the list of species referred with more or less certainty to the *Vetustum*-Subgroup.

74. Cerithium (species or variety). Plate VIII, fig. 14.

Description.—Probable length 35 mm., spiral angle about 14°. Shell elongate, subulate, whorls numerous, convex, and well separated by the suture. The spiral lines are fine and numerous, upwards of twelve on the anterior whorls; one, slightly broader than the others, occupies the shoulder of each whorl, forming

a slight belt near the posterior margin. The longitudinal costæ are numerous, regular, and slightly arcuate on all the posterior whorls, but become faint and almost effete on the anterior whorls. Other indications wanting.

Relations and Distribution.—This rare form has a certain resemblance to the finer varieties of *C. spinicostatum*, and at one time I was disposed to regard it as, possibly, a worn example of that rather abundant species; but further examination induces me to believe that the differences are not so brought about, since the whorls are more tumid in addition to the great difference in the ornamentation. The anterior portion of the shell is not unlike *C. costellatum*, Desl. (p. 202, pl. xi, 19). As regards the failure of the longitudinal ornaments anteriorly we have similar instances in *C. vetustum*, var. *seminuda* of the Dogger.

A single specimen in the *Sowerbyi*-bed of Bradford Abbas.

75. Cerithium (species or variety). Plate VIII, fig. 15.

An incomplete specimen. Length of fragment 21 mm., spiral angle about 11°. Shell elongate, subulate. Number of whorls remaining thirteen, short, subconvex, well separated by the suture. The spiral lines on each whorl are about eight in number; longitudinal costæ numerous, slightly arcuate, extending from suture to suture, and slightly decussating with the spirals. Upper row of spirals slightly nodular. Other indications wanting.

This may be an extremely subulate variety of *C. spinicostatum*, of which the apical portions alone are preserved. A single specimen in Mr. Whidborne's collection, apparently from the *Sowerbyi*-bed of Bradford Abbas.

76. Cerithium armatum, *Münster*, 1844. Plate IX, fig. 1.

1844. Cerithium armatum, *Münst.* Goldfuss, Petref., t. 173, fig. 7.

A single specimen from the Sands below the Cephalopoda-bed at North Nibley, though somewhat larger than typical specimens from the *Torulosus-schichten* of Uhrweiler, answers the description of this species very well. It may be distinguished from *Cryptaulax scobina* by having only two extremely spiny spiral belts. The specimen under consideration does not show an aperture, but Mr. Wilson informs me that specimens from the Lias show that this species is a true *Cerithium*.

77. Cerithium leckhamptonense, sp. nov. Plate IX, fig. 2.

Description :

Length (about)	27 mm.
Width	9 mm.
Length of body-whorl to entire shell about	33 : 100.
Spiral angle	20°.

Shell elongate, scarcely turrited ; number of whorls probably twelve, apical conditions unknown. Whorls short, slightly convex in the middle stage, but becoming flat anteriorly, sutures close. The ornaments consist of about ten spiral lines of somewhat unequal strength, which are decussated by numerous thick, though not prominent costæ, which are slightly arcuate, and slope considerably from left to right. The costæ become faint in the penult.

The body-whorl is about one-third the total length of the shell. Fine spiral lines are the only ornaments, the costæ having entirely disappeared. Base tolerably full and spirally striated. Aperture (?) ovate, with a considerable callus on the columella. Other indications wanting.

Relations and Distribution.—As far as I know, this form seems to stand pretty much by itself. The failure of axial costæ on the anterior whorls might suggest some degree of relationship to certain varieties of the *vetustum*-group, but otherwise there is no resemblance.

A single specimen from the Inferior Oolite of Leckhampton Hill.

78. Cerithium (species or variety). Plate IX, fig. 3.

Description :

Length (about)	20 mm.
Width	4 mm.
Spiral angle (about)	10°.

Shell very subulate, turrited ; spiral angle nearly regular. Whorls about sixteen, short and very flat; suture close. The extreme apical whorls are apparently devoid of ornament. The subapicals have three well-cut spirals, which decussate with numerous longitudinals of about equal strength, inclining from left to right. Four, and ultimately five, spirals are developed in the anterior whorls. A very fine mesh results from the decussation of such equal spiral and longitudinal lines, the enclosed space being rectangular and spirally elongated; the nodes at the intersections are very slight.

The body-whorl is relatively small, base rather flat. Aperture subquadrate, with a straight columella. Canal apparently short, other indications wanting.

Relations and Distribution.—This form appears to have relationship to the several species described by Deslongchamps from the Inferior Oolite of Normandy, as *Cerithium triseriatum*, *quadriseriatum*, &c. With these, unfortunately, I am unacquainted. It is noticeable, however, that in this species we lose the comparatively strong longitudinal ornamentation of the *vetustum*-group.

Single specimen from the Inferior Oolite (*? Murchisonæ*-zone) of Coker.

The *Limæforme*-Group.

This group is intended to include *Cerithia* which are usually rather small, often pupoid, and with fine ornaments, where the spiral lines are more conspicuous than the longitudinals. The aperture has rather a tendency to be subquadrate, columella short, with a short but well-developed anterior canal, slightly reflexed. Judged by the character of the aperture these little shells are perhaps more nearly allied to the existing genus *Cerithium* (including *Bittium*) than the group last described. In the Lower Oolites of this country *Cerithium Beanii*, and *C. limæforme* are the two species round which the less common forms may be grouped. But these also vary so obviously that it is almost impossible to draw a very distinct line. In order to realise how hopeless it is to make "hard-and-fast species" out of this group, let anyone study a well-stocked collection of small *Cerithia* from the Lincolnshire Limestone. And yet it is equally impossible to avoid the temptation of making a certain amount of nominal differentiation.

79. Cerithium Leckenbyi, *Hudleston*, 1884. Plate IX, fig. 4.

1884. Cerithium Leckenbyi, *Hudl.* Geol. Mag., dec. iii, vol. i, p. 61, pl. iii, fig. 12.

Description:

Length (restored)	? 17 mm.
Width	4 mm.
Height of whorl to width	2 : 3·75.
Spiral angle	14°.

Shell elongate, subturrited; whorls (?) thirteen, flat, short in comparison with their width; sutures close. The ornaments consist of finely granulated or tuberculated spirals, of which the first is strongest and the fifth the faintest. The longitudinals are irregular as in *C. Beanii*, frequently not reaching to the

anterior portions of the whorls. Spirals on the base of the body-whorl scarcely granulated. Other indications wanting.

Relations and Distribution.—*C. Leckenbyi* may, perhaps, be regarded as an unusually fine development of *C. Beanii*, from which, however, it differs in its greater size, more marked turriting, and in the details of its ornaments. Rare in the Dogger.

80. Cerithium Beanii, *Morris and Lycett*, 1851. Plate IX, figs. 5 *a*, 5 *b*.

1851. Cerithium Beanii, *M. and L.* Great Ool. Moll., p. 112, pl. xv, fig. 5.
1884. — — — Hudleston, Geol. Mag., dec. iii, vol. i, p. 59, pl. iii, figs. 10 and 11.

Compare also for varieties
Cerithium pupæforme, *Koch and Dunker*. Beitr., p. 33, pl. ii, fig. 10.

Bibliography, &c.—Although described by the authors of the 'Great Oolite Mollusca' as occurring near Scarborough, their type, I have very little doubt, came from the Dogger at Blue Wyke.

Description of the Dogger or type-form:

Length varying from	9—12 mm.
Width	3—3·5.
Spiral angle of apex	25°.
Do., anterior portion of spire	15°.

The above dimensions are only approximate, regard being had to the numerous varieties.

Shell small, more or less pupoid, turrited; whorls from ten to twelve, narrow, and rather flattened. The anterior whorls are ornamented by five tuberculated spirals, of which the third and fifth are least prominent. Sometimes the tubercles become slightly confluent, in which case there is a tendency to the formation of axial costæ, especially in the upper part of each whorl. The upper row of spirals is strongly tuberculated, though this feature is subject to some variety.

Body-whorl slightly compressed, and not exceeding one-third the total length of the shell; ornaments as in the anterior whorls of the spire. Base spirally striated. Aperture subquadrate; columella short, and terminated by a short but rather deeply cut anterior canal.

Relations and Distribution.—The Yorkshire specimens are to a certain extent *sui generis*. Those from the Lincolnshire Limestone, and the very rare specimens from the Inferior Oolite of the Cotteswolds, vary considerably from these types.

81. Cerithium Beanii, var. Weldonis, sp. nov. Plate IX, figs. 6 *a*, 6 *b*, 6 *c*; 6′ *a*, 6′ *b*, 6′ *c*, 6′ *d*.

Description.—Sub-variety A with five spirals. Three specimens are figured figs. 6 *a*, 6 *b*, 6 *c*), each showing some difference of ornament or condition. The usual form is decidedly pupoid, and the ornaments are rather coarser and more open than in the Dogger specimens. It often happens that in the sub-apical whorls the tubercles are so fused together axially as to produce a costate appearance. The uppermost row of spirals is very strongly tuberculated, and the distinctions as to the fineness of the third and fifth spirals not so strong as in Dogger specimens. Specimens of *C. Beanii* from the Inferior Oolite of Cleeve much resemble these forms, though slightly larger. These are in Mr. Brodie's collection.

Sub-variety B with four spirals (figs. 6′ *a*, 6′ *b*, 6′ *c*, 6′ *d*). The ornamentation is, on the whole, similar to the preceding, but the general form of the shell is more stumpy. This, for the sake of distinction, we might term *C. Beanii-quadricinctum.*

There are also other forms with four spirals approaching *C. limæforme.*

Relations and Distribution.—The fossils described under the above heading, as *C. Weldonis*, afford an excellent example of the proneness to change of form and ornament in these small pupoid *Cerithia.* They are very abundant in the Lincolnshire Limestone of Weldon, and less so at other fossil-localities in that Limestone, where for the most part their place is taken by *C. limæforme* and its relatives.

82. Cerithium quadricinctum, *Münster*, 1844. Not figured.

1842—1844. Cerithium quadricinctum, *Münst.* Goldfuss, Petr. Germ., t. 173, fig. 11.

The sub-varieties of *C. Beanii* with four spirals are passing into the form figured by Goldfuss, but their ornaments are less regular and the shell more pupoid. Very rarely, however, specimens occur in the Lincolnshire Limestone, where the granulations are small and regular, and the shell less pupoid. These we seem justified in referring to *C. quadricinctum.*

83. Cerithium limæforme, *Römer*, 1836, var. *Pontonis*, sp. nov. Plate IX, fig. 7.

1836. Cerithium limæforme, *Röm.* Ool. Geb, tab. xi, fig. 19, p. 142.

Bibliography, &c.—Römer's species was originally described and figured from the Coral Rag of Hoheneggelsen. Morris and Lycett referred to *C. limæforme* and to *C. quadricinctum*, Münst., a similar group of shells occurring in the Great Oolite of Minchinhampton. Subsequently Lycett ('Suppl.,' p. 122) observed that what the authors of the 'Great Oolite Mollusca' had regarded as two separate forms must be united into one species, and to this he assigned the name of *C. quadricinctum*, Münst. The figure in Goldfuss is not very like either the Ponton or the Minchinhamptom fossils. On the other hand, there cannot be any doubt that the Ponton shells are closely related to *C. limæforme*, Röm., a name which in a certain sense is applicable to the entire group now under consideration.

Description:

Length	10 mm.
Width	3 mm.
Length of body-whorl to entire shell, about	33 : 100.

Shell small, subelongate, scarcely turrited; spiral angle very convex. The apex is blunt; number of whorls about ten, flattish; suture rather open. The subapical whorls exhibit two to three tuberculated spirals, and the tubercles on the two upper rows have a tendency to coalesce axially so as to produce costæ. In the anterior whorls the two upper spirals are strongly tuberculate, and have the effect of producing a kind of zone. The number of spirals varies, but is three or four. In some cases where there are four the third is faint, as in *C. Beanii*.

The body-whorl is about one-third the length of the entire shell, and similarly ornamented with spiral lines on the base. Aperture sub-oblong, with a broad, short anterior canal.

Relations and Distribution.—This particular variety of the *limæforme*-group is distinguished by its slender shape and somewhat more delicate ornamentation both from *C. Beanii* on the one hand, and from C. *Wansfordiæ* on the other. It is the prevailing form at Ponton, but met with sparingly elsewhere in the Lincolnshire Limestone. The Minchinhampton forms, referred by Lycett to *C. quadricinatum*, Münst., are on the whole more slender, less markedly pupoid, and finer in their ornamentation. Although the bulk of the specimens of *C. Pontonis* are more irregular in ornamentation, and have a slight tendency to the cingulate arrangement, there are specimens from Ponton which can in no way be distinguished from specimens of *C. limæforme* occurring in the type locality of Hoheneggelsen.

84. Cerithium (species or variety). Plate IX, fig. 8.

A single specimen from the shelly freestones of the Cotteswolds presents the zonal arrangement of *C. Pontonis* in a more complex form; the zone in the upper part of each whorl being made up of three granulated spirals instead of two. As a means of distinction merely I would propose to call this *Cerithium* "*cingula*."

85. Cerithium Wansfordiæ, sp. nov. Plate IX, figs. 9 *a*, 9 *b*, 9 *c*.

Description:

Length	6 mm.
Width	2·75 mm.
Spiral angle	30°—35°

Shell short, subconical, turrited; apex obtuse, but angle of increase nearly regular in the majority of specimens. Number of whorls about nine, flat, very narrow, and richly ornamented. Suture well marked. The subapical whorls are ornamented with from two to three spirals, whose tuberculations are fused axially. In the anterior whorls the richly cut spirals are three in number, the two upper ones being strongly tuberculate and generally fused axially.

The body-whorl is rather more than one-third the entire length of the shell, and similarly ornamented; the spiral lines on the base are finer than those on the flank. The aperture is subquadrate and contracted with a relatively large anterior canal, which is reflexed.

Relations and Distribution.—Although evidently related to *C. limæforme*, this species is, in the majority of cases, conical rather than pupoid, with a rather wide base for a *Cerithium*. Nevertheless, there are many connecting links. Indeed, the whole of the small *Cerithia* of the Lincolnshire Limestone are so linked by connecting forms that, under some aspects of the case, they might be regarded as one and the same species, represented by local varieties. *C. Wansfordiæ* is the prevailing form about Wansford and Barnack, though met with occasionally, but in a modified form, at the other localities.

86. Cerithium Georgii, sp. nov. Plate IX, fig. 10.

Description:

Length	12 mm.
Width	3 mm.
Spiral angle	Very convex.

Shell slender, pupoid, turrited. The spiral angle ranges from about 20° at the opening to 13° in the anterior portions of the spire. Whorls numerous, narrow and flattened. Sutures distinct. The subapical whorls are ornamented by three granulated spirals, which in the anterior whorls are increased to the number of five or six. The spirals undulate and decussate, with short and not prominent costæ at regular intervals, producing a very pretty basket-shaped pattern. There is some irregularity in the development of these spirals, the nodulations of the upper row being always the strongest.

The body-whorl is about one-third the length of the shell, compressed, and with ornaments similar to those of the spiral whorls (in the figured specimen these have suffered from wear). Aperture subquadrate, with a short, stout anterior canal.

Relations and Distribution.—Closely related to the *limæforme* section of the group. Specimens somewhat resembling *C. Georgii* occur in the Corallian of England and possibly also in the Great Oolite. We may regard such either as distinct species, or as megalomorphs of the prevailing form. Named after Mr. George, curator of the Northampton Museum. Rare in the Lincolnshire Limestone.

87. Cerithium subcostigerum, sp. nov. Plate IX, fig. 11.

Description :

Length	8 mm.
Width	2·75 mm.

Shell short, subpupæform, slightly turrited; number of whorls about seven, subconvex, and separated by a wide and shallow suture. Apex obtuse. The ornaments consist of numerous fine spiral lines, so fine as to be scarcely visible in the upper part of the whorls. These are decussated by robust costæ, which extend from suture to suture, being, however, strongest towards the posterior margin of each whorl. These costæ have a kind of twist from left to right, and do not follow in true sequence.

The body-whorl somewhat exceeds one-third the total length of the shell, and its flanks are similarly ornamented. Base full, spirally striated, but without any axial lines. Aperture subquadrate; other indications wanting.

Relations and Distribution.—This species has some resemblance to *Eveliss a* (*Kilvertia*). On the other hand, it also has relations to some varieties of the *limæforme*-group, where the tuberculations have a tendency to fuse throughout into axial costæ. Only found, to my knowledge, in the Lincolnshire Limestone.

88. Cerithium latisulcatum, sp. nov. Plate IX, fig. 12.

Description:

Length	11 mm.
Width	3·75 mm.
Length of body-whorl to entire shell	28 : 100.
Spiral angle about	20°.

Shell elongate, subconical, turrited; spiral angle moderately convex. Number of whorls ten to twelve, flat, subangular, and separated by a wide suture. In the subapical whorls the tubercles coalesce so as to produce short axial costæ, which preponderate over the obscure spiral lines. In the anterior whorls four spirals are distinguished, of which the two uppermost are the most strongly tuberculated, the third is faint, and the fourth spiral is so prominent as to impart an angular shape to the whorls of the spire.

The body-whorl is barely one-third the entire length of the shell, and in shape and ornament similar to the whorls of the spire. Base rather full and finely striated. Aperture nearly quadrate, with a deep anterior canal.

Relations and Distribution.—Distinguished from *C. Beanii*, *C. limæforme*, and their numerous varieties by the less curved spiral angle, by the great width of suture, by the angular shape of the whorls, and by the relative shortness of the body-whorl. In the matter of ornamentation, however, there is a certain general resemblance to the shells of the *limæforme*-group, though we can scarcely regard *C. latisulcatum* as belonging to that group.

Rare in the Lincolnshire Limestone at Weldon and Wackerly.

89. Cerithium pisoliticum, sp. nov. Plate IX, figs. 13 *a*, 13 *b*.

Description:

Length	8 mm.
Width	1·75 mm.
Spiral angle (about)	10°.

Shell small, slender, turrited; spiral angle nearly regular, apex but slightly obtuse. Number of whorls about twelve; apical whorls smooth; third whorl slightly costated; subapical whorls flat, not very closely defined by the suture, and ornamented by three granular spirals. The anterior whorls are turrited, and the spirals are four or five in number, and each row is studded with a series of circular tubercles, which are largest on the upper row. A slight failure in the third spiral

may sometimes be noticed. There is no trace of axial (longitudinal) ornamentation.

Body-whorl rather less than one-third the entire length of the shell, and ornamented similarly to the whorls of the spire, base spirally striated but not granulated. Aperture restricted, subquadrate, with a relatively large and deeply notched canal, moderately reflexed.

Relations and Distribution.—The typical specimens are found in the Peagrit of the Cheltenham district, where they occur in two stages, viz. an apical portion without the turrited whorls, and the complete shell as above described. Lately I have received additional specimens, which serve to connect this species with *C. Beanii*.

A variety (or possibly another species) with a less acute spiral angle, but with very similar ornamentation, occurs in the Cephalopoda-bed at Frocester and also in the "Lower Limestone" of the Nailsworth district. Specimens of the latter, like nearly all fossils from the "Lower Limestone," are too much worn for figuring. Hence such fossils are only doubtfully referred to *C. pisoliticum*.

90. Cerithium (species). Plate IX, fig. 14.

Description:

Length	15 mm.
Width	5 mm.
Spiral angle	22°.

Shell subelongate, strongly turrited; spiral angle somewhat convex. Whorls nine to ten in number, flat, short, and increasing by gradations. The sculpture is very prominent, consisting of five spirals. The upper row is strongly tuberculated at frequent intervals, thus imparting to the shell a spinose appearance; the second and third rows are less strongly tuberculate, but the fourth is almost as strong as the first row; the fifth is feeble, like the second and third. The longitudinal ornaments are coarse and somewhat irregular on account of the unequal tuberculation of the spiral rows, the general effect of their decussating with the spirals being a coarse reticulation.

The body-whorl is barely one-third the entire height of the shell, and similarly ornamented; base somewhat depressed and spirally striated. Aperture ? subquadrate, with a well-marked anterior canal. Other indications wanting.

Relations and Distribution.—Resembles *C. Chapuisenm*, Piette ('Bull. Soc. Géol. France,' 2^{me} sér., vol. xiv, pl. v, fig. 40), from the Upper Bathonian of Rumigny. Also not unlike *C. Beanii*, but more rugose, and less pupæform. Very rare in the *Parkinsoni*-zone of the Castle Cary neighbourhood.

91. Cerithium turris, *Hudleston*, 1884. Plate IX, fig. 15.

1884. Cerithium turris, *Hudl.* Geol. Mag., dec. iii, vol. i, p. 61, pl. iii, fig. 13.

Description :

Length	13 mm.
Width	4·75 mm.
Spiral angle (mean)	20°.

Shell rather short, strongly turrited ; spiral angle somewhat convex Whorls about twelve in number, flat and short, suture close. The ornaments are conspicuous. Seven spirals are counted on the penultimate, consisting of wavy lines drawn out spirally, at considerable intervals, producing a sort of basket-like pattern. The longitudinals are strong, and close together, especially in the upper part of each whorl, but are on the whole irregular.

Aperture subquadrate to oval, with a well-developed anterior canal.

Relations and Distribution.—This is more widely angled and less pupoid than average specimens of *C. Beanii*, has a more complex system of ornamentation, and is more strongly turrited. Very rare in the Yorkshire Dogger.

92. Cerithium (species). Plate X, fig. 1.

Description.—Probable length 28 mm., width about one-fourth ; spiral angle about 18°, and tolerably regular. The shell is scarcely turrited. The upper half of the specimen is not sufficiently preserved for description. Whorls subtumid with very close sutures, the sutural angle being but little inclined. The ornaments consist of numerous fine spiral lines which are decussated at wide intervals by irregular nodular costæ, with a tendency to curve and incline from left to right. These costæ are usually the most developed anteriorly, and this causes the preceding whorl to project somewhat over the succeeding one—a feature the reverse of turriting. The number of the nodular longitudinals is about seven. Aperture ovate with indications of an anterior canal.

The specimen under consideration comes from the Inferior Oolite of Rodborough Hill, and was regarded by Lycett as a *Cerithium*. It has some resemblance to *C. variculosum*, Desl. (vol. cit., p. 210, pl. xi, fig. 46), a fossil of the Upper Lias of Fontaine-Étoupefour.

The *Comma*-Group.

This name is applicable to a group of shells which are rare in the Inferior Oolite of this country, but not so unfrequent in the Bajocian of Normandy. There can be very little doubt that they are included by Deslongchamps (op. cit., pl. xi, figs. 64—66) as forming part of his var. *a*, "*Melania scalariformis*, Deshayes." The other part of var. *a*, viz. fig. 63, is the basis of *Cerithium subscalariforme*, D'Orb. As this name, then, has been used for quite a different species of *Cerithium*, we must fall back upon Münster's name. The forms described below as distinct species are probably little more than varieties; but as, owing to their rarity in England, the missing links are not forthcoming, I propose to describe some two or three different forms for which more or less appropriate foreign names may be found.

93. Cerithium comma, *Münst.*, 1844. Plate X, fig. 2.

1842. Melania scalariformis, *Desl.* (pars). Deslongchamps, Mém. Soc. Linn. Norm., vol. vii, pl. xi, fig. 64.
1844. Cerithium comma, *Münst.* Goldfuss, Petr., t. 173, fig. 14.
1850. Synonym Cerithium opis, *D'Orb.* Prod., vol. i, p. 271.

Bibliography, &c.—The following is the original description by Goldfuss: "Turrited, with twelve to fourteen whorls, quadrangular, subquadrate, beset in the upper part with numerous wrinkles. These wrinkles form at the suture elongated knots, and run off into feeble, somewhat crooked ribs, which split up, and terminate at the lower margin in a row of very fine knots. At one place are observed obscure traces of faint spiral lines." The length of this specimen was about 20 mm.

Description of an English specimen: Length 30 mm., width 9·5 mm. Spiral angle about 20°. Shell sharply turrited. Spiral angle regular, whorls numerous, about sixteen, flat or slightly concave, rather narrow, and increasing by steps. The spiral striæ are very fine and numerous; longitudinals bold and prominent on the posterior half of each whorl, having a spinous projection upon the upper border. About half way across the whorls the longitudinals become attenuated, usually bifurcating and curving from right to left, so as to give the appearance of a comma.

The body-whorl is less than one-third the total length of the shell; the

ornaments are similar to those on the whorls of the spine; base finely striated; other indications wanting.

Relations and Distribution.—D'Orbigny relied upon the presence of the row of fine spiral knots at the anterior margins in the type *C. comma* to separate it from *C. opis*. If this be a valid difference, then our specimen should be called *C. opis*. But I regard the difference as more a question of preservation than anything else. This variety occurs in the upper part of the *Humphriesianus*-zone at Sherborne, where it is very scarce.

94. Cerithium comma, variety near to *C. unitorquatum*, Héb. and Desl. Plate X, fig. 3.

The step-like character is fully maintained in this variety. The chief differences are in the ornamentation. The longitudinal costæ are more nodular on the upper margin of each whorl, and bifurcate much higher up. The closeness of the tubercles gives the aspect of a narrow band on the upper margin of the whorls, which answers to the "cordon transversal étroit" of Hébert and Deslongchamps ('Foss. Montreuil-Bellay,' p. 41, plate vi, fig. 3).

This variety occurs in the *Parkinsoni*-zone of South Dorset—Bridport Harbour, Burton Bradstock, Vitney Cross, and Loders, but it is somewhat rare, and extremely difficult to extract in good condition.

95. Cerithium circe, *D'Orbigny*, 1850. Plate X, fig. 4.

1842. Melania scalariformis, *Desl.* (pars). Desl., vol. cit., pl. xi, fig. 66.
1850. Cerithium circe, *D'Orb.* Prod., vol. i, p. 271.

Bibliography, &c.—D'Orbigny's species is described as much elongated, and the whorls, which are step-like, as costulated transversely by arched ribs. This is the name applied usually in Calvados to the whole *comma*-group without any distinction. They are much more plentiful there than with us.

Description.—Length 32 mm., width 8·5 mm., spiral angle about 15°, and regular; whorls slightly concave, and increasing by steps, though slightly. The longitudinal ornament is conspicuous, consisting of close-set semilunar costæ, which extend entirely across the whorls. These are irregularly flexuous at times, but as a rule do not bifurcate; each terminates posteriorly in a tubercular thickening, which adds to the tabulate character of the whorls.

Body-whorl small relatively to the spire; aperture ? subovate, with a good-sized anterior canal.

Relations and Distribution.—The more slender spire, its less strongly tabulate character, and the continuity of the costæ without bifurcation, separate this species from other members of the *comma*-group. French specimens of *C. circe* are certainly more tabulate than the one figured, which is from the Inferior Oolite of Dorsetshire, and is the only one of the kind known to me as British.

The above constitute the *comma*-group as far as it is known to occur for certain in our Inferior Oolite. Thus restricted, it would be seen to be confined to the Upper Division.

96. Cerithium (species or variety). Plate X, fig. 5.

A *Cerithium*, apparently belonging to the *comma*-group, occurs very rarely in the Lincolnshire Limestone at Weldon. It is about 15 mm. long, extremely tabulate, and with concave whorls. The costæ are numerous, short, and confined to the posterior margin. But these conditions are not altogether reliable, owing to peculiarities of mineralization.

The body-whorl is angular, concave, and bicarinate; base rather depressed; aperture subquadrate, with a well-developed anterior canal.

The whorls are more concave than in *C. comma*, and the bicarination of the body-whorl is another marked feature of difference. As a temporary name we may distinguish this as *Cerithium commaoïdes*.

In some respects also this form leads up to a group of *Cerithia* with tabulate whorls and no axial ornamentation.

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97. Cerithium pergradatum, sp. nov. Plate X, fig. 6.

Description:

Length	20 mm.
Width	6·25 mm.
Spiral angle	18°.

Shell subelongate, conical, strongly turrited; apical conditions unknown. Whorls about twelve in number, flat or slightly excavated anteriorly, and increasing by steps so as to overlap the suture, which is channeled. A raised rim marks the posterior margin, which is spirally striated; plain spiral lines succeed, which are about six in number in the anterior whorls.

The body-whorl is about one-third the height of the entire shell, with ornaments similar to those of the spire; there is a faint rim at the base, which causes it to be very slightly carinate at either extremity. Base depressed and ornamented with numerous fine spiral striæ. Aperture almost quadrate. Columella short, with a considerable callus; anterior canal apparently small.

Relations and Distribution.—This form, or something very like it, occurs in several countries, and on more than one horizon of the Jurassic system. The nearest approach, so far as I am aware, is *Cerithium aptyxoides*, Gemmellaro, which has nearly the same spiral angle and general proportions, though not quite so "gradate." Moreover, Gemmellaro states that *C. aptyxoides* has a smooth surface ('Gemm. Faun. Giur.,' &c., p. 290, plate 23, figs. 10—12). *Cerithium gradatum*,[1] Hudl., from the Yorkshire Corallian, is also very similar ('Geol. Mag.,' dec. ii, vol. vii, pl. xvi, fig. 5), but this also is without ornament, though possibly the circumstance may have been due to conditions of mineralization.

Cerithium pergradatum occurs at Haselbury, possibly in the *Opalinus*-zone, and is extremely rare.

98. Cerithium (? species). Plate X, figs. 7 *a*, 7 *b*.

Description.—The length of specimens about 5 mm., spiral angle about 16°; shell subulate, spiral angle nearly regular. Whorls about ten in number, smooth and belted posteriorly, so as to form steps.

Body-whorl scarcely one-third of the total height of the shell, concave and slightly bicarinate. Aperture restricted, subquadrate, with a fairly well-developed anterior canal. The whorls in section are seen to be subcircular to ovate.

Relations and Distribution.—These little shells occur sparingly in the Lincolnshire Limestone. Being so small, it is possible that they represent the immature conditions of some other species, described or unknown. Simply as a name of convenience, and awaiting further evidence, I would call this "species" *C.* "*annulatum*."

99. Cerithium clypeus, sp. nov. Plate X, figs. 8 *a*, 8 *b*, 8′.

Description.—Length of an average specimen 24 mm., greatest breadth rather more than one-fourth of the length; spiral angle 16°. Shell elongate, turrited. Spiral angle nearly regular, sutures close. Whorls about fourteen, raised posteriorly by a belt which occupies the upper margin, nearly flat; the increase is by steps,

[1] This name will not stand, since it had been previously applied by Moore to a species of *Cerithium* in the Lias, which belongs to a different section of the genus.

though not very strongly marked. Fine spiral lines, somewhat wide apart, may be traced in well-preserved specimens.

Body-whorl scarcely one-third the entire length of the shell, almost smooth; aperture subovate? Whorls ovate in section. Other indications wanting.

Relations and Distribution.—This is a modified form of the "gradate" *Cerithia;* but how far these modifications are due to mineralization it is not easy to tell. Until we can gauge the measure of this element of uncertainty close comparisons are out of the question. Rare in the *Clypeus*-grit of Rodborough and in the *Parkinsoni*-zone of Aston.

The *Abbas*-Group.

One other group, provisionally referred to *Cerithium*, yet remains, consisting of elongate shells of considerable size, with closely fitting whorls spirally ornamented (or smooth), and ovate in section. The aperture is ovate-elongate, with a long anterior canal, more or less reflexed. The type of the group is *Cerithium abbas*. It is possible that some shells heretofore referred to *Fibula* may belong here. It may be regarded as a Nerinæoid group.

100. Cerithium attritum, sp. nov. Plate X, figs. 9 *a*, 9 *b*.

Description:

Length of a full-sized specimen	48 mm.
Width of same	12 mm.
Length of body-whorl to entire shell[1]	28° : 100.
Spiral angle	16°.

Shell elongate, scarcely turrited; spiral angle regular. Whorls about sixteen, flat in the posterior part of the spire, subtumid in the anterior portion. The width of a whorl is equal to its height *plus* the height of the preceding whorl. Slight traces of spiral lines or belts are noticeable in the earlier whorls, but not so in the later ones, which are smooth and subconvex.

Body-whorl relatively short, smooth, and subtumid. Aperture? ovate, with a long anterior canal considerably reflexed. Whorls in section squarishly ovate.

Relations and Distribution.—The evidently rolled condition of all available specimens makes me rather cautious about instituting comparisons based on the external appearance of the shell. It clearly belongs to what I have ventured to call the Nerinæoid group of *Cerithia*. *Cerithium multivolutum*, Pictte ('Bull. Soc.

[1] The canal is included in this measurement.

Géol. France, 2me sér., vol. 14 (1857), pl. v, fig. 16, &c., p. 547), has a certain resemblance. This species, according to Cossmann, has many synonyms (' L'Étage Bathonien,' p. 94), and is far from being uncommon in the Bathonian of North-East France. *C. attritum* is tolerably abundant at Weldon, but it is rare to find a specimen of the size figured.

101. Cerithium abbas, sp. nov. Plate X, figs. 10 *a*, 10 *b*, 10 *c*.

Description:

Length of a good-sized specimen . .	60 mm.
Width of same	14 mm.
Spiral angle	16°—18°.

Shell elongate, turrited; spiral angle regular. Whorls sixteen to twenty, flat, about twice as wide as high, suture close. The posterior whorls are not turrited, and increase as an elongated cone; lower down a shoulder is developed on the upper part of each whorl, which gives this part of the shell a turrited aspect. The ornaments consist of numerous spiral lines of unequal strength, thick or thin lines frequently alternating; towards the shoulder one or two lines are stronger than the rest, giving a slight appearance of a zone or girdle.

The body-whorl is sub-cylindrical, and with ornaments similar to those of the spire, except that in some specimens the rugosities due to increase are very strongly marked. The base is full, rounded, and finely striated spirally. Aperture ovate-elongate, with a considerable callus on the columella. Anterior canal well developed, elongate, and slightly reflexed. In section the whorls are ovate-elongate, both outer and inner walls being rather thick.

Varieties.—In some specimens the whorls, instead of being flat, are subconvex, and almost without any shoulder; in this variety the body-whorl is not so cylindrical (B). Not figured.

In another variety, which occurs at Beaminster, the conical outline of the earlier whorls is maintained throughout, so that there is no turriting whatever, the sutures lying in a sulcus or groove; there is also a slight belt at the anterior margin of each whorl (C). Almost a distinct species. Not figured.

Relations and Distribution.—Hitherto I have failed to find any species in the Inferior Oolite of Normandy which appears to possess any relationship to the shells above described. *Cerithium abbas* has been at times taken for a *Nerinæa*, and I believe that it has been so marked in collections. However, the longitudinal section shows that the resemblance to *Nerinæa* is external rather than internal. It is placed provisionally under *Cerithium* until a suitable genus is provided for it and similar shells. *Cerithium abbas* is tolerably abundant in the

Sowerbyi-bed at Bradford Abbas, and the variety C occurs on what is nearly the same horizon at Beaminster. It has occurred to me that possibly *Cerithium Lorieri*, D'Orb. (Prod., i, 271), from the Bajocian of the Sarthe might in some sense represent this species.

102. Cerithium polystrophum, sp. nov. Plate X, figs. 12, 13.

Description:

Length (estimated)	55 mm.
Width	10·5 mm.
Spiral angle	14°.

This species so nearly approaches *Cerithium abbas*, var. B, that it is best described by comparison with that form. The shell is more uniformly subulate, having a narrower spiral angle; the whorls are all convex, the principal convexity being rather below the middle; there is no trace of a shoulder in any of them. The spiral striæ are very close, regular, and equal. In the earlier whorls (fig. 13) the ornaments consist of about half-a-dozen such striæ, those adjoining the sutures being slightly crenulate; in the mature whorls these lines increase in numbers till they are not far short of twenty.

The body-whorl is rather short in comparison with the entire shell; aperture ovate-elongate, with a well-developed anterior canal.

Relations and Distribution.—This fossil is rare in the Lincolnshire Limestone of Weldon. The condition of the few specimens is by no means satisfactory, so that its actual relations to *C. abbas* cannot be fully made out.

103. Cerithium obornense, sp. nov. Plate X, fig. 11.

Description:

Length (restored)	60 mm.
Width	12 mm.
Spiral angle	15°.

Shell elongate, somewhat turrited; spiral angle regular. Whorls numerous, flat, and sub-concave, much broader than high, and slightly rising towards the sutures, which are bounded on either side by a raised rim, of which that on the lower side is the strongest. The ornaments consist of numerous fine spiral lines of somewhat unequal thickness, and they diminish somewhat in strength anteriorly.

The body-whorl is similarly ornamented, and is slightly angular; base full and striated spirally with a very fine pattern, which slightly decussates with axial lines. Aperture ovate-elongate; columella straight and but little encrusted; anterior canal produced.

Relations and Distribution.—Related to *Cerithium abbas*, var. C, this species is still more like a *Nerinæa*. A single specimen from the *Sauzei*-bed at Oborne.

Genus—Fibula, *Piette*, 1857. 'Bull. Soc. Géol. France,' 2me sér., vol. xiv, p. 556.

The characters of this genus are not particularly well defined. Piette regarded it as something between a *Turritella* and a *Cerithium*. Lycett ('Suppl.,' p. 16) gives the following modified diagnosis: "A rounded, straight columella, with a rudimentary umbilical groove near the base, is combined with an arcuated outer lip, slightly notched posteriorly at the suture; the base of the aperture forms a slight canal at its junction with the anterior extremity of the columella, or in other instances there is no canal. . . . . The surface of the volutions is plain or slightly ornamented with oblique costæ." Piette's types were *Fibula undulosa* and *F. nudiformis*, to which Lycett added *Fibula variata*, Lyc., *F. eulimoides*, Whiteaves, and *F. phasianoides*, M. and L. All five are Great-Oolite species.

M. Cossmann ('L'Étage Bathonien,' p. 108, *et seq.*) more or less does away with *Fibula* by merging it in *Ceritella*, so that, according to this arrangement, *F. undulosa*, P., and *F. nudiformis*, P., become *Ceritellæ*.[1] Fischer regards *Fibula* as a subgenus of *Ceritella*. Whether *Fibula* is worth preserving as a genus or not it is eminently a Bathonian group; so also is *Ceritella*. Both are extremely rare in the Inferior Oolite of England. The two species which I now propose to classify under *Fibula* might possibly be allowed a place under *Cerithium*. The species in the Inferior Oolite which I regard as belonging to *Ceritella* have the body-whorl relatively longer and more approaching the cylindrical form.

104. Fibula angustivoluta, sp. nov. Plate XI, fig. 1.

Description:

Length	12 mm.
Width	4 mm.
Ratio of body-whorl to entire shell . .	30 : 100.
Spiral angle	25°.

[1] *Fibula Royssii*, d'Arch., comes under another category.

Shell elongate, conical, spiral angle regular; whorls ten to twelve, flat to subconvex, narrow, smooth; a slightly raised belt in the upper part of each whorl gives a faint appearance of turriting; suture close.

Body-whorl rather short, subtumid, rounded, and smooth. In some specimens there is a slight indication of an umbilicus; columella short and straight. Aperture subquadrate, with a thin rounded outer lip and a square base strongly notched at its junction with the columella.

Relations and Distribution.—The small size of all specimens hitherto found may be deceptive, since Gasteropoda in the Lincolnshire Limestone are usually small. The narrowness of the whorls seems to distinguish it from any other species hitherto referred to *Fibula*. Somewhat rare in the Lincolnshire Limestone at Weldon.

105. Fibula canina, *Hudleston*, 1884. Plate XI, figs. 2 *a*, 2 *b*.

1884. Cerithium (?) caninum, *Hudl.* Geol. Mag., dec. iii, vol. i, p. 107, pl. iv, figs. 1 and 2.

Description:

Length of a large specimen	51 mm.
Width	21 mm.
Ratio of body-whorl to entire shell	35 : 100.
Spiral angle	32°.

Shell subelongate, conical, with perhaps a rudimentary umbilicus; spiral angle regular. Whorls about ten, smooth, somewhat tumid towards the centre, and separated by a suture of moderate depth. Wavy longitudinal lines, apparently lines of growth, are seen in some specimens.

Body-whorl rather more than one-third the total height of the shell, rounded, and smooth; aperture quadrate, with some traces of an anterior notch. Other indications wanting.

Relations and Distribution.—When one has to deal with a doubtful species it is as well to place it in a doubtful genus. The nature of the matrix may have somewhat modified the available specimens. The number of whorls seems to be few for such large shells. *F. canina* has some resemblance to *Fibula* (*Chemnitzia*) *phasianoides*, M. and L. (pl. ix, fig. 5), whilst it has less resemblance to the types of Piette. We are also reminded of *Fibula Gastaldi*, Gemm., ('Faune Giuresi,' p. 281, pl. 22, fig. 55). Rare in the Yorkshire Dogger.

Genus—CERITELLA, *Morris and Lycett*, 1851.

"*Shell turrited, spire acute, subulate, volutions flattened, their margins usually sulcated; the last whorl large, aperture lengthened and oblique, canal very short; columella smooth, rounded, and slightly reflected at the base; outer lip thin.*"—'Gt. Ool. Moll.,' p. 37.

This is so essentially a Bathonian genus that it is hardly necessary to say much regarding it in this Memoir. It is well known that Piette in 1856–57 ('Bull. Soc. Géol. France,' 2^{me} sér., t. 13, p. 592, and t. 14, p. 558) constituted the genus *Tubifer* to receive a group of shells from the Bathonian of the Ardennes, which are, on the whole, very similar to the *Ceritellæ* of Morris and Lycett. Fischer ('Manual,' p. 684) regards *Tubifer* as a subgenus of *Ceritella*, having the form of an *Actæon*, the last whorl cylindrical and strongly developed. Cossmann (op. cit., p. 108) does not regard *Tubifer* as being even a subgenus.

In the Great Oolite of Minchinhampton, where alone *Ceritellæ* can be regarded as at all abundant, two very distinct sections may be noted, viz. species which have the shell perfectly smooth, such as *C. unilineata* and *C. Sowerbyi*, and those which are sculptured longitudinally as in *C. conica*. An impressed line on the shoulder of the whorls is a frequent characteristic of the smooth species, but appears to be absent in *Ceritella acuta*.

In the Inferior Oolite of this country *Ceritella* is extremely rare, and none of the forms attain even to the size of the little shells from Bathonian beds. Lycett ('Proc. Cottes. Nat. Club,' vol. i, p. 80, pub. 1853) describes *Ceritella sculpta* and *Ceritella tumidula* from the Inferior Oolite of Gloucestershire. These I have not seen, nor are they mentioned in the lists of the 'Handbook to the Cotteswold Hills' published in 1857. As far as my present opportunities extend I have not been able to determine any species of *Ceritella* from the Inferior Oolite of the Cotteswolds, though there are some small forms in the "Lower Limestone" of the Stroud-Nailsworth district which rather suggest this genus, but these are too imperfect for description. However, since the physical resemblance of these beds to the Minchinhampton beds is considerable, we may expect to find *Ceritella* in them. The Lincolnshire Limestone seems to be the only part of the Inferior Oolite which has hitherto yielded *Ceritella*. A few specimens have been found at Weldon and at Ponton. These most resemble the smooth species with sulcated margins, such as *C. Sowerbyi*. The body-whorl is cylindrical, and the general aspect of the shells so much like that of certain forms of *Nerinæa* that it has been found necessary to cut sections for the purpose of ascertaining the internal structure. With considerable variety as to width there seems too much general resemblance to constitute more than one species.

106. Ceritella Lindonensis, sp. nov. Plate XI, figs. 3 *a*, 3 *b*, 4.

Description.—Length from 8—10 mm., with an average width of about three-eighths of the height, but varying considerably; mean of spiral angle about 30°. Shell turrited, apex acute; whorls about eight, flat, smooth, and increasing suddenly by steps; shoulder somewhat sloping, marked with a spiral line below the suture, producing a sort of zoned appearance in some specimens.

Body-whorl large, fully equal to half the entire length of the shell, smooth, cylindrical, slightly constricted in the centre, and rounded at the base. Columella long, slightly arcuate, and reflexed; aperture elongate, and anteriorly oblique, terminating in a sort of tube which has very much the appearance of a canal. In section the outer wall of the whorls is perfectly smooth, but a slight tendency to a fold may be noticed on the columellar side.

Relations and Distribution.—The impressed line on the shoulder, the large relative size and cylindrical shape of the body-whorl, clearly distinguish this species from *C. acuta*, M. and L. It is much more nearly allied to *C. Sowerbyi*, M. and L. Indeed, there are specimens in the Great Oolite of Minchinhampton which can hardly be said to differ from some of those in the Lincolnshire Limestone. But *C. Sowerbyi*, as figured and described, has not the body-whorl quite so cylindrical or so large. In fact *C. Sowerbyi* is not quite so like a *Nerinæa*.

The varieties of *C. Lindonensis* are considerable. Figs. 3 *a*, 3 *b*, represent a front view and a section of a short stout form, which might lead to a different species. It is rare. Fig. 4 represents an unusually large specimen of the more prevailing form, which occurs sparingly at Weldon. The small, slender forms from Ponton are almost identical with *C. Sowerbyi*. Indeed, the less completely developed specimens, whether from Ponton or from Weldon, are not to be distinguished from ordinary forms of the Great-Oolite species.

Genus—Exelissa, *Piette*, 1861, 'Bull. Soc. Géol. France, 2me sér., t. 18, p. 15;
= Kilvertia, *Lycett*, 'Supplement,' pp. 15 and 93.

"*Shell small, narrow, subcylindrical, somewhat pupæform; whorls numerous, ornamented with longitudinal ribs, tuberculated or spinous; last whorl contracted at the base, with a tendency to detach itself from the axis; aperture orbicular, entire, with lips elevated, prominent, slightly thickened; columella solid.*"—Fischer.

With few exceptions, the above is the original diagnosis of *Kilvertia*, which was

so well formulated by Lycett, although Piette's name appears to have the priority. Fischer places this genus with a query under the Cerithiidæ.

These curious little shells are by no means abundant. *Exelissa numismalis* is described by Tate from the Lower Lias. The ornaments of this species are not very characteristic, and, as usual with Lias specimens, the character of the aperture is not well-defined. Four species were recognised by Lycett in the Great Oolite, one of which, *Ex. strangulata*, D'Arch., is regarded as the type of the genus. All four are recorded by Cossmann as occurring in the Bathonian of France.

In the Inferior Oolite of this country there are three if not four species of *Exelissa*, two of which are closely allied to, and possibly in one case identical with, Bathonian species.

107. Exelissa strangulata, *D'Archiac*, 1843, Inf.-Ool. Varieties. Plate XI, figs. 5 *a*, 5 *b*, 6.

1843. Cerithium strangulatum, *D'Arch.* Mém. Soc. Géol. France, t. v, p. 382, pl. xxxi, figs. 1 *a*, *b*.
1851. — — — Morris and Lycett, Great Ool. Moll., p. 31, pl. ix, fig. 18.
1863. Cerithium ? (Kilvertia) strangulatum, *D'Arch.* Lycett, Suppl., pp. 8 and 94, pl. xliv, fig. 2.

Bibliography, &c.—Lycett's figure in the 'Supplement' is good, showing the straight, thick ribs characteristic of this species. He says (p. 8): "The present specimen, which agrees more nearly with the example figured by D'Archiac, has *seven* longitudinal costæ, which are conspicuous even to the base."

Var. Pisolitica (figs. 5 *a*, 5 *b*).

Length about same as in specimens of *Ex. strangulata* from Eparcy (8 or 9 mm.), figure rather more slender, and apex less obtuse. The ornamentation differs considerably. In the var. *pisolitica* the longitudinal costæ are not quite so regular, and straight; moreover the granulations of which the costæ are built up are larger and about half as numerous; they correspond in fact to four or five spiral lines on each whorl instead of at least eight as in *Ex. strangulata*. The contracted, pupæform aperture, with its prominent lips, is alike in both; but this, of course, is a generic feature.

This variety occurs rarely in the lower part of the Inferior Oolite of the Cotteswold, and chiefly in the Pea-grit.

Var. Ovalis (fig. 6).

About 8 mm. in length, this variety is broader than typical specimens from

Eparcy; the apex also is somewhat more obtuse. The ribs are wider apart, the last whorl somewhat less constricted, and the aperture less filled up, and not quite so circular. There are eight costæ, which are decussated by about as many fine spiral lines. This variety differs from the type exactly in the opposite direction to *Ex. pisolitica*, but is, on the whole, nearer to the Great-Oolite forms.

Rare in the Lincolnshire Limestone of Weldon, where poorly preserved specimens are difficult to distinguish from bad specimens of *Cerithium subcostigerum*.

108. Exelissa pulchra, *Lycett*, 1863. Plate XI, fig. 7.

1863. Kilvertia pulchra, *Lycett*. Suppl., pp. 10 and 94, pl. xliv, fig. 4.

The following is Lycett's description: "Shell small, thick, elongately turrited (?); volutions eight, convex, the sutures deeply impressed; transverse (*i. e.* axial) costæ about twelve in each volution, oblique, large, decussated, and rendered nodulous by six narrow encircling lines; . . . . the figure of the aperture in shells of the same size presents some variability, the typical suborbicular figure becomes subquadrate, and in other instances is somewhat pointed at the two extremities, but in the young condition apparently the aperture is always orbicular."

As I have not had an opportunity of seeing specimens of *Ex. pulchra* either from the Great Oolite of Minchinhampton or from the Forest Marble of Laycock, there may be room for doubting the present identification. But certain shells from the Lincolnshire Limestone at Ponton answer very well to Lycett's figure and description. This case affords another instance of the resemblance in Ponton fossils to Bathonian forms.

109. Exelissa Weldonis, *Hudleston*—Correction of name. Plate XI, figs. 8 *a*, 8 *b*.

1884. Cerithium (Kilvertia) Comptonense, *Hudl.* Geol. Mag., dec. iii, vol. i, p. 62, pl. iii, fig. 14.

Bibliography, &c.—By inadvertence this species, so characteristic of the Lincolnshire Limestone of Weldon, received the specific name of "*Comptonense*."

Description.—Length about 6 mm., width less than one-third of the length. Shell pupæform; whorls six to eight, sutures not very distinct in the spire. The ornaments are more conspicuous spirally than longitudinally. In the majority of specimens are three spirals, the upper and lower of which, but sometimes all three,

are distinguished by large oval granulations, drawn out spirally, but arranged so as to form the axial costæ of the spire. In the body-whorl the oval granulations are sometimes lost. Body-whorl much constricted anteriorly, and not unfrequently showing a tendency to detach itself. Aperture small, thickened, and orbicular.

Relations and Distribution.—This species was originally described from a specimen obtained from the Millepore Rock of the Yorkshire coast, which differs in some details from Weldon specimens. It is more slender than *Ex. strangulata*, besides differing very much in ornamentation. The large oval granulations and general coarseness of the spiral lines completely distinguish this species from *Ex. pulchra* and *Ex. formosa*.

110. Exelissa Normanniana, *D'Orb.*, 1850. Plate XI, fig. 9.

1850. Cerithium Normannianum, *D'Orb.* Prod., i, p. 271.

Bibliography, &c.—D'Orbigny describes his species as near to *C. contortum*, but shorter and provided with seven longitudinal rows of costæ. It occurs at Bayeux. By the kindness of Prof. Eugene Deslongchamps I possess a specimen from the "Oolite ferrugineuse," thus identified. It is barely 12 mm. in length, and is pupæform, so that its resemblance to *C. contortum* is very slight indeed. It has seven longitudinal rows of costæ, as stated by D'Orbigny. Whether it should be referred to *Exelissa* or to *Cryptaulax* is not quite clear. The small size and pupoid shape are in favour of the former view, whilst the ornaments are more those of *Cryptaulax*. No perfect aperture has been seen by me.

Description.—Length about 10 mm., width two-fifths of the length. Shell pupæform. Number of whorls about eight, polygonal, and well separated by the suture, the last whorl narrowing towards the base. Ornaments rugose; regarded longitudinally, *i. e.* in the direction of the axis, there are eight rows of costæ, the spirals in each whorl being three in number, and grossly tuberculated for so small a shell, especially as regards the first and third spirals. Columella short and encrusted by the peristome, which is subcircular and situated in the base of the shell. Other indications wanting.

Relations and Distribution.—In size, shape, and details of ornamentation, English specimens agree fairly well with those from Bayeux, the chief difference being that there are eight rows of costæ instead of seven.

It may be that this rugose little species serves to form a connecting link between *Exelissa* and *Cryptaulax*. Before deciding we await better specimens; both *Exelissa* and *Cryptaulax* are very tender in the mouth.

Occurs at Stoford, Burton Bradstock, and Grove—in the *Parkinsoni*-zone.

Genus—Cryptaulax, *Tate*, 1869, 'Ann. and Mag. Nat. Hist.,' ser. 4, vol. iv, p. 418; = Pseudocerithium, *Cossmann* (at least in part), 1884, 'L'Étage Bath.,' p. 124.

Shell elongate, pointed, with a more or less polygonal spire, ornamented with longitudinal ribs, which succeed each other with a twist from left to right—a feature more conspicuous in some species than in others. Suture wide, columella short, aperture suborbicular to ovate, with little or no anterior canal. Peristone entire, and broadly reflexed on the inner side—a shallow, oblique, posterior canal in the angle formed by the body-whorl and outer lip. (Tate's diagnosis somewhat modified.) *Type*, C. tortilis, *H. and D.*

Cossmann (op. cit.) gives a somewhat similar diagnosis as regards the shell, but does not mention the concealed posterior canal as one of the features of his genus, *Pseudocerithium*, the type of which he takes to be *Cerithium undulatum*, Quenst.

It may be that *Cryptaulax* and *Pseudocerithium* are not exactly synonyms, though M. Cossmann is now disposed to regard them as such. If we allow that they are synonyms, the genus *Cryptaulax* certainly will cover shells which present considerable differences.

Cryptaulax occurs most abundantly in the *Parkinsoni*-zone, and is mainly confined to No. 1 District. No species, either from the Lincolnshire Limestone or from Yorkshire, has hitherto come under my notice.

111. Cryptaulax scobina, *Deslongchamps*, 1842. Plate XI, fig. 10.

1842. Cerithium scobina, *Desl.* Mém. Soc. Linn. Norm., vol. vii, p. 196, pl. x, fig. 49.
1867. — varicosum, *Desl.* Moore, Middle and Upper Lias, p. 83, pl. iv, fig. 15.
1869. Cryptaulax scobina, *Desl.* Tate, Ann. Mag. N. H., ser. 4, vol. iv, p. 418.

Bibliography, &c.—Originally described from a single specimen in the Upper Lias of Fontaine-Étoupefour. Moore obtained four examples from the highest horizon of the Ilminster Upper Lias; these he referred inadvertently to *Cerithium varicosum*, Desl. Tate pointed out the mistake.

Description:

Length	17 mm.
Width	5 mm.
Spiral angle	18°.

Shell elongate, but slightly turrited; spiral angle nearly regular. Whorls about twelve, flattish, sutures wide but varying. Each whorl is ornamented by three strong nodular spirals, of which the two posterior are somewhat removed from the third, the centre one being usually the weakest, an indistinct fourth spiral line may sometimes be noticed. The longitudinals are prominent, and extend throughout the shell in an almost continuous series with a twist from left to right.

Base depressed and marked with three spiral lines. Aperture confined, and suborbicular, with a considerable callous deposit on the columella, which is extremely short. Other indications wanting.

Relations and Distribution.—The above description is sufficiently near to the original diagnosis of Deslongchamps to leave little doubt that this is at least a variety of *C. scobina*. It occurs very rarely in the Inferior-Oolite Sands, the figured specimen being described by the late Mr. Witchell as from "the base of the Sands, Nailsworth." Tate, on the authority of Lycett, speaks of *C. scobina* from the "Upper-Lias Sands, Upper zone, Nailsworth." It is related to *Cryptaulax tortilis*, H. and D., which may be regarded as the generalised representative of the group on several horizons. *Cryptaulax scobina* also occurs towards the base of the Yeovil Sands at East Cliff, near Bridport Harbour.

112. Cryptaulax tortilis, *Hébert and Deslongchamps*, 1860. Plate XI, figs. 12 *a*—*c*.

1860. Cerithium tortile, *H. and D.* Foss. Montreuil-Bellay, p. 39, pl. vi, figs. 1, *a*—*e*.

1884. Cf. also Exelissa tortilis, *H. and D.* Cossmann, Étage Bathonien, p. 123, pl. xiv, fig. 46.

Non Cerithium tortile, *Eudes Deslongchamps.* Mém. Soc. Linn. Norm., vol. vii, p. 200, pl. xi, fig. 15.

Bibliography, &c.—The authors observe that this species might almost be ranked with the Turritellas. They make the diagnosis very comprehensive so as to include a number of varieties. It is thus that *Cryptaulax tortilis* comes to have a wide range both in time and space. Originally described from the Callovian of Montreuil-Bellay, where it attains a length of about 14 or 15 mm., a variety of it about 10 mm. in length, with only three spirals, occurs at Hutka[1] in Poland, on what is stated to be the same horizon. The subjoined description refers more especially to varieties occurring in the Inferior Oolite of England.

Description:

Length	15 mm.
Width	$4\frac{1}{2}$ mm.
Spiral angle	15°—17°.

[1] Specimens from this locality are in the Museum of the Geological Society of London.

Shell elongate, turrited, apex sharp; spiral angle regular; sutural sulcus wide. Whorls eight to ten, short, subpolygonal; apical whorls more turrited in some specimens than the anterior ones. The ornaments consist of from three to four spinous or tuberculated spiral belts, of which the two outer ones are always the strongest. The costæ are from ten to twelve in number, and only moderately twisted, in some varieties scarcely at all; usually the costæ are not very prominent.

Body-whorl about one-fourth of the total height of the shell, in some specimens slightly constricted anteriorly; base depressed and spirally striated. Aperture suborbicular, columella short and strongly encrusted. In some specimens there are indications of the groove at the posterior angle.

Varieties.—Fig. 12 *a* represents a specimen, from the *Parkinsoni*-zone of Aston, with four closely set spirals, and costæ nearly straight and numerous. Fig. 12 *b* is a specimen from the same horizon and locality with three spirals. This might be almost called "*triarmatum*." Fig. 12 *c* is a specimen from the highest part of the *Humphriesianus*-zone at Oborne. This is longer than usual, possesses four spirals; and the costæ are not quite so close; they are also more twisted. Fig. 11 represents a form apparently intermediate between *C. tortilis* and *C. scobina*.

Relations and Distribution.—If we accept all the varieties above enumerated as belonging to one species then it is somewhat difficult to see why *Crypt. scobina* should not be included. The longitudinal costæ in the latter species are less numerous, and the ornaments less close.

As regards distribution, *Cryptaulax tortilis* in this country is principally confined to the higher zones of the Inferior Oolite. Besides the localities already mentioned it is met with in the *Parkinsoni*-zone at Grove. Aston and Notgrove are the points farthest north where any of its varieties have come under my notice.

113. Cryptaulax papillosa, *Deslongchamps*, 1842. Plate XI, fig. 13.

1842. Cerithium papillosum, *Desl.* Mém. Soc. Linn. Norm., vol. vii, p. 209, pl. xi, figs. 42—44.

Bibliography, &c.—Described from a single specimen of the "Oolite ferrugineuse," Bayeux; considerably smaller than the specimen described below.

Description:

Length	14 mm.
Width	5 mm.
Spiral angle	20°.

Shell subelongate, rugose; spiral angle nearly regular. Whorls about ten, short, and separated by a wide sutural sulcus. The ornaments consist of two very strong spiral bands, which are grossly nodular (papillæ) at the intersection with the longitudinal costæ. These latter are seven or eight in number, and but slightly interrupted; the amount of inclination or twist is very slight.

Body-whorl small; base depressed and marked with strong spiral lines. Aperture suborbicular, with a short and thickly encrusted columella; indications of the groove or furrow at the posterior angle.

Relations and Distribution.—Distinguished by its very coarse tuberculation, and by having only two spiral bands. A single specimen from the *Parkinsoni*-zone of Grove.

114. Cryptaulax, cf. undulata, *Quenst.*, 1858. Plate XI, fig. 14.

1858. Cerithium undulatum, *Quenst.* Der Jura, p. 488, t. 65, fig. 24.
1860. Turritella undulata, *Quenst.* Héb. and Desl., Foss. Mont.-Bellay, p. 49, pl. vii, figs. 13, *a*—*c*.
Cf. also Cerithium hystrix, *Desl.* Mém. Soc. Linn. Norm., vol. vii, p. 195, pl. x, fig. 47.

Bibliography, &c.—*T. undulata* was very doubtfully described as a *Turritella* by Hébert and Deslongchamps, who remark that it has some resemblance to *Cerithium hystrix*, Desl. In the latter, they say, the whorls are more concave, the spiny tubercles of the anterior and posterior spiral belts (cordons) are more numerous, whilst the costæ do not form a regular longitudinal series, but suffer interruption.

Description.—Probable length 40 mm.; spiral angle about 12°. Whorls numerous, polygonal, widely separated by the sulcus of the suture. Each whorl possesses a pair of prominent spiral bands or keels near the sutures; numerous fine spiral lines occupy the intermediate area. The costæ are stout, wide apart, and extend nearly from suture to suture, but are irregular in sequence. They are about six in number. At the points where the costæ decussate with the two spiral bands are very spiny tubercles, which give a rough aspect to the shell. Other indications wanting in English specimens.

Relations and Distribution.—The species to which I now draw attention is very rarely found in the *Parkinsoni*-zone of South Dorset, and hitherto only in fragments. It is probably intermediate between *C. hystrix* and *C. undulata*. The former occurs somewhat rarely in the Bajocian of Normandy.

115. Cryptaulax contorta, *Deslongchamps*, 1842. Plate XI, figs. 15 *a*, 15 *b*, 15 *c*.

1842. Cerithium contortum, *Desl.* Mém. Soc. Linn. Norm., vol. vii, p. 194, pl. x, fig. 44.

Bibliography, &c.—A fossil of the "Oolite ferrugineuse" of Les Moutiers and Bayeux, where it is by no means rare.

Description :

Length of a fair-sized specimen . .	40 mm.
Width	$7\frac{1}{4}$ mm.
Length of body-whorl to entire shell .	22 : 100.
Spiral angle	11°.

Shell subulate, turrited, apex very sharp; spiral angle regular. Whorls numerous, pentagonal, subconcave, and separated by a broad sutural sulcus. The ornaments consist of two stout spiral bands at each extremity, enclosing one or two which are less prominent; between these bands are fine spiral lines or striæ. There are five prominent longitudinal costæ twisted from left to right, and producing at the points of interseetion blunt tubercles drawn out spirally. In the posterior whorls the costæ are for the most part in sequence, but anteriorly this line becomes irregular and dislocated.

Body-whorl relatively short, base very flat, and spirally striated. Aperture suboblong, columella short; inner lip circular, outer lip angular, especially at the junction with the body-whorl, where indications of the furrow may be noticed. Whorls in section ovate-oblong.

Relations and Distribution.—The strongly pentagonal outline of the spire, besides minor differences of ornamentation, serve to distinguish *Cryptaulax contorta* from the species last described. Both of them belong to what I may term the Turritelloid section of *Cryptaulax*. They also more especially answer to Cossmann's genus "*Pseudocerithium*," which is represented in the Bathonian of France by *Pseudocerithium densistriatum*, Cossmann. Both sections of *Cryptaulax* are unrepresented in the Great Oolite of this country. On the whole, it would seem that *Cryptaulax contorta* and its allies might just as well be placed under the Turritellidæ as under the Cerithiidæ.

Cryptaulax contorta, in this country, seems confined to the *Parkinsoni*-zone, or to the very highest beds of the *Humphriesianus*-zone, such as the *Cadomensis*-bed at Oborne. It is especially abundant in P_1 at Burton Bradstock, Vitney Cross, &c., and occurs on the same horizon at Stoford and at Grove, all in No. 1 district.

It has been traced in the Cotteswolds (No. 2 district) as far as Horton Hill (Sodbury), where it occurs in the equivalents of the Upper *Trigonia*-grit. North of this point it has not hitherto been obtained.

Genus—Cerithinella, *Gemmellaro*, 1878. 'Faune Giuresi,' &c., p. 282.

Shell subulate, conical-elongate, subcylindrical; whorls numerous, nearly flat, the surface puckered and ornamented with spiral lines. Aperture quadrangular, with a very short anterior canal.

The shells described by Gemmellaro under *Cerithinella* are extremely elegant in form, being externally not unlike some of the more cylindrical Nerinæas, though internally the arrangement is quite different. The spiral system of ornamentation predominates. He describes and figures eight species from the crystalline Limestone of Montagne del Casale in Sicily, which appears to be of Liassic or Lower Oolite age.

We have in the Lower Division of our Inferior Oolite a few extremely elegant Nerinæoid fossils, which display considerable resemblance to the Cerithinellæ of Gemmellaro. The chief difference consists in the sutural sulcus being more open in the majority of our specimens. The group also occurs in the Lias, where it is represented by such forms as *Cerithium confusum*, Tate ('Geol. Mag.,' 1875, p. 205), described from the *Spinatus*-zone of the neighbourhood of Banbury. Probably also some of the so-called *Turritellæ* of the Lias might be referred here. If I am right in classifying our fossils under *Cerithinella*, the genus is perhaps more nearly allied to the Turritellidæ than to the Cerithiidæ. Placed by Fischer provisionally in the latter family.

116. Cerithinella Bajocensis, sp. nov. Plate XII, figs. 1 *a*, 1 *b*, 2, 3.

Description:

Length (estimated)	35 mm.
Width	7 mm.
Spiral angle	10°—12°.

Shell subcylindrical, somewhat turrited; spiral angle slightly convex at first, afterwards regular. Number of whorls eighteen to twenty, constricted rather below the middle, rising slightly towards the sutural sulcus. The subapicals have two nodular spiral belts, the posterior being the most prominent, and

exhibiting short, thick costæ. Beyond this point the ornaments vary considerably within certain limits. The upper spiral belt becomes a complex zone made up of several spiral lines more or less undulating, which decussate with a system of numerous short nodular costæ; about three spiral lines without any decussation occupy the lower and more constricted portion of the whorl, which is terminated by a nodular spiral belt, representing the lower of the two belts in the earlier whorls. The above description only applies to very fully developed specimens.

Body-whorl short, concave, and similarly ornamented; base depressed and somewhat excavated, marked with strong spiral lines. Aperture small, sub-oblong, and somewhat constricted anteriorly. Anterior angle strongly marked, but with scarcely any canal. A slight incrustation of the inner lip.

Varieties.—With the above I associate provisionally two varieties, one of which (fig. 2) occurs in the "Dew-bed" of Bradford Abbas. The proportions are nearly the same, except that the body-whorl is somewhat shorter relatively. The shell itself is more turrited and the whorls rather more angular; the ornaments also are less rich, the number of spirals especially being fewer. Altogether it is a less well-developed variety. I propose to distinguish this as var. *drosera*. The specimen is unique.

The other variety (fig. 3) is from the neighbourhood of Beaminster, and occurs, no doubt, on one of the lower horizons. The whorls are not angular, and are separated by a very wide and shallow sutural sulcus. There is no turriting in the sense of the succeeding whorls projecting beyond the preceding ones. The ornaments are less elaborate; the short costæ in the posterior part of each whorl are simpler, and have a decided twist from left to right. The specimen, which is unique, exhibits an almost imperceptible fold in the outer lip, as in *Nerinæa*. This I propose to distinguish as var. *melitta*.

Relations and Distribution.—But little more can be said at present on the score of affinities. These beautiful shells are very scarce and never perfect. Excluding the two varieties already named, the *Sowerbyi*-bed of North Dorset alone has yielded these fossils.

117. Cerithinella Brodiei, sp. nov. Plate XII, figs. 4 *a*, 4 *b*.

Description:

Length about	30 mm.
Width	6 mm.
Spiral angle about	10°.

Shell subcylindrical; whorls numerous, angular, varying from subconvex to

subconcave, sutural sulcus wide. The ornaments undergo considerable modification. Apical whorls unknown. Towards the middle of the spire the posterior margin of each whorl carries a single row of roundish tubercles, below which is a slight constriction, and then a convex zone made up of undulating spirals decussating with short costæ. In the anterior whorls a considerable change takes place; the whorls become concave, and instead of costæ a single row of tubercles occurs at each extremity, the spiral ornaments remaining the same.

The body-whorl is relatively small, angular, and with a base which is depressed and slightly excavated towards the centre. Aperture restricted anteriorly, suboblong, columella short, outer lip slightly constricted.

Relations and Distribution.—This is the most cylindrical of the several forms described from the Inferior Oolite. It also differs considerably in the details of ornamentation from *C. Bajocensis*. In other respects it must be regarded as closely approximating to that species. When comparing it with species from the Lias of Sicily it seems to resemble *Cerithinella elegans*, Gemm. (op. cit., p. 285, pl. 23, fig. 34). Fig. 4 *a* represents the type-specimen obtained by Mr. Brodie from the Leckhampton Freestones. Fig. 4 *b* represents either a variety, or the earlier stage before the whorls become concave; it was collected by Lycett from the Inferior Oolite of Nailsworth.

Fig. 5 represents the anterior whorls of a larger shell, somewhat modified by mineralization from the *Murchisonæ*-zone of Stoford. This last may represent the maturer condition of *C. Brodiei;* or, what is more probable, of *C. Bajocensis*, var. *drosera*.

Pseudalaria, genus novum.

Testâ subelongatâ, conicâ, acutâ. Anfractibus spiraliter striatis, in medio vel sub medio carinatis, carinis sæpe crenulatis; ultimo anfractu bicarinato. Aperturâ quadratâ, anticè et posticè subcanaliculatâ; labro dextro sinuato.

The above generic diagnosis is practically that given by Deslongchamps in describing *Turritella unicarinata* (vol. cit., p. 151, pl. xi, fig. 68), said to occur in the Oxford Clay of Dives. *Turritella Guerrei*, Héb. and Desl. (op. cit., p. 46, pl. vi, fig. 6), from the Callovian of Montreuil-Bellay, is a somewhat narrower form. Cossmann (op. cit., p. 229, pl. v, fig. 15) describes a still narrower variety of *T. Guerrei* from the Bathonian of Le Wast.

The latter author observes that *T. Guerrei* might almost as well be an *Alaria* as a *Turritella*, since the double keel reminds us so much of the former, though the form of the aperture removes it completely from *Alaria*. He suggests a change of genus. Undoubtedly the spire has a remarkable resemblance to some

of the didactyl Alarias, such as those of the *trifida*-group. The form of the aperture is peculiar and suggestive of *Potamides*, as was justly observed by Hébert and Deslongchamps. But in the modern *Potamides* there really is a canal, whilst in *Pseudalaria* there is little more than the semblance of one. Bearing in mind that both M. Cossmann and the late Mr. Tawney have borne testimony to the resemblance of these shells to *Alaria*, the name selected for the genus is not altogether inappropriate. Whether it should be placed under the Cerithiidæ or the Turritellidæ is not quite clear. The existence of a sort of posterior canal is in favour of the former view.

118. Pseudalaria Etheridgii, *Tawney*, 1873. Plate XII, figs. 6 *a*, 6 *b*, 6 *c*, 7, 8.

1873. Alaria Etheridgii, *Tawney*. Dundry Gasteropoda, p. 14, pl. i, fig. 7.
Cf. also
1842. Turritella unicarinata, *Desl.* Mém. Soc. Linn. Norm., vol. vii, p. 151, pl. xi, fig. 68.
1844. Cerithium concavum, *Münst.* Goldf., Petrifacta, t. 173, fig. 16.

Bibliography, &c.—A single specimen from "Yeovil," *i. e.* from the Inferior Oolite of Bradford Abbas, was all the material available for Mr. Tawney, who was evidently unaware of the true nature of the aperture. *Cerithium concavum*, M., from the "Unter-Oolithe" of Rabenstein, has considerable resemblance. Moreover, Münster's species has crenulated carinæ, which is the case with *Pseudalaria Etheridgii*, though the fact was not noticed by Mr. Tawney.

Description:

Length	20 mm.
Width	8 mm.
Length of body-whorl to entire shell	37 : 100.
Spiral angle	24°.

Shell conical, sharp; whorls about ten, angular, spirally striated, and provided with a very large keel, which is nearly median, sharp, and crenulate. A rudimentary second keel is partly exposed in the penult. Just below the suture in each whorl is a beaded band.

The body-whorl is rather more than one-third the total height, and bicarinate, the anterior carina being quite equal to the other as it approaches the outer lip. Base flattish, and marked with spiral lines of considerable prominence. Aperture quadrate, outer lip sinuous and effuse, base very square, forming at its junction with the extremity of the columella an angular recess in imitation of a canal. There is also a short posterior canal. In section the earlier whorls are very similar to those of keeled *Alariæ*, having about the same spiral angle, but in the

later whorls the section is more inclined to be quadrate, giving evidence of the absence of preparations for the anterior canal.

Varieties.—A variety from near Beaminster (fig. 7) is rather more squat in figure, has the keel somewhat lower down, and does not expose the rudimentary lower keel in the penult to such an extent. Another variety (fig. 8), from the irony-nodule bed of the *Murchisonæ*-zone in Burton Cliff, differs in an exactly opposite direction, being narrower, and displaying the lower keel at a still earlier stage than *Ps. Etheridgii*. Moreover, the crenulations on the keel, and the granular zone on the posterior margin, are much more pronounced. This I propose to call var. *granosa*, indeed it is almost worthy of being regarded as a distinct species.

Relations and Distribution.—*Pseudalaria Etheridgii* occurs somewhat sparingly in the *Sowerbyi*-bed of Bradford Abbas, and has been met with on or about the same horizon at Pitcombe. This species may be regarded as the type of a genus which has representatives on lower as well as on higher horizons. My attention has lately been called by Mr. Edward Wilson to a specimen obtained from the Lias, which he regards as identical with *Purpurina Patroclus*, D'Orb. This well-preserved fossil differs from *Ps. Etheridgii* chiefly in the more decided character of the anterior canal, which gives to this part of the aperture an appearance not unlike that of the Purpurines.

119. Pseudalaria jugosa, *Bean*. No date. Plate XII, fig. 9.

1885. "Trochus jugosus," *Bean* MS. Hudleston, Geol. Mag., dec. iii, vol. ii, p. 255, pl. v, fig. 11.

Bibliography.—It was mentioned (*loc. cit.*) that this could hardly be a *Trochus*. "It has more the look of an *Alaria* without the wing. On the other hand, it may represent a shell which never had a wing." Attention was at the same time directed to *Turritella unicarinata*, Desl.

Description.—Shell conical, turrited; whorls five or six; suture well marked, and situated in a hollow. The whorls of the spire are angular, and slope outwards to a very prominent carina situate about two-thirds down. Keels sharp and apparently plain. Faint traces of a lower keel may be noted in the whorls of the spire; body-whorl strongly bicarinate. The whole of the shell, including the base, is marked by fine spiral lines. Other indications wanting.

Relations and Distribution.—This species somewhat resembles the Beaminster variety of *Pseud. Etheridgii;* the deficiency of ornament may be due to conditions of mineralization. Very rare in the Yorkshire Dogger.

Family—NERINÆIDÆ.

"*Shell turrited, subcylindrical, conical or ovate-elongate, solid, thick; aperture slightly channeled in front. . . . Columella or walls of the aperture furnished with folds, which are continued into the whorls of the spire.*"—Fischer.

The author of the 'Manuel de Conchyliologie' is evidently disposed to agree with Blainville and Woodward in placing the Nerinæidæ in close relationship to the Cerithiidæ rather than to the Pyramidellidæ, in accordance with the views of Defrance and D'Orbigny. The family is almost entirely composed of one genus, *Nerinæa* (including sub-genera, such as *Ptygmatis*, &c.); but, as if to show that no family can be constituted without an exceptional member, there is just one limited genus which violates the rule as to the existence of internal folds.

Genus—Aptyxiella, *Fischer*, 1885, 'Manual,' p. 689; = Pachystylus, *Gemmellaro*, 1878; = Aptyxis, *Zittel*, 1873.

Shell conical-elongate, subcylindrical, not umbilicated; whorls numerous, not embracing. Aperture quadrangular, terminating anteriorly in an insignificant canal; no internal folds on the columella and walls.

The above diagnosis is a modification of those given by Gemmellaro and Fischer. The former regards *Pachystylus* as belonging to the Pyramidellidæ; three species are described by him from the white crystalline Limestone of Montagne del Casale. Fischer gives as an example of the genus *Aptyxiella sexcostata*, D'Orb., from the Corallian of La Rochelle.

120. Aptyxiella subconica, sp. nov. Plate XII, figs. 10, 11.

Description:

Probable length	55 mm.
Width about	$\frac{1}{5}$th.
Spiral angle about	10°.

Shell elongate, subcylindrical; whorls numerous, concave, the width of one whorl being nearly equal to its own height, *plus* that of the preceding whorl. The whorls are apparently smooth, but the available specimens are much worn.

Body-whorl short, angular, concave, with a raised rim on the anterior margin, and a wide, depressed base. Aperture quadrate, columella short. In section (fig. 11) the whorls are subrectangular, and nearly square ; columella and walls equally without folds. Other indications wanting.

Relations and Distribution.—In comparison with *Pachystylus conicus*, Gemm., this species is of somewhat larger habit, and its whorls are not quite so narrow. Coming nearer home one would suspect its relationship to *Cerithium Defrancii*, Desl. (Mém. Soc. Linn. Norm., vol. vii, p. 193, pl. viii, fig. 36), a fossil occurring in the Bathonian of France.

Aptyxiella subconica has not hitherto been found out of the *Parkinsoni*-zone of Aston and Over Harford in the Eastern Cotteswolds.

Genus—Nerinæa, *Defrance*, 1825.

General definition—"*Shell perforate or not; whorls numerous; aperture subquadrangular, oval or elongate, with a short anterior canal or superficial notch; lip forming posteriorly a narrow sinus, which leaves in passing off a narrow sutural band; lines of growth strongly inflected near the suture; columella furnished with folds, which are internally persistent throughout its entire length; other folds appear sometimes on the lip and the columellar side.*"—Fischer, 'Manuel,' p. 687.

Before dealing with the question of the sections and subgenera of this most important genus a few remarks on its development in the Jurassics of this country may not be inappropriate. The following passage bearing on this point is quoted from 'Contributions to the Palæontology of the Yorkshire Oolites.'[1]

"A peculiar interest attaches to the Nerinæas of the Inferior Oolite, since they are the earliest of their kind. The genus, we are told by Sharpe, usually occurs in calcareous strata associated with shallow-water shells. Thus we do not find Nerinæas in the Lias nor in the *Striatulus*-beds, nor even in the Dogger Sands. Indeed, I am not aware that any remains of the genus have been detected in the lower portions of the Dogger itself, such as the nodule beds which occur at intervals immediately above the *Cynocephala*-zone (Yellow Sands). But when we come to what was once the more calcareous portion of the Dogger, the shell-bed towards the top is so full of them as to have received the name of *Nerinæa*-bed. In this bed, only eighteen inches thick, the first noteworthy accumulation of Nerinæas occurs, nor are they ever plentiful again throughout the Yorkshire Oolites until we reach the Corallian Rocks.

[1] 'Geol. Mag.,' decade iii, vol. i, p. 108.

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A MONOGRAPH

OF THE

BRITISH JURASSIC GASTEROPODA.

BY

WILFRID H. HUDLESTON, M.A., F.R.S., Sec.G.S.

PART I, No. 4.

GASTEROPODA OF THE INFERIOR OOLITE.

Pages 193—224; Plates XII—XVI.

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"How and whence did they come, these curious cylindrical shells with their internal folds? Such a question must occur as a matter of course to everyone interested in Jurassic palæontology. . . . . Does the evidence at present in our possession lead us to suppose that they appeared almost simultaneously along the whole line, or earlier in one place than another? We may fairly believe that these shells originated in the calcareous shallows which succeeded the more sandy deposits of the *Cynocephala*-stage towards the base of the Inferior Oolite."

Since the above was written the attention of Mr. Witchell and others has been drawn to this very question, and I myself have had many opportunities for extending the investigations, which originally commenced in Yorkshire, into the Midland and South-western Counties. The following is a partial summary of the results.

There is no authentic evidence of the existence of *Nerinæa* in the British Lias, although the late Charles Moore enumerates four species.[1] In Yorkshire *Nerinæa* has not yet been detected below the *Nerinæa*-bed which occurs in the upper part of the Dogger at Blue Dyke. Here a well-known and well-developed form (*N. cingenda*, Phil.) suddenly appears in abundance, and a large variety of the same species appears with equal suddenness in the Northampton Sand. In the Cotteswolds several species of *Nerinæa* appear in the Pea-grit, mostly cylindrical forms belonging to the sub-genus *Ptygmatis*. These are undoubtedly in the *Murchisonæ*-zone. But in the shell-bed below the Lower Limestone at Crickley Hill, in what is perhaps the top of the *Opalinus*-zone, occurs a *Nerinæa* (*Ptygmatis*) to which I have given the specific name of *xenos*, possessing an internal structure considerably different from that of *N. cingenda*. This appears to be the oldest form of *Nerinæa* hitherto discovered in the Cotteswolds, and it serves to bear out the general conclusion that the genus, as far as this country is concerned, makes its first appearance on the confines of the zones of *Am. Murchisonæ* and *Am. opalinus*. In Dorsetshire, on the other hand, where a strong cephalopod facies characterizes all the zones, *Nerinæa* is as unknown in the Inferior Oolite as in the Lias.[2]

We owe much of our knowledge of the Nerinæas of the Cotteswolds to the ability and enthusiasm of the late Mr. Witchell, of Stroud, who literally died at the edge of his favourite quarry on Swift's Hill, whither he was in the habit of repairing for the purpose of extracting fossils. In his admirable paper "on the genus *Nerinæa* and its stratigraphical distribution in the Cotteswolds" Mr. Witchell enumerates twenty species from the Inferior Oolite of that region, these being classified under five groups according to their internal structure.

It is well known that many attempts have been made to subdivide this

[1] Some of these are founded on very imperfect fragments. "*Nerinæa*" *liassica* is stated by Mr. Walford to be a *Cerithium*, as proved by the section.

[2] For further information relative to the distribution of *Nerinæa* see Introduction, especially p. 61.

inconveniently large genus. For instance, in 1850 D. Sharpe divided *Nerinæa* into four sub-genera, of which *Trochalia* may be omitted as having no representative in our Inferior Oolite. There remain then (1) *Nerinella*—columella either simple or furnished with one fold, the outer lip with one internal fold; (2) *Nerinæa*—columella with two or three folds, outer lip with one or two folds, all simple; (3) *Ptygmatis*—columella usually with three folds, outer lip with one to three folds, one or two of the folds of a complex form, either dividing into two lobes or wider towards the edge than at the base. D'Orbigny objected to these sub-genera, mainly on the grounds that no definite line could be drawn showing where one ended and the other began; an objection which, if urged nowadays, would be applicable to most zoological divisions. Subsequently both Zittel and Cossmann have more or less recognised the value of these distinctions.

As a matter of fact, in our Inferior Oolite six sections or divisions of *Nerinæa* may be made out, the distinctions being based upon internal structure.

Section A (*Uniplicatæ*). Simple fold on the outer wall; *e. g. Nerinella gracilis*, Lycett.

Section B (*Biplicatæ*). Simple fold on the outer wall and on the columella; *e. g. Nerinella*, species unnamed from Weldon.

Section C (*Triplicatæ*). One well-marked fold on the outer wall, one on the lower part of the columella, and one about the junction of the columella with the posterior wall, all simple, *e.g. Nerinæa oolitica*, Witchell. This is a very numerous section, and includes most of the proper Nerinæas of our Inferior Oolite.

Section D. Outer wall with sometimes one and sometimes two folds, columella with two folds, all simple; *e. g. Nerinæa cingenda*, Phillips.

Section E. Five simple folds, in all, on the outer wall and columella; *e. g. Nerinæa* (? *Ptygmatis*) *Guisei*, Witchell. The above species is the only representative of this section, which appears to be a sort of connecting link between *Nerinæa* and *Ptygmatis*.

Section F. Outer wall and columella with several more or less complex folds, the result being a narrow and whimsical section; *e. g. Ptygmatis Oppelensis*, Lycett. This is the most numerous section of all. The contrast presented by the internal section almost entitles this to the rank of generic distinction.

General Features of the Nerinæas of the Inferior Oolite.—In most cases the columella is solid. If there be exceptions, they occur in the upper parts of the Lincolnshire Limestone, where a peculiar admixture of forms takes place. Where no mention is made to the contrary, it may be taken for granted that the columella is regarded as having been solid. Narrow, cylindrical forms are the most prevalent. The apical whorls differ greatly from the anterior ones (dimorphism). Owing to the indifferent preservation of the surface the original character of the ornamentation is somewhat difficult to determine.

Where the ornaments have been preserved we find very fine spiral lines, whose granulations can only be seen under a lens of some power; these lines have a tendency to die out in the more mature whorls. Rich tubercular ornamentation is rare, and would seem mainly confined to species from the highest beds of the Lincolnshire Limestone, which appear to have Bathonian affinities. The mature whorls sometimes show the curving lines of growth and the slight raised line on the posterior margins, but too often almost every surface feature is obscured.[1]

Although there is considerable uniformity in the section of an individual *Nerinæa*, that is to say, that the folds vary but little in the several whorls, yet there does seem a tendency in many cases for the mature whorls to be less restricted as to internal space. It may be that the folds of the body-whorl were more or less absorbed, so as to give the animal additional space. I have noticed, especially in *Ptygmatis*, this tendency of the folds to diminish, and indeed to become almost effete in the body-whorl. Mr. Witchell also noticed this feature, and attributed it to wear. It is not a little singular that when we obtain an unbroken shell, as is frequently the case in the Oolite Marl horizon, there is no trace of folds to be found, either on the lip or columella.

Definition and Range of Species.—When Lycett wrote 'The Cotteswold Hills,' in 1857, he enumerated no more than six species of *Nerinæa* in the Inferior Oolite of the Cotteswolds. In 1887 Witchell had brought up the number to twenty. In the present Monograph certain forms have been named provisionally, but not described as distinct species. Some of the forms described as species to a certain extent run into each other, and it may be predicted that future collectors are sure to find an increased number of intermediate forms. Moreover, many of the species appear to be local, and often limited in range. A few are useful as indicating horizon, but it would seem as though still fewer could be relied upon for any great distance. The most marked Nerinæan horizon known to me is that of *N. Guisei* in the *Clypeus*-grit. The varieties of *N. Cotteswoldiæ* also help to connect both the Pea-grit and Oolite Marl with certain horizons in the Lincolnshire Limestone.

Nerinæas of the Lincolnshire Limestone.—To a certain extent these require separate treatment, especially as regards specimens from Weldon and Great Ponton. The species at Weldon are extremely numerous, including examples of *Nerinella*, *Nerinæa*, and *Ptygmatis*, though *Nerinæa* greatly preponderates. Many are very small, and nearly all have suffered either before or since mineralization. There seems to be a great admixture, suggesting the possibility of some of the

[1] As regards ornamentation it is curious to note what different artistic treatment has been accorded to the same species. Thus, *N. funiculus*, Desl., *N. clavus*, Desl., *N. pseudocylindrica*, D'Orb., are represented in Deslongchamps' work as having fine *spiral* ornamentation, whilst in D'Orbigny's figures of the same species the spiral ornamentation is entirely ignored, and a very elaborate system of *growth-lines* is substituted.

fossils having been *remanié* from earlier beds destroyed by contemporaneous erosion. At Great Ponton only *Nerinæa* has been noticed by me; the specimens are less fragmentary than at Weldon, but their surface condition is sadly apt to mislead. When to these difficulties we add the prevalence of dimorphism, it must be allowed that the Nerinæas of the upper beds of the Lincolnshire Limestone (Weldon and Great Ponton) constitute about as undesirable a group as any one could have to investigate. One thing, I think, comes out pretty clearly, viz. a strong admixture of forms related to and nearly identical with those in Bathonian beds.

Section A (Uniplicatæ).

121. Nerinæa (*Nerinella*) gracilis, *Lycett*, 1857. Plate XII, figs. 12, 13 *a*, 13 *b*.

1853.	Chemnitzia gracilis, *Lycett*.	Proc. Cottesw. Nat. Field Club, vol. i, p. 79, pl. ii, fig. 3.
1857.	Nerinæa gracilis, *Lycett*.	Cotteswold Hills, p. 124, pl. ii, fig. 3.
1887.	— — —	Witchell, Proc. Cottesw. Nat. Field Club, vol. ix, p. 37, pl. ii, fig. 2.

Description:

Spiral angle	5°—8°.
Height of whorl to width	1 : 1·15.
Approximate length	60—140 mm.

Shell cylindrical, scarcely turrited. Whorls twenty-five or more, with a slight posterior prominence in the younger shells; flat or very slightly turrited in the more matured whorls. No sutural carina. Fine spiral lines mark the anterior portion of each whorl, of which the prominent portion is smooth. In the more advanced stage the whorls are smooth.

Aperture ovate-oblong, with a narrow and but slightly twisted canal. *Section* uniplicate, with one simple fold in the middle of the outer wall.

Relations and Distribution.—In order not to multiply specific names unduly a considerable breadth of variety as regards spiral angle has been admitted in this case. It is just possible that fig. 12 may represent a narrow variety, of which fragments representing very long shells are occasionally found. Lycett's type was from the Oolite Marl[1] horizon at Nailsworth Hill; the other specimens are from the Oolite Marl of Swift's Hill or Longridge, where *N. gracilis* is moderately plentiful in fragments. In the Lincolnshire Limestone, specimens of *Nerinella* not

[1] In referring to the Oolite Marl the horizon is meant, see p. 61, *antea*.

to be distinguished from this species are of occasional occurrence. Figs. 15 and 16, representing specimens from Weldon, might possibly be referred to as immature forms.

122. Nerinæa (*Nerinella*) conoidea, sp. nov. Plate XII, fig. 14.

(But see Witchell, vol. cit., p. 37, pl. ii, fig. 1.)

Description:

Spiral angle (slightly obtuse) . . .	12°
Height of whorl to width . . .	1 : 1·25
Approximate length	80 mm.

Shell cylindro-conical, apical whorls alone turrited. The whorls are about twenty in number, increasing by slight steps in the earlier stages, where, also, each whorl has a slight posterior prominence; the matured whorls are without any prominence in the neighbourhood of the sutures, and perfectly flat. No specimens showing apical ornaments have as yet been found.

Aperture as in the preceding species but less elongate; internal section similar.

Relations and Distribution.—If we are to allow that the differences in these very plain *Nerinellæ* justify us in making specific distinctions, it is chiefly in the relative proportions of the spiral angle and the whorls that we must look for the evidences. The difference between such shells as figs. 12 and 14, one having a spiral angle of 5° and the other of 12°, is most striking, and almost forbids us to include them under the same species.

Occurs on the Oolite Marl horizon, chiefly at Swift's Hill and Longridge.

123—126. Species of uniplicate Nerinella found in the Lincolnshire Limestone at Weldon. Plate XII, figs. 15—18.

A 1 (fig. 15). Spiral angle 8°, height of whorl to width 1 : 1·25, length of figured specimen 11 mm. Shell elongate and not turrited; whorls smooth; aperture oblong with a well-marked canal. *Section* uniplicate.

A 2 (fig. 16). Spiral angle 12°, height of whorl to width 1 : 1·35, length of figured specimen 18 mm. Shell elongate and slightly turrited; whorls smooth. Body-whorl somewhat constricted; aperture and *section* as in the preceding. These two forms might almost be taken to represent the early stages of *N. gracilis* and *N. conoidea* respectively.

A 3 (fig. 17). Spiral angle 16°, height of whorl to width 1 : 1·65, length of figured specimen 16 mm. Shell conical-elongate, scarcely turrited; whorls short and smooth; sutures rather open. Body-whorl slightly constricted posteriorly; *section* uniplicate.

A 4 (fig. 18). Spiral angle 16°, height of whorl to width 1 : 1·5, length of figured specimen (restored) 20 mm. Shell conical-elongate, strongly turrited. The whorls are smooth and marked posteriorly by a bevilled margin of considerable breadth. Body-whorl salient, and constricted in the middle. *Section* uniplicate.

The four specimens figured and partially described above clearly belong to at least three very distinct species of *Nerinella*. Like so many of the Weldon Nerinæas, there is an appearance as though the columella had been partially hollow, but in all cases the umbilicus is closed. The appearance of excessive smoothness is probably misleading.

Section B (Biplicatæ).

127, 128. Species of biplicate Nerinella found in the Lincolnshire Limestone at Weldon. Plate XIII, figs. 1 and 2.

B 1 (fig. 1). Spiral angle 13°, height of whorl to width 1 : 1·6, length of fragment 16 mm. Shell elongate, strongly turrited; whorls encircled by a wide posterior rim (slightly bevilled), otherwise smooth and constricted in the anterior third. *Section* biplicate; *i. e.* a simple central fold on the outer wall, and a very slight fold on the columella.

B 2 (fig. 2). Spiral angle 17°, height of whorl to width 1 : 1·8, length of fragment figured 22 mm. Shell conical-elongate, scarcely turrited. Whorls nearly flat, without visible ornament, and very slightly raised at each extremity, where they meet the sutures. *Section* biplicate and similar to the preceding, except that the fold of the lower part of the columella is even less developed.

Nerinellæ with two folds have not, as far as I know, been hitherto figured from the British Jurassic rocks. The group is more characteristic of Bathonian beds, whence fine specimens of *Nerinella Bathonica*, Rig. and Sauv., have lately been obtained in the Cotteswolds.

Section C (Triplicatæ).

129. Nerinæa parva, Witchell, 1887. Plate XIII, fig. 3.

1887. Nerinæa parva, *Witchell*. Vol. cit., p. 31, pl. i, fig. 5.

Description :

Spiral angle	12°
Height of whorl to width . . .	1 : 1·85
Approximate length . . .	45 mm.

Shell cylindro-conical, strongly turrited. Whorls about eighteen, very short and increasing by steps. In the earlier whorls the anterior portion is much excavated, a feature which accentuates the sudden volutional increase. The depth of the excavation continues to diminish until each whorl becomes nearly flat, but the step-like character is retained. In the later whorls the width is not quite so great in proportion to the height. The hollows are ornamented by fine spiral lines, of which there are no traces in the maturer whorls.

Body-whorl angular and short, with a squarish aperture and very short canal. *Section* triplicate ; one blunt and wide fold a little below the middle of the outer walls, one rather wide fold on the columella considerably below the middle, and one on the posterior wall.

Relations and Distribution.—Distinguished from the succeeding species by the excessive shortness of the whorls, and by their strongly step-like character. It is also more free from dimorphism and of smaller growth. Somewhat rare on the Oolite Marl horizon of Swift's Hill and Longridge.

130. Nerinæa oolitica, *Witchell*, 1887. Plate XIII, figs. 4 *a*, 4 *b*, 4 *c*, 4 *d*, 6, and 7.

1887. Nerinæa oolitica, *Witchell*. Vol. cit., p. 30, pl. i, fig. 1.

Description :

Spiral angle	12°—16°.
Height of whorl to width . . .	1 : 1·45.
Length	80—120 mm.

Shell cylindro-conical, turrited. Whorls twenty to twenty-five, exhibiting much dimorphism. The apical whorls, as far as about the middle of the spire, are much thickened at the suture and strongly excavated anteriorly, so as to produce an appearance of excessive turriting ; they are also ornamented with fine spiral lines. Presently the thickening at the suture ceases, the whorls become nearly flat and

smooth, and the increase by steps less pronounced. The point where this change comes on varies in individual shells.

Body-whorl angular, smooth, and slightly projecting; aperture oblong, with rather a wide and moderately reflexed canal. *Section* triplicate; one acute fold near the centre of the outer wall, one rather wide shallow fold low down in the columella, one acute small fold in the posterior wall.

Relations and Distribution.—This species is essentially the common triplicate *Nerinæa* of the Oolite Marl horizon, and probably passes by gradations into *Nerinæa attenuata* on one side, and *Nerinæa expansa* on the other. Figs. 4 *a* and 4 *b* may be regarded as typical; figs. 6 and 7 seem to connect it with *Nerinæa expansa* of the Lincolnshire Limestone.

The chief localities are Swift's Hill and Longridge in the Cotteswolds, and similar forms may be traced in parts of the Lincolnshire Limestone. It is somewhat singular that so abundant a species should have escaped the notice of Lycett; but most species, even the commonest, are wont to be local in distribution.

131. Nerinæa Longfordensis, sp. nov. Plate XIII, fig. 5.

Description:

Spiral angle (obtuse)	10°.
Height of whorl to width . . .	1 : 1·4.
Length	90 mm.

Shell cylindro-conical, turrited. Whorls about sixteen. The apical whorls, as in *N. oolitica*, are thickened at the suture, though scarcely to the same extent. The whorls are much excavated, and this is continued throughout, the more mature whorls being much pinched in about two-thirds down, which gives this part of the spire a peculiarly constricted look.

The aperture is oblong, and the *section* is remarkable for the smallness of the folds.

Relations and Distribution.—The pinching in of the outer portion of the whorls gives this genus a superficial resemblance to *N. cingenda*, Phil. Rare in the Upper Pisolite of Longfords.

132. Nerinæa attenuata, *Witchell*, 1887. Plate XIII, fig. 6 *a*.

1887. Nerinæa attenuata, *Witchell*. Vol. cit., p. 32, pl. i, figs. 7 and 8; pl. ii, fig. 6.

Description :

Spiral angle	10°—12°.
Height of whorl to width	1 : 1·35.
Approximate length	60—70 mm.

Shell conical-elongate, strongly dimorphous. Whorls about twenty; those towards the apical end are excavated anteriorly, and the sutural prominence is excessive. Later on the sutural ridges disappear, and the whorls are quite flat and plain, increasing in the form of a regular cone. It is probable that the earlier whorls were ornamented with fine spiral lines, which disappear with the flattening of the whorl.

Body-whorl smooth and without salience; aperture widely ovate, canal rather wide. *Section* triplicate; an obtuse fold on the outer wall, one very low on the columella, and one on the posterior wall.

Relations and Distribution.—Although obviously related to *Nerinæa oolitica*, this species differs in its more marked dimorphism, and in the extremely conical figure produced by the lower whorls. The whorls are also relatively rather higher than in the majority of specimens of *N. oolitica*, and there are slight differences in the internal section.

It has been found in the Pea-grit of Longfords, in the Oolite Marl of Swift's Hill and Longridge, and possibly also in the Lincolnshire Limestone at Belmisthorpe.

133. Nerinæa expansa, sp. nov. Plate XIII, fig. 6 *b*.

Description :

Spiral angle	15°—17°.
Height of whorl to width	1 : 1·30.
Approximate length	90—100 mm.

Shell conical-elongate, the spire exhibiting a moderate amount of dimorphism. Number of whorls about eighteen, increasing by steps, but not much excavated, and with only a moderate sutural prominence; the subapical whorls show traces of fine spiral lines. The later whorls are smooth, nearly flat, and without prominence, whilst the suture is close or even depressed. The aperture is ovate-oblong, and *section* similar to that of *N. oolitica*.

Relations and Distribution.—These shells are found at one or two points in the Lincolnshire Limestone, and notably at Wakerly and Nettleham. Such specimens as fig. 6, from the Oolite Marl, seem to constitute a connecting link both with *N. oolitica* and *N. attenuata*.

In view of the undoubted fact that forms of *Nerinæa* do run into one another by easy gradations, some might prefer to regard *N. parva*, *oolitica*, *attenuata*, and *expansa* as varieties of one species; but if we accept this lumping view, it would be scarcely possible to constitute any species for triplicate Nerinæas with little or no ornament, as the similarities might be extended indefinitely. A form (Pl. XIV, fig. 6) which is not uncommon in the upper beds of the Lincolnshire Limestone at Great Ponton may be a narrow variety of this species. The chief difference appears to be that the columella is partly hollow. There are also some trifling differences in the section.

134. Nerinæa deducta, sp. nov. Plate XIII, fig. 8.

Description:

Spiral angle	6°.
Height of whorl to width . . .	1 : 1·35.
Approximate length	80 mm.

Shell subcylindrical, spire dimorphous. For about one-third the distance from the apex the sutural belts are very thick and prominent, with corresponding excavation of the whorls. From twelve to fourteen whorls present this phase. The change to a plain and flat whorl is rather sudden; there are about ten of these, fitting close so as to produce a very elongated cone. In the specimen figured the slightly raised rim on the posterior margin of each whorl is well preserved. No ornaments in the anterior whorls other than lines of growth, which seem to have been nearly straight.

Body-whorl not prominent, smooth, scarcely excavated; aperture oblong, with rather a wide and relatively long canal. *Section* triplicate, and closely resembling that of the *oolitica*-group generally.

Relations and Distribution.—As this form occurs in the Pea-grit horizon, it may be regarded, in a certain sense, as the precursor of the several forms of the *oolitica*-group, from which it is distinguished by its smaller spiral angle and more cylindrical figure. Not abundant.

135. Nerinæa pseudocylindrica, *D'Orbigny*, 1850, *fide* Lycett, 1857. Plate XIII, fig. 9 and ? fig. 11.

1842.	Nerinæa cylindrica, *Deslongchamps.*		Mém. Soc. Linn. Norm., vii, p. 187, pl. viii, fig. 33.
1850.	—	pseudocylindrica, *D'Orb.*	Prod., i, p. 298 (Ét. Bathonien).
1852.	—	— —	Terr. Jurass., vol. ii, p. 86, pl. cclii, figs. 11—13.
1857.	—	— —	Lycett, Cotteswold Hills, pl. ii, fig. 5.

Bibliography, &c.—Lycett makes no mention of D'Orbigny's species in the text of the 'Cotteswold Hills.' His specimen (in the Jermyn Street Museum) is much longer than the one now figured, and may indeed differ both from the forms hereunder described and also from the Bathonian species, originally figured and described by Deslongchamps, and renamed by D'Orbigny.

Description:

Spiral angle (very regular) . .	8°.
Height of whorl to width . . .	1 : 1.
Length	50—120 mm.

Shell subcylindrical, subulate. Whorls about sixteen in the specimen figured, but sometimes more, flat, about as high as wide and scarcely projecting; they are separated by an open and somewhat depressed suture. Numerous fine spiral lines ornament the whorls, but they become fainter in the more advanced whorls.

Body-whorl nearly smooth, not salient, aperture narrow. *Section* triplicate; a deep fold with a square head occupies the centre of the outer wall, one very small fold towards the base of the columella, one fold on the posterior wall.

Relations and Distribution.—Distinguished from the next species by its wider spiral angle. A few specimens have been found in the Oolite Marl horizon of Longridge. The fragment from Weldon (fig. 11) may represent the same species in a different state of preservation.

136. Nerinæa altivoluta, *Witchell*, 1887. Plate XIII, figs. 10 *a*, 10 *b*, 10 *c*, 10 *d*.

1887. Nerinæa altivoluta, *Witchell.* Vol. cit., p. 33, pl. i, figs. 11, 12.

Bibliography, &c.—This species was founded by Mr. Witchell on fragments of the posterior portion of a very cylindrical *Nerinæa*. It is believed that specimens (such as 10 *a* and 10 *d*) represent apical conditions of this species.

Description:

Spiral angle	3°—4°.
Height of whorl to width	1 : 1 nearly.
Approximate length	200 mm.

Shell cylindrical. Whorls numerous, high, with a very oblique suture. The extreme apical conditions are unknown. In the subapical stage (fig. 10 *a*) the spire can scarcely be described as turrited, although the posterior margin of each whorl shows a slightly raised rim. In this stage the whorls are slightly constricted, and ornamented by numerous very fine spiral lines. In the mature stage (fig. 10 *b*) the whorls are quite flat and smooth, and a simple line indicates the suture.

Body-whorl smooth and without salience; aperture narrow-oblong; canal relatively long. *Section* triplicate, one large obtuse fold occupying a considerable portion of the centre of the outer wall; a small acute fold very low down in the columella; a prominent fold at the junction of the columella with the posterior wall.

Relations and Distribution.—Differs from *N. pseudocylindrica* in having a smaller spiral angle and slightly higher whorls. It seems to be the most cylindrical of all the Nerinæas of the Inferior Oolite. Somewhat rare in the Pea-grit near Stroud and at Longfords; occurs also on the same horizon at Crickley. In the specimen from Weldon (fig. 10 *b*) the whorls are not quite so high.

137. Nerinæa Hudlestoniana, *Witchell*, 1887. Pl. XIV, fig. 1.

1887. Nerinæa Hudlestoniana, *Witchell*. Vol. cit., p. 31, pl. i, fig. 4.

Description:

Spiral angle	15°.
Height of whorl to width	1 : 1·5.
Approximate length	75 mm.

Shell subconical. Whorls about fifteen, deeply excavated in the centre and short. Sutural carina thick and very prominent. Apical condition and ornaments unknown. *Section* triplicate; one rather prominent fold on the outer wall, a small acute fold low down on the columella, and a very narrow fold on the posterior wall.

Relations and Distribution.—Regarded by Mr. Witchell as resembling a *Nerinæa* from the Inferior Oolite of Whitwell in Yorkshire (see 'Geol. Mag.,' dec. 3, vol. i, p. 112, pl. iv, fig. 7). The Yorkshire specimen has suffered so much from compression as to make the identification somewhat doubtful. Differs from the

varieties of *N. Eudesii*, Mor. and Lyc., in having a smaller spiral angle and solid columella.

The specimen figured is the only one known; it is said to have come from the marly limestone of Longridge, but the matrix is not very characteristic of that bed. To be regarded as a doubtful species.

138. Nerinæa Eudesii, *Morris and Lycett*, 1851. Plate XIV, figs. 2 and 2 *a*.

1851. Nerinæa Eudesii, *M. and L.* Great Ool. Moll., p. 33, pl. viii, figs. 6 and 6 *a*.

Bibliography, &c.—Morris and Lycett appear to have had some doubts as to the generic[1] position of *N. Eudesii*, comparing it with *Cerithium Defrancii*, Desl. An examination of the specimens in the Jermyn Street Museum, where the types are kept, favours the notion that they really are triplicate Nerinæas. Moreover, a triplicate *Nerinæa* which answers to their figures and description is far from scarce in our Great Oolite. Hence Mons. Cossmann ('Ét. Bathonien,' p. 216) has been misled by the doubts of Morris and Lycett in regarding *N. Eudesii* as identical with *C. Defrancii*.

Description of Great Oolite varieties.—Spiral angle about 20°. Shell conical-elongate, turrited, and often of considerable length. Whorls ten or more, narrow, with numerous fine lines of unequal prominence, and much excavated; sutures carinated, the carinæ sharp. Columella ? hollow, but with closed umbilicus. Body-whorl short, and almost as much excavated as the whorls of the spire; base flattened, aperture subquadrate. *Section* triplicate (fig. 2); one shallow fold in the centre of the outer wall, two rather pointed folds on the columellar side, which shows a peculiar outline, only to be understood by reference to the figure.

Specimens from the Lincolnshire Limestone (fig. 2 *a*), owing to indifferent preservation, seldom show the fine spiral lines. They are, on the whole, less conical and shorter than these from the Great Oolite. The chief differences are in the internal section, especially in the outline of the columellar portion of each whorl.

Relations and Distribution.—*N. Eudesii* belongs to a group of Nerinæas with more or less deeply excavated whorls and prominent sutural carinæ, which are, on the whole, more characteristic of Bathonian beds. Modifications in the spiral angle, relative height of whorls, and slight differences in the internal section are almost the only points whereon specific differences can be founded, and the value of

[1] The sub-genus *Trochalia*, to which they also referred it, should be restricted to trochiform shells with an infundibular umbilicus, such as *N. pyramidalis* (Goldf., pl. clxxvi, 11).

these may be doubtful in some instances. It is evidently closely related to some of the species next to be described.

My own specimens of *N. Eudesii* are from Weldon, where it is by no means abundant.

139. Nerinæa Weldonis, sp. nov. Plate XIV, figs. 3 *a*, 3 *b*, 4, and ? 5 (apical conditions).

Description:

Spiral angle (regular) . . .	12°—16°.
Height of whorl to width, average . .	1 : 1·4.
Approximate length . . .	45 mm.

Shell cylindro-conical, turrited. Whorls from fourteen to eighteen, moderately concave, the extreme depression being slightly anterior. The sutural belt is tolerably prominent, but in the narrower varieties (3 *a*) the posterior margin of each whorl constitutes the most marked prominence. Fine spiral lines may be traced on the apical whorls, two very slightly granulated ones showing a little above the others. These ornaments probably change with the age of the whorls, but the available specimens are for the most part much defaced. Columella ? hollow, with closed umbilicus.

The aperture is subquadrate. *Section* triplicate; one deep fold in the centre of the outer walls, the fold on the lower part of the columella very small, the fold in the posterior wall (upper columellar fold) deeply impressed.

Relations and Distribution.—Differs from *N. Eudesii* in the smaller spiral angle and less excavated whorl, although it undoubtedly approaches closely to the Lincolnshire Limestone variety of *N. Eudesii*, which may be regarded as forming the connecting link between *N. Weldonis* and the true Bathonian form. It also has affinities with some varieties of *Nerinæa oolitica*,[1] and probably with certain Bathonian Nerinæas described and figured by Cossmann from beds in the north and east of France.

Forms such as fig. 3 *a* and fig. 4 are abundant at Weldon, which is in the upper part of the Lincolnshire Limestone. These beds show some affinity to the Great Oolite, but less so than those of Great Ponton. Fig. 5 is believed to represent the apical conditions.

[1] There can be little doubt that these named forms are modifications, due to time and place, of other named forms, and that they pass into each other.

140. Nerinæa zonophora, sp. nov. Plate XIV, fig. 7.

Description:

Spiral angle (regular) . . .	14°.
Height of whorl to width . .	1 : 1·3.
Approximate length	50 mm.

Shell cylindro-conical, turrited. Number of whorls about fourteen, strongly concave, the principal depression median. Sutural carina prominent and extremely thick, the suture being in the centre of the carina. Columella ? hollow, with closed umbilicus. The apical whorls present fine and very slightly granulated spiral lines; two in the earliest whorls, and increasing to four, and possibly more, lower down. The *section* is triplicate, and differs but little from that of *N. Weldonis*.

Relations and Distribution.—Distinguished from *N. Weldonis* by the greater constriction of the whorls, which is median, and by the great thickness of the sutural belt; the whorls are longer and the spiral angle narrower than in *N. Eudesii*. It bears a certain resemblance to *N. tumentisutura*, Piette,[1] but the internal section is very different.

Rare in the Lincolnshire Limestone of Weldon.

141. Nerinæa subglabra, sp. nov. Plate XIV, fig. 8.

Description:

Spiral angle (nearly regular) . . .	12°—13°.
Height of whorl to width . .	1 : 1·25.
Approximate length	70 mm.

Shell cylindro-conical, subulate. Whorls probably fourteen, nearly flat; sutural varix not prominent, merely a rim on the posterior margins. The middle whorls are ornamented with four or five granulated spirals, which seem to die out gradually, the last two whorls being smooth. [The figured specimen shows the lines of growth in this portion of the shell.] Umbilicus closed; it is uncertain if columella be solid or not. *Section* triplicate, with one small anterior fold on the columella very low down.

Relations and Distribution.—Differs from such forms as Pl. XIV, fig. 6, in its greater smoothness of outline and freedom from turriting, and in some minor points. It approaches *N. Sharmanni*, Rig. and Sauv. ('Bathonien du bas Boulonnais,'

[1] See Cossmann, op. cit., p. 197, pl. xvii, figs. 49—51, where *N. tumentisutura*, though described in the text as a *Ptygmatis*, is figured as a triplicate *Nerinæa*.

p. 28, pl. ii, fig. 4), but M. Rigaux considers the differences too great for both to be placed under the same species. The figure (Pl. XIV, fig. 8) is composite. This form, and others not very dissimilar to it, are moderately abundant at Great Ponton. Some of these varieties may have been taken for *Nerinæa Voltzii*, which species I have not myself found, as yet, in any beds of the Lincolnshire Limestone.

142. Nerinæa cf. Stricklandi, *Morris and Lycett*, 1851. Plate XIV, fig. 9.

1851. Nerinæa Stricklandi, *M. and L.* Great Ool. Moll., p. 35, pl. vii, fig. 9.

Bibliography, &c.—The types, from the Stonesfield Slate on the borders of Minchinhampton Common, are fragmentary, and the character of the folds was unknown to the authors. The proportions of the whorls, moreover, are not quite the same as in the Lincolnshire Limestone fossil. Hence the identification is provisional.

Description:

Spiral angle (somewhat irregular) . .	10°.
Height of whorl to width (variable) . .	1 : 1·45.
Approximate length	110 mm.

Shell elongate, subulate, dimorphous. Whorls about twenty, flat, and increasing by steps, which become less salient and finally disappear. There is an irregularity in the development of the later whorls, some of which project more than others. Columella ? hollow; umbilicus closed. The subapical whorls carry numerous fine spiral lines, which are slightly granulated; the adult whorls are smooth.

Body-whorl short, smooth, and rather projecting; aperture subquadrate. *Section* triplicate, the anterior fold in the columella being low and very small, as in the two preceding species.

Relations and Distribution.—Specimens being fragmentary, no one specimen is available for showing all the characters. Fig. 9 is composite. The more apical portions have a strong resemblance to Morris and Lycett's figures, whilst the rest of the shell again reminds us of *N. Sharmanni*. From *N. subglabra* it is distinguished by its smaller spiral angle, more elongate form, and shorter whorls; also by the irregularity of its development, and the step-like character of the earlier whorls. Nevertheless, *N. Stricklandi* (as identified), *N. subglabra*, and the unnamed form (Pl. XIV, fig. 6) have an internal structure which is very similar, the columella apparently having been hollow with a closed umbilicus, whilst the anterior fold on the columella is low down and extremely small.

Not uncommon in the Lincolnshire Limestone at Great Ponton; occurs also at Weldon.

143. Nerinæa, cf. pseudopunctata, *Cossmann*, 1884. Plate XIV, figs. 10 *a*, 10 *b*, 10 *c*.

Compare 1851. Nerinæa punctata, *Voltz*. Morris and Lycett, Great Ool. Moll., p. 35, pl. vii, fig. 10.

— 1884. Nerinæa pseudopunctata, *Cossmann*. Ét. Bathonien, p. 210, pl. i, figs. 18—20.

Bibliography, &c.—The type of Voltz and Brönn ('Jahrb.,' 1836, p. 559, pl. 6, fig. 23) is an Upper-Jurassic species from the "Portlandian" of the Haute-Saône. Mons. Cossmann considers that Morris and Lycett were in error in thus referring the Bathonian fossil, which he renamed *N. pseudopunctata*. The specimens from Great Ponton, whilst presenting many analogies with those from Minchinhampton, are more elongate, and apparently less disposed in steps. I am induced, therefore, to doubt the specific identity; but as the specimens from the Lincolnshire Limestone are much worn, a comparison of the ornaments cannot be instituted with certainty.

Description (partial).—The spiral angle is about 12° and regular; the whorls are short (1 : 1·5), and the approximate length about 90 mm. Shell conical-elongate. Whorls about twenty, the apical ones somewhat in steps, the later ones flat and without any turriting.

At an early stage (fig. 10 *c*) two granulated spiral lines occupy the space between the sutural varices, the lowest having the largest granules. In the next stage (fig. 10 *b*) there are three spirals, the middle one having the strongest granulations or tubercles; there are also finer intermediate lines not always visible. Some traces of the ornaments above described are noticed in the larger shells (fig. 10 *a*). The *section* is triplicate, and similar to that of the preceding species.

Relations and Distribution.—Differs from the Minchinhampton *N. punctata*, which has a spiral angle of 18°, in its more elongate form. The ornaments are well cut and almost like tubercles—not merely finely granulated lines, as is the case with most of the Nerinæas of the Inferior Oolite. Occurs sparingly at Great Ponton, where so many of the Gasteropoda resemble species from the Great Oolite.

144. Nerinæa, triplicate species. Plate XIV, fig. 11.

Specimens which may represent the apical conditions of the species referred to *N. Stricklandi* occur sparingly at Weldon, but the spiral angle is wider in this form. The granulations are finer than those of the *pseudopunctata*-group, and

more like those of other species from the Inferior Oolite. The number of spirals is four. It probably represents apical conditions merely.

145. Nerinæa, cf. elegantula, D'Orbigny, 1850. Plate XIV, fig. 12.

1850. Nerinæa elegantula, *D'Orb.* Prodrome, i, p. 298.
1852. — — — Terr. Jurass, vol. ii, p. 88, pl. celiii, figs. 5 and 6.

Description.—Spiral angle about 12°, length 22 mm. The number of whorls about fourteen, narrow, flat, and increasing by steps; the posterior margin of each whorl is occupied by a prominent belt, the suture lying in the depression immediately above. In the earlier whorls are two tuberculated spiral lines, the lower one being the stronger; these increase in number up to four, the one towards the centre having the largest tuberculations. *Section* triplicate. Rare at Great Ponton.

N.B.—This concludes the list of triplicate Nerinæas. The identification of the species from the upper beds of the Lincolnshire Limestone at Weldon and Great Ponton is far from satisfactory, and yet the fossils are too imperfect in the majority of cases for one to venture on making many new species. The forms clearly have Bathonian affinities, and yet are not exactly Bathonian species. The ornaments in two or three cases are more of the nature of tuberculations than is usual with species in the Inferior Oolite.

Section D (Quadriplicatæ).

146. Nerinæa cingenda, *Phillips*, 1829. Plate XIV, figs. 13 *a—f*, 14.

1829 and 1835. Turritella cingenda, *Sowerby.* Phillips, Geol. of Yorksh. Coast, p. 164, pl. xi, figs. 28 and 29.
1836. Nerinæa cingenda, *Phil.* Bronn, in Neues Jahrbuch for 1836, p. 558.
1875. — — — Geol. of Yorksh. Coast, 3rd edition, p. 258, pl. xi, figs. 28 and 29.
1884. — — — Hudleston, in Geol. Mag., dec. 3, vol. i, p. 110, pl. iv, figs. 3 and 4.

Description.—Since this species exhibits a considerable amount of dimorphism, both the proportions and external markings are subject to some variation.

Spiral angle (subapical) . . . 7°.

Height of whorl to width (mean about) . 1 : 1·25.
Approximate length . . . 100—140 mm.

Shell subcylindrical, turrited. Whorls numerous, and variable in relative proportions, but on the whole rather high. At first the sutural belt or carina is very prominent, and the whorl very concave (13 *b*). Presently the whorls are divided almost equally by a median belt, the anterior portion being excavated whilst the posterior portion is flat. Fine spiral lines with faint granulations are usually present, but appear to fail in the anterior whorls, where a considerable modification takes place, though, on the whole, the somewhat long whorl, the median varix, and the constricted anterior area are usually characteristic.

Available specimens rarely have a good aperture, and the actual body-whorl is seldom seen. Fig. 13 *a* shows a good aperture, with one wide fold rather below the centre of the outer wall, and two finer folds on the columella. It is probable, however, that this is not the real body-whorl, but merely the lowest whorl of an imperfect specimen.[1] The very small posterior fold on the outer wall may not have been developed in this particular case. The *section* is shown in figs. 13 *d* and 13 *e*, both from the Dogger of Blue Wyke. It may be described as triplicate to quadruplicate. The posterior fold on the outer wall is small, and not always present in every whorl of the same specimen. Fig. 14 represents a cast of a fragment of a large specimen from the ironstone of Irchester, where the posterior fold of the outer wall has been developed on one whorl and not on another.

Relations and Distribution.—In Yorkshire *Nerinæa cingenda* occurs abundantly in the upper part of the shell-bed towards the top of the Dogger at Blue Wyke, but has never yet been found in any part of the Dogger below that bed. It may also occur in the Millepore Bed, though I have not been able to identify it for certain.[2] From its proneness to dimorphism, and the variability of its internal section, it affords an excellent example of the instability of the genus, of which in Yorkshire it is the first representative. The two species, or sub-species, next described are its more immediate relatives.

As regards distribution in other parts of England, *N. cingenda* may usually be looked for on the Dogger-horizon in the counties of Lincoln, Rutland, and Northampton, although I only know of it myself in the last county. Many of the large casts in the Duston ironstone belong to this species. As we proceed south-westwards there seems to be an indication of it in the Inferior Oolite of Otley Hill. I have never seen genuine specimens from the Cotteswolds, although

[1] See *antea*, p. 195.

[2] Although I possess several interesting fragments from the Millepore-bed, one of which is a *Ptygmatis*, they are too imperfectly preserved for description. In the Scarborough Limestone, as is usual where a Cephalopod facies predominates, *Nerinæa* is hardly to be found.

the forms next described may be varieties, and the species described as *Longfordensis* (Pl. XIII, fig. 5) resembles it in the anterior constriction of the whorls.

147. Nerinæa, species or variety. Plate XIV, fig. 15.

Description.—From a fragment 20 mm. in length. Spiral angle about 5°. Shell cylindrical, turrited. Whorls moderately high with a deep median furrow, and separated by a wide suture; in the lower whorls a spiral line is seen in the furrow, but other ornaments, if any, are obliterated. *Section* triplicate or quadruplicate.

Relations and Distribution.—There may be a considerable amount of deception produced by mineralization in this case. This form possesses a certain degree of resemblance to the later stage of *N. cingenda*, such as fig. 13 *c*, but the central furrow occupies the position of the median belt in the Yorkshire species, hence I would give it the provisional term of "*pseudocingenda.*" The specimen is of interest as coming from the Lower Limestone of the Cotteswolds near Holcombe Mill, which occupies a position below the Pea-grit and yet above the recognised *Opalinus*-zone.

148. Nerinæa subcingenda, sp. nov. Plate XIV, figs. 16 *a*, 16 *b*.

Description:

Spiral angle (regular) . . .	10°.
Height of whorl to width . . .	1 : 1·4.
Usual length	30—35 mm.

Shell cylindro-conical, strongly turrited. Whorls twelve to fourteen, much excavated anteriorly, flat and prominent posteriorly. Three spiral lines are conspicuous and rather wide apart in the anterior whorls; and finer intermediate spirals probably also exist. These decussate with lines of growth.

The body-whorl, in addition to the thin spiral raised lines, has a sharp anterior keel; the base is drawn out and ornamented with numerous fine spiral lines of rather unequal strength, partially decussating with lines of growth. Aperture rhomboidal, with a short and wide reflexed canal. *Section* unknown.

Relations and Distribution.—The peculiar mineralization of the Dogger fossils renders a close comparison almost impossible. This species or variety is of shorter habit and more conical than average specimens of *N. cingenda*, and the whorls are

also shorter. There is also some difference in details of ornament, but the difference of mineralization may partly account for this. It is a good local variety, if not entitled to be regarded as a distinct species.

Rare in the Lincolnshire Limestone at Santon, but more common at Geddington Grange, where the specimens are usually weathered.

Section E.—Folds numerous, simple.

149. Nerinæa (? *Ptygmatis*) Guisei, *Witchell*, 1880. Plate XV, figs. 1 *a*—*c*.

1880. Nerinæa Guisei, *Witchell*. Notes on a Section of Stroud Hill, &c., Proc. Cottesw. Nat. Field Club, vol. for 1879-80, p. 128, pl. iv, fig. 2.
1887. — — — Proc. cit., vol. for 1887, p. 25.

Bibliography, &c.—In the original diagnosis Mr. Witchell says, "Columella with one fold, outer wall with two folds near the middle of the volution." Subsequently, having obtained better specimens, he described the species as possessing "two folds on the columella, two on the outer wall, and one on the posterior wall."

Description:

Spiral angle (regular) . . .	$3\frac{1}{2}°$.
Height of whorl to width about . . .	1 : 1.
Approximate length	150 mm.

Shell cylindrical, turrited. Whorls numerous, much excavated, and ornamented with closely-set fine spiral lines (rarely preserved, and probably not extending to the more mature whorls). The constriction of the whorls is slightly anterior, so that each sweeps up very sharply towards the raised anterior margin. Sutural girdles extremely prominent, sutural angle very oblique.

Aperture oblong, form and length of canal unknown. *Section*, five folds, with two wide but simple folds on the outer walls, two smaller V-shaped folds on the columella, and one small V-shaped fold on the posterior wall.

Relations and Distribution.—This singular and well-marked species appears to stand alone in the Inferior Oolite, and to be without near relations in any English beds. It is somewhat difficult to say whether it should be regarded as a *Nerinæa* or a *Ptygmatis*. The folds on the columellar side are small, so that the section is not deeply indented. The existence of species having the internal structure of *Nerinæa cingenda* and *Nerinæa Guisei* affords evidence of a bridge, as it were, between the triplicate *Nerinææ* and the more complex internal structure of *Ptygmatis*.

N. Guisei was first described from the *Clypeus*-grit of Rodborough Hill, where fragments are numerous, though well-preserved specimens are rare. North of these quarries no specimens have hitherto been discovered, but south of Rodborough it has been found at several localities, and always in the same part of the *Clypeus*-grit, *e. g.* (1) Road-side between Symonds Hall Hill and Wootton-under-Edge; (2) Horton Hill (Sodbury); (3) Freshford, in the Avon Valley; (4) Twerton Hill, near Bath; and (5) in the quarries about Radstock. At this latter locality, especially on Clan Down, *N. Guisei* occurs somewhat abundantly in the form of external casts. In this case the spiral lines have been well preserved, and we thus obtain an insight into the apical conditions of the shell.

It has already been indicated in the Introduction that Clan Down is the most southerly point whence specimens of the genus *Neritæa* have hitherto been obtained from the Inferior Oolite, and it is worthy of remark that a form in many respects exceptional should be the first to reward the collector coming from the south.

Section F.—Folds numerous, complex.

150. Nerinæa (*Ptygmatis*) campana, sp. nov. Plate XV, figs. 2 *a*, 2 *b*.

Description :

Spiral angle (regular) . . .	10°.
Height of whorl to width . . .	1 : 1·8.
Approximate length	65 mm.

Shell cylindro-conical, strongly turrited. Number of whorls about twenty-two, very short and deeply excavated anteriorly. The sutural carina, thick and prominent in the early stages, is sharp and even more prominent in the later ones, almost overhanging the preceding whorl. Ornaments unknown.

The *section* (fig. 2 *b*) is not perfectly clear, but the indications are those of a *Ptygmatis*, especially the large square-headed fold in the anterior portion of the outer wall.

Relations and Distribution.—Belongs to the more conical forms of the subgenus *Ptygmatis*, but easily separated from all by the salience of the sutural carinæ. It is just possible that a specimen figured by me from the Millepore-oolite of Whitwell, in Yorkshire (‘ Geol. Mag.,’ dec. iii, vol. i, pl. iv, fig. 7), is a flattened representative of this species.

Rare in the Lincolnshire Limestone at Belmisthorpe, in company with *Ptygmatis Cotteswoldiæ*.

151. Nerinæa (*Ptygmatis*) pisolitica, *Witchell*, 1887. Plate XV, figs. 3 *a*—*c*, and Plate XVI, fig. 7.

1887. Nerinæa pisolitica, *Witchell*. Vol. cit., p. 32, pl. i, fig. 6.

Description:

Spiral angle	3°—5°.
Height of whorl to width . . .	1 : 1·25.
Approximate length . . .	80—200 mm.

Shell cylindrical, subulate. Whorls numerous, of moderate length, flat, sutural prominence scarcely marked. Assuming that fig. 3 *b* represents the apical conditions, there are numerous fine spiral lines in the earlier whorls, whilst the later ones appear to have been perfectly smooth.

In *section* the outer wall has two folds, the anterior of which is very large and complex; the posterior fold is small and flat-headed. On the columellar side the anterior fold is expanded and angulated, the middle fold is almost simple, the posterior fold is deep and bifurcated.

Relations and Distribution.—The internal structure easily distinguishes this species from any member of the *Oppelensis*-group, where the section exhibits seven folds; the whorls also are perfectly flat throughout, whilst in most of the members of the *Oppelensis*-group they are excavated, at least in the earlier stages.

It is described by Mr. Witchell as abundant in the pisolitic beds near Stroud, and at Longfords near Nailsworth. It occurs also in the Pea-grit at Crickley. There is a variety with rather shorter whorls, a rather wider spiral angle, and with the apical whorls slightly excavated, which occurs in a hard arenaceous rock about halfway between Seven Wells and Snow's Hill. This is said to be on the horizon of the Oolite Marl. Very long specimens showing the characteristic internal structure of *Ptyg. pisolitica* occur in the Inferior Oolite of Otley Hill (Mr. Walford's collection.) The fragment from Weldon (Pl. XVI, fig. 7) also greatly resembles this species, which, if this identification be correct, appears to possess a wide vertical range. The shell-bed at Weldon is undoubtedly high[1] in the Inferior Oolite series, but there is probably a mixture due to *remanié* forms.

[1] When I spoke of the Lincolnshire Limestone as being in the Lower Division of the Inferior Oolite an exception should have been made as regards the fossiliferous beds of Weldon and Great Ponton (see *antea*, p. 73).

152. Nerinæa (*Ptygmatis*) xenos, sp. nov. Plate XV, figs. 4 *a*, 4 *b*.

Description:

Spiral angle (regular)	4°.
Height of whorl to width (approximate) . .	1 : 1.

Shell cylindrical, slightly turrited. Whorls tolerably numerous, for the most part flat, but slightly constricted about three-fourths of the way down. The suture is situated in the middle of a sutural belt of moderate prominence, which becomes almost effete in the later whorls. Sutural angle oblique. The ornaments consist of numerous fine spiral lines, of which one, rather larger than the rest, occupies the hollow of the constriction; they seem to fade away in the later whorls.

The *section* shows five principal folds of a peculiar character. The anterior fold on the outer wall is much extended longitudinally; it is broad-headed, and develops slight subsidiary folds; the posterior fold is small and curved. Of the folds on the columellar side, the lowest is much extended longitudinally, the second is slight, the third (on the posterior wall) is narrow and deep.

Relations and Distribution.—The whorls are relatively higher than in *Ptyg. pisolitica*, and the peculiarly extended character of the lower folds of the section still further helps to differentiate it from that species, to which it is probably the most nearly allied. There seems also to be some slight differences of ornamentation, but the indications are obscure, even if they be of much specific value.

Ptyg. xenos is interesting as occurring on the lowest horizon of any *Nerinæa* yet discovered in the Cotteswolds. It is met with somewhat sparingly in the shell-bed below the Lower Limestone on Crickley Hill, which is on the border-land between the *Murchisonæ*- and the *Opalinus*-zone. Whether this species or *Nerinæa cingenda* is the oldest member of the genus in England remains yet to be determined; if the *Nerinæa*-bed of the Dogger is strictly on the Pea-grit horizon, as supposed by some, we must regard *Ptyg. xenos* as the oldest *Nerinæa* at present known in this country.

The following group of species has this much in common, viz. that each possesses, or is presumed to possess, an internal structure very similar to that of *Nerinæa Oppelensis*, Lycett. The section has seven folds, but although the folds are so numerous, they do not seem to restrict the space so much as is the case in some other species of *Ptygmatis* presently to be described. This group appears to be represented in the Bathonian of France by *Nerinæa bacillus*, D'Orb.

153. Nerinæa (*Ptygmatis*) bacillus, *D'Orbigny*, 1850. Plate XV, figs. 5 *a*, 5 *b*, 6 *a* —*c*, 7 *a*, and Plate XVI, fig. 12.

1850. Nerinæa bacillus, *D'Orb.* Prod., i, p. 298.
1852. — — — Ter. Jurass., ii, p. 84, pl. cclii, figs. 3—6.
1884. — (*Ptygmatis*) bacillus, *D'Orb.* Cossmann, Ét. Bath., p. 196, pl. i, figs. 25 and 26, and pl. xi, fig. 18.

Bibliography, &c.—The specimens from the Bathonian of Marquise figured by D'Orbigny are represented as having a whorl whose height and width are about equal. It is on the supposition that these figures are correct that the following comparisons are founded, as no measurements are given in the text of the *Paléontologie Française*. In our Inferior Oolite there are varieties of a species so closely resembling the *Nerinæa bacillus* of the *Terrain Jurassique* that I can hardly venture to give it a different name.

General Description:

Spiral angle . . .	3°—4°.
Height of whorl to width . .	from 1 : 1 to 1 : 1·1
Length estimated up to . .	150 mm.

Shell cylindrical and greatly elongated. Whorls numerous, about as high as wide, excavated, the chief constriction being rather below the centre and slightly increasing with age. Sutural belt prominent. In the young and the median stage the whorls are ornamented with about six spiral lines, which are somewhat unequally distributed, but, as is often the case, these have a tendency to disappear with age.

The *section* shows seven folds more or less complex (see figs. 5 *b*, 6 *b*, and 6 *c*), but the posterior fold on the columellar side, *i. e.* the fold on the posterior wall, is simple and very slight, and scarcely to be seen in some of the volutions. The two anterior folds on the outer wall extend about halfway up, and are flat-headed with two projections. The posterior fold on this side is at some distance from these, and is also flat-headed with two projections. The anterior fold on the columella is large, deep, and bifid, in some cases with three angles; the second fold is narrow and slightly bifid; the third is deep and very strongly bifid.

Relations and Distribution.—The interior structure differs but slightly from the description given by D'Orbigny of *N. bacillus*, and is very similar to that of *N. Oppelensis* presently to be described. Such differences as do exist may be partly the result of the conditions of preservation. Our Inferior Oolite varieties of *Ptygmatis bacillus* may be distinguished from *Ptyg. Oppelensis* by the greater

length of the whorls, and by the absence of dimorphism; and from *Ptyg. Jonesii* by the absence of dimorphism and the more regular excavations of the whorls.

A variety, which may be known as "*Carnicotensis*" (figs. 5 *a* and 5 *b*), represents in part the earlier stages of the species. This form is not uncommon in the *Clypeus*-grit horizon of the neighbourhood of Radstock. A very cylindrical variety occurs in the upper *Nerinæa*-bed at Little Ponton (fig. 6 *a*), at Weldon (fig. 6 *b*), and in the highest part of the Freestone Series at Crickley (fig. 6 *c*). This may be known as var. "*cervicula*." There is a third variety (fig. 7 *a*), which I would describe as var. "*crassicincta*" from the great thickness of the sutural belt; the whorls also are not quite so high. This occurs in the Pea-grit of Nailsworth Hill. The *section* is somewhat obscure, but is evidently on the same plan as in *Ptyg. bacillus* and *Ptyg. Oppelensis*. This form may ultimately prove to be worthy of stronger distinction. But, accepting it as a representative of the species now under description, we obtain a wide range from the Pea-grit to the *Clypeus*-grit. The case is exceptional, as there are but few species of *Nerinæa* which can be regarded as common to the upper and lower divisions of our Inferior Oolite. If I have been mistaken in referring our Inferior Oolite species to *Ptyg. bacillus*, I would propose for it the name of *Ptygmatis cervicula*, the two other names to stand as varieties.

154. Nerinæa (*Ptygmatis*) Jonesii, *Lycett*, 1857. Plate XV, figs. 9 *a*—*c*.

1857. Nerinæa Jonesii, *Lycett*. Cotteswold Hills, p. 124, pl. ii, fig. 4.
1887. — — — Witchell, vol. cit., p. 25.

Bibliography, &c.—Owing to the interior of the type specimen being filled with spar, there is no chance of getting a section. Hence Witchell (op. cit., p. 25) places *N. Jonesii* in the unclassified group. There can be little doubt that it is a true *Ptygmatis*, though its excessive dimorphism causes the fragments to be difficult of identification, as the two parts seldom occur on the same specimen.

Description:

Spiral angle (approximate) . . .	4°—5°
Height of whorl to width nearly as . .	1 : 1.
Approximate length	150 mm.

Shell cylindrical, elongated, very dimorphous. Whorls about as high as wide. The posterior whorls are excavated and much thickened posteriorly, so as to form a strong sutural belt. The salience of this belt diminishes, the elevation of the whorls becomes less, and ultimately the whorls become quite flat and without any marked sutural prominence.

The *section* of the type is unknown; a specimen from the Pea-grit of Longfords, showing the posterior half (fig. 9 *c*), gives indications of a structure on the *bacillus* or *Oppelensis* plan. A section of the anterior half (fig. 9 *b*) gives faint indications of a similar character.

Relations and Distribution.—Owing to the fact that the two portions of this very dimorphous form are rarely found in one piece, a degree of uncertainty hangs about the species. Posteriorly its relations with *Ptyg. bacillus* are intimate, but the anterior portion is quite different. From *Ptyg. Oppelensis* it is separated by the height of the whorls and by its more elongate habit.

Rare in the Freestone, Nailsworth, and in the Pea-grit at Longfords.

A specimen from the Lincolnshire Limestone of Wakerly (figs. 8 *a* and 8 *b*), which I temporarily designate as *Ptygmatis* "*baccilloides*," reminds us of the posterior portion of *Ptyg. Jonesii*, though the whorls are a little shorter.

The section of the Wakerly fossil seems to be on the *bacillus-Oppelensis* plan, but it possesses considerable peculiarities of its own, which at present require the confirmation of other specimens.

155. Nerinæa (*Ptygmatis*) Oppelensis, *Lycett*, 1857. Plate XV, figs. 11 *a*—*e*.

1857.	Nerinæa Oppelensis, *Lycett*.	Cotteswold Hills, p. 123, pl. ii, figs. 6, 6 *a*.
1887.	—	—	—	Witchell, vol. cit., p. 30, pl. i, fig. 3, 3 *a*.

Bibliography, &c.—Originally described from a fragment found in the Oolite Marl of Selsley Hill. Witchell considered the section shown by Lycett to have been much worn. Accordingly he substituted another, which is again figured (fig. 11 *e*). This figure, he says, occurs with slight variations in four Inferior Oolite species. This number may be increased.

Description:

Spiral angle (mean)	6°.
Height of whorl to width	1 : 1·4.
Approximate length	80 mm.

Shell conical to cylindrical, dimorphous. The spire has a bluntish apex, and the apical angle is nearly double the mean spiral angle, so that the general angle is very obtuse. Whorls twenty-five and upwards, short, with indications of spiral ornament in the earlier stages. The apical whorls are deeply excavated, the spiral belt being thick and prominent. These features gradually soften down until we reach the stage described by Lycett, where the whorls are "slightly tumid at the junctions," and the excavation is but slight. In specimens from the marly Lime-

stone of Swift's Hill and Longridge, and in specimens from the Pea-grit horizon of Longfords (fig. 11 *d*), which are better preserved than those from Selsley Hill, a third stage is noted. The excavation of the whorls and the sutural prominence disappear, and the whorls become flat or very nearly so.

The body-whorl is short and angular, with an excavated base; aperture nearly square, with a short canal. In complete specimens possessing the true body-whorl there are no signs of folds either on the columella or lip.

The *section* is very complex; it has seven folds. Fig. 11 *e* (Mr. Witchell's type) may be regarded as showing the plan most completely. Fig. 11 *c* exhibits a somewhat curious divergence. The *section* of *Ptyg. Oppelensis* differs in no material respect from the *sections* of *Ptyg. bacillus* (figs. 5 *b* and 6 *c*) already described. The three angles in the head of the anterior columellar fold, mentioned by D'Orbigny as one of the characters of *Ptyg. bacillus*, are noticeable in Mr. Witchell's specimen, and also in the specimen of *Ptygmatis bacillus* (fig. 6 *c*) from the Upper Freestones of Crickley.

Relations and Distribution.—*Ptyg. Oppelensis* is a somewhat aberrant member of the *bacillus*-group. From D'Orbigny's species it is easily distinguished by the shortness of the whorls, the obtuse-angled subconical spire, and by its marked dimorphism. It has already been indicated in what way it differs from *Ptyg. Jonesii*.

The distribution of this species is somewhat local: The Pea-grit of Longfords, the Oolite Marl horizon of Selsley Hill, and, further north, of Swift's Hill and Longridge, are the only localities where it has been identified with certainty. There are so many species which possess this internal structure that strict identification is out of the question without reasonably good specimens. The fossil from the Lincolnshire Limestone of Wakerly (figs. 8 *a* and 8 *b*) has already been mentioned in this connection under *Ptygmatis Jonesii*.

156. Nerinæa (*Ptygmatis*) producta, *Witchell*, 1887. Plate XV, figs. 10 *a*—*c*.

1887. Nerinæa producta, *Witchell*. Vol. cit., p. 34, pl. i, fig. 13.

Description:

Spiral angle (regular) . .	3°.
Height of whorl to width .	1 : 1.
Estimated length . . .	150—200 mm.

Shell cylindrical, very narrow. Whorls about twenty-five, flat, sometimes higher than wide, in other cases slightly the reverse; suture without prominence and close-fitting; angle oblique. Faint traces of spiral ornament on the early

whorls, later ones perfectly smooth. The only salience throughout the long and narrow spire is a slight spiral band on the posterior margin of each whorl.

Body-whorl smooth, angular, elongate; aperture oblong, with a canal rather long for the genus and slightly deflected. *Section* shows seven folds, arranged on the *bacillus*- or *Oppelensis*-plan.

Relations and Distribution.—In its narrow cylindrical outline and in the relative height of the whorls this species resembles *Ptyg. bacillus*, from which it is separated by the complete flatness of the whorls and the absence of any prominence at the sutures. Rare in the Pea-grit of Longfords.

157. Nerinæa (*Ptygmatis*) consobrina, *Witchell*, 1887.

1887. Nerinæa consobrina, *Witchell*. Vol. cit., p. 33, pl. i, figs. 10, 10 *a*.

As I have not seen the type, and never found a specimen which answers to this description, the species is inserted on the authority of Mr. Witchell alone.

He says that it differs very little in its internal structure from *N. Oppelensis*, but it has a more conical figure and the whorls are higher. Found at Longfords in the Pisolite.

158. Nerinæa (*Ptygmatis*) velox, *Witchell*, 1887. Plate XVI, fig. 1.

1887. Nerinæa velox, *Witchell*. Vol. cit., p. 34, pl. ii, fig. 3.

Description:

Spiral angle (slightly obtuse) . . .	10°.
Height of whorl to width . . .	1 : 1·5.
Average length	75 mm.

Shell cylindro-conical, dimorphous. Whorls about thirty, of which the posterior two-thirds are deeply excavated and much thickened at the sutures. Ultimately the whorls become flat and without any sutural prominence. The whorls are extremely short, and no trace of spiral ornament has been detected in the specimens, though it is probable that the posterior whorls of the spire were spirally striated.

The aperture is nearly square, with a short and not very reflexed canal. *Section*, seven folds, identical with that of *Ptyg. Oppelensis*.

Relations and Distribution.—From *Ptyg. Oppelensis* this species differs in its more conical form, and in the excessive flatness of the anterior whorls. Rare in the Oolite Marl horizon of Swift's Hill and Longridge.

159. Nerinæa (*Ptygmatis*) Stroudiensis, *Witchell*, 1887. Plate XVI, figs. 2 *a*, 2 *b*.

1887. Nerinæa Stroudiensis, *Witchell*. Vol. cit., p. 33, pl. i, fig. 9.

Description:

Spiral angle (slightly obtuse) . . .	8°.
Height of whorl to width . . .	1 : 1·4.
Length of full-sized specimen . . .	85 mm.

Shell cylindro-conical, turrited, scarcely dimorphous. Whorls about twenty-five, short and excavated towards the apex, and with a very thick sutural prominence. Lower down the whorls become almost flat and angular, increasing by steps. In some cases the anterior whorls are themselves slightly excavated. Traces of spiral ornament are observable in the earlier whorls (see enlargement of fig. 2 *b*). The *section* shows seven folds on the *Oppelensis* type.

Relations and Distribution.—Rather more conical than *Ptyg. Oppelensis*, this species further differs in the step-like character of the anterior whorls. *Ptygmatis velox*, as we have seen, varies from *Ptyg. Oppelensis* in an opposite direction. Internally all three are closely related, and some might be disposed to regard them as varieties of one species.

Rare in the marly Limestone of Swift's Hill and Longridge.

This terminates the *Oppelensis*-group.

160. Nerinæa (*Ptygmatis*) Cotteswoldiæ, *Lycett*, 1857. Plate XVI, figs. 3 *a*—*d*, and var. conica, *Witchell*, figs. 4 *a*, *b*, and ? 4 *c*, *d*.

1857. Nerinæa Cotteswoldiæ, *Lycett*. Cotteswold Hills, p. 124, pl. ii, fig. 2.

Description:

Spiral angle (regular) . . .	10°.[1]
Height of whorl to width . . .	1 : 1·75.
Full length	80—100 mm.

Shell cylindro-conical, slightly dimorphous, apex acute. Whorls from twenty to twenty-five, extremely short and flat, except towards the apex, where a few of the earlier whorls exhibit considerable sutural prominence, but there is much variety in this respect. The anterior whorls are flat or only very slightly excavated, and there is little or no prominence at the sutures, beyond traces of a

[1] The spiral angle varies considerably, and is usually below 10° in specimens from the Lincolnshire Limestone.

posterior marginal rim. No signs of spiral ornamentation have as yet been detected, though we should expect fine spiral lines in the apical whorls.

The body-whorl is short, flat or scarcely hollowed, and angular. The aperture is subrhomboidal, and where the specimens are complete or nearly so (fig. 3 *a*) there is no trace of the folds which are so conspicuous in the section of the spire.[1] Canal short and moderately reflexed. The *section* exhibits six folds, some of which are very complex. On the outer wall the anterior fold is very wide, and has three or four small angular indentations, whilst the posterior fold is small and deep, but almost simple. Of the three folds on the columella the lower one is the largest and square-headed; the fold on the posterior wall occupies a large space and bifurcates unequally. Altogether the space for the animal in the whorls of the spire must have been excessively small, and specimens, especially from the Lincolnshire Limestone, when cut longitudinally, exhibit very whimsical figures. There are indications, however, that this system underwent modification in the later whorls, and that possibly it was non-existent in the body-whorl. But other interpretations of these appearances have been suggested.

Var. CONICA, *Witchell.*

1887. NERINÆA CONICA, *Witchell.* Op. cit., p. 30, pl. i, fig. 2.

Description:

Spiral angle	13°.
Height of whorl to width . . .	1 : 1·85.
Length	75 mm.

In the apical whorls there is a thick sutural prominence, which gradually passes off into a step-like increase of the anterior whorls (well seen in figs. 4 *a* and 4 *b*), which are short and flat, and without ornament. The type specimen (fig. 4 *a*) did not enable Mr. Witchell to ascertain the internal structure of his "*Nerinæa conica*," but specimens since obtained by myself (fig. 4 *b*) show that the section is practically identical with that of *Ptygmatis Cotteswoldiæ*, from which it is distinguished by its more conical figure and by the strap-like arrangement of the lower whorls. The forms 4 *c* and 4 *d* represent short conical specimens of *Ptygmatis Cotteswoldiæ* without the strap-like arrangement of the anterior whorls, characteristic of the var. *conica*. Such specimens are very abundant in the Oolite-Marl horizon of Longridge, and may possibly be regarded as abraded specimens of the var. *conica*. At all events, they are short conical varieties of *Ptyg. Cotteswoldiæ* with very short whorls.

Relations and Distribution.—The peculiar internal character serves to dis-

[1] This seems to have been the case with other species of *Nerinæa*. See remarks, p. 195.

tinguish *Ptygmatis Cotteswoldiæ* from any species hitherto described in this Monograph, but it has affinities with some of the species that follow. The group of which it is the type is characterized by very short whorls, which are flat and unornamented in the anterior stage, and by a very restricted and whimsical section. Specimens from the Pea-grit and from the Lincolnshire Limestone are, as a rule, narrower than those from the Oolite-Marl horizon of the Cotteswolds.

This species and its varieties are widely distributed, both vertically and horizontally, but especially on the Oolite Marl horizon of the Cotteswolds. In the Lincolnshire Limestone it occurs in the lower bed of Little-Ponton cutting, at Wakerly, Belmisthorpe, and Geddington, and at the slate-pits of Kirby and Dene Lodge, and probably at many other places. Of late a more cylindrical variety, with some difference of internal structure, has been found in considerable numbers in the lower beds of the Lincolnshire Limestone at Hungerton Hall. On the other hand, the upper beds of the Lincolnshire Limestone show but doubtful traces, and in the Great-Ponton cutting there are none.

161. Nerinæa (*Ptygmatis*), species or variety. Plate XVI, fig. 6.

The spiral angle is about 14°, the relative height of the whorls the same as in *Ptyg. Cotteswoldiæ*. The whorls are slightly excavated, and the sutural prominence is the most conspicuous at the base of each whorl, which causes it to overhang the surrounding one. The internal structure only differs from *Ptyg. Cotteswoldiæ* in the presence of an incipient additional fold on the upper part of the columella.

This form diverges from Lycett's species more widely than the var. *conica*, and to a certain extent in an opposite direction. But it may have been a diseased or abnormal individual. A single specimen from the marly Limestone, Swift's Hill.

162. Nerinæa (*Ptygmatis*) Santonis,[1] sp. nov. Plate XVI, figs. 8 *a*—*c*.

Description :

Spiral angle (regular) . . .	8°.
Height of whorl to width . . .	1 : 1·4.
Length	70—100 mm.

Shell cylindro-conical, slightly dimorphous. Whorls twenty to twenty-two in well-grown specimens. The subapical whorls are flat, and this portion of the

[1] *N. Santonensis*, D'Orb. (T. J., vol. ii, p. 156), is a "Portlandian" species of *Nerinæa*.

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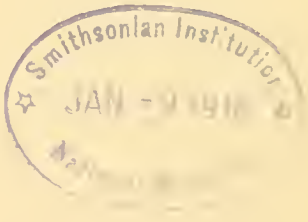

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A MONOGRAPH

OF THE

BRITISH JURASSIC GASTEROPODA.

BY

WILFRID H. HUDLESTON, M.A., F.R.S.

PART I, No. 5.

GASTEROPODA OF THE INFERIOR OOLITE.

Pages 225—272; Plates XVII—XX.

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spire is sub-turrited or step-like. Lower down this feature disappears, and the whorls succeed each other without any prominence, except that, in well-preserved specimens, a slight posterior marginal rim may be noted on one or two of the latest whorls. Lines of growth may be observed in the later whorls of such a specimen as fig. 8 *a*, otherwise no traces of ornament have been discovered.

The aperture is subrhomboidal, and, as in the case of *Ptyg. Cotteswoldiæ*, bears no trace of the presence of folds when the shell is complete (fig. 8 *a*). On the other hand, when the shell is fragmentary (fig. 8 *b*) the aperture exhibits three folds on the columella, and one on the outer wall. The *section* shows five folds in all, two on the outer wall and three on the columellar side, of which the upper one may be regarded as being in the posterior wall. These folds are large and complex, and must have reduced the available space, the result being a whimsical figure.

Relations and Distribution.—*Ptygmatis Santonis* belongs to the *Cotteswoldiæ*-group, but differs in the absence of the fourth fold on the columellar side. It is also narrower than the majority of specimens of *Ptyg. Cotteswoldiæ*, and the whorls are relatively higher. It may possibly represent *N. triplicata*, Voltz. based on the cast of a *Ptygmatis* too imperfectly diagnosed to be accepted as a species.

Occurs in the Lincolnshire Limestone at Santon, and very rarely in the marly Oolite of Longridge.

163. Nerinæa (*Ptygmatis*) brevivoluta, sp. nov. Plate XVI, figs. 9 *a*, 9 *b*, and ? 10.

Description:

Spiral angle (regular) . . .	12°—14°.
Height of whorl to width . .	1 : 2·2.
Length	35 mm.

Shell conical, slightly turrited, apex acute. Whorls about twenty-one, extremely short. In the apical region the sutural belts are thick and prominent, in the later whorls they are well defined but thinner, and the whorls themselves are slightly excavated. No trace of ornamentation has hitherto been noted.

Body-whorl short and angular; aperture angular and more wide than high; canal but little reflexed. The *section* shows five folds, two on the outer wall, three on the columellar side. Owing to the large size and complex nature of three of these folds (fig. 9 *b*), the interior space was very much restricted. The anterior fold on the outer wall might sometimes be construed as two folds.

Relations and Distribution.—*Ptyg. brevivoluta* belongs to the *Cotteswoldiæ*-group,

its section partaking of the whimsical character of that abundant species, though, like *Ptyg. Santonis*, it possesses only three folds on the columellar side. It is easily distinguished from all other species of *Nerinæa* previously described in this Monograph by the excessive shortness of the whorls. The width of a whorl is equal to its height *plus* the height of the preceding one, *plus* half the height of the next preceding one.

Found in considerable numbers in the *Clypeus*-grit of Barrington, in the Cotteswolds, and noted also on the same horizon at Twerton Hill, near Bath.

A fragment from the Lincolnshire Limestone of Weldon (fig. 10) presents similar proportions, and may at least represent a variety.

164. Nerinæa (*Ptygmatis*), species or variety. Plate XVI, fig. 11.

Description:

Spiral angle	12°.
Height of whorl to width . . .	1 : 1·75.
Length about	45 mm.

This form differs from the preceding, chiefly in the greater relative length of the whorls, and consequent difference in the shape of the aperture. The *section* is pretty much on the same plan; but, as the folds were somewhat smaller, there was more interior space, the anterior fold on the columella being markedly less than in *Ptyg. brevivoluta*.

A single specimen from the Lincolnshire Limestone of Weldon, to which I give the temporary name of "*sub-brevivoluta*."

N.B.—In spiral angle and internal structure *Ptyg. brevivoluta* and the Weldon form rather remind us of the figure of *N. subtruncatana*, D'Orb. (T. J. 2, p. 94, pl. ccliv, figs. 1 and 2), a species described by D'Archiac from the Bathonian of Eparcy. But that species has a thoroughly conical figure and no sutural prominences. Moreover, the spiral ornamentation is very marked.

Family—TURRITELLIDÆ.

"*Shell imperforate, turrited, many-whorled, conical, elongate; aperture small, rounded, oval, or sub-quadrangular, entire or slightly notched at the base; lip simple, arched, or sinuous; operculum corneous . . . .*"—FISCHER.

It is quite possible that *Cerithinella* and even *Pseudalaria*, which I have placed provisionally under the CERITHIIDÆ, should be regarded as belonging to this family.

Genus—TURRITELLA, Lamarck, 1801.

"*Shell elongated, many-whorled, spirally striated; aperture rounded, margin thin, operculum horny . . . .*"—S. P. WOODWARD.

As restricted by Fischer the family of the Turritellidæ is mainly composed of this one genus, which, he says, commences in the Lias, and embraces more than 400 species of fossils. S. P. Woodward, on the other hand, traced the genus no further back than the Neocomian. There can be little doubt, however, that fossils with a very strong resemblance to existing *Turritellæ* are far from uncommon in the Lias, and several species, yielding remarkably handsome shells, occur in the Inferior Oolite of this country.

It is just possible that some of these species might be referred to Semper's genus, *Mathilda*, but only, perhaps, in a subgeneric sense. Laube described and figured a small shell, 9 mm. in length, from the Brown Jura of Balin, under the name of *Mathilda euglypha* (vide postea, p. 235). He also refers to *Turritella eucycla*, Héb. and Desl. ('Foss. Mont.-Bellay,' p. 47, pl. ii, fig. 11) as belonging to the genus *Mathilda*. The authors of this last-quoted work observe that their *Turritella eucycla* greatly resembles "*Cerithium*" *zic-zac*, Desl., from the Lias, and "*Cerithium*" *amœnum*, Desl., from the "Oölite ferrugineuse," although specifically distinct. All these fossils are Turritellids, and they appear to be related to each other so as to constitute a group.

Attention has been drawn lately by Mons. Cossmann (Ét. Bath., p. 221) to the probability of many of these Jurassic Turritellas belonging to the genus *Mathilda*, as suggested by Laube. He has, in fact, discovered the peculiar sinistral apex and "embryonic button," held to be one of the characteristics of Semper's genus, in the species named by him *Mathilda Janeti*. He describes eight species in all from the Bathonian of France under the genus *Mathilda*.

There can be no doubt whatever that the specimen from the Upper Lias of Heyford (Pl. XVII, fig. *x*), procured by Mr. Crick of Northampton, is closely related to *M. euglypha*, Laube, though sufficiently different perhaps to be regarded as specifically distinct. The "embryonic button" and general features of the shell speak strongly in favour of its being placed under the genus *Mathilda*. Possibly most of the Turritellids figured on Pl. XVII, with the exception, perhaps, of *T. Dorsetensis*, might be allowed to follow suit. As a matter of fact I propose to describe these species under the genus *Turritella*, placing the word *Mathilda* in brackets. The genus *Mathilda* was made to receive certain Tertiary fossils; its family relationships are somewhat mixed, since it possesses the shell of a *Turritella* with the sinistral apex of the Pyramidellidæ.

As might be expected these long and slender shells are usually in a fragmentary condition, and for the most part the apertures are not preserved. The spiral ornamentation and peculiar axial cross-hatching, in addition to the great width of the sutural sulcus, may be regarded as characteristic of the section associated with the genus *Mathilda*. These fossils occur chiefly, if not entirely, in the Lower Division of the Inferior Oolite, and principally, as far as my experience goes, in Dorsetshire and Yorkshire.

165. Turritella Dorsetensis, sp. nov. Plate XVII, figs. 1 *a*, 1 *b*, 1 *c*.

Description :

Spiral angle	10°.
Height of whorl to width . . .	1 : 1·15.
Approximate length	110 mm.

Shell conical-elongate, inversely turrited. Whorls about 30; these increase with great regularity, are slightly excavated, and provided with a prominent carina a short distance above the suture Actual apex unknown. In the apical whorls the carina is relatively more prominent, and the position of the carina in some cases more median. The position of the carina varies considerably in different specimens, but is in all cases anterior, and in some mature specimens rather near the base of each whorl. The carinæ are richly granulated by the cross-hatching, or axial ornamentation, which is very fine and close in this species. In the more apical whorls there are about four fine spirals above the carina and about two below, but this number increases with age, so that in some specimens the adult whorls have as many as seven spirals above and four below the keel, the latter being much crowded together. This represents the usual form (figs. 1 *a*, 1 *c*), but there is a variety (fig. 1 *b*) where the keel is more centrally situated, and where the

number of spirals above the keel is only five. Other specimens present trifling differences.

The base is nearly flat and spirally striated; columella short, aperture subquadrate and restricted. (N.B.—The columellar lip is too much rounded in the figure.)

Relations and Distribution.—This species stands out very prominently from the other Turritellids of the Inferior Oolite, being distinguished by the conical form of the whorls and by the prominence of the single carina near the base of each whorl. *T. Dorsetensis* differs from the *T. Schlumbergeri*, Eug. Desl., in its richer ornamentation, and in having, in the adult shells, a greater number of spirals, but, above all, in the more median position of the keel. In the variety from the *Murchisonæ*-zone of Bradford Abbas (fig. 1 *b*) this difference in the position of the keel is at its maximum.

T. Dorsetensis occurs rarely in the Irony-nodule Bed of Burton Bradstock, and in the Lower Division of the Inferior Oolite of Bradford Abbas, where it is also rare. A small fragment has been found in the freestones of the Inferior Oolite near Cheltenham (Brodie Collection).

166. Turritella cf. Schlumbergeri, *Eugène Deslongchamps*, 1863—66. Not figured.

1863—69. Turritella Schlumbergeri, *Eugène Deslongchamps*. Notes Paléontologiques, p. 93, pl. viii, figs. 8 *a*, 8 *b*, 8 *c*.

The late Prof. Eugène Deslongchamps founded his species upon four specimens belonging to the Faculty of Sciences at Caen procured by Mons. Schlumberger from the Inferior Oolite of the Meurthe. None are quoted from the "Oölite ferrugineuse" of Normandy.

This species has considerable affinity with *T. Dorsetensis*, but the keel is represented as being less prominent, and, moreover, is placed much nearer the base of the whorls, so that only one spiral instead of four occupies the space between the keel and the suture.

One specimen, answering fairly well to the figures and description in the 'Notes paléontologiques,' is in my possession from the Inferior Oolite of Dorsetshire. It is interesting to make this identification, since the fossils from the so-called *Sowerbyi*-bed of the Meurthe seem to possess considerable affinity with those from the *concavus*-bed of Bradford Abbas. Possibly *T. Dorsetensis* might be regarded as a marked local variety of *T. Schlumbergeri*.

Turritella opalina group.

The following species or sub-species of *Turritella*, occurring in the Inferior Oolite of England, are placed in this category. *Turritella abbas*, sp. n., *T. opalina*, Quenstedt, and var. *canina*, Hudleston, *T. strangulata*, sp. n. These forms may belong to the genus *Mathilda*.

167. Turritella (*Mathilda*) abbas, sp. nov. Plate XVII, figs. 2 *a*, 2 *b*, 2 *c*.—cf. *Turritella septemcincta*, Münst., Goldf., Pl. 196, fig. 12.

Description :

Spiral angle	9°—11°.
Height of whorl to width	1 : 1·1.
Approximate length	70 mm.

Shell elongate, turrited, much indented by the sutural sulcus. Number of whorls from 16—20. Indications of a sinistral apex have been observed on one specimen. Between the subapical and anterior whorls there is but little difference except as to size; in shape the whorls are narrow and subtumid, the chief protuberance being postero-mesial, with a tendency to be pinched in at either extremity. The spirals are seven in number; usually there is a slight space between the first spiral and the suture, the second spiral is about equidistant, both are situated in a depressed area and are small. Between the second and third spirals there is a sharp rise of the whorl, and upon the most salient portion occurs the third spiral, which is the largest of all and constitutes the principal prominence; it might almost be described as a carina; the fourth and fifth spirals are nearly as large, the sixth spiral is sometimes small, the seventh spiral occupies the base of the whorl close to the suture. These ornaments are subject to a certain amount of variation in individual specimens; both the spiral and the interspiral spaces are cross-hatched, but in this species the spirals are not deeply cut or granulated. Specimens such as fig. 2 *c* exhibit some difference as to the size of the spirals; for instance, the sixth spiral is large and the whorls rather more tumid, showing, in fact, a passage towards the form recognised as *T. opalina*.

The base is very flat and has from two to three spiral ridges; aperture ovate with a slight tendency to be subquadrate anteriorly.

Relations and Distribution.—Turritella abbas clearly differs from *T. opalina* in the narrow and elongate character of the whorls. As regards *T. septem-cincta*,

Münster, that species was founded on a fragment, some 12 mm. in length, said to come from the Lias. The enlargement by Goldfuss shows a whorl not dissimilar to that of *T. abbas;* but, as we are left in doubt on many points, it is safer to make a new species in this case, and I am the more inclined to do so because *T. abbas* is decidedly the characteristic and most abundant *Turritella* in the Inferior Oolite of Dorsetshire.

T. abbas occurs chiefly in the *concavus*-bed at Bradford Abbas, where fragments are not uncommon; it also occurs in the corresponding zone near Beaminster, and has been noted rarely in the Pea-grit of Crickley.

168. Turritella (*Mathilda*) opalina, *Quenstedt*, 1858. Pl. XVII, fig. 3 *a*.

1858. Turritella opalina, *Quenstedt*. Der Jura, p. 326, pl. xliv, fig. 13.

Bibliography, &c.—This is most probably the *Turritella elongata* of Zieten (= *Cerithium elongatum*, d'Orb, Prod. 1, p. 250). The specific name *elongata* had been already appropriated by Sowerby for a *Turritella* of Tertiary age, cf. Hudleston, 'Geol. Mag.,' dec. 3, vol. i (1884), p. 200. Quenstedt's name may be accepted as a generalised term for elongate *Turritellæ* of Jurassic age possessed of about six or seven spirals, but the following description relates to a specialised form which, it is believed, more distinctly resembles Quenstedt's species.

Description:

Spiral angle	14°—15°.
Height of whorl to width	1 : 1·75.
Approximate length	45 mm.

Shell conical-elongate, spiral angle very regular, sutural sulcus wide. Whorls about fifteen, short and tumid, the chief prominence nearly mesial. Sinistral apex probable. Usually there are six spirals, the fourth and fifth being the most prominent; between these two is a sulcus of considerable depth, the impression of which is left on the internal mould. The cross-hatching or axial ornamentation, as in the *opalina*-group generally, is distinct, equally spaced, and but slightly oblique; the spirals are slightly granulated.

Base very flat and slightly excavated; aperture subcircular with a tendency to be subquadrate anteriorly, columellar lip short and straight.

Relations and Distribution.—Quenstedt does not give a detailed description of *T. opalina*, but the fossils now under description correspond well in proportions, and to a certain extent in ornamentation with that author's figure; our examples are rather shorter. It is clearly distinguished from *T. abbas* by its more conical

figure, wider spiral angle, and by the shorter and more tumid whorls. The details of ornamentation also differ considerably.

But just as there are specimens, such as fig. 2 *c*, which seem to connect *T. abbas* with *T. opalina*, so also there are specimens which serve to bridge over the gap between *T. opalina* and *T. quadrivittata*. On the other hand fig. 3 *b* represents a richly ornamented and unusually well-preserved specimen of *T. opalina*, where the sulcus between the two principal carinæ is occupied by a secondary spiral, thus adding to the number.

A single specimen of *T. opalina* has been found in the *opalinus*-bed of Burton Bradstock. A few in a better state of preservation have been obtained from the *concavus*-bed, Bradford Abbas. It may also occur in the Dogger at Blue Wyke and in the Millepore-bed.

169. Turritella (*Mathilda*) opalina, var. canina, *Hudleston*, 1884. Plate XVII, fig. 4.

1884. Turritella opalina, *Quenstedt*, var. canina, *Hudl.* Geol. Mag., dec. 3, vol. i, p. 200, pl. vii, fig. 9.

Description :

Spiral angle	20°—23°.
Height of whorl to width . . .	1 : 2.
Approximate length	40 mm.

This variety possesses the conical shape of *T. opalina*, but under a wider spiral angle, and the relative width of the whorls is greater. The whorls are very short and globose, and separated by a well-marked sutural sulcus. The apex is unknown ; the subapical whorls are globose and have about seven spirals ; the more mature whorls have about eight. Of these, three nearly equal strap-like bands are distinguished, occupying the area a little below the centre, the uppermost of the three being slightly the strongest and representing the most salient portion of the whorl. Owing to the crowding of the spirals (and partly also to the peculiarity of the matrix) the cross-hatching is not conspicuous. Aperture similar to that of *T. opalina*, but slightly more orbicular.

Relations and Distribution.—The relations of this variety to other members of the *opalina*-group have been already indicated. A very few specimens have been found in the Dogger at Blue Wyke. Specimens approaching this variety, such as fig. 3 *b*, occur in the *concavus*-bed, Bradford Abbas.

170. Turritella (*Mathilda*) strangulata, sp. nov. Plate XVII, fig. 5.

Description:

Spiral angle	12°.
Height of whorl to width . . .	1 : 1.
Approximate length	65 mm.

Shell elongate, strongly turrited, deeply sulcated, sutural angle very oblique. The whorls (about fifteen) are long and irregularly bulging, the principal prominence being posterior, where also is situated the principal spiral or carina. The spirals are six and sometimes seven in number, the third being the most prominent. Cross-hatching is conspicuous throughout the shell, the lines being nearly parallel to the axis, and fairly close. Other indications wanting.

Relations and Distribution.—This species is distinguished from *Turritella abbas* by the width and depth of the sutural sulci, which, in conjunction with the excessive postero-mesial bulge of the whorls, give a curious strangulated appearance to the spire; the ornamentation also is coarser than in *T. abbas*. As regards the outline of the spire, *T. strangulata* has considerable resemblance to *T. Hartmanniana*, Münst. (Goldf. iii, p. 98, pl. cxcvi, fig. 8, a fossil of the Lias). But, to judge from the enlargement of Münster's species, the ornamentation differs considerably.

Note on the *opalina*-group. From *Turritella eucycla*, Héb. and Desl., and from *T. Clapensis*, Terquem and Jourdy, the members of this group are separated by the greater number of spirals in the whorls. Both the last-named fossils are more nearly related to *T. quadrivittata*, Phil.

171. Turritella (*Mathilda*) quadrivittata, *Phillips*, 1829. Plate XVII, fig. 6.

1829 and 1835.	Turritella quadrivittata, *Phillips*.	Geol. Yorks., pt. 1, p. 129, pl. xi, fig. 23.
1850.	Cerithium quadrivittatum, *d'Orbigny*.	Prod. i, p. 271.
1884.	Turritella quadrivittata, *Phillips*.	Hudleston, Geol. Mag., dec. 3, vol. i, p. 202, pl. vii, figs. 11—13.

Bibliography, &c.—Without multiplying references it may be sufficient to state that authors have differed greatly as to whether Phillips' species should be regarded as a *Cerithium* or a *Turritella*. Morris, in his 'Catalogue,' enters it under

both genera—a very unusual proceeding. It clearly belongs to the *Mathilda*-like *Turritellæ*. It is possible that two species, or at any rate two varieties, are included under *T. quadrivittata;* one a wide, the other a narrow form. The wider form, which is Phillips' type, is represented in pl. vii, figs. 11, 12 of the above quoted volume of the 'Geological Magazine.' The narrower form is represented in pl. vii, fig. 13, and also in Pl. XVII, fig. 6, of the present work.

Description.—Accepting, at least provisionally, the view that both wide and narrow forms belong to one species, the spiral angle will range from 18°—28°. The height of whorl to width is about as 1 : $1\frac{3}{4}$, and the average length may be about 20 mm.

The spire consists of from ten to twelve whorls; apex unknown. The whorls are sub-globose, sutural sulcus wide with sometimes a faintly-marked rim in the centre. Each whorl is ornamented by four granular spirals, the third being the strongest and most granulated. The cross-hatching is close and sinuous, decussating with the spirals so as to form nodes. Base nearly flat, and spirally striated: aperture suborbicular.

Relations and Distribution.—The differences which separate this species from the *opalina*-group have been already indicated. *Turritella tricincta,* Münst. (Goldf. pl. cxcvi, fig. 11), a fossil of the Lias, may possibly be merely a variety, *T. eucycla* and *T. Clapensis* may be regarded as elongated and eucycloid varieties of the *quadrivittata*-group, the former especially coming near to the narrow section of *T. quadrivittata.*

Rare in the Dogger and Millipore-bed; a single specimen from the Lincolnshire Limestone of Weldon. A variety, which occurs in the shell-bed at Pitcombe, and also in the *concavus*-bed at Bradford Abbas, develops an additional spiral posteriorly; it belongs to the slender section, and is closely related to *T. eucycla,* Héb. and Desl.

172. Turritella (? *Mathilda*) cf. binaria, *Hébert and Deslongchamps,* 1860. Plate XVII, fig. 7.

1860. Turritella binaria, *Héb.* and *Desl.* Foss. Mont.-Bellay, p. 47, pl. vi, fig. 7; pl. viii, fig. 10.

A fragment consisting of four whorls from the Lower Division of the Inferior Oolite near Beaminster presents so many points of resemblance to the Callovian species from Montreuil-Bellay that I feel justified in making this reference, pending the discovery in our Inferior Oolite of more complete specimens.

Our fragment shows a spiral angle of about 14°. The whorls, which are

separated by a wide sutural sulcus, are angular and strongly bicarinate, the upper carina being the most prominent. Besides the two central carinæ a fine spiral line is noticeable towards the top and bottom of each whorl, and in the last whorl the lower of these has considerable prominence, forming the edge of the base. The cross-hatchings in this specimen are wide apart and considerably oblique to the axis.

The Beaminster specimen most resembles pl. viii, fig. 10, of the "Fossils of Montreuil-Bellay," but there are elements of difference. It has also some affinity with "*Cerithium*" *amœnum*, Desl. ('Mém. Soc. Linn. Norm.,' vol. vii, p. 201, pl. xi, figs. 16, 17, 18). It is most probably one of the *Mathilda*-like *Turritellæ*.[1]

Family—PSEUDOMELANIIDÆ.

"*Shell elongate, turrited, many-whorled, resembling that of the Melaniidæ; aperture oval, usually entire, seldom notched or channeled at the base; columella simple or folded anteriorly, lip thin, arcuate, slightly sinuous.*"—Fischer.[2]

I have already indicated (pp. 8 and 144) the reasons for no longer making use of the old term "*Chemnitzia*" for any of the *Melania*-like shells of the Jurassic rocks. As regards the genus, *Pseudomelania* (including Gemmellaro's sections—*Pseudomelania* as restricted, and *Rhabdoconcha*), there is no difficulty. In this we perceive a very natural group of which the Corallian species, *Pseudomelania Heddingtonensis*, may be taken as the type. The genus is also well represented in the Inferior Oolite.

Neither is there much difficulty with respect to such a shell as *Bourguetia* (*Phasianella*) *striata*. This we can readily refer with Fischer to the Pseudomelaniidæ. Then comes the question what are we to do with the numerous,

[1] Attention should here be drawn to some curious fossils lately discovered by Mr. Crick in the Upper Lias of Heyford (see Pl. xvii, fig. *x*). These resemble *Mathilda euglypha*, Laube. I would scarcely aver that the two forms are specifically identical. *M. euglypha* has a much larger habit, being at least 10 mm. in height, whilst the Heyford specimens do not average more than 3 mm. Moreover, if we can trust to the enlargement in Laube's figure, there is much more decussation of ornament in *M. euglypha*. The spiral angle is about the same, viz. 24°. Our fossil exhibits the embryonic button in an excellent state of preservation.

The specimens on which the drawings and description of this species of *Mathilda* are based have been kindly lent to me by Mr. Crick. I suggest that the species be known as Mathilda Crickii.

[2] "It would be curious to investigate from the point of view of descent whether the Pseudomelaniidæ had not furnished two parallel branches, the one marine becoming extinct in the Tertiaries, the other fluviatile and related to the existing Melaniidæ" ('Manual,' p. 697).

smooth, subturbinate shells, often rather small, which have been hitherto regarded as Phasianellas? Their intimate connection with *Bourguetia striata* has been admitted when both were classed under *Phasianella*. In fact, Fischer (Man. p. 812) says, "La plupart des prétendus *Phasianella* des terrains Jurassiques sont des *Bourguetia*." We might then rank these as a second section of *Bourguetia*, or we might make use of Gemmellaro's subgenus *Oonia*, to help us out of our difficulty. Judging from Gemmellaro's figures such shells as *Oonia turgidula*, Gemm., are scarcely to be differentiated from some of our Inferior Oolite "Phasianellas." Without in the least degree believing that this group has any connection with the Turbinidæ as the name, *Phasianella*, would imply, I have concluded to continue the use of "*Phasianella*," simply as a term borrowed from existing conchology, whilst classifying with a query under Pseudomelaniidæ.

This family is represented in the Tertiaries by *Bayania*, Mun. Chalmas, in the Cretaceous and Jurassic by *Pseudomelania*, and in the Palæozoic by *Loxonema* and *Macrochilus*. The latter seems to have had a slight fold on the columella.

Genus—Pseudomelania, Pietet and Campiche, 1862.

Shell turrited, elongated (spire pointed), not umbilicated, thick; ornaments usually confined to lines of growth; aperture oval, entire, regularly rounded in front, and terminating posteally in an angle; columella thick, and sharing in the general curvature of the mouth, always without folds.

Abridged from "Les fossiles du Terrain Crétacé des environs de Ste. Croix."

The authors further distinguished this genus from "*Chemnitzia*" by the mouth being regularly rounded in front, and by the absence of transverse (*i. e.* axial) ribs; from *Eulima* by the unpolished surface; from the Pyramidellidæ by the absence of columellar teeth; from *Niso* by the want of umbilicus. According to the authors the genus appeared in the Trias, attained its maximum in the Jurassic, and diminished in the Cretaceous, beyond which period it did not pass.

Some slight modifications of the above diagnosis may be required. Thus the earlier Pseudomelanias of our Oolitic rocks develop a tendency to nodose ornament, which they may have inherited from ancestors in the Lias, such as *Melania nodosa*, Desl. found in the Upper Lias of Fontaine Étoupe-Four. In one case also, as we shall perceive, there is a slight tendency to an anterior notch in the aperture. It may be doubted also whether the spire is much pointed in all cases.

There is great variety of form in the *Pseudomelaniæ* of the Inferior Oolite; yet, within certain limits, the group represented by *Pseudomelania procera*, Desl.,

which itself runs into *Ps. lineata*, Sow. might almost be regarded as one species. Certainly, it would save much trouble to adopt this view, as is generally done in our museums, where nearly every *Pseudomelania* from the Inferior Oolite is labelled *Chemnitzia lineata*, Sow. In singling out certain forms for specific distinction it is not maintained that these do not run into each other; according to the belief now universally accepted they must needs do so. The *lineata-procera* group may be held to embrace such extreme forms as *Ps. heterocycla* (Pl. XVIII, fig. 4) and *Ps. coarctata* (Pl. XVIII, fig. 9). In all of them the early whorls are smooth, flat, and scarcely project; presently the whorl is slightly constricted, the sutural space widens, and turriting or reversed turriting supervenes.

Accepting the specific distinctions which it seems convenient to adopt, the following species characterise the Lower Division of the Inferior Oolite, viz. *Ps. procera*, Desl. (long variety), *Ps. bicarinata*, Wright, MS., and *Ps. heterocycla*, Eug. Desl.; whilst in the Upper Division we have *Ps. lineata*, Sow., *Ps. procera*, Desl. (short variety), which is nearly the same thing as Sowerby's species, and *Ps. coarctata*, Desl.

173. Pseudomelania procera, *Deslongchamps*, 1842. Plate XVII, fig. 9, Plate XVIII, figs. 1 and 2, Plate XXI, fig. 1.

1842. Melania procera, *Desl.* Mém. Soc. Linn. Norm., vol. viii, p. 222, pl. xii, figs. 5, 6.

1882. Chemnitzia lineata, *Sow.* Hudleston, Geol. Mag., dec. 2, vol. ix, p. 241, pl. vi, figs. 1 and 2.

Bibliography, &c.—As before observed, it has been the fashion to refer most of the Pseudomelanias of the Inferior Oolite to Sowerby's species, and thus the elongate form in the Dogger was so referred by me. Subsequently I have concluded that the original *Melania lineata*[1] represents the form in the iron-shot Oolite of Dundry, which has smooth whorls with little or no turriting and scarcely any constriction.

Description [N.B.—The chief points of distinction between the members of

[1] It is probable that the name *lineata* was given by Sowerby with reference to the wavy lines of growth, which are really characteristic of the genus. Mr. Tawney ('Dundry Gasteropoda,' p. 16) believed the chief characteristic to be the lines of puncta arranged spirally, which, he says, alone perhaps enables one to distinguish it from *Ps. procera*. This structure can only be seen occasionally and under peculiar conditions of preservation, and is not of much value for differentiation, since it may be seen in almost every species of *Pseudomelania* in the Inferior Oolite, but best in those specimens where the outer shell-layer has been partly destroyed.

the *lineata-procera* group are briefly stated; the apical whorls are very similar in all]:

Spiral angle	12°—15°.
Height of whorl to width . . .	1 : 1·2.
Length variable, say	70—80 mm.

Shell moderately turrited, extremely smooth and destitute of ornament save lines of growth, but under certain conditions, exhibiting a striato-punctate structure, sutures close, whorls very slightly constricted, and raised towards the posterior border where there is a faint bevilled edge. The body-whorl is sometimes rather rugose from lines of growth.

The very peculiar and highly subulate form (Pl. XXI, fig. 1) is probably an extreme variety of *Ps. procera*. The conditions of mineralization, where the outer shell-layer is entirely gone, serve to disclose the striato-punctate structure in this specimen to a marked degree.

Relations and Distribution.—This is the narrowest and least ornamented of all the Pseudomelanias of the Inferior Oolite. The long form is characteristic of the *Murchisonæ*-zone, and is fairly abundant at Blue Wyke. It occurs also somewhat rarely in the Cotteswolds, and in the "Dew-bed" at Bradford Abbas. Immature specimens are not easy to distinguish, but the whorls are appreciably longer in proportion to their breadth than those of *Ps. lineata*, Sow.

A specimen of *Ps. procera* in the cabinet of Mr. Brodie, from the *opalinus*-zone of Buckholdt Wood, exhibits the tendency to sutural gaping in the later stage which is so characteristic of the species next to be described. The body-whorl exhibits striato-punctate structure spirally arranged.

The variety *minor* (Pl. XVII, fig. 9) is a shortened form which serves to connect with *Ps. lineata*, Sow. This variety probably would also include *Ps. acicula*, Desl. It is rare in the *Parkinsoni*-zone at Burton Bradstock.

The Dogger varieties of *Pseudomelania* are repeated in the Northampton Sand at Duston. The prevailing form is *Ps. procera*, having a tendency towards the species next described.

174. Pseudomelania bicarinata, *Wright, MS.* Plate XVIII, figs. 3 *a*, 3 *b*, 3 *c*.

Description:

Spiral angle	12°—16°.
Height of whorl to width . . .	1 : 1·2.
Length of well-grown specimen, say .	100 mm.

This is a variable shell and somewhat dimorphous. The apical whorls are

smooth and flat with close sutures, which presently begin to gape widely, when a sharp bevilled edge or keel appears at each extremity of the whorls, which undergoes a considerable amount of constriction. The lower of these sharp keels is ornamented with a variable amount of tubercles, which are well developed on the body-whorl, where they constitute a handsome carina at the commencement of the sloping base.

Relations and Distribution.—Although so different in appearance to the close-sutured, smooth, and unornamented *Ps. procera*, the connection between the two is by no means difficult to trace, whilst the affinities with the next described species are still closer. Strictly speaking it is probable that the differences are varietal rather than specific.

Pseudomelania bicarinata is abundant in the *concavus*-bed at Bradford Abbas, whence specimens were obtained by Dr. Wright. A similar but rather narrower shell, with gaping sutures and tuberculated carinæ, occurs in the *opalinus*-zone of Burton Bradstock, and possible also in the Dogger. Similar forms occur in the Gryphite grit of Stroud.

175. Pseudomelania heterocycla (*Eugène Deslongchamps*), 1863—69. Plate XVIII, figs. 4 *a*, 4 *b*, 4 *c* (variety).

1863-69. Chemnitzia heterocycla, *Eugène Deslongchamps.* Notes Paléontologiques, p. 91, pl. viii, fig. 7.

Description:

Narrow and long variety from the *concavus*-bed, Bradford Abbas:

Spiral angle	12°.
Height of whorl to width	1 : 1·2.
Length of well-grown specimen	110 mm.

Wide and short variety from Coker:

Spiral angle	18°.
Height of whorl to width	1 : 1·4.
Length	60—70 mm.

The Coker fossil resembles the figure in the "Notes paléontologiques" more than the common form from Bradford Abbas. The following is the author's description: "Shell slender, with a sharp spiral angle (his figure shows an angle of 20°), whorls numerous, the number varying with the age; smooth when young, but showing later on a keel near the suture, which ends in becoming a range of nodosities slightly marked, but more and more pronounced according as the shell advances in age."

Relations and Distribution.—The most peculiar feature of *Ps. heterocycla* is a sort of reversed turriting which arises from the overlap of each whorl by its predecessor in the adult or carinated portion of the shell. It is this character, in conjunction with the slight constriction of the whorl, which serves to distinguish it from *Ps. bicarinata*. But the two forms run into each other very much, especially in the Bradford Abbas beds, so that they might be regarded as one species. In such cases, the older name, *heterocycla*, would seem to have the preference, although possibly there might be no overlap of the whorls.

It is noteworthy that Eugène Deslongchamp's type comes from the so-called *Sowerbyi*-bed of the forest of Haye (Meurthe), and not from the "Oölithe ferrugineuse." This shows it to be a fossil of the Lower Division, which is exactly what we find on this side the channel. The Coker-beds are in the *Murchisonæ*-zone. The narrow form is extremely abundant in the *concavus*-bed at Bradford Abbas, and this same form occurs also in the Lower Trigonia grit of Leckhampton.

176. Pseudomelania, species or variety. Plate XVIII, fig. 5.

Description:

Spiral angle	22°.
Height of whorl to width	1 : 1·45.
Length	85 mm.

This form approaches *Ps. bicarinata*, but has the whorls shorter, and the sutures do not gape so much. In the shortness of the whorl and wider spiral angle it more resembles the Coker variety of *Ps. heterocycla*. The nodosities are coarser than in either species.

As a mere distinction this may be known as *Pseudomelania "robusta."* A single specimen from the *opalinus*-zone (*Moorei*-beds), Coaley Peak.

177. Pseudomelania, species or variety. Plate XVIII, fig. 6.

Description:

Spiral angle	18°.
Height of whorl to width	1 : 1·3.
Length	70 mm.

This form differs from *Ps. procera* in the wider spiral angle and somewhat

shorter whorls. Some of the specimens, such as the one figured, are apt to recall certain stages of *Ps. Heddingtonensis*.

For distinction's sake this may be known as *Pseudomelania* "*pinguis*," and regarded as a wide variety of *Ps. procera*.

178. Pseudomelania lineata, *Sowerby*, 1821. Plate XVIII, figs. 7 *a*, 7 *b*.

1821. Melania lineata, *Sowerby*. Min. Conch., pl. ccxviii, fig. 1.
1852. ? Chemnitzia lineata, *d'Orbigny*. Terr. Jur., ii, p. 43, pl. ccxxxix, figs. 4, 5.
1852. — Normaniana, *d'Orbigny*. Vol. cit., p. 40, pl. ccxxxviii, figs. 4, 5, 6.

Bibliography, &c.—There has been a twofold difficulty in dealing with *Melania lineata*. First, in ascertaining what form Sowerby really intended; and second, in discovering his reasons for the name adopted. In the footnote to *Ps. procera* this subject has been discussed. I would only further remark that Sowerby says the striæ are very fine, regular, and elegantly bent to form the lip. This shows clearly that it was to the lines of growth and not to the spiral punctate structure he was alluding.

Description:

Spiral angle	18°—20°.
Height of whorl to width . . .	1 : 1·45.
Length	50—60 mm.

Shell conical, subelongate. Whorls smooth and tumid throughout, the contraction in the upper part of the whorl being so slight as to be scarcely visible; no keel or posterior margin. The number of whorls is from nine to twelve; in many specimens both linear and spiral structure is well seen.

Relations and Distribution.—*Ps. lineata* may generally be distingished from nearly all varieties of *Ps. procera* and its more immediate allies by the small trace of turriting, and by the shortness and almost uniform tumidity of the whorls. It may be said, however, to inosculate with *Ps. procera*, through the var. *minor*, of which *Ps. Normanniana*, d'Orb., may be regarded as a still smaller variety.

The type is from the ironshot Oolite of Dundry, which is believed to be in the *Humphriesianus*-zone, where the form is not uncommon. This species also occurs in the *Humphriesianus*-zone at Oborne, and a smaller variety almost identical with *Ps. Normanniana* is rather abundant in the *Parkinsoni*-zone of Burton Bradstock. Colour-bands and blotches are seen in some of the specimens, but this feature is less common than in Normandy.

179. Pseudomelaria coarctata, *Deslongchamps*, 1842. Plate XVIII, figs. 9 *a*, 9 *b*, 9 *c*, and varieties Plate XIX, figs. 1 *a*, 1 *b*.

1842. Melania coarctata, *Deslongchamps*. Mém. Soc. Linn. Norm., vol. vii, p. 226, pl. xii, figs. 11 and 12.
1842. — turris, *Deslongchamps*. Vol. cit., p. 224, pl. xii, fig. 8.
1852. Chemnitzia coarctata, *d'Orbigny*. Terr. Jur., ii, p. 45, pl. ccxl, figs. 1, 2, 3.

Bibliography, &c.—Irrespective of their gorgeous colouring Deslongchamps' figures of this fine species seem to give a better idea of its form than those of d'Orbigny, though it is generally admitted that there is no necessity for maintaining a distinction between *Melania coarctata* and *Melania turris*. In Dorsetshire there is no difficulty in dealing with the species, but further north the specimens are found in worse condition, and the evidences are less clear.

Description:

Spiral angle	18°—20°.
Height of whorl to width . . .	1 : 1·45.
Length	70—100 mm.

Shell strongly turrited in the adult whorls, but having the subapical whorls without any salience. The young form can scarcely be distinguished from *Ps. lineata;* there is a difference in the colour-bands of individual specimens, but no evidence that this is a constant feature. But specimens such as fig. 9 *c* already begin to show a sudden increase of the body-whorls. After this stage is reached the sudden increase of the whorls is maintained throughout, but differs considerably in degree. The posterior portion of each whorl is provided with a bevilled edge terminating in a carina, below which there is a constriction of the whorls; the anterior portion of the whorl is without any raised edge. Flexuous colour-bands, more or less parallel to the axis, are seen in some specimens, and appear to be more characteristic of *Ps. coarctata* than of any other species. Specimens from the *Cadomensis*-bed, Oborne, show this feature well, as also the fine cross-hatching produced by spiral lineation decussating with the fine lines of growth.

Varieties.—Pl. XIX, fig. 1 *a*, represents a specimen from the *Humphriesianus*-zone at Oborne, where a slight rise is observable in the anterior portion of the whorl, whilst the posterior keel is less prominent, and the sutural sulcus better defined. This is a variety of *Ps. coarctata*, slightly in the direction of *Ps. Lonsdalei*, Morris and Lycett.

Pl. XIX, fig. 1 *b*, represents a specimen from the *clypeus*-grit of Nailsworth Hill in which there is a still further change in the direction of *Ps. Lonsdalei*. But this form differs from all others related to *Ps. coarctata* in the relative length of the whorls, and also apparently in the greater width of the flexuous lines. Too much importance should not be attached to the latter feature in a corroded specimen.

Distribution.—The typical form is nowhere abundant in England, being almost exclusively confined to the *Humphriesianus*-zone. The best and most numerous specimens are from the *Cadomensis*-bed at Oborne.

180. Pseudomelania Lonsdalei, *Morris* and *Lycett*, 1851. Plate XIX, fig. 2.

1851.	Chemnitzia Lonsdalei, *Morris and Lycett*.	Great Ool. Moll., p. 49, pl. vii, fig. 13.
1851 ?	— Scarburgensis, *Morris and Lycett*.	Op. cit., p. 115, pl. xv, fig. 8.
1882.	— lineata-procera, var. Scarburgensis, *Hudleston*.	Geol. Mag., dec. 2, vol. ix, p. 243, pl. vi, fig. 4.

The essential difference between *Ps. Lonsdalei* and *Ps. coarctata* consists in the softening of the posterior bevilled edge, and the development of a well-defined median sulcus in the whorls, which has the effect of dividing the whorls into a posterior and anterior area, the latter being slightly the larger. These conditions are perfectly fulfilled in the specimen (Pl. XIX, fig. 2) from the Scarborough Limestone of Pickering Cliff in Cloughton Wyke. It is precisely like specimens from the Great Oolite of Minchinhampton. (N.B. The median sulcus is not shown sufficiently well in the figure.) The following are the dimensions : Spiral angle, 16°; height of whorl to width, 1 : 1·4 ; length, 85 mm.

As *Chemnitzia Scarburgensis* is founded on a cast from the same horizon and locality, the specimen is very likely to have been a cast of this species. A fine specimen from the same place was figured and described by me as *Chemnitzia lineata-procera*, var. *Scarburgensis*. This was certainly "lumping." The figure is now reproduced (Pl. XIX, fig. 3). It differs from *Ps. Lonsdalei*, found in the same place, and might pass for a very narrow variety of *Ps. coarctata*.

181. Pseudomelania simplex, *Morris* and *Lycett*, 1851. Plate XIX, fig. 4.

1851. Chemnitzia simplex, *Morris and Lycett.* Great Ool. Moll., p. 49, pl. vii, fig. 15.

Bibliography, &c.—The authors observe "that the fine example figured is from the hard weatherstone of Bisley Common," *i. e.* presumably from the Great Oolite. Yet in the Jermyn Street Museum, where Morris and Lycett's types are kept, there is no specimen from the Great Oolite, although there is one large specimen placed with the Inferior Oolite Collection. At present, therefore, I am without any direct evidence that *Ps. simplex* occurs in the Great Oolite.

Description.—Since nearly all the specimens seen by me have suffered from compression, no dimensions are given. Large specimens attain a length of nearly 200 mm. The shell is turrited in the anterior whorls; the whorls are smooth, and, except those near the apex, are convex, almost globose, with deeply impressed sutures; aperture oval and oblique, with a considerable columellar callus.

Relations and Distribution.—The considerable convexity of the anterior whorls seems to separate this species from all varieties of the *lineata-procera* group. The aperture also is more oval, showing less of the posterior angle. It is rarely found except as a megalomorph, and is by no means uncommon in the Oolite Marl at Notgrove Station. The exact locality of the specimen figured is unknown, but it is possibly from the Upper Pisolite of the Nailsworth district.

A fragment of a *Pseudomelania* from the "Oolite Marl," Nailsworth, is figured (Pl. XIX, fig. 16). Spiral angle, 25°; height of body-whorl to entire shell, 45 : 100; length, 16 mm. The whorls are elongate, being nearly as wide as high, smooth, convex, clearly separated by a suture, which has no canaliculation or ledge. Body-whorl slightly ventricose, aperture ovate-elongate. This might possibly represent an immature stage of *Ps. simplex*, but is more likely to belong to the "Eulimoid" group of *Pseudomelania*.

182. Pseudomelania lævigata, *Morris* and *Lycett*, 1851. Plate XXI, fig. 6.

1851. Eulima lævigata, *Morris and Lycett.* Great Ool. Moll., p. 114, pl. xv, fig. 4.

1882. — — — Hudleston, Geol. Mag., dec. 2, vol. ix, p. 245, pl. vi, figs. 7 and ? 8.

cf. also 1863. Eulima ? lævigata, *Lyc.* Suppl., p. 13, pl. xxxi, fig. 3.

Bibliography, &c.—Very little of a satisfactory nature can be made out with regard to these quondam "Eulimas" of the Yorkshire Beds. It seems reasonable to regard the Jurassic "*Eulimæ*" as constituting a group of small *Pseudomelaniæ*. The group is more characteristic of the Great Oolite.

When we come to deal with the so-called "*Eulima*" *lævigata* of the Scarborough Limestone, the difficulty is further increased by the divergence between the authors' description and their figure. According to the text the shell is very subulate, the length of the whorls being nearly equal to their transverse diameter. But the figure shows a shell with very short whorls, whose breadth is nearly twice their height. On the whole the figure is more reliable than the text, and more in accordance with the few specimens available. The following description is based upon two specimens from the Scarborough Limestone, one of which is said to be the type.

Description :

Spiral angle	22°.
Height of whorl to width (mean)	1 : 1·8.
Length	14—15 mm.

Shell conical-elongate, scarcely turrited. Whorls 10—12, narrow, smooth, yet showing fine spiral and axial lines where well-preserved, convex. Sutures distinct, but without canaliculation.

Body-whorl rather short, base rounded and smooth. Aperture subovate and slightly expanded anteriorly.

Relations and Distribution.—Since the "subulate" character of this species cannot be maintained, it is not very easy to say in what respect it differs from "*Eulima*" *communis*, Morris and Lycett. Rare in the Scarborough Limestone. A single specimen from the Dogger presents somewhat similar features.

183. Pseudomelania Astonensis, sp. nov. Plate XVIII, figs. 8 *a*, 8 *b*.

Description :

Spiral angle	18°.
Height of whorl to width	1 : 1·45.
Length (full)	20—25 mm.

Shell conical-elongate, scarcely turrited, smooth, spiral angle rather obtuse towards the apex. Number of whorls about sixteen, but often less. The whorls are extremely flat, and fit up close to the suture, so that there is no sulcus. The width of a whorl is equal to its height plus the height of the preceding one;

broad lines of growth, and markings suggestive of colour bands are seen on some specimens.

Body-whorl well within the spiral angle, and entirely without keel; base rounded off; aperture ovate-elongate with a slight posterior angle, rather flattened anteriorly and sometimes exhibiting a small notch or spout.

Relations and Distribution.—As this species is not strictly holostomatous it scarcely comes within the diagnosis of *Pseudomelania*, unless we extend that diagnosis a little. The casts and section prove conclusively that it is not a *Nerinæa*. In its small habit of growth and in other respects this species resembles "*Eulima*" *communis*, Morr. and Lyc. said to be the most common univalve of the Great Oolite. The authors make no mention of the anterior notch in "*Eulima*" *communis*; but there are specimens in my collection from the Great Oolite, not otherwise to be distinguished from *E. communis*, which show the anterior notch distinctly. But the whorls, and especially the body-whorl, are more globose in "*Eulima*" *communis* than in our species.

Cf. *Pseudomelania Laubei*, Cossmann ('Ét. Bath.,' p. 176, pl. xv, fig. 47). No mention is made of an anterior notch in Mons. Cossmann's species, but the figure seems to imply that there might be one. It is probable that the quondam "Eulimas" might constitute a section of *Pseudomelania*.

Ps. Astonensis is rather abundant in the *Parkinsoni*-zone of Aston and Notgrove. A similar form, but smaller, has been found in the Lincolnshire Limestone.

184. Pseudomelania Burtonensis, sp. nov. Plate XIX, fig. 5.

Description:

Spiral angle	30°.
Height of whorl to width . . .	1 : 2·5.
Length	7 mm.

Shell short, conical, scarcely turrited. Number of whorls about nine, short, the width equalling the height plus that of the two preceding whorls. The apex is blunt, and the succeeding whorl is globose and smooth; the succeeding three whorls are marked by stout costulæ, slightly oblique to the axis; the remaining whorls of the spire are smooth and full.

Body-whorl smooth and full, but not ventricose; it occupies between one third and one half the height of the shell. Aperture ovate to suborbicular, rather flattened in front, where there is an extremely faint trace of a notch.

Relations and Distribution.—The apical costulæ remind us of a similar feature

in *Ps. Nerei*, d'Orb ('Terr. Jur.,' ii, p. 50, pl. ccxlii, figs. 5, 6, 7), but in other respects our shell has no resemblance to the fossil of Marquise. This form, again, in the shortness of its spire scarcely comes within the diagnosis of *Pseudomelania*. Five specimens from the *Parkinsoni*-zone of Burton Bradstock are in my collection.

Genus—CLOUGHTONIA, Hudleston, 1882.

Shell short, conical, solid. Whorls about five, flat, angular, and disposed in steps. Suture often canaliculated. Body-whorl more or less bicarinated. Surface smooth, or ornamented with rugose lines of growth. Aperture ovate to ovate-oblong, rounded anteriorly, angular behind. Pillar nearly straight, and with but little callus.

This genus was constituted in order to receive a peculiar group of shells, of which *Cloughtonia cincta*, Phil., may be taken as the type. It is difficult to distinguish from certain Naticas, but the real affinities of *Cloughtonia* are with *Pseudomelania*. *Melania abbreviata*, Römer, which occurs in the Corallian of Bradley near Oxford, may probably be referred to this genus. There are also two forms occurring in the Portlandian of Bucks and the Vale of Wardour, described by me provisionally under *Pseudomelania* ('Geol. Mag.,' September, 1881, p. 389), which belong to *Cloughtonia*.

In 1878 Gemmellaro ('Faune Giuresi,' &c., p. 252) described *Microschiza* as a sub-genus of *Chemnitzia*. This appears to differ but little from *Cloughtonia*, which, therefore, would be merely a synonym of *Microschiza*. Provisionally it may be safer to retain *Cloughtonia* for our English fossils.

185. CLOUGHTONIA CINCTA, *Phillips*, 1829. Plate XIX, figs. 7 *a*, 7 *b*.

1829 and 1835. PHASIANELLA CINCTA, *Phillips*. Geol. Yorks., pt. 1, p. 123, pl. ix, fig. 29.
1851. NATICA (EUSPIRA) ? CINCTA, *Phil.* Morris and Lycett, Great Ool. Moll., p. 113, pl. xv, fig. 20.[1]
1882. CLOUGHTONIA CINCTA, *Phil.* Hudleston, Geol. Mag., dec. 2, vol. ix, p. 203, pl. v, fig. 14.

[1] This figure is so extremely unlike the one by Phillips that it can hardly represent the type, as stated by Morris and Lycett. Nevertheless Morris and Lycett's figure is a faithful representation of the specimen in the York Museum. In some respects this reminds me of *Euspira subcoronata*, see *postea*, p. 270.

Bibliography, &c.—The figures by Phillips and by Morris and Lycett, though supposed to represent the same specimen, are very unlike. The specimen from the Leckenby Collection figured in the 'Geological Magazine' is in a more satisfactory condition, and affords a better notion of the species. One of those figured in the present work, though small, has the mouth very well preserved.

Description :

Spiral angle	45°—55°.
Height of body-whorl to entire shell .	60 : 100.
Length	20—30 mm.

Shell stumpy, and in the majority of cases without any trace of umbilical slit; angle of spire regular, apex probably sharp. Number of whorls from five to six, flat, angular, and step-like, with the posterior margins projecting; suture slightly channeled. Body-whorl strongly bicarinated, the keel near the suture being obtuse, the anterior keel sharp and prominent, the space between the keels slightly constricted, aperture oval and well rounded in front.

The available specimens present no trace of ornament. Specimens from the Lincolnshire Limestone have a narrower spiral angle, are less canaliculate, and the anterior keel of the body whorl is usually less sharp.

Relations and Distribution.—*Cloughtonia cincta* seems to stand alone in our Inferior Oolite. It may possibly be represented in France by *Chemnitzia curta*, d'Orb. ('Terr. Jur. ii,' p. 44, pl. ccxxxix, figs. 6, 7).

It occurs in all three zones of the Inferior Oolite on the Yorkshire Coast, but is most abundant in the Scarborough Limestone. It has also been found on the same horizon in the Castle Howard district. A few specimens are found in the Lincolnshire Limestone at Weldon and Ponton, but none have hitherto been discovered either in the Cotteswolds or in Dorsetshire.

Genus—Bourguetia, *Deshayes in Terquem*, 1871.

"*Shell large, conical-turrited; spire long, sharp; whorls convex, ornamented with spiral striæ; last whorl ventricose; aperture entire, oval, angular behind, round and enlarged in front; lip simple, sharp.*"—Fischer.

The 1st section of *Bourguetia* may be said to consist of one variable and wide ranging species, which extends from the Inferior Oolite to the Corallian.

186. Bourguetia striata, *Sowerby*, 1814. Plate XIX, figs. 8, 9.

1814. Melania striata, *Sowerby*. Min. Conch., p. 101, pl. xlvii.
1851. Phasianella striata, *Sowerby*. Morris and Lycett, Great Ool. Moll., p. 118, pl. xv, fig. 19.
1852. — — *d'Orbigny*. Terr. Jur., ii, p. 322, pl. cccxxiv, fig. 15, and pl. cccxxv, fig. 1.
1858. — Sæmanni, *Oppel*. Juraformation, p. 387.
1871. Bourguetia striata, *Sowerby*. Terquem and Jourdy, Bath. Moselle, p. 51, pl. ii, figs. 21, 22, 23.
1884. "Phasianella" striata, *Sowerby*. Hudleston, Geol. Mag., dec. 3, vol. i, p. 49.

Bibliography, &c.—It is not a little significant of the vertical range of this species, that the type figure is compounded of two parts, the upper portion from a specimen found at Lymington [1] in Somersetshire, the lower from the Coral Rag of Goatacre.

MM. Terquem and Jourdy, perceiving the objections to placing Sowerby's species under any of the genera to which it had been referred, adopted Deshayes MS. name. On the whole they were disposed to regard the new genus as being more nearly allied to *Natica* than to *Melania*. Fischer has no difficulty in referring *B. striata* to the Pseudomelaniidæ.

Description.—The spiral angle may be taken at from 35°—40°, but with considerable variation either way. Extreme length nearly 200 mm., the shell being about two and a half times as long as wide. In some specimens the spiral angle is regular (fig. 8), in others convex and giving a pupoid appearance (fig. 9). Shell substance thin. Whorls nine or ten, tumid, with a deeply impressed suture, spirally striated; the striæ rather unequally distributed, the most deeply impressed and the widest apart being anterior.

The body-whorl is somewhat less than half the height of the entire shell, ventricose, with rounded base. The spiral striæ or grooves are continued throughout the base, being much deeper and wider apart anteriorly.

Varieties are numerous. The figures represent two medium-sized specimens from the *Murchisonæ*-zone of North Dorset. These may be said to constitute a good local variety, if not a distinct species; the striæ are numerous and the whorls, especially in the pupoid form, very convex. This I propose to call var.

[1] With reference to this place Mr. H. B. Woodward writes as follows:—"Lymington is one mile east of Ilchester on Lower Lias Clay, with here and there small patches of *river gravel* brought down by the River Yeo. I have seen and mapped some of these gravels, and know they contain much *Oolitic* material. Tributaries even now rise at the base of Corallian rocks; so you have at any rate choice of Inferior Oolite or Corallian for the Lymington specimen."

multistriata. These distinctions differentiate the North Dorset fossils more from the typical forms than any characters ascribed by Oppel to his *Ph. Sæmanni*.

The most typical forms, and those most easily matched by Corallian specimens occur in the well known beds on Cleeve Hill. Yorkshire specimens from White Nab, to judge by the figure of Morris and Lycett, are similar to these, but perhaps with fewer striæ. In all the localities (both Inferior Oolite and Corallian) there seems to be a broad and narrow variety side by side.

Relations and Distribution.—This variable species almost constitutes a genus in itself, but the varieties for the most part repeat themselves on the several horizons.

The var. *multistriata* occurs sparingly in the *Murchisonæ*-zone of Bradford Abbas. The more ordinary forms occur in the Pea-grit of the Cotteswolds. The beds on Cleeve Hill, though higher, still belong to the Lower Division, and not to the *Humphriesianus*-zone. The Scarborough Limestone of White Nab, however, contains the Ammonites of this zone. Small specimens of *Bourguetia striata*, much defaced, occur in the Lincolnshire Limestone at Weldon.

"*Phasianella*" *costata*, Witchell ('Proc. Cottes. Nat. Fld. Club,' 1879—80, p. 127, pl iv, fig. 1), from the *Clypeus*-grit of Rodborough Hill is probably another variety.

Bourguetia, Section 2, the conventional Phasianella.

Shell medium-sized to small, oval, conical-turrited, usually few-whorled, solid. Whorls smooth, usually convex, and for the most part devoid of ornament, save faint traces of lines of growth, suture simple. Body-whorl large and sometimes ventricose. Aperture oval, rounded in front, and scarcely angled posteriorly; outer lip curved and full.

The above diagnosis embraces what seems a natural group. It has been suggested that, out of the numerous forms in the Jurassics which have been referred to *Phasianella*, all may not belong to the same genus. This argument will scarcely apply to the group figured on Pl. XIX. These shells must hang together, whatever be the name or systematic position of the genus to which they are assigned.

It has already been stated that the genus *Oonia*, Gemmellaro, appears to fulfil the required conditions. But, although some of that author's figures greatly resemble our Phasianellas, there are considerations which preclude our accepting the name *Oonia* for the group now under consideration. The diagnosis of *Oonia* is somewhat meagre, but the striæ of growth are stated to be sinuous, and it is regarded as a section or subgenus of *Pseudomelania*. The sinuous growth-

lines so characteristic of *Pseudomelania* are absent in these very smooth shells, which also in other respects differ from *Pseudomelania* rather too much to be regarded merely as a section. Similarly there is great outward resemblance in some of the Jurassic Phasianellas to *Ph. australis*, but the large calcareous operculum of *Phasianella* has never been discovered in connection with any of these Jurassic fossils. Hence we hesitate to class them with the Turbinidæ.

If *Bourguetia striata* is really one of the Pseudomelaniidæ, it would seem to carry the second section along with it. Whilst retaining the name "*Phasianella*" for conventional purposes, we may regard the group as most probably belonging to the Pseudomelaniidæ. In the Inferior Oolite the Phasianellas of this section seldom attain to any size, and are somewhat rare except at certain localities in the Lincolnshire Limestone, where they appear to replace the Naticas. To a considerable extent these Lincolnshire Limestone fossils are micromorphs of those occurring in the Great Oolite, but the forms so referred are not precisely similar, though these names are adopted in preference to our giving others. In the Inferior Oolite of the Cotteswolds "*Phasianella*" would seem to be extremely rare.[1] In Dorsetshire it is sparingly represented by a very few forms, which are smaller than those of the Lincolnshire Limestone.

187. "PHASIANELLA" LATIUSCULA, *Morris and Lycett*, 1851. Plate XIX, figs. 10 *a*, 10 *b*.

1851.	PHASIANELLA LATIUSCULA,	*Morris and Lycett.*		Great Ool. Moll., p. 117, pl. xv, fig. 16.
1884.	—	—	—	Hudleston, Geol. Mag., dec. 3, vol. i, p. 50.

Bibliography, &c.—This species was founded on a cast from the Scarborough Limestone, and the authors admit that their remarks were made with a certain degree of reservation. In 1884, no specimens, except the one in the York Museum, being available, I was unwilling to accept *Ph. latiuscula* as a species. There are, however, a certain number of forms, occurring chiefly in the upper beds of the Lincolnshire Limestone, which seem to tally fairly with Morris and Lycett's figure and also with the specimen labelled *Ph. latiuscula* in the York Museum.

Description:

Spiral angle	50°—55°.
Height of body-whorl to entire shell .	60 : 100.
Length of well-grown specimens .	25—28 mm.

[1] Lycett, in the 1st vol. of 'Proc. Cottes. Nat. Club,' p. 79, refers to *Ph. turbiniformis* and *Ph. subangulata*. There is no evidence as to what these are.

Shell subelongate, ovate, turrited. Number of whorls in the larger and more typical form six to seven; the width equals the height plus the height of the two preceding whorls; whorls very convex, smooth and slightly flattened at the shoulders. Body-whorl about three-fifths of the entire length, ventricose, base rounded. Aperture ovate (length to width as $1\frac{1}{2}$: 1 nearly), and almost equally rounded at either extremity.

Varieties.—The small form (fig. 10 *b*) seems to represent this species in the Bradford Abbas beds. It is somewhat wider-angled, and the body-whorl more ventricose, and in most specimens the whorls are rather more flattened at the shoulder than is usual with "*Phasianellæ*." The aperture is perfectly oval and some specimens show a considerable umbilical fissure.

Another micromorph (fig. 14 *b*) occasionally met with in the Dorsetshire Beds, combines so many characters that it seems to be related to more than one named form. It is rather more ventricose in the body-whorl than *Ph. elegans*, but approaches that species.

Relations and Distribution.—*Ph. latiuscula* may be taken to represent a sort of average form of the Jurassic "*Phasianellæ*," characterised by a body-whorl more ventricose than in *Ph. elegans*, less so than in *Ph. tumidula*.

It is fairly abundant in the upper beds of the Lincolnshire Limestone, especially at Weldon, but would seem to be rare in the Scarborough Limestone.

188. "Phasianella" elegans, *Morris and Lycett*, 1851. Plate XIX, figs. 11 *a*, 11 *b*, and fig. 12.

1851. Phasianella elegans, *Morris and Lycett*. Great Ool. Moll., p. 74, pl. xi, fig. 27.

Description of the Lincolnshire Limestone variety:

Spiral angle	40°—44°.
Height of body-whorl to entire shell .	52 : 100.
Length about	25 mm.

Shell conical, ovate, turrited. Number of whorls from eight to nine in full-grown specimens, often fewer; these are smooth, convex, and moderately short. Body-whorl scarcely longer than the spire, but slightly ventricose; base rounded. Aperture as in the preceding.

Relations and Distribution.—Differs from *Ph. latiuscula* in having a narrower spire, and a body-whorl relatively shorter and less ventricose. Specimens from the Great Oolite are much larger, but their proportions are nearly the same.

Ph. elegans is not quoted by Morris and Lycett ('Quart. Journ. Geol. Soc.,' vol. ix, p. 326) as occurring in the "Upper Shelly Beds" at Ponton, but one sees

the name in collections from the Lincolnshire Limestone generally. The small variety, as above described, is fairly abundant in the Lincolnshire Limestone at Weldon, and there are also forms which seem to connect it with the preceding, such as fig. 11 *a*. This particular specimen happens to display striato-punctate structure, reticulating with lines of growth, reminding us of *Littorina punctura*, Bean.

189. "PHASIANELLA" PONTONIS, *Lycett*, 1853. Plate XIX, fig. 13.

1853. PHASIANELLA PONTONIS, *Lycett*. Quart. Journ. Geol. Soc., vol. ix, p. 342, pl. xiv, fig. 9.
cf. 1851. — PARVULA, *Morris and Lycett*. Great Ool. Moll., p. 75, pl. xi, fig. 9.

The following is the author's description: "Shell with the whorls (six) convex; spire elevated, apex acute, the last whorl very large and ventricose, aperture oblique, base narrow." It differs but little from *P. parvula*. The whorls in some specimens, such as the one figured (fig. 13), are rather less convex. Occurs in the Lincolnshire Limestone at Ponton, and perhaps also at Barnack and Weldon, and is probably only a local form.

190. "PHASIANELLA" LEYMERIEI, *d'Archiac*, 1843, var. LINDONENSIS. Plate XXI, fig. 5.

1843. PHASIANELLA LEYMERIEI, *d'Archiac*. Mém. Soc. Geol., France, vol. v, pt. 2, p. 380, pl. xxviii, fig. 12.
1851. — — — Morris and Lycett, Gt. Ool. Moll., p. 74, pl. xi, figs. 31, 32.
1852. — — — d'Orbigny, Terr. Jur. 2, p. 320, pl. cccxxiv, figs. 5—7.

Bibliography, &c.—The small shell of Eparcy (10 mm.) originally described by d'Archiac has relationships in the Inferior Oolite as well as in the Great Oolite of this country. The specimens from Minchinhampton, referred by Morris and Lycett to d'Archiac's species, are very much larger, and as a rule have a slightly higher spire and more tumid whorls than the type.

Description of the variety *Lindonensis*:

Spiral angle	55°.
Height of body-whorl to entire shell . .	65 : 100.
Length of figured specimen . . .	21 mm.

Shell short, conical, umbilical fissure scarcely traceable; apex sharp. Number

of whorls in well-developed specimens from six to seven; whorls short, almost flat, and with very little sutural impression. The body-whorl is sub-tumid, and constitutes about two-thirds of the whole length. Aperture oval, the longer diameter being about twice the shorter diameter. Fine spiral striæ (similar to those on *Bourguetia striata*) may be noted on well-preserved specimens.

Relations and Distribution.—This form differs from the type chiefly in its relatively longer spire and in its larger habit of growth. In the flatness of the whorls and in the extremely conical outline of the shell it more nearly resembles d'Archiac's species than do the Minchinhampton specimens.

Occurs rather abundantly at Lincoln in the so-called "Bastard-bed" at the base of the Lincolnshire Limestone, where that series reposes on the Northampton Sand. The majority of the specimens are smaller than the one figured.

Phasianella Leymeriei, d'Arch., is quoted by Morris, Lincolnshire Oolites ('Quart. Journ. Geol. Soc.,' ix, 326), as occurring in the Upper Shelly Beds at Ponton.

191. "PHASIANELLA" CONOIDEA, sp. nov. Plate XIX, fig. 14 *a*.

Description:

Spiral angle	50°.
Height of body-whorl to entire shell . .	60 : 100.
Length of figured specimen . . .	20 mm.

Shell stumpy, conical, solid. Whorls about six, smooth, sub-convex, and but slightly separated by the suture. The apex is sharp and the whorls increase under a regular angle. The body-whorl is large but not ventricose, and its height is only a little more than half the height of the entire shell. Aperture roundly oval.

Relations and Distribution.—An apology is almost needed when one ventures to make a new species of "*Phasianella*." This form differs from the preceding in the increased relative height of the spire, which is so marked that we could scarcely place it under *Ph. Leymeriei*, even as a variety. The aperture also is much shorter and the body-whorl is more stumpy. It is more regularly conical than *Ph. latiuscula*, towards which it has affinities in the opposite direction.

Rare in the Scarborough Limestone. A similar form in the Dogger has rather a wider spiral angle.

192. "PHASIANELLA" cf. SUBUMBILICATA, *D'Archiac*, 1843. Plate XIX, fig. 15.

1843. NATICA SUBUMBILICATA, *d'Archiac*. Mém. Soc. Géol. France, vol. v, p. 378, pl. xxviii, fig. 11.
1852. PHASIANELLA — *d'Orbigny*. Terr. Jur., ii, p. 321, pl. cccxxiv, figs. 8—10.
1884. — — *d'Archiac*, sp. Cossmann, Ét. Bath., p. 254.

Description of the specimen :

Spiral angle	60°.
Height of body-whorl to entire shell	65 : 100.
Length	14 mm.

Shell short, ovate, slightly turrited. Whorls five or six, smooth, narrow, tumid, and slightly disposed in steps. Body-whorl very large and rounded, but not exceeding the limits of the spiral angle. Aperture subcircular to oval; indications of an umbilical groove.

Relations and Distribution.—This form is first cousin to *Natica subumbilicata*, D'Archiac, from which it differs in its larger habit of growth, in the greater height of the spire, and in its less globose outline. It belongs to a section of "Phasianella" which has a general resemblance to the Jurassic Naticas. A single specimen from the Lincolnshire Limestone, Weldon.

193. "PHASIANELLA," species or variety. Plate XIX, fig. 17.

Description of the specimen :

Spiral angle	55°.
Height of body-whorl to entire shell	70 : 100.
Length	5 mm.

This micromorph, of which only a single specimen is in my possession from the Lincolnshire Limestone of Weldon, presents characters not dissimilar to those of *Ph. Leymeriei*, D'Archiac, and it also has some resemblance to the larger species, *Ph. nuciformis*, Morris and Lycett.

Family—NATICIDÆ.

"*Shell turbinate or ear-shaped; aperture entire, columella thickened or callous; lip thin* . . . ."—FISCHER.

There are a considerable number of shells in the Jurassic rocks which may safely be referred to the Naticidæ. Their generic grouping, however, is not quite

so obvious. D'Orbigny had no difficulty in referring them all to the genus *Natica*. Whether there were traces of an umbilicus or not, whether the whorls were square-shouldered or round-shouldered, these differences were not accounted as of generic importance. Seeing, however, that the genus thus constituted would include very divergent forms, he divided it into four groups, of which the fourth group, viz. the *Prælongæ*, is characterised by the length of the shell exceeding the width. To this by far the larger portion of his Jurassic *Naticæ* were assigned.

Genus—Natica, Adanson, 1757; as defined by D'Orbigny, 1852.

"*Shell globular, thick, varying from the depressed to the elongated form. Spire usually short. Mouth oval or semilunar, modified by the winding of the spire . . . Umbilical region very variable, simple or compound, open or closed by callosities.*"

Morris and Lycett, in dealing with the Naticidæ of the Great Oolite, classed the round-shouldered forms for the most part under *Natica*, and the square-shouldered forms under a sub-genus—*Euspira* (Ag.). The following is their diagnosis:

Sub-genus—Euspira, Agassiz, 1837, as defined by Morris and Lycett, 1851.

"*Shell smooth, ovate; spire elevated; of few whorls which are angulated, the angles sometimes taking the form of a carina*[1] . . . . *aperture entire, elliptical, modified by the angle of the whorl; base wide, rounded; pillar-lip smooth and excavated, outer lip thin and smooth.*"

Mons. Cossmann, in his 'Contribution to the Fauna of the Bathonian in France," like d'Orbigny, minimises the difference between the round-shouldered and the square-shouldered Naticidæ, but groups the whole under the genus *Ampullina*, Lamarck. This is divided by Dr. Fischer ('Manual,' p. 766) into sections and sub-genera, one of the latter being *Euspira*, which he thus describes:—"*Whorls swollen or canaliculate at the suture; spire sometimes elevated, umbilical fissure but little indicated or concealed.*"

There can be no doubt that most of the Naticidæ of our Inferior Oolite might be classed under *Euspira;* but then we are met by this difficulty, that some of Lycett's species, such as *Euspira canaliculata*, were classed by that author under *Euspira*, whilst others, such as *Natica Oppelensis*, were classed under *Natica*. And yet no shells can have a better title to be regarded as *Euspira* than *Natica Oppelensis*, *Natica adducta*, *Natica Lorieri*, &c. Moreover, the only species of *Natica* known to me in the Lias of this country, viz., *Natica Pelops*, D'Orb. (*N. buccinoides*, Y. & B., *fide* Tate) must come under this designation. In the

[1] The portion of the diagnosis framed for the admission of "*Euspira*" *coronata* is omitted.

Great Oolite, on the other hand, the round-shouldered forms show some increase, so that the Euspiroid forms have not so full a possession of the field as is the case in the Inferior Oolite; though such species as *Euspira Sharpei* and *Euspira pyramidata* are very pronounced.

The following diagnosis will comprehend all the Naticidæ of the Inferior Oolite with the exception of one rare species. These species are nowhere abundant, save *Natica Bajocensis* locally, and with one notable exception they are of medium size.

Genus—NATICA; Section A.—Euspiroid or sub-Euspiroid.

Shell globular, or sub-globular, thick; spire short or elevated, always in steps; whorls more or less flattened posteriorly and mostly canaliculate. Columella thick and moderately encrusted, outer lip thin. Sometimes a narrow umbilical fissure. Aperture oval or semilunar, the longer axis ranging from half to three-quarters the total length of the shell. Spiral lines, rather wide apart, may sometimes be traced.

In this division there are forms (sub-Euspiroid) such as *Natica globata*, *Natica Dundriensis*, *Natica Hulliana*, and even *Natica cincta*, where the slope or modification of the sutural ledge (méplat) approaches the round-shouldered species. Hence the difficulty of drawing the line.

In the Lower Division of the Inferior Oolite and generally rather low down is a group of medium-sized shells, of which *Natica adducta* may be taken as the type. This group comprises *Natica adducta*, with *N. Oppelensis* and *N. globata* as varieties, and *Natica Lorieri*, with *N. proxima* and *N. canina* as varieties.

194. NATICA ADDUCTA, Phillips, 1829. Type form, Plate XX, fig. 3.

1829 and 1835.	NATICA ADDUCTA,	*Phil.*		Geol. Yorks., pt. 1, pl. ix, fig. 30.
1851.	—	—	—	Morris and Lycett, Great Ool. Moll., p. 112, pl. xv, fig. 17.
1852.	—	—	—	d'Orbigny, Terr. Jur., ii, p. 189, pl. cclxxxix, figs. 4, 5.
1882.	—	—	—	Hudleston, Geol. Mag., dec. 2, vol. ix, p. 199, pl. v, fig. 6.

Bibliography, &c.—The history of this wide-spread if not very common species has been slightly complicated owing to Phillips having given two different figures of *Natica adducta*, viz. pl. ix, fig. 30, and pl. xi, fig. 35. The former

was from the Scarborough Limestone, the latter from the Dogger. Since Morris and Lycett refigure the specimen from the Scarborough Limestone as the type, we may so regard it. This form is not rare in all three zones of the Inferior Oolite in Yorkshire, being most abundant in the Dogger.

Description:

Spiral angle . . .	90°—92°.
Height of body-whorl to entire shell	70 : 100.
Length about . . .	25 mm.

Shell longer than wide (5 : 4), oval, apex sharp. Whorls (6 or 7) smooth, convex, and narrow, the width of the penultimate being nearly twice the height of the spire. Upper part of each whorl flattened and moderately canaliculate. Body-whorl relatively large, angular, scarcely tumid, in some specimens marked by fine curved lines of growth.

Aperture widely oval, and with the columella slightly encrusted; rarely indications of an umbilical fissure.

Relations and Distribution.—The above description may be taken as typical of the whole group to a certain extent; hence it will be sufficient to show in what way the other named forms differ from this one. Since it seldom happens that the angles of the whorls are so well preserved as in the figured specimen, the Euspiroid character of *Natica adducta* is not always recognised, the more so as the ledge is rather narrow.

Besides its occurrence in all three horizons of the Inferior Oolite on the Yorkshire coast, I have typical specimens of *Natica adducta* from the lower part of the Lincolnshire Limestone in Mid-Lincolnshire, and again from the Pea-grit and Oolite Marl of the Cotteswolds. Mr. Witchell quotes it from the Gryphite-grit.

Var. Oppelensis, *Lycett*, 1857. Plate XX, fig. 2.

1857. Natica Oppelensis, *Lycett*. Cotteswold Hills, p. 123, pl. i, fig. 4.

This is a small variety of *N. adducta*, which occurs in the Cotteswold Sands of the Nailsworth district (*Opalinus*-zone). Although quite as much an *Euspira* as any one of the Naticidæ in the Cotteswolds, Lycett described this form as a *Natica*. It has exactly the same angle of whorl as *Natica adducta*, and the same ratio of body-whorl to entire shell, viz. 7 : 10. The spiral angle is a little over 90°. The encircling lines, on which Lycett relied for specific characters, are seen on some specimens not on others. These, it is believed, are mainly due to conditions of preservation, where the inner shell layers are exposed. It is

probable that most of the Euspiroid Naticas of the Inferior Oolite possess this character, but it can only be seen under certain conditions.

Var. GLOBATA. Plate XX, figs. 5 and 6.

Description:

Spiral angle	95°—100°.
Height of body-whorl to entire shell . .	75 : 100.

The chief characteristics of this variety are a more globose and sloping body-whorl, and a somewhat shorter spire. The canaliculation is but slight, and the Euspiroid character less evident. This is a case where it is not so easy to formulate a distinction between *Natica* and *Euspira*. The larger specimen (fig. 5) is from the *concavus*-bed at Bradford Abbas, where this variety occurs to some extent. The aperture is semilunar and effuse; fine lines of growth are decussated by fine spiral lines (not visible without the aid of a lens), and besides this are two or three larger lines, like undeveloped carinæ. Such globose forms seem to point somewhat in the direction of *Natica cincta*. Specimens occur more or less intermediate between the angular and globose varieties. The most globose of all are those in the Lower Trigonia-grit (fig. 6), which is probably about the same horizon as the *concavus*-bed at Bradford Abbas.

195. NATICA, cf. LORIERI, *d'Orbigny*, 1850. Plate XX, fig. 8.

1850.	NATICA LORIERI, *d'Orbigny*.	Prod., i, p. 264.
1852.	— — —	Terr. Jur., ii, p. 190, pl. cclxxxix, figs. 6, 7.

Bibliography, &c.—D'Orbigny was the first to point out that a form similar to *Natica adducta*, but more elongate and having a smaller spiral angle, occurs in the Inferior Oolite of Asnières (Sarthe) and Niort (Deux Sevres). This he called *Natica Lorieri;* it is described as having an umbilical fissure. The English specimens which I have ventured to assign to this species, either directly or as varieties, show but little trace of umbilicus. However, the mere presence or absence of an almost invisible umbilical fissure ought not to have much weight.

Description:

Spiral angle	80°.
Height of body-whorl to entire shell . .	72 : 100.
Length	25—30 mm.

Shell Euspiroid; length to width as 4 : 3; without visible umbilicus. Spire in well-marked steps; whorls of the spire (5—6) convex, narrow. Body-whorl large, angular, and mesially prominent, with some spiral lines at wide intervals, and numerous curved lines of growth. Aperture semilunar and rather effuse.

Relations and Distribution.—The points in which this form differs from *Natica adducta* are mainly those of proportions. But these differences are considerable, and correspond in the main to the differences indicated by d'Orbigny for *Natica Lorieri*. Intermediate forms connecting this with *N. adducta* occur, so that it is sometimes difficult to decide. The specimen figured is from the beds at Cold Comfort near Cheltenham. There are others from Bradford Abbas, and forms not dissimilar occur in the Inferior Oolite at Hook Norton.

Var. PROXIMA, *Hudleston*, 1882. Plate XX, fig. 7.

1882. NATICA PROXIMA, *Hudleston*. Geol. Mag., dec. 2, vol. ix, p. 200, pl. v, fig. 8.

Description:

Spiral angle	75°.
Height of the body-whorl to entire shell . .	70 : 100.

Shell oval, subumbilicate. Whorls six, regular, smooth, and slightly tumid. The sutural ledge is narrow, with only a slight canaliculation. Aperture oval; umbilical fissure distinct, with a considerable callus on the inner lip.

The presence of an umbilicus seems to connect this form more nearly with that of d'Orbigny's *Natica Lorieri* than the one last described. In this variety the whorls are less tabulate and the general outline differs.

Var. CANINA, *Hudleston*, 1882. Plate XX, figs. 9 *a*, 9 *b*, and ? fig. 1.

1882. NATICA ADDUCTA, *Phil.*, var. CANINA, *Hudleston*. Geol. Mag., dec. 2, vol. ix, p. 200, pl. v, fig. 7.

? — — — Geol. Yorks., pt. 1, pl. xi, fig. 35.

The proportions approach somewhat those of the shells referred by me to *Natica Lorieri;* but if it should turn out that d'Orbigny's name is inadmissible I would propose to call them all *Natica canina*. There is no trace of umbilicus; the mesial bulge in the body-whorl is the same as in the Cold Comfort shell, and

the aperture is very large. Under certain conditions of preservation there is a tendency to form spiral lines.

Most of the specimens in the Dogger are small; but here and there one finds fragments of a large shell which present similar peculiarities. This makes me rather disposed to consider that the very large casts which occur in the Northampton Sand (see Pl. XX, fig. 1) may be megalomorphs of *Natica canina*. The tendency to a median keel is seen even better in the cast than in the shell.

196. Natica, species or variety. Plate XX, fig. 10.

Description:

Spiral angle	70°.
Height of body-whorl to entire shell . .	65 : 100.
Length	30—35 mm.

Shell Euspiroid, oval, length to width as 1·3 : 1, traces of an umbilical fissure. Whorls about seven, square-shouldered, and deeply canaliculate, smooth, and moderately convex. Body-whorl full, yet angular, and with a slight tendency to a median keel. Lines of growth wide and rugose. Aperture semilunar with a slight incrustation on the columellar lip, and some trace of umbilicus.

Relations and Distribution.—This form constitutes a step in advance beyond the members of the *adducta*-group in the narrowing of the spiral angle coupled with a slight relative increase in the height of the spire. It is also a narrower and more elegant form than *Natica Dundriensis*, next to be described. The proportions are not far from those of *Natica Bajocensis*, but it is of larger habit, and less compressed in the body-whorl than that species. It has some resemblance to *Natica Crythea*, Laube (non d'Orb.), Die Gasteropoden des Brannen Jura von Balin, p. 4, Pl. I, fig. 6.

Two specimens are known to me; the one figured from the *Parkinsoni*-zone of Bradford Abbas, and another from the *Parkinsoni*-zone of Horton Hill. Casts which correspond fairly in size and appearance occur in the *Clypeus*-grit of Rodborough and the *Parkinsoni*-zone of Aston and Notgrove. Those from the *Clypeus*-grit have been identified by Mr. Witchell as *Natica Stricklandi*, Morris and Lycett. There are also some specimens in the Woodwardian Museum like these. Simply as a distinction I would call this *Natica* "*subelegans*."

197. Natica Dundriensis, *Tawney*, 1873. Plate XX, figs. 11 *a*, 11 *b*, 11 *c*.

1873. Euspira Dundriensis, *Tawney*. Dundry Gasteropoda, p. 7 (15), pl. i, fig. 3.
„ ? — Zelima, *d'Orb.* Tawney, op. cit., p. 6 (14), pl. i, fig. 1.

Description:

Spiral angle	75°.
Height of body-whorl to entire shell .	68 : 100.
Length	35 mm.

"Shell globose, spire somewhat elevate, apex acute; whorls six, obtusely rounded, separated by a broad, flat space at the suture, but round at the angle. Last whorl swollen, surface of shell with numerous very fine transverse lines, and a few distant obscure spiral raised lines. The test is punctate; puncta in equidistant rows. There is no umbilicus visible, the lip seems expanded over it."

Relations and Distribution.—This is sub-Euspiroid, and rather a clumsy form, the result in part of the salience of the penultimate whorl. In the young specimen (fig. 11 *c*) the system of axial and spiral lines, mentioned by Mr. Tawney, are so well preserved as to produce a complete reticulation. But this feature seems confined to specimens from Dundry where the matrix is suitable and other conditions favourable, and is most obvious in the tender young shell. Specimens from Oborne exhibit the wide-apart spiral lines, but not very clearly.

Natica Dundriensis occurs in the *Humphriesianus*-zone at Oborne and in the iron-shot Oolite at Dundry, ? also at Hook Norton. The single shell identified by Tawney as *Natica Zelima*, d'Orb., is probably an exceptionally large specimen of this species.

198. Natica Hulliana, *Lycett*, 1863. Plate XX, fig. 12.

1863. Natica Hulliana, *Lycett*. Suppl., p. 13, pl. xli, fig. 2.

Bibliography, &c.—The author says he has obtained this species in the Great Oolite of Minchinhampton and in the Inferior Oolite of the same locality. The type specimen, now refigured, is labelled "Inferior Oolite, Nailsworth." The matrix somewhat resembles the upper bed at Longfords. Mr. Witchell quotes this species from the *Clypeus*-grit.

Description.—Proportions nearly the same as in the preceding species. "Shell ovate, subglobose, smooth; volutions (six) very convex, the sutures deeply

impressed; the spire is elevated, acute, the last volution being very large; the aperture is ovate, oblique, the anterior side rounded, the posterior side acute, the length exceeding a moiety of the entire shell; the columella is rounded, thickened, and there is no umbilicus."

Relations and Distribution.—Lycett says that this species differs from *Natica intermedia* in having "a more elevated acute spire, more deeply depressed sutures, and a more globose ultimate volution." It is a more elegant shell than *Natica Dundrienſis* and of smaller habit. Moreover the sutural ledge (méplat) is so narrow that the shell scarcely comes within the definition of Euspiroid; still it has a sutural ledge and not a round shoulder, and is very slightly canaliculate. The type is almost the only specimen known. I have one other from the *Parkinsoni*-zone of Lodge Hill near Castle Cary.

199. Natica Bajocensis, *d'Orbigny*, 1850. Plate XX, figs. 13 *a*, 13 *b*.

1850.	Natica Bajocensis, *d'Orbigny*.	Prod., i, p. 264.
1852.	— — —	Terr. Jur., ii, p. 189, pl. cclxxxix, figs. 1—3.
1873.	Euspira Bajocensis, *d'Orbigny*.	Tawney, Dundry Gasteropoda, p. 5 (13), pl. i, fig. 4.
? Syn.	Natica Pictaviensis, *d'Orbigny*.	Terr. Jur., ii, p. 191, pl. cclxxxix, figs. 8—10.

Bibliography, &c.—In grouping *N. Bajocensis* and *N. Pictaviensis* together we seem to ignore d'Orbigny's distinction with reference to the presence or absence of an umbilical fissure. Oppel (Juraform., p. 384) regarded the Burton Bradstock fossil as *N. Pictaviensis*. It is the exception to find an umbilical fissure in any Dorsetshire specimen. Mr. Tawney united them. It may be worth remarking here that his fig. 2 represents so abnormal a form that one would hesitate to place it under *N. Bajocensis*. Accepting the view that the numerous and well-preserved little Naticas of Burton Bradstock should be grouped under one species, the following is the diagnosis.

Description:

Spiral angle	60°—68°.
Height of body-whorl to entire shell, from .	60—63 : 100.
Length of adult individuals. . .	23—28 mm.

Shell Euspiroid, much longer than wide, oval, and usually without umbilical fissure. Spiral angle regular, apex very sharp, whorls from six to seven, smooth, slightly convex, flatted at the top, and deeply canaliculate; sutural ledge narrow. Body-whorl rather compressed. Aperture semilunar with but little callus.

Numerous lines of growth decussate with very fine spiral lines; and some specimens exhibit a spiral punctate structure. This is especially the case with specimens from the *Humphriesianus*-zone of North Dorset, where a fine reticulate structure scarcely interferes with the general smoothness of the shell.[1]

Relations and Distribution.—Although the form of this little shell is Euspiroid it is by no means clear that Lycett would have placed it under *Euspira*, because of the narrowness of the sutural ledge. Fig. 13 *a* may be taken as nearly an average specimen, inclining to be rather wide; whilst 13 *b* represents an exceptionally narrow variety, somewhat approaching *N. Calypso*, d'Orb.

This species is extremely abundant in the *Parkinsoni*-zone of South Dorset, especially at Burton Bradstock. It also occurs in the upper part of the *Humphriesianus*-zone of North Dorset, and notably in the *Cadomensis*-bed at Oborne. These specimens are for the most part wider-angled, the narrowest specimens coming from the upper part of the *Parkinsoni*-zone. *N. Bajocensis* occurs in the *Parkinsoni*-zone of Bradford Abbas, at Lodge Hill near Castle Cary, and at some other places, though not abundantly. But it may be always expected at the confines of the *Humphriesianus* and *Parkinsoni*-zones. A few typical specimens may be collected at Aston and Notgrove.

In the Cotteswolds *N. Bajocensis* appears to be partially replaced by a form nearly twice the size, but not dissimilar in proportions. It generally occurs in an imperfect condition. This is probably the form referred by Mr. Witchell to *Natica Stricklandi*, Mor. and Lyc. See remarks on No. 196.[2]

N.B.—*Natica punctura*, Bean (*pars*). See Plate XX, fig. 14.

LITTORINA PUNCTURA, *Bean*. Magazine of Natural History, vol. iii, p. 62, fig. 23.
NATICA PUNCTURA, *Bean*. Hudleston, Geol. Mag., dec. 2, vol. ix, p. 201, pl. v, fig. 10.

Shells from the Dogger thus referred exhibit a spiral angle of about 65°; ratio of the body-whorl to the full length 60 : 100, usual length 25 mm. The whorls are scarcely in steps, the sutural ledge being very narrow; the body-whorl is rather more tumid than in *N. Bajocensis*. Specimens from the Dogger are full size, and often spirally punctate (condition). Specimens from the Scarborough Limestone, when well preserved, show a fine linear spiral structure. They are usually shorter

[1] As this peculiar brown translucent calcite shows up the structure very well in other fossils we may presume that much depends upon the character of the mineraliser.

[2] Antea, p. 261.

in the spire and more tumid in the body-whorls than specimens from the Dogger. Without doubt these obscure and often ill-preserved forms are nearly related to *Natica Bajocensis*, but it would be scarcely safe to say that they are identical.

200. ? Natica (Euspira) protracta, sp. nov. Plate XX, fig. 15.

Description:

General spiral angle about . . .	50°.
Height of body-whorl to entire shell . .	55 : 100.
Length about	55 mm.

Shell thick, sub-elongate, Euspiroid, about twice as long as wide. Apex ? blunt, number of whorls ? six or seven, angular, protracted, and strongly tabulate, scarcely canaliculate. The whorls of the spire are swollen towards the centre. Body-whorl only moderately tumid, with a slight tendency towards a median keel; fine spiral lines $\frac{2}{3}$ mm. apart, decussate with curved growth-lines.

Aperture ovate-elongate, the longer diameter being slightly less than half the entire length of the shell.

Relations and Distribution.—It must be admitted that this rare form has not much the appearance of a *Natica*, though possibly, with the aid of the sub-genus *Euspira*, it may come to be regarded as one of the Naticidæ. It has a certain degree of resemblance to *Pseudomelania*, but against this view we must place the relative size of the aperture, and also the fine and curved, rather than sinuous, growth-lines. There is just the possibility that these shells represent a diseased or abnormal growth of some other species, though what that species may have been it is by no means easy to indicate.

Two specimens are in my collection; these are believed to have come from the *Parkinsoni*-zone of Bradford Abbas.

201. Natica canaliculata, *Morris* and *Lycett*, 1851. Plate XX, fig. 16.

1851. Euspira canaliculata, *Morris and Lycett*. Great Ool. Moll., part i, p. 45, pl. xi, fig. 23.

Natica (Euspira) canaliculata, *Morris and Lycett*. In the Explanation of pl. xi.

Bibliography, &c.—The authors observe that several specimens have been extracted from the limestone beds of the Great Oolite, but that it is much more common in the middle beds of the Inferior Oolite in Gloucestershire. Having never been able to see any specimens of *Euspira canaliculata* from the Great

Oolite, I lately proceeded to examine the type at the Jermyn Street Museum. This was the only specimen in the Great Oolite Collection, and a careful examination showed that this was most probably from the Pisolite of Longfords, and consequently an Inferior Oolite specimen. There is no evidence to my knowledge that *Euspira canaliculata* ever occurs in the Great Oolite of this country, though a micromorph, *Euspira subcaniculata*, Morris and Lycett, is occasionally found in that series.

Description:

Spiral angle	96°.
Height of body-whorl to entire shell . .	74 : 100.
Length about	30 mm.

The following is the authors' diagnosis: "Shell oblong, spire but little elevated, apex acute, whorls angulated, the angles acute, the upper portion of the whorls deeply channeled, their lower portions rather convex, the last whorl oblique, its base attenuated; aperture elliptical, the umbilical fissure narrow. Several obscure encircling lines may be traced upon the middle of the last whorl."

Relations and Distribution.—Since this species is put forwards by the authors in the front rank of the sub-genus *Euspira*, it becomes necessary to study it with special attention, and all the more so as there is every reason to believe that it is an exclusively Inferior Oolite species. There can be little doubt that *Natica* (*Euspira*) *canaliculata* is first cousin to the typical form of *Natica adducta*, from which it mainly differs in the greater width of the sutural ledge, or "méplat." There are, in fact, forms in the Dogger which seem to connect the two. The group to which *Natica Pelops*, *Natica Oppelensis*, *Natica adducta*, and *Natica canaliculata* belong have the following elements in common, viz. a spiral angle, which is a right angle or slightly in excess, a body-whorl about seven-tenths the total height, and very square-shouldered whorls.

Specimens with a sutural ledge almost as broad as in the type occur in the Dogger, but the species is most abundant and most typically developed in certain beds of the Inferior Oolite in Gloucestershire.

202. Natica cincta, *Phillips*, 1829. Plate XX, fig. 17; Plate XXI, figs. 3 and 4.

1829 and 1835. Natica cincta, *Phil.* Geol. Yorks., pt. 1, pl. iv, fig. 9, p. 101.
1853. — Leckhamptonensis, *Lycett.* Proc. Cottesw. Nat. Club, vol. i, p. 77.
1854. — cincta, *Phil.* = Natica Leckhamptonensis, *Lycett.* Morr. Cat., p. 262.
1882. — — *Phil.* Hudleston, Geol. Mag., dec. 2, vol. ix, p, 197, pl. v, fig. 4.

Bibliography, &c.—This remarkable shell was first figured by Phillips, without a description, as from the Coralline Oolite of Malton, along with "*Echinus*" *germinans* and "*Clypeus*" *semisulcatus*. The distinction between the Coralline Oolite of the Malton district, and the Inferior Oolite of the Castle-Howard district was not made known in those early days. The type is at Leeds.

The Rev. P. B. Brodie, in a paper "On the Geology of the Neighbourhood of Grantham,"[1] speaks of a very large *Natica* characteristic of the Inferior Oolite of Denton, of which casts only were known. This was described by Lycett as a new species under the title of *N. Leckhamptonensis*, with the following diagnosis: "Spire elevated, whorls convex, the last enormously expanded, upper surface of the whorls rounded and sulcated; aperture very effuse, orbicular. Only casts known. A gigantic species."

In 1854 Morris, with his usual sagacity, perceived the close connection between *N. cincta*, Phil., and *N. Leckhamptonensis*, Lyc., but, misled by Phillips, quotes it from the Coralline Oolite. Moreover, under the then prevailing impression that the Denton Limestone was Great Oolite (contrary to the opinion expressed by Brodie) he quotes it from the "Great Oolite" of Lincolnshire, as well as from the Inferior Oolite of Gloucestershire.

Description:

Spiral angle	115°—120°.
Height of body-whorl to entire shell . .	80 : 100.
Length about	100 mm.

N.B.—The largest specimen known measures: Length, 116 mm.; width, 110 mm.

Shell globosely angular, thick, nearly as wide as long, spire rather short, sub-euspiroid, apex probably blunt. Whorls (4—5) increase with great rapidity, causing an enormous expansion of the body-whorl. Sutural ledge very wide, and sloping downwards, so as to produce an inclined tabulate surface, which rises slightly to meet the keel at the angle of the whorl; only canaliculate in the early stage.

Body-whorl extremely ventricose, often richly marked by broad and curved lines of growth, and sometimes showing a kind of spiral line towards the middle. Aperture very effuse, hardly any sign of umbilicus, the shell-substance being very thick in this region (20 mm. in the type specimen).

Varieties or Stages of Growth.—The figure (Pl. XX, fig. 17) represents a small fossil such as may occasionally be found in the Oolite Marl, where casts of *Natica cincta* are fairly numerous. The proportions are almost exactly those of *Natica cincta*. It is more canaliculate than mature specimens of that species.

The largest specimen of *Natica cincta* known was found in a pale chalky-look-

[1] 'Proc. Cottesw. Nat. Club,' vol. i, p. 56.

ing limestone at North Luffenham (Rutland). Remains of spiral ornamentation decussating with growth-lines are very conspicuous on portions of the sloping ledge or shoulder of the body-whorl. This suggests a kind of ornamentation not dissimilar to that of *Sigaretus*.

Relations and Distribution.—The tabulate character of the whorls and step-like spire serve to connect this species with *Euspira*. Probably *Euspira canaliculata* must be regarded as its nearest relative. The low spire, wide ledge and angular, yet tumid body-whorl are points of resemblance. On the other hand the ledge or shoulder, instead of being canaliculate, slopes outwards, the spiral angle is considerably wider, and the habit of the species much larger. Indeed the great size of *Natica cincta*, in view of the fact that all other Inferior Oolite Naticas in this country are of modest dimensions, is a phenomenon of much interest, which becomes emphasised by the fact that this big shell appears entirely confined to the horizon of the Oolite Marl and its equivalents.

Commencing in the north, this species, as we have seen, was first noticed in the Inferior Oolite Limestone of the Castle Howard district, which is generally admitted to be on the horizon of the Lincolnshire Limestone. Casts are abundant in the lower part of the latter series, though the connection of these corkscrew-like forms with *Natica cincta* is not always so evident, until we bear in mind the enormous thickness of this shell, especially in the umbilical region. *Natica cincta* is not found in the upper beds of the Lincolnshire Limestone at Weldon and Great Ponton. The best specimens are from Coombe Hill near Deddington (North Oxfordshire), where it occurs with *Ammonites Murchisonæ*, *Terebratula fimbria*, and *Spiropora straminea*.[1] The next place where we meet with *Natica cincta* in any quantity is in the railway-cutting through the Oolite Marl at Notgrove (between Bourton and Cheltenham). In specimens from this locality a considerable portion of the shell is apt to remain on the spire, so that we rarely get the corkscrew-like forms which are characteristic of the Lincolnshire Limestone at Denton and elsewhere. The casts which suggested the name *Leckhamptonensis* were most likely from the Oolite Marl of the Cotteswold escarpment. The shell quoted by Witchell ('Geology of Stroud,' p. 50) from the Oolite Marl as *Natica macrostoma*, Röm., is most probably *Natica cincta*.

No such species as *Natica cincta* has yet been discovered in Dorsetshire, but the form described by me as *N. adducta* var. *globata* (Pl. XX, fig. 5) presents some points of resemblance.

[1] Judd, 'Geology of Rutland,' pp. 25—27.

Section B.—Mammillated.

203. Natica cf. Michelini, *d'Archiac*, 1843. Plate XX, figs. 18 *a*, 18 *b*.

1843. Natica Michelini, *d'Archiac*. Mém. Soc. Géol. France, vol. v, 2nd part, p. 377, pl. xxx, fig. 1.
1851. — — — Morris and Lycett, Great Ool. Moll., part i, p. 44, pl. vi, fig. 3 (*non* fig. 2).
1852. — — — D'Orbigny, Terr. Jur., ii, p. 192, pl. cclxxxix, figs. 11, 12.
1884. Ampullina Michelini, *d'Archiac*. Cossmann, Ét. Bath., p. 131, pl. ii, figs. 9, 10.

Bibliography, &c.—D'Archiac's diagnosis is repeated by d'Orbigny. The shell is described as thick, ovoid, and with a very sharp spire, apex mammillated; seven whorls, the last very enveloping, and depressed near the suture.

Morris and Lycett described what they regarded as two varieties. Of these the longer and commoner form has only a faint degree of resemblance to d'Archiac's figure. Hence de Loriol (*fide* Cossmann, *loc. cit.*) has renamed this form *Natica Minchinhamptonensis* ('Alpes Vaud.,' p. 13, pl. i, figs. 8, 9).

The Inferior Oolite variety to which I now call attention has much more resemblance to d'Archiac's species than the Minchinhampton shell renamed by de Loriol, but it presents also considerable differences.

Description of Inferior Oolite Variety:

Spiral angle	106°.
Height of body-whorl to entire length	85 : 100.
Length of figured specimen	31 mm.

The points wherein this form differs materially from *Natica Michelini* are—it is narrower, the shoulder is less sloping, and the body-whorl is less globose. There are other differences such as absence of callus on the inner lip, &c., which may possibly be due to conditions of preservation. There is no visible umbilicus.

Relations and Distribution.—This form almost stands alone in the Inferior Oolite. The very effuse aperture also serves to distinguish it from all other species except *Natica cincta*. In the Northampton Sand are casts of a very large *Natica*, which is closely related, possibly identical. A few specimens are known from the Oolite Marl of the Stroud-Nailsworth district; and there is a specimen, 45 mm. long, in Mr. Walford's collection from the Gryphite-grit of Bourton-on-the-Water which might be assigned to this variety of *Natica Michelini*.

There are some very small specimens from the Oolite Marl which might be regarded as micromorphs of *Natica Verneuili*, d'Arch., or of some closely-related species. These I have not ventured to figure.

204. ? Euspira species. Plate XXI, fig. 2.

Cf. *Euspira coronata*, Morris and Lycett, 'Great Ool. Moll.,' part 1, page 46, plate vi, fig. 9.

Bibliography, &c.—The authors admit that *Euspira coronata* may be regarded as an aberrant form of *Euspira* in which the carina becomes nodulous. But in reality there is no median carina on the body-whorl of any of the species described by those authors from the Great Oolite or the Inferior Oolite, such as *E. canaliculata*, *E. Sharpei*, *E. pyramidata*, or *E. subcanaliculata*. Moreover these species show hardly any trace of umbilicus, whereas "*Euspira*" *coronata* is largely umbilicated. Thus "*Euspira*" *coronata* can scarcely be classified with the other *Euspiræ* of Morris and Lycett, which are in facts Naticas, or, as our French contemporaries would say, Ampullinas. The type, which may be seen at the Jermyn Street Museum, is in excellent preservation, and appears to be unique. Its authenticity as a Great Oolite specimen seems beyond question.

The above remarks are made in consequence of the discovery in Mr. Crick's Collection of a fossil from the Northampton Sand of which the following is a

Description:

Spiral angle	70°.
Height of body-whorl to entire shell . .	65 : 100.
Length	29 mm.

Shell globosely conical, turrited, umbilicated; apex sharp. The whorls of the spire (four or five) are angulated, flat or slightly concave, arranged in steps or ledges, and ornamented with a nodulous carina which forms the angle of each whorl; sutures close.

The body-whorl, which occupies between six and seven-tenths of the total height of the shell, is largely expanded and flattened posteriorly; it is ornamented by two conspicuous and nodulous keels, the upper one at the angle of the whorl, the lower one about halfway between the suture and the extremity of the rounded base; between the keels the whorl is constricted. Aperture wide and semilunar, the outer lip slightly angulated; a considerable umbilical cavity is exposed, but this portion of the specimen is much corroded.

Relations, &c.—Differs from "*Euspira*" *coronata* in having a relatively longer spire, but chiefly in the different position of the anterior keel, which changes the form of the shell materially. I would distinguish it for the present as "*Euspira*" *subcoronata*. Occurs in the Northampton Sand, Old Duston.

Family—RISSOIIDÆ.

"*Shell usually small, turbinate; aperture oval or semilunar, entire or subcanaliculate at the base, peristome continuous; operculum horny.*"—FISCHER.

Genus—RISSOA, Fréminville, 1814.

"*Shell imperforate or subperforate, more or less oblong, turbinate; aperture scarcely oblique, oval, entire; peristome simple or reflected.*"—FISCHER.

This genus can scarcely be regarded as occurring in the Inferior Oolite, although ? *Rissoa lævis*, Sow., has been quoted from the Cotteswolds by Lycett (Proc. Cottesw. Nat. Club, vol. i, p. 72). There is a smooth species found in the Lincolnshire Limestone at Weldon, which might at first sight be taken for *Rissoa lævis*, Sow., but which has been described under *Rissoina*.

Genus—RISSOINA, *d'Orbigny*, 1840?.

"*Shell turrited, whorls numerous, but slightly convex; apex mammillated; aperture oval, semilunar; lip thickened internally, slightly reflected, canaliculate or subcanaliculate in front; operculum horny.*"—FISCHER.

The distribution of *Rissoina* in the Inferior Oolite is very local, and mainly confined to the upper beds of the Lincolnshire Limestone. A few obscure fragments have been found in the Lower Limestone (Witchell) of the Cotteswolds, and better preserved specimens are occasionally obtained from the Pea-grit. These are the earliest recognisable forms hitherto noted from the British Jurassics.

The prevailing form of *Rissoina* in the Lincolnshire Limestone is *R. obliquata* Sow., or some of its varieties. This form Mons. Cossmann unites with *R. acuta*, Sow., retaining the name *acuta* for the species. There are specimens both from the Pea-grit of the Cotteswolds, and also from the Lincolnshire Limestone at Weldon, which answer fairly well to Sowerby's description of *R. acuta*, having the slender spire and straight ribs of that species, but they seem to run into *R. obliquata*, which is certainly the more abundant form. This latter may be divided into more than one variety. Taking this view of the case, I recognise three

species of *Rissoina* in the Inferior Oolite, viz. *R. obliquata*, Sow., with varieties; *R. obtusa*, Lycett; and *R. gymnoides*, sp. nov.[1]

205. Rissoina obliquata, *Sowerby*, 1829. Plate XXI, fig. 7; var. *parvicostata*, fig. 8—? var. fig. 9.

1829. Rissoina obliquata, *Sowerby*. Min. Conch., pl. dcix, fig. 3.
1851. — — *Morris and Lycett*. Great Ool. Moll., part i, p. 52, pl. ix, fig. 19.
1852. — "duplicata," *d'Orbigny*. Terr. Jurass., vol. ii, pl. ccxxxvii, figs. 1—3.

Bibliography, &c.—Originally described by Sowerby from the Great Oolite of Ancliff, together with *R. acuta* and *R. duplicata*. Morris and Lycett speak of it as rare in the Great Oolite of Minchinhampton. D'Orbigny's figure named "*duplicata*" is not at all like Sowerby's *R. duplicata*. The artist seems to have got hold of *R. obliquata* by mistake.

Description:

Length about	6 mm.
Length to width as . . .	1 : 0·45.
Spiral angle (obtuse) about . . .	28°.

Shell turrited, subelongate, turbinate, often twisted. Whorls about seven, tumid, close, and costated; the costæ (about twelve in each whorl) are prominent, and curve with a slope from right to left. Aperture restricted, ovate posteriorly, flattened and subcanaliculate in front; lips much thickened.

Relations and Distribution.—As compared with *R. acuta* this species is wider and stouter, the whorls are more tumid, and the costæ usually more prominent; in the varieties they are fewer in number. It has a considerable resemblance to the existing *R. costata*. The typical form is fairly plentiful at Weldon.

Var. *parvicostata* (fig. 8). This is a still more stumpy form; the costæ are fewer in number, prominent, and less curved. This variety prevails at Great Ponton. Micromorphs occur there and in the Scarborough Limestone.

Variety or sport (fig. 9). The points wherein *R. obliquata* differs from *R. acuta* become intensified in this form, which is extremely stumpy and very coarsely ribbed. It has a length of 6 mm. and a spiral angle of about 40°. The aperture is strongly canaliculate anteriorly.

A single specimen in the Sharp collection at the British Museum. We might call this *R. obliquata*, var. "*inflata*," or simply *Rissoina* "*inflata*."

[1] *Rissoina cancellata*, Morris and Lycett, is quoted from the shelly beds of Ponton (Morris, 'Quart. Journ. Geol. Soc.,' vol. ix, p. 326), but I can find no confirmation of this.

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A MONOGRAPH

OF THE

BRITISH JURASSIC GASTEROPODA.

BY

WILFRID H. HUDLESTON, M.A., F.R.S., F.L.S.,
PRESIDENT OF THE GEOLOGICAL SOCIETY OF LONDON.

PART I, No. 6.

GASTEROPODA OF THE INFERIOR OOLITE.

Pages 273—324; Plates XXI—XXVI.

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206. Rissoina obtusa, *Lycett*, 1853. Plate XXI, figs. 10 *a*, 10 *b*.

1853. Rissoina obtusa, *Lycett*. Proc. Cottesw. Nat. Club, vol. i, p. 80.

Bibliography, &c.—Lycett makes no mention of this species in the 'Cotteswold Hills,' nor does Witchell enumerate any species of *Rissoina* in his 'Geology of Stroud.' It is not absolutely certain that the species under consideration is the one intended by Lycett, although his description tallies fairly. It must be allowed, however, that the name "*obtusa*" is unfortunate, as this is rather a slender shell. As a matter of fact an obtuse apex is characteristic of the genus. although the earlier authors speak of *Rissoina* as pointed.

Description:

Length	3·5 mm.
Spiral angle about	25°.

"Spire obtuse; whorls slightly convex, six; outer lip moderately large; costæ numerous, closely arranged, slightly curved from left to right."—Lycett, *loc. cit.*

Relations and Distribution.—Found sparingly in the Pea-grit at Crickley and Leckhampton. *Rissoina Milleri*, Lycett (Suppl., p. 18, pl. xliv, fig. 10), has some resemblance.

207. Rissoina gymnoides, sp. nov. Plate XXI, fig. 11.

Description:

Length	4 mm.
Height of body-whorl to entire length	50 : 100.
Spiral angle (obtuse) about	22°.

Shell subelongate, pupoid, scarcely turrited. Whorls about six, smooth, convex, close; body-whorl about half the height of the entire shell. Aperture square in front and slightly canaliculate, lips only moderately thickened.

Relations and Distribution.—At first sight this might seem to be some form of *Pseudomelania*, since the thickening of the peristome is less obvious than usual in *Rissoina*. But the pupoid character of the spire militates against this supposition. It bears considerable resemblance to *Rissoina gymna*, Cossmann (Ét. Bath., p. 234, pl. xiv, figs. 23, 24), from which it differs in the greater relative length of the spire and in having a wider spiral angle. Four specimens are in my collection from the Lincolnshire Limestone of Weldon.

Note.—Hitherto it has been possible for the most part to assign a family position to the genera of Gasteropoda occurring in the Inferior Oolite; but we now are called upon to consider several groups of shells, more or less turbinate in character, whose family position cannot with certainty be defined. The majority of these were referred to *Turbo* by d'Orbigny.

The following genera are included in the above category, viz. *Amberleya*, "*Littorina*," *Cirrus* (including *Hamusina*), and *Straparollus* (including *Discohelix*).

Preliminary Note on *Amberleya* and "*Littorina*."

There is a twofold difficulty attendant on dealing with the numerous species of fossil shells which I propose to place under one or other of the above genera. To the uncertainty of family affinities there is also to be added the difficulty of synonymy. The former is, of course, the more serious difficulty of the two; for if we are wrong in supposing that *Amberleya*, *Eucyclus*, &c., belong to the Littorinidæ, in that case we are not justified in assigning the generic term "*Littorina*" to the group of smaller species which are associated with them. The older writers, and particularly d'Orbigny, regarded nearly the whole of these forms as belonging to the Turbinidæ, and the modern tendency seems to be to revert to that conclusion. We may use *Amberleya* or *Eucyclus* without pledging ourselves to the family affinities of the genus, but if we use *Littorina* or *Turbo* the case is different. In the following pages "*Littorina*" is used only in a conventional sense.

In 1851, Morris and Lycett ('Grt. Ool. Moll.,' p. 54) thus diagnosed *Amberleya*:—"Shell turrited, turbinate, apex acute; whorls flattened above, convex and nodulated beneath, the last whorl ventricose; aperture ovate, entire; inner lip thickened and nearly covering a small umbilicus; sutures deeply impressed; no columella."

The genus *Eucyclus* was constituted by J. A. Deslongchamps ('Bull. Soc. Lin. Norm.,' vol. v, p. 23 of separate copy) in 1860, being based on *Turbo ornatus*, Sowerby, and similar shells. The author alludes to *Aberleya* (*sic*). He considered that genus to have been established on bad specimens, and to have been imperfectly characterised. His own diagnosis of *Eucyclus* is comprehensive enough. It contains most of the points in the diagnosis which I offer below.

There can be no doubt that Deslongchamps' diagnosis was far more accurate and full than that of Morris and Lycett, which was little better than a description of one species. At the same time Deslongchamps, when he alluded to *Amberleya*, seems unconsciously to admit that his new genus might possibly be covered by that of the authors of the 'Great Oolite Mollusca.'

The late Professor Eugène Deslongchamps (' Notes Palèontologiques,' vol. ii, May, 1889, p. 70) could not be persuaded that *Amberleya* and *Eucyclus* were synonymous, and thus he maintained that *Amberleya nodosa*, M. and L., could not be a *Eucyclus*. The presence in that species of a slight umbilical excavation was one of his principal reasons for considering that *Amberleya* and *Eucyclus* are distinct genera. As so often happens, *Amberleya nodosa*, the type, is far from being a typical species, and it would have been far more satisfactory if *Turbo ornatus*, Sow., could be taken for the type, as was done by Deslongchamps in constituting his genus *Eucyclus*.

With regard to the relationship of *Amberleya*, some authors, like Fischer, admit that the various forms grouped under this genus have the appearance of *Tectarius*, *Echinella*, and *Littorina;* but Fischer considers that the alleged existence of a nacreous layer in the Jurassic Amberleyas proves their affinity with the Turbinidæ and the Trochidæ. Of course, if this is the case, the group of small shells which appear to be connected by so many links with *Amberleya* are wrongly named *Littorina;* and that is why, as already stated, this term is only used in a conventional sense. It would save trouble if they were replaced under *Turbo;* and yet they certainly are not Turbos in the modern restricted sense, although they may belong to the Turbinidæ.

Many of the forms described in the sequel seem to run into each other. Moreover some of the species differ so much at different stages of their growth, especially in the character of the aperture, that one and the same species might well be placed under two distinct genera. (See description of *Amberleya ornata*.)

As regards arrangement, exception might be taken to the wide extension of the term *Amberleya* adopted in the subjoined classification of Inferior Oolite species. Unless we fall back upon *Turbo* and *Trochus*, I do not see how this is to be avoided. The distinction also between *Amberleya* and "*Littorina*" is admittedly not a very philosophic one.

If we attempt to deal with the *Amberleya-Littorina* group in sections, the first and most important section is that (1) of *Eucyclus*, where the shell is much turrited, the suture wide, the body-whorl ventricose, and one or more of the spiral belts exceedingly prominent. The *Trochus*-section (2) contains shells more or less trochiform, but with an ornamentation closely resembling that of *Eucyclus*. Through the more turbinate and finely ornamented forms of the *Eucyclus*-section, such as *Amberleya densinodosa*, a connection is established with (3) the *Turbo*-section, which presents some extreme forms. The shells of all three sections are rather thin, and exhibit a considerable resemblance in the general style of ornamentation, and frequently also in the changing character of the aperture.

In the fourth section (4) the shells are thicker, but do not attain to any

size; these have been referred to "*Littorina*." In the majority of cases they do not seem to have the *Purpurina*-like mouths exhibited in the early stage of many Amberleyas.

The following is the classification of the Inferior Oolite species described in the sequel, arranged on the principles already indicated.

AMBERLEYA.

Eucyclus-section:

Amberleya capitanea, Münst. · } *Ornata*-group
— *ornata*, Sow., typical
— — var. *spinulosa*, Münst.
— — var. *abbas*
— — var. *horrida*
— *gemmata*, Lyc.
— *densinodosa*, sp. n.
— *Meriani*, Goldf.
— *cygnea*, sp. n.

— *goniata*, Desl. } *Goniata*-group
— *Orbignyana*, sp. n.
— *Murchisoni*, Münst.
— *Obornensis*, sp. n.
— *pagodiformis*, sp. n.
— *generalis*, Münst.

Trochus-section:

Amberleya species, cf. *Trochus anaglypticus*, Münst.
— *biserta*, Phil., A.
— — — B.

Turbo-section:

Amberleya Milleri, Wright, MS.
— *turbinoides*, sp. n.
— *Stoddarti*, Tawney.
— *elongata*, sp. n.
— *Dundriensis*, Tawney.

LITTORINA (*? Echinella* in part).

Littorina prætor, Goldf.
— *polytimeta*, sp. n.

Littorina Phillipsii, Mor. and Lyc.
— *sulcata*, Héb. and Desl.
— *Weldonis*, sp. n.
— *ædilis*, Münst.
— *Dorsetensis*, sp. n., A.
— — — B.
— — — C.
— (*? Trochus*) *pisolitica*, sp. n.
— (*? Trochus*) *recteplanata*, Tawney.
— (*? Trochus*) *triarmata*, Héb. and Desl.

Œdilis-group

AMBERLEYA, *Morris and Lycett*, 1851.

Shell turbinate, more rarely trochoid, rather thin, imperforate or nearly so; subelongate, frequently turrited, sutural space wide; ornamented with spiral bands, usually spinulose or nodular, some of which are prominent (Eucyclus). *The interspaces are finely striated, the striæ being slightly oblique to the axis; sometimes these fine lines are strong enough to represent fine axial ribs. Base rounded, spirally ribbed, and marked by fine radial striæ.*

Aperture suboval, but varying according to age. In the early stage the columellar lip is nearly straight, and produced anteriorly so as to be almost reflexed at the extremity (*like* Purpurina). *In the adult the aperture is more or less rounded, so as to become suboval or subcircular; there is usually a considerable deposit of callus; outer lip thin and often crenulate.*

208. AMBERLEYA CAPITANEA, *Münster*, 1844. Plate XXI, fig. 12.

1844.	TURBO CAPITANEUS, *Münst.*	Goldf., Petref., pl. cxciv, fig. 1.
1852.	— — —	D'Orb., Terr. Jur., vol. ii, p. 341, pl. cccxxix, figs. 7, 8.
1863.	AMBERLEYA CAPITANEA (?), *Goldf.*	Lycett, Suppl., p. 95, pl. xli, fig. 1.
1884.	— — —	Beeby Thompson, Upper Lias of Northants, p. 309, pl., fig. 3.
	Non TURBO CAPITANEUS, *Münst.*	Morris and Lycett, Great Oolite Moll., pt. 1, p. 65, pl. ix, fig. 33.

Bibliography, &c.—The type is stated to be from the Inferior Oolite near Grötz. D'Orbigny says that the species occurs everywhere along with *Turbo subduplicatus* in the Toarcian. No locality in Calvados is quoted by him. The form from the Great Oolite, doubtingly referred by Morris and Lycett to Münster's

species, was subsequently named by Lycett (Suppl., p. 19) *Amberleya Jurassi*, Lyc. This name is regarded by Cossmann ('Ét. Bathonien,' p. 243) as a synonym of *Amberleya* (*Turbo*) *Castor*, d'Orbigny. In the Addenda to the Supplement Lycett refers a small form from the Forest Marble of Laycock and Pound Pill to *Amberleya capitanea*. We may perhaps regard this as a case of atavism.

Description :

Length of full-grown shell . . .	30—35 mm.
Length of body-whorl to total height . .	50 : 100.
Spiral angle	55°.

Shell eucycloid, turrited. Whorls about seven, angular, narrow, and sloping outwards from the suture ; sutural space wide.

In the whorls of the spire the ornaments consist of two centrally situated tubercular spirals forming a double belt; the cross-hatchings are fine and numerous, and fill up the interspiral spaces. The body-whorl is large, and the sides are similarly ornamented; in the base are four or five less prominent spirals, with tuberculations gradually diminishing in size anteriorly; cross-hatchings numerous.

Aperture ovate, with a tendency in the columellar lip to be produced anteriorly; outer lip thin and crenulate.

Relations and Distribution.—The differences between *Amberleya capitanea* and the numerous varieties or sub-species more intimately allied with *Amberleya ornata* are slight, but they are fairly constant, and occur for the most part on a certain horizon. The spinulose varieties of *Amb. ornata* are very near indeed, but they may be always distinguished by the presence of a third circlet of small tubercles on the upper margin of all the whorls, this circlet being less prominent than the other two, and also by the more elongate form of the tubercles, which in *Amb. capitanea* are very round.

Amberleya capitanea is interesting as the earliest member of the *ornata*-group in the British Jurassics. A fairly good specimen is figured by Mr. Beeby Thompson from the Lower *Cephalopoda*-bed at Preston Capes. This is presumably from the *Serpentinus*-beds, and is the earliest occurrence of which I have any knowledge, though there are other instances in the Upper Lias of the Midlands. In Dorsetshire, according to Moore ('Mid. and Up. Lias, S.W. England,' p. 78, pl. vi, figs. 1—4), *Amb. capitanea* occurs characteristically along with *Amm. bifrons* and *Amm. communis* in the Upper Lias at Compton.

The evidence in England is thus distinctly in favour of this being regarded as a Toarcian species, as had been already indicated by d'Orbigny for France. Moore (*loc. cit.*) goes on to say that on the uppermost horizon of the Upper Lias in the Cotteswolds *Amb. capitanea* occurs along with *Amm. variabilis*, &c. This is the horizon and locality whence comes the specimen figured in the present work.

It does not occur in the Inferior Oolite proper, and may on the whole be viewed as a Liassic form.

209. Amberleya ornata, *Sowerby*, 1819. Plate XXI, figs. 13, 14, typical; fig. 15, var. *spinulosa*, Münst.; figs. 16, 17, 18, and Plate XXII, fig. 1, var. *abbas*; fig. 2, var. *horrida*.

1819. Turbo ornatus, *Sow.* Min. Conch., pl. ccxl, figs. 1, 2.
1844. — spinulosus, *Münst.* Goldf., Petref., pl. cxciv, fig. 3.
1852. Purpurina Bathis, *d'Orb.* Terr. Jur., vol. ii, pl. cccxxx, figs. 6—8.
1854. Littorina ornata, *Sow.*, sp. Morris, Cat., p. 255.
1873. Amberleya ornata, *Sow.*, sp. Tawney, Dundry Gasteropoda, p. 27 (19), pl. i, fig. 9.
Non Turbo ornatus, *Sow.*, sp. Goldfuss, *nec* d'Orbigny.

Bibliography, &c.—It would not be difficult, perhaps, to fill a page with references to "*Turbo*" *ornatus* under the heading *Turbo*, *Purpurina*, *Eucyclus*, or *Amberleya*. Owing to the very poor figures given in the 'Mineral Conchology' most foreign authors have been mistaken in their attempts to identify Sowerby's species. The *Turbo ornatus*, Sow., of Goldfuss is rather like an Oxfordian member of the *ornata* group described and figured by me in 1884 ('Geol. Mag.,' dec. 3, vol. i, p. 247, pl. viii, fig. 8) as *Amberleya clavata*, Bean, MS. On the other hand, the *Purpurina ornata* of d'Orbigny's identification ('Terr. Jur.,' vol. ii, pl. cccxxx, figs. 4, 5) is a well-known species characteristic of the Upper Division of the Inferior Oolite (vide *Amberleya Orbignyana*, page 285).

Mr. Tawney regarded *Turbo capitaneus* doubtfully as a synonym.

Description:

Length from about . . .	25—50 mm.
Height of body-whorl to total length .	say 50 : 100.
Spiral angle	50°.

Shell eucycloid, turrited. Whorls from seven to nine, angular and narrow, the slope of the posterior area broken by a slight spiral band near the suture; suture almost gaping.

The ornaments consist of three tuberculated spirals, of which the upper one recedes and is sometimes rather faintly developed. The tuberculations are drawn out spirally, and vary much in force. The interspiral cross-hatchings are fine and numerous. The body-whorl is large and angular, with two prominent tuberculated spirals and one posterior spiral, which is often only faintly crenulate. In the base are five spirals scarcely tuberculated, with fine and numerous interspiral striæ.

The aperture in the early stage is very like *Purpurina*, the anterior canaliculation being well marked. This feature is also seen in the middle stage, but disappears more or less completely in the big shells, where the mouth is subcircular, the shape of the aperture being materially modified, with considerable thickening of the inner lip (see especially Pl. XXI, figs. 16, 17, and 18).

Varieties. — The specimens from the type locality are of medium size. Pl. XXI, fig. 13, is probably one of Sowerby's types with the tuberculations worn off the spiral ridges, and the cross-hatchings almost obliterated by usage. Fig. 14 from the same locality is in very fair preservation, and probably shows the true character of the type form. The cross-hatchings are wide and coarse, the posterior spiral is very close to the suture, and there is some tendency to tuberculation on the spirals in the base of the body-whorl.

The variety *spinulosa*, Münst., Pl. XXI, fig. 15, which I consider synonymous with *Purpurina Bathis*, d'Orbigny, is a large, handsome, and richly ornamented form, which occurs rarely in the *Concavus*-bed at Bradford Abbas.

The variety to which I have given the name *abbas*, Pl. XXI, figs. 16, 17, 18, and Pl. XXII, fig. 1, is extremely common on the same horizon and at the same place. From well-preserved specimens of this most abundant form we gather that, although the spire is pointed on the whole, yet the apex is obtuse; the earlier whorls are extremely angular, and the third spiral is seen to be developed at a very early stage, already receding and less prominent than the others. In the more mature whorls of this variety the crenulations or tuberculations on the spirals become very faint, and in the very large shells disappear altogether. On the whole the var. *abbas* is rather more slim in shape and more delicate in ornamentation, though attaining to a much greater size than the type variety.

Relations and Distribution.—We may well regard this as nothing more than a modified descendant, on a higher horizon, of *Amb. capitanea*. Besides the differences already indicated, it may be worth while to point out that the spirals in the case of *Amberleya ornata* are but slightly tuberculated as compared with those of *Amb. capitanea*.

In Dorsetshire *Amb. ornata* is essentially a fossil of the *Concavus*-zone, and is probably the most abundant fossil on that horizon at Bradford Abbas. At Dundry one cannot say on what horizon it occurs, but probably below the *Humphriesianus*-zone. It is rare in the Cotteswolds, where specimens are usually small and poorly preserved. Small forms of *Amb. ornata*, showing a slight tendency to produce an intermediate keel in the body-whorl, occur towards the base of the Inferior Oolite at Lincoln. There are also small specimens in the Dogger at Blue Wyke, which may either be immature forms of *Amb. ornata* or varieties of *Littorina* (*Turbo*) *Phillipsii*.

AMBERLEYA ORNATA, var. *horrida*. Plate XXII, fig. 2.

Description :

Length	30 mm.
Length of body-whorl to total height . .	52 : 100.
Spiral angle	56°.

Shell eucycloid, turrited. Whorls about six, angular, and increasing suddenly; suture wide. The ornaments are very coarse, consisting of three nearly equal spiral belts, rugosely crenulated, the upper one at some distance from the suture; cross-hatchings coarse and wide apart. Body-whorl ventricose in most cases, rather exceeding half the height of the shell; base with five spirals, moderately crenulate. Aperture as in other varieties of *Amberleya ornata*.

Relations and Distribution.—This form differs from other varieties of *Amb. ornata*, already described in the position and development of the posterior spiral belt, in having fewer whorls, and in the rugoseness of the ornamentation.

It occurs in the *Murchisonæ*-zone of Bradford Abbas, and is thus intermediate in time between *Amb. capitanea* and *Amb. ornata*, var. *abbas*.

210. AMBERLEYA GEMMATA, *Lycett*, 1853. Plate XXIII, fig. 19.

1853. TURBO GEMMATUS, *Lyc.* Quart. Journ. Geol. Soc., vol. ix, p. 342, pl. xiv, fig. 7.

Bibliography, &c.—Lycett, in describing this species from the Lincolnshire Limestone of Ponton, points out in what respect it differs from "*Turbo*" *capitaneus*. I also agree with him that it is more slender than "*Turbo*" *ornatus*, Sow.; but the arrangement of the carinæ is practically the same.

Description :

Length	10 mm.
Length of body-whorl to total height . .	40 : 100.
Spiral angle	44°.

"Shell ovately turbinated, spire elevated, whorls (5) turrited, convex, biangulated, and ornamented with three tuberculated carinæ, of which the first carina is the smallest; the last whorl is large and ventricose; its base is convex and encircled with numerous small serrated carinæ; the aperture is ovate."

Relations and Distribution.—This is a micromorph of *Amberleya ornata*, which

might almost be described as a variety. Besides being very much smaller, this form is less turbinate and more conical than *Amb. ornata;* the posterior spiral is rather more strongly developed, and the tuberculation generally somewhat larger proportionately. It is common in the upper beds of the Lincolnshire Limestone at Weldon, Ponton, &c. A somewhat similar form occurs in the Inferior Oolite of Hook Norton.

211. Amberleya densinodosa, sp. n. Plate XXII, figs. 3, 4, 5.

Cf. Littorina spinulosa, *Münst.*, sp. Héb. and Desl., Foss. Montreuil-Bellay, p. 56, pl. iii, fig. 4.

N.B.—There has been a tendency to regard the form now under consideration as the representative of *Turbo spinulosus*, Münster. It has some resemblance to the fossils figured by Hébert and Deslongchamps, but as the differences appear to be considerable it may be safer to describe it as a distinct species.

Description:

Length (three specimens) . .	23, 35, and 43 mm.
Length of body-whorl to total height .	48 to 52 : 100.
Spiral angle . . .	58°.

Shell turbinate, eucycloid, turrited. Number of whorls, eight or nine, convex and subangular; sutural space very wide. The ornaments consist of four finely tuberculated spirals; the uppermost of those near the suture consist of a circlet of closely-set rounded tubercles; the second spiral is a tuberculated belt, the tubercles being small and rounded; the third and fourth spirals constitute the principal carinæ, the third usually having the strongest tuberculations; the interspiral spaces are marked by closely-set interspiral striæ. The ornamentation of the matured whorls is generally finer than that of the earlier stages.

The body-whorl is almost ventricose and similarly ornamented, the number of finely-granulated spirals in the base being seven or eight. In the adult shell the aperture is subcircular, with a short, straight, columellar lip, forming a slight angle anteriorly. In the younger shells (fig. 5) the *Purpurina*-like character of the aperture is more obvious.

Relations and Distribution.—Distinguished from all varieties of *Amb. ornata* by a somewhat larger spiral angle and more turbinate whorls, and by the number and fineness of the ornaments. The variety from the Irony Nodule-bed of Burton Bradstock (fig. 3) is longer, narrower, and with a more gaping suture than specimens from the *concavus*-bed of Bradford Abbas, where *Amb. densinodosa* is somewhat sparingly distributed. A stout variety occurs at Dundry.

Amb. densinodosa serves to connect the more eucycloid species of *Amberleya* with the *Turbo*-section through such a species as *Amberleya Milleri*. Intermediate forms occur.

212. Amberleya, cf. Meriani, *Goldf.*, 1844. Plate XXIII, fig. 17.

1844. Turbo Meriani, *Goldfuss*. Petref., vol. iii, p. 91, pl. cxciii, fig. 16.

Bibliography, &c.—Goldfuss originally described *Turbo Meriani* as from the Upper Lias of Altdorf and the Inferior Oolite of Normandy. He also quoted it from the Oxford Clay of Dives. Subsequently it has been regarded mainly as an Oxfordian species. It seems, on the whole, to answer to one of those more or less recurrent forms which do occasionally show themselves on more than one horizon.

Description.—The form to which I now draw attention is evidently a member of the *ornata*-group, of moderate size and somewhat more elaborate ornamentation than the regular *Amb. ornata*.

Length about	20 mm.
Length of body-whorl to total height	60 : 100.
Spiral angle	46°.

The whorls have four spirals (the secondary spirals mentioned by Goldfuss not always to be seen), and the tuberculations are proportionately large. The aperture ovate, but with the columellar lip produced anteriorly (not rounded off as in Goldfuss's figure). The body-whorl is ventricose, and longer in proportion to the spire than is usual with members of the *ornata*-group.

Relations and Distribution.—There are smaller varieties which seem to connect with *Littorina Phillipsii*, which is probably nothing more than a variety. Occurs at Weldon and Ponton in the Lincolnshire Limestone, and in the Scarborough Limestone at Cloughton Wyke.

213. Amberleya cygnea, sp. nov. Plate XXIV, fig. 10.

Description:

Length, full size	35 mm.
Length of body-whorl to total height	50 : 100.
Spiral angle	46°.

Shell eucycloid, turrited. Spire pointed, but with an obtuse apex. Whorls seven or eight, sub-biangulate, suture wide. The first whorls on which ornaments

can be traced are anteriorly bicarinate; in the next stage a posterior spiral is further developed; later still there are four spirals, of which the third forms the most salient carina; the spirals are more or less tuberculate; in the interspaces subordinate spirals may be detected.

The ornamentation of the body-whorl is very elaborate. There are five primary spirals, the fourth being the most salient, and constituting with the fifth a double carination. In the posterior spiral the nodules are nearly circular, the other spirals are serrated; there are about half a dozen deeply-serrated spirals in the base; the interspaces throughout are cross-hatched with coarse axial lines.

The aperture is ovate-elongate in the earlier stages, with a certain amount of anterior canaliculation, but becomes more round in the larger shells, as is usually the case with *Amberleya*.

Relations and Distribution.—This might almost be called *Amb. Meriani*, Goldf., var. *major*. The ornamentation, as shown in the enlargement of that author's figures, greatly resembles the ornaments of *Amb. cygnea*. But ours is a finer and more eucycloid form, which possesses peculiarities worthy of distinction. It differs still further from d'Orbigny's *Turbo Meriani* (T. J. ii, pl. cccxxxv, figs. 1—5).

The "Bastard-bed," in which this handsome member of the *ornata*-group occurs, lies at the base of the Lincolnshire Limestone, and just above the Ironstone at Lincoln. Here *Amb. cygnea* is fairly plentiful in a rough fawn-coloured matrix along with many other interesting Gasteropoda.

214. Amberleya goniata, *Deslongchamps*, 1860. Plate XXII, fig. 6 (juv.).

1860. Eucyclus goniatus, *J. A. Deslongchamps*. Bull. Soc. Linn. Norm., vol. v, p. 31, sep. copy, pl. xi, fig. 6.

1873. Amberleya ? goniata, *Desl.*, sp. Tawney, Dundry Gasteropoda, p. (20) 28, pl. ii, fig. 5.

The type occurs in the Inferior Oolite of Les Moutiers. The specimen figured by Tawney appears correctly identified with Deslongchamps' species, which is probably only a bizarre variety of the one described on the next page. Fig. 6 most likely represents the young stage. This form is found rarely in the *Parkinsoni*-zone of Burton Bradstock. It is more markedly angular and more coarsely ribbed than the commoner form next to be described, and has rather a wider spiral angle. All members of the *goniata*-group have a sharp spire with an obtuse apex (see enlargements of figs. 6 and 11).

215. Amberleya Orbignyana, sp. nov. Plate XXII, figs. 7, 8.

. Purpurina ornata, *d'Orbigny*. Terr. Jur., vol. ii, pl. cccxxx, figs. 4, 5.

Bibliography, &c.—There is no reference to *Purpurina ornata* in the text of the 'Terrains Jurassiques,' though we gather from the explanation to the plate that it is a fossil of the Inferior Oolite. *Purpurina ornata* is evidently an *Amberleya* (*Eucyclus*), and we at once recognise the form as common and characteristic of the *Parkinsoni*-zone of Dorset. The specific name "*ornata*" being preoccupied, it becomes necessary to bestow on this fossil a fresh appellation.

Description :

Length of well-grown specimens .	. 35—45 mm.
Length of body-whorl to total height .	. 50 : 100.
Spiral angle . . .	. 45°.

Shell eucycloid, turrited. Whorls nine or ten, angular, and sloping flatly towards the dominating keel. The whorls of the spire are biangulated anteriorly; a faintly nodular spiral is developed close to the upper suture, then ensues the flat sloping area, marked by extremely fine striæ rather oblique to the axis; the two principal keels or spirals are quite low down, the upper one having large tubercles, wide apart and spirally extended; in the lower keel the ornaments are usually less conspicuous.

The body-whorl is large, very angular, with the great keel strongly tuberculated; there are five spirals in the base, these being slightly tuberculated. The aperture is ovate-elongate, with a straight columellar lip much produced anteriorly, as in *Purpurina*. This is the stage in which the shells are usually found. Larger specimens have the aperture more circular.

Relations and Distribution.—This may be regarded as the average form of the *goniata*-group. It occurs throughout the *Parkinsoni*-zone, principally in South Dorset, being especially abundant at Burton Bradstock, Loders, &c. It also occurs in the upper part of the *Humphriesianus*-zone at Louse Hill, and in the *Parkinsoni*-zone at Grove, &c. Casts of this form are found in the *Parkinsoni*- or *Martinsii*-zone of Midford. *Purpurina Belia*, d'Orb. (T. J, ii, pl. cccxxx, figs. 9, 10), is perhaps nearly the same.

216. Amberleya Murchisoni, *Münster*, 1844. Plate XXII, fig. 11.

1844. Turbo Murchisoni, *Münst.* Goldf., Petref., pl. cxciv, fig. 10.

Except that ours is a better specimen, showing the apical conditions, there seems no difference between the fossil from the *Humphriesianus*-zone of Bradford Abbas and the one figured by Goldfuss. No other British specimen is known to me. *Amb. Obornensis*, next described, is probably only a variety.

217. Amberleya Obornensis, sp. nov. Plate XXII, fig. 10.

Description :

Length	25—35 mm.
Length of body-whorl to total height . .	48 : 100.
Spiral angle	40°.

Shell eucycloid, turrited. Spire pointed, with an obtuse apex. Whorls nine or ten, sutures very wide. The apical whorls smooth, full, and flattened towards the summit (the enlargement of figs. 6 and 11 is also suitable for this species), the succeeding whorls sub-biangulate, spirally ornamented, with the principal keel almost median. Close to the suture is a posterior row of tubercles, which are rather small and wide apart; next succeeds the flat sloping area, with axial striæ, also rather wide apart; then the principal keel, which forms the angle of the whorl, the tuberculations being of moderate size; the lower median carina has the tuberculations still smaller and numerous; and below this, owing to the gaping of the suture, an additional carina, corresponding to the first spiral in the base, may frequently be detected.

The body-whorl is angularly ventricose, the keel being situated rather high up, so as to shorten the posterior area, which together with the rest of the shell is axially striated, the striæ being rather wide apart.

The aperture is ovate-elongate, with a straight columellar lip produced anteriorly, somewhat after the manner of *Purpurina*, with a tendency to become more circular in the larger and more mature specimens.

Relations and Distribution.—*Amberleya Obornensis*, which is at least a good local variety of *Amb. Murchisoni*, although clearly a member of the *goniata*-group, has certain affinities with the more elegant forms of *Amb. ornata*, var. *abbas*. To a certain extent, then, it may be regarded as intermediate between the *ornata*- and *goniata*-groups, though its relations are mainly with the latter.

This intermediate character corresponds with its stratigraphical position in

the lower part of the *Humphriesianus*-zone at Oborne, where it is the most abundant and characteristic species of *Amberleya*.

218. Amberleya pagodiformis, sp. nov. Plate XXII, fig. 9.

Description :

Length	40 mm.
Length of body-whorl to total height . .	48 : 100.
Spiral angle	48°.

Shell conical, eucycloid, turrited. The spire consists of about eight or nine whorls, the apical conditions being unknown. Whorls angular and distended by a large carina situated in the anterior region. In the earlier whorls of the spire two tuberculated circlets may be distinguished, connected by a kind of axial ribbing; the posterior circlet is close to the suture, the anterior one becomes more and more prominent, and in the later whorls the tubercles project like the teeth of a saw.

Body-whorl large, angular, and similarly ornamented; base rather flat, with about four finely-granulated spirals; the axial striæ are wide apart, and strongly marked throughout the shell.

Aperture almost trapeziform, with a short and very straight columella.

Relations and Distribution.—This form, it seems to me, helps to connect the eucycloid with the trochiform Amberleyas. The want of biangulation makes us regard it as a somewhat aberrant member of the *goniata*-group; whilst the flatness of the base, the wide space between the two spirals, and the trapeziform character of the aperture serve to connect it with *Amb. biserta*.

Occurs sparingly at Bradford Abbas, and probably in the *Murchisonæ*-zone.

219. Amberleya, cf. generalis, *Münster*, 1844. Plate XXIII, fig. 3.

N.B.—It must be borne in mind that the posterior portion of the last two whorls in our specimen has been stripped of all ornament.

The length of the figured specimen is 35 mm., the ratio between the length of the body-whorl and total height 48 : 100, and the spiral angle 40°.

Amongst other points of resemblance the serrated keel, anteriorly situated, is conspicuous. One can hardly say whether this species should be referred to the *Eucyclus*- or to the *Trochus*-section.

The specimen is unique. It occurs in a brownish ferruginous stone, partly ironshot, which resembles the matrix of the *Humphriesianus*-zone of Dundry.

220. Amberleya, sp.; cf. *Trochus anaglypticus, Münster.* Plate XXII, fig. 12.

1844. Trochus anaglypticus, *Münster.* Goldf., Petref., pl. clxxx, fig. 4.

It must be admitted that the details of ornamentation do not tally very well with those of Goldfuss's figure, though, making allowance for difference of artistic treatment, and of mineral conservation, there are some grounds for inviting comparison. Our fossil is unique from the "marl with green grains" at the base of the *Humphriesianus*-zone of the Sherborne district. It may be merely a sport of the very abundant *Amb. Obornensis.*

221. Amberleya biserta, *Phillips*, 1829, Section A. Plate XXII, figs. 13, 14; Section B, Plate XXIII, figs. 1, 2.

1829 and 1835. Trochus bisertus, *Phillips.* Geol. Yorks, pt. 1, pl. xi, fig. 27, 3rd edit. (1875), p. 259.

1884. The "Trochus" bisertus-group, *Hudleston.* Geol. Mag., dec. 3, vol. i, p. 248, pl. viii, figs. 9—11.

Bibliography, &c.—Phillips's type was from the Dogger, and appears to have been lost, but the original figure leaves no doubt as to what fossil is meant. Bean recognised a species belonging to the same group, which in the second edition of Phillips's work, p. 129, was quoted, without figure or description, as *Turbo unicarinatus*, Bean, MS., and in the third edition, p. 258, as *Littorina unicarinata*, Bean, MS.

We have actually in the present case four different forms to deal with. A form like Pl. XXII, fig. 13, was originally described by me as *Littorina biserta*, but I now consider it to be the earlier stage of *Amberleya* (*Trochus*) *biserta* (Pl. XXII, fig. 14). Those who have followed me thus far in dealing with *Amberleya* will be fully prepared to believe in the modification of the aperture from an ovate and almost *Purpurina*-like aperture (fig. 13) to a subcircular or almost trapeziform aperture (fig. 14). These two, then, are merely varieties of age, and constitute our Section A. That there is an analogous relationship between *Littorina unicarinata* (Pl. XXIII, fig. 1) and the larger form (Pl. XXIII, fig. 2) is also probable, though not quite so clear, owing to imperfectly preserved apertures, and to the slight flattening out of the smaller specimen. It might, perhaps, be possible to separate them specifically from the more typical forms of *Amb. biserta*, but at present it seems safer not to do so. This, then, constitutes our Section B, which includes the *Littorina* (*Turbo*) *unicarinata* of Bean.

Description, Section A :

Length of adults (*Trochus bisertus*) .	. 25—30 mm.
Length of body-whorl to total height .	. 54 : 100.
Spiral angle . . .	. 55°.

Shell conical, trochiform. Spire pointed, with probably an obtuse apex; number of whorls about eight. The extreme apical whorls are smooth, convex, and without ornament; remaining whorls flat or slightly concave; sutural gutter very deep. The ornaments consist of two finely tuberculated circlets or girdles of nearly equal strength, one close to the posterior margin, the other, which forms a slightly salient keel, is situated near the anterior extremity. The whorls are richly ornamented by a system of deeply-cut axial striæ, which add much to the beauty of these shells.

In the body-whorl a similar system of ornamentation prevails, and the axial striæ are continued down to a third circlet, which is tuberculated. The base varies from moderately full in the early stage, where the columellar lip is straight and pointed at the extremity (fig. 13), to rather flat in the mature stage, where the aperture is subrhomboidal or subcircular (fig. 14); it carries four or five spirals, which are nearly plain.

N.B.—Specimens from Drympton, such as the one figured, have a flatter base and more trochiform aspect than those from the Dogger.

Section B.—The specimen of *Littorina unicarinata* (Pl. XXIII, fig. 1) has been somewhat distorted by compression, which has the effect of increasing the apparent width of the spiral angle. The points in which the *unicarinata*-variety differ from Section A are mainly those of ornamentation. The lower or keel girdle preponderates greatly over the other, which latter in some specimens is almost effete. This has the effect of making the shell more unicarinate and less trochiform in outline, and in the adult forms (fig. 2) recalls the *Eucyclus*-section.

Relations and Distribution.—*Amberleya biserta* and its varieties seem to form a group somewhat isolated. My reasons for not regarding it as a *Trochus* were given in the 'Geological Magazine.' Continental authors do not seem to have noticed it; nor can I find that d'Orbigny, who generally quotes Phillips' species, mentions it in the 'Prodrome.'

In England it is essentially a fossil of the *Opalinus*-zone or lower part of the *Murchisonæ*-zone, occurring sparingly in the Dogger at Blue Wyke, and in the Dorset-Somerset district at Drympton and Haselbury. Drympton is, on the whole, the best locality for these beautiful trochiform Amberleyas, and there are indications there also of the unicarinate variety.

222. Amberleya (Turbo) Milleri, *Wright*, MS. Plate XXIII, fig. 5.

Description:

Length	15—25 mm.
Length of body-whorl to total height .	60 : 100.
Spiral angle	62°.

Shell conical, turbinate, rather thin. Number of whorls about eight; apicals rather convex and smooth, remaining whorls but slightly tumid; suture well impressed. In the whorls of the spire the ornaments consist of finely tuberculated spirals increasing in number up to about five; these are nearly equal in degree of salience, but in the penult the lower one slightly projects; fine axial costæ and striæ decussate the spirals.

The body-whorl has about seven spirals, the upper ones being usually the most spiuulose; the two lower ones are more closely tuberculate, and constitute a slight double keel (sub-eucycloid). In the base are nearly a dozen spirals, slightly tuberculate and with fine intermediate axial striæ. Aperture subcircular, with a short and rather straight pillar lip.

Relations and Distribution.—Through *Amberleya densinodosa* this turbinate species is connected with the eucycloid Amberleyas, whilst, on the other hand, it has obvious relations with the species next described. Although there are forms figured by Goldfuss, d'Orbigny, and others which approach *Amberleya* (*Turbo*) *Milleri*, it seems to stand out with sufficient distinctness to be accepted as a species of *Amberleya* which still retains some trace of the eucycloid character.

It is fairly plentiful in the *concavus*-bed at Bradford Abbas.

223. Amberleya (Turbo) turbinoides, sp. nov. Plate XXIII, fig. 7 and ? fig. 6.

Description:

Length	25 mm.
Length of body-whorl to total height .	48 : 100.
Spiral angle	44°.

Shell conical, subelongate, turbinate. Number of whorls about eight; those in the upper part of the spire are rather flat, but become angular towards the penult; suture wide and finally gaping.

The ornaments exhibit considerable variety; in the middle stage the whorls possess four or five finely tuberculated spirals, the lowest being the longest and most prominent, forming a kind of keel. In the penult the spirals become more

numerous and variable, and, as the suture gapes very much, spirals are sometimes seen below the keels.

The body-whorl is globose, the spirals, including those in the base, being sometimes twenty in number. The sub-eucycloid character of the spire is more or less lost. The two posterior spirals are more strongly tuberculated than the others. Fine axial striæ are conspicuous in well-preserved specimens. Aperture ovate to subcircular, with a very short columellar lip.

Relations and Distribution.—This shell approaches *Amberleya* (*Turbo*) *Milleri*, which is more trochiform, has a wider spiral angle, and a less gaping suture. There is, however, in *Amb. turbinoides* an amount of irregularity such as tends to the suspicion that the name may represent a group of aberrant forms rather than a distinct species. It also has affinities with *Amb. densinodosa*. From *Turbo modestus*, Héb. and Desl., it is clearly distinguished by the irregularity of the whorls of the spire.

There are four specimens in my collection from Stoford and Bradford Abbas.

224. Amberleya (Turbo) Stoddarti, *Tawney*, 1873. Plate XXIII, fig. 11.

1873. Turbo Stoddarti, *Tawney*. Dundry Gasteropoda, p. (29) 21, pl. ii, fig. 1.
Cf. . — modestus, *Héb. and Desl.* Foss. Montreuil-Bellay, p. 57, pl. iii, fig. 2.

Bibliography, &c.—Mr. Tawney described his species from a single imperfect specimen in the Bristol Museum, smaller than the one figured above, and differing from it to a certain extent in the alternately stronger and fainter spirals. If the form figured in the plate is not fairly referable to *Turbo Stoddarti*, it may be accepted as an Inferior Oolite variety of *Turbo modestus*.

Description:

Length	30 mm.
Length of body-whorl to total height . .	55 : 100.
Spiral angle	56°.

Shell turbinate, thin. Number of whorls about eight, convex, and ultimately globose; suture distinct. The ornaments consist of about ten fine and evenly nodulated spirals of nearly equal prominence, the interspiral striæ being fine and regular. In some specimens are faint secondary spirals.

The body-whorl is rather more than half the height of the entire shell, ventricose, and has about ten spirals, of which two pairs, on either side of a line of tubercles in the centre, are slightly distinguished from the rest (sub-eucycloid). There are about fourteen finely granulated spirals in the very full and rounded base.

The aperture is wide, subcircular, with scarcely any trace of anterior canaliculation, though slightly flattened in front.

Relations and Distribution.—Differs from *Amberleya turbinoides* in its more globose character, and in its freedom from angularity in the whorls of the spire. Less trochiform, and with finer and more nodular ornaments than *Amb. Milleri*. The eucycloid character is almost at a minimum. Rare at Dundry, and not found elsewhere in England.

N.B.—Mr. Tawney relied upon the alternate arrangement of the markings to differentiate *Turbo Stoddarti* from *Turbo cyclostoma*, a well-known but much smaller Liassic species. It is not improbable that, after all, *Turbo Stoddarti*, as interpreted in the present instance, is to a certain extent little more than an amplification of a Liassic form. Lately Mr. Wilson has found some specimens of *Turbo cyclostoma* which show traces of the nacreous layer. Hence, though not really a *Turbo*, it is likely to be one of the *Turbinidæ*. The bearing of this upon *Amberleya* generally and associated forms must not be lost sight of.

225. Amberleya (Turbo) elongata, sp. nov. Plate XXIII, figs. 8, 9.

Cf. Turbo terebratus, *Münst.* Goldf., Petref., pl. cxciv, fig. 6.

Description:

Length, full size	60 mm.
Length of body-whorl to total height . .	45 : 100.
Spiral angle	36°.

Shell conical-elongate, turbinate, turrited. Number of whorls about nine, convex, widely separated by the suture; axial striæ fine and numerous.

Smaller Specimen.—Five spirals in the earlier whorls, six in the penult and body-whorl, the fourth being slightly the most prominent; base full and ornamented by numerous plain spirals. Aperture ovate-elongate, with a straight pillar-lip and indications of a shallow anterior canal.

Larger Specimen.—The penult has seven spirals, the body-whorl about eight, exclusive of the spirals in the base, which are numerous. The body-whorl is ventricose; aperture apparently subcircular.

Although the differences between the smaller and larger specimens are considerable, yet they may be regarded most probably as representing different stages of the same species. The rotund outline of the whorls, the elongate spire, and the character of the ornamentation are greatly similar. The spiral angle, too, is almost the same, if we exclude the ventricose projection in the body-whorl of the larger specimen.

Relations and Distribution.—This form is very rare, and would seem to represent the most extreme phase of the large and diverse series which I have ventured to group under *Amberleya*. Both specimens occur in the *Murchisonæ*-zone, the smaller one at Bradford Abbas, the larger one in the Pisolite at Longfords.

Pl. XXIII, fig. 10, represents a specimen from the *Murchisonæ*-zone of Stoford, which seems in some way to combine the characters of *Amb. turbinoides* and *Amb. elongata*. The specimen is unique, and I have not ventured to name it.

226. ? Amberleya (Turbo) Dundriensis, *Tawney*, 1873. Plate XXIV, fig. 11.

1873. Turbo Dundriensis, *Tawney*. Dundry Gasteropoda, p. 30 (22), pl. ii, fig. 2.

Description.—"Shell elongate, acutely conical. Whorls seven, angular, outline slightly convex above the keel, and then bending in towards a deep suture. Aperture angular, trapezoidal." The spiral angle is about 50°. The ornaments are fine; it is uncertain whether there are two or three spirals above the keel, the one nearest the suture having the most distinct nodulations; axial striæ conspicuous throughout. About nine spirals in the base.

Relations and Distribution.—Mr. Tawney refers to several shells from the Lias which come near this shape, such as *Trochus imbricatus-Suecicus*, Quenstedt; *T. concinnus*, Moore; *T. Gaudryanus*, d'Orbigny. He further says, "This and allied forms might form a distinct genus; they seem to differ from the recent *Turbo*."

There can be no doubt that "*Turbo*" *Dundriensis* takes the place at Dundry of *Purpurina* (*Eucycloidea*) *bianor*, d'Orb., already noticed in this Monograph.[1]

At that time I was not aware that several of d'Orbigny's Purpurinas were really Amberleyas, and that the *Purpurina*-like mouth in many cases was merely a stage in the development of *Amberleya*. I should be now disposed, therefore, to withdraw *Eucycloidea* from its supposed relationship to *Purpurina*. Whether *Eucycloidea* should be retained or merged in *Amberleya* is at present uncertain. Since *Amberleya* is likely to become too large and comprehensive, *Eucycloidea* might, perhaps, be retained as a sub-genus for shells of this class.

[1] Page 95, *Purpurina* (*Eucycloidea*) *bianor*, d'Orb, Pl. II, figs. 5 *a*—*h*.

227. Amberleya, cf. pinguis, *Deslongchamps*, 1860. Not figured.

1860. Eucyclus pinguis, *Desl.* Bull. Soc. Linn. Norm., v, p. 145 (p. 30 sep. copy), pl. xi, fig. 7.

Mr. Tawney found an indifferently preserved specimen of *Amberleya* at Midford, which he referred to *Amb.* (*Turbo*) *princeps*, Römer. Recently Mr. Wilson has found another specimen, which is not calculated to throw much additional light on the subject. These fossils more resemble *Eucyclus pinguis*, Desl., than any other figured species. The calcareous beds at Midford are mainly within the *Parkinsoni*-zone. *Eucyclus pinguis* is quoted from the *primordialis*-zone.

There are one or two other ill-defined forms of *Amberleya*, which I have concluded not to notice on the present occasion.

Genus—Littorina, Férussac, 1821.

Shell turbinate, thick, pointed, few-whorled; aperture rounded; outer lip acute, columella rather flattened, imperforate.

Tectarius, *Valenciennes*, 1833. *Shell muricated or granulated, sometimes with an umbilical fissure; columella callous, partially toothed at the base.*

Echinella, *Swainson*, 1840. *Shell granulated, thick; base of the columella toothed.*

From what has already been said, the true affinities of the shells about to be described are somewhat uncertain. They differ from the Amberleyas principally in having a small and thick shell. Most of them seem to have more affinity with *Tectarius* or *Echinella* than with *Littorina*, nor can I in all cases strictly define the difference between *Amberleya* and *Littorina*. It must be understood that in the succeeding pages *Littorina* is used partly in a conventional sense.

228. Littorina (Echinella) prætor, *Goldfuss*, 1844. Plate XXIV, fig. 8.

1844. Turbo prætor, *Goldf.* Petref., pl. cxciv, fig. 8.
Cf. also Turbo Meriani, *d'Orb.*, non *Goldf.*, T. J., ii, pl. cccxxxv, fig. 5, non figs. 2—4.

Description:

Length	25 mm.
Length of body-whorl to total height	52 : 100.
Spiral angle	55°.

Shell pyramidal. Number of whorls about seven, flat, increasing under a regular spiral angle, and well separated by the suture. The ornaments consist of

four serrated spirals of nearly equal prominence; in some cases the fourth spiral has a slight salience, and where the suture gapes a fifth spiral without tuberculations may be detected towards the bottom of the hollow.

The body-whorl rather exceeds half the height of the shell; it is slightly angular, and not ventricose; ornaments as in the whorls of the spire; base full with about six finely cut spirals. Throughout the shell the interspiral striæ are deep, and the serrations of the carinæ almost tooth-like and somewhat bent upwards; but there is considerable variety in the nature of the ornaments.

Aperture ovate with a straight pillar lip, in the earlier stage slightly reflexed anteriorly.

Relations and Distribution.—Our specimen is rather more conical than the one figured by Goldfuss, but there are others which correspond in almost every particular. In younger specimens which are free from matrix intermediate spirals of slight salience may be seen.

This is a sort of average form, which may be said to inosculate with others in the Jurassic rocks. The abundant *Littorina muricata* of the Corallians might be regarded as a micromorph on a higher horizon. Some varieties of *Amb. Milleri* are also near. On the other hand, the eucycloid varieties approach the *ornata*-group in many ways.

Littorina prætor is rare. My own specimens are mostly from the *Murchisonæ*-zone of Bradford Abbas. There is a specimen in the Woodwardian Museum stated to have come from Dundry.

The handsome shell, Pl. XXIII, fig. 4, may possibly represent a modification of *Litt. prætor* on a higher horizon, viz. the *concavus*-zone. In most shells of this class the pillar-lip is straight with a considerable deposit of callus. This specimen is the only one I have seen of the kind.

229. Littorina (*Tectarius* or *Echinella*) polytimeta, sp. nov. Plate XXIII, figs. 12, 13.

Cf. Turbo Davidsoni, *Laube.* Gast. braun. Jur. Balin, p. 8, pl. ii, fig. 1, for this and the following species.

Description:

Length	15—20 mm.
Length of body-whorl to total height .	60 : 100.
Spiral angle	62°.

Shell thick, conical; spire pointed. Number of whorls about seven, the apical ones being convex and smooth, the remaining whorls nearly flat, and marked off by a channelled suture. The ornaments are peculiar; they consist of

three nearly equal, equidistant spiral girdles (in the penult usually a subordinate fourth), which are evenly and regularly serrated. The appearance is almost that of a coil of whipcord wound round a top.

The body-whorl considerably exceeds half the height of the shell; it is rounded, but not ventricose. There are four principal spiral girdles similar to those already described, and in the base about six spirals similarly ornamented, and of nearly equal prominence, but becoming less salient towards the point of the columella.

The aperture is subcircular, flattened anteriorly with a straight pillar lip and large callus, much thickened towards the centre, so as to form a kind of tooth; outer lip crenulated.

Relations and Distribution.—The regularity, prominence, and peculiar rope-like character of the spiral ornaments clearly distinguish this from any other species in the Inferior Oolite of England. Laube's species is near to it, but appears more eucycloid in character.

The figured specimens are both from Bradford Abbas, most probably from the *concavus*-zone. It occurs also on nearly the same horizon in the neighbourhood of Beaminster and at Stoford. There were three specimens without locality in Dr. Wright's collection. There is also a specimen in a ragstone matrix said to come from Cleeve Hill. Altogether about a dozen specimens are known to me.

Attention is here drawn to a shell (Pl. XXIII, fig. 14) which appears to be an *Amberleya* rather than a *Littorina*. The following are the dimensions:—Length 20 mm., length of body-whorl to total height 55 : 100, spiral angle 50°. The style of ornamentation is somewhat similar to that of *Littorina polytimeta*, but the serrations are rather finer, and there are four spirals in the whorls of the spire, and also the spirals in the base are more numerous. In conformity with the shape of the shell the aperture is more elongate, otherwise similar, and with a similar tooth-like thickening.

This form is rare in the "Base-bed" at Lincoln.

230. Littorina Phillipsii, *Morris and Lycett*, 1851. Plate XXIII, fig. 16.

1851. Turbo Phillipsii, *Morr. and Lyc.* Great Ool. Moll., p. 117, pl. xv, fig. 12.
1884. Littorina Phillipsii, *Morr. and Lyc.* Hudleston, Geol. Mag., dec. 3, vol. i, p. 242, pl. viii, fig. 1.

Description:

Length	12—18 mm.
Length of body-whorl to total height	60 : 100.
Spiral angle . . .	68°.

Shell thick, trochiform, sub-eucycloid. Spire pointed, but with an obtuse apex. Whorls about six, sutures moderately wide; each whorl furnished with three, or more often four, granulated spiral bands, the lowest being the most prominent.

The body-whorl is large relatively to the shell, and somewhat eucycloid, owing to the prominence of the two lowest spirals. Number of spirals in the base five; axial striæ moderately shown throughout.

Aperture widely ovate, slightly flattened in front and angular at the point. Outer lip thin and crenulated, inner lip very callous; indications in some specimens of an umbilical fissure.

Relations and Distribution.—This form passes by easy stages into others already named. *Turbo Davidsoni*, Laube, may be intermediate between this and the species last described. In another direction *Litt. Phillipsii* has affinities with *Amberleya* (*Turbo*) *Meriani* (Pl. XXIII, fig. 17), but is smaller, has a wider spiral angle, and is less turrited. Some Yorkshire specimens seem to connect this form with *Amberleya ornata*.

Typical specimens occur in the Grey Limestone of Cloughton Wyke and in the upper beds of the Lincolnshire Limestone at Weldon and Ponton; also in the *Humphriesianus*-zone at Milborne Port. Specimens which might be referred to this species occur in the Dogger at Blue Wyke and in the Pea-grit at Crickley.

231. Littorina, cf. sulcata, *Hébert and Deslongchamps*, 1860. Plate XXIII, fig. 15.

1860. Littorina sulcata, *Héb. and Desl.* Foss. Montreuil-Bellay, p. 55 (sep. copy), pl. iii, fig. 3.

Fig. 15 represents a unique specimen from the *Parkinsoni*-zone of Bradford Abbas. It is characterised by the richness of its ornamentation and the width of the interspiral spaces or furrows. The English specimen is more conical, and has a smaller spiral angle; the body-whorl also is relatively shorter and more angular than is shown in the type figure.

232. Littorina Weldonis, sp. nov. Plate XXIII, fig. 18.

Description:

Length	8 mm.
Length of body-whorl to total height	52 : 100.
Spiral angle	55°.

Shell conical, spire acute; whorls five or six, flat and well separated by the suture. The ornaments consist of three rather finely granulated spirals of equal prominence, with widish interspiral sulci where the axial ornamentation is well seen.

Body-whorl subangular, with five plain spirals in the base; aperture subovate. N.B.—The figured specimen has suffered considerably from usage.

Relations and Distribution.—Despite the very considerable difference of appearance, this is probably the representative in the Lincolnshire Limestone of shells not far removed from *Littorina sulcata*. Its perfectly conical form and freedom from turriting seems to distinguish *Litt. Weldonis* from *Amb. gemmata* or *Litt. ædilis*.

Rather abundant in the upper beds of the Lincolnshire Limestone.

233. Littorina ædilis, *Münster*, 1844. Plate XXIV, fig. 1 and ? fig. 2.

1844. Turbo ædilis, *Münst.* Goldf., Petref., pl. cxciv, fig. 9.
1869. — — — Brauns, Mittl. Jura, p. 180.
1873. Littorina ædilis, *Münst.* Tawney, Dundry Gasteropoda, p. 23 (15).

Description :

Length	13 mm.
Length of body-whorl to total height . .	54 : 100.
Spiral angle	52°.

Shell ovately conical, turrited; spire acute. Whorls five or six, angular, widely separated by the suture. The ornaments consist of three prominent spirals decussated at the widely separated nodes by coarse axial costæ; in the gape of the suture a fourth spiral may sometimes be seen.

Body-whorl subangular and slightly ventricose; ornaments similar to those of the spire, with five rather fine spirals in the base; fine axial striæ throughout. Aperture ovate, pillar-lip produced in front.

Relations and Distribution.—There cannot be much doubt as to the correctness of Mr. Tawney's identification. A few specimens have been found at Dundry, and possibly such a form as fig. 2 may represent this species in the Lincolnshire Limestone.

Litt. ædilis is a sort of poor relation to the *ornata*-group, and is more or less intimately connected with numerous named forms. The species next described is probably only a local variety of polymorphous tendencies.

234. Littorina Dorsetensis, sp. nov., or ? var. of *Litt. ædilis*. Plate XXIV, fig. 3 (A), fig. 4 (B), fig. 5 (C).

Cf. for B Trochus granarius, *Héb. and Desl.* Foss. Montreuil-Bellay, p. 53, pl. ii, fig. 8.

Description, A and B :

Length	14—17 mm.
Length of body-whorl to total height . .	say 50 : 100.
Spiral angle (convex) . . .	60°.

Shell irregularly conical, spiral angle usually convex. Whorls seven, narrow, flattish, or slightly biangulated; suture well marked, rarely gaping. Within certain limits there is considerable variety, some shells being more trochiform, others more turbinate. Apex sub-obtuse, the two apical whorls being smooth and full; in the rest of the spire and body-whorl there are three nodose spirals, the nodes being rather wide apart, decussated by short, thick, axial ribs. The base is rather flattened, with five or six plain spirals. Fine axial striæ throughout.

Occasionally a fourth spiral is developed (fig. 4), in which case we seem to have the most characteristic features of *Trochus granarius*, Héb. and Desl.

Aperture sub-orbicular, with an extremely short and straight pillar lip, which is rounded off at the anterior extremity instead of being produced.

Variety C.—Shell thin, eucycloid; whorls biangulated, sutures rather gaping; spiral ornamentation much subdued, axial striæ conspicuous and very oblique. Pillar-lip rather longer than in vars. A and B, and the aperture less restricted in front.

In a large series of specimens every gradation between A, B, and C may be noted. There are also specimens which approach "*Turbo*" *centurio* (Goldf., pl. cxciv, fig. 7).

Relations and Distribution.—The group of shells which I have focussed under *Litt. Dorsetensis* is primarily related to *Litt. ædilis*. As a group given to sporting it helps to show how "*Littorina*" and *Amberleya* seem to wait upon each other, even to the thinning out of the shell-substance when the eucycloid character is assumed.

Extremely abundant in the *concavus*-zone at Bradford Abbas. A few very small specimens in the Pea-grit at Leckhampton.

235. Littorina (*? Trochus*) pisolitica, sp. nov. Plate XXIV, fig. 9.

Description:

Length	4—5 mm.
Length of body-whorl to total height .	56 : 100.
Opening of the spiral angle . .	70°.

Shell small, trochiform, spiral angle convex, sutures distinct. Number of whorls five, apex obtuse and smooth; remaining whorls convex, and ornamented by five spirals, decussated at the nodes by axial lines which produce a subreticulate structure; the anterior spiral slightly prominent.

Body-whorl large, subangular, with six spirals; base rather flattened, and with about seven nearly smooth spirals. Aperture subcircular, pillar-lip very short and with but little callus.

Relations and Distribution.—Failing to recognise any corresponding adult form, I am disposed to conclude that "*Littorina*" *pisolitica* is a variable micromorph, which seems to be related to species described under *Littorina*, but which may really be a *Trochus*.

Occurs in the Pea-grit at Crickley and Leckhampton.

N.B.—The two remaining species described under *Littorina* are cylindro-conical forms which resemble *Trochus*.

236. Littorina (*? Trochus*) recteplanata, *Tawney*, 1873. Plate XXIV, figs. 6 and 7.

1873. Littorina recteplanata, *Tawney*. Dundry Gasteropoda, p. 24 (16), pl. ii, fig. 6.

Description:

Length	13—20 mm.
Length of body-whorl to total height .	40 : 100.
Spiral angle	40°—45°.

Shell cylindro-conical, spire pointed. Number of whorls probably seven, flat and well separated by the suture. The ornaments consist of four closely tuberculated spirals, of which the anterior is the strongest and forms a slight salience; sometimes a fifth spiral may be noted in the gape of the suture; axial costæ sharply defined throughout.

Body-whorl angular, with four or five spirals much tuberculated, the fourth spiral constituting a carina at the angle; base subconvex, with five almost plain spirals. Aperture trapezoidal, with a thick columellar lip.

Fig. 7 represents a specimen from the Cotteswolds in much better preservation than the type (fig. 6); this has also rather a smaller spiral angle, and has probably developed an additional whorl.

Relations and Distribution.—"*Littorina*" *recteplanata* seems generically related to certain cylindro-conical forms of *Amberleya* which are rather characteristic of the Lias. It is extremely rare. In the Inferior Oolite, besides the type, I know of one specimen from Dundry and two from the Pea-grit of Longfords. Cf. also "*Monodonta*" *imbricata*, Morr. and Lyc., 'Grt. Ool. Moll.,' pt. 1, p. 67, pl. xi, fig. 3.

237. Littorina (*? Trochus*) triarmata, *Hébert and Deslongchamps*, 1860. Not figured.

1860. Trochus triarmatus, *Héb. and Desl.* Foss. Montreuil-Bellay, p. 62 (sep. copy), pl. iii, fig. 5.

A single specimen of this well-marked cylindro-conical form has come under my observation; it is somewhat longer and narrower than the type, but possesses the characteristic ornamentation.

It is apparently from North Dorset, and not improbably from the *concavus*-zone of Bradford Abbas. In this case it may be an extreme "sport" of the polymorphous *Littorina Dorsetensis*.

The Sinistral Group.

This group comprises a number of shells which have been described under *Cirrus*, *Hamusina*, *Scævola*, and perhaps *Tectus*, the three last-named genera having been constituted by Gemmellaro for the reception of species of this group which occur in the Lias-Oolite of Sicily. Besides the common feature of being sinistral, most of them are characterised by rugose ornamentation, by possessing a shell more or less trochiform or turbinate, and in the case of *Hamusina* rather thin. The aperture is circular, and there is scarcely any columella. Some species, such as *Cirrus nodosus*, Sowerby, have an enormous umbilical excavation, whilst in *Hamusina* the closure is complete. Nevertheless the presence or absence of an umbilicus is probably not of much generic importance, though we may make use of it for purposes of separating, for instance, *Hamusina* from *Cirrus*.

This group, to judge from Gemmellaro's work, is evidently well represented in the Lias-Oolite of Sicily. It is also fairly abundant in the lower division of the

Inferior Oolite in this country, and there occurs one species in the Upper Lias of Compton which may be regarded as a variety of *Cirrus Leachi*. This form seems to have been the first of the group in the British Jurassics, and its modified descendant, *Cirrus Leachi*, remained the demoid species of the Inferior Oolite. These would be classed under *Scævola* by Gemmellaro.

Whatever generic names are assigned to these rugose sinistral Gasteropods, as a matter of fact in this country they nearly all occur on one horizon, viz. the *Murchisonæ*-zone, and are, I suspect, pretty closely related to each other. It would not have been difficult, perhaps, to have folded them all under *Cirrus* had that genus been more fortunately constituted.

Bibliography of Cirrus.—In October, 1816, Sowerby gave his diagnosis of the genus, laying great stress upon the funnel-shaped umbilicus. "It is a curious genus, and would be considered a Turbo till modern discernment showed the necessity of nicer distinctions; having no columella, it represents the whorls of some tendrils called Cirri, or a curled lock of hair; I have therefore named it *Cirrus*."

The sinistral character seems to have been lightly regarded by Sowerby. Accordingly ('Min. Conch.,' t. 141) he described, first, a dextral shell from the Carboniferous Limestone of Derbyshire as *Cirrus acutus;* this is referred by Morris to *Euomphalus*. The second figure on the plate is that of a sinistral shell which Sowerby named *Cirrus nodosus*. This is interesting as being the first of the group to which I am now referring that was ever figured. The specimen was picked up near Yeovil, and evidently came from the Inferior Oolite of Coker, Stoford, or Bradford Abbas. As Sowerby subsequently described a very different set of shells under the title "*nodosus*," this form has been named *Cirrus intermedius* by J. Buckman.

In December, 1818, Sowerby ('Min. Conch.,' t. 219, figs. 1, 2, and 4) described *Cirrus nodosus*, No. 2, from specimens obtained at Dundry. It is more than probable that two distinct species are included in these three figures. A very imperfectly preserved fragment of a sinistral shell (op. cit., t. 219, fig. 3) was described as *Cirrus Leachi*.

In September, 1823, Sowerby (op. cit., tt. 428, 429) described four additional species of *Cirrus*, all dextral shells, and most probably Pleurotomarias, two being from the Chalk.

Thus we perceive that the *Cirrus* of Sowerby, regarded as a genus, includes three distinct genera, viz. *Cirrus* as restricted to certain sinistral forms, *Euomphalus*, and *Pleurotomaria*. It was held to extend from the Carboniferous Limestone to the Chalk inclusive. It will be necessary, therefore, in adopting the generic name *Cirrus* for a group of sinistral shells occurring in the Inferior Oolite to reconstitute and define the genus, and to eliminate as far as possible those

sources of error which are so liable to attach to a name of which such an unfortunate use has been made.

All names apart, and simply stating the facts as they are presented to us in the Inferior Oolite of this country, we recognise three *sections* of sinistral shells, which, by way of a temporary arrangement, we might classify as A, B, and C. It is hardly necessary to say that these inosculate.

Section A consists of regularly conical forms, more or less turrited; the shell is thin, and entirely devoid of umbilicus. These we have no difficulty in assigning to *Hamusina*, and indeed the first specimen on our list I have ventured to identify as a variety of one of the forms named by Gemmellaro.

Section B corresponds in the main to *Scævola*, Gemm. The shells are somewhat thicker, and the general character is turbinate rather than trochiform. The spiral angle (measuring in the body-whorl) is more or less concave; the ornamentation is very rugose, with a tendency to produce varices; the umbilicus is well developed and tolerably deep. This section subdivides into the *Calisto*-group and the *Leachi*-group, of which the latter is by far the most abundantly represented. These shells form the bulk of the genus *Cirrus* as subsequently defined.

Section C consists of subdiscoidal forms of considerable variety, where the tendencies already manifested in Section B attain their maximum. The conical form has entirely disappeared owing to the abortion of the spire, thus making the spiral angle extremely concave, whilst the umbilicus is enormous. These forms may be all gathered under *Cirrus nodosus*, Sowerby. Some authors seem disposed to restrict the genus *Cirrus* to this species. I have already pointed out that this is not the original *Cirrus nodosus* of Sowerby, but it is the "*Cirrus nodosus*, Sow.," of authors and of collections, being *Cirrus nodosus*, No. 2, of the author of the 'Mineral Conchology.'

Accepting *Hamusina* as a near relative of *Cirrus*, and regarding *Scævola* as a synonym of *Cirrus* in part, I have concluded to arrange the sinistral shells of our Inferior Oolite under the two genera *Hamusina* and *Cirrus*.

Genus—HAMUSINA, *Gemmellaro*, 1878.

Shell thin, sinistral, conical, turrited, tuberculated, without umbilicus. Spire acute; body-whorl externally angular; base subconvex. Aperture circular; columellar side excavated and incrusted; lip simple and somewhat extended laterally. Growth-lines oblique.

It is difficult to share the opinion of Gemmellaro that *Hamusina* is related to

Amberleya, though its affinities may possibly be stronger with Liassic forms of that genus than my own experience enables me to recognise. Certainly one would say that the Oolitic Amberleyas differ widely both from *Hamusina* and from *Cirrus*, more especially in the character of the aperture. The most marked difference between *Amberleya*, as developed in the Inferior Oolite, and *Hamusina* is the shortness of the columellar area in *Hamusina*, a feature which it shares with *Cirrus*. The probable relations of *Hamusina* will be more conveniently discussed when we consider the possible position of *Cirrus* itself.

238. Hamusina Damesi, *Gemmellaro*, 1878, var. "Babylonica." Plate XXIV, fig. 12.

1878. Hamusina Damesi, *Gemmellaro*. Faune Giuresi, &c., p. 338, pl. xxvi, figs. 39—41.

Description (British variety):

Length	35 mm.
Height of body-whorl to total length . .	35 : 100.
Spiral angle	40°.

Shell sinistral, thin, conical, turrited, without umbilicus. Spire acute, consisting of seven or eight whorls, keeled towards the base, and slightly hollowed out towards the centre. The ornaments are somewhat rugose; close to the posterior margin in each of the more adult whorls is a zone of tuberculations; below this are some fine undulating spirals, their number increasing with each successive whorl; a little above the dominant keel is another zone of tuberculations, each tubercle being connected with a corresponding one in the posterior zone by a rugose axial rib sloping from right to left; these ribs are less strong in the penult, and are almost effete in the body-whorl; growth-lines, sloping from right to left, pervade the entire shell.

The body-whorl is angular, with a flattish base, becoming subconvex towards the aperture; the ornamentation is substantially as in the spire-whorls, but the fine, undulating spiral lines are more numerous; these decussate with axial striæ. So likewise in the base. The aperture is rounded on the columellar side, the columella being extremely short and incrusted, but the outer lip is angular, and drawn out laterally.

Relations and Distribution.—The details of ornamentation differ considerably from Gemmellaro's type, the principal difference being that in the English specimens the keel is more anterior. The smoothness of the base in Gemmellaro's specimen was most probably due to the accidents of conservation, since it is not probable that a shell whose sides are so rugose should possess a perfectly smooth base.

Nevertheless the more salient features of the British and Sicilian shells approximate sufficiently to justify our regarding the two forms as varieties of one species.

Our best specimens occur in the *Murchisonæ*-zone of Babylon Hill. Hence we might name this form *H. Damesi*, var. *Babylonica*. It is also found sparingly on the same horizon at Stoford and Bradford Abbas. Modifications of ornament induced by solvents are apt sometimes to produce rather puzzling results in this species.

239. Hamusina Oppelensis, *Lycett*, 1857. Plate XXIV, fig. 13 (Coker variety), fig. 14 (type refigured).

1857. Turbo Oppelensis, *Lycett*. The Cotteswold Hills, p. 127, pl. iii, fig. 8.
Cf. also Turbo Bertheloti, *d'Orbigny*. Prodrome, i, p. 248; and Terr. Jur., vol. ii, p. 337, pl. cccxxviii, figs. 7 and 8.

Bibliography, &c.—Lycett observes that this is a remarkable species, resembling *Turbo Bertheloti* in its general figure and sinistral spire, but the latter has a double row of tubercles, and is destitute of the transverse ribs. As the result of a careful examination of the only three available specimens from the Cotteswolds, I am forced to conclude that the strong transverse (axial) ribs shown in the original figure, and also in Pl. XXIV, fig. 14, of the present work, are not structural features. The real ornamentation is more truly depicted in the large shell from Coker (fig. 13); but the Cotteswold specimens show it more or less, though the ornaments have been variously modified by mineralisation and development from a hard and unkindly matrix. As so often the case, the "type" is an unfortunate specimen, calculated to mislead alike the author, the artist, and the reader.

The subjoined description of *Hamusina Oppelensis* is based partly on Cotteswold and partly on Coker specimens. It would seem to be a very general rule that species of Gasteropoda, as they are followed from Dorset-Somerset into the Cotteswolds, diminish greatly in size. The sinistral Gasteropods are no exception to the rule.

Description:

Length	30—50 mm.
Height of body-whorl to total length .	35 to 40 : 100.
Spiral angle about . . .	46°.

Shell sinistral, thin, conical, without umbilicus. Apical conditions unknown. Number of whorls about eight; these are somewhat convex towards the centre, and upon the convexity is a single row of tubercles; at the anterior extremity is

a plain carina. The sutures are close. Fine spiral granulation is shown both in the flanks and base of some of the Cotteswold specimens.

Body-whorl angular and similarly ornamented; base rather flat, and probably spirally striated. Aperture subcircular; lip rounded and thickened on the columellar side, which is very short; outer lip slightly angulated.

Relations and Distribution.—The points wherein *H. Oppelensis* differs from *H. Bertheloti* have been already indicated. The Cotteswold shells may be said to differ from d'Orbigny's species more than do the Coker specimens.

The Cotteswold specimens occur in the Upper Pisolite of Longfords, in the Nailsworth district. This also is in the *Murchisonæ*-zone, but presumably somewhat higher than the Coker beds.

Genus—Cirrus, *Sowerby*, 1816.

Re-defined as follows :—*Shell sinistral, irregularly conical to subdiscoidal, often turbinate; columellar area very short; more or less umbilicated. Spire acute; spiral angle more or less concave; whorls very irregular and variable, sometimes flat, sometimes more or less tumid; sutures rather close. Whorls rugosely ornamented; large and sometimes spinous tubercles occur at the intersections of the spiral and axial systems; varices sometimes occur, whilst the striæ of growth are conspicuous and oblique. Body-whorl ventricose; aperture circular, expanding, and adherent.*

The above diagnosis would include *Scævola*, Gemmellaro, which Fischer classifies along with *Cirrus* under the Delphinulidæ. Other authors, like Tate, place *Cirrus* under the Solariidæ. Sowerby thought that *Cirrus* and *Euomphalus* merged into each other, and that both were distinct from *Delphinula*.

It will be convenient to commence with those forms, which, from their more regular spiral angle and trochiform shell, most nearly approach *Hamusina*.

240. Cirrus Etheridgii, *Lycett*, 1857. Plate XXIV, fig. 15.

1857. Turbo Etheridgii, *Lycett*. The Cotteswold Hills, p. 125, pl. vi, fig. 3.

Description:

Length	26 mm.
Height of body-whorl to total length	42 : 100.
Spiral angle	46°.

Shell sinistral, conical, moderately turrited; umbilicus contracted, spiral angle slightly concave, spire acute; number of whorls seven or eight, rather flat,

and ornamented with about five rows of granulated spirals, more or less decussated by axial lines, thus producing a structure partly granular and partly reticulate.

Body-whorl subventricose with a rounded base, produced anteriorly, and ornamented by close and finely granulated spirals; the narrow umbilicus has a distinct row of granules encircling its edge; aperture round.

Relations and Distribution.—We may regard *Cirrus Etheridgii* as a somewhat aberrant form of the *Leachi*-group. It is, as far as I know, peculiar to the Cotteswolds. The only two specimens to which I have had access are said to come from the Gryphite-grit of Rodborough Hill, which is about the horizon of the *concavus*-zone at Bradford Abbas.

241. Cirrus, species or variety. Plate XXIV, fig. 16.

Attention may here be drawn to a very fine specimen of *Cirrus* belonging to Mr. Monk, which comes from Stoford or Bradford Abbas. It is not unlike *C. Etheridgii* just described, except in being a little broader and more ventricose, and in having the system of ornamentation more espaced and reticulate. The umbilicus also is larger. This form also is a member of the *Leachi*-group, though it differs in several important characters from that demoid species.

So fine a specimen as the one figured is unique; but here and there in the North-Dorset beds one finds fossils which are difficult to refer to *Cirrus Leachi*, and which have a certain resemblance to this one. These I distinguish temporarily as *Cirrus* "*reticulatus*." The fossil noticed by Mr. J. Buckman ('Proc. Dorset N. H. Club,' p. 139, pl., fig. 5) as *Cirrus pyramidalis*, Tawney, an altogether erroneous identification, bears some resemblance to the forms I call *Cirrus* "*reticulatus*."

242. Cirrus gradatus, sp. nov. Plate XXIV, fig. 17.

But cf. as possibly an immature specimen—

Cirrus intermedius, *J. Buckman*. Proc. Dorset N. H. Field Club, p. 138, pl., fig. 4.

Description:

Length	48 mm.
Height of body-whorl to total length	35 : 100.
Spiral angle	46°.

Shell sinistral, conical, turrited, deeply umbilicated. Spire acute; spiral angle moderately concave. The extreme apical conditions are unknown. Num-

ber of whorls about twelve; the earliest recognisable are flat without turriting, and ornamented by spirals decussating with numerous axial ribs, the most prominent spiral being a little below the centre (see enlargement of fig. 17). Presently the whorls of the spire are seen to be turrited in steps with a central keel, which is very salient and nodose, and a less conspicuous anterior keel, which forms a thin serrated border. In the matured whorls the strong axial ribbing of the earlier portions of the spire has a tendency to become faint; the growth-lines are numerous and fine.

The body-whorl is angular, subventricose, and bicarinate, but the lower keel representing the serrated border is apparently not salient or much tuberculated. The character of the base is not established with certainty (the specimen, fig. 17, is defective in this respect), but it is probably more or less marked by axial ribbing; umbilicus funnel-shaped and deep. Aperture circular, small, and adherent.

Relations and Distribution.—This elegant and conical species is a member of the *Leachi*-group, and there are so many intermediate forms (*? Cirrus intermedius*, J. Buckman) that one cannot doubt the one passes into the other. It is distinguished from the majority of specimens of *Cirrus Leachi* by a greater number of whorls, by its more conical figure, by the less concavity of the spiral angle, and the less ventricose figure of the body-whorl. On the whole, likewise, the ornamentation is less rugose, and the axial ribbing of the spire whorls less strongly developed, whilst the whorls themselves are more disposed in steps.

Occurs sparingly in the *Murchisonæ*-zone of Coker and Stoford.

As regards *Cirrus intermedius*, Buckm., if this really is the immature form of *C. gradatus*, then the older name would take precedence. But there seems to be so much doubt as to what *Cirrus intermedius* really is that I prefer to keep them distinct for the present.

243. Cirrus Leachi, *Sowerby*, 1818. Plate XXV, figs. 3, 4, and 5.

1818. Cirrus Leachi, *Sow.* Min. Conch., pl. ccxix, fig. 3, and ? fig. 1.
1866. — (T. Hörnesi or T. Bertheloti), *Moore.* Middle and Upper Lias S.W. England, p. 94, pl. vi, figs. 7, 8.
1879. — Leachi, *Sow.*; sp., *J. Buckman.* Proc. Dorset N. H. Field Club, vol. iii, p. 137, pl., figs. 1 and 2.

Cf. for doubtful members of the *Leachi*-group—

1816. Cirrus nodosus, *Sow.* (No. 1)—Min. Conch., pl. cxli, fig. 2.
1879. — intermedius, *J. Buckman.* Op. et vol. cit., p. 138, pl., figs. 4, 4 *a*.

Cf. for more or less closely allied species—

1861. Turbo Hörnesi, *Stoliczka*. Hierlatzsch., p. 176, pl. ii, figs. 14, 14 *a*.

1874. Cirrus Fourneti, *Dumortier*. Dépôts Jurass. Bass. Rhône, pt. 4, p. 146, pl. xxxvi, fig. 9.

1878. Scævola busambrensis, *Gemmellaro*. Faune Giuresi, &c., p. 341, pl. xxvii, figs. 1, 2.

Bibliography, &c.—We have now to consider the prevailing forms of *Cirrus*, which it is convenient to focus under the general term of *C. Leachi*. The upper row of spiniform tubercles mentioned by Sowerby as noted in the type are rarely seen in specimens, simply because they are not preserved. The type which was obtained at Dundry is now the property of the Bristol Museum. On comparing this fragment with numerous specimens from Coker, Stoford, &c., there can be little doubt as to its substantial agreement with the prevailing forms.

There is, of course, the usual difficulty about names. When Sowerby's attention was first drawn in 1816 to the sinistral Gasteropods of the Inferior Oolite he named the cast "which was picked up near Yeovil," *Cirrus nodosus*. It is necessary to put this *C. nodosus*, No. 1, out of court altogether. First, it is only a cast; secondly, it was imperfectly diagnosed; and thirdly, the name "*nodosus*" was two years later applied by the author to a very different species. I may also remark that the title "*nodosus*" is applicable to nearly all these shells.

Thus Sowerby, who had made a complete mess of his genus *Cirrus*, bequeathed us an evil inheritance in the awkward mixture of names for the two most abundant species. Was it this which led the late Mr. Tawney to state that there was sufficient material in the Bristol Museum to prove the identity of *Cirrus Leachi* with *Cirrus nodosus?* Why did he not go a step further and include *Cirrus Calisto*, since an excellent specimen of that very distinct form was found on the same tablet? Undoubtedly *Cirrus Leachi* is the central form which holds out its hand to all the others, but there are many named forms much nearer to *C. Leachi* than the subdiscoidal species we now recognise as *C. nodosus*.

Description.—(N.B.—Since there is so much variety in this species a considerable margin must be allowed in interpreting proportional dimensions.)

Length	35—40 mm.
Height of body-whorl to total length . .	40 : 100.
Spiral angle (mean)[1] . . .	56°.

Shell sinistral, irregularly conical, strongly turrited, more or less umbilicated. Spire acute, spiral angle very concave, sutures close. Number of whorls eight to ten; extreme apical conditions unknown; the earlier whorls flat, without

[1] The angle is measured so as to include the periphery of the body-whorl. Owing to the concave shape of the shell the difference between the opening of the spiral angle and the mean spiral angle amounts to about 20° in *Cirrus Leachi* and about 80° in *Cirrus nodosus*.

turriting, and ornamented by spirals decussating with numerous closely set axial lines. In the last three or four whorls of the spire the ornamentation becomes very rugose, but with considerable differences of development. The anterior half of the whorls is occupied by two keels, of which the upper one is grossly tuberculated; the lower keel is sometimes tuberculated, sometimes it is little more than a serrated band (as in *C. gradatus*). Axial ribbing extremely coarse and rather wide apart. In well-preserved specimens a system of reticulation between fine intermediate spirals and the oblique growth-lines may be seen. In specimens from Coker this feature is rarely preserved.

The body-whorl is largely ventricose, subangular, and rugosely bicarinate, but there are considerable differences; specimens from Dundry have a rounder and still more ventricose body-whorl, with ornamentation so irregular that the spiral is often overpowered by thick tubercular axial costæ. The base is full, subangular or rounded, and strongly costated; the umbilicus varies considerably in width and depth. Aperture circular, expanding somewhat, and adherent.

Relations and Distribution.—There is a strong temptation to make several species out of *Cirrus Leachi*, and indeed one might fill a quarto plate with figures of varieties. Firstly, we have—

a. The very wide angled and coarsely costate form with bicarinate and angular whorls from the *bifrons*-beds of Compton, which was figured by Moore; the ornamentation somewhat resembles that of *Turbo Hörnesi*, Stol., but the Compton fossils have a much wider spiral angle, and are umbilicated.

b. The prevailing form at Coker and elsewhere in the *Murchisonæ*-zone of Dorset is not unlike that of the Compton fossils, but the ornaments are not quite so rugose, and the spire is rather higher. This variety was well figured by J. Buckman. Fig. 3 of the accompanying plate represents a somewhat less angular form of this variety.

c. There is a smaller and somewhat less ventricose variety with finer and closer costæ from Bradford Abbas (see fig. 5).

d. Specimens from Dundry, in the Bristol Museum, are extremely ventricose, the body-whorl being both wide and high, and the bicarinate character becomes almost obliterated by rugose axial ornamentation. To a certain extent this variety is represented by *Cirrus Fourneti*, Dum. I am somewhat inclined to classify the very elegant specimen from Bradford Abbas, fig. 4, with this section. In this particular specimen the umbilicus is so restricted that I have distinguished it in my Collection as var. "*subumbilicata*."

Cirrus Leachi abounds at Coker and Stoford, but is not very common at Bradford Abbas. Fine specimens were formerly obtained at Dundry. One would expect some modification of the demoid species of *Cirrus* to occur in the Cotteswolds, but at present I am without reliable information on this point.

A single specimen, said to be from the Oolite Marl, may fairly be regarded as a member of the *Leachi*-group, but it would be going a long way in "lumping" to describe it even as a variety of *Cirrus Leachi*. No species of *Cirrus* has, to my knowledge, been found either in the Lincolnshire Limestone or in the beds of Inferior Oolite age in Yorkshire.

244. Cirrus pyramidalis, *Tawney*, 1873. Plate XXIV, figs. 18, 19, types refigured; fig. 20, variety from the Cotteswolds.

1873. Cirrus pyramidalis, *Tawney*. Dundry Gasteropoda, p. 37 (29), pl. ii, figs. 10 *a*, 10 *b*.

Non — — — sp., *J. Buckman*. Proc. Dorset N. H. Field Club, p. 139, pl., fig. 5.

Description:

Length	30 mm.
Height of body-whorl to total length	40 : 100.
Spiral angle (mean) about	65°.

Shell sinistral, turbinate, moderately umbilicated. Spiral angle concave; apex acute, but extreme apical conditions unknown. Number of whorls about ten or eleven; the apical ones are nearly flat, but with the sudden increase in the width of the spiral angle become convex, with a basal keel moderately developed, below which the sutures have rather a tendency to gape. The ornaments consist of a number of fine wavy spirals, which decussate with very numerous closely-set oblique growth-lines. Rugose axial costæ extend from suture to suture in the earlier whorls, but fail quite to reach the anterior margin in the penult.

The body-whorl is very ventricose, with one strong keel at the angle of the whorl, which the axial costæ just fail to reach. Numerous fine undulating lines represent the spiral ornamentation, and one of these lines is sometimes of sufficient prominence to form a slight posterior keel. The base is rounded, and full of fine reticulate ornament, and the margin of the umbilicus is corrugated by low radial costæ not always perceptible. Aperture circular, expanding, and adherent.

Relations and Distribution.—It may be doubted whether this is anything more than a local variety of the species next described. The differences are mainly those of ornamentation, but in the form now under consideration the whorls are less turbinate, the body-whorl is more angular, the habit of growth smaller, and the spiral lines much finer and more close-set. Rare at Dundry. A variety (fig. 20) occurs in the Cotteswolds.

245. Cirrus Calisto, *d'Orbigny*, 1850. Plate XXV, fig. 1 (British variety).

1850. Turbo Calisto, *d'Orbigny*. Prodrome, vol. i, p. 300.
1852. — — — Terr. Jur., ii, p. 345, pl. cccxxxii, figs. 9, 10.
1879. Cirrus Calisto, *d'Orbigny*, sp., *J. Buckman*. Proc. Dorset N. H. Field Club, p. 139, pl., figs. 6, 6 *a*.
1884. Hamusina Calisto, *d'Orbigny*, sp., *Cossmann*. Ét. Bath., p. 249, pl. xiv, fig. 5.

Bibliography, &c.—Rather than make a new species on this occasion I prefer to follow the example of J. Buckman, and identify the Coker fossils with d'Orbigny's species. There are certain difficulties which present themselves with respect to "*Turbo*" *Calisto*. The type required some restoration, and thus it came to pass that d'Orbigny and Cossmann have differed somewhat as to the interpretation to be placed upon the fragments at their disposal. Moreover the French specimen is said to come from the Bathonian of Luc, whereas it is important to remember that no species of *Cirrus* or of *Hamusina* is known from the Great Oolite of this country, nor even from the Upper Division of the Inferior Oolite.

D'Orbigny's original diagnosis in the 'Prodrome' fits our specimens very well: "Magnificent sinistral species, whose convex whorls are striated spirally [*en long*] and ornamented with thick transverse undulations near the suture." The *Calisto*-group includes *Cirrus pyramidalis* and *Cirrus varicosus*, and appears to be connected with the *Leachi*-group through var. *d* of the latter species and its modifications.

Description:

Length	50 mm.
Height of body-whorl to total length . .	42 : 100.
Spiral angle	60°.

Shell sinistral, turbinate, umbilicated; apical conditions unknown. The number of whorls is conjectural, but the indications point to about ten, as there is every probability that the spire contracts with a concave spiral angle. The sutures of the lower whorls are wide, almost to gaping. The umbilicus is funnel-shaped, and of moderate width. There is no need to add further to d'Orbigny's description.

Relations and Distribution.—The differences which separate this species from *Cirrus pyramidalis* are little more than varietal, such differences being accentuated by change of matrix. What I have termed the British variety of *Cirrus Calisto* is not very uncommon at Coker, though generally much smaller than the figured specimen. These specimens bear considerable resemblance to each other, so that

the figured specimen, though unusually fine, is thoroughly representative (I have one even larger). The French specimen, according to the figure in the 'Terrains Jurassiques,' has the whorls somewhat more angular than the Coker variety, but there does not seem anything in the author's description to bear out this feature. Some of the Coker specimens show the laminated structure due to the oblique growth-lines, which is also very conspicuous in the types of *Cirrus pyramidalis*.

Smaller specimens of *Cirrus Calisto*, crushed and badly preserved, occur in the Pea-grit at Longfords and at Crickley.

246. Cirrus varicosus, sp. nov. Plate XXV, fig. 2.

Description:

Length	20 mm.
Height of body-whorl to total length	44 : 100.
Spiral angle (mean)	62°.

Shell sinistral, turbinate, moderately umbilicated; spiral angle concave. Number of whorls probably ten; apical ones unknown. The whorls are convex, widely separated by the suture, and ornamented by numerous rugose spiral lines, whilst the traces of axial costæ are slight and confined to the posterior half of each whorl. About three stout varices are developed in each whorl, but not in regular sequence, and this kind of ornamentation is continued throughout the base to the margin of the umbilicus.

The body-whorl is moderately ventricose and without keel; aperture circular, adherent, and probably expanding.

Relations and Distribution.—There can be no doubt that this form is closely related to *Cirrus Calisto*, *i. e.* to the Coker variety of that species. But it cannot be regarded as merely the local representative of the Coker fossils, for we find exact micromorphs of these on the Pea-grit horizon. There is every reason to believe that *Cirrus varicosus* occurs in the Oolite-Marl, and thus represents the *calisto*-group on a somewhat higher horizon. Extremely rare.

247. Cirrus nodosus, *Sowerby*, 1818. Plate XXV, fig. 6.

1818. Cirrus nodosus, *Sow.* Min. Conch., pl. ccxix, figs. 2 and 4.
1879. — — sp., *J. Buckman.* Proc. Dorset N. H. Field Club, p. 137, pl., figs. 3, 3 *a*.
Non Cirrus nodosus, *Sow.* Min. Conch., pl. cxli, fig. 2.

Bibliography, &c.—It is unnecessary to repeat what has already been intimated with respect to this species when dealing with *Cirrus Leachi*.

Description.—The following are the proportional dimensions of the shell figured (spire restored) :

Length (*i. e.* height) . . .	32 mm.
Height of body-whorl to total length .	50 : 100.
Ratio of height to width . . .	62 : 100.
Opening of the spiral angle . . .	30°.
Mean spiral angle of shell . . .	120°.

Shell sinistral, conical-depressed (subdiscoidal), widely and deeply umbilicated. The spire is conical-elongate, having towards its upper part an angle of 30°—35°. The precise apical conditions are unknown, but there is no reason to doubt that the earlier whorls are flat, as in *C. Leachi*, costate or reticulate, close and not turrited.

When this earlier stage is concluded, with an entire change of shape the nodose character of the whorls becomes more and more conspicuous. By sudden bounds the whorls begin to increase outside the apical angle, and the anterior whorls, including the body-whorl, expand into a broad discoidal shell with canaliculate sutures. The ornaments in this stage are somewhat variable, but the main feature is a central keel at the angle of each whorl, which is grossly tuberculated in connection with axial costæ.

The body-whorl expands greatly, so as partly to enclose the preceding whorl. It somewhat resembles a tube, angular externally, circular internally. Thick costæ occur at regular intervals on the upper surface ; at the upper angle of the tube these costæ thicken into a series of knots which constitute the first or uppermost spiral ; a short distance below this is a subsidiary spiral on the flank of the shell, and below this again the ribs cross a clear space until they reach another spiral, which is subsidiary to the row of nodosities (fourth spiral) at the lower angle of the tube. In the base is a fifth tuberculated spiral (row of nodes) at the edge of the umbilicus, which is enormous both in width and depth. The aperture is circular, adherent, and expanding considerably towards the peristome.

In the Coker specimens the finer ornamentation is rarely preserved, but we see traces of closely-set curved growth-lines decussating with extremely fine spiral lines.

Relations and Distribution.—This very remarkable species seems to stand alone, though probably its nearest relative is *Cirrus Leachi*. But I fail to detect in collections obviously intermediate forms. The short spire, discoidal aspect of the shell, and tubiform shape of the body-whorl will usually serve to distinguish *C. nodosus* from any other species of *Cirrus*. As far as appearances go, the form of this shell would seem to justify Sowerby's idea that there was a connection between *Cirrus* and *Euomphalus*.

Cirrus nodosus is very abundant at Coker—the most abundant species according to J. Buckman. It also occurs in the irony nodule-bed (*Murchisonæ*-zone) at Burton Bradstock, whence splendid specimens are sometimes obtained. It is also met with at Stoford, at Bradford Abbas, and at Dundry. I have not seen any representative of this species from the Cotteswolds.

Note on Discohelix *and* Straparollus.

I have already indicated that *Discohelix* may be regarded as a sub-genus of *Straparollus*, which, if we accept the views of d'Orbigny, is the same as *Euomphalus*, Sowerby. It is evident that *Straparollus*, as interpreted by d'Orbigny, included *Discohelix*. On the other hand, Mons. Cossmann ('Ét. Bath.') is inclined to refer most of the Bathonian species of *Straparollus* to *Solarium*.

There certainly does seem to be a sort of gradation between the flat and biconcave form of the most typical *Discohelix* through the several species of *Straparollus* into *Solarium*. But in the latter genus the whorls slope towards the apex, whereas in *Discohelix* and *Straparollus* they are more or less flat, like a strap-coil. Hence *Solarium* is more easily separated from *Straparollus* than the latter is from *Discohelix*.

In the following diagnosis of *Discohelix* and *Straparollus* the peculiarities of the Inferior Oolite forms have been more especially studied, and it is by no means pretended that such a diagnosis of *Straparollus* would be found wholly applicable to the Palæozoic species thus named.

I should be rather inclined to classify under one genus all the forms which, in the following pages, have been assigned to *Discohelix* and *Straparollus*. With this proviso the two following diagnoses are submitted.

Genus—Discohelix, *Dunker*, 1847.

Shell discoidal, depressed, more or less biconcave; whorls arranged in flattened coils round a centre, squared at the periphery and furnished with two marginal keels, usually tuberculated; aperture quadrangular.

Genus—Straparollus, *Montfort*, 1810.

Shell discoidal, more or less depressed; the under side largely excavated, the upper side flat, or with the spire slightly raised in steps; whorls coiled like straps, somewhat

flattened at the periphery, but more or less pinched in anteriorly, usually provided with two tuberculated marginal keels. Aperture quadrangular.

As a rule in the species referred to *Straparollus*, the shell, even when there is no salience of the spire, is proportionately higher than in *Discohelix*. All the forms are rare.

248. Discohelix Cotswoldiæ, *Lycett*, 1850. Plate XXV, fig. 7.

1850.	Solarium Cotswoldiæ, *Lycett*.			Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 419, pl. xi, fig. 2.
1853.	—	—	—	Proc. Cotteswold Nat. Club, vol. i, p. 80, pl. ii, fig. 2.
1854.	—	—	sp. Morris.	Catalogue, p. 279.
1857.	—	—	*Lycett*.	Cotteswold Hills, p. 40.

Description :

Diameter (large size)	12 mm.
Height	4 mm.

Shell discoidal, depressed, upper and under surfaces nearly equally excavated, but there is some difference in this respect, and also in the relative height of the specimens. Diameter ranges from 6 to 12 mm. The sides of the whorls are rather flattened, but having the margins rounded off; these latter are furnished both on the upper and under surface with numerous nodules of moderate size, rather close together. The smaller specimens show richer ornamentation than the larger ones, and in some specimens (like the one figured) there is a tendency for the nodes to die out towards the aperture.

All the whorls are ornamented by fine wavy spiral lines, and in the body-whorl this feature prevails both above and below and on the flank. Aperture quadrangular, spiral and axial diameters nearly equal.

Relations and Distribution.—There is considerable variety in the shells referred to *Discoheliæ Cotswoldiæ*. Moreover, in many instances, the specimens are by no means well preserved. Consequently we may in fact be dealing with more than one species. Morris suggested that *Solarium Cotswoldiæ* might be identical with *Euomphalus tuberculosus*, Thorent; but the differences are very considerable, as may be seen further on. Doubtless most of these forms are merely local varieties of some other form, but, on the whole, *Discoheliæ Cotswoldiæ* is sufficiently distinct from anything hitherto described to be entitled to rank as a separate species.

It occurs chiefly in the Oolite-Marl and Freestones of the Nailsworth district. I have small specimens from Crickley. Lycett also quotes it from Leckhampton.

249. Discohelix spinosus, *Wright*, MS. Plate XXV, fig. 8.

1859. Straparollus spinosus (name only), *Wright*. Quart. Journ. Geol. Soc., vol. xvi, p. 36.
1873. ? — sp., *Tawney*. Dundry Gasteropoda, p. 36 (28).
Cf. also — subæqualis, *d'Orbigny*. Terr. Jur., vol. ii, p. 311, pl. 322, figs. 8—11.

Description :

Diameter (fair size)	24 mm.
Height	8 mm.
Diameter of largest specimen known	46 mm.

Shell depressed, discoidal, upper and under surfaces nearly equally excavated. The whorls are subquadrangular, with sides almost perfectly flat, and the marginal keels are largely tuberculated at intervals. The spiral ornamentation is so fine as in many cases not to be detected; this is decussated with somewhat rugose striæ of growth, perpendicular or curved. In the larger shells the marginal tuberculation extends in ill-defined swellings or costæ right across the body-whorl. Aperture quadrangular, spiral and axial diameters nearly equal.

Relations and Distribution.—This species is by far the largest of any described under *Discohelix-Straparollus* from the Inferior Oolite of this country.[1] It most resembles *Straparollus subæqualis*, d'Orbigny, from the Inferior Oolite of Fontenay and Niort, both as to habit of growth and general character, but the marginal tuberculations present a considerable difference. It is also related to *Straparollus tuberculosus*, Thorent, but is truly biconcave and dextral. From all other British species of *Discohelix* and *Straparollus*, except the one next described, it may be separated by the fineness of the spiral ornamentation. In many specimens this is so fine that the shells appear smooth, though this appearance, no doubt, is partly due to wear.

Discohelix spinosus occurs principally in the *concavus*-bed of Bradford Abbas, where it is rather rare.

250. Straparollus "tuberculosus-dexter." Plate XXVI, fig. 1.

1854. Euomphalus tuberculosus, *Thorent*, sp. Morris, Cat., p. 248.
Cf. — — — Mém. Soc. Géol. France (1839), vol. iii, pt. 2, p. 259, pl. xxii, fig. 8.

Bibliography, &c.—To a certain extent the specific name "*tuberculosus*" is applicable to all species of *Discohelix* and *Straparollus* described in this Mono-

[1] Owing to unequal enlargement, and to the selection of medium-sized specimens, this fact is not made sufficiently evident in the plates.

graph. Hence there is a sort of natural tendency to identify the British forms with Thorent's species from the Inferior Oolite of the Aisne. As regards the form of tuberculation, *Discohelix spinosus* more nearly resembles it. The fossils now under consideration merely represent a modified form of *Discohelix spinosus* on a higher horizon, but they are flat atop and not biconcave: hence, according to the distinction adopted, they belong to *Straparollus;* and thus in structure, and probably in habit of growth, they most nearly resemble the original *Euomphalus tuberculosus*. From the fact of Morris having quoted "Bridport" as the locality, I have very little doubt that he was referring to the form now under consideration.

Description:

Diameter	15 mm.
Height	5 mm.

Shell depressed, discoidal; under surface largely excavated, upper surface nearly flat or slightly concave. The whorls are quadrangular, with flattened sides, which exhibit a very slight tendency towards contraction anteriorly. The marginal keels are grossly tuberculated, both on the upper and under side; on the flanks of the body-whorl these tuberculations almost extend across. Spiral ornamentation very faint; striæ of growth conspicuous, perpendicular or curved. Aperture quadrangular, spiral and axial diameters nearly equal.

Relations and Distribution.—The affinities of *Str. tuberculosus-dexter* have already been partly discussed. It differs from the French fossil in its dextral habit, and to some extent in the shape of the tuberculations. There are no sinistral forms in the Inferior Oolite of this country, but *Straparollus sinister* makes its appearance in our Middle Lias precisely as it does in France. Hence it seems to me that a dextral habit in our shell is an important element of difference.

There are two specimens in my Collection from the *Parkinsoni*-zone of Burton Bradstock, besides one in the Jermyn Street Museum evidently in a similar matrix, and another from (?) Dundry. Small specimens from Hook Norton (C or upper part of B of Mr. Walford's classification) approach the Burton Bradstock fossils, though with a leaning towards *Solarium disculum*, Morris and Lycett. There is also a specimen from the Lincolnshire Limestone of Stoke Lodge, which in some respects has more resemblance to Thorent's figure than any previously examined.

251. Straparollus pulchrior, sp. nov. Plate XXV, fig. 9.

Description:

Diameter	20 mm.
Height	6 mm.

Shell depressed, discoidal; under surface largely excavated, upper surface flat or scarcely concave. The whorls are numerous, narrow, quadrangular, with flattened sides, which in some specimens exhibit more tendency towards contraction anteriorly than in others. The marginal keels are closely tuberculated, the tubercles being rather round and small. These tuberculations are of equal strength on both upper and under surface, but are scarcely connected by costæ across the flanks of the body-whorl. The entire shell is richly ornamented by a trellis-work of spiral lines decussating with growth-lines. Aperture quadrangular, the axial diameter considerably longer than the spiral.

Relations and Distribution.—This beautiful species is easily distinguished from those previously described by the narrowness of the whorls and the peculiar roundness and closeness of the nodes. In the character of the spiral lines it somewhat approaches *Discohelix Cotswoldiæ*, but differs greatly both in ornamentation and the shape of the whorls. To a certain extent our shell resembles *Str. pulchellus*, d'Orb. ('T. J.,' ii, p. 312, pl. cccxxiii, figs. 1—4), but that species is more depressed, and its whorls are triangular rather than square.

Straparollus pulchrior is essentially a fossil of the *Murchisonæ*-zone. I have specimens from Mapperton, Coker, and Bradford Abbas, at all which places it is very rare. Apparently it occurs also at Dundry.

252. Straparollus Dundriensis, *Tawney*, 1873. Plate XXVI, fig. 2.

1873. Straparollus Dundriensis, *Tawney*. Dundry Gasteropoda, p. 35 (27), pl. ii, figs. 9 *a*, 9 *b*.

Description:

Diameter	18 mm.
Height	9 mm.

Shell depressed, discoidal; under surface considerably excavated, upper surface nearly flat, or sometimes slightly raised. The whorls are numerous, quadrangular, narrow (spirally), deep (axially); the sides are flattened with a considerable amount of anterior contraction as shown in the body-whorl. The tuberculations on the upper marginal keel are very dense and round, and the effect is to raise the keel considerably, and thus produce a sulcation of the rest of the upper surface, which also has about four dotted spiral lines between the rows of tubercles.

The body-whorl is deep, its height being equal to half the total diameter of the shell, though there is some difference in this respect; ornamented on the flank with spiral lines, which decussate with curved growth-lines so as to produce a rich reticulate pattern. The upper angle is somewhat less than a right

angle; its edge (upper marginal keel) is ornamented with numerous sharpish tubercles, decussated by spiral lines. The lower marginal keel is also provided with a number of sharp tuberculations set like a ring round the umbilicus. Ornaments of the lower or umbilical surface uncertain, though there are indications that they bear considerable resemblance to those of the upper surface. Aperture quadrangular, the axial diameter longer than the spiral.

Relations and Distribution.—The great depth of this shell, irrespective of its peculiar ornamentation, separates this species readily from any previously described in this work.

The best and most characteristic specimens are from Dundry. A variety occurs at Stoford, most probably in the *Murchisonæ*-zone. I also possess five specimens in a matrix similar to that of the *Murchisonæ*-zone at Coker, and there is one specimen belonging to the Jermyn Street Museum from the same locality. Altogether about a dozen specimens are known to me.

253. Straparollus exsertus, sp. nov. Plate XXVI, figs. 3 and 4.

Description:

Diameter	20 mm.
Height excluding spire	8 mm.
Height including spire	13 mm.

Shell depressed, subdiscoidal, widely umbilicate. Spire rather oblique, slightly trochoid, and sometimes equal to about one-third the entire height. Number of whorls about seven, narrow, subquadrangular, and arranged in steps. The tuberculations on the upper marginal keels are large, pointed, and wide apart, the tuberculations being drawn out spirally.

The upper angle of the body-whorl is nearly a right angle, but the flank is rapidly pinched in towards the anterior marginal keel so as to produce a subtrigonal shape of the whorl. The ornaments of the base or umbilical area are not known for certain, except that the edge of the umbilicus formed by the lower marginal keel is tuberculated. The aperture is quadrangular, the axial diameter being the longest, and the outer lip is somewhat produced anteriorly.

Relations and Distribution.—This species forms a step in the direction of *Solarium*. The bold and rather widely spaced tuberculation separates it from those varieties of *Str. Dundriensis* where the spire is somewhat salient. Of the forms previously described in this Monograph, the nearest in ornamentation and in the narrowness of the whorls is *Str. pulchrior*, but in that species the whorls are square rather than subtrigonal, and not nearly so deep, whilst the upper surface is always flat.

Straparollus exsertus is a fossil of the *Murchisonæ*-zone of Bradford Abbas and Coker, where it is extremely rare. Fig. 4 represents a more depressed variety from North Dorset, but the precise horizon and locality are unknown.

254. Straparollus, cf. altus, *d'Orbigny*, 1853. Plate XXVI, fig. 5.

1852–3. Straparollus altus, *d'Orb.* Terr. Jur., vol. ii, p. 314, pl. cccxxxii, figs. 5—8.

Description:

Diameter	11 mm.
Height	10 mm.

In the specimen under notice the width and height are nearly equal; spire about one-fifth the total height. The whorls externally (six) are subquadrangular to trigonal, flat atop, and occur in steps. The marginal tuberculations are well developed and rather close. The upper angle of the body-whorl is a right angle, but the flank rapidly contracts towards the umbilicus, which is of moderate dimensions and surrounded by a few large and pointed tubercles. Aperture trapezoidal and produced in front.

Relations and Distribution.—This form seems to be a further step in the direction of *Solarium;* though about three times the size of d'Orbigny's type from the Bathonian of Langrune, the resemblance is strong. A single specimen from the Inferior Oolite near Beaminster.

Note.—Besides the species of *Discohelix* and *Straparollus* enumerated above, we find here and there throughout the Inferior Oolite specimens which from imperfect preservation it is impossible to diagnose, *e. g.* below the *Opalinus*-bed at Burton Cliff. Again, there is a very thin form in the *Opalinus*-bed of the same locality: a similar form occurs in the blue stone at Duston.

Genus—Solarium, *Lamarck*, 1799.

Shell orbicular, conical-depressed, largely umbilicated; whorls subtrigonal and sloping; spire regular, nucleus oblique; umbilicus deep, the outer margin crenulated; aperture trapezoidal.

D'Orbigny seemed to entertain no doubt as to *Solarium* having been a Jurassic

genus ; and Cossmann would still further enlarge its scope, since the latter author refers several of the species described by d'Orbigny under *Straparollus* to *Solarium*. Fischer, on the other hand, expresses doubts, observing that "the numerous species [of *Solarium*] indicated in the Jurassic beds belong probably to the genus *Straparollus*." Morris and Lycett described two species of *Solarium* from the Great Oolite ; one of these (*S. disculum*) is, according to my views, a species of *Straparollus*.

The small shells from the Inferior Oolite which I refer to *Solarium* constitute a fairly distinct group in that series ; and one of them, *S. subvaricosum*, may fairly be regarded as a typical representative of the modern genus.

255. Solarium pisoliticum, sp. nov. Plate XXVI, figs. 6—8.

Description :

Diameter (average size)	4 mm.
Height	2·75 mm.
Spiral angle	125°.

Shell greatly depressed, moderately umbilicated ; nucleus oblique. Number of whorls in the majority of specimens about five ; the earlier ones convex and orbicular at the periphery, but the body-whorl is flatter and slightly angulated at the periphery. As regards ornaments, the extreme apicals appear to have been rather smooth, but a rich radial ornamentation is early developed, and this in the body-whorl is slightly decussated spirally, so as to form a series of closely-set nodose costæ.

The body-whorl is relatively large and bicarinated, and the radial ornamentation is carried as far as the anterior keel, which, as a rule, is less nodose than the upper one. Base full, rounded, and produced ; it is provided with fine reticulate ornaments, which are gathered into a ring of tubercles at the edge of the umbilicus.

Aperture trapeziform or subpentagonal.

Relations and Distribution.—This pretty little shell is easily distinguished from the majority of the species referred to *Straparollus* by its regular spire and sloping whorls, and also by the radial or axial character of the ornamentation.

The very small specimen from Crickley (fig. 7) is believed to represent the earlier stage, when the periphery is extremely orbicular. The very large one (9 mm. in diameter) from the Pea-grit of Cleeve Hill may, on the other hand, be regarded as a megalomorph, where another whorl has been added. The usual or average form is tolerably abundant in the Pea-grit at Leckhampton.

256. Solarium polygonoïdes, sp. nov. Plate XXVI, fig. 9.

Description :

Diameter	4 mm.
Height	3 mm.
Spiral angle	115°.

This rare form, although related to the species last described, differs from it in being somewhat less depressed; the radial costæ are wider apart, and more strongly developed towards the periphery, thus imparting a slightly polygonal outline, which is well seen in the body-whorl. The bicarination of the body-whorl is less pronounced, and the ring of tubercles at the margin of the umbilicus less distinct. [The conditions of preservation leave some doubt upon this point.]

Relations and Distribution.—From specimens of *S. polygonium*, d'Arch., in the Great Oolite of Minchinhampton this form is distinguished by the greater number and lesser salience of the angles of the periphery, and by other points of ornamentation. As a matter of fact, *S. polygonoïdes* would seem to occupy an intermediate position between *S. pisoliticum* and *S. polygonium*, and this accords with its stratigraphical position in the *Clypeus*-grit at Barrington. A single specimen.

257. Solarium diadema, *Lycett*, MS. Plate XXVI, fig. 10.

Note.—No publication has given me so much trouble and cause for perplexity as the paper by Lycett on the "Fossil Shells from the Inferior Oolite in Gloucestershire," which appeared in the first volume of the 'Proceedings of the Cotteswold Naturalists' Club' in 1853, and previously in the 'Annals.' In that paper (p. 80) Lycett describes "*Solarium*" *Cotswoldiæ* and no other species, although previously (p. 72) he had enumerated in addition three species of *Solarium*, one of which received the specific name "*diadema*."

Of mere names in a table I should not feel bound to take notice unless there was corroborative evidence on the point. It so happens that in Mr. Brodie's Collection there is a very pretty fragment marked "*Solarium diadema*," presumably on Lycett's authority. It is different from any other form, and seems worthy of distinction.

Description :

Diameter	7 mm.
Height	6 mm.
Spiral angle	100°.

The ornaments are somewhat similar to those of *S. pisoliticum*, but the proportions differ considerably, as this is a truly conical shell. It occurs in the Freestones of Leckhampton, and seems to be very rare.

258. Solarium subvaricosum, sp. nov. Plate XXVI, figs. 11, 12.

Description :

Diameter (large size)	13 mm.
Height	10 mm.
Spiral angle	90°.

Shell conical, moderately depressed, deeply but not widely umbilicated. The form is that of a true cone with a somewhat flattened apex; nucleus oblique. Number of whorls six, increasing under a regular angle, and rather concave; sutures distinct. The upper margin of each whorl has a circlet of fine, closely-set granulations, whilst the corresponding ornament at the base of each whorl consists of a circlet of stout tuberculations set widely apart. The interspaces are markedly rugose; axial lines inclined from left to right, and decussated by very fine spirals.

The body-whorl occupies somewhat more than half the height of the shell, and is markedly concave, with a blunt carinated margin studded with broad tubercles; the base is nearly flat, being only slightly raised towards the edge of the umbilicus, where the ends of the curved axial wrinkles are gathered into a ring of tubercles. The base is decussated throughout by a system of fine spiral and growth lines. Aperture subquadrate or trapezoidal.

Relations and Distribution.—This very typical species of *Solarium* is obviously related to *S. varicosum*, Morris and Lycett. It differs from the Great Oolite species inasmuch as the whorls are concave rather than angular. The umbilicus also in the Inferior Oolite shell is larger and more tuberculated at the margin, and the base less flat. It is also closely related to *Solarium formosum*, Terq. and Jourd., and to *S. serpentinum*, Terq. and Jourd., both from the Bathonian of Les Clapes. The Inferior Oolite species is less depressed.

The smaller specimen (fig. 11) is from the *Parkinsoni*-zone of Aston cutting; the larger specimen (fig. 12) probably from the Inferior Oolite of the Yeovil district, but the exact locality is doubtful. Six specimens are known to me. Those from the *Parkinsoni*-zone of Aston cutting differ somewhat from the shells of the Dorset-Somerset district.

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A MONOGRAPH

OF THE

BRITISH JURASSIC GASTEROPODA.

BY

WILFRID H. HUDLESTON, M.A., F.R.S., F.L.S.

PART I, No. 7.

GASTEROPODA OF THE INFERIOR OOLITE.

Pages 325—390; Plates XXVII—XXXII.

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Genus—Onustus, Humphrey, 1797.

We owe to the late Eugène Deslongchamps, in the first instance, the recognition of the fact that several trochiform shells found in the Jurassic rocks, which had been referred by d'Orbigny to the genus *Trochus*, might with more propriety be classed under the genus *Onustus*. Deslongchamps published his conclusions on this subject in 1860,[1] and pointed out that in the Jurassic rocks of France the genus had been noted in the Middle Lias, the Upper Lias, the Inferior Oolite, the Great Oolite, and the Callovian. Lycett in 1863[2] accepted these conclusions, and gave a diagnosis, based upon that of Deslongchamps, more especially applicable to the Jurassic species.

Shell conical, wide-angled, whorls flattened or rendered somewhat concave by an expansion of their lower borders, which overhang and conceal the suture; the lower border of the last whorl is produced horizontally; surface irregularly striated.

The base is concave towards the outer border and convex towards the centre; the umbilical orifice is sometimes large but in other instances small, and becomes nearly concealed by advance of growth; the aperture is depressed and oblique, columellar side curved, outer lip angular and produced.—Modified after Lycett.

As observed by Lycett, none of the Jurassic species exhibit those agglutinations of shells and stones which are so characteristic of the Tertiary and Recent examples of *Onustus*.

In the Jurassic rocks of this country the genus is first noted in the Upper Lias, where fairly characteristic specimens of *O. heliacus*, d'Orb., are quoted from more than one locality, and a similar form occurs in the Lias-Oolite sands of Nibley, in Gloucestershire.

A small and interesting form, near to *O. heliacus*, occurs sparingly in the *Opalinus*-zone; whilst the *Murchisonæ*-zone is characterised by a group of much larger forms, which it is convenient to focus for the most part under *Onustus pyramidatus*, Phil. In the Upper Division of the Inferior Oolite *Onustus ornatissimus*, d'Orb., is far from uncommon at Burton Bradstock, and a variety of this has been noted by Morris from the Lincolnshire Limestone. The genus is but poorly represented in the Inferior Oolite of the Cotteswolds, and has not been recorded, to my knowledge, from the Great Oolite of Minchinhampton. The French authors have described one or two species from the Bathonian and Callovian of France, and Lycett described *Onustus Burtonensis* from the Forest-Marble of Burton Bradstock.

[1] 'Bull. Soc. Linn. Norm.,' vol. v.

[2] 'Suppl. to Great Oolite Mollusca,' p. 103.

There can be little doubt that these shells have their ornamentation considerably modified by the accidents of preservation and mineralisation, so that appearances are not altogether to be trusted. This is especially the case in the Dogger, where it sometimes happens that the characteristic species, *O. pyramidatus*, Phil., appears deprived of all its costæ, or is otherwise so modified as to invite distinct recognition. Hence my hesitation to deal with forms which undoubtedly present considerable variety, and which under other conditions I should scarcely hesitate to regard as fairly distinct species. Roughly speaking, the Jurassic species referred to *Onustus* may be divided into two groups, viz. (1) that represented by *O. pyramidatus*, Phil., where the basal periphery is almost simple and the base nearly smooth. To this group belong *O. lamellosus*, d'Orb., and *O. acuminatus*, sp. n. (Pl. XXVII, fig. 3), in the Inferior Oolite; *O. liasinus*, E. Desl., of the Middle Lias of May; and *O. papyraceus*, Héb. and Desl., from the Callovian of Montreuil-Bellay. (2) The second group is represented by *O. ornatissimus*, d'Orb., where the basal periphery is more or less serrated, whilst in the majority of cases the base itself is more or less marked by spiral striæ. This group includes *O. heliacus*, d'Orb., of the Upper Lias, and the var. *opalina* (Pl. XXVII, fig. 4). In *O. Heberti*, Laube, the characters of the two groups seem to be somewhat blended.

259. Onustus pyramidatus, *Phillips*, 1829. Plate XXVII, figs. 1 and 2.

1829, 1835. Trochus pyramidatus, *Phillips*. Geol. Yorks., pt. 1, pl. xi, fig. 22.
1884. Onustus pyramidatus, *Phil.*, sp. Hudleston, Geol. Mag., dec. 3, vol. i, p. 294, pl. ix, figs. 2 and 3.

See also for this group of *Onustus*—

Trochus lamellosus, *d'Orbigny*. Terr. Jur., vol. ii, p. 270, pl. cccxi, figs. 11—13.
Onustus liasinus, *Eugène Deslongchamps*. Bull. Soc. Linn. Norm., vol. v, pl. x, fig. 10.
— papyraceus, *Héb. and Desl.* Op. et vol. cit., pl. ix, fig. 3.
— ornatissimus, *Hudl.*, non *d'Orb.* Geol. Mag., dec. 3, vol. i, p. 293, pl. ix, fig. 1.

Bibliography, &c.—The original *Trochus pyramidatus*, now preserved in the York Museum, does not very much resemble the figure by Phillips in the 'Geology of Yorkshire,' which seems to represent a more costated shell. I think, however, the specimen may have suffered from scaling, to which fossils from the Dogger are liable.

Description.—The following are the proportions of the type specimen:

Height	17 mm.
Width	23 mm.
Spiral angle	80°.

The spiral angle may be said to range from about 80° to 86°, and is slightly concave to nearly regular. Whorls six to seven in number; they are irregularly concave and more or less overlap, the line of junction being usually slightly crenulated. The costæ are numerous, prominent, straight or slightly sinuous, the intercostal spaces being roughened by closely-set lamellæ, which give a scaly appearance. This is much more conspicuous in some specimens than in others—a circumstance which may be attributed to differences in mineralisation.

The margin of the base is but slightly crenulated, the peripheral edge being almost plain, and so thin that the outline is seldom perfectly preserved in any of the specimens. The base has very fine radial lines, with occasional traces of spiral ones, but is otherwise smooth; it is only slightly concave, rising again towards the columella. There is a semicircular umbilical excavation of moderate dimensions, but no umbilicus. Aperture very oblique.

Varieties.—Of those to which it may be necessary to draw particular attention the most frequent is one which occurs in the Dogger and elsewhere, and which was mistaken by me for *O. ornatissimus*, d'Orb. (*vide* 'Geol. Mag.' *ut supra*). In this form the costæ are very short, and do not meet, so that the imbrication or overlap of the whorls is very conspicuous; spire conical. This variety might be known as *semicostata*.

Another variety from the Dogger is a very conical form, presenting the usual characteristics of *O. pyramidatus*, especially the flat and scarcely excavated base, but is absolutely devoid of costæ. Whether or no this is a trick of mineralisation seems uncertain. This may be known as var. *incostata*.

There are also in the *Murchisonæ*-zone of Bradford Abbas and Halfway House some megalomorphs, which it would seem proper to regard as referable to this species, the more so as they exhibit the characteristic base; one of these must have measured 40 mm. in width. These seem to answer to Eugène Deslongchamps' description of *Onustus lamellosus*, d'Orb. (*vide* 'Bull. Soc. Linn. Norm.,' vol. v, p. 133).

Relations and Distribution.—*Onustus pyramidatus* may be regarded as the most abundant representative of the genus in the Jurassic rocks; distinguished from *O. heliacus*, d'Orb., by its larger habit, more closely-set costæ, and more scaly surface, and also by the greater smoothness of the basal border. The same features will also serve to distinguish it from *O. ornatissimus*, d'Orb.

It is not common anywhere, but occurs mostly in the Yorkshire Dogger

and in the lower zones of the Inferior Oolite in Dorset, especially at Bradford Abbas. Rare at Duston.

The two species next described are closely related, and indeed *Onustus acuminatus* is little more than a variety.

260. Onustus acuminatus, sp. nov. Plate XXVII, fig. 3.

Description:

Height restored	22 mm.
Width	26 mm.
Opening of spiral angle	40°.
Mean spiral angle	75°.

Shell pyramidal, imperforate; spiral angle extremely concave. Number of whorls about nine; the apical whorls are flat, but with the increase of the spiral angle become much more excavated, so much so that the spire seems as if it scarcely belonged to the three anterior whorls. The ornaments are similar to those in some of the varieties of *O. pyramidatus*, the costæ being fully developed to the very edge of each whorl. The base is flat, smooth, or with slight radial lines of growth, and there is scarcely any trace of an umbilical excavation.

Relations and Distribution.—This form exhibits the concave spiral angle to a far greater extent than any species of *Onustus* in the Inferior Oolite of this country, in this respect somewhat resembling *Onustus papyraceus*, Héb. and Desl., from the Callovian of Montreuil-Bellay. It is quite possible that where the spire has been lost there are no means of distinguishing *O. acuminatus* from the more common *O. pyramidatus*.

Rare in the *Murchisonæ*-zone at Bradford Abbas, and probably occurring on the same horizon at one or two other places in North Dorset. There are two specimens from the Inferior Oolite of Nailsworth, now in the Jermyn Street Museum, which may be referred to *O. acuminatus*.

261. Onustus, species or variety. Plate XXVII, figs. 5 *a*, 5 *b*.

Description:

Height	16 mm.
Width	23 mm.
Spiral angle	82°.

The proportions in this form are very similar to those of an average specimen of *O. pyramidatus*. The chief differences to note are that the costæ are finer and more numerous, the scaly character remaining much about the same. Instead, however, of the nearly flat and unexcavated base, there is a very marked umbilical cavity. The base is plain, convex towards the centre, and presents towards the periphery a wide channel occasioned by the overlap of the margin of the body-whorl. It is true that this feature is partly shared by all varieties of the *pyramidatus*-group, but it seems especially developed in this form.

Relations and Distribution.—In many respects this variety approaches *O. lamellosus*, d'Orb., more especially in the character of the base. None of our specimens exhibit the fine spiral striæ round the umbilicus mentioned by the author, but the absence of these might easily be accounted for by the state of preservation.

Very rare at Bradford Abbas; the figured specimen is from the *Concavus*-bed.

262. Onustus heliacus, d'Orbigny, var. opalina. Plate XXVII, figs. 4 *a*, 4 *b*.

In this variety, which is rather narrower than the typical form, the spiral angle rarely attains to 70°. The figure is perfectly conical, rather reminding us of *O. pyramidatus*, from which species it obviously differs in its smaller habit of growth, in the wideness of the space between the axial costæ, and in the more crenulated margin of the base.

The base itself is smooth with fine radial lines. In the figured specimen very slight spiral striæ are also noted. There is scarcely even a trace of an umbilical fissure, and this seems inconsistent with d'Orbigny's description of *O. heliacus*. But Eugène Deslongchamps tells us ('Bull. Soc. Linn. Norm.,' vol. v, p. 132) that the so-called umbilicus in that species is a mere umbilical hollow.

This variety of *O. heliacus* occurs on or about the *Opalinus*-zone at Drympton and Burton Bradstock. The majority of the specimens are in very bad condition, but the width between the costæ in those cases where the crenulated margin is broken away will serve to distinguish it from all varieties of the *pyramidatus*-group.

263. Onustus Heberti, *Laube*, 1867. Plate XXVII, figs. 6 *a*, 6 *b*, and 7.

1867. Onustus Heberti, *Laube*. Gastropoden des braunen Jura von Balin, p. 14 (sep. copy), pl. iii, fig. 5.

Bibliography, &c.—The author recognised a form of *Onustus*, occurring rarely at Balin and Sanka, which he regarded as occupying an intermediate position between *O. ornatissimus*, d'Orbigny, and *O. papyraceus*, Héb. and Desl., the latter representing the section of which *O. pyramidatus* is the type.

Description:

Height	10 mm.
Width	12 mm.
Spiral angle	68°.

Shell short, conical, pointed. The spiral angle but slightly concave. Number of whorls about six. These are flat, closely fitting, and ornamented with very regular costæ of moderate prominence, so arranged that there are about thirty in the body-whorl. The intercostal spaces are moderately scaly.

Base nearly flat, but rising towards the rhomboidal aperture; peripheral border slightly crenulated. There is a very faint submarginal channel, and an umbilical hollow rather than a true umbilicus: spiral striæ of the base very distinct.

Relations and Distribution.—Although this shell does not correspond in all respects with the form described by Laube, its obviously intermediate character between the *pyramidatus*-group and *O. ornatissimus* must be my justification for thus identifying it. Whilst the flanks of the shell are characteristic of *O. pyramidatus* and its allies, though with a narrower spiral angle, the spiral ornamentation of the base entirely removes it from this group, and brings it into comparison with the still stronger basal striæ of the species next described.

A single specimen from Stoford, horizon unknown. Fig. 7, representing a shell from the *Cadomensis*-bed, Oborne, may be a variety.

264. Onustus ornatissimus, *d'Orbigny*, 1850. Plate XXVII, figs. 8 *a*, 8 *b*.

	1850.	Trochus ornatissimus, *d'Orbigny*.		Prod., i, p. 264.
	1852.	—	—	Terr. Jur., vol. ii, p. 272, pl. cccxii, figs. 5—8.
Cf. also		—	—	?, var. Pontonis. *Morris*, Quart. Journ. Geol. Soc., vol. ix, p. 343, pl. xiv, fig. 10.
	Non	Onustus ornatissimus, *d'Orb.*, sp.		Hudleston, Geol. Mag., dec. 3, vol. i, p. 293, pl. ix, fig. 1.

Description:

Height of average specimen	10—12 mm.
Width	17—19 mm.
Spiral angle (concave)	80°—85°.

The following description by d'Orbigny suits the British specimens very well. "Shell much wider than high, considerably umbilicated. Spire formed by a concave angle, excavated, composed of whorls somewhat concave, furnished axially with straight costæ, radiating from the summit of the spire towards the margin, where they are terminated by a point. In the interspaces are fine oblique transverse lamellæ. The last whorl, somewhat convex above, carinated, and with points on the periphery, is umbilicated in the centre, and around this occurs a prominence with concentric striæ." The aperture is rhomboidal and depressed, as in all species of *Onustus* from the Jurassic rocks.

Relations and Distribution.—This species is easily distinguished from *O. pyramidatus* and its allies by the coarseness and wideness apart of the axial costæ and the serrated character of the basal periphery, which in some specimens almost equals the figures in the 'Terrains Jurassiques.' Fig. 8 of the accompanying plate represents the usual British form, whilst fig. 7 represents a peculiar form occurring in the upper part of the *Humphriesianus*-zone at Oborne, which seems to connect rather with *O. Heberti*.

In the width between the costæ and in some other respects *O. ornatissimus* presents certain analogies with *O. heliacus* and its varieties, which it also more resembles in size; but it is distinguished from that species by the presence of a distinct umbilicus, the edge of which is spirally striated, and also by the much stronger serrations of the basal periphery. Typical specimens are somewhat abundant in the *Parkinsoni*-zone of Burton Bradstock and Vitney Cross, but very rare elsewhere, and almost unknown much further north.

Var. *Pontonis*, Morris.—Specimens from the Lincolnshire Limestone are in such a poor state of preservation that it is difficult to say what their relations may be. I have a specimen from Ponton which seems to be a small variety of this species, but as the base is not seen the identification cannot be regarded as certain.

Family—NERITIDÆ.

Shell imperforate, globular, semiglobular, or patelliform; spire very small, cavity simple owing to the absorption of the internal portions of the whorls; aperture semilunate; columellar side expanded and often flattened.

In the Inferior Oolite of this country the following genera or sub-genera occur, viz. *Nerita*, *Neridomus*, and *Pileolus*. Of these *Neridomus* is perhaps best considered as a section of *Nerita* allied to *Neritina*. Shells of this family are far from abundant in our Inferior Oolite. They mostly occur on a low horizon, and appear to be wanting in the rich shell-beds of the Dorset-Somerset district.

Genus—Nerita, *Linnæus*, 1758.

Systematic conchologists, such as Fischer, do not carry the genus *Nerita* so far back in time as the Jurassic period. That author ('Manuel,' p. 800) observes that the Jurassic forms of *Nerita* are doubtful and belong to the genus *Neridomus*, Morris and Lycett. Accepting provisionally the classification of these authors for the Neritoid shells of the Lower Oolites, I think that *Nerita* will cover the more rugose and costated forms with flatteued inner lip, though, as far as my experience goes, there is no denticulation of the edge. Viewing *Neridomus* as a section of *Nerita*, this will include shells which are smooth and have the inner lip convex. It has always seemed to me that *Neridomus* was more nearly related to *Neritina* than to *Nerita*. Cossmann, I may remark, is disposed to query the value of the generic distinction between *Neritina* and *Nerita*, and he has no hesitation in placing all the Nerite-like shells of the Jurassic rocks under *Nerita*.[1]

As a matter of fact, I distinguish in our Inferior Oolite three rugose and costated forms, which no doubt are closely related, and more or less run into each other. There are also two, if not three, fairly distinct smooth forms which belong to the section *Neridomus*, besides some others which are too obscure to notice.

265. Nerita costulata, *Deshayes*, 1838. Plate XL, figs. 6 *a*, 6 *b*; and ? Plate XXVIII, figs. 6 *a*, 6 *b*.

1824.	Nerita	costata,	*Sowerby*.	Min. Conch., pl. cccclxiii, figs. 5 and 6.
1838.	—	costulata,	*Deshayes*.	Lamarck, Anim. sans Vert., 2nd edit., vol. viii, p. 617.
1851.	—	—	—	Morris and Lycett, Great Ool. Moll., pt. i, p. 57, pl. viii, fig. 6.
1884. ?	—	—	—	[var.] *Hudleston*. Geol. Mag., dec. 3, vol. i, p. 299, pl. ix, fig. 10.
1885.	—	minuta,	*Sow*.	Cossmann, Ét. Bath., p. 154, pl. xiii, figs. 30, 31.

Bibliography, &c.—There has been much trouble in regard to the synonymy of this well-marked species, first described by Sowerby from the Great Oolite of Ancliff. But it seems to me that this confusion has been intensified through the view taken by d'Orbigny in the 'Terrains Jurassiques' (vol. ii, p. 231) that *Nerita minuta*, Sow., is the young stage of the costate species. I quite agree that Morris and Lycett were not correct in their identification of Sowerby's *Nerita*

[1] 'Étage Bathonien,' p. 151.

minuta, as pointed out by Cossmann (*loc. cit.*), but that is a very different thing from our accepting the view that *Nerita minuta* and *Nerita costata* are different stages of the same species. The figures of d'Orbigny are altogether beside the mark, as his artist evidently had no idea whatever of *Nerita costata*. Specimens from the Pea-grit, except as to size, very much resemble the Ancliff fossil, and we can trace the costate form in the very earliest whorls. Consequently, as far as the Inferior Oolite is concerned, I cannot agree to the union of these two species of Sowerby, and must continue to regard *Nerita minuta* as a distinct fossil. The *Nerita minuta* figured by Cossmann is evidently Sowerby's *Nerita costata* = *costulata*, Deshayes.

Description :

Height . . . . average 9 mm.
Width . . . . . 11—12 mm.

Shell transversely ovate, tumid, moderately thick; variable in size, but rarely exceeding 15 mm. in width. Spire small and depressed, consisting of about two and a half whorls, which are costated and sunk in a deep sutural channel. Body-whorl relatively large, constituting about nine-tenths of the total height, and flattened posteriorly so as to impart a certain degree of angularity to the shell, which is ornamented throughout with numerous and rather fine radial costæ, closely set and deflected posteriorly. Aperture large; columellar lip wide and flat, but without denticulation of the inner margin.

Relations and Distribution.—This species may be regarded as one of the most typical Nerites occurring in the Lower Oolites. The most numerous and best preserved specimens occur in the Pea-grit of Crickley Hill, where they are seen to differ somewhat in shape; here and there a specimen being unusually transverse, as though approaching the contour of *Nerita Buvignieri* of the Great Oolite. The shorter specimens exhibit a tendency to merge into the species next described. In the Yorkshire beds *Nerita costulata* is rare, being generally represented in the Dogger by *Nerita pseudo-costa* (perhaps only a variety), whilst in the Scarborough Limestone it seems to pass into a more rugose form.

266. Nerita pseudo-costata, *d'Orbigny*, 1850. Plate XXVIII, figs. 7, 8, and 9.

1829 and 1835.	Nerita	costata, *Sow.*, sp.	Phillips, Geol. Yorks., pt. 1, pl. xi, fig. 32.
1850.	—	pseudo-costata, *d'Orb.*	Prod., i, p. 264 (*non* Gmelin, 1789). Blue Wick.
1854.	—	—	Morris, Cat., p. 264. Blue Wick.
1884.	—	—	Hudleston, Geol. Mag., dec. 3, vol. i, p. 298, pl. ix, figs. 7, 8, and 9.
Cf. also	—	costifera, *Piette.*	Cossmann, Ét. Bath., p. 156, pl. xvii, figs. 59 and 60.

Bibliography, &c.—This species or variety was first noticed by Phillips, who referred it to the *Nerita costata* of the 'Mineral Conchology.' D'Orbigny re-named it *N. pseudo-costata*, and by that name this rather abundant Dogger shell has generally been known to British palæontologists. Not quoted in the 'Terrains Jurassiques.'

Description.—The width and height are nearly equal, the height of a full-sized specimen being about 9 mm. In other respects the shape of the shell as in the preceding species. The flanks of all the whorls are ornamented with very strong radial costæ, regular, and separated by sulci about twice the width of each rib.

Relations and Distribution.—This form can be regarded as little more than a variety of the preceding species, somewhat less transverse in shape, and with stouter and fewer ribs. It replaces *N. costulata* in the Yorkshire Dogger, and occurs very sparingly in the Pea-grit of Crickley. It is not improbable that *Nerita costifera*, Piette, from the Bathonian of Rumigny, is a micromorph of this species on a higher horizon.

267. Nerita subrugosa, sp. nov. Plate XL, figs. 7 *a*, 7 *b*, 8.

Description :

Height	8 mm.
Width	9·3 mm.

Shell transversely ovate, angulated, rather higher than wide, thick; spire short, few-whorled, whorls sunk in a deep channel. Body-whorl relatively large, flattened and angulated posteriorly, and provided with a carina of moderate salience, which is situated rather above the middle of the whorl. Costæ fine, regular, and numerous, and exhibiting slight nodes on crossing the median carina. Aperture very wide, columellar area flattened; other indications wanting.

Relations and Distribution.—*Nerita subrugosa* is a form intermediate between *Nerita costulata*, Desh., and *Nerita rugosa*, Morris and Lycett. From the former it differs in its more angular outline, in the development of a median carina, and in the finer and more closely-set costæ.

The specimen figured (Plate XXVIII, fig. 6) in the present work, from the Scarborough Limestone, probably represents a sort of a passage between *N. costulata* and *N. subrugosa*, where there is a very slight tendency to a median carina. On the other hand, *Nerita rugosa*, M. and L., is less transversely ovate, has a higher spire, and the median carina is much more strongly developed; it is in fact altogether a coarser shell.

Nerita subrugosa has been found sparingly in the Scarborough Limestone at

Scarborough, and in the Northampton Sand at Duston, thus appearing on two different horizons of the Inferior Oolite.

The smooth Nerites—*Neridomus*, Morris and Lycett.

There is more than ordinary difficulty as regards nomenclature in this group, part of which has originated in the interpretation placed upon that very troublesome and obscure micromorph, *Nerita minuta*, Sow. I have endeavoured to focus the smooth Nerites of our Inferior Oolite under two names. There are also a few forms which could not be thus arranged, but as the indications are obscure I have concluded not to attempt them.

268. Nerita (Neridomus) tumidula, *Phillips*, 1829. Plate XXVIII, figs. 12 *a*, 12 *b*.

1829 and 1835.	Natica tumidula, *Phil.*	Geol. Yorks., pt. i, pl. xi, fig. 25. (*Nerita minuta*, Min. Conch., pl. ccccIxiii ?).
1854.	— — —	Morris, Cat., p. 262.
1884.	Nerita minuta, *Sow.*, var. tumidula, *Phil.*	Hudleston, Geol. Mag., dec. 3, vol. i, p. 296, pl. ix, figs. 4 *a*, 4 *b*, 5 *a*, 5 *b*, 6.

Bibliography, &c.—Morris in his Catalogue, it would seem, did not favour the view that "*Natica*" *tumidula*, Phil., was to be regarded either as a synonym or variety of *Nerita minuta*, Sow. On the other hand, the Yorkshire fossil has been labelled *Nerita minuta*, Sow., in the Lycett collection of the Jermyn Street Museum, presumably in accordance with the identification of Lycett himself.

Description.—Measurements of a specimen from the Dogger: height 11 mm., width 11 mm.

Shell ovate, tumid, smooth, and but slightly oblique, the height and width being nearly equal. The spire is composed of a small button-like apex, expanding in the course of two or three widely separated volutions into a large body-whorl, which exhibits a slight posterior flattening, whilst the rest of the whorl is globose, and without ornament other than fine lines of growth. No colour markings are visible in the Dogger shells, the matrix not being favorable.

Aperture large, outer lip crescent-shaped and thin; inner lip thick, subconvex, and slightly sinuated, without denticulations on the margin. N.B.—In the majority of specimens, as in the one figured, there is a slight abrasion of the

anterior extremity of the aperture, thus producing a somewhat Naticoid aspect. It may have been the above peculiarity which induced Phillips to regard this species as a *Natica*.

Pl. XXVIII, figs. 11 *a*, 11 *b*. *Variety* from the Pea-grit of Crickley, almost identical with *Nerita ovata*, Römer ('Nordd. Oolith.,' p. 156, pl. x, fig. 6). Specimens are a little larger than those from the Dogger, and are somewhat more transversely ovate. The callus on the inner lip is subconvex, thus bringing the shell within the definition of *Neridomus*. The colour markings, often well preserved, are suggestive of *Neritina;* cf. also *Neritina Cooksonii*, Desl.

Relations and Distribution.—In addition to the above a few small shells, about the size of buckshot, occur in the Lincolnshire Limestone both at Weldon and at Ponton, and also more rarely in the Cotteswolds. Because they are small they are sometimes named *Nerita* "*pulla*." They are probably micromorphs of *N. tumidula*, which is the representative on this horizon of *N. ovata*, Röm., if not absolutely identical. A small species in the Great Oolite of Minchinhampton, described by Morris and Lycett ('Grt. Ool. Moll.,' p. 58, pl. xi, figs. 19, 19 *a*) as *Nerita minuta*, Sow., may be ranked in the same category.

269. Nerita (Neridomus), transverse species. Plate XL, figs. 9 *a*, 9 *b*.

Description:

Height	12·6 mm.
Width	14·3 mm.

Shell transversely ovate, tumid, moderately thick; spire low, occupying about one-tenth the height of the entire shell, and formed of about two and a half whorls widely separated by the suture, which is canaliculate at the junction with the body-whorl. This is extremely ventricose, only slightly flattened posteriorly, and sloping.. Aperture large, with a thin hemispherical outer lip, whilst there is a very wide and convex (*Neridomus*) callus on the columellar lip, the margin of which is nearly straight and not denticulated. Colour markings are often well preserved; these resemble the markings shown on Pl. XXVIII, fig. 11 *a*.

Relations and Distribution.—Throughout the various horizons in the Oolitic rocks we distinguish an ovate and also a transverse form of Nerite. Such a transverse form as the one figured in Pl. XL is met with sparingly in the Oolite Marl horizon of the Cotteswolds, and also in the Dogger at Blue Wyke. It is more transverse than *Neritina Cooksonii*, Desl., yet not precisely like the *Nerita transversa*, von Seebach, of the Upper Oolites. The species is marked in my collection as *Neritina* "*subtransversa*."

Genus—Pileolus, G. B. Sowerby, 1823.

Shell limpet-like above, with a subcentral apex; concave beneath, with a narrow semilunar aperture, having a raised border and a columellar disc, surrounded by a broad and continuous peristome. Apex not spiral; shell provided with a columellar septum.

According to the original diagnosis of this singular genus, Sowerby regarded it as possessed of a short internal spire, and this statement is repeated by Morris and Lycett. There does not seem any reason, however, to suppose that *Pileolus* possessed an internal spire, although the plications shown in the enlarged section (Pl. XXVIII, fig. 16) in the region to the left of the columellar septum are somewhat imitative of one.

Fischer speaks of the apex as being subcentral, not spiral. Mr. B. B. Woodward also, in a recent communication to the Zoological Society,[1] observes that this genus most clearly possesses a septum, as in *Neritina crepidularia* and *Tomostoma*, and that there is no true internal spire.

270. Pileolus plicatus, *G. B. Sowerby*, 1823. Plate XXVIII: var. A, figs. 13 *a*, 13 *b*; var. B, figs. 14 *a*—*c*. Enlarged section, fig. 16.

1823.	Pileolus plicatus,	*G. B. Sowerby.*	Genera of British Shells, No. 19, figs. 1—4.
1823.	—	— *J. Sow.*	Min. Conch., pl. cccexxii, figs. 1—4.
1851.	—	— *Sow.*	Morris and Lycett, Great Ool. Moll., pt. i, p. 60, pl. ix, figs. 36, 36 *a*—*c*.
1854.	—	— *G. Sow.*	Morris, Cat., p. 268.
? Syn.	Patella costulata,	*Münst.*	Goldf., Petref. Germ., pl. clxvii, fig. 9.

Bibliography, &c.—The type of *Pileolus plicatus* was obtained from the Great Oolite of Ancliff; the species is also well known, though far from common, in the Great Oolite of Minchinhampton. Morris quotes both this and *P. lævis* from the Inferior Oolite of the same district, and other authors, including Witchell ('Geology of Stroud,' p. 47), make mention of these two species as occurring in the Inferior Oolite of the Cotteswolds. I have not seen specimens from the Cotteswolds, but the specimens from Lincoln, figured in the accompanying plate, differ considerably from the form prevailing in the Great Oolite of Minchinhampton.

[1] "On the Mode of Growth and the Structure of the Shell in *Velates conoideus*, Lamk., and other Neritidæ," 'Proc. Zool. Soc.,' June 14th, 1892.

At Lincoln I recognise two varieties, each of which differs more or less from the Minchinhampton shell.

Description, var. A (fig. 13):

Height	2·75 mm.
Basal length	6·50 mm.

Shell suborbicular, with a sharp subcentral apex of low elevation. The radiating ribs are about eighteen in number, the four posterior ones being more elevated and wider apart than the others. The indications as to the base are not good, so that one cannot say whether the margin is serrated or otherwise.

This form is much more depressed and of smaller habit than the one which prevails in the Great Oolite, whilst the ribs are fewer in number and relatively larger.

Var. B (fig. 14):

Height	3·50 mm.
Basal length	8·50 mm.

This form, which is more abundant at Lincoln than var. A, has a higher and blunter apex, the whole shell being more cap-like. Four or five conspicuous costæ occupy the posterior area, whilst the indications of costæ in the anterior portion of the shell are usually indistinct. A few coarse serrations are noticeable in the posterior portion of the margin, the rest of which is smooth.

In height and shape var. B resembles the typical *P. plicatus*, but the costæ are less numerous. There are also some indications of difference in the base, the position of the cushion not being exactly the same. So far as I can ascertain the inner lip is not crenulated, as stated by Sowerby; Morris and Lycett make no mention of this feature.

Relations and Distribution.—*Pileolus plicatus* may be accepted as a sort of generalised term for costate forms of the genus. Strictly speaking, I consider that there are two forms at Lincoln, which so far differ from the regular Bathonian *P. plicatus* as to be possibly entitled to rank as two distinct species. But, in order to establish these, more favorable conditions for comparison are required.

The Pea-grit horizon of the Cotteswolds and the "Base bed" at Lincoln are the only places in the Inferior Oolite of this country where *Pileolus plicatus* and its varieties are known to occur.

271. Pileolus lævis, *G. B. Sowerby*, 1823. Plate XXVIII, figs. 15 *a*—*c*.

1823. Pileolus lævis, *G. B. Sowerby*. Genera of Shells, No. 19, figs. 5—8.
1823. — — *J. Sow.* Min. Conch., pl. ccccxxxii, figs. 5—8.

1851. Pileolus lævis, *Sow.* Morris and Lycett, Great Ool. Moll., pt. i, p. 60, pl. ix, figs. 37, 37 *a*, 37 *b*.
1852. — — — d'Orbigny, Terr. Jur., ii, p. 240, pl. cccix, figs. 1—4.
1854. — — *G. Sow.* Morris, Cat., p. 268.
? Syn. Patella mammillaris, *Münst.* Goldf., Petref. Germ., pl. clxvii, fig. 10.

Description:

Height	1·35 mm.
Basal length	7 mm.

Shell elliptical, extremely depressed, apex subcentral; surface smooth, or only marked with indistinct furrows; the cushion is central; there are no indications of any crenulation on the inner lip.

Relations and Distribution.—It is not possible fully to verify Sowerby's diagnosis either for this or the preceding species. Morris and Lycett recognise the form in the Great Oolite of Minchinhampton. D'Orbigny's figure may represent this species, though it is too orbicular.

A single specimen from the "Base bed," Lincoln. Quoted from the Inferior Oolite of the Cotteswolds by Morris and by Witchell.

Family—NERITOPSIDÆ.

"*Shell neritiform or naticiform, imperforate, solid; aperture entire, semilunar or oval; lip arched; columella slightly excavated, internal septa not entirely absorbed. Operculum calcareous, thick, non-spiral.*"—Fischer.

This family is limited to the genera *Neritopsis* and *Naticopsis*, whose opercula have in former days puzzled alike the Mesozoic and Palæozoic palæontologist.

Genus—Neritopsis, Grateloup, 1832.

Shell imperforate, subglobular, neritiform, solid, few-whorled; spire short; surface ornamented with spiral bands and axial ribs or striæ. Aperture semicircular, entire, columellar side not denticulated, excavated towards the middle; lip simple, thick. Operculum scutiform, not spiral; upper surface provided with a wide truncated appendix which fits into the columellar notch.—Modified after Fischer.

It must be admitted that none of the specimens figured in illustration of this Monograph, though as good as any which can be procured on this side of the Channel, exhibit the columellar notch so characteristic of *Neritopsis*. Moreover

the operculum of *Neritopsis Bajocensis* (Pl. XXVII, fig. 10) shows no very obvious signs of the process which should fit into the notch. Hence it must be remembered that, so far as the Inferior Oolite of this country is concerned, one of the most characteristic features in the diagnosis of the genus *Neritopsis* is wanting. The most probable explanation is that the feature has been obscured through the accidents of fossilisation; but the absence of this character has induced some conchologists of eminence, such as the late Robert Bell, to regard these forms as belonging to *Narica* (*Vanikoro*).

Several species of *Neritopsis* are noticed by Moore as occurring in the Upper Lias, and he also described *Neritopsis cancellata*, Moore, from the Lower Lias of Brocastle. Seeing that specific differences, both in the Lias and Oolites, are mainly based on variety of ornamentation, which evidently varied according to locality as well as according to horizon, the precise biological value of these distinctions may not be very great. In the Inferior Oolite of Dorsetshire specimens run much larger than in other districts, but, on the whole, *Neritopsis*, though far from being abundant, is by no means confined in its distribution.

272. Neritopsis Bajocensis, *d'Orbigny*, 1850. Plate XXVII, figs. 9 *a*—*c*. Operculum, fig. 10.

1850.	Neritopsis	Bajocensis,	*d'Orbigny.*	Prod., i, p. 264.
1852.	—	—	—	Terr. Jur., vol. ii, p. 223, pl. ccc, figs. 8—10.
1867.	—	—	—	Laube, Gast. Br. Jura von Balin, p. 6, pl. i, fig. 9.
Non	—	—	—	Hudleston, Geol. Mag., dec. 3, vol. i, p. 300, pl. ix, fig. 11.

Description:

Height of a medium specimen . . .	23 mm.
Width	26 mm.

The following is the author's diagnosis:—"Shell oval, transverse. Spire very short, composed of three very convex whorls, excavated near the suture, increasing very rapidly, of which the last, of enormous size, is furnished spirally with numerous small alternate unequal costæ, and with radial undulations, like rounded furrows."

Relations and Distribution.—This species is especially characterised by the thick undulating costæ on the rounded shoulder of the body-whorl. It is essentially a fossil of the Upper Division of the Inferior Oolite, and is almost

restricted in this country to the *Parkinsoni*-zone of Burton Bradstock, where it occasionally attains a large size.

273. Neritopsis Philea, *d'Orbigny*, 1850. Inferior Oolite variety, Plate XXVII, figs. 11 *a*, 11 *b*, 11 *c*.

	1850.	Neritopsis Philea, *d'Orbigny*.	Prod., i, p. 247.
	1852.	— — —	Terr. Jur., vol. ii, p. 222, pl. ccc, figs. 5—7.
Cf. also	—	Bajocensis, *d'Orb.*	Hudleston, Geol. Mag., dec. 3, vol. i, p. 300, pl. ix, fig. 11 (Dogger variety).

The Dogger specimen above referred to was described by me as an intermediate form, and it belongs to the variety figured on the accompanying plate (XXVII, 11), which is the prevailing form in the *Concavus*-bed at Bradford Abbas, where it sometimes attains a width of nearly 40 mm. It has the flattened shoulder and spiral ornamentation of *Neritopsis Philea*, and is devoid of the thick radial costæ so characteristic of *N. Bajocensis*. The "rampe postérieur," however, is scarcely developed in this variety, and the ornamentation generally is finer. Occasionally a specimen which corresponds almost exactly with d'Orbigny's figure and description may be found in the *Concavus*-bed. To these the name *N. Philea* may be applied without hesitation. If it is desirable to recognise the variety I would suggest *Neritopsis Philea*, var. *Abbas*.

274. Neritopsis varicosa, *Morris and Lycett*, 1851. Plate XXVIII, figs. 1 *a*, 1 *b*, 1 *c*.

1851.	Neritopsis varicosa, *Morris and Lycett*.	Great Ool. Moll., pt. i, p. 106, pl. xi, figs. 20, 20 *a*; pl. xiii, fig. 5.
1854.	— — —	Morris, Cat., p. 265.

Description:

Height of a full-sized specimen . .	13·5 mm.
Width	16·5 mm.

The following is the diagnosis by the authors:—"Shell neritiform, ovately oblong; varices large, longitudinal (about ten in a volution), more or less elevated, decussated, with numerous regular, elevated, and transverse (spiral) lines; the lines are impressed with extremely fine and dense perpendicular striæ; the aperture round."

Relations and Distribution.—This species is related to *N. Bajocensis*, from

which it may be distinguished by its uniformly smaller habit, by its more transverse shape, and by the fact that the longitudinal (*i. e.* radial) varices are relatively larger and extend across the entire body-whorl. But, as noted by the authors, the varices vary much in magnitude, so that in some specimens they are nearly obsolete. Under these circumstances the shells are not easily distinguished from *Neritopsis*, cf. *decussata*, Münster.

Although regarded by Morris and Lycett as a Great Oolite species, I am somewhat doubtful of the occurrence of *Neritopsis varicosa* in the Great Oolite of Minchinhampton. On the other hand, it occurs not unfrequently in the Oolite Marl of the Cotteswolds, and more rarely in the Pea-grit.

275. Neritopsis, cf. decussata, *Münster*, 1844. Plate XXVIII, figs. 5 *a*, 5 *b*, 5 *c*.

1844. Natica decussata, *Münst.* Goldfuss, Petref. Germ., pl. cxcix, fig. 10. As a species from the Coral Rag.

1852. Neritopsis decussata, *Münst.* D'Orbigny, Terr. Jur., vol. ii, p. 227, pl. ccci, figs. 8—10.

The species described above (*N. varicosa*) gradually shades off into cancellated forms such as those figured in the accompanying plate. I might also refer to *Neritopsis cancellata*, Moore ('Quart. Journ. Geol. Soc.,' vol. xxiii, p. 548, pl. xv, fig. 20), and to some of the forms described under *N. Guerrei*, Héb. and Desl. ('Bull. Soc. Linn. Norm.,' vol. v, p. 185, pl. i, fig. 4). Cancellated forms of this kind seem to occur on more than one horizon. There are two specimens from the "Base-bed" at Lincoln, one of which is figured in the accompanying plate. The aperture is somewhat more angular on the columellar side than usual.

276. Neritopsis incisa, sp. nov. Plate XXVIII, fig. 2.

Description:

Height	12·5 mm.
Width	16 mm.

Shell transversely ovate-oblong; spire extremely few-whorled and very low. Body-whorl relatively enormous, with a somewhat flattened posterior area. The ornaments consist of about ten or twelve extremely rugose radial ribs, irregularly developed and divided by deeply-cut sulci. These are decussated throughout by

numerous coarse spiral bands, forming very prominent nodes at the intersections. Aperture nearly circular.

Relations and Distribution.—From *Neritopsis varicosa*, M. and L., this species may be distinguished by its more angular and transverse form, by the almost aborted spire, and by the exaggerated character of the radial costæ. It is nearly related to *Neritopsis Hebertana*, d'Orb., and might perhaps be regarded as little more than a variety. The spiral belts are more numerous and less salient than seems to be the case with d'Orbigny's species.

This bizarre form was first noticed in the "Base-bed" at Lincoln, whence I have obtained some characteristic specimens since the one figured on the accompanying plate was drawn. A single specimen from the *Nerinæa*-bed in the Pea-grit at Crickley.

277. Neritopsis, cf. hebertana, *d'Orbigny*, 1852. Plate XXVIII, figs. 3 *a*, 3 *b*, 3 *c*.

1852. Neritopsis Hebertana, *d'Orbigny*. Terr. Jur., vol. ii, p. 221, pl. ccc, figs. 1—4.

Description:

Height	12·5 mm.
Width	15 mm.

Shell transversely oblong, angular, thick; spire very short, composed of two or three angular and rugosely ornamented whorls set in a sutural hollow, and developing into a relatively enormous body-whorl, which is transversely oblong and very angular. Four extremely prominent spiral bands are decussated by radial costæ of nearly equal strength; the points of intersection are marked by nodes which must have been extremely spinous. Aperture subcircular and wide, but not sufficiently preserved in the available specimens for correct diagnosis.

Relations and Distribution.—There is something in this form not exactly like *Neritopsis*, and yet on the whole I think it must be regarded as an extremely rugose relative of *Neritopsis Hebertana*. There are two specimens from Stoford (North Dorset), and I have seen two more, which are stated to have come from the Inferior Oolite at Bathford.

278. Neritopsis, cf. sulcosa, *d'Archiac*, 1843. Plate XXVIII, fig. 4.

1843. ? Nerita sulcosa, *d'Archiac*. Mém. Soc. Géol. France, vol. v, pt. 2, p. 377, pl. xxviii, fig. 10.
1851. Neritopsis sulcosa, *d'Archiac*. Morris and Lycett, Great Ool. Moll., pt. 1, p. 59, pl. xi, fig. 12.
1884. — — — Cossmann, Ét. Bath. (Mém. Soc. Géol. France), p. 159, pl. iii, figs. 15—17.

Attention is called to a specimen from the *Nerinæa*-bed in the Pea-grit of Crickley, which has considerable resemblance to this Bathonian species. The Inferior Oolite specimen is somewhat squeezed out of shape, but the ornamentation is similar to that of *N. sulcosa*. It might also be regarded as a modified form of the fine variety of *Neritopsis Philea*.

279. "Neritopsis lævigata." Plate XXVIII, fig. 10.

1885. Neritopsis (? Turbo) lævigata, *Phil.*, pars. Hudleston, Geol. Mag., dec. 3, vol. ii, p. 49, pl. ii, fig. 2. *Non* figs. 1, 3, 3 *a*.

Since the Dogger shell, represented in the accompanying plate, was originally figured, evidence has been obtained which renders it probable that this form should be separated entirely from *Turbo lævigatus*, Phil.

A very similar and possibly identical form occurs at Duston in the Northampton Sand. These shells are transversely ovate, globose, and thick, averaging 22 mm. in height and 26 mm. in width. The very small spire consists of from two to three smooth and rounded whorls, the whole shell suddenly expanding into an enormous body-whorl, the sutures being rather close. The posterior area of the body-whorl is subtabulate, the sides ventricose, and the ornaments consist of fine spiral striæ decussated by growth-lines. Aperture large and semilunar; character of the inner lip uncertain.

It cannot be affirmed with certainty that this species really is a *Neritopsis*. The Duston shells seem related to a very large form of *Natica* or *Ampullina*, which occurs in the Lincolnshire Limestone, and which I have hitherto considered as being identical with *Natica cincta* (*Leckhamptonensis*). On the whole, "*Neritopsis levigata*" cannot be regarded as an established species.

Family—TURBINIDÆ.

"*Shell spiral, turbinated or pyramidal, nacreous inside; operculum calcareous and pauci-spiral, or horny and multispiral.*"—S. P. Woodward.

The above diagnosis includes the Turbinidæ, Trochidæ, and Delphinulidæ of other authors, and, as far as Jurassic fossils are concerned, where the nacreous layer is generally destroyed and opercula hardly ever to be found, cannot be followed very closely.

The withdrawal of *Amberleya* and the so-called "*Littorina*" reduces the number of shells remaining to be considered under this family. These are for the most part small. Whatever generic names are adopted, we recognise two groups, viz. a group of smooth and a group of richly sculptured shells.

Group I.—*Smooth Shells.*

The smooth and generally small Turbinidæ of the Jurassic Rocks have been variously classified. The following are amongst the genera which have been invoked: *Ataphrus*, *Crossostoma*, *Chrysostoma*, *Monodonta*, *Pleuratella*, *Plocostylus*, *Rotella*, *Teinostoma*, *Trochopsis*, *Trochus*, and *Turbo*.

In the Inferior Oolite of this country I think that the smooth Turbinidæ may be focussed, provisionally at least, under three genera. Apart from one or two forms which it may be convenient to arrange under *Turbo* (Section 1), the rest of the shells exhibit a sequence from the most depressed form—*Crossostoma Prattii*, to the most acutely trochiform Monodontoid, viz. *Ataphrus Acis*. Mr. Tawney, it may be remembered, only recognised two species in his 'Dundry Gasteropoda,' viz. "*Monodonta*" *lævigata*, Sow., and "*Monodonta*" *Acmon*, d'Orb.

Genus—Crossostoma, *Morris and Lycett*, 1851.

"*Shell thick, turbinated, smooth, somewhat depressed or rotelliform; whorls more or less flattened, few; apex of the spire obtuse, depressed; aperture nearly circular, entire; the columella forms at its base a simple prominent obtuse tooth; the outer lip is smooth; there is no umbilicus. . . . .*"—Morris and Lycett.

Lycett, in notes and corrections to the 'Supplement,' p. 153, withdrew

Crossostoma discoideum and *C. heliciforme*, which he finally regarded as adult and discoidal forms of smooth "Monodontas," leaving only *Crossostoma Prattii* as the representative of the genus. This fossil was said to have come from the Inferior Oolite near Bath. I have not succeeded in obtaining a sight of the type. The genus is held to include *Crossostoma* (*Delphinula*) *reflexilabrum*, d'Orb., from the Lias.

280. Crossostoma, sp.; cf. *Crossostoma Prattii*, Morris and Lycett, 1851. Plate XXVIII, figs. 17 *a*, 17 *b*.

1851. Crossostoma Prattii, *Morris and Lycett*. Great Ool. Moll., pt. 1, p. 72, pl. xi, figs. 21, 21 *a*.

Cf. also Rotella macrostoma, *Stoliczka*. Hierlatzschicten, p. 178, pl. iii, fig. 5.
Teinostoma Neumayri, *Gemmellaro*. Faune Giuresi, &c., p. 344, pl. xxvii, figs. 15, 16.

Description.—Shell thick, nearly twice as wide as high, discoidal; spire greatly depressed. The width of the figured specimen is 15 mm., and of a smaller one, which I possess, 10 mm. The body-whorl is essentially rotelliform, the aperture small and circular, and there is a considerable thickening towards the columellar extremity.

N.B.—There is no umbilicus, as might possibly be inferred from the figure.

Relations and Distribution.—The probable relations of this very discoidal shell are indicated in the list of references. It may be *Crossostoma Prattii*, but if so the figure in the 'Great Oolite Mollusca' is not sufficiently discoidal. The form is very rare. The figured specimen is a brown ferruginated fossil, suggestive of Dundry or of some of the Dorset beds. Another specimen in my collection is from the Pea-grit of Crickley. This is much smaller, and altogether more representative of *C. Prattii*, as far as one can judge of that species.

Genus—Ataphrus, *Gabb*, 1869.

The bulk of the smooth "Monodontas" remain to be described, and the question for consideration is—under what genus? Monsieur Cossmann, in his excellent memoir on the 'Bathonian' in France, adopted the genus *Ataphrus*. He attached much importance to the presence of a columellar furrow in the species thus classified by him. Certainly, in the majority of the smooth "Monodontas"

of our Inferior Oolite this feature of a columellar furrow is greatly subordinate to the columellar callosity which generally culminates in a sort of denticle—the small tubercle of Gemmellaro's genus *Plocostylus*. This feature was especially recognised by d'Orbigny in his description of *Trochus Belus* and *Trochus Acmon*, the former of which was regarded by Gabb as typical of his genus *Ataphrus*.

On the whole, it would seem that Gemmellaro's genus *Plocostylus*, slightly modified, would embrace the depressed forms of the smooth "Monodontas" more correctly than *Ataphrus*. But it is desirable to place the trochiform as well as the turbinate "Monodontas" under one genus. This view was adopted by Messrs. Hudleston and Wilson in their 'Catalogue of British Jurassic Gasteropoda.' Notwithstanding certain difficulties, to which allusion has been made, a similar arrangement is adopted in this Monograph. The following diagnosis, although somewhat different from that of Gabb, relates more especially to the fossils of the Inferior Oolite described below. If this diagnosis is inapplicable to *Ataphrus*, we must look for another generic name.

Shell thick, smooth, and generally small, turbinate or trochiform, imperforate; spire obtuse and often much depressed. Body-whorl relatively large, base more or less flattened, aperture subcircular and restricted. The columellar lip is very short and much incrusted, so that the thickening usually assumes the form of a small blunt denticle towards the extremity of the columella. Growth-lines extremely fine and close.

The above diagnosis possesses many of the characteristics of *Plocostylus*, but is more comprehensive, since it includes trochiform species, such as *Ataphrus Acis*. In fact, as far as the Inferior Oolite is concerned, it comprises a regular ascending sequence from ovulate to trochoidal forms. The question of texture is important in defining the genus. In certain matrices these shells present a glabrous appearance, due to the extreme fineness of the growth-lines, which very often are invisible. The glabrous surface, the blunt and obtuse character of the apical region, the full whorls, and the closely fitting suture are distinctive features, quite as much as the columellar callosity, or the furrow with which it is associated.

In assigning specific names I have endeavoured in nearly all cases, even at the risk of stretching a point, to make use of those already in existence, and of these there is a plentiful supply. It need scarcely be said that forms intermediate to those named also present themselves, and are not easy to allocate. There does not seem to be any special relation between the species and the horizon.

281. Ataphrus, cf. lucidus, *Thorent*, 1839. Plate XXVIII, figs. 18 *a*, 18 *b*.

1839. (Rotella) lucida, *Thorent*, sp. *Fide* Cossmann, Étage Bath., p. 277, pl. vii, figs. 1, 2.

Cf. also Plocostylus typus, *Gemmellaro*. Faune Giuresi, p. 346, pl. xxviii, figs. 1 and 2.

The specimen from the Oolite Marl of the Nailsworth district, figured in the accompanying plate, is unique as far as my collection goes. It has a basal diameter of 13 mm.; ratio of width to height as 10 : 7. There is the possibility that this may be nothing more than a megalomorph of *Ataphrus heliciformis*, M. and L. D'Orbigny's figure of *Trochus lucidus* ('T. J.,' ii, pl. cccxiv, figs. 5—7) differs from that given by Cossmann.

282. Ataphrus heliciformis, *Morris and Lycett*, 1851.

1851. ? Crossostoma heliciforme, *Morris and Lycett*. Great Ool. Moll. pt. 1, p. 73, pl. xi, fig. 8.

1863. Monodonta heliciformis, *Morris and Lycett*. Lycett, Suppl., p. 123.

Cf. also — ovulata, *Héb. and Desl.* Foss. Montreuil-Bellay, p. 58, pl. ii, fig. 9.

Bibliography, &c.—Although originally described as a fossil of the Great Oolite, the authors noted that *C. heliciforme* occurred in the middle division of the Inferior Oolite at Leckhampton. *Monodonta ovulata* seems to occupy an intermediate position between this form and the more abundant *Ataphrus lævigatus*.

Description.—In the majority of the specimens the basal diameter is about 10 mm. or rather less; ratio of width to height as 4 : 3, being slightly less depressed than *Ataphrus lucidus*.

The following is the original diagnosis:—"Shell smooth, turbinated, somewhat depressed; spire small, but little elevated; whorls rather convex; aperture elliptical."

Relations and Distribution.—More depressed than *Ataphrus lævigatus*, less so than the preceding species. Occurs at Stoford in Dorset, but principally in the Oolite Marl of the Cotteswolds, and in the *Parkinsoni*-zone of Aston and Notgrove.

283. Ataphrus lævigatus, *Sowerby*, 1818. Plate XXIX, fig. 5; and variety approaching A. Belus, *d'Orb.*, fig. 6.

1818.	Nerita lævigata, *Sowerby*.	Min. Conch., pl. ccxvii, fig. 1.
1853.	Monodonta lævigata, *Sow.*	Lycett, Proc. Cotteswold Nat. Club, vol. i, p. 71.
1854.	— — —	Morris, Cat., p. 258.
1873.	— — —	Tawney, Dundry Gasteropoda, p. 34 (26).
1885.	Turbo (Monodonta) lævigatus, *Sow.*	Hudleston, Geol. Mag., dec. 3, vol. ii, pl. ii, fig. 6.
Cf. also	Monodonta ovulata, *Héb. and Desl.*	*Op. cit.*
	Chrysostoma ovulata, *Héb. and Desl.*	Laube, Gast. Br. Jura von Balin, p. 13, pl. iii, fig. 3.

Bibliography, &c.—Sowerby's figure is far from being characteristic, as he remarks that "the specimens do not exhibit the columella." Had this been otherwise he would hardly have taken his fossil for a Nerite. Mr. Tawney thought that Sowerby's type was in the Bristol Museum. With reference to this point Mr. Wilson, the present Curator, wrote in 1893, "The types do not appear, after all, to be at Bristol. Our tablet of specimens, so classed, probably gives a good exemplification of Sowerby's species." With this latter remark I quite agree; in the majority of these specimens the denticle is conspicuous.

Description:

Width or basal diameter . .	12—14 mm.
Width to height . . .	5 : 4.

Shell globular, smooth and thick; spire moderately depressed; number of whorls about four; last whorl ventricose, with sometimes a slight posterior flattening; sutures close. Aperture circular and small, with a strong columellar callosity or denticle, associated in some cases with a faint columellar furrow or pit.

Relations and Distribution.—This is the most common form of *Ataphrus* in the Inferior Oolite, and may be regarded as the representative of the turbinate section, where the spiral angle, as far as it can be determined in such obtuse shells, exceeds 90°. There is considerable variety; or, what amounts to the same thing, we are content to place a certain range of forms under one specific designation. These differences are greatly accentuated by the state of preservation, which varies considerably according to the nature of the deposit.

The finest and most characteristic specimens occur at Dundry; but it is to be met with, more frequently perhaps on a low horizon, in many parts of the Inferior Oolite from Dorset to Yorkshire.

Variety in the Lincolnshire Limestone. Cf. Trochus Belus, *d'Orb.*, 'Terr. Jur.,' vol. ii, p. 283, pl. cccxv, figs. 9—12.

This variety (see Pl. XXIX, fig. 6) is smaller and slightly less depressed than average specimens of *Ataphrus lævigatus*. It is, I have no doubt, the form identified ('Quart. Journ. Geol. Soc.,' vol. ix, p. 326) as *Trochus Belus* from Ponton. Extremely abundant also at Weldon. The denticle is usually more conspicuous than in the accompanying figure, where indeed it is scarcely noticeable.

284. Ataphrus obtortus, sp. nov. Plate XXIX, figs. 7 and 8.

Description:

Width or basal diameter . . .	10—14 mm.
Width to height	10 : 9.

Shell smooth, thick and gibbous; spire moderately depressed, and consisting of about four or five whorls, of which the penultimate exhibits a remarkable bulge in the anterior portion. Aperture circular and small, with a thick denticle on the columella, succeeded anteriorly by a shallow pit.

Relations and Distribution.—In many places where *Ataphrus lævigatus* occurs this form may also be noticed, though in fewer numbers. It is probably nothing more than a gibbous variety of the common form. I recognise specimens of *Ataphrus obtortus* from Dundry, Beaminster, Mapperton, Stoford, and also from the *Parkinsoni*-zone of Burton Bradstock; also in the Dogger. The interest consists in the fact that this species gradually shades off into less depressed forms, which are difficult to separate from gibbous varieties of *At. Acmon*.

285. Ataphrus Labadyei, *d'Archiac*, 1843. Inferior Oolite varieties. Plate XXIX, figs. 9 and 10.

1843. Trochus Labadyei, *d'Archiac*. Mém. Soc. Géol. France, vol. v, pt. 2, p. 379, pl. xxix, fig. 2.

1850. Turbo Labadyei, *d'Arch.* D'Orbigny, Prod., i, p. 301.

1851. Monodonta Labadyei, *d'Arch.* Morris and Lycett, Great Ool. Moll., pt. 1, p. 68, pl. xi, fig. 2; and var., fig. 11.

1884. Ataphrus Labadyei, *d'Arch.* Cossmann, Étage Bath., p. 279, pl. vii, figs. 5—8.

Cf. also ? Monodonta lævigata, *Münst.* Goldfuss, Petref. Germ., pl. cxcv, fig. 5.

Chrysostoma Acmon, *Laube* (non *d'Orb.*). Gast. Br. Jura von Balin, p. 13, pl. iii, fig. 2.

Turbo (Monodonta) lævigatus, *Sow.*; var. bellulata, *Bean*. Hudleston, Geol. Mag., dec. 3, vol. ii, p. 53, pl. ii, fig. 4.

Bibliography, &c.—Our Inferior Oolite specimens appear somewhat more elongated than the Bathonian types, yet not so dissimilar but what they may be referred to d'Archiac's species. "*Nerita*" *bellulata*, Bean, which I include here, is perhaps more close to *Monodonta papilla*, H. and D. ('Foss. Mont.-Bellay,' p. 59, pl. iii, fig. 1). In fact, *At. Labadyei*, *At. papilla*, and *At. Acmon* have at least this feature in common, viz. that they are smooth trochiform shells, where the height and width are about equal.

Description:

Height of full-sized specimens . . .	15 mm.
Width, about	15—16 mm.

Shell conoidal, subturbinate, smooth, tolerably thick. Spire elevated, the apex very obtuse. Whorls about six, subconvex and prominent, standing out well from the suture. The body-whorl is large, slightly depressed posteriorly, rounded at the angle, and subconvex in the base. Aperture restricted and almost circular, with a moderate columellar denticle, succeeded anteriorly by a very shallow sulcus or pit.

Relations and Distribution.—Distinguished from *At. Acmon* by the prominence of the whorls. *At. Labadyei*, and the varieties therewith included, are also more widely distributed throughout the Inferior Oolite.

Although in the main a Great Oolite species, *At. Labadyei* occurs in the Lower Division of the Inferior Oolite both in Dorset and in the Cotteswolds. It also occurs in the *Clypeus*-grit and in other localities and horizons; whilst in the Dogger it is represented by the var. *bellulata*, Bean. N.B.—Should there be any disposition to challenge the identification of *At. Labadyei* as an Inferior Oolite species, I would suggest that the forms from the Lower Division be classified as *Ataphrus bellulatus*.

286. Ataphrus Acmon, *d'Orbigny*, 1850. Plate XXIX, figs. 11 and var. fig. 12; var. approaching *Ataphrus papilla*, H. and D., fig. 13.

1850.	Trochus Acmon, *d'Orbigny*.	Prod., i, p. 265.
1852.	— — —	Terr. Jur., vol. ii, p. 278, pl. cccxiv, figs. 1—4.
1873.	Monodonta Acmon, *d'Orb.*	Tawney, Dundry Gasteropoda, p. 35 (27).
1884.	Ataphrus Acmon, *d'Orb.*	Cossmann, Étage Bath., p. 281, pl. vii, figs. 9, 10.
Cf. also	— Heberti, *Piette.*	Cossmann, *op. cit.*, p. 281, pl. xvii, figs. 43, 44.

Bibliography, &c.—This is essentially a Bajocian form, the types being from Bayeux and Port-en-Bessin; also abundant at Sully; all places where the fossili-

ferous beds are on the horizon of the Upper Division of the Inferior Oolite. M. Cossmann records it as Bathonian on the strength of a single specimen.

Description:

Height of a large specimen . . .	13 mm.
Width, the same	13 mm.

Shell smooth, almost polished, height and width in most cases nearly equal; spire convex with a very obtuse apex, sutures close. Number of whorls about five, convex, but not salient. Body-whorl large, more than half the entire height, smooth, convex, but pinched in towards the basal angle; base smooth and rather flat. Apertnre circular and small, columellar denticle well developed, and situated near the anterior extremity.

Variety (fig. 12).—This represents a form very abundant in the *Parkinsoni*-zone at Burton Bradstock, which has an average height of about 10 mm., the height being sometimes equal to, sometimes in excess of the width. It also possesses the ordinary characters of *At. Acmon*, except that the spiral angle is even more obtuse, and that it is very gibbous owing to the sudden change in that angle immediately below the apical whorls. There are also other and narrower varieties leading up to *Ataphrus Acis*.

Relations and Distribution.—There are some differences between the very variable species just described and the typical Normandy shell. Not to multiply names, I include a considerable series under *Ataphrus Acmon*, which in this case must be considered as representative of rather than identical with d'Orbigny's species. The horizon on which these English shells occur is, however, the same as in Normandy. They may be distinguished from *Ataphrus Labadyei* by the closeness of the sutures and the want of convexity in the whorls, besides other points.

Ataphrus Acmon is tolerably abundant in the Upper Division of the Inferior Oolite, and notably at Burton Bradstock. A narrow variety approaching *Ataphrus Acis* occurs in the Upper *Trigonia*-grit of Cold Comfort. A small and wide-based variety (fig. 13) occurs at Hook Norton.

287. Ataphrus Acis, *d'Orbigny*, 1850. Plate XXIX, fig. 14.

1850. Trochus Acis, *d'Orbigny*. Prod., i, p. 265.
1852. — — — Terr. Jur., vol. ii, p. 277, pl. cccxiii, figs. 13—16.
1873. "Trochus Ibbetsoni," *Morris and Lycett*. Tawney, Dundry Gasteropoda, p. 33 (25).

Bibliography, &c.—The remaining shells of this group may be roughly gathered under *Trochus Acis*, which occurs in the same localities and on the same horizon as

the last-named species. It is true that d'Orbigny described his shell as being formed of a regular angle, whereas our shells have an obtuse apex with a mean spiral angle under 50°. But on examining a series of Normandy specimens (Sully) referred to *Trochus Acis*, I find that the apex is in all cases extremely obtuse. Hence it would seem that in this respect, d'Orbigny's figure is misleading.

The Bristol Museum contains several specimens from Dundry, which Mr. Tawney referred provisionally to *Trochus Ibbetsoni*, Morris and Lycett ('Great Oolite Moll.,' pt. 1, p. 62, pl. x, figs. 4, 4 *a*). At the same time he remarked that their texture and aspect seemed to connect them with *Monodonta lævigata*, Sow., a supposition which there is little doubt was correct. The question as to how far *Trochus Ibbetsoni* and *Ataphrus Acis* represent the same species still remains for consideration.

Description :

Average height about . . .	12 mm.
Width about	10 mm.
Mean spiral angle about . . .	50°.

Shell obtusely trochoid, smooth, rather thick; number of whorls five or six. The body-whorl is about half the entire height, but slightly convex, and making a blunt angle at the periphery. Base nearly flat; aperture small and circular, with a slight denticle towards the end of the columella, succeeded anteriorly by a shallow pit or furrow.

Relations and Distribution.—This is the narrowest and most trochoid of all the smooth "Monodontas." It also shows a feebler development of the denticle—the "tubercle" of Gemmellaro. By a widening of the spiral angle it passes into *Ataphrus Acmon*, and there are intermediate forms. *Ataphrus Acis* is essentially a fossil of the Upper Division of the Inferior Oolite, occuring somewhat rarely at Burton Bradstock, and also at Dundry. Typical forms are probably not found outside the Dorset-Somerset district.

Variety in the Lincolnshire Limestone (*Trochus Ibbetsoni*, M. and L.), height about 7 mm. These small shells, chiefly from Weldon and Ponton, are not in good preservation. The proportions are about the same as in *Ataphrus Acis*, of which species they are most likely a variety reduced in size, as is the case with so many of the Gasteropods of the Lincolnshire Limestone. I think that analogous representatives of *At. Labadyei* and *At. Acmon* also occur in this formation.

N.B.—Morris, in his paper on the "Lincolnshire Oolites" ('Quart. Journ. Geol. Soc.,' vol. ix, p. 326), quotes *Trochus Acis*, and not *Trochus Ibbetsoni*, from Ponton. On the other hand, Mr. Etheridge (Judd, 'Geology of Rutland,' p. 283) gives *Trochus Ibbetsoni* in his catalogue of Lincolnshire Limestone fossils, and not *Trochus Acis*.

"Turbo."

A certain number of smooth turbinate forms are classed provisionally under *Turbo*.

288. Turbo lævigatus, *Phillips*, 1829.

1829 and 1835. Turbo lævigatus (Nerita lævigata, *Sow.*, Min. Conch.), *Phillips*. Geol. Yorks., pt. 1, pl. xi, fig. 31; and 3rd edit. (1875), p. 330, pl. xi, fig. 31.

1885. Neritopsis (? Turbo) lævigata, *Phil.*, pars. Hudleston, Geol. Mag., dec. 3, vol. ii, p. 49, pl. ii, fig. 3.

Cf. also ? Turbo gibbosus, *d'Orbigny*. Terr. Jur., vol. ii, p. 342, pl. cccxxx, figs. 1—3.

? Monodonta lævigata, *Thorent*. Morris, Cat., p. 258.

I must refer to my remarks in the 'Geol. Mag.' restricted to var. B. See also *antea*, p. 344, with reference to "*Neritopsis lævigata*." It still remains a matter of doubt what the Phillipsian species may be. The specimen from the York Museum, figured in the 'Geol. Mag.' (*vol. cit.*, pl. ii, fig. 3) is, perhaps, the nearest, but the system of undulating spirals seen in that specimen on close inspection is rather puzzling. I have in my own collection a similar but smaller fossil from the Dogger, where such spirals are not noticeable.

? *Variety* from the Lincolnshire Limestone, Pl. XXIX, fig. 1.

Height	6·5 mm.
Width	7·5 mm.
Spiral angle (regular) . . .	95°.

Shell smooth, turbinate, oblique, not umbilicated; spire subdepressed, apex sharp. Number of whorls about five, smooth, tumid, and well marked off by the suture. Body-whorl fully two-thirds the entire height, regularly convex, large and without ornament other than broad growth-lines. Aperture wide and circular, with a rather thin outer lip, and an excavated and slightly encrusted columella, which carries no denticle, but is scored by a double furrow.

Although there is a superficial resemblance to the turbinate forms described above under *Ataphrus*, there are several indications which point to a different genus. Thus the apex is sharp, not obtuse, the spire regular, the sutures are impressed, and the texture, as shown by the broad growth-lines, is coarse. In a second and smaller specimen which I possess these lines exhibit colour-markings. The aperture is wide, and there is no actual denticle.

289. "Turbo paludinoides." Plate XXIX, fig. 2.

Description:

Height	10·5 mm.
Width	10·5 mm.
Mean spiral angle	70°.

Shell smooth, conical, turbinate, imperforate; substance rather thin. The apex is rather obtuse, with a change in the spiral angle about the third whorl. Total number of whorls six or seven, convex, and well marked off by the suture; without ornament, and rather glabrous, though fairly wide growth-lines are visible in some portions of the shell. The body-whorl slightly exceeds one-half of the total height, and is regularly convex throughout, with a full and rounded base. Aperture fairly wide and circular, outer lip thin; columella excavated, but only moderately encrusted, and marked by a narrow sinuous furrow.

It is not intended that this form, though figured, should take rank as a species until we know something more of its true relationships. The aperture is more circular than in *Bourguetia;* at the same time the shell is very thin for a *Turbo*, whilst the sutures are rather too close for a *Paludina*.[1] A single specimen, presumably from the *Concavus*-bed of Bradford Abbas.

290. Turbo (? Ataphrus) Lindecolinus, sp. nov. Plate XXIX, figs. 3 and 4.

Description:

Height	9 mm.
Width	7·5 mm.
Mean spiral angle	55°—60°.

Shell conical, turbinate, rather thick, not umbilicated; spire slightly obtuse. Number of whorls six, smooth, convex, and well marked off by the suture. The body-whorl is about half the entire height, smooth, regularly convex, and with no other indication of ornament than curved growth-lines; basal angle rounded, base full and smooth. Aperture subcircular and rather small; outer lip thin and semilunar; columella short and inclined to be straight, with a moderate callus, and in some specimens a slight columellar furrow.

[1] N.B.—There is a bed in the Chipping Norton district, somewhere about the junction of the Inferior and Great Oolites, which yields a species of *Paludina* in considerable quantities.

N.B.—The figured specimen does not exhibit these latter features distinctly.

Relations and Distribution.—This very commonplace little shell seems to differ, as far as I can judge, from any species in the Inferior Oolite, though it may resemble some of the smooth Turbos recognised in the Lias. Notwithstanding the absence of any well-defined denticle, the character of the aperture rather reminds one of *Ataphrus*.

Not very uncommon in the "Base-bed" at Lincoln.

Group II.—*Sculptured Shells.*

One of the most difficult problems which present themselves for solution in Jurassic palæontology is the correct generic classification of the numerous members of the Turbinidæ coming under Group II. Except as regards the genus *Trochus*, which is undoubtedly represented in considerable numbers, the identification of the modern genera, *Monodonta*, *Turbo*, *Delphinula*, &c., is to a certain extent empirical. I have always had an objection to the acceptance of *Monodonta*, but there is safety in *Turbo* as a general term, which may be held to include various sections by some recognised as distinct genera. *Delphinula*, too, has had its advocates, and many species of Jurassic Turbinidæ have from time to time been thus classified. If, then, I continue to use the genus *Monodonta* for Jurassic shells, it is only in a conventional sense, as *Turbo* would do just as well. For the same reason no diagnosis is offered either of Monodonta, Turbo, or Delphinula.

291. Monodonta pisolitica, sp. nov. Plate XXIX, fig. 17 and ? fig. 18.

Description :

Height	4 mm.
Width	3·5 mm.
Spiral angle	65°.

Shell trochiform, thick, imperforate; apex rather obtuse, spiral angle regular. Number of whorls about five; the apical ones are smooth and round, the remainder flat, and ornamented by four tuberculated spirals, which in the body-whorl present some differences, the anterior spiral at the angle of the shell having larger granulations than the others. Body-whorl subangular and rather more than half the total height; base full, and ornamented with granulated spirals rather finer than those at the sides. Outer lip circular; columella nearly straight, and reflexed

towards the anterior extremity, so as to produce a denticulated appearance succeeded by a kind of notch.

Relations and Distribution.—Although there is much in this curious little shell to remind one of *Brachytrema*, I think we must regard it as a member of the Turbinidæ. The form (fig. 18) may represent an aged specimen, or possibly another species. It bears some resemblance to *Monodonta exigua*, Lycett ('Suppl.,' p. 22, pl. xliv, fig. 29), from the Great Oolite.

Monodonta pisolitica is fairly plentiful in the Pea-grit at Leckhampton.

292. Monodonta Lyelli, *d'Archiac*, 1843. Plate XXX, figs. 1 and 2; var. *humilis*, fig. 3.

1843.	Monodonta Lyelli, *d'Archiac.*	Mém. Soc. Géol. France, vol. v, pt. 2, p. 380, pl. xxix, figs. 8 and 8 *a*; id., var., 8 *b*, 8 *c*.
1850.	Turbo Lyelli, *d'Orb.*	Prod., i, p. 301.
1851.	Monodonta Lyellii, *d'Arch.*	Morris and Lycett, Great Ool. Moll., pt. 1, p. 67, pl. xi, fig. 4.
1853.	— — —	Morris, Quart. Journ. Geol. Soc., vol. ix, p. 326.
1884.	— Lyelli, *d'Arch.*	Cossmann, Étage Bath., p. 271, pl. vii, figs. 28, 29.

Bibliography, &c.—We have the authority of Morris as to the occurrence of this well-known Bathonian species in the Lincolnshire Limestone, where the forms differ somewhat from those in the Great Oolite of Minchinhampton, and possibly still more from d'Archiac's types. It seems to be an eastern form, being quoted from the Bathonian and Bajocian of Eastern France.

Description:

Height of average specimen . . .	8 mm.
Width	7 mm.
Mean spiral angle	65°.

Shell turbinate, subumbilicate; spiral angle fairly regular, but with a flattened apex; sutures wide and canaliculate. Number of whorls four, the two at the apex smooth, the other two ornamented with from three to four tuberculated spirals, the tubercles having a shallow concave pit on the anterior side.

The body-whorl is subventricose, more or less carinated, and carries three strongly tuberculated spirals on the side, and a fourth, with lesser tuberculations, at the angle. Four more tuberculated spirals ornament the base, including the umbilical cavity, the margin of which is fringed by the one carrying the strongest

row of tubercles. The aperture is subcircular, outer lip lunate and crenulated; columella curved, slightly reflexed and truncated.

Relations and Distribution.—As a rule, specimens from the Lincolnshire Limestone are smaller, less elevated, and more distinctly tuberculated than those from the Great Oolite of Minchinhampton referred to *Monodonta Lyelli*. But they vary also much amongst themselves. A depressed and more carinated form is represented in Pl. XXX, fig. 2, and this tendency is further shown in the var. *humilis* described below.

It is not always easy, when specimens are indifferently preserved, to distinguish between *Monodonta Lyelli* and *Turbo Hamptonensis* (Inferior Oolite variety). Athough for the sake of reference it is convenient to place these in separate genera, so as to change the usual names as little as possible, yet practically they belong to the same genus. *M. Lyelli* may generally be distinguished by the more gaping suture, less regular form, more carinated body-whorl, and by the more irregular character of the ornaments. It seems to be chiefly confined to the upper beds of the Lincolnshire Limestone, notably at Ponton, Barnack, and Weldon. I think, too, that it may be recognised at Hook Norton.

Var. *humilis*, Pl. XXX, fig. 3. More depressed than the preceding; the height averages 4 mm., and the width 5 mm. There are four whorls, the apical ones very depressed; the third whorl is angular and subbicarinate, having two spirals, of which the upper one only is tuberculated. The body-whorl, more than half the entire height of the shell, is large, bicarinate, and furnished with two or three spirals, of which the lower one is often plain; the spirals in the base are finer, except the last, which encircles the umbilicus with a richly tuberculated demilune.

Since the number of whorls is the same, this form cannot be regarded as the young of *M. Lyelli*, but rather as a stunted and local variety, which is itself very variable, and only partly represented in fig. 3 of the accompanying plate. Most of my specimens are from Weldon.

293. Turbo "depressiuscula." Plate XXX, fig. 4.

Description:

Height	5 mm.
Width	8 mm.

Shell obtusely conical, subdepressed, umbilicate; apex obtuse, consisting of two smooth and flattened whorls; third whorl bicarinate with two richly tuberculated spirals, the tubercles being connected by short axial costæ; sutures wide and canaliculate. The body-whorl is angular and strongly bicarinate, having

three tuberculated spirals, one on the posterior margin, and one on each of the carinæ; the tubercles of the first and second spiral are connected across the sloping part of the whorl by axial costæ. Base rather inclined to be flat, and ornamented with four spirals which are finely granulated, except the last, surrounding the circular margin of the umbilicus, where the tuberculations are again larger. The umbilicus is rather wide, and the aperture inclined to be circular, but the indications are not clear.

Apparently related to the more depressed section of *M. Lyelli*, but differing considerably in the ornamentation and shape of the whorls. There is one specimen in the Sharp Collection at the British Museum, most probably from Ponton or Barnack. A second specimen in my own Collection already shows some difference. No others have come under my notice.

294. Turbo "spathica." Plate XXX, fig. 5.

Description:

Height	4·5 mm.
Width	5 mm.

Shell conical, umbilicated, spire elevated, apex obtuse, number of whorls five. To a certain extent this form reminds one of *Turbo delphinuloides*, d'Arch. (*op. cit.*, p. 379, pl. xxix, figs. 3 *a*—*c*). Ours is a smaller and more conical shell than d'Archiac's species, but the angular character of the whorls and the thick radial costæ are points of resemblance. The base is rounded and smooth (radial lines alone being visible)—a feature which at once separates *M.* "*spathica*" from *M. Lyelli* and its relatives.

Two specimens are known to me, both being from the Lincolnshire Limestone, precise locality unknown—probably Ponton, Barnack, or Weldon.

295. Turbo Hamptonensis, *Morris and Lycett*, 1851, Inferior Oolite variety, Plate XXIX, figs. 19 and 20.

1851. Turbo Hamptonensis, *Morris and Lycett*. Great. Ool. Moll., pt. 1, p. 64, pl. ix, fig. 30.

Cf. also — Burtonensis, *Lycett*. Supplement, p. 100, pl. xlv, fig. 15.

— (Delphinula) funiculatus, *Phil.*, vars. Hudleston, Geol. Mag., dec. 3, vol. ii, p. 54, pl. ii, figs. 7 and 8.

Bibliography, &c.—In adopting the above name I wish to indicate that a certain form is widely, though not abundantly, spread throughout the Lower Oolites, which undoubtedly belongs to the group of which the Corallian species, *D. funata*, Münst., is a member, but yet is not the same species. The question calling for immediate decision is, what shall we call this fossil? On the whole, it seems to me that *Turbo Hamptonensis* may be made to cover the ground with the reserve, "Inferior Oolite variety."

Description.—Height 11 mm., width 10 mm., but variable in this respect; spiral angle 65°. Shell conical, moderately umbilicated. Spiral angle fairly regular, but with a flattened apex. Number of whorls usually five, those at the apex smooth, the others richly ornamented with tuberculated spiral bands, about three in number on the penult and antepenult; sutures wide and in some cases almost gaping.

The body-whorl is about half the entire height, subventricose, and carries four tuberculated spirals on the flank, which is in some specimens somewhat bicarinated. Base rounded and studded with tuberculated spirals, of which the lowest, distinguished by larger granulations, forms a prominent demilune at the margin of the umbilical cavity. The aperture is subcircular, the outer lip thin and crenulated; the inner lip is slightly angular towards the columellar extremity, where there is a sort of thickening.

Relations and Distribution.—The above diagnosis represents a more vigorous form than *Turbo Hamptonensis*, which was described from a single specimen in the Great Oolite of Minchinhampton. A still smaller variety is *Turbo Burtonensis*, from the Forest-Marble. Not always to be distinguished from *Monodonta Lyelli*, and intimately connected with *Turbo Davoustii*, which is probably nothing more than an exaggerated and squamose variety.

Rare in Dorset; occurs at different places and on different horizons in the Cotteswolds. Some of the most characteristic specimens are from the neighbourhood of Hook Norton, where it is not always easy to distinguish it from *Monodonta Lyelli*. Varieties from the Dogger and Cornbrash of Yorkshire have been figured by me in the 'Geological Magazine' (*vol. cit.*).

296. Turbo (Delphinula) Davoustii, *d'Orbigny*, 1850. Plate XXX, fig. 7; and var. *Lindonensis*, fig. 6.

1850. Turbo Davoustii, *d'Orbigny*. Prod., i, p. 266.
1852. — — — Terr. Jur., vol. ii, p. 344, pl. cccxxxi, figs. 7—10.

Bibliography, &c.—This is perhaps the form recognised by Lycett ('Proc. Cotteswold Nat. Club,' vol. i, p. 71) as *Delphinula funata*, Goldfuss, and also by

Witchell (' Geology of Stroud,' p. 51) as a fossil of the Oolite-Marl under the same name. It belongs to the same group, no doubt, and has another relative in *Turbo segregatus*, H. and D. (' Foss. Mont.-Bellay,' p. 57, pl. ii, fig. 10). N.B.—Hitherto I have always quoted *D. funata* as a fossil of the Inferior Oolite in the Cotteswolds on the authority of Lycett and Witchell, but it seems that *Turbo* or *Delphinula Davoustii* is more suitable.

Description :

Height	13 mm.
Width	14 mm.
Spiral angle	75°.

The description given by d'Orbigny is sufficiently near to permit of an approximate identification, although there are some differences of detail. *T. Davoustii* may be regarded as a wide-angled and spinulose relative of *T. Hamptonensis*. It is especially characterised by tuberculations which have semilunar pits of varying depth on the anterior side (a feature also of *D. funata*, Goldf., and of *Turbo* [*Delphinula*] *funiculatus*, Phil.). The character of the base and aperture is also the same, except that the tuberculations are far more vigorous.

The best specimens are from Bradford Abbas, presumably from the higher zones; it is also found at Horton Hill in the *Parkinsoni*-zone, but the specimens are inferior. There are also, in all probability, inferior specimens on other horizons and in other localities of the Cotteswolds.

Variety *Lindonensis* (fig. 6).

Description :

Height	11 mm.
Width	13 mm.
Spiral angle	80°.

Shell turbinate, moderately umbilicated. The spire is convex and irregular, with a gaping suture, especially pronounced in the last whorl. Apex obtuse; number of whorls about four, angular and subtabulate, the whole shell being conspicuously muricated; penult ornamented by three or four rows of spinous tubercles.

The body-whorl is somewhat bicarinate, and has on the flank three rows of very spinous tubercles, hollowed anteriorly; the middle row, which is situate at the posterior angle, carries the largest spines. Base rounded, and ornamented with four or five rows of smaller tubercles. Umbilicus and aperture as in *T. Davoustii*.

Of all the members of the group known to occur in the Inferior Oolite, the var. *Lindonensis* has perhaps the most considerable resemblance to the Corallian

Delphinula funiculata, Phil., which I hold to be very much the same as *D. funata*, Goldf. In the looseness of the whorls it also serves to remind us of *T. segregatus*.

Occurs rather abundantly in the "Base-bed" at Lincoln. Inferior specimens in the Oolite-Marl of the Cotteswolds, rare.

Group related to *Delphinula alta*, Morris and Lycett (Great Ool. Moll., pt. 1, p. 71, pl. ix, fig. 31).

From a purely biological point of view it is probable that the "species" hereunder described are all localised varieties of a generalised form, which might be focussed under the general term *Delphinula alta*—the more so since these variations occur on one horizon, and consequently do not in any way mark time. *Delphinula alta* has been quoted as a fossil of the Lincolnshire Limestone by Mr. Etheridge (Judd, 'Geology of Rutland,' p. 282); but whether or not in reference to the strongly marked fossils from the base of that formation at Lincoln, figured in pl. xxx, I cannot ascertain.

For this group generally cf.—

Delphinula serrata, Buvig., 'Géol. Meuse,' pl. xxiv, figs. 26—29.

— *stellata*, Buvig., *op. cit.*, pl. xxiv, figs. 37—39.

— *hirsuta*, Eug. Desl., MS., Cossmann, 'Étage Bath.,' p. 270, pl. x, figs. 42, 43.

297. Delphinula alta-bicarinata, sp. nov. Plate XXX, fig. 8.

Description :

Height	10 mm.
Width	12 mm.

Shell irregularly turbinate, umbilicate; apex obtuse, the apical whorls being smooth; number of whorls four; sutural space very wide, almost gaping. The penultimate is angular and bicarinate, each angle being marked by a studded belt of tuberculations, those in the upper belt are the strongest.

The body-whorl is large, extremely angular and bicarinate, the carinæ being furnished with large squamous tuberculations, strongest in the upper row, the tubercles being very hollow. Fine and sinuous radial ornamentation pervades the sides, especially on the posterior area, where it is sometimes wrinkled up into a subsidiary carina. The base is much produced, and has three raised spirals, the anterior one

bordering the umbilical excavation being roughly serrated. The umbilical hollow terminates in a true umbilicus of considerable depth. Aperture circular, with an expansion of the inner lip, so as to produce a slight projection towards the columellar extremity.

Relations and Distribution.—This form occurs rarely in the "Base-bed" at Lincoln, and also at Stoke Lodge. I possess a specimen, considerably larger than the one figured, said to have come from the Inferior Oolite of Rodborough Hill.

298. Delphinula alta-acanthica, sp. nov. Pl. XXX, fig. 9; variety, fig. 10.

Description:

Height	8 mm.
Width	10 mm.

Differs from the preceding chiefly in the more gaping suture, in the freedom from bicarination, which is especially marked in the body-whorl; and, above all, in the great size and length of the spinous processes (hollow) on the single carina situate at the angle of each whorl.

Relations and Distribution.—It is just possible that this form may represent *D. alta*, M. and L., under circumstances which permit of its bizarre ornamentation being preserved.

Excellent specimens are occasionally obtained from the "Base-bed" at Lincoln. Hitherto I have not noticed this particular form elsewhere in the Inferior Oolite.

Delphinula acanthica, var. depressa, fig. 10.

Description.—Height 4·3 mm.; width (without spines) 6·5 mm. Number of whorls the same as in the more usual form, but all extremely depressed. The penult and body-whorl are flattened out, angular, muricated, and furnished with a keel, which produces wide-apart, upturned spines, whose length keeps increasing anteriorly until a very salient projection is attained.

This is the most bizarre of all the forms connected with this group of *Delphinula*. For comparison *vide* list given *supra*. It is just possible that *Euomphalus coronatus*, Sow., may be a micromorph, though, if Sowerby's enlargement is to be relied on, that shell is more likely to be a *Straparollus*.

Rare in the "Base-bed" at Lincoln.

299. Delphinula (Turbo) Buckmanni, *Morris and Lycett*, 1851, Inferior Oolite variety. Plate XXX, fig. 11.

1851. Delphinula Buckmanni, *Morris and Lycett*. Great Ool. Moll., pt. 1, p. 71, pl. v, fig. 8.

1884. Turbo Buckmanni, *Morris and Lycett*. Cossmann, Étage Bath., p. 265, pl. vii, fig. 50.

Bibliography, &c.—The authors speak of *D. Buckmanni* as occurring in the beds of coarse planking on Minchinhampton Common, though it must be rare, as I have never seen any specimens from the Great Oolite except the three in the Jermyn Street Museum, one of which is the type. In none of these are there strong indications of an umbilicus. Quoted by Cossmann from two localities in the Bathonian of France.

Specimens from the Inferior Oolite show a considerable umbilicus. The following relates exclusively to Inferior Oolite specimens, which may possibly represent a distinct species.

Description:

Height	10 mm.
Width	11 mm.
Spiral angle	80°.

Shell turbinate, moderately thick, more or less umbilicated; the spire, which is pointed and conical, occupies about two-fifths of the total height. Number of whorls five; the two apical ones smooth, the next two are carinated anteriorly, and ornamented with a pair of tuberculated spirals, the points of which are joined by thick radial costæ; sutures moderately wide.

The body-whorl is large, angular, and bicarinate; base full. The primary ornaments consist of a tuberculated spiral on the posterior margin, and one on each of the carinæ, these being decussated by a system of thick radial costæ, which extend from the posterior margin of the whorls across the intercarinal hollow, and right across the base to the margin of the funnel-shaped umbilicus; fine spiral striæ, especially conspicuous in the intercarinal hollow, constitute a secondary ornamentation. The aperture is circular, with but little callus on the inner lip. The radial costæ are sometimes continued over the margin of the umbilicus, which varies as to size, being much encroached upon in some of the older shells.

Relations and Distribution.—If this is really the same as the Great Oolite species, the range of *D. Buckmanni* is considerable. In the Inferior Oolite it has only been found, so far as I know, in the Oolite-Marl of the Nailsworth district, whence specimens are occasionally obtained.

N.B.—The remainder of Pl. XXX is occupied with figures of an interesting group of turbinate shells, generally known to me as the *Granata*-group. This group is confined to the Lower Division of the Inferior Oolite, and often to a low horizon such as the *Opalinus*-zone and the lower part of the *Murchisonæ*-zone, but is also abundantly represented in the *Concavus*-bed of Bradford Abbas.

These depressed and highly ornamented "Turbos" are characterised by a large and infundibuliform umbilicus. Interiorly the aperture is circular, but with a subrhomboidal peristome, reminding one greatly of *Delphinula*, a view which is further supported by the character of the umbilicus. Bean seems to have been the first naturalist in this country whose attention was drawn to the subject. Specimens from the Dogger were sometimes named in his MS. *Delphinula granata*, sometimes *Solarium granatum*. Mr. Tawney named a species of this group from the *Concavus*-bed of Bradford Abbas *Turbo Shaleri*. If, on the present occasion, I adopt the double name, it must be understood that "*Turbo*" is only used in a conventional sense, and that to my mind *Delphinula* is nearer the mark. Then comes the question of "species." The relationship of the forms from 12 to 17 figured in the accompanying plate is obvious, and one might select a much larger number of varieties. This is a case where the binomial system of nomenclature is evidently at fault. Whatever specific name is used, in each case the word "*granata*" should be understood.

300. Turbo (Delphinula) Shaleri, *Tawney*, 1873. Plate XXX, fig. 12.

1873. Turbo Shaleri, *Tawney*. Dundry Gasteropoda, p. 31 (23), pl. ii, fig. 3.

Description :

Height	9 mm.
Width	12·5 mm.
Spiral angle	90°—95°

N.B.—The largest specimen from Bradford Abbas does not exceed 14 mm. in width. Specimens from Dundry, according to Mr. Tawney's measurements, seem to be larger.

Shell turbinate, widely umbilicate; the spire is regular in some specimens, gibbous in others, and ranges from one-third to two-fifths the total height. Apex pointed, number of whorls five, sloping easily to a very strong anterior keel, which is richly ornamented with rather fine granulations; in some cases a second keel is exposed in the penult; a fine and almost imperceptible circle of granulations also lines the posterior margin.

The body-whorl is large, angular, and sub-bicarinate, the widest part being at the upper keel, but the difference in width between the upper and lower keel varies considerably. The keels are richly granulated, the granulations in the lower keel being smaller, and the whole surface of the shell is covered by an interlacing network of spiral and radial striæ, the umbilicus being encircled by a row of prominent tubercles rather wide apart. Aperture sub-rhomboidal to circular; umbilicus funnel-shaped and deep.

Relations and Distribution.—There is much variety in the shells classed under *Turbo Shaleri*, chiefly owing to the difference in the amount of exposure in the penultimate—thus producing a figure very different to that of the specimen selected (fig. 12). It is obviously a member of the *Granata*-group, especially characteristic of the *Concavus*-bed, Bradford Abbas. Quoted from Dundry by Tawney, where specimens seem to be less highly ornamented.

301. *Delphinula*, species or variety. Plate XXX, fig. 13.

The specimen figured in the accompanying plate differs so considerably, both from *Turbo Shaleri* and also from the other members of the *Granata*-group, described below, as to be worthy of notice. The opening of the spiral angle is about 115°, the body-whorl is equally bicarinate, and the ornaments are very fine, except where a circle of elongated tubercles borders the wide and funnel-shaped umbilicus.

The specimen is believed to be from the Inferior Oolite of the Dorset district and is unique. As a mere name of convenience I would distinguish it as *Delphinula* "*densistriata.*" In shape, but not in ornamentation, it has some resemblance to *Turbo Theodori* (Goldf., t. 179, 1).

302. Delphinula Shaleri, var. pulchrior. Plate XXX, fig. 14.

Description:

Height	12 mm.
Width	16 mm.
Mean spiral angle about	85°.

Shell turbinate, moderately umbilicated, spire fairly elevated, ranging from more than one-third to less than one-half the total height; apex flattened, apical whorls smooth. Number of whorls five, concave, and ornamented by tuber-

culated spirals at the posterior and anterior margins, the interspaces being richly interwoven with fine granular ornaments; sutures regular and canaliculate.

Body-whorl large, subangular and bicarinate, the tuberculated carinæ being equal and approximate; a granulated spiral belt adorns the posterior margin. The tuberculations on the carinæ are radially elongate, and the entire surface of the shell, including the full base, is richly chased with granular spiral ornament. A system of radiating tubercles encircles the somewhat restricted umbilicus; aperture circular to subquadrate.

Relations and Distribution.—Strictly speaking, this may be regarded as a megalomorph of *Turbo* (*D.*) *Shaleri*, although there are many points of difference. Yet varieties classed with *T. Shaleri* seem to lead up to this form, which occurs in the same beds, though more sparingly. Found at Stoford and in the *Concavus*-bed at Bradford Abbas.

303. Delphinula angulata, sp. nov. Plate XXX, figs. 15 and 16.

Description.—There are two well-marked varieties in this species, an elevated form with larger tuberculations (Fig. 15), and a depressed form with finer tuberculations (Fig. 16). It is to the former and more common variety that the subjoined description particularly applies.

Height	11 mm.
Width	14 mm.
Spiral angle	90°—95°

Shell conical, turbinate, umbilicated; spire about one-third the total height, obtuse, but with a sharp apex. Number of whorls five to six, richly ornamented with finely tuberculated spirals at the posterior and anterior margins, the intervening area being very concave; sutures canaliculate, but not very wide.

The body-whorl is very angular, owing to the large and equal double keels, which are rather wide apart. There is a granulated spiral belt on the posterior margin of the body-whorl, and the space between this and the upper keel is very concave; the keels are richly tuberculated, the upper one being rather the stronger; the base is very full and, together with the rest of the shell, spirally striated and slightly decussated. The deep and funnel-shaped umbilicus is encircled by a girdle of axially-extended tubercles, fairly wide apart. Aperture circular to subquadrate.

Relations and Distribution.—Distinguished from *D. Shaleri* and var. *pulchrior* by the very concave whorls, biangular outline, and round or granular character of the tuberculations.

This species is rather widely distributed. The best specimens come from the

Opalinus-zone, at Drympton, and from the lowest *Murchisonæ*-zone at Bradford Abbas and Halfway House. May be noted in the shell-bed below the Lower Limestone at Crickley. It also occurs in the Dogger, and generally in those portions which are below the *Nerinæa*-bed, being, on the whole, a fossil characteristic of a low horizon. By the gradual rounding of the angles and refinement of the ornaments *D. angulata* passes into the species next described.

304. Delphinula (Turbo) granata, *Hudleston*, 1885. Plate XXX, fig. 17.

1885. Turbo (Delphinula) granatus, *Bean, MS.* Hudleston, Geol. Mag., dec. 3, vol. ii, p. 55, pl. ii, figs. 9—12.

Bibliography, &c.—In the description of this species, two varieties were noticed by me. The first of these is more properly *D. granata;* the second variety probably shades off into *D. angulata.*

Description:

Length	11·5 mm.
Width	14 mm.
Spiral angle (variable)	95°.

Shell turbinate and umbilicate; spire rather more than one-third the total height, but variable in this respect, the younger shells being the most depressed. Number of whorls in the full-grown shell five, usually flattened towards the apex. In those cases where the ornaments of the spire-whorls are preserved, tuberculated spirals at the posterior and anterior margins may be noted, but very often adult shells (as in the figured specimen) show scarcely any ornament in the whorls of the spire. In the more gibbous varieties, where a portion of the base of the penultimate is exposed through gaping of the suture, the whorl appears strongly carinated.

Body-whorl large, rounded to subangular and ornamented by a number of tuberculated and granular spiral bands. There is generally a compound spiral band on the posterior margin; the widest part of the shell is marked by a slight carina with conspicuous granulations, below which are other slight keels. The base is very full and granulated, the spiral ornaments terminating in a circle of tubercles round the deep and funnel-shaped umbilicus. Aperture as in the preceding species.

Relations and Distribution.—This is so variable a species that scarcely any two shells are alike. It is more rounded in outline, and the ornaments are of a more granular character than is the case with the forms previously described.

Fairly abundant in the Dogger, *D. granata* is elsewhere represented by allied

rather than by identical forms of the *Granata*-group; although, here and there, as in the "Base-bed at Lincoln and also at Leckhampton, there are micromorphs which may be taken to represent this species. In my own collection "*D. granata*, var.," stands for certain forms of this group. One of the most beautiful of these, apparently between *D. angulata* and *D. granata*, was found by Mr. Wilson in the Inferior Oolite, "Juniper, Painswick."

305. Delphinula (Turbo) Santonis, sp. nov. Plate XXX, figs. 18, 18 *a*.

Description:

Height	9 mm.
Width	9 mm.

Shell conical, turbinate, umbilicated. Spire elevated, spiral angle rather obtuse (about 68°); apex smooth. Number of whorls five, slightly carinated, the ornaments consisted of deep-cut granulated spirals, with one median spiral of moderate prominence, situate at the angle of the whorl; sutures slightly canaliculate.

The body-whorl is full and rounded; it carries three granulated spirals posterior to the keel which is merely indicated by a spiral of larger granulations; below this are two granulated spirals rather more wide apart. The base is full and richly decussated by fine spiral and radial lines, collected into a frill at the margin of the variable umbilicus. Aperture suborbicular, with a slight thickening of the inner lip.

Relations and Distribution.—Notwithstanding its narrower spire, smooth outlines, and *Turbo*-like character, this form must, I think, be classed with the *Granata*-group, and more especially with *D. granata*. There are three specimens in the Jermyn Street Museum from Santon, in North Lincolnshire.

Genus—Trochus, Linnæus, 1758.

Shell conical with an elevated spire, whorls numerous, but slightly convex; spire somewhat pointed; last whorl keeled or angular; base concave, flattened or slightly convex; aperture rhomboidal; lip sharp, very oblique; columella curved, more or less prominent at its union with the outer lip.

The species from the Inferior Oolite classed below under *Trochus* answer fairly to the above diagnosis, though presenting considerable differences amongst themselves. They may be roughly separated into three divisions.

1. Umbilicated species with a somewhat convex base. These forms seem to establish a link with the Delphinulas just described.

2. Species with a nearly flat base, and mostly without umbilicus = *Zizyphinus*.

3. Trochiform shells without umbilicus, some of doubtful nature.

N.B.—There is a group of small umbilicated *Trochi* belonging to the first division, which I might designate the *Sandersii*-group. It so happens that Mr. Tawney founded this species on a single and rather imperfect specimen from Dundry, where probably the form is very rare. In Dorsetshire, however, there is a somewhat numerous group of shells, possessing a general resemblance to the type of *T. Sandersii*, though passing through numerous varieties into something very different. The three following named forms are placed in this group.

306. Trochus Sandersii, *Tawney*, 1873. Dorset variety, Plate XXXI, fig. 1.

Cf. Trochus Sandersii, *Tawney*. Dundry Gasteropoda, p. 31 (23), pl. ii, fig. 4.

Description:

Height	14 mm.
Width	15 mm.
Spiral angle	68°.

Shell conical and moderately umbilicated. Spire about half the total height and rather obtuse towards the apex. Number of whorls about six; those of the spire are concave and marked off by a very wide suture. At the posterior margin of each whorl is a circlet of fine tuberculations, whilst the anterior margin is keeled and marked with a circlet of larger tuberculations; radial costæ cross the intervening hollow.

The body-whorl is concave above and bicarinate below, the upper carina being the most salient; the ornaments are similar in character to those of the spire; base moderately convex with decussated ornamentation; umbilicus deep and somewhat funnel-shaped and encircled by a fringe of tubercles. Aperture subrhomboidal.

Relations and Distribution.—The single specimen described by Tawney from Dundry is narrower than the majority of the Dorset shells referred to this species. Nevertheless, these differ among themselves to such an extent that it is not easy to say what the type should be. In Dorsetshire *T. Sandersii*, *i. e.* the fossils referred to this species seem to occur on a low horizon, chiefly in the *Murchisonæ*-zone or at the base of the *Concavus*-bed.

307. Trochus rupestris, sp. nov. Plate XXXI, fig. 2.

Amongst the forms more or less related to *T. Sandersii* is one from the Irony Nodule-bed at Burton Bradstock, which almost merits to be named as a distinct species, or at least as a variety.

Description :

Height and width	15 mm.
Spiral angle	72°.

The apex is more pointed than in *T. Sandersii*, and the outline more regularly conical. The chief difference lies in the number and position of the spiral belts; the whorls also are less concave, and the base somewhat fuller, and in some specimens the umbilicus is smaller.

Found sparingly at Burton Bradstock, and a variety at Mapperton.

308. Trochus sybilla, sp. nov. Plate XXXI, fig. 3.

Cf. Trochus Sedgwickii, *Münst.* Goldf., Petref. Germ., pl. clxxix, fig. 4.

Description :

Height	10 mm.
Width	11·5 mm.
Mean spiral angle	75°.

Shell subconical, angulated, slightly umbilicated. The spire, which is rather more than one-third the total height, is very obtuse at the apex. Number of whorls five, well separated by the suture. Close to the posterior margin of each whorl is a circle of tubercles, between which and the principal keel the whorl is concave and sloping; the principal keel is richly tuberculated.

This kind of ornamentation is continued in the body-whorl, which is largely biangulated, owing to the development of a lower tuberculated keel, close to the basal periphery, base moderately full and decussated with spiral and axial lines. In addition to the fine spiral lines which pervade the whole shell, there is a system of radial costæ with posterior deflection. A sweep of elongated tubercles encircles the restricted umbilicus. Aperture subquadrate.

Relations and Distribution.—Differs from *T. Sedgwickii,* Münst., chiefly in the less elevated spire and more stumpy character of the shell generally. In fact, this is a somewhat abnormal *Trochus*, serving to remind us of *Delphinula angulata*. Nevertheless *T. sybilla* is related to *T. Sandersii*.

The small variety figured in the accompanying plate is characteristic of the *Opalinus*-zone of Drympton and Haselbury, and probably of other localities. Some specimens more conical than the one figured I distinguish in my collection as var. *conica*. There is also a large variety in the *Murchisonæ*-zone of Burton Bradstock which comes very near to *T. Sedgwickii*, Münst. It is just possible that a modification of this species—or species-group—from the Dogger is represented in 'Geol. Mag.,' 1885, pl. ii, fig. 13.

309. Trochus Winwoodi, *Tawney*, 1873. Plate XXXI, fig. 4 (minor), fig. 5 (major).

1873. Trochus Winwoodi, *Tawney*. Dundry Gasteropoda, p. 34 (26), pl. ii, fig. 8.

Bibliography, &c.—This species was based upon a single specimen in the Bristol Museum, the locality being uncertain. The author observed that there was some resemblance to Quenstedt's figure of *Trochus bijugatus* ('Der Jura,' p. 485, pl. lxv, fig. 9). Since the year 1873, analogous if not positively identical forms have been found abundantly in the *Concavus*-bed at Bradford Abbas, where the species exhibits great variety. The form is probably derived from the more conical varieties of the *Sandersii*-group, which is, in the main, characteristic of a lower horizon.

Description, var. minor:

Height	19 mm.
Basal width	15 mm.
Spiral angle	47°

Shell regularly conical, elevated, more or less umbilicated. Spire acute and occupying nearly two-thirds of the entire height. Number of whorls seven or eight; these are concave with finely tuberculated keels, not very salient, at the posterior and anterior margins, the intervening space being seamed with granulated spiral striæ somewhat decussated axially; sutures wide and regular.

The body-whorl is similar in shape and similarly ornamented, the second carina forming the angle of the whorl, immediately below which, and partly in the base, is a third subordinate carina. The base inclines to be flat, though rising anteriorly, and is richly ornamented with granular spirals which are partly decussated by axial striæ and growth-lines: a row of slight tubercles girdles the umbilicus, which is sometimes barely indicated. Aperture trapezoidal.

In the variety *major* the ornaments are much coarser, in the whorls of the spire a third carina being exposed. In the body-whorl this attains to considerable importance, so as to produce a duplicate keel at the angle of the shell. The

umbilicus, likewise, is of considerable importance, being deep, though not funnel-shaped; it is encircled by tuberculations of considerable size.

Relations and Distribution of *Trochus Winwoodi*.—Mr. Tawney described his species as having the umbilicus closed, but in point of fact this is hardly ever the case with the specimens from Dorset. Small forms are not very far from the conical variety of *Trochus sybilla*, but the ornaments are always finer, and the shape of the body-whorl different. There are other varieties—almost distinct species.

Abundant in the *Concavus*-bed at Bradford Abbas. Occurs also at Stoford and Halfway House, on or about the same horizon. There is a short conical variety at Beaminster, to which a varietal name might be given.

310. Trochus duplicatus, *Sowerby*, 1817. Plate XXXI, fig. 10.

	1817.	Trochus duplicatus, *Sowerby*.		Min. Conch., pl. clxxxi, figs. 5, 5.
	1852.	—	—	d'Orbigny, Terr. Jur., vol. ii, p. 275, pl. cccxiii, figs. 5—8.
	1867.	—	—	? var. Laube, Gast. B. J. von Balin, p. 10, pl. ii, fig. 7.
cf. also		—	—	Tawney, Dundry Gasteropoda, p. 32 (24).
	Non.	Turbo duplicatus, *Sow.*		Goldfuss, Petref. Germ., pl. clxxix, fig. 2.
	Non.	Trochus duplicatus, *Quendstedt.*		Der. Jura., p. 314, pl. xliii, figs. 18, 19.

Bibliography, &c.—The types of *Trochus duplicatus*, *T. angulatus* (*concavus*), and *T. dimidiatus* came from Little Sodbury; these are now in the Sowerby type-collection at the British Museum. The village of Little Sodbury is at the foot of the Cotteswold escarpment and on the Lias; but, as far as I have been able to ascertain, the parish pit in the early part of the century must have been well up the hill and towards the top of the Inferior Oolite. The horizon is doubtless represented in the adjacent quarry on Horton Hill, where the equivalent of the Upper Trigoniagrit of the Cotteswolds (*Parkinsoni*-zone), yields a number of interesting Gasteropoda. *Vide supra*, pp. 57, 58.

Mr. Tawney was, I consider, too comprehensive in his synonymy; for instance, Quenstedt (*loc cit.*) expressly says that the species figured by Goldfuss is not that of Sowerby.

Description:

Height	15 mm.
Width	15·5 mm.
Spiral angle	62°—66°.

Shell regularly conical, moderately umbilicated; spire elevated, considerably

more than half the total height. Number of whorls seven; sides concave, the posterior and anterior margins decorated by nodular carinæ. A wide and regular suture separates the lower carina of one whorl from the upper carina of the next; the intercarinal spaces have no spiral ornamentation, but very fine axial lines may be seen on the glabrous surface.

The body-whorl is similar, but with a double nodulated carina round the base, which is flat and smooth, but rises towards the centre, where an umbilicus of moderate width and depth is girdled by a set of large tubercles, about eight in number. Aperture subrhomboidal and depressed.

Relations and Distribution.—This species is, perhaps, the most abundant Gasteropod in the Upper Division of the Inferior Oolite, being especially characteristic of the *Parkinsoni*-zone from Burton Bradstock as far north at least as Aston in the Cotteswolds. I have no specimens either from the Lincolnshire Limestone or from Yorkshire. It is essentially a Bajocian (*i. e.* Upper Division) form, being abundant at Bayeux, &c. French specimens seem to be rather wider-angled than ours. There is a marked variety from Powerstock in Dorset, which I have not figured.

This is very different to the polymorphous species usually known as *Trochus subduplicatus*, d'Orb., from the Lower Beds, but is closely related to the two forms next described.

311. Trochus angulatus, *Sowerby*, 1817. Plate XXXI, fig. 11.

1817. Trochus concavus, *Sowerby*. Min. Conch., pl. clxxxi, fig. 3; op. cit., vol. iv, index and corrigenda, 1823, as Trochus angulatus.
1854. — angulatus, *Sow.* Morris, Cat., p. 281.

This form is somewhat wider than average specimens of *T. duplicatus*, of which it may, to a certain extent, be considered a glabrous variety. Sowerby relied upon the presence of a few transverse striæ as helping to separate it. Though this test fails, the following important differences may be noted, viz. the extreme smoothness of the shell, the absence of umbilicus, and the fusion of the two keels into one.

Intermediate forms which show the connection, but which incline more towards *T. duplicatus*, occur in several places. Specimens, such as the one figured, are rare.

312. Trochus Duryanus, *d'Orbigny*, 1852. Plate XXXI, fig. 12.

1852. Trochus Duryanus, *d'Orbigny*. Terr. Jur., vol. ii, p. 280, pl. cccxiv, figs. 12—15.

Description:

Height	7 mm.
Width	6 mm.
Spiral angle	52°.

A single specimen from Grove (*Parkinsoni*-zone), having the above dimensions, so nearly accords with the description and figures of d'Orbigny that we seem fairly safe in making the identification.

This little shell has no umbilicus; otherwise it seems to vary from its near relative, *Trochus duplicatus*, in a direction precisely opposite to that of *Trochus angulatus*.

The *Subduplicatus*-group.

There is a varied series of trochiform shells in the Lower Division of the Inferior Oolite, mostly towards the Lias-boundary, which it is convenient to focus under "*Turbo*" *subduplicatus*, d'Orbigny, as the primary division, even if we indulge in varietal names.

313. Trochus subduplicatus, *d'Orbigny*, 1850. Plate XXXI, figs. 13 and 14.

1850. Turbo subduplicatus, *d'Orbigny*. Prod., 1, p. 248.
1852. — — — Terr. Jur., vol. ii, p. 339, pl. cccxxix, figs. 1—6 (notably figs. 4, 5, and 6).

Bibliography, &c.—When d'Orbigny, in the "Terrains Jurassiques," placed *Trochus duplicatus*, Sow., at the head of the synonymy of "*Turbo*" *subduplicatus*, d'Orb., that author appears to have forgotten that he had already (p. 275, pl. cccxiii, figs. 5—8) accepted Sowerby's species, which he described and figured with his usual fidelity. If anyone doubts the essential difference between *T. duplicatus*, Sow., and *T. subduplicatus*, d'Orb., let him refer to the figures and descriptions in d'Orbigny's own work. Moreover *T. duplicatus*, Sow., and *T. subduplicatus*, d'Orb., besides being very distinct in form, occur on quite different horizons.

Description.—There are two sizes; the dimensions given are those of the larger (fig. 14):

Height	16 mm.
Width	15 mm.
Spiral angle	68°.

Shell conical, not umbilicated; spire acute and about half the entire height. Number of whorls seven, slightly concave, distinctly separated by the suture, and provided with spinous carinæ on the posterior and anterior margins; there is no spiral ornamentation in the interspace, but in the younger and better preserved specimens a system of radial costæ connecting the spinous points may be noted. A fine system of growth-lines is associated with this ornamentation.

The body-whorl is large and sub-bicarinate; in the older shells the posterior row of spinous tubercles becomes indistinct towards the aperture, whilst the double carina is markedly spinous. The base is very full and puckered by a rugose system of axial costæ, which almost obliterate the fine spiral ornamentation noticeable in the younger shells; these costæ terminate in an irregular semicircle of large tubercles around a slight umbilical depression. Aperture subrhomboidal, the height and width being nearly equal, with a considerable callus on the rounded inner lip.

Relations and Distribution.—The chief point of resemblance in this species and *T. duplicatus* consists in a tendency to a duplex keel towards the basal periphery. *T. subduplicatus* is rugose, though wear and other causes may somewhat modify this peculiarity. There is also some variation in the size of the umbilical depression, though no true umbilicus exists; there is likewise considerable variation in other respects.

T. subduplicatus is probably better known as a fossil of the Upper Lias. Characteristic specimens, such as those figured, occur at Newton (Yeovil Sands) in the *Dumortieria*-beds. An extremely rugose variety, referred with some doubt to this species, was found in the *Variabilis*-beds of North Nibley.

Var. PLICATA, *Goldfuss*. Plate XXXII, fig. 2.

Turbo plicatus, Goldf., 'Petref. Germ.,' pl. 179, fig. 3. Cf. also d'Orbigny, 'Terr. Jur.,' vol. ii, pl. cccxxix, figs. 2 and 3, and Quenstedt, 'Der. Jura.,' p. 314, pl. xliii, fig. 19. Both d'Orbigny and Quenstedt agree that this form is only a variety of the preceding; the latter author observed that it is a somewhat simpler modification.

This modification consists chiefly in the fusion of the duplex carina of the

body-whorl into one thick nodular belt. In this form, also, the umbilicus is, for the most part, more completely closed, whilst the ornaments are softer in outline and less disposed to be spinous. Specimens are obtained from the lower part of the Yeovil Sands at Bridport Harbour in the *Dumortieria*-beds, and more rarely in the *Opalinus*-zone of Burton Cliff.

This tendency to fusion of the duplex carina is also noticeable in certain fine specimens of *T. duplicatus* from the *Parkinsoni*-zone of Powerstock, Broadwindsor, &c.

314. Trochus subduplicatus, var. Abbas. Plate XXXII, fig. 1.

Description :

Height	24 mm.
Width	21 mm.
Spiral angle	55°—60°.

Shell regularly conical, scarcely umbilicate; spire elevated, in most cases considerably exceeding half of the total height; apex sharp. Whorls seven to eight, very concave, and distinctly separated by a considerable suture. There is a nodular carina at the posterior and anterior margin of each whorl, the anterior one being usually compound; fine and regular spiral lines ornament the hollow portion of the whorls.

The body-whorl is much excavated and similarly ornamented, the nodular anterior carina being excessively thick and complex. The base is rather inclined to be flat, and is decorated with fine spiral lines throughout, which are more or less puckered by coarse radial lines converging towards the very slight umbilical fissure. Aperture subrhomboidal and slightly depressed, with a considerable callus on the inner lip.

Relations and Distribution.—In this very beautiful and highly ornamented shell we scarcely recognise our old acquaintance of the *Dumortieria*-beds. The intercarinal spaces, instead of being smooth, are full of spiral lines, which are also conspicuous in the base; the base likewise is flatter and the aperture more depressed. In the general figure there is some approach to *T. duplicatus*, but in no other respect.

Trochus Abbas is characteristic of the *Concavus*-bed at Bradford Abbas. I have one specimen from Burton Bradstock, horizon unknown. It may at once be distinguished from the *Dumortieria*-bed fossils by the fine spiral ornamentation in all stages, by its flatter base and larger habit of growth.

315. Trochus spiratus, *d'Archiac*, 1843, Inferior Oolite variety. Plate XXXI, figs. 6 and 7.

1843.	Trochus spiratus, *d'Archiac.*			Mém. Soc. Géol. France, vol. v, pt. 2, p. 378, pl. xxix, fig. 4.
1851.	—	—	—	Morris and Lycett, Great Ool. Moll., pt. 1, p. 106, pl. xiii, fig. 6.
1852.	—	—	—	d'Orbigny, Terr. Jur., vol. ii, p. 291, pl. cccxvii, figs. 16—19.
1853.	—	—	—	Morris, Q. J. G. S., vol. ix, p. 326.

Bibliography, &c.—D'Archiac refers to five or six spiral lines as occupying the flat part of the whorls. This species was first noticed in England by Morris and Lycett in the Great Oolite of Minchinhampton, and the same authors recognised it in the Lincolnshire Limestone of Ponton. *T. spiratus* seems not to be a fossil of the Anglo-Norman basin.

Description of the Lincolnshire Limestone variety:

Height	7 mm.
Width	6·5 mm.
Spiral angle	70°—76°.

The relations of width and height vary considerably. The shell is conical and not umbilicated. Spire elevated, but always less than half the total height, acute, but with a slightly flattened apex. Number of whorls five, the apical ones mostly plain, there being seldom any visible ornamentation above the penult, which is angular and possesses two principal and a small intermediate carina.

The body-whorl is relatively large and angular, and has five prominent spiral lines, of which the two principal, situate at the angle, cause it to be strongly bicarinate. The base is full and spirally striated. Aperture subrhomboidal with a slight tendency to a notch at the columellar extremity.

Relations and Distribution.—Specimens from Minchinhampton are more conical in outline, and the base is smooth instead of being spirally striated, as is also the case with specimens from Eparcy (Cossmann 'Ét. Bath.,' p. 298). In the Lincolnshire Limestone, specimens from Weldon show strong spiral lines in the base, whilst those from Ponton, on or about the same horizon, are smooth. Hence we might regard the Weldon fossil as a variety. Only found in the Upper Beds of the Lincolnshire Limestone, as far as the Inferior Oolite is concerned.

316. Trochus dimidiatus, *Sowerby*, 1817. Plate XXXI, fig. 8.

1817. Trochus dimidiatus, *Sowerby*. Min. Conch., pl. clxxxi, fig. 4.

Description :

Height	9 mm.
Width	9·5 mm.

Shell conical, smooth, without umbilicus. Spiral angle obtuse, from 70°—76°, spire rather less than half the total height. Number of whorls five, carinated above and below, concave between; sometimes the lower keel of the penult projects so as to produce a gibbous appearance.

Body-whorl large, angular, and bicarinated; base moderately full. Aperture subrhomboidal, with a tendency in some specimens to show a columellar furrow.

Relations and Distribution.—Trochus dimidiatus is variable as to size and shape, though rarely exceeding 10 mm. in height. In general outline it resembles *T. spiratus*, but has no spiral ornament beyond the very smooth keels.

It is principally a fossil of the Upper Division. A very depressed variety occurs rarely in the Dogger. A variety occurs at Weldon; small specimens at Hook Norton; typical forms in the *Parkinsoni*-zone of the Cotteswolds, also at Midford and at Dundry. Rather more elongated specimens occur in the *Parkinsoni*-zone of Grove, &c. There is a curious form in my Collection from Dundry.

As a possible variety of the above I draw attention to—

Trochus Zetes d'Orb., *fide* Tawney, Pl. XXXI, fig. 9.

1852. Trochus Zetes, *d'Orbigny*. Terr. Jur., vol. ii, p. 281, pl. cccxv, figs. 1—4.
1873. — — — Tawney, Dundry Gasteropoda, p. 32 (24), pl. ii, fig. 7.

We do not gather from the text of the "Dundry Gasteropoda," whether the specimen figured as *T. Zetes* came from Dundry or from Bradford Abbas. In the *Concavus*-bed at the latter place, *Trochus Zetes*, so-called apparently on Tawney's authority, occurs in considerable numbers (*vide* Fig. 9). The identification appears fairly correct; but the question naturally arises whether *Trochus Zetes* differs materially from *T. dimidiatus*. In the shells from Bradford Abbas the whorls of the spire are less angular, and there is a somewhat more marked umbilical excavation, the spire generally is less stumpy than in *T. dimidiatus*.

317. Trochus monilitectus, *Phillips*, 1829. Plate XXXII, figs. 3 *a*, 3 *b*.

1829 and 1835.	Trochus monilitectus,	*Bean*,	MS.	Phillips, Geol. Yorks., pt. 1, p. 152 (3rd edit., p. 259), pl. ix, fig. 33.
1850.	—	—	*Phil.*	d'Orbigny, Prod., 1, p. 265.
1851.	—	—	—	Morris and Lycett, Great Ool. Moll., pt. 1, p. 116, pl. xv, fig. 1.
1885.	—	—	—	Hudleston, Geol. Mag., dec. 3, vol. ii, p. 121, pl. iii, figs. 1, 1 *a*, 1 *b*.
Cf. also	—	Brutus,	*d'Orbigny.*	Terr. Jur., vol. ii, p. 283, pl. cccxv, figs. 13—16.
	—	—	—	Cossmann, Étage Bath., p. 285, pl. vii, figs. 23—24.

Bibliography, &c.—This little shell is a genuine representative of the section *Zizyphinus*, and belongs to a group completely conical in outline, the result of flat whorls and a close suture. In the Bathonian of France *Trochus Zenobius*, d'Orb., seems to represent it. *Trochus Brutus*, which has a wider spiral angle, is stated by M. Cossmann, on the authority of Schlumberger, to be common in the Bajocian, I presume of eastern France.

Description.—Typical form from the Scarborough Limestone of Cloughton Wyke :

Height	8 mm.
Width	7·5 mm.
Spiral angle	60°.

Shell regularly conical, imperforate ; spire acute, and nearly two-thirds the total height. Whorls flat, suture extremely close. The ornaments consist of four, and sometimes five equal spiral bands, which are close together and evenly tuberculated, the tubercles or granules being nearly circular.

The body-whorl has four tuberculated spirals, together with a thicker belt, constituting the basal periphery. Base flat with faint spiral striæ towards the margin (not always visible), the rest smooth or only marked by faint radial lines. Aperture rhomboidal and depressed.

Relations and Distribution.—The typical *T. monilitectus* seems almost confined to the Scarborough Limestone and to the Upper Beds of the Lincolnshire Limestone, especially at Ponton, where its presence was first recorded by Morris in 1853 (' Quart. Journ. Geol. Soc.,' vol. ix, p. 326).

Further south, *e. g.* in the *Parkinsoni*-zone of Aston, Notgrove, and Horton Hill, and also at Grove, near Castle Cary in Somersetshire, there occurs a larger form with five or six nodular spirals (see fig. 4). The greater number of spirals is often

associated with a slight basal carina which breaks the uniformity of the cone, and thus we gradually pass to another species. In my own Collection these are marked var. "*nemoralis*." It is quite possible that they are undeveloped forms of *Trochus substrigosus*, described below. For similar forms see 'Geol. Mag.' vol. *cit.*, pl. iii.

318. Trochus subluciensis, sp. nov. Plate XXXII, figs. 6 and 7.

Description (full size):

Height	14 mm.
Width	10 mm.
Spiral angle	40°—45°.

Shell regularly conical, not umbilicate. Spire acute, about two-thirds the total height. Number of whorls about seven, perfectly flat, and increasing with complete regularity; sutures close. The ornaments consist of four thick, tuberculated spirals, each tubercle presenting a squamous appearance, owing to a crescent-shaped hollow on the anterior side.

In the body-whorl the number of these squamous spirals increases to five and even more; the anterior spiral is usually deflected away from the base, which is flat and without ornament. Aperture rhomboidal and much depressed.

Relations and Distribution.—It is extremely probable that there is more than one species amongst these narrow-angled and squamously-ornamented shells, but the state of preservation is scarcely favorable for close discrimination. The spiral angle accords with that of *Trochus Luciensis*, d'Orb.; but in that species the spirals are simply nodular, and do not appear to assume the peculiar rope-like character, which enables one to recognise even a fragment of *Trochus subluciensis*.

These shells are characteristic of the *Murchisonæ*-zone, occurring in the Oolite Marl of Nailsworth, and in the *Murchisonæ*-zone at Stoford and Bradford Abbas; also on the same horizon in the Irony Nodule-bed at Burton Bradstock.

A modified form is found in the "Base-bed" at Lincoln, which is also in the *Murchisonæ*-zone. With reference to the Gasteropoda in this bed, it may be observed that their tendency to vary in the direction of bizarre forms is noteworthy. Whether *Trochus squamosior*, next described, is a species or a "sport" must be left an open question.

319. Trochus squamosior, sp. nov. Plate XXXII, fig. 5.

Description :

Height	9 mm.
Width	9 mm.
Spiral angle	65°.

Shell conical, not umbilicate; spiral angle slightly concave. Spire acute, sutures close. Number of whorls seven, flat, those at the apex without ornament; the three succeeding whorls carry from two to three tuberculated and subsquamose spirals. The penult has four spirals, of which the third is the least prominent.

The body-whorl has five spirals, of which the middle one is the weakest. All the spirals of the anterior whorls are armed with hollow spinous projections, the hollow inclining to the anterior side; the last spiral, constituting the basal periphery, is turned backwards. Base flat and smooth. Aperture rhomboidal and depressed.

Relations and Distribution.—Although possibly only a sport of the local representative of *T. subluciensis*, yet the wider spiral angle and tendency to a concave spire are indications which may be relied on, even when the exceptional preservation of the spines, exhibited in the figured specimen, is wanting.

Rare in the "Base-bed" at Lincoln. I have seen something like this form on a small scale in Mr. Walford's Collection from Hook Norton.

320. Trochus squamiger, *Morris and Lycett*, 1851, Inferior Oolite variety. Plate XXXII, fig. 8.

1851. Trochus squamiger, *Morris and Lycett*. Great Ool. Moll., pt. 1, p. 62, pl. ix, fig. 34; pl. xiii, fig. 7.

Description :

Height	6·3 mm.
Width	7 mm.
Spiral angle	68°.

Shell regularly conical, imperforate. Spire elevated and acute, though the actual apex is slightly obtuse. Number of whorls six, perfectly flat and increasing regularly; sutures close. The ornaments consist of spiral bands distinguished by nodules which are squamosely tubular and excavated on the anterior side. On the

body-whorl these spirals are four in number. Base flat, with a crenulated margin and delicate spiral ornamentation (rarely preserved).

Relations and Distribution.—The Inferior Oolite variety is more perfectly conical and wider than the Minchinhampton one. Obviously related to *T. squamosior*, this species never exhibits the deflected basal periphery.

Rare in the Oolite Marl horizon near Nailsworth.

321. Trochus vicinus, sp. nov. Plate XXXII, fig. 9.

Description :

Height	8 mm.
Width	7 mm.
Spiral angle	57°.

Shell regularly conical, imperforate. Spire acute and nearly two-thirds of the total height. Number of whorls seven, flat; those near the apex probably plain; sutures distinct. Anterior whorls of the spire ornamented with four granular spirals, the posterior of which contains the strongest nodulations.

In the body-whorl the first and third spirals contain the largest nodulations; the fourth spiral is often split, and the basal periphery is prominent. Base moderately flat and smooth. Aperture subquadrate with a columellar furrow.

Relations and Distribution.—In spiral angle and general outline this species greatly resembles *T. monilitectus*, from which it is chiefly distinguished by its more varied spiral ornamentation, and by a fuller base and less depressed aperture. I have not been able actually to identify this form with any from the Lower Oolites of the east of France, although it seems to run into forms not very unlike *Trochus Bellona*, d'Orb.

Common in the Lincolnshire Limestone at Weldon, where the varieties are numerous; occasionally met with in the *Parkinsoni*-zone of the Cotteswolds.

322. Trochus Dunkeri, *Morris and Lycett*, 1851, var. *Weldonis*. Plate XXXII, fig. 10.

1851. Trochus Dunkeri, *Morris and Lycett*. Great Ool. Moll., pt. 1, p. 61, pl. x, fig. 3.

Description :

Height and width about	7 mm.
Spiral angle	57°.

Shell regularly conical, imperforate. Spire acute and about two-thirds the total height. Number of whorls seven, flat or very slightly concave, sutures distinct; apical whorls smooth; in the later whorls a fine unornamented spiral belt bounds the anterior margin of each whorl; sinuous growth lines are conspicuous throughout. In the body-whorl these lines start from a granular spiral belt, situate at the posterior margin, and extend to the basal angle, which is sharply defined. Base rather flat and smooth; aperture subquadrate.

Relations and Distribution.—The Weldon fossil differs from *T. Dunkeri*, of the Great Oolite, in the plain anterior belt at the base of each whorl, in this respect resembling *Trochus Actæa*, d'Orb. But other considerations prevent us from regarding it as identical with d'Orbigny's species. This is undoubtedly very near to *T. Dunkeri*, but even the rolling to which the Minchinhampton shells have been subject could scarcely have obliterated the belt entirely. The other differences might be fairly accounted for by difference of matrix.

There are many varieties of *Trochus Weldonis*, connecting with other forms. Common in the Lincolnshire Limestone at Weldon.

323. Trochus substrigosus, sp. nov. Plate XXXII, fig. 11, and ? fig. 4 (incomplete).

But cf. Trochus acanthus, *d'Orbigny*. Terr. Jur., vol. ii, p. 273, pl. cccxii, figs. 9—12.
— strigosus, *Lycett*. Suppl., p. 29, pl. xlv, fig. 12.
— acanthus, *d'Orb*. Cossmann, Ét. Bath., p. 286, pl. x, figs. 27, 28.

N.B.—Although *T. acanthus*, d'Orb., is a fossil of Port-en-Bessin, and consequently belonging to the true Bajocian or Upper Division of the Inferior Oolite, our fossils differ so much from d'Orbigny's figures that I scarcely dare venture on absolute identification. On the other hand, there is a considerable resemblance between our fossils and *T. strigosus*, Lycett, from the Yorkshire Cornbrash. Now M. Cossmann, *loc. cit.*, observes that, even supposing *T. strigosus* is not an actual synonym of *T. acanthus*, the name is pre-occupied. The only way out of these difficulties is to make a new species.

Description (complete specimen):

Height	23 mm.
Width	21 mm.
Spiral angle	60°.

Shell conical, imperforate; spiral angle tolerably regular. Spire rather more than half the total height and acute. The total number of whorls is about eight; those of the spire (except close to the apex) are flat to very slightly concave, with

a rather close suture in the early stage, which becomes wider; six or seven fine granular spirals ornament the whorls of the spire, the posterior and anterior spiral being slightly the most prominent in some cases, so as to form slight belts in the neighbourhood of the suture.

In the body-whorl, which is rather tumid, the ornaments become irregular with a tendency to effacement of the spiral lines, but there is often a marked bicarination at the angle of the shell; the angle is rounded off into a full base, which is marked by fine wavy spiral striæ. Growth-lines decussate the general ornamentation and are very conspicuous where the spiral lines fail. Aperture subquadrate with some thickening of the inner lip.

Relations and Distribution.—*Trochus substrigosus* is a truly polymorphous shell, and when, it develops an additional whorl, we have some difficulty in believing that the species is the same—in other words, that fig. 4 and fig. 11 are different conditions of the same species.

The more perfect form (fig. 11) occurs sparingly in the *Parkinsoni*-zone of Bradford Abbas and Burton Bradstock. Fossils from the Cornbrash of Scarborough exhibit a similar polymorphous tendency.

324. Trochus Burtonensis, *Lycett*, 1863, Inferior Oolite variety. Plate XXXII, fig. 12.

1863. Trochus Burtonensis, *Lycett*. Suppl., p. 99, pl. xlv, fig. 16.

Description :

Height	13 mm.
Width	13 mm.
Spiral angle	60°.

Shell regularly conical, imperforate. Spire elevated, acute; sutures close. Number of whorls seven, flat and without ornament. Sometimes one of the whorls overhangs a little, otherwise there is hardly any break in the outline of a perfect cone. There is a slight keel at the base of the body-whorl. Base nearly flat and smooth. Aperture subrhomboidal and depressed, with a considerable columellar callus.

Relations and Distribution.—One would imagine that there should not be much difficulty in finding a name for this perfectly smooth and regularly conical shell. *Trochus Halesus*, d'Orb., presents some features of resemblance, but M. Cossmann regards that species as an *Ataphrus* rather than a *Trochus*. Again *Trochus Actæa*, d'Orb., has a resemblance, yet we miss the "bourrelet" characteristic of that species. The Inferior Oolite fossil figured in the accompanying plate differs from

Trochus Burtonensis, Lyc., in the greater flatness of the base and the sharper angles of the basal periphery. Yet some of our Inferior Oolite specimens are scarcely distinguishable from real Bradford Clay fossils. As a mere collection name I suggest var. "*Hortonensis*."

I notice this form from the Inferior Oolite of the Hook Norton district. In the Cotteswolds it is chiefly confined to the *Parkinsoni*-zone and is especially abundant at Horton Hill.

325. ? Trochus Leckenbyi, *Morris* and *Lycett*, 1851. Plate XXXII, fig. 13.

1851. ? Trochus Leckenbyi, *Morris and Lycett*. Great Ool. Moll., pt. 1, p. 115, pl. xv, fig. 21.
1885. — — — Hudleston, Geol. Mag., dec. 3, vol. ii, p. 126, pl. iii, fig. 7.

Bibliography, &c.—The authors appeared to have had a suspicion that this was a *Pleurotomaria*, although nothing upon the surface of the whorls indicated that such was the case.

Description :

Height	15 mm.
Width	17 mm.
Spiral angle	85°.

Shell conical, imperforate. Spire regular and about half the entire height. Number of whorls five, nearly flat ; suture rather close. The ornaments consist of stout granulated spiral bands, those towards the base of each whorl having a slight prominence.

The body-whorl shows a slight prominence at the basal periphery. Base nearly flat, with strong spirals decussated by radiating lines. Aperture trapezoidal and depressed.

Relations and Distribution.—Probably a *Pleurotomaria* with the *sinus*-band obscured. A single specimen from the Scarborough Limestone.

326. Trochus biarmatus, *Münster*, 1844. Plate XXXII, fig. 14.

1844. Trochus biarmatus, *M.* Goldf., Petref. Germ., pl. clxxx, fig. 2.
1873. Littorina biarmata, *M.* Tawney, Dundry Gasteropoda, p. 24 (16).
Cf. also Trochus bitorquatus, *Héb. and Desl.* Foss. Moutreuil-Bellay, p. 61, pl. ii, fig. 6.

Bibliography, &c.—According to Tawney (*op. cit.*), Oppel, and after him Brauns, identified Münster's species with *T. monilitectus*, Phil., but for this identification there is clearly no warrant. I cannot follow Tawney in regarding this species as a *Littorina*.

Description :

Height	12·5 mm.
Width	10·5 mm.
Spiral angle	52°.

Shell conical, not umbilicated, slightly turreted. Spire nearly two-thirds the total height; spiral angle sometimes rather obtuse. Number of whorls seven, separated by a very wide suture. Those at the extreme apex are smooth, but all the principal whorls are concave, and bounded by tuberculated spiral belts at the posterior and anterior margins.

The body-whorl, which is separated from the spire by a very wide suture, is similar in shape and ornament, but carries a third keel at the angle of the shells, the third one being the least prominent. Base nearly flat and spirally ornamented. Aperture subrhomboidal and depressed.

Relations and Distribution.—Regarded as a *Trochus* this species stands pretty well alone. *T. biarmatus*, M., differs from English specimens in having the third keel exposed in the whorls of the spire—always supposing the enlarged figure of Goldfuss to be an accurate representation. *Trochus bitorquatus*, Héb. and Desl., greatly resembles our Inferior Oolite specimens.

Trochus biarmatus with us is essentially a fossil of the *Parkinsoni*-zone or of the beds immediately below. The most northerly point noted is Notgrove. At Horton Hill it is abundant and well developed. The best specimens come from Grove and Woolston (Castle Cary district). It is met with in the *Parkinsoni*-marl of Bradford Abbas; also at Stoford, and in the *Parkinsoni*-zone of South Dorset.

327. Trochus marga, sp. nov. Plate XXXII, fig. 15.

Description :

Height	6 mm.
Width	5 mm.
Spiral angle	52°.

Shell conical, imperforate. Spire elevated and acute with a slightly obtuse apex. Number of whorls six; slightly concave, with a considerable anterior prominence. Body-whorl very concave with a blunt carina at the angle. The entire shell is ornamented by fine spiral striæ, closely set, and faintly decussated

by axial lines. Base rounded and similarly ornamented. Aperture subquadrate with a columellar furrow.

Relations and Distribution.—An increase in the strength of the axial ornamentation would approximate this form to *Trochus Niortensis*.

T. marga is most abundant in the *Parkinsoni*-marl at Bradford Abbas. It occurs more rarely on the same horizon at Burton Bradstock.

328. Trochus Niortensis, *d'Orbigny*, 1852.

1852. Trochus Niortensis, *d'Orbigny*. Terr. Jur., vol. ii, p. 282, pl. cccxv, figs. 5—8.
1873. — — — Tawney, Dundry Gasteropoda, p. 33 (25).

When Mr. Tawney wrote, there were in the Bristol Museum two specimens from Dundry agreeing precisely with d'Orbigny's description. A third specimen has since been added. Mr. Wilson, the present curator, informs me that this species ranges up from the Middle Lias. The micromorph from the Pea-grit of Leckhampton (Pl. XXXII, figs. 18 *a*, 18 *b*) is related. N.B.—The whorls of this small shell are more concave than is shown in the enlargement.

329. Trochus, species or variety. Plate XXXII, fig. 16.

A small, unornamented *Trochus*, with whorls very much undercut, occurs sparingly at Weldon in the Lincolnshire Limestone. In my Collection this is designated *Trochus* "*subimbricatus*."

330. Trochus cf. Bixa, *d'Orbigny*, 1850. Plate XXXII, fig. 17; and ? Plate XXXI, fig. 16.

1850. Trochus Bixa, *d'Orbigny*. Prod., 1, p. 300.
1852. — — — Terr. Jur., vol. ii, p. 287, pl. cccxvi, figs. 13—16.
Cf. also — Langrunensis, *d'Orb.* Cossmann, Étage Bath., p. 289, pl. xiii, figs. 24—25.

Bibliography, &c.—Specimens from our Inferior Oolite agree so well with the description and figures of d'Orbigny of a shell from the Bathonian of Luc in Calvados that I do not feel justified in separating them, notwithstanding the difference in geological age. M. Cossmann regards *T. Bixa*, d'Orb., as merely a synonym of *T. Langrunensis*, d'Orb.; but as our shells resemble *T. Bixa* I retain the former name, the more so since the essential feature of spiral striation is entirely wanting in *T. Langrunensis*—possibly from attrition.

Description :

Height	8 mm.
Width	6 mm.
Spiral angle (about)	60°.

Shell conoidal, imperforate; spiral angle obtuse with a rather sharp apex. Number of whorls about five, moderately convex, sutures close; the ornaments consist of very numerous, fine, spiral lines, with but faint traces of radial decussation. The body-whorl is about half the entire height, and slightly compressed anteriorly so as to be well within the spiral angle. The spiral lines are extremely numerous, and one, a little more elevated than the rest, forms a slight keel at the angle of the whorl; this angle is rounded off into the very full base, which is similarly striated. The aperture is suborbicular and rather restricted, without the least trace of an umbilical or columellar furrow.

Specimens from Lincoln are similar, except that the base is rather more rounded off and there is a slight "monodontoid" appearance on the columella.

Relations and Distribution.—This peculiar form seems to stand by itself in our Inferior Oolite, occurring in the *Murchisonæ*-zone at two widely separate localities, viz. at Lincoln in the "Base-bed," and at Burton Bradstock in the Irony Nodule-bed.

331. ? Trochus bicingendus, *Lycett*, 1850. Plate XXXI, fig. 15.

1850. Trochus bicingendus, *Lycett*. Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 416; and Proc. Cotteswold Nat. Club, vol. i, p. 77.

The following is the author's diagnosis:—"Elevated whorls rather concave, with two encircling nodose ribs, one at each margin of the whorl, and three mesial circles of nodules."

The type, which is in the Jermyn-Street Museum, measures:—Height 8 mm., width 4·5 mm., spiral angle 45°. From the Inferior Oolite of the Cotteswolds.

It seems probable that *Trochus bicingendus* represents the early stage of a shell from the Pea-grit of Longfords, represented in the present work (Pl. XXIV, fig. 7), and which was correlated (p. 301) with *Littorina recteplanata*, Tawney. If this correlation be correct, it would seem proper to substitute Lycett's specific name; but, since there is a doubt, we must retain both names for the present.

It is quite likely that I have not succeeded in enumerating every species of fossil shell from our Inferior Oolite entitled to the name of *Trochus*. For instance, there is *T. clypeatus*, Witchell ('Proc. Cotteswold Nat. Club,' vol. vii, p. 128, pl. iv, fig. 3), which I have not seen; though, to judge from the figure and description, it is most probably identical with *Trochus dimidiatus*, Sow.

On the other hand, there occurs in the *Concavus*-bed at Bradford Abbas a remarkable trochoid species, which, although it is probably not a *Trochus*, I may enumerate provisionally under this genus.

332. "Trochus" attrochus, sp. nov. Plate XXIX, fig. 15, and var. fig. 16.

Description :

Height	5·5 mm.
Width	6 mm.

Shell irregularly conical, thin, subumbilicate. The angle of the spire is regular, but owing to the sudden increase of the body-whorl, the spiral angle of the entire shell is concave. In fact, so ventricose is the body-whorl that, in some cases, the spire has the appearance of belonging to another shell. Total number of whorls five; those of the spire are flat (smooth at the extreme apex), whilst the penult and antepenult are ornamented with a loosely granulated spiral on the posterior margin, and a finely granulated keel anteriorly.

The body-whorl is angular and enormously ventricose, and separated from the spire by a wide and subcanaliculate suture. The ornaments are the same as in the lower whorls of the spire, viz. a circlet of distant nodules on the posterior edge, and a conspicuous carina with fine granulations; this carina is median, and above it there are no certain traces of spiral lines, whilst below and in the base are considerable indications of spiral lines. Base widely but not deeply excavated. The aperture is large and prominent anteriorly, the lips being somewhat thin, outer lip angular, inner lip circular. N.B.—The thickening of the inner lip, shown in Fig. 15, is not quite correct.

Varieties.—There is considerable irregularity of development. In some specimens the whorls of the spire appear undercut owing to the salience of the the carina; in these cases the body-whorl is usually less ventricose, and the shell more regularly conical. The variety from Beaminster (fig. 16), besides being smaller, shows some modification in the spiral ornament below the carina of the body-whorl, and otherwise differs in some minor points.

Relations and Distribution.—At present this curious species seem to stand alone with reference to the other Gasteropoda of the Inferior Oolite. It may be related to some of the perforated *Trochi* of the Paléontologie Française; but Gemmellaro's genus *Palæoniso*, if one may judge from the species described and figured by that author, does not seem applicable in the present instance.

Known only from the *Concavus*-bed at Bradford Abbas and the parallel horizon at Beaminster.

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A MONOGRAPH

OF THE

BRITISH JURASSIC GASTEROPODA.

BY

WILFRID H. HUDLESTON, M.A., F.R.S., F.L.S., V.P.G.S.

PART I, No. 8.

GASTEROPODA OF THE INFERIOR OOLITE.

Pages 391—444; Plates XXXIII—XL.

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Family—PLEUROTOMARIIDÆ.

"*Shell nacreous, variable in form; whorls regular in their volutions, deflected or unrolled, but always exhibiting a special streak or* sinus-*band, constituted by the obliteration of a slit of the lip; this slit is generally permanent on the last whorl, but in some genera is partly closed, and the character of the perforation changed; aperture oval, rounded, or angular; lip thin; operculum circular, corneous, with a central nucleus.*"—Fischer.

In the Inferior Oolite of Britain two genera represent this family, viz. *Pleurotomaria* and *Trochotoma*.

Genus—Pleurotomaria, *Defrance*, 1826.

"*Shell very variable; trochiform, turbinate, discoidal, or globular, internally nacreous; last whorl furnished with a notch of greater or less length, slitting the lip, and elsewhere prolonged by an obliterated band, bordered by one or two elevated lines; the growth-lines of the whorls above and below converge towards this band with posterior inclination; the striæ of the* sinus-*band are slightly curved and convex on the side of the spire; aperture oval or subrhomboidal; lip thin; operculum corneous, subspiral, or multispiral.*"—Fischer.

As far as the Jurassic rocks of this country are concerned, the genus *Pleurotomaria* seems to have reached its maximum development in those districts of the Inferior Oolite which are characterised by a Cephalopod facies. But its distribution is singularly unequal. Thus in the Dorset-Somerset district nearly all the beds, especially those towards the base of the Upper Division which more especially represent the "Oolithe ferrugineuse" of Normandy, abound with the fossilised remains of *Pleurotomariæ*, often in an excellent state of preservation. Dundry must be included in this category. In the Inferior Oolite of the Cotteswolds *Pleurotomariæ* are fairly numerous, but badly preserved, and consequently of very little use to the palæontologist. In the East Midland district the genus is sparingly represented, being almost entirely confined to the Northampton Sand and the lower beds of the Lincolnshire Limestone. From the rich shell-beds of Weldon and Great Ponton, believed to be in the upper part of the latter formation, *Pleurotomaria* is almost entirely absent or represented by dwarfed forms.[1]

[1] *Pl. reticulata*, Deslong. (*Pl. subreticulata*, d'Orb.), is doubtfully quoted by Morris from Ponton.

The various zones of the Inferior Oolite in Yorkshire are almost equally destitute of *Pleurotomariæ*, a very few specimens of a large form, related to the Liassic species, *Pl. Anglica*, being found in the lower portion of the Dogger.

Our collections, therefore, have received the bulk of their supplies from the Inferior Oolite of Dorset-Somerset, including Dundry. Most of the species recorded from these beds bear more or less resemblance to those already so well described and figured by Deslongchamps and d'Orbigny. Consequently it is proposed, in some cases, to deal rather briefly with the descriptions in the text. One of the points of interest which I have been able to elucidate relates to the distribution of the particular species in the Dorset beds. It is also clear that the several "species" have a tendency to run into each other, and thus gradually to merge or to become something requiring a different diagnosis. In no other group of the Gasteropoda has the lesson been enforced upon me more strongly that the mere enumeration of named forms, which we regard as species, is inadequate to convey a complete idea of the actual facts.

As regards the sections or groups into which the Inferior Oolite *Pleurotomariæ* most naturally fall, opinions may to a certain extent differ. Again reverting to the two principal authors who have dealt with the subject, we perceive in the pages of Deslongchamps a systematic arrangement applied to the entire Jurassic *Pleurotomariæ* of Normandy, whilst d'Orbigny appears to have made very little attempt at classification in any respect. Deslongchamps' treatment of the subject was much the most philosophic, and although he lived before the days when the doctrine of Evolution had been revealed to mankind, it is evident that he had some inkling of it. On the other hand, if ever there was a man who thoroughly believed in species, especially of his own creation or rectification, that man was the author of the 'Terrains Jurassiques.' His method undoubtedly has its merits, and the rigidity of his species is convenient for the collector.

In submitting the following grouping, which does not differ very widely from that adopted by Deslongchamps, I must again express my belief that sections, groups, and species must be regarded merely as means to an end, viz. the presentation of certain palæontological facts in what seems to be the most natural form. That there is a certain amount of inconvenience in appending a long string of varieties to certain "species" I admit, and some would, perhaps, prefer the more rigid d'Orbignian method; but if this is adopted the number of species would be greatly increased.

Section 1.—Conicæ.

Shells conical-elongate, not umbilicate, or having a very slight umbilical pit. Spire regular or concave. Whorls numerous; the body-whorl not exceeding one-third the total height, and often much less. Sinus-band rather narrow, often elevated, always anterior.[1] Aperture oblique, depressed, and nearly always showing a notch or fold at the columellar extremity.

Pleurotomaria punctata, Sowerby.
— *bicingulata*, sp. nov.
— *elongata*, Sowerby (typical form).
— var. *angusta*.
— — *conoidea*, Deshayes.
— — *Ebrayana*, d'Orb.
— — *turrita*, Deslong.
— *abbreviata*, Sowerby.
— *Agatha*, d'Orbigny.
— var. *Sandersii*, Tawney.
— *circumsulcata*, d'Orbigny.
— *subglabra*, sp. nov.
— *Bessina*, d'Orbigny.

It will be remembered that the greater part of this section, with the exception of the first two species, were included by Deslongchamps in his *Pleurotomaria mutabilis*.

Section 2.—Breves.

Shells small, conical, short; in most cases distinctly but not strongly umbilicate. Spire regular or inclining to convex; body-whorl seldom less than half the total height. Sinus-band submedian to anterior, and not very prominent. Aperture (except in *Pl. Dundriensis*) inclined to be subquadrate, strongly angled at the columnar extremity.

[1] The ornaments of the sinus-band in *Pleurotomaria* vary considerably even in different parts of the same specimen, and generally have a direct relation to the ornaments of the whorls.

Pleurotomaria Dundriensis, Tawney.
— *distinguenda*, Tawney.
— *scrobinula*, Deslongchamps.
— *Athulia*, d'Orbigny.
— *Alcyone*, d'Orbigny.

There is, perhaps, no sound palæontological basis for this section, which may include some incomplete forms more or less allied to species classed elsewhere.

Section 3.—Sulcatæ (*Leptomaria*, Eugène Deslongchamps, in part).

Shells small to middle-size, inclined to be heliciform, largely umbilicate. Spire variable, often very convex, apex more or less depressed. The whorls have the ornaments but slightly engraved, and are sometimes nearly smooth. Sinus-band narrow, usually without spiral lines, and often sunken. The slit of the inner lip extends some way back.

Pleurotomaria sulcata, Sowerby.
— — var. *obconica*, Tawney.
— *Ajax*, d'Orbigny.
— *monticulus*, Deslongchamps.
— *monticuloïdes*, sp. nov.
— *sulcata-Humphriesiana*, sp. nov.
— *Amyntas*, d'Orbigny.

Section 4.—Fasciatæ.

Shells conical, often of large habit, umbilicus moderate to *nil*. Whorls convex or subangular, sutures distinct; spiral ornament regular, but not very deeply incised, decussated in the earlier whorls (decussato-striated) with a tendency to smoothness in some cases. The sinus-band is almost exactly median and wide, usually presenting a flat strap-like appearance, although in the earlier whorls the spiral ornamentation may sometimes be noted.

Pleurotomaria subplatyspira, d'Orbigny.
— *fasciata*, Sowerby.
— *Stoddarti*, Tawney.
— *amata*, d'Orbigny.
— *transilis*, d'Orbigny.
— *Alimena*, d'Orbigny.

} *Fasciata*-group.

Pleurotomaria phyospira, Deslong.
— *subfasciata*, d'Orb. (*crenata*, Deslong.).
— cf. *subdecorata*, Münster.
— *Allica*, d'Orbigny.

Sub-section.—Whorls more angular, ornaments sometimes reticulate throughout; sinus-band situate at the angle, and rather less median.

Pleurotomaria subreticulata, d'Orbigny.
— *textilis*, Deslongchamps.

Section 5.—Ornatæ.

Shells turrited, trochiform, turbinate or discoidal, with great range as to size; always umbilicate, often largely so. Whorls usually angular and carinated with sutures often canaliculate. The ornamentation is rich, with extensive and varied tuberculation on the carinæ. The sinus-band, except in *Pl. ornata*, Sow., is very wide, nearly median, flat or rarely projecting, and in the later whorls without much spiral striation.

Pleurotomaria paucistriata, d'Orbigny. } *Proteus*-group.
— *Proteus*, Deslongchamps. }
— *armata*, Münster.
— cf. *Sauzeana*, d'Orbigny.
— *tuberculosa*, Defrance. } *Ornata*-group.
— *ornata*, Sowerby. }
— *ornata-depressa*, sp. nov. }
— *Actæa*, d'Orbigny.
— *oxytera*, sp. nov.
— *Baugieri*, d'Orbigny.
— *actinomphala*, Deslongchamps.
— *Mopsa*, d'Orbigny.
— *mirabilis*, Deslong. (micromorphic variety).

Sub-section.—Shells turrited, attaining a great size, umbilicus small or *nil.* Whorls subtabulate with rich sculpture, and often much tuberculate ornament on the carinæ.

Pleurotomaria subaraneosa, sp. nov.
— cf. *araneosa*, Deslongchamps.

Section 6.—Granulatæ.

Shells trochiform, mostly inclined to be depressed, generally rather small, more or less umbilicate. Whorls sloping, flat or subangular; body-whorl relatively large, and usually with a very convex base. Ornaments for the most part deeply incised, so that cross-hatching produces a granular appearance. Sinus-band anterior, narrow and prominent, frequently constituting a keel.

Pleurotomaria Yeovilensis, Tawney.
— — var. *rugosior*.
— *granulata*, Sowerby.
— *phylax*, sp. nov.
— *plicopunctata*, Deslongchamps.
— *Palæmon*, d'Orbigny.
— *trapeza*, sp. nov.

In the above, *Pl. granulata*, *plicopunctata*, and *Palemon* constitute the *granulata*-group proper, which, be it remembered, was united with the *mutabilis*-group by Deslongchamps to form one section. Hence, according to the classification of that author, the Conicæ and the Granulatæ, as defined above, should for the most part be united. This constitutes the principal difference between the arrangement now adopted and the divisions in the 'Mémoire sur les Pleurotomaires.'

333. Pleurotomaria punctata, *Sowerby*, 1818. Plate XXXIII, figs. 1 and 2.

1818.	Trochus punctatus,	*Sowerby*.		Min. Conch., pl. cxciii, figs. 1 and 4.
1850.	Pleurotomaria punctata,	*Sow.*		D'Orbigny, Prod. i, p. 267.
1854.	—	—	*d'Orbigny*.	Terr. Jur., vol. ii, p. 513, pl. cccxcix, figs. 11—13.
1854.	—	—	*Sow.*	Morris, Cat., p. 271.
1873.	—	—	—	Tawney, Dundry Gasteropoda, p. 38 (30).
Non	—	—	—	Goldfuss, Petref. Germ., pl. clxxxvi, fig. 6.

Bibliography, &c.—Sowerby's figure, from a Dundry specimen, is somewhat indifferent, but there is no doubt as to the identification, this being one of the three species of Inferior Oolite *Pleurotomariæ*, where the figured specimen is preserved in the "Sowerby Type Collection" at the British Museum. D'Orbigny's

figure (also from a Dundry specimen) is characteristic, though the aperture is not seen. The species does not appear to have been recognised by Deslongchamps in the Normandy beds. On the other hand, Tawney regarded it as one of the commonest species at Dundry. He suggested that *Pl. Allionta*, d'Orbigny, might be a synonym.

Description :

Height	40 mm.
Basal diameter	33 mm.
Spiral angle	48°.

Shell acutely conical, not umbilicate. Spire perfectly regular. Whorls (ten to twelve) flat, with a close suture, and spiral lines of unequal strength ; these are more or less granulated towards the posterior and anterior margins of each whorl ; the almost invisible suture lies between the raised lines which carry the strongest granulations.

The sinus-band forms a salient belt on the sides of the whorls, and is situated some distance below the centre ; it is full, round, and rather narrow, having in the apical whorls a central spiral line crossed by growth-lines, but in the later whorls the growth-lines alone are seen, and even these are often effaced. The body-whorl is angular at the periphery ; the base has a flat marginal area, but is excavated towards the centre ; it is spirally striated with slight radial decussation. Aperture subrhomboidal and extremely depressed.

In the smaller shells the columellar notch is very characteristic (Fig. 2), and even in the larger shells a modification of this feature may be detected. In very large forms (? *Pl. Allionta*) the notch is effete.

Relations and Distribution.—Pl. punctata is a well-defined species, somewhat remotely related to the *elongata*-group. Excellent specimens have been obtained from Dundry. Good specimens are also obtained from the *Murchisonæ*-zone of Coker, and inferior ones from the same horizon at Bradford Abbas. The *Concavus*-bed at Bradford Abbas furnishes us with a number of beautiful specimens. The above are all in the Lower Division.

In the *Humphriesianus*-zone of North Dorset typical specimens may occasionally be met with. There is a large specimen in my collection, said to come from the *Parkinsoni*-zone, which may possibly represent *Pl. Allionta*, d'Orb. In this case there is no trace of the columellar notch.

334. Pleurotomaria bicingulata, sp. nov. Plate XXXIII, fig. 3.

Cf. Pleurotomaria Mariæ, *d'Orbigny*. Terr. Jur., vol. ii, p. 430, pl. ccclvi, figs. 9—11 (= *Pl. decipiens*, var. *turrita*, Deslongchamps).

Description :

Height	37 mm.
Basal diameter	31 mm.
Spiral angle	48°.

Shell acutely conical, not umbilicate. Spire regular to slightly concave. Whorls (eleven to twelve) flat; sutures close. The base of each whorl is marked by a slightly crenulated rim, which projects over the succeeding whorl, and in the more adult whorls becomes smooth ; spiral lines, slightly decussated, constitute the general ornamentation.

The sinus-band is anterior and prominent in the later whorls, and the spiral ornament is almost effaced ; a round and almost smooth belt, here and there marked by growth-lines, remains. This belt of the sinus-band and the basal rim together constitute a marked bicarination in the anterior half of the whorls. The body-whorl is narrow and angular at the periphery ; base flat towards the margin, slightly excavated in the centre, spirally striated with faint decussation. Aperture subrhomboidal and depressed with a sharp columellar notch.

Relations and Distribution.—This form differs from *Pl. Mariæ* chiefly in having the basal carinæ rather more prominent than the sinus-band, whereas in the species from the Lias the prominence is represented as being equal ; the spiral angle also is less concave. *Pl. bicingulata*, through the prominence of the sinus-band, is related to *Pl. punctata*, whilst the presence of a modified basal rim connects it with certain varieties of the *elongata*-group, such as *Pl. Pictaviensis*.

Typical specimens occur in the *Concavus*-bed, Bradford Abbas, where they seem to shade off into the narrow variety of *Pl. elongata*. In some specimens the whorls are so much undercut that the shell, if held with the point downwards, appears like a nest of funnels, one within the other.

335. Pleurotomaria elongata, *Sowerby*, 1818. (= *Pl. mutabilis*, Deslongchamps, *pars.*) Plate XXXIII, figs. 4, 5, 6, and 7; Plate XXXIV, fig. 8.

1818. Trochus elongatus, *Sowerby*. Min. Conch., pl. cxciii, figs. 2 and 3.
1854. Pleurotomaria elongata, *Sowerby*. Morris, Cat., p. 271.
1873. — — — Tawney, Dundry Gasteropoda, p. 37 (29).
Syn. — mutabilis, *Deslongchamps*, vars. elongata, mutica, and ambigua. Mém. Soc. Linn. Norm., vol. viii ("Les Pleurotomaires"), p. 108, &c., pl. x, figs. 14 and 15; pl. xi, fig. 1.

Bibliography, &c.—Since this is a group rather than a species, in the stricter acceptation of the term, it would be useless to attempt a full synonymy. Tawney included the following, with more or less doubt, under this heading, viz. *Pl. abbreviata*, Sowerby, *Pl. conoidea*, Deshayes, and *Pl. Ebrayana*, d'Orbigny. The above, together with other named forms, are doubtless connected, and may for the most part be regarded as varieties. Nevertheless Deslongchamps, who attached, little value to the spiral angle as a means for determining species in *Pleurotomaria* made his *Pl. mutabilis* a little too comprehensive. Since Sowerby originally recognised two species in this group, viz. *Pl. elongata* and *Pl. abbreviata*, I have concluded to follow his example.

It will be observed in the sequel that *Pl. elongata*, as thus limited, covers a considerable variety of forms according to the horizon, the lower beds usually presenting the narrower forms, although in the *Parkinsoni*-zone at Burton Bradstock and elsewhere are a number of small specimens, many of which may be allotted to *Pl. elongata* in a general sense.

General Description.—Shell conical-elongate, not umbilicated. Spire regular or slightly concave, the spiral angle ranging from about 40° to somewhat less than 50°. Whorls about twelve, excavated, and terminated by a basal rim which projects over each succeeding whorl and constitutes an important feature. This rim is crenulated in some cases, and subcrenulate to smooth in others, presenting considerable variety in its sculpture. The intercarinal spaces have rich spiral ornament, slightly reticulate in the earlier whorls, subgranulate in the later ones.

The sinus-band is very anterior, rather narrow, and but slightly prominent, usually presenting one median spiral cross-hatched by growth lines, but in some cases the ornamentation is more complex. The body-whorl is angular at the periphery, with a flat base which is not as a rule excavated; base spirally grooved;

aperture subquadrate and moderately depressed with a slight columellar notch, not always preserved.

Var. *angusta* (Fig. 4).

This represents a form which may be noted in the Lower Division of the Inferior Oolite, where the spiral angle does not exceed 40°, and in some cases, as in the *Opalinus*-zone at Drympton, is even less. The specimen figured is from Bradford Abbas (? *Murchisonæ*-zone). Another specimen (Fig. 5), from the *Concavus*-bed of Bradford Abbas, presents a wider spiral angle besides some difference of ornamentation.

Var. near to *Pl. conoidea*, Deshayes (Fig. 6).

1831. Pleurotomaria conoidea, *Deshayes.* Coq. caract., p. 181, pl. iv, fig. 4.

This is a variety with extremely rich sculpture; the spiral angle in some cases is slightly concave, whilst the sinus-band is very anterior and not at all prominent.[1] These forms occur at Mapperton, Louse Hill, and other places believed to be in the *Humphriesianus*-zone.

Pleurotomaria elongata, Sowerby. Type form (Fig. 7).

Cf. 1854. Pleurotomaria Pictaviensis, *d'Orbigny.* Terr. Jur., vol. ii, p. 510, pl. cccxcix, figs. 1—5.
— — mutabilis, var. ambigua, *Deslongchamps.* Vol. cit., p. 113, pl. xi, fig. 1.

This is a robust form with spiral angle of about 50°. It more nearly approaches Sowerby's type (one of the three species-types preserved in the British Museum[2]) than any of the others. In this variety the sculpture is principally seen in the more apical whorls; the basal rim of the anterior whorls being thick, round, and nearly smooth, whilst the spiral striæ in the whorls themselves are less deeply incised. The sinus-band in the lower whorls is smooth and very anterior; striæ in the base indistinct. Aperture subquadrate and moderately depressed; traces of the columellar notch very slight.

Characteristic specimens occur abundantly at Dundry and in the *Sauzei*-bed (base of the *Humphriesianus*-zone) at Combe and Oborne. Some persons might be disposed to restrict the specific name, *elongata*, to this form.

[1] Mr. Wilson considers that *Pl. conoidea* should be regarded as a distinct species, as he attaches great importance to the want of prominence in the sinus-band.

[2] *Vide antea*, p. 396.

Var. *Ebrayana*, d'Orbigny. Not figured.

1854. Pleurotomaria Ebrayana, *d'Orbigny*. Terr. Jur., vol. ii, p. 483, pl. ccclxxxvii.

We have only to imagine the typical *Pl. elongata*, Sow., sufficiently enlarged with a corresponding increase of smoothness in the anterior whorls, and we obtain these megalomorphs, which occur at Dundry and more especially in the *Sauzei*-bed at Combe and Oborne.

Var. *turrita*, Deslongchamps. (Plate XXXIV, fig. 8.)

1848. Pleurotomaria mutabilis, var. turrita, *Deslongchamps* Vol. cit., p. 115, pl. x, fig. 16.

A narrow-angled and strongly turrited variety; the right lip almost vertical, and prolonged into a well-marked gutter or notch; ornaments of the basal rim large and richly cut; sinus-band inconspicuous. This very rare form occurs in the *Parkinsoni*-zone of Bradford Abbas and Woolston. It is interesting to note that with the narrow form we again see a well-developed columellar notch.

Relations, &c., of *Pl. elongata* generally. Sufficient has been said as to relations under the head of "Bibliography, &c." Whilst narrow and peculiar forms occur, as we have seen, both in the lowest and highest beds of the Inferior Oolite, the typical *Pl. elongata* is especially characteristic of the *Humphriesianus*-zone.

336. Pleurotomaria abbreviata, *Sowerby*, 1818 (= *Pl. mutabilis*, Deslongchamps, pars). Plate XXXIII, figs. 8 and 9.

1818. Trochus abbreviatus, *Sowerby*. Min. Conch., pl. cxciii, fig. 5.
1854. Pleurotomaria abbreviata, *Sowerby*. Morris, Cat., p. 271.
Syn. — mutabilis, *Deslongchamps*, vars. abbreviata and corrugata. Vol. cit., pp. 108, 109, pl. x, figs. 13 and 18.

Bibliography, &c.—Admitting that this is little more than a variety of the

preceding species, yet there seems to be a considerable jump between the narrow-angled (*elongata*) and the wide-angled (*abbreviata*) forms. Moreover, in this country *Pl. abbreviata* is confined to the *Humphriesianus*-zone, and more particularly to the *Sauzei*-bed or subzone. One of the figures given by d'Orbigny of *Pl. conoidea*, Deshayes (vol. cit., Pl. ccclxxxii, fig. 1), covers this form very fairly; but, as there can be no doubt that the specimens from Dundry and Oborne represent the form described by Sowerby as *Trochus abbreviatus*, if we are to recognise the species at all it should be under the name given by Sowerby.

Description.—The spiral angle is about 65°, and in some cases very slightly concave; but the form is usually that of a perfect cone, where the height and basal diameter are nearly equal, the latter being usually a little in excess. The ornamentation is rather stronger than in most varieties of *Pl. elongata*, but the character of the basal rim and sinus-band is, on the whole, pretty much the same, though possibly the nodules of the basal rim have a tendency to become rather more complex. The aperture is subquadrate, the columellar lip being only slightly oblique, whilst the terminal notch or gutter is barely indicated.

There is a variety of *Pl. abbreviata* (see fig. 9) analogous to that which is observed in the typical variety of *Pl. elongata*. Here the ornamentation has a tendency to become smoother, especially in the basal carinæ. When this is carried to excess in very large specimens, we obtain a wide-angled *Pl. Ebrayana*.

Relations and Distribution.—Highly ornamented specimens of *Pl. abbreviata* approach *Pl. circumsulcata*, but in that species the sulcus in the base is usually distinct, and where this fails, the concave spire of *Pl. circumsulcata* will serve to distinguish them. On the other hand, it approaches the *conoidea* var. of *Pl. elongata*.

Pl. abbreviata is abundant in the *Sauzei*-bed at Oborne, and possibly occurs on the same horizon at Dundry. In the *Parkinsoni*-zone of Burton Bradstock are some small forms, which may be allotted partly to this species and partly to *Pl. elongata*.

337. Pleurotomaria Agatha, *d'Orbigny*, 1850 (= *Pl. mutabilis*, Deslongchamps, pars.) Plate XXXIII, figs. 12 *a*, 12 *b*, and Plate XXXIV, fig. 6. Var. *Sandersii*, Tawney, Plate XXXIV, fig. 7. Var. unnamed, XXXIV, fig. 9.

1850. Pleurotomaria Agatha, *d'Orbigny*. Prod., i, p. 268.
1854. — — — Terr. Jur., vol. ii, p. 474, pl. ccclxxxiii, figs. 1—3.

1873. Pleurotomaria Agatha, *d'Orbigny*. Tawney, Dundry Gasteropoda, p. 40 (32).

Syn. — mutabilis, var. cœlata, *Deslongchamps*. Vol. cit., p. 109, pl. x, fig. 17.

Bibliography, &c.—It is through the figure rather than the description that English specimens are connected with the var. *cœlata* of Deslongchamps. On the other hand, as pointed out by Tawney, d'Orbigny's figure more nearly resembles the var. *corrugata* than the var. *cœlata* of Deslongchamps. The principal characters by which I recognise *Pl. Agatha* are (1) the nodular character of the carinæ, and (2) the coarse ornamentation of the intercarinal spaces.

Description :

Height (full size)	50 mm.
Basal diameter	50 mm.
Spiral angle	60°.

Shell conical, thick, not umbilicated. The spire is slightly concave. The whorls are flat, but owing to the prominence of the carinæ in some cases appear to be concave. The suture is extremely close. In the more typical forms the carinæ are coarsely nodular, and the intercarinal groovings (spiral) are deep and coarsely decussated.

The sinus-band is narrow, flat, and inconspicuous, and situate very close to the basal rim or carina. The body-whorl is more or less angular at the periphery, the base varying from rather flat to subconvex with spiral striæ. The aperture is subdepressed, with an oblique inner lip and but slight trace of the columellar notch.

Var. *Sandersii*, Tawney.

1873. Pleurotomaria Sandersii, *Tawney*. Dundry Gasteropoda, p. 39 (31), pl. iii, fig. 1.

The indications, as noted by Tawney, are very much those of Deslongchamps' var. *cœlata*. But the whorls and also the base are more convex. The sinus-band also is very sunken and flat.

The unique specimen on which this variety is founded comes from Dundry. It is in a highly crystalline condition, a circumstance which may partly account for the peculiarities of the sinus-band.

338. Pleurotomaria Obornensis, sp. nov. Plate XXXIV, fig. 9.

Description :

Height	44 mm.
Basal diameter	36 mm.
Spiral angle	52°.

Shell conical, elongate, with a slightly concave spire. Number of whorls nine or ten, but slightly excavated and rather narrow, the body-whorl occupying about one-fifth of the entire height. Each whorl is terminated by a wide, flattened, and richly sculptured basal rim or border, slightly undercut by the succeeding whorl, the rest of the whorl being marked by subreticulate ornament, in which the spiral element predominates.

The sinus-band is anterior, but not markedly so, owing to the great width of the basal rim; it is rather narrow and fairly prominent, with one strong median spiral and the usual cross-hatchings. In the body-whorl all the ornaments, even those of the basal rim, become smooth, and the sinus-band is rounded, narrow, and prominent. Base nearly flat or with a very slight concavity, spirally striated, with some radial decussation. Aperture oblique and depressed. Other indications wanting.

Relations and Distribution.—The excessive flatness and great width of the basal rim serve to separate this elegant conical shell from members of the *elongata*-group generally. In the richness of its sculpturing it approaches *Pl. Agatha*, but presents important differences. Very rare in the *Sauzei*-bed (Marl with green grains) at Oborne.

339. Pleurotomaria circumsulcata, d'Orbigny, 1854 (= *Pl. mutabilis*, Deslongchamps, pars). Plate XXXIII, figs. 10 and 11; and Plate XXXIV, fig. 3.

1854. Pleurotomaria circumsulcata, *d'Orbigny*. Terr. Jur., vol. ii, p. 470, pl. cccl xxxi, figs. 6—10.

Syn. — mutabilis, *Deslongchamps*, var. circumsulcata. Vol. cit., p. 112, pl. xi, fig. 2.

The spiral angle is about 70°, and very distinctly concave. Unless the base is well exposed and in good preservation, the submarginal furrow which constitutes one of its peculiar features cannot be observed. The original figure by Deslongchamps

represents an acutely conical shell with a concave spiral angle and tuberculated carinæ. Hence the species seems to occupy a position between *Pl. abbreviata* and *Pl. Bessina*.

I have a small specimen (Pl. XXXIII, fig. 11), from the *Parkinsoni*-zone of Burton Bradstock, which plainly shows the submarginal furrow in the base. In this specimen the sinus-band is narrow and prominent; it corresponds precisely both in size and structural details with specimens from the *Parkinsoni*-zone of Bayeux, which are generally referred to *Pl. circumsulcata*. The other figured specimens, which are referred with some doubt to *Pl. circumsulcata*, correspond as regards spiral angle and general ornamentation, but they do not show a well-developed marginal furrow in the base.

340. Pleurotomaria subglabra, sp. nov. Plate XXXIV, figs. 1 and 2.

Description :

Height	48 mm.
Basal diameter	55 mm.
Spiral angle (mean)	68°.

Shell acutely conical, scarcely umbilicate. Spire markedly concave. Full number of whorls about eleven; these are flat or only very slightly excavated, with a very close suture. The earlier whorls are terminated by a slight basal rim or carina, but in the later whorls this feature is almost effaced, although the spirals at the base have somewhat larger granulations where we should expect to find the basal carina; the rest of the whorl is ornamented with fine spiral striæ, more or less decussated, the striæ in some cases being so delicate that the shell becomes almost smooth.

The sinus-band is very anterior; it is narrow, and more prominent in the coarsely ornamented than in the finely ornamented specimens, but it is not, on the whole, a conspicuous feature. The body-whorl projects somewhat beyond the angle of the spire, the periphery being slightly rounded off; base flat to subconvex, with spiral striæ corresponding to those on the flanks of the shell. There is a small umbilical hollow, but no true umbilicus. Aperture subrhomboidal and oblique, with but a faint trace of the columellar notch.

Relations and Distributions.—The concave spire serves to remove *Pl. circumsulcata*, *Pl. subglabra*, and *Pl. Bessina* from *Pl. abbreviata*. Yet we may expect to find links in the chain. Thus *Pl. subglabra*, which is probably only a glabrous variety of *Pl. circumsulcata*, constitutes an intermediate stage between *Pl. abbreviata*

and the very wide-angled and concave forms which it is convenient to focus under *Pl. Bessina*.

Pl. subglabra is somewhat rare; the very smooth varieties come from the *Humphriesianus*-zone of the neighbourhood of Sherborne.

341. Pleurotomaria Bessina, *d'Orbigny*, 1854 (= *Pl. mutabilis*, Deslongchamps, pars). Plate XXXIV, figs. 4 and 5.

1854.	Pleurotomaria Bessina, *d'Orbigny*.			Terr. Jur., vol. ii, p. 460, pl. ccclxxvi.
1873.	—	—	—	Tawney, Dundry Gasteropoda, p. 41 (33).
Syn.	—	mutabilis, *Deslongchamps*, var. patula.		Vol. cit., p. 111, pl. x, fig. 12.

Bibliography, &c.—Dr. Wright first noticed this as a British species from Dundry (*vide* Tawney, loc. cit.). It will be observed that none of our specimens exhibit the submarginal line in the base, which is delineated in the "Terrains Jurassiques." Fortunately, Deslongchamps speaks of the "cordon marginal" as slightly marked or entirely disappearing; whilst his figure of the var. *patula* does not show a trace of it. Hence the absence of this feature in our English specimens need cause no apprehension.

Description:

Height	50 mm.
Basal diameter	70 mm.
Spiral angle	80°—85°.

Shell acutely conical, scarcely umbilicated. Spire extremely concave ("comme un tort chinois"). Whorls about eight or nine, flat or but slightly excavated, with regular spiral striæ throughout. In the more typical form (fig. 4), which in England is rare, the basal rim is prominent and coarsely nodular. As a rule, in British specimens the basal rim is flattened and subnodular (fig. 5), whilst in all cases the basal rim of the body-whorl in the adult shell has a tendency to become smooth. Flanks richly sculptured.

The sinus-band varies with the age of the whorls, being on the whole narrow, raised, and close to the basal rim. The body-whorl largely projects beyond the angle of the spire, and in the adult whorl the sinus-band is slightly flattened; the ornaments are rather smoother than in the whorls of the spire. Base flat to subconvex, spirally striated, and with a small umbilical slit (not a true umbilicus). The aperture is subrhomboidal, oblique, and depressed, and the traces of the columellar notch seem entirely obliterated.

Relations and Distribution.—Closely related by its concave spire and general character to the two preceding species, *Pl. Bessina* and its numerous varieties represent the most wide-angled forms of the *mutabilis*-group. In this country it is essentially a fossil of the *Parkinsoni*-zone, and is not uncommon in that horizon at Halfway House.

342. Pleurotomaria Dundriensis, *Tawney*, 1873. Plate XXXIV, fig. 11.

1873. Pleurotomaria Dundriensis, *Tawney*. Dundry Gasteropoda, p. 46 (38), pl. iii, fig. 3.

Description:

Height	27 mm.
Basal diameter	32 mm.
Spiral angle	75°.

Shell regularly conical and moderately umbilicated. Whorls (about seven) flat and close together, the anterior ones being slightly undercut owing to the development of a broad basal ring. The spiral ornamentation is strong throughout, with marked reticulation in the earlier whorls; the posterior half of the last two whorls is ornamented by thick oblique costæ, rather wide apart.

The sinus-band is submedian, of moderate width and salience, with a raised line in the centre (where this feature happens to be preserved). The body-whorl is relatively large, subangular at the periphery; the base is somewhat concave midway to the umbilicus, with strong spiral ornament radially decussated. Aperture rhomboidal and depressed, the inner lip very oblique.

Relations and Distribution.—In this species Tawney fancied that he traced a resemblance to *Pl. Mysis*, d'Orbigny, a Middle Lias fossil not hitherto identified in England. Indirectly *Pl. Dundriensis* is connected with the *Fasciata*-group. Rare at Dundry, and only doubtfully identified elsewhere. Not, perhaps, a very satisfactory species.

343. Pleurotomaria distinguenda, *Tawney*, 1873. Plate XXXIV, fig. 10, and Plate XXXV, fig. 1.

1873. Pleurotomaria distinguenda, *Tawney*. Dundry Gasteropoda, p. 45 (37), pl. iii, fig. 2.

Description:

Height	18 mm.
Basal diameter	20 mm.
Spiral angle	70°.

The following is the original diagnosis:—"Shell conical, regular; whorls straight-sided, ornamented with rows of separate tubercles, placed obliquely in opposite directions on either side of the sinus-band. Above the band are three rows of compressed tubercles; below it are three of smaller round tubercles, and then three to four larger ones which form the angle in the last whorl [*vide* Pl. XXXV, fig. 1]. Sinus-band [submedian] with a central salient ridge, and crossed by curved lines; base of last whorl slightly convex. The umbilicus was probably closed."

Relations and Distribution.—Tawney was at some pains to point out how the ornaments of this species differ from those of *Pl. punctata*. However, the almost median position of the sinus-band would seem altogether to remove it from the section to which *Pl. punctata* belongs. The peculiar Dundry matrix gives emphasis to the ornamentation on which the author largely based his specific characters.

It is met with sparingly at Dundry, and shells which most nearly approximate to this form occur in the *Sauzei*-bed, or subzone, at Oborne and Milborne Wick. These have no umbilicus, and the aperture is almost quadrate with a straight inner lip.

344. Pleurotomaria scrobinula, *Deslongchamps*, 1848. Plate XXXV, figs. 3 and 3 *a*, and ? fig. 2.

1848. Pleurotomaria scrobinula, *Deslongchamps*. Vol. cit., p. 60, pl. ix, fig. 4.
1854. — — — D'Orbigny, Terr. Jur., vol. ii, p. 501, pl. cccxciv, figs. 4—6.

Description:

Height	20 mm.
Basal diameter	20 mm.
Spiral angle	60°—62°.

Shell small, conical, scarcely umbilicated. Spire regular or very slightly convex. Whorls (about seven) flat or scarcely angulated, suture close; the ornaments consist of a tolerably uniform system of fine spirals which are more or less reticulate, the reticulation being best seen in the earlier whorls.

The sinus-band is almost median, of fair width and prominence, with ornaments which vary from a single spiral with cross-lines (see Pl. XXXV, fig. 3 *a*) to almost smooth. The body-whorl is relatively large and bluntly angular at the periphery; base rather flat with faint spiral striæ, and sometimes a very slight umbilical pit occurs. Aperture rhomboidal to square, the inner lip being straight and reflexed at the extremity so as to form a widish gutter.

Relations and Distribution.—The specimens referred to *Pl. scrobinula* occur for the most part in the *Parkinsoni*-zone, where they are by no means abundant. The one figured is from Woolston. The agreement with Deslongchamps' description is substantial, though he describes *Pl. scrobinula* as having a smooth base—a feature possibly due to wear.

Fig. 2 represents a specimen from the *Cadomensis*-bed, Clatcombe (top of the *Humphriesianus*-zone), where the spire is rather more convex and the whorls slightly undercut, and the sinus-band is broad and with little apparent ornament; there is no umbilicus whatever. This may be a variety of *Pl. scrobinula*, but the ornamentation is rather coarser. In fact, this shell seems to occupy a position between *Pl. Dundriensis* and *Pl. scrobinula*.

345. Pleurotomaria Alcyone, *d'Orbigny*, 1850. Plate XXXV, figs. 4, 4 *a*, 4 *b*.

1850.	Pleurotomaria Alcyone, *d'Orbigny*.	Prod., i, p. 268.	
1854.	— — —	Terr. Jur., vol. ii, p. 488, pl. cccl xxix, figs. 6—10.	

Description:

Height	20 mm.
Basal diameter	23 mm.
Spiral angle	73°.

Shell conical, trochiform, moderately umbilicate. Spire regular. Whorls (seven) subconvex, with a slight belt developed at the base of each. Spiral ornaments fine throughout, but strongly reticulate from oblique radii in the posterior area of the whorls.

The sinus-band is submedian, rather narrow, and slightly sunk; carries one central spiral crossed by growth-lines, is sometimes smooth. The body-whorl is angular at the periphery, subconvex, and has the ornamentation subdued, the base being almost smooth; umbilicus small and rather steep, with curved radii springing from the margin. Aperture subrhomboidal and depressed.

Relations and Distribution.—The figured specimen, from the *Parkinsoni*-zone of Burton Bradstock, answers well to the description and figures of *Pl. Alcyone* in the 'Terrains Jurassiques.' It is rare.

346. Pleurotomaria Athulia, *d'Orbigny*, 1850. Plate XXXIV, fig. 12.

1850.	Pleurotomaria Athulia, *d'Orbigny*.	Prod., i, p. 269.	
1854.	— — —	Terr. Jur., vol. ii, p. 489, pl. cccl xxxix, figs. 11—16.	

Description :

Height	13 mm.
Basal diameter	18 mm.
Spiral angle	84°.

A single specimen from Crewkerne station (? *Parkinsoni*-zone) corresponds well with the description in the "Terrains Jurassiques." The spire is very convex, and the ornaments similar. The peculiarity of the sinus-band, which is wide and placed in a groove towards the middle of the whorls, further helps the identification. In d'Orbigny's figure the base is somewhat fuller than in my specimen, and the aperture more oblique.

347. Pleurotomaria, species or variety. Plate XXXV, figs. 5 and 5 *a*.

Description :

Height	18 mm.
Basal diameter	20 mm.
Spiral angle	66°.

Shell conical, not umbilicate. Spire regular, with apex slightly obtuse. Whorls (about seven) flat or scarcely convex, with close sutures, spirally striated, and with conspicuous radial ornamentation in the posterior areas. There is a small granulated belt at the base of each whorl.

The sinus-band is anterior, and situated in a slight groove. In the body-whorl, which is relatively large, the basal belt at the periphery becomes very conspicuous; base inclined to be flat, spirally striated and radially decussated, rising towards the columella. There is no umbilicus whatever. Aperture rhomboidal inclining to square, with a nearly straight inner lip.

Hitherto I have failed to identify this form, which differs from all the small conical species previously described in the anterior position of the sinus-band. A single specimen, believed to come from the *Parkinsoni*-zone of Burton Bradstock.

348. Pleurotomaria (*Leptomaria*) sulcata, *Sowerby*, 1818. Plate XXXV, figs. 6, 6 *a*, 6 *b*; and obconical variety figs. 7, 7 *a*, 7 *b*.

1818. Trochus sulcatus, *Sowerby* (Miller's MS.). Min. Conch., pl. ccxx, fig. 3.
1854. Pleurotomaria sulcata, *Sowerby*. Morris, Cat., p. 272.
1873. — — — Tawney, Dundry Gasteropoda, p. 43 (35).

Bibliography, &c.—Sowerby's type is at the Bristol Museum, and in all respects corresponds with the specimen now figured. The specimen in the collection of Sowerby's types at the British Museum seems to represent a somewhat narrow variety of *Pl. unisulcata*, d'Orbigny. As pointed out by Tawney, the whorls of Sowerby's species are convex but not angular. This may be gathered both from the description and figure in the 'Mineral Conchology.' The entire section (*Leptomaria*) of which *Pl. sulcata* may be regarded as the type-species, as developed in the Inferior Oolite, presents a series of forms which run into each other. Moreover, in such slightly sculptured shells what little ornament there may have been is often modified by fossilisation, whilst the spiral angle varies so much that it almost ceases to be a guide. Hence the division into "species" is attended with unusual difficulty.

Description:

Height	22 mm.
Basal diameter	32 mm.
Spiral angle (convex)	95°.

Shell heliciform and largely umbilicated. Spire convex, with an obtuse apex. The spire-whorls (about six) are narrow, convex or scarcely angulated, and separated by a suture, which in the early stages is somewhat canaliculate. The ornaments are faintly impressed, and vary much; specimens from Dundry generally show radial furrows in the upper part of the whorls, whilst the visible spiral ornamentation is chiefly anterior. Specimens from the *Murchisonæ*-zone of Burton Bradstock exhibit spiral striæ on the spire-whorls throughout, and this, in the apical portion, is reticulate, whilst the body-whorl is smooth, merely showing the growth-lines.

The sinus-band is antero-mesial and very narrow, being situated on the most prominent part of the whorl; it is usually countersunk and smooth. The body-whorl is relatively large and smooth, the flexuous growth-lines constituting the only ornament; these are continued in the rounded base to the edge of the wide and deep umbilicus. Aperture subovate and oblique.

Obconical variety (figs. 7, 7 *a*, 7 *b*).

Cf. Pleurotomaria obconica, *Tawney*. Dundry Gasteropoda, p. 45 (37), pl. iii, fig. 6.

Cf. also Pleurotomaria lævigata, *Deslongchamps*. Vol. cit., p. 138, pl. xvii, fig. 7.

The general outline is that of a blunt cone, the spire being convex and the spiral angle ranging from 80° to 85°. Most of the specimens which I have

referred to this form further differ from the typical *Pl. sulcata* in having the sutures rather more canaliculate and the umbilicus narrower and deeper; on the whole, too, the shells have less ornament. In most of my specimens the sinus-band is flat or countersunk, and the body-whorl relatively very large.

This is to all appearance an obconical variety of *Pl. sulcata*, though not exactly *Pl. obconica*, Tawney.

The figured specimen of Tawney's "*obconica*," which must of course be regarded as the type, has the whorls distinctly angular, as in *Pl. unisulcata*, d'Orb. But on the very same tablet (in the Bristol Museum) is an obconical specimen with rounded whorls, just like fig. 7 of the accompanying plate. It seems only reasonable to suppose that Tawney included such a form in his "*obconica*." Inferentially, therefore, this variety represents *Pl. obconica*, Tawney, although the figured specimen is not exactly the same.

Relations and Distribution.—In Dorset *Pl. sulcata* and the obconical variety just described are essentially fossils of the *Murchisonæ*-zone, being especially abundant at Coker and the Irony Nodule-bed at Burton Bradstock; rarer at Bradford Abbas and Stoford. The exact horizon at Dundry is not known to me, although there is good reason to believe that it is in the *Murchisonæ*-zone.

This species, in common with many other Inferior Oolite *Pleurotomariæ*, probably occurs in the Cotteswolds. Most specimens there are in the form of casts; hence the exact species is not easy to determine.

349. Pleurotomaria (*Leptomaria*) Ajax, *d'Orbigny*, 1850. Plate XXXV, figs. 8, 8 *a*, 8 *b*; and obconical variety, figs. 9, 9 *a*.

1850. Pleurotomaria Ajax, *d'Orbigny*. Prod., i, p. 268.
1854. — — — Terr. Jur., vol. ii, p. 484, pl. ccclxxxviii, figs. 1—5.

Description:

Height	15 mm.
Basal diameter	23 mm.
Spiral angle (convex)	100°.

Shell heliciform, with a narrow umbilicus. Spire convex and depressed, apex very obtuse. Whorls (about six) narrow, tumid, and regularly marked with fine spiral striæ; these are very faintly cross-hatched in the earlier whorls, otherwise there is no axial ornamentation; sutures canaliculate.

The sinus-band is narrow and sunken, marked with fine lines or plain; in the

earlier whorls its position is so anterior as to be almost concealed. The body-whorl is relatively large, convex, and rounded off at the basal periphery, the whole being ornamented with regular spiral striæ up to the edge of the umbilicus; in this portion of the shell the sinus-band is about two-thirds down. Aperture subdepressed and oblique.

Obconical Variety (fig. 9).—This presents certain analogies with the variety described under the preceding species. Usually specimens run rather larger than in the more depressed and typical form of *Pl. Ajax;* spiral angle in some cases as low as 80°, always obtuse. The sinus-band is less concealed in the earlier whorls, and also more prominent and striated. There are also other differences.

Relations and Distribution.—Pl. Ajax, including the obconical variety, is rather abundant in the bottom bed of the Lincolnshire Limestone at Lincoln, which is in the *Murchisonæ*-zone. It seems to be a representative of *Pl. sulcata*, which occurs on the same horizon in the south-west; the chief difference lying in the regular and more deeply incised spiral ornamentation and the smaller umbilicus. There is a somewhat similar form in the Northampton Sand at Duston.

350. Pleurotomaria (*Leptomaria*) monticulus, *Deslongchamps*, 1848. Not figured.

1848.	Pleurotomaria monticulus, *Deslongchamps*.			Vol. cit., p. 143, pl. xiii, figs. 5 *a—d*.
1854.	—	—	—	? D'Orbigny, Terr. Jur., vol. ii, p. 485, pl. cccIxxxviii, figs. 6—10.
1873.	—	—	—	? Tawney, Dundry Gasteropoda, p. 44 (36).

The specimen on which Tawney based this identification has more resemblance to *Pl. Agathis*, Desl. Lately, however, Mr. Wilson has found a specimen at Dundry, which, though rather small, may be safely identified with *Pl. monticulus*.

351. Pleurotomaria monticuloides, sp. nov. Plate XXXV, figs. 10, 10 *a*.

Description:

Height	27 mm.
Basal diameter	29 mm.
Spiral angle (subconvex)	70°.

Shell conoidal, moderately umbilicate. Spire subconvex, apex rather obtuse.

Whorls (about seven) flat to slightly convex, sutures rather close and not canaliculate. Spiral ornamentation is faintly inscribed thoughout the apical whorls, but in the later whorls it is only seen in the anterior areas; traces of radial ornamentation slight.

The sinus-band is narrow and inconspicuous; it is nearly mesial, or only slightly anterior. The body-whorl occupies about half the height of the shell, and is bluntly angular towards the base, which is rather flat with faint spiral striæ. Indications respecting the umbilicus not very clear; aperture nearly square.

Relations and Distribution.—The conoidal figure, almost flat whorls, and non-canaliculate sutures serve to distinguish this form from *Pl. monticulus*, which it otherwise greatly resembles. Rare on a low horizon at Haselbury and Coker.

352. Pleurotomaria (*Leptomaria*) sulcata-Humphriesiana, sp. nov. Plate XXXV, fig. 11.

N.B.—It is not without much hesitation that I venture in this case to make a new species. The form now under consideration occupies a position midway between—

Pleurotomaria Agathis, *Deslongchamps*. Vol. cit., p. 139, pl. xiii, fig. 8,
and
— sulcata, *Deshayes* after *Sowerby*. Deslongchamps, vol. cit., p. 135, pl. xiii, fig. 4 = *Pl. unisulcata*, d'Orbigny.

Description:

Height	24 mm.
Basal diameter	31 mm.
Spiral angle	80°.

Shell conical, largely and deeply umbilicate. Spire almost regular, with a subacute apex. Whorls (seven) slightly convex, and with rather faint spiral ornament, often decussated posteriorly by sinuous growth-lines. There are two varieties, one where the suture is slightly canaliculate and the whorls subangular, another where the whorls are rather undercut. In some specimens the radial ornament on the posterior area of the whorls is strong.

The sinus-band is very narrow, and situate slightly below the middle of the whorls, and in the subangular variety occupies the prominence. The body-whorl is bluntly angular at the periphery; base scarcely convex, smooth, or only marked with faint radial striæ. Umbilicus steep and "staircase-like." Aperture nearly square, inner lip straight and rather thickened, being slightly removed on the columella.

Relations and Distribution.—The oblique and sinuous radial ornamentation in the upper part of the whorls resembles that which characterises both *Pl. sulcata* and *Pl. Agathis*. But the conical outline and sharper apex distinguish it from both these species. The general form is undoubtedly near to *Pl. unisulcata*, though somewhat too uniformly conical, and the whorls not sufficiently angular.

I have six specimens from the *Humphriesianus*-zone of Louse Hill and Oborne. The exact locality of the figured specimen is unknown (? Louse Hill). The form may be regarded as representing *Pl. sulcata*, Sow., on a higher horizon, and very nearly equivalent to *Pl. unisulcata*, d'Orb.

353. Pleurotomaria (? *Leptomaria*) Amyntas, *d'Orbigny*, 1850. Plate XXXV, fig. 12.

1850.	Pleurotomaria Amyntas, *d'Orbigny*.			Prod., i, p. 268.
1854.	—	—	—	Terr. Jur., vol. ii, p. 495, pl. cccxcii, figs. 6—10.
1873.	—	—	—	Tawney, Dundry Gasteropoda, p. 41 (33).

Description:

Height	44 mm.
Basal diameter	44 mm.
Spiral angle	55°.

Shell smooth, conical, subelongate, with a deep but narrow umbilicus. Spire regular and sharp, with the apex rather flattened. Number of whorls about nine in fully-developed specimens, though eight is more usual; these are subangular and moderately convex. The ornaments are usually very fine; in well-preserved specimens it is seen that the spiral striæ in the apical whorls are crossed by fine axial lines, so as to be subreticulate; later, the spiral ornamentation becomes feeble; the body-whorl in most specimens is nearly smooth, though in some (such as the one figured) the spiral ornaments are still visible.

The slit is narrow, and extends backwards about a quarter of the circumference of the body-whorl. The sinus-band is narrow and smooth, being situate on the angular prominence of each whorl, so as to constitute a slight keel about two-thirds the way down. The body-whorl is usually smooth and bluntly angular at the basal periphery, the base flat, and glabrous or substriated; umbilicus funnel-shaped. Aperture suboval.

Relations and Distribution.—This fine and often glabrous shell has affinities with the typical *Leptomariæ* through its narrow sinus or slit; whilst the size and

shape of the spire and, to a certain extent, the ornamentation connect it with the *Fasciatæ*.

It is abundant and characteristic in the Irony Nodule-bed (*Murchisonæ*-zone) at Burton Bradstock. A smaller and more glabrous variety occurs in the *Concavus*-bed at Bradford Abbas. Tawney quotes it from Dundry. All my specimens indicate a fossil of the Lower Division.

354. Pleurotomaria subplatyspira, *d'Orbigny*, 1850. Plate XXXVI, fig. 1.

1850.	Pleurotomaria subplatyspira, *d'Orbigny*.	Prod., i, p. 269.
1854.	— — —	Terr. Jur., vol. ii, p. 496, pl. cccxciii, figs. 1—3.
Syn.	— fasciata, var. platyspira, *Deslongchamps*.	Vol. cit., p. 54, pl. vi, fig. 2.

Bibliography, &c.—This and the three following species constitute the *Fasciata*-group (*Gyrocycla*, Deslong., *pars*).

Description.—A somewhat imperfect specimen from the *Sauzei*-bed, Milborne Wick, is about 44 mm. in height and width, with a spiral angle, slightly convex, of 64°. Shell umbilicate, rather obtuse at the apex. Whorls (nine) slightly convex; spirally striated in the anterior areas only, except in the extreme apical whorls, where the ornaments are reticulate, as is usually the case with *Pleurotomariæ* belonging to this section; sutures distinct, but not deeply impressed. The sinus-band is broad and slightly raised, showing but little trace of striæ or growth-lines, even in the earlier whorls; it is flat and strap-like in the later ones, and antero-mesial in position. The body-whorl is almost devoid of ornamentation.

This specimen is slightly wider than the types of Deslongchamps and d'Orbigny. The broad submesial sinus-band at once separates it from *Pl. Amyntas* and the whole of the "narrow-slit" section.

355. Pleurotomaria fasciata, *Sowerby*, 1818. Plate XXXVI, fig. 3.

1818.	Trochus fasciatus, *Sowerby*.	Min. Conch., pl. ccxx, fig. 1.
1854.	Pleurotomaria fasciata, *Sowerby*.	Morris, Cat., p. 271.
1873.	— — —	Tawney, Dundry Gasteropoda, p. 51 (43).

Bibliography, &c.—*Pleurotomaria fasciata* represents a group rather than a species, since forms which may fairly be classed as varieties are numerous. Indeed, the exact Dundry type is not often met with elsewhere. Deslongchamps (vol. cit., p. 53) expressed a suspicion that his var. *platyspira* was possibly identical with *Trochus fasciatus*, Sow., but I have followed d'Orbigny in regarding them as distinct. The following description of *Pl. fasciata* is based on Dundry specimens.

Description :

Height	65 mm.
Basal diameter	67 mm.
Spiral angle	66°.

Shell conical, moderately umbilicate. Spire rather obtuse towards the apex, otherwise nearly regular. Whorls (about nine) of moderate and regular convexity, and ornamented throughout by a complete system of rather fine spirals which in the earlier whorls are decussated so as to produce a reticulate pattern; sutures very distinct, but not deeply impressed.

The sinus-band occupies the crown of the convexity in each whorl, and is broad and almost median in position, being rather salient in the earlier whorls, flat and strap-like in the later ones; the ornaments are composed of two or more spirals with the usual cross-hatching, but in the later whorls these are generally worn smooth. The body-whorl is full, subangular at the periphery, and spirally striated both in the flank and base, in addition to growth-lines radiating from the margin of the narrow funnel-shaped umbilicus. Aperture subquadrate to oval.

Relations and Distribution.—The "Gyrocyclas" and, to a certain extent, the "Gyroplatas" of Deslongchamps are more or less related to *Pl. fasciata*, which may be accepted as a general term where specimens do not admit of any close differentiation.

This species has a wide distribution throughout the Inferior Oolite in this country. The finest specimens known to me are from Dundry, the matrix being the Iron-shot Oolite, which is probably in the *Humphriesianus*-zone. Both the typical form and the variety *platyspira* occur rarely in the *Sauzei*-bed at Oborne. In the Cotteswolds it is found chiefly in the form of casts. I have a specimen from the *Murchisonæ*-zone of Coker. It is by far the most abundant species of *Pleurotomaria* in the Northampton Sand at Duston, where individual specimens are nearly as fine as at Dundry. Small specimens of this species, resembling *Pl. Niortensis*, d'Orb., are not uncommon in the "Base-bed" at Lincoln (*Murchisonæ*-zone); subreticulate ornament is very conspicuous in the apical whorls of some of these.

356. Pleurotomaria Stoddarti, *Tawney*, 1873. Plate XXXVI, fig. 2.

1873. Pleurotomaria Stoddarti, *Tawney*. Dundry Gasteropoda, p. 50 (42), pl. iii, fig. 5.

Description:

Height (full size)	70 mm.
Basal diameter	84 mm.
Spiral angle	75°.

Shell conical, subacute, largely umbilicated. Spire regular. Whorls (nine) very convex, and curving each way towards the deep suture. The ornamentation consists of spiral lines and oblique decussating radial lines inclined, as usual, in opposite directions on either side of the sinus-band; the earlier whorls have a cancellated appearance, but in the later ones the area above the sinus-band is almost smooth from the absence of spiral lines and the faintness of the cross-hatching.

The sinus-band is broad and situated very slightly below the middle of the whorls; where these possess much ornament, it exhibits three spirals which are cross-hatched; in the later whorls it is flat and strap-like. The body-whorl is tumid and rounded at the periphery; base rounded, full, and almost smooth, or only marked by curved radii springing from the deep and funnel-shaped umbilicus. Apex subovate.

Relations and Distribution.—As an obvious member of the *Fasciata*-group this is most nearly related to *Pl. subplatyspira*, especially in the failure of ornament in the upper part of the whorls. But the wider spiral angle, convex whorls, and deep suture, serve to separate it. Viewed as a member of Deslongchamps' compound species, *Gyrocycla*, it most nearly approaches the var. *saccata*, but has a much wider spiral angle, besides other differences.

Apparently known only from Dundry, where the Iron-shot Oolite has yielded the Bristol Museum two fine specimens.

357. Pleurotomaria amata, *d'Orbigny*, 1854. Plate XLIV, figs. 11 *a*, 11 *b*, 11 *c*.

1854. Pleurotomaria amata, *d'Orbigny*. Terr. Jur., vol. ii, p. 512, pl. cccxcix, figs. 6—10.

The principal objection to this identification arises from the circumstance that d'Orbigny regarded his species as approaching *Pl. unisulcata*. This is certainly

not the case with the fossils now under consideration. Yet for these d'Orbigny's description and, to a certain extent, his figures answer exceedingly well.

The following may be taken as representing the dimensions of British specimens:

Height	25 mm.
Basal diameter	30 mm.
Spiral angle	72°.

My specimens are somewhat smaller than the French ones, but the spiral angle, shape, and ornamentation are almost identical. If there is any difference, the whorls in d'Orbigny's figured specimen are rather more angular.

The specimens which I refer to *Pl. amata* occur principally at Louse Hill, in the upper part of the *Humphriesianus*-zone. They evidently belong to the Fasciatæ, though restricted in size as compared with the bulk of that section.

358. Pleurotomaria transilis, *d'Orbigny*, 1854. Plate XXXVI, figs. 4, 4 *a*.

1854. Pleurotomaria transilis, *d'Orbigny*. Terr. Jur., vol. ii, p. 482, pl. cccl xxxvi.

Syn. — gyrocycla, var. transilis, *Deslongchamps*. Vol. cit., p. 60, pl. vii, fig. 1.

The specimen figured in the accompanying plate has a spiral angle of 58°, and is without umbilicus. On the whole it tallies fairly well with the figures and descriptions of the French authors, especially Deslongchamps, of this member of the *Gyrocycla*- or *Fasciata*-group. There are two specimens in my collection from the *Parkinsoni*-zone of Burton Bradstock.

359. Pleurotomaria Alimena, *d'Orbigny*, 1850. Not figured.

1850. Pleurotomaria Alimena, *d'Orbigny*. Prod., i, p. 268.

1854. — — — Terr. Jur., vol. ii, p. 462, pls. cccl xxvii and cccl xxviii, fig. 1.

Syn. — gyroplata, var. æquistriata, *Deslongchamps*. Vol. cit., p. 57, pl. vi, fig. 4.

Since it is probable that the varieties *æquistriata* and *inæquistriata* merely represent different stages or conditions of the same species, it might be permissible to retain the specific name *gyroplata*. Provisionally, however, we may accept d'Orbigny's name *Alimena*.

A specimen in my collection answering well to the description and figures, as quoted above, has a height of 80 mm. and a spiral angle of 50°. The shell is acutely conical, and scarcely umbilicated. The whorls are subconvex to flat, but well marked off by the suture. The body-whorl is angular at the basal periphery, and the base nearly flat. In the early whorls the ornaments are finely reticulate, becoming smooth in the adult stage. Sinus-band quite median, broad and very flat in the later whorls.

One specimen from the *Parkinsoni*-zone of Burton Bradstock.

360. Pleurotomaria subfasciata, *d'Orbigny*, 1850. Plate XLIV, fig. 10.

1850.	Pleurotomaria subfasciata, *d'Orbigny*.			Prod., i, p. 269.
1854.	—	—	—	Terr. Jur., vol. ii, p. 500, pl. cccxciv, figs. 1—3.
Syn.	—	fasciata, var. crenata, *Deslongchamps*.		Vol. cit., p. 53, pl. vi, fig. 1.

This is so well marked a form as to present little difficulty in identification. A specimen, believed to have come from the *Humphriesianus*-zone of the neighbourhood of Sherborne, has a height of 75 mm. and a spiral angle of 62°. It differs from Normandy specimens, as described, in having no umbilicus. *Pl. subfasciata* (*crenata* is more descriptive) helps to connect the Fasciatæ with the still more numerous section of the Ornatæ.

361. Pleurotomaria phyospira, *d'Orbigny*, 1850. Not figured.

1850.	Pleurotomaria phyospira, *d'Orbigny*.			Prod., i, p. 269.
1854.	—	—	—	Terr. Jur., vol. ii, p. 502, pl. cccxcv.
Syn.	—	fasciata, var. phyospira, *Deslongchamps*.		Vol. cit., p. 53, pl. v, fig. 4.

A large but somewhat imperfect specimen, nearly 100 mm. in height, from the *Humphriesianus*-zone of the neighbourhood of Sherborne may, without doubt, be referred to this very characteristic form. Mr. Wilson has also found this species in the Iron-shot Oolite of Dundry. The shell is conical and subturrited, the earlier whorls being angular and carinated, with nodular ornaments on the carinæ; the lower whorls are smooth and tumid, and in harmony with the gyrocycloid forms of the Fasciatæ. This species constitutes another link between the Fasciatæ and the Ornatæ.

362. Pleurotomaria subdecorata, *Münster*, 1844, Inferior Oolite variety. Plate XXXVI, fig. 10.

1844.	Pleurotomaria subdecorata, *Münster*.			Goldf., Petref., pl. clxxxv, fig. 3.
1854.	—	—	—	? D'Orbigny, Terr. Jur., vol. ii, p. 445, pl. cccIxiv, figs. 1—6.
1873.	—	—	—	(? non *d'Orb.*) Tawney, Dundry Gasteropoda, p. 44 (36).

Description :

Height	30 mm.
Basal diameter	40 mm.
Spiral angle	80°.

Shell turbinate, subturrited, widely umbilicate. Spire regular. Whorls (seven) subconvex and rather flattened posteriorly, sutures subcanaliculate in the later whorls. The ornamentation is regular throughout, consisting of well-cut and slightly undulating spirals, which show beautiful cancellation in the early whorls, and a certain amount of radial striping in the posterior area of the later ones.

The sinus-band is submedian, prominent, and moderately wide, but does not constitute an angle ; it has spiral ornament similar to that of the whorls, though rather closer. The body-whorl is bluntly angular at the periphery ; base subconvex and largely umbilicated with strong spiral and radial ornamentation. Aperture subrhomboidal.

Relations and Distribution.—Near to *Pl. subdecorata*, M., this form differs in having the whorls less angular ; yet, on the whole, conforming to Goldfuss' rather than to d'Orbigny's description. It belongs to the Fasciatæ, though with a tendency towards the Ornatæ.

The figured specimen, from Dundry, is the only one of that size from the Inferior Oolite. A much smaller form, about 12 mm. in height, and with six whorls, occurs sparingly in the *Concavus*-bed at Bradford Abbas and in the " Base bed " at Lincoln. These specimens seem to be truly micromorphs of *Pl. subdecorata*, but are rather more turrited and with canaliculate sutures. At present we should not be justified in constituting a new species.

363. Pleurotomaria Allica, *d'Orbigny*, 1850. Plate XXXVI, figs. 5, 5 *a*.

1850.	Pleurotomaria Allica, *d'Orbigny*.			Prod., i, p. 268.
1854.	—	—	—	Terr. Jur., vol. ii, p. 490, pl. cccxc.
1873.	—	—	—	Tawney, Dundry Gasteropoda, p. 42 (34).

Description :

Height (large specimen) . . .	55 mm.
Basal diameter	45 mm.
Spiral angle	48°—52°.

Shell conical, elongate, not umbilicated. Spire regular. Whorls (about nine) flat to subconvex, and slightly projecting over each other. There is some difference of ornamentation between the apical and anterior whorls; generally the system may be described as consisting of rather wide-apart spirals above the sinus-band, with a stronger and more decussated pattern below, *i. e.* the anterior portion of each whorl is minutely cancellate down to the sutural margin.

The sinus-band is median or only slightly anterior, fairly prominent in the apical whorls, flattish and not very wide in the more advanced ones. The body-whorl is between one third and one half the total height, and bluntly angular at the periphery; base flat to subconvex, with distinct spiral ornament and no umbilicus. Aperture subquadrangular and moderately oblique, with a very thick columellar lip.

Relations and Distribution.—Pl. Allica must be regarded as a member of the *Fasciata*-group, having a narrow spiral angle and a comparatively small habit. Its relationship to *Pl. Alimena* is obvious.

Tawney mentions one specimen from Dundry; I have five from the Louse Hill beds, which are generally regarded as in the upper part of the *Humphriesianus*-zone.

364. Pleurotomaria subreticulata, *d'Orbigny*, 1850. Plate XXXVI, figs. 6, 6 *a*, and ? fig. 7.

1850.	Pleurotomaria subreticulata, *d'Orbigny*.			Prod., i, p. 268.
1854.	—	—	—	Terr. Jur., vol. ii, p. 494, pl. cccxcii, figs. 1—5.
1873?	—	—	—	Tawney, Dundry Gasteropoda, p. 46 (38), pl. iii, fig. 7.
Syn.	—	reticulata, *Deslongchamps*.		Vol. cit., p. 64, pl. ix, fig. 3.

Bibliography, &c.—Deslongchamps had some doubt whether his *Pl.* "*reticulata*" was really distinct from *Pl. textilis*, which latter, likewise, was held to merge into *Pl.* "*scalaris*." It must be admitted that these three forms wait upon each other closely, and I am inclined to regard *Pl.* "*scalaris*" as merely a megalomorph of *Pl. textilis*. *Pl.* "*reticulata*" seems distinct, but as the specific name had already been appropriated, the species was re-named *subreticulata* by d'Orbigny.

Description. (N.B.—There are two forms or varieties of *Pl. subreticulata* in the Dorset beds. The following more particularly relates to the narrow, elongate variety from the *Humphriesianus*-zone—fig. 6 :)

Height	36 mm.
Basal diameter	28 mm.
Spiral angle	55°.

Shell conical-elongate, not umbilicate. Spire regular, with a sharp apex. Whorls (nine or ten) flat to subangular, with a slight basal rim ; sutures rather close. The entire shell, including even the sinus-band, is finely and evenly reticulate.

The sinus-band, which has three spiral lines, is rather below the middle of the whorls, prominent but not very wide ; it forms a keel, and thus, in conjunction with the basal rim, causes the whorls to be slightly bicarinate. Body-whorl distinctly bicarinate, the upper keel being formed by the sinus-band ; sharply angular at the periphery, with a flat base. There is a slight umbilical fissure but no true umbilicus. Aperture almost square, with a straight inner lip.

This variety occurs at Louse Hill and Mapperton ; the former locality yields fossils of the *Humphriesianus*-zone. The precise horizon at Mapperton has not, to my knowledge, been exactly determined, but the Gasteropoda greatly resemble those from Louse Hill.

Description of a smaller variety from the *Parkinsoni*-zone :—Short, conical shells about 20 mm. in height, and with a spiral angle of 60°. These approach *Pl. distinguenda*, Tawney, but are more bicarinate, whilst the ornamentation is more reticulate than in that species. The aperture is very square, and the inner lip thickened and slightly recurved. I have four specimens from the bed distinguished as P. 1, Burton Bradstock.

Relations and Distribution.—*Pl. subreticulata*, besides its intimate relation with the species next described, is connected with a kind of sequence of reticulate *Pleurotomariæ* which are found on more than one horizon in the British Jurassic rocks. Tawney recognised this species from the Dundry beds ; in Dorset it is only found in the Upper Division of the Inferior Oolite.

A specimen from the Lincolnshire Limestone of Rauceby (fig. 7) is provisionally referred to *Pl. subreticulata*. It differs from the Dorset shells (long type) in its wider spiral angle and less bicarinate whorls. The axial lines or

wrinkles on the posterior areas are, also, strongly developed,—a feature which is emphasised in d'Orbigny's figures, but is probably of no great importance. Morris ('Quart. Journ. Geol. Soc.,' vol. ix, p. 326) quotes *Pl. reticulata*, Desl., with a query, from the Ponton beds.

365. Pleurotomaria textilis, *Deslongchamps*, 1848. Plate XXXVI, fig. 8; including *Pl. scalaris*, Deslongch., fig. 9.

1848.	Pleurotomaria textilis, *Deslongchamps.*			Vol. cit., p. 63, pl. ix, fig. 2.
1850.	—	—	—	D'Orbigny, Prod., i, p. 268.
1854.	—	—	—	D'Orbigny, Terr. Jur., vol. ii, p. 492, pl. cccxci, figs. 6—10.
1873.	—	—	—	Tawney, Dundry Gasteropoda, p. 53, (45).
Syn. or var.	—	scalaris, *Deslongchamps.*		Vol. cit., p. 66, pl. vii, fig. 4; pl. viii, figs. 1, 2, 3; pl. ix, fig. 1.

Bibliography, &c.—Not without hesitation Deslongchamps concluded to separate *Pl. textilis* and *Pl. scalaris*, though doubting the validity of the latter species. Finally he left it an open question. D'Orbigny recognised three species in this group, viz. *Pl. textilis*, Deslongch. ('Terr. Jur.,' vol. ii, p. 492, pl. cccxci); *Pl. strigosa*, d'Orb. (vol. cit., p. 504. pl. cccxcvi); and *Pl. subscalaris*, d'Orb. (vol. cit., p. 505, pl. cccxcvii).

For the present I am content to regard the *scalaris* section of this group as representing megalomorphic forms of *Pl. textilis*, which must be accepted as the specific name.

Description (medium size = *Pl. textilis*):

Height	60 mm.
Basal diameter	48 mm.
Spiral angle	56°.

Shell conical, turrited, not umbilicated. Spire regular. Whorls (about nine) angular and bicarinate or subbicarinate, according to the greater or less prominence of the basal rim. The whorls increase by steps, and in some cases are rather undercut; sutures close. In well-preserved specimens the ornaments of the apical whorls are seen to be reticulate, but in the later whorls spiral ornamentation alone prevails.

The sinus-band is nearly median, large, round, and prominent; and apparently without ornament other than curved growth-lines; it is situate at the angle, and constitutes the greatest salience of each whorl, being more especially conspicuous

where the basal rim is wanting or only slightly developed. The body-whorl is bicarinate, though generally the keel which carries the sinus-band is the more prominent, the intervening space being much excavated. The periphery is more or less angular; base subconvex in the smaller specimens, very tumid in the larger ones, and apparently smooth. Aperture subquadrate, with inner lip but slightly oblique.

Relations and Distribution.—This species attains a considerable size, and its megalomorphs (*Pl. scalaris*) present much variety. The smaller forms have some resemblance to *Pl. reticulata*, but may be distinguished by the smooth and rounded sinus-band, and also by the more angular shape of the whorls.

The specimens in my collection are from the *Parkinsoni*-zone of Dorset. Fig. 8 represents a bicarinate specimen of medium size (*Pl. textilis*) from P. I, Burton Bradstock. From Halfway House are two large specimens, one of which (fig. 9) may be identified as *Pl. scalaris*, var. *stricta*, and another and still larger one (not figured) as *Pl. scalaris*, var. *ambigua*.

Tawney mentions one specimen of *Pl. textilis* from Dundry, but this perhaps is a doubtful identification.

366. Pleurotomaria paucistriata, *d'Orbigny*, 1850. Plate XXXVII, fig. 1.

1850.	Pleurotomaria paucistriata, *d'Orbigny*.	Prod., i, p. 269.	
1854.	— — —	Terr. Jur., vol. ii, p. 454, pl. ccclxxi.	
Syn.	—	proteus, var. paucistriata, *Deslongchamps*.	Vol. cit., p. 48, pl. i, fig. 2.

Bibliography, &c.—This is simply a wide-angled member of the great *Proteus*-group, of which such large specimens are figured in the 'Memoirs of the Linnean Society of Normandy.' The softened outline of the whorls and the paucity of the tuberculations in this "species," together with the general character of the ornamentation, seems to connect the Ornatæ with the Fasciatæ.

Description:

Height (medium size)	55 mm.
Basal diameter	60 mm.
Spiral angle	72°.

Shell conical, turrited, umbilicated. Spire regular. Whorls (eight or nine) angular and increasing by steps, the keel being situated in the posterior third of the whorl. The upper whorls have reticulate ornament, with nodules on the keel; later on the nodules become fainter and gradually disappear, leaving a somewhat naked carina; the spiral ornament is continuous throughout.

The sinus-band is situated a little above the centre of the subcarinal portion of the whorls; it is wide, flat, and non-salient; a strong spiral line in the middle may be noted, but later on this seems to undergo modification. The body-whorl is bicarinate with a sharp angle at the periphery (more like d'Orbigny's figure than his description). Generally, too, the basal angle is subnodular, almost like that in *Pl. subfasciata*. Base flat, with a large umbilical excavation, the spiral striæ being faint and confined to the outer margin. Aperture oval and oblique.

Relations and Distribution.—As a member of the *Proteus*-group its relations have already been partially indicated. The figured specimen is from the Iron-shot Oolite of Dundry. I have a large specimen from the *Humphriesianus*-zone of the Sherborne district, and a few smaller ones. It is less abundant than the species next described.

367. Pleurotomaria Proteus, *Deslongchamps*, 1848. Plate XXXVII, fig. 2.

1848.	Pleurotomaria Proteus, var excelsa,		*Deslongchamps.*	Vol. cit., p. 50, pl. i, fig. 1.
1854.	—	---	*Deslongchamps.*	D'Orbigny, Terr. Jur., vol. ii, p. 453, pl. cccIxx.
1873.	—	—	—	Tawney, Dundry Gasteropoda, p. 52 (44).

N.B.—It should be borne in mind that specimens, such as the one figured, are incomplete, and do not attain to the smooth stage, as is the case with the very much larger ones in Normandy.

The height of the largest British specimen known to me is about 50 mm.; whilst the spiral angle is at least 10° narrower than in *Pl. paucistriata;* the whorls are drawn out axially and have a rather different shape, whilst the umbilicus is very narrow. The nodules on the carinæ are bolder and more wide apart in *Pl. Proteus* than in *Pl paucistriata*, but there are intermediate forms. The elongate specimens which I refer to *Pl. Proteus* are most abundant in the *Humphriesianus*-zone of Louse Hill; and, generally speaking, the group is chiefly found in the Sherborne district.

From Louse Hill (upper part of *Humphriesianus*-zone) I have likewise a portion of a large specimen indicative of *Pl. constricta*, Deslongch. This species, as the author remarks (vol. cit., p. 42), links the varieties of *Pl. Proteus* with those of *Pl. armata*.

368. Pleurotomaria armata, *Münster*, 1844. Plate XXXVII, fig. 5.

1844.	Pleurotomaria armata, *Münster*.			Goldf., Petref., pl. 186, fig. 7.
1848.	—	—	—	Deslongchamps, vol. cit., p. 39, pl. ii, fig. 2; pl. iii, fig. 2.
1854.	—	—	—	D'Orbigny, Terr. Jur., vol. ii, p. 451, pls. cccIxviii, cccIxix.
1873.	—	—	—	Tawney, Dundry Gasteropoda, p. 50 (42).
Syn.	—	dentata, *Deslongchamps*.		Vol. cit., p. 37, pl. iv, figs. 1 and 2.

Bibliography, &c.—Münster's species was originally described from the "Upper Oolite" of Streitberg and Vigors; but since it has been identified by Deslongchamps, d'Orbigny, and other palæontologists as a fossil of the French Bajocian, there is no need to step behind their conclusion.

Description (especially applicable to the var. *Münsteriana*, Deslongch.):

Height	60 mm.
Basal diameter	75 mm.
Spiral angle (approx.)	100°.

Shell thick, trochiform, subdepressed, deeply umbilicated. Spire convex. The whorls, six in number, are angular and step-like in their increase, the angle of the whorl being situate about one third the way down, the upper third being nearly flat, and the remaining two thirds nearly vertical. The keels carry thick nodulations at rather wide intervals, and at the base of the lower whorls is a set of tuberous undulations. The sides of the shell are ornamented by richly-cut spirals, which are large and flexuous towards the anterior margin. Sutures rather close and undulating.

The sinus-band is placed about the middle of the height of the whorls; it is wide, flat, and spirally striated, but in the body-whorl smooth and strap-like. The body-whorl is bicarinate, the upper carina being grossly nodular as in the rest of the shell; whilst the lower carina, situate on the basal periphery, is bluntly angular and ornamented with a series of striated undulations rather than nodules, these become fainter anteriorly. Base convex, with marginal striæ and sometimes a marginal furrow; nearly smooth towards the centre, but spirally striated in the cavity. The umbilicus is somewhat funnel-shaped, and very deep. Aperture nearly circular, with some obliqueness of the outer lip.

The var. *precatoria*, Deslongchamps, has a less depressed spire and some slight differences of ornamentation.

Relations and Distribution.—This species is one of the most vigorous and charac-

teristic of the Ornatæ, being related on one side to the turrited, and on the other to the depressed forms.

The best specimens are from the *Parkinsoni*-zone of Burton Bradstock, where also the var. *dentata* occurs. From the *Humphriesianus*-zone at Bradford Abbas I have a specimen something between *Pl. armata* var. *precatoria*, and *Pl. Sauzeana*, d'Orb. Smaller and less characteristic specimens of *Pl. armata* are found in the *Sauzei*-bed of the Sherborne district and at Louse Hill, both in the *Humphriesianus*-zone.

369. Pleurotomaria, cf. Sauzeana, *d'Orbigny*, 1850. Not figured.

1850.	Pleurotomaria Sauzeana, *d'Orbigny*.			Prod., i, p. 267.
1854.	—	—	—	Terr. Jur., vol. ii, p. 457, pl. cccl xxiii.
1873.	—	—	—	Tawney, Dundry Gasteropoda, p. 51 (43).

Specimens referred to this species do not quite fit in with the description and figure in the 'Terrains Jurassiques.' Yet there are specimens from Dundry reaching up to 90 mm. in height, which approach more nearly to *Pl. Sauzeana* than to the most elongate varieties of *Pl. armata*. The fineness of the nodulations in *Pl. Sauzeana* is one characteristic feature. I have already alluded to the specimens from the Irony Bed of Bradford Abbas (*Humphriesianus*-zone). These, together with the Dundry specimens, are distinguished in my Collection as *Pl.* "*sub-Sauzeana*."

370. Pleurotomaria tuberculosa, *Defrance*, 1826. Plate XXXVII, figs. 4 *a*, 4 *b*.

1826.	Pleurotomaria tuberculosa, *Defrance*.			Dict. Sci. Nat., vol. xli, p. 382, pl. lxxxvi, fig. 3.
1854.	—	—	—	Morris, Cat., p. 272 (I. O., Bridport).
Syn.	—	ornata, *Deslongchamps* (especially var. sulcifera).		Vol. cit., p. 37, pl. iv, fig. 3.
—	—	—	—	D'Orbigny, Terr. Jur., vol. ii, p. 449, pls. cccl xvi, cccl xvii.
Non.	—	tuberculosa, *Zieten* (1830).		Verstein. Württ., p. 47, pl. xxxv, fig. 3.

Bibliography, &c.—Deslongchamps, and after him d'Orbigny, regarded this species as identical with *Trochus ornatus*, Sow. Tawney (op. cit., p. 49) did not

accept this view, and I am inclined to agree with him. Certainly one could fill a plate with forms of the Ornatæ which might possibly be regarded as intermediate between *Pl. tuberculosa*, Defrance, and *Pl. ornata*, Sow. But under any circumstances the fossils we are now considering differ so widely from the average form of Sowerby's species as to merit distinction. Since a name is required, that of "*tuberculosa*" is certainly appropriate. The type was obtained from "near Caen in the Oolite bed."

Description :

Height	25 mm.
Basal diameter	55 mm.
Spiral angle	128°.

Shell turbinate, much depressed, widely umbilicate. The spire, though low, is regular. Whorls (six) angular, and increasing by wide steps with a canaliculate suture. The angle of each whorl is ornamented with very thick tubercles, and the entire shell is pervaded by fine spiral lines, radially decussated in the earlier whorls, and undulating towards the anterior margin of the later ones.

The sinus-band is rather wide, flat and submedian; its ornaments vary with the ornaments of the whorls, but anteriorly have a tendency to disappear, showing only sinuous growth-lines. The body-whorl is relatively very large, euomphaloid, and bicarinate; the upper keel is grossly nodular; in the lower keel the nodules are drawn out spirally, exhibiting a dentate periphery. Base round, with a large infundibuliform umbilicus. Aperture oval, depressed.

Relations and Distribution.—This is pretty near to *Pl. ornata*, var. *sulcifera*, Deslongch. The form is rare in England. The best specimens come from Louse Hill (*Humphriesianus*-zone). The fossil quoted by Morris as from the "I. O. Bridport" came most probably from Burton Bradstock, whence also I have seen specimens of *Pl. tuberculosa*.

371. Pleurotomaria ornata, *Sowerby*, 1818. Plate XXXVII, figs. 3 *a*, 3 *b*, 3 *c*.

1818.	Trochus ornatus, *Sowerby*.	Min. Conch., pl. ccxxi, fig. 1.
Syn. 1823.	— Pallium, *Farey*.	Sowerby, Min. Conch., vol. iv, Index (Corrigenda).
1843.	Pleurotomaria Pallium, *Sowerby*.	Morris, Cat., p. 158 (edition of 1854, p. 271).
1873.	— — *Morris*.	Tawney, Dundry Gasteropoda, p. 49 (41).

Bibliography, &c.—So long as this species was referred to the genus *Trochus*, the name selected by Sowerby was open to Farey's correction. Subsequently

Defrance, in constituting the genus *Pleurotomaria*, applied the name "*ornata*" to quite a different species (*vide infra*). This was accepted by Morris, who accordingly retained the name "*Pallium*" for Sowerby's species, and Tawney followed suit. It is now proposed to restore Sowerby's specific name.

Description (Sherborne variety) :

Height	30 mm.
Basal diameter	42 mm.
Spiral angle	90°.

Shell turbinate, subdepressed, umbilicate. Spire regular, apex pointed. Whorls (six to seven) angular to subconvex and increasing by steps; sutures canaliculate. On the flattened posterior area of all the whorls is a system of close tubercular undulations drawn out radially, whilst the spiral ornamentation is rather faint; in some specimens an anterior crenulated belt is developed.

The sinus-band is median, flat and retreating in the upper whorls, rounder and more prominent in the lower ones; it is mostly without markings other than the usual sinuous growth-lines. The body-whorl is large and subconvex, with the undulating radial costæ on the posterior area well developed, and sometimes the prominence of the sinus-band almost constitutes a keel; it is bluntly angular at the periphery, which is subcrenulate to smooth in many of the Sherborne specimens. Base convex, with radial ornamentation preponderating over the spiral; umbilicus rather small. Aperture oval-depressed.

Varieties.—The Sherborne specimens present many varieties amongst themselves, some being less glabrous and with more marginal crenulation than the one figured. From other districts are specimens in which the whorls are more angular, the tuberculations wider apart, and the base rather flatter with well-marked spiral ornament. On the other hand, the Sherborne variety develops glabrous forms where the whorls are smooth-convex, the base tumid, and the umbilicus almost *nil*.

Relations and Distribution.—*Pl. ornata*, Sow., is essentially a small form, rarely exceeding 30 mm. in height. It can hardly be regarded as the young of *Pl. tuberculosa*, though without doubt the species recognised in the *Ornata*-group have a tendency to inosculate. On the other hand, the narrow and prominent character of the sinus-band in the body-whorl, and the rounding off of the whorls, so different from that of the Ornatæ generally, seem to connect *Pl. ornata*, Sow., with some of the Granulatæ, more especially with *Pl. granulata*, Sow.

The type was from Dundry. The variety above described is abundant in the *Sauzei*-bed at Oborne. Very characteristic specimens, obtained from Dundry, are to be seen in the Bristol Museum These have somewhat bolder ornaments than the figured specimen, but in other respects agree.

372. Pleurotomaria ornata-depressa, sp. nov. Plate XXXIX, figs. 3 *a*—*c*.

Cf. Cirrus carinatus, *Sowerby*. Min. Conch., pl. ccccxxix, figs. 3, 4.

Description :

Height	14 mm.
Basal diameter	40 mm.
Spiral angle	135°.

Shell turbinate, subdiscoidal, umbilicate. Spire regular. Whorls (about five) angular and discoidal; sutures strongly canaliculate. The spiral ornamentation is well developed, and, in addition, the crown of each whorl carries a zone of undulating radial tubercles regularly disposed.

The sinus-band is wide, median and flat, with traces of spiral lines, which, however, are not seen anteriorly. The body-whorl is relatively large and similar in character to the whorls of the spire, with an angular periphery and flattish base richly decussated; umbilicus deep rather than wide. Aperture oval-depressed.

Relations and Distribution.—The figured specimen is from Bradford Abbas most probably from the *Concavus*-bed. Small depressed forms, with somewhat similar ornamentation, occur in the *Murchisonæ*-zone of the Cotteswolds; I also possess a cast from Leckhampton which corresponds well with this figure. *Pl. ornata-depressa* may be regarded as the most depressed variety of the *Ornata*-group. A large specimen showing similar ornamentation, but with a rounder body-whorl and rather higher spire, presents us with another variety of the *Ornata*-group. This is from Dundry.

Note respecting *Cirrus carinatus*.—It will be remembered that this very discoidal cast came from Leckhampton. Presuming that it is the cast of a *Pleurotomaria*, this makes one of the three Jurassic species of which the actual figured specimen is preserved in the Sowerby type collection at the British Museum.

Unfortunately, the name "*carinata*" as applied to *Pleurotomaria* is bespoken for a Palæozoic fossil, viz. *Pleurotomaria* (*Helix*) *carinata*, Sowerby ('Min. Conch.,' pl. x, upper and lower figures).

373. Pleurotomaria Actæa, *d'Orbigny*, 1850. Plate XXXVII, fig. 8.

1850.	Pleurotomaria Actæa, *d'Orbigny*.			Prod., i, p. 267.
1854.	—	—	—	Terr. Jur., vol. ii, p. 459, pl. cccl.xxv.
1873.	—	—	—	Tawney, Dundry Gasteropoda, p. 50 (42).

Description:

Height	45 mm.
Basal diameter	75 mm.
Spiral angle	120°.[1]

Shell turbinate, depressed, umbilicate. Spire convex. Whorls (six to seven) subangular, and increasing by steps with a canaliculate suture. The crest of each whorl is surmounted by a diadem of tubercles, rather small and oblique but somewhat closely set, whilst flexuous spiral lines ornament the sides of all the whorls; moreover in some cases the posterior margin of each whorl shows a ridge lying between two furrows, in the upper of which is the suture, whilst the lower furrow constitutes a sort of trough immediately behind the diadem of tubercles. In other cases there is a slight anterior keel at the base of each whorl.

The sinus-band is broad and median, and shows three spirals in the earlier whorls; but there is great variety in this respect, and also in the degree of its prominence; in the body-whorl of very large specimens it is flat and scaly. The body-whorl is relatively very large and biangular, the upper carina being surmounted with tubercles, whilst the lower one, forming the angle or basal periphery, is little more than crenulated in some specimens. The base is subconvex and without any special ornament, but the flexuous growth-lines are very conspicuous, and may be traced into the deep and funnel-shaped umbilicus. Aperture subovate-depressed.

The younger forms have a strongly dentate periphery and actinomphaloid base, but the umbilicus is not so wide as in *Pl. actinomphala*.

Relations and Distribution.—This is one of the representatives, on a higher horizon, of *Pl. actinomphala;* but the spire is more convex, the ornaments are different, the body-whorl is more angular, and the rugose character of the base appears to be modified. There is, however, much variety.

It was quoted by d'Orbigny from Dundry, from which locality I have one specimen. By far the best specimens come from the *Sauzei*-bed at Oborne. I have one in a good state of preservation which has a basal diameter of 100 mm.; in this one the basal periphery has become quite smooth. No other horizon in Dorset has, to my knowledge, yielded *Pl. Actæa*.

[1] D'Orbigny gives the spiral angle as 102°, but his figured specimen shows an angle of 110°. It seems probable that the Dorset specimens are wider on the whole.

374. Pleurotomaria oxytera, sp. nov. Plate XXXVII, fig. 6.

Description:

Height	35 mm.
Basal diameter	55 mm.
Spiral angle	92°.

Shell conical, trochiform, moderately umbilicated. Spire regular or very slightly concave; apex sharp. Number of whorls about eight; those at the apex slope regularly, but presently become subgradate, sutures close and not canaliculate. The spiral system of ornament is strong, undulating, and rather wide apart; there is a diadem of regular and rather fine tubercles at the angle and another at the base of each whorl, which is subbicarinate.

The sinus-band is median, prominent, and pretty wide, but varies in the different whorls; showing from one to three spirals, though this feature is effaced in the body-whorl, where it is somewhat flattened. The posterior area of the body-whorl is mostly without tuberculation, but the lower keel is very prominent and nodular, showing a strongly dentate periphery. Base convex, without marked spiral ornament, deeply but not widely umbilicate, and very actinomphaloid, the larger specimens being smoother. Aperture subrhomboidal and oblique.

Relations and Distribution.—Distinguished both from *Pl. Actæa* and *Pl. actinomphala* by its conical habit and sharp spire, it approaches the latter in the character of its ornamentation, whilst the actinomphaloid base is a feature shared by all three species. It is very directly connected with the acute variety of *Pl. actinomphala*, but the umbilicus is always smaller, and there are other differences.

I have three specimens from the *Sauzei*-bed, Oborne.

375. Pleurotomaria actinomphala, *Deslongchamps*, 1848. Acute variety, Plate XXXVII, figs. 7 *a*, 7 *b*, and Plate XXXVIII, fig. 5. Obtuse variety, Plate XXXVIII, figs. 1—4.

1848.	Pleurotomaria actinomphala, *Deslongchamps*.			Vol. cit., p. 32, pl. xviii, fig. 1.
1854.	—	—	—	D'Orbigny, Terr. Jur., vol. ii, p. 458, pl. cccl xxiv.
1873.	—	—	—	Tawney, Dundry Gasteropoda, p. 49 (41).

Bibliography, &c.—It should not be forgotten that the types of *Pl. actinomphala* occur in the "Mâlière" of Normandy, a bed underlying the "Oolithe ferrugineuse." Deslongchamps speaks of it as being common in the condition of casts. It so happens that in the *Concavus*-bed at Bradford Abbas, which should be somewhat about the horizon of the "Mâlière," *i. e.* in the Lower Division of the Inferior Oolite, a group of *Pleurotomaria* occurs, exhibiting great variety both as to size and form, but which, without using varietal names, it may be convenient to focus under *Pl. actinomphala*.

Similarly, it seems probable that considerable variety exists in the specimens from France, if we are to regard the figures of Deslongchamps and d'Orbigny as representing the same species.

Description.—Amidst a multiplicity of fossils of all ages and sizes, and with much variety of character, there are two groups of varieties which attract our attention.

Acute Variety (Pl. XXXVII, fig. 7, and Pl. XXXVIII, fig. 5).—The form is conical, and the shell may have a smooth periphery as in the first figure, or a rugose periphery as in the second. Generally speaking, this form is rugose in ornament, and it seems, on the whole, more nearly to represent the *Pl. actinomphala* of the French authors. It is also intimately related to *Pl. oxytera*, described above, though the whorls are always more tabulate.

I have specimens of this variety, chiefly from the *Concavus*-bed at Bradford Abbas and Halfway House, also from Dundry, and even from the neighbourhood of Sherborne.

Obtuse Variety (*actinomphala-abbas*) :

Height (moderate size) . . .	42 mm.
Basal diameter	65 mm.
Spiral angle	110°—115°.

Shell turbinate, depressed, largely umbilicate. Spire regular; apex subacute. Whorls (seven) subangular and inclined to be tabulate, increasing by steps; in the spire-whorls the suture is canaliculate. On the crest of each whorl is a corona of tubercles, which are regular, and there is a certain amount of spiral ornamentation, which is rather worn off in the older specimens; there is no trace of a second carina or belt at the base of the whorls.

The sinus-band is median, wide, and flat, showing some spiral lines in the younger and better preserved specimens, but usually smooth and strap-like in the later ones. The body-whorl is relatively very large, convex, and biangular, the anterior angle being nodular to smooth according to age and condition. The base is convex and without much trace of spiral ornament, except in very young shells; umbilicus wide, steep, and like a "staircase" in the earlier stage, with large ribs radiating therefrom, though scarcely reaching the margin. In the old shells these

flexuous radii in the base, so characteristic of the species, are lost, and only growth-lines remain. Aperture subcircular.

[*Note* as to the figures on Plate XXXVIII.—*Figs.* 1 *a*, 1 *b*, represent two aspects of the early adult stage, where strong traces of the actinomphaloid character still remain. *Fig.* 2 represents three aspects of the early stage of one of the more rugose forms. Specimens of this size and character are very common in the *Concavus*-bed at Bradford Abbas, though showing much variety amongst themselves. *Fig.* 3 represents two aspects of the early stage of a smooth variety, where the staircase-like character of the umbilicus is preserved, but the umbilical rays are almost wanting. *Figs.* 4 *a*, 4 *b*, represent the last stage of *Pl. actinomphala-abbas*, where the actinomphaloid character is entirely lost, and the shell is smooth alike from age and wear. Of these forms, too, there is a very great variety. Most of them exhibit a tendency to gibbosity in the penultimate whorl; there is also considerable variety in the degree of depression, and in some instances the whorls of these old shells are so much undercut as to produce quite a different figure.]

All the above are from the *Concavus*-bed, Bradford Abbas. In the *Murchisonæ*-zone of that locality are specimens which one hardly knows whether to refer to *Pl. actinomphala*, *Pl. Aglaia*, or *Pl. Baugieri*.

376. Pleurotomaria Baugieri, *d'Orbigny*, 1850. Plate XXXIX, figs. 4 *a*, 4 *b*, 4 *c*; and var., figs. 5 *a*, 5 *b*, 5 *c*.

1850. Pleurotomaria Baugieri, *d'Orbigny*. Prod., i, p. 267.
1854. — — — Terr. Jur., vol. ii, p. 463, pl. ccclxxviii, figs. 2—4.

Description.—Though not attaining to so large a size, the English specimens correspond satisfactorily with those described by d'Orbigny.

Height (average)	10 mm.
Basal diameter	28 mm.

Shell subdiscoidal, largely umbilicate. The spire is coiled almost in the same plane, and is composed of whorls which are subangular and in shallow gradations. The whorls are spirally striated, and provided near the upper margin with a furrow, the remainder of the space being radially ornamented with about twenty costæ having tubercular terminations.

The sinus-band is placed near the outer margin in the furrow, wide, slightly sunken, and flanked by raised lines. The body-whorl is subdiscoidal and bluntly biangular; the upper carina is formed by the nodular terminations of the radial ornaments; the lower, or peripheral carina, is also strongly nodular and

salient, and between these lies the sinus-band. Base subconvex, with a marginal furrow, and spiral lines decussated by strong radii. Umbilicus wide and deep, exhibiting the inner coil of the whorls.

Varieties.—Specimens, such as fig. 5, present some modifications of ornament with a higher spire. These seem to connect with *Pl. Aglaia*, d'Orb. (vol. cit., p. 469, pl. cccIxxxi, figs. 1—5). There is also another form (not figured) from the *Murchisonæ*-zone of Bradford Abbas, which may possibly represent a variety of this species. This latter I have hitherto considered to represent an early stage of *Pl. actinomphala* on a lower horizon.

Relations and Distribution.—Closely related to *Pl. actinomphala*, the position of *Pl. Baugieri* both in France and in England lies in the Lower Division of the Inferior Oolite. Nearly all my specimens are from the *Murchisonæ*-zone of Bradford Abbas.

377. Pleurotomaria mopsa, *d'Orbigny*, 1850. Plate XXXIX, figs. 6 *a*, 6 *b*, 6 *c*.

1850.	Pleurotomaria mopsa, *d'Orbigny*.			Prod., i, p. 230.
1854.	—	—	—	Terr. Jur., vol. ii, p. 421, pl. ccclv, figs. 6—10.
Syn.	—	Debuchii, var. exsertiuscula, *Deslongchamps*.		Vol. cit., p. 93, pl. xv, fig. 10.

Bibliography, &c.—So many forms were grouped by Deslongchamps under the "species" named *Debuchii* that d'Orbigny concluded to break it up. *Pl. Debuchii* and all its varieties are mainly Liassic, but traces of some of them certainly occur in the Lower Division of the Inferior Oolite.

Description:

Height	13 mm.
Basal diameter	27 mm.
Spiral angle	140°.

Shell subdiscoidal, largely umbilicate. Spire low but regular. Whorls (six) increasing by steps, angular and carinate, posterior areas tabulate and wide, anterior areas sloping at an angle of 60°; suture canaliculate. The flat part of the whorls is ornamented by three (in the body-whorl sometimes four) raised tuberculated spirals, the outermost occupying the keel (in the body-whorl the nodules are fused into an appearance of radial costæ); the anterior sloping area is decussated, but more than half its total width is occupied by the sinus-band.

The sinus-band is wide, flat, and rather receding; it is margined above and below by a spiral line, with a single central line decussated; in the last whorl it occupies a position between the nodulated keel and the more prominent basal

angle. The body-whorl is relatively very large, subdiscoidal, and convex, forming a blunt angle at the periphery; this angle carries about three decussated spirals, nodose at the points of intersection. The base is tumid, and largely excavated by the funnel-shaped umbilicus; strong spirals are decussated by sinuous radii not extending quite to the margin. Aperture ovate-depressed.

Relations and Distribution.—One of the most prominent features in this species is presented by the radial costæ of the flat part of the whorls, and this likewise is characteristic of the other varieties of *Pl. Debuchii*.

My specimens are from the *Murchisonæ*-zone of Chideock and Bradford Abbas, and there are smaller ones, with a rounder basal periphery, from the *Concavus*-bed. Rare.

A micromorph closely resembling *Pl. platyspira*, d'Orb. (= *Pl. Debuchii*, var. *platyspira*, Deslongch.), occurs in the *Murchisonæ*-zone at Crickley.

378. Pleurotomaria mirabilis, *Deslongchamps*, 1848. Micromorph. Plate XXXIX, figs. 7 *a*, 7 *b*, 7 *c*.

1848.	Pleurotomaria mirabilis, *Deslongchamps*.			Vol. cit., p. 31, pl. xvi, fig. 2.
1854.	—	—	—	D'Orbigny, Terr. Jur., vol. ii, p. 433, pl. cccIvii.

There are two specimens in my collection (one figured), which possess the characteristic euomphaloid shape, sunken spire, wide umbilicus, and general ornamentation of this remarkable Middle Lias species. The ornaments on the upper side present some difference, being finer and less nodose. The specimens are small, the breadth averaging about 20 mm. Provisionally labelled *Pl.* "*submirabilis*"; there is scarcely sufficient material for constituting a new species. Believed to come from the *Murchisonæ*-zone of Bradford Abbas.

From the above it may be gathered that we have three Middle Lias species reappearing in the *Murchisonæ*-zone, viz. *Pl. Mopsa*, *Pl. platyspira*, and *Pl. mirabilis*; the two latter as micromorphs.

379. Pleurotomaria subaraneosa, sp. nov. Plate XXXIX, figs. 1 *a*, 1 *b*.

Description:

Height (medium size)	38 mm.
Basal diameter	45 mm.
Spiral angle	85°.

Shell conical, turrited, only slightly umbilicate. Spire regular and sharp, except just at the apex, where it is rather flattened. Whorls in a medium-sized specimen seven, angular, the posterior third having a moderate slope, and the anterior two-thirds being nearly vertical; sutures close and not canaliculate. The keel of each whorl carries a coronet of undulating tubercles, and the whole shell is pervaded by fine and close undulating spiral ornament, which is decussated by extremely fine radial lines.

The sinus-band is wide, flat, and submedian, with spiral striæ decussated by growth-lines, and this kind of ornamentation is continued throughout, except in the body-whorl of very large specimens. The body-whorl is large and biangular; the lower keel, or basal periphery, is scarcely tuberculate, and in very large specimens almost smooth. The base is flat-convex with extremely fine reticulate ornament; the umbilicus is small and inconspicuous, but rather deep in some of the younger forms. Aperture square to subcircular.

Relations and Distribution.—In *Pl. intermedia*, Münster (Goldfuss, pl. clxxxi, 5), which is said to occur in the Lias, we have in many respects a very similar shell; but in that species the sinus-band is represented as occurring on the keel. *Pl. subaraneosa* is little more than a modified form of *Pl. araneosa*, var. *reticulata*, Deslongch. (vol. cit., p. 89, pl. xiv, fig. 5), thus affording another instance of a Liassic survival. Our shell, however, is rather more subdued in ornaments and presents some minor points of difference; which facts, coupled with its comparative abundance in the *Concavus*-bed at Bradford Abbas, seem to entitle it, provisionally at least, to be regarded as a distinct species.

At Bradford Abbas the majority of the specimens are immature, consisting of about five or six whorls. The fine and close reticulate ornamentation is well exhibited in some of these, and there is a specimen from the same horizon at Beaminster where the close and delicate spiral system in the base is well brought out. On the other hand, the base of the larger specimens appears smooth (? from wear). Individuals with eight whorls attain to a large size (basal diam. 80 mm.). In these the umbilicus is almost closed, and the shells present the appearance of having been worn. There is a specimen from Dundry, in Mr. Wilson's Collection, where the ornamentation in the spire is bolder (or better preserved), and this still more nearly resembles *Pl. araneosa*.

In this connection, also, I would draw attention to a specimen (Pl. XXXIX, figs. 2 *a*, *b*) from the Liassic Sands of Gloucestershire, where the ornamentation is bolder than in *Pl. subaraneosa*, and altogether more like that of Deslongchamps' species. N.B.—The actual specimen does not warrant the amount of umbilicus shown in the figure.

Secondly, there remains for consideration the large species of *Pleurotomaria* occasionally found in the lower part of the Yorkshire Dogger, and identified by me

in a general sort of way with *Pl. Anglica*, Sow. I quote the following:—"Owing to the imperfect condition of the shell, an absolutely correct identification of the Dogger fossil with this or that member of the *Anglica*-group is almost impossible. It comes very near to *Pl. araneosa*, Desl." ('Geol. Mag.,' dec. 3, vol. ii, p. 154, pl. iv, fig. 5). This is about as near as we can get pending the discovery of better specimens.

N.B.—Whatever may have been the original or originals of *Pl. Anglica*, Sowerby, that species seems now to be restricted to certain wide-angled tabulate forms which occur in the Lower Lias.

380. Pleurotomaria Yeovilensis, *Tawney*, 1873. Plate XXXIX, figs. 8 *a*, *b*, *c*; and var. rugosior, figs. 9 *a*, *b*.

1873. Pleurotomaria Yeovilensis, *Tawney*. Dundry Gasteropoda, p. 52 (44), pl. iii, fig. 4.

Bibliography, &c.—Pl. Yeovilensis was described by Tawney at a time when good specimens were rare. The locality "Yeovil" was given because so many of the Bradford Abbas fossils in those days were supplied to collections and museums by "fossil-men" who resided at Yeovil, the nearest town to Bradford Abbas.

The species is one of remarkable beauty, and interesting as the representative of the Granulatæ in the Lower Division of the Inferior Oolite. *Pl. Alcibiades* is possibly a more depressed and less ornamented form; this, too, in France most likely occurs on a low horizon, not being noted from the "Oolithe ferrugineuse."

Description:

Height	17 mm.
Basal diameter	30 mm.
Spiral angle	105°.

Shell conical-depressed, deeply umbilicate. Spire regular and sharp, with a slightly flattened apex. Whorls (seven) subangular and sloping; suture subcanaliculate. The whorls exhibit fine reticulate ornaments, having the tendency to become granulate; whilst in the two last whorls an elegant tuberculate corona is developed on the posterior ridge, the tubercles radiating away from the centre.

The sinus-band is very salient, being situated at the anterior angle in the whorls of the spire; it has granulated spiral lines to the number of three. The body-whorl is relatively very large, and, in addition to the posterior corona and the prominence of the sinus-band, exhibits a thick tuberculated belt at the periphery; these tuberculations are drawn out radially, and correspond to the tuberculations of the corona. The base is subconvex, being excavated by a deep

marginal furrow, from which it rises towards the edge of the umbilicus: throughout the base spiral lines are decussated by bold sinuous radii, which die out before reaching the marginal furrow. The umbilicus is steep and smooth, and so deep as to expose the internal coils. Aperture oval, depressed.

Var. *rugosior*.—Of somewhat larger habit than the preceding. The spiral angle is scarcely 90°; consequently the sides of the shell are steeper, whilst the ornaments are coarser, especially throughout the base; the umbilicus, too, is narrower, but equally steep and penetrating.

Relations and Distribution.—Although *Pl. Yeovilensis* possesses considerable general resemblance to *Pl. Baugieri*, especially in its basal aspect, the very different character of the sinus-band forbids them being placed even in the same section. It is not impossible, however, that the Ornatæ and the Granulatæ may, to a certain extent, approach each other in these two species.

Practically, then, as a member of the Granulatæ, *Pl. Yeovilensis* stands alone in the *Concavus*-bed of Bradford Abbas, where excellent specimens are by no means rare. If we desire to see the change wrought through lapse of time we have a remarkable instance in the var. *rugosior*, which represents this species on the next horizon, viz. the *Sauzei*-bed of Oborne. Specimens from Beaminster and Dundry are rare, and not very satisfactory. There is one specimen in my Collection from Bradford Abbas, which in its depressed spire and soft ornamentation might almost pass for *Pl. Alcibiades*.

381. Pleurotomaria granulata, *Sowerby*, 1818. Plate XXXIX, figs. 10 *a*, 10 *b*, 10 *c*; and Plate XL, figs. 1, 1 *a*.

1818. Trochus granulatus, *Sowerby*. Min. Conch., pl. ccxx, fig. 2.
1873. Pleurotomaria granulata, *Sowerby*. Tawney, Dundry Gasteropoda, p. 47 (39).
Syn. — — vars. reticulata and cœlata, *Deslongchamps*. Vol. cit., p. 101, pl. xvi, figs. 6 and 8.

Bibliography, &c.—Morris ('Cat.,' p. 271) quotes *Pl. granulata*, Sowerby, from the Corallian of Malton and Scarborough; and also from the Inferior Oolite of Blue Wick (Dogger). There is no justification for this. He also quotes the species from Dundry, which is correct.

The forms described below, which I regard as being nearly if not absolutely identical with *Trochus granulatus*, Sow., may be accepted as the central figures of the *Granulata*-group, the others being regarded as species or varieties according to individual opinion.

Description :

Height (elevated variety)	28 mm.
Basal diameter	40 mm.
Spiral angle	95°.

Shell conical-depressed, slightly umbilicated. Spire regular and sharp, the angle ranging from 95° to about 110°. Whorls (seven) flat and sloping, with a close suture which is scarcely canaliculate. The ornamentation is granulated throughout, a feature arising from an elevated decussation of the spiral and radial lines. A belt which is studded with a kind of triple tuberculation forms the base of each whorl, but the ornaments of this belt are subject to modification, and its character is sometimes changed owing to the undercutting of the whorls.

The sinus-band is anterior, round, and prominent, but not wide. In the earlier stages are spiral lines decussated, but in the later stages the growth-lines alone are seen, very closely packed (Pl. XL, fig. 1). The body-whorl is relatively large with granulate ornament and a blunt belt, or basal carina, richly granulated or tuberculated, these tuberculations losing their sharpness towards the anterior extremity. Base convex, with spiral ornamentation rather faint, generally wanting in the middle portion of the base, though the radial lines are pretty strong. Umbilicus rather small, and inclined to be funnel-shaped. Aperture subrhomboidal.

Relations and Distribution.—Originally described from Dundry, *Pl. granulata* swarms in the *Sauzei*-bed at Oborne and other localities in the Sherborne district. There is a wide-angled variety from Milborne Wick (XXXIX, 10) which, to a certain extent, prefigures forms that are characteristic of the *Parkinsoni*-zone, *e. g. Pl. Palæmon.*

382. Pleurotomaria phylax, sp. nov. Plate XL, figs. 4 *a*, 4 *b*, 4 *c*.

This rather curious shell is found rarely in the *Sauzei*-bed at Oborne, and may be a sport or megalomorph of the more depressed variety of *Pl. granulata*. The sinus-band, however, presents considerable differences.

Description :

Height	25 mm.
Basal diameter	44 mm.
Spiral angle	115°.

Shell conical-depressed, thick, slightly umbilicate. Spire rather convex with a very obtuse apex. Whorls (six) sloping regularly to the basal carina, which in some cases is rather undercut. The spiral ornamentation is delicate and regular

throughout, but the radial decussation is so slight that the shell is merely subgranulate.

The sinus-band is below the middle and not conspicuous, owing to the resemblance of its spiral lines to the general spiral system; there is a strong central line and a fine one on each side. The body-whorl is bluntly angulated at the periphery and carries an obtuse carina with about three subgranulate spirals, corresponding to the basal keels in the spire whorls. Base extremely convex, with well-marked spirals only faintly decussated by radii; umbilicus small. Aperture ovate to subrhomboidal.

N.B.—The three following "species" represent the *Granulata*-group in the *Parkinsoni*-zone, and exhibit a sequence of forms from the flat and delicately-sculptured *Pl. Palæmon* to the turrited and rugose *Pl. trapeza*, the species next described occupying the middle position.

383. Pleurotomaria plicopunctata, *Deslongchamps*, 1848. Pl. XL, figs. 2 *a*, 2 *b*, 2 *c*.

1848. Pleurotomaria granulata, var. plicopunctata, *Deslongchamps*. Vol. cit., p. 102, pl. xvi, figs. 7 *a*, *b*.

Syns. — ornata, *Defrance*. Diet. Sci. Nat., vol. xli, p. 382, pl. lxxxvi, fig. 2.

— — — Deshayes, Coq. caract., p. 179, pl. iv, fig. 3.

— granulata, *Deslongchamps*. D'Orbigny, Terr. Jur., vol. ii, p. 466, pl. cccIxxx, figs. 1—6.

— ornata, *Defrance*. Morris, Cat., p. 271.

— Defrancii, *Hudleston and Wilson*. Cat. Brit. Jur. Gast., p. 102.

Bibliography, &c.—Owing to the original misapprehension of Defrance in identifying this member of the *Granulata*-group with Sowerby's *Trochus ornatus*, there has been a considerable amount of confusion in the nomenclature. Endeavouring to escape from the labyrinth of "granulatas" and "ornatas" which invested it, Messrs. Hudleston and Wilson proposed the specific name "*Defrancii*." This had, however, been already applied by d'Archiac and de Verneuil ('Trans. Geol. Soc.,' 2nd series, vol. vi, p. 360) to a palæozoic *Pleurotomaria*. In order to distinguish this species it seems best to fall back on Deslongchamps' varietal name.

Description:

Height	16 mm.
Basal diameter	35 mm.
Spiral angle	125°—130°.

Shell depressed, umbilicus deep and narrow. The spire is convex-depressed with a flattened apex. Whorls (seven) flat and sloping, and ornamented with oblique radial costæ which are granulate at the points of intersection with the spiral system.

The sinus-band forms a narrow, prominent ridge rather more than halfway down; owing to its prominence the spiral lines have not been well preserved, the general appearance being that of a narrow, winding cord. The body-whorl is relatively large, angular-compressed, and provided with a narrow, tuberculated carina at the periphery; base very convex and ornamented with a system of flexuous radial costæ, which spring from the margin of the small but deep umbilicus. Aperture oval-depressed and oblique.

Relations and Distribution.—*Pl. plicopunctata* differs from *Pl. granulata* in being more depressed, in its narrow but deep umbilicus, and especially in the conspicuous radial ornamentation of the base. In both there is a tendency to develop a tuberculated basal carina in the lower whorls of the spire, which adds materially to the beauty of the shell.

It is mainly a fossil of the *Parkinsoni*-zone, being especially abundant at Burton Bradstock, Vitney Cross, &c., also in the *Parkinsoni*-zone of Bradford Abbas, Stoford, &c. There is considerable variety, with a tendency on the one hand to pass into *Pl. Palæmon*, and on the other into *Pl. trapeza*.

384. Pleurotomaria Palæmon, *d'Orbigny*, 1850. Plate XL, figs. 3 *a*, 3 *b*, 3 *c*.

1850.	Pleurotomaria Palemon, *d'Orbigny*.		Prod., i, p. 267.
1854.	—	— —	Terr. Jur., vol. ii, p. 468, pl. ccclxxx, figs. 7—11.
1873.	—	Palæmon, *d'Orbigny*.	Tawney, Dundry Gasteropoda, p. 48 (40).
Syn.	—	granulata, vars. lentiformis and lævigata, *Deslongchamps*.	Vol. cit., p. 101, pl. xvi, figs. 4 and 5.

Bibliography, &c.—It is pretty clear that Tawney, in quoting this species, was disposed to include both *Pl. plicopunctata* and *Pl. Palæmon* under the latter designation. Undoubtedly they are near relatives.

Description:

Height	13 mm.
Basal diameter	35 mm.
Spiral angle	142°.

The sunken spire, fineness of the lines, and the absence of coarse radial ornamentation in the base, are the principal features which separate *Pl. Palemon* from the preceding species. It is essentially a fossil of the *Parkinsoni*-zone, and

possibly also of the higher parts of that zone. I have one specimen from Shotwell, which in all respects corresponds with d'Orbigny's figure. The specimen figured in the accompanying plate (Pl. XL, fig. 3) is between this extremely smooth form and the ordinary *Pl. plicopunctata*.

385. Pleurotomaria trapeza, sp. nov. Plate XL, figs. 5 *a*, 5 *b*.

Description:

Height	35 mm.
Basal diameter	44 mm.
Spiral angle	95°.

Shell trochiform, subtabulate, slightly umbilicated. Spire regular, with sharp apex. Whorls (seven) angular, and increasing by steps; the posterior area has a moderate slope, whilst the anterior area (below the sinus-band) is almost perpendicular, and constitutes a broad costated girdle round each whorl; sutures close. The spiral system is overpowered by strong radial costæ, which are oblique above the sinus-band and axial below.

The sinus-band is narrow and prominent, being situated mesially at the angle of the whorl; owing to its prominence the ornaments seem worn. The body-whorl is large and bluntly angular at the periphery, so as to be slightly biangular Base very convex, with spiral ornamentation stronger than the radial; umbilicus small. Aperture subquadrate

Relations and Distribution.—Intermediate forms between this and the larger varieties of *Pl. plicopunctata* may be noted, and yet there is a tolerably sudden jump at last; whilst in the narrowing of the spiral angle there is a sort of return to *Pl. granulata* of the lower horizon. Still I do not doubt that this is a kind of offshoot from the common "granulate" *Pleurotomaria* of the *Parkinsoni*-zone (*i. e. Pl. plicopunctata*). Moreover it is of importance with reference to the occurrence of a tabulate form connected with the Granulatæ on higher horizons, such as *Pl. granulata*, Lycett, of the Scarborough Cornbrash, and even *Pl. Münsteri*, Röm. (*Pl. filigrana*, Deslongch.), of the Lower Corallian. See page 440 with reference to Morris' identification of *Pl. granulata* on different horizons.

Pl. trapeza is found at Burton Bradstock, and may be expected to occur at Broadwinsor, and other localities of the *Parkinsoni*-zone.

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A MONOGRAPH

OF THE

BRITISH JURASSIC GASTEROPODA.

BY

WILFRID H. HUDLESTON, M.A., F.R.S., &c.,

VICE-PRESIDENT OF THE PALÆONTOGRAPHICAL SOCIETY.

PART I, No. 9.

GASTEROPODA OF THE INFERIOR OOLITE.

PAGES 445—514; PLATES XLI—XLIV.

WITH TITLE-PAGE AND DIRECTIONS FOR BINDING.

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Genus—Trochotoma, *Deslongchamps*, 1842.

"*Shell trochiform, conical or depressed; base infundibuliform; whorls but slightly convex, keeled; sinus band obliterated up to the lip, with the exception of an oblong fissure, choked in the middle, bipartite; aperture subquadrangular, oblique; lip simple and without slit; columellar lip deeply sunk in the false umbilicus, entire, sinuous.*"—Fischer.

Specimens in our Inferior Oolite, which exhibit the more interesting characters of this genus, such as the strangulation of the fissure, and the sinuous or toothed character of the columellar lip, are exceedingly rare. This partly arises from the false umbilicus being plugged up with matrix. The toothed character of the columellar lip is well shown in a specimen of *Trochotoma Lindonensis*, from Lincoln (Pl. XLI, fig. 9). Fischer in 1885 constituted the section, *Didymodon*, on this feature, the type being *Trochotoma quinquecincta*, Zieten, from the Corallian of Nattheim, which in many respects resembles the Lincoln specimen.

The genus *Trochotoma* in this country is mainly confined to the Lower Oolites, being most abundant in the Bathonian section. The lowest horizons of our Inferior Oolite in Dorsetshire contain some forms which in Normandy are quoted from the Lias, such as *Trochotoma gradus*. We may admit that *T. gradus*, *T. affinis*, and *T. calix* are little more than varieties of one tabulate form.

386. Trochotoma calix, *Phillips*, 1829. Plate XLI, figs. 1 *a*, 1 *b*, variety from the Cotteswolds, approaching *T. affinis*, Deslongchamps; figs. 6 *a*, 6 *b*, 6 *c*, typical form from the Dogger; fig. 7.

1829.	Solarium calix, *Bean*, MS.	Phillips, Geol. Yorks., pt. 1, p. 157, pl. xi, fig. 30.
1854.	Trochotoma calyx, *Phillips*.	Morris, Cat., p. 280.
1875.	— — —	Geol. Yorks., pt. 1, 3rd edit., p. 259.
1885.	— calix, *Phillips*.	Hudleston, Geol. Mag., dec. 3, vol. ii, p. 156, pl. iv, figs. 6, 6 *a*, 6 *b*.
	Non Pleurotomaria calix, *d'Orbigny*.	Terr. Jur., vol. ii, p. 476, pl. cccl xxxiii, figs. 6, 7.

Bibliography, &c.—On the view that we should separate *T. calix* from *T. gradus* and *T. affinis*, the synonymy given by me in the 'Geol. Mag.' is too comprehensive.

The type specimen of *Solarium calix* is not, I believe, to be found at York,

but Phillips' figure is characteristic. There are two varieties in the Dogger which we may refer to *T. calix*. Specimens are not uncommon, but the state of preservation is indifferent.

Description (more depressed variety) :

Height	16 mm.
Basal diameter	24 mm.
Spiral angle about	90°.

Shell trochiform, tabulate, and profoundly excavated. Whorls (five) nearly rectangular, with a close suture. In some specimens the whorls of the spire show only one keel; but in others, where the spire is relatively higher, a lower keel is exposed. The upper keel is situate at the angle, and carries the obliterated fissure-band. Spiral ornament regular and in raised lines, which are somewhat wide apart (see fig. 7) and ropy, the sides of the whorls being somewhat concave.

The body-whorl exhibits a well-defined lower keel which is thick and sub-angular at the periphery; hence the body-whorl is strongly bicarinate and subconcave. The base is widely excavated. The aperture is depressed and oblique, but the available specimens from the Dogger do not admit of any close description. The loop is long and narrow, and its presence is often indicated on the upper keel by a raised border. In other specimens the loop, having been a source of weakness, causes a deflection in the continuity of the keel.

The variety from the Cotteswolds (figs. 1 *a*, 1 *b*), which presents features intermediate between *T. calix* and *T. affinis*, has a narrower spiral angle and a larger habit of growth. In some of these specimens it is possible to note the sinuous character of the columellar lip.

Relations and Distribution.—The features on which it is relied to separate *T. calix* from its undoubtedly close relatives, *T. gradus* and *T. affinis*, are possibly of little biological value. There really is very little difference except as to size, and, to some slight extent, in ornamentation. The truth is that all these tabulate Trochotomas are very much alike. Yet in the Dogger and partially also in the Cotteswolds certain small forms or races prevail which we know as *T. calix;* whilst in the Anglo-Norman area larger and more markedly tabulate forms, such as *T. gradus* and *T. affinis*, occupy the ground.

T. calix is fairly abundant in the *opalinus*-zone (Dogger) of Yorkshire, and a very similar form, with a very thick basal rim, occurs in the *opalinus*-zone of Frocester Hill. In the Oolite-Marl horizon (*Murchisonæ*-zone) we also get these small forms with the thick basal rim, as well as others of a larger size (figs. 1 *a*, 1 *b*) where this feature is not so conspicuous. In the base-bed at Lincoln (*Murchisonæ*-zone) are forms showing the connection between *T. calix* and *T. Lindonensis*.

387. Trochotoma gradus, *Deslongchamps*, 1842. Inferior Oolite variety. Plate XLI, figs. 2 and 3.

1842. Trochotoma gradus, *Deslongchamps*. Mém. Soc. Linn. Norm., vol. vii, p. 106, pl. viii, figs. 4—7.
1873. — — — Tawney, Dundry Gasteropoda (p. 53), 45.
Syn. Ditremaria bicarinata, *d'Orbigny*. Terr. Jur., vol. ii, p. 380, pl. cccxl, figs. 8—11.

Bibliography, &c.—The fossils described under the above title are not exactly the same as *T. gradus*, which in Normandy is regarded as a Liassic species. They are in fact intermediate between *T. gradus* and *T. affinis*.

Description :

Height	28—30 mm.
Basal diameter	40 mm.
Spiral angle	95°.

Shell trochiform and broadly tabulate, with a somewhat obtuse apex; whorls of the spire almost rectangular and increasing by wide steps, being strongly angulated towards the middle. The ornaments consist of regular spiral lines, which pervade the entire shell and are somewhat wide apart; the lines are decussated obliquely. Sutures close.

The body-whorl is strongly bicarinate, the anterior carina forming a blunt angle at the periphery, whilst the space between the carinæ is considerably excavated. The base is infundibuliform and rounded towards the periphery, which is striated like the spire. Aperture for the most part concealed in all specimens available to me.

Relations and Distribution.—This is a tabulate form of *Trochotoma*. All my specimens are from Coker, occurring in beds which yield such an abundance of *Cirrus* (*Murchisonæ*-zone). Tawney mentions its occurrence at Dundry, but possibly this might be held to include *T. affinis*.

388. Trochotoma affinis, *Deslongchamps*, 1842. Plate XLI, fig. 4.

1842. Trochotoma affinis, *Deslongchamps*. Mém. Soc. Linn. Norm., vol. vii, p. 106, pl. viii, figs. 8—10.
Syn. Ditremaria affinis, *d'Orbigny*. Terr. Jur., vol. ii, p. 381, pl. cccxli, figs. 1—3.
— Trochotoma carinata, *Lycett*. Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 417; and Cotteswold Hills, pl. iv, fig. 5.

Description :

Height	26 mm.
Basal diameter	32 mm.
Spiral angle	85°.

This is a less broadly tabulate form than the one previously described, the whorls being higher and the apex sharper. In some cases also the whorls are more numerous (six to seven). In other respects similar to *T. gradus*.

Relations and Distribution.—The figured specimen is from Stoford, and may be taken as the representative of *T. affinis*. Lycett figured his *T. carinata* with the fossils of the *Spinosa*-stage.

As before observed, we are almost entitled to look upon *T. calix*, *T. affinis*, and *T. gradus* as varieties of one species; where *T. gradus* is a large tabulate form with about six whorls and an obtuse apex, *T. affinis* is a large subtabulate form with higher whorls and a sharper apex; whilst *T. calix* is a small subtabulate form with five whorls and a very obtuse apex.

389. Trochotoma depressiuscula, *Lycett*, 1850. Plate XLI, fig. 10.

1850.	Trochotoma depressiuscula,	*Lycett.*	Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 417.
1853.	—	—	—	Proc. Cotteswold Nat. Club, vol. i, p. 78.
Cf. also	—	discoidea,	*Römer.*	Morris and Lycett, Grt. Ool. Moll., pt. i, p. 84, pl. x, fig. 10.

Bibliography, &c.—*T. depressiuscula* was not accepted by Morris in 1854, nor by Hudleston and Wilson in 1892. The type specimen is in the Jermyn Street Museum.

Description :

Height	13 mm.
Basal diameter	24 mm.
Spiral angle	100°.

"Depressed; whorls five, narrow and angulated; ribs below the angle three, above more numerous. Upper surface of the whorls concave, lower flattened; base striated, excavation large not deep, height half the basal diameter."

Relations and Distribution.—More depressed even than *T. gradus*, and less strongly bicarinated. It is nearly related to "*T. discoidea*, Römer," of the Great Oolite Mollusca, and may be the same as that form.

390. Trochotoma Lindonensis, sp. nov. Plate XLI, figs. 8, 8 *a*, and 9.

But cf. Trochus quinquecinctus, *Zieten.* Verstein. Württ., p. 46, pl. xxxv, fig. 2 (*Trochotoma quinquecincta*, Zieten, Fischer, Man., p. 848).

Cf. also Trochotoma calix, *Phillips.* Lycett, Cotteswold Hills, pl. iii, fig. 6 (fossils of the *Fimbria*-stage).

Description :

Height	9 mm.
Basal diameter	11 mm.
Spiral angle	80°.

Shell thick, conical, subtabulate, and largely excavated. Spire rather obtuse at the apex, otherwise regular. Number of whorls five to six; these are angular with a narrow tabular ledge and steeply sloping flanks; sutures slightly canaliculate. The ornaments are sharp and conspicuous; the narrow posterior flat area of each whorl is marked by a strong granular spiral line between two deep sulci; the upper carina at the angle of the whorls is boldly prominent and somewhat subdivided, although there is no actual fissure-band; there is a single spiral rather below the middle of the side of the whorl (fig. 8 *a*), and this is followed by a sort of double basal keel, which causes the whorls of the spire, except at the extreme apex, to be bicarinate.

The body-whorl is strongly bicarinate with a very full and bluntly angular periphery, which is spirally striated up to the margin of the excavation. The loop is long and narrow. The aperture is subquadrangular, but curiously indented owing to the sinuous and toothed character of the columellar lip; the outer lip is thin at the margin, but toothed and grooved internally, in connection apparently with the loop.

Relations and Distribution.—The Lincoln shells are, in some cases, so well preserved as to exhibit characters which may exist in other British specimens of *Trochotoma*, but are yet obscured by the plugging of the basal cavity; hence a comparison with *T. calix*, for instance, is difficult. *T. Lindonensis* is related to *T. calix* just in the opposite direction to the latter's affinity for *T. gradus*. But it is distinguished from *T. calix* by its more conical outline, higher spire, and narrow tabulation; also by the invariable bicarination of the spire whorls, and the very considerable difference in the details of ornament. The specimen figured by Lycett as *T. calix* from the *Fimbria*-stage of the Cotteswolds possesses some of the features of *T. Lindonensis*, especially as regards ornament, and seems to be a kind of intermediate form.

On the other hand, *T. Lindonensis* presents a strong resemblance to *T. quinque-*

cincta, a Corallian species, and may possibly be identical. *T. Lindonensis* is rather abundant in the "base-bed" at Lincoln (*Murchisonæ*-zone), where it seems to replace *T. calix*. Specimens of *Trochotoma* from the Ironstone of Duston also possess considerable resemblance to the Lincoln shells.

391. Trochotoma funata, *Lycett*, 1850. Plate XLI, figs. 5 *a*, 5 *b*.

1850.	Trochotoma funata, *Lycett*.			Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 417.
1853.	—	—	—	Proc. Cotteswold Nat. Club, vol. i, p. 78.
1854.	—	—	—	Morris, Cat., p. 280.

Bibliography, &c.—The acceptance by Morris of this species as an Inferior Oolite fossil is a strong point in its favour, but owing to the absence of any material evidence it was not listed by Hudleston and Wilson. Since that time a specimen answering fairly well to Lycett's diagnosis has been obtained from the Pea-grit of Nailsworth Hill. In some respects this specimen reminds me of *Pleurotomaria*.[1]

Description:

Height	12 mm.
Basal diameter	14 mm.
Spiral angle	65°.

"Elevated, acuminated, nearly smooth; whorls convex, their lower portions flattened, with numerous encircling granulated ribs, faintly traced; basal excavation contracted. Height about equal to the basal diameter."

The aperture of the figured specimen has greatly the aspect of *Pleurotomaria*, but I cannot find any trace of the sinus-band.

Family—Fissurellidæ.

Shell conical, limpet-shaped; apex recurved; nucleus spiral, often disappearing in the course of growth; anterior margin notched or shell perforated; muscular impression horseshoe-shaped, open in front.

There are three genera of this family in the Inferior Oolite, *Rimula* being the most characteristically developed. In the case of *Emarginula* the anterior notch is not always in evidence. It is probable that the shells in the Jurassic Rocks

[1] Lycett also described "*Pleurotomaria funata*."

hitherto referred to *Fissurella* belong to another genus, possibly to *Puncturella*. I have never seen either in the Inferior Oolite or the Great Oolite a true keyhole Limpet.[1]

I have not seen any members of this family in the Dorset-Somerset district, nor in the Yorkshire Dogger. Inferior Oolite specimens are from the Cotteswolds and the Lincolnshire Limestone, but in all cases somewhat rare.

Genus—Emarginula, *Lamarck*, 1801.

Shell oval, conical, elevated, with the apex recurved; surface cancellated; anterior margin notched; nucleus spiral; slit variable in extent.

392. Emarginula scalaris, *Sowerby*, 1826. Plate XLI, figs. 12 *a*, 12 *b*. N.B.—In the figured specimen the intercostal lamellæ have perished.

1826.	Emarginula scalaris, *Sowerby*.			Min. Conch., pl. dxix, figs. 3 and ? 4.
1851.	—	—	—	Morris and Lycett, Gt. Ool. Moll., pt. i, p. 88, pl. viii, fig. 4.
1854.	—	—	—	Morris, Cat., p. 246, as from the Great Oolite and Inferior Oolite.
1885.	Emarginula scalaris, *Sowerby*.			Cossmann, Étage Bathonien, p. 346, pl. xii, figs. 39 and 40.
? Non	—	—	—	Deslongchamps, Mém. Soc. Linn. Norm., vol. vii, p. 125; and ? pl. vii, figs. 30—32.

Bibliography, &c.—The Ancliff fossils differ somewhat from those now figured; but the differences are probably due to mineralisation to some extent. Deslongchamps' identification is held by Cossmann to be incorrect, and he has named the species so identified *E. Deslongchampsi*.

Description (based on specimens from the Lincolnshire Limestone):

Length	Approximate	. . .	4 mm.
Width		. . .	2·75 mm.
Height		. . .	2·75 mm.

Shell elevated, apex posterior, periphery ovate, with slight expansion of the anterior area. The ribs, about seventeen in number, are nearly equal and

[1] Pl. viii, fig. 5, of Morris and Lycett's work must, I fear, be regarded as the result of artistic treatment.

prominent, but considerably narrower than the intercostal spaces. The latter are traversed by a system of cross-lines or lamellæ, giving the shell a scaly appearance (scarcely seen in the figured specimen). The two ribs which enclose the fissure approximate, but of the length of the fissure it is not easy to speak with certainty. The margin was probably crenulate.

Relations and Distribution.—This form, which most nearly approaches *E. scalaris* of the Great Oolite, is fairly abundant in what is believed to be the upper part of the Lincolnshire Limestone at Spittlegate Quarries. The species is quoted by Lycett from the Inferior Oolite of Leckhampton, but I have not seen any satisfactory specimens from that quarter.

393. Emarginula Leckhamptonensis, *Lycett*, 1850. Plate XLI, figs. 11 *a*, 11 *b*.

1850.	Emarginula Leckhamptonensis,	*Lycett.*		Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 415.
1853.	—	—	—	Proc. Cotteswold Nat. Club, vol. i, p. 76.

Description.—"Oval, depressed; apex posterior; costæ large, rounded and tuberculated, where crossed by encircling lines; costæ twenty-six in number."

The figured specimen answers in many respects to Lycett's brief diagnosis, especially as to its oval shape and depressed character, but the costæ are no more than twenty in number. The following are the dimensions of the figured specimen, which is from Leckhampton.

Length	Approximate	. . .	2·5 mm.
Width		. . .	2 mm.
Height		. . .	1·25 mm.

394. Emarginula Lindonensis, sp. nov. Plate XLI, figs. 14 *a*, 14 b; and ? 13 *a*, 13 *b*.

Description:

Length	.	.	.	.	4 mm.
Width	.	.	.	.	3 mm.
Height	.	.	.	.	2·75 mm.

Shell elevated, apex very posterior, periphery ovate and rather expanded anteriorly. Number of ribs twenty-five to twenty-six, prominent and wide. The intercostal spaces have closely-set lamellæ which infringe upon the costæ and produce a granular appearance; very fine intermediate costæ may also be noticed. There is but slight approximation of the pair of ribs which contain the fissure.

Relations and Distribution.—This is an elegant little shell belonging to the more highly ornamental species of *Emarginula*, represented in the Great Oolite by *E. Deslongchampsi*, Cossmann. The number of ribs and general ornamentation answer to *E. Leckhamptonensis*, Lycett. But this is an elevated species, whereas *E. Leckhamptonensis* is a depressed one. The "base-bed" at Lincoln has furnished the type, besides two smaller forms of similar shape but with fewer ribs.

The specimen (Figs. 13 *a*, 13 *b*) from the Lincolnshire Limestone of Stoke Lodge, with much the same dimensions and ornamentation, has a less oval periphery and only twenty ribs. In some respects this form seems intermediate between *E. scalaris* and *E. Lindonensis*.

395. Emarginula granulata, *Lycett*, 1850. Not figured.

1850.	Emarginula granulata, *Lycett.*			Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 415.
1853.	—	—	—	Proc. Cotteswold Nat. Club, vol. i, p. 76.
1854.	—	—	—	Morris, Cat., p. 246.

Bibliography, &c.—There must have been something unusually satisfactory in this species to induce Morris, who ignored the majority of Lycett's Inferior Oolite list, to give it a place in his catalogue. Hudleston and Wilson did not recognise it. Lately, however, the Brodie-Lycett collection has been acquired for the Jermyn Street Museum, and what purports to be a named specimen from the shelly freestones of Leckhampton is available for inspection.

Description—"Ovately globose; apex curved posteriorly; costæ numerous, very fine, with others still more delicate alternating, and rendered granular by transverse encircling lines."[1]

Genus—Rimula, *Defrance*, 1819 (? 1827).

Shell having a general resemblance to Emarginula, *but more capuliform, with a perforation on the midrib near the anterior margin, which is itself entire.*

Fischer, who regards this as a sub-genus, expresses a doubt whether the shells of the Mesozoic rocks, referred to *Rimula*, have precisely the same interior structure as those of more recent date.

[1] Lycett, 'Ann. Mag. Nat. Hist.,' 2nd ser., vol. vi, p. 410, also quotes *E. planicostula*, Deslong., from the I. O. of Leckhampton, and this is accepted by Morris.

396. Rimula clathrata, *Sowerby*, 1826. Plate XLI, figs. 15 *a*, 15 *b*.

1826.	Emarginula clathrata, *Sowerby*.			Min. Conch., pl. dxix, fig. 1.
1851.	Rimula clathrata, *Sowerby*.			Morris and Lycett, Gt. Ool. Moll., pt. i, p. 86, pl. viii, fig. 1.
1854.	—	—	—	Morris, Cat., p. 276, from G. O. only.
1885.	—	—	—	Cossmann, Étage Bathonien, p. 342, pl. vi, figs. 31—33.

Bibliography, &c.—Essentially a Great Oolite species, the type being from Ancliff, rare at Minchinhampton; stated by Cossmann to be tolerably abundant at Epernay. Quoted by Lycett from the Inferior Oolite, Leckhampton. I have not seen satisfactory specimens myself from that locality. On the other hand, the Lincolnshire Limestone, which contains so many Bathonian forms, has yielded quite a series of fossils at Stoke Lodge, which may fairly be ranked under *R. clathrata*, though somewhat more angular in outline than the Ancliff shells.

Description (Inf. Ool. variety):

Length of base	approximate	. .	6 mm.
Width		. .	4·5 mm.
Height		. .	5 mm.

Shell capuliform with a perfectly oval base and curved apex, which projects considerably beyond the posterior margin. The convex dorsal area is somewhat flattened on each side of the very conspicuous midrib, which is separated from the ribs of either flank by a considerable space. From eight to ten strong longitudinal ribs on each side ornament the surface, and these are strongly decussated by transverse ribs producing nodes at the points of intersection: subsidiary longitudinal ribs may also be noted. The midrib is thick, and the lower edge of the perforation at a considerable distance from the anterior margin.

Relations and Distribution.—The size, the somewhat rounded back, and especially the regularly nodose ornamentation, may serve to distinguish this from any other species of *Rimula* in the Inferior Oolite. My specimens are all from Stoke Lodge.

397. Rimula rugosa, sp. nov. Plate XLI, figs. 16 *a*, 16 *b*.

Description:

Length	approximate	. . .	4 mm.
Width		. . .	2·5 mm.
Height		. . .	2·75 mm.

Shell small, conical, elevated; base oval, apex strongly curved posteriorly, sides compressed. The midrib and the two diverging lateral ribs on the anterior

area constitute a tricarinate figure, whilst smaller ribs to the number of about nine on each side occupy the flanks and posterior area. Extremely rich transverse ornament pervades the entire shell. The perforation (incorrectly shown in the apical figure) is at some distance from the anterior margin.

Relations and Distribution.—Differs from *R. tricarinata*, Sow, in being more elevated, in the less square outline of the anterior margin, and in the stronger character of the side ornaments. Two specimens from the "base-bed," Lincoln.

398. Rimula subtricarinata, sp. nov. Plate XLI, figs. 17 *a*, 17 *b*.

Description.—This is an extremely small shell, so that even approximate measurements are difficult to obtain. Fairly elevated, with the apex curved so as to slightly overhang the posterior margin; with three conspicuous anterior ribs, of which the midrib is much the thickest, whilst the other two are thin and divergent; these constitute a tricarinate figure with a squarish anterior margin. The sides and posterior part of the shell are thickly costated, and the whole surface is marked with transverse lines, so as to produce a close and delicate reticulation throughout. The perforation is fairly distant from the anterior margin.

Relations and Distribution.—While evidently related, as regards its general figure, to *R. tricarinata*, Sow., the ornaments in this species are much closer and finer, also the two divergent anterior ribs are more slender. There are five specimens in my collection from the Pea-grit of Leckhampton.

399. Rimula alta, *Lycett*, 1850. Plate XLI, figs. 18 *a*, 18 *b*.

1850. Emarginula alta, *Lycett*. Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 416.
1853. — — — Proc. Cotteswold Nat. Soc., vol. i, p. 77.

Bibliography, &c.—Morris does not quote this species in his 'Catalogue' (1854), Fortunately there is one well-preserved specimen in the Jermyn Street Museum. which may be accepted as the type. This is evidently a *Rimula*, and is so marked in that collection.

Description:

Length of base	5·5 mm.
Width	3·75 mm.
Height	5 mm.

"Shell much elevated, compressed laterally; apex curved posteriorly, the convex side beneath the apex having narrow, simple, smooth, elevated ribs, of

which the middle one is the most prominent; there are also slight traces of smaller costæ upon the flattened sides of the shell; the height exceeds the length of the aperture; rare."

This diagnosis agrees with the specimen in the Jermyn Street Museum, although, according to my measurements, the height does not quite equal the length of the base.

Relations and Distribution.—The relative height and compression may serve to distinguish this from any other species of *Rimula*, though it is evidently related to the species erroneously identified by Morris and Lycett ('Great Oolite Moll.,' pt. i, p. 87, pl. viii, fig. 3), with *Rimula* (*Emarginula*) *Blotii*, Deslongchamps. The form figured by Morris and Lycett has been referred with a query to *R. Deslongchampsi*, Cossmann ('Ét. Bath.,' p. 342, pl. xii, figs. 33—34). *Rimula alta*, as a species, is based on a single good specimen from Leckhampton.

400. Rimula oolitica, sp. nov. Not figured.

This name I propose for the forms in the Inferior Oolite which several British authors have referred, under the generic title of *Rimula*, to *Emarginula Blotii*, Deslongchamps.[1]

Description.—Shell small, strongly tricarinate, sides much compressed and flattened, and ornamented by seven or eight curved costæ of considerable prominence. The two intercarinal grooves are narrow, and show no trace of an intermediate rib. Transverse scalate ornament pervades the shell. Other indications clearly those of a *Rimula* and not of an *Emarginula*.

Relations and Distribution.—Differs from *R. tricarinata*, Sow., in its narrow, compressed, and elongated form: not so elevated as *R. alta*, which also possesses somewhat different lateral ornamentation; resembles the Great Oolite species

[1] Thus we find the following identifications:

1851.	Rimula Blotii, *Deslongchamps.*		Morris and Lycett, Gt. Ool. Moll., pt. i, p. 87, where it is stated to occur in the shelly roestone at Leckhampton.
1854.	—	—	Morris, Cat., p. 275, both in G. O. and I. O.
1875.	—	Blottii (sic), *Deslongchamps.*	Judd, Geology of Rutland, p. 282, as a fossil of the Inf. Ool. in the Midlands (Etheridge).
1892.	—	Blotii, *Deslongchamps.*	Hudleston and Wilson, Cat., p. 116, both in G. O. and I. O. This view was based on the identifications of the authors previously quoted.

figured by Morris and Lycett (Great Oolite Moll., pt. i, p. 87, pl. viii, fig. 3), but is more compressed, more sharply angular, and quite devoid of the intermediate ribs in the intercarinal grooves.

There are three specimens from the Leckhampton freestones in the Brodie Collection.

Genus—PUNCTURELLA, *Loire*, 1827.

Shell conical, elevated, apex slightly recurved; perforation in front of the apex, small; interior exhibiting a raised border behind the aperture, and on a level with the apex; external surface cancellated.

Mons. Cossmann was probably one of the first to point out that the Jurassic forms hitherto referred to *Fissurella* might with more justice be assigned to *Puncturella*. I have already stated that no true Keyhole Limpet has been seen by me from the Jurassic Rocks.

401. PUNCTURELLA ACUTA, *Deslongchamps*, 1842. A micromorph, Pl. XLI, figs 19 *a*, 19 *b*, 19 *c*.

1842.	FISSURELLA ACUTA, *Deslongchamps.*	Mém. Soc. Linn. Norm., vol. vii, p. 122, pl. vii, figs. 22—24.
1851.	— — —	Morris and Lycett, Great Ool. Moll., pt. i, p. 85, pl. viii, fig. 5.
1885.	PUNCTURELLA ACUTA, *Deslongchamps.*	Cossmann, Étage Bathonien, p. 344, pl. vi, figs. 25—27.

Description.—The length of the figured specimen is about 2 mm., width and height a little less. The base is nearly circular, the apex subcentral. Radial costæ are numerous and close, and decussated by finer transverse lines, the points of intersection being marked by small rounded granulations. The perforation appears to be a little in front of the apex, and very narrow. The internal border or septum is distinctly visible in the figured specimen.

Relations and Distribution.—These micromorphs from the Peagrit of Leckhampton possess such a general resemblance to Deslongchamps' species that this identification seems legitimate. There are four specimens in my collection, all about the same size.

Family—CALYPTRÆIDÆ.

"*Shell limpet-like, with the apex more or less spiral; interior simple or divided by a shelly process, variously shaped, to which the adductor muscles are attached.*"—S. P. Woodward.

Genus—Capulus, *Montfort*, 1810.

"*Shell conical, apex posterior, spirally recurved: aperture rounded; muscular impression horseshoe-shaped.*"—S. P. Woodward.

Since *Capulus* dates from Palæozoic times, we need not be surprised at finding it in beds of Jurassic age. The two following species are somewhat more oval than is usual in this genus.

402. Capulus rugosus, *Sowerby*, 1816. Plate XLII, figs. 1 *a*, 1 *b*, 2 *a*, 2 *b*.

1816. Patella rugosa, *Sowerby*. Min. Conch., pl. cxxxix, fig. 6.
1851. — — — Morris and Lycett, Gt. Ool. Moll., pt. 1, p. 89, pl. xii, figs. 1 *a*—1*e* (non fig. 1*f*).
1885. Patella (Helcion) rugosa, *Sowerby*. Cossmann, Étage Bathonien, p. 349, pl. xii, figs. 1—5.
1894. Capulus rugosus, *Sowerby*. Böhm, Neues Jahrbuch, 1894, Bd. i, p. 201.
Syn. or var. Patella Tessonii, *Deslongchamps*. Mém. Soc. Linn. Norm., vol. vii, p. 113, pl vii, figs. 3 and 4.

Bibliography, &c.—*Patella rugosa* was originally described by Sowerby from the Great Oolite of Minchinhampton, where it is extremely abundant, but for the most part much worn, like many of the Minchinhampton shells. Hence the slight spiral apex is in no case preserved in the Minchinhampton fossils. The species is very much rarer in the Inferior Oolite, yet specimens from the Lincolnshire Limestone, such as the one figured, do occasionally exhibit the capuliform apex Such specimens had been in my Collection for some years, when Herr Böhm (op. cit.) was able to demonstrate that *P. rugosa* is in reality a species of *Capulus*.

Description.—The figured specimen has the following dimensions :

Length	44 mm.
Width	34 mm.
Height	12 mm.

Shell conical-depressed; base oval, but slightly expanding anteriorly; apex posterior with a slender spiral curve. The strong radiating ribs are closely arranged and decussated by encircling growth-lines, which are crowded on the posterior side, wide apart anteriorly. The actual apex is smooth, and presents an extremely small spiral knot, but the radiating ribs commence at a very early stage (figs. 2 *a*, 2 *b*).

Relations and Distribution.—Whether *Capulus* or *Patella*, this is by far the most abundant limpet-like shell in the Jurassic rocks. *P. Tessonii* may be regarded as a megalomorph from the "Oölithe ferrugineuse" of Moutiers, where the radial costæ are wide apart.

Capulus rugosus is certainly rare in the Inferior Oolite of this country. It is quoted from the "roestone" of Leckhampton Hill. I remember also to have seen a specimen of considerable size from an inland locality of the Yorkshire Dogger. Though by no means abundant, it is better represented in the Lincolnshire Limestone than in any other beds of Inferior Oolite age, *e. g.* Stoke Lodge, Ponton, and Weldon. Varieties of this species may also be noted in beds of later age than the Great Oolite.

403. Capulus ancyloides, *Sowerby*, 1824. Plate XLII, figs. 3 *a*, 3 *b*.

1824. Patella ancyloides, *Sowerby*. Min. Conch., pl. cdlxxxiv, fig. 2.
1851. — rugosa, *Sowerby*, pars. Morris and Lycett, Gt. Ool. Moll., pt. 1, p. 89, pl. xii, figs. 1 *f*, 1 *g*.

Bibliography, &c.—Originally described from Ancliff. Sowerby noted the decidedly spiral apex, "which being turned to one side makes it resemble the *Ancylus fluviatilis*." Morris and Lycett regarded it as the immature form of "*Patella*" *rugosa*. There is only one specimen in the Sowerby type collection at the British Museum, somewhat cracked, but otherwise in good condition.

Description:

Length	6·5 mm.
Width	5 mm.
Height	2 mm.

Shell conical-depressed, smooth; base oval, apex spiral and posterior. The spiral coil is relatively large, and is marked by fine striæ (not sufficiently shown in fig. 3 *b*); the rest of the shell is devoid of all ornament, except concentric lines of growth, which become strong towards the margin.

Relations and Distribution.—The apical conditions of *Capulus* (*Patella*) *ancyloides* are so different from those of *Capulus rugosus*, that this alone would

justify their separation; whilst in the shell itself the rugose radial ornamentation of the latter species is entirely wanting.

Rare in the Great Oolite of Ancliff and Minchinhampton. My own specimens are from the Lincolnshire Limestone (Inferior Oolite) at Stoke Lodge, whence several interesting fossils have been procured; rare.

Family—PATELLIDÆ.

Shell conical, with apex turned forwards; muscular impression horseshoe-shaped, open in front.—S. P. Woodward.

The Patellids of the Jurassic rocks have been described under several genera, viz. *Patella, Scurria, Acmæa, Scurriopsis, Guerangeria, Deslongchampsia*, &c. In the Inferior Oolite of this country we do not possess many more than half a dozen species, and these on the whole are scarce and locally distributed. In the absence of special evidence these will be described primarily under *Patella*.

Genus—Patella, *Linnæus*, 1758.

Shell ovately conical, with an oblong or oval base; apex subcentral, or inclining towards the anterior side; internal surface smooth; margin of the aperture entire.

Section A without radial ornament (? = *Scurria*, Gray).

404. Patella inornata, *Lycett*, 1850. Plate XLII, figs. 4 *a*, 4 *b*.

1850.	Patella inornata,	*Lycett.*		Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 415.
1853.	—	—	—	Proc. Cotteswold Nat. Club, vol. i, p. 76.
? Syn.	—	—	*Morris and Lycett.*	Gt. Ool. Moll., pt. 1, p. 93, pl. xii, figs. 11, 11 *a*.

Description:

Length	30 mm.
Width	18 mm.
Height	9 mm.

"Ovate, smooth; apex pointed, moderately elevated, subcentral, but posterior and inclined slightly forwards."

In specimens from the Great Oolite the figure is stated to be a more lengthened oval, whilst the apex is somewhat more elevated.

Relations and Distribution.—Less orbicular and less conical than *P. nitida;* moreover, in this species, the convex side (not sufficiently convex in fig. 4 *a*) is the shorter. My best specimens are from the base of the Lower Freestones, Leckhampton, where *P. inornata* is not uncommon. It also occurs in the Northampton Sand at Duston, and in the Lincolnshire Limestone at Stoke Lodge.

405. Patella cf. cingulata, *Münster*, 1844. Plate XLII, figs. 5 *a*, 5 *b*, 5 *c*.

1844. Patella cingulata, *Münster*. Goldfuss, Petref. Germ., pl. clxvii, fig. 11.

Morris and Lycett ('Great Ool. Moll.,' pt. i, p. 88) refer certain shells from the Cotteswolds to Münster's species. Their figures are not satisfactory; and, as *P. cingulata* is an Upper Jurassic form, Cossmann ('Étage Bathonien,' p. 354) suggests that the Great Oolite forms may represent a different species.

There are two specimens in the Jermyn Street Museum from the Inferior Oolite of Rollwright Heath, in Oxfordshire, which is very high in the series. In their depressed outline these specimens more nearly resemble the figures of Goldfuss than those of Morris and Lycett. The principal resemblance, however, is in the striated growth-lines (fig. 5 *c*), thus producing a marked concentric ornamentation.

406. Patella nitida, *Deslongchamps*, 1842. Plate XLII, figs. 7 *a*, 7 *b*.

1842. Patella nitida, *Deslongchamps*. Mém. Soc. Linn. Norm., vol. vii, p. 116, pl. vii, figs. 7 and 8.
1850. — — — Lycett, Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 410.

Bibliography, &c.—There are two specimens in the Jermyn Street Museum, most probably from the Inferior Oolite, Leckhampton. On these Lycett based his identification.

Description:

Length	4·5 mm.
Width	4 mm.
Height	3 mm.

Shell conical, capuliform, with a high and sharp apex, which is subcentral.

The base is roundly oval, with a perfectly smooth edge. The surface is smooth, but with a strong lens it is possible to discern very faint concentric lines.

Relations and Distribution.—The points wherein *P. nitida* differs from *P. inornata* have been already indicated. *P. nitida* is stated by Deslongchamps to be common in the Bath Oolite of Normandy, whereas at Minchinhampton it seems to be represented only by *P. inornata*. *Scurria nitida* is quoted by Dr. Glangeaud ('Le Jurassique à l'ouest du plateau central,' p. 119) from beds of Bajocian age.

407. Patella nana, *Sowerby*, 1824. Plate XLII, figs. 6 *a*, 6 *b*.

1824.	Patella nana, *Sowerby*.			Min. Conch., pl. cdlxxxiv, fig. 3.
1851.	—	—	—	Morris and Lycett, Gt. Ool. Moll., pt. 1, p. 93, pl. xii, fig. 10.
1854.	—	—	—	Morris, Cat., p. 266 (G. O.).

Bibliography, &c.—Sowerby's enlargement of his *P. nana* from Ancliff represents a more oval shell than the one now figured. Morris and Lycett figure a more conical form with almost central apex, and this is the prevailing form at Minchinhampton and Bussage. It is just possible that Sowerby's species may be different.

Description (Lincolnshire Limestone specimen):

Length	9 mm.
Width	8 mm.
Height	5·5 mm.

Shell small, suborbicular, conical; apex almost central, erect and subobtuse, smooth.

Relations and Distribution.—This small species has the most orbicular base of any of the smooth Patellas of the Inferior Oolite, and is correspondingly lofty. Specimens from the Lincolnshire Limestone are rather smaller and less peaked than some of those from the Great Oolite of Minchinhampton. Under certain conditions of preservation fine "cingulate" ornament may be detected, but the shell is always more peaked than Goldfuss' representations of *P. cingulata*.

Most of my specimens are from the Lincolnshire Limestone at Stoke Lodge. Not hitherto noticed in the Inferior Oolite of the Cotteswolds.

Section B with radial ornament.

408. Patella Römeri, *Morris and Lycett*, 1851. Plate XLII, figs. 8*a*, 8 *b*.

1851. Patella Römeri, *Morris and Lycett*. Gt. Ool. Moll., pt. 1, p. 91, pl. xii, figs. 6, 6 *a*, 6 *b*.

A single specimen from the lowest bed of Tinkler's quarry at Stamford (Lincolnshire Limestone) greatly resembles the typical forms from Minchinhampton and Bussage. The Inferior Oolite specimen is somewhat more depressed and orbicular, whilst the interstitial radials are less conspicuous.

409. Patella fenestræ, sp. nov. Plate XLII, figs. 9 *a*, 9 *b*.

Description :

Length	41 mm.
Width	31 mm.
Height	21 mm.

Shell elliptical, conical, elevated; apex nearly central, corroded and obtuse. Base oval, sides compressed. Ornamented by rugose radiating costæ, which are wide apart and decussated at wide intervals by concentric lines; tuberculations occur at the points of intersection. Margin thickened.

Relations and Distribution.—This form seems to stand alone amongst the Patellids of the Lower Oolites. The nearest described species of Jurassic age appears to be *P. sulcata*, Deslongchamps ('Mém. Soc. Linn. Norm.,' vol. vii, p. 115, pl. vii, figs. 9 and 10), from the Inferior Oolite of Port-en-Bessin. But even this species differs widely. On the other hand, its resemblance to the more elevated varieties of the existing *Patella vulgata* are quite startling.

A single specimen has been found by Mr. Windoes in the Chipping Norton Limestone, which overlies the *Clypeus*-grit in the neighbourhood of that town. This may be regarded as the highest horizon of the Inferior Oolite.

410. Patella retifera, *Lycett*, 1850. Not figured.

1850. Patella retifera, *Lycett*. Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 415.

1853. — — — Proc. Cotteswold Nat. Club, vol. i, p. 76.

Syn. Fissurella Brodiei, *Lycett*. Ann. Mag. Nat. Hist., vol. cit., p. 415; and Proc. Cotteswold Nat. Club, vol. cit., p. 76.

Bibliography, &c.—Briefly described by Lycett, but not figured. Not accepted by Morris, nor enumerated by Lycett in the 'Cotteswold Hills' amongst the fossils of the *Fimbria*-stage. In the absence of further evidence *P. retifera* was included by Hudleston and Wilson in the list of "species not accepted." Quite lately (1895) Mr. Brodie's collection of fossils from the Leckhampton freestones has been acquired for the Jermyn Street Museum. There are two specimens purporting to be *Patella retifera*, besides specimens of *Fissurella Brodiei*, which latter is a closely allied, if not identical form, in a somewhat different matrix. The labels are not in Lycett's handwriting.

Description :

Length	9 mm.
Width	6·5 mm.
Height	4 mm.

"Ovate, costated, and cancellated; costæ numerous and unequal, crossed by numerous encircling lines; apex moderately elevated, posterior, but inclined forwards."

The so-called *Fissurella Brodiei* exhibits the same characters, but is a slightly narrower shell.

Relations and Distribution.—Both radial and concentric ornaments of this extremely pretty little shell are very sharp, and this serves to distinguish it from *Patella* (*Guerangeria*) *clypeola*, Deslongchamps, a Bathonian species, where the radial ornamentation only is in evidence. There is something peculiar in the character of the apex, which seems to indicate that it may not be a *Patella* in a strict sense, though none of the specimens could be placed under *Fissurella*.

There are about half a dozen specimens in the Brodie Collection from the Leckhampton freestones, which contain a shallow-water fauna.

Order—OPISTHOBRANCHIATA, *Milne-Edwards.*

Sub-order—TECTIBRANCHIATA, *Cuvier.*

N.B.—The fossil Opisthobranchiata have lately received a large share of attention in M. Cossmann's admirable work 'Essais de Paléoconchologie comparée' (Première livraison, Fevrier, 1895); and still more recently in his splendid Monograph, 'Études sur les Gastropodes des Terrains Jurassiques,' now in course of publication in the Memoirs of the Geological Society of France. This author greatly favours the subdivision of families and genera. Thus we find the following families enumerated from the Jurassic rocks,—Actæonidæ, Tornatinidæ, Bullidæ, Aceridæ (nov. fam.), and Aplustridæ. M. Cossmann also includes *Ceritella* and *Fibula* amongst the Opisthobranchiata under Tubiferidæ (nov. fam.). The genera and sections are also largely multiplied. Without in the slightest degree questioning the scientific value of these subdivisions, it is proposed to group the Opisthobranchiata of our Inferior Oolite, for present purposes, under the families Tornatellidæ (Actæonidæ) and Bullidæ.

Family—TORNATELLIDÆ (Actæonidæ).

"*Shell external, convoluted, ovoid, conoidal, spire depressed or prominent; whorls tolerably numerous, without internal absorption, aperture entire, narrow.*"—Fischer.

N.B.—The following genera, subgenera, and sections of this family are recognised by M. Cossmann as occurring in the Inferior Oolite, viz. *Tornatellæa*, Conrad (e.g. *T. pulchella*, Deslong.); *Actæonina*, d'Orbigny (e.g. *A. gigantea*, Deslong.); *Striactæonina*, nov. sect. (e.g. *Act. Sarthacensis*, d'Orb.). *Cylindrobullina*, von Ammon (e.g. *Act. Scarburgensis*, Lycett; *Cylindrites*, Morris and Lycett (e.g. *Actæon acutus*, Sowerby).

Trochactæonina, Meek, is also quoted from the Bathonian (e.g. *Act. rentricosa*, d'Orbigny, and *Cassis Esparcyensis*, d'Archiac).

In the present instance it is proposed to retain the older generic classification of the Tornatellidæ of the Inferior Oolite, whilst indicating as far as possible the equivalents under the new system. For the most part the specimens are not sufficiently well-preserved to show the finer points.

Genus—Actæon, *Montfort*, 1810.

"*Shell oval, spirally striated; spire prominent, conical, sharp; apex reversed; suture well-marked; aperture lengthened, entire, rounded at the base; outer lip sharp, columella furnished with a strong basal fold.*"—Fischer.

In *Tornatellæa*, Conrad, there are two folds, and the aperture is slightly notched at the base.

411. Actæon (Tornatellæa) pulchellus, *Deslongchamps*, 1848. Plate XLII, figs. 12 and 13.

1848. Tornatella pulchella, *Deslongchamps*. Mém. Soc. Linn. Norm., vol. viii, p. 162, pl. xviii, fig. 4.

185? Acteonina pulchella, *d'Orbigny*. Terr. Jur., vol. ii, p. 169, pl. cclxxxvi, figs. 7 and 8.

1895. Tornatellæa pulchella, *Deslongchamps*. Cossmann, Gastr. Terr. Jur., p. 14, pl. i, figs. 6—8.

Bibliography, &c.—Deslongchamps described this species as having three columellar folds, though it might require an exceptionally well-preserved specimen to show them. He justly hesitated to make a new genus. D'Orbigny placed it with doubt under *Actæonina*, considering that the folds indicated by Deslongchamps might bring it within the range of *Actæon*. The species is not quoted as British either by Morris or by Hudleston and Wilson.

Description:

Height	11 mm.
[1] Body-whorl to total height	60 : 100.
Spiral angle	55°.

Shell oval, apex acute; whorls from five to six, tumid, with tabulated edge, body-whorl large. The entire shell is marked with deeply cut striæ, wide apart, and exhibiting punctations. Aperture sub-elongate, elliptical, columella short and marked with oblique folds two or three in number; indications of an anterior notch.

Relations and Distribution.—This is perhaps one of the best marked species belonging to the Tornatellidæ which the Inferior Oolite affords. Undoubtedly it belongs to *Actæon* rather than to *Actæonina*, and to the section or sub-genus

[1] Measured at the back of the shell.

Tornatellæa, Conrad. There are three specimens in my Collection from the *Parkinsoni*-zone of Burton Bradstock, one from the same horizon at Grove, and two smaller specimens from the *Parkinsoni* Marl of Bradford Abbas.

412. Actæon (Tornatellæa) ooliticus, sp. nov. Plate XLII, fig. 11.

Description:

Height	13 mm.
Body-whorl to total height	55 : 100.
Spiral angle	48°.

Shell oval, apex acute. Number of whorls six, sub-tumid, with the posterior edge more sloping than tabulate. The spiral striæ are close, deeply cut and punctate, the sloping shoulder of the whorls exhibiting a special form of grooving, whilst the spirals in the upper portion of the whorls are wider apart. Aperture sub-elongate, elliptical, with a very short columella; this has evidently been marked with oblique folds, but it is not easy to say whether two or three; indications of an anterior notch.

Relations and Distribution.—This form obviously differs from *Actæon pulchellus* in its more slender shape, in the comparatively sloping posterior margin of the whorls, and especially in the general closeness of the spiral striæ. It is near to *Tornatellæa multistriata*, Rigaux and Sauvage, and also resembles *Tornatellæa Brasili*, Cossmann, which is described from the Bajocian of France.

The finest specimens of *Actæon ooliticus* occur in the *Concavus*-bed at Bradford Abbas. Stoford and Horton Hill have also yielded specimens, which bear considerable resemblance to the Bradford Abbas forms. When the folds on the aperture have been effaced, it might be difficult to distinguish this species from *Actæonina pulla*, K. and D. There is a very slender variety with five whorls from the "Base-bed," Lincoln, ? a distinct species.

413. Actæon sculptus, *Lycett*, 1850. Plate XLII, figs. 10 and 10 *a*.

1850. Ceritella sculpta, *Lycett*. Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 419.
1853. — — — Proc. Cotteswold Nat. Club, vol. i, p. 80.

The following is Lycett's diagnosis:—"Small, turrited; whorls few, long, nearly flat, each with three encircling striæ, equidistant; the body-whorl has six striæ besides numerous others closely arranged at the base."

The figured specimen has the following dimensions:—Height 10 mm., spiral angle 45°. The number of whorls five; aperture sub-elongate, elliptical, with a short columella, which has folds and anterior notch somewhat reflexed.

Relations and Distribution.—Lycett's type is smaller than the figured specimen, and ill-preserved, but there is sufficient of the aperture remaining to show that it belongs to this section of *Actæon* (*Tornatellæa*): it was obtained from the Freestones of the Cotteswolds—*Murchisonæ*-zone. The figured specimen is a larger shell, and was obtained from Drympton (most probably *Opalinus*-zone).

This species comes very near to *Tornatellæa inæquistriata*, Cossmann, from the *Murchisonæ*-zone of the Meurthe.

Besides the three species of *Actæon* (*Tornatellæa*) described above, there are two other species or varieties: viz. a form in the *Opalinus*-bed, Drympton, resembling but not identical with *Actæon pulchellus;* secondly the narrow form from the "Base-bed," Lincoln, provisionally classed with *Actæon ooliticus*.

Genus—Actæonina, *d'Orbigny*, 1850 (= *Orthostoma*, Deshayes).

"*Shell oval or fusiform; spire salient, but shorter than the last whorl, which is angular in the vicinity of the suture; aperture elongated, narrow, entire, not sinuous; outer lip simple, sharp; columellar lip curved; columella thick, but smooth.*"—Fischer.

There is nothing in this diagnosis with reference to sculpture, but one might add "smooth or striated." The above is a somewhat generalised diagnosis, which would include the sections previously mentioned.

The genus *Actæonina* is interesting to the palæontologist as perhaps the oldest member of the Tornatellidæ, the section, *Cylindrobullina*, dating back from Carboniferous times. It is best represented in the Jurassic period, and, according to d'Orbigny, the maximum development of the genus was attained during the deposition of the Lower Lias. As regards distribution in the Inferior Oolite of this country, the several horizons in Yorkshire have yielded a considerable number of species, the Lincolnshire Limestone and the Inferior Oolite of the Cotteswolds are also accountable for several species, whilst the Dorsetshire beds, usually so rich in Gasteropods, have not yielded many species of *Actæonina*.

We may admit that *Actæonina* is an inconveniently large genus, including forms of somewhat diverse character, both as to shape and ornamentation. As regards ornamentation merely, we might divide the Actæoninas of the Inferior Oolite into three groups:

1. *Actæoninæ* with deep spiral grooving and a general resemblance to *Actæon*

(*Tornatellæa*), but with no proved columellar plication. This group includes such forms as *Auricula Sedgvici* and *Tornatella pulla*, which I have hitherto classed with the Actæons, as indeed have most authors, though Tate referred *Tornatella pulla*, K. and D., to *Actæonina*.

2. *Actæoninæ* with fine spiral lines (*Striactæonina* in part) such as *Actæonina Sarthacensis*, d'Orbigny. Possibly also *Actæonina humeralis*, Phillips, which has a strongly impressed line on the shoulder, might come in here.[1]

3. *Actæoninæ* which are perfectly glabrous, or only exhibit striation, more or less faint, towards the anterior extremity. This division would include, amongst others, *Actæonina* as limited, and the sections *Ovactæonina*, *Cylindrobullina*, and *Trochactæonina*.

414. Actæon vel Actæonina Sedgvici, *Phillips*, 1829. Plate XLII, fig. 15.

1829–35.	Auricula Sedgvici, *Phillips*.			Geol. Yorks, part 1, pl. xi, fig. 33.
1850.	Actæon Sedgvici, *d'Orbigny*.			Prod., i, p. 263.
1851.	—	—	*Phillips*.	Morris and Lycett, Grt. Ool. Moll., part i, p. 118, pl. xv, fig. 9.
1885.	—	—	—	Hudleston, Geol. Mag., 1885, p. 252, pl. v, fig. 4.

Bibliography, &c.—Owing to imperfect preservation it is still doubtful whether Phillips' species is an *Actæon* or a striated *Actæonina*. "In the few cases where the aperture has been visible it is invariably without plication" (Hudleston, *loc. cit.*). Brauns ('Mittlere Jura,' p. 194) considered *Tornatella pulla*, K. and D., the same as *Actæon pullus*, Morris and Lycett, but different to *Auricula Sedgvici*, Phillips.

Description.—From 5 to 10 mm. in height and considerably more than half as wide as high. Ovate, with a stumpy spire composed of about three whorls. The whorls are strongly tabulate. The body-whorl and penult are ornamented by deeply-cut spiral striæ, which are but slightly punctate; the surface of the body-whorl is thus divided into a number of strap-like belts, of which two, situated slightly below the middle, are wider than the rest. Other indications wanting.

Relations and Distribution.—A stumpy form almost peculiar to the Dogger,

[1] Stoliczka remarked that the "surface of many *Actæoninæ* appears to be perfectly smooth, but it is more likely this is only in consequence of the uppermost punctated layer of the shell having been removed" ('Cretaceous Gastropoda of Southern India,' p. 399).

where it takes the place of *Actæonina pulla*. Indifferent specimens, smaller than the one figured, are not rare. I have one specimen from the Pea-grit of Leckhampton.

415. Actæonina pulla, *Koch and Dunker*, 1837. Plate XLII, fig. 14.

1837. Tornatella pulla, *Koch and Dunker*. Beiträge Nordd. Oolith., p. 33, pl. ii, fig. 11.
1851. Actæon pullus, ? *Koch*. Morris and Lycett, Grt. Ool. Moll., part 1, p. 119, pl. xv, fig. 11.
1876. Actæonina pulla, *Koch and Dunker*. Tate and Blake, Yorkshire Lias, p. 356.
1885. Actæon Sedgvici, *Phil.*, var. pulla, *Morris and Lycett*. Hudleston, Geol. Mag., 1885, p. 253, pl. v, fig. 5.

Description.—Morris and Lycett say :—" Shell ovate, spire elevated, somewhat acute; whorls (six) convex, the last whorl sub-cylindrical; aperture ovate; the surface with numerous regular punctated encircling striæ." The above description refers to specimens either from the Millepore-bed or the Scarborough Limestone.

Relations and Distribution.—More elongated and oval than *Actæonina Sedgvici*, and probably a more widely distributed form. I have specimens from the Scarborough Limestone of Scarborough Bay which are rather stouter than Morris and Lycett's type. *Actæonina* (*Actæon*) *pulla* also occurs in the Lincolnshire Limestone at Weldon, and in the Inferior Oolite of Hook Norton (Walford Collection). These are all specimens without folds on the columella. But it is quite possible that, in some instances, imperfectly preserved specimens of *Actæon* (*Tornatellæa*), such as *Actæon ooliticus*, are set down to Koch and Dunker's species. In this way *Actæonina* (*Actæon*) *pulla* is a convenient name for any small and badly preserved specimen of the striated Tornatellidæ.

416. Actæonina " pulloides." Plate XLII, fig. 16 and 16 *a*.

Description.—This is a small form, from 5 to 6 mm. in height and with a spiral angle of about 58°; oval-oblong, number of whorls five, tumid with a slight ledge on the posterior margin, which is marked by an impressed line. Body-whorl about twice the height of the spire. The texture of the shell is smooth with very fine striations, which have a tendency to become effete towards the centre of the body-

whorl (fig. 16 *a*), but are well marked where the anterior compression commences. Aperture ovate-elongate with a thin straight outer lip and a smooth columella.

Relations and Distribution.—Differs from *Actæonina pulla* in the fineness of the striations, though, if we accept the view of Stoliczka, this may be somewhat a matter of preservation. Resembles *Actæonina sparsisulcata*, d'Orbigny ('Terr. Jur.,' ii, p. 166, pl. 285, figs. 14 and 15). This form occurs in the Lincolnshire Limestone at Weldon, in the *Parkinsoni*-zone of Burton Bradstock, and in the *Cadomensis*-bed at Oborne.

Since I do not venture to constitute this as a distinct species, it may be regarded as a possible variety of *Actæonina pulla*.

417. Actæonina (Striactæonina) tenuistriata, sp. nov. Plate XLII, figs. 18, 19, 19 *a*.

1885. Actæonina humeralis, *Phillips*, striated variety. Hudleston, Geol. Mag., 1885, p. 202, pl. v, fig. 3.

Cf. also Actæonina Sarthacensis, *d'Orbigny*. Terr. Jur., vol. ii, p. 167, pl. cclxxxvi, figs. 1 and 2.

Description :

Height	12 mm.
Body whorl to total height	75 : 100.
Spiral angle	60°.

Shell cylindro-conical; the spire occupies about one fourth of the total height, and consists of five or six whorls, which are cylindrical with tabulate posterior margin, except towards the very sharp apex, where they are slightly convex. The entire shell is pervaded by fine and close striato-punctate ornament. There is a strongly impressed line on the posterior margin of the whorls, and a somewhat finer line on the flat area between the margin and the suture. The body-whorl is a narrow cylinder much compressed anteriorly; aperture ovate-elongate with a smooth columella.

Relations and Distribution.—This may be regarded as a narrow representative of *Actæonina Sarthacensis* on a lower horizon. (Cossmann says that *A. Sarthacensis* is really a Bathonian species, and not Bajocian as represented by d'Orbigny.) On the other hand, if we accept the suggestion of Stoliczka as regards striation in the Tornatellidæ, *Actæonina tenuistriata* may be nothing more than a different mineral condition of *Actæonina humeralis*. This was the view I took in 1885. There are, however, certain slight differences of shape which favour the notion of their being distinct species.

Occurs sparingly in the Yorkshire Dogger. I have also a specimen from Dorset (? Broad Windsor), which might be thus referred.

418. Actæonina (? Striactæonina) humeralis, *Phillips*, 1829. Plate XLII, figs. 20 *a*, 20 *b*.

1829–35. Actæon humeralis, *Phillips*. Geol. Yorks., part 1, pl. xi, fig. 34.
1850. Actæonina humeralis, *d'Orbigny*. Prod., i, p. 264.
1885. — — *Phillips*. Hudleston, Geol. Mag., 1885, p. 202, pl. v, figs. 1, 1 *a*.

Description (based principally on the type-specimen, which is somewhat affected by mineralisation) :

Height	15 mm.
Body-whorl to total height	71 : 100.
Spiral angle	66°.

Shell cylindro-conical; the spire about three-tenths the total height, and composed of five whorls. In many respects the description of the preceding species is applicable to this one. Thus the whorls of the spire are flat atop and marked on the shoulder by a grooved line, which produces two steps, or a sort of double tabulation. The grooving on the shoulder is very distinct in the body-whorl, which is perfectly cylindrical. But there are no traces of spiral striation, except some faint lines towards the anterior extremity. The length of the aperture is about two-thirds the height of the shell: it is narrow behind, wide in front; outer lip straight and thin, columellar lip smooth and without plications.

Relations and Distribution.—Actæonina humeralis is not uncommon in the Yorkshire Dogger, though good examples are scarce. Many specimens also are much smaller than the one figured.

A narrow and perfectly glabrous variety occurs in the *Concavus*-bed at Bradford Abbas. My "MS." name for this variety is "*sub-humeralis*." This passes by degrees into a distinct form.

419. Actæonina subovalis, sp. nov. Plate XLII, fig. 21.

Description:

Height	16 mm.
Body-whorl to total height	65 : 100.
Spiral angle	50°.

Shell oval-elongate. Total number of whorls six, the spire occupying from three to four tenths of the entire height. The apex is slightly obtuse. The whorls are subconvex, with a narrow posterior ledge indented by a deep groove; sutural angle oblique. The body-whorl is very ovate, and like the rest of the shell perfectly smooth, growth-lines alone being visible. The aperture is oval-elongate, and about half the height of the entire shell. There is a considerable incrustation on the columella, which is only slightly sinuous.

Relations and Distribution.—The peculiar ovate-elongate character of this shell and the convexity of the whorls forcibly remind us of *Actæonina Loriereana*, d'Orb., which may be regarded as a typical *Ovactæonina*. On the other hand, the grooved ledge on the posterior margin of the whorls, although very narrow, serves to remind us of *Striactæonina*.

A single specimen from the *Concavus*-bed, Bradford Abbas.

420. Actæonina (Cylindrobullina) glabra, *Phillips*, 1829. Plate XLII, figs. 22, 23 *a*, 23 *b*.

1829–35.	Actæon glaber (Bean, MS.), *Phillips*.				Geol. Yorks., part 1, pl. ix, fig. 31.
1851.	Actæonina glabra, *Phillips*.				Morris and Lycett, Grt. Ool. Moll., part 1, p. 120, pl. xv, fig. 10.
1885	?	—	—	—	Hudleston, Geol. Mag., 1885, p. 205, pl. v, figs. 6 and 6 *a*.

Bibliography, &c.—The type of *Actæon glaber* is probably lost, but figs. 23 *a*, 23 *b* represent a specimen in the Bean Collection (that portion now in the British Museum), which is thus labelled. Although a typical form, it is somewhat larger than usual, and the drawing suggests *Cylindrites*, for which there is probably no justification. Fig. 22 represents a medium-sized shell.

Description:

Height	10—20 mm.
Body-whorl to total height . .	90 : 100.
Spiral angle	80°.

Shell cylindro-conical, with a very short spire. The whorls of the spire (four) are sub-tumid and sloping with a posterior ledge or tabulation which is rounded off at the margin. The body-whorl is elongate and quite cylindrical, and like the rest of the shell smooth, even the growth lines being very fine, and in many specimens scarcely visible.

The aperture is extremely long and narrow in the upper half, but widens anteriorly owing to the hollowing out of the columellar region; the columellar

lip is thickened and drawn out obliquely, being quite smooth and rounded at the extremity.

Relations and Distribution.—*Actæonina glabra* possesses the most stumpy spire of all the truly cylindro-conical *Actæoninæ* (*Cylindrobullina*). In Yorkshire it occurs chiefly in the uppermost horizon of the Inferior Oolite. I have a specimen in my Collection from the Dean and Chapter Pit at Lincoln (*Murchisonæ*-zone) 22 mm. in height. On the higher horizons of the Lincolnshire Limestone at Wansford and Weldon, and also at Barnack, smaller specimens like fig. 22, and still smaller ones, are by no means rare.

421. Actæonina (Cylindrobullina) cinerea, *Hudleston*, 1885. Plate XLIII, figs. 1 *a*, 1 *b*.

1885. Actæonina cinerea, *Hudleston*. Geol. Mag., 1885, p. 206, pl. v, figs. 8, 8 *a*.

Description:

Height	10—25 mm.
Body-whorl to total height . . .	80 : 100.
Spiral angle	90°.

Shell cylindro-conical, with a regular spire about one-fifth the total height. The angle of increase is exactly a right angle; apex obtuse. Whorls of the spire five, short, sub-tumid, and smooth, with a well-marked posterior tabulation or ledge, which is also very conspicuous on the body-whorl. Body-whorl relatively large and cylindrical, sides compressed. Aperture two-thirds of the total height, narrow with very straight outer lip, and rounded off anteriorly; columella smooth. More or less flexuous growth-lines are visible on some specimens.

Relations and Distribution.—Near to *Actæonina glabra*, of which this may be considered a broad variety with a somewhat higher spire and more distinct tabulation. On the other hand, the rectangular outline of the whorls and shorter spire serve to separate it from *Act. Scarburgensis*. Not uncommon in the Scarborough Limestone.

422. Actæonina gigantea, *Deslongchamps*, 1842. Plate XLIII, figs. 2 and 3, var. *attenuata*, fig. 4.

1842. Tornatella gigantea, *Deslongchamps*. Mém. Soc. Linn. Norm., vol. vii, p. 137, pl. x, figs. 27 and 28.

1851.	Actæonina gigantea,	*Deslongchamps.*		Morris and Lycett, Grt. Ool. Moll., part 1, p. 119, pl. xv, fig. 13.
1885.	—	—	—	Hudleston, Geol. Mag., 1885, p. 203.
1895.	—	—	—	Cossmann, Gast. Terr. Jur., p. 22, pl. ii, figs. 12, 13.
Syn.	—	Deslongchampsii,	*d'Orbigny.*	Terr. Jur., vol. ii, p. 171, pl. cclxxxvi, fig. 11.

Bibliography, &c.—The Normandy specimens (Bathonian) are mainly casts. The very large specimens from the Inferior Oolite of the Yorkshire coast are broader than the French types. This is one of the few species for which the generic name, *Actæonina*, is retained by M. Cossmann.

Description.—The specimens from our Inferior Oolite are variable as to size and shape. The Yorkshire specimen figured by Morris and Lycett has a height of 40 mm., whilst the specimens figured in the accompanying plate do not exceed 25 mm. The spiral angle may be said to range from 52° to 60°, whilst the body-whorl is generally less than two-thirds the total height.

The shell is oval, thin, and smooth, whorls (seven or eight) rather flattened at the sides, sub-convex, with the posterior tabulation slightly rounded off; aperture narrow above, dilated below, and about three-fifths the entire length.

Relations and Distribution.—This may be taken as an average representative of the genus *Actæonina*, closely related to the cylindro-conical forms (*Cylindrobullina*), yet passing by protraction into such forms as *Actæonina acuta*, d'Orb. Besides the Yorkshire specimens, there are some from the *Parkinsoni*-zone of the Cotteswolds (fig. 2), which are rather short in the spire and approaching *Act. Scarburgensis*. This variety of *Act. gigantea* I have noticed on several horizons and localities of the Inferior Oolite; it is an intermediate form.

Fig. 3 from the Dean and Chapter Pit at Lincoln (*Murchisonæ*-zone) may be taken as a small but more typical representative of the species; whilst in Fig. 4 (specimen also from Lincoln), where the spiral angle is reduced to 45°, we have the variety *attenuata*, which might almost be regarded as a distinct species.

423. Actæonina ovata, *Lycett*, 1850. Not figured.

1850.	Actæonina ovata,	*Lycett.*		Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 418.
1853.	—	—	—	Proc. Cotteswolds Nat. Club, vol. i, p. 79.

This species is not enumerated by Morris nor by Hudleston and Wilson. There is one very poor specimen in the Jermyn Street Museum, from the Inferior

Oolite of Gloucestershire, which may be the type. Two micromorphs from the Lincolnshire Limestone of Weldon seem to answer to Lycett's diagnosis, which is as follows:

"Ovate; spire of moderate elevation, consisting of four flattened whorls, last whorl subcylindrical, large; aperture lengthened, oblique."

424. Actæonina tumidula, *Lycett*, 1850. Plate XLIII, fig. 5 and ? fig. 9.

1850.	Actæonina tumidula, *Lycett.*			Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 418.
1851.	—	—	*Morris and Lycett.*	Grt. Ool. Moll., part 1, p. 120, pl. xv, fig. 14.
1885.	—	—	—	Hudleston, Geol. Mag., 1885, p. 205, pl. v, fig. 7.
? Syn.	—	Davoustana, *d'Orbigny.*		Terr. Jur., vol. ii, p. 169, pl. cclxxxvi, figs. 5, 6.

Description by Morris and Lycett.—"Shell small, spire depressed, volutions very narrow, rounded, their sutures deeply depressed; the last whorl gibbous, aperture an elongated oval. This species is shorter than any other with which we are acquainted." The height of the type is about 10 mm. and the spiral angle 100°.

Fig. 5 represents the specimen from the Bean Collection at the British Museum, which is believed to be the Yorkshire type, though somewhat different to the figure given by Morris and Lycett. It is obviously much broken away anteriorly. Lycett had previously described the species from the Inferior Oolite of Gloucestershire, but no specimens are forthcoming. Very rare in the Scarborough Limestone of White Nab.

Fig. 9, representing a small *Trochactæonina*, may possibly be the same species with the anterior portion of the aperture preserved.

425. Trochactæonina cf. Esparcyensis, *d'Archiac*, 1843. Plate XLIII, fig. 8.

1843.	Cassis Esparcyensis, *d'Archiac.*		Mém. Soc. Géol. France, vol. v, p. 385, pl. xxxi, fig. 10.

A single specimen from the Lincolnshire Limestone of Weldon, though only a micromorph 10 mm. in height, has considerable resemblance to this well-known Bathonian species. The spire is even more depressed than in *Actæonina tumidula*, whilst the body-whorl is broader atop and more pyriform in outline.

426. Actæonina antiqua, *Lycett*, 1857. Plate XLIII, fig. 6.

1859. Actæonina antiqua, *Lycett*. Cotteswold Hills, p. 125, pl. iv, fig. 9.[1]

Description.—The height of the figured specimen is 38 mm. Shell oblong, thin, with an obtuse apex and short spire of about four or five volutions; the spire is from one sixth to one seventh of the total height; whorls rounded upon their upper borders. Aperture elongate, narrow above and expanded anteriorly; columella curved and emarginated at its base.

The above is a slight modification of Lycett's original diagnosis.

Relations and Distribution.—The proportions bear some resemblance to those of *Actæonina glabra*, though in this case the spire is shorter and the figure of the body-whorl is somewhat different. The type is from the *Spinosa*-stage of Rodborough Hill, and is the only specimen of that size which has come under my notice. Smaller specimens, when compared with *Actæonina glabra*, exhibit a shorter spire than that species.

427. Actæonina (?) convoluta, *Lycett*, 1857. Plate XLIII, fig. 7.

1857. Actæonina convoluta, *Lycett*. Cotteswold Hills, p. 125, pl. iv, fig. 8.

Description.—The height of the figured specimen is 35 mm. "Shell oblong, rather compressed at the sides; spire depressed, scarcely produced, consisting of five volutions, which embrace each other and rise but little above the body-whorl; apex obtuse; aperture lengthened, very narrow above, more expanded towards the base; columella curved at the base, emarginated and slightly twisted."

Relations and Distribution.—The tendency of *Actæonina* in the direction of the Bullidæ seems to reach a maximum in this curious form. As pointed out by Lycett, it differs from *Bulla primæva*, Deslongchamps, in its more cylindrical figure and in the fact that the spire is slightly prominent, and not sunk in an apical cavity.

The type is from the *Spinosa*-stage of Rodborough Hill. I have a characteristic specimen from the *Clypeus*-grit of Aston Farm, and a smaller one from the Rag of Cleeve Hill, all in the *Parkinsoni*-zone. In these specimens the outer lip is straighter than in the figured specimen, which in this respect is rather misleading.

[1] In Lycett's plate the numbers referring to *Actæonina antiqua* and *Act. convoluta* have been transposed.

Genus—Cylindrites, *Morris and Lycett*, 1851.

"*Shell smooth, sub-cylindrical, or ovate; spire small; whorls usually flattened, with acute margins, the last whorl cylindrical, aperture lengthened, linear above, rounded and entire at the base; columella rounded, twisted near to the base and slightly directed outwards; right lip thin, but thicker at the base.*"—Morris and Lycett.

This is chiefly a genus of the Great Oolite; the number of species in the Inferior Oolite is limited, and their distribution very partial. Considerable difficulty arises from the uncertain evidence with regard to the identification of Lycett's species from the Inferior Oolite of Gloucestershire. On the whole the species of *Cylindrites* may stand thus:

Turrited	*Cy. turriculatus*, Lycett.
Spire consisting of a low cone	*Cy. attenuatus*, Lycett. *Cy. brevispira*, sp. nov.
Spire flat or subdepressed, with a mammillary knob	*Cy. tabulatus*, Lycett. — var. *Weldonis*. *Cy. mammillaris*, Lycett.
Spire sunken	*Cy. cylindricus*, Morris and Lycett.

428. Cylindrites turriculatus, *Lycett*, 1853. Plate XLIII, fig. 12.

1853.	Cylindrites turriculatus,	*Lycett.*		Quart. Journ. Geol. Soc., vol. ix, p. 342, pl. xiv, fig. 8.
1863.	—	—	—	Great Ool. Moll., Suppl., p. 25, pl. xliv, fig. 26.

Description.—"Shell elongated, subcylindrical; spire lengthened, its apex acute; whorls convex, their sutures deeply excavated, the last whorl ovately cylindrical; aperture narrow." Lycett's type is not available, nor have I seen a specimen so large as the one figured by him. My specimen (fig. 12) has a spiral angle of 60°, and no more than six whorls; the spire is nearly one third of the total height.

Relations and Distribution.—Probably only a small variety of *Cylindrites altus*, Morris and Lycett, from the Great Oolite, but less cylindrical, and with the posterior edge of the whorls less flattened. Rare in the Lincolnshire Limestone at Ponton and Weldon, it is the only species of *Cylindrites* from the Inferior Oolite which has a well-developed spire.

429. Cylindrites attenuatus, *Lycett*, 1850. Plate XLIII, figs. 15 *a*, 15 *b*.

1850.	Cylindrites attenuatus, *Lycett*.		Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 418.
1853.	—	—	Proc. Cotteswold Nat. Club, vol. i, p. 79.
Syn.	—	gradus, *Lycett*.	Op. et. vol. cit.
Cf. also	—	gradatus, *Cossmann*,	Gast. Terr. Jur. p 76, pl. iii, fig. 50.

Description.—Height 8 to 10 mm. and about two and a half times as long as wide; the shell is cylindro-conical, with a short conoidal spire, consisting of about six whorls which are narrow and step-like, with sharp edges. The body-whorl is flattened and attenuated towards the base. The posterior portion of the aperture is extremely narrow, and the twist on the columella not very strongly marked.

Relations and Distribution.—The strongly step-like character of the spire-whorls is a characteristic feature. Rare in the Inferior Oolite at Leckhampton.

430. Cylindrites brevispira, sp. nov. Plate XLIII, figs. 17 and 18.

Description.—Height 6·4 mm., width 4 mm. Shell sub-cylindrical, wide at top and much narrowed towards the anterior extremity. The spire is very low, but the margin of each spire-whorl projects slightly beyond the margin of the body-whorl, so that the figure of the spire is that of a very depressed, though regular cone. There are about six whorls in all, the margin of each presenting a sharp upturned edge with a slight hollow between. The body-whorl is pyriform.

Relations and Distribution.—Differs from *Cy. attenuatus* in its pyriform rather than cylindrical shape, its greater proportional width, and in having a still more depressed spire, whose whorls also are less flattened. Bears some resemblance to *Cy. bullatus*, Morris and Lycett, but in that species the spire is sunken.

There are five specimens in my Collection from the Lincolnshire Limestone of Weldon.

431. Cylindrites tabulatus, *Lycett*, 1850. Plate XLIII, figs. 14 *a*, 14 *b*, and var. *Weldonis*, figs. 13 *a*, 13 *b*.

1850.	Cylindrites tabulatus, *Lycett*.		Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 418.
1853.	—	—	Proc. Cotteswold Nat. Club, vol. i, p. 79.

Bibliography, &c.—The type is preserved in the Jermyn Street Museum. It cannot be said to correspond very closely with Lycett's diagnosis.

Description.—(Based upon the specimen in the Jermyn Street Museum.) Height 17 mm., width 9 mm. Shell cylindrical, but tapering anteriorly. The spire, consisting of about five whorls, is nearly flat and slightly sunken, but with a prominent mammilliform apex of considerable size. The posterior margin of the body-whorl is flattened and encloses the spire, the dividing suture lying in a deep groove. The columellar lip is strongly twisted.

The var. *Weldonis* is a fossil of much smaller habit, the usual height being 8 mm., width 4 mm. It is also somewhat more pyriform in figure.

Relations and Distribution.—Belongs to the section of *Cylindrites* which have sunken spires. Differs from *Cy. mammillaris* in the extensive flattening of the posterior margin of the body-whorl, and in the groove which divides this from the spire-whorls ; it is also rather broader in proportion to its length.

The specimen in the Jermyn Street Museum, from the Inferior Oolite of Nailsworth, is the only one I have seen from the Cotteswolds. The var. *Weldonis* is the most abundant Cylindrite in the Lincolnshire Limestone at Weldon and Ponton.

432. Cylindrites mammillaris, *Lycett*, 1850 (not figured).

1850.	Cylindrites mamillaris, *Lycett*.			Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 418.
1853.	—	—	—	Proc. Cotteswold Nat. Club, vol. i, p. 79.

Description.—Height 20 mm., width 8 mm. in a good-sized specimen. Shell cylindrical, elongate, sharply truncated atop. Spire flattened and sub-depressed, but the inner whorls have their upper flat surfaces visible, the first two or three of which are rounded into a mammillary knob. Aperture elongate with a strong columellar fold.

Relations and Distribution.—This is an extremely narrow and cylindrical form, only differing from *Cy. cylindricus*, Morris and Lycett, in the salience of the mammillary knob and in the flattening, rather than depression, of the spire.

There are two specimens of *Cy. mammillaris* in the Brodie Collection from the Leckhampton Freestones. A variety, approaching *Cy. cylindricus*, also occurs sparingly in the Lincolnshire Limestone of Weldon. This has been quoted as *Cy. cylindricus*.

433. Cylindrites cylindricus, *Morris* and *Lycett*. Inferior Oolite variety. Plate XLIII, figs. 16 *a*, 16 *b*.

In this form the upper margin of the last whorl slopes slightly inwards, and encloses the spire-whorls within the depression thus formed, so that even the central mammilla is sunken.

The figured specimen is thought to be from Nailsworth. It is preserved in the Inferior Oolite collection of the Jermyn Street Museum, and is the only one I have ever seen from that formation.

Family—BULLIDÆ.

"*Shell globular or cylindrical, convoluted, thin, often punctate-striated; spire small or concealed; aperture long, rounded and sinuated in front, lip sharp.*"—S. P. Woodward.

The few representatives of this family (now broken up into Bullidæ, Aceridæ, and Aplustridæ) in the Inferior Oolite may provisionally be retained under *Bulla* without prejudice to their being recognised as *Hydatina* or *Acera*.

Genus—Bulla, *Linnæus*, 1758.

434. Bulla Favrei, *Lycett*, 1857. Plate XLIII, fig. 10.

1857. Bulla Favrei, *Lycett*. Cotteswold Hills, p. 125, pl. iv, fig. 7.

Description.—Height 36 mm., width 28 mm.

Shell ovate, ventricose or pyriform, summit contracted, and partially concealing the inner whorls, the first of which is slightly elevated. The columellar lip is drawn out anteriorly and sinuous. Aperture widely ovate anteriorly, and but moderately contracted posteriorly.

Relations and Distribution.—The mammillary apex and extension of the columella easily serve to separate this shell from *Bulla undulata*, Bean. Indeed, they may be generically distinct. A single specimen from a high horizon in the *Spinosa*-stage near Avening, a village not far from Minchinhampton.

435. Bulla (Hydatina) undulata, *Bean*, 1839. Micromorphic variety. Plate XLIII, figs. 11 *a*, 11 *b*.

1839. Bulla undulata, *Bean*. Ann. Mag. Nat. Hist., n. s., vol. iii, p. 61, fig. 22.
1851. — — — Morris and Lycett, Grt. Ool. Moll., part 1, p. 96, pl. viii, figs. 8, 8 *a*.

Height 6·5 mm., extreme width 5 mm.

Besides being considerably smaller than Bean's species, this variety is rather wider in proportion to its height, but in other respects it would be difficult to separate them. But cf. *Bulla globulosa*, Cossmann. A single specimen in my Collection from the Scarborough Limestone.

There is a specimen, also in my Collection, from the Inferior Oolite near Radstock, which has a height of 10 mm., and whose proportions accord better with those of *Bulla undulata*.

SUPPLEMENT.

During the period that the Monograph on the Inferior Oolite Gasteropoda has been in course of publication, a certain number of specimens have been noticed or procured too late to be recorded in their proper places. They are mostly rare forms, and in some cases the genus is doubtful. These it is now proposed somewhat briefly to describe, in most cases with a figure. See Plates XLIII and XLIV.

436. Purpuroidea, species. Plate XLIV, fig. 9.

A single fragment of a large *Purpuroidea* was recently obtained from the Lincolnshire Limestone at Rauceby. There is not enough material to constitute a species, but the circumstance is interesting from its being the only instance of *Purpuroidea* as yet recorded from the Inferior Oolite of this country.

Though apparently differing from any of the Great Oolite species, it most nearly resembles *P. Morrisea*, Buvignier, which is the common form at Minchinhampton. Possibly also some of the Corallian species described by Buvignier, such as *P. Moreana*, may be near.

437. Purpurina varicosa, *Lycett*, 1850. Not figured.

1850. Turbo varicosus, *Lycett*. Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 416.
1853. — — — Proc. Cotteswold Field Club, vol. i, p. 77.

The following is Lycett's description :—"Turrited, whorls six, convex, each with four encircling, rounded and smooth costæ, crossing about eight large longitudinal elevations, which pass rather obliquely from left to right : axis two lines."

From want of evidence "*Turbo*" *varicosus* was not listed either by Morris

or by Hudleston and Wilson. Quite recently the Brodie Collection of fossils from the Leckhampton Freestones has been acquired for the Jermyn Street Museum. A specimen marked "*Turbo*, n. sp., 34," answers fairly well to Lycett's description, so far as the whorls of the spire are concerned. This is evidently a *Purpurina*, and has some resemblance to the form on Pl. I, fig. 2, of this Monograph.

438. Brachytrema Pontonis, sp. nov. Plate XLIII, figs. 21 *a*, 21 *b*.

Description:

Height	14 mm.
Spiral angle	65°.

Shell thick, trochiform, imperforate. The spire and body-whorl are nearly equal in height, and the spiral angle perfectly regular. Number of whorls five or six, sutures well-marked; the spire-whorls carry three sub-nodular spiral bands. The body-whorl is large and bicarinate owing to the prominence of the second and third spirals; number of spirals in the base about five.

The aperture is quadrangular with the columella considerably produced and slightly curved, and terminated at the point by a conspicuous reflexed notch or gutter.

Relations and Distribution.—This curious shell has a strong resemblance to *Littorina Phillipsii*, except as regards the aperture. A single specimen from Great Ponton.

439 ? Brachytrema "prætenue." Plate XLIII, figs. 24, 24 *b*.

Description:

Height	3 mm.
Spiral angle	32°.

Shell minute, conical-elongate, imperforate. There are about six whorls, flat and close, though the sutures are fairly distinct. The ornaments consist of fine spiral lines decussating with nodular longitudinal lines, slightly variciform. The body-whorl is about one-third the total height. Aperture subquadrate with a reflexed notch at the columellar extremity.

Relations and Distribution.—More acute than any other species of *Brachytrema*, this might almost be regarded as a *Cerithium*, though the style of ornamentation connects it with *Brachytrema*. A single specimen from the Oolite Marl, Notgrove.

440. Cerithium (Colina[1]) Lycetti, sp. nov. Plate XLIII, figs. 22 *a*, 22 *b*.

Description :

Height	15 mm.
Body-whorl to total height . . .	35 : 100.
Spiral angle	35°.

Shell sub-fusiform; apex sharp; spire regular; number of whorls eight, sutures close fitting. The ornaments consist of wide-apart longitudinal varices, which are decussated by strong spiral lines, slightly nodular.

The body-whorl is considerably expanded so as to make the outer lip patulous. The longitudinal varices are scarcely to be traced in the body-whorl, which is ornamented by numerous spiral ribs, expanding outwards with the increase of the whorl and causing the margin of the lip to be crenulate. The aperture is oblique with a full and rounded outer lip, somewhat flattened anteriorly, with a sinuous and rather encrusted columella, which terminates in a broad, short notch turned outwards almost at right angles to the axis of the shell.

Relations and Distribution.—This form is very different to the general facies of the shells in the Inferior Oolite which have been referred to *Cerithium*. It is suggestive of *Pyrazus* and other sub-genera of *Potamides*, but these are at least brackish-water shells. On the other hand, its resemblance to such shells as *Cerithium* (*Colina*) *contractum*, Sow., and *Cerithium* (*Colina*) *tæniatum* from the Indian Ocean (Natal) is very striking. Provisionally we may refer the Oolite specimens to *Colina*. Mr. Wilson considers that, possibly, there is a generic affinity between *C. Lycetti* and the Upper Lias *Nortonia Patroclus*.

From Nailsworth (Oolite Marl or Pea-grit) there are four specimens in the Jermyn Street Museum (Lycett Collection). The figured specimen is the most elongate.

441. Brachytrema, sp. Plate XLIII, fig. 23.

An imperfect specimen with an estimated height of 15 mm. and a spiral angle of 40°. The aperture, which happens to be well-preserved, is widely sub-quadrate with an effuse outer lip; columella much twisted near the base, with a broad gutter or notch directed outwards at an angle of 45°. There is strong granulated spiral ornamentation throughout the shell, which appears to have been very thick.

This seems to be a typical *Brachytrema*. A single specimen from the Irony Nodule-bed, Burton Bradstock.

[1] H. and A. Adams, 1853.

442. ? Fibula velox, sp. nov. Plate XLIV, figs. 7 *a*, 7 *b*.

Description:

Height	11 mm.
Spiral angle	42°.

Shell smooth, conical-subelongate, solid; apex acute, spiral angle regular. Number of whorls six; height of spire and of body-whorl nearly equal. The whorls are flat towards the apex, becoming gradually more convex, whilst the body-whorl is sub-tumid, with a rounded periphery; the whorls are quite smooth, with close sutures. The aperture is angular and oblong, the columella being considerably drawn out with a slight anterior twist, terminating in a somewhat ill-defined notch.

Relations and Distribution.—The true relations of this curious shell are not very obvious. A single specimen from the *Murchisonæ*-zone of the Cotteswolds; most probably from the Oolite Marl of Swift's Hill or Longridge.

443. Ceritella tumidula, *Lycett*, 1850. Not figured. And var. *angusta*. Plate XLIII, fig. 26.

1850. Ceritella tumidula, *Lycett*. Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 419.
1853. — — — Proc. Cotteswold Nat. Club, vol. i, p. 86.

Description:

Height	11 mm.
Body-whorl to total height	38 : 100.
Spiral angle	30°.

The following is Lycett's diagnosis: "Small, smooth, much lengthened; whorls flattened, but slightly tumid at their upper junctions; body-whorl symmetrical."

The number of whorls in the type-specimen (Brodie Collection) is eight; the thickening of these on the posterior margin produces a slight ledge at the suture (hence the name *tumidula*, otherwise inappropriate).

Relations and Distribution.—Closely related to *Ceritella Sowerbii*, Morris and Lycett, a Great Oolite species, though somewhat more slender than the majority of these. In fact, *C. Sowerbii* is merely a variety of *C. tumidula*. Rare in the shelly freestone at Leckhampton.

The var. *angusta* (fig. 26) has a height of 5 mm., and a spiral angle of 24°,

and may be regarded as a slender micromorph of Lycett's species. A single specimen from the Lower Limestone (below the Pisolite horizon) at Nailsworth. Cf. *Ceritella minutissima*, Lycett, Grt. Ool. Moll., Suppl., Plate 45, fig. 5.

N.B.—*Ceritellæ* of this group are not always easy to distinguish from the early stage of certain species of *Nerinæa*.

444. Ceritella Stokensis, sp. nov. Plate XLIII, fig. 25.

Description:

Height	5 mm.
Body-whorl to total height	70 : 100.
Spiral angle	60°.

Shell smooth and sub-globose, consisting of about five whorls; apex sharp; the whorls of the spire are narrow and flat, with a close but distinct suture. There is a slight ledge on the posterior margin of the body-whorl, which is tumidly elongate, being very large in comparison with the spire. The aperture is oval-elongate, outer lip thin, columella curved, and terminating in a wide notch, which is slightly reflexed.

Relations and Distribution.—This form differs completely from any species of *Ceritella* known in this country. A single specimen from the Lincolnshire Limestone at Stoke Lodge.

445. Cerithinella, sp. Plate XLIV, figs. 5, 6 *a*, 6 *b*.

The lower beds of the Lincolnshire Limestone have yielded some fragments of *Cerithinella*, a genus not hitherto noted in the East Midland district. In external ornamentation these specimens serve to remind me of *Cerithinella Brodiei*. The section (fig. 5) has slight indications of a fold in the outer wall as in *Nerinella*.[1]

446. Nerinæa (Nerinella) neglecta, sp. nov. Plate XLIV, figs. 4 *a*, 4 *b*.

Description:

Height	12 mm.
Spiral angle	30°.

Shell conical-elongate, turrited, with a somewhat convex spiral angle. Number of whorls about eight, narrow, without visible ornament, but much thickened at the posterior margin, so as to cause a marked increase or turreting of

[1] For an account of *Nerinæa* (or *Cerithinella*) *cingenda*, Sowerby, figured on Plate XII of this Monograph, see 'Geol. Mag.,' dec. iii, vol. i, p. 112, pl. iv, figs. 9 and 9 *a*.

each successive whorl. The body-whorl occupies one third of the total height, and is somewhat bicarinate. All the whorls, including the body-whorl, are slightly convex and very smooth. The aperture is quadrate, with a short thick columella, and wide anterior notch. A fold on the inner and outer walls of each whorl.

Relations and Distribution.—This species belongs to the biplicate section of *Nerinella* (see p. 198, and Pl. XIII, figs. 1 and 2, of this Monograph). It is much broader than either of the two unnamed forms there described. Consequently the shape of the whorl in section is much more squat.

There are two specimens in my Collection from the Lincolnshire Limestone of Weldon, and others which seem to connect with the narrower forms.

447. Nerinæa (Ptygmatis) cf. cingenda, *Phillips*. Plate XLIV, figs. 8, 8 *a*, 8 *b*.

Specimens of an elongate *Nerinæa*, not unlike *N. cingenda*, occur somewhat plentifully in the Lincolnshire Limestone at Stoke Lodge. In this case the internal section is that of a *Ptygmatis* with five folds. The specimens greatly resemble a variety provisionally named "*pseudocingenda*" (see p. 212, Pl. XIV, fig. 15, of this Monograph). Bearing in mind that sections of Dogger specimens of *Nerinæa cingenda* are liable to mislead, the Stoke Lodge fossils may possibly represent the true internal structure of this species.

Genus—Paludina, *Lamarck*, 1812.

Shell turbinated with round whorls, thin; aperture circular, slightly angular behind, peristome continuous, entire; operculum horny, concentric.

Conchologists have expressed a doubt whether *Paludina* extends as far back as the Jurassic. Yet *Paludina* occurs abundantly in the Upper Purbecks. Neither can we doubt that *Paludina scotica*, Tate ('Quart. Journ. Geol. Soc.,' vol. xxix, p. 349, pl. xii, fig. 3), from the Infra-Oxfordian beds of Loch Staffin, is correctly referred to that genus.

448. Paludina Langtonensis, sp. nov. Plate XLIV, figs. 1 *a*, 1 *b*.

Description:

Height (full size)	30 mm.
Body-whorl to total height . . .	60 : 100.
Spiral angle	62°.

Shell smooth, turbinate, often rather dark in colour, and with a considerable

umbilical furrow. Number of whorls five to six. These are very tumid and separated by a deeply impressed, almost canaliculate suture; sutural angle very oblique. No ornamentation, other than growth-lines, which are rugose and varix-like on the body-whorl. Aperture nearly circular with thin sharp lips.

Relations and Distribution.—This species resembles in some respect *Paludina scotica*, which occurs in the Hebrides on approximately the same horizon. It also differs but little from *Paludina vivipara*, being perhaps of smaller habit and with a more sloping sutural angle and more convex whorls than the existing species. On the other hand the Paludinas of the Upper Purbeck are for the most part very different.

Paludina Langtonensis is abundant in the so-called *Paludina*-bed, a kind of mortar-like deposit which occurs high up in the Chipping Norton limestone at Langton Bridge, along with other freshwater species and occasionally seeds of *Chara*, &c. But associated with these are species of *Cerithium* and *Nerinæa* along with a small variety of *Amberleya nodosa*—apparently a Bathonian fauna. This deposit, where developed, is found to underlie a gritty bed containing teeth and palates of fish.

Paludina Langtonensis also occurs in great abundance at Castle Barn, three and a half miles from Chipping Norton, and traces may likewise be seen at Sharp's Hill in a similar position.

Genus—Valvata, *Müller*, 1774.

Shell umbilicated, turbinoid, or subdiscoidal, spire but slightly prominent, whorls convex and few; aperture circular, oblique; peristome entire, thin, sharp, slightly expanded.

449. Valvata comes, sp. nov. Plate XLIII, fig. 27; and Plate XLIV, figs. 2 *a*, 2 *b*.

The transverse diameter of these little shells does not exceed 3 mm. Judging from the figure they differ slightly from *Valvata præcursor*, Tate ('Quart. Journ. Geol. Soc,' vol. xxix, p. 348, pl. xii, fig. 9). The spire is more salient than in *Valvata cristata*.

Somewhat rare in the *Paludina*-bed at Langton Bridge.

450. Cirrus, species or variety. Plate XLIV, fig. 12.

The interest of this specimen consists in the fact that it is the only one of the genus known to me from the Lincolnshire Limestone (Stoke Lodge). It may possibly be a micromorph of *Cirrus Leachi*.

451. Onustus pileus, *Lycett*, 1850. Not figured.

1850. Trochus pileus, *Lycett*. Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 417.
1853. — — — Proc. Cotteswold Nat. Club, vol. i, p. 78.

The following is Lycett's diagnosis. "Very elevated; whorls few, concave, with longitudinal elevations united at the base, and overwrapping the upper portion of the succeeding whorl, base discoidal." Further on he adds that this will probably be erected into a new genus.

There is a single specimen in the Brodie Collection, the apical whorls alone being preserved. It is clearly a species of *Onustus*, related to *O. acuminatus*, Hudl. There are two much larger specimens, also from the Cotteswolds, which have been in the Jermyn Street Museum for some years (see p. 328, supra). These may be referred to *Onustus pileus*, Lycett.

452. Delphinula or Margarita, species. Plate XLIV, figs. 3 *a*, 3 *b*.

This form has considerable resemblance to *Delphinula* (*Turbo*) *Santonis*, Hudl., differing principally in details of ornamentation. At the same time I would scarcely refer to it as absolutely the same species.

A single specimen, said to come from Cold Comfort in the Cheltenham district.

453. Delphinula quaterno-cingillata, *Lycett*, 1850. Not figured.

1850. Delphinula quaterno-cingillata, *Lycett*. Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 416.
1853. — — — Proc. Cotteswold Nat. Club, vol. i, p. 77.

This is a doubtful species, since the two specimens thus marked in the Brodie Collection differ in more than one respect from the diagnosis, which is as follows:— "Subglobose, spire of several whorls, angulated; longitudinal costæ large, elevated, rather angular, impressed by numerous transverse (spiral) lines; umbilicus costated; aperture orbicular."

Chilodontoïdea, genus nov.

Shell short, thick, eucycloid, slightly pupæform, imperforate. Whorls irregular, the anterior ones carinate; body-whorl considerably shorter than the spire; ornamentation subreticulate. Aperture externally quadrate and oblique, with a double callosity on the columella, which is dentate at the angle; a broad callosity inside the outer lip further restricts the aperture internally.

There are many points of resemblance between this curious genus and *Chilodonta*, Étallon, which, however, is represented as having five internal teeth or callosities. The Corallian genus also has a more distinctly trochiform spire, though the character of the ornamentation is somewhat similar. Fischer ('Manuel,' p. 818) makes *Chilodonta* a sub-genus of *Clanculus*, one of the Trochidæ. In this connection the following references may be useful.

Chilodonta clathrata, Étallon. Corallien du Haut Jura ii, p. 54.

Trochus (*Monodonta*) *clathratus*, Étallon. Zittel, Gast. Stramb. Schicht, p. 329, pl. xlviii, figs. 27 and 28.

Chilodonta clathrata, Étallon. De Loriol, Mém. Soc. Pal. Suisse, vol. xvii (1890), p. 147, pl. xvi, fig. 15.

454. Chilodontoïdea oolitica, sp. nov. Plate XLIII, figs. 19, 20 *a*, 20 *b*.

Description:

Height	9 mm.
Body-whorl to total height	35 : 100.

Spiral angle irregular and convex.

The apex is sharp; number of whorls eight, flat to subconvex in the early stages, strongly carinate in the later ones, and separated by a deep suture. The ornaments in the upper part of the whorls consist mainly of delicate and rather sinuous axial lines, which on the keels produce a fine granulation; in the anterior portion of the whorls the ornaments are chiefly spiral. The shell gapes somewhat between the penult and body-whorl, which latter is stumpy, and towards the aperture its upper margin encroaches on the penult. The body-whorl is carinate and spirally ornamented on the base. There are, however, considerable differences in ornamentation according to locality.

The characters of the aperture are those of the genus.

Relations and Distribution.—The distinction between this form and *Chilodonta*

clathrata have already been partially indicated. Attention is also drawn, in the accompanying footnote, to another form, lately found in the Lias of Thorncombe, which evidently belongs to the same group, though generically, or at least subgenerically, distinct.[1]

Chilodontoïdea oolitica is a rare species, yet it occurs on the same horizon at four localities, viz. the *Concavus*-bed at Bradford Abbas and the Irony Nodule-bed of Burton Bradstock; also at Beaminster and Stoford.

455. Fossarus (Couthouya[2]) oolitICUS, sp. nov. Plate XLII, fig. 17.

Description :

Height	13 mm.
Body-whorl to total height . . .	70 : 100.
Spiral angle	60°.

An ovate elongate shell with a short spire and few whorls, which are non-embracing. A very slight umbilical fissure. The entire shell is ornamented with strong spiral ribs, regular and equidistant. Aperture a lengthened oval, with an arched and crenulated outer lip, expanded anteriorly, and a long and almost straight columellar lip. The entire peristome is thick.

Relations and Distribution.—There is very little difference between this shell and the existing *Couthouya reticulata*, A. Adams, from the China seas. The modern shell has a better developed umbilical fissure, and is rather smaller; *Isapis fenestrata*, Carpenter, from the west coast of North America, is also very near.

A single specimen from the *Concavus*-bed, Bradford Abbas.

[1] In order to find a place for the Lias shell, I propose to constitute the genus *Wilsonia*, thus named in honour of Edward Wilson, Esq., F.G.S., Curator of the Bristol Museum, who is our chief authority on the Gasteropoda of the Lias. The following is the diagnosis:

Shell small, very thick, irregularly pupæform, imperforate, whorls increasing irregularly and scarcely convex, separated by a distinct but rather narrow suture. Ornaments pronounced, consisting of four or five granular spiral belts in each whorl, with fine intermediate axial decussation. Body-whorl rather shorter than the spire and compressed. Aperture sub-circular, with a thick outer lip and two prominent teeth towards the middle of the short columella.

Wilsonia liassica, sp. nov. (Plate XLIV, figs. 13 *a*, 13 *b*, 13 *c*), has seven or eight whorls and a total height of about 14 mm. The prominence of the penult, which quite equals the body-whorl in width, is a characteristic feature; the ornamentation is very rich. A single specimen from the "junction-bed," Thorncombe, Dorset.

In *Wilsonia* the aperture possesses two distinct teeth: in *Chilodontoïdea* there are three callosities or teeth, and the internal portion of the aperture thus assumes a somewhat keyhole-like shape: in *Chilodonta* the aperture is restricted by five irregular teeth, and thus becomes still more fanciful in outline. We can scarcely doubt that these three genera (or sections) stand in ancestral relationship to each other, either linear or collateral.

[2] *Couthouya*, A. Adams, 1860, sub-genus of *Fossarus*, Philippi, 1841, member of the Littorinidæ. Cf. also *Fossariopsis*, Laube, from the Trias.

TABLE I.

ALPHABETICAL INDEX OF THE INFERIOR OOLITE GASTEROPODA,

WITH A TABLE OF DISTRIBUTION ACCORDING TO DISTRICTS.

NOTE.

1.—As a rule no species are quoted in this Index unless based on specimens which have been seen by myself: *Nerinæa consobrina*, Witchell, is perhaps the only exception. Forms provisionally named in the Monograph are not listed: exception, *Nerinæa sub-brevivoluta*.

2.—Practically there are five districts: viz. (1) The Yorkshire Basin, *Lower* Division, including the Dogger and Millepore Bed; *Upper* Division, the Scarborough Limestone. (2) The East Midland District is not at present divided into a Lower and Upper Division; it embraces the Northampton Sand and Lincolnshire Limestone. (3) The Cotteswold District includes the Inferior Oolite outcrop from the neighbourhood of Banbury (Hook Norton) to the Mendip axis. The *Lower* Division comprises the *Opalinus*- and *Murchisonæ*-zones, including the Pea-grit, Oolite-marl, and the Freestones. It is probable also that the Gryphite-grit and Lower *Trigonia*-grit should come in here. The *Upper* Division includes the Upper *Trigonia*-grit and *Clypeus*-grit with their equivalents, lying for the most part in the *Parkinsoni*-zone. (4) The Dundry exposure is regarded as a district by itself, not at present divided. (5) The Dorset-Somerset District extends from the Mendip axis to the Channel at Burton Bradstock. The *Lower* Division includes the Yeovil Sands, together with the *Opalinus*-zone, *Murchisonæ*-zone, and *Concavus*-bed (in the early part of this Monograph called the *Sowerbyi*-bed). The *Upper* Division includes the *Sauzei*-bed, which is much more nearly on the *Sowerbyi*-horizon, the *Humphriesianus*-zone generally, and the *Parkinsoni*-zone.

3.—In the columns a "note of interrogation" (?) in some cases signifies that the identification is questioned, in others that the locality is in doubt. In those cases where an Upper and a Lower Division are adopted, the query may relate to the Division only. With respect to the East Midland District there is considerable difference between the Fauna of the Lower Division of the Lincolnshire Limestone, as exemplified by the extremely fossiliferous horizon at Lincoln, and the Fauna of the Upper Division, as exemplified by the beds at Weldon and Ponton; but since some fossiliferous localities are doubtful it has been thought best not to attempt to distinguish an Upper and Lower Division.

	Page.	Plates and Figures.	Lias.	Yorkshire. L.	Yorkshire. U.	East Midlands.	Cotteswolds. L.	Cotteswolds. U.	Dundry.	Dorset—Somerset. L.	Dorset—Somerset. U.	Higher beds.
ACTÆON (*Tornatellæa*)												
ooliticus, *Hudleston*	467	XLII, 11	..	..	..	?	..	..	..	×		
pulchellus, *Deslongchamps*	466	XLII, 12, 13	..	..	..	..	..	..	..	..	×	
sculptus, *Lycett*	467	XLII, 10, 10 *a*	..	..	..	..	..	..	..	×		
ACTÆONINA (*Striactæonina, Cylindrobullina, Trochactæonina*, &c.)												
antiqua, *Lycett*	477	XLIII, 6	..	..	..	..	..	×				
cinerea, *Hudleston*	474	XLIII, 1 *a*, 1 *b*	..	..	×							
? convoluta, *Lycett*	477	XLIII, 7	..	..	..	..	..	×				
cf. Esparcyensis, *d'Archiac*	476	XLIII, 8	..	..	..	×	..	..	..	..	..	G. O.
gigantea, *Deslongchamps*	474	XLIII, 2, 3	..	..	×	×	..	×	.	..	..	G. O.
— var. attenuata	475	XLIII, 4	..	..	..	×						
glabra, *Phillips*	473	XLII, 22, 23 *a*, 23 *b*	..	..	×	×	..	×				
humeralis, *Phillips*	472	XLII, 20 *a*, 20 *b*	..	×	..	?	..	..	..	×		
ovata, *Lycett*	475	Not figured	..	..	..	?	..	?				
pulla, *Koch & Dunker*, fide *M. & L.*	470	XLII, 14	..	..	×	×	..	×				
? Sedgvici, *Phillips*	469	XLII, 15	..	×								
subovalis, *Hudleston*	472	XLII, 21	..		..	..	..	..	..	×		
tenuistriata, *Hudleston*	471	XLII, 18, 19, 19 *a*	..	×	..	..	..	..		×		
tumidula, *Lycett*	476	XLIII, 5 and ? 9	..	..	×	×	?					
ALARIA												
angusta, *Hudleston*	111	IV, 2	..	..	..		..	..		?		
arenosa, *Hudleston*	110	IV, 1	..	×								
Doublieri, *d'Orbigny*	127	V, 11; VI, 1 *a—c*	..	..	..	.	..	..	?	..	×	
Dundriensis, *Tawney*	122	V, 2	..	..	..	.	..	..	×			
fusca, *Hudleston*	121	V, 3	..	..	..	.	..	..	..	..	×	
hamoides, *Hudleston*	140	VII, 7 *a*, *b*	..	..	..	×						
hamus, *Deslongchamps*	113	IV, 6 *a–d*, 7 *a–c*; VII, 9	.	..	..	.	..	×	.	..	×	
— var. nodosa	117	IV, 9	..	..	..	..	..	..	..	.	?	
— var. Phillipsii, *d'Orbigny*	116	IV, 8 *a—c*	..	×	×	.	..	×				
Lorieri, *d'Orbigny*	132	VI, 6 *a—d*; 6′ *a*, *b*; 6″ *a*	..	..	..	.	.	.	..	..	×	
— var. gracilis, *Lycett*	135	VI, 5	..	..	..	.	×					
Lotharingica, *Schlumberger*	125	V, 9	..	.	..	..	..	..	×			
myurus, *Deslongchamps*	130	VI, 4 *a—c*	..	..	..	..	..	×	×	..	..	? G. O.
pinguis, *Hudleston*	117	IV, 10; VII, 11	..	..	..	.	..	..	.		×	
Pontonis, *Hudleston*	135	VII, 1 *a*, *b*	..	..	..	×						
— var. spinifera	135	VII, 2	..	..	..	×						
prælonga, *Hudleston*	126	V, 10	..	..	..	..	..	..	.	×		
primigenia, *Hudleston*	137	VII, 3	..	..	..	..	..	..	.	..	×	
pseudo-armata, *Hudleston*	125	V, 8	..	×								
cf. rarispina, *Schlumberger*	118	IV, 12	..	..	..	.	..	..	..	?		
Roubaleti, *Schlumberger*, var. Dorsetensis	123	V, 5 *a—f*, 6; VII, 10	..	..	×	.	..	..	.	×		
solida, *Lycett*	139	VII, 5, 6	..	..	..	.	?					
spinigera, *Lycett*	138	VII, 4	..	..	..	.	×					
sublævigata, *Hudleston*	129	VI, 3 *a*, *b*, 3′ *a*, 3′ *b*	..	×	..	..	..	..	.	×		
unicarinata, *Hudleston*	118	IV, 13 *a–c*	..	×	..	?						
unicornis, *Lycett*	119	V, 1 and ? 7 *a*, *b*	.	..	..	..	×	..	..	×		
(? Diartema) varicifera, *Hudleston*	141	II, 10, *a*, *b*; VII, 8 *a*, *b*, 8′ *a*, *b*	..	..	..	×						

	Page.	Plates and Figures.	Lias.	Yorkshire. L.	Yorkshire. U.	East Midlands.	Cotteswolds. L.	Cotteswolds. U.	Dundry.	Dorset—Somerset. L.	Dorset—Somerset. U.	Higher beds.
CERITELLA												
Lindonensis, *Hudleston*...	177	XI, 3 *a*, *b*, 4	...	...	...	×						
Stokensis, *Hudleston*	487	XLIII, 25	...	...	...	×						
tumidula, *Lycett*	486	Not figured	...	...	...	...	×					
— var. angusta	486	XLIII, 26	...	...	...	...	×					
CERITHINELLA												
Bajocensis, *Hudleston*	186	XII, 1 *a*, *b*, 2, 3	...	...	...	...	...	...	...	×		
Brodiei, *Hudleston*	187	XII, 4 *a*, *b*; ? XLIV, 5, 6 *a*, 6 *b*	...	...	...	?	×	...	...	×		
? cingenda, *Sowerby*	487	XII, *x*	...	×								
CERITHIUM												
abbas, *Hudleston*	172	X, 10 *a*—*c*	...	...	...	...	...	...	...	×		
armatum, *Münster*	156	IX, 1	×	...	...	...	×					
attritum, *Hudleston*	171	X, 9 *a*, *b*	...	...	...	×						
Beanii, *Morris & Lycett*	159	IX, 5 *a*, *b*	...	×	...	×	?					
— var. Weldonis	160	IX, 6 *a*—*c*, 6′*a*—*d*	...	...	...	×						
cæruleum, *Hudleston & Wilson* (turris, *H.*)	166	IX, 15	...	×								
circe, *d'Orbigny*	168	X, 4	...	...	...	...	...	...	...	...	×	
clypeus, *Hudleston* (? clypeatum, *Wite.*).	170	X, 8 *a*, *b*, 8′	...	...	...	...	...	×	...	...	...	
comma, *Münster*	167	X, 2	...	...	...	...	...	...	...	...	×	
— var. near to C. unitorquatum, *Heb. & Desl.*	168	X, 3	...	...	...	...	...	...	...	...	×	
gemmatum, *Morris & Lycett*	147	VIII, 4	...	...	×							
Georgii, *Hudleston*	162	IX, 10	...	...	...	×						
latisulcatum, *Hudleston*	164	IX, 12	...	...	...	×						
Leckenbyi, *Hudleston*	158	IX, 4	...	×	...	...	...	...	...	...	...	
Leckhamptonense, *Hudleston*	157	IX, 2	...	...	...	...	×	...	...	...	...	
limæforme, *Römer*, var. Pontonis	161	IX, 7	...	...	...	×	...	...	...	...	...	
Lycetti [Colina], *Hudleston*	485	XLIII, 22 *a*, 22 *b*	...	...	...	...	×	...	...	...	...	
muricatum, *Sowerby*	146	VIII, 2 *a*, *b*	...	×	...	...	...	...	...	...	...	
— var. trilineata	147	VIII, 3	...	...	×	...	...	...	...	...	...	
? obesum, *Hudleston*	154	VIII, 12	...	...	...	...	...	...	...	...	×	
Obornense, *Hudleston*	173	X, 11	...	...	...	...	...	...	...	...	×	
pergradatum, *Hudleston*	169	X, 6	...	...	...	...	...	...	...	×	...	
pisoliticum, *Hudleston*	164	IX, 13 *a*, *b*	...	...	...	...	×	...	...	...	...	
polystrophum, *Hudleston*	173	X, 12, 13	...	...	...	×	...	...	...	...	...	
quadricinctum, *Münster*	160	Not figured	...	...	...	×	...	...	...	...	...	
quadrilineatum, *Römer*	145	VIII, 1	×	×	...	...	...	...	...	...	...	
subabbreviatum, *d'Orbigny*	154	VIII, 11	...	...	...	...	...	...	...	...	×	
subcostigerum, *Hudleston*	163	IX, 11	...	...	...	×	...	...	...	...	...	
subglabrum, *Hudleston*	155	VIII, 13	...	...	...	...	...	...	...	×	...	
subscalariforme, *d'Orbigny*, two vars.	153	VIII, 9, 10 *a*—*b*	...	...	...	...	...	...	...	...	×	
— var. spinicostata, *Wright MS.*	151	VIII, 8 *a*—*f*	...	...	...	...	...	...	...	×	...	
vetustum, *Phillips*	148	VIII, 5 *a*—*d*	...	×	×	?	...	×	...	...	...	
— var. seminuda	151	VIII, 7	...	×	...	...	...	...	...	...	...	
vetustum-majus, *Hudleston*	150	VIII, 6 *a*, *b*	...	×	...	...	...	...	...	...	...	
Wansfordiæ, *Hudleston*	162	IX, 9 *a*—*c*	...	...	...	×	...	...	...	...	...	
CHILODONTOÏDEA												
oolitica, *Hudleston*	491	XLIII, 19, 20 *a*, 20 *b*	...	...	...	...	...	...	...	×	...	

	Page.	Plates and Figures.	Lias.	Yorkshire.		East Midlands.	Cotteswolds.		Dundry.	Dorset—Somerset.		Higher beds.
				L.	U.		L.	U.		L.	U.	
EUCYCLOIDEA (*Purpurina*, sect. 2)												
bianor, *d'Orbigny*	95	II, 5 *a—h*	..	..	..	.	..	..	..	..	×	
carino-crenata, *Lycett*	97	II, 7 *a*, *b*	..	..	..	..	×	..	..	..	..	
EUSPIRA?												
Species, "subcoronata"	270	XXI, 2	..	.	..	×	..	..	..	..	..	
EXELISSA												
Normaniana, *d'Orbigny*	180	XI, 9	..	..	..	..	..	..	..	..	×	
pulchra, *Lycett*	179	XI, 7	..	..	..	×	..	..	..	..	..	G. O.
strangulata, *d'Archiac*	178		.	..	..	..	..	..	..	..	..	G. O.
— var. ovalis	178	XI, 6	..	..	..	×	..	..	..	..	..	
— var. pisolitica	178	XI, 5 *a*, *b*	..	..	..	.	×	..	..	..	..	
Weldonis, *Hudleston*	179	XI, 8 *a*, *b*	..	..	×	×	..	..	..	..	..	
FIBULA												
angustivoluta, *Hudleston*	174	XI, 1	..	..	..	×	..	..	..	..	..	
canina, *Hudleston*	175	XI, 2 *a*, *b*	..	×	..	.	..	..	..	..	..	
? velox, *Hudleston*	486	XLIV, 7 *a*, *b*	..	.	..	..	×	..	..	..	..	
FOSSARUS												
ooliticus [Couthouya], *Hudleston*	492	XLII, 17	..	..	..	..	..	..	..	×	..	
HAMUSINA												
Damesi, *Gemmellaro*	304	XXIV, 12	..	..	..	..	..	..	..	×	..	
Oppelensis, *Lycett*	305	XXIV, 13, 14	..	..	..	..	×	..	..	×	..	
LITTORINA												
ædilis, *Münster* (fide *Tawney*)	298	XXIV, 1 and ? 2	..	..	..	..	×	..	×	..	..	
Dorsetensis, *Hudleston*	299	XXIV, 3, 4, 5	..	..	..	.	×	..	..	×	..	
pisolitica [? Trochus], *Hudleston*	300	XXIV, 9	..	..	..	.	×	..	..	..	..	
Phillipsii, *Morris & Lycett*	296	XXIII, 16	..	?	×	×	?	..	..	..	×	
polytimeta [Tectarius], *Hudleston*	295	XXIII, 12, 13	..	..	..	?	..	..	..	×	..	
prætor [Echinella], *Goldfuss*	294	XXIV, 8	..	.	..	.	..	..	..	×	..	
recteplanata [? Trochus], *Tawney*	300	XXIV, 6, 7	..	.	..	.	×	..	×	..	..	
cf. sulcata, *Hébert & Deslongchamps*	297	XXIII, 15	..	..	..	..	..	..	..	..	×	
triarmata [? Trochus], *Heb. & Desl.*	301	Not figured	..	..	..	..	..	..	..	?	..	
Weldonis, *Hudleston*	297	XXIII, 18	..	..	..	×	..	..	..	..	..	
MALAPTERA												
Bentleyi, *Morris & Lycett*	101	III, 1 *a—c*	..	..	..	×	..	..	..	..	..	
— var. neglecta	102	III, 2	..	..	..	×	..	..	..	..	..	
MONODONTA												
Lyelli, *d'Archiac*	357	XXX, 1, 2	..	..	..	×	.	?	..	..	..	G. O.
— var. humilis	357	XXX, 3	..	..	..	×	..	..	..	..	..	
pisolitica, *Hudleston*	356	XXIX, 17 and ? 18	..	..	.	..	×	..	..	..	..	
NATICA												
adducta, *Phillips*	257	XX, 3	..	×	×	×	×	..	..	..	..	
— var. globata	259	XX, 5, 6	..	..	..	..	×	..	..	×	..	
— var. Oppelensis, *Lycett*	258	XX, 2	..	..	..	..	×	..	..	..	..	
Bajocensis, *d'Orbigny*	263	XX, 13 *a*, *b*	..	..	..	.	..	×	..	..	×	

	Page.	Plates and Figures.	Lias.	Yorkshire. L.	Yorkshire. U.	East Midlands.	Cotteswolds. L.	Cotteswolds. U.	Dundry.	Dorset—Somerset. L.	Dorset—Somerset. U.	Higher beds.
NERITA												
costulata, *Deshayes*	332	XL, 6 *a*, *b* and ? XXVIII, 6 *a*, *b*	..	×	×	.	×					
pseudocostata, *d'Orbigny*	333	XXVIII, 7, 8, 9	...	×	...	...	×					
subrugosa, *Hudleston*	334	XL, 7 *a*, *b*; 8	..	..	×	×						
tumidula [Neridomus], *Phillips*	335	XXVIII, 12 *a*, *b*	..	×	...	×	×					
transverse species [Neridomus]	336	XL, 9 *a*, *b*	...	×	...	.	×					
NERITOPSIS												
Bajocensis, *d'Orbigny*	340	XXVII, 9 *a—c*	..	...	...	...	..	...	.	..	×	
cf. decussata, *Münster*	342	XXVIII, 5 *a—c*	..	...	...	×	..	...	.	..	..	Cor.
cf. Hebertana, *d'Orbigny*	343	XXVIII, 3 *a—c*	×	..	...	...	?	...	.	×		
incisa, *Hudleston*	342	XXVIII, 2	..	..	...	×	×					
Philea, *d'Orbigny*	341	XXVII, 11 *a—c*	...	×	...	..	.	...	.	×		
cf. sulcosa, *d'Archiac*	344	XXVIII, 4	..	..	...	.	×	...	...	...	..	G. O.
varicosa, *Morris & Lycett*	341	XXVIII, 1 *a—c*	...	..	...	..	×	..	...	...	...	?G.O.
ONUSTUS												
acuminatus, *Hudleston*	328	XXVII, 3	...	..	..	..	..	..	..	×		
Heberti, *Laube*	329	XXVII, 6 *a*, *b*; 7	..	..	.	.	..	..	..	?		
heliacus, *d'Orbigny*, var. opalina	329	XXVII, 4 *a*, *b*	×	.	.	.	..	..	...	×		
cf. lamellosus, *d'Orbigny*	328	XXVII, 5 *a*, *b*	..	..	..	.	..	..	..	×		
ornatissimus, *d'Orbigny*	330	XXVII, 8 *a*, *b*	..	...	..	?	.	...	.	..	×	
pileus, *Lycett*	490	Not figured	...	..	...	.	×					
pyramidatus, *Phillips*	326	XXVII, 1, 2	..	×	.	×	..	..	.	×		
PALUDINA												
Langtonensis, *Hudleston*	488	XLIV, 1 *a*, *b*	..	..	..	.	.	×				
PATELLA												
cf. cingulata [? Scurria], *Münster*	461	XLII, 5 *a—c*	...	..	..	..	..	×	.	.	..	G. O.
fenestræ, *Hudleston*	463	XLII, 9 *a*, *b*	...	..	.	.	..	×				
inornata [Scurria], *Lycett*	460	XLII, 4 *a*, *b*	.	..	..	×	×					
naua [Scurria], *Sowerby*	462	XLII, 6 *a*, *b*	..	..	..	×	.	..	..	..	..	G. O.
nitida [Scurria], *Deslongchamps*	461	XLII, 7 *a*, *b*	..	..	..	.	×	..	..	..	..	G. O.
retifera, *Lycett*	463	Not figured	...	..	..	.	×					
Römeri, *Morris & Lycett*	463	XLII, 8 *a*, *b*	...	..	..	×	..	..	..	..	..	G. O.
"PHASIANELLA"												
conoidea, *Hudleston*	254	XIX, 14 *a*	...	?	×							
elegans, *Morris & Lycett*	252	XIX, 11 *a*, *b*; 12	..	.	..	×	..	..	..	..	..	G. O.
latiuscula, *Morris & Lycett*	251	XIX, 10 *a*, ? 10 *b*	...	..	×	×	..	..	..	..	?	
Leymeriei, *d'Arch.*, var. Lindonensis	253	XXI, 5	..	..	..	×	..	..	..	..	.	G. O.
Pontonis, *Lycett*	253	XIX, 13	...	..	..	×	.	...	.	..	?	G.O.
cf. subumbilicata, *d'Archiac*	255	XIX, 15	..	..	..	×	..	..	..	..	..	G. O.
PILEOLUS												
lævis, *G. B. Sowerby*	338	XXVIII, 15 *a—c*	...	..	..	×	?	...	..	..	..	G. O.
plicatus, *G. B. Sowerby*	337	XXVIII, 13 *a*, *b*; 14 *a—c*; 16	.	..	..	×	×	..	.	..	..	G. O.

	Page.	Plates and Figures.	Lias.	Yorkshire. L.	Yorkshire. U.	East Midlands.	Cotteswolds. L.	Cotteswolds. U.	Dundry.	Dorset—Somerset. L.	Dorset—Somerset. U.	Higher beds.
PLEUROTOMARIA[1]												
abbreviata, *Sowerby*	401	XXXIII, 8, 9							×		×	
Actæa, *d'Orbigny*	431	XXXVII, 8							×		×	
actinomphala, *Deslongchamps*	433	XXXVII, 7*a*,*b*; XXXVIII,1–5							×	×		
Agatha, *d'Orbigny*	402	XXXIII, 12 *a*, *b*; XXXIV, 6									×	
— var. Sandersii, *Tawney*	403	XXXIV, 7							×			
Ajax [Leptomaria], *d'Orbigny*	412	XXXV, 8, 8 *a*, *b*; 9, 9 *a*				×						
Alcyone, *d'Orbigny*	409	XXXV, 4, 4 *a*, *b*									×	
Alimena, *d'Orbigny*	419	Not figured									×	
Allica, *d'Orbigny*	422	XXXVI, 5, 5 *a*							×		×	
amata, *d'Orbigny*	418	XLIV, 11 *a—c*									×	
Amyntas [? Leptomaria], *d'Orbigny*	415	XXXV, 12							×	×		
cf. araneosa, *Deslongchamps*	438	XXXIX, 2 *a*, *b*	×	×			×					
armata, *Münster*	427	XXXVII, 5									×	
Athulia, *d'Orbigny*	409	XXXIV, 12									?	
Baugieri, *d'Orbigny*	435	XXXIX, 4 *a—c*; var. 5 *a—c*								×		
Bessina, *d'Orbigny*	406	XXXIV, 4, 5									×	
bicingulata, *Hudleston*	398	XXXIII, 3								×		
circumsulcata, *d'Orbigny*	404	XXXIII, 10, 11; XXXIV, 3									×	
distinguenda, *Tawney*	407	XXXIV, 10; XXXV, 1							×		×	
Dundriensis, *Tawney*	407	XXXIV, 11							×			
elongata, *Sowerby*	399											
— var. angusta	400	XXXIII, 4								×		
— var. near to conoidea, *Deshayes*	400	XXXIII, 6									×	
— type form = Pl. Pictaviensis, *d'Orbigny*	400	XXXIII, 7							×		×	
— var. Ebrayana, *d'Orbigny*	401	Not figured							×		×	
— var. turrita, *Deslongchamps*	401	XXXIV, 8									×	
fasciata, *Sowerby*	416	XXXVI, 3				×	×	?	×	×	×	
granulata, *Sowerby*	440	XXXIX, 10 *a—c*; XL, 1, 1 *a*							×		×	
mirabilis, *Deslongchamps*	437	XXXIX, 7 *a—c*	×							×		
mopsa, *d'Orbigny*	436	XXXIX, 6 *a—c*	×							×		
monticulus [Leptomaria], *Deslongchamps*	413	Not figured							×			
monticuloides, *Hudleston*	413	XXXV, 10, 10 *a*								×		
Obornensis, *Hudleston*	404	XXXIV, 9									×	
ornata, *Sowerby*	429	XXXVII, 3 *a—c*							×		×	
ornata-depressa, *Hudl.* (? carinata, *Sow.*)	431	XXXIX, 3 *a—c*					×		×	×		
oxytera, *Hudleston*	433	XXXVII, 6									×	
Palæmon, *d'Orbigny*	443	XL, 3 *a—c*							×		×	
paucistriata, *d'Orbigny*	425	XXXVII, 1							×		×	
phylax, *Hudleston*	441	XL, 4 *a—c*									×	
phyospira, *d'Orbigny*	420	Not figured							×		×	
plicopunctata, *Deslongchamps*	442	XL, 2 *a—c*							×		×	
Proteus, *Deslongchamps*	426	XXXVII, 2									×	
punctata, *Sowerby*	396	XXXIII, 1, 2							×	×	×	
cf. Sanzeana, *d'Orbigny*	428	Not figured							×		×	
scrobinula, *Deslongchamps*	408	XXXV, 3, 3 *a*; ? 2									×	
subaraneosa, *Hudleston*	437	XXXIX, 1 *a*, *b*								×		
subdecorata, *Münster*	421	XXXVI, 10	×			×			×	×		
subfasciata, *d'Orbigny*	420	XLIV, 10									×	

[1] It is probable that more species of *Pleurotomaria* occur in the Cotteswold District than those quoted in the Table. But as the specimens are found chiefly in the condition of casts or in bad preservation the specific characters are often uncertain. Thus we may expect to find *Pl. elongata* and other common species.

	Page.	Plates and Figures.	Lias.	Yorkshire. L.	Yorkshire. U.	East Midlands.	Cotteswolds. L.	Cotteswolds. U.	Dundry.	Dorset—Somerset. L.	Dorset—Somerset. U.	Higher beds.
PLEUROTOMARIA												
subglabra, *Hudleston*	405	XXXIV, 1, 2									×	
subplatyspira, *d'Orbigny*	416	XXXVI, 1									×	
subreticulata, *d'Orbigny*	422	XXXVI, 6, 6 *a*; ? 7				?			×		×	
sulcata [Leptomaria], *Sowerby*	410	XXXV, 6, 6 *a*, *b*; 7, 7 *a*, *b*					×		×	×		
sulcata-Humphriesiana [Leptomaria], *Hudleston*	414	XXXV, 11									×	
Stoddarti, *Tawney*	418	XXXVI, 2							×			
textilis, *Deslongchamps*	424	XXXVI, 8							?		×	
including Pl. scalaris, *Deslongch.*		XXXVI, 9									×	
transilis, *d'Orbigny*	419	XXXVI, 4, 4 *a*									×	
trapeza, *Hudleston*	444	XL, 5 *a*, *b*									×	
tuberculosa, *Defrance*	428	XXXVII, 4 *a*, *b*									×	
Yeovilensis, *Tawney*	439	XXXIX, 8 *a*, *b*, *c*							×	×		
— var. rugosior	439	XXXIX, 9 *a*, *b*									×	
PSEUDALARIA												
Etheridgii, *Tawney*	189	XII, 6 *a*—*c*, 7								×		
— var. granosa	190	XII, 8								×		
jugosa, *Bean*	190	XII, 9		×								
PSEUDOMELANIA												
Astonensis, *Hudleston*	245	XVIII, 8 *a*, *b*				×		×				
bicarinata, *Wright, MS.*	238	XVIII, 3 *a*—*c*								×		
Burtonensis, *Hudleston*	246	XIX, 5									×	
coarctata, *Deslongchamps*	242	XVIII, 9 *a*—*c*; XIX, 1 *a*, *b*						×			×	
heterocycla, *Eugène Deslongchamps*	239	XVIII, 4 *a*, *b*; (variety) 4 *c*					×			×		
lævigata, *Morris & Lycett*	244	XXI, 6			×							?G.O.
lineata, *Sowerby*	241	XVIII, 7 *a*, *b*							×		×	
Lonsdalei, *Morris & Lycett*	243	XIX, 2			×							G. O
procera, *Deslongchamps*	237	XVII, 9; XVIII, 1, 2; XXI, 1	?	×		×	×			×		
simplex, *Morris & Lycett*	244	XIX, 4					×					?G.O.
PUNCTURELLA												
acuta, *Deslongchamps*	457	XLI, 19 *a*—*c*					×					G. O
PURPURINA												
aspera, *Hudleston*	91	I, 11 *a*—*e*								×		
bellona, *d'Orbigny*	88	I, 5 *a*—*f*									×	
— var. pagoda	89	I, 7 *a*—*c*									×	
calcar, *Hudleston*	91	II, 1 *a*, *b*								×		
cancellata, *Hudleston*	87	I, 3 *a*, *b*								?		
curta, *Hudleston*	90	I, 6 *a*, *b*									×	
elaborata, *Lycett*	85	I, 1 *a*—*g*		×	×	×	×			×		G. O.
inflata, *Tawney*	92	II, 2 *a*—*f*						×	×		×	
parcicosta, *Hudleston*	90	I, 10 *a*, *b*								?		
rotunda, *Hudleston*	93	II, 3 *a*—*d*								×		
cf. Sowerbyi, *Waagen*	93	Not figured								×		
tabulata, *Hudleston*	94	II, 4 *a*—*c*								×		
varicosa, *Lycett*	483	Not figured					×					
PURPUROIDEA												
species	483	XLIV, 9				×						

	Page.	Plates and Figures.	Lias.	Yorkshire. L.	Yorkshire. U.	East Midlands.	Cotteswolds. L.	Cotteswolds. U.	Dundry.	Dorset—Somerset. L.	Dorset—Somerset. U.	Higher beds.
RIMULA												
alta, *Lycett*	455	XLI, 18 *a*, *b*					×					
clathrata, *Sowerby*	454	XLI, 15 *a* *b*				×						G. O.
oolitica, *Hudleston*	456	Not figured				?	×					
rugosa, *Hudleston*	454	XLI, 16 *a*, *b*				×						
subtricarinata, *Hudleston*	455	XLI, 17 *a*, *b*					×					
RISSOINA												
gymnoides, *Hudleston*	273	XXI, 11				×						
obliquata, *Sowerby*	272	XXI, 7				×						G. O.
— var. parcicostata	272	XXI, 8			×	×						
— var. inflata	272	XXI, 9				×						
obtusa, *Lycett*	273	XXI, 10 *a*, *b*					×					
SOLARIUM												
diadema, *Lycett, MS.*	323	XXVI, 10					×					
pisoliticum, *Hudleston*	322	XXVI, 6—8					×					
polygonöides, *Hudleston*	323	XXVI, 9						×				
subvaricosum, *Hudleston*	324	XXVI, 11, 12						×				
SPINIGERA												
crassa, *Hudleston*	107	III, 7									×	
didactyla, *Hudleston*	106	III, 6 *a*—*g*								×		
longispina, *Deslongchamps*	104	III, 4 *a*—*c*							×		×	
recurva, *Hudleston*	105	III, 5 *a*—*h*									×	
trinitatis, *Tawney*	103	III, 3 *a*—*e*							×	×		
STRAPAROLLUS												
cf. altus, *d'Orbigny*	321	XXVI, 5								×		
Dundriensis, *Tawney*	319	XXVI, 2							×	×		
exsertus, *Hudleston*	320	XXVI, 3, 4								×		
pulchrior, *Hudleston*	318	XXV, 9								×		
cf. tuberculosus, *Thorent*	317	XXVI, 1						?			×	
TROCHOTOMA												
affinis, *Deslongchamps*	447	XLI, 4						×			×	
calix, *Phillips*	445	XLI, 1 *a*, *b*; 6 *a*—*c*; 7		×		?	×					
depressiuscula, *Lycett*	448	XLI, 10						×				
funata, *Lycett*	450	XLI, 5 *a*, *b*					×					
gradus, *Deslongchamps*	447	XLI, 2, 3	×							×		
Lindonensis, *Hudleston*	449	XLI, 8, 8 *a*; 9				×						
TROCHUS												
angulatus, *Sowerby*	374	XXXI, 11						×			×	
biarmatus, *Münster*	386	XXXII, 14						×			×	Cal.
? bicingendus, *Lycett*	389	XXXI, 15					×					
cf. Bixa, *d'Orbigny*	388	XXXII, 17; and ? XXXI, 16				×				×		G. O.
Burtonensis, *Lycett*	385	XXXII, 12						×				
dimidiatus, *Sowerby* (? *Zetes*, *d'Orb.*)	379	XXXI, 8		?		×		×	×		×	
Dunkeri, *Morris & Lycett*, var. Weldonis	383	XXXII, 10				×						G. O.
duplicatus, *Sowerby*	373	XXXI, 10						×			×	
Duryanus, *d'Orbigny*	375	XXXI, 12									×	
? Leckenbyi, *Morris & Lycett*	386	XXXII, 13			×							

	Page.	Plates and Figures.	Lias.	Yorkshire.		East Midlands.	Cotteswolds.		Dundry.	Dorset—Somerset.		Higher beds.
				L.	U.		L.	U		L.	U	
TROCHUS												
marga, *Hudleston*	387	XXXII, 15									×	
monilitectus, *Phillips*	380	XXXII, 3 *a*, *b*			×	×		?			?	
Niortensis, *d'Orbigny*	388	Not figured	×				?		×			
rupestris, *Hudleston*	371	XXXI, 2								×		
Sandersii, *Tawney*	370	XXXI, 1							×	×		
spiratus, *d'Archiac*	378	XXXI, 6, 7				×						G. O.
sqamiger, *Morris & Lycett*	382	XXXII, 8					×					G. O.
squamosior, *Hudleston*	382	XXXII, 5				×						
subduplicatus, *d'Orbigny*	375	XXXI, 13, 14	×				×			×		
— var. abbas	377	XXXII, 1								×		
— var. plicata, *Goldfuss*	376	XXXII, 2								×		
subluciensis, *Hudleston*	381	XXXII, 6, 7				×	×			×		
substrigosus, *Hudleston*	384	XXXII, 11, and ? 4									×	
sybilla, *Hudleston*	371	XXXI, 3								×		
vicinus, *Hudleston*	383	XXXII, 9				×		×				
Winwoodi, *Tawney*	372	XXXI, 4, 5								×		
Zetes, *d'Orbigny*, fide *Tawney*	379	XXXI, 9								×		
"TROCHUS"												
attrochus, *Hudleston*	390	XXIX, 15, 16								×		
TURBO												
Davoustii [Delphinula], *d'Orbigny*	360	XXX, 7						×			×	
— var. Lindonensis	361	XXX, 6				×	×					
Hamptonensis, *Morris & Lycett*	359	XXIX, 19, 20		×			×	×		×		G. O
lævigatus, *Phillips*	354	XXIX, 1		×		?						
? Lindecolinus, *Hudleston*	355	XXIX, 3, 4				×						
TURRITELLA												
abbas [Mathilda], *Hudleston*	230	XVII, 2 *a—c*					×			×		
cf. binaria [? Mathilda], *Hébert & Desl.*	234	XVII, 7								×		Cal.
Dorsetensis, *Hudleston*	228	XVII, 1 *a—c*					×			×		
opalina [Mathilda], *Quenstedt*	231	XVII, 3 *a*, *b*								×		
— var. canina	232	XVII, 4		×						?		
quadrivittata [Mathilda], *Phillips*	233	XVII, 6		×		×				×		
strangulata [Mathilda], *Hudleston*	233	XVII, 5								×		
cf. Schlumbergeri, *Eug. Deslongchamps*	229	Not figured								?		
VALVATA												
comes, *Hudleston*	489	XLIII, 27; XLIV, 2 *a*, *b*						×				

TABLE II.

INDEX OF SYNONYMS, ETC.

Pterocera Lorieri, d'Orbigny, vide ALARIA.
— *Phillipsii*, d'Orbigny, vide *Alaria hamus*, Deslongchamps, var. *Phillipsii*, d'Orbigny.
Ptygmatis, vide NERINÆA.
Purpurina Bathis, d'Orbigny, vide *Amberlaya ornata*, Sowerby, var. *spinulosa*, Münster.
— *ornata*, d'Orbigny, vide *Amberleya Orbignyana*, Hudleston.
Ranella longispina, Deslongchamps, vide SPINIGERA.
Rimula Blotii, auctorum, vide *Rimula oolitica*, Hudleston.
Rissoa obliquata, Sowerby, vide RISSOINA.
Rissoina duplicata, d'Orbigny, vide *Rissoina obliquata*, Sowerby.
Rostellaria composita (Sow.), Phillips, vide *Alaria hamus*, Deslongchamps, var.
— *gracilis*, Lycett, vide *Alaria Lorieri*, d'Orbigny, var. *gracilis*, Lycett.
— *hamus*, Deslongchamps, vide ALARIA.
— *myurus*, Deslongchamps, vide ALARIA.
— *solida*, Lycett, vide ALARIA.
— *spinigera*, Lycett, vide ALARIA.
— *unicornis*, Lycett, vide ALARIA.
Rotella lucida, Thorent, vide ATAPHRUS.
Rotella macrostoma, Stoliczka, cf. *Crossostoma Prattii*, Morris and Lycett.
Solarium calix, Phillips, vide TROCHOTOMA.
— *Cotswoldiæ*, Lycett, vide DISCOHELIX.
Teinostoma Neumayri, Gemmellaro, cf. *Crossostoma Prattii*, Morris and Lycett.
Terebra vetusta, Phillips, vide CERITHIUM.
Tornatella gigantea, Deslongchamps, vide ACTÆONINA.
Trochotoma carinata, Lycett, vide *Trochotoma affinis*, Deslongchamps.
Trochus abbreviatus, Sowerby, vide PLEUROTOMARIA.
— *Acis*, d'Orbigny, vide ATAPHRUS.
— *Acmon*, d'Orbigny, vide ATAPHRUS.
— *anaglypticus*, Münster, cf. AMBERLEYA.
— *Belus*, d'Orbigny, vide *Ataphrus lævigatus*, Sowerby, var.
— *bisertus*, Phillips, vide AMBERLEYA.
— *bitorquatus*, Hébert and Deslongchamps ?, vide *Trochus biarmatus*, Münster.
— *cingillato-serratus*, Lycett, doubtful, but cf. *Trochus Winwoodi*, Tawney.
— *concavus*, Sowerby, vide *Trochus angulatus*, Sowerby.
— *elongatus*, Sowerby, vide PLEUROTOMARIA.
— *fasciatus*, Sowerby, vide PLEUROTOMARIA.
— *granulatus*, Sowerby, vide PLEUROTOMARIA.
— *Ibbetsoni* (Morris and Lycett), Tawney, vide *Ataphrus Acis*, d'Orbigny.
— *jugosus*, Bean, vide PSEUDALARIA.
— *Labadyei*, d'Archiac, vide ATAPHRUS.
— *ornatissimus*, d'Orbigny, vide ONUSTUS.
— *ornatus*, Sowerby, vide PLEUROTOMARIA.
— *pallium*, Farey, in Sowerby, vide *Pleurotomaria ornata*, Sowerby.
— *pileus*, Lycett, vide ONUSTUS.
— *punctatus*, Sowerby, vide PLEUROTOMARIA.
— *pyramidatus*, Phillips, vide ONUSTUS.
— *sulcatus*, Sowerby, vide PLEUROTOMARIA (*Leptomaria*).
— *triarmatus*, Hébert and Deslongchamps, vide ? LITTORINA.
Turbo ædilis (Münst.), Tawney, vide LITTORINA.

TABLE III.

List of Gasteropoda from the Inferior Oolite, partially described by Lycett, but not figured, which are not accepted as species in this Monograph.

Chemnitzia nitida, Lycett. No evidence.
Cylindrites bulbiformis, Lycett. No evidence.
Eulima parvula, Lycett. The apical condition of some species of *Pseudomelania*.
Fusus obliquatus, Lycett. No evidence.
Natica Gomondii, Lycett. No evidence.
Nerita cassidiformis, Lycett. A fragment in the Brodie Collection, genus doubtful; not sufficient material to constitute a species.
— *lineata*, Lycett. No evidence.
Phasianella subangulata, Lycett. No evidence.
Pleurotomaria funata, Lycett. No evidence. } Possibly synonyms of some of Sowerby's species.
— *lævigata*, Lycett. No evidence. }
Rimula minutissima, Lycett. No evidence.
Rostellaria simplex, Lycett. No evidence.
Scalaria pygmæa, Lycett. A fragment apparently of *Rissoina*.
Trochus alternans, Lycett. No evidence.
— *infundibuliformis*, Lycett. No evidence.

TABLE IV.

The following list includes species quoted by previous authors from the Inferior Oolite, which are not tabulated in this Monograph.

Actæonina parvula, Römer.
Alaria subpunctata, Goldfuss.
Ceritella acuta, Morris and Lycett.
Cerithium Roissyi, d'Archiac.
Chemnitzia Wetherellii, Morris and Lycett.
Cylindrites acutus, Sowerby.
— *brevis ?* Morris and Lycett.
Delphinula alta, Morris and Lycett.
— *funata*, Goldfuss.
Emarginula Blotii, Deslongchamps.
— *planicostulata*, Deslongchamps.
Fusus ? carinatus, Römer.
Natica formosa, Morris and Lycett.
— *macrostoma*, Römer.
— *? neritoidea*, Morris and Lycett.
— *Stricklandi*, Morris and Lycett.
— *Verneuili*, d'Archiac.
Nerinæa Bruntrutana, d'Archiac.
Nerinæa punctata, Voltz.
— *triplicata*, Bronn.
— *Voltzii*, Deslongchamps.
Nerita pulla, Römer.
Onustus Burtonensis, Lycett.
Phasianella conica, Morris and Lycett (=*Ph. acutiuscula*, M. and L.).
— *parvula*, Morris and Lycett.
— *tumidula*, Morris and Lycett.
Pleurotomaria clathrata, Morris and Lycett.
Rimula tricarinata, Sowerby.
Trochotoma extensa, Morris and Lycett.
— *obtusa*, Morris and Lycett.
— *tabulata*, Morris and Lycett.
Trochus bigugatus, ? Quenstedt.
Turbo depauperatus, Lycett.
— *princeps*, Römer.

Of the above species, some, such as *Cerithium Roissyi* and other Bathonian forms, most probably occur in the higher beds, and especially in the *Paludina*-bed at Langton Bridge, which has more of a Great Oolite than an Inferior Oolite fauna. The same may also be said of *Natica Stricklandi* (quoted by Witchell from the *Clypeus*-grit), and possibly other Bathonian species of *Natica*. Again, we may regard *Nerita pulla* as a general term for any small *Nerita* (*Neridomus*), which in the Inferior Oolite may possibly be covered by *Nerita tumidula*. *Delphinula alta*, as it occurs in the Lincolnshire Limestone, has been split up into two species, each of which differs more or less from the Great Oolite form.

On the other hand, it seems highly probable that some of the names on the list, such as *Natica macrostoma*, *Turbo princeps*, and several more, are the result of incorrect identification.

TABLE V.

The following species of Gasteropoda are quoted from the Bajocian (Oolitic facies) of the region lying to the west of the Central Plateau in France.[1] It is interesting to observe how many of our Inferior Oolite Nerinæas have been identified in that region.

Actæonina, species.
Cylindrites exiguus, Lycett.
— *excavatus*, Morris and Lycett.
— *bullatus*, Morris and Lycett.
Cerithium, species.
Exelissa, species.
Ceritella, species.
Brachytrema subvaricosum, Hudleston.
Nerinæa Oppelensis, Lycett, very common.
— *Cotteswoldiæ*, Lycett, very common.
— *deducta*, Hudleston.
— *oolitica*, Witchell.
— *expansa*, Hudleston, fairly common.
— *campana*, Hudleston.
— *acicula*, d'Archiac.
— *subbrevivoluta*, Hudleston.
— *pisolitica*, Witchell.
— *deducta*, Hudleston.
— *subbruntrutana*, d'Orbigny.
— *elegantula*, d'Orbigny.
— species.
Aptyxiella, species.
Turritella (*Mathilda*) *opalina*, Hudleston.
Pseudomelania Niortensis, d'Orbigny, common.
Pseudomelania Astonensis, Hudleston.
— *lineata*, d'Orbigny.
Purpuroidea, cf. *nodulata*, Young and Bird.
Pleurotomaria, species.
Rissoina, species.
Natica Bajocensis, d'Orbigny.
Nerita, species.
Neritopsis sulcosa, d'Archiac.
Pileolus, cf. *radiatus*, d'Orbigny.
Phasianella acutiuscula, Morris and Lycett (= *Ph. conica*, M. and L.).
Turbo, cf. *Calypso*, d'Orbigny.
Amberleya, species.
Trochus, species.
Delphinula, species.
Discohelix, species.
Trochotoma tabulata, Morris and Lycett.
Ditremaria, species.
Fissurella, species.
Emarginula, species.
Scurria squamula, Deslongchamps.
— *nitida*, Deslongchamps.
Patella (*Helcion*) *rugosa*, Sowerby.

[1] 'Bulletin des services de la Carte Géologique de France' (No. 50), vol. viii (1896-7), p. 118, Dr. Glangeaud.

TABLE VI.

ERRATA.

TEXT.

Page 32, line 15, *for* rich-shell *read* rich shell-bed.
,, 39, lines 34 and 40, *for* Broadwinsor *read* Broadwindsor.
,, 45, line 14, *for* vol. xv *read* vol. xvi.
,, 72, ,, 26, *for limæforma*-group *read limæforme*-group.
,, 75, ,, 12, *for* Plant-beds *read* Plant-bed.
,, 77, ,, 27, *for* Linnæan *read* Linnean.
,, 79, ,, 1, *for* Petrifacta *read* Petrefacta.
,, ,, ,, 10, *delete* '53, '55; and *for* Mollusca *read* Gasteropoda.
,, 80, between lines 28 and 29 *insert* Moore. Abnormal Secondary Deposits. *Quart. Journ. Geol. Soc.*, vol. xxiii, p. 449.
,, 81, ,, 13 and 14 *insert* Tate. New Liassic Fossils. *Geol. Mag.*, 1875, p. 203.
,, 82, line 1 *for* Northamtonshire *read* Northamptonshire.
,, 83, ,, 24, *for* vol. xviii *read* vol. xiii.
,, 85, ,, 10, *for* Pl. II *read* Pl. XI.
,, 101, ,, 14, *for* Chenopus *read* Pterocera.
,, 116, ,, 32, *for* Millipore *read* Millepore.
,, 119, ,, 29, *for* 1853 *read* 1850.
,, ,, between lines 29 and 30 *insert* "1850. Rostellaria unicornis, *Lycett.* Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 419."
,, 122, lines 7 and 8, *for* Dundryensis *read* Dundriensis.
,, 132, line 20, *for* G *a' read* G' *a.*
,, 135, ,, 1, *for* 1853 *read* 1850.
,, 135, between lines 1 and 2 *insert* "1850. Rostellaria gracilis, *Lycett.* Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 119."
,, 138, line 14, *for* 1853 *read* 1850.
,, ,, between lines 14 and 15 *insert* "1850. Rostellaria spinigera, *Lycett.* Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 119.
,, 139, line 13, *for* 1853 *read* 1850; and *for* Plate IV *read* Plate VII.
,, ,, between lines 13 and 14 *insert* "1850. Rostellaria solida, *Lycett.* Ann. Mag. Nat. Hist., 2nd ser., vol. vi, p. 119."
,, ,, line 14, *for* Alaria *read* Rostellaria.
,, 146, ,, 12, *for* vol. i *read* part i.
,, ,, ,, 13, *for* 135 *read* 102.
,, 147, ,, 8, for *trilineatum* read *trilineata.*
,, ,, ,, 11, *for* p. 11 *read* p. 115.
,, 148, ,, 27, *delete* vol. i; and *for* 152 *read* 123.
,, 154, ,, 3 *insert* vol. vii after "Norm."
,, 160, ,, 1, *delete* sp. nov.
,, 161, ,, 1, *delete* sp. nov.

Page 161, line 10, *for* Minchinhamptom *read* -ton.
„ 180, „ 11, *for* Normannniana *read* Normaniana.
„ „ „ 12, *for* Normannnianum *read* Normanianum.
„ 181, „ 7, for *Peristone* read *Peristome*.
„ „ „ 27, *for* 418 *read* 419.
„ 202, „ 3, *for* fig. 6 *read* figs. 6 *c* and 7.
„ 203, „ 32, *for* posterior *read* anterior.
„ 205, „ 7, *for* pl. viii *read* pl. vii.
„ 226, „ 24, for *subtruntrutana* read *subbruntrutana*.
„ 231, „ 11, *for* fig. 13 *read* fig. 15.
„ 236, „ 4, *for* p. 812 *read* p. 810.
„ „ „ 16, *for* Pietet *read* Pictet.
„ 238, „ 22, *for* Buckholdt *read* Buckholt.
„ 240, „ 9, *for* Deslongchamp's *read* Deslongchamps'.
„ 241, lines 30 and 34, for *Normannniana* read *Normaniana*.
„ 247, line 25, *for* note p. 152, 1829, 1st edit., *read* p. 123, 1835, 2nd edit.
„ 261, „ 24, *for* Gasteropoden *read* Gastropoden : and *for* Brannen *read* Braunen.
„ 266, „ 6, for *subcaniculata* read *subcanaliculata*.
„ 272, „ 5, *for* Rissoina *read* Rissoa.
„ „ „ 6, *for* — *read* Rissoina.
„ 275, heading, *for* Rissoina *read* Amberleya.
„ 336, line 4, *for* Pea-grit of Crickley *read* Oolite-marl, Swifts' Hill.
„ 369, „ 2, *for* " Base-bed *read* " Base-bed."
„ 389, „ 15, *for* columela *read* columella.
„ 390, beginning of line 26, *delete* the.
„ 394, line 12, *for* inner *read* outer.

EXPLANATION OF PLATES.

Plate II, figs. 6 *a*, 6 *b*, for *fusiforme* read *fusiformis*.
Plate IV, fig. 12, *for* Whidborne collection *read* Woodwardian Museum.
Plate XI, fig. 9, for *Normannniana* read *Normaniana*.
Plate XIII, line 12, *for* fig. 6 *read* fig. 6 *c*.
Plate XVI, fig. 7. This should be represented as × $1\frac{1}{2}$.
Plate XXVIII, figs. 11 *a*—*c*, *for* Pea-grit, Crickley, *read* Oolite-marl, Swifts' Hill.
Plate XXX, fig. 14, for *pulchior* read *pulchrior*.

POSTSCRIPT.

In addition to the species described and figured in the foregoing Monograph, there are several others in my own collection which I have not ventured to bring forward, in most cases because of their imperfect condition. This is notably the case with regard to some specimens obtained in 1887 from the Yeovil sands on the coast, most probably from the *Dumortieria*-beds and other horizons of the *Jurensis*-zone.

PLATE I.

(All figures natural size, unless otherwise stated.)

FIGS.

1 *a*, 1 *b*. *Purpurina elaborata*, Morris & Lycett. *Sowerbyi*-bed, Bradford Abbas. My collection. (Page 85.)

1 *c*, 1 *d*. The same. Another specimen. Same horizon and locality. Buckman collection. 1 *e*, same specimen, part enlarged.

1 *f*. The same. Another specimen. Lincolnshire Limestone, Weldon. My collection. Enlarged.

1 *g*. The same. Another specimen. Dogger, Blue Wyke. Leckenby collection.

2. *Purpurina*, species or variety. *Sowerbyi*-bed, Bradford Abbas. Buckman collection. (Page 91.)

3 *a*, 3 *b*. *P. cancellata*, sp. nov. Stoford? My collection. (Page 87.)

4 *a*, 4 *b*. *Purpurina*, species or variety. (? Oolite-Marl.) Nailsworth. Jermyn Street Museum. (Page 87.)

5 *a*, 5 *b*. *P. bellona*, D'Orb. Var. with fine ribs. *Parkinsoni*-zone, Grove. My collection. (Page 89.)

5 *c*, 5 *d*. The same. Var. with coarse ribs. *Parkinsoni*-zone. Vitney Cross. My collection.

5 *e*, 5 *f*. The same. Another specimen. Same horizon, locality, and collection. 5 *g*, same specimen, apical view.

6 *a*, 6 *b*. *P. curta*, sp. nov. *Humphriesianus*-zone, Milborne Wick. My collection. (Page 90.)

7 *a*, 7 *b*. *P. bellona*, var. *pagoda*. *Parkinsoni*-zone, Burton Bradstock. 7 *c*, apical view. (Page 89.)

8 *a*, 8 *b*, 9 *a*, 9 *b*. *Purpurina*; doubtful forms, related to *P. pagoda*. (Page 89.)

10 *a*, 10 *b*. *P. parcicosta*, sp. nov. *? Sowerbyi*-bed, Bradford Abbas. My collection. (Page 90.)

11 *a*, 11 *b*. *P. aspera*, sp. nov. *Sowerbyi*-bed, Bradford Abbas. Buckman collection. (Page 91.)

11 *c*, 11 *d*. The same. Another specimen. Same horizon and locality. My collection.

11 *e*. Large specimen of *P. aspera*, probably from same place. Jermyn Street Museum.

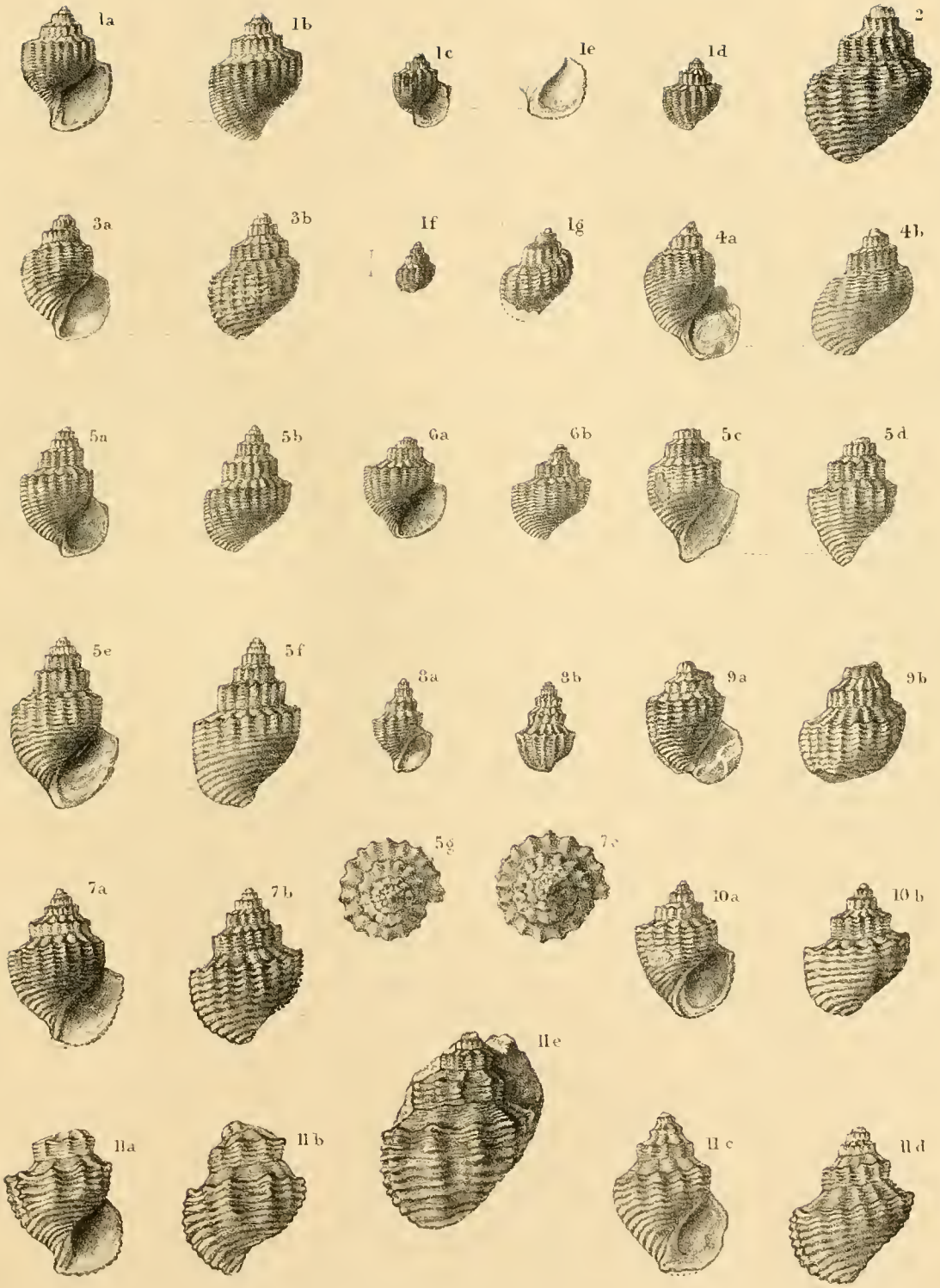

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PLATE II.

FIGS.

1 *a*, 1 *b*. *Purpurina calcar*, sp. nov. *Sowerbyi*-bed, Bradford Abbas. My collection. (Page 91.)

2 *a*, 2 *b*. *P. inflata*, Tawney. *Parkinsoni*-zone. Burton Bradstock. My collection. 1 *c*, apical view. (Page 92.)

2 *d*, 2 *e*. The same. Another specimen. Inferior Oolite, Dorsetshire. My collection.

2 *f*. The same. Another specimen. I. O., Rodboro' Hill. Jermyn Street Museum.

3 *a*, 3 *b*. *P. rotunda*, sp. nov. *Sowerbyi*-bed, Bradford Abbas. Buckman collection. 3 *c*, apical view. (Page 93.)

3 *d*. The same. Another specimen. I. O., Dorsetshire. Jermyn Street Museum.

4 *a*, 4 *b*. *P. tabulata*, sp. nov. *Sowerbyi*-bed, Bradford Abbas. My collection. 4 *c*, apical view. (Page 94.)

4 *d*, 4 *e*. Var. of *P. tabulata*. *Sowerbyi*-bed, Bradford Abbas. My collection.

5 *a*, 5 *b*. *P.* (*Eucycloidea*) *bianor*, D'Orbigny. *Parkinsoni*-zone, Burton Bradstock. My collection. × $1\frac{1}{2}$. 5 *c*, apical view × 3. (Page 95.)

5 *d*, 5 *e*. The same. Another specimen. × $1\frac{1}{2}$.

5 *f*, 5 *g*. The same. Small specimen. × 2. 5 *h*, aperture × 4.

6 *a*, 6 *b*. *P.* (*Eucycloidea*) "*fusiforme*." Inf. Ool. "Yeovil." Woodwardian Museum × $1\frac{1}{2}$. (Page 96.)

7 *a*, 7 *b*. *P.* (*Eucycloidea*) *carino-crenata*, Lycett. Inferior Oolite. Jermyn Street Museum. × $1\frac{1}{2}$. (Page 97.)

8 *a*, 8 *b*. *Brachytrema Wrightii*, Cotteau, var. *despecta*. *Parkinsoni*-zone, Vitney Cross. My collection. × 4. 8 *c*, basal view. (Page 99.)

9 *a*, 9 *b*. *B. sub-varicosum*, sp. nov. Lincolnshire Limestone, Great Ponton. British Museum. × 4. (Page 98.)

10 *a* 10 *b*. *? Alaria varicifera*, sp. nov. Lincolnshire Limestone. × 4. See also Pl. VII, figs. 8 *a*, &c.

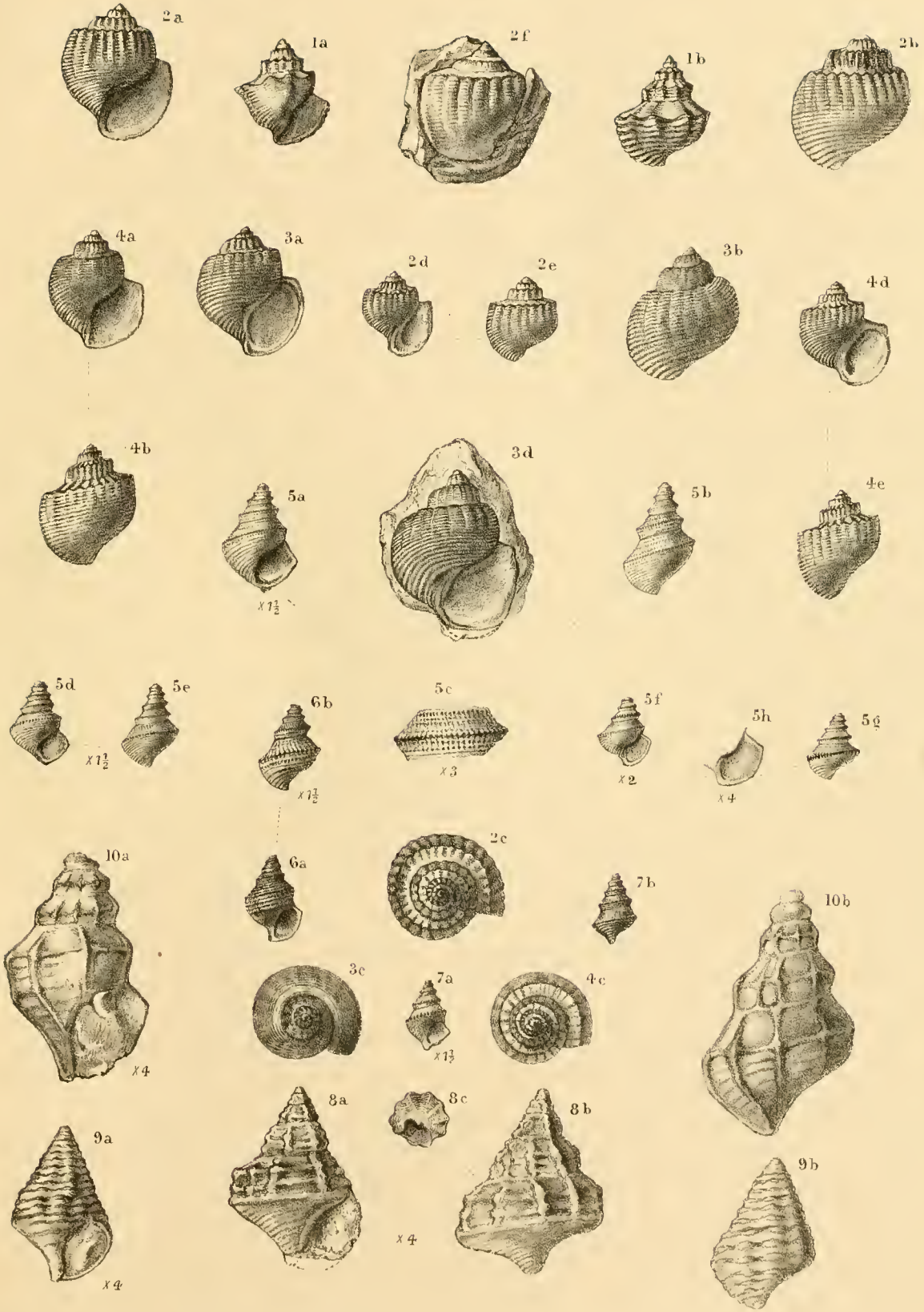

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PLATE III.

FIGS.

1 *a*. *Malaptera Bentleyi*, Morris & Lycett. Collyweston Slate. Jermyn Street Museum. (Page 101.)

1 *b*. The same. Another specimen. Impression in gutta percha. My collection.

1 *c*. The same. Another specimen. Impression in gutta percha. My collection.

2. *M. Bentleyi*, var. *neglecta*. Impression in gutta percha. Collyweston Slate. My collection. (Page 102.)

3 *a*. *Spinigera trinitatis*, Tawney. *Sowerbyi*-bed, Bradford Abbas. My collection. 3 *b*, part of spire × 3. (Page 103.)

3 *c*, 3 *d*, 3 *e*. The same. Another specimen. Buckman collection.

4 *a*, 4 *b*. *S. longispina*, Deslongchamps. *Humphriesianus*-zone (*? Sauzei*-bed), Sherborne. Buckman collection. Two specimens. (Page 104.)

4 *c*. The same. Another specimen. *Humphriesianus*-zone, Milborne Wick. My collection.

5 *a*. *S. recurva*, sp. nov. *Parkinsoni*-zone, Burton Bradstock Cliff. My collection. (Page 105.)

5 *b*. The same. Another specimen. *Parkinsoni*-zone, Vitney Cross. My collection. × $1\frac{1}{2}$.

5 *c*, 5 *d*. The same. Another specimen. *Parkinsoni*-zone, Upper Loders. 5 *e*, spire × 3.

5 *f*. The same. Another specimen. "Blackrock, Bridport." Jermyn Street Museum. × $1\frac{1}{2}$. 5 *g*, whorl × 2. 5 *h*, apical portion of spire × 4.

6 *a*. *S. didactyla*, sp. nov. *Sowerbyi*-bed, Bradford Abbas. My collection. (Page 106.)

6 *b*. The same. Another specimen. Buckman collection.

6 *c*. The same. Another specimen. Buckman collection.

6 *d*. Variety of *S. didactyla*. ? Bradford Abbas. Jermyn Street Museum. 6 *e*, *f*, *g*, the same, under three different aspects × $1\frac{1}{2}$.

7. *S. crassa*, sp. nov. *Sauzei*-bed, Oborne. My collection. (Page 107.)

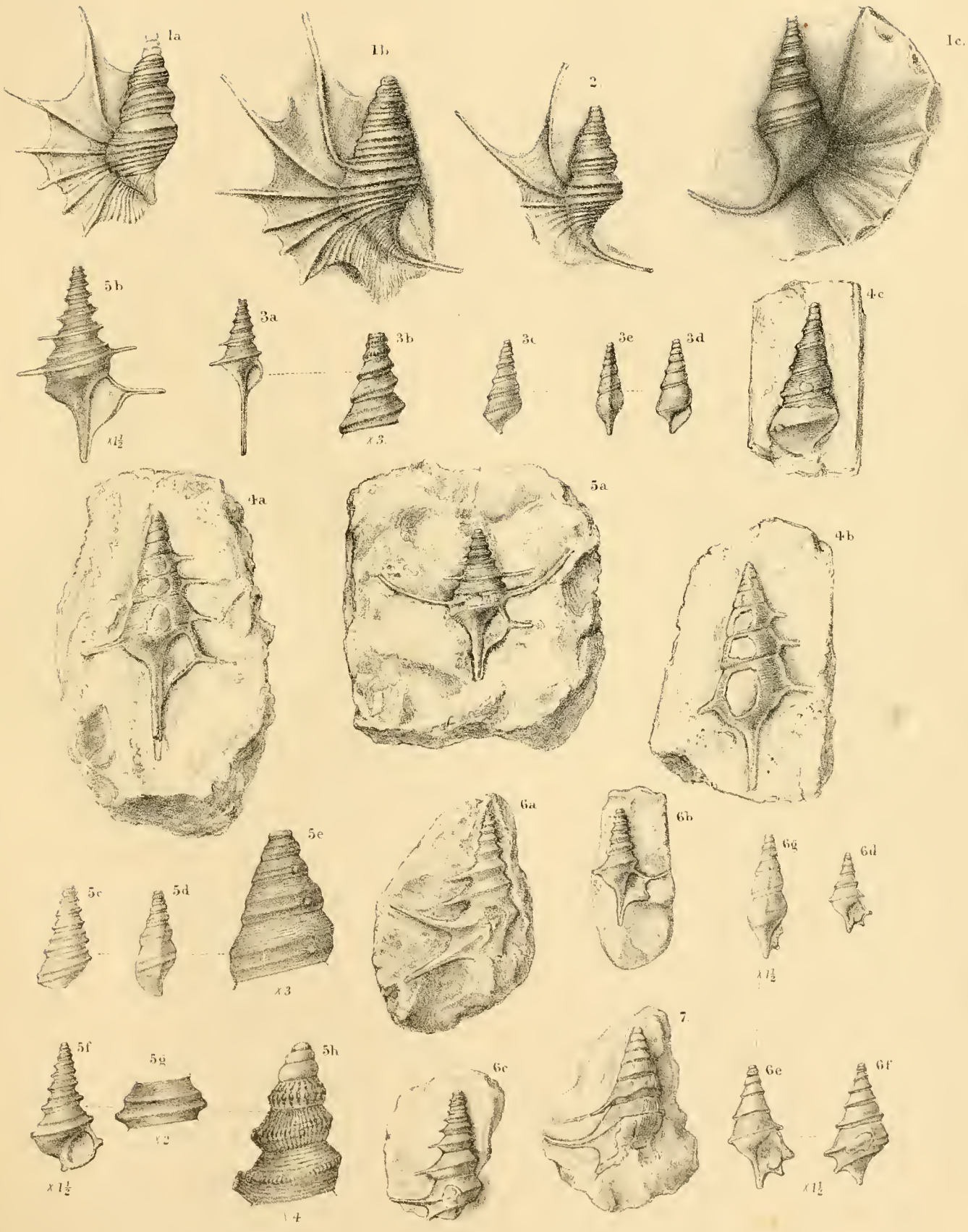
1a
1b
2
1c.
5b
×1½
3a
3b
×3.
3c
3e
3d
4c
4a
5a
4b
5e
5c
5d
×3
6a
6b
6g
6d
×1½
5f
5g
×2
5h
×4
6c
7
6e
6f
×1½

PLATE IV.

FIGS.

1. *Alaria arenosa,* Hudleston. Dogger Sands. Leckenby collection. (Page 110.)
2. *Al. angusta*, sp. nov. Inferior Oolite. Bristol Museum. (Page 111.)
3. *Al.* "*crassicostata.*" Dogger, Blue Wyke. My collection. (Page 111.)
4. *Al.* "*Hortonensis.*" *Parkinsoni*-zone, Horton Hill. My collection. (Page 112.)

5 *a, b. Al.* "*spinulosa.*" Two specimens. Dogger, Blue Wyke. (Page 113.)

6 *a, b, c, d. Al. hamus*, Deslongchamps. Four specimens. *Parkinsoni*-zone, Burton Bradstock. My collection. (Page 113.) See also Pl. VII, fig. 9.

7 *a.* Dwarfed var. of *Al. hamus. Parkinsoni*-zone, Notgrove. 7 *b,* another specimen. *Parkinsoni*-zone, Horton Hill. My collection. (Page 115.)

7 *c.* Another variety, "*tricincta.*" Gryphite-grit near Stroud. Witchell collection. (Page 115.)

8 *a. Al. hamus*, var. *Phillipsii*, D'Orb. Scarborough Limestone, Cloughton Wyke. My collection. 8 *b,* specimen from the Dogger. 8 *c,* from Millepore Rock or Scarborough Limestone. Both Leckenby collection. (Page 116.)

9. *Al. hamus*, var. *nodosa.* Inferior Oolite, Stoford. Buckman collection. (Page 117.)
10. *Al. pinguis*, sp. nov. Inferior Oolite, Dorset. My collection. (Page 117.) See also Pl. VII, fig. 11.
11. Immature form of *Alaria ? Phillipsii.* Gryphite-grit, near Stroud. Witchell collection. (Page 115.)
12. *Al.* cf. *rarispina*, Schlumberger. *? Sowerbyi*-bed, Dorset. Whidborne collection. (Page 118.)

13 *a, b, c. A. unicarinata,* Hudleston. Three specimens. Dogger, BlueWyke. My collection. (Page 118.)

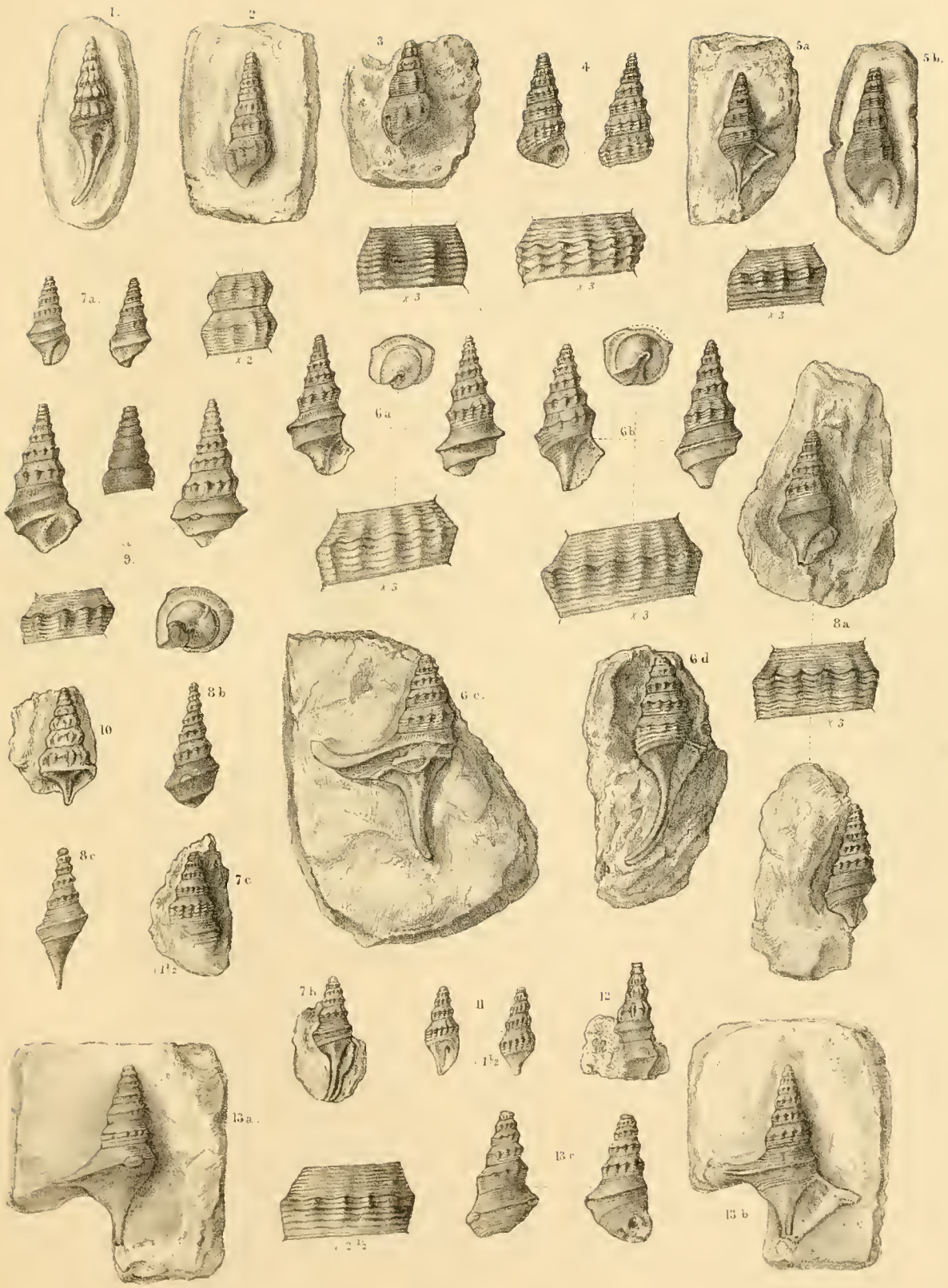
1.
2
3
4
5a
5b.
x 3
x 3
x 3
7a.
x 2
6a
6b
x 3
x 3
9.
8a
6c.
6d
8b
10
x 3
8c
7c
7b
11
12
13a.
13c
13b
x 2½

PLATE V.

FIGS.

1. *Alaria unicornis*, Lycett. I. O., Nailsworth. Jermyn Street Museum. (Page 119.)
2. *Al. Dundryensis*, Tawney. Type RE-FIGURED. I. O., Dundry. Bristol Museum. (Page 122.)
3. *Al. fusca*, sp. nov. *Cadomensis*-bed. Oborne. My collection. (Page 121.)
4. *Al.* "*alienigena.*" I. O., Dorsetshire. My collection. (Page 121.)

5 *a*. *Al. Roubaleti*, Schlumberger, var. *Dorsetensis*. *Sowerbyi*-bed, Bradford Abbas. My collection. Showing front and base.[1] (Page 123.)

5 *b*. The same. Wide-angled variety. I. O., Dorsetshire. My collection.

5 *c*. The same. Another specimen. I. O., Dorsetshire. My collection.

5 *d*. The same. Another specimen. *Sowerbyi*-bed, Bradford Abbas. Buckman collection. See also Pl. VII, fig. 10.

5 *e*. The same. Immature form. *Sowerbyi*-bed, Bradford Abbas. My collection.

5 *f*. The same. Small variety. Scarborough Limestone, Pickering Cliff. My collection.

6. *Al. Roubaleti*, Schlumb., var. "*dimidiata.*" *? concavus*-bed, Halfway House. Whidborne collection. (Page 124.)

7 *a*. *Al.* (compare) *unicornis*, Lycett, var. *Bradfordiensis*. *Sowerbyi*-bed, Bradford Abbas. Buckman collection. (Page 120.)

7 *b*. The same. *Murchisonæ*-zone, Bradford Abbas. My collection.

8. *Al. pseudo-armata*, Hudleston. Dogger, Blue Wyke. Leckenby collection. (Page 125.)
9. *Al. Lotharingica*, Schlumberger. I. O., Dundry. Bristol Museum. (Page 125.)
10. *Al. prælonga*, sp. nov. *Murchisonæ*-zone, Halfway House. Buckman collection. (Page 126.)
11. *Al. Doublieri*, D'Orb. var. B. *Cadomensis*-bed, Oborne. My collection. (Page 128.)

[1] Explanation of letters—*a*, anterior spine; *p*, posterior spine; *c*, canal sheath (tail); *w*, wing.

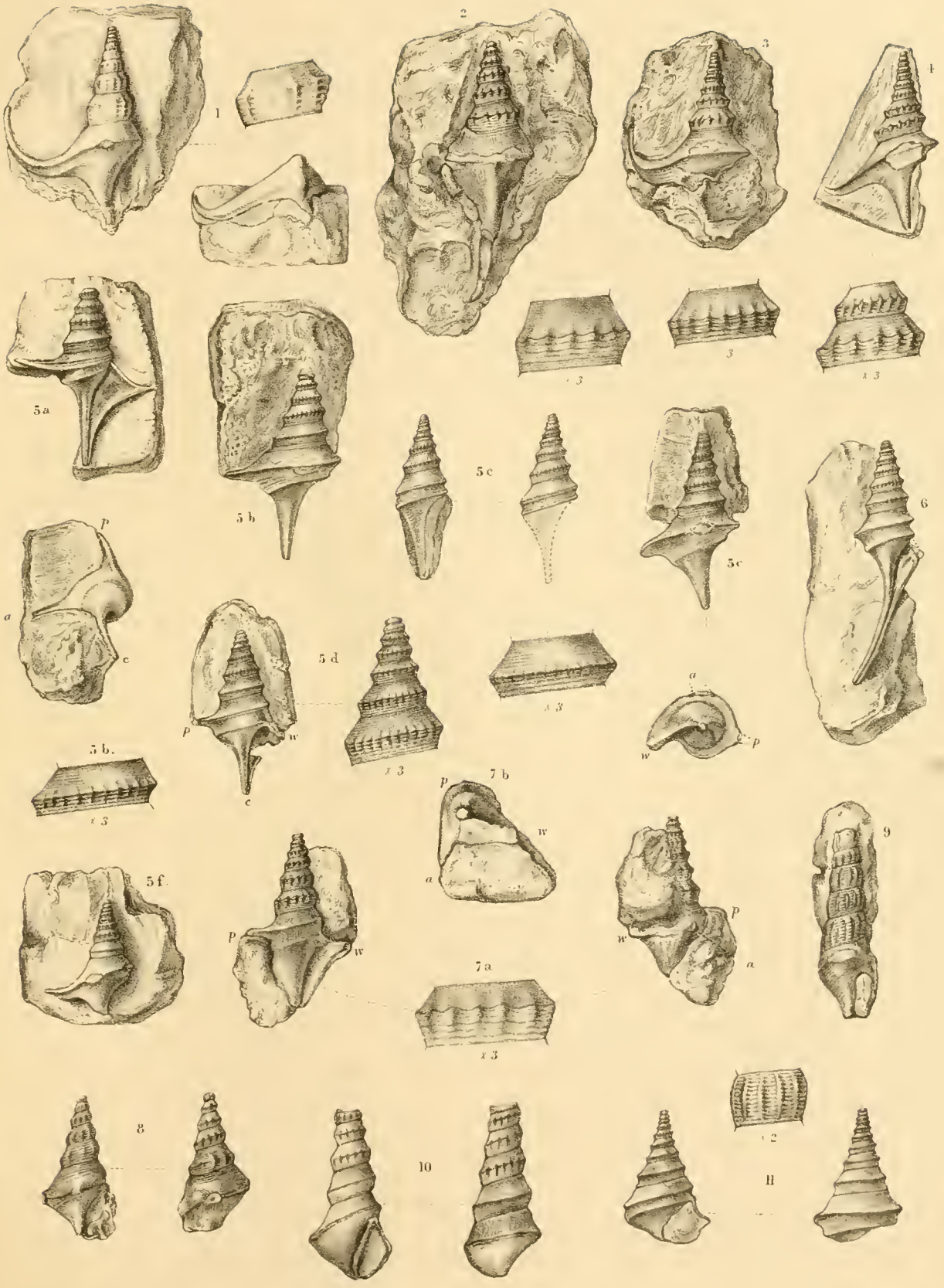

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PLATE VI.

FIGS.

1 *a*. *Alaria Doublieri*, D'Orbigny, var. A. I. O., Dorset. My collection, quarter-view (midway between back and front), and base. (Page 127.)

1 *b*. The same. Another specimen. I. O., Halfway House. Whidborne collection.

1 *c*. The same. Another specimen. I. O., Dorset. My collection.

2. *Al.* "*dubia*." I. O., Dorset. My collection. (Page 129.)

3 *a*. *Al. sublævigata*, sp. nov. *Sowerbyi*-bed, Bradford Abbas. My collection. (Page 129.)

3 *b*. The same. Another specimen. Dogger, Blue Wyke. Leckenby collection.

3′ *a*. *Al. sublævigata* var. *Sowerbyi*-bed, Dorset. Buckman collection. (Page 130.)

3′ *b*. The same. Another specimen. *Sowerbyi*-bed, Bradford Abbas. Buckman collection.

4 *a*. *Al. myurus*, Deslongchamps. I. O., Dundry. Woodwardian Museum. (Page 130.)

4 *b*. The same. *Clypeus*-grit variety, Rodboro' Common. Witchell collection. 4 *c*, the same. Same locality and collection.

5. *Al. Lorieri*, D'Orb., var. *gracilis*, Lycett. Freestones below Oolite Marl, Leckhampton. Brodie collection. (Page. 135)

6 *a*. *Al. Lorieri*, D'Orb., var. A. P_1, Burton Bradstock Cliff. My collection. (Page 133.)

6 *b*. The same. Another specimen. P_1, Loders. My collection.

6 *c*. The same. Another specimen. P_1, Burton Bradstock Cliff. My collection.

6 *d*. The same. Another specimen. ? I. O., Dundry. Bristol Museum.

6′ *a*. *Al. Lorieri*, D'Orb., var. B. P_1, Burton Bradstock Cliff. My collection. (Page 134.)

6′ *b*. The same. Another specimen. P_1, Vitney Cross. My collection.

6″ *a*. *Al. Lorieri*, D'Orb., var. C. P_1, Burton Bradstock Cliff. My collection. (Page 134.)

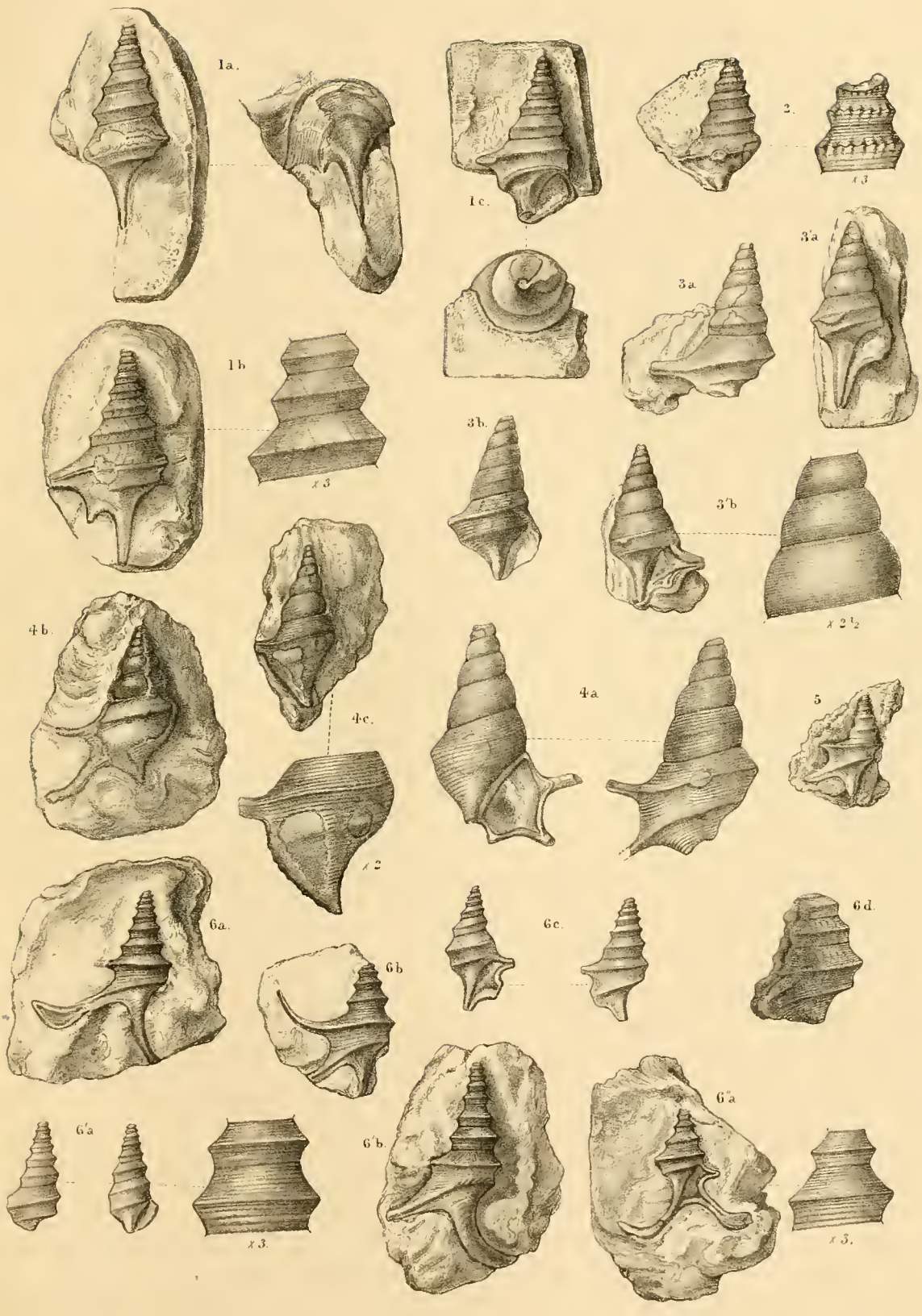

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PLATE VII.

Fig.

1 *a*. *Alaria Pontonis*, sp. nov. Lincolnshire Limestone, Great Ponton. My collection. (Page 135.)

1 *b*. The same. Another specimen, front view. Same locality and collection.

2. *Alaria Pontonis*, var. *spinifera*. Lincolnshire Limestone, Great Ponton. My collection. (Page 136.)

3. *Alaria primigenia*, sp. nov. P_1., Vitney Cross. My collection. (Page 137.)

4. *Alaria spinigera*, Lycett. I. O., Nailsworth. Jermyn Street Museum. (Page 138.)

5. *Alaria solida*, Lycett. I. O. Cotteswolds. Jermyn Street Museum. (Page 139.)

6. *Alaria solida*, Lycett, var. I. O. (? Oolite Marl), Crickley. Brodie collection. (Page 140.)

7 *a*. *Alaria hamoides*, sp. nov. Lincolnshire Limestone, Great Ponton. My collection. (Page 140.)

7 *b*. The same. Another specimen. Lincolnshire Limestone, ? Great Ponton. Sharp collection.

8 *a*. *Alaria* (*? Diartema*) *varicifera*, sp. nov. Lincolnshire Limestone, Great Ponton. Sharp collection. (Page 141.)

8 *b*. *Diartema varicifera*. L. L., Great Ponton. My collection. (Page 141.)

8′ *a*. ? The same. The usual form in the L. L. of Weldon. My collection. (Page 141.)

8′ *b*. ? The same. An exceptional form in the L. L. of Weldon. My collection. (Page 141.)

9. *Alaria hamus*, Deslongchamps. I. O., ? Dorsetshire. Whidborne collection. (Page 113.)

10. *Alaria Roubaleti*, Schumberger, var. *Dorsetensis*. I. O., Bradford Abbas. Buckman collection. *Specimen showing the character of the digitation and canal-sheath, but without the spines.* (Page 123.)

11. *Alaria pinguis*, sp. nov. *Parkinsoni*-zone, Vitney Cross. My collection. (Page 117.)

12. *Brachytrema binodosum*, sp. nov. Lincolnshire Limestone, Great Ponton. My collection. (Page 99.)

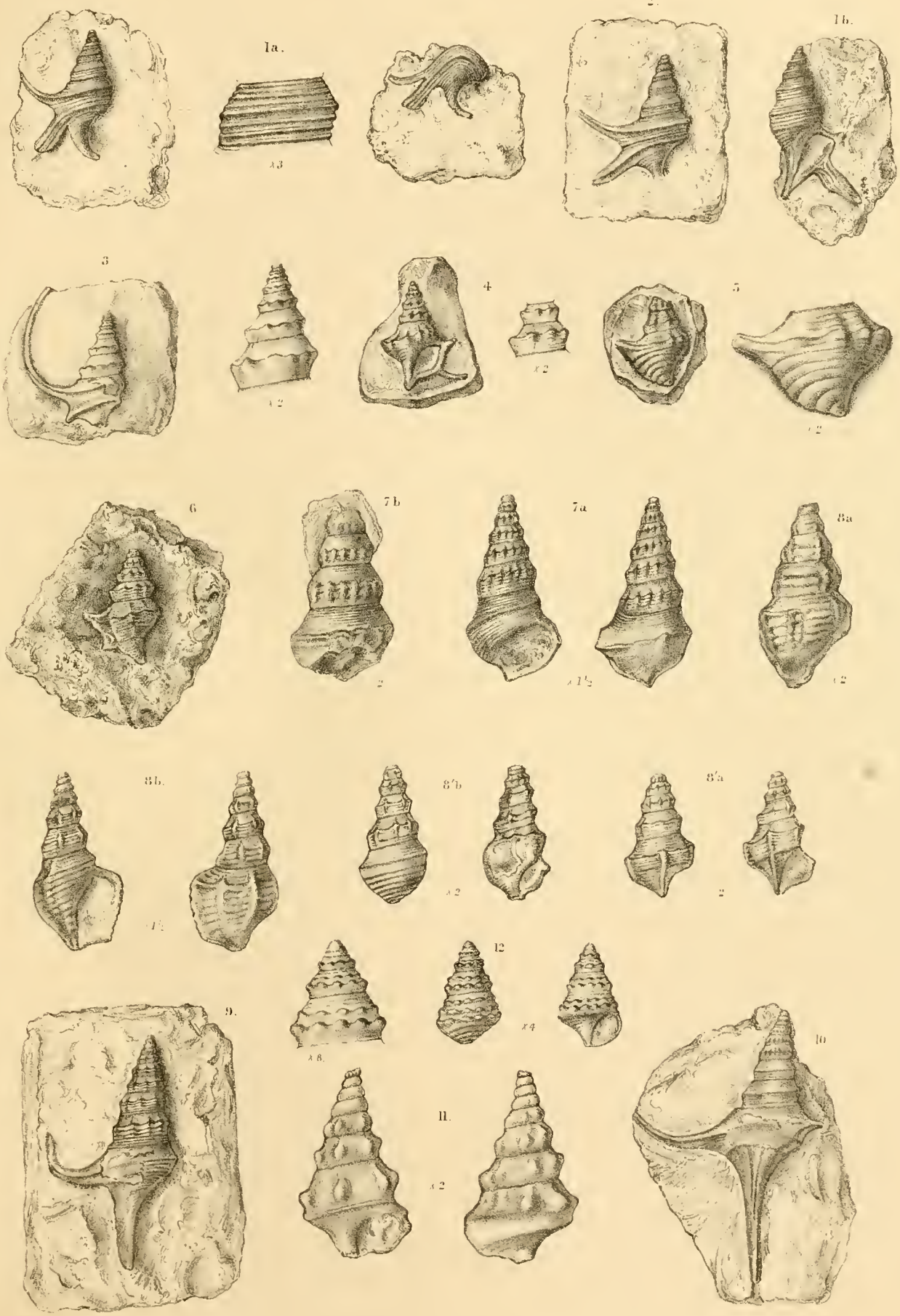
1a.
x3
2.
1b.
3
4
x2
5
x2
6
7b
2
7a
x1½
8a
x2
8b.
1½
8'b
x2
8'a
2
9.
12
x4
x8.
10
11.
x2

PLATE VIII.

Fig.

1. *Cerithium quadrilineatum*, Röm. Blue Wyke Sands. My collection. (Page 145.)

2 *a*. *Cerithium muricatum*, Sow. Dogger, Blue Wyke. One of Sowerby's types, British Museum. (Page 146.)

2 *b*. The same. Group of shells in Dogger matrix. My collection.

3. *Cerithium muricatum* var. *trilineata*. Scarborough Limestone. York Museum. (Page 147.)

4. *Cerithium gemmatum*, Morris and Lycett. Scarborough Limestone. British Museum. (Page 147.)

5 *a*, 5 *b*, 5 *c*. *Cerithium vetustum*, Phil. Scarborough Limestone, Pickering Cliff. My collection. (Page 148.)

5 *d*. Variety. Leckenby collection.

6 *a*. *Cerithium vetustum-majus*, Hudl. Dogger, Blue Wyke. My collection. (Page 150.)

6 *b*. The same. Leckenby collection.

7. *Cerithium vetustum* var. *seminuda*, Hudl. Dogger, Blue Wyke. Leckenby collection. (Page 151.)

8 *a—f*. *Cerithium subscalariforme*, D'Orb. var. *spinicostata*, Wright, MS. *Sowerbyi*-bed, Bradford Abbas. My collection. (Page 151.)

9. *Cerithium subscalariforme*, D'Orb., var. in the *Humphriesianus*-zone, Oborne. My collection. (Page 153.)

10 *a*. *Cerithium subscalariforme*, D'Orb., var. in the *Parkinsoni*-zone (*? granulato-costatum*, Münst.). Grove near Castle Cary. (Page 153.)

10 *b*. The same from another locality. My collection.

11. *Cerithium subabbreviatum*, D'Orb. P_1, Burton Bradstock. My collection. (Page 154.)

12. *? Cerithium obesum*, sp. nov. P_1, Vitney Cross. My collection. (Page 154.)

13. *Cerithium subglabrum*, sp. nov. *Sowerbyi*-bed, Bradford Abbas. My collection. (Page 155.)

14. *Cerithium*, species or variety. *Sowerbyi*-bed, Bradford Abbas. My collection. (Page 155.)

15. *Cerithium*, species or variety. *Sowerbyi*-bed, Bradford Abbas. Whidborne collection. (Page 156.)


1
2a
2b
3
4
5a
5b
5c
5d
6a
6b
7
8a
8b
8c
8d
8e
8f
9
10a
10b
11
12
13
14
15

PLATE IX.

Fig.

1. *Cerithium armatum*, Münst. Sands below Cephalopoda-bed, North Nibley. Buckman collection. (Page 156.)
2. *Cerithium Leckhamptonense*, sp. nov. I. O., Leckhampton Hill. Jermyn Street Museum. (Page 157.)
3. *Cerithium*, species or variety. ? *Murchisonæ*-zone, Coker. My collection. (Page 157.)
4. *Cerithium Leckenbyi*, Hudleston. Dogger, Blue Wyke. Woodwardian Museum. (Page 158.)

5 *a*, 5 *b*. *Cerithium Beanii*, Morris and Lycett. Dogger, Blue Wyke. York Museum. (Page 159.)

6. *Cerithium Beanii*, var. *Weldonis*. Lincolnshire Limestone. (*a*) Weldon. My collection. (*b*) No locality. Collection of Mr. George. (*c*) Rolled specimen, no locality. Sharp collection, B. M. (Page 160.)

6′. *Cerithium Beanii*, var. *Weldonis*, subvariety B (with four spirals). *a*, *b*, *c*, *d*, Weldon. My collection. (Page 160.)

7. *Cerithium limæforme*, Röm., var. *Pontonis*. Lincolnshire Limestone, Ponton. Sharp collection, B. M. (Page 161.)
8. *Cerithium* "*cingula*" (? var. of *C. limæforme*). Shelly freestones in I. O. of Cotteswolds. Jermyn Street Museum. (Page 162.)
9. *Cerithium Wansfordiæ*, sp. nov. Lincolnshire Limestone, Wansford or Barnack. *a*, *b*, Sharp collection, B. M. *c*, Collection of Mr. George. (Page 162.)
10. *Cerithium Georgii*, sp. nov. Lincolnshire Limestone. Collection of Mr. George. (Page 162.)
11. ? *Cerithium subcostigerum*, sp. nov. Lincolnshire Limestone, Weldon. Jermyn Street Museum. (Page 163.)
12. *Cerithium latisulcatum*, sp. nov. Lincolnshire Limestone, Weldon. My collection. (Page 164.)

13 *a*, 13 *b*. *Cerithium pisoliticum*, sp. nov. Peagrit, Cheltenham. My collection. (Page 164.)

14. *Cerithium*, species or variety. *Parkinsoni*-zone, near Castle Cary. My collection. (Page 165.)
15. *Cerithium turris*, Hudleston. Dogger, Blue Wyke. Jermyn Street Museum. (Page 166.)

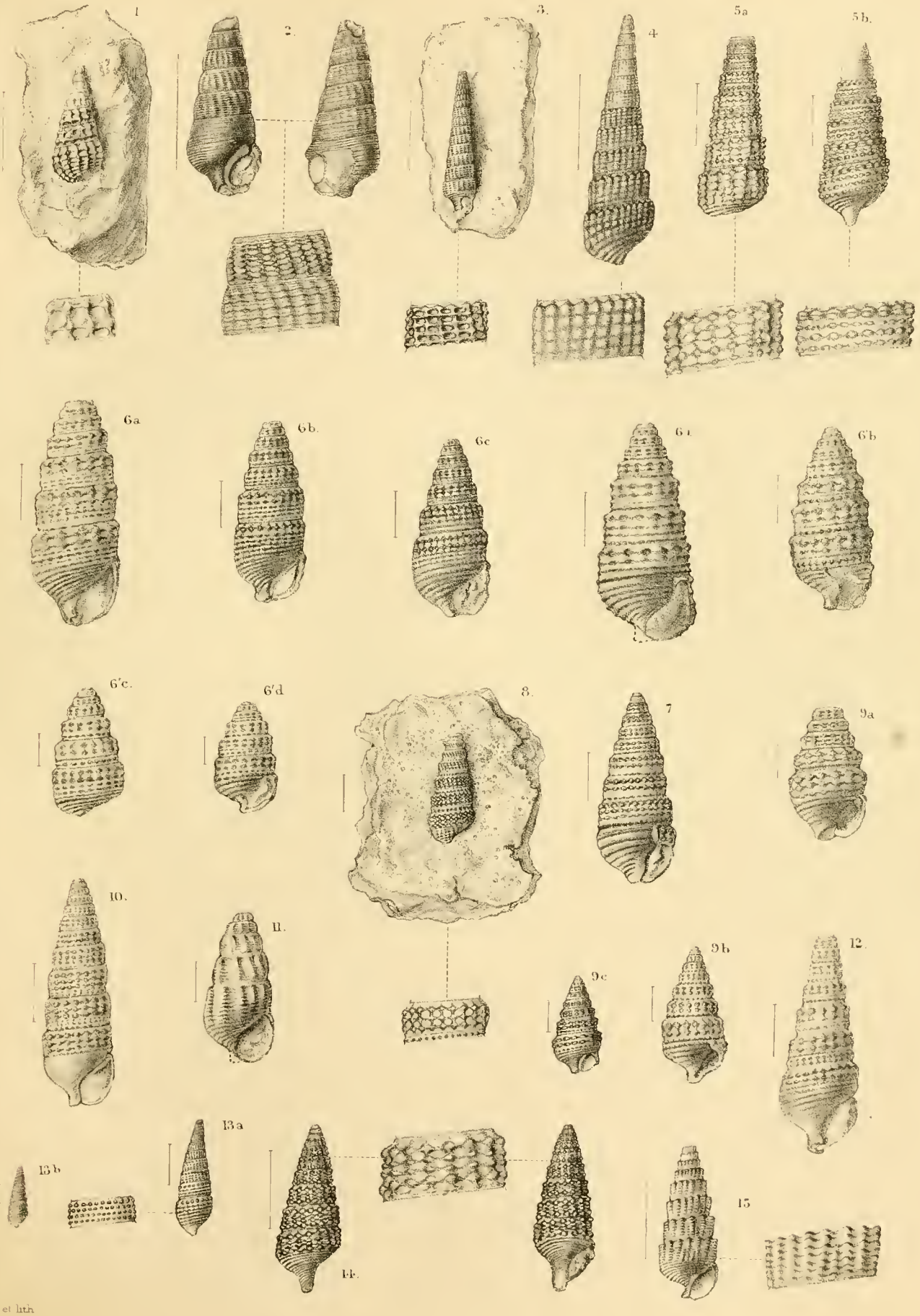

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PLATE X.

Figs.

1. *Cerithium* near to *variculosum*, Desl. I. O., Rodborough Hill. Jermyn Street Museum. (Page 166.)
2. *Cerithium comma*, Münst. *Cadomensis*-bed, Oborne. Woodwardian Museum. (Page 167.)
3. *Cerithium comma*, var. near to *C. unitorquatum*, H. & D. P_1, Bridport Harbour. Woodwardian Museum. (Page 168.)
4. *Cerithium circe*, D'Orb. I. O., Dorset. Woodwardian Museum. (Page 168.)
5. *Cerithium* "*commaoides*." Lincolnshire Limestone, Weldon. My collection. (Page 169.)
6. *Cerithium pergradatum*, sp. nov. Haselbury, ? from the *Opalinus*-zone. My collection. (Page 169.)

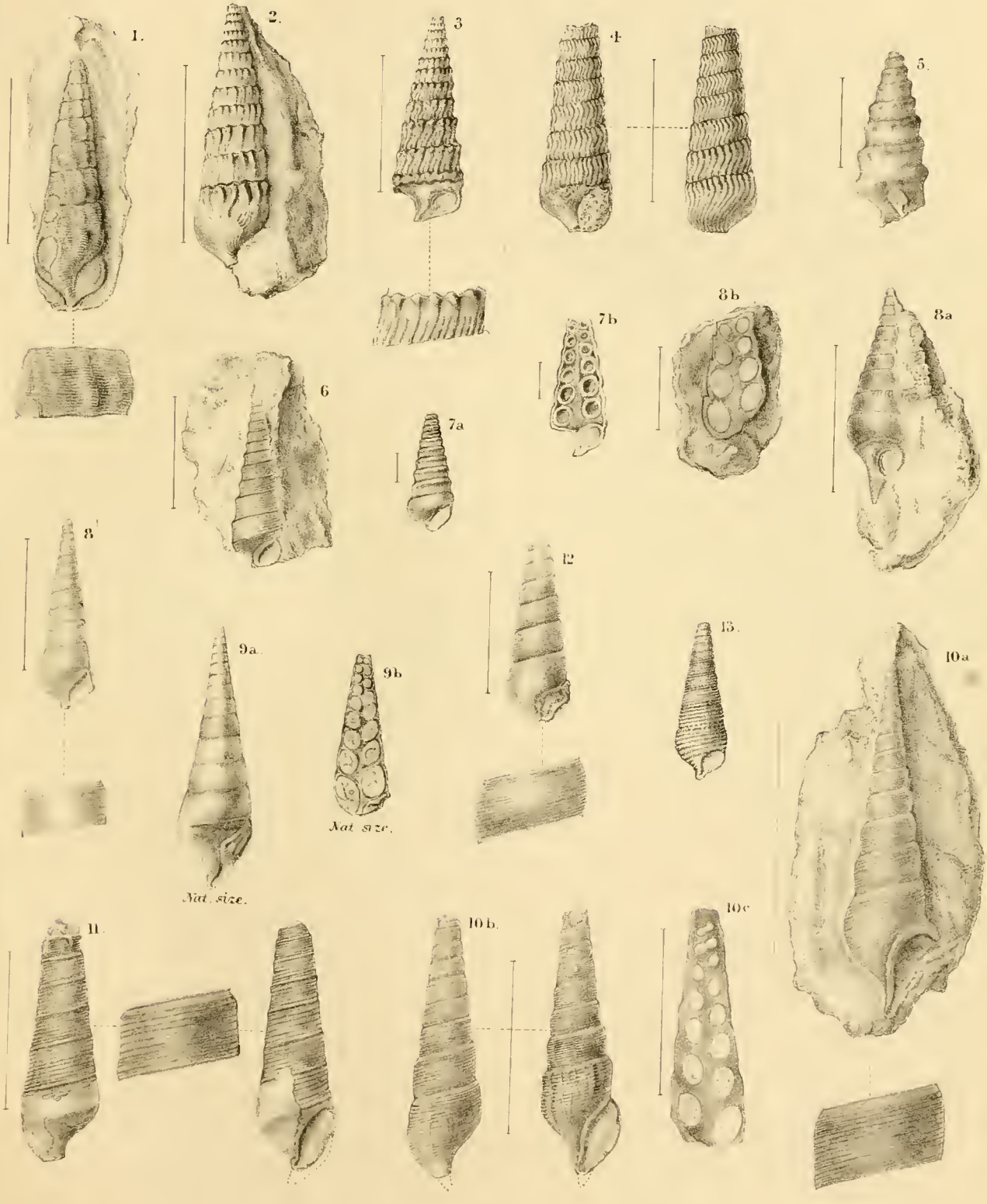
7 *a*. *Cerithium* "*annulatum*." Lincolnshire Limestone. Sharp collection, British Museum. 7 *b*. Section of another specimen, same collection.

8 *a*. *Cerithium clypeus*, sp. nov. *Clypeus*-grit of Rodborough. Witchell collection. 8 *b*. Section of another specimen. 8′. Variety from the *Parkinsoni*-zone of Aston. My collection. (Page 170.)

9 *a*. *Cerithium attritum*, sp. nov. Lincolnshire Limestone, Weldon. My collection. 9 *b*. Section of another specimen, same collection. (Page 171.)

10 *a*, 10 *b*. *Cerithium abbas*, sp. nov. *Sowerbyi*-bed, Bradford Abbas. My collection. 10 *c*. Section of another specimen, same collection. (Page 172.)

11. *Cerithium obornense*, sp. nov. *Sauzei*-bed, Oborne. My collection. (Page 173.)
12. *Cerithium polystrophum*, sp. nov. Lincolnshire Limestone, Weldon. My collection. (Page 173.)
13. *Cerithium* species or immature form. Lincolnshire Limestone, Weldon. My collection.


1.
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Nat. size.
Nat. size.
12
13.
10a
11.
10b.
10c

PLATE XI.

Figs.

1. *Fibula angustivoluta*, sp. nov. Lincolnshire Limestone, Weldon. My collection. (Page 174.)

2 *a*. *Fibula canina*, Hudleston. Dogger, Blue Wyke. Bean collection, British Museum. 2 *b*. Another specimen from same locality. Leckenby collection. (Page 175.)

3 *a*. *Ceritella Lindonensis*, sp. nov., var. *pinguis*. Lincolnshire Limestone. Sharp collection, British Museum. 3 *b*. Section of do. (Page 177.)

4. *Ceritella Lindonensis*, usual form. Lincolnshire Limestone, Weldon. My collection.

5 *a*. *Exelissa strangulata*, D'Arch., var. *pisolitica*. Pea grit, Crickley. My collection. 5 *b*. Another specimen showing the apical whorls in good preservation. (Page 178.)

6. *Exelissa strangulata*, D'Arch., var. *ovalis*. Lincolnshire Limestone, Weldon. My collection.

7. *Exelissa pulchra*, Lycett. Lincolnshire Limestone, Ponton. My collection. (Page 179.)

8 *a*. *Exelissa Weldonis*, Hudleston. Millepore Rock of Yorkshire coast. Leckenby collection. 8 *b*. Specimen from the Lincolnshire Limestone, Weldon. My collection. (Page 179.)

9. *Exelissa normanniana*, D'Orb. Stoford. My collection. (Page 180.)

10. *Cryptaulax scobina*, Desl. Base of I. O. sands, Nailsworth. Witchell collection. (Page 181.)

11. *Cryptaulax scobina*, Desl., var. approaching *C. tortilis*, H. & D. I. O. sands, Nailsworth. Jermyn Street Museum.

12 *a*. *Cryptaulax tortilis*, Hébert & Desl., var. with four spirals, *Parkinsoni*-zone, Aston. 12 *b*. Do. from same locality with three spirals. 12 *c*. Do. large specimen with four spirals from *Cadomensis*-bed, Oborne. My collection. (Page 182.)

13. *Cryptaulax papillosa*, Desl. *Parkinsoni*-zone, Grove. My collection. (Page 183.)

14. *Cryptaulax*, cf. *undulata*, Quenst. *Parkinsoni*-zone, Bridport Harbour. Woodwardian Museum. *x*. Copy figure of "*Turritella*" *undulata*, Quenst. Héb. and Desl., Foss. de Montreuil-Bellay, pl. vii, 13. (Page 184.)

15 *a*, 15 *b*, 15 *c*. *Cryptaulax contorta*, Desl. P_1, Burton Bradstock. My collection. (Page 185.)


1
2a
Nat size
2b
Nat size
3a
3b
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5b
5a
6
7
8b
8a
8b
9
10
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12a
12b
12c
13.
14
15c
15b
15a

PLATE XII.

Fig.

1 *a*, 1 *b*. *Cerithinella Bajoeensis*, sp. nov. "*Sowerbyi*-bed,"[1] Bradford Abbas. My Collection. (Page 186.)

2. *Cerithinella Bajocensis*, var. *drosera*. *Murchisonæ*-zone, Bradford Abbas. My Collection.

3. *Cerithinella Bajocensis*, var. *melitta*. Beaminster district. My Collection.

4 *a*. *Cerithinella Brodiei*, sp. nov. Freestones, Leckhampton. Brodie Collection. (Page 187.)

4 *b*. *Cerithinella Brodiei*, ? early stage. I. O., Nailsworth. Jermyn Street Museum.

5. *Cerithinella*, species or variety. Stoford. My Collection.

6 *a*. *Pseudalaria Etheridgii*, Tawney, in matrix. 6 *b*. Detached specimen. 6 *c*. Longitudinal section. "*Sowerbyi*-bed," Bradford Abbas. My Collection. (Page 189.)

7. *Pseudalaria Etheridgii*, var. from Beaminster district. My Collection.

8. *Pseudalaria granosa*, sp. nov. *Murchisonæ*-zone, Burton Bradstock. My Collection. (Page 190.)

9. *Pseudalaria jugosa*, Bean. Dogger, Blue Wyke. Bean Collection, British Museum. (Page 190.)

10. *Aptyxiella subconica*, sp. nov. *Parkinsoni*-zone, Over Harford. 11. Section of specimen from *Parkinsoni*-zone, Aston. My Collection. (Page 191.)

x. *? Cerithinella* (the *Nerinæa cingenda*, Sow., *non* Phil. of the Leckenby Collection). Dogger, Blue Wyke.

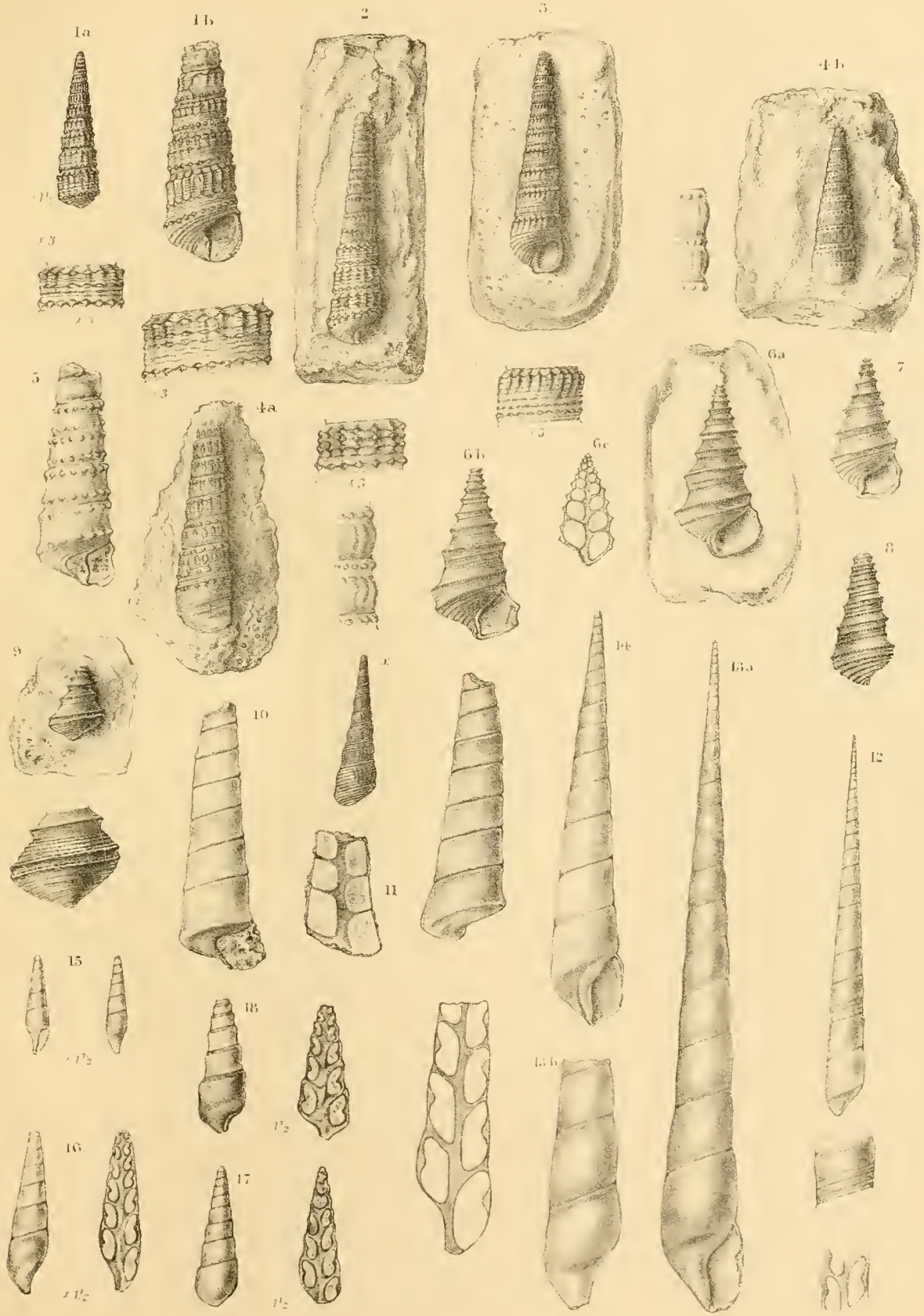
12. *Nerinella graeilis*, Lycett, slender variety. Oolite Marl, Longridge. My Collection. (Page 196.)

13 *a* *Nerinella gracilis*, Lycett; type refigured. Oolite Marl, Nailsworth. Jermyn Street Museum. 13 *b*. The same. Oolite Marl, Longridge. My Collection. (Page 196.)

14. *Nerinella conoidea*, sp. nov. Oolite Marl, Longridge. My Collection. (Page 197.)

15. *Nerinella* (A 1). 16. *Nerinella* (A 2). 17. *Nerinella* (A 3). 18. *Nerinella* (A 4). Lincolnshire Limestone, Weldon. My Collection. (Page 197.)

[1] As it is now generally admitted that this appellation is inapplicable, the so-called "*Sowerbyi*-bed" will in future be quoted as the "*concavus*-bed" or "*concavus*-zone." See p. 44 of this Monograph.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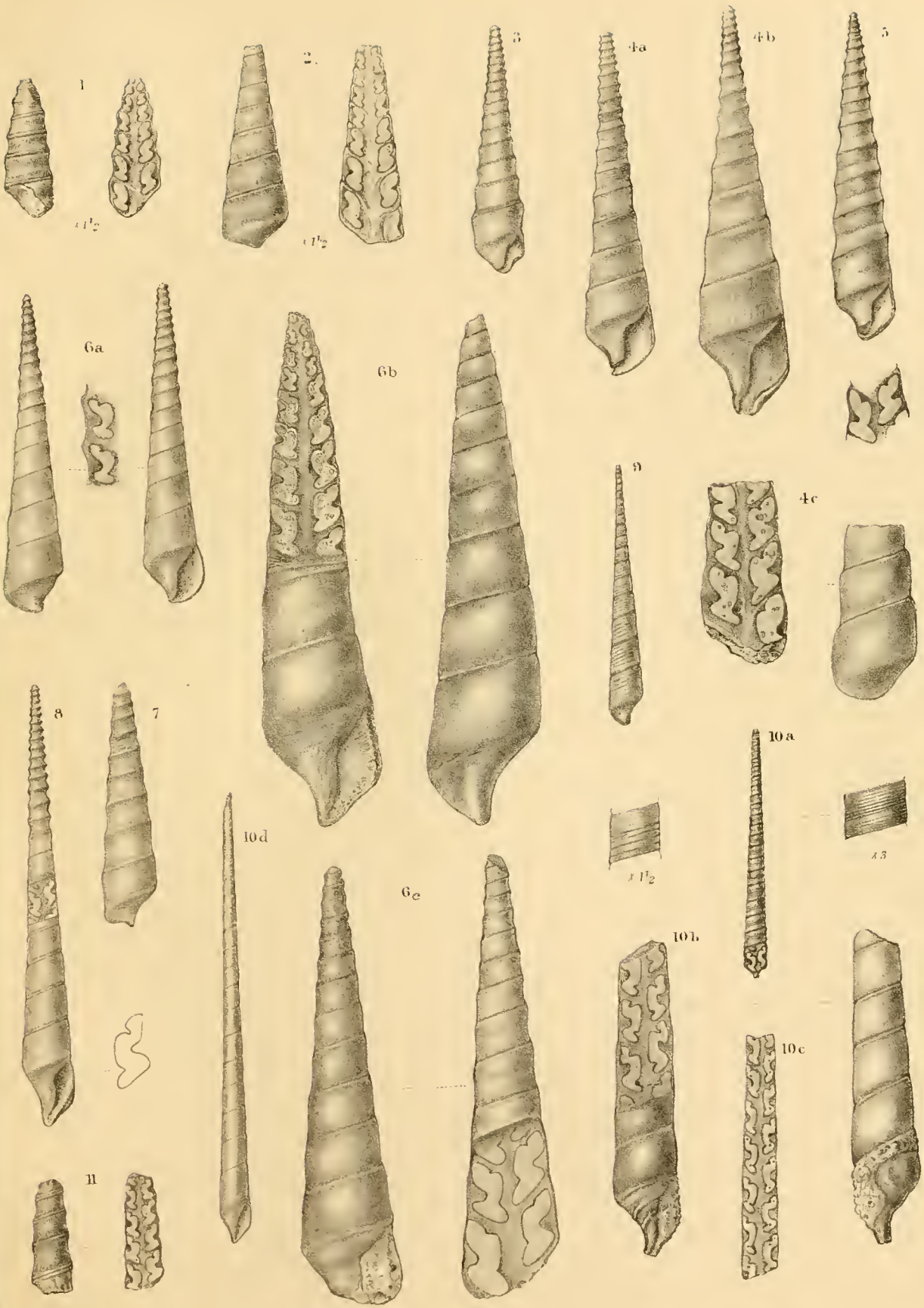
18

PLATE XIII.

FIG.

1. *Nerinella* (B 1). 2. *Nerinella* (B 2). Lincolnshire Limestone, Weldon. My Collection. (Page 198.)
3. *Nerinæa parva*, Witchell. Oolite Marl, Longridge. My Collection. (Page 199.)
4 *a*, 4 *b*, 4 *c*. *Nerinæa oolitica*, Witchell. Specimens showing different stages of growth. Oolite Marl, Longridge. My Collection. (Page 199.)
5. *Nerinæa Longfordensis*, sp. nov. Pea-grit (upper bed), Longfords. My Collection. (Page 200.)
6 *a*. *Nerinæa attenuata*, Witchell (usual form). Oolite Marl, Longridge. My Collection. (Page 201.)
6 *b*. *Nerinæa expansa*, sp. nov. Lincolnshire Limestone, Wakerly. My Collection. (Page 201.)
6, 7. *Nerinæa*, varieties of *N. oolitica* or *expansa*. Oolite Marl, Longridge. My Collection.
8. *Nerinæa deducta*, sp. nov. Pea-grit, The Knap. My Collection. (Page 202.)
9. *Nerinæa pseudocylindrica*, D'Orb. (*fide* Lycett). Oolite Marl, Longridge. My Collection. (Page 203.)
10 *a*. *Nerinæa altivoluta*, Witchell. Specimen showing the apical condition. Pea-grit (upper bed), Longfords. 10 *b*. The same. Fragment showing aperture. Lincolnshire Limestone, Weldon. 10 *c*. The same. Section of a fragment. Pea-grit, Crickley. 10 *d*. The same (in this case the apical ornaments are presumed to have been obliterated). Pea-grit, Longfords. My Collection. (Page 203.)
11. *Nerinæa*, fragment of species, ? allied to *pseudocylindrica*. Lincolnshire Limestone, Weldon. My Collection. (Page 203.)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x 3
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x 1½
6c
10b
10c
11

PLATE XIV.

Fig.

1. *Nerinæa Hudlestoniana*, Witchell. Oolite Marl, Swift's Hill. Witchell Collection. (Page 204.)

2 *a*. *Nerinæa Eudesii*, Morris and Lycett. Lincolnshire Limestone, Weldon. 2. The same. Fragment from the Great Oolite for comparison. My Collection. (Page 205.)

3 *a*, 3 *b*. *Nerinæa Weldonis*, sp. nov. Lincolnshire Limestone, Weldon. My Collection. (Page 206.)

4. *Nerinæa Weldonis*, wide-angled variety. 5. ? Apical conditions of the same. Lincolnshire Limestone, Weldon. My Collection.

6. *Nerinæa*, ? variety of *N. expansa*. Lincolnshire Limestone, Great Ponton. My Collection. (Page 202.)

7. *Nerinæa zonophora*, sp. nov. Lincolnshire Limestone, Weldon. My Collection. (Page 207.)

8. *Nerinæa subglabra*, sp. nov. Lincolnshire Limestone, Great Ponton. My Collection. (Page 207.)

9. *Nerinæa* cf. *Stricklandi*, Morris and Lycett. Lincolnshire Limestone, Great Ponton. My Collection. (Page 208.)

10 *a*. *Nerinæa* cf. *pseudopunctata*, Cossmann. 10 *b*, 10 *c*. Apical conditions of the same. Lincolnshire Limestone, Great Ponton. My Collection. (Page 209.)

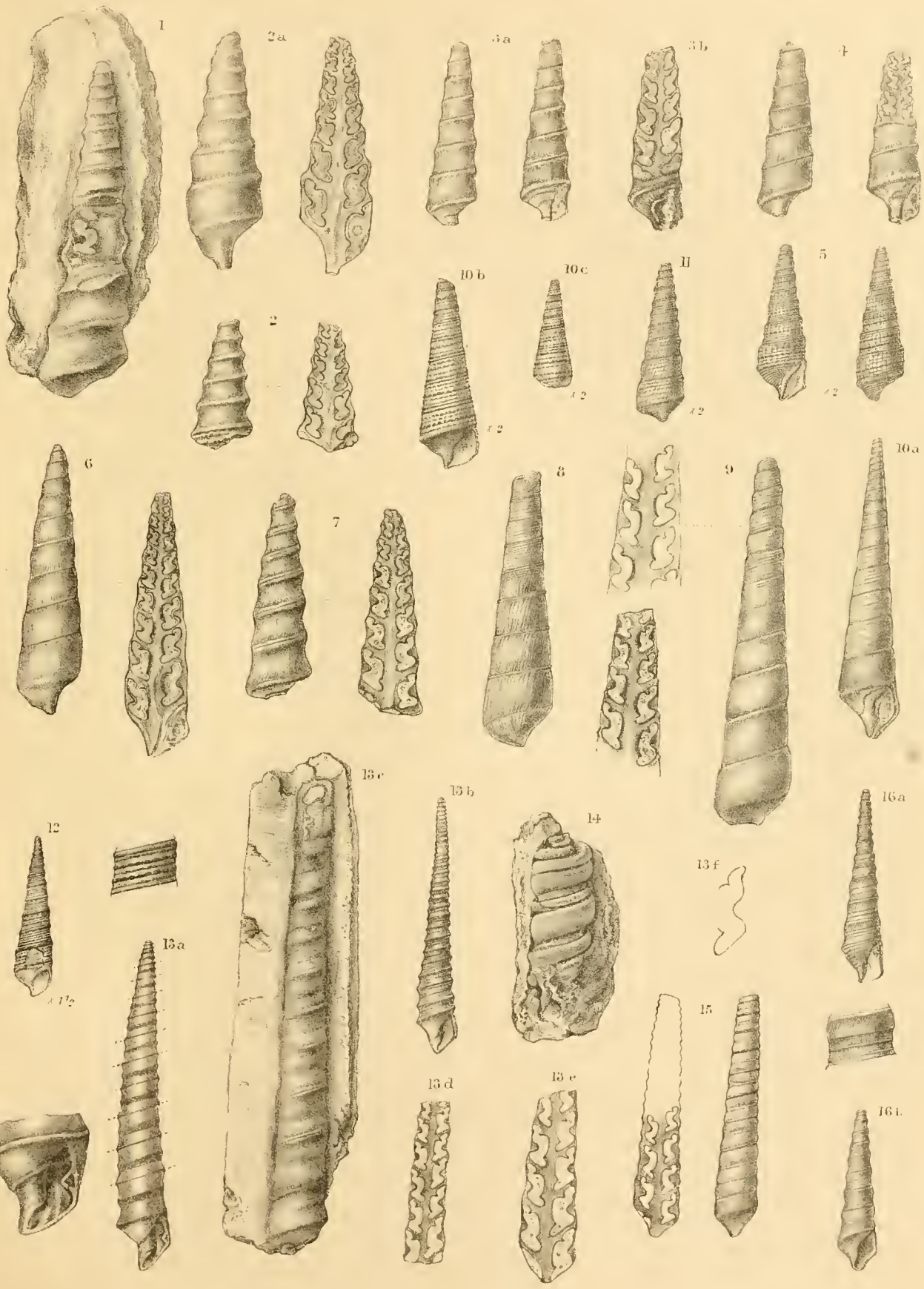
11. *Nerinæa* species, apical conditions. Lincolnshire Limestone, Weldon. My Collection. (Page 209.)

12. *Nerinæa* cf. *elegantula*, D'Orbigny. Lincolnshire Limestone, Great Ponton. My Collection. (Page 210.)

13*a*, 13 *b*. *Nerinæa cingenda*, Phillips. Dogger, Blue Wyke. Leckenby Collection. 13 *c*, *d*, *e*, *f*. The same. Dogger, Blue Wyke. My Collection. 14. The same. Cast from the Northampton Sand of Irchester. Crick Collection. (Page 210.)

15. *Nerinæa* "*pseudocingenda*." Lower Limestone, Holcombe Mill. My Collection. (x2). (Page 212.)

16 *a*. *Nerinæa subcingenda*, sp. nov. Lincolnshire Limestone, Santon. Jermyn Street Museum. 16 *b*. The same. Lincolnshire Limestone, Geddington. My Collection. (Page 212.)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16a
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13e
16b

PLATE XV.

Fig.

1 *a*. *Nerinæa* (*? Ptygmatis*) *Guisei*, Witchell. 1 *c*. Section of another specimen, both from the *Clypeus*-grit of Rodborough. 1 *b*. The same. Figure made up of two specimens from *Parkinsoni*-zone of Clan Down, near Radstock. My Collection. (Page 213.)

2 *a*. *Ptygmatis campana*, sp. nov. Lincolnshire Limestone, Belmisthorpe. 2 *b*. Section of a fragment from same place. My Collection. (Page 214.)

3 *a*. *Ptygmatis pisolitica*, Witchell. Pea-grit, Longfords. 3 *b*. The same, showing apical conditions. Pea-grit, Crickley. 3 *c*. The same. Fragment of adult shell, with section. Pea-grit, Longfords. My Collection. (Page 215.)

4 *a*. *Ptygmatis xenos*, sp. nov., fig. ×2. 4 *b*. The same. Section of a fragment, natural size. Shell-bed below Lower Limestone, Crickley. My Collection. (Page 216.)

5 *a*. *Ptygmatis bacillus*, D'Orbigny. Figure composed of two squeezes, the apical portion from Red Post Quarry, the other from Carnicot; both from the *Parkinsoni*-zone of the Radstock District. 5 *b*. The same. Section of partly dissolved shell fragment. Carnicot, ×2½. My Collection. (Page 217.)

6 *a*. *Ptygmatis bacillus*, var. *cervicula*. Little Ponton cutting (upper *Nerinæa*-bed). 6 *b*. The same. L. L., Weldon. 6 *c*. Section of ? same species, top of Freestones, Crickley, ×1½. My Collection. (Page 218.)

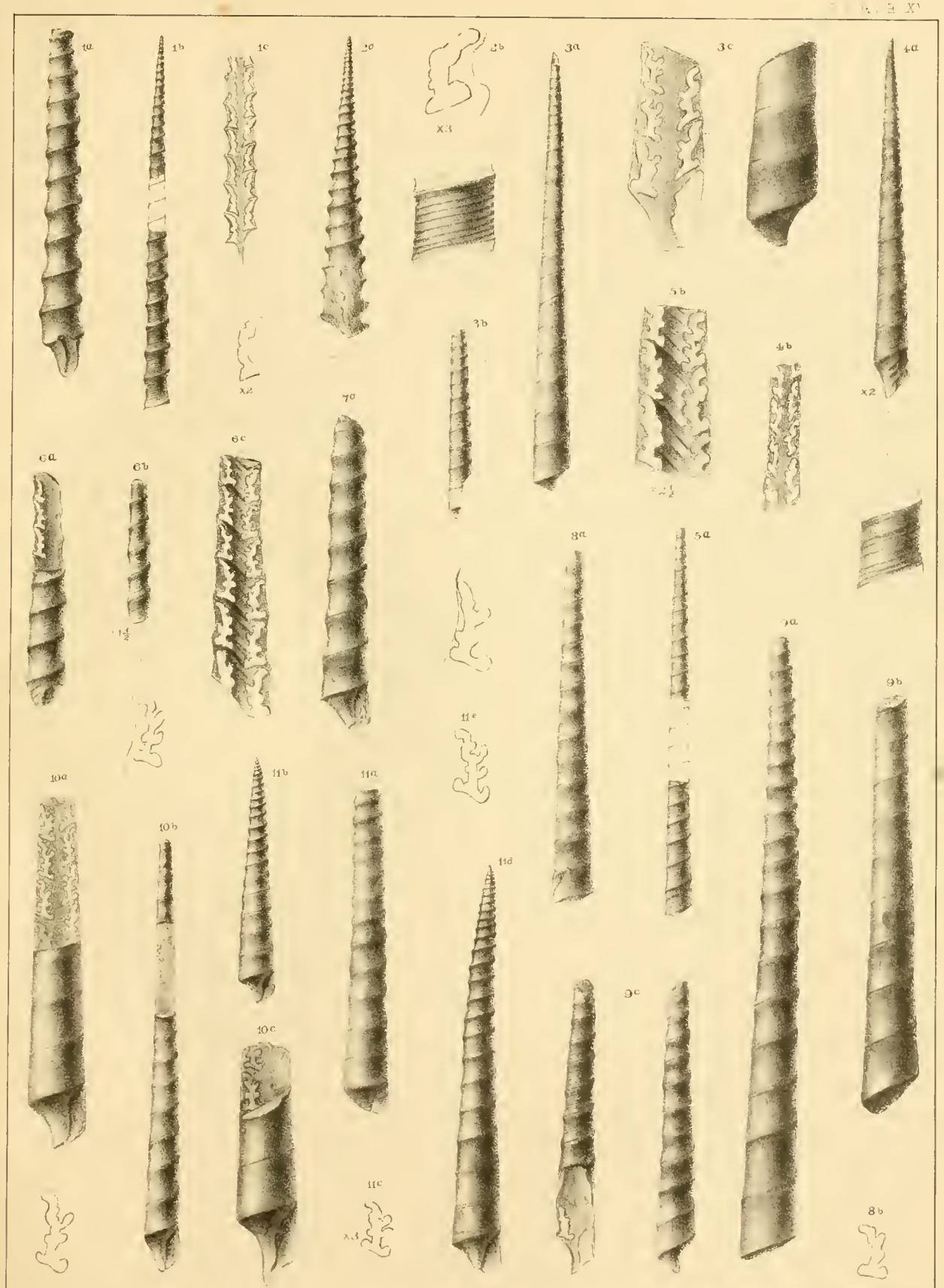
7 *a*. *Ptygmatis bacillus*, var. *crassicincta*. Pea-grit, Nailsworth Hill. 7 *b*. Section of same specimen. My Collection. (Page 218.)

8 *a*. *Ptygmatis* "*bacilloides*." Lincolnshire Limestone, Wakerly. 8 *b*. Section of same specimen. My Collection. (Page 219.)

9 *a*. *Ptygmatis Jonesii*, Lycett; type refigured. "Freestone, Nailsworth." Jermyn Street Museum. 9 *b*. The same. Fragment of lower portion. Pea-grit, Longfords. My Collection. 9 *c*. ? The same, showing sub-apical conditions. Upper Pisolite of Longfords. My Collection. (Page 218.)

10 *a*. *Ptygmatis producta*, Witchell, with section. 10 *b*. The same, showing earlier conditions. Both from Pea-grit of Longfords. My Collection. 10 *c*. The same; type refigured. Pea-grit, Longfords. Witchell Collection. (Page 220.)

11 *a*. *Ptygmatis Oppelensis*, Lycett. Oolite Marl, Selsley. Witchell Collection. 11 *b*. The same. Oolite Marl, Swift's Hill. 11 *c*. Section of the above. 11 *d*. The same. Pea-grit, Longfords. My Collection. 11 *e*. Section of specimen from Swift's Hill. Witchell Collection. (Page 219.)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3c
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X2
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4b
X2½
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6c
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8a
5a
11e
9a
9b
10a
10b
11b
11a
11d
10c
9c
11c
X4
8b

PLATE XVI.

FIG.

1. *Ptygmatis velox*, Witchell. Oolite Marl, Longridge. My Collection. (Page 221.)

2 *a*. *Ptygmatis Stroudiensis*, Witchell. Oolite Marl, Longridge. 2 *b*. The same, Swift's Hill. My Collection. (Page 222.)

3 *a*, 3 *b*. *Ptygmatis Cotteswoldiæ*, Lycett. Pea-grit, Longfords. 3 *c*. The same. Fragment showing natural section. Lincolnshire Limestone, Dene. 3 *d*. The same. Lincolnshire Limestone, Belmisthorpe. My Collection. (Page 222.)

4 *a*. *Ptygmatis Cotteswoldiæ*, Lycett, var. *conica*, Witchell; type refigured. Oolite Marl, Swift's Hill. Witchell Collection. 4 *b*. The same, showing section of interior. Oolite Marl, Longridge. 4 *c* and 4 *d*. Possibly the same, with worn surface—a common form in the Oolite Marl, Longridge. My Collection. (Page 223.)

5. Specimen of *Ptygmatis* with the aperture and canal well preserved. Oolite Marl, Longridge. My Collection. N.B.—This probably represents the true form of aperture in this group.

6. *Ptygmatis*, species or variety. Oolite Marl, Swift's Hill. My Collection. (Page 224.)

7. *Ptygmatis ? pisolitica*, Witchell. Fragment from the Lincolnshire Limestone, Weldon. My Collection. (Page 215.)

8 *a*. *Ptygmatis Santonis*, sp. nov. Oolite Marl, Longridge. My Collection. 8 *b*, 8 *c*. The same. Lincolnshire Limestone, Santon. Jermyn Street Museum. (Page 224.)

9 *a*. *Ptygmatis brevivoluta*, sp. nov. 9 *b*. The same; specimen cut longitudinally, × 2. *Clypeus*-grit, Barrington. My Collection. (Page 225.)

10. *Ptygmatis ? brevivoluta*, × 1½. Lincolnshire Limestone, Weldon. My Collection.

11. *Ptygmatis* "*sub-brevivoluta*." Lincolnshire Limestone, Weldon. My Collection. (Page 226.)

12. *Ptygmatis ? bacillus*, D'Orb. (rolled fragment). Lincolnshire Limestone, Weldon. My Collection. (Page 217.)

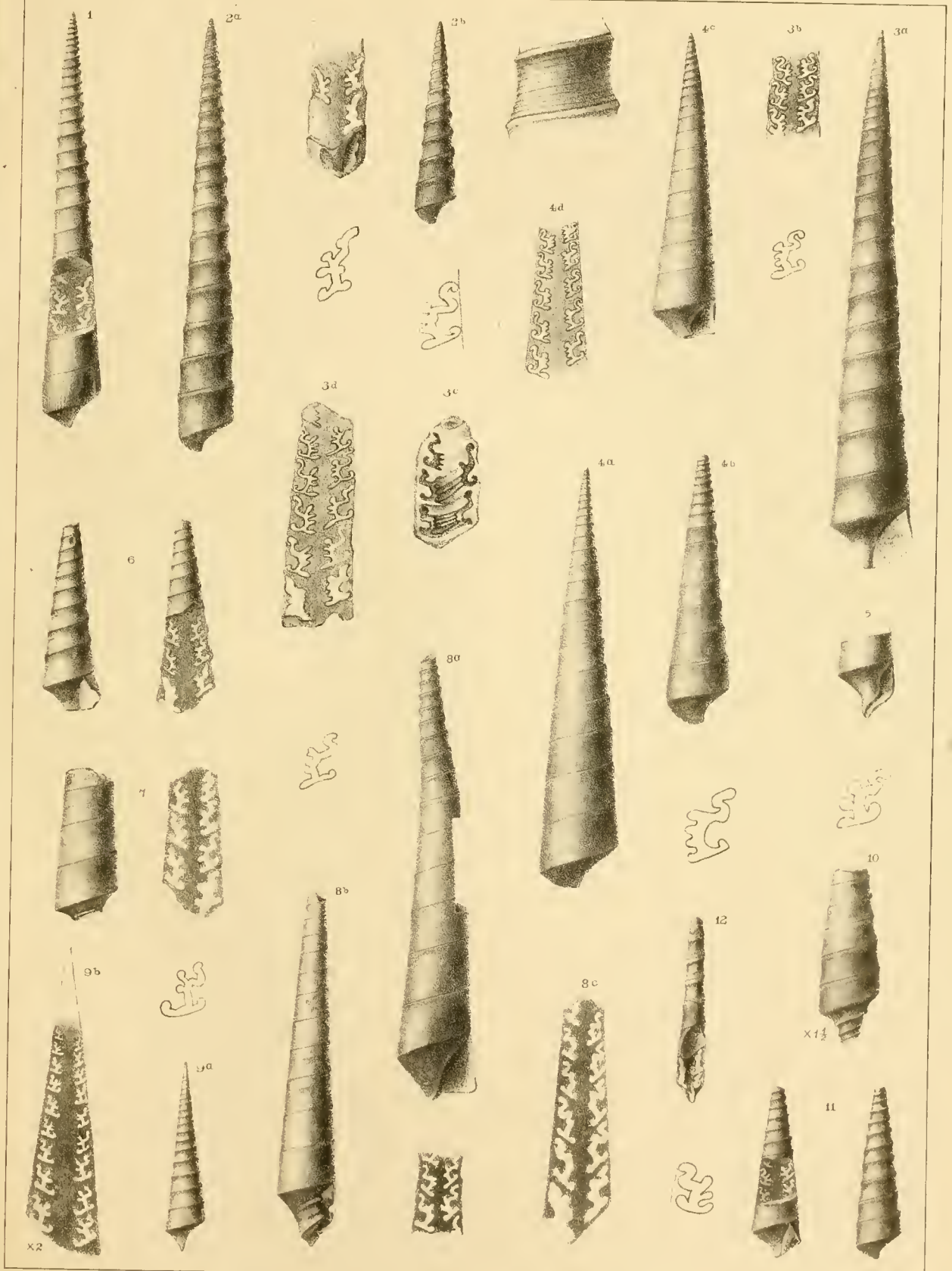

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PLATE XVII.

Fig.

1 *a*. *Turritella Dorsetensis*, sp. nov. Irony-nodule bed, Burton Bradstock. My Collection.

1 *b*. Variety of the same. *Murchisonæ*-zone, Bradford Abbas. My Collection.

1 *c*. *Turritella Dorsetensis*. Composite figure drawn from three specimens; the apical and anterior portions from the irony-nodule bed, Burton Bradstock; median portion from the *Murchisonæ*-zone, Stoford. My Collection. (Page 228.)

2 *a*. *Turritella* (*Mathilda*) *abbas*, sp. nov. 2 *b*. The same, apical condition. 2 *c*. Variety of the same. All from the *concavus*-bed, Bradford Abbas. My Collection. (Page 230.)

3 *a*. *Turritella* (*Mathilda*) *opalina*, Quenstedt. *Concavus*-bed, Bradford Abbas. 3 *b*. Variety of the same, approaching var. *canina*. *Murchisonæ*-zone, Stoford. Both in my Collection. (Page 231.)

4. *Turritella* (*Mathilda*) *opalina*, var. *canina*, Hudleston. Dogger, Blue Wyke. British Museum. (Page 232.)

5. *Turritella* (*Mathilda*) *strangulata*, sp. nov. *Concavus*-bed, Bradford Abbas. My Collection. (Page 233.)

6. *Turritella* (*Mathilda*) *quadrivittata*, Phillips. Dogger, Blue Wyke. My Collection. (Page 233.)

7. *Turritella* (*Mathilda*), cf. *binaria*, Héb. and Desl. Neighbourhood of Beaminster. My Collection. (Page 234.)

8.[1] *Cerithinella cingenda*, Sowerby. Dogger, Blue Wyke. British Museum.

9. *Pseudomelania procera*, var. *minor*, Deslongchamps. *Parkinsoni*-zone, Burton Bradstock. My Collection. (Page 238.)

x. *Mathilda*, cf. *euglypha*, Laube. Upper Lias, Heyford. Crick Collection. Magnified; apex largely magnified. (Footnote, page 235.)

N.B.—All other species figured in this plate are natural size, with one whorl enlarged.

[1] Possibly the type-specimen of *Turritella cingenda*, Sow. Subsequently this was regarded as a *Nerinæa* (*vide* Hudleston, 'Geol. Mag.,' dec. 3, vol. i (1884), p. 112, pl. iv, fig. 9). For an account of *Cerithinella* see p. 186 of the present work.

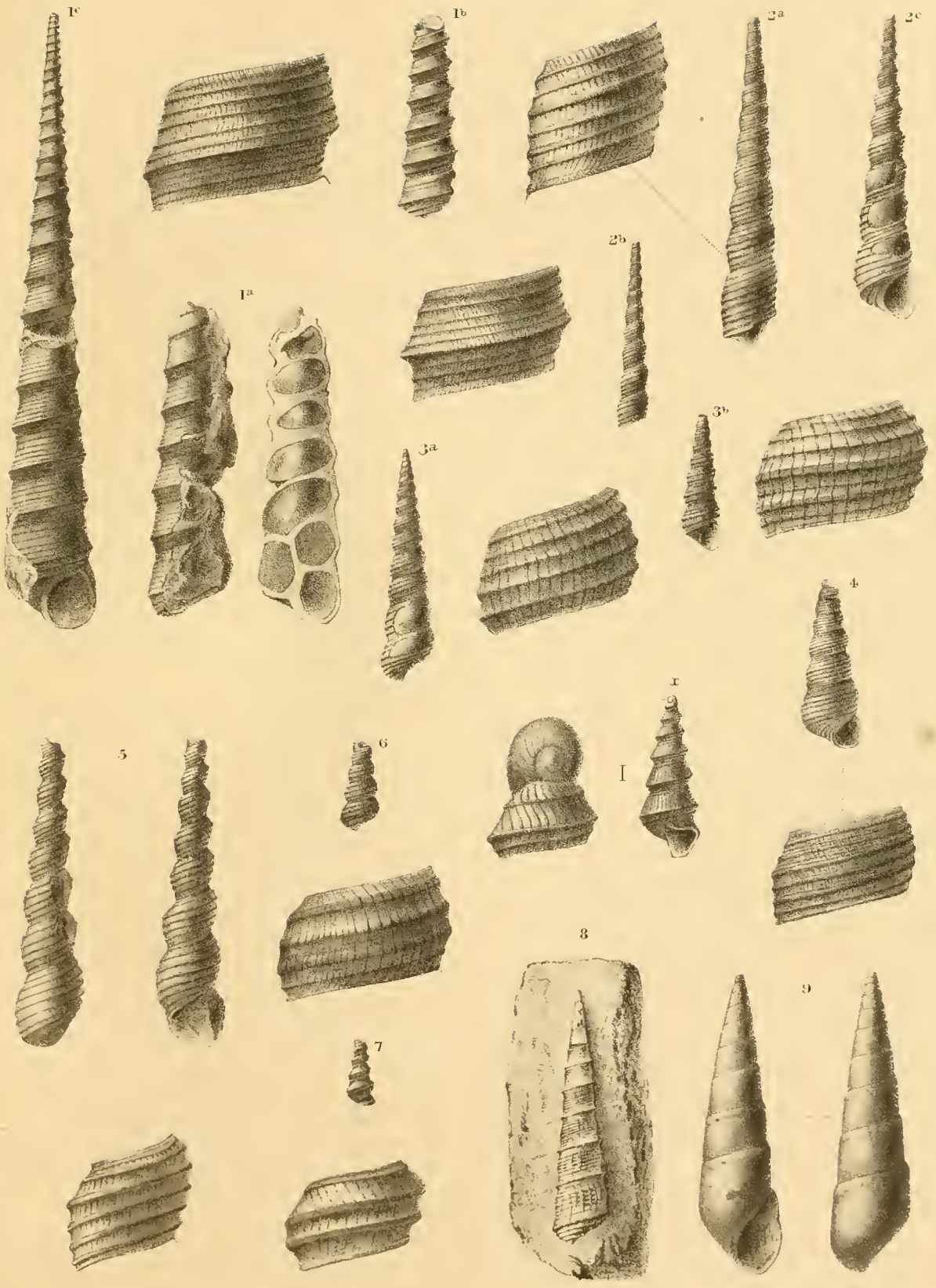

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PLATE XVIII.

Fig.

1. *Pseudomelania procera*, Deslongchamps. *Murchisonæ*-zone, Bradford Abbas. My Collection (Buckman[1]). (Page 237.)
2. The same (*lineata-procera*). Dogger, Blue Wyke. Leckenby Collection.
3 *a*. *Pseudomelania bicarinata*, Wright, MS. *Concavus*-bed, Bradford Abbas. 3 *b*. Young specimen; same horizon and locality. Both from my Collection (Stephens[1]). (Page 238.)
3 *c*. *Pseudomelania bicarinata*. *Opalinus*-zone, Burton Bradstock. My Collection.
4 *a*. *Pseudomelania heterocycla*, Eugène Deslongchamps. *Concavus*-bed, Bradford Abbas. 4 *b*. The same. *Murchisonæ*-zone, Stoford. Both from my Collection. (Page 239.)
4 *c*. *Pseudomelania heterocycla*. Specimen from Coker (*Murchisonæ*-zone). British Museum.
5. *Pseudomelania* "*robusta*." *Opalinus*-zone (*Moorei*-beds), Coaley Peak. My Collection (Buckman). (Page 240.)
6. *Pseudomelania* "*pinguis*." *Murchisonæ*-zone, Coker. My Collection. (Page 240.)
7 *a*. *Pseudomelania lineata*, Sowerby; variety approaching *P. Normaniana*, d'Orb. *Parkinsoni*-zone, Burton Bradstock. My Collection. (Page 241.)
7 *b*. *Pseudomelania lineata*. Specimen showing spiral puncta. Locality unknown. My Collection.
8 *a*. *Pseudomelania Astonensis*, sp. nov. *Parkinsoni*-zone, Aston cutting. My Collection. 8 *b*. The same. Lincolnshire Limestone. British Museum. (Page 245.)
9 *a*, 9 *b*, 9 *c*. *Pseudomelania coarctata*, Deslongchamps. Three specimens showing different stages of development. *Cadomensis*-bed (upper part of *Humphriesianus*-zone), Oborne. My Collection. (Page 242.)

[1] These names indicate the source from which the specimen was obtained.

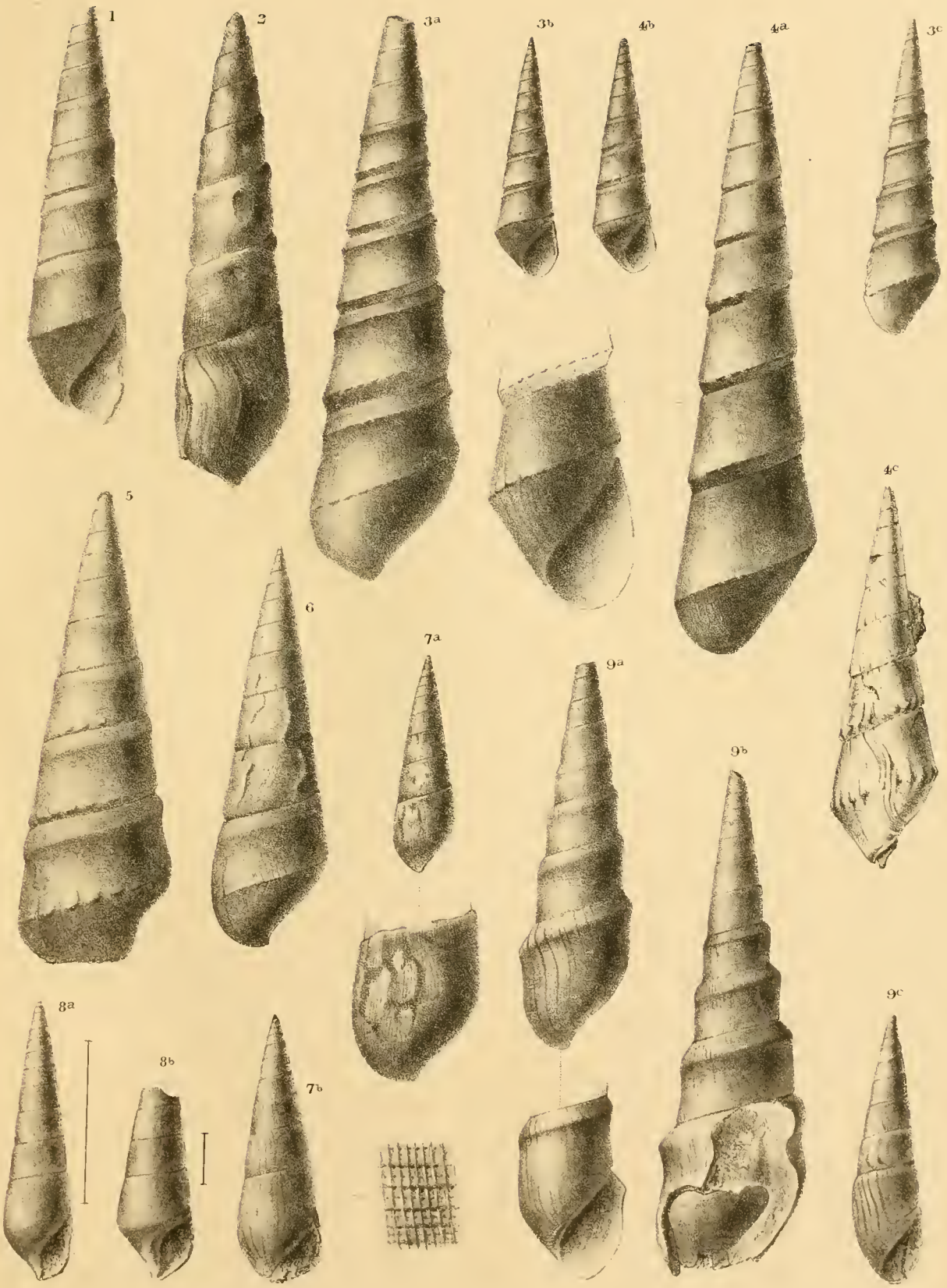

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PLATE XIX.

Fig.

1 *a*. *Pseudomelania coarctata*, Deslongchamps. Variety from *Humphriesianus*-zone, Oborne, showing resemblance to *Ps. Lonsdalei*. My Collection. (Page 242.)

1 *b*. *Pseudomelania*, near to *coarctata*, Desl., also showing some affinity with *Ps. Lonsdalei*. *Clypeus*-grit, Nailsworth Hill. My Collection. (Page 243.)

2. *Pseudomelania Lonsdalei*, Morris and Lycett. Scarborough Limestone, Pickering Cliff. My Collection. (Page 243.)

3. *Pseudomelania ? Scarburgensis*, Morris and Lycett. Scarborough Limestone. Leckenby Collection. (Page 243.)

4. *Pseudomelania simplex*, Morris and Lycett. Cotteswolds (? Oolite Marl). My Collection (Wright). (Page 244.)

5. *Pseudomelania Burtonensis*, sp. nov. *Parkinsoni*-zone, Burton Bradstock. My Collection. (Page 246.)

6. *Pseudomelania*, species (accidentally introduced).

7 *a*. *Cloughtonia cincta*, Phillips. Lincolnshire Limestone, Weldon. 7 *b*. The same. Scarborough Limestone, Cloughton Wyke. Both from my Collection. (Page 247.)

8. *Bourguetia striata*, Sowerby; wide and conical form. *Murchisonæ*-zone, Halfway House. My Collection (Buckman). 9. The same (narrow and pupoid form). *Murchisonæ*-zone, Bradford Abbas. My Collection (Stephens). N.B.—Both these belong to the local variety *multistriata*. (Page 249.)

10 *a*. "*Phasianella*" *latiuscula*, Morris and Lycett. Lincolnshire Limestone, Weldon. 10 *b*. ? The same, small variety. Bradford Abbas. My Collection. (Page 251.)

11 *a*. "*Phasianella*" *elegans*, Morris and Lycett. Specimen showing punctate structure. Lincolnshire Limestone. Jermyn Street Museum. (Page 252.)

11 *b*. "*Phasianella*" *elegans*, Morris and Lycett. Barnack Rag (Lincolnshire Limestone). British Museum.

12. "*Phasianella*" *elegans*, Morris and Lycett. Narrow variety. Lincolnshire Limestone, Great Ponton. My Collection.

13. "*Phasianella*" *Pontonis*, Lycett. Barnack Rag. British Museum. (Page 253.)

14 *a*. "*Phasianella*" *conoidea*, sp. nov. Scarborough Limestone. My Collection. (Page 254.)

14 *b*. "*Phasianella*" *? elegans*, Morris and Lycett. Small specimen. *Parkinsoni*-zone, Stoford. My Collection (Buckman).

15. "*Phasianella*," cf. *subumbilicata*, d'Archiac. Lincolnshire Limestone, Weldon. My Collection. (Page 255.)

16. *? Pseudomelania*, species. Oolite Marl, Nailsworth. My Collection. (Page 244.)

17. "*Phasianella*," cf. *nuciformis*, Morris and Lycett. Lincolnshire Limestone, Weldon. My Collection. (Page 255.)

All figures natural size except Figs. 5 and 17.

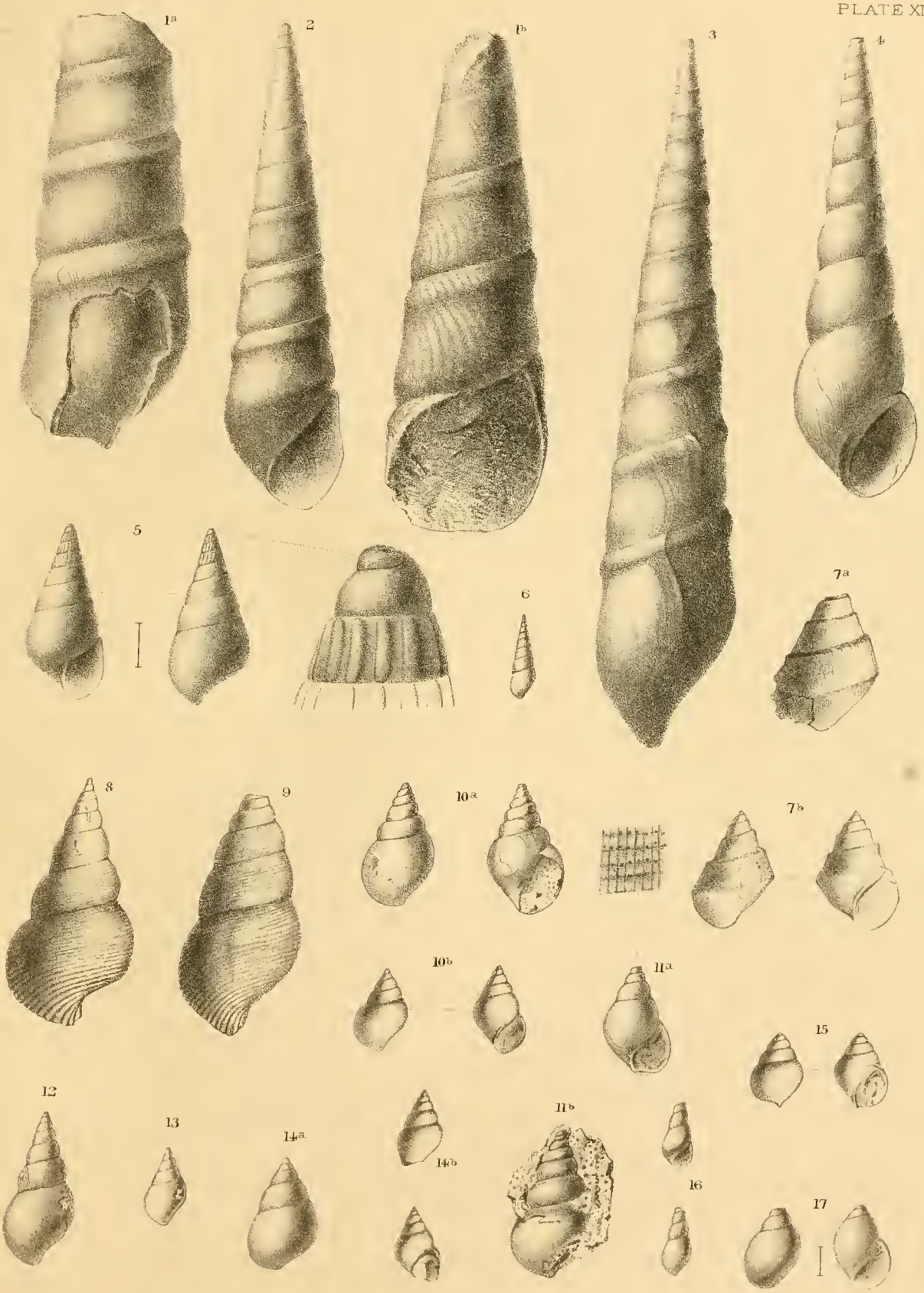

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PLATE XX.

Natica, section A. = Euspira in part.

Fig.

1. *Natica*, species (cast). Northampton Sand, Duston. British Museum. (Page 261.)
2. *Natica adducta*, Phillips, var. *Oppelensis*, Lycett. Cotteswold Sands, Nailsworth. Jermyn Street Museum. Type. (Page 258.)
3. *Natica adducta*, Phillips. Dogger, Blue Wyke. Scarborough Museum. (Page 257.)
4. The same. Pea-grit, Leckhampton. My Collection.
5. *Natica adducta*, Phil., var. *globata*. *Concavus*-bed, Bradford Abbas. My Collection. (Page 259.)
6. The same. Lower Trigonia grit, Leckhampton. Jermyn Street Museum.
7. *Natica proxima*, Hudleston (var. of *Natica Lorieri*). Dogger, Blue Wyke. Woodwardian Museum. (Page 260.)
8. *Natica*, cf. *Lorieri*, d'Orbigny. Cold Comfort, near Cheltenham. My Collection. (Page 259.)

9 *a*. *Natica Lorieri*, d'Orb., var. *canina*, Hudleston. Dogger, Blue Wyke, Woodwardian Museum. 9 *b*. Another specimen. Dogger, Blue Wyke. My Collection. (Page 260.)

10. *Natica* "*subelegans*." *Parkinsoni*-zone, Bradford Abbas district. My Collection (Buckman). (Page 261.)

11 *a*. *Natica Dundriensis*, Tawney. Base of *Humphriesianus*-zone, Oborne. My Collection (Buckman). 11 *b*, 11 *c*. Specimens of *Natica Dundriensis* from the iron-shot Oolite of Dundry showing reticulate structure. Woodwardian Museum. (Page 262.)

12. *Natica Hulliana*, Lycett. Nailsworth. Jermyn Street Museum. Type. (Page 262.)

13 *a*. *Natica Bajocensis*, d'Orbigny. *Parkinsoni*-zone, Burton Bradstock. 13 *b*. Another specimen (narrower variety, approaching *N. Calypso*, d'Orb.) *Parkinsoni*-zone, South Dorset. Both from my Collection. (Page 263.)

14. *Natica* "*punctura*," Bean. Dogger variety (*? N. Bajocensis*). Blue Wyke. Woodwardian Museum. (Page 264.)

15. *Natica protracta*, sp. nov. *Parkinsoni*-zone, Bradford Abbas. My Collection (Buckman). (Page 265.)

16. *Natica canaliculata*, Morris and Lycett. Upper Pisolite, Longfords. My Collection. (Page 265.)

17. *? Natica cincta*, Phillips. Young specimen Oolite Marl, Leckhampton. Jermyn Street Museum. For adult specimens see Plate XXI, figs. 3 and 4. (Page 266.)

Natica, section B. = Mammillated.

18 *a*, 18 *b*. *Natica*, cf. *Michelini*, d'Archiac. Two specimens, Inferior Oolite, Nailsworth. Jermyn Street Museum. (Page 269.)

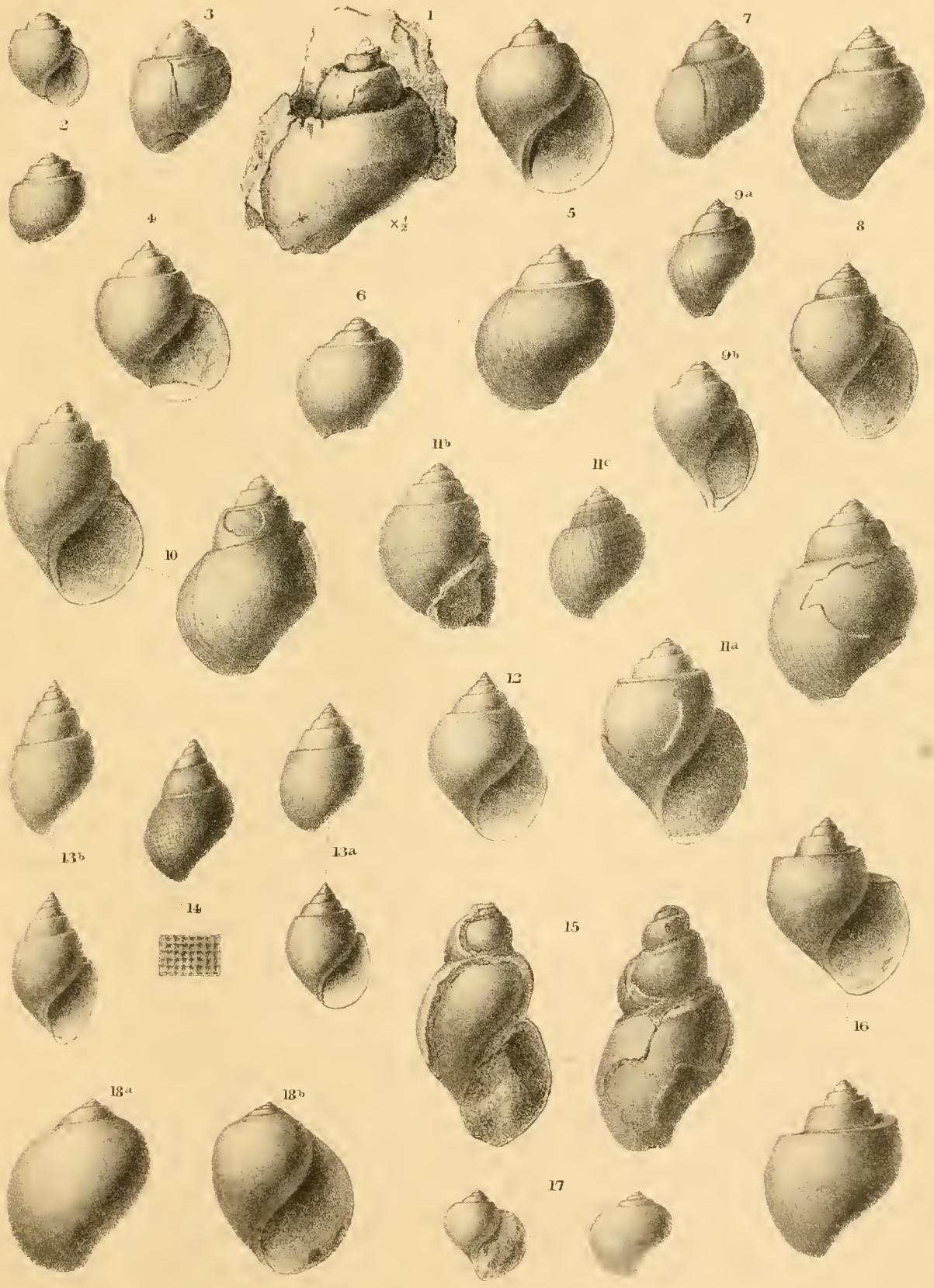

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PLATE XXI.

FIG.

1. *Pseudomelania procera*, Deslongchamps. Subulate and corroded specimen, showing striato-punctate structure. *Murchisonæ*-zone, Bradford Abbas. My Collection (Stephens). (Page 237.)
2. *Euspira*, cf. *coronata*, Morris and Lycett. Northampton Sand, Duston. Crick Collection. (Page 270.)
3. *Natica cincta*, Phillips, cast, $\times \frac{1}{2}$. Lincolnshire Limestone, ? Denton. British Museum. (Page 266.)
4. *Natica cincta*, Phillips, shell, $\times \frac{2}{3}$. Coombe Hill, Deddington, Oxfordshire. My Collection.
5. "*Phasianella*" *Leymeriei*, d'Archiac, var. *Lindonensis*. "Bastard" bed between the Northampton Sand and the Lincolnshire Limestone, Lincoln. My Collection. (Page 253.)
6. *Pseudomelania lævigata*, Morris and Lycett. $\times 2$. Scarborough Limestone, Cloughton Wyke. Figure compounded of two specimens, one in the British Museum (type), the other in my Collection. (Page 244.)
7. *Rissoina obliquata*, Sowerby. $\times 4$. Lincolnshire Limestone, Weldon. My Collection. (Page 272.)
8. *Rissoina obliquata*, Sowerby, var. *parcicostata*. $\times 4$. Lincolnshire Limestone, Ponton. My Collection. (Page 272.)
9. *Rissoina obliquata*, Sowerby, var. *inflata*. $\times 4$. Lincolnshire Limestone, Ponton or Barnack. British Museum. (Page 272.)

10 *a*. *Rissoina obtusa*, Lycett. $\times 4$. Pea-grit, Crickley. My Collection. 10 *b*. The same specimen, $\times 10$. (Page 273.)

11. *Rissoina gymnoides*, sp. nov. $\times 6$. Lincolnshire Limestone, Weldon. My Collection. (Page 273.)
12. *Amberleya capitanea*, Münster. *Jurensis*-zone, *variabilis*-beds, North Nibley. My Collection (Buckman). (Page 277.)
13. *Amberleya ornata*, Sowerby. Dundry. Bristol Museum; probably one of Sowerby's types—a worn specimen. (Page 279.)
14. The same. Dundry. My Collection (Wilson)—an unworn specimen from the same locality.
15. *Amberleya ornata*, Sow., var. *spinulosa*, Münst. (*Bathis*, d'Orb). *Concavus*-bed, Bradford Abbas. My Collection.
16. *Amberleya ornata*, var. *abbas*. *Concavus*-bed, Bradford Abbas. My Collection. Middle-sized specimen, showing the *Purpurina*-like mouth.

17, 18. Portions of more adult specimens of *A. ornata*, var. *abbas*, showing the modification of the aperture. Same locality and Collection. (Page 280.)

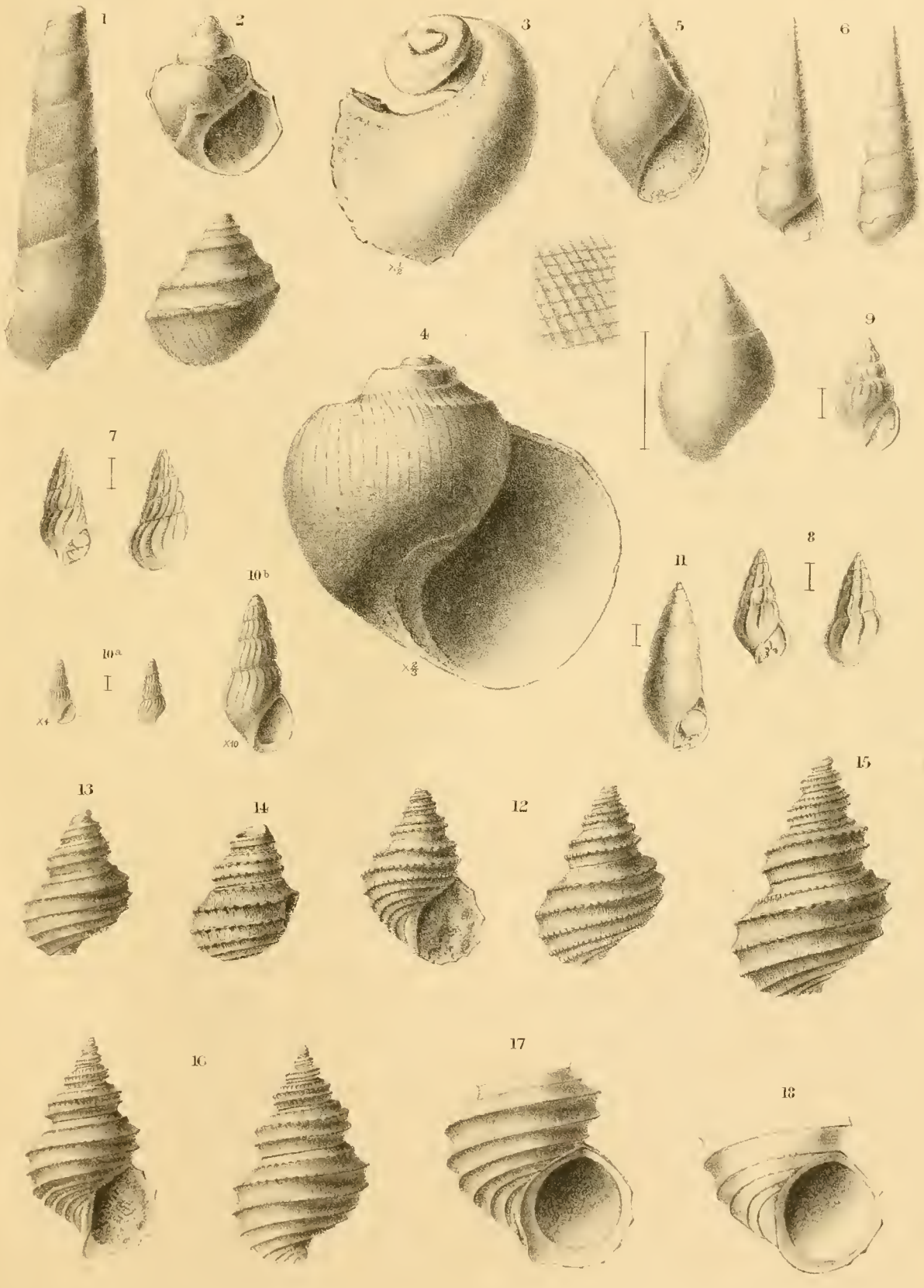
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PLATE XXII.

Fig.

1. *Amberleya ornata*, Sow., var. *abbas;* young form, showing the *Purpurina*-like mouth. × $1\frac{3}{4}$. *Concavus*-bed, Bradford Abbas. My Collection. (Page 280.)
2. *Amberleya ornata*, Sow., var. *horrida*. *Murchisonæ*-zone, Bradford Abbas. My Collection. (Page 281.)
3. *Amberleya densinodosa*, sp. nov. Burton Bradstock variety. Irony nodule bed, B. B. (*Murchisonæ*-zone). My Collection. (Page 282.)
4. *Amberleya densinodosa*, typical form. *Concavus*-bed, Bradford Abbas. My Collection (Stephens).
5. The same; young form, showing the *Purpurina*-like mouth. Same horizon and locality. My Collection.
6. *Amberleya goniata*, Deslongchamps, young form. *Parkinsoni*-zone, Burton Bradstock. My Collection. (Page 284.)
7. *Amberleya Orbignyana*, sp. nov. (*Purpurina ornata*, d'Orb., non Sow.). *Parkinsoni*-zone, Broadwindsor. My Collection. (Page 285.)
8. The same. *Humphriesianus*- or *Parkinsoni*-zone, Louse Hill. My Collection.
9. *Amberleya pagodiformis*, sp. nov. *Murchisonæ*-zone, Bradford Abbas. My Collection (Buckman). (Page 287.)
10. *Amberleya Obornensis*, sp. nov. Base of *Humphriesianus*-zone, Oborne. My Collection. (Page 286.)
11. *Amberleya Murchisoni*, Münster. × $1\frac{1}{2}$. *Humphriesianus*-zone, Bradford Abbas. My Collection. (Page 286.)
12. *Amberleya*, cf. *Trochus anaglypticus*, Münst. *Humphriesianus*-zone, Oborne. My Collection (Stephens). (Page 288.)
13. *Amberleya* (*Littorina*) *biserta*, Phillips (section A); young specimen, showing the *Purpurina*-like mouth. ×2. Dogger, Blue Wyke. My Collection. (Page 288.)
14. The same, = *Trochus bisertus*, Phillips. *Opalinus*-zone, Drympton. My Collection.

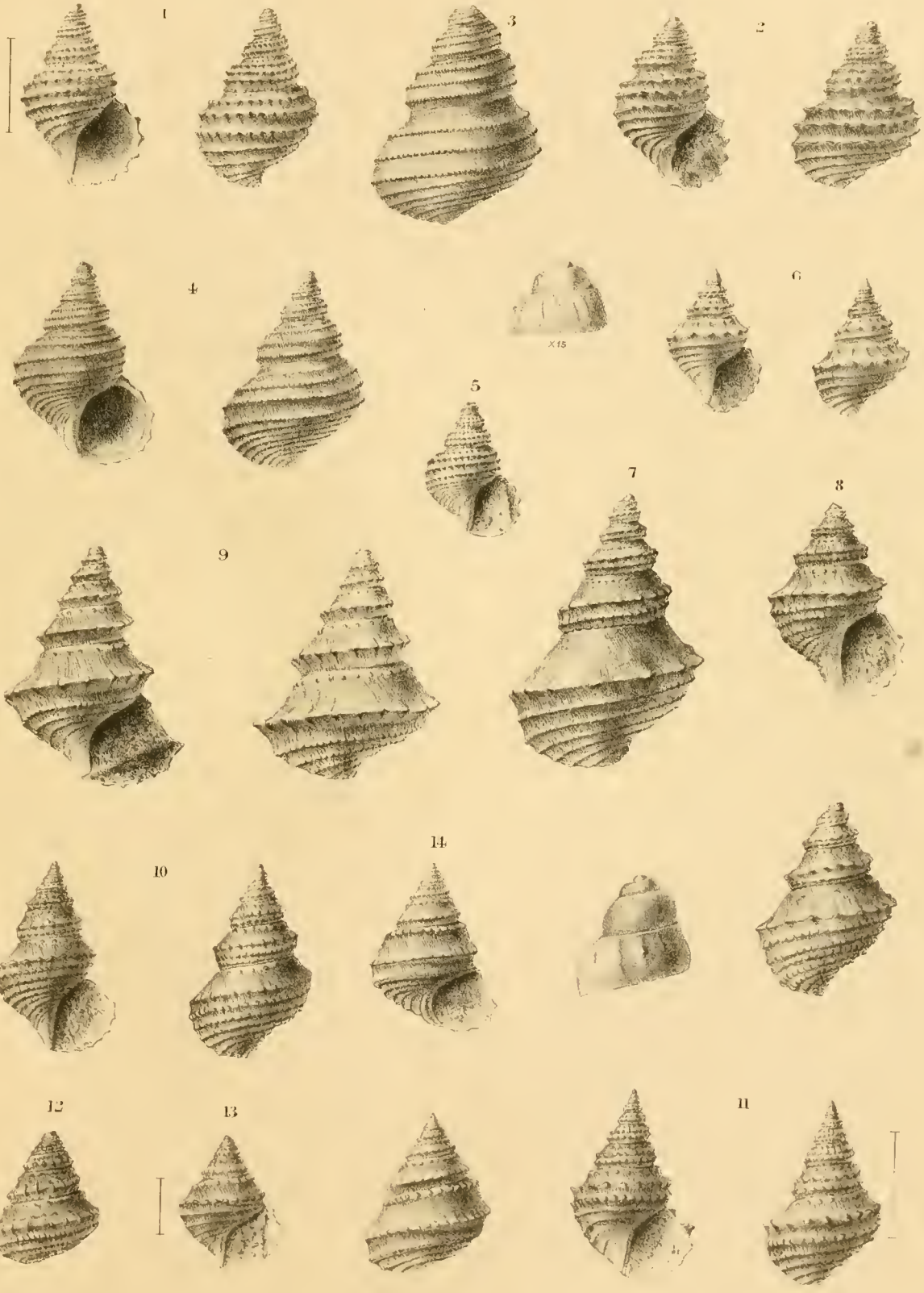

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PLATE XXIII.

Fig.

1. *Littorina unicarinata*, Bean. ? Young of *Amberleya biserta*, Phillips, section B. Dogger, Blue Wyke. Leckenby Collection. (Page 289.)
2. *Amberleya biserta*, Phillips, section B. Dogger, Blue Wyke. Jermyn Street Museum. (Page 288.)
3. *Amberleya generalis*, Münster. ? Dundry. My Collection (Buckman). (Page 287.)
4. *Littorina* or *Echinella*, species or variety. × $1\frac{3}{4}$. *Concavus*-bed, Bradford Abbas. My Collection. (Page 295.)
5. *Amberleya* (*Turbo*) *Milleri*, Wright, MS. × $1\frac{3}{4}$. *Concavus*-bed, Bradford Abbas. My Collection (Stephens). (Page 290.)
6. *Amberleya* (*Turbo*), between *Amb. Milleri* and *Amb. turbinoides*, but probably nearer to the latter. × $1\frac{3}{4}$. *Concavus*-bed, Bradford Abbas. My Collection (Stephens). (Page 290.)
7. *Amberleya turbinoides*, sp. nov. ? Stoford. My Collection. (Page 290.)
8. *Amberleya elongata*, sp. nov. *Murchisonæ*-zone, Bradford Abbas. My Collection. (Page 292.)
9. The same. ? A megalomorph. Pea-grit, Longfords. My Collection.
10. *Amberleya* or *Littorina*, species or variety. × $1\frac{3}{4}$. *Murchisonæ*-zone, Stoford. My Collection (Buckman). (Page 293.)
11. *Amberleya* (*Turbo*) *Stoddarti*, Tawney. Dundry. My Collection (Wright). (Page 291.)
12. *Littorina polytimeta*, sp. nov. × 2. *Concavus*-bed, Bradford Abbas. My Collection (Stephens). (Page 295.)
13. The same. Larger specimen, to show the increased thickening on the pillar-lip. × $1\frac{1}{2}$. Same horizon, locality, and Collection.
14. *Littorina* or *Amberleya*, species or variety. ? Allied to *L. polytimeta*. × 2. "Base-bed," Lincoln. My Collection. (Page 296.)
15. *Littorina sulcata*, Hébert and Deslongchamps. × 2. *Parkinsoni*-zone, Bradford Abbas. My Collection (Buckman). (Page 297.)
16. *Littorina Phillipsii*, Morris and Lycett. × 2. Lincolnshire Limestone, Weldon. My Collection. (Page 296.)
17. *Amberleya* cf. *Meriani*, Goldfuss. Lincolnshire Limestone, Ponton. My Collection. (Page 283.)
18. *Littorina Weldonis*, sp. nov. × 3. Lincolnshire Limestone, Weldon. My Collection. (Page 297.)
19. *Amberleya gemmata*, Lycett. × 3. Lincolnshire Limestone, Ponton or Barnack. British Museum. (Page 281.)

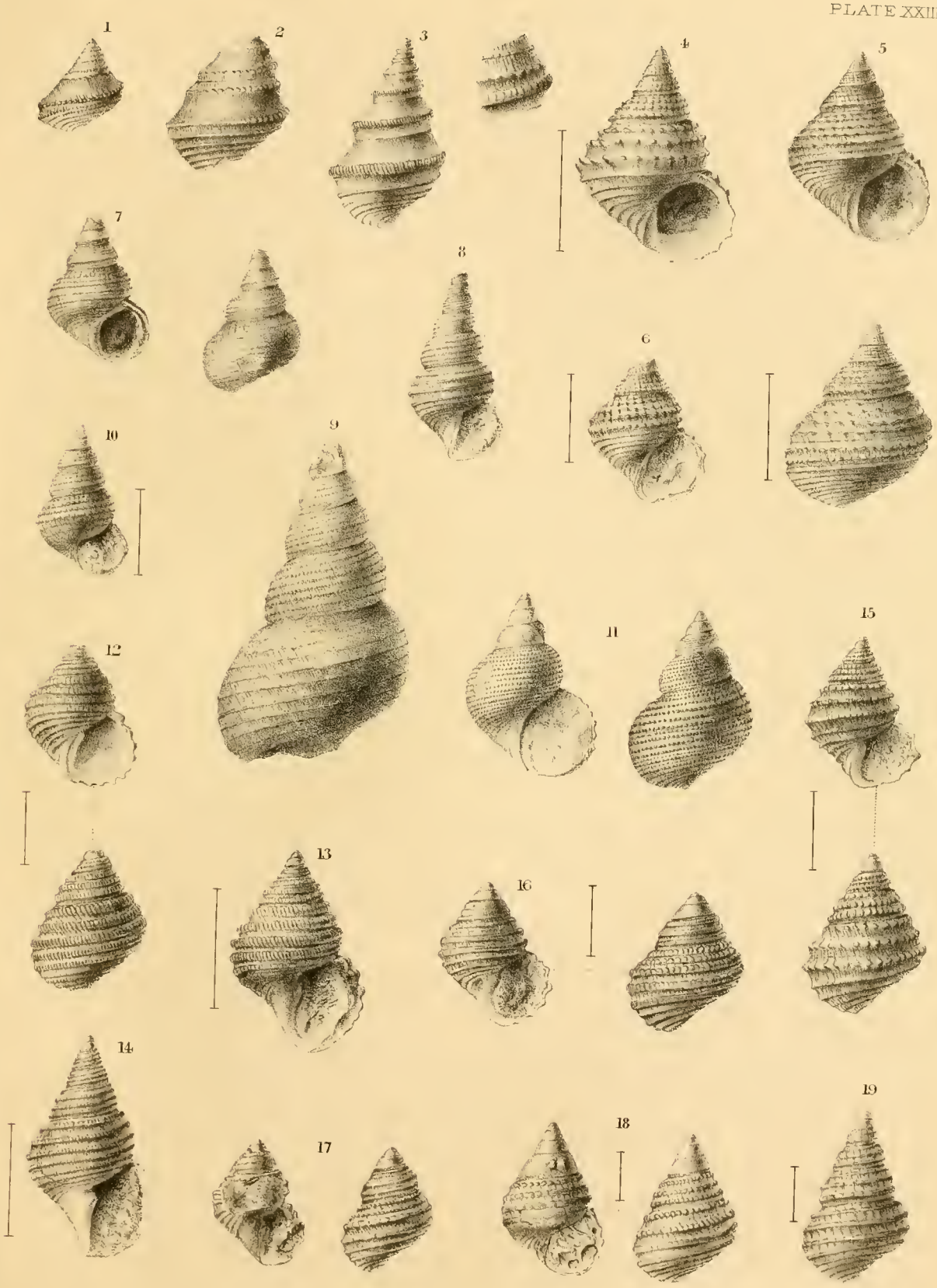

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PLATE XXIV.

Fig.

1. *Littorina ædilis*, Münster. × 2. Dundry. Bristol Museum. (Page 298.)
2. *Littorina ? ædilis*, Münster. × 3. Lincolnshire Limestone, Ponton or Barnack. British Museum.
3. *Littorina Dorsetensis*, sp. nov.—var. A, typical. × 2. (Page 299.)
4. The same, var. B, resembling *Trochus granarius*, Hébert and Deslongchamps. × 2.
5. The same, var. C, eucycloid variety. × 1½. All from the *Concavus*-bed, Bradford Abbas. My Collection.
6. *Littorina* (*? Trochus*) *recteplanata*, Tawney. × 1½. Dundry. Bristol Museum. (Page 300.)
7. The same. Pea-grit, Longfords. × 1½. My Collection. N.B.—Fig. 6 represents a worn specimen, fig. 7 a well-preserved and much larger one.
8. *Littorina prætor*, Goldfuss. *Murchisonæ*-zone, Bradford Abbas. My Collection (Buckman). (Page 294.)
9. *Littorina* (*? Trochus*) *pisolitica*, sp. nov. × 6. Pea-grit, Leckhampton. My Collection. (Page 300.)
10. *Amberleya cygnea*, sp. nov. (but cf. *Turbo Meriani*, Goldf.). "Base-bed," Lincoln. My Collection. (Page 283.)
11. *Amberleya* (*Turbo*) *Dundriensis*, Tawney. × 3. Dundry. Bristol Museum. (Page 293.)
12. *Hamusina Damesi*, Gemmellaro, var. *Babylonica*. *Murchisonæ*-zone, Babylon Hill. Whidborne Collection. (Page 304.)
13. *Hamusina Oppelensis*, Lycett, Dorset variety. *Murchisonæ*-zone, Coker. My Collection. This specimen shows the single row of nodules as distinguished from the double row in *Hamusina Bertheloti*, d'Orb. (Page 305.)
14. The same. ? Upper Pisolite, Longfords. Jermyn Street Museum. N.B.—Type refigured to show the supposed costæ which are really due to an imperfect and misleading surface.
15. *Cirrus Etheridgii*, Lycett. Nailsworth district. Jermyn Street Museum. × 1½. (Page 306.)
16. *Cirrus* "*reticulatus*;" may possibly represent *Cirrus Etheridgii* in the Dorsetshire beds, Bradford Abbas. Monk Collection. (Page 307.)
17. *Cirrus gradatus*, sp. nov. *Murchisonæ*-zone, Coker. My Collection. (Page 307.)

18 and 19. *Cirrus pyramidalis*, Tawney. Dundry. Bristol Museum. The types refigured. (Page 311.)

20. *Cirrus pyramidalis*, Tawney. Cotteswold variety. Longfords. My Collection.

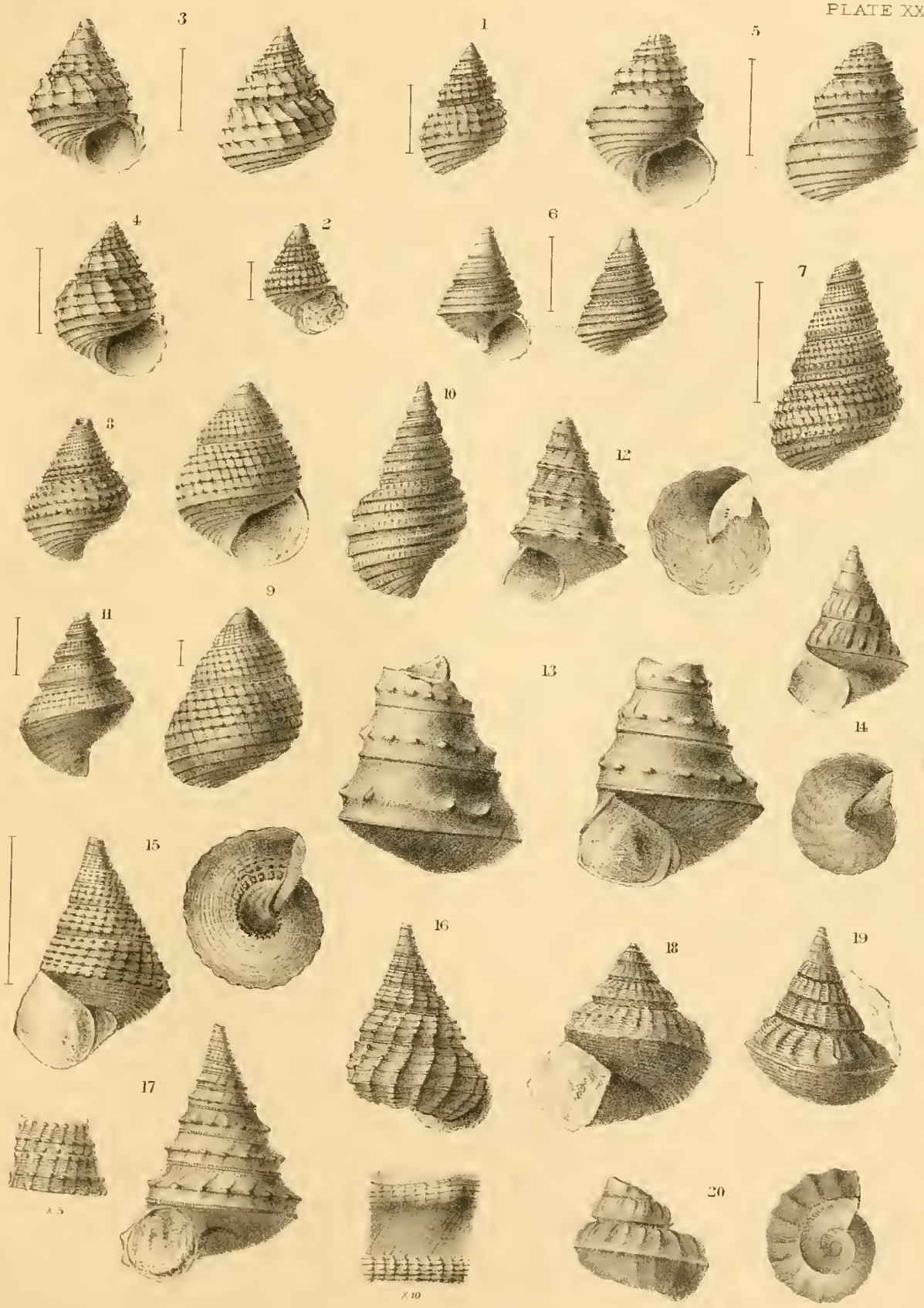

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PLATE XXV.

Fig.

1. *Cirrus Calisto*, d'Orbigny, *Murchisonæ*-zone, Coker. My Collection (Buckman). (Page 312.)
2. *Cirrus varicosus*, sp. nov. × 1¾. Oolite-Marl or Pisolite of the Nailsworth district. My Collection (Wright). (Page 313.)
3. *Cirrus Leachi*, Sowerby, rugose variety. *Murchisonæ*-zone, Mapperton. My Collection. (Page 308.)
4. The same. Variety with small umbilicus. *Murchisonæ*-zone, Bradford Abbas. My Collection.
5. *Cirrus Leachi*, Sowerby, ornaments finer and closer. *Murchisonæ*-zone, Bradford Abbas. My Collection.
6. *Cirrus nodosus*, Sowerby. *Murchisonæ*-zone, Coker or Stoford. My Collection. (Page 313.)
7. *Discohelix Cotswoldiæ*, Lycett. × 2. Oolite-Marl or Pisolite of the Nailsworth district. My Collection (Wright). (Page 316.)
8. *Discohelix spinosus*, Wright, MS. Slightly enlarged. *Concavus*-bed, Bradford Abbas. Woodwardian Museum. (Page 317.) N.B.—This species attains to a considerable size; one specimen in my Collection has a diameter of 44 mm., which is very much larger than any other species of *Discohelix* or *Straparollus* from the Inferior Oolite of this country.
9. *Straparollus pulchrior*, sp. nov. *Murchisonæ*-zone, Mapperton. My Collection. (Page 318.)

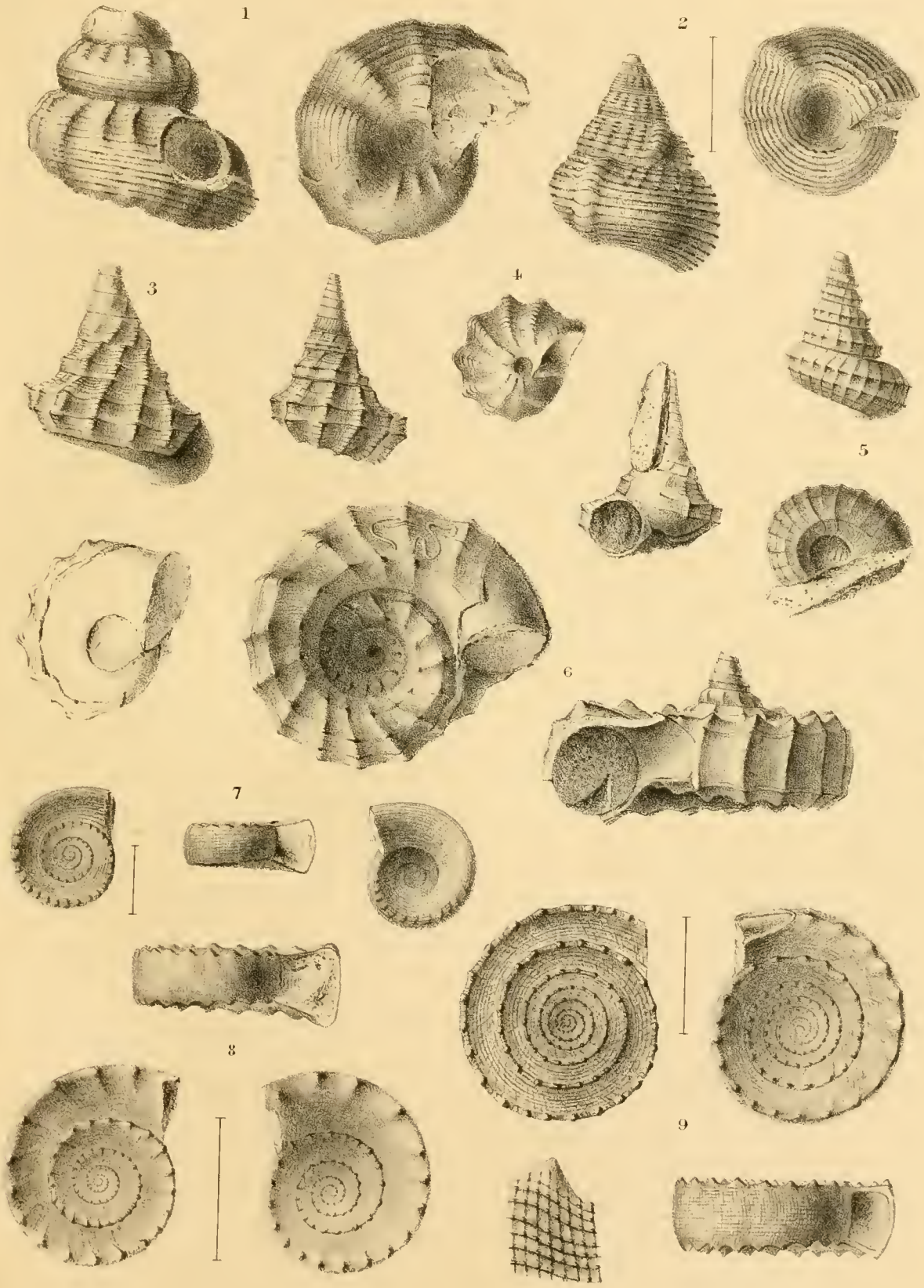

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PLATE XXVI.

Fig.

1. *Straparollus* "*tuberculosus-dexter*," Thorent (dextral form). × 2. *Parkinsoni*-zone, Burton Bradstock. Jermyn Street Museum. (Page 317.)
2. *Straparollus Dundriensis*, Tawney. Dundry. × 2. Bristol Museum, type refigured. (Page 319.)
3. *Straparollus exsertus*, sp. nov. × 1½. Bradford Abbas, ? *Murchisonæ*-zone. Monk Collection. (Page 320.)
4. Variety of *Straparollus exsertus*. × 1¾. The precise horizon and locality unknown; probably from the *Murchisonæ*-zone of Stoford. Woodwardian Museum.
5. *Straparollus*, cf. *altus*, d'Orbigny. × 2. *Murchisonæ*- or *concavus*-zone, neighbourhood of Beaminster. My Collection. (Page 321.)
6. *Solarium pisoliticum*, sp. nov. × 4½. Pea-grit, Leckhampton. My Collection. This represents an average specimen. (Page 322.)
7. The same. × 8. Specimen from the Pea-grit, Crickley, showing the earlier stage. My Collection.
8. The same. × 4. Unusually fine specimen from the Pea-grit, Cleeve Hill. My Collection.
9. *Solarium polygonoïdes*, sp. nov. × 5. *Clypeus*-grit, Barrington. My Collection. (Page 323.)
10. *Solarium diadema*, Lycett. × 4½. Freestones, Leckhampton. Brodie Collection. (Page 323.)
11. *Solarium subvaricosum*, sp. nov. × 4. *Parkinsoni*-zone of Aston cutting. My Collection. (Page 324.)
12. The same. × 4. ? Dorset-Somerset district. Woodwardian Museum (Walton Collection).

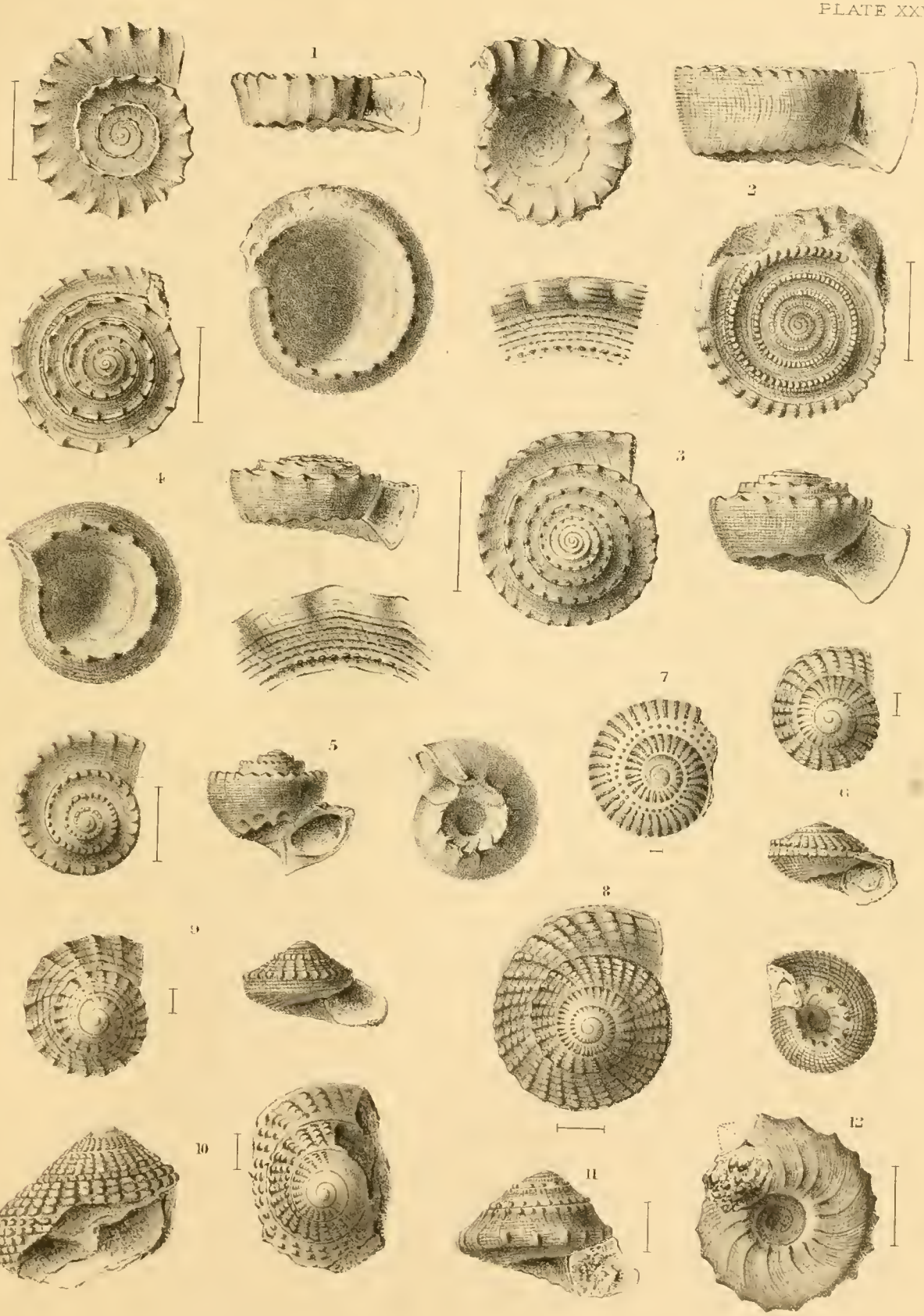
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PLATE XXVII.

N.B.—*About half the figures are drawn from photographs, more or less enlarged.*

Fig.

1 *a*, 1 *b*. *Onustus pyramidatus*, Phillips. Wide-angled variety with straight ribs. From (?) *Murchisonæ*-zone, Chideock. My Collection. Front and base × 1½. (Page 326.)

2 *a*, 2 *b*. The same. Specimen believed to be the type, Dogger; Blue Wyke. York Museum. Back and base × 1½.

3. *Onustus acuminatus*, sp. nov. *Murchisonæ*-zone, North Dorset. Whidborne Collection. Back × 1½. (Page 328.)

4 *a*, 4 *b*. *Onustus heliacus*, d'Orb., var. *opalina*. *Opalinus*-zone, Drympton. My Collection. Front and base × 1½. (Page 329.)

5 *a*, 5 *b*. *Onustus* cf. *lamellosus*, d'Orbigny. (The base shows a deeply excavated umbilicus as in d'Orbigny's figure, but the radial ornaments are wanting). *Concavus*-bed, Bradford Abbas. My Collection. Front and base × 1½. (Page 328.)

6 *a*, 6 *b*. *Onustus Heberti*, Laube. Stoford. ? *Parkinsoni*-zone. My Collection. Front and base × 2. (Page 329.)

7. The same. Wide-angled variety, with the spirals in the base and the crenulations of the margin more strongly developed. *Cadomensis*-bed, Oborne. My Collection. Base × 2.

8 *a*, 8 *b*. *Onustus ornatissimus*, d'Orbigny. *Parkinsoni*-zone, Burton Bradstock. My Collection. Front and base × 1½. (Page 330.)

9 *a*, 9 *b*, 9 *c*. *Neritopsis Bajocensis*, d'Orbigny. *Parkisoni*-zone, Burton Bradstock. My Collection (Stephens). Front, back, and apex × 1½. (Page 340.)

10. Operculum of *Neritopsis Bajocensis*, d'Orb. *Humphriesianus*-zone, Sherborne district. My Collection (Stephens). In position, natural size.

11 *a*, 11 *b*, 11 *c*. *Neritopsis Philea*, d'Orbigny, Inferior Oolite variety. *Concavus*-bed, Bradford Abbas. My Collection. Front, back, and apex × 1½. (Page 341.)

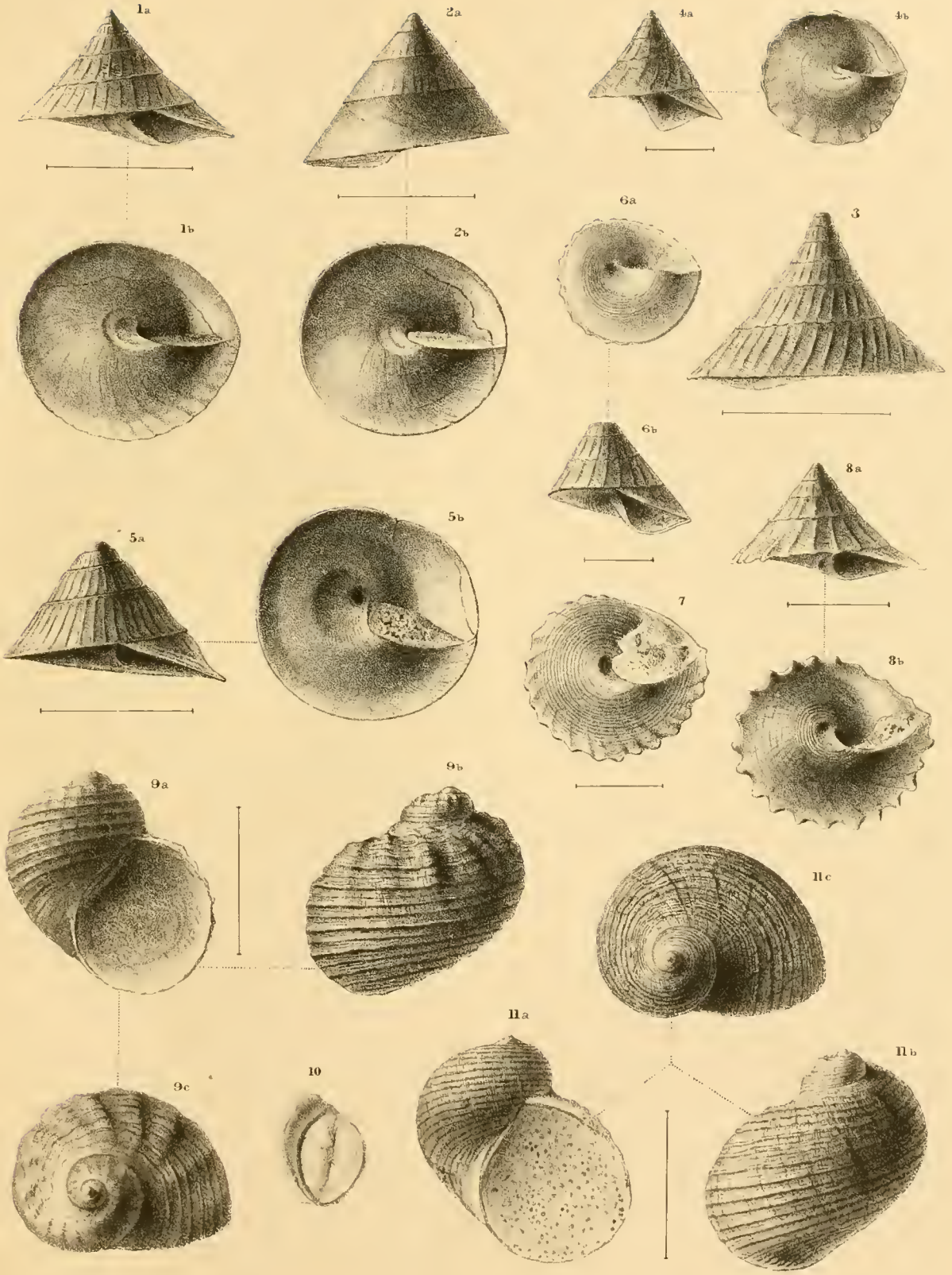

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PLATE XXVIII.

N.B.—*All figures, except figs.* 16, 17 *b, and* 18 *b, are from pencil drawings.*

Fig.

1 *a*, 1 *b*, 1 *c*. *Neritopsis varicosa*, Morris and Lycett. Oolite Marl, Nailsworth. My Collection (Wright). Front, back, and apical × 2. (Page 341.)

2. *Neritopsis incisa*, sp. nov. Base of Lincolnshire Limestone, Swan's Brickyard, Lincoln. My Collection. Back × 2. (Page 342.)

3 *a*, 3 *b*, 3 *c*. *Neritopsis* cf. *Hebertana*, d'Orbigny. Stoford. My Collection. Back, front, and apical × 2. (Page 343.)

4. *Neritopsis* cf. *sulcosa*, d'Archiac, or ? a modified form of *N. Philea*, d'Orb. Pea-grit, Crickley. My Collection. Back × 2. (Page 344.)

5 *a*, 5 *b*, 5 *c*. *Neritopsis* cf. *decussata*, Münster. Base-bed, Lincoln. Back, front, and apical × 2. (Page 342.)

6 *a*, 6 *b*. *Nerita costulata*, Deshayes (*Nerita costata*, Sow.). Variety from the Scarborough Limestone, White Nab. Herries Collection. Back and apical × 2. (Page 332.)

7, 8, 9. *Nerita pseudocostata*, d'Orbigny. Dogger, Blue Wyke. Leckenby Collection. Three specimens showing different aspects, each × 2. (Page 333.)

10. "*Neritopsis lævigata*." Dogger, Blue Wyke. Jermyn Street Museum. Front × 2. (Page 344.)

11 *a*, 11 *b*. *Nerita* (*Neridomus*) near to *ovata*, Römer (cf. also *Neritina Cooksonii*, Deslongchamps). Pea-grit, Crickley. My Collection. Front and back × 2. 11 *c*. Portion further enlarged to show colour markings. (Page 336.)

12 *a*, 12 *b*. *Nerita* (*Neridomus*) *tumidula*, Phillips. Dogger, Blue Wyke. My Collection. Front and back × 2. (Page 335.)

13 *a*, 13 *b*. *Pileolus plicatus*, Sowerby, var. A. Base-bed, Lincoln. My Collection. Apical and side × 3. (Page 337.)

14 *a*, 14 *b*, 14 *c*. *Pileolus plicatus*, Sow., var. B. Same locality and Collection. Apical, side and base × 3. (Page 337.)

15 *a*, 15 *b*, 15 *c*. *Pileolus lævis*, Sowerby. Inferior Oolite variety. Same locality and Collection. Apical, side and base × 3. (Page 338.)

16. Section of *Pileolus* to show the columellar septum. Base of Lincolnshire Limestone, Lincoln. My Collection. Section × 3. (Page 337.)

17 *a*, 17 *b*. *Crossostoma* cf. *Prattii*, Morris and Lycett. ? Irony Nodule-bed, Burton Bradstock. My Collection. Front and back × $1\frac{3}{4}$. (Page 346.)

18 *a*, 18 *b*. *Ataphrus* cf. *lucidus*, Thorent. Freestones of the Oolite Marl horizon, Nailsworth Hill. My Collection. Front and back × $1\frac{3}{4}$. (Page 348.)

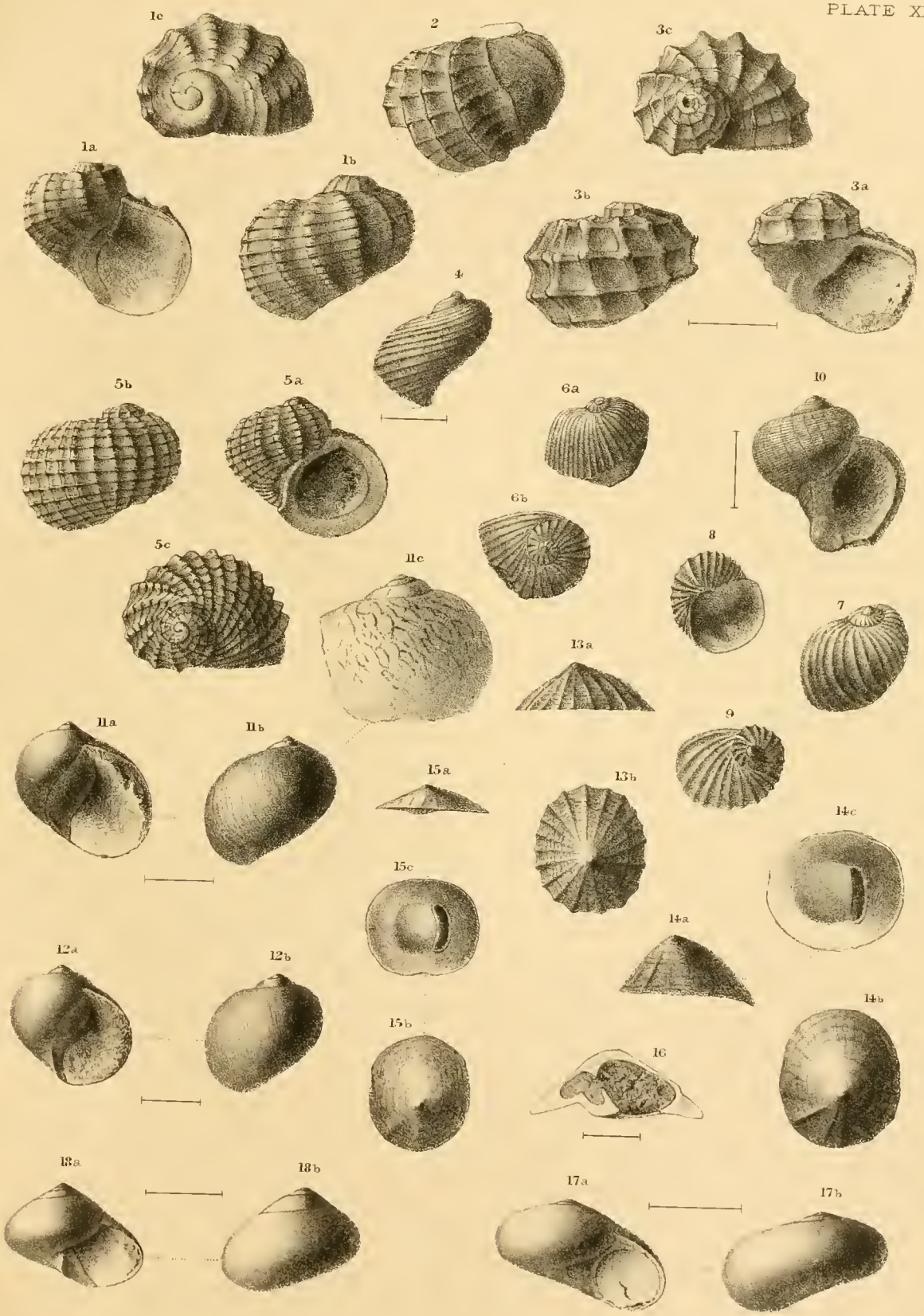

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PLATE XXIX.

N.B. 1. *About half the figures are drawn from photographs, more or less enlarged.*
N.B. 2. *All specimens are from my Collection unless otherwise stated.*

Fig.

1. *? Turbo lævigatus*, Phillips. Lincolnshire Limestone, Weldon. Front and back × $2\frac{1}{2}$. (Page 354.)
2. *Turbo* "*paludinoides.*" *Concavus*-bed, Bradford Abbas. Back and front. (Page 355.)
3. *Turbo* (*? Ataphrus*) *Lindecolinus*, sp. nov. Base of Lincolnshire Limestone, Lincoln. Front × $2\frac{1}{2}$. (Page 355.)
4. The same (another specimen). Same horizon and locality. Back × $2\frac{1}{2}$.
5. *Ataphrus lævigatus*, Sowerby. *Concavus*-bed, Bradford Abbas. Front and back × $1\frac{3}{4}$. (Page 349.)
6. The same; variety approaching *Ataphrus Belus*, d'Orb. Lincolnshire Limestone, Weldon. Front and back × $1\frac{3}{4}$.
7. *Ataphrus obtortus*, sp. nov. Inferior Oolite, Beaminster. Front and back × $1\frac{3}{4}$. (Page 350.)
8. The same. Burton Bradstock, horizon unknown. Back and front × $1\frac{3}{4}$.
9. *Ataphrus Labadyei*, d'Archiac. Bradford Abbas, ? *Concavus*-bed. Front and back × $1\frac{3}{4}$. (Page 350.)
10. The same; wider-angled variety. Pea-grit, Holcomb. Front and back × $1\frac{3}{4}$.
11. *Ataphrus Acmon*, d'Orbigny; wide-angled variety. *Parkinsoni*-zone, Burton Bradstock. Front and back × $1\frac{3}{4}$. (Page 351.)
12. The same; Neritoid variety. *Parkisoni*-zone, Burton Bradstock. Front and back × $1\frac{3}{4}$.
13. The same; variety from Hook Norton, approaching *Monodonta papilla*, Héb. and Desl. Front × 2.
14. *Ataphrus Acis*, d'Orbigny (*? Trochus Ibbetsoni*, Morris and Lycett). Burton Bradstock, probably from the *Parkinsoni*-zone. × $1\frac{3}{4}$. (Page 352.)
15. "*Trochus*" *attrochus*, sp. nov. *Concavus*-bed, Bradford Abbas. Front × $4\frac{1}{2}$. (Page 390.)
16. The same; variety from Beaminster. Front × $4\frac{1}{2}$.
17. *Monodonta pisolitica*, sp. nov. Pea-grit, Leckhampton. Front and back × $2\frac{1}{2}$. (Page 356.)
18. ? The same; specimen modified by age. Same horizon and locality. Front and back × $2\frac{1}{2}$.
19. *Turbo Hamptonensis*, Morris and Lycett. Bradford Abbas. Back × $2\frac{1}{2}$. (Page 359.)
20. The same. Inferior Oolite, Hook Norton. Front × $2\frac{1}{2}$.

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PLATE XXX.

N.B. 1. *All the figures on this plate are drawn from photographs.*

N.B. 2. *All specimens are from my Collection unless otherwise stated.*

N.B. 3. *All figures magnified about two diameters.*

Fig.

1. *Monodonta Lyelli*, d'Archiac. Lincolnshire Limestone, Weldon. Back and front (Page 357.)
2. The same; variety with shorter spire. Same horizon and locality. Back.
3. *Monodonta Lyelli*, var. *humilis*. Lincolnshire Limestone, Ponton or Barnack. British Museum. Back and front.
4. *Turbo* "*depressiuscula*." Lincolnshire Limestone. Same Collection. Back. (Page 358.)
5. *Turbo* "*spathica*" (cf. *T. delphinuloides*, d'Archiac). Lincolnshire Limestone. Same Collection. Back and front. (Page 359.)
6. *Turbo Davoustii*, d'Orbigny, var. *Lindonensis*. Base of Lincolnshire Limestone, Lincoln. Back. (Page 361.)
7. *Turbo Davoustii*, d'Orbigny. *Parkinzoni*-zone, Aston. Back and front. (Page 360.)
8. *Delphinula alta-bicarinata*, sp. nov. Base of Lincolnshire Limestone, Lincoln. Front and back. (Page 362.)
9. *Delphinula alta-acanthica*, sp. nov. Same horizon and locality. Back and front. (Page 363.)
10. *Delphinula alta-acanthica*, var. *depressa*. Same horizon and locality. Back and front. (Page 363.)
11. *Delphinula Buckmanni*, Morris and Lycett. Oolite Marl, Nailsworth. Front and back. (Page 364.)
12. *Turbo* (*Delphinula*) *Shaleri*, Tawney. *Concavus*-bed, Bradford Abbas. Back and front. (Page 365.)
13. *Delphinula* or *Turbo*, species or variety. Inferior Oolite, Dorset. Front and back. (Page 366.)
14. *Delphinula Shaleri*, var. *pulchior*. Stoford. Back and front. (Page 366.)
15. *Delphinula angulata*, sp. nov. *Murchisonæ*- or *concavus*-zone, Half-way House. Back and front. (Page 367.)
16. The same; depressed variety. *Opalinus*-zone, Drympton. Front and back.
17. *Delphinula* (*Turbo*) *granata*, Hudleston. Dogger, Blue Wyke. Front and back. (Page 368.)

18, 18 *a*. *Delphinula* (*Turbo*) *Santonis*, sp. nov. Lincolnshire Limestone, Santon. Jermyn Street Museum. Back and front. (Page 369.)

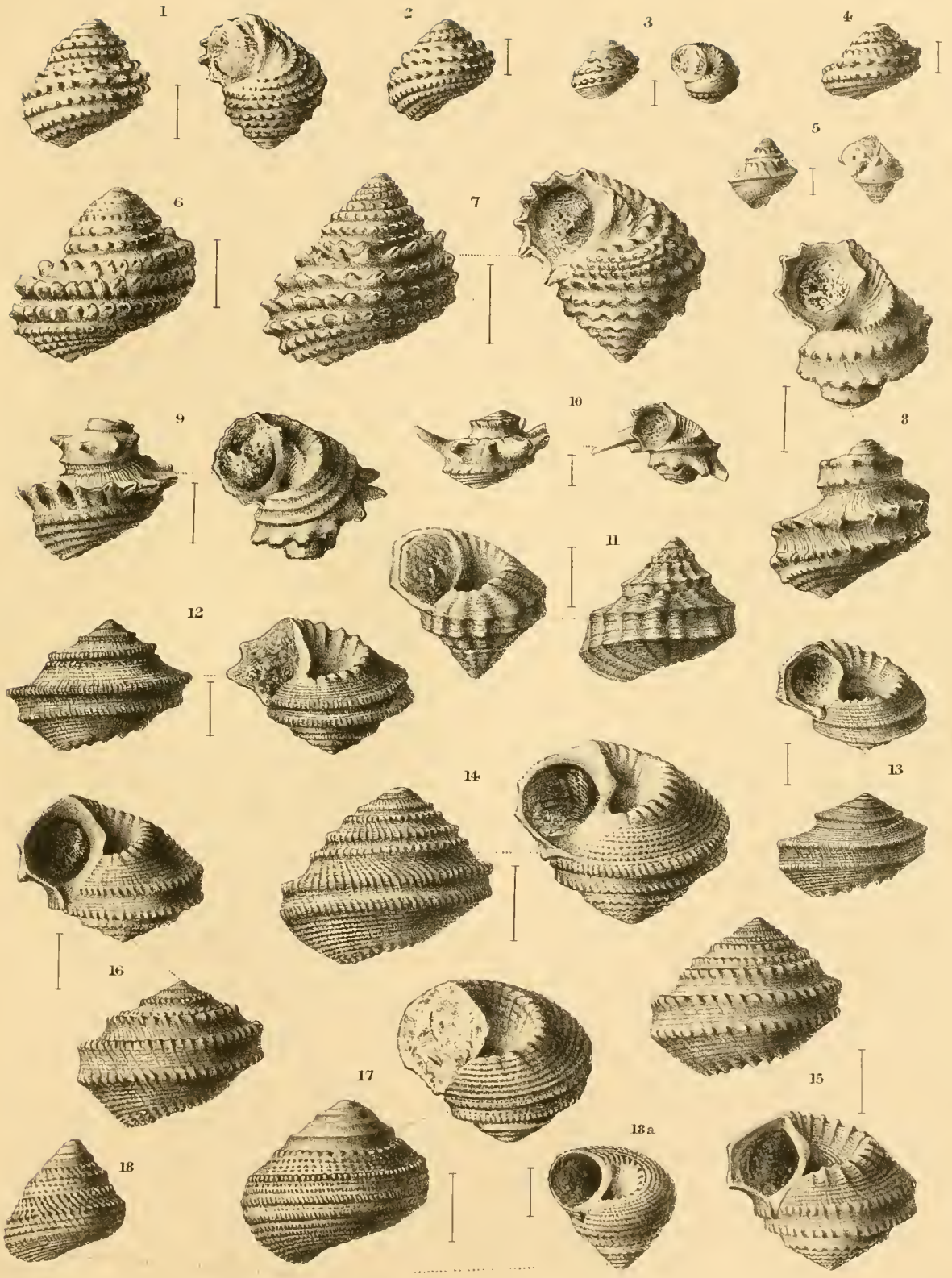

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PLATE XXXI.

N.B. 1. *All figures on this plate are drawn from photographs.*
N.B. 2. *All specimens are from my Collection unless otherwise stated.*
N.B. 3. *All figures are magnified a little over two diameters except fig.* 16.

Fig.

1. *Trochus Sandersii*, Tawney. *Murchisonæ*-zone, Bradford Abbas. Back and front. (Page 370.)
2. *Trochus rupestris*, sp. nov. Irony Nodule-bed (*Murchisonæ*-zone), Burton Bradstock. Back. (Page 371.)
3. *Trochus sybilla*, sp. nov. *Opalinus*-zone, Drympton. Back and front. (Page 371.)
4. *Trochus Winwoodi*, Tawney, var. *minor*. Stoford (*? Concavus*-bed). Back and front. (Page 372.)
5. *Trochus Winwoodi*, Tawney, var. *major*. *Concavus*-bed, Bradford Abbas. Back and front. (Page 372.)
6. *Trochus spiratus*, d'Archiac. Lincolnshire Limestone, Weldon. Front and back. (Page 378.)
7. *Trochus spiratus*, conical variety. Weldon. Back. N.B.—This specimen, like so many of the Weldon fossils, has suffered from attrition.
8. *Trochus dimidiatus*, Sowerby. *Parkinsoni*-zone, Woolston. Front and back. (Page 379.)
9. *Trochus Zetes*, d'Orbigny, as identified by Tawney. *Concavus*-bed, Bradford Abbas. Back and front. (Page. 379.)
10. *Trochus duplicatus*, Sowerby. *Parkinsoni*-zone, Burton Bradstock. Back and front. (Page. 373.)
11. *Trochus angulatus*, Sowerby [? var. of *T. duplicatus*, Sow., cf. also *T. Lorieri*, d'Orb.]. *Parkinsoni*-zone, Burton Bradstock. Back and front. (Page 374.)
12. *Trochus Duryanus*, d'Orbigny. *Parkinsoni*-zone, Grove. Back and front. (Page 375.)
13. *Trochus subduplicatus*, d'Orbigny. Small form from the "Sands," Brimscombe. Back. (Page 375.)
14. The same. Large form from the "Sands," Newton, near Yeovil. Front.
15. "*Trochus bicingendus*," Lycett. Oolite Marl, Nailsworth. Jermyn Street Museum. Back. (Page 389.)
16. *Trochus* cf. *Bixa*, d'Orbigny. Base of the Lincolnshire Limestone, Lincoln. Front. × $1\frac{1}{2}$. (Page 388)

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PLATE XXXII.

N.B. 1. *All figures, except figs.* 3 *a*, 3 *b*, 13, *and* 18 *b*, *are drawn from photographs.*

N.B. 2. *All specimens are from my Collection unless otherwise stated.*

N.B. 3. *The majority of the figures are magnified a little over two diameters.*

Fig.

1. *Trochus subduplicatus*, d'Orbigny, var. *Abbas*. *Concavus*-bed, Bradford Abbas. Back and front. (Page 377.)
2. *Trochus subduplicatus*, var *plicata*, Goldf. *Dumortieria*-beds, foot of East Cliff, Bridport Harbour. Back and front. (Page 376.)

3 *a*, 3 *b*. *Trochus monilitectus*, Phillips. Scarborough Limestone. Bean Coll., British Museum. Back and front. (Page 380.)

4. *Trochus substrigosus*, sp. nov., incomplete form, say *T.* "*nemoralis*" by way of distinction. *Parkinsoni*-zone, Grove. Front and back. (Page 384.)
5. *Trochus squamosior*, sp. nov. Base of Lincolnshire Limestone, Lincoln. Back. (Page 382.)
6. *Trochus subluciensis*, sp. nov. Oolite-Marl, Nailsworth Hill. Front and base. (Page 381.)
7. The same; larger and coarser form. Irony Nodule-bed, Burton Bradstock. Back.
8. *Trochus squamiger*, Morris and Lycett. Freestones of the Oolite-Marl, Nailsworth Hill. Base and front. (Page 382.)
9. *Trochus vicinus*, sp. nov. Lincolnshire Limestone, Weldon. Front and back. (Page 383.)
10. *Trochus Dunkeri*, Morris and Lycett, var. *Weldonis*. Lincolnshire Limestone, Weldon. Front and back. (Page 383.)
11. *Trochus substrigosus*, sp. nov. *Parkinsoni*-zone, Burton Bradstock. Front and back. (Page 384.)
12. *Trochus Burtonensis*, Lycett; Inferior-Oolite variety. *Parkinsoni*-zone, Horton Hill. Front and back. (Page 385.)
13. ? *Trochus Leckenbyi*, Morris and Lycett. Scarborough Limestone. Leckenby Collection, Woodwardian Museum. Back. (Page 386.)
14. *Trochus biarmatus*, Münster. *Parkinsoni*-zone, Grove. Back and front. (Page 386.)
15. *Trochus marga*, sp. nov. *Parkinzoni*-zone, Burton Bradstock. Front and back. (Page 387.)
16. *Trochus* "*subimbricatus*." Lincolnshire Limestone, Weldon. Front and back. (Page 388.)
17. *Trochus Bixa*, d'Orbigny. Irony Nodule-bed, Burton Bradstock. Front. (Page 388.)

18 *a*. Micromorph of *? Trochus Niortensis*, d'Orb. Pea-grit, Crickley. Back. 18 *b*. The same × 10. (Page 388.)

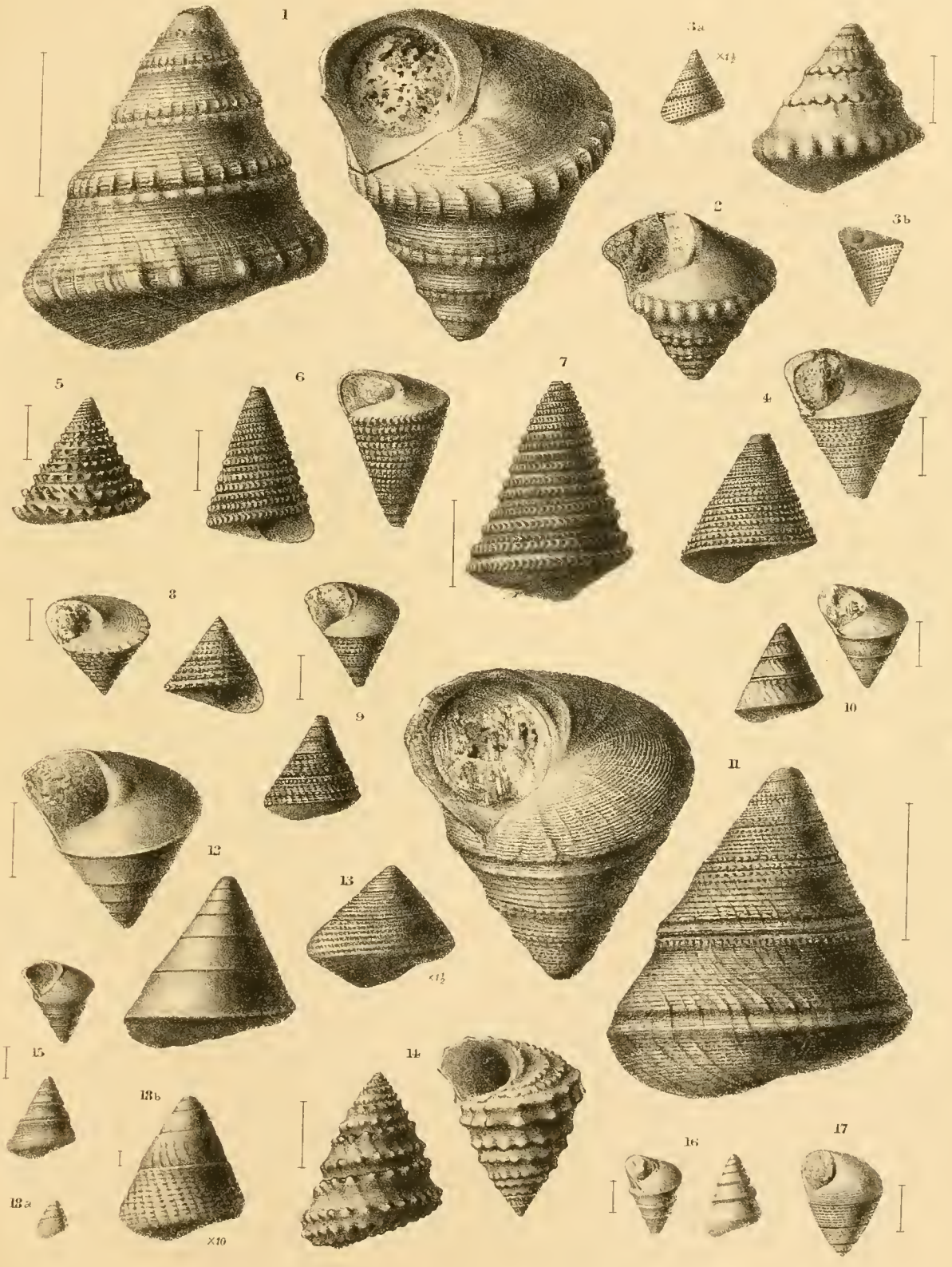

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PLATE XXXIII.

N.B.—*With reference to the* Pleurotomariæ *on Plates XXXIII to XL inclusive, it should be observed*—1. *That all figures are natural size unless otherwise stated.* 2. *All figures are from pencil drawings.* 3. *All specimens are from my own Collection unless otherwise stated.*

Fig.

1. *Pleurotomaria punctata,* Sowerby. Dundry. Front and base. (Page 396.)
2. The same. Small specimen. *Concavus*-bed. Bradford Abbas. Front.
3. *Pl. bicingulata,* sp. nov. *Concavus*-bed, Bradford Abbas. Front. (Page 398.)
4. *Pl. elongata,* Sowerby, var. *angusta.* Bradford Abbas. ? *Murchisonæ*-zone. Whidborne Collection. Back. (Page 399, *et seq.*)
5. *Pl. elongata,* Sow. Another variety. *Concavus*-bed, Bradford Abbas. Front and base.
6. *Pl. elongata,* Sow., var. near to *Pl. conoidea,* Deshayes. Louse Hill (*Humphriesianus*-zone). Front and base.
7. *Pl. elongata,* Sowerby. The type-form. Cf. *Pl. Pictavieusis,* d'Orb. *Sauzei*-bed. Neighbourhood of Sherborne (Combe). Front.
8. *Pl. abbreviata,* Sowerby. Usual form. *Sauzei*-bed, Oborne. Back and base. (Page 401.)
9. *Pl. abbreviata,* Sow. Smooth variety, analogous to *Pl. Pictaviensis* but wider, *Sauzei*-bed, Oborne.
10. *Pl. circumsulcata,* d'Orbigny. Dorset. ? *Parkinsoni*-zone. Front. (Page 404.) N.B.—The submarginal furrow in the base characteristic of this species cannot be identified in this specimen owing to wear of the surface.
11. *Pl. circumsulcata,* d'Orbigny. *Parkinsoni*-zone, Burton Bradstock. Back and front.

12 *a*, 12 *b*. *Pl. Agatha,* d'Orbigny. Small nodular form. *Parkinsoni*-zone, Broadwindsor. Front and base. (Page 402.) N.B.—This specimen, which differs considerably from the more recognised forms of *Pl. Agatha,* especially in the fulness of the base, is classed here provisionally.

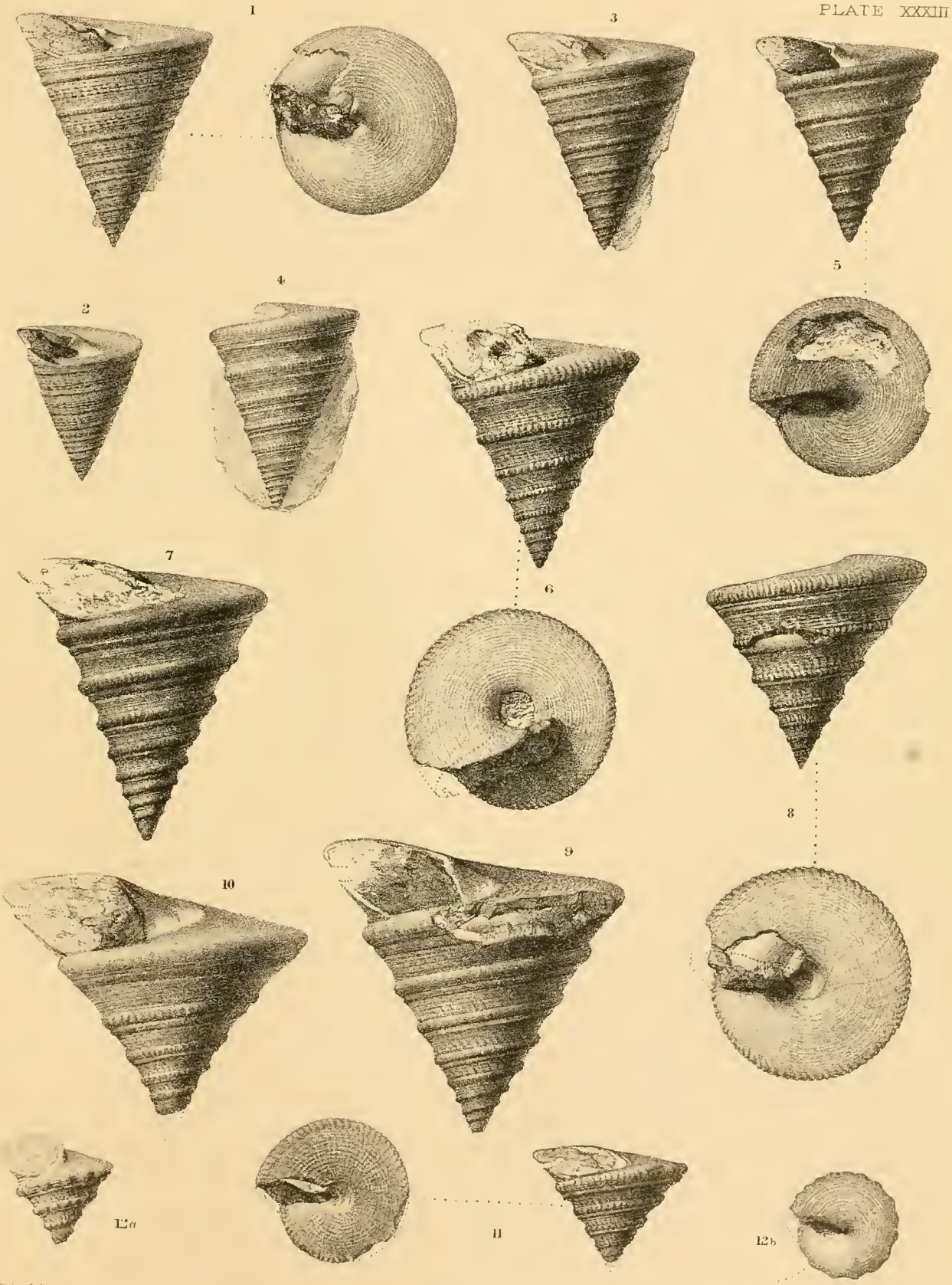

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PLATE XXXIV.

Fig.

1. *Pleurotomaria subglabra*, sp. nov. *Humphriesianus*-zone, Oborne. Front. (Page 405.)
2. Another specimen. *Humphriesianus*-zone, Oborne. Base.
3. *Pl. circumsulcata*, d'Orbigny. *Humphriesianus*-zone of the Sherborne district. Base. (Page 404.) N.B.—The spiral angle and general character of this specimen resemble fig. 10 on Plate XXXIII.
4. *Pl. Bessina*, d'Orbigny. *Parkinsoni*-zone, ? Halfway House. Nodular variety resembling the Normandy types. Front. (Page 406.)
5. Another specimen. *Parkinsoni*-zone, Burton Bradstock. N.B.—This is a small and rather depressed specimen of the variety most usual in the English beds.
6. *Pl. Agatha*, d'Orbigny. (= *Pl. mutabilis*, var. *cœlata*, Deslong.) *Parkinsoni*-zone, ? Halfway House. Front. (Page 402.)
7. *Pl. Agatha*, d'Orbigny, var. *Sandersii*, Tawney. Dundry. Bristol Museum. Back. (Page 403.)
8. *Pl. elongata*, Sow., var. *turrita*, Deslongchamps. *Parkinsoni*-zone, Burton Bradstock. Back and front. (Page 401.)
9. *Pl. Obornensis*, sp. nov. Marl with green grains, Oborne. Front. (Page 404.)
10. *Pl. distinguenda*, Tawney. Dundry. Bristol Museum. Front and back. (Page 407.)
11. *Pl. Dundriensis*, Tawney. Dundry. Bristol Museum. Base and front. (Page 407.)
12. *Pl. Athulia*, d'Orbigny. Crewkerne Station, ? *Parkinsoni*-zone. Base and front. (Page 409.)

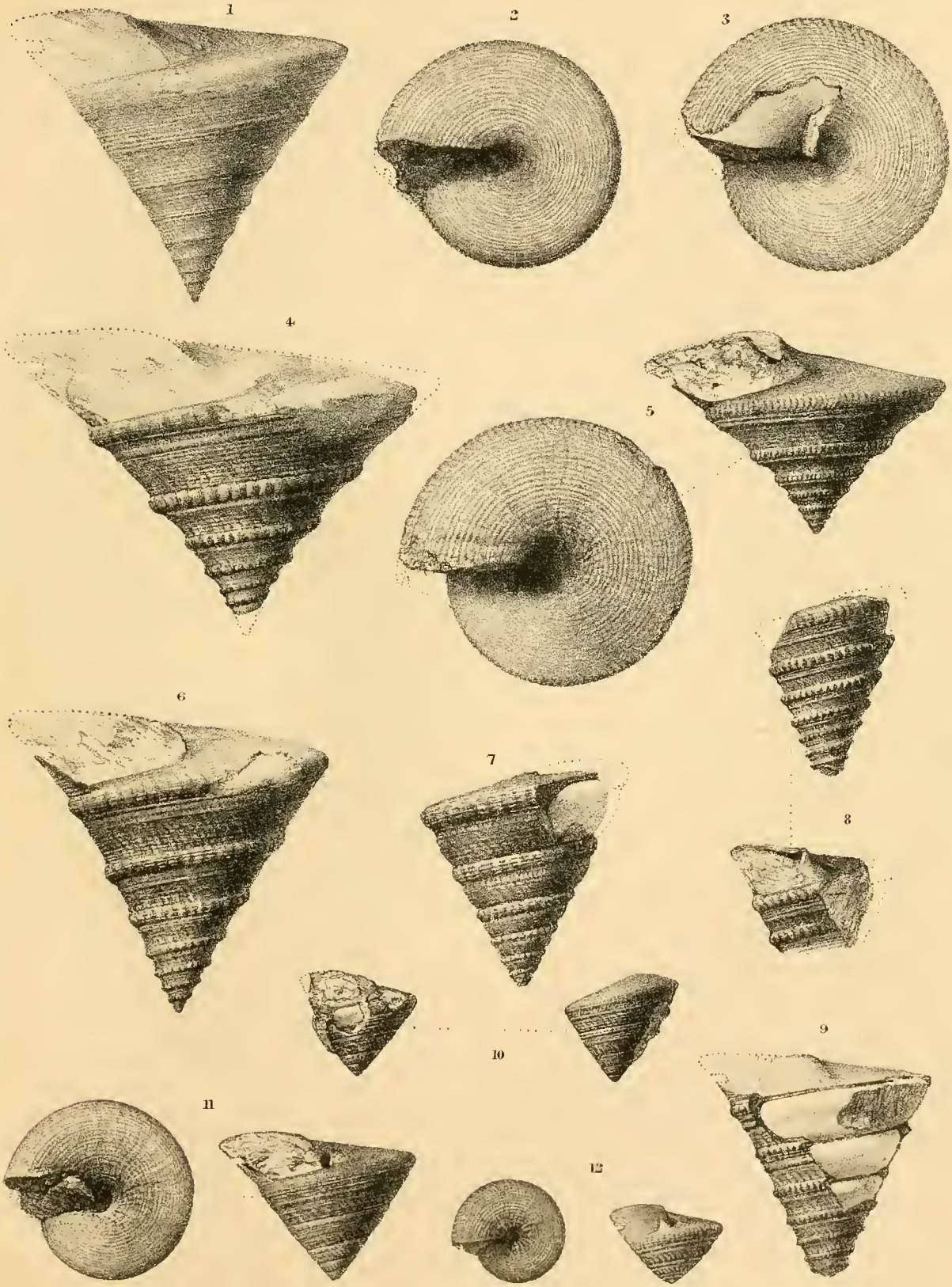

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PLATE XXXV.

Fig.

1. *Pleurotomaria distinguenda*, Tawney. Dundry. Bristol Museum. Portion of the type specimen enlarged. (Page 407.)
2. *Pleurotomaria*, species or variety. *Cadomensis*-bed, Clatcombe. Front and base. (Page 408.) ? A variety of *Pl. scrobinula*.
3. *Pl. scrobinula*, Deslongchamps. *Parkinsoni*-zone, Woolston. Front. 3 *a*. Portion enlarged. (Page 408.)
4, 4 *a*, 4 *b*. *Pl. Alcyone*, d'Orbigny. *Parkinsoni*-zone, Burton Bradstock. Front, enlargement and base. (Page 409.)
5. *Pleurotomaria*, species or variety. ? *Parkinsoni*-zone, Burton Bradstock. Front. 5 *a*. Portion enlarged. (Page 410.)
6, 6 *a*, 6 *b*. *Pl. sulcata*, Sowerby. Dundry. Front, enlargement and base. (Page 410.)
7, 7 *a*, 7 *b*. *Pl. sulcata*, Sow. Obconical variety. Cf. *Pl. obconica*, Tawney; cf. also *Pl. lævigata*, Deslongchamps. Irony nodule-bed, Burton Bradstock (*Murchisonæ*-zone). Front, base and enlargement. (Page 411.)
8, 8 *a*, 8 *b*. *Pl. Ajax*, d'Orbigny. *Murchisonæ*-zone, Lincoln. Front, enlargement and base. (Page 412.)
9, 9 *a*. *Pl. Ajax*, d'Orbigny. Obconical variety. *Murchisonæ*-zone, Lincoln. Front and enlargement.
10, 10 *a*. *Pl. monticuloides*, sp. nov. Haselbury. Front and enlargement. (Page 413.)
11. *Pl. sulcata-Humphriesiana*, sp. nov. *Humphriesianus*-zone, Louse Hill. Base and front. (Page 414.)
12. *Pl. Amyntas*, d'Orbigny. Irony nodule-bed, *Murchisonæ*-zone, Burton Bradstock. Base and front. (Page 415.)

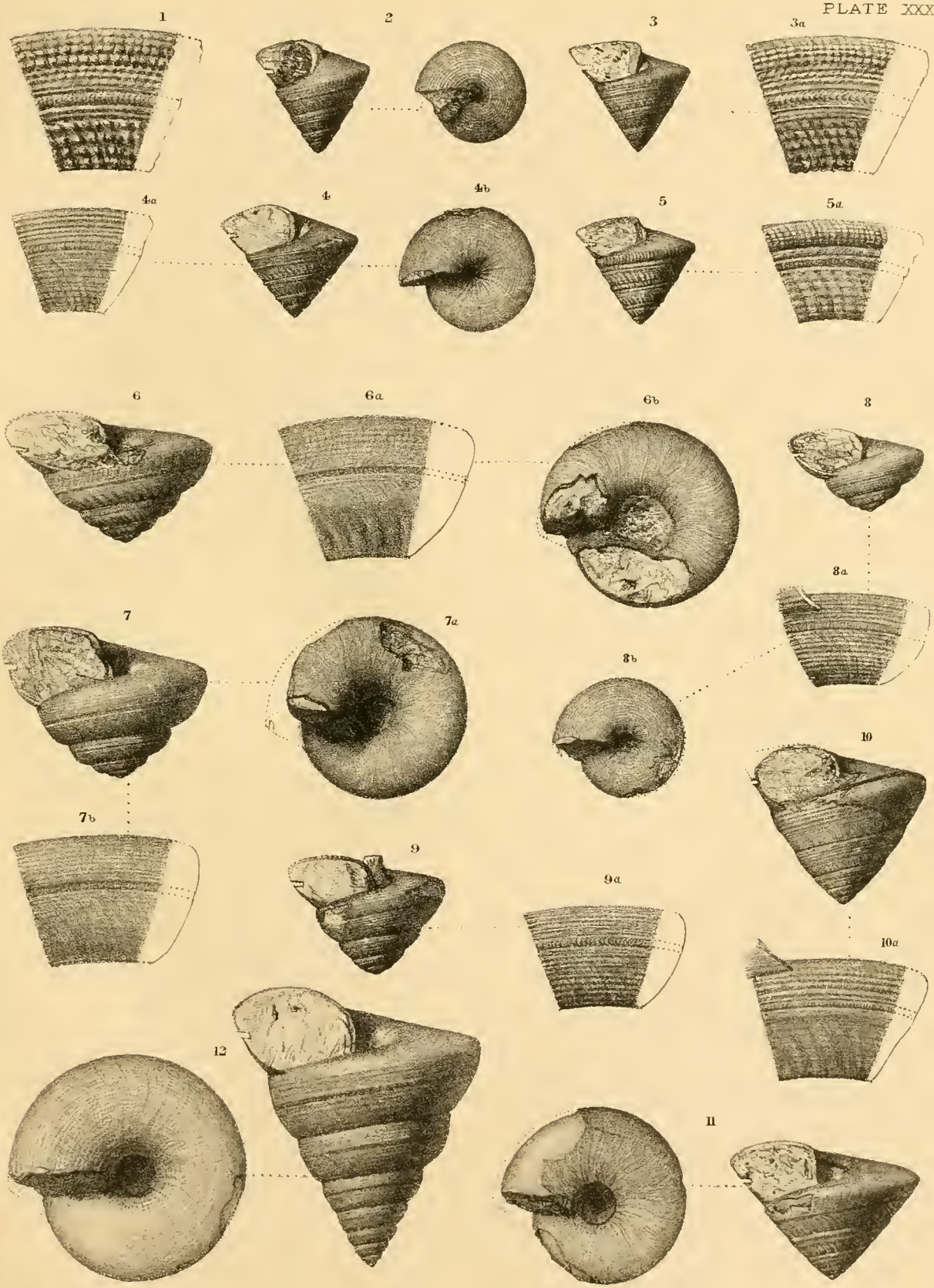

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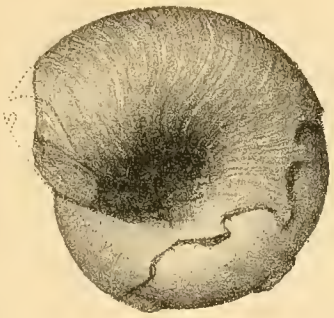
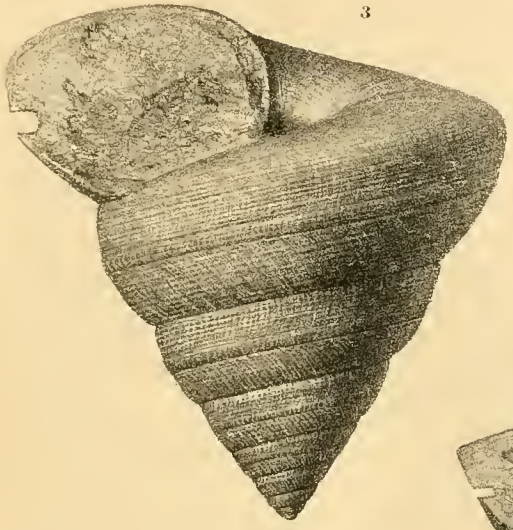
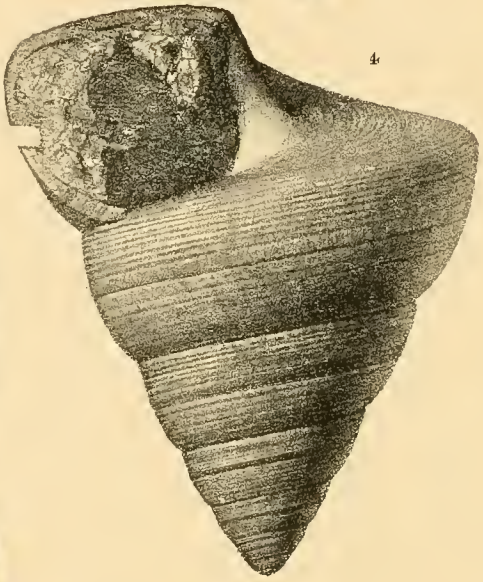
PLATE XXXVI.

Fig.

1. *Pleurotomaria subplatyspira*, d'Orbigny. *Sauzei*-bed, Milborne Wick. Back. (Page 416.)
2. *Pl. Stoddarti*, Tawney. Dundry. Bristol Museum. Base and back. (Page 418.)
3. *Pl. fasciata*, Sowerby. Dundry. Front. (Page 416.)
4, 4 *a*. *Pl. transilis*, d'Orbigny. *Parkinsoni*-zone, Burton Bradstock. Front and enlargement. (Page 419.)
5, 5 *a*. *Pl. Allica*, d'Orbigny. *Humphriesianus*-zone, Louse Hill. Front and enlargement. (Page 422.) N.B.—Specimens more nearly resembling the type are associated.
6, 6 *a*. *Pl. subreticulata*, d'Orbigny. Mapperton, ? *Humphriesianus*-zone. Front and enlargement. (Page 422.)
7. *Pl. ? subreticulata*, d'Orb. Lincolnshire Limestone, Rauceby. Front. (Page 423.)
8. *Pl. textilis*, Deslongchamps. *Parkinsoni*-zone, Burton Bradstock. Front. (Page 424.)
9. *Pl. textilis*, var. *scalaris*, Deslongchamps (= *Pl. scalaris*, var. *stricta*, Deslongchamps). *Parkinsoni*-zone, Halfway House. Front. (Page 425.)
10. *Pl.* cf. *subdecorata*, Münster. Dundry. Bristol Museum. Front. (Page 421.)







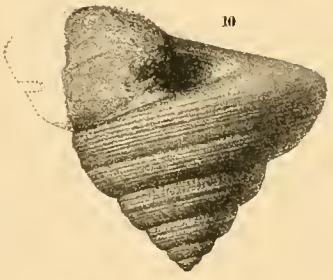


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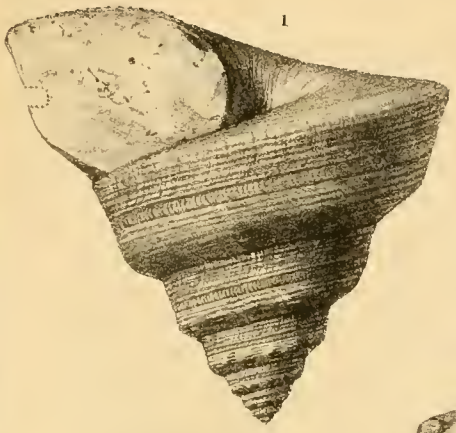
PLATE XXXVII.

Fig.

1. *Pleurotomaria paucistriata*, d'Orbigny. Iron-shot Oolite, Dundry. Bristol Museum. Front. (Page 425.)
2. *Pl. proteus*, Deslongchamps. *Humphriesianus*-zone, Louse Hill. Front. (Page 426.)
3 *a*—*c*. *Pl. ornata*, Sowerby. *Sauzei*-bed, Oborne. Front, apical and base. (Page 429.)
4 *a*, *b*. *Pl. tuberculosa*, Defrance. *Humphriesianus*-zone, Louse Hill. Apical, front. (Page 428.)
5. *Pl. armata*, Münster. Var. *Münsteriana*, Deslongchamps. *Parkinsoni*-zone, Burton Bradstock. Front. (Page 427.)
6. *Pl. oxytera*, sp. nov. *Sauzei*-bed, Sherborne district. Front. (Page 433.)
7 *a*, 7 *b*. *Pl. ? actinomphala*, Deslongchamps (acute variety). *Concavus*-bed, Bradford Abbas. Apical and base. (Page 433.)
8. *Pl. Actæa*, d'Orbigny. *Sauzei*-bed, Oborne. Front. (Page 431.)

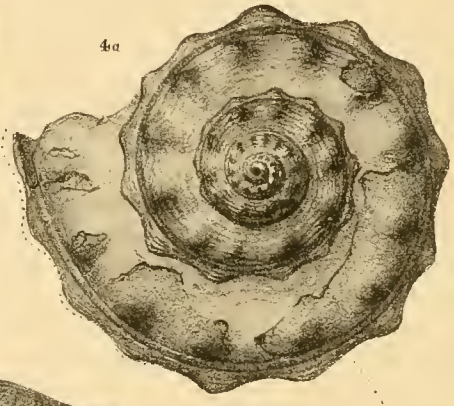

1


3a


2


3b


3c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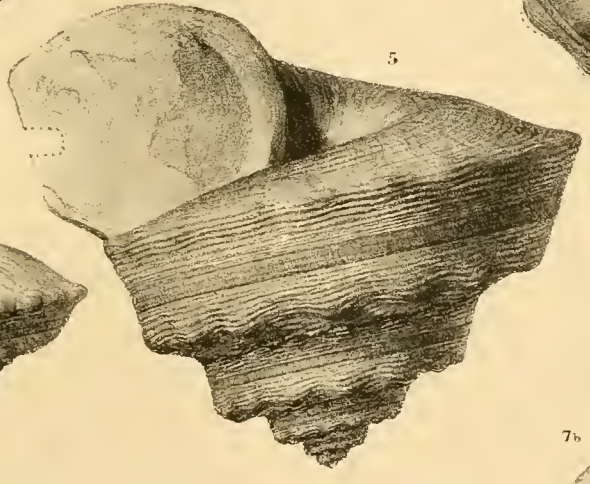
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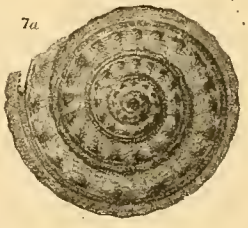
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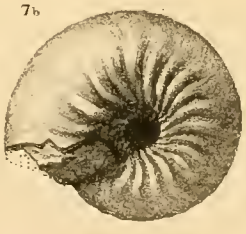
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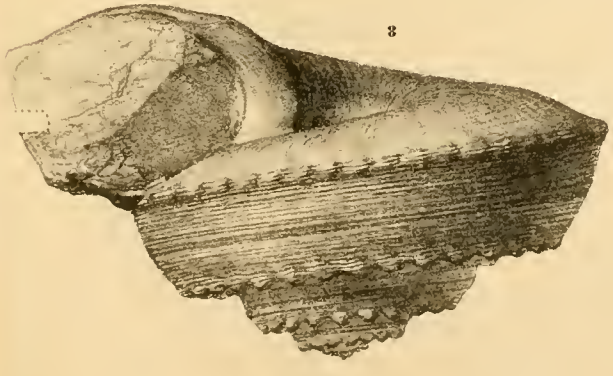
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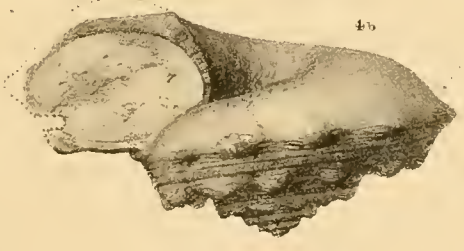
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PLATE XXXVIII.

Fig.

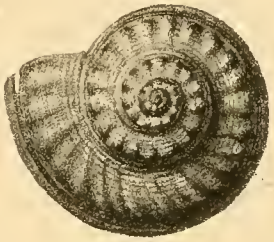
1 *a*, 1 *b*. *Pleurotomaria actinomphala*, Deslongchamps, var. *abbas* (obtuse variety). *Concavus*-bed, Bradford Abbas. Base and front. (Page 433, *et seq.*) N.B.—These figures represent two aspects of the fresh adult, where strong traces of the actinomphaloid character still remain.

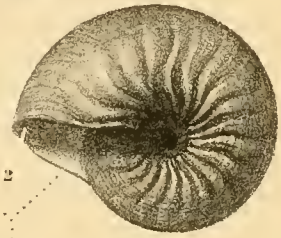
2. *Pl. actinomphala*, Deslongch., var. *abbas*. *Concavus*-bed, Bradford Abbas. Three aspects of the early stage of one of the more rugose forms.

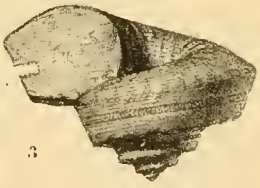
3. *Pl. actinomphala*, Deslongch., var. *abbas*. *Concavus*-bed, Bradford Abbas. Two aspects of the early stage of a smoother form, which is rare in the young shells.

4 *a*, 4 *b*. *Pl. actinomphala*, Deslongch., var. *abbas*. *Concavus*-bed, Bradford Abbas. Two aspects of the last stage where the actinomphaloid character is entirely lost, and the shell is smooth in the base, growth-lines alone being visible.

5. *Pl. actinomphala*, Deslongchamps (acute variety). *Concavus*-bed, Bradford Abbas. Base. (Page 434.)







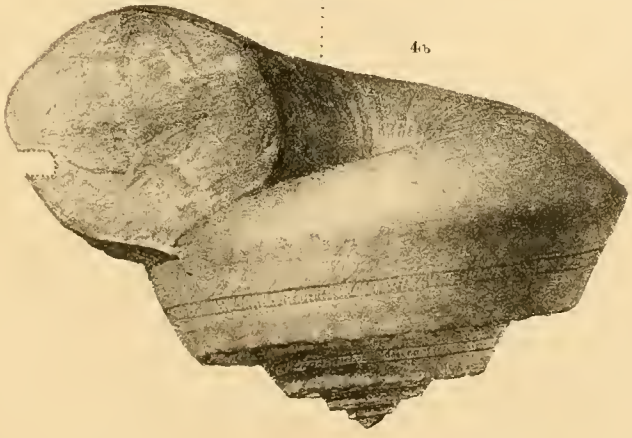


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PLATE XXXIX.

Fig.

1 *a*, *b*. *Pleurotomaria subaraneosa*, sp. nov. *Concavus*-bed, Bradford Abbas. Bristol Museum. Front and base. (Page 437.)

2 *a*, *b*. *Pl.* cf. *araneosa*, Deslongchamps. *Moorei*-beds, Buckholt Wood. Front and base. (Page 438.) N.B.—The umbilicus is not so large as shown in the figure.

3 *a*—*c*. *Pl. ornata-depressa*, sp. nov. (cf. *Cirrus carinatus*, Sowerby). *Concavus*-bed, Bradford Abbas. Apical, front and base. (Page 431.)

4 *a*—*c*. *Pl. Baugieri*, d'Orbigny. *Murchisonæ*-zone, Bradford Abbas. Front, apical and base. (Page 435.)

5 *a*—*c*. *Pl. Baugieri*, d'Orb., var. with higher spire and rather different ornamentation. (In some respects approaches *Pl. Aglaia*, d'Orb.) Most likely from the *Concavus*-bed at Halfway House. Front, base and apical.

6 *a*—*c*. *Pl. Mopsa*, d'Orbigny. *Murchisonæ*-zone, Chideock. Apical, front and base. (Page 436.)

7 *a*—*c*. *Pl. mirabilis*, Deslongchamps (micromorph). Believed to come from the *Murchisonæ*-zone, Bradford Abbas. Base, apical and side. (Page 437.)

8 *a*—*c*. *Pl. Yeovilensis*, Tawney. *Concavus*-bed, Bradford Abbas. (Page 439.)

9 *a*, *b*. *Pl. Yeovilensis*, Tawney, var. *rugosior*. *Sauzei*-bed, Oborne. Front and base.

10 *a*—*c*. *Pl. granulata*, Sowerby. Depressed variety. *Sauzei*-bed, Milborne Wick. Front, apical and base. (Page 440.) N.B.—These figures of *Pl. granulata* are based on more than one specimen.

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PLATE XL.

Fig.

1 *a*, *b*. *Pleurotomaria granulata*, Sowerby. (Elevated variety with coarse granulation = var. *cælata*, Deslong.) *Sauzei*-bed, Oborne. Front and enlargement. (Page 440.)

2 *a*—*c*. *Pl. plicopunctata*, Deslongchamps. *Parkinsoni*-zone, Burton Bradstock. Apical, base and front. (Page 442.)

3 *a*—*c*. *Pl. Palæmon*, d'Orbigny. *Parkinsoni*-zone, Vitney Cross. Apical, base and front. (Page 443.)

4 *a*—*d*. *Pl. phylax*, sp. nov. *Sauzei*-bed, Oborne. Apical, front, base, and enlargement. (Page 441.)

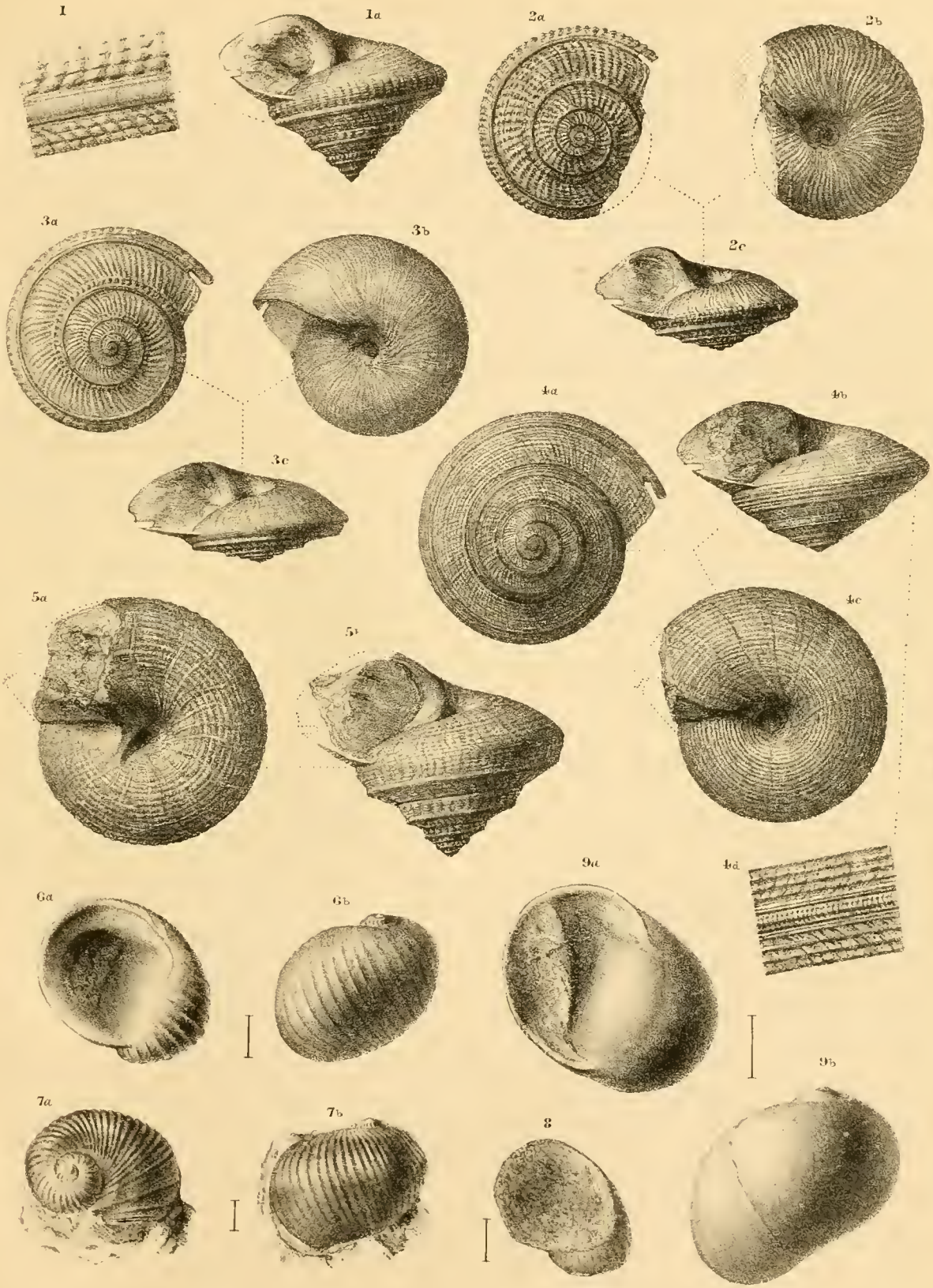
5 *a*, 5 *b*. *Pl. trapeza*, sp. nov. *Parkinsoni*-zone, Burton Bradstock. Base and front. (Page 444.)

6 *a*, 6 *b*. *Nerita costulata*, Deshayes. Pea-grit, Crickley. Front and back × 4. (Page 332.)

7 *a*, 7 *b*. *Nerita subrugosa*, sp. nov. Scarborough Limestone, Scarborough. Apical and back × 4. (Page 334.)

8. Another specimen. Northampton Sand, Duston. Front × 4.

9 *a*, *b*. "*Neritina subtransversa*." Oolite Marl of the Cotteswolds. (Page 336.)



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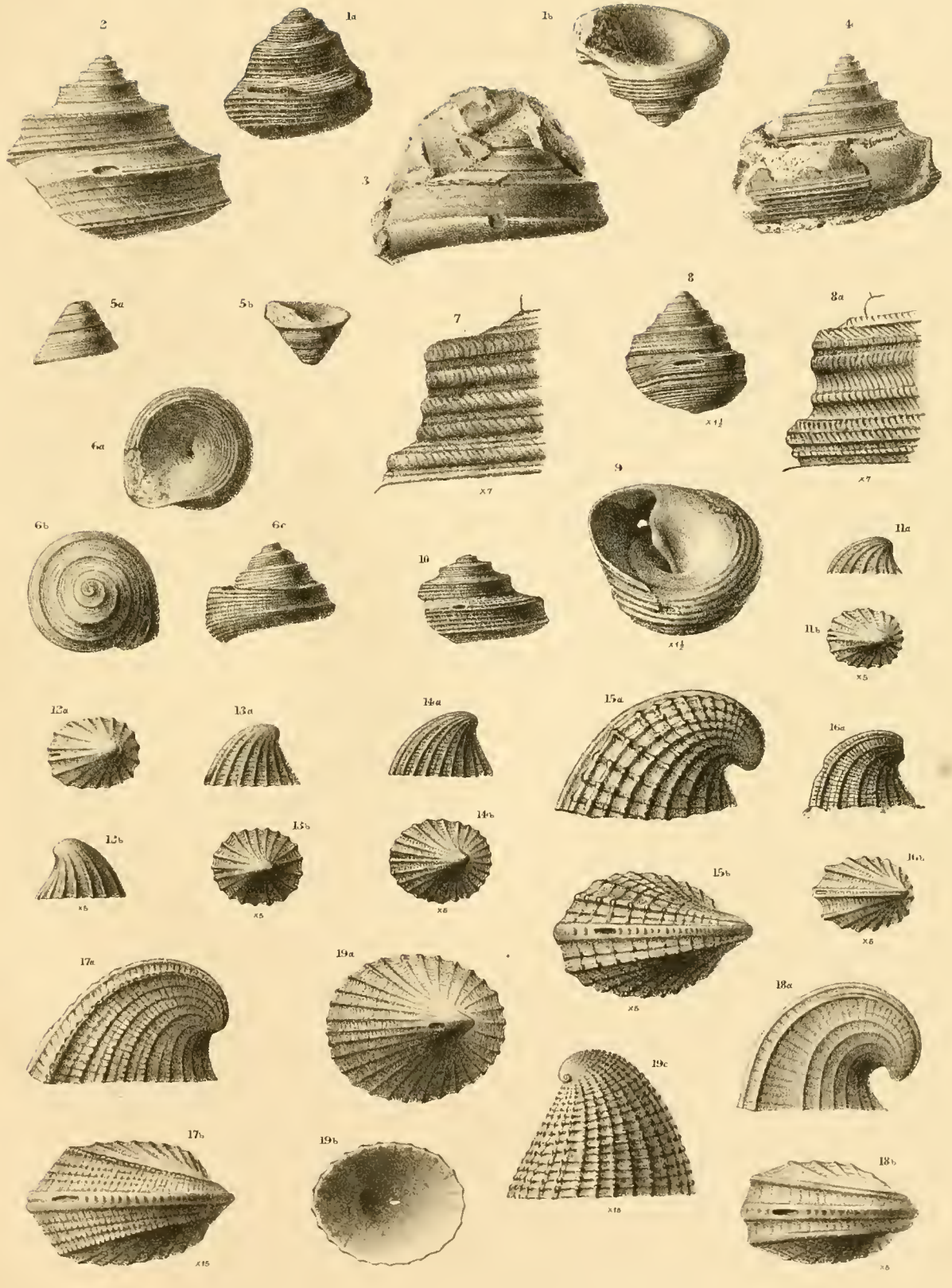

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PLATE XLII.

N.B.—*About two-thirds of the figures are drawn from photographs.*

Fig.

1 *a*, 1 b. *Capulus rugosus*, Sowerby. Lincolnshire Limestone, Weldon. Side and apical; natural size. (Page 458.)

2 *a*. The same. Lincolnshire Limestone, Stoke Lodge. Apical; natural size. Fig. 2 *b*, side view × 4. (Scale of enlargement omitted on the plate.)

3 *a*. *C. ancyloides*, Sowerby. Lincolnshire Limestone, Stoke Lodge. Apical × 3. Fig. 3 *b*, side view × 5. (Scale of enlargement omitted on the plate.) (Page 459.)

4 *a*, 4 *b*. *Patella* (*? Scurria*) *inornata*, Lycett. Base of Lower Freestones, Leckhampton. Side and apical; natural size. (Page 460.)

5 *a*, 5 *b*. *P.* (*? Scurria*) cf. *cingulata*, Münster. Inferior Oolite, Rollwright Heath. Jermyn Street Museum. Side and apical; natural size. Fig. 5 *c*, portion enlarged to show the concentric lines. (Page 461).

6 *a*, 6 *b*. *P.* (*? Scurria*) *nana*, Sowerby (variety described by Morris and Lycett). Lincolnshire Limestone, Stoke Lodge. Apical and side; natural size. (Page 462.)

7 *a*, 7 *b*. *P.* (*? Scurria*) *nitida*, Deslongchamps. Inferior Oolite, Leckhampton. Jermyn Street Museum. Apical and side × 3. (Page 461.)

8 *a*, 8 *b*. *P. Römeri*, Morris and Lycett. Lincolnshire Limestone, Stamford. Apical and side × 3. (Scale of enlargement omitted on the plate.) (Page 463.)

9 *a*, 9 *b*. *P. fenestræ*, sp. nov. Chipping Norton Limestone. Windoes Collection. Apical and side; natural size. (Page 463.)

10. *Actæon* (*Tornatellæa*) *sculptus*, Lycett. *Opalinus*-zone, Drympton. Front × 2. Fig. 10 *a*, body-whorl × 3. (Page 467.)

11. *A.* (*Tornatellæa*) *ooliticus*, sp. nov. *Concavus*-bed, Bradford Abbas. Front × 2. (Page 467.)

12. *A.* (*Tornatellæa*) *pulchellus*, Deslongchamps. *Parkinsoni*-zone, Grove. Front × 2. (Page 466.)

13. The same. *Parkinsoni*-zone, Burton Bradstock. Front × 2.

14. *Actæonina pulla*, Koch and Dunker (*fide* Morris and Lycett). Millepore-bed or Scarborough Limestone, Cloughton Wyke. Bean Collection, British Museum. Front × 2. (Page 470.)

15. *Actæon* or *Actæonina Sedgvici*, Phillips. Dogger, Peak. Bean Collection, British Museum. Back × 2. (Page 469.)

16. *Actæonina* "*pulloides*." Lincolnshire Limestone, Weldon. Front × 2. Fig. 16 *a*. Body-whorl × 4. (Page 470.)

17. *Fossarus* (*Couthouya*) *ooliticus*, sp. nov. *Concavus*-bed, Bradford Abbas. Front × $1\frac{1}{3}$. (Page 492.)

18. *Actæonina* (*Striactæonina*) *tenuistriata*, sp. nov. Dogger, Peak. York Museum. Back × $1\frac{3}{4}$. (Page 471.)

19. The same. Dogger, Peak. Front × $1\frac{3}{4}$. Fig. 19 *a*, body-whorl × 3.

20 *a*, 20 *b*. *A.* (*Striactæonina*) *humeralis*, Phillips. Dogger, Peak. York Museum. Back and front × 2. (Page 472.)

21. *A. subovalis*, sp. nov. *Concavus*-bed, Bradford Abbas. Front × $1\frac{1}{3}$. (Page 472.)

22. *A.* (*Cylindrobullina*) *glabra*, Phillips. Lincolnshire Limestone, Barnack. Front × 2. (Page 473.)

23 *a*, 23 *b*. The same. Millepore-bed or Scarborough Limestone of the Yorkshire coast. Bean Collection, British Museum. Back and front × 2.

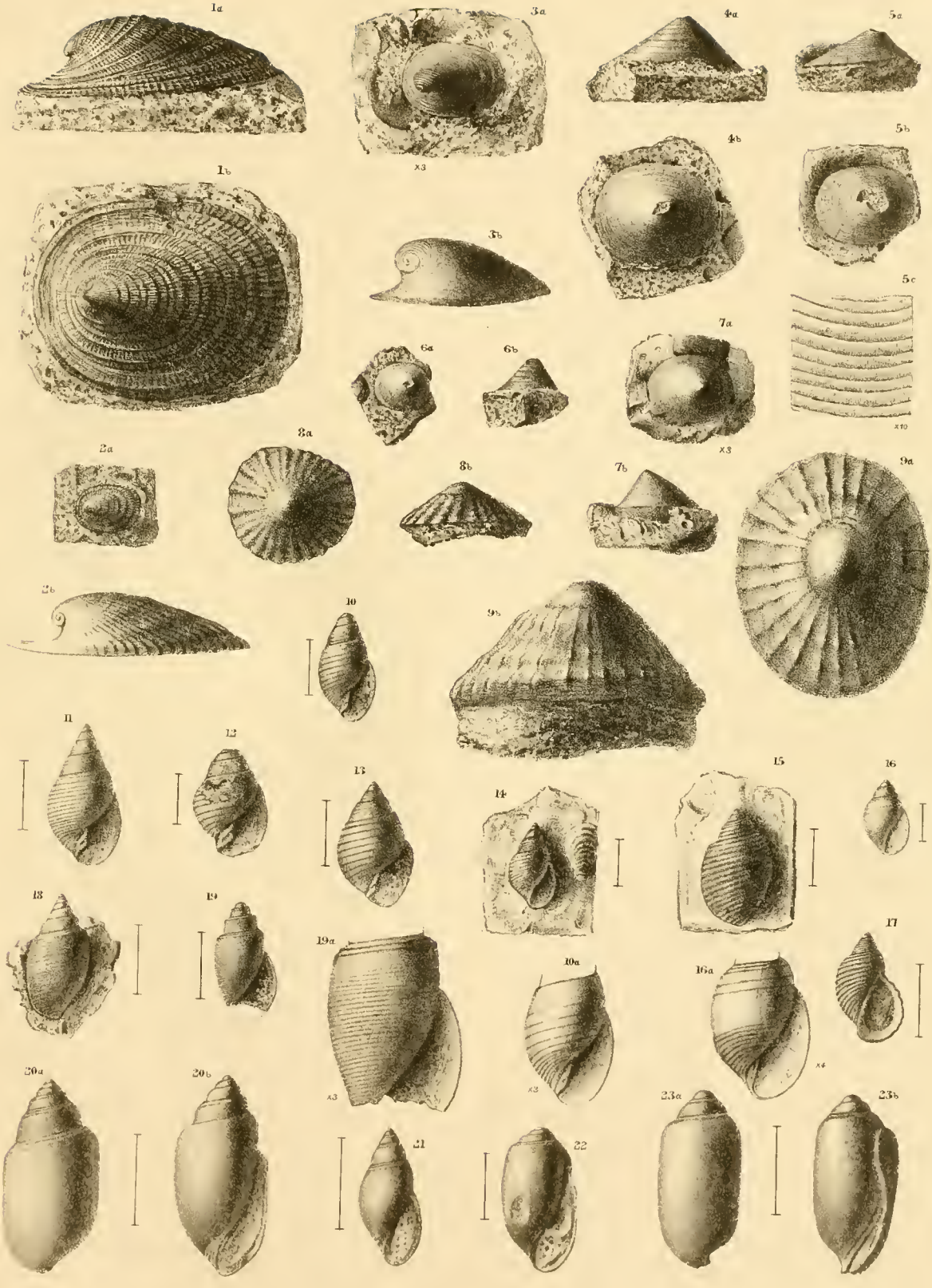

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PLATE XLIII.

Fig.

1 *a*, 1 *b*. *Actæonina* (*Cylindrobullina*) *cinerea*, Hudleston. Scarborough Limestone, Cloughton Wyke. Leckenby Collection, Woodwardian Museum. Back and front; natural size. (Page 474.)

2. *A. gigantea*, Deslongchamps (short variety). Inferior Oolite of the Cotteswolds. Jermyn Street Museum. Front; natural size. (Page 474.)

3. The same. Dean and Chapter pit, Lincoln. Front slightly enlarged.

4. *A. gigantea*, var. *attenuata* (near to *A. acuta*, d'Orb.). Dean and Chapter pit, Lincoln. Front × 2. (Page 475.)

5, *A.* (*? Trochactæonina*) *tumidula*, Lycett. Scarborough Limestone, White Nab. Bean Collection, British Museum. Front × 2. (Page 476.)

6. *A. antiqua*, Lycett. *Spinosa*-stage, Rodborough Hill. Jermyn Street Museum. Front; natural size. (Page 477.)

7. *A. convoluta*, Lycett. *Spinosa*-stage, Rodborough. Jermyn Street Museum. Front; natural size. (Page 477.)

8. *A.* (*Trochactæonina*) cf. *Esparcyensis*, d'Archiac (micromorph). Lincolnshire Limestone, Weldon. Front × 1¾. (Page 476.)

9. *A.* (*Trochactæonina*) *? tumidula*, Lycett. Lincolnshire Limestone, Weldon. Front × 2. (Page 476.)

10. *Bulla Farrei*, Lycett. Inferior Oolite, Avening. Jermyn Street Museum. Front; natural size. (Page 481.)

11 *a*, 11 *b*. *B.* (*Hydatina*) *undulata*, Bean (micromorph). Scarborough Limestone, Pickering Cliff. Front × 1½; apical × 3. (Page 482.)

12. *Cylindrites turriculatus*, Lycett. Lincolnshire Limestone, Weldon. Front × 2. (Page 478.)

13 *a*, 13 *b*. *C. tabulatus*, Lycett, var. *Weldonis*. Lincolnshire Limestone, Weldon. Jermyn Street Museum. Front and apical × 3. (Page 480.)

14 *a*, 14 *b*. *C. tabulatus*, Lycett. Inferior Oolite, Nailsworth. Jermyn Street Museum. Front × 1½; apical × 2. (Page 479.)

15 *a*, 15 *b*. *C. attenuatus*, Lycett. Pea-grit, Leckhampton. Front × 2½; apical × 3. (Page 479.)

16 *a*, 16 *b*. *C. cylindricus*, Morris and Lycett (Inf. Ool. var.). ? Nailsworth. Jermyn Street Museum. Front and apical × 2. (Page 481.)

17. *C. brevispira*, sp. nov. Lincolnshire Limestone, Weldon. Front × 3. (Page 479.)

18. The same. Another specimen from the same locality. Apical × 5.

19. *Chilodontöidea oolitica*, sp. nov. Beaminster. Front × 2½. (Page 491.)

20 *a*. The same. *Concavus*-bed, Bradford Abbas. Front × 2½. Fig. 20 *b*, aperture × 5.

21 *a*, 21 *b*. *Brachytrema Pontonis*, sp. nov. Lincolnshire Limestone, Ponton. Back and front × 2½. (Page 484.)

22 *a*, 22 *b*. *Cerithium* (*Colina*), *Lycetti*, sp. nov. Inf. Ool., Nailsworth. Jermyn Street Museum. Front (portion) and back × 2½. (Page 485.)

23. *Brachytrema* species. Irony Nodule-bed, Burton Bradstock. Front × 2. (Page 485.)

24, 24 *b*. *? Brachytrema* "*prætenue*." Oolite Marl, Notgrove. Front and back × 8. (Page 484.)

25. *Ceritella Stokensis*, sp. nov. Lincolnshire Limestone, Stoke Lodge. Front × 5. (Page 487.)

26. *C. tumidula*, Lycett, var. *angusta*. Lower Limestone (of Witchell), Nailsworth. Front × 6. (Page 486.)

27. *Valvata comes*, sp. nov. *Paludina*-bed, Langton Bridge. Front × 7. (Page 489.)

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PLATE XLIV.

Fig.

1 *a*, 1 *b*. *Paludina Langtonensis*, sp. nov. *Paludina*-bed, Langton Bridge, Oxon. Back and front; natural size. (Page 488.)

2 *a*, 2 *b*. *Valvata comes*, sp. nov. *Paludina*-bed, Langton Bridge. Base and apical × 7. (Page 489.)

3 *a*, 3 *b*. *Delphinula* (*Margarita*) species, near to *D. Santonis*, Hudleston. Cold Comfort, near Cheltenham. Front and back × $1\frac{3}{4}$. (Page 490.)

4 *a*, 4 *b*. *Nerinæa* (*Nerinella*) *neglecta*, sp. nov. Lincolnshire Limestone, Weldon. Front and back × 2. (Page 487.)

5. *Cerithinella*, species. Lincolnshire Limestone, Leadenham. Longitudinal section × $2\frac{1}{2}$. (Page 487.)

6 *a*, 6 *b*. *Cerithinella*, probably the same species as fig. 5. Lincolnshire Limestone, Hungerton Hall. Front and back × $3\frac{1}{2}$.

7 *a*, 7 *b*. *? Fibula veloæ*, sp. nov. *Murchisonæ*-zone of the Cotteswolds. Front and back × $1\frac{1}{2}$. (Page 486.)

8. *Nerinæa* (*Ptygmatis*) cf. *cingenda*, Phillips. Lincolnshire Limestone, Stoke Lodge. Back; natural size. Fig. 8 *a*, portion enlarged. Fig. 8 *b*, longitudinal section enlarged. (Page 488.)

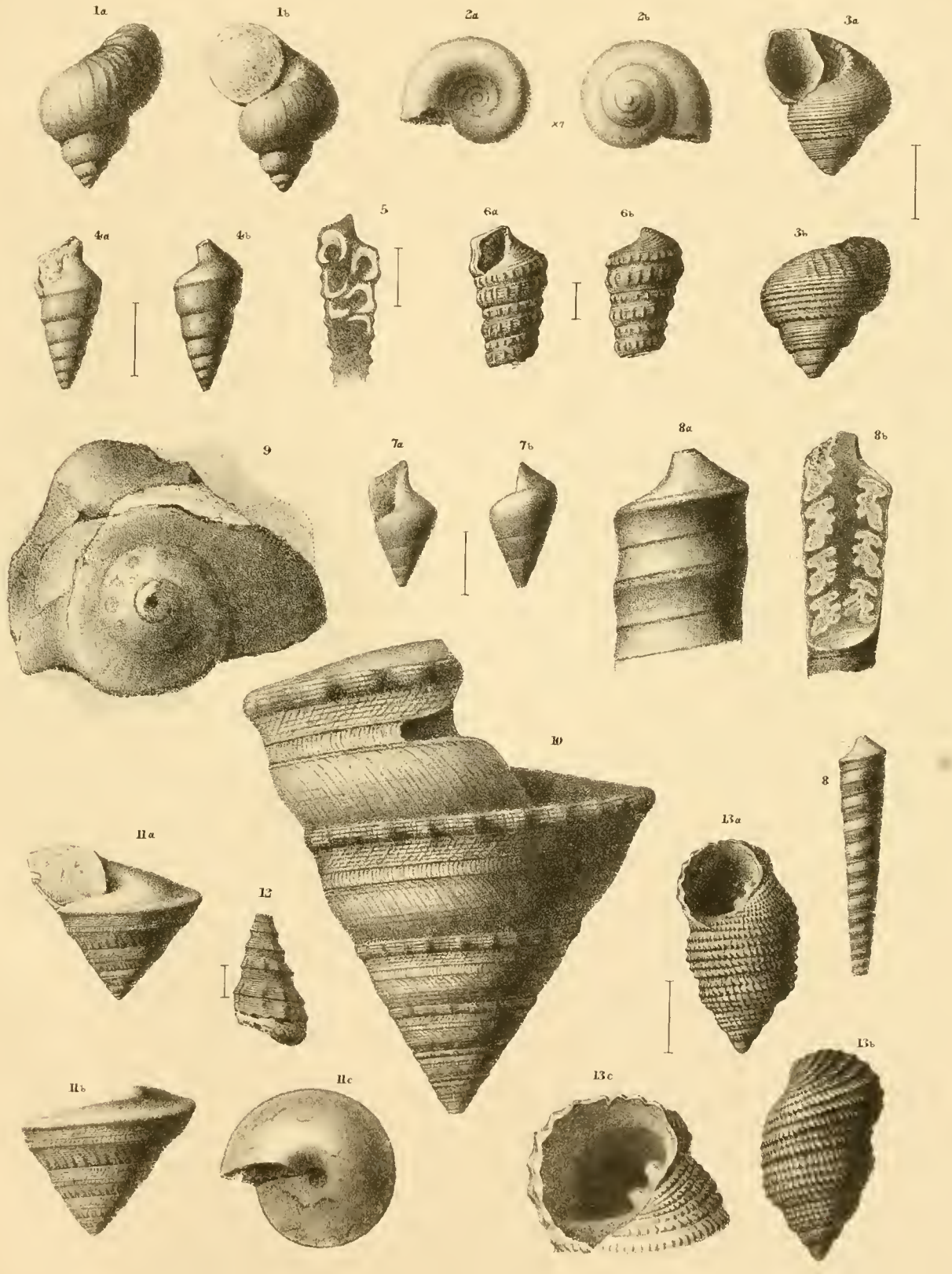
9. *Purpuroidea*, species. Lincolnshire Limestone, Rauceby. Apical view; natural size. (Page 483.)

10. *Pleurotomaria subfasciata*, d'Orbigny. *Sauzei*-bed, neighbourhood of Sherborne. Natural size. (Page 420.)

11 *a*—*c*. *Pl. amata*, d'Orbigny. *Humphriesianus*-zone, Louse Hill. Front, back and base, natural size. (Page 418.)

12. *Cirrus*, species or variety. Lincolnshire Limestone, Stoke lodge. Back × 4. (Page 490.)

13 *a*, 13 *b*. *Wilsonia liassica*, sp. nov. Junction of Middle and Upper Lias, Thorncombe, near Bridport. Front and back × $2\frac{3}{4}$. Fig 13 *c*, aperture further enlarged. (Page 492, foot-note.)



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