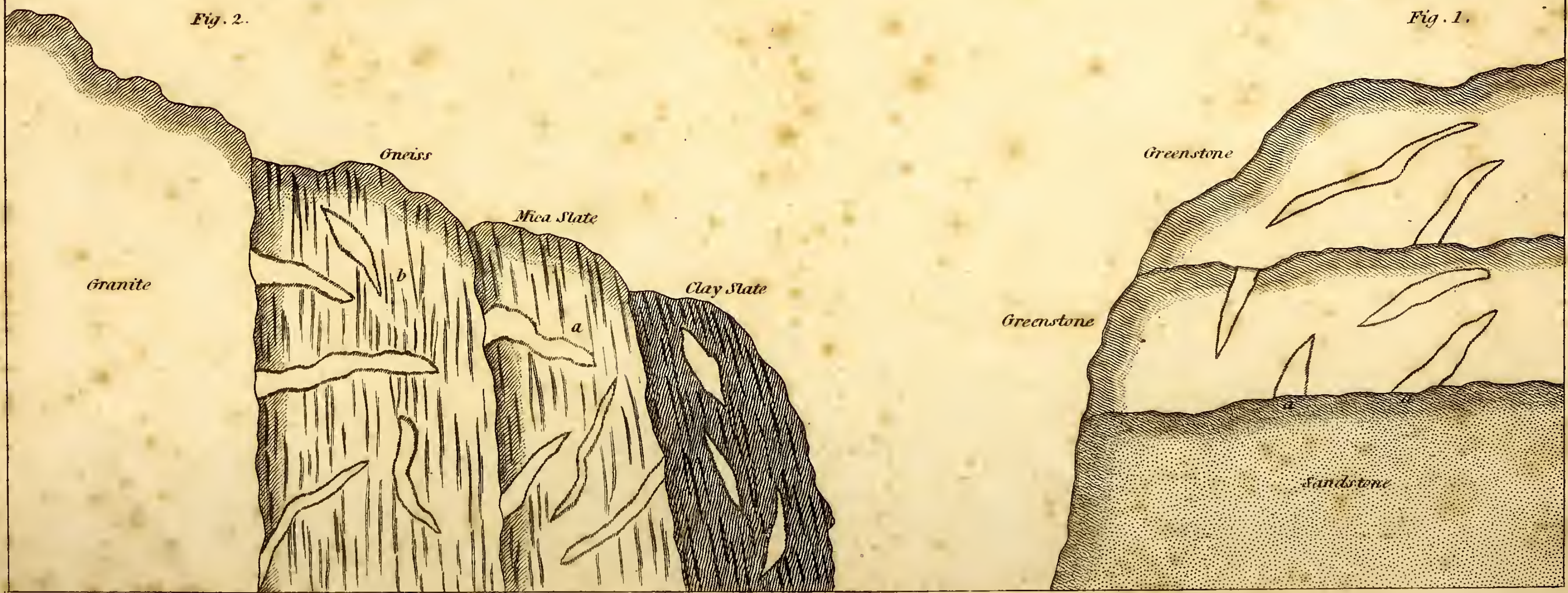
MEMOIRS

OF THE

WERNERIAN

NATURAL HISTORY SOCIETY.

PLATE I.



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OF THE

WERNERIAN NATURAL HISTORY SOCIETY.

VOL. I.

FOR THE YEARS 1808,-9,-10.

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I. *On Cotemporaneous Veins.*

By Professor JAMESON.

(Read 2d March 1808.*)*

AS it is of importance to be able to distinguish *true* from *cotemporaneous veins*, and also to know the different cotemporaneous veins that occur in mountain-rocks, I shall now state to the Society the characters by which these kinds of veins are distinguished from each other, and also the more striking instances of cotemporaneous veins that occur in several of the great rock-formations.

1. *True Veins* are from a few inches to several fathoms wide; and from a few yards to several hundred yards long. They traverse different strata, and are confined to single beds or strata, only

in those cases when the beds or strata are of uncommon thickness. Their direction is not tortuous, and they seldom give off many branches. The mass of the vein is generally distinctly separated from its walls: it is frequently disposed in beds or layers, and these are parallel with the walls of the vein. At the outgoing of bedded veins, the beds are near the walls; but farther down, they approach the middle of the veins, and consequently are so arranged, that the newer beds are contained in the older. They often contain fragments, which lie promiscuously, and are either acute-angular, blunt-angular, or rounded. Lastly, the materials of true veins, are more or less different from the rock which they traverse, and the same vein sometimes contains several formations.

2. *Cotemporaneous Veins* are from a few inches to the smallest discernible breadth. Their length is from a few inches to an hundred feet and upwards. Their course is tortuous, and they give off numerous branches. The mass of the vein is generally intimately mixed with and passes into that of its walls, and differs but little in its constituent parts from that of the rock which it traverses. They contain but few drusy cavities; never more than one formation; and when they contain apparent fragments, the slaty structure of these is ever conformable to that of the contiguous rocks. Lastly, they traverse but single

beds and strata, and are observed to wedge out in every direction, and consequently have no outgoing above, below, or laterally, intimating, that they have not been filled from above or below, but are, as it were, a secretion from the rock itself. These veins are denominated *cotemporaneous*, because they appear to have been formed at the same time with the rock in which they are contained.

Cotemporaneous veins occur in every mountain-rock. *Granite*, which is the oldest rock hitherto discovered, contains different kinds of cotemporaneous veins. Thus, some are entirely filled with quartz ; others contain only felspar or mica ; others are composed either of felspar and quartz, forming a granular rock, or of felspar, quartz, and mica, in the usual granitic proportion, therefore forming a true granite. Thus, it appears, that all the constituent parts of granite occur either singly or together in the form of cotemporaneous veins. *Gneiss* has the same constituent parts as granite ; hence we find it containing similar cotemporaneous veins. These veins do not present the slaty structure which is one of the discriminating characters of gneiss when it occurs in strata ; hence cotemporaneous veins, filled with common granular, or what may be called granitic gneiss, have been confounded with true granite. *Mica-slate*, the rock next in age to gneiss, is composed of quartz and mica ; and these are granular in the small, and slaty in the large. It contains cotemporaneous veins of quartz; also of mica; and of a granular rock composed of quartz and mica, differing from mica-slate in wanting the slaty structure; thus bearing the same relation to mica-slate, that granitic gneiss does to common gneiss. *Greenstone*, a well known aggregate rock of hornblende and felspar, contains numerous cotemporaneous veins of felspar, also of hornblende, and of greenstone. These veins are sometimes of great extent: in the flœtz-greenstone of Salisbury Craigs near Edinburgh, there are cotemporaneous veins of felspar, upwards of an hundred feet long, and from half an inch to two inches wide.

All the cotemporaneous veins we have just described, contain the same minerals as those that compose the rock which they traverse. It frequently happens, however, that cotemporaneous veins occur composed of minerals that differ considerably from those of the rock in which they are contained: Thus *serpentine* contains cotemporaneous veins of asbest, talc, steatite, and lithomarge: these substances, it is true, have a strong oryctognostic affinity with serpentine, but differ more from it than granular gneiss does from common gneiss, or granular mica-slate from common mica-slate. *Flinty-slate* is frequently traversed by numerous cotemporaneous veins of quartz; and *transition-limestone* with numerous veins of calc-spar. Numerous examples also occur of cotemporaneous veins filled with materials entirely different from the rock in which they are situated: Thus, *clay-slate* is sometimes traversed by cotemporaneous veins of quartz: *serpentine*, by cotemporaneous veins of magnetic ironstone, and *clay ironstone*, by numerous cotemporaneous veins of calc-spar, and also of mineral pitch.

It is worthy of particular remark, that cotemporaneous veins sometimes open at the upper or under side of the stratum or bed in which they are contained, owing to the rent accidentally reaching either to the upper or under surface. Instances of this appearance, are to be seen in the greenstone of Salisbury Craigs, where cotemporaneous veins of felspar traverse greenstone, but open in some places at the lower side of the bed where it rests upon sandstone. Very striking appearances of the same kind occur in Glencloy, in the island of Arran: there the cotemporaneous veins are of greenstone, and above a foot wide; they traverse a bed of greenstone, and open on its lower side where it rests upon sandstone. *Vide* Pl. I. Fig. 1. These veins, where in contact with the sandstone, as at *a*, are sometimes partly intermixed with it. Similar appearances occur in other rocks, as mica-slate, transition-limestone, and gneiss. Thus we often observe in mountains composed of mica-slate, cotemporaneous veins of quartz opening on the upper and under sides of a stratum, which rests upon and is covered by strata of mica-slate; but these veins in general do not extend beyond the individual stratum in which they are contained. Transition-limestone is often traversed by cotemporaneous veins of calc-spar, and these veins frequently open on the upper and under sides of individual beds, contained between strata of grey-wacke, and grey-wacke-slate. Sometimes the matter of these veins is observed mixed with the matter of the subjacent stratum, although that stratum be completely different from the limestone or calc-spar. In mountains composed of strata of gneiss, veins of felspar, and of quartz, also of simple granular or granitic gneiss, occur in precisely the same situation and relations, as the veins of quartz, and granular mica-slate, in mountains of common mica-slate. It sometimes happens, that cotemporaneous veins of granitic gneiss open on the under-side or floor of a stratum of common gneiss, where it rests upon granite; and such appearances, which are not uncommon, have been viewed as veins of granite, shooting from old granite into the superincumbent gneiss, and as demonstrating that granite is newer than the rocks which rest upon it *.

* If granite be really newer than the rocks which rest upon it, it follows, that it must be newer than grey-wacke, transition-trap, transition-limestone, flœtz-limestone, and flœtz-sandstone, because these rocks have been observed, and in highly inclined strata, resting upon granite: in short,

Pl. I. Fig. 2. *a.* represents cotemporaneous veins in mica-slate.

Pl. I. Fig. 2. *b.* represents cotemporaneous veins of granitic gneiss in gneiss, and in some places in contact with the old granite.

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in place of being the oldest rock hitherto observed, it must be one of the newest. It is also equally evident, that if granite be of so new a formation, we should find the supposed granite veins issuing from the subjacent granite, and traversing the superincumbent newer rocks. Yet no one ever saw a granite vein in any of the transition or flœtz rocks, although their junctions with granite have been carefully examined in many and very distant countries.

II. *An Analysis of Fluor-Spar.*

By Thomas Thomson, M. D. F. R. S. E.

(Read 11th June 1808.)

The mineral called Fluor-Spar, has been long known, and valued on account of its beauty, and the ease with which it can be turned on the lathe into various ornaments and useful utensils. It occurs chiefly in veins, and very frequently accompanies lead-ore. Some of its properties have been described more than a century ago, as, for example, its phosphorescing when heated, and its corroding glass when mixed with sulphuric or nitric acid. But it is not forty years since its composition was discovered by Scheele, who demonstrated, that it is composed of lime, and a peculiar acid, called Fluoric. Chemists now distinguish it by the name of Fluate of Lime.

Hitherto, no chemical analysis of this salt has been published, except a very incorrect one by Kirwan and Gren, which has been ascribed to Scheele, though I cannot find it in any of his dissertations on fluor-spar. By that analysis, it is made to contain 27 *per cent.* of water, a proportion very inconsistent with the properties of native fluate of lime, which, when strongly heated in a wind furnace, loses at an average, only $\frac{1}{600}$th part of its weight. The obvious inaccuracy of the analysis given by the authors just mentioned, induced me to make a set of experiments on it last summer (1807). I selected the purest transparent colourless crystal, which I found by repeated trials to be very nearly pure fluate of lime. When reduced to a fine powder, and digested in nitric acid, I found in the acid only a little lime, owing doubtless to the partial decomposition of the fluate, and minute traces of iron and lead: these two metals I detected, by evaporating the nitric solution to dryness, heating it to redness, and then dissolving the residue in muriatic acid. The colour of the solution shewed the presence of iron, and a few needleform crystals of muriate of lead were deposited after the solution had stood for some days. The fluate which I used, had been dug out of a lead-mine in Northumberland, and small crystals of sulphuret of lead were here and there to be seen in it. Probably some one of these had escaped my attention, and, by being mixed with the fluate which I used, occasioned the appearance of the lead, which, however, did not amount to $\frac{1}{300}$th part of the salt, and therefore could not occasion any sensible error in the subsequent analysis.

I first tried to decompose the fluate of lime, by fusing it with twice its weight of carbonate of potash in a platinum crucible. Only a small portion of the fluate was decomposed. I was, therefore, obliged to repeat the fusions very often, washing off the alkali after each operation, by means of water, and then dissolving the carbonate of lime formed, in muriatic acid. Fatigued with the tediousness of this method, and despairing of an accurate result from the great number of successive solutions, I abandoned it altogether, and adopted the following method, much more expeditious and equally precise.

From a mass of fluor-spar which I had ascertained to contain no sensible portion of foreign matter, I separated 100 grains, which I reduced to powder, and digested for some hours in a platinum crucible, with rather more than an ounce of pure concentrated sulphuric acid. The mixture was then evaporated to dryness, and the crucible exposed for an hour to a strong heat, in a wind furnace. To ensure the complete decomposition of the fluor, the mass was reduced to powder, and treated a second time in the same manner with another ounce of sulphuric acid. The residue, which was white with a slight shade of red, proved, on examination, to be pure sulphate of lime. It weighed 156.6 grains.

Now, it has been ascertained by the most careful experiments, that sulphate of lime thus violently heated, contains 43 per cent. of lime. Of consequence, the whole quantity of lime in 156.6 grains of sulphate is 67.34 grains. This is obviously the whole lime contained in 100 grains of fluor-spar; and since that mineral contains no sensible portion of water, the remainder of the 100 must be fluoric acid. Hence fluate of lime is composed of,

Lime	- -	67.34
Fluoric acid	-	32.66
		100.00

This result differs very materially from the analysis alluded to in the beginning of this paper, which makes the amount of the acid in the same weight of spar, only 16 grains, and the lime 57 grains; the remaining 27 grains being considered as water. But, from the care with which my experiment was conducted, I flatter myself that the result which it exhibits is very near the truth *.

* Since the preceding paper was read, I have seen an analysis of fluor-spar by Klaproth, in the 4th volume of his Beiträge, conducted in a very different manner from mine, but leading to almost the very same result. He found fluate of lime composed of $67\frac{3}{4}$ lime, and $32\frac{1}{4}$ acid,—quantities which coincide with mine, within less than 1 per cent.——*Nov.* 1809.

III. *On the Asclepiadeæ, a Natural Order of Plants separated from the Apocineæ of Jussieu.*

By Robert Brown, Lib. Lin. Soc.

(*Read 4th November* 1809.)

The vast additions to the number of species which botany is constantly receiving, while they make a natural arrangement absolutely necessary to the general botanist, render it at the same time proportionally difficult. For though there are still many tribes of plants easily distinguishable even by a superficial observer, yet there are others, that hitherto have been thought abundantly distinct, which can no longer be circumscribed by means of characters taken from their organs of reproduction. This is perhaps now the case with the RUBIACEÆ and APOCINEÆ of Jussieu. It is true, that to an experienced observer, it may still be practicable to refer the greater part, perhaps the whole, of these plants to their proper places in a natural series; but it is, I apprehend, no longer so, to distinguish the two orders by definitions derived from the usual source. Such at least is the opinion I have been led to form from all that I have seen published respecting them, as well as from that I have lately had an opportunity of observing in New Holland.

As, however, both these families are already too extensive, it becomes expedient rather to attempt their subdivision into smaller groups, which may possibly admit of more accurate limitation, than to unite them into one vast order, the distinguishing characters of which, could they be obtained, must probably be extremely vague, and clogged with numerous exceptions. Such a subdivision, it seems to me, may be easily made of the Apocineæ, by employing a character at once obvious and important, and which while it preserves the natural series unbroken, has the additional advantage of dividing the order into two nearly equal parts. To one of these which includes the genus Apocynum, the name of Apocineæ will of course remain.

The consideration of the other, which from one of its most remarkable genera, I propose naming ASCLEPIADEÆ forms the chief subject of the following essay; but the more completely to illustrate it, I have subjoined new, and I trust amended characters of the genera of the most nearly related section of the Apocineæ strictly so called. The singular structure of the stamina in the Asclepiadeæ, has attracted the attention of botanists since the days of Tourneforte: it is therefore not a little remarkable, that two opposite opinions should still be held even respecting the origin of these parts, and that between these opinions botanists should be almost equally divided.

In a paper which was some time ago read to the Linnean Society of London, I had occasion, in inculcating the necessity of examining the parts of the flower before expansion, to advert to this tribe of plants; and I there entered at some length, both into the opinions generally received respecting their male organs, and also into that which I had deduced from an examination of these parts before the opening of the corolla: And being unwilling to repeat now, what I then stated, I shall content myself with referring to the figures and descriptions published by Jacquin in the first volume of his "Miscellanea Austriaca," which give a correct idea of the state of the organs after expansion; and only add the observations I have made on one species of the family, the *Asclepias Syriaca*, in the earlier stages of the flower.

The flower-bud of this plant I first examined, while the unexpanded corolla was yet green and considerably shorter than the calyx. At this period, the gland-like bodies which afterwards occupy the angles of the stigma were absolutely invisible; the furrows of its angles were extremely slight, and, like the body of the stigma, green; the antheræ, however, were distinctly formed, easily separable from the stigma, and their cells, which were absolutely shut, were filled with a turbid fluid, the parts of which did not so cohere as to separate in a mass; of the cuculli, which in the expanded flower are so remarkable, and constitute the essential character of the genus, there was no appearance.

In the next stage submitted to examination, where the corolla nearly equalled the calyx in length, the gland-like bodies of the stigma were become visible, and consisted of two nearly filiform, light brown, parallel, contiguous and membranaceous substances, secreted by the sides of the furrow, which was now somewhat deeper: Instead of the filiform processes, a gelatinous matter occupied an obliquely descending depression proceeding from towards the base of each side of the angular furrow.

In a somewhat more advanced stage, the membranes which afterwards become the glands of the stigma, were found to be linear, closely approximated, and to adhere at their upper extremity. At the same time the gelatinous substance in the oblique depression, had acquired a nearly membranaceous texture and a light brown colour, and on separating the gland from its furrow, which was then practicable, this membrane followed it. At this period, too, the contents of each cell of the anthera had acquired a certain degree of solidity, a determinate form, and were separable from the cell in one mass; the cuculli were also observable, but still very small and green, nearly scutelliform, having a central papilla, the rudiment of the future horn-like process. Immediately previous to the bursting of the cells of the antheræ, which takes place a little before the expansion of the corolla, the cuculli are completely formed, and between each, a pair of minute, light green fleshy teeth are observable, the single teeth of each pair being divided from each other by the descending alæ of the antheræ. The glands of the stigma have acquired a form between elliptical and rhomboidal, a cartilaginous texture, and a brownish-black colour; they are easily separable from the secreting furrow, and on their under surface there is no appearance of a suture, or any indication of their having originally consisted of two distinct parts: Along with them separate also the descending processes, which are compressed, membranous, and light brown; their extremity, which is still unconnected, being more gelatinous but not perceptibly thickened. The pollen has acquired the yellow colour and the degree of consistence which it afterwards retains. On the bursting of the cells, the gelatinous extremity of each descending process becomes firmly united with the upper attenuated end of the corresponding mass of pollen. The parts are then in that condition in which they have been commonly examined, and are exhibited in the figures of Jacquin, who having seen them only in this state, naturally considered these plants as truly gynandrous, regarding the masses of pollen as the antheræ, originating in the glands of the stigma, and merely immersed in the open cells of the genuine antheræ, which he calls antheriferous sacs; an opinion in which he has been followed by Rottboell, Koellreuter, Cavanilles, Smith, and Desfontaines. The conclusion to be drawn from the observations now detailed, is sufficiently obvious; but it is necessary to remark, that these observations do not entirely apply to all the plants which I have referred to the Asclepiadeæ, some of them, especially Periploca, having a granular pollen, applied in a very different manner to the glands of the stigma: they all, however, agree in having pollen coalescing into masses, which are fixed or applied to processes of the stigma, in a determinate manner; and this is, in fact, the essential character of the order. Dr Smith, in the second edition of his valuable "Introduction to Botany," has noticed my opinion on this subject; but, probably from an indistinctness in the communication, which took place in conversation, has stated it in a manner somewhat different from what I intended to convey to him: For, according to his statement, the pollen is *projected* on the stigma. The term projection, however, seems to imply some degree of impetus, and at the same time presents the idea of something indeterminate respecting the part to which the body so projected may be applied. But nothing can be more constant than the manner in which the pollen is attached to the processes of the stigma in each species; and as considerable differences in this respect take place in various species, I have with advantage employed these in the new generic divisions of the order which I have attempted to establish, and to which I now proceed.

As I have every where mentioned the sources from which my knowledge both of genera and species is derived, it becomes unnecessary particularly to notice here the extent of my obligations to the unrivalled Herbarium of Sir Joseph Banks, who, with his accustomed liberality, has permitted me to examine, and, where necessary, to dissect such specimens as seemed to have any peculiarity of structure, and has thus enabled me to found my genera on a more satisfactory induction than I could have done in any other part of the world.

I. POLLINIS MASS cess
A. CORPUSCULA

ASCLEPIADEÆ.

I. POLLINIS MASSÆ (10-20) CEREACEÆ, LÆVES, nec in granulis separandæ.

A. CORPUSCULA STIGMATIS (5) SULCO LONGITUDINALI BIPARTIBILIA, juxta basin, v. latere utrinque exserentia processum, Massam Pollinis unicam, affigentem.

a. Pollinis massæ erectæ v. conniventes, stigmati incumbentes: basi, v. infra medium lateris, affixæ.

† Antheræ apice simplices, nec membranâ terminatæ.

* Columna fructificationis tubo corollæ inclusa. Tubus stamineus extus appendiculatus.
1. Corollæ tubus e basi ventricosâ cylindraceus: limbi 5partiti laciniæ ligulares, conniventes. Corona staminea 2plex, interioris foliola lobis exterioris opposita . . . . . Ceropegia.
2. Corolla campanulata, limbo 10fido, laciniis accessoriis nanis. Corona staminea 2plex; *exterior* 5fida laciniis bifidis; *interior* 5phylla, foliolis laciniis exterioris oppositis . Huernia.
3. Corolla campanulata, 5fida. Corona staminea simplex, 5phylla, foliolis dorso dentato-cristatis . . . . Piaranthus.

** Columna fructificationis exserta v. semi-exserta.
1. Corona staminea duplex: (utriusque figura varia); interior (cujus foliola antheris opposita) quandoque obsoleta. Massæ pollinis altero margine cartilagineo-pellucido . Stapelia.
2. Corona staminea simplex, 10phylla; foliolis 5, antheris oppositis, indivisis, obtusis, 5 reliquis bipartitis, acutis. Massæ pollinis utroque margine opaco . . . . Caralluma.
3. Corona staminea simplex, 5loba, lobis antheris alternantibus! denticulis nanis quandoque interjectis. Massæ pollinis medio affixæ, stigmati incumbentes . . . . Microstemma.
4. Corona staminea nulla: Corollæ subrotatæ faux squamis 5 coronata. Massæ pollinis basi affixæ, apice coarctato pellucido . . . . Leptadenia.

†† Antheræ membranâ terminatæ.

‡ Tubus stamineus extus appendiculatus.

* Corona staminea (simplex, 5phylla), foliolis *depressis*, carnosis. Corolla rotata . . . . Hoya.
1. Coronæ foliola angulo interiori producto in dentem antheræ incumbentem . . . . Tylophora.
2. Coronæ foliola angulo interiori simplici edentulo

** Corona staminea (5phylla), foliolis *compressis* . . . . Marsdenia.
1. Coronæ foliola apice indivisa, intus edentula . . . . Pergularia.
2. Coronæ foliola apice indivisa, intus lacinulâ aucta . . . . Dischidia.
3. Coronæ foliola bifida, laciniis apice recurvis.

‡‡ Tubus stamineus extus inappendiculatus.
1. Semina comosa. Folliculi graciles, læves. Corolla urceolata, fauce coronatâ, nunc edentulâ . . . . Gymnema.
2. Semina calva, marginata. Folliculi ventricosi, carnosi. Corolla subrotata, fauce edentulâ . . . . Sarcolobus.

b. Pollinis massæ transversæ, extremitate exteriore (respectu loculi transversim dehiscentis) affixæ, stigmate occultatæ. Corona staminea 1phylla, lobata.
1. Semina comosa. Folliculi sæpius costati v. muricati. (Caulis volubilis) . . . . Gonolobus.
2. Semina calva, crenata. (Caulis erectus) . . . . Matelea.

c. Pollinis massæ pendulæ, apice v. supra medium lateris affixæ. Antheræ membranâ terminatæ.

† Tubus stamineus appendiculatus.

‡ Corona staminea simplex, 5phylla, foliolis antheris oppositis, lacinulis 5 nanis in eadem serie quandoque interjectis.

* Corolla 5partita reflexa. Coronæ foliola subcucullata, apice tubi filamentorum imposita.
1. Coronæ foliola cucullata, e fundo exserentia lacinulam corniformem. Folliculi graciles, læves . . . . Asclepias.
2. Coronæ foliola subcucullata, utrinque unidentata, absque lacinula interiori. Folliculi inflati, ramentacei . . . . Gomphocarpus.

** Corolla rotata, non reflexa. Coronæ foliola acuta v. acuminata, intus edentula . . . . Oxystelma.

*** Corollæ subcampanulatæ tubus ventricosus.

α. Columna fructificationis exserta. Massæ pollinis compressæ.
1. Coronæ foliola carnosa, obtusa, simplicia, denticulis 5 alternantibus nanis. Folliculi ventricosi, ramentacei . . . . Xysmalobium.
2. Coronæ foliola longitudinaliter adnata, aversa, basi recurva. Folliculi ventricosi, læves . . . . Calotropis.
3. Coronæ foliola carnosa, obtusa, soluta. Massæ pollinis curvaturæ processuum dein adscendentium affixæ. Corollæ laciniæ ligulares . . . . Oxypetalum.

β. Columna fructificationis inclusa. Massæ pollinis ventricosæ.
1. Corolla campanulata. Coronæ foliola e basi dilatatâ subulata, intus simplicia. Massæ pollinis apice affixæ. Stigma muticum . . . . Kanahia.
2. Corolla urceolata. Coronæ foliola lacinulâ interiori parallelâ aucta. Massæ pollinis infra apicem affixæ. Stigma rostratum . . . . Diplolepis.

‡‡ Corona staminea simplex, monophylla, tubo intus quandoque laciniis carinisve aucto. Corolla subrotata.
1. Corona annularis integerrima. Massæ pollinis compressæ . . . . Holostemma.
2. Corona ore 5-20fido, dum 5fida lobis antheris oppositis . . . . Cynanchum.
3. Corona 5partita, lobis antheris alternis . . . . Metaplexis.

‡‡‡ Corona staminea composita, seriebus 2 v. 3 insertione distinctis.

* Corona duplex, *exterior* 1 v. 5phylla, *interior* 5phylla. Faux corollæ esquamata.
1. Corona *exterior* 5partita, laciniis acuminatis: *interior* brevior, exterori opposita . . . . Ditassa.
2. Corona *exterior* 5partita, cum v. absque lacinulis alternantibus, nanis: *interior* longior, exteriori alternans, foliolis basi solutis. Folliculi ramentacei . . . . . . Doemia.
3. Corona *exterior* cyathiformis v. annularis, crenulatus: *interior* longior: *utraque* carnosa. Folliculi graciles, læves . . . . Sarcostemma.

** Corona triplex, singula 5phylla, *extima* fauci inserta laciniis opposita; *media* foliolis tripartitis; *intima* indivisis . . . . Eustegia.

†† Tubus stamineus nudus.
1. Faux corollæ campanulatæ coronata dentibus 5, tubum decurrentibus . . . . Metastelma.
2. Faux corollæ urceolata, nuda. Tubus squamis 5, inclusis. cum fasciculis totidem pilorum alternantibus . . . . Microloma.
3. Faux corollæ suburceolata, nuda. Tubus esquamatus, pilosiusculus . . . . Astephanus.

B. CORPUSCULA STIGMATIS (5) EXSULCA. Singula apice affigentia Massas Pollinis 4, sessiles, subsimiles. Tubus stamineus appendiculatus. Corolla rotata . . . . . Secamone.

II. POLLINIS MASSÆ (5-20) GRANULOSÆ (granulis e sphærulis 4 connatis compositis) 1-4 apici dilatato, soluto, corpusculi singuli stigmatis, applicatæ.
1. Filamenta basi connata, suprà distincta. Antheræ cohærentes, imberbes. Massæ pollinis 4, corpusculo singulo affixæ. Corolla rotata . . . . Hemidesmus.
2. Filamenta longitudinaliter distincta. Antheræ cohærentes, barbatæ. Massa pollinis 1, corpusculo singulo affixa. Corolla rotata, squamis faucis aristatis . . . . Periploca.
3. Filamenta longitudinaliter distincta. Antheræ imberbes. Massæ pollinis 4, corpusculo singulo affixæ. Corolla hypocrateriformis . . . . Gymnanthera.

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um, Massam Pollinis unicam, affigentem.

ASCLEPIADEÆ.

Contortarum genera, *Linn.* Apocinearum genera, *Juss.* Apocynarum genera, *Adans.*

Calyx quinquedivisus, persistens.

Corolla monopetala, hypogyna, quinqueloba, regularis, æstivatione imbricata, rarissime valvata, decidua.

Stamina 5, epipetala, laciniis limbi alternantia. *Filamenta* sæpius connata. *Antheræ* biloculares, septisve semicompletis, nunc subquadriloculares. *Pollen* ad dehiscentiam antherarum coalescens, in massas numero loculorum, rariusve per paria confluentes, et geminatim, v. quaternatim, v. solitarie processubus quinque stigmatis affixas.

Ovaria 2. *Styli* 2, arctè approximati, sæpe brevissimi. *Stigma* ambobus commune, dilatatum, pentagonum, angulis corpusculiferis.

Folliculi 2; altero nunc abortiente. *Placenta* suturæ intus applicata, demum libera.

Semina numerosa, imbricata, pendula, ad umbilicum sæpissimè comosa. *Albumen* tenue.

Embryo dicotyledoneus, rectus. *Cotyledones* foliaceæ. *Radicula* supera. *Plumula* inconspicua.

Frutices, rariùsve *Herbæ*, utplurimum lactescentes et volubiles. *Folia* integra, opposita, quandoque alterna v. verticillata, ciliis interpetiolaribus loco stipularum, sæpiùs instructa. *Flores* subumbellati, fasciculati, v. racemosi, interpetiolares.

I. Asclepiadeæ veræ.

Massæ Pollinis 10, læves, per paria, (diversis antheris pertinentia), affixæ stigmatis corpusculis, sulco longitudinali, bipartibilibus. *Filamenta* connata, extus sæpius appendiculata.

CEROPEGIA. [Ceropegiæ pleræque, *Linn.*

Char. *Corolla* tubo e basi ventricosâ cylindraceo; limbi laciniis ligularibus.

Columna fructificationis inclusa.

Corona staminea duplex, *exterior* abbreviata, 5-loba: *interior* 5phylla, foliolis ligularibus, indivisis, lobis exterioris oppositis.

Antheræ apice simplices.

Massæ pollinis erectæ, basi affixæ, marginibus simplicibus.

Stigma muticum.

Folliculi cylindracei, læves. *Semina* comosa.

Habitus. *Herbæ* glabræ, volubiles. *Radice* tuberosa. *Umbellæ* interpetiolares, nunc paucifloræ.

Patria. India Orientalis.

Obs. To this genus belong *C. Candelabrum*, Linn. *C. biflora*, Linn.; *C. tuberosa*, *bulbosa*, *juncea*, *acuminata*, of Roxburgh, and two undescribed species.

HUERNIA. [Stapeliæ species, *Linn. Juss. Masson.*

Char. *Corolla* campanulata, limbo decemfido, laciniis accessoriis nanis, dentiformibus.

Columna fructificationis inclusa.

Corona staminea duplex; *exterior* quinquefida, laciniis bifidis: *interior* 5phylla, foliolis e basi gibbosâ subulatis, indivisis, laciniis exterioris alternantibus.

Antheræ apice simplices.

Massæ pollinis erectæ, basi affixæ, altero margine cartilagineo-pellucido.

Stigma muticum.

Folliculi subcylindracei, læves. *Semina* comosa.

Habitus Stapeliæ.

Patria. Africa Australis.

Obs. The whole of the third section of Stapelia in Willdenow's edition of the "Species Plantarum," probably belongs to this genus; but I have only had an opportunity of examining *S. campanulata*, *venusta*, and *guttata*, from which the character is formed. I have named the genus in memory of Justus Heurnius, one of the earliest collectors of Cape plants, and from whose drawings the first account of Stapelia was taken.

PIARANTHUS. [Stapeliæ sp. *Masson.*

Char. *Corolla* campanulata, 5fida, carnosa.

Columna fructificationis inclusa.

Corona staminea simplex, 5phylla, foliolis dorso dentatis.

Antheræ apice simplices.

Massæ pollinis erectæ, basi affixæ, altero margine cartilagineo-pellucido.

Stigma muticum.

Folliculi. . . . .

Habitus Stapeliæ.

Patria. Africa Australis.

Obs. The want of the external corona renders it necessary to separate from Stapelia and Huernia, this genus; of which the only two certain species are *Stapelia punctata* and *pulla* of Masson; of both these I have examined specimens collected by Masson, and preserved in spirits, in the collection of Sir Joseph Banks.

STAPELIA. [Stapeliæ plures, *Linn. et Mass.*

Char. *Corolla* rotata, 5fida, carnosa.

Columna fructificationis exserta.

Corona staminea duplex, utraque in variis varia; interior quandoque obsoleta.

Antheræ apice simplices.

Massæ pollinis basi affixæ, altero margine cartilagineo-pellucido.

Stigma muticum.

Folliculi subcylindracei, læves. *Semina* comosa.

Habitus. *Plantæ* carnosæ, aphyllæ, angulatæ, sæpe tuberculatæ. *Flores*, utplurimum speciosi, odore nauseoso, stercorario.

Patria. Africa Australis, præsertim in planitiis desertis, argillaceis, *Karroo* nuncupatis.

Obs. The essential character of this extensive and singular genus, consists, according to Linnæus and all subsequent botanists, in the double corona. But I have already shewn, that certain plants that have been referred to it, and which entirely accord in habit, have a corona of a single series; and it will hereafter appear, that other, and very different genera, agree with Stapelia in this part of its structure. The genus, even as it is here limited, is capable of further subdivision; and I have little doubt, that when the species become better known, such a subdivision will be found expedient, and probably from characters like the following, by which, in the mean time, it may be disposed into very natural sections.

I. Corona exterior 5phylla, foliolis indivisis.

Stapelia hirsuta, *Linn.* sororia, *Mass.* vetula, *Mass.* ambigua, *Mass.* asterias, *Mass.* glandulifera, *Mass.* stellaris, *Jacq. ined.*

II. Corona exterior 5partita, laciniis bifidis.

Stapelia revoluta, *Mass.* pedunculata, *Mass.*

verrucosa, *Mass.* mixta, *Mass.* variegata, *Linn.* lepida, *Jacq. ined.*

III. Corona exterior 1phylla, indivisa vel ciliato-multifida.

Stapelia articulata, *Hort. Kew. et Mass.* geminata, *Mass.*, aliæque ineditæ, in Museo Banksiano, spir. vin. asservatæ.

CARALLUMA.

CHAR. *Corolla* rotata, profundè 5fida.

Columna fructificationis exserta.

Corona staminea simplici serie 10phylla; foliolis quinque antheris oppositis indivisis; reliquis bipartitis, subulatis.

Antheræ apice simplices.

Massæ pollinis erectæ, basi affixæ, marginibus simplicibus.

Stigma muticum.

Folliculi graciles, læves. *Semina* comosa.

HABITUS ferè Stapeliæ.

PATRIA. India Orientalis.

OBS. This genus is the Stapelia adscendens of Roxburgh, the *Car-allum* of the Telingas.

MICROSTEMMA.

CHAR. *Corolla* rotata, 5fida.

Columna fructificationis exserta.

Corona staminea monophylla, carnosa, 5loba, lobis cum antheris alternantibus.

Antheræ apice simplices.

Massæ pollinis medio lateri insertæ, stigmati incumbentes.

Stigma muticum.

Folliculi graciles, læves. *Semina* comosa.

HABITUS. *Herba* glabra, erecta. *Radix* tuberosa. *Caulis* infra simplex, foliis minutis; supra ramosus, foliis oppositis linearibus. *Umbellæ* laterales et terminales, subsessiles. *Corollæ* nigro-purpureæ intus barbatæ.

PATRIA. Nova Hollandia tropica.

HOYA.

CHAR. *Corolla* rotata, 5fida.

Corona staminea 5phylla, foliolis depressis, carnosis, angulo interiore producto in dentem antheræ incumbentem.

Antheræ membranâ terminatæ.

Massæ pollinis basi affixæ, conniventes, compressæ.

Stigma depressum, papillâ obtusâ.

Folliculi læves. *Semina* comosa.

HABITUS. *Caulis* suffruticosus, volubilis, v. decumbens. *Folia* opposita, carnosa, v. membranacea. *Umbellæ* interpetiolares, multifloræ.

PATRIA. India Orientalis, China, et Nova Hollandia tropica.

OBS. I have named this genus in honour of Mr THOMAS HOY, whose merits as an intelligent and successful cultivator, have been long known to the botanists of this country. I have added specific characters of the only two species with which I am acquainted; but *Hoya carnosa* probably includes several species, which can only be determined from living specimens: it is also to be considered as the type of the genus, *Hoya viridiflora* differing in some degree in the structure of its corona, and considerably in habit.

1. H. *carnosa*, foliis ovali-oblongis carnosis, corollis barbatis, coronæ foliolis subtus sulcatis!

Asclepias carnosa, *Linn. suppl.* 170. *Murr. syst. veg. ed.* 14. *p.* 260. *Willd. sp. pl.* 1. *p.* 1264. *Pers. syn.* 1. *p.* 275. *Sims in bot. magz. t.* 788. *Smith, exot. bot.* 2. *p.* 21. *t.* 70.

Stapelia Chinensis, *Lour. Cochin.* 1. *p.* 205. fide specim. ab auctore missi in Herb. Banks.

Hab. In Asiæ tropicæ variis regionibus, etiam in Nova Hollandia (ubi et in hort. Angl. v. v.)

2. H. *viridiflora*, foliis ovatis acuminatis membranaceis corollisque glabris, coronæ foliolis exsulcis.

Asclepias volubilis, *Linn. suppl.* 170*. *Willd. sp. pl.* 1. *p.* 1269. *Pers. syn.* 1. *p.* 276.

Watta-haka-codi, *Rheed. Malab.* 9. *p.* 25. *t.* 15.

Hab. Inter frutices in nemorosis Zeylonæ, J. G. Kœnig, in Herb. Banks. (ubi v. s.)

TYLOPHORA.

CHAR. *Corolla* rotata, 5partita.

Corona staminea 5phylla, foliolis depressis, carnosis, angulo interiori simplici edentulo.

Antheræ membranâ terminatæ.

Massæ pollinis erectæ, basi affixæ, marginibus simplicibus.

Stigma muticum.

Folliculi læves. *Semina* comosa.

HABITUS. *Herbæ* v. *suffrutices* volubiles. *Folia* opposita, membranacea, plana. *Umbellæ* interpetiolares. *Flores* utplurimum parvi.

PATRIA. Nova Hollandia, præsertim intra tropicum, sed usque, ad grad. 33. lat. aust. India Orientalis, et Africa æquinoctialis. Octo species nobis cognitæ, quarum nullæ adhucdum editæ sunt.

MARSDENIA.

CHAR. *Corolla* urceolata, 5fida, nunc subrotata.

Corona staminea 5phylla, foliolis compressis, indivisis, intus edentulis.

Antheræ membranâ terminatæ.

Massæ pollinis erectæ, basi affixæ.

Folliculi læves. *Semina* comosa.

HABITUS. *Suffrutices* sæpiùs volubiles. *Folia* opposita, latiuscula, plana. *Cymæ*, nunc *Thyrsi*, interpetiolares.

Stigma sæpiùs muticum, quandoque rostratum, rostro indiviso vel bifido.

PATRIA. India Orientalis et Nova Hollandia; rarius in America Meridionali, et Syria.

OBS. This genus differs from Pergularia, chiefly in the want of the inner laciniæ of the corona: it is therefore an arbitrary separation, and made principally to obtain clearer characters for both. The two species, with an elongated stigma, are perhaps not truly of this genus, but if separated from it, must form each a distinct genus.

It is named in honour of WILLIAM MARSDEN, Esq; F. R. S., late Secretary to the Admiralty, and author of a very judicious and learned "History of Sumatra," in which, though it is evident that he has not made botany his particular study, he has had the merit of turning the attention of botanists to several valuable plants, among others, to the Camphor-Tree of Sumatra, and to a species of this genus, *Marsdenia tinctoria*, said to afford the best indigo in that island.

† *Stigma muticum.* Marsdeniæ veræ.

1. M. *velutina*, caule volubili, foliis cordatis latè ovatis acuminatis tomentosis mollibus, cymis umbelliformibus, fauce nudâ.

HAB. In Nova Hollandia, intra tropicum, (ubi v. v)

2. M. *tinctoria*, caule volubili, foliis cordatis ovato-oblongis acuminatis glabriusculis basi anticè glandulosis, thyrsis lateralibus, fauce barbatâ.

Tarram akkar. *Mars. Sumat.* 78.

Hab. In insula Sumatra. (v. s. in Herb. Banks.)

3. M. *viridiflora*, caule volubili, foliis oblongo-lanceolatis glabriusculis basi obtusa, tubo intus villosiusculo.

Hab. In Nova Hollandia, intra tropicum, (ubi v. v.)

4. M. *clausa*, caule volubili, foliis lanceolatis utrinque acutis glabris: supra parum rugosis, fauce densè barbatâ.

Hab. In Jamaica. *Swartz.* (in Herb. Banks. ubi v. s.)

5. M. *suaveolens*, caule suberecto, foliis ovali-lanceolatis glabris aveniis, tubo ventricoso, fauce barbatâ.

Hab. In Nova Hollandia, extra tropicum, (ubi v. v.)

6. M. *cinerascens*, caule erecto, foliis ovatis obtusiusculis venosis pube rarâ conspersis, petiolis semuncialibus, corollis subrotatis.

Hab. In Nova Hollandia, intra tropicum, (ubi v. v.)

† † *Stigma rostratum.*

7. M. *erecta*, caule erecto, foliis cordatis ovatis acutis, cymis umbelliformibus, limbi laciniis imberbibus tubo 4-5ies longioribus.

Cynanchum erectum, *Linn.*

8. M. *rostrata*, caule volubili, foliis ovatis subcordatis acuminatis glabris, umbellis multifloris, limbo barbato.

Hab. In Nova Hollandia extra tropicum, (ubi v. v.)

PERGULARIA. [Pergulariæ species, *Linn.*

Char. *Corolla* hypocrateriformis, tubo urceolato.

Corona staminea 5phylla, foliolis compressis apice indivisis, intus lacinulâ auctis.

Antheræ membranâ terminatæ.

Massæ pollinis erectæ, basi affixæ.

Stigma muticum.

Folliculi ventricosi, læves. *Semina* comosa.

Habitus. *Plantæ* volubiles. *Folia* latiuscula, membranacea. *Cymæ* interpetiolares. *Flores* flavescentes, odoratissimi.

Patria ignota: in China et India Orientali ob flores suaveolentes culta.

Obs. Of this genus the only certain species are Pergularia odoratissima, Roxb. et Smith, and P. minor, *And. Repos.* 160. Pergularia purpurea, *Vahl.* and Japonica, *Thunb.* may belong to it. P. edulis of Thunberg, prod. cap.

is probably very different. When Linnæus established this genus in his Mantissa, he certainly meant his character to apply to *Pergularia glabra*, of which he had a specimen in his herbarium, and which is the Flos Pergulanus of Rumphius; but unfortunately this plant does not belong to the order of Asclepiadeæ, but to that section of Apocineæ of which I shall hereafter treat. The character of Linnæus was no doubt chiefly taken from a plant of P. odoratissima, that had flowered in the Upsal Garden, and which he confounded with the Asclepias cordata of Forskael, an error long since pointed out by Dr Smith in his very accurate and satisfactory account of Pergularia odoratissima.

DISCHIDIA.

CHAR. *Corolla* urceolata, 5fida.

Corona staminea 5phylla, foliolis bifidis, laciniis subulatis, patentibus, apice recurvis.

Antheræ membranâ terminatæ.

Massæ pollinis erectæ, basi affixæ.

Stigma muticum.

Folliculi læves. *Semina* comosa.

HABITUS. *Herba* in arboribus parasitica, dependens, perennis, lactescens, farinâ albâ tota conspersa. *Caulis* ad genicula radicans. *Folia* opposita, subrotunda, crassa, carnosa. *Flores* parvi, subumbellati.

Patria. India Orientalis, præsertim Insulæ Moluccanæ, necnon Nova Hollandia, ubi prope Endeavour River detexit *Illust. Banks.*

GYMNEMA.

Char. *Corolla* suburceolata 5fida. *Fauce* sæpe coronatâ, squamulis denticulisve 5, sinubus insertis.

Corona staminea nulla.

Antheræ membranâ terminatæ.

Massæ pollinis erectæ, basi affixæ.

Folliculi graciles, læves. *Semina* comosa.

Habitus. *Suffrutices* sæpius volubiles. *Folia* opposita, membranacea, plana. *Umbellæ* interpetiolares, cymosæ.

Patria. India Orientalis, Nova Hollandia tropica, et Africa æquinoctialis.

Obs. Of this genus I have examined four species. Two of these are unpublished plants; the third is Asclepias lactifera *Linn.*, of which there is no specimen in the Linnean Herbarium: it therefore rests entirely upon Hermann's specimens, which, though collected 140 years ago, were by maceration in water so far recovered, as to enable me with certainty to determine its genus. The fourth is Periploca sylvestris, *Willd. sp. pl.* 1. *p.* 1252.

LEPTADENIA.

CHAR. *Corolla* subrotata, *tubo* brevi, *fauce* coronata, squamis 5 sinubus impositis: *limbo* barbato, æstivatione valvata.

Corona staminea nulla.

Antheræ liberæ, apice simplices.

Massæ pollinis erectæ, basi affixæ, apice coarctato pellucido!

Stigma muticum.

Folliculi . . . . . .

HABITUS. *Herbæ?* perennes? volubiles, tomento impalpabili, pulvereo, cinerascentes. *Folia* plana, opposita. *Umbellæ* interpetiolares, quandoque cymosæ. *Corpuscula* stigmatis minuta.

PATRIA. India Orientalis, Africa æquinoctialis et septentrionalis.

OBS. Of this genus I have examined three species in the Banksian Herbarium, none of which are as yet described, though one of them was collected by Forskael; it is unnamed, however, and does not correspond with any of his descriptions.

SARCOLOBUS.

CHAR. *Corolla* subrotata, 5fida. *Fauce* nudâ.

Corona staminea nulla.

Antheræ membranâ terminatæ.

Massæ pollinis erectæ, basi affixæ.
Stigma muticum.
Folliculi ventricosi, carnosi. *Semina* marginata!

HABITUS. *Frutex* volubilis, glaber. *Folia* opposita, latiuscula. *Umbellæ* interpetiolares, multifloræ.

PATRIA. Java; in Prince's Island, prope Bataviam, detexit *Illust. Banks.*

GONOLOBUS. [*Richard? in Mich. Fl. Bor. Amer.* Cynanchi species, *Linn. Jacq.*

CHAR. *Corolla* subrotata, 5partita.
Corona staminea scutelliformis, lobata.
Antheræ transversim dehiscentes, membranâ terminatæ.
Massæ pollinis extremitati exteriori respectu loculi affixæ, stigmate tectæ.
Stigma planiusculo-depressum.
Folliculi ventricosi, subcostati. *Semina* comosa.

HABITUS. *Suffrutices* volubiles. *Folia* opposita latiuscula. *Umbellæ* interpetiolares.

PATRIA. America, præsertim intra tropicos.

OBS. Cynanchum maritimum *Linn.* suberosum *Linn.* crispiflorum *Hort. Kew.* belong to this genus; and I suppose also C. planiflorum, grandiflorum, rostratum, nigrum, racemosum, Carolinense, obliquum, hirtum, prostratum, and undulatum of Willdenow's *Spec. Plant.*: these, however, I have not determined, and the whole genus requires to be re-examined.

MATELEA. [*Aubl. Gujan. tab.* 109. Hostea., *Willd. sp. pl.* 1. *p.* 1274.

CHAR. *Corolla* rotata, 5partita.

Corona staminea scutelliformis, lobata.

Antheræ transversim dehiscentes, membranâ terminatæ.

Massæ pollinis extremitate exteriore respectu loculi affixæ, stigmate tectæ.

Stigma planiusculo-depressum.

Folliculi ventricosi, costati. *Semina* calva. (*Aubl.*)

HABITUS. *Frutex* erectus. *Folia* opposita, basi supra biglandulosa. *Flores* racemosi, laterales.

PATRIA. America meridionalis.

ASCLEPIAS. [Asclepiadis sp. *Linn.*

CHAR. *Corolla* 5partita, reflexa.

Corona summo tubo filamentorum imposita, 5-phylla, foliolis cucullatis, e fundo exserentibus processum aversum corniformem.

Antheræ membranâ terminatæ.

Massæ pollinis compressæ, apice attenuato affixæ, pendulæ.

Stigma depressum, muticum.

Folliculi læves. *Semina* comosa.

HABITUS. *Herbæ* erectæ. *Folia* opposita, nunc alterna! vel verticillata. *Umbellæ* interpetiolares.

PATRIA. America Septentrionalis.

OBS. The species of this genus which I have examined, are *A. Syriaca*, (most improperly so called, as it is a native of North America only), *amœna*, *purpurescans*, *variegata*, *curassavica*, *nivea*, *elevata*, *parviflora*, *incarnata*, *decumbens*, *verticillata*, *tuberosa*, of Willdenow's Spec. Plant., and some unpublished species in the Banksian Herbarium; and there can be little doubt that *A. pulchra*, *citrifolia*, *Mexicana*, *linaria*, *rubra*, and all the species of Michaux, belong to it.

GOMPHOCARPUS. [Asclepiadis sp. *Linn.*

CHAR. *Corolla* 5partita, reflexa.

Corona summo tubo filamentorum imposita, 5-phylla, foliolis cucullatis utrinque unidentatis, intus simplicibus.

Antherae membranâ terminatæ.

Massæ pollinis compressæ, apice attenuato affixæ, pendulæ.

Stigma depressum, muticum.

Folliculi ventricosi, spinis innocuis, echinati.

Semina comosa.

Habitus. *Frutices* v. suffrutices erectæ. *Folia* opposita, margine sæpe revolutæ. *Umbellæ* interpetiolares.

Patria. Africa Australis.

Obs. *Asclepias arborescens*, *fruticosa* and *setosa*, are the three certain species of this genus; but *crispa* has probably the same structure. The flowers I have examined, but have not seen the fruit. *A. pubescens* ought probably to be altogether omitted; for, according to the description and specimen in Linnæus's Herbarium, it is *A. arborescens*, while according to the reference to Plukenet, it is *A. crispa*. This observation I have copied from Mr Dryander's notes.

XYSMALOBIUM. [Asclepiadis sp. *Linn.*

Char. *Corolla* 5fida, patens.

Corona staminea summo tubo filamentorum imposita, simplici serie decempartita, laciniis 5 antheris oppositis carnosis, subrotundis, intus simplicibus; 5 reliquis nanis.

Antheræ membranâ terminatæ.

Massæ pollinis compressæ, apice affixæ, pendulæ, processubus connectentibus latiusculis.

Stigma muticum.

Folliculi ventricosi, ramentacei. *Semina* comosa.

HABITUS. *Frutices* erecti. *Folia* opposita. *Umbellæ* interpetiolares. *Flores* majusculi, limbo nunc barbato.

PATRIA. Africa Australis.

OBS. This genus at present consists of only two species, *Asclepias undulata* and *grandiflora*.

CALOTROPIS. [Asclepiadis sp. *Linn.*

CHAR. *Corolla* sub-campanulata, tubo angulato, angulis intus saccatis, limbo 5partito.

Corona staminea 5phylla, foliolis carinæformibus, tubo filamentorum longitudinaliter adnatis, basi recurvâ.

Antheræ membranâ terminatæ.

Massæ pollinis compressæ, apice attenuato affixæ, pendulæ.

Stigma muticum.

Folliculi ventricosi, læves. *Semina* comosa.

HABITUS. *Frutices* erecti, glabri. *Folia* opposita, lata. *Umbellæ* interpetiolares. *Flores* speciosi.

PATRIA. India Orientalis, et Persia.

KANAHIA.

CHAR. *Corolla* campanulata, limbo 5partito.

Columna semi-inclusa.

Corona staminea apice tubi filamentorum imposita, 5phylla, foliolis e basi incrassatâ subulatis, indivisis.

Antheræ membranâ terminatæ.

Massæ pollinis ventricosæ, apice affixæ, pendulæ.

Stigma muticum.

Folliculi graciles, striati. *Semina* comosa?

HABITUS. *Frutex?* erectus. *Folia* opposita, plana. *Pedunculi* interpetiolares, apice fasciculatim multiflori, pedicellis imbricatis, basi unibracteatis.

PATRIA. Arabia.

OBS. Asclepias laniflora, *Forsk. Ægypt. Arab.* p. 51. KANAKK of the Arabs, is the only species of the genus. I have examined the flowers of an original specimen. The account of the fruit is taken from Forskael's description, and Vahl's figure.

OXYSTELMA.

CHAR. *Corolla* rotata, patens.

Columna exserta.

Corona staminea 5phylla, foliolis acutis, indivisis.

Antheræ membranâ terminatæ.

Massæ pollinis compressæ, apice attenuato affixæ, pendulæ.

Stigma muticum.

Folliculi læves. *Semina* comosa.

HABITUS. *Suffrutices* volubiles, glabri. *Folia* opposita. *Racemi* v. *umbellæ* interpetiolares.

PATRIA. India Orientalis et Nova Hollandia?

Obs. Periploca esculenta, *Linn. Suppl.* *Roxb. Corom.* 1. *p.* 13. *t.* 11. is the type of the genus, and perhaps the only genuine species; for a New Holland plant which I have at present joined with it, differs considerably both in the form of its corolla and that of its corona.

OXYPETALUM.

Char. *Corolla* tubo brevi ventricoso; limbo 5-partito, laciniis supra ligulatis.

Corona staminea 5phylla, foliolis subrotundis simplicibus, carnosis.

Antheræ membranâ terminatæ.

Massæ pollinis lineares, pendulæ, affixæ curvaturæ processuum, dein adscendentium.

Stigma acumine elongato bipartito.

Folliculi. . . . . . .

Habitus. *Frutex* volubilis. *Folia* opposita, cordata. *Umbellæ* subcorymbosæ, interpetiolares. *Flores* suaveolentes.

Patria. America Meridionalis.

Obs. The genus consists of a single species, which was discovered in 1768, near Rio de Janeiro, by Sir Joseph Banks.

DIPLOLEPIS.

Char. *Corolla* tubo brevi, urceolato, limbo 5partito.

Corona staminea 5phylla, foliolis obtusis squamulâ interiori auctis.

Antheræ membranâ terminatæ.

Massæ pollinis ventricosæ, juxta apicem affixæ, pendulæ.

Stigma rostro elongato indiviso.

Folliculi. . . . . .

HABITUS.

PATRIA. America Australis.

OBS. Only one certain species is known, which was discovered by my friend *Mr Archibald Menzies*, in Chili, near Valparaizo.

Asclepias vomitoria of Kœnig's MSS., of which I have examined specimens in the Banksian Herbarium, agrees with this genus in many respects, especially in the form and insertion of its masses of pollen, but differs considerably in appearance, and in having a blunt stigma.

HOLOSTEMMA.

CHAR. *Corolla* subrotata, 5fida.

Corona imo tubo stamineo inserta, simplex, annularis, integra.

Antheræ membranâ terminatæ.

Massæ pollinis pendulæ, compressæ, apice attenuato affixæ.

Stigma muticum.

Folliculi ventricosi, læves. *Semina* comosa.

HABITUS. *Frutex* volubilis, glaber. *Folia* opposita, lata. *Umbellæ* interpetiolares, subsessiles. *Flore* speciosi.

PATRIA. India Orientalis.

OBS. This is Ada-Kodien, *Rheed. Mal.* 9. *p.* 9. *t.* 7., in which the leaves are represented alternate, an error that is corrected in the description, which is excellent, and well accords with a specimen in the Banksian Herbarium collected by Dr Patrick Russell.

CYNANCHUM. [Cynanchi sp. *Linn.*

CHAR. *Corolla* subrotata, 5partita.

Corona staminea monophylla, 5–20loba, dum 5-fida lobis antheris oppositis.

Antheræ membranâ terminatæ.

Massæ pollinis ventricosæ, pendulæ.

Stigma apiculatum.

Folliculi læves. *Semina* comosa.

HABITUS. *Plantæ* perennes, vel *suffrutices*, utplurimum volubiles. *Folia* opposita. *Umbellæ* interpetiolares.

PATRIA varia, a gradu 59° lat. bor.! usque ad 32^m lat. aust.

OBS. Though I have here very much limited the Linnean genus Cynanchum, yet it appears still to contain the elements of several genera: I shall therefore add the characters of all the species I am acquainted with, divided into such sections as will probably hereafter be considered distinct genera.

I. *Corona staminea* tubulosa, columnam includens, ore 5-10fido. Laciniæ 5, interiores antheris, exterioribusque oppositæ et parallelæ.

Massæ pollinis infra apicem insertæ.
Stigma apiculo semibifido.
Folliculi cylindracei, divaricati.
Caulis volubilis. *Folia* cordata.

1. C. *acutum*, foliis oblongo-ovatis cordatis acutis, corollæ laciniis oblongis obtusis.
   Cynanchum acutum, *Linn.* cum synonymis.

2. C. *Monspeliacum*, foliis reniformibus: apice coarctato, semi-lanceolato, laciniis corollæ lanceolatis obtusiusculis.
   Cynanchum Monspeliacum, *Linn.*, cum synonymis.
   Obs. Forsan haud distinctum a priori.

3. C. *Chinense*, foliis ovatis cordatis: acumine brevi, laciniis corollæ lanceolato-linearibus acutis, coronæ laciniis 5 exterioribus compresso-filiformibus integris.
   Hab. In Chinæ provincia Peckeley, *Georgius, Staunton, Baronettus.* (v. s. in Herb. Banks.)

II. Coronea staminea tubulosa, columnam includens, ore 5-10fido, carinis decem interioribus simplicibus v. in lacinulas supra productis.
Massæ pollinis infra apicem insertæ.
Stigma apiculo emarginato.
Folliculi ventricosi, angulati, patentes.
Caulis volubilis. *Folia* cordata.

4. C. *pedunculatum*, pedunculo communi foliis glabriusculis longiore, carinis interioribus coronæ in lacinulas productis.
HAB. In Nova Hollandia tropica (ubi v. v.)

5. C. *floribundum*, pedunculo communi foliis glaberrimis breviore, carinis interioribus coronæ in lacinulas productis.
HAB. In Nova Hollandia extra tropicum (ubi v. v.)

6. C. *erubescens*, carinis interioribus coronæ 10-fidæ corolla brevioris simplicibus, pedunculo communi petiolum æquante, ramulis floribusque extus pubescentibus.
HAB. In Nova Hollandia tropica, ubi a *Josepho Banks, Baronetto*, detectum.

7. C. *pauciflorum*, carinis interioribus coronæ 5-fidæ corollam æquantis simplicibus, pedunculo communi petiolo breviore, ramulis floribusque glabris.

Periploca tunicata, *Retz. obs.* 2. *p.* 15. *Willd. phyt.* 1. *p.* 7. *n.* 23. *t.* 5. *f.* 3. *Willd. sp. pl.* 1. *p.* 1252.

Hab. In India Orientali. (v. s. in Herb. Banks.)

III. Corona staminea tubulosa, columnam includens, ore 5-10fido, laciniis carinisve interioribus nullis.

Massæ pollinis apice sæpius affixæ.

Stigma apiculo bifido.

Caulis volubilis. *Folia* subcordata.

8. C. *pilosum*, foliis ovatis acutiusculis calycibusque pilosis, corona 10fida longitudine corollæ.

Periploca Africana, *Linn.*, cum synonymis.

Hab. In Africa Australi prope Promont. B. Spei. (ubi v. v.)

9. C. *crassifolium*, foliis ovatis subcordatis obtusis, cum mucronulo carnosis calycibusque glabris, corona 10fida longitudine corollæ.

Cynanchum obtusifolium, *Linn. suppl.* 169 ?

Hab. In Africa Australi. (v. s. in Herb. Banks.)

10. C. *Capense*, foliis ovatis cordatis obtusis cum mucronulo caulibusque glabris, calycibus pubescentibus, corona 5fida corollâ duplo breviore.

Cynanchum Capense, *Linn. suppl.* 168 ?

Hab. In Africa Australi. (v. s. in Herb. Banks.)

IV. Corona staminea tubulosa, columnam includens, ore 10fido, intus laciniis carinisve nullis.
Massæ pollinis apice affixæ.
Stigma apiculo integro.
Caulis erectus.

11. C. *roseum*, foliis lanceolato-linearibus undulatis glabriusculis, pedicellis calycibusque pilosis.

Asclepias foliis ex lineari-lanceolatis, floribus umbellatis, umbellis alternis erectis, caule erecto. *Gmel. Sib.* 4. *p.* 78. *t.* 42.

Asclepias Davurica. *Willd. sp. pl.* 1. *p.* 1272?

HAB. In Siberia. *P. S. Pallas*, in Herb. Banks.

V. Corona scutelliformis, carnosa, 5-10loba, intus simplex.
Massæ pollinis infra apicem affixæ.
Stigma apiculo brevissimo, integro.
Folliculi læves.
Caules erectiusculi.

12. C. *Vincetoxicum*, caule erecto, corollis imberbibus, pedicellis umbellæ simplicis pedunculo communi triplo longioribus, corona 5loba.

Asclepias Vincetoxicum, *Linn.*

HAB. In Europa: in Suecia, etiam ad 59° 40′ Lat.

13. C. *medium*, caule supernè volubili, corollis imberbibus, pedicellis umbellæ, sæpe divisæ pedunculo communi vix longioribus, corona 5loba.

HAB. . . . . . . Specimen e Hort. Reg. Paris. in Herb. Banks.

Sequenti proximum.

14. C. *nigrum*, caule supernè volubili, corollis barbatis, pedicellis umbellæ simplicis pedunculo communi vix longioribus, corona semidecemfida.

Asclepias nigra, *Linn.*

HAB. In Europa Australi.

VI. *Corona* profundè 5fida, laciniis simplicibus.

Massæ pollinis infra apicem affixæ.

Stigma papilla emarginata.

Folliculi ventricosi.

15. C. *Sibiricum*, foliis lanceolato-linearibus oppositis ternisque, caule decumbente.

Asclepias Sibirica, *Linn.*

HAB. In Siberia, etiam in China. (v. s. in Herb. Banks.)

OBS. Vix hujus generis.

METAPLEXIS.

CHAR. *Corolla* subrotata.

Corona staminea 5phylla, foliolis nanis, cucullatis, cum antheris alternantibus.

Antheræ membranâ terminatæ.

Massæ pollinis ventricosæ, pendulæ, latere affixæ.

Stigma rostro elongato indiviso.

Folliculi. . . . . . .

Habitus. *Suffrutex* volubilis, glaber. *Folia* cordata. *Racemi* pedunculati, interpetiolares. *Corollæ* limbus barbatus.

Patria. China, in provincia Peckeley. *Georgius Staunton, Baronettus.*

DITASSA.

Char. *Corolla* subrotata.

Corona staminea duplex; *exterior* 5partita, laciniis acuminatis; *interior* 5phylla, brevior, exteriori antherisque opposita.

Antheræ membranâ terminatæ.

Massæ pollinis ventricosæ, infra apicem affixæ, pendulæ.

Stigma apiculo obtuso.

Folliculi. . . . . .

Habitus. *Suffrutex* volubilis, glaber. *Folia* opposita, plana. *Umbellæ* interpetiolares.

Patria. America Meridionalis, Brasilia, ubi prope Rio de Janeiro detexit *Josephus Banks, Baronettus.*

DŒMIA.

CHAR. *Corolla* subrotata, tubo brevi.

Corona staminea duplex, *exterior* brevis, 10-partita, laciniis alternis nanis; *interior* 5-phylla; foliolis basi solutis, supra subulatis.

Antheræ membranâ terminatæ.

Massæ pollinis compressæ, apice affixæ, pendulæ.

Stigma muticum.

Folliculi ramentacei. *Semina* comosa.

HABITUS. *Caulis* volubilis. *Folia* opposita, cordata. *Flores* umbellati.

PATRIA. India Orientalis, et Africa Æquinoctialis.

OBS. Asclepias cordata, *Forsk. Arab. p.* 49, and Cynanchum extensum, *Jacq. ic.* 1. *t.* 54, are the only certain species of the genus: from the latter, Asclepias scandens, *Palis. Hor. D'Owar*, 1. *p.* 92. *t.* 56, is probably not distinct, and Cynanchum bicolor, *And. Repos.* 562, is very nearly related to it.

SARCOSTEMMA.

CHAR. *Corolla* rotata.

Corona staminea duplex; *exterior* cyathiformis v. annularis, crenata; *interior* 5phylla, exteriorem superans, foliolis carnosis.

Antheræ membranâ terminatæ.

Massæ pollinis apice affixæ, pendulæ.
Stigma sub-muticum.
Folliculi graciles, læves. *Semina* comosa.

HABITUS. *Caulis* volubilis v. decumbens, aphyllus, articulatus, v. foliis oppositis distantibus. *Flores* umbellati, laterales v. terminales.

PATRIA. India Orientalis, Nova Hollandia, et Africa.

OBS. To this genus belong Cynanchum viminale, *Linn.*; a species nearly allied to it from New Holland, and New Caledonia; and Asclepias viminalis *Linn.*, all of which I have examined. The probable species are, Asclepias aphylla, *Thunb. prod.*; Asclepias stipitacea, *Forsk. Arab.* 50.; Cynanchum pyrotechnicum, and perhaps also Asclepias aphylla, of the same author.

EUSTEGIA.

CHAR. *Corolla* rotata.

Corona triplex; singula 5phylla; *extima* fauce inserta laciniis limbi opposita; *reliqua* extimâ alternantia, antheris oppositâ, foliolis *mediæ* tripartitis, *intimæ* indivisis.
Antheræ membranâ terminatæ.
Massæ pollinis apice attenuato affixæ, pendulæ.
Stigma submuticum.
Folliculi. . . . . .

Habitus. *Herba* decumbens, humilis. *Folia* opposita, hastata. *Flores* subumbellati.

Patria. Africa australis.

Obs. This remarkable character is taken from Apocynum hastatum, *Thunb. prod.* 47. ; A. minutum, *Linn. Suppl.* 169., and from a very nearly related species found at the Cape of Good Hope, by Mr Ferdinand Bauer.

METASTELMA.

Char. *Corolla* subcampanulata ; *Fauce* coronatâ dentibus 5 exsertis, sinubus oppositis, tubum decurrentibus.

Corona staminea nulla.

Antheræ membranâ terminatæ.

Massæ pollinis compressæ, apice attenuato affixæ, pendulæ.

Stigma muticum.

Folliculi. . . . . .

Habitus. *Planta* perennis, volubilis, glabra. *Folia* opposita, membranacea. *Umbellæ* interpetiolares, subsessiles. *Flores* parvi.

Patria. America meridionalis.

Obs. This is the Cynanchum parviflorum of *Swartz*, whose description, however, of the corona, in *Flor. Ind. oc.* 1. *p.* 537., does not agree with ours, which was taken from excellent specimens in the Banksian Herbarium, collected in the islands of St Croix, and St Christopher, by *Masson* and *Von Rohr.*

MICROLOMA. [Ceropegiæ sp. *Linn. Jacq.* Ceropegia *Lam. Illust. Gen. tab.* 179.

CHAR. *Corolla* urceolata, tubo ventricoso, angulato, fauce nudâ, limbo breviore.

Squamæ 5, inclusæ, medio tubo sub sinubus insertæ, totidem fasciculis villorum alternantes.

Corona staminea nulla.

Antheræ membranâ terminatæ, sagittatæ.

Massæ pollinis compressæ, apice affixæ, pendulæ.

Stigma apiculatum.

Folliculi. . . . .

HABITUS. Suffrutæ volubiles. *Folia* opposita. *Umbellæ* interpetiolares.

PATRIA. Africa australis.

OBS. This genus is formed from the two Cape species of *Ceropegia*, viz. *sagittata* and *tenuiflora*, plants which are widely different from the original species of that genus.

1. M. *sagittatum*, foliis sagittatis pubescentibus, corollæ limbo acutiusculo.
   Ceropegia sagittata, *Linn. mant.*

2. M. *lineare*, foliis linearibus glabris, corollæ limbo obtusissimo.
   Ceropegia tenuiflora, *Linn.*

ASTEPHANUS. [Apocyni sp. *Lin. fil.* et *Thun.*

CHAR. *Corolla* subcampanulata, fauce tuboque esquamatis.
Corona staminea nulla.
Antheræ membranâ terminatæ.
Massæ pollinis pendulæ.
Stigma caudatum, v. muticum.
Folliculi. . . . .

HABITUS. *Plantæ* perennes, sæpius volubiles. *Folia* opposita.
Umbellæ interpetiolares. *Flores* parvi.

PATRIA. Africa australis.

OBS. This generic character is formed from *Apocynum triflorum* and *lineare*, *Linn. suppl.*, and from two new species in the Banksian collection. Apocynum cordatum and lanceolatum, *Thunb. prod.*, probably likewise belong to the genus; and I have modified the character, to admit a very remarkable plant, found by Mr Masson in South Africa, the stem of which is shrubby with spinescent branches, the leaves extremely minute, opposite, distant, and heartshaped. The corolla rather urceolate than bellshaped; the orifice of the tube furnished with deflected hairs; the masses of pollen are fixed by their attenuated apices; the stigma is blunt; the folliculi nearly cylindrical and smooth, with seeds of the usual structure. The whole genus is evidently very near akin to Microloma, and differs chiefly in the want of squamæ within the tube. They might, therefore, be united; but this would lead to the junction also of Metastelma, a native of the West India Islands, which I am unwilling to join with these South African plants.

II.

Massæ pollinis 20, læves, quaternatim (duabus antheris pertinentes), affixæ apice corpusculorum exsulcorum stigmatis.

Filamenta connata, extus appendiculata.

SECAMONE. [Periplocæ sp. *Linn.*

CHAR. *Corolla* rotata.

Corona staminea 5phylla.

Massæ pollinis erectæ quaternatim affixæ apice corpusculi subsimilis, exsulci stigmatis.

Stigma apice coarctato.

Foliculi. . . . . .

HABITUS. *Frutices* erecti v. volubiles, glabri. *Folia* opposita. *Cymæ* dichotomæ, interpetiolares. *Flores* minuti.

PATRIA. Africa, India Orientalis, et Nova Hollandia tropica.

OBS. From the extreme minuteness of the parts, no genus has been more difficult to determine than this: it is, however, perfectly natural and distinct, and is evidently the connecting link between the true Asclepiadeæ, and the Periploceæ, which follow. I have examined five species, of which two are published plants, viz. Periploca secamone *Linn.* and emetica of *Retz.* and *Willdenow.* The third is a climber, a native of India, discovered by Dr Roxburgh; and two are erect shrubs, natives of the tropical part of New Holland.

III. Periploceæ.

Massæ pollinis 5-20, granulosæ, (granulis e sphærulis 4 compositis), solitariæ, usque quaternatim apici dilatato corpusculi singuli stigmatis affixæ.

Filamenta partim v. omnino libera.

HEMIDESMUS. [Periplocæ sp. *Linn.*

Char. *Corolla* rotata, squamis 5, sub sinubus, obtusis.

Filamenta basi connata, supra distincta. *Antheræ* cohærentes, a stigmati liberæ, imberbes, apice simplices.

Massæ pollinis 20.

Stigma muticum.

Folliculi cylindracei, divaricatissimi, læves. *Semina* comosa.

Habitus. *Frutices* volubiles, glabri. *Folia* opposita, nitida. *Flores* interpetiolares, congesti, parvi.

Patria. India Orientalis.

Obs. This genus, whose name is derived from the partial connection of the stamina, is composed of *Periploca Indica*, and two very nearly related unpublished species. Its strict affinity to Periploca, is unquestionable, but the differences in the structure of its flower, appear to me sufficient to justify its separation from that genus.

PERIPLOCA. [Periplocæ sp. *Linn.*

Char. *Corolla* rotata. *Squamis* 5, faucis laciniis alternatibus, aristatis.

Filamenta distincta. *Antheræ* cohærentes, dorso barbatæ.

Massæ pollinis apice dilatato corpusculi stigmatis applicitæ, solitariæ, e quatuor confluentibus.

Stigma submuticum.

Folliculi cylindracei, divaricatissimi, læves. *Semina* comosa.

Habitus. *Frutices* sæpius volubiles, glabri. *Folia* opposita, nitida. *Flores* subcorymbosi interpetiolares.

Patria. Europa australis. Syria. Africa septentrionalis, et æquinoctialis.

Obs. Periploca Græca, and lævigata, are the two principal species of the genus. P. angustifolia, *Billard.* no doubt also belongs to it; and I have seen a fourth and very remarkable species brought from Sierra Leone, by Professor Afzelius, on account of which, I have been obliged slightly to modify the character.

GYMNANTHERA.

CHAR. *Corolla* hypocrateriformis. *Corona* faucis 5phylla.

Filamenta distincta, fauci inserta. *Antheræ* imberbes.

Massæ pollinis quaternatim applicitæ apice dilatato corpusculorum.

Stigma apiculo bifido.

Folliculi cylindracei, læves, divaricatissimi. *Semina* comosa.

HABITUS. *Frutex* volubilis, glaberrimus. *Folia* opposita, nitida. *Pedunculi* laterales sub-dichotomi. *Flores* albo-virescentes, imberbes.

PATRIA. Nova Hollandia, intra tropicum.

I. SEMINA A

A. FAUX

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lateres..

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b. ......

B. FAUX.......

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ibus in

II. SEMINA arolla h

III. SEMINA ......

Stamina

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APOCINEÆ.

Sect. I. SEMINA COMOSA.

I. SEMINA AD EXTREMITATEM UMBILICALEM (superiorem) COMOSA. Embryo planus.

A. FAUX COROLLÆ NUDA, nec coronata.

a. Tubus corollæ intus absque squamulis denticulisve.

† Stamina inclusa.

* Antheræ medio stigmate cohærentes. Squamulæ 5 hypogynæ distinctæ, raro connatæ. Corollæ laciniæ dimidiatæ .... Echites.

** Antheræ a stigmate solutæ.
1. Corpuscula 5 hypogyna, filiformia. Antheræ sagittatæ, lobis posticis polline vacuis. Corollæ laciniæ falcatæ .... Ichnocarpus.
2. Corpuscula nulla hypogyna. Antheræ lanceolatæ, longitudinaliter polliniferæ. Corollæ laciniæ æquilateres .... Holarrhena.

†† Stamina exserta; medio stigmate cohærentes.

* Filamenta fauci inserta.
1. Filamenta apice simplici. Squamæ nullæ hypogynæ. Corolla hypocrateriformis, limbo 5partito .... Isonema.
2. Filamenta apice extus gibbere carnoso. Squamæ 5 hypogynæ, basi connatæ. Corolla subhypocrateriformis, limbo 5fido .... Vallaris.

** Filamenta medio v. juxta basin tubi inserta; filiformia, simplicia. Squamæ 5 hypogynæ, distinctæ v. connatæ.
1. Folliculi duo, placentis liberis .... Parsonsia.
2. Capsula bilocularis, septo parallelo placentifero .... Lyonsia.

b. Tubus corollæ intus squamis denticulisve 5 inclusis. Stamina inclusa. Styli nulli. Squamæ 5 hypogynæ.
1. Corolla campanulata. Denticuli acuti tubi laciniis limbi oppositi .... Apocynum.
2. Corolla infundibuliformis. Squamulæ obtusæ tubi laciniis limbi alternantes .... Cryptolepis.

B. FAUX COROLLÆ CORONATA, squamis (tubulove) exsertis.

* Corona monophylla, cum vel absque squamis interioribus.
1. Corona duplex; *exterior* annularis integerrimus; *interior* e squamis 5 laciniis limbi alternantibus. Urceolus hypogynus .... Prestonia.
2. Corona simplex, tubulosa, crenulata. Squamæ nullæ hypogynæ, sed 10 basi calycis extra corollam impositæ. Corollæ laciniæ æquilateres. Antheræ mucrone brevissimo. Balfouria.

** Corona simplici serie polyphylla.
1. Coronæ foliola divisa. Squamæ nullæ hypogynæ. Corollæ laciniæ ecaudatæ inæquilateres. Antheræ elongato-aristatæ .... Nerium.
2. Coronæ foliola 10 indivisa. Squamæ 5 hypogynæ. Corollæ laciniæ caudatæ .... Strophanthus.

II. SEMINA AD EXTREMITATEM UMBILICO OBVERSAM (inferiorem) COMOSA. Embryo cotyledonibus involutis. Corolla fauce coronata. Wrightia.

III. SEMINA PELTATA, CILIATA, UTRAQUE EXTREMITATE CILIIS ELONGATIS COMOSA. Corolla hypocrateriformis, fauce nuda. Stamina inclusa, antheris liberis. Squamæ 0. hypogynæ .... Alstonia.

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.... ECHITES.

æ... ICHNOCARPUS.
.... HOLARRHENA.

.... ISONEMA.
o 5fido.. VALLARIS.

.... PARSONSIA.
.... LYONSIA.

.... APOCYNUM.
.... CRYPTOLEPIS.

.... PRESTONIA.
quilateres. Antheræ mucrone brevissimo. BALFOURIA.

.... NERIUM.
.... STROPHANTHUS.

volutis. Corolla fauce coronata. WRIGHTIA.

ypocrateriformis, fauce nuda. } ALSTONIA.
.... }

APOCINEÆ.

Sect. I. SEMINA COMOSA.

A. *Coma ad extremitatem umbilicalem (superiorem) seminis.*

ECHITES. [*Brown.* Echitides pleræq. *Jacq.* Echitidis species, *Linn.*

Char. *Corolla* hypocrateriformis, fauce tuboque esquamatis. Laciniis limbi 5partiti inæquilateris.

Stamina inclusa. *Antheræ* sagittatæ, medio stigmati cohærentes, lobis posticis polline vacuis.

Ovaria 2. *Stylus* 1, filiformis.

Squamæ 5 hypogynæ.

Folliculi graciles.

Habitus. *Frutices* volubiles. *Folia* opposita, ciliis interpetiolaribus glandulosis. *Pedunculi* interpetiolares, multiflori. *Flores* utplurimum speciosi, albi, lutei et purpurei.

Patria. America meridionalis.

Obs. Of Echites I have only examined *E. umbellata*, the original species when the species was establishsd by Brown in his " History of Jamaica;" *biflora, circinalis,* and *Domingensis:* But, from the descriptions and figures of authors, especially of Jacquin, Swartz, and the authors of the "Flora Peruviana," I without hesitation refer to it the following species: E. suberecta *Jacq.* repens *Jacq.* agglutinata *Jacq.* asperuginis *Swartz,* torulosa *Jacq.* acuminata *H. Peruv.* laxa *H. Peruv.* hirsuta *H. Peruv.* E. quinquangularis, *Jacq.* and annularis, *Linn. Suppl.* are probably not genuine species, on account of the prominent ring of the faux, and E. glandulosa *H. Peruv.* which according to the figure has a crown of 5 entire laciniæ and the segments of the corolla equal-sided, must be excluded from this genus. E. siphilitica, the specimen of which in the Linnean Herbarium I have seen but not sufficiently examined, is somewhat doubtful. E. floribunda, corymbosa and spicata are removed to another genus. The two remarkable species of South Africa, E. bispinosa and succulenta, require further examination; for their peculiar habit indicates their being a distinct genus from Echites, which it would be desirable to limit to the species of tropical America: hence it will be necessary to re-examine certain plants of India that in many respects agree with this genus, especially Tsjeria-pupal-valli of *Rheed, Mal.* 7. *p.* 103. *t.* 55. which appears to differ from Echites chiefly in having a calyx longer than the tube of the corolla, in the scales surrounding the ovarium being united, (which, however, is also the case in E. Domingensis,) and in the greater quantity and density of the albumen, which is between fleshy and cartilaginous.

The authors of the "Flora Peruviana" have reformed the character of Echites, but the scales which they describe between the calyx and corolla will certainly not materially assist in distinguishing this genus from those most nearly related to it; and I have observed, a nearly similar structure in most of the genera of this family, as well as of Asclepiadeæ: these scales, however, truly belong to the calyx, and are either five or ten in number, or more rarely consist of an uninterrupted series of ciliæ, not unlike those which so frequently occur within the footstalks of the leaves. My observations are not sufficiently numerous to enable me to determine whether their modifications might not generally assist in characterizing genera, and I have, therefore, very seldom had recourse to them.

ICHNOCARPUS.

CHAR. *Corolla* hypocrateriformis, limbi laciniis dimidiatis, fauce tuboque esquamatis.

Stamina inclusa. *Antheræ* sagittatæ, a stigmate liberæ.

Ovaria 2. *Stylus* 1, filiformis. *Stigma* ovatum, acuminatum.

Filamenta 5, hypogyna, staminibus alternantia. *Folliculi* graciles.

Habitus. *Frutex* oppositifolius. *Panicula* terminalis, brachiata. *Flores* parvi.

Patria. India Orientalis et Zeylona.

Obs. This is the Apocynum frutescens *Linn.*, of which I have examined the original specimen in Herman's herbarium. The Quirivelia Zeylanica of Lamarck and Poiret, in *Encycl. method. botan. vol.* 6. *p.* 42. considered by them as Linnæus's plant, must, from the description, be widely different, and probably does not belong to the same natural family.

HOLARRHENA.

Char. *Corolla* hypocrateriformis, laciniis æquilateris, fauce tuboque esquamatis.

Stamina inclusa, imo tubo inserta. *Antheræ* a stigmate liberæ, lanceolatæ, integræ, longitudinaliter polliniferæ.

Ovaria 2. *Stylus* brevissimus. *Stigma* cylindraceum.

Squamæ nullæ hypogynæ.

Folliculi graciles.

Habitus. *Frutices* erecti, glabri. *Folia* membranacea. *Cymæ* terminales et laterales.

Patria. India Orientalis et Zeylona.

Obs. This genus consists of two species; one of which is Carissa mitis, *Vahl. symb.* 3. *p.* 44. : a specimen of this, so named by Kœnig, I have examined in the Banksian Collection.

ISONEMA.

Char. *Corolla* hypocrateriformis; fauce tuboque esquamatis; limbo 5partito.

Stamina exserta. *Filamenta* fauci inserta, apice simplicia. *Antheræ* sagittatæ, medio stigmati cohærentes.

Ovaria 2. *Stylus* 1, filiformis. *Stigma* incrassatum, obtusum.

Squamæ nullæ hypogynæ.

Folliculi. . . . . .

Habitus. *Frutex* erectus? oppositifolius, pilosus. *Panicula* terminalis, brachiata, floribus corymbosis. *Calycis* foliola basi intus, squamâ duplici. Corollæ (semuncialis) tubus cylindraceus, intus medio barbatus.

Patria. Africa Æquinoctialis. (*H. Smeathman*, in Herb. Banks.)

VALLARIS. [*Burm. Ind.* 51. Pergulariæ sp. *Linn.*

Char. *Corolla* hypocrateriformis; fauce tuboque esquamatis, limbo 5fido obtuso.

Stamina exserta. *Filamenta* fauci inserta, brevissima, apice extus gibbere carnoso. *Antheræ* sagittatæ, medio stigmati cohærentes.

Ovarium biloculare. *Stylus* filiformis. *Stigma* conico-ovatum.

Squamæ 5, hypogynæ, basi connatæ, apicibus ciliatis.

Folliculi. . . . .

Habitus. *Frutex* volubilis, oppositifolius. *Pedunculi* interpetiolares, dichotomi. *Flores* corymbosi, suaveolentes.

Patria. India Orientalis.

Obs. This is the Flos Pergulanus of Rumphius, which Linnæus considered as the first species of his genus Pergularia: it does not, however, belong to the same order with the plant that afforded his generic character, and to which the name has been since generally applied.

PARSONSIA. [Echitidis sp. *Jacq.* et *Swartz.*

Char. *Corolla* infundibuliformis, fauce tuboque esquamatis, limbo 5partito, recurvo, laciniis æquilateris.

Stamina exserta. *Filamenta* medio v. juxta basin tubi inserta, filiformia. *Antheræ* sagittatæ, medio stigmati cohærentes, lobis posticis polline destitutis.

Ovaria 2, v. 1, biloculare. *Stylus* 1. *Stigma* dilatatum.

Squamæ 5, hypogynæ, distinctæ, v. connatæ.

Folliculi 2, distincti, v. cohærentes.

Habitus. *Frutices* volubiles. *Folia* opposita. *Flores* cymosi, v. racemosi, racemis sæpe compositis, terminales v. interpetiolares, parvi, colore in variis vario.

PATRIA. America Meridionalis et Australasia.

OBS. The American species of this genus, viz. Echites corymbosa *Jacq.* floribunda *Sw.* and spicata *Jacq.* differ considerably from the rest, which are natives of New Holland and New Zealand. Among these, the only published species is Periploca capsularis, *Forst. prod. n.* 126. When the fruit of all has been examined, they will probably be divided in the following manner :

† *Americanæ.* Ovariis duobus. Folliculis distinctis.

† † *Australasienses.* Ovario biloculari. Folliculis longitudinaliter cohærentibus.

The genus is named in memory of Dr JAMES PARSONS, the author of a Dissertation on the Analogy between the Propagation of Animals and that of Vegetables, and of an unfinished work, entitled, " The Microscopical Theatre of Seeds." The Parsonsia of Brown, which Linnæus reduced to Lythrum, is a species of Cuphea.

LYONSIA.

Char. *Corolla* infundibuliformis, fauce tuboque esquamatis, limbo 5partito, recurvo, laciniis æquilateris: æstivatione valvata.

Stamina exserta. *Filamenta* medio tubo inserta, filiformia. *Antheræ* sagittatæ, medio stigmati cohærentes, lobis posticis polline vacuis.

Ovarium biloculare. *Stylus* 1, filiformis, apice dilatato.

Stigma subconicum.

Squamæ 5, hypogynæ, connatæ.

Capsula cylindracea, bilocularis, valvis folliculiformibus, dissepimento parallelo libero utrinque semenifero.

Habitus. *Frutex* volubilis. *Folia* opposita. *Cymæ* terminales, trichotomæ. *Flores* inter minores, limbo barbato.

Patria. Nova Hollandia.

Obs. This genus is perhaps too nearly related to the New Holland portion of Parsonsia, from which it differs chiefly in its fruit being capsular. It is named in memory of Israel Lyons, author of "Fasciculus Plantarum circa Cantabrigiam nascentium," and from whom Sir Joseph Banks received his earilest instructions in botany.

APOCYNUM. [Apocyni sp. *Linn. et Juss.*

CHAR. *Corolla* campanulata. *Tubus* denticulis 5, acutis, inclusis, laciniis limbi oppositis. *Faux* nuda.

Stamina inclusa. *Antheræ* sagittatæ, medio stigmati cohærentes, lobis posticis polline vacuis.

Ovaria 2, *Styli* subnulli. *Stigma* dilatatum, apice conico.

Squamæ 5, hypogynæ.

Folliculi graciles, distincti.

HABITUS. *Herbæ* perennes, erectæ. *Folia* opposita, membranacea. *Flores* cymosi.

PATRIA. America Borealis, et Europa Australis.

OBS. The Linnean genus Apocynum, at present contains many plants widely different from the species of which it originally consisted. Most of the spurious species I have already referred to different genera, and I here add specific characters of all the genuine species with which I am acquainted.

1. A. *androsæmifolium*, foliis ovatis glabris, cymis terminalibus lateralibusque, tubo corollæ calycem bis superante.

Apocynum androsæmifolium, *Linn.*

2. A. *cannabinum*, foliis lanceolatis utrinque acutis, glabris, cymis paniculatis, calyce tubum corollæ æquante.

Apocynum cannabinum, *Linn.*

3. A. *hypericifolium*, foliis oblongis glabris brevissimè petiolatis mucronatis: basi obtusa subcordata, cymis folio brevioribus, calyce tubum corollæ æquante.

Apocynum hypericifolium, *Hort. Kew.*

4. A. *pubescens*, foliis ovato-oblongis mucronatis; basi obtusis; utrinque cymaque breviore pubescentibus, calyce corollam subæquante.

Hab. In Virginia. *Mitchell*, in Herb. Banks. (ubi v. s.)

5. A. *Sibiricum*, foliis ovato-oblongis mucronatis glabris; basi obtusa, cymis terminalibus pedunculatis pulvereo-pubescentibus, tubo corollæ calycem superante.

Hab. In salsis desertorum Astrachanensium. *P. S. Pallas, M.D.* in Herb. Banks. (ubi v. s.)

6. A. *venetum*, foliis oblongo-ellipticis glabris mucronatis; basi subattenuata, cymis paniculatis lateralibus terminalibusque, calyce tubum corollæ æquante.

Apocynum venetum, *Linn.*

CRYPTOLEPIS.

CHAR. *Corolla* infundibuliformis. *Tubus* squamulis 5, obtusis, inclusis, laciniis limbi alternantibus. *Faux* nuda.

Stamina inclusa, imo tubo inserta. *Antheræ* sagittatæ.

Ovaria 2. *Styli* 0. *Stigma* dilatatum, apiculo conico.

Squamulæ 5, hypogynæ.

Folliculi. . . . . .

HABITUS. *Frutex* volubilis. *Folia* opposita, paginis discoloribus, inferiore venosa. *Corymbi* interpetiolares subsessiles brevissimi.

PATRIA. India Orientalis. (*Francis Buchanan, M. D.*, in Herb. Banks.)

PRESTONIA.

CHAR. *Corolla* hypocrateriformis. *Faux* coronata, *tubulo* annulari indiviso, *squamisque* 5, interioribus laciniis limbi alternantibus.

Antheræ semi-exsertæ, sagittatæ, medio stigmati cohærentes, lobis posticis polline vacuis.

Ovaria 2. *Stylus* 1, filiformis, apice dilatato. *Stigma* turbinatum apiculo angustiore.

Urceolus hypogynus, 1phyllus.

Folliculi. . . . . .

HABITUS. *Frutex* volubilis, tomentosus. *Folia* opposita, tomentosa. *Corymbi* congesti interpetiolares. *Calyx* foliaceus, laciniis basi intus squamulâ instructis.

PATRIA. America Meridionalis.

P. *tomentosa.*

HAB. In sepibus propè Rio de Janeiro, in Brasilia, detexit *Josephus Banks, Baronettus.*

OBS. This genus is named in memory of Dr CHARLES PRESTON, the correspondent of Ray, and styled by him, "eruditissimus vir, et curiosissimus stirpium observator." Many of his observations, chiefly on the more minute plants, occur in Ray's "Methodus emendata." Blair also mentions him as an ingenious and expert botanist.

BALFOURIA.

CHAR. *Corolla* infundibuliformis. *Faux* coronata, tubulo crenulato. Limbi laciniæ rectæ, æquilateres.

Stamina semi-exserta, fauci inserta. *Antheræ* sagittatæ, medio stigmati cohærentes, mucronatæ.

Ovarium biloculare. *Stylus* 1, filiformis, apice dilatato.

Stigma angulatum.

Squamulæ 10, basi calycis extra corollam insertæ: hypogynæ nullæ.

Folliculi. . . . .

HABITUS. *Arbor* inter minores. *Folia* opposita, lanceolato-linearia, falcata, denticulis interpetiolaribus. *Cymæ* trifidæ, laterales et terminales.

PATRIA. Nova Hollandia tropica.

OBS. I have named this genus in memory of Sir ANDREW BALFOUR, the founder of the Edinburgh Botanic Garden and Museum, of whose merits in natural history, especially in botany, an interesting account is given by his friend Sir Robert Sibbald, in a small volume, entitled, "Memoria Balfouriana."

NERIUM. [Nerii sp. *Linn. et Juss.*

CHAR. *Corolla* hypocrateriformis. *Faux* coronata, foliolis lacero-multifidis. Limbi laciniis tortis, inæquilateris ecaudatis.

Stamina. *Filamenta* medio tubo inserta. *Antheræ* sagittatæ aristatæ, medio stigmati cohærentes.

Ovaria 2. *Stylus* 1, filiformis, apice dilatato. *Stigma* obtusum.

Squamæ nullæ hypogynæ. . . . denticuli in basi calycis, extra corollam.

Folliculi cylindracei.

HABITUS. *Frutices* erecti. *Folia* terna, elongata, coriacea, venis numerosis, parallelis.

PATRIA. India Orientalis.

Obs. The only true species of Nerium are, *N. Oleander*, *odorum*, and probably *salicinum*, *Forsk.*

Nerium Zeylanicum and antidysentericum, form a very distinct genus, which I have named *Wrightia*. N. coronarium is probably a *Tabernæmontana*, and N. divaricatum, from an examination of the specimen in Hermann's Herbarium, on which this species entirely rests, I believe to be the same plant.——Nerium obesum, Forsk., seems to be *sui generis*: it cannot, at least, be a Nerium.

STROPHANTHUS, *Decandolle*. [Echitidis sp. *Linn.*

Char. *Corolla* infundibuliformis. *Faux* coronata squamulis decem, indivisis. Limbi laciniæ caudatæ.

Stamina medio tubo inserta. *Antheræ* sagittatæ, aristatæ, v. mucronatæ.

Ovaria 2. *Stylus* 1, filiformis, apice dilatato. *Stigma* subcylindraceum.

Squamæ 5, hypogynæ.

Folliculi. . . . . .

Habitus. *Frutices* sarmentosi. *Folia* opposita.

Patria. Africa Æquinoctialis, et India Orientalis.

SECT. I. B. *Coma ad extremitatem umbilico obversam (inferiorem) seminis.*

WRIGHTIA. [Nerii sp. *Linn.*

CHAR. *Corolla* hypocrateriformis. *Faux* coronata squamis decem, divisis.

Stamina exserta. *Filamenta* fauci inserta. *Antheræ* sagittatæ, medio stigmati cohærentes.

Ovaria 2, cohærentia. *Stylus* 1, filiformis, apice dilatato. *Stigma* angustius.

Squamæ 5-10, basi calycis extra corollam insertæ.

Folliculi distincti, v. cohærentes, placentis adnatis.

HABITUS. *Frutices* erecti, arboresve minores. *Folia* opposita. *Corymbi* subterminales. *Flores* albi. *Albumen* 0. *Embryo* cotyledonibus longitudinaliter inoclutis, albus, aquâ calidâ immersus roseus evadit!

PATRIA. India Orientalis, Zeylona, Archipelago Malaica, et Nova Hollandia tropica.

OBS. Gærtner has given an excellent account of the fruit of this genus, in his description of Nerium Zeylanicum, and he no doubt supposed, that the fruit of Nerium Oleander was essentially the same. It is, however, very remarkably different. And no genus is more distinct in habit, or more beautifully characterized than this, which I have dedicated to my much respected friend, WILLIAM WRIGHT,

M. D. F. R. S. L. & E., whose ardour in the pursuit of botanical knowledge, even while engaged in extensive medical practice, in the island of Jamaica, has long entitled him to this mark of distinction.

1. W. *antidysenterica*, foliis obovato-oblongis breviter acuminatis glabris, corymbis subterminalibus, tubo corollæ calyce 6ies longiore, folliculis distinctis.

Nerium foliis ovatis acuminatis petiolatis *Linn. Flor. Zeyl.* 107. fide speciminis in herbario Hermanni.

Nerium antidysentericum *Linn. sp. pl. ed.* 2. *p.* 306.

Hab. in Zeylona. *Herman*, et *J. G. Kœnig*, in Herb. Banks.

Obs. Codaga pala, *Rheed. mal.* 1. *p.* 85. *t.* 47. vix hujus loci, præsertim ob diversam figuram foliorum, et coronæ defectum; ideoque forsan Holarrhenæ species sit.

2. W. *Zeylanica*, foliis oblongo-lanceolatis subacuminatis glabris, corymbis terminalibus, tubo corollæ calyce 4-5ies longiore, folliculis distinctis.

Nerium Zeylonicum, *Linn. Amœn. Acad.* 4. *p.* 309*.

Hab. In Zeylona. Exemplar visum ex Herbario fuit D. Van Royen. nunc in Museo Banksiano.

Obs. Præcedenti nimis affinis, diversa præsertim figura foliorum, quæ etiam paulo minora sunt.

3. W. *tinctoria*, foliis elliptico-lanceolatis ovatisque acuminatis glabris, ramis corymbisque divari-

catis, corollæ tubo calyce duplo longiore, folliculis distinctis.

HAB. In India Orientali *J. G. Koenig, M. D.* et *Gul. Roxburgh, M. D.* in Herb. Banks. (ubi v. s.)

4. W. *pubescens*, foliis elliptico-oblongis acuminatis calycibusque pubescentibus, corymbis erectis, tubo corollæ calyce parum longiore, folliculis cohærentibus.

HAB. In Novæ Hollandiæ ora septentrionali Arnhenis Land, et in insula Timor prope Coepang, (ubi v. v.)

SECT. I. C. *Semina peltata, ciliata, utriusque extremitatis ciliis elongatis comosa.*

ALSTONIA. [Echitidis sp. *Linn.*

CHAR. *Corolla* hypocrateriformis, fauce tuboque esquamatis.

Stamina inclusa. *Antheræ* lanceolatæ, longitudinaliter polleniferæ a stigmate liberæ.

Ovaria 2. *Stylus* 1, filiformis, apice dilatato. *Stigma* subconicum.

Squamulæ nullæ hypogynæ, nec calycinæ.

Folliculi teretes.

HABITUS. *Arbores* sæpe proceræ, lactescentes. *Folia* verticillata vel opposita, costata, glabra. *Cymæ* terminales, paniculatæ. *Flores* sæpius albi. *Folliculi* plerumque longissimi.

Patria. India Orientalis, Archipelago Malaica, et Insulæ Societatis.

Obs. Had Linnæus examined the fruit of this genus, or even attended to the figure given of it in the "Hortus Malabaricus," (of which work, it is proper to observe, he had not a copy,) it is probable he would have distinguished it from Echites, to which it has so little affinity. As it is, I am happy in having it in my power to commemorate the merits of Dr Alston, the predecessor of Dr Hope, by so distinct and splendid a genus. The Alstonia of the Younger Linnæus, is, according to L'Heritier, a species of Symplocos.

1. A. *scholaris*, foliis verticillatis 5-7, obovato-oblongis obtusis costatis venaque margini approximata cinctis, cymis breviter pedunculatis, limbo corollæ parum barbatis, folliculis longissimis.

Pala, *Reed. mal.* 1. *p.* 81. *t.* 45. optima.

Lignum scholare, *Rumph. amb.* 2. *p.* 246. *t.* 82. quoad descriptionem, sed figura potius sequentis.

Echites scholaris, *Linn. mant.* 53.

Hab. In India Orientali et in Insulis Moluccanis. (v. s. in Herb. Banks).

2. A. *spectabilis*, foliis quaternis elliptico-oblongis sub-acuminatis costatis: margine simplicibus,

cymis pedunculatis folio brevioribus, corolla limbo barbato, folliculis longissimis.

HAB. In Insula Timor prope Coepang, cum floribus fructibusque Aprili 1803 observavi.

OBS. Præcedenti quàm maximè affinis, sed reverà distincta, nec malè ab icone cit. Rumphii repræsentata; descriptio autem A. *scholari* melius convenit.

3. A. *venenata*, foliis quaternis oblongo-lanceolatis, acuminatis basi attenuatis, cymis dichotomis, corollæ tubo sursum ampliato, limbo imberbi acuto, folliculis utrinque attenuatis folium vix æquantibus.

HAB. In India Orientali, *Gul. Roxburgh, M. D.* (v. s. in Herb. Banks).

4. A. *costata*, foliis oppositis elliptico-oblongis acuminatis costatis, cymis effusis, limbi laciniis imberbibus lanceolatis tubo longioribus, folliculis longissimis.

Echites costata, *Forst. Prod. n.* 123.

HAB. In Insulis Otaheité et Ulaietea, inter juga montium (insularibus Attahé nuncupata). *Josephus Banks Baronettus.* (v. s. in Herb. Banks.)

OBS. Rameth-valli, *Rheed. mal.* 9. *p.* 23. *t.* 14., which is given in Willdenow's *sp. pl.* 1. *p.* 1240., as a synonyme of this plant, differs in the shortness of the folliculi, and in having winged and naked seeds. Rheede also describes his plant as being a climber. The seeds of the Otaheité plant, which forms a moderate-sized tree, are distinctly ciliated; but I am not certain that the ciliæ are so remarkably elongated at each extremity, as in the other species; and it may, therefore, be a connecting link between this section of Apocineæ, in which I have placed it, and the nearly related genera Plumeria, Cameraria, and Vinca.

IV. *An Account of Five rare Species of British Fishes.*

By GEORGE MONTAGU, Esq; F. L. S. & M. W. S.

(Read 11th March 1809.)

NATURE opens her stores to us by slow degrees; and thus, by not unfolding all her treasures at once, the human mind is not only kept in constant expectation, but impressed with sentiments of the highest importance, by continual novelty, leading us to reflect on the infinite power and wisdom of that Being, whose wondrous works are daily and hourly multiplying upon our senses.

Among the animals whose powers of loco-motion are considerable, there are none that appear to have so little difficulty in transporting themselves, or so small a share of the vicissitudes of temperature to contend with, as fishes. Birds which are endowed with superior powers of transportation, have to contend with elements that frequently baffle their intentions, and subject them to imminent dangers: violent storms oppose their airy pinions, and frequently whole wearied flocks are precipitated into, and perish in the raging sea. Yet by far a greater variety of birds than of fishes appear to migrate to any considerable distance; although the latter can traverse the ocean in perfect security, during the most violent tempest, by keeping in the deep, where neither storms, nor change of temperature are materially felt.

This being the case, it appears extraordinary that so little has been added to the ichthyology of Great Britain since the days of *Ray*. But we may conclude the range of most fishes to be confined by certain sensations, or limited by certain laws, by which their nature is governed; and as all their wants are amply supplied within a small distance, they have little propensity to extensive migration. A few species, therefore, are found to visit us annually from the north; or perhaps to come in shoals, only from the deep ocean to the shallow waters, for the purpose of spawning more immediately within the influence of the sun's rays.

Mr Donovan, in his late publication on British Fishes, has given a few additions to those described by Mr Pennant; and I have the pleasure of submitting two others to the Wernerian Society,—one of which appears to be a non-descript, and the other so little known as perhaps to have occasioned a doubt of its existence as a distinct species. Both these are now in my museum, and the following are correct descriptions of them.

The first is of the *Apodal* order, but not sufficiently connected with any genus at present formed, to find a place : I have, therefore, been induced to constitute a new genus for the purpose. The head and forepart very much resemble the figure given of *Trichiurus Lepturus ;* but this being destitute of the caudal fin forbids our arranging them together. In the fins it comes nearest to *Ammodytes Tobianus*, or Sand-lance ; but the head, shape of the body, and other particulars, materially differ. Upon the whole, it comes nearest to *Ophidium aculeatum*, which differs from the rest of that genus in having a distinct caudal fin.

Under these circumstances I have thought proper to affix to it the following generic characters, together with the title of

ZIPHOTHECA.

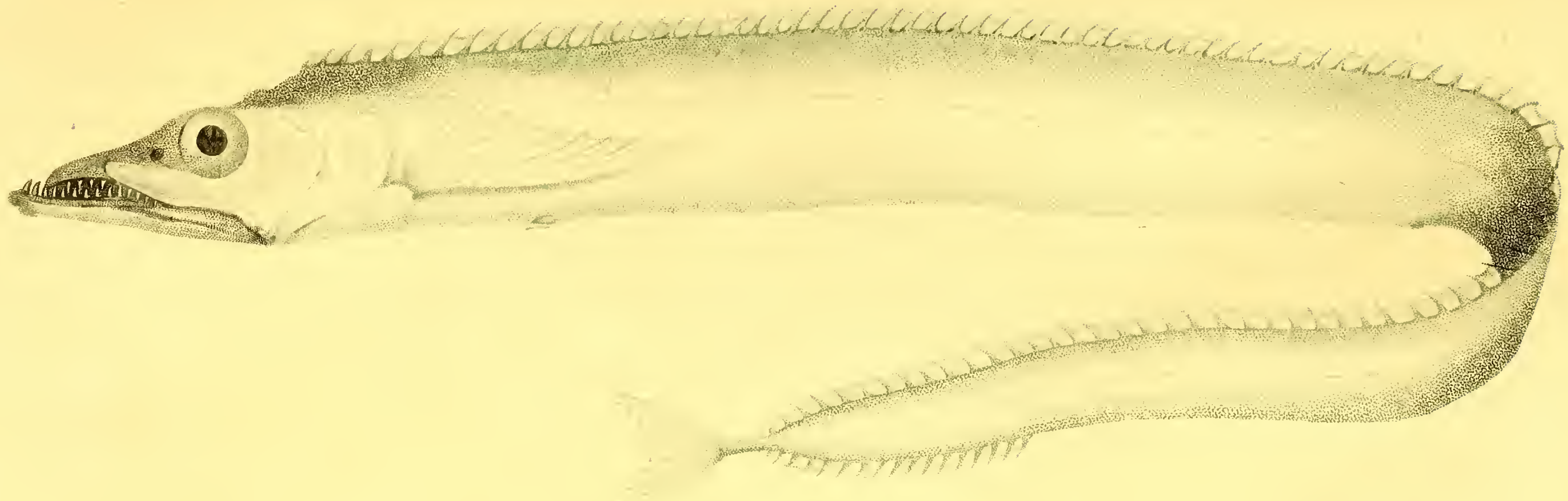
Head lengthened : teeth surrounding the jaws in one row, the foreteeth longest, semi-sagittate : eyes large, lateral : body compressed, carinated, ensiform : dorsal, anal, and caudal fins distinct : two small scales on the abdomen in the place of ventral fins.

Z. TETRADENS. (Pl. II.)

The length of the fish is five feet six inches depth at the gills four inches and a half, and from thence to the vent the size is nearly the same; from the vent it gradually decreases to the commencement of the anal fin, where it is about two inches in depth; and afterwards decreases more suddenly to the end of that fin, where it becomes nearly round and about half an inch in diameter: its thickness just behind the gills scarcely exceeds one inch and a quarter; behind the vent one inch and one eighth; at the commencement of the anal fin, five eighths of an inch; and across the gills, one inch three quarters. The weight, without the intestines, was six pounds one ounce. The shape is completely ensiform, being much compressed, and equally carinated above and beneath, except the head, which is flat on the top; and the eyes placed lateral, and as distant as the thickness of the head will admit: the head * is porrected, and conic, the under jaw the longest by half an inch, terminating in a callous fleshy projection beyond the teeth: each jaw is furnished with an irregular row of extremely sharp-pointed teeth, standing very conspicuous, even when the jaws are closed; those in the under, are about twenty in number on each side; in the upper, not quite so numerous, but in this jaw there are four large teeth in front, (hence the specific name *tetradens*),

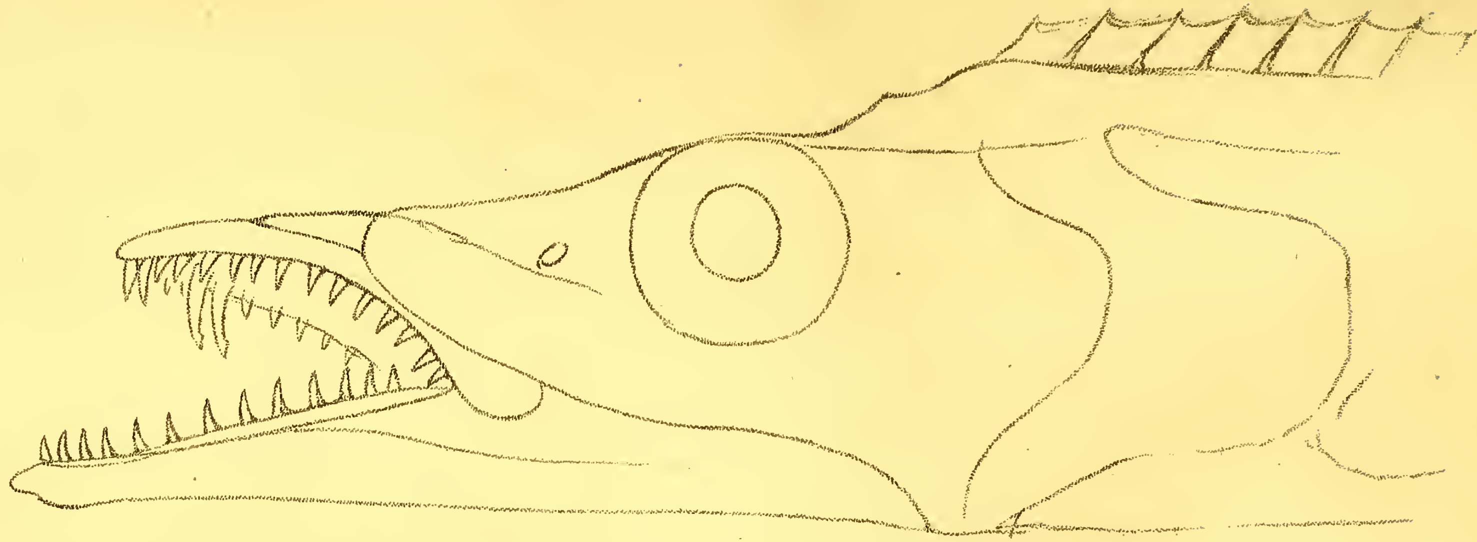
* Plate III.

Plate II



Montagne del

E. Mitchell sculp.t



Engr.d by E. Mitchell

with which the other is not furnished; two fore-teeth approximating; and two larger canine, which are rather crooked and compressed, with a slight process or barb on the inside near the point; these are three quarters of an inch in length*: the tongue is smooth, and, like the inside of the mouth, silvery: the roof of the mouth is furnished with a row of minute teeth on a prominent bone on each side: the branchiostegous rays were injured, and the gills were taken out, except one left by accident, which was furnished with teeth on the inside of the arched bone: the eyes are very large, being nearly one inch and three quarters in diameter, independent, not covered with the common skin; irides silvery, nostrils ovate, placed just before the eyes: gill-coverts of one very thin plate: pectoral fins five inches long, consisting of twelve rays, the lower ones exceeding the upper by one half: instead of ventral fins there are two oblong silvery scales, half an inch in length, partly detached from the body, and connected to each other at the base; these are situated considerably behind the pectoral fins: the anus is about half way between the two extremities: the anal fin commences at about eleven inches from the end of the tail, and runs within one and a half of the caudal fin, containing seventeen rays: the dorsal

* This pair of teeth does not interrupt the line of the smaller teeth, but stands within them.

fin arises on the back of the head, and continues uninterrupted till it reaches the posterior end of the anal fin, and consists of one hundred and five rays, increasing in length from one inch and a quarter, to one and three quarters near the tail; the three first rays are sub-spinous, the rest soft: the caudal fin is about three inches long, and forked: the lateral line is slightly elevated, and runs straight, in a middle direction, till it approaches the head, and then gradually rises, and terminates over the gills: the colour of the skin, which is quite smooth and destitute of scales, is like burnished silver, with a bluish tint.

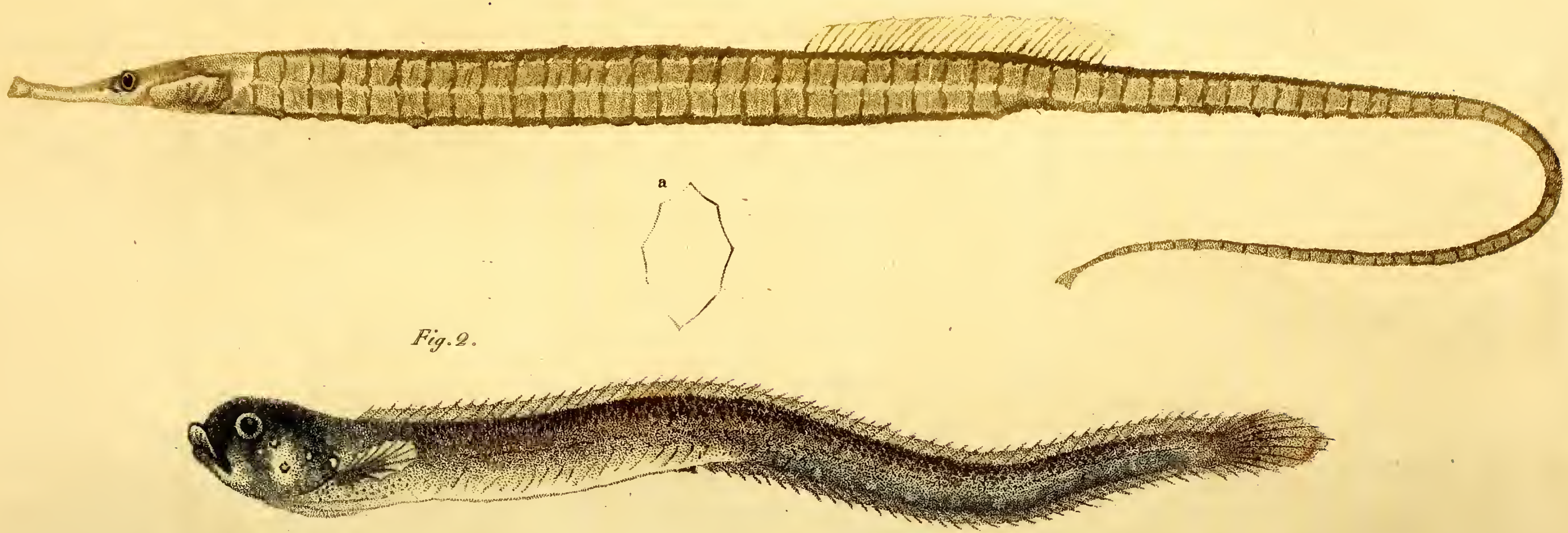
This singular fish was taken in Salcomb harbour on the coast of South Devon, on the 4th of June last (1808). It was swimming with astonishing velocity, with its head above water;—to use the fisherman's expression, "going as swift as a "bird;" and was killed by a blow of an oar.

It was made a public show in Kingsbridge, where in one day a guinea was taken for its exhibition at one penny each person. It was embowelled before I first saw it; and to prevent the destruction of so valuable an acquisition to natural history, I prevented a journey intended for it the next day to a distant fair, from whence had it ever returned it would not have been (as it was now warm weather) a fit subject for preservation, or minute description.

In preparing this fish, I observed within the skin, on the abdominal parts, a great many small

P. 83.

Plate IV.



Engr.d by E. Mitchell.

ascarides, pointed at each end, and of a whitish colour: they were all coiled up in a spiral manner. On the head, beneath the skin, and along the root of the dorsal fin, were several of a species of *echinorhynchus*, of a yellow colour, nearly two inches in length, and more than one eighth of an inch in diameter: the proboscis short, with a round termination furnished with spines: the anterior end of the body sub-clavated, with a groove each side: posterior part wrinkled, and obtusely pointed.

These *vermes* had formed sinuses under the skin, and were firmly attached by one end. I do not find this species described.

SYNGNATHUS ÆQUOREUS.

(Pl. IV. Fig. 1. Section of the Body, a.)

Syngnathus æquoreus, *Gmel. Syst.* p. 1456.—*Shaw, Gen. Zool.* v. p. 454.

There appears to be some confusion relative to the slender species of that genus of fishes termed *Syngnathus*. Mr Pennant originally described three species as British, namely, the *barbarus*, or longer, *acus*, shorter, and *ophidion*, or little pipe-fish. The *typhle* is also mentioned in the "British Zoology," but with a remark, that the author joins with Gronovius in thinking it only a variety of *acus**. To this opinion I am ready to subscribe, notwithstanding a late author has attempted to define the two species; for, in the vast abundance that have come under my inspection, considerable variation in the size of the snout in proportion to the head has been noticed, as well as the bulk of the body in proportion to the length, the colour, and carina or angle on the belly; and it must be confessed, nothing has appeared sufficient to constitute two species, nor have I been able to find any description of *typhle* sufficient to characterize a distinction from *acus*. By consulting various authors, it is observable, that both these supposed species vary considerably in the number of rays in the dorsal fin, and that the anal is, from its minuteness, sometimes overlooked. The distinction, therefore, of these, is by no means made evident; but we have an additional species given to us as British by Mr Donovan, the *Syngnathus pelagicus*. This is destitute of the anal fin, but resembles the *acus*, in being possessed of the dorsal and caudal fins, and in being heptangular; but the form is said to be more slender, the snout comparatively less, and the whole length of the fish rarely exceeds five or six inches.

It might indeed be doubted, whether this is actually the *pelagicus*, since the figure in Bloch

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* The figures in tab. xxiii. Br. Zool. are numbered wrong: 60. and 61. should be reversed.

is referred to by Gmelin, who expressly assigns to the anal fin four rays, if we did not know that that fin is frequently so inconspicuous in other species as to occasion its being overlooked.

Mr Donovan, in a note of interrogation, says, "May not Pennant's figure, plate 23. vol. iii. of the *British Zoology*, be taken from a fish of this species, in which the pectoral fins and tail were dried up, or had been destroyed by accident?" It is true, the figure alluded to has no visible pectoral fins; but the description of that author particularly specifies that fin to have twelve rays, which, together with its being destitute of the caudal fin, brings it nearer to the *barbarus* of Linnæus, and of which the existing doubt consists in that fish having been originally described as destitute of anal fin, whereas Mr Pennant states that fin of his fish to have three rays; but this circumstance may be reconciled, as before stated with regard to other species, the anal fin being so extremely small as readily to pass unnoticed, by even an attentive observer, without the aid of a lens.

Here, then, we have four British species of *Syngnathus*, independent of the doubtful one *typhle*. To these I have the satisfaction to add, that which appears to be the Æquoreal Pipe-fish, a species originally described by Linnæus, and which, I believe, has not since been identified by any author.

Length, twenty inches and a half, viz. ten to the vent, and ten and a half to the end of the tail: the snout is similar to that of *acus;* its length to the eye three quarters of an inch; from thence to the end of the gills including the eye, one inch: the form of the body is rather compressed, and angular, with an acute dorsal, and abdominal ridge, which, together with three slight angles on each side, gives it an octangular appearance: it is of equal size from the gills to the vent, which part contains about thirty plates; from the vent to the extremity of the tail it is almost round, and extremely taper, containing about sixty-six plates: immediately behind the vent, the body of this specimen suddenly decreases to one-third less in diameter; but this may be a sexual distinction.

The dorsal fin consists of forty rays, commencing considerably before the vent, and terminating rather behind it, so that three-fourths of the fin is before the ventral aperture. It has neither pectoral nor anal fin. The end of the tail is extremely small, and compressed into a spurious fin, the rays of which are enveloped in the common skin, and are scarcely definable by a lens, and not visible to the naked eye. The colour is yellowish, with transverse pale lines, with dark margins, one in each joint, and another down the middle of each plate, giving it the appearance of possessing double the number of joints it really has: these markings, however, cease just beyond the vent.

This fish was taken at Salcomb, in the year 1807, and selected from the common species, by a fisherman in the habit of collecting for me, and who remarked that he had never before seen one of the kind.

Another specimen, of about fifteen inches in length, has been picked up on the same coast this summer, in a dried state, but apparently perfect.

In this there is no visible caudal finlike extremity, although the point of the tail is compressed: the angle on the back and belly is also less defined: but the dorsal fin is similarly situated, and consists of the same number of rays, and the number of plates on the body is very nearly similar.

This is the only species of Syngnathus (ophidion excepted) that is destitute of the pectoral fins, and therefore the lower figure but one in Tab. 23. of the "British Zoology" might have been referred to for it, had not the description of the Longer Pipe-fish, for which that figure is intended, clearly evinced that the defect of those fins originated with the draughtsman.

The *ophidion*, according to some authors, grows to the length of two feet; such, most certainly, do not inhabit our shores; at least, it has never fallen to my lot to see one at all approaching to that magnitude; and I should not be in the least surprised, if a different species had been figured by some authors for *ophidion*. For instance, nothing can be more evidently distinct than Fig. 3.

in Tab. xxiii. of the "British Zoology," and the *Snake Pipe-fish* of the "General Zoology," V. tab. 179., both given for the Linnean *ophidion*. The former has, I believe, been generally considered by the ichthyologists of our own country, as the true *ophidion*, and is the most common species on our coasts; and, as Mr Pennant justly remarks, seldom exceeds five inches in length, and is remarkably short in the snout. The latter has not only a long snout, but the dorsal fin is not situated, with respect to the vent, as in the generally accepted *ophidion* of our shores, and as properly defined in the "British Zoology," but more like what I have described to be in the *æquoreus*; that is, the vent is more nearly opposite the posterior part of the dorsal fin, whereas, in the *ophidion*, it is, *vice versâ*, nearest the anterior end. These circumstances cannot well be reconciled, without concluding, that the larger specimens, described as *ophidion*, are, in reality, that variety of *æquoreus* above mentioned, in which the angles are less defined, and the caudal fin inconspicuous, in which state it pretty well accords with the Linnean specific definition of *ophidion*,—"*pinnis caudæ ani pectoralibusque nullis, corpore tereti.*"

Plate V.

Fig. 1.

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Fig. 2.

Engr.d by E.Mitchell.

CYCLOPTERUS MONTAGUI.

(Pl. V. Fig. 1.——Part of adhesion, a.)

Diminutive Lump-sucker. *Don. Br. Fishes*, iii. tab. 68. (young.)

Turton, Br. Fauna, p. 115. No. 157.

At the time Mr Donovan was publishing his work on British fishes, I sent him a drawing of a very minute species of Sucking-fish, accompanied with a description, which he thought proper to publish, and, in compliment, gave it the above title. I had at that time taken only two or three of this very diminutive species, which were, in every respect, similar to each other, and by that circumstance alone, could an opinion be formed as to the probable size of the fish in an adult state.

After the third volume of the *British Fishes* was completed, I sent Mr Donovan another fish of the same genus (which was taken in the same place), double the size of the former, and of a more robust make. By the comparison of these fishes, I really suspected them to be actually belonging to the same species, and that this last was, in fact, only a more matured specimen; but, without mentioning my conjecture to Mr Donovan, I requested him to give me his opinion, which he did, by expressing his suspicion that it was of the same species.

This confirmed me in my opinion; for although there is a considerable difference both in shape and colour, such variation must be attributed to incidental circumstances attendant on the infant state, not less observable in many other fishes. I have been equally puzzled with the fry of *Cyclopterus bimaculatus*, which are of a green colour, minutely speckled with blue, and without the smallest trace of the pectoral spots: in this state, the body is proportionally longer, and differs a little in the shape of the fins. The *C. Cornubicus*, when very young, are also destitute of the two dorsal ocellate blue spots, and the tail is frequently most elegantly barred *.

As this difference might hereafter lead to some confusion without explanation, and as Mr Donovan has not, in the subsequent part of his work, given any additional figure or description, I have thought it proper to submit a figure of it to the Wernerian Society, together with descriptive remarks.

The *Cyclopterus Montagui*, in the adult state, is about two inches long: the body is rounded as far as the vent; the posterior end somewhat compressed: head broad, a little depressed, and inflated about the gills: mouth moderately large; both jaws armed with several rows of minute teeth: eyes small, and placed high; irides, golden; pupil, dark blue, and when alive, angulated at the

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* The name of this species has lately been unfortunately changed for that of *ocellatus*.

upper corner: the dorsal fin commences a little behind the gill-coverts; the rays of the anterior part are very obscure; about twenty-six may be counted, which at first are very short, but gradually increase in length, forming a broad fin towards the tail; but those close to the tail are short, giving the termination of this fin a rounded appearance: the anal fin consists of about twenty-four rays, formed similar to the last, but neither unite with the caudal fin: the pectoral and ventral fins unite, forming about twenty-nine rays; the first is rounded; in the last, the four or five lower rays are only connected at their base, and the fifth is much the longest, forming an angle at that part: the caudal fin has twelve rays, the outer one shortest, which gives it a slightly rounded appearance: the opercula of the gills project into an angle: the instrument of adhesion is single, small, circular, and composed of thirteen concave tubercles on the radius; in the disk, which is concave, there are four or five lateral curved lines, originating from each side of a central longitudinal line: the vent is far removed from the sucker: the belly is very tumid: the front of the head, above the upper lip, is scalloped with six indentations, beneath which the lip protrudes a little: between the eyes, or a little farther forward, are two minute erect tubes; and in front of those, two small holes, probably the nostrils.

The colour is purplish-brown in appearance to the naked eye; but by the assistance of a lens, the ground colour is dull orange, covered with minute confluent spots of the former; the under parts are paler, and about the throat and sucker, white.

This species of *Cyclopterus*, like the *Cornubicus* or Jura-sucker of Pennant, inhabits only the rocky parts of the coast, and of course is rarely taken by the dredge: those I have obtained, were taken at extraordinary low tides, among the rocks at Milton, on the south coast of Devon, one instance excepted; and the number altogether has not exceeded a dozen.

When it is adhering to a rock, the posterior part of the body is frequently turned to one side, nearly parallel with the anterior part, and the tail brought close to the head. In this particular, however, it is not singular, as the Bimaculated Sucker is frequently observed in that position. This last-mentioned species has something peculiar in its eyes, which deserves notice: they are extremely prominent, capable of very considerable motion, and are independent of each other; one is frequently turned upwards, while the other is looking downwards; but, what I never could observe in any of the other species is, that the eye revolves within a fixed transparent sphere, which protects that delicate organ.

OPHIDIUM IMBERBE.

(Pl. IV. Fig. 2.)

Ophidium imberbe, *Linn. Syst. p.* 431. *Gmel. Syst. p.* 1147. *B. Zool. App. t.* 93. *Shaw, Zool.* iv. p. 70.

This species of *Ophidium* may be considered as one of the most rare of the British fishes, and indeed so little known as to have caused others to be described for it. Mr Pennant first introduced it into the *fauna* of British Zoology, but has given no description of it, and the figure above referred to is by no means correct. All we know, therefore, is that it was taken at Weymouth.

None of the more modern authors seem to have identified this fish; but Artedi and Gronovius are referred to. Gmelin is certainly mistaken in refering to 401 of the latter author; for that species is not only described to have double the number of rays it actually has in the dorsal fin, but is also destitute of caudal fin, which at once separates it from the present subject.

Considering it would not be unacceptable to the Society and to the lovers of science in general, to have a good representation of this rare fish to refer to, the drawing of a small specimen lately taken on the south coast of Devon, will accompany this, and of which the following is a correct description.

Length about three inches: depth about a quarter of an inch. Pectoral fin furnished with eleven rays : dorsal about seventy-seven : anal forty-four : caudal eighteen or twenty. The head is very obtuse, and rounded in front: eyes large, placed forward, and lateral; irides dark, with a circle of silver round the pupil: mouth, when closed, inclines obliquely upwards; the lips are marginated: the gill-membranes inflated beneath. The body is ensiform, considerably compressed towards the tail, and in shape is not unlike *Cepola rubescens :* the lateral line is nearly in the middle, originating at the angle of the operculum to the gills, but rather obscure : vent nearly in the middle : the pectoral fin is rounded : the dorsal fin commences immediately above the base of the pectoral, and is at first not so broad, and usually not so erect, as the other part, which accounts for the defect of the figure given in the "British Zoology," in not having that fin continued to the head : the anal fin commences at the vent, and, together with the dorsal, unites with the caudal fin, which is cuneiform, but obtusely pointed. The colour is purplish-brown, disposed in minute speckles; and along the base of the anal fin are about ten small bluish-white spots regularly placed, but scarcely discernible without a lens, and possibly peculiar to younger fishes : all the fins are like in colour to the body, except the pectoral and caudal; the first is pale, the last is yellowish.

It died with its mouth shut, the pectoral fins thrown forwards, and the body curved a little near the vent, throwing the head upwards.

It does not appear to be very tenacious of life, like some of the blennies, as it was placed in a tin box with the Crested and Smooth Blenny, covered with wet algæ, and although these were lively, the *Ophidium* was dead before it could be got to my house.

Little can be said of the natural habits of this fish; but as it so rarely occurs, it is most probably an inhabitant of the rocky parts; in such a situation at low water, the specimen here described, was taken.

The *Ophidium barbatum* has been introduced into the catalogue of British fishes, and I believe, was first given as such in Berkenhout's "Outlines," but whether on the personal authority of that author, or on what part of the British coast it was observed, no mention is made. Upon comparison of the *imberbe* with the figures of *barbatum* delineated by Bloch and Dr Shaw, there appears to be a considerable difference in colour and other particulars, independent of the *cirrhi* with which the *barbatum* is furnished, so that if any doubts have existed with respect to the identity of *imberbe* as a distinct species, from its very rare occurrence, the figure which accompanies this description will, it is presumed, remove them.

BLENNIUS GALERITA.

(Plate V. Fig. 2.)

A FISH, in some particulars corresponding with the description usually given of the Crested Blenny, has several times occurred to me on the western coast; but upon comparing it with that described by Gmelin and Dr Turton, there appears such a material difference in the number of rays in the fins, especially in the dorsal, that either some unaccountable mistake must have originally happened, or it cannot possibly be the same species. My doubts on this subject are not the least removed by consulting the figure in the *British Zoology*, in which the dorsal fin is extremely narrow, and continued in a straight line throughout, and the anal fin is of a corresponding breadth; whereas, on the contrary, in my fish, these fins are very broad, and the first has a remarkable flexure in the middle; neither possess above half the number of rays they are generally described to have, and that, in so large a number as sixty, is too great a difference to be considered as an accidental variety. Dr Turton says, of these sixty rays, fifty are spinous. This adds new difficulties to our inquiries, since my fish has all the rays soft.

Bloch does not appear to have described this species; nor is it figured in the *British Fishes*. In the *General Zoology*, *British Fauna*, and *Elements of Natural History*, the most modern publications, no light is thrown on the subject; all that is there said about this blenny is borrowed, and nothing is to be met with that can reconcile any description I have been able to examine, or the only figure I could consult, with the fish in question; yet, unwilling to give it as a new species until the subject shall be more thoroughly sifted, (and which is so much obscured by its rarity), I shall submit the following description of my fish, accompanied by a figure, to the opinion of the ichthyologists of the Wernerian Society, who may choose to offer some remarks upon the subject.

Body rather more slender than the Smooth Blenny. Head much sloped; eyes high up, approximating, gilded; the upper lip furnished with a bony plate that projects at the angles of the mouth into a thin lamina that turns downwards, the ends of which are orange-coloured: on the top of the head, between the eyes, is a transverse, fleshy, fimbriated, membrane; the *fimbriæ* of a purplish-brown colour tipped with white: the nostrils furnished with a minute bifid appendage: behind the crest are several minute, erect, filiform *appendiculæ*, between that and the dorsal fin, placed longitudinally: the lateral line considerably curved near the head: the pectoral fins are large and ovate, consisting of twelve rays reaching as far as the vent: the ventral fins, two unconnected rays: the dorsal fin extends from the head to the tail, consisting of thirty rays, and appears like two distinct fins, by reason of the slope to the thirteenth ray, which is not above half the length of the anterior ones, and the sudden elongation of the fourteenth ray; this fin is very broad, and in one specimen there was an ovate black spot between the first and second ray, and another obscure one between the next rays, but this is not a constant character. The anal fin is equally broad, and extends from the vent to the tail, consisting of eighteen rays usually margined with black, and tipped with white: caudal fin slightly rounded, composed of fourteen rays. The colour above is generally olive-green spotted with pale-blue shaded to white; the belly white, and the pectoral fins spotted with orange.

Not fewer than eight or ten of this species have come under my inspection, the greater part of which did not exceed an inch and a half in length; but two at present before me measure nearly two inches and a half, and differ in nothing but the spots on the dorsal fin. There is no triangular lump on the head, as described by Mr Pennant; nor is the crest capable of being erected, at least no voluntary motion could be observed while the fish was examined alive in sea-water; but this appendage is invariably transverse, and generally conic or angular, but sometimes irregularly truncated, though always fimbriated.

Many of the genus *Blennius* are more or less crested; but the *Galerita* appears to be the only species hitherto described, which has that appendage placed transversely.

This, as well as the *Gattorugine*, is occasionally taken, with the *Pholis* or Smooth Blenny, among the rocks on the south coast of Devon, in the pools left by the receding tide, and of these the *Gattorugine* may be esteemed the most rare, as only two instances have occurred in many years research*.

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* A very respectable author says, the Gattorugine has two pairs of ramified tentacula on the head, the first pair over the eyes, the other over the back of the head. It is usually described to have only one pair, and those I have examined had only one branched appendage on each eyebrow, but the nostrils are tubular, and fimbriated.

V. *Elucidation respecting the Pinna ingens of* PENNANT'S "*British Zoology.*"

By Captain J. LASKEY, M. W. S.

(*Read, 11th June* 1808.)

FROM the time when Mr Pennant first published his "British Zoology," in 1777, a doubt has occurred with regard to this shell, which, to the best of my knowledge, has never been removed. Singular good fortune having lately brought under my view, the different shells described for Pinna ingens by various authors, I am enabled to describe precisely what Mr Pennant had so indefinitely stated, and by that means, created those doubts under which every writer on conchology has laboured since; and although the subject of this paper may appear of little importance, I am still confident the elucidation of any doubtful point in Natural History, will meet with due attention from this Society.

I shall therefore proceed to point out from the works of a few conchological writers, since the time of Pennant, the errors and doubts into which he has led them. The fact is, every writer has followed his own ideas on this subject, no definite distinctive characters having at first been established.

Mr Pennant, in vol. iv. page 115. of his "British Zoology," states as follows: "*Pinna* "*ingens.*—I saw specimens of some vast pinna, "found among the farther Hebrides, in the col-"lection of Dr Walker of Moffat: they were "very rugged on the outside, but I cannot recol-"lect whether they were of the kind found in the "Mediterranean or West Indies."

Mr Donovan, in his "Natural History of British "Shells," plate 152., figures and describes a pinna dredged on the coast of Shetland, now in the cabinet of A. Macleay, Esq; and names it *Pinna lævis.* He is induced to give it this name, he says, "from the "difference to any other shell of this genus before "described, as British," (and adds,) "if we are "not mistaken, from either the Linnean or "Gmelinian species of the genus also;" though it appears clear, that if Pennant's definition of Pinna ingens had been referred to, a strong characteristic would have been found, viz. the ruggedness of the outside. This would have agreed well with Mr Donovan's description, "Valves rugose on the "posterior parts."

Mr Stewart, in his "Elements of Natural His-" tory," mentions, in course, this shell, and says, in vol. ii. page 381. that "a very large species "was found by Dr Walker, off the island of "Barra, in 1764, called by him *Pinna borealis*."

In the "Testacea Britannica," of that laborious and able conchologist, George Montagu, Esq; page 180., he describes a shell under the name Pinna ingens, discovered by him in Salcombe Bay on the south coast of Devonshire; and he adds a full and circumstantial description of the same, but unfortunately is led into an error by observing a few concave spines on his specimen; for which reason he quotes a synonyme from Lister, but with a note of interrogation expressing his doubt. On referring to this synonyme, and the plate given by Lister, we find the shell to be the Pinna muricata. The similarity of shape also tended to mislead this author. Where no perfect description has been given, or any figure or true synonyme to follow it up, vague conjecture must necessarily be the result. This accurate conchologist seems, however, to be the only one who has formed any just idea of the shell of Pennant, as, in his account, page 181., he gives the description from Pennant, and adds, "Mr Pennant seems to be the only "one who has made mention of this shell, and "that under the denomination of Pinna ingens." In his Appendix, page 583, he appears to be farther confirmed in this opinion, and says, "This "species is doubtless the same as Mr Pennant "noticed in the cabinet of Dr Walker of Moffat."

We next find Pinna ingens, noticed in the 7th vol. of the "Linnean Transactions," in a long and elaborate paper on British Conchology, by Dr Maton and the Reverend T. Racket. From their account a doubt also exists with them; for after having noticed the shell described by Mr Montagu, and the one figured by Mr Donovan, they add, "Specimens from Scotland and the "western coast do not appear to differ; and "there is great probability that this is the species "mentioned by Pennant."

Having thus pointed out the doubts and errors that have arisen respecting this shell, it falls to my lot to clear up the mystery. This (as already hinted) I am fully enabled to do, by having in the first place received specimens from my friend Mr Montagu, of his Pinna ingens of the western coast, and by having seen the Pinna lævis of Donovan; and lastly, through the kindness of my friend P. Walker, Esq; of Drumsheugh, who obligingly offered me the inspection of the original specimen, remaining in the cabinet of the late Dr Walker of Moffat. I am therefore confident in saying, that the Pinna ingens of Pennant, the Pinna ingens of Montagu, the Pinna lævis of Donovan, the Pinna borealis of Stewart, and the

Pinna ingens of the " Linnean Transactions," are one and the same species of shell.

It will, perhaps, be agreeable to conchological readers, to see Dr Walker's account of this shell, as transcribed from his MSS. *Catalogue raisonnée*, page 665. in his own handwriting: " No. 2268. *Pinna* " *borealis*.—It was brought up on a fishing-hook " with the animal alive in it, thirty miles E. N. E. " of Zetland. It is different, I think, from all the " Linnean species, and different also from all those " figured by Gualtieri, Seba, and D'Argenville. " It is the same with the *feaskand* (its Gaelic " name) I found in Barra."

VI. *Mineralogical Queries, proposed by* Professor Jameson.

(Read, 9th April and 14th May 1808.*)*

I. General Queries.

1. Can we discern a general direction and dip of the strata in Great Britain and Ireland; or is not the direction and dip rather conformable with that of the fundamental rock of the districts where the strata occur *?

* In Humboldt's "Sketch of the Mineralogy of South "America," in the *Journal de Physique*, we meet with the following observations: "What I have long said, "that the direction and inclination of the primitive stra- "ta, the angles which they form with the meridian of "the place, and with the axis of the earth, are indepen- "dent of the direction and inclination of mountains; that "they depend on laws; and that they observe a general "parallelism, which can be founded only in the motion

2. If there is a general direction and dip of the strata, is it confined to the primitive rocks, or does it not also extend to the transition and flœtz formations?

"and rotation of the earth: What Friesleben, Von Buch, "and Grüner, have proved better than I,—will be found "confirmed, namely, That the succession of the flœtz-"strata, which was considered as a peculiarity of certain "provinces, such as Thuringia and Derbyshire, takes "place generally; and that there appears an identity in "the order of the strata: from whence, there is reason to "conclude, that the same deposition has been effected at "the same time over the whole surface of the globe. All "these ideas are of the greatest importance, not only to "the philosopher, who endeavours to rise to general "principles, but also to the miner, who must conceive in "his mind what he has not before his eyes, and guide "himself by analogy deduced from actual experience."

As the sketch of the geognostic structure of South America, above alluded to, was written during a journey attended with every difficulty, and transmitted to Europe in the form of letters to different individuals, it is not surprising that it contains a few errors; and one of the most striking of these, is contained in the concluding paragraph of the quotation. wherein Humboldt claims for himself, and the celebrated pupils of Werner, Von Buch, Friesleben, and Grüner, the discovery of the universality of formations,—a doctrine which they, for the first time, heard proposed and explained by WERNER, at the Academy of Freyberg.

3. If a general direction and dip occurs amongst the strata of which the crust of the earth is composed, is it the same in the three great classes of rocks,—in primitive, transition, and flœtz ?

4. Is it probable that iron, and other metals allied to it, occur in greater quantity in the north-polar, than the equatorial regions ; and does it appear probable, from the observations hitherto made, that silver and other metals oryctognostically and geognostically allied to it, occur far more abundantly in the equatorial than the polar regions ?

5. Is it probable that quartz will be found to be the oldest rock of the crust of the earth ?

II. Particular Queries.

A. *Geognostical Queries.*

a. *Scotland.*

1. Does the granular rock, of Fassneyburn in East Lothian, belong to the tran-

sition-rocks or the newest flœtz-trap formation* ?

Some time ago, I visited Fassney-burn, with the view of ascertaining whether or not this rock was granite, as asserted by Professor Playfair †. The rock appeared to me, to resemble certain varieties of sienitic greenstone; but I could not afford time to determine its geognostic relation to the transition-rocks which form the great proportion of that part of the county.

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* Since this query was proposed, Dr Ogilby of Dublin has examined the country around Fassney, and is of opinion, that the rock is greenstone, and belongs to the transition class.

† "Another instance of real granite disposed in regu-
" lar beds, but without any character of gneiss, is one
" which I saw in Berwickshire, in Lammer-muir, near
" the village of Priestlaw. The little river Fassnet, cuts
" the beds across, and renders it easy to observe their
" structure. The beds are not very thick; they run
" from about S. S. W. to N. N. E. like the schistus
" on either side of them. I was in company with Sir
" James Hall when I saw these rocks. We examined
" them with a good deal of attention, and traced them
" for more than a mile in the bed of the river; and, if I
" mistake not, our opinions concerning them were pre-
" cisely the same."

PLAYFAIR'S "Illustrations," p. 328.

2. Does claystone occur in beds in the coal-fields of the Lothians?

Claystone occurs in different parts of the Lothians; but it appears in general rather to rest upon the coal-formation, than to form beds in it. It may, however, occur in beds, as a similar rock occurs in beds in the coal-formation of the Plauischen-grunde between Tharand and Dresden.

3. Are the geognostic relations of the porphyry-slate of East Lothian, similar to those observed in that rock in other countries?

At the Girleton Hills near Haddington, the porphyry-slate is associated with claystone-tuff and probably also claystone,—rocks that are not mentioned by Werner, as occurring along with porphyry-slate in Saxony, Bohemia, and other countries. This fact would incline us to conjecture, that the porphyry-slate of that district has something peculiar in its geognostical characters.

4. What are the geognostic relations of the claystone, compact-felspar, and clinkstone, of the Pentland hills near Edinburgh?

The fundamental rock of the Pentland hills, is in some places grey-wacke and grey-wacke-slate; and the newer rocks, viz. those that lie over this older rock, are conglomerate, claystone-tuff, trap-tuff, claystone, compact-felspar, clinkstone, porphyry-slate, and sandstone. I have not as yet been able to determine with certainty to what formation or formations they belong.

5. Are the upper parts of the Lomonds in Fifeshire, of Tinto in Lanarkshire, and of the Eilden hills in Roxburghshire, composed of rocks belonging to the newest flœtz-trap formation?

From the general nature of the rocks in Fifeshire, and the conical shape of the Lomonds, it is probable that they are composed of sandstone, and other older flœtz rocks, which are caped with rocks of the newest flœtz-trap formation*. The rather conical shape of Tinto, a hill apparently situated in transition country, renders it probable that rocks of the newest flœtz-trap formation, form at least its upper part. The Eilden hills have also somewhat of a conical shape, are situated in transition country, contain compact-felspar, and claystone, and hence they probably belong to the newer flœtz rocks.

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* Since the above query was proposed, I have visited the Lomonds, and find, that the wester hill is principally composed of sandstone, caped with basalt: the easter hill appears rather to be caped with greenstone, but of this I am not perfectly certain.

6. To what formation do the Castle-rock of Edinburgh and the Calton-hill belong?

A part of the Calton-hill appears to belong to the newest flœtz-trap formation. The principal rocks are trap-tuff, amygdaloid, and porphyry-slate; but we have still to ascertain, whether or not the whole hill belongs to this formation, and also the nature of its fundamental rock. It would seem that the Castle-rock of Edinburgh is also a portion of the same flœtz formation as the Calton-hill.

7. To what formation do Braid-hills, Blackford-hills, and Craig-Lockart, near Edinburgh, belong?

It is probable, from observations I have made in these hills, that they belong to the newer flœtz rocks.

8. Does the greenstone of Corstorphin-hill belong to the independent coal-formation?

9. Does the Bass-rock at the mouth of the Frith of Forth belong to the newest flœtz-trap formation?

From the observations of Dr Ogilby, it would appear that clinkstone occurs at the Bass; and hence it is probable that a portion or the whole of that isle, belongs to the newest flœtz-trap formation.

10. Does the Craig of Ailsa in the Frith of Clyde, belong to the newest flœtz-trap formation?

Several years ago, I made a hasty examination of that rock, and then it appeared to me, in conformity to the then prevailing ideas regarding sienite, to belong to the sienite-formation. Since that period, I have found, that certain rocks formerly considered as sienite, are but sienitic-greenstone, and that this greenstone occurs in primitive and flœtz countries; and that these greenstones are distinguished from each other, not only by geognostic, but also by oryctognostic relations. A consideration of the oryctognostic characters of the rock of Ailsa seems to point it out as flœtz sienitic-greenstone, and one that probably belongs to the newest flœtz-trap.

11. Does pitchstone occur in beds in the prevailing sandstone formation in the island of Arran?

A peculiar variety or sub-species of pitchstone of a green colour, occurs very abundantly in the island of Arran, in the form of veins that traverse granite, sandstone, &c. These veins are sometimes parallel with the direction of the strata, and might be confounded with true beds: in other parts of the same highly interesting island, great bodies of pitchstone are to be observed, running parallel with the strata, in the form of beds, for several miles. Are these masses to be considered as true beds, or veins parallel with the direction of the strata?

12. What are the geognostic characters and relations of the porphyritic-rock of the Ochil-hills?

As far as I can judge, from that portion of the range of the Ochils I have examined, this rock appears to belong to the same formation as the claystone and felspar of the Pentlands.

13. What is the extent and mode of distribution of the granite and sienite of Galloway?

In Galloway, I found both the sienite and what appeared to be the newest granite formations, but had not leisure to ascertain the geognostic relations of another granite which appears to belong to the oldest formation.

14. Does the upper part of Ben Nevis belong to the second porphyry formation? And if so, on what rock does this porphyry rest? And does not the granular rock found in this mountain, rather belong to the sienite than to the oldest granite formation?

From specimens of that mountain, which I have had an opportunity of examining, its upper part appears to be composed of a dark-coloured, nearly greyish-black, porphyry; its lower parts of sienite; but I have never seen any specimens, or received any accurate account, of the rocks that form its base, and the neighbouring country. Are we then to consider this great mountain as a portion of the overlying, consequently newest primitive formations, and that the upper part is the second porphyry formation, and the lower probably sienite, or newer granite, or both?

15. Does the porphyry at the fall of the Brauer, near Blair, in Athol belong to the first or to the second porphyry formation?

16. What are the geognostic characters and relations of the metalliferous veins of Tyndrum?

17. Is the granite rock of Loch Clony, in Inverness-shire, old granite, sienite, or newest granite?

18. Does the pitchstone of Ardnamurchan, in Inverness-shire, belong to the newest flœtz-trap formation?

19. Does porphyry occur in beds in the transition mountains of Scotland?

Several appearances in the upper part of Dumfriesshire and Lanarkshire, seem to intimate that a porphyry, or a remarkably porphyritic greenstone, occurs in the grey-wacke and grey-wacke slate of these districts.

20. Does the granite of Aberdeen and Peterhead, belong to the oldest or to the newest granite formation?

21. Is the granular quartz of the islands of Isla and Jura subordinate to mica-slate, or does it constitute a distinct formation?

In my *Outline of the Mineralogy of the Scottish Isles*, this rock is particularly described; and I have mentioned its alternation with a passage into mica-slate, facts that render it probable that it is subordinate to mica-slate. The opinion, however, cannot be considered as absolutely certain, until the rocks of Isla and Jura be again examined.

22. Are the Cullin mountains in the island of Skye, composed of rocks belonging to the newest flœtz-trap or to the second porphyry formations? or do they contain both of these formations?

23. What are the geognostic relations and characters of the Scure Eigg, one of the Hebrides?

The Scure Eigg, of which I have given an account in my mineralogical description of the island of Eigg, is one of the most magnificent assemblages of natural columns, hitherto noticed by any naturalist. The rock of which these columns are composed is porphyritic, with a base intermediate between basalt and pitchstone. It appears to belong to the newest flœtz-trap formation.

24. What are the rocks of which the island of Staffa is composed, and what are their geognostic relations?

The columnar distinct concretions, or pillars of Staffa, are said to rest upon trap-tuff; but the true nature of these pillars has not been hitherto distinctly ascertained.

25. Is the porphyry of the isle of Raasay, porphyritic claystone, and porphyry-slate?

26. What are the geognostic relations of the tremolite and zoisite of Glenelg in Inverness-shire?

27. Does the sandstone of the Shetland islands belong exclusively to the oldest coal formation, or do different sandstone formations occur there *?

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* The Reverend Mr Fleming, in a paper read before the Society, has rendered it probable that the sandstone of Shetland belongs to the oldest coal formation.

28. What are the geognostic characters and relations of the ores of Sandlodge in Shetland?

29. Does the claystone, &c. of Papa Stour, one of the Shetland islands, belong to the newest flœtz-trap or to the coal formation?

I have described the claystone and other similar rocks of Papa Stour, under the name *wacken* in my account of that island, because wacken and claystone were formerly considered by mineralogists as varieties of the same species. The occurrence of this rock, along with a kind of tuff resembling that found in the flœtz-trap formation, would incline me to consider it as belonging to the trap formation, did not its intimate connection with the sandstone which forms the base of the island, (and which does not appear to belong to the newest flœtz-trap, but rather to the independent coal formation, or some of the particular sandstone formations), seem to refer it to the coal or sandstone formations. Data are still wanting for the determination of this interesting point *.

* Since this query was proposed, the Reverend Mr Fleming, in a paper read before the Society, refers this claystone, and its accompanying rocks, to the coal formation.

30. Does the serpentine of the islands of Unst and Fetlar, belong to the first or to the second serpentine formation?

As a great proportion of this serpentine is the precious sub-species, it may, notwithstanding its great extent and breadth in these islands, be found to belong to the first or oldest formation.

31. Does the rock of the Hill of Kinnoul, near Perth, belong to the flœtz-trap or to the newest flœtz-trap formation?

32. Is the mountain of Cairnsmuir, in Galloway, composed of the oldest granite?

33. What are the extent, and particular geognostic relations, of the black pitchstone of Eskdale-muir in Dumfriesshire?

As this pitchstone lies over transition rocks, and is associated with clinkstone, it would appear to belong to the newest flœtz-trap formation *.

34. Does the black pitchstone of the Cheviot

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* *Vid.* "Mineralogy of Dumfriesshire."

hills belong to the newest flœtz-strap formation * ?

35. What are the particular species of petrifactions that occur in the transition-limestone, near the Crook, on the road from Edinburgh to Moffat?

36. Does not the hill on which the town of Stirling is built, belong to the oldest coal-formation?

37. What are the geognostic characters and relations of the veins that traverse, or are included in, the greenstone of the independent coal-formation?

38. Are the trap veins that traverse the mining field at Strontian, basalt, greenstone, or porphyry-slate; or do all these species of rock occur in that district?

39. Are the leadglance veins of Strontian situated in sienite; and what are their other geognostic relations?

40. Does the quartz-rock of Scuraben and Morven in Caithness, and of Portsoy in Banff-

* This Cheviot pitchstone was first observed by my friend Mr Murray, Lecturer on Chemistry.

shire, occur in an unconformable and overlying position; or does it belong to the comformable primitive-rocks, as clay-slate or mica-slate?

b. *England.*

1. Does the granite of Cornwall belong to the oldest or to the newest granite formation; or do both formations occur in that county?

2. Is the shorl-rock of Cornwall disposed in an uncomformable and overlying position in regard to the older rocks? If this be its position, on what rock or rocks does it rest, and what are its other geognostic relations?

3. Does the serpentine of Cornwall belong to the first or to the second serpentine formation; and what are the imbedded and venigenous fossils it contains?

4. What are the characters of the different venigenous formations in Cornwall? Are any of them identical with those described by Werner *, Möhs †, Friesleben ‡, and others?

* "Theory of Veins," translated by Dr Charles Anderson of Leith, 1809.

† Beschreibung des Gruben Gebäudes Himmelsfurst, von F. Möhs, 1804.

‡ Mineralog Bemerkungen bei gelegenheit eines Reise durch den merkwurdigsten theil der Harzgebirges, von Friesleben, 1795.

5. Do the inclined slaty strata, in the vicinity of Plymouth, belong to the transition class of rocks?

Mr Professor Playfair, in his eloquent work, the "Illustrations of the Huttonian Theory," maintains that they are primitive: to me they appear to be transition.

6. Does the upper part of the mountain of Cader-Idris, in Wales, belong to the newest flœtz-trap formation?

My friend, Colonel Fullerton of Bartonholm, shewed me specimens from the summit of Cader-Idris, all of which proved to be porphyry-slate; hence I infer, that a part, if not the whole, of the summit of this mountain, belongs to the newest flœtz-trap formation.

7. Are not the mountains in Cumberland principally composed of transition rocks, partially covered with the newest flœtz-trap formation?

Some late writers consider the rocks of Cumberland as primitive; but from the information communicated to me, and the specimens from that county in my possession, I am inclined to refer a considerable portion of them to the transition class.

8. Is not the porphyry of Cumberland in general porphyry-slate?

9. Does the gypsum of Cumberland belong to the first or to the second flœtz-gypsum formation?

10. Is the salt formation of Chesshire identical with the rock-salt formation of Werner *, or is it newer?

11. Is the Bath-stone newer or older than chalk?

12. Does chalk ever contain the remains of quadrupeds †?

13. What are the geognostic relations and characters of the fullers-earth of Hampshire, Bedfordshire, and Surry?

The fullers-earth of Saxony, as I have mentioned in my "System of Mineralogy," occurs along

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* Jameson's "Elements of Geognosy," p. 174.

† Mr Aitken, in his valuable "Dictionary of Chemistry," remarks, "It (chalk) contains, in abundance, "the relics of marine organized bodies, such as echinites, "glossopetræ, pectinites, &c. and also, not unfrequently, "the hard parts of amphibious and sand animals, as the "heads and vertetræ of crocodiles, and teeth of ele-"phants." As the occurrence of elephants' teeth in chalk, is not mentioned by any other naturalist, and as Mr Aitken gives no description of the places where this very remarkable appearance has been observed, the above query will not be considered as improper.

with greenstone-slate, and hence is to be considered as of primitive formation ; but the fullers-earth of England, is evidently a flœtz formation, and appears to occur in beds, in a particular kind of sandstone which forms the fundamental rock of the chalk formation *. This is all we know of the English fullers-earth,—a proof how much remains to be done before we can consider our knowledge of its geognostic relations as complete and satisfactory.

14. Does the limestone of Derbyshire, belong to the transition class ?

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* Aitken's "Dictionary of Chemistry," article Fullers-earth.

VII. *On the Transition Greenstone of Fassney.*

By JAMES OGILBY, M. D.

(Read, 10th December 1808.*)*

In consequence of a query proposed by Professor Jameson, I was led to a minute examination of a very interesting rock which occurs at Fassney-burn, in that part of the Lammermuir range of mountains forming the southern boundary of East Lothian. For the purpose of exactly ascertaining its geognostic situation, I began my examination immediately below Herd's Hill, near the source of the rivulet called Fassney which, at about three miles north-east of this spot, has uncovered the rock in question. This precaution was the more necessary, as the same obstacle to the researches of the mineralogist presents itself in this mountainous district, as in other parts of the county of East Lothian. The highest of the hills does not much exceed 1500 feet. The rocks are decomposable, favourable to vegetation, and no where visible except in the beds of rivulets.

In the bed of the rivulet south of Herd's Hill, there occurs an alternation of very thick beds of *Grey-wacke* and *Grey-wacke-slate*. These beds are stratified: their direction corresponds with that of the mountain range, which runs nearly north-north-east, and south-south-west. The dip is north-westerly, and the angle of inclination about 60°. The beds of grey-wacke-slate are the most considerable in thickness, and I understand, have been worked to some extent, for roofing, by Mr Knox, but without much success.

Following the course of the water, I came upon a curious *porphyritic rock*, having a basis of compact felspar, approaching to claystone, with numerous small imbedded crystals of quartz, and a few of felspar. This stone has a striking resemblance to one of the members of the overlying porphyry formation; but as we have only an opportunity of examining a very small portion of the bed, it is difficult to say, whether it is Felspar Porphyry, a variety of Compact Felspar, or of Claystone. This bed is six or eight feet thick, is conformable with the strata of Grey-Wacke, and must therefore be regarded as of the same formation. Another bed of this rock, but thinner, is met with a little to the westward, with strata of grey-wacke intervening.

Still lower down the brook, to the north-east, I met with three stratified beds of a singular variety of *Greenstone*, alternating with strata of grey-wacke, and in all respects conformable. These beds are from six or eight, to ten or twelve feet in thickness, and are almost entirely composed of compact felspar, with very little hornblende, which is generally of a light greenish-grey colour, and of a slender acicular form; but sometimes the colour is red; and in this case it is very decomposable, and by falling out, leaves the stone vesicular. One of these beds has been worked for millstones; but I should suppose it must be an indifferent material for that purpose. It contains iron-pyrites,—one of the characters which enables us to discriminate between Sienite and Sienitic Greenstone.

Proceeding still down the water to the north-east, and leaving behind us the usual Transition rocks, we come to a thin bed of *Sienitic Greenstone*, resting immediately upon the grey-wacke, and covered by a bed of great thickness, of a distinct granular aggregate rock, composed of reddish-white or flesh-red felspar, greenish-black hornblende, and brownish-black mica. This bed is made up of strata from one to three feet in thickness, corresponding in direction, dip, and inclination, with those of the grey-wacke, above and below it. It alternates occasionally with the above Sienitic Greenstone, and with thick beds of a disintegrated rock, composed of felspar, hornblende, and mica; and these continue, with little interruption, for nearly a mile down the brook, a little to the eastward of Mill Know, where the grey wacke again comes in, and upon which they rest.

The uncommon thickness of the beds of this beautiful rock, and the covered state of the country, rendered it very difficult to ascertain its geognostic relations; but I soon satisfied myself, by attending to the course of the water, that the thickness is in a great measure only apparent, and that the same strata were cut by the water three times in pursuing a very serpentine course. This deception is easily made apparent, by drawing lines through the course of the stream, as delineated on the map. Small veins of heavy-spar, from one inch to four in thickness, occur in this rock. As this rock contains mica in addition to felspar, it might be supposed, by those who only attended in a superficial manner to oryctognosy, to be essentially different from either Sienite or Greenstone, and to deserve a particular name. But a number of reasons here lead us to conclude, that the mica is an accidental or adventitious ingredient, similar to crystals of felspar in basalt, or garnets in mica-slate, by which the general characters of these rocks, or their names, are not affected. A specimen taken at a little distance from the water, favours the supposition; it approaches to common greenstone, by the felspar assuming a white colour, and the mica diminishing in quantity. The geognostic characters enable us to distinguish it sufficiently from Sienite.

The name *Sienitic Greenstone*, as used by Professor Jameson, for this rock, appears to me happily chosen, and quite unobjectionable.

This rock has been strangely confounded with Granite, by Dr Hutton and Mr Playfair; and I shall conclude with a quotation from the "Illus-"trations" of that system by the latter, with a view of pointing out to those who are inclined to admire the Huttonian Theory, one of the numerous and glaring errors upon which it has been founded.

"Another instance," says Mr Playfair, "of "real Granite, disposed in regular beds, but "without any character of Gneiss, is one which I "saw in Berwickshire, in Lammermuir, near the "village of Priestlaw. The little river of Fass-"net cuts these beds across, and renders it easy "to observe their structure," &c.

We may ask, Where was Granite ever seen without Quartz, and united with Hornblende, and in such a situation?

VIII. *Description of a Small-headed Narwal, cast ashore in Zetland.*

By the Rev. JOHN FLEMING, F. A. S. Minister of Bressay, Zetland.

(Read, 10th December 1808.)

THE Narwal, or Unicorn-fish, which I am now to describe, was found close by the shore, at the entrance of the Sound of Weesdale, in Zetland, on the morning of the 27th September 1808.

The fishermen who live in the neighbourhood of the Sound, observed it entangled among the rocks on the preceding day; and when they went to bring it ashore, they found it dead, though still warm. By the orders of Mr Ross of Sound, it was carefully conveyed to the neighbourhood of his house, and was preserved untouched for several days, until I should have an opportunity of examining it. His anxiety in this instance to forward my design of investigating the Natural History of Zetland, I am happy to have this opportunity of mentioning with respectful gratitude.

In order to give as complete a description as possible of this curious animal, I shall first advert to its external appearance; compare these with the account given by M. La Cepède of the Small-headed Narwal; then take notice of those parts of its internal structure, which my slight acquaintance with anatomy enabled me to investigate; and lastly, point out those circumstances which seem to distinguish the Common Narwal from the species now under consideration.

The animal measured only twelve feet from the snout to the notch which divides the tail. It was much smaller, therefore, than those which have been found in other seas. A narwal of the same species, we are informed by La Cepède *, was found at Boston, in the month of February 1800, which measured above twenty-six feet in length; and another of the same kind, described by Tulpius †, was about twenty-two feet long. From these circumstances, it appears exceedingly probable, that the Zetland narwal had not attained its full size, but was a young animal.

The *head* of this narwal occupied about a seventh part of the total length of the body. In

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* "Histoire Naturelle des Cetacées," 4to, p. 160.

† "Observ. Medic."

general, however, according to La Cepède, the head occupies only a tenth part of the length of the body, or nearly so. The forehead rose suddenly from the snout, as may be seen in the plate *, and then proceeded nearly in a horizontal direction, for a few inches, when it became slightly elevated. Over this elevation, in the forepart of which the blowhole, afterwards to be noticed, is situated, the head was four feet two inches and a half in circumference. The forepart of the head was rounded, and when viewed from before, resembled a ball.

Behind this elevation on the head, there was a slight depression, which served to point out the line of separation between the head and the body. The back swelled gradually, to within a few inches beyond the paws, (or pectoral fins), where it appeared to be thickest. There was a slight elevation on the back, immediately above the genitalia. From this elevation, a small ridge proceeded, which continued to within a few inches of the division of the tail. Over the beginning of this ridge, the body was four feet four inches in circumference. On the belly, there was likewise a ridge extending from the anus to the tail. On both sides of the animal, there were likewise ridges, similar to those on the back and under-side of the body. These ridges commenced near the middle of the body, and increas-

* Plate VI.

ed in height as they approached the tail, with the edges of which they at last coalesced. The animal was thickest in the middle, continuing nearly of the same thickness towards the head, but becoming lengthened or acuminated towards the tail. Owing to these ridges above described, the body appeared of a quadrangular form, especially towards the tail.

The *mouth* was somewhat pointed before, and the upper lip extended a little way beyond the under. The extent of the opening of the mouth was small, being little more than five inches in depth.

The *eye* was situated behind the opening of the mouth, and nearly under the blowhole. It was about an inch in diameter. The orbit was oval; the pupil black; the iris of a chesnut colour; and the sclerotic coat, white.

There were two *swimming-paws*, (if I may be allowed the expression), corresponding to the pectoral fins in fishes, situated in the forepart of the body towards the under-side. These were thirty inches distant from the snout, fifteen inches long, five inches broad at the base, and six inches broad towards the middle of the paw. They were pointed and wedge-shaped, thickest in the forepart, and thinnest behind. The distance between the extreme points of both paws, measuring across the body, was forty-six inches. The dimensions of these swimming-paws, must be considered as uncommonly small, when compared with the size of the animal. In all probability, they serve only the purpose of rudders in changing the direction of the course of the animal, and do not aid its progressive motion in any considerable degree.

The *tail* was placed in a horizontal position, as in the other genera of the cetacea. It was divided by a slight indentation into two lobes of equal size. The outer edge of the lobes, did not extend farther than three inches beyond the notch which separated them. The lobes of the tail were pointed and turned from the body, and the distance between their extreme points, was thirty-two inches. Like the fore-paws, the tail was wedge-shaped, thickest in the middle, and growing thin towards the edges. This part of the animal appears to be the principal organ of advancing motion.

This narwal had one *tooth* projecting from the left side of the upper jaw, and pointing a little downwards. There was no external appearance of any tooth on the right side; and in the cranium itself, only a small canal was observable, but no appearance of a tooth. The external length of the tooth was twenty-seven inches, and the remaining portion of the base inserted in the socket twelve inches, thus making its whole length thirty-nine inches. The weight was twenty-eight ounces. In diameter at the base, where it entered the upper lip, one inch and a quarter. It was spirally grooved or twisted, and striated from right to left, and tapered from the external base to the point, which was blunt and solid. The portion of the tooth concealed in the skull was cylindrical and hollow. The tooth of the Narwal found at Boston, was equal to one-third of the length of the animal; in this specimen, it was little more than one-fifth.

There is the figure of the head of a Narwal of this kind, given by La Cepède, (Plate ix. fig. 1.), in which there are two teeth of equal length. Occasionally, in the young narwals, but rarely in the old ones, two teeth have been found, the one tooth in general considerably smaller than the other. When these animals become old, they seldom possess more than one tooth, and have no external appearance of another on the other side of the lip, so that it is probable one of the teeth falls out when the animal is of a certain age, the skin then uniting and covering the socket.

La Cepède supposes that the teeth of the animal are often broken, when combating with masses of ice in which it gets entangled; by its battles with other whales, or by its striking at the planks of vessels: and in this fanciful manner, he seems to account for the general absence of one of the teeth in the older animals*.

* If the account of the manners of the Narwal, given us by Egede in his Description of Greenland, deserves any credit, we ought perhaps to be surprised at the existence of any tooth at all in the head of that animal. "Fur-"thermore, (says the Greenland Missionary), this horn

The Narwal now under consideration was a male. The external organs of generation were situated in a groove, seven inches long, and nearly five feet distant from the tail. The anus was placed about four feet from the tail.

The *colour* of this singular animal was a dusky black on the upper parts of the body, variegated with still darker spots not very apparent. The belly was of a white colour. On the sides there were numerous spots of an oblong figure, and placed horizontally, or in a direction with the length of the body. The skin was smooth and glossy. The scarf-skin was extremely thin and pellucid, and easily separated from the true skin. The true skin was nearly a quarter of an inch in thickness, and was closely united to the fat. On the sides, where the spots were chiefly situated, numerous dark-coloured fibres traversed the skin in a direction perpendicular to its surface. The exterior ends of these blackish fibres, appeared to unite and constitute the spots. The spots on the Narwal of Boston, according to La Cepède, were deepest and most numerous on the head, the top of the nose, the most elevated part of the back, on the paws,

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" serves many other ends : as to stir up his food from " the bottom of the sea, as he is said to feed upon small " sea-weeds, and likewise therewith to bore holes in the " ice, in order to fetch fresh air."—Egede's Greenland, translation, Lond. 1745, p. 79.

and on the tail. In the Zetland Narwal the spots on these places were united, and the skin nearly of a uniform colour.

The animal was entirely surrounded with a layer of *fat* or *spick*. The fat was very closely connected to the skin, and was about an inch and a half in thickness. It yielded, upon boiling, about three gallons of oil, of bad quality.

From an inspection of the outline of the forehead, it would be impossible to form a just idea of the shape or size of the *skull*. For there was a mass of fat like a cushion which rested on the forehead, as if calculated to defend the animal from bruises on that part. The skull was concave before, and much depressed and lengthened towards the nose; and in this lengthened part of the forehead, the mass of fat was contained.

I now proceed to mention those parts of its internal structure, which I had an opportunity of investigating.

The *tongue* was long and rounded at the extremity. It was closely connected with the under jaw. At the base of the tongue were numerous follicles, with very perceptible orifices, which poured out a thick white mucous fluid.

The *stomach* was divided into several apartments. The extent of its internal surface must be greatly increased, by numerous cylindrical papillæ, (some of them more than two inches long), which were dispersed over it. There were a few remains of animals of the order mollusca in it, and the intestines were filled with a greenish coloured fluid.

The *heart*, as in other whales, consisted of two auricles and two ventricles. It was of a quadrangular form, and considerably compressed.

The *lungs* occupied a considerable proportion of the cavity of the thorax. They rose high in the chest and were not, as in most animals, divided into small lobes. The trachea was short, owing to the shortness of the neck, and divided into four branches or bronchi. The upper part of the trachea terminated in a cartilaginous cavity, having its diameter somewhat larger than the trachea. From this cavity proceeded a tube, opening longitudinally, so as to act like a valve. Each side of the tube consisted of two solid cartilaginous parts, united before, and connected with each other by a strong muscular membrane, the two sides likewise being joined by a similar membrane. The upper end of this tube was surrounded with a cartilaginous ring. When this tube or valve was open, as represented in the plate *, the passage from the nares to the lungs was perfectly free; but when it was closed, nothing could then enter the lungs. This tube or valve was placed in the posterior part of the *blowholes* or nasal openings.

* Plate VI. Fig. 3.

The *blowholes* * or *nares* were united at the posterior part into one tube, destined to receive the upper end of the trachea. In passing through the skull they were separated from each other by a bonny septum. This division of the nares ceased a few inches before it reached the external opening. Between the anterior end of this septum and the exterior orifice of the nares, there were two cavities situated, one on each side, immediately under the skin. Each of these cavities was capable of containing about an English pint of water. In regard to the use of these cavities or bags, we can only hazard the conjecture, that they may probably aid the animal in the act of respiration. The external opening of the nares was in the form of a crescent, the forks of which pointed towards the forehead, and it was about an inch and a half in diameter.

The preceding description, which I have detailed with all possible fidelity and accuracy, by no means corresponds with the account of the Common Narwal, as given us by La Cepède, the latest writer on the order Cetacea. It agrees, however, pretty nearly with the account of the

* Whales seldom throw out water in any quantity through the nares, but the act of respiration merely produces a hissing noise; hence I have employed the term *blowholes* instead of spout-holes, as being more appropriate and just.

Small-headed Narwal, *le Narwal microcéphale* of that author, a species unknown to Linnæus.

I shall now briefly state those particulars in which the Common Narwal and this Small-headed kind differ from each other, as pointed out by La Cepède, in his descriptions of the two species.

The general form of the Common Narwal is ovoid: the other species is somewhat conical, thickest towards the forepart of the body, and lengthened towards the tail. The tooth of the Common Narwal never exceeds one-fourth of the length of the body; whereas, in the other species, the tooth is sometimes equal to nearly one-third of the length of the animal. The back of the common Narwal is raised and convex; in the other, rather flat and even. The head of the common Narwal is large in proportion to the body, being equal to one-fourth of the whole length; the head of the other is small, being only one-tenth of the length of the body. The head of the Narwal which I examined, was equal to one-seventh part of the whole length: but I am of opinion, that this animal, as formerly said, had not attained its full size, nor consequently, its adult proportions. The lobes of the tail of the Common Narwal are rounded, and turned from the body; in the other species, they are likewise rounded, but bent towards the body, like the flukes of an anchor. I must remark, however, that in the specimen which I examined, the tail did not agree with either of those descriptions; on the contrary, it was pointed and turned from the body, as represented in the second figure *. In the common Narwal, a crest or ridge extends from the blowhole, along the back, to the tail; in the other species, the ridge commences only at the middle of the back, and continues to the tail.

If the figures given by La Cepède, of the two species of Narwals, could be depended upon as correct, even the colour delineations of the body would afford a good mark of discrimination. In the figure of the Small-headed Narwal, which La Cepède informs us, he copied from a drawing by Mr Brand, the spots are somewhat round, and very distinct from each other; in the other species, the spots on the tail are represented as of a roundish form, but the large spots on the sides are of no determinate figure, being much indented and branched. The curiously shaped spots indeed of the common Narwal, as represented by La Cepède, are calculated to excite the suspicion, that the whole is more a picture from fancy, than a true copy of nature.

The characters now detailed, seem to point out the necessity of adding another species to the genus Monodon of Linnæus, and likewise of changing the trivial name *monoceros*, which he bestowed

* Plate VI. Fig. 2.

on the only species known to him. But we are by no means equally satisfied as to the propriety of changing the Linnæan name of the *genus*, as has been done by La Cepède.

We are fully persuaded, that the eager desire which the naturalists of France have of late displayed, to multiply unnecessarily the names of genera; to alter the received language of natural history; and wantonly to change the names employed by the father of natural science, ought to be condemned. It certainly has a direct tendency to introduce confusion into natural history, and thereby render a study, pleasant in itself, both irksome and laborious.

In natural history, the generic characters ought to be taken from appearances or marks, constant and uniform, and common to every species of the genus. The name of the genus ought to express some striking circumstance in the history, economy, or structure of the most common or interesting species. In these respects, the generic name Monodon (or one-tooth), is well chosen, as it expresses one of the most obvious and striking peculiarities in the appearance of both species. In opposition, however, it may be said, that Narwals have been found with two teeth, and therefore the name Monodon ought not to be given to the genus. But as this circumstance occurs extremely seldom, only two instances being on record, it can never justify a change in the name of the genus given by Linnæus.

If the French naturalist was offended at the generic name Monodon, as leading to a false conclusion, he ought to have substituted another in its place not liable to such an objection. But in endeavouring to do this, we are persuaded, he has committed as great, if not a greater error, than the one he was attempting to correct:—*Incidit in Scyllam, cupiens evitare Charybdin.*

La Cepède informs us, that according to Willoughby, Wormius, and Klein, the name *Narwal*, (from which La Cepède has formed his generic name Narwalus), is derived from "*Nar*, which "in many languages of the North, signifies a "dead body, and from *Wal* or *Whal*, a whale." Now, from the meaning of the word, as thus explained, it would be natural to conclude, that the species of the genus Narwalus subsisted on the dead or putrid bodies of fishes and other marine animals. But the language of La Cepède himself is hostile to such a conclusion. He informs us, that the food of the Narwal consists of worms and fishes*; that it often pierces them with its tooth, and by means of its flexile lips conveys them to its mouth. The generic name, therefore, proposed

* "Il aime, parmi les mollusques, ceux que l'on a "nommés *planorbes;* il paroît préférer, parmi les pois-"sons, les *pleuronectes pôles.*" Hist. Nat. des Cetacées, p. 153.

by La Cepède, if adopted, would have a tendency to produce error; whereas, the generic name Monodon, of the Swedish Naturalist, expresses one of the most striking appearances of the two species of which the genus consists; and, what is of equal importance, it has been long received, and generally adopted. It has not only been employed by Linnæus, but by Artedi, Müller, Bonnaterre, Fabricius, and other eminent naturalists.

The two species of narwals, mentioned above, may perhaps be distinguished from each other, by the following specific characters:

1. Monodon *vulgaris*. Common Narwal.

Unicorn Narwal. Shaw, Gen. Zool. vol. ii. part 2. tab. 225. p. 473.

Le Narwal vulgaire, Narwalus vulgaris. La Cepède, Hist. Nat. des Cet. pl. iv. fig. 3. p. 142.

Narhval, Unicornu marinum, Unicorn-fish. Pontop. Nat. Hist. Norw. pl. p. 113. part 2. p. 137.

Narwhale, or Unicorn. Egede, Desc. of Greenland, pl. v. p. 76.

Figure approaching to ovoid: the head equal to one-fourth of the whole length: A ridge extending from the tail to the blowhole: tail divided; lobes rounded.

2. Monodon *microcephalus*. Small-headed Narwal.

Le Narwal microcéphale. Narwalus microcephalus. La Cepède, Hist. Nat. des Cet. pl. v. fig. 2. p. 159.

Body of a conical shape : head blunt, and equal to one-tenth of the whole length : the ridge extending from the tail to the middle of the back : tail divided ; lobes pointed.

Plate VI.

Fig. 1. Represents a side view of the Monodon microcephalus.

Fig. 2. The under-side of the animal. *a*. The sulcus containing the organs of generation. *b*. The anus.

Fig. 3. *a*. The arytenoid cartilages, forming the valvular tube, which enters the nares, and through which the animal breathes. *b*. A lateral view of the thyroid cartilage. *c*. A side view of the back part of the cricoid cartilage. *d*. A portion of the trachea.

Supplement.

Since the above account was written, I have been able to collect a few more particulars concerning the Small-headed Narwal, which I shall take the liberty to communicate.

In La Cepède's account of the Small-headed Narwal, he mentions, that it was found in the

Plate VI.

Fig. 1.

Fig. 3.

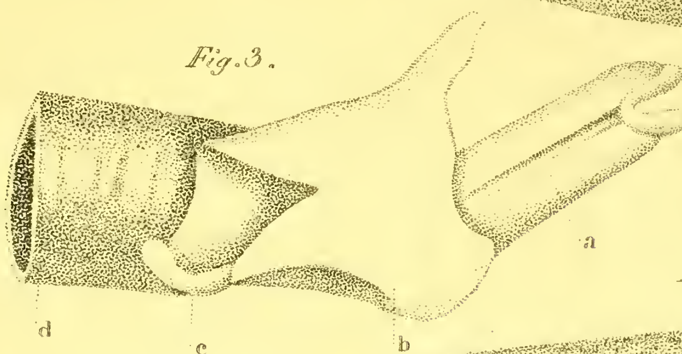
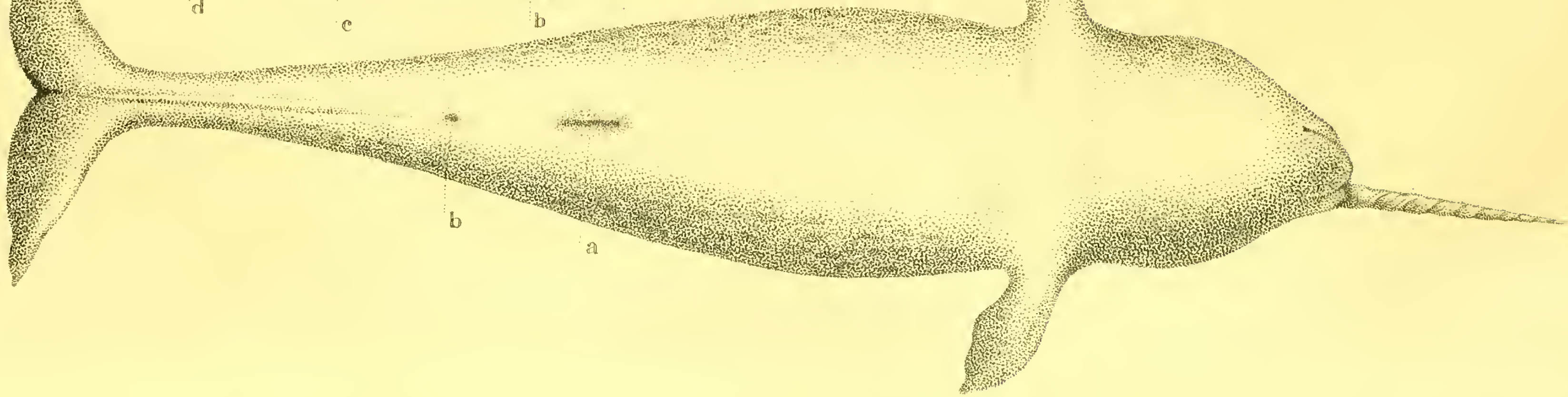


Fig. 2.



Rev. J. Fleming del.

E. Mitchell sculp.

seas which wash the coast of Boston, in lat. 40° evidently meaning Boston in America. As Dr Shaw has mentioned the occurrence of one at Boston in Lincolnshire, and as La Cepède received his drawing and description from Sir Joseph Banks, I began to suspect that they referred to one and the same specimen, and that the similarity in the name of the place had occasioned the mistake. In order to satisfy myself on this subject, I made known my suspicion to Sir Joseph Banks, who, in a letter, dated 19th January 1809, politely communicated the following information, which completely confirms the truth of my conjecture. When speaking of the Zetland narwal (which I had mentioned to him) he says, "I agree with "you in thinking it the same species as that des-"cribed by La Cepède, whose information was "wholly derived from me;" and adds, "that a "note under the drawing, stated it to have been "taken at Frieston, a village near Boston in Lin-"colnshire. The animal, when found, had buried "the whole of its body in the mud of which the "beach there is composed, and seemed safely and "securely waiting the return of the tide. A fisher-"man going to his boat, saw the horn, which "was covered up, and trying to pull it out of the "mud, raised the animal, who stirred himself "hastily to secure his horn from the attack."

How are we to account for such carelessness and inaccuracy in La Cepède!

There is a drawing given of the Boston Narwal, by Mr Sowerby, in his "British Miscellany," tab. 9. Although La Cepède and Mr Sowerby profess to delineate the same animal, their drawings do not quite agree. In neither do the swimming-paws and tail seem copies of nature. Mr Sowerby, I may observe, as well as Dr Shaw, has fallen into the mistake (if, indeed, it be a mistake) of considering it as the Monodon monoceros of Linnæus, or Common Narwal, whereas it is apparently the small-headed kind. Only this last species, therefore, can yet be ranked in the British Fauna. I must also remark, that he has used a very strange liberty in his plate: he tells us, that the Boston or Lincolnshire specimen, "perfectly agreed (to use his own words) with "the name given by Linnæus, in having but *one* "tooth looking like a horn; but on examining "the upper jaw, it was very evident that the "other tooth had been lost; and we have since "(he adds) seen a perfect skeleton of the head "of the animal, with the *two* teeth fixed in their "proper sockets." Because he had thus seen what he calls a perfect specimen, (which may probably be the one formerly in the Leverian Museum), he has thought himself warranted to give a *second tooth* to the Boston narwal, and thus to represent it in his plate. Such liberties cannot be allowed in the construction of drawings of objects in natural history.

Bressay, Zetland,
September 1809.

IX. *On Colouring Geognostical Maps.*

By Professor JAMESON.

(Read 9th April 1808.*)*

IN constructing geognostic maps, after having delineated the aspect of the surface of the country we have examined, our next business is to exhibit, as far as possible, by means of colouring, a true and harmonious representation of the alternation, extent, and relative position, of the different rocks that appear at its surface. Various methods have been adopted for accomplishing this object. In some maps the boundaries of the different rocks are marked by a continuous or dotted line, and the inclosed space representing the rock, by a particular symbol; in others the inclosed spaces are distinguished by lines running in different directions, or by dotts of various magnitudes; lastly, in others the inclosed spaces are coloured. Of all these, this last is the preferable method, and is besides that which has been most generally followed. But it is liable to some objections; for example, it only points out the different rocks; it does not make us acquainted with their geognostic relations; and the colours hitherto chosen to represent the various rocks, are so very different from each other, that maps coloured in this manner have a disagreeable and patch-like appearance.

In colouring geognostical maps, it is absolutely necessary to establish and follow certain rules, in order that there may be an uniformity or unity of execution in all the parts, and consequently that similarly executed delineations, may appear as parts of one and the same whole. The following rules should be observed in colouring maps: 1. In every case we must use such colours as will allow the ground-work of the map or delineations of the mountains, to appear through them distinctly. 2. The colours must agree as nearly as possible with nature, that is, they must correspond with the most common colour of the rock, or at least differ from it as little as possible, and agree with the transition suite of the colours. 3. The use of all very bright colours must be avoided. 4. The colours must not be too pale or too deep, and they ought to be laid on as much as possible of the same intensity: perfectly dark and light coloured rocks are exceptions to this rule. 5. The colours of mountain-rocks must form suites or transitions, in order to express the transitions of the rocks into each other: at the same time, they must be sufficiently distinct from each other, so that they may not appear indistinct and give rise to confusion.

All mountain-rocks, therefore, ought to be coloured according to the preceding rules; and the particular rocks distinguished by certain colours.

For this purpose, the following colours have been recommended by Werner, and I have prefixed to each rock the particular symbol employed by him to distinguish them.

 Quartz.—Reddish-white, inclining a little to yellow.

 Topaz-rock.—Pale brick-red.

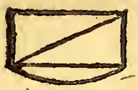
 Granite.—Pale cochineal-red, approaching carmine-red.

 White-stone.—Pale flesh-red.

 Gneiss.—Lilac-blue.

 Mica-slate.—Pearl-grey.

 Primitive Clay-slate.—Greenish-grey, falling into blue.

 Alum-slate.—Pale bluish-black, falling into grey.

 Flinty-slate.—Deep ash-grey.


 Grey-wacke slate, and Grey-wacke.—Greenish-grey, falling into yellow.

 Granular primitive trap,

 Greenstone,

 Greenstone-slate,

 Hornblende-slate,

Trap-rocks.—Blackish-green, inclining to blue.

 Basalt.—Greenish-black.

 Porphyry-slate.—Pale greenish-black.

 Amygdaloid.—Pale greenish-black, slightly inclining to brown.

 Serpentine.—Pale pistachio-green.

 Talc and Chlorite slate.—Pale grass-green.

 Porphyry.—Pale reddish-brown, slightly inclining to yellow.

 Sienite.—Pale reddish-brown, inclining to bluish, that is, clove-brown, passing into bluish-red.

Ψ prim. 1. Granular primitive Limestone.—Pale Berlin-blue.

Ψ prim. 2. Compact primitive Limestone.—Smalt blue, faintly inclining to red.

Ψ tran. Transition Limestone.—Indigo-blue, slightly inclining to grey.

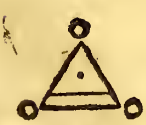
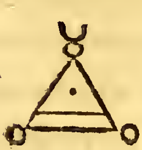
Ψ fl. 1. Flœtz Limestone.—Pale bluish-grey, without any trace of grey.

Ψ ch. Chalk.—Milk-white, that is, bluish-white.

Ψ Calc-tuff.—Smoke-grey.

 prim. Older
 fl. 1. Newer
} Gypsum.—Pale sky-blue, that is, blue inclining to green.

⊖ Rock-salt, and rocks from which salt springs issue.—Pale verdigris-green.

 Common,
 With mercury,
} Coal-formation.—Pale blackish-brown, approaching to yellowish-brown.

 Alum-earth,
 Brown and Earth Coal,
— Liver-brown.

 Conglomerate, and
 Claystone,
— Pale orange-yellow, slightly inclining to reddish-brown.

 Sandstone.—Straw-yellow.

 Sand.—Yellowish-white, slightly inclining to red.

  Loam and Clay.—Yellowish-grey, passing to ochre-yellow.

 Iron-clay, and
 Calamine.
— Pale ochre-yellow.

 Turf and Peat.—Liver-brown streaks.

 Bog iron-ore.—Ochre-yellow streaks *.

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* The following observations will serve to elucidate the Wernerian symbols above enumerated. The symbols

Werner remarks, that formation-suites may also be represented in colours †: thus, the slate-forma-

used by Werner, to express sand, inflammable substances, chalk, salt, iron, and copper, have been long known; but the others are of his own framing. Thus, the curved line in the symbol of serpentine, &c. intimates, that the rock is of a magnesian or greasy nature; the square symbol intimates, that the rocks to which it refers, generally break into a quadratic shape, as quartz; the lengthened square, that the rock breaks into tables, as gneiss; the rhomboidal-shape, that the rock breaks into sharp-angled pieces, as porphyry; diagonal-streaks in a square, when drawn from right to left, or across from one side to the other, intimate, that the rock has a slaty texture, as gneiss and topaz-rock; perpendicular streaks, or lines in a square, intimate, that the rock wants the slaty structure, as granite; a diagonal line from the left to the right, always marks rocks of the trap-formation, as greenstone; a small oval in a square, expresses the occurrence of masses of after-formation in a rock, and is used as the symbol for amygdaloid; small black squares inclosed in a larger square, express embedded crystals, as in porphyry; shorter and shorter lines above each other, are the symbol for clay; and when conjoined with dotts, express clay and sand together. All these signs are more or less combined together, so as to form the different symbols. Thus, the symbol of greenstone-slate is a lengthened square, including two lines drawn from the right hand to the left, and one from the left to the right: The lengthened square, intimates, that it has a slaty fracture; the two lines from the right hand to the left, that it has two constituent parts; and the line from the left to the right, that it belongs to the trap-formation.

† For explanation of *formation-suites*, see "Elements "of Geognosy," p. 88., &c.

tion-suite, will be red shaded into blue, the blue into grey, and this latter into green, and the green into yellow.—The inflammable-fossils, subordinate to these formations, will be dark-brown. —The limestone-formation suite, will be blue, which will pass into grey, and lastly into white.—The salt and gypsum formation suites, which are allied to the preceding, will be greenish-blue, and bluish-green.—The trap-suite, greenish-black, and blackish-green, shaded into blue.—The porphyry-suite, light-brown.—The talc and serpentine suite, pale yellowish-green.

Such then is the method of representing by means of colours, the different rocks of which a country is composed: we have now to point out how their relative positions are to be delineated. These are most satisfactorily and simply expressed in the following manner, as first pointed out by Werner: Boundaries of superimposed rocks, are to be marked with a broad line of the same colour as the rock, only darker, and in those cases where we are uncertain as to the superposition of the rock, the junction is to be merely streaked. Beds, when they appear at the surface, should have their boundaries distinguished by a broad but darker line of the same colour as that of the rock of which they are composed. When the beds are inclined, the lower side should be marked with a broad line of the same colour as the bed itself, but its upper-side by a broad dark line of the colour of the rock that rests upon it.

Thus, a bed of greenstone, in inclined strata of mica-slate, as represented in the map, will have its lower side marked with a broad dark-green coloured line, but its upper side with a broad line of dark pearl grey.

Veins are to be represented by lines drawn in the direction of the veins of the district. Metalliferous veins should be pointed out by red lines; and veins filled with mountain-rocks, by lines of the same colour as the rock of which they are composed.

There is still another object to be attended to, in the execution of geognostic maps: it is the dip of the strata. This is to be expressed by black-coloured arrows, whose length should be in proportion to the angle of inclination, and their direction to the point of the compass towards which the strata dip or incline. When the strata are vertical, or under any angle from 90° to 80°, they are marked by two cross lines thus ×; horizontal strata, or strata under any angle from 0 to 10°, by two lines crossing each other at right angles, and having darts at each extremity. The intermediate angles, from 80° to 10°, are marked by simple arrows, which are $\frac{1}{8}$, $\frac{1}{4}$, and $\frac{1}{2}$ of an inch in length. The arrow $\frac{1}{8}$ inch in length intimates, that the strata are inclined at any angle between 80° and 60°: the arrow $\frac{1}{4}$ inch in length that the strata are inclined at any angle between 60° and 40°: the arrow $\frac{1}{2}$ inch in length, that the strata are inclined at any angle between 40° and 10°. The first, or shortest arrow, is said to point out strata inclined under an angle of 70°; the second arrow, strata under an angle of 50°; the third arrow, strata under an angle of 25°. Probably an equally convenient mode would be to mark the angle of inclination alongside the arrow, and proportion its size to the length of the map. Thus, if the map were on a large scale, the arrow might be $\frac{3}{4}$ of an inch long; if on a smaller scale, $\frac{1}{2}$ inch, or even $\frac{1}{4}$ of an inch in length. The highest points on a mountain range should be distinguished by a cross ; a level, by a figure resembling a door ; and a shaft, by a lengthened square .

The following tabular view of the different Colours that should be employed in geognostical maps, will be found useful.

WHITE COLOURS.

Quartz.	Reddish-white, slightly inclining to yellowish white.
Chalk.	Milk-white.
Sand.	Yellowish-white, faintly inclining to reddish-white.

GREY COLOURS.

Mica-slate.	Pearl-grey.
Primitive-Clay-slate.	Pale greenish-grey, falling into bluish-grey.

Grey-wacke.	Greenish-grey, inclining to yellowish-grey.
Flœtz-limestone.	Pale bluish-grey, without any trace of green.
Calc-tuff.	Smoke-grey.
Loam and Clay.	Yellowish-grey, passing to ochre-yellow.
Flinty-slate.	Ash-grey.

BLACK COLOURS.

Basalt.	Greenish-black.
Alum-slate.	Pale bluish-black, passing into greyish-black.
Porphyry-slate.	Pale greenish-black.
Amygdaloid.	Pale greenish-black, passing into brownish-black.

BLUE COLOURS.

Gneiss.	Lilac-blue.
Granular primitive limestone.	Pale Berlin blue.
Compact primitive limestone.	Smalt blue, slightly inclining to red.
Transition-limestone.	Indigo blue, slightly inclining to grey.
Gypsum.	Pale sky-blue.

GREEN COLOURS.

Rock-salt, and rocks from which salt springs issue.	Pale verdigris green.
Salt springs.	Dark verdigris green rings.
Trap-rocks.	Blackish-green, inclining to blue.
Boundaries of countries.	Dark emerald green.
Talc and Chlorite-slate.	Pale grass-green.
Serpentine.	Pale pistachio-green.
Mineral-springs.	Pistachio green rings.

YELLOW COLOURS.

Sandstone.	Straw yellow.
Iron-clay, and Calamine.	Pale ochre-yellow.
Conglomerate and Clay-stone.	Pale orange-yellow, slightly inclining to reddish-brown.

RED COLOURS.

Granite.	Pale cochineal-red, approaching nearly to carmine-red.
Topaz-rock.	Pale brick-red.
Whitestone.	Pale flesh-red.

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Kirkwood Sculp.t Edin.r

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	BROWN COLOURS.
Black-coal.	Pale blackish-brown, approaching to yellowish-brown.
Porphyry.	Pale reddish-brown, slightly inclining to yellowish-brown.
Sienite.	Pale reddish-brown, falling into bluish.
Brown and Earth coal.	Liver-brown.

X. *Mineralogical Account of Papa Stour, one of the Zetland Islands.*

By the Rev. JOHN FLEMING, F. A. S. Minister of Bressay.

(Read 12th November 1808.)

THE island of Papa Stour is situated on the west side of the Mainland (or largest island) of Zetland, and forms the south side of the entrance into St Magnus Bay. It possesses no hills of any considerable height. It is of a very irregular form, being deeply indented with four bays, which are here termed *voes*, viz. Houseavoe, Olisvoe, Culliesvoe, and Hamnavoe. In these bays, the shore is somewhat level, but in other parts of the island, it is bold and rocky, presenting to the furious Atlantic, precipices several hundred feet in height. In these rocks, there are numerous caves, which form commodious retreats for seals; and at different parts of the coast, there are naked insulated projecting masses of rock, on which myriads of sea-fowl hatch their young in safety, the steep sides of these islets preventing even the enterprising natives from reaching their summits.

As the rocks of Papa Stour are of very different degrees of induration, so the sea has in many places made great encroachments, and formed creeks and caves of considerable magnitude. These present great obstacles to the examination of the mineralogy of this island, in consequence of the place of junction of the different rocks, being often covered by loose blocks of stone, or concealed in the recess of a deep and gloomy cave.

The strata are in general nearly horizontal, seldom vertical, and in a few instances trough-shaped and bason-shaped. In many places they present appearances of much confusion. Immense *slips* or translations of the strata have taken place, whereby they have been depressed many fathoms since their original deposition. These translations are not confined to particular beds of rock, but have taken place generally over the island. In these translations, the beds on the hanging side are always depressed, and lower than the same bed on the lying side. Appearances of this kind may be seen at Ungly-braed-head, and Lammer-banks.

The rocks of this island appear to be the following: Sandstone, Slate-clay, Amygdaloid, Greenstone, Breccia, Compact-felspar, Porphyritic-slaty-felspar, and Claystone. I shall, therefore, proceed to give an account of the appearances accompanying each of these rocks, beginning with the

SANDSTONE.

The rocks of sandstone chiefly occur at Houseavoe and the Kirk-sand. The beds are usually thin. It is often of a brown and also of a greenish-grey colour. It is fine-grained in some instances. It frequently contains rounded nodules of quartz, and is much mixed with quartz. When it contains much mica, it splits into plates. The surface of the beds is sometimes elegantly undulated, similar to the impressions made on the sand of the sea shore by the retiring waves. This appearance on the surface of the beds of sandstone has in all probability been occasioned by the action of the same cause.

The different seams of the sandstone are generally separated from each other by thin beds of clay, and also by beds of breccia. On the north side of Houseavoe, the sandstone covers a bed of amygdaloid, and at the Kirk-sand it alternates with beds of amygdaloid and greenstone. At a place called Little-Peatie's-gio *, the sandstone is covered with a bed of breccia, upon which it also rests, and both these beds of sandstone and breccia

* Pronounced *gio* or *geau*.

rest on a thick bed of compact-felspar inclining to claystone. At Olisvoe, northward from the *Boothe*, a thin bed of sandstone is inclosed between beds of compact-felspar, which is very hard owing to intermixed quartz. At Forewick it is covered with beds of compact-felspar. At the point of contact, the horizontal beds of sandstone suddenly bend downwards to a much-inclined position, and the beds of compact-felspar rest on the inclining beds of sandstone. The two rocks are separated from each other, by a thin division of clayey sand. The direction of the slaty structure of the compact-felspar at the line of junction, is parallel with the inclined surface of the beds of sandstone; and hence, it is in all probability the margin of a bason-shaped hollow in the strata, and not a slip or translation, as I at first supposed. The sandstone at Forewick, alternates with beds of slate-clay. Between Forewick and North-house, the sandstone is covered with thick strata of compact-felspar, and porphyritic claystone.

The beds of sandstone, which are horizontal, are separated from the felspar, by a division of soft clayey matter arising from the decomposition of both rocks. These rocks are in conformable stratification, and seem to have been equally exposed to dislocation, as several *slips* are to be observed.

Both the sandstone, and its covering of felspar, have undergone a depression of several yards. The appearance and extent of one of these *slips* is very distinct, in a small creek called Tury-gio.

SLATE-CLAY.

This rock occurs very sparingly in this island. It sometimes makes its appearance between beds of sandstone, and at Forewick it exists in thick beds. It is often mixed with mica, and then passes into slaty-sandstone.

AMYGDALOID.

The beds of this rock are of considerable thickness. Its basis seems to be a claystone, of a greyish-black colour. It contains numerous cavities, filled with different crystalline minerals, as calc-spar, heavy-spar, fluor-spar, and quartz. As these substances are liable to fall out by being decomposed, the empty vesicles then give the stone the appearance of vesicular lava. These vesicles are sometimes filled with calcedony, or with calc-spar, and in company with these, crystals of quartz, heavy-spar, and fluor-spar are likewise found. When all these substances occurred in the same cavity, they were arranged in the following order. The calcedony covered the cavity nearest the rock, the quartz was imposed upon the calcedony, and covered with the calc-spar: The heavy-spar rested on the calc-spar, and the remaining cavities of the vesicle were filled with fluor-spar. The crystals of the calc-spar were often rhomboidal and sometimes prismatic. The fluor-spar was least abundant. Hence, it appears, that as the fluor-spar formed the central part of the cavity, it had been last deposited, and that the calcedony, which inclosed the others, was the oldest formed.

On the north side of Houseavoe, the amygdaloid is covered with the sandstone, floating pieces of which it likewise contains, sometimes of the quartzy kind. The surface of these floating masses was parallel with the surface of the bed of amygdaloid. At the west side of Kirk-sand, it distinctly alternates with the sandstone, and seems in some places to have a slaty structure. It alternates with felspar, containing much quartz, at Culliesvoe. At a place called Herdy-gio, the amygdaloid alternates with breccia, and both these beds are covered with a thick bed of compact-felspar, passing to claystone. Two *slips* occur at this place, which affect equally the amygdaloid and felspar. The amygdaloid is traversed by small veins of hæmatite, and the neighbouring rocks are much impregnated with iron.

GREENSTONE.

The two component ingredients of this rock, the felspar and hornblende, being often intimately mixed, it is difficult to distinguish them from each other. The beds are of moderate thickness. To the westward of the Kirk-sand, several beds of greenstone alternate with the sandstone in a very regular manner; and on the west side of Culliesvoe, it likewise appears to rest upon a bed of compact-felspar, although their relative position is by no means obvious.

BRECCIA *.

By this, I mean a rock of angular fragments, cemented by a basis of a different composition.

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* I have employed this word, which is of frequent use, to express an aggregated rock of angular fragments, cemented by a basis of a different composition. It differs from Puddingstone, not only in the cement, but in the fragments not being rounded. From Conglomerate, it likewise differs, in the fragments not being the same with the cement. In Zetland, there are three distinct kinds of agglutinated rocks:—The first consists of angular fragments of porphyritic or compact-felspar rocks, cemented by a clayey or sandstone basis. It occurs in thin beds. This I have termed Breccia.—The second is moderately fine-grained sandstone, containing rounded masses of granite, gneiss, and other rocks of the primitive class, from the size of an egg, to one or two feet in diameter. These beds are of great thickness.—Lastly, clayey sandstone, including angular fragments of similar composition, the cement and the fragments being the same. This occurs in moderately thin beds, along with fine-grained sandstone. This last kind is, with propriety, termed Sandstone-conglomerate; but the same phrase does not appear so applicable to the second kind, whose imbedded masses claim a very different origin,

The fragments, which are small, seldom exceeding a pea in size, consist of compact felspar, and, in one instance, of sandstone. The cement is a greenish-coloured clay, of various degrees of induration, and, in some instances, it seems to be sandstone. When fresh broken, the stone has a homogeneous appearance; but where it has been exposed to the influence of the weather, the fragments are very distinct, the cement having been decomposed.

At Houseavoe, the breccia alternates with the sandstone, and is in thin beds. At Hirdy-gio, it alternates with the amygdaloid. At Ungly-braed-head, there is first a bed of felspar, much mixed with quartz, and presenting a number of diverging radiated points: above this bed, breccia occurs, indistinctly stratified, into which the felspar passes: over this bed of breccia, there is another divided into thin strata, and containing galls of green-clay, and nodules of compact-felspar; and above all, is a bed of amygdaloid. These beds are altered from their original situation, by a slip, which elevates or depresses them six or seven yards. At Little-Peatie's-gio, there

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and seem to have been brought to their present situation, by a more general cause than operated in the formation of the first and third kind. Nor is it applicable to the first kind, since, in it, the fragments are of a different substance from the cement which connects them.

is first a bed of compact-felspar ; over it breccia, with layers of a rock of felspar, inclining to claystone and much intermixed with quartz ; and above all, beds of amygdaloid. At Bordie, there are first vertical strata of felspar, separated from each other by thin layers of greenish clay. The felspar is in the form of globular distinct concretions, with cavities lined with quartz, or filled with steatite: this bed is covered with beds of breccia, similar to those at Little-Peatie's-gio, in an unconformable position, the strata of felspar being vertical, and those of the breccia horizontal. The strata of breccia are separated by clay, similar to that which separates the strata of felspar. A bed of red compact felspar covers the breccia. The breccia, in this place likewise, contained fragments of sandstone.

COMPACT-FELSPAR.

This rock is of a reddish-brown colour, and occurs in the form of thick beds, which, in some instances, appear to be seamed or stratified. At Lammer-banks, on the east side of Houseavoe, it rests on beds of sandstone, being separated therefrom by a thin partition of clay. Both these beds rest in a horizontal position. The compact-felspar is porphyritic, containing crystals of felspar, likewise of a red colour. This bed, in another place between the Kirk-sand and Forewick, alternates or rather is intimately mixed with a variety of porphyritic slaty-felspar. On the west side of the island, it covers beds of breccia and amygdaloid. To the eastward of Hirdy-gio, it is in the form of a conglomerate, containing angular masses, having the cement and fragments of similar composition and appearance. At Little-Peatie's-gio, the compact-felspar is covered with breccia, and a rock of felspar that contains much quartz. The compact-felspar, in some instances, contains crystals of disintegrated felspar and steatite. It is usually massive; but it seems, upon assuming the porphyritic structure, to have a slaty structure; as near Hirdy-gio, where the slaty fracture is very distinct.

CLAYSTONE.

This rock chiefly occurs at a place called Stain, between Houseavoe and Olisvoe. It is of a bluish-grey colour. The beds are moderately thin, not much inclined, and considerably decayed, as appears by numerous fissures or rents which traverse them. It contains crystals of red felspar, thus forming porphyritic-claystone. Two curious varieties of this rock are here to be observed: the first is a claystone-conglomerate, containing angular fragments of the claystone, connected by an impure cement of claystone, mixed with mica and sand: in the second variety, the claystone occurs in the form of globular distinct concretions, connected by a softer basis than the concretions themselves, which are hard, and nearly resemble the fragments which compose the breccia rocks. The concretions are porphyritic, as is also the cementing claystone. Both these varieties are included in the beds of porphyritic claystone. This bed rests upon a porphyritic rock, which is intermediate between the compact felspar and claystone, but has a distinctly slaty structure. On the south-side, towards Houseavoe, it passes, by imperceptible degrees, into amygdaloid, which appears to rest upon the claystone, and to be covered in its turn with the sandstone.

PORPHYRITIC SLATY FELSPAR.

By this I mean, rocks having a basis of felspar of considerable hardness, containing imbedded crystals of felspar, thus constituting a porphyry, and having the principle fracture slaty, thus forming a porphyritic-slate. The colour is usually reddish-brown. The cross fracture fine splintery. It contains crystals of red felspar, and rounded grains of quartz; which last are often disposed in the direction of the principal fracture. It also contains small cavities filled with steatite. It is sometimes in the form of distinct concretions, as at Ungly-braed-head, where it passes into the breccia which covers it. At Bordie, it is beautifully formed into distinct concretions, as formerly mentioned. It is here covered by breccia. On the east side of Olisvoe, it is in the form of a conglomerate; the cement and the fragments cemented, being both of the same composition*. At the east side of the Kirk-sand, it seems to lose in some measure its slaty structure, and to pass into porphyritic-claystone. At Culliesvoe, it is of a greyish-black colour, the felspar in small quantity, and presenting the appearance of certain varieties of porphyry-slate; and on the west side of the same *voe*, it is compact, of a red colour, and full of minute grains of quartz. It is intimately connected with the claystone, compact-felspar, amygdaloid, and breccia rocks.

All the rocks enumerated above, are traversed by veins filled with calc-spar, heavy-spar, quartz,

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* Three kinds of Conglomerate have been mentioned above, viz. Compact-felspar Conglomerate; Claystone Conglomerate; and Porphyritic-slaty-felspar Conglomerate. This occurrence does not seem to warrant the conclusion, that the beds of felspar, claystone, and porphyritic-slaty-felspar, owe their origin to rocks of a similar kind, but much more ancient, and belonging to a different order of things; but rather support the conclusion, that disturbances have taken place in the fluid, during the period of deposition, of sufficient extent, to break into fragments, portions of the new-formed rocks; and that the individual beds of the series have been frequently repeated. This may serve also to explain the occurrence of the breccia at Bordie, in unconformable stratification, and covered also with compact-felspar.

common jasper; and the amygdaloid contains veins of red hæmatite.

From the above statement of facts, it does not seem improper to conclude, that all the beds of rock in Papa Stour, belong to one and the same formation. Besides the support which this conclusion receives from the account of the relative position of the different rocks as mentioned above, it is likewise countenanced by the occurrence of veins in the different beds, filled with similar mineral substances; and particularly, from the circumstance of those *slips*, or dislocations of the strata, whereby the beds are depressed, and which affect the beds of sandstone, compact-felspar, and porphyry-slate, and the other rocks in the island, all in a similar manner. This probably would not have been the case if they had belonged to separate formations. The fissures, formed in consequence of these slips, are filled with decomposed portions of the surrounding strata.

Since the conclusion,—that the rocks of Papa Stour belong to one and the same formation,—appears supported by such proof, it still remains to be determined, to which of the formations, in the class of flœtz-rocks, they ought to be referred.

The sandstone of Papa Stour, is exactly similar to the sandstone in the islands of Foulah and Bressay. In the former of these islands, the sandstone is accompanied with bituminous-shale and clay-ironstone, and rests on gneiss as the fundamental rock. In Bressay, the sandstone includes beds of slate-clay, and contains vegetable impressions, similar to those common in the sandstone of the coal-fields of the Lothians. Hence it seems reasonable to conclude, that the different rocks in the island of Papa Stour, together with the sandstone of the Zetland Islands, belong to the Independent Coal Formation.

I shall be happy, if this communication shall be thought to afford an answer, in some degree satisfactory, to two of the mineralogical queries suggested by my esteemed friend, the President of the Wernerian Natural History Society.

XI. *Observations on some Peculiarities observable in the structure of the Gannet,* Pelecanus Bassanus. *And an account of a new and curious Insect, discovered to inhabit the Cellular Membrane of that Bird.*

By George Montagu, Esq; F. L. S. & M. W. S.

(Read 16th July 1808.)

Among the animals whose various peculiarities of structure appear out of the common course of nature, the Gannet claims particular attention.

Having made a longitudinal incision from the breast to the vent of a Gannet, in order to prepare it for preservation, I was struck with the appearance of several pellucid bodies, by which the skin was connected with the body. This circumstance brought to recollection the fact related of thepelican, by Buffon; who remarks, that, from the lungs, the air passes through axillary pipes, into a thick vesicular cellular membrane that covers the muscles, and envelopes the whole body. The structure, however, of the gannet, although probably intended for similar purposes, is very different from that of the pelican, according to the relation of that naturalist.

The gannet differs materially from its congeners, the Corvorant and Shag, in being extremely buoyant, floating on the surface of the water like a gull; whereas those species of *Pelecanus* sink deep in the bosom of the water: it is therefore reasonable to conclude, that the gannet, like the gull, is incapable of immersion, and consequently cannot pursue its prey under water*.

During the season that they frequent the British Channel, they are easily captured, as they rise with difficulty, unless against the wind; consequently by keeping to windward, they are readily run down by the assistance of two or three boats, for they never attempt to evade their pursuers by

* The leg-bone or *tibia* of the gannet is remarkably broad in front, not compressed, as is usual with those birds who pursue their prey under water. The serrated middle claw cannot be indicative of its habits, since many land-birds are equally furnished with a similar formation, the use of which has never been discovered.

diving, (from which it is natural to infer they are incapacitated for diving) ; but they defend themselves most obstinately, when about to be seized.

The bill of the gannet differs from that of most birds, for it is not only destiture of nostrils, but on each side the upper mandible towards the base, is a dentation that divides the margin, and thus admits of a considerable motion. The eye is protected by an unusually pellucid nictitating membrane, that at once guards that delicate organ from the common accidents incident to its habits, and at the same time admits of a sufficiency of light for all the purposes of vision. This circumstance has been noticed by several authors ; but those who affirm that the gannet possesses a dilatable pouch, like the pelican, under the chin, of a size sufficient to contain five or six herrings, cannot have examined that part with due attention. The œsophagus, it is true, is extremely capacious, and the skin of the throat and neck is equally capable of distention, so that five or six fishes, of the size of a herring, might be contained in the gullet and stomach ; for there appears to be very little difference between them, or in other words, the stomach is a continuation of the œsophagus with little or no stricture or division.

It is well known, that many birds regurgitate with much ease and facility ; and that instinct points out to them this mode of preparing the food intended for the nourishment of their young, in the receptacle, usually termed the craw : in this manner, the gannet can readily disgorge the contents of its stomach, (for it has no craw), to satisfy its young.

Having taken a cursory view of the natural habits, and the more striking external appearances of this bird, I shall proceed to detail my observations upon the more occult properties with which it is endowed, and which are apparently so admirably adapted to its mode of life, and continued residence on the waters, even in the most turbulent sea, and most inclement season. I must, however, candidly acknowledge myself inadequate to the task of a minute, anatomical disquisition, and must therefore claim the indulgence of the zootomist, or comparative anatomist; requesting such to bear in remembrance, that I am only stating circumstances as they have occurred; my object being to stimulate others, better qualified to dissect, to detail their anatomical observations upon this singular bird.

By comparative anatomy, it has been clearly demonstrated, that birds in general are provided with air-vessels in different parts of the body, and that many of their bones are not destitute of this contrivance, admirably fitted for increasing their levity, and consequent buoyancy, as well as progressive motion through that element in which they are intended principally to move, and that too with a velocity that far surpasses all the other parts of animated nature. Mr John Hunter, in the

"Transactions of the Royal Society," proves, that the air-cells, in the parts already mentioned, have a free communication with the lungs by means of openings on their surface, through which the air passes readily into them; and it clearly appears, there is no diaphragm that confines the air to the regions or cavity of the breast, but that the whole of the abdomen is equally inflated by inspiration through the lungs.

Thus far has the scientific researches of that anatomist contributed to our knowledge on this subject; but we may presume, much remains to be done. No one appears to have noticed the phenomena attendant on the construction of the gannet, or to what further extent this circulation of aerial fluid is carried in some particular species of birds; a circumstance which demands our highest admiration, when we contemplate the advantages which such a structure may be of, in conducing to the comforts, and perhaps to the very existence of such animals.

Several gannets having been subjected to artificial inflation, I shall state the result, and relate the manner in which the experiments were pursued. A pipe was first introduced into the trachea, and when air was propelled through it, the whole internal cavity of the body was inflated, but no air passed into the external cells between the skin and the body. An incision was then made in the lower part of the abdomen into the body, very near the vent; air was forced through a pipe introduced at that part, (the pipe in the trachea having been previously stopped), and a similar inflation ensued without affecting the exterior cells. The pipe was now removed from the trachea, and, upon the air being propelled with force through the pipe at the vent, it readily found its way through the larynx, producing a noise similar to the sound emitted by the living bird. A small opening was then made in the skin on the left side, about mid-way between the wing and the thigh, and a pipe introduced, having first stopped those directly communicating with the internal parts, it was obvious, that when air was forced through this orifice, the skin on that side, as far as the middle line of the body, was greatly inflated, and it extended into the lower part of the neck, along the larger joints of the wing, down the thigh, and also into the cavity of the body, but the right side was not in the least affected: the pipe at the trachea being removed, the air produced a similar effect upon the larynx as before mentioned, but not so loud. Still suspecting there was a communication between the sides, by means of some valvular apparatus, the right side was subjected to the same experiment; but the result negatived my expectation, the effect produced being similar in every respect.

From a repetition of these experiments upon several subjects, it became evident, that there was a communication between the lungs and the cellular membrane that covers the greater part of the body, as well as with the whole cavity of the body, but that, by reason of some valvular contrivance, the skin could not be artificially inflated through the lungs, although air would readily pass in the contrary direction. It is also clear, that there is no direct communication between the sides.

In order to examine this extraordinary structure, I made a longitudinal incision the whole length of the body, a little on one side of the keel, or what is commonly termed the breast-bone; by this means, the membrane that connects the skin to the body, and cuts off the communication between the sides, was easily examined; but nothing was observed, indicating that a communication could be effected, even at the will of the animal. On each side, nearly equidistant between this pectoral membrane and the back, is situated another longitudinal one, very similar to the last, but perforated; between this and the pectoral are about nine irregular transverse membranous septa, that hold the skin firmly to the body, having a free communication with each other. The skin is also furnished with a transparent cellular membrane, the cells being regularly perforated, close to the base of each feather. At the upper part of the breast is a large bag, which extends some way up the neck; this is attached to the skin by the septa of innumerable small cells, but no opening into this cellular bag could be discovered; the introduction, however, of a small pipe through the artificial aperture, clearly demonstrated a passage to the lungs, as the whole internal cavity of the body was inflated, and the air issued from the trachea. Upon opening this bag, the passage of communication with the internal parts appeared to be under the clavicles, as a thin perforated membrane was perceived at the bottom, leading to the thorax, not directly into the lungs, but near the part where the trachea divaricates, and afterwards communicating with the lungs. It could not, however, be discovered where the air could find a passage from the great magazine into the cellular bag, and yet there is every reason to conclude that at this part some valvular passage exists.

Pursuing my researches, I observed, at the bottom of each lobe of the lungs, a considerable opening, for the passage of air into the cavity of the body; but what arrested my particular attention, was a wonderful provision of nature, for the protection of the vital parts, by guarding the whole viscera with a strong integument, that preserves them in a proper degree of moisture, and contributes to the due secretions for lubricating those parts, so essential to the functions of their delicate nature, which might otherwise be too quickly carried off, by the constant circulation of fresh air that nearly surrounds them; for this integument is held only by ligaments to the back and front, leaving all other parts free for inspired air. The liver and intestines are firmly attached to the surrounding integument; the heart is enveloped by a similar covering, which is only partially connected to the common one.

In the trachea nothing very remarkable occurs, except two small glands about the size of a pea, at the lower extremity *. The tongue is so ex-

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* It may not be improper to remark, that much important matter in the science of ornithology, may yet be expected, from a strict attention to the *trachea* of different birds. Dr Latham has paved the way to this discrimination of species, by his excellent paper on the subject, given in vol. iv. of the *Transactions of the Linnean Society*; but as much remains to be done, much may be expected, through the medium of the Wernerian Society, towards discriminating some of the northern birds, which as yet are much in obscurity. In the *Berlin Trans.* vols. iii. and iv., figures are given of the *trachea* of *Mergus Merganser*, and *Mergus Castor*, that are so essentially different, as to leave no doubt that the birds from which they were extracted, are actually distinct; for in these, not only a difference is observable in the labyrinth, but the trachea of the former has two enlargements, whereas the latter has only one.

How this is to be reconciled with the account related by Mr Simmonds, in vol. viii. of the *Linnean Transactions*, is left to the developement of the naturalists of North Britain, where these birds are frequently obtained.

tremely diminutive, as scarcely to be entitled to that denomination.

Has not the discovery of a labyrinth in *Mergus Castor*, of similar appearance to that of *M. Merganser*, been considered conclusive, without examining the rest of the trachea; or may not the female *Merganser* resemble in plumage both the sexes of the *Castor?* Has any one yet observed a bird in the plumage of *M. Merganser*, to be a female; and are we certain that the young male Mergus serrator, in its immature plumage, has not been confounded with these, since it has been ascertained, that that species is furnished with one enlargement in the trachea? If *M. Merganser*, in its immature state, should resemble in plumage *M. Castor*, the trachea of the young males would undoubtedly be similar to the adults, and we should be led still to look for a distinct species in a similar dress, with one enlargement in the trachea, as figured in the *Berlin Transactions*. It is also related by Mr Simmonds, that two specimens of *M. Merganser*, and two of *M. Castor*, now at Edinburgh, have only eighteen feathers in the tail. Those in my museum differ in this respect; the former has certainly that number, but the latter has twenty: this specimen I obtained fresh, and being a female, it was destitute of labyrinth.

It is much to be wished, that this subject may be more minutely investigated by those, who, from situation, may have more frequent opportunity; for, so rare are these birds become, in the southern parts of the kingdom, that, in the course of nearly thirty years collecting, I never obtained but the single specimen before mentioned, in a recent state.

The clavicles, or what is commonly called the merry-thought, which is usually affixed to the point of the keel of the breast-bone by a ligament, is, in the gannet, so firmly united, as to appear a part of it.

The very singular structure of this bird, so widely different from any that had before come under examination, could not surprise me more, than the discovery of a new and singular insect found to inhabit the cellular membrane attached to the skin. It is well known, that the species of *Vermes intestinales*, found to inhabit almost all the internal parts of animals possessed of a red circulating fluid, are extremely numerous, and that many others are not wholly destitute of them; but no instance, to my recollection, has been authentically proved, of a true insect having been observed, constantly to inhabit and propagate in a similar situation. A description and figure of this singular species of insect accompanies this paper.

Those who have had an opportunity of examining a great variety of birds, will have noticed the great difference in the general construction of the body, and in particular the abdominal parts, of the aquatic tribes; and doubtless will have observed how much more capable they are of enlarging the cavity of the body than land birds, and by that means are enabled to contain a much larger supply of air, so essential to the vital principle under peculiar circumstances, in order to support life with ease, without continued respiration, as in long submersion. But in order to derive the most ample advantage from so curious a conformation, a free circulation of the confined air must be carried on through the lungs, in order to supply vital energy, by the absorption of oxygen which is absolutely necessary to the existence of animals; thus, by passing and repassing through the lungs, the duration of submersion may be greatly extended, beyond what would result from simple pulmonary inspiration.

From the attachment of the lungs of a bird to the ribs and backbone, they are not capable of much distension, consequently can contain a very small portion of air; if, therefore, some extraordinary, or peculiar means, different from what is found to obtain in the class *Mammalia*, had not been given it, respiration must have been extremely quick and laborious, to supply the blood with that vital principle which is furnished by the decomposition of the air in these organs. Besides, by so small a portion of air as the lungs of a bird would alone contain, their voice must have been so extremely weak, as to be wholly useless to many, whose active, restless, and migratory life renders it absolutely necessary that their cry should be strong, in proportion to quick transportation from one place to another, in order that those of the same species should discover each other at a very considerable distance, especially by night. To obviate, therefore, the difficulty of the former, and to produce the desired effect of the latter, nature has been abundantly kind in providing this class of animals with a passage from the lungs, to a capacious magazine for air, not only for the purpose of temporary respiration, but as a kind of reservoir for certain exigencies; and in particular, that of supplying the instrument of sound with a sufficient quantity of it to be expelled with force through the larynx.

No one who has a previous knowledge of the size and construction of the lungs, can have observed the great exertion of a cock in the act of crowing, without being convinced, that the air, requisite for so strong and continued a sound by one expiration, could not be contained in that part.

If a duck or a goose is attended to when the usual cry is emitted, it will be evident, that the pressure of the abdomen propels the air which is therein contained, with much force into the anterior part of the body, which, with what is there already not being able to escape through the trachea, not only inflates the cellular membrane about the breast to an unusual size, but, by compression, rushes with violence through the larynx, and produces a sound more or less intense, in proportion as the muscles are more or less exerted.

Although this contrivance is so absolutely necessary to the existence of every species of bird, it is not immediately obvious for what particular purpose the property of inflation is so much further extended than usual in the gannet. We should not expect to find this power of inflating the skin, peculiar to those who obtain their subsistence by diving, because, in the act of immersion, such power could not be exerted without obstructing that operation; and it is obvious, that the air contained within the cavity of the body, is sufficient for all the ordinary purposes of seeking their prey under water.

From what has been already observed, it will not be unreasonable to conclude, that the gannet is endowed with such singular properties, for very different purposes than that of long and continual immersion. It cannot be doubted, but such a power of inflation must contribute greatly to lessen the concussion in its rapid descent upon the water, in order to seize its prey: besides, as the enlargement of the surface without materially adding to the specific gravity, must greatly contribute to its buoyancy both in air and water, it is well adapted for residing in the midst of the most tempestuous sea, floating on its surface in perfect security, and following those shoals of fish, on which depends its whole existence: thus, when all others are compelled to seek shelter in bays and creeks, the gannet is enabled to brave the severest weather in all seasons, without attempting to near the shore.

This contrivance may also be of the most important service to an animal which is constantly exposed, even in the most inclement season, and cannot quit its station without starving: nothing could possibly conduce more to its security against intense cold, or be better adapted to preserve the necessary temperature of animal-heat, than this intermediate body of air between the skin and the body, since that element is found to be a non-conductor of heat. Upon this principle, what animal can be more securely protected against cold, or retain its vital heat so effectually as the gannet, or such birds as are almost surrounded with a body of confined air, divided by cells, and intersected by membranes between the skin and the body, and that skin so amply covered with a light porous substance, filled also with air, and impervious to water *?

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* The Gannet is capable of containing about three full inspirations of my lungs, divided into nearly three equal portions, the cellular parts under the skin, on each side, holding nearly as much as the cavity of the body. Now, as a full or extraordinary expiration of the human lungs has been considered to occupy a space of about sixty cubic inches, (Phil. Trans. vol. 69. p. 349.), so the gannet is capable of containing not less than 180 cubic inches of air at one time, subject to the will of the bird, under certain impressions.

Description of the Insect which inhabits the cellular membrane of the Gannet.

Ovate-oblong, smooth, glossy, white, with eight short legs, furnished with several joints, and terminated by bristles; two on each side approximating, and near to the anterior end; the others similarly disposed, about one-third of its length from the posterior end: of the posterior legs, the hindmost pair is furnished with a very long bristle, the other pair usually with two; the anterior legs possess several bristles each. No other appendages were discernible under the best constructed microscope, not even the mouth or eyes could be clearly ascertained; but beneath, at the anterior end from whence the fore-legs arise, there are four light depressions, surrounded by dark lines, in the two hindmost of which is a dark spot, but these had not the appearance of eyes: behind this part, is usually a fold in the skin, at which place there is an independent motion: the feet are also observed to be in continual alternate motion, while under the microscope.

Size about that of *Acarus siro*, or cheese-mite.

Pl. VII. Fig. 1. Under part.
2. Upper part.
3. Side view.
(All greatly magnified).

As far as I have hitherto observed, this insect is peculiar to the gannet, and does not appear to inhabit any other part than the cellular membrane: in some subjects, it is found in prodigious abundance, together with the ova;

and no instance has occurred in which it has not appeared more or less in every specimen dissected.

To class this insect with any of the Linnean genera, is impossible; nor am I acquainted with any genus, in the arrangement of any of the more modern systematic writers, in which it could with propriety be placed. It appears to be more nearly allied to *Acarus* than to any other; but the want of eyes, proboscis, or sucker, and palpi, will not admit of connection; the situation, too, of the legs, seem to be characteristic. Under these circumstances, I propose giving it a distinct place in the system of nature, under the title of CELLULARIA *Bassani*, with the following generic characters: Head, thorax, and abdomen united: No eyes, antennæ, palpi, nor proboscis: Legs eight, the four posterior remote from the four anterior: Feet unarmed, but furnished with bristles.

Before I conclude this paper, it may be proper to remark, that the gannet, like all other birds, is not destitute of some species of *pediculus* that inhabit the feathers. But as the insects of this very numerous genus are so extremely similar, that they have been considered distinct, only from the circumstance of having been found on different animals, it appears useless to perplex science with a catalogue of names without specific distinction. That which inhabits the gannet, appears to be the same as those found on

Fig. 1.

Fig. 2.

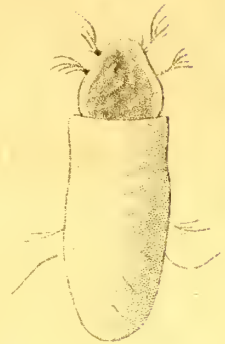

Fig. 3.

Fig. 4.

E. Mitchell sculp.t

many other birds, at least those observed by me had nothing remarkable to substantiate a character. From personal experience, I can aver, that two or three species are sometimes found to infest the same subject, and that one or other of these has also been found on others. There is every reason to believe, that the *pediculus* of the magpie is found on some of the duck tribe, and the very long and slender *pediculus*, of the Cinereous eagle, has been taken from the black martin, so that this class of insects may be extended without limits, and without benefit to science, unless specific distinctions can be clearly defined.

XII. *Account of a species of Fasciola which infests the Trachea of Poultry, with a mode of Cure.*

By GEORGE MONTAGU, Esq; F. L. S. & M. W. S.

(Read 1st August 1808.*)*

MOST persons in rural life, who have in the least attended to their poultry, know, that young chickens are subject to a fatal distemper, usually termed the *gapes*, from the principal symptom of the disorder; which is a frequent gaping, attended with an extension of the neck, like suffocation, and sometimes an apparent phthisical affection or irritation of the lungs. This distemper, which generally attacks them at the age of a month or six weeks, is, I believe, found to obtain in high as well as in low situations, but whether the nature of the soil, or that of the water, is productive of the cause, remains to be discovered. This disease is produced by a species of *fasciola* lodging within the trachea, frequently extending from the pharynx to the trachea, but never, that I have observed, into the lungs.

I have, at this time, (June 20. 1808), a brood of sixteen chickens, of about six weeks old, all of which, one excepted, appear to be more or less affected with it. Upon laying open the trachea of one that died this morning, that part was found to be highly inflamed, and contained no less than twenty of these *vermes* firmly adhering to its surface by their single arm. These had so completely choked up the passage, that the chick had undoubtedly died of strangulation*. Although none of these worms had passed into the lungs, they were found to be much inflamed.

In the year 1806, I first discovered the cause of the distemper; and, in the following year, on the first appearance of the attack, I administered a simple medicine, considered by some persons in this part of the kingdom as infallible; and, to my astonishment, not only not one of a large brood, suffering under its influence, died, but, on the contrary, all speedily recovered. The recipe consists in mixing up their meat (barley or oatmeal) with urine, instead of water, and feeding them with it three or four times a-day. Rue chopped small, and mixed with their food, has been a fa-

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* It is remarkable, that the only chick which was never affected, is black, and all the others white; and it will probably be found, that the dark coloured variety are not so subject to the distemper.

vourite remedy; but it may be proper to remark, that my chickens, affected at this time, have been under a course of that medicine since the first appearance of the distemper, and that so far from yielding to it, the malady increased during its administration, and one chicken, as before mentioned, had died. Under this disadvantage, in the advanced state of the disorder, the former prescription was given, and its good effects were visible in two or three days, and the whole brood is now in a state of convalescence.

I shall not attempt to reason upon the curative principle of the medicine prescribed, but leave that matter to those better qualified to judge on the subject. If the remedy has any real merit, (and there is every reason, from experience, to give it some degree of credit), it was not, I believe, originally administered with any knowledge of the cause of the distemper, but as a country housewife's nostrum, and adopted with as little reason, as many others, which have, by accident, been discovered to be beneficial.

It may be proper to remark in this place, that this vermicular distemper, seems to be peculiar to the young of the common domestic fowl, since neither my turkeys, nor ducks, all of which are reared together upon the same spot, have ever been attacked.

Whether, upon further experience, the remedy here prescribed, may be found a specific or not, it will be admitted, that the discovery of the cause of so fatal a disorder in an animal so profitable to man, is a matter of no small importance; for without a knowledge of the cause, no remedy can be applied upon physical reasoning. Hence, the great advantage of physiological inquiry, in enabling us to trace the distemper of a useful animal to its origin, and to solicit the aid of the learned in physic.

The *fasciola* which occasions this fatal disease, is, as far as I have been able to ascertain, a non-descript species, differing from all others hitherto described, by the great extension of the peduncle or arm that supports the lower foramen. The following is a description of this animal.

Cl. Vermes.—Ord. Intestina.

FASCIOLA trachea.

Pl. VII. Fig. 4. (Magnified four times.)

Body round, acuminated at the posterior end, the lower aperture produced on a long stalk or arm, that extends rather beyond the anterior end of the body, where the other aperture is placed, and is not above half the size of that part: these openings spread a little, or are subinfundibuliform; the larger appears to be the mouth, and is slightly sexpartite; that on the arm is used as a sucker, and is the part by which it adheres to the inside of the trachea: the divarication takes place at about one-fifth part of the length of the body: the colour is red, and the intestines, which are extremely numerous and tortuous, are white: the length is about an inch, and the breadth not above half a line.

Since the preceding was written, I have been informed by my friend Lord Porchester, that three parts of the young pheasants in his Lordship's menagery, die of a similar complaint, but at a more advanced age, generally at the time the feathers begin to shew the sexual distinction. This Nobleman favoured me with a specimen for examination, in which the trachea was stuffed with the same species of *fasciola*.

I have also had some old partridges lately affected with the same complaint: one that died, was evidently suffocated by these vermes; and, what is remarkable, the posterior half of one of the worms had got through the membrane of the trachea,—the only instance hitherto noticed of that part being perforated. Change of food, and change of place, together with the infusion of rue and garlic, instead of plain water to drink, and chiefly hemp-seed to eat, independant of the green vegetables which the grass-plot of the menagery afforded, recovered the others in a very short time.

DEC. 28. 1808.

NOTE BY THE EDITORS.

An animal similar to that here described, has been observed by Dr Wiesenthal, Professor of Anatomy at Baltimore in North America, an account of which has been published in the "Medi-"cal and Physical Journal" (1799), vol. ii. p. 204. The description given by him, agrees in most particulars with that delivered above, and is accompanied with a figure of the animal, of the natural size, and also magnified. The only difference is the want of the arm, by which the animal is supposed to attach itself to the inner surface of the trachea. In America, the disease produced by these animals, is not confined to the common fowl; for Dr W. informs us, that the young turkey is also subject to a similar complaint; to which the same name *(gapes)* has been applied, that it has obtained in Devonshire. No internal remedy has been discovered for it: a feather stript to within a little of the point, is introduced into the mouth and twisted round, by which the animals are frequently entangled and withdrawn.

The preceding communication is the more valuable, as a simple remedy is pointed out, which experience has shewn to be very efficacious in removing the disease.

That poultry in Scotland, are subject to a similar complaint, is highly probable; for we know that the domestic hen is liable to diseases affecting the organs of respiration, which may proceed from a cause similar to that here pointed out; but no observations have yet been made, which confirm this supposition.

XIII. *Some account of a Fin-Whale stranded near Alloa.*

By Patrick Neill, F. A. S. & Sec. W. S.

(Read 11th February 1809.)

On Sunday morning, the 23d October 1808, a large whale ran itself ashore on the banks of the Forth, a little way above the town of Alloa. About break of day, the servants belonging to the farm-house of Longcarse were alarmed by the noise of the animal's blowing, and floundering among the sludge. Assistance was soon procured from Alloa, and it was killed and secured.

As soon as I learned the occurrence, I resolved to see the animal; but it was the 1st of November before I could accomplish my purpose. By this time, the *flenching* was over, or the blubber had been cut away, and the *krang* or carcase had been sent afloat with the tide, on account of the very offensive smell it emitted. I found the carcase lying on the beach at the village of Lower

Airth, about two miles below Alloa, and on the opposite side of the river. It was very much disfigured; and consequently I had no opportunity of examining some of the external characters. For several of the particulars, therefore, which I have now to state, I am indebted to Mr Robert Bald, civil engineer, and manager of the collieries at Alloa, who had carefully examined the animal when complete, and had taken the dimensions with accuracy, and who most readily and politely answered all the queries I put to him, as far as the observations he had made enabled him to do so.

I shall first describe the animal as fully as my opportunities and information allow, and shall then subjoin some remarks as to the species to which it seems allied.

The total length of this whale was forty-three feet. Its circumference, where thickest, immediately behind the *swimming-paws*, (to use a term suggested by the Reverend Mr Fleming *, for their form and structure were more analogous to those of a hand or foot, than of a fin), was about twenty feet.

It had a single dorsal fin, (if the horny protuberance on the back may be so called), only two feet six inches high, and nearly the same in breadth at the base,—very diminutive certainly when compared with the bulk of the animal's body. This

* *Antea*, p. 134.

fin was placed very far down the back, about twelve feet only from the extremity of the tail, and nearly over the vent. It was of an acute triangular shape, blunt in front, and sloping off to a thin edge behind; slightly hooked, the curvature being towards the tail. From its shape, the sailors engaged in the whale-fishery, call such a dorsal fin a *pike*.

The under jaw projected about three inches beyond the upper jaw. It was nearly fourteen feet long. It was somewhat broader or wider than the upper jaw.

In the upper jaw there were two rows of short horny laminæ placed perpendicularly, and very closely set together *: the largest laminæ were in

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* By *horny laminæ*, I need scarcely observe, I mean the *whalebone* of commerce. "The substance called *whale-* "*bone*," Mr J. Hunter remarks, "is of the same nature as "horn: it is wholly composed of animal substance, and "extremely elastic. From this it must appear," he adds, "that the term *bone* is an improper one."—Phil. Trans. 1787. There is no appropriate and correct term, therefore, in the English language, equivalent to *fanons* in the French. But it is remarkable, that we do possess an appropriate word in the Scottish language. That word is *baleen*, evidently from the old French. It is still employed by the Scottish whale-fishers. The term appears to have been familiar to Sir R. Sibbald. In the preface to his "Phalainologia," he says, "Quædam balenæ corneas "laminas habent, quæ nautis nostris dicuntur *whales* "*with baleen*; quod enim Angli *whalebone*, nostri *baleen* "vocant."

the middle of the rows, and were only about eighteen inches long. Each lamina was dark-coloured in the thickest part, but became of a greenish or bluish-white colour on the thin side, next the interior of the mouth, where it separated into long white hairs or bristles. There might be about 300 laminæ on each side of the jaw, or 600 in all.

The tongue was black, of great size, soft, and nearly smooth.

There were two blowholes, long and narrow apertures, separated from each other only by a thin partition. They were situated in the highest part of the upper jaw.

The eyes were placed on the sides of the head, a very little way behind and above each angle or corner of the mouth. From eye to eye, measuring across the head, was nearly seven feet. The socket of the eye was fully 2½ inches in diameter.

The skin was black on the back; but, towards the belly, the colour changed to whitish. The cuticle was very fine; the true skin soft, spongy, and of considerable thickness.

The whole skin of the thorax, and upper part of the belly, was plaited or folded. The *sulci*, (or *plicæ*, as Sir Robert Sibbald calls them), were about two dozen in number. They extended from the lower lip to about four feet beyond the swimming-paws. On the under jaw, they ran obliquely downwards; but on the belly, they had a straight longitudinal direction. On the fore-part of the body, they were uniform and parallel;

but they diverged a little towards their termination behind. The *flenchers* having found no blubber under the plaited skin, had left a considerable portion of it untouched*.

The back was rounded next to the head: a little before the dorsal fin, it began to assume a somewhat angular shape, and this form was continued till a subordinate short ridge marked the commencement of the tail. The flattened or extended part of this member, was, as in other cete, horizontal, and divided into two lobes. The breadth, measuring between the extremities of the lobes, was no less than ten feet; its depth was nearly three feet.

The swimming-paws, measuring from the tip to the bone or ball which was received in the socket of the scapula, were nearly five feet long. In breadth, at the widest part, they did not extend to one foot, and they tapered to a pretty sharp point. They were narrow at their junction with the body. The socket which received them, was large, being 4¼ inches in diameter.

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* The use of these folds in the skin of the thorax, which was long a problem, has now been ascertained. They are calculated to permit the animal to swell up a large pouch or bladder, placed in the forepart of the body. When this bladder is expanded, the folds disappear, and the creature seems then as if striped, the covered interstices of the folds being of a paler colour than the rest of the skin of the thorax.

The dorsal or largest vertebræ, were eight inches in diameter. None of the others were laid open so as to admit of examination.

The animal was of the male sex.

I regret that I had no opportunity of examining the stomach, or any of the entrails, putrefaction having proceeded too far. The whole muscular parts of the body had completely lost their fibrous texture, and become putrid; and the smell was exceedingly offensive.

In the common Greenland whale, the blubber is from eight inches to one foot in thickness: In this whale, however, it was, on an average, little more than two inches thick. In the former, I understand, it covers the thorax, as well as the back and sides; but in this whale, as already observed, there was no layer of fat where the folds or sulci occurred. The blubber was firm in texture, and not unlike the fat of pork, when rendered soft or transparent by heat. It does not appear to be so subject to putrescency as the blubber of the common whale. It filled seven large casks; but was not expected to yield much oil, compactness not being a desirable quality in blubber. A soap-boiler accordingly, I am informed, bought the whole for the small sum of L. 15 Sterling.

I cannot help here observing, that the carcase might, along with peat-moss, which abounds in the neighbourhood, have produced, on Lord Meadowbank's principle *, a quantity of compost manure,

* "Transactions of the Highland Society of Scotland," vol. ii. p. 138, *et seq.*

worth probably a good deal more than the trifling sum procured with so much labour and expense from the blubber. Yet this source of profit, and of agricultural improvement, seemed to have been quite overlooked.

In regard to the species, to which the whale, which I have now imperfectly described, should be referred, I shall state the result of my examination of the most recent book on this branch of natural history, M. La Cepède's, "Histoire des "Cetacées." According to this author's new arrangement of the Cete, it must belong to his genus of *Baleinoptera*, or whales having whalebone in the mouth, and a fin on the back; as the termination *ptera*, from πτερον, intimates.

This genus is subdivided into two.

1*st*, Those that have the skin of the thorax smooth.

2*d*, Those that have folds or plicæ on the thorax.

This last subdivision contains three species. 1. *Baleinoptera jubartes*, (Balæna boops), with tuberosities near the blowholes. 2. *Baleinoptera rorqual*, (Balæna musculus), with a very wide and round under-jaw. 3. *Baleinoptera acuto-rostrata*, "with both jaws pointed; the upper a little "shorter, and considerably narrower than the "under." This is announced by La Cepède as the Balæna rostrata of Gmelin, and the Pike-headed whale of the English *.

Considering the enormous bulk of the body, the jaws of the Alloa whale tapered sufficiently, perhaps, to be described generally as " pointed," and the under jaw did in fact terminate in a little projecting acumination or point, proceeding from a short twisted bony ridge in the middle of the under side of the jaw,—most exactly as represented in a drawing of one of this species sent to La Cepède by Sir Joseph Banks †. The upper jaw was only a " little shorter" than the under, and it was also somewhat narrower. From the abridged specific character, therefore, assigned by La Cepède, I was immediately led to conclude, that it was his *Baleinoptère müseau-pointu* that I had seen.

On turning, however, to his more detailed account of this species, I was not a little puzzled to be informed, in the very outset, that this is the least of all the whalebone whales, it appearing, (to

* The original name, as employed by Sir R. Sibbald, is *Pyked whale*, being derived from the *pyke* on the back, or dorsal fin. Mr John Hunter also uses the name *Piked whale*. Mr Pennant, however, converted it into *Pike-headed whale*, as if its head resembled that of a pike-fish.

† " Histoire des Cetacées," *in loco*.

use his own words, " qu'elle ne parvient qu'à " une longeur de huit ou neuf metres,"—from twenty-six to twenty-nine feet and a half: whereas the Alloa whale, was forty-three feet long.

It is to be kept in view, that La Cepède himself acknowledges that he enjoyed no opportunity of describing the Baleinoptere museau-pointu from his own observation. For all his information, as well as his figures, he is indebted to the late Mr John Hunter, to Sir Joseph Banks, and to Geoffroy de Valogne. This last-mentioned naturalist, it appears, examined a specimen taken near Cherbourg, which measured only four metres and two-thirds, or something more than fifteen feet. This, La Cepède considers as a young one. Mr Hunter mentions one killed on the Dogger Bank, which measured seventeen feet, and from this specimen, it seems probable, that Sir Joseph Banks's figures were taken.

In La Cepède's description, it is said, " Les " fanons sont d'une couleur blanchâtre." In the Alloa specimen, they were of a blackish or rather a dirty bluish colour; and it was remarkable, that the larger laminæ were of a darker colour than the smaller; some of the very least, at the extremities of the upper jaw, being nearly white. I have heard it remarked, of the common Greenland whale, that the whalebone of the young ones is much paler in colour, than that of what are termed " sizable fish." The dark colour would seem, therefore, to increase with the age of the animal; and I am inclined to believe, that these horny laminæ, have this analogy with the teeth of other animals, that they do not all appear at once in the young, but gradually increase in number as the jaw enlarges with the creature's growth. In the Cherbourg specimen, Geoffroy de Valogne tells us there were only 200 laminæ on each side: in the Alloa specimen, there were about 300 on each side.

I have stated, that, in the Alloa whale, the upper jaw was only "somewhat narrower" than the under; while in the Baleinoptere museau-pointu, La Cepède characterizes it as "beaucoup "plus étroite." I am inclined to suspect, however, that La Cepède has here used too strong an expression through mere carelessness,—a charge of which he may easily be convicted in many instances*. The under jaw being *much* wider than the upper, is one principal characteristic of the *rorqual* or Balæna musculus. But La Cepède fur-

* See the Rev. Mr Fleming's description of a Narwal, p. 147. of this volume.—From information communicated to me by my friend Mr William Scoresby *junior* of Whitby,—a very accurate observer, who has been eight voyages to the Greenland seas,—I am much inclined to suspect, that La Cepède has constituted his *two* species of Narwals without sufficient evidence. The older figures of the Sea-Unicorn have no resemblance to any animal seen in the Northern Seas, farther than in possessing a twisted horn: the drawing furnished to La Cepède by Sir Joseph Banks, seems to have been the first approach to a correct resemblance of the

nishes real evidence to prove his own inaccuracy in this instance : he refers to Mr Hunter's *Piked whale* as a synonime ; but Mr Hunter's plate does not represent the under jaw as *much* wider, and, in his description, he merely says, " In the piked whale, " when the mouth is shut, the projecting whale-" bone remains entirely on the inside of the low-" er jaw, the two jaws meeting every where " along their surface."

I may next remark, that Sir Robert Sibbald, when in his Phalainologia, he treats, " de Balæna " tripinni quæ rostrum acutum habet et plicas in " ventre *," alludes, in my opinion, to a whale of the same species as the one killed at Alloa. In the

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animal ; and the French naturalist, finding it so very different from former figures, has been led to describe it as a new species, *le narwal microcephale*. If this view of the subject be correct, the Rev. Mr Fleming's drawing (Plate vi.), may be considered as the only accurate representation of the narwal yet extant.

* The specific character given by Linnæus, in his own editions of the Systema, " B. fistula duplici in rostro, " dorso extremo protuberantia cornea ;" and that given by Artedi, " B fistula duplici in rostro, protuberantia " corniforme in extremo dorso ;" apply equally to the Balæna boops, and to the species now under consideration. But it is worthy of remark, that Sir Robert Sibbald's character, " B. tripinnis. nares habens, *cum rostro* " *acuto*, et plicis in ventre," is not liable to this objection.

London edition, indeed, of the Phalainologia, Mr Pennant marks this as the *Pike-headed whale*. La Cepède, however, considers Sir Robert Sibbald's description as applicable to his Baleinoptera jubartes, or Balæna boops of Linnæus; but without any good reason that I can perceive, and he himself has not assigned any. In the *jubarte*, the *rostrum*, far from being *acutum*, as in Sibbald's whale, is, according to La Cepède, *un peu arrondi*. And it would surely be wrong to take it for granted, that so sagacious an observer as Sibbald would fail to take notice of any *tuberosities* occurring in front of the blowholes, which form a striking part of the specific character of the *jubarte*; especially as he is very particular in describing the *nares*, as he chooses to call the blowholes.

Sibbald's specimen came ashore a little to the westward of Burntisland, on the 17th November 1690 (O. S.). It measured forty-six feet long, and was twenty feet in circumference where thickest.

I have seen a MS. account, by the late Dr Walker, of a whale seemingly of the same species, and precisely of equal size, which was forced ashore very near to the same spot at Burntisland, on the 10th of June 1761. Dr Walker named it *Balæna sulcata*, from the longitudinal folds on the thorax; but as two other species (for, till we be better taught, we must consider them all as distinct species) possess similar sulci, this specific name is inadmissible. His description is pretty minute, and agrees, upon the whole, remarkably well with the characters of the Alloa whale. He makes no mention of any tuberosities in front of the blowholes, which he could not have overlooked, and which, as already observed, are characteristic of the *jubarte*, the only species with which the Pike-headed whale could well be confounded. He is clearly of opinion, that his whale is of the same species with that described by Sir Robert Sibbald, above mentioned; and he seems to think that it was unknown to Linnæus; for he adds, that he believes no other naturalist has ever described it. The MS. is dated in 1782, when the latest writings of Linnæus must have been familiar to Dr Walker.

With diffidence, I presume to state, therefore, that the Baleinoptera acuto-rostrata has occurred three times in the Frith of Forth. Two of the specimens, it has been seen, were forty-six feet long; and the third, forty-three. The circumstance of their all being so nearly of the same size, may perhaps afford some presumption, that they were full grown animals. It shews, at least, that La Cepède errs in restricting the size of this species below thirty feet.

In concluding, I must, however, observe, that there still appears to be a good deal of uncertainty and indistinctness in authors, concerning the species of finners or piked whales. These animals, therefore, deserve the particular attention of gentlemen who have opportunities of visiting high latitudes, and who are willing to contribute to the elucidation of a class of animals, which, though the hugest in the world, are remote from the observation of most of the cultivators of natural history. Every specimen, also, which may accidentally be cast on the shores of Great Britain, deserves to be carefully examined and described. By multiplying descriptions and observations, facilities will be furnished for rectifying mistakes, and ultimately settling the species.

XIV. *A List of the rarer Plants observed in the neighbourhood of Edinburgh.*

By Robert Maughan, Esq; F. L. S.

(Read 9th December 1809.*)*

Since the publication of Lightfoot's "Flora Scotica," in 1777, a very considerable addition has been made to the catalogue of indigenous and naturalized plants of Scotland, particularly by the researches of the indefatigable Mr George Don of Forfar, and of the late Mr John Mackay of the Botanic Garden at Edinburgh.

The following list contains an enumeration of such of the rarer species and varieties as have been observed within a day's excursion of the metropolis.

It may be proper to remark, that some of the plants here introduced, though perhaps common in other districts, are exceedingly rare in this part of the country.

With regard to *habitats*, I have endeavoured, as far as possible, to quote the testimony of those upon whose authority the different places of growth depend, adding my own initials to those stations which rest upon my personal observation.

In the arrangement and nomenclature of the *phænogamous* plants, I have followed Hull's second edition of the "British Flora,"—in the *Filices* and *Musci*, Dr Smith's justly celebrated "Flora "Britannica,"—in the genus *Lichen*, Turton's "General System of Nature,"--and in the genus *Fucus*, Turner's "Synopsis of the British Fuci."

HIPPURIS

vulgaris. In a ditch at the west end of Duddingston Loch.

CIRCÆA

alpina. King's Park. *Mr P. Neill.*

VERONICA

Anagallis. Duke's Walk, in the King's Park, at Edinburgh, and in a ditch near Muttonhole. *R. M.*

scutellata. South side of Duddingston Loch.

montana. In Arniston * and Lugton Woods, and about Roslin.

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* Arniston, the well known seat of Lord Chief Baron Dundas, who in the most obliging manner, indulged me with permission freely to explore his extensive woods, in which many of our rarest plants are to be found, such as Pulmonaria officinalis, Galanthus nivalis, Convallaria majalis, Spiræa salicifolia, Lathræa squamaria, &c.

UTRICULARIA

minor. In the Peat-pits near Ravelrig Toll. *Mr Sommerville and E. J. Maughan.*

VERBENA

officinalis. "Without the gates of Inver-"keithing *."

SALVIA

verbenaca. Upon the bank under Salisbury Craig,—at Burntisland,—and near Pettycur.

VALERIANA

rubra. On old walls at Inverleith. First observed by *E. J. Maughan.*

dioica. Bogs to the westward of Borthwick Castle. *Mr P. Neill and E. J. Maughan.*

pyrenaica. Collington Woods. *Mr G. Don.* Abercorn Woods. *R. M.*

dentata †. Near Crossgate Toll, about three miles south of Musselburgh. Observed in 1809. *R. M.*

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* This plant is inserted by Lightfoot, in his "Flora "Scotica," on the authority of Dr Parsons.

† New to Scotland.

SCHŒNUS

compressus. Neighbourhood of Borthwick Castle.

rufus. On the coast, two miles to the eastward of South Queensferry. *Rev. J. Fleming, Bressay, Shetland.*

SCIRPUS

pauciflorus. Leith Links. *Mr J. T. Mackay.*

sylvaticus. By the side of Gogar Burn. *Mr G. Don.*

ERIOPHORUM

vaginatum. Boggy places on the Pentland Hills, and near Dalmahoy Hill.

polystachion. Pentland hills. *Mr G. Don.*

AGROSTIS

vulgaris. var. 2. Pentland hills.

POA

aquatica. Banks of Leith river, at Bonnington bridge.

rigida. King's park,—by the side of the road leading from Edinburgh to Haddington, near Drummore,—and on walls about Burntisland, plentifully.

compressa. On walls about the King's Park.

FESTUCA

loliacea. In the marsh at the foot of Salisbury Craigs. *Dr Yule.*

bromoides. Frequent on walls about Edinburgh. *Dr Yule.*

BROMUS

erectus. King's park. *Mr G. Anderson.*

ARUNDO

colorata. Meadow ground, west end of the North Loch, at Edinburgh. *E. J. Maughan.*

HORDEUM

pratense. On the east point of Salisbury Craig. First observed by *Mr J. Neill,* in 1794.

DIPSACUS

sylvestris. Inch Colm.

GALIUM

pusillum. Habbie's How, in the Pentland Hills. *Mr G. Don.*

erectum. Fishwives Causeway near Portobello.

Mollugo. Near Dreghorn, the seat of Alex. Trotter, Esq;—By the road side, at Four-mile-hill, between Corstorphine and Kirkliston.

PLANTAGO

media. Roman Camp above Newbattle, in the greatest abundance. *R. M.*

CORNUS

suecica. Pentland hills. *Lightfoot**.

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* On the authority of the late Dr Hope, one of the few respectable botanists which Scotland has produced.

ILEX

Aquifolium. var. 2. In a hedge by the road leading from Edinburgh to Queensferry, within a short distance of the ferry. *Withering.*

POTAMOGETON

densum. Ditches in the King's Park.

lucens. var. 2. At Bogsmill, near Slateford. *R. M.*

pusillum. In a ditch close by the Flint-mill at Musselburgh. *R. M.*

SAGINA

maritima. Near the Wet Dock at Leith. *Mr G. Don.*

LITHOSPERMUM

officinale. Arniston Woods, and among the ruins of Roslin Castle.

ANCHUSA

sempervirens. Deanbank, near the village of Water of Leith.

PULMONARIA

officinalis. Arniston Woods very abundant. Banks of the North Esk near Kevock-mill sparingly.

maritima. On the Fifeshire coast near Seafield Tower. *Mr Sommerville, and E. J. Maughan.*

SYMPHYTUM

tuberosum. Frequent on the banks of the Water of Leith, as opposite St Bernard's Well,—Collington Woods,—Woodhall, &c.—I have also observed it in several places on the banks of the North and South Esk.

BORAGO

officinalis. On rubbish at Burntisland *.

ECHIUM

vulgare. var. with white flowers. Hills behind Burntisland. *E. J. Maughan.*

PRIMULA

vulgaris. var. 2. of *With.* Collington Woods. *E. J. Maughan.*

elatior. Woods about Starley Burn near Burntisland, in great abundance †.

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* Probably the outcast of a garden.

† Dr Smith thinks it possible, that this species may be a hybrid production between P. vulgaris and P. veris. In its long common fruit-stalk, it resembles the latter; in the expanded border of the blossom it agrees with the former. I have a specimen, in which, both the Primrose and Oxlip are produced from the same root, corresponding exactly with those mentioned by Withering, as being in the possession of my much valued friend Dawson Turner, Esq; of Yarmouth.

CONVOLVULUS

sepium. In a hedge by the side of the road leading from Abbey-hill to Leith. *Dr Yule.*

POLEMONIUM

cœruleum. On the coast two miles to the eastward of South Queensferry, growing with Arundo arenaria. *R. M.*

CAMPANULA

latifolia. Collington and Roslin Woods abundantly.

glomerata. Hills behind Pettycur. *Mr P. Neill.* Links near Gosford. *R. M.*

VIOLA

hirta. Blackford hill. Links between Cockenzie and Gosford.

lutea. Top of Arthur's Seat. *Mr P. Neill.* Corstorphine hill,—woods near Ravelrig toll,—Banks of Bevelaw Burn,—and Pentland hills.

VERBASCUM

nigrum. Links between Seton and Gosford. *Dr Yule.*—Banks of the river Esk opposite Coalpits, and at Borthwick Castle. *R. M.*

ATROPA

Belladonna. Among the ruins of Borthwick Castle. *Mr P. Neill and E. J. Maughan.*

SOLANUM

Dulcamara. Frequent in hedges about Dalkeith.

LONICERA

Caprifolium. Collington Woods. First observed there by *R. M.* in company with *Mr Weatherhead*, in summer 1809.

EUONYMUS

europæus. King's Park, and near Craigmillar Castle.

RIBES

nigrum. Auchindenny Woods. *Mr Edward Shuter and R. M.*

VINCA

major. Dundas hill. *Mr P. Neill.* Collington Woods. *R. M.*

CHENOPODIUM

rubrum. West side of the Earthen Mound at Edinburgh, *Mr G. Don.* Restalrig, *Mr P. Neill.*

hybridum. Cultivated fields about Edinburgh, but rare. *Mr G. Don.*

olidum. Fisherrow Links.

BETA

maritima. Opposite Gosford gate. *Mr P. Neill.* Sea-shore near Kirkaldy. *Mr Sommerville and E. J. Maughan.*

GENTIANA

Amarella. Links to the eastward of Cockenzie. *R. M.*

campestris. Hills between Pettycur and Burntisland. King's Park.

HYDROCOTYLE

vulgaris. King's Park, near the west end of Duddingston Loch; and Figget Whins.

CAUCALIS

nodosa. On the bank below Salisbury Craig, towards Duddingston Loch, and by the side of the road leading from Drummore to the village of Preston.

PEUCEDANUM

Silaus *. Borders of corn-fields near Oxenford Castle, the seat of Sir J. Dalrymple, Bart. First observed by *R. M.* in 1809.

LIGUSTICUM

scoticum. Back of the Glass-works at Leith.—Inch Colm.—Very frequent along the coast between Barnbougle and Hopeton.—Links near Gosford. *R. M.*

OENANTHE

fistulosa. "In ditches and rivulets between "Inverkeithing and North Queensferry." *Lightfoot.*

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* Supposed new to Scotland.

PHELLANDRIUM

aquaticum. Ditches near Corstorphine *.

CICUTA

virosa †. Lochend.

IMPERATORIA

Ostruthium. Near Borthwick Castle. *Mr Shuter and R. M.*

CARUM

Carui. Roadside between Newhall and South Queensferry.—Banks of a rivulet near the Village of Abercorn. *Mr Shuter and R. M.*

APIUM

Petroselinum. Old Walls near Inverleith,—on an old wall at Coltbridge,—and by the

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* Found by Mr Yalden, above forty years ago, and again in 1801 by Mr P. Neill. I have repeatedly, within these two or three years, searched for it in vain; which leads me to suspect, that it is now extirpated by the cleaning out of the ditches.

† Perhaps the most poisonous plant indigenous to Scotland.

APIUM

road side between Collington and Dreghorn*. *R. M.*

graveolens. Ditches in Musselburgh Links, behind Loretto.

VIBURNUM

Opulus. Auchindenny Woods. *R. M.*

SAMBUCUS

Ebulus. In a field by the road leading from Edinburgh to Dalkeith, a little beyond Newington. First observed by *Mr J. Mackay, Dr Mitchell, and Mr J. Neill.*

nigra. var. 3. Collington Woods.

GALANTHUS

nivalis. Arniston Woods, in the greatest abundance, covering whole acres of ground. *Mr Shuter and R. M.*

ALLIUM

vineale. King's Park.

ASPARAGUS

officinalis. Links near Gosford. Observed by *E. J. Maughan and R. M.* in 1806.

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* This plant may now be considered as naturalized in Britain, having also been found by my friend Mr Borrer at Arundel and Shoreham in Sussex; and Mr Turner, whose authority I highly respect, thinks it has as good a claim to a place in our Flora as Valeriana rubra.

CONVALLARIA

majalis. Arniston and Collington Woods. *Mr Sommerville, Mr Shuter, and E. J. Maughan.*

JUNCUS

uliginosus. Frequent on the Pentland Hills, and in the peat-pits near Ravelrig Toll.

PEPLIS

Portula. Braid Hill marshes. *Mr G. Don.*

RUMEX

sanguineus. King's Park. *Mr P. Neill.* Abercorn Woods. *R. M.*

maritimus. Near Burntisland.

ALISMA

ranunculoides. In the Hunting Bog. *Mr J. Neill.* South-east side of Duddingston Loch. *E. J. Maughan.* Near Burntisland. *Mr G. Don.*

EPILOBIUM

angustifolium. Habbie's How, Pentland Hills. In Collington and Abercorn Woods.

VACCINIUM

Vitis-idæa. Pentland Hills.

Oxycoccus. West side of Otterston Loch, Fifeshire. *E. J. Maughan.* Marshy ground, Pentland Hills, on sphagnum. *Mr P. Neill.*

DAPHNE

Laureola. Roslin Woods.

POLYGONUM

Bistorta. Marshy ground at Roseburn near Coltbridge.—Banks of the North Esk below Kevock mill. *R. M.*

PARIS

quadrifolia. "In a wood about a mile to the "south of Newbattle*."

BUTOMUS

umbellatus. Duddingston Loch. *Mr J. Mackay.*

PYROLA

rotundifolia. Auchindenny Woods.

minor. Woods near Ravelrig Toll; Auchindenny Woods; and at Newhall.

CHRYSOSPLENIUM

alternifolium. Roslin Woods, and by the side of Bilston Burn.

SAXIFRAGA

umbrosa. Auchindenny Woods, but very rare. *Mr Sommerville and Mr Kennedy.*

granulata. var. flore pleno. Collington Woods. *R. M.*

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* Inserted by Lightfoot on the authority of Dr Parsons.

SAXIFRAGA

tridactylites. On the top of an old wall near Craiglockhart, *Mr G. Don.* Links a little to the eastward of Cockenzie. *R. M.*

hypnoides. Arthur's Seat.—On Dalmahoy Hill.—At Habbie's How, Pentland hills.

SAPONARIA

officinalis. By the side of a road leading from the Dean to Ravelston.—In a lane near Roslin Chapel.—Banks of the river Esk above Coalpits. *R. M.*

DIANTHUS

barbatus. Banks of the Water of Leith between Coltbridge and Saughtonhall. *R. M.* Collington Woods. *E. J. Maughan.* Near Maleny. *Mr G. Don.*

deltoides. Banks of Lochend,—King's Park,—Blackford and Pentland hills.

SILENE

nutans. Hills at North Queensferry. *Mr Brown.*

STELLARIA

nemorum. Frequent in woods on the Banks of North and South Esk.

glauca. Lochend and Duddingston Loch.

ARENARIA

trinervis. Collington and Roslin Woods.—Hedges near Redhall.

tenuifolia. Near Pettycur Harbour. *Mr Don.*

ARENARIA

verna. King's Park and Blackford Hill plentifully.

SEDUM

Telephium. Hedge banks near Roslin.
reflexum. Walls about Craigcrook.

LYCHNIS

Viscaria. Rocks in the King's Park, and Blackford Hill.—Dundas Hill, near Kirkliston. *Mr P. Neill.*

CERASTIUM

semidecandrum. Walls about the King's Park.

RESEDA

lutea. Hills between Pettycur and Burntisland. *Mr P. Neill.*

EUPHORBIA

exigua. In a field at the marl pit near Muttonhole. By the side of a hedge at Crossgate Toll, and also in a field near Musselburgh.

Esula. "In a wood near a rivulet at Abercorn, 1792. *Mr J. Mackay.*" Near Gladsmuir Kirk, in a lane leading from the Haddington road to Elvingston. First observed in 1806, by *R. M.*

PRUNUS

Padus. Collington Woods and on the banks of Bevelaw Burn.

PRUNUS

insititia. Pentland Hills. *Mr G. Don.*

PYRUS

Aria. Rocks in the King's Park.

SPIRÆA

salicifolia. Very abundant in the woods at Arniston and about Craigiehall.

ROSA

spinosissima. var. with petals red at the base*. Links near Cockenzie. *Mr Weatherhead and R. M.*

RUBUS

Chamæmorus. Top of the eastern Cairn Hill, one of the Pentlands, very plentiful. *Mr Sommerville and E. J. Maughan.*

POTENTILLA

argentea. Blackford Hill and Binny Craig. *R. M.*

reptans. On the coast near Caroline Park,—Fisherrow Links,—and other places about Edinburgh, not unfrequent.

verna. King's Park, and hills about North Queensferry, common.

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* Rosa Ciphiana of Sir R. Sibbald.

GEUM

rivale, var. 2. Collington Woods *.

——— var. 3. *Ibid. R. M.*

GLAUCIUM

luteum. Shore near Rosyth Castle, North Queensferry. *Mr J. Mackay.* Sandy shores near Gosford.

PAPAVER

cambricum. Banks of the Water of Leith near Woodhall. *Mr Sommerville and R. M.*

NYMPHÆA

lutea. Lochend.

alba. In the same lake.

AQUILEGIA

vulgaris. Collington Woods.

STRATIOTES

aloides. Duddingston Loch.

CLEMATIS

Vitalba. Collington Woods.

THALICTRUM

majus. Hills about North Queensferry.

flavum. "At North Queensferry." *Lightfoot.*

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* G. intermedium of Withering on the authority of Mr Robson, and Mr Curtis, who consider it a distinct species.—Dr Smith is of opinion, that this var. is a hybrid between G *urbanum* and G *rivale*, to the former of which it has a nearer resemblance in habit.

RANUNCULUS

Lingua. West side of Duddingston Loch.

arvensis. In a corn-field near Stockbridge, but rare. *R. M.*

TROLLIUS

europæus. Banks of the Water of Leith opposite Newmill above Currie.—Meadow-ground to the southward of Ravelrig Toll,—and near Borthwick Castle.

GALEOPSIS

Ladanum. By the road side near Oxenford Castle, and at Crossgate toll. *R. M.*

versicolor. Corn-fields about Edinburgh very common.

BETONICA

officinalis. Collington and Auchindenny Woods.

STACHYS

ambigua. Eng. Bot.—Near Habbie's How, Pentland hills. Discovered by *Mr Weatherhead* in 1809.

MARRUBIUM

vulgare. Fisherrow Links, and at Long Niddry.

LEONURUS

Cardiaca. In a shady walk behind Fisherrow, and in Collington Woods.

MELAMPYRUM

sylvaticum. Auchindenny and Roslin Woods.

LATHRÆA

squamaria. Arniston Woods abundantly. *Mr G. Don.*—Woods between Auchindenny and Roslin. *E. J. Maughan.*

SCROPHULARIA

aquatica. Gogar Burn; and at the village of Hopeton. *Mr G. Don.*

vernalis. On old walls near Hatton. *R. M.*

OROBANCHE

major. Near Kirkaldy. *Mr Sommerville, and E. J. Maughan.*

THLASPI

arvense. Corn-fields about Edinburgh.

hirtum. Woods near Roslin. *Mr G. Don.* In a corn-field at Belismills. *E. J. Maughan.*

COCHLEARIA

danica. At Burntisland, and on Cramond Island, in the Frith of Forth.

Armoracia. In a field near Craigcrook. *R. M.*

CORONOPUS

Ruellii. By the road-side, west of Tobago Street, Edinburgh,—at Burntisland,—and at Seton harbour.

CARDAMINE

pratensis. var. *flore pleno.* In a bog between Law of Laurieston's house and the sea. *Mr J. Neill, and R. M.*

amara. Near Bellsmills, and Kevock mill.

SISYMBRIUM

terrestre. Figget Whins. *Mr G. Don.* Edge of Kinghorn Loch. *Mr P. Neill.*

amphibium. Duddingston Loch. *Mr Yalden.*

HESPERIS

inodora. Collington and Auchindenny Woods.

TURRITIS

hirsuta. King's Park, and at Habbie's How, Pentland Hills.

BRASSICA

campestris. By the side of the road leading from Leith to Queensferry, near Bangholm. *Mr G. Don.*

Napus. On the rocks behind Edinburgh Castle.

SINAPIS

alba. Corn-fields about Edinburgh not unfrequent.

GERANIUM

phæum. Collington Woods but very rare. First observed in 1809 by *R. M.*

sylvaticum. var. *floribus albis.* Right bank of the Water of Leith between Collington

GERANIUM

and Currie. *Mr E. J. Maughan.*

pyrenaicum. Near Bells-mills and in the King's Park, but not common.

columbinum. Road side near North Queensferry, rare. *R. M.*

sanguineum. Rocks about Arthur's Seat in abundance. Sea-shore at Gosford gate near Aberlady, very plentiful.

LAVATERA

arborea. Inch Garvie and Inch Mickery, two small Islands in the Frith of Forth.

GENISTA

anglica. Pentland Hills. *E. J. Maughan.*

ULEX

nanus. Pentland Hills. *Mr G. Don.*

VICIA

sylvatica. On the bank below Salisbury Craig, and in Collington Woods.

sativa. var. 3. King's Park, and Dalmahoy Hill.

lathyroides. Common in the King's Park, and on Blackford Hill.

lutea. Hills at North Queensferry. *Mr Don.*

ORNITHOPUS

perpusillus. In a field near Maitland Bridge. *Mr John Mackay.*

ASTRAGALUS

hypoglottis. In the King's Park, and on the Coast near Granton, plentifully.

glycyphyllos. Banks of the Water of Leith between Coltbridge and Saughtonhall.—In many places on the coast between Nether Cramond and Queensferry.

uralensis. Hills about North Queensferry *.

TRIFOLIUM

ornithopodioides. In a field near Maitland Bridge. *Mr J. Mackay.* Fisherrow and Musselburgh Links. *R. M.*

scabrum. "On dry soils by the sea shore near "Edinburgh." *Lightfoot.*

arvense. var. 2. Fisherrow Links. *R. M.*

fragiferum. Links near Cockenzie. *Mr C. Stewart.* Leith Links. *Mr J. I. Mackay.*

HYPERICUM

humifusum. Banks of the river Esk at Newhall, and on the Pentland Hills.

pulchrum. Pentland Hills, Roslin Woods, and other places, frequent.

LACTUCA

virosa. King's Park.

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* This rare plant, I observed growing most abundantly near the top of a hill, about a mile west of the Ferry, where I have also gathered a variety of it with white flowers.

LEONTODON

palustre. Pentland Hills.

HIERACIUM

sabaudum. Roslin and Collington Woods.

CICHORIUM

Intybus. In a field near Foxhall. *R. M.*

CARDUUS

tenuiflorus. Very common about Edinburgh.

nutans. Fisherrow Links, — West-pans, — and about Cockenzie.

marianus. King's Park; and at the foot of the rocks, west side of Edinburgh Castle.

eriophorus. By the road-side near Oxenford Castle. *R. M.*

heterophyllus. Roslin and Auchindenny Woods.

ONOPORDUM

Acanthium. In a field hard by the village of Cockenzie.

GNAPHALIUM

dioicum. King's Park, and Dalmahoy Hill.

SENECIO

viscosus. King's Park; and Figget Whins.

SOLIDAGO

Virgaurea. Collington Woods, Pentland hills, and Roslin Woods.

ORCHIS

conopsea, var. *flore albo.* In meadow ground, south of Dalmahoy Hill. *Mr Sommerville, and E. J. Maughan.*

viridis. (Satyrium *viride,* Fl. Brit.) Small hillocks near Caroline Park gate. *Mr P. Neill.* Hills at North Queensferry. *R. M.*

EPIPACTIS

Nidus avis. (Ophrys *Nidus avis,* Fl. Brit.) Auchindenny Woods.

ovata. (Ophrys *ovata,* Fl. Brit.) Swanston Wood. *Mr P. Neill.* Meadow-ground to the southward of Ravelrig Toll.

cordata. (Ophrys *cordata,* Fl. Brit.) In a fir-wood, between Woodhouselee and the Bush,—Peat-bog, near Ravelrig Toll,—and on the Pentland Hills. *Mr Sommerville, and E. J. Maughan.*

CYMBIDIUM

corallorhizon. (Ophrys *corallorhiza,* Fl. Brit.) West side of the peat-bog, near Ravelrig Toll, among salices. Discovered by *E. J. Maughan,* in 1807.

ARUM

maculatum. Banks of the Water of Leith, opposite Bogsmill, near Slateford. *Mr G. Don.*

CHARA

flexilis. Ditches at Ravelrig Toll;—in a ditch close by the Flint-mill near Musselburgh, and in a pond at Powderhall. *R. M.*

LEMNA

gibba. Lochend and Duddingston Loch.

TYPHA

latifolia. Lochend.

SPARGANIUM

natans. Loch on Dunearn hill. *Mr P. Neill.* In the peat-pits, south side of Dalmahoy Hill. *E. J. Maughan.*

CAREX

curta. North Queensferry. *Mr J. Mackay.*

teretiuscula. North Queensferry, *Mr J. Mackay;* and in a marsh at the foot of Dundas Hill, *Mr P. Neill.*

pendula. Roslin Woods, and in the Duke of Buccleugh's park at Dalkeith.

strigosa. Arniston Woods.

distans. Pentland Hills.

Carex

pilulifera. King's Park, and by the side of Bevelaw Burn.

stricta. Banks of the Water of Leith, above Currie.

ampullacea. Near Duddingston Loch. Bevelaw Burn.

Salix

Russelliana. Common about Edinburgh.

pentandra. On the banks of the Esk and Water of Leith, and also near Ravelrig Toll.

fragilis. At Ravelrig Toll, and some other places about Edinburgh, but much less frequent than *S. Russelliana.*

arenaria. Collington Woods, rare. *Mr G. Don,* and *E. J. Maughan.*

oleifolia. Bogs south side of Dalmahoy Hill.

mollissima. Banks of the Esk above Musselburgh, rare. *R. M.*

Empetrum

nigrum. Pentland Hills, in abundance.

Atriplex

laciniata. Sea-shore behind Fisherrow.

CRYPTOGAMIA.

Equisetum

hyemale. In Roslin, and Collington Woods.

OPHIOGLOSSUM
vulgatum. In a field near Little Vantage.

OSMUNDA
Lunaria. Hills behind Pettycur harbour, and also on the Pentland Hills, but rare.

LYCOPODIUM
Selaginoides. Pentland Hills. *Mr P. Neill.*
alpinum. Pentland Hills.

POLYPODIUM
Phegopteris. Arniston Woods, and by the side of Bevelaw Burn.
Dryopteris. Arniston, Roslin, and Auchindenny Woods; and at Habby's How, on the Pentland Hills.

ASPIDIUM
Oreopteris. Arniston Woods, and Habby's How, on the Pentland Hills.
lobatum. Roslin Woods, frequent.

ASPLENIUM
marinum. Rocks near Queensferry.
septentrionale. Rocks in the King's Park, and on Blackford and Braid Hills, abundantly.

SPHAGNUM
squarrosum. In the peat-bog, south side of Dalmahoy Hill.

Buxbaumia

aphylla. Roslin Woods, very rare. Discovered by *E. J. Maughan*, and *R. M.*, 31st October 1807.

Phascum

piliferum. King's Park. *Mr J. Neill.*

serratum. In a stubble field near the village of Pentland. *E. J. Maughan.*

Gymnostomum

ovatum. Frequent on mud-topped walls about Edinburgh.

Splachnum

ampullaceum. Pentland Hills.

Andræa

rupestris. Pentland Hills.

Encalypta

ciliata. At Habby's How, on the Pentland Hills. *E. J. Maughan.*

Grimmia

recurvata. Bilson and Bevelaw Burns.

Dicksoni. Hermitage. *Mr G. Don*, and at Binnycraig, *Rev. Mr Fleming.*

recurvirostra. Craigmillar.

Browniana. Bilston Burn.

Doniana. Upon' oose stones on the Pentland Hills. *Mr G. Don.*

alpicola. Collington Wood, by the river side. *Mr G. D n.*

DICRANUM

majus. Roslin Woods.
fuscescens. Pentland Hills. *Mr G. Don.*
varium. Collington Woods.
rufescens. Pentland Hills. *Mr G. Don, and E. J. Maughan**.
aciculare. Roslin Woods, by the river side.
ovale. Corstorphine Hill. *Mr G. Don.*
pellucidum. Collington Woods, Roslin Woods, and Bilston Burn.
osmundioides. Pentland Hills.
taxifolium. Collington Woods.
adiantoides. Pentland Hills.

TRICHOSTOMUM

fasciculare. Near Craigmillar, and on the Pentland hills.

ORTHOTRICHUM

pumilum. Collington Woods.
aristatum. On an *elder* tree in the Botanic Garden. *Mr G. Don.*

PTEROGONIUM

gracile. Near Craigmillar.

NECKERA

crispa. Habbie's How, on the Pentland Hills, *E. J. Maughan.*

HYPNUM

trichomanoides. Collington Wood.

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* "Discovered in 1782, on a moist bank by the side of the rivulet at the Hermitage." Fl. Brit. p. 1210.

HYPNUM

undulatum. In *fruit.* Roslin Wood. *R. M.*
lucens. Roslin Woods, Collington Woods, and Bilston Burn.
alopecurum. In *fruit.* Collington Woods. *R. M.*
lutescens. Near Granton. *E. J. Maughan.*
Schreberi. Pentland Hills. *Mr G. Don.*
nitens. Pentland Hills.
cordifolium. In the peat pits, south side of Dalmahoy Hill, and on Pentland Hills.
stellatum. Bevelaw Burn, and the Pentland Hills.
palustre. Bilston Burn. *Mr G. Don.*

BARTRAMIA

arcuata. Pentland Hills.

BRYUM

dealbatum. King's Park. *Mr G. Don.*
carneum. Collington Woods, *Mr J. Mackay,* and Bevelaw Burn, *Mr G. Don.*
bicolor. On the coast between Burntisland and Aberdour. *E. J. Maughan.*
Zierii. Habbie's How, on the Pentland Hills. *E. J. Maughan.*
bimum. Pentland Hills.
punctatum. Very common in Roslin and Collington Woods.
rostratum. Abercorn Woods. *R. M.*
ligulatum. In *fruit.* Abercorn Woods abundantly.

POLYTRICHUM

alpinum. Eastern Cairn Hill, one of the Pentlands. *Mr Sommerville** and *E. J. Maughan.*

JUNGERMANNIA

polyanthos. Bilston Burn. *Mr G. Don.*

purpurea. Bilston Burn. *Mr G. Don.*

LICHEN

polytropus. (LECIDEA *polytropa*, ACHARII *Methodus Lichenum*). Pentland Hills.

miniatus. (ENDOCARPON *miniatum*, *Ach.*) King's Park, and on the Castle rock.

inclusus. (THELOTREMA *lepadium*, *Ach.*) Bilston Burn, on the bark of *Ilex Aquifolium.* *Mr G. Don.*

fragilis. (SPHÆROPHORON *compressum*, *Ach.*) Pentland Hills.

corallinus. E. B. t. 1541. Pentland Hills.

upsaliensis. (PARMELIA *upsaliensis*, *Ach.*) Pentland Hills.

tartareus. (PARM. *tartarea*, *Ach.*) *Ibid.*

coccineus. (PARM. *Hæmatomma*, *Ach.*) Roslin Wood, and on rocks in the King's Park.

pezizoides. (PARM. *brunnea*, *Ach.*) Pentland Hills.

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* Mr THOMAS SOMMERVILLE, was for some time superintendent of the Botanic Garden at Edinburgh. He died, (17th March 1810, while this List was in the press), at the early age of 27. He was a young man of very promising abilities, both as a professional gardener and as a botanist.

LICHEN

hypnorum. (PARMELIA *lepidora, Ach.*) Roslin Wood.

aquilus. (PARM. *aquila, Ach.*) Hermitage, Pentland Hills, and the King's Park.

caperatus. (PARM. *caperata, Ach.*) Craigleith Hill.

glomuliferus. (PARM. *glomulifera, Ach.*) Pentland Hills.

scrobiculatus. (PARM. *scrobiculata, Ach.*) Pentland Hills.

pulmonarius. (PARM. *pulmonacea, Ach.*) Pentland Hills.

physodes. (PARM. *physodes, Ach.*) Pentland Hills.

prunastri. (PARM. *prunastri, Ach.*) Roslin and Collington Woods.

jubatus. (PARM. *jubata, Ach.*) Pentland Hills.

islandicus. (CETRARIA *islandica, Ach.*) In the King's Park, and on Corstorphine, Dalmahoy, and Pentland Hills.

glaucus. (CETR. *glauca, Ach.*) Pentland Hills.

floridus. (USNEA *florida, Ach.*) Swanston Wood.

hispidus. (CORNICULARIA *spadicea, Ach.*) Pentland Hills.

paschalis. (STEREOCAULON *paschale, Ach.*) Corstorphine, and Pentland Hills. *Mr G. Don, and E. J. Maughan.*

FUCUS

sinuosus. On the sea-shore at Caroline Park.

siliquosus. var. 2. *Ibid.*

Fucus

ligulatus. Caroline Park. *E. J. Maughan.* And at Newhaven, *Lightfoot*; and lately by *Mr P. Neill.*

dentatus. Between Newhaven and Cramond.

pygmæus. Common on the rocks behind Caroline Park.

pinnatifidus. Same place.

plumosus. On the beach between Newhaven and Cramond.

rotundus. Caroline Park. *E. J. Maughan.*

flagelliformis. Near Nether Cramond.

subfuscus. Ibid.

Opuntia. On the rocks at Caroline Park.

Ulva

purpurascens. Near Granton.

Conferva

spiralis. In the peat-pits south side of Dalmahoy Hill.

aurea. (Nidularia *lævis*, *Withering.*) Bilston Burn.

Byssus

nigra. Roslin Woods.

Peziza

crucibuliformis of *Lightfoot.* On rotten wood, Fisherrow Links.

XV. *Meteorological Journals, kept during Voyages from Whitby to Greenland, and back again, on board the Ship Resolution, in the Years* 1807, 1808, *and* 1809.

By Mr WILLIAM SCORESBY *jun.* M. W. S.

(Read 3d Feb. 1810.*)*

1807.

	Thermometer.	*Barom.*	*Wind.*	*Lat.*	*Remarks.*
Mar. 23	4 P.M. 54	30.684	S. S. E.	56.24	Fresh breezes, cloudy.
24	Midn. 37	3[illegible].594	S. b. E. S. W.	58.14	Gentle breezes, fine wr.
25	8 A.M. 46	30.459	North.	58.50	Do.
26	——— 44	30.401	Do.	59.54	Strong breezes, hazy.
27	7 P.M. 44	30.056	Do.	———	Moderate breezes.
28	6 P.M. 43	29.842	N. W. N. E.	60.00	Fresh breezes, snow.
29	6 P.M. 40	29.659	N. E. various.	Zetl.	Strong breezes, snow.
30	4 A.M. 36	29.780	North.	Do.	Hard gales, do.
31	Midn. 32	29.707	Do.	Do.	Do. do.
April 1	6 A.M. 43	[illegible]9.858	to E. N. E.	Do.	Fresh breezes, do.
2	6 A.M. 47	29.904	to North.	Do.	Do. do.
3	7 P.M. 50	30.[illegible]37	Northerly.	Do.	Moderate breezes.
4	Noon, 41	29.787	S. W.	60.30	Little wind.
5	8 A.M. 45	29.351	to W. N. W.	Balta	Strong breezes, snow.
6	11 A.M. 48	29.650	to N. b. E.	Sound	Strong gales. Rain.
7	Noon, 55	29.987	Southerly.	Zetl.	Little wind.
8	4 P.M. 50	29.782	W. N. W.	Do.	Strong breezes. Rain.
9	4 A.M. 38	30.047	Variable.	Do.	Fresh gales. Rain.
10	7 A.M. 42	29.704	Do.	Do.	Little wind and rain.
11	Noon, [illegible]6	[illegible]9.214	S. E. E.	62.34	Fresh breezes, do.
12	10 A.M. 33	29.741	East.	63.26	Hard gales, with rain.

	Thermometer.	Barom.	Wind.	Lat.	Remarks.
April 13	8 A.M. 29	29.767	E. N. E.	63.52	Hard gales.
14	9 A.M. 28	29.896	Do.	64.20	Strong gales, cloudy.
15	9 A.M. 25	29.649	to S. E.	66.10	Long. 6° 30′ W. Lat. 64° 37′ var. 35° W.
16	8 A.M. 17	29.531	N. N. E.	66.8	Hard gales, with snow.
17	Noon, 29	30.084	Do.	65.24	Do. do.
18	8 A.M. 32	30.162	Do.	65.13	Little wind.
19	Noon, 39	30.001	S. S. W.	67.21	Strong breezes, cloudy.
20	Midn. 35	29.974	S. W.	69.47	Fresh breezes, hazy.
21	9 A.M. 36	29.963	Do.	72.04	Fresh breezes, foggy.
22	9 A.M. 34	29.897	W. S. W.	73.40	Do. do.
23	8 A.M. 29	29.762	to W. b. N.	75.09	Strong breezes, fine wr.
24	9 P.M. 24	29.760	N.b.W.toE.b.S.	74.59	Mod. breezes, cloudy.
25	4 A.M. 26	29.669	N. N. E.	75.00	Fresh breezes, do.
26	11 P.M. 26	29.661	Do.	75.19	Do. do.
27	1 A.M. 24	29.675	Do.	75.36	Little wind.
28	8 A.M. 16	29.503	E. b. N.	75.30	Fresh breezes, snow.
29	Midn. 20	29.481	N. N. E.	75.20	Strong gales, snow.
30	Noon, 16	29.701	Do.	75.10	Do. showers of snow.
May 1	1 P.M. 18	30.054	N. N. E. to N.	75.20	Fresh gales, much snow.
2	7 A.M. 28	30.067	W. S. W.	75.7	Little wind, variable.
3	10 P.M. 20	30.155	Do. and N.erly.	74.26	Strong gales.
4	11 P.M. 14	30.178	N. b. E. and E.	75.55	Strong breezes.
5	4 P.M. 18	30.309	E. to N. E.	75.57	Fresh gales, and clear.
6	Midnight 27	30.201	N. E.	75.47	Moderate breezes.
7	5 A.M. 34	30.000	N. N. E.	75.51	Little wind.
8	3 A.M. 20	29.868	N. N. E.	76.00	Fresh breezes, cloudy.
9	8 A.M. 19	29.804	Do.	75.31	Brisk gales, with snow
10	8 P.M. 21	29.806	Do.	75.30	Fresh gales, with snow.
11	Noon, 22	29.752	to E.	75.30	Fresh breezes, do.
12	9 A.M. 20	29.807	N. N. E.	75.20	Do. do.
13	Noon, 17	29.479	N. b. W.	75.30	Strong breezes, do.
14	—— 15	29.457	N. W.	75.22	Fresh breezes, do.
15	Midnight 18	29.468	N. W.	75.22	Do. cloudy.
16	1 A.M. 26	29.600	S. W.	75.32	Very little wind.
17	7 A.M. 24	29.780	W. S. W.	75.45	Mod. breezes, cloudy.
18	6 P.M. 27	29.782	W. N. W.	75.50	Do. snow.
19	11 P.M. 22	29.764	N. to E.	75.35	Light airs, often calm.
20	9 P.M. 22	29.803	N. W. N. E.	75.55	Fresh breezes, cloudy.
21	3 A.M. 22	29.760	N. N. E.	75.55	Inclinable to calm.
22	Midnight 28	[illegible]9.758	— —	76.02	Calm.
23	Noon, 31	29.664	Do.	75.58	Moderate breezes.
24	Noon, 26	29.798	N. b. W.	75.56	Do. cloudy.
25	2 A.M. 29	[illegible]0.002	N. E.	75.55	Little wind, variable.
26	7 P.M. 26	30.011	E. b. N.	75.55	Do
27	2 A.M. 25	29.880	N. E. b. N.	75.57	Fresh breezes, cloudy.
28	11 P.M. 26	29.910	Do. to N.	75.56	Do. with snow.
29	4 A.M. 23	29.836	N. to N. N. W.	75.56	Fresh breezes, snow
30	2 P.M. 18	29.778	N. N. W.	75.55	Strong breezes, do.
31	6 A.M. 22	29.812	to N.	75.51	Fresh breezes, cloudy.

	Thermometer.	*Barom.*	*Wind.*	*Lat.*	*Remarks.*
June 1	6 A.M. 25	29.931	Calm.	75.48	Calm.
2	4 A.M. 28	29.991	S. S. E. W.	75.46	Moderate breezes.
3	10 P.M. 32	29.882	W. S. W. S.W.	75.49	Little wind, variable.
4	4 P.M. 33	29.823	S. W. b. S.	75.59	Strong breezes, hazy.
5	Midnight 32	29.969	to W.	76 16	Brisk gales, with rain.
6	6 P.M. 31	29.971	S.S.E. to E.b.S.	76.20	Little wind.
7	Noon, 30	29.832	N. N. W.	76.36	Do.
8	11 A.M. 28	29.600	W. b. S.	76.35	Light airs, variable.
9	Midnight 32	29.782	N. W. b. W.	76.4[illegible]	Fresh gales, cloudy.
10	5 A.M. 32	29.794	N. W. b. W.	76.48	Little wind, and foggy.
11	6 A.M. 32	29.883	N. W. to S. E.	76.50	Sometimes nearly calm.
12	Noon, 32	29.935	E. S. E. S. E.	76.49	Fresh breezes, cloudy.
13	7 P.M. 29	29.998	S. E.	76.52	Brisk gales, and cloudy.
14	1 P.M. 31	29.972	E. S. E.	77.00	Fresh gales, with snow.
15	Noon, 31	29.681	Do. to E.	76.54	Moderate gales, do.
16	7 A.M. 30	29.647	Do.	76.50	Do. do.
17	9 A.M. 33	29.655	E. N. E.	77.00	Do. do.
18	Midnight 32	29.721	Do.	77.34	Mod. breezes, foggy.
19	Noon, 34	29.810	N. E. N. W.	76.26	Fresh, do. do.
20	—— 40	29.728	to S. W.	74.47	Moderate breezes, do.
21	—— —	29.774	to N. W.	73.56	Fine moderate weather.
22	—— —	29.832	to E. N. E.	72.46	Fresh breezes, cloudy.
23	—— —	29.891	E. N. E.	70.51	Do. do.
24	—— —	29.931	N. E.	69.00	Gentle breezes.
25	—— —	29.547	N. E. to W.	68.5	Fresh gales, and cloudy.
26	—— —	29.524	N. W. N.	65.41	Strong gales, do.
27	—— —	29.950	N. E.	63.46	Mod. breezes, cloudy.
28	—— —	29.888	North.	62.27	Little wind, fine weather
29	—— —	29.892	N. E.	61.35	Do
30	—— —	29.775	S. W.	60.30	Do. cloudy.

From the above journal, I find that the medium height of the barometer, in the month of May 1807, was 29.852; and between April 23. and June the 19th, 29.817 between the latitudes of 75° and 77½° N. The medium height of Fahrenheit's thermometer, in May, being 23°, and for the above time, 25°.5. The barometer was always observed about noon, and the thermometer at the time specified in the second column.

1808.

	Thermometer.	Barom.	Winds.	Lat.	Remarks.
March 16	Noon, 40	30.29	S. S. E.	56.30	Strong breezes, cloudy.
17	—— —	30.2	S.	59.43	Strong gales.
18	—— —	30.16	S. b. E.	Zetl.	Do.
19	—— —	30.13	S. b. E.	Do.	Hard gales, cloudy.
20	—— 36	30.20	S. S. E.	Do.	Very hard gales.
21	—— 38	30.30	S. b. E.	Do.	Strong gales, snow.
22	—— —	30.53	S. S. E.	Do.	More moderate, snow.
23	—— —	30.53	E.erly.	Do.	Moderate breezes.
24	—— —	30.56	E.	Do.	Light airs, fine weather.
25	—— —	30.50	E. S. E.	61.6	Fresh breezes, clear wr.
26	—— —	30.60	S. E.erly.	61.46	Do. cloudy.
27	—— —	30.60	S. S. E.	61.50	Strong gales, snow.
28	—— —	30.55	S. S. W.	63.47	Fresh gales, do.
29	Noon, 36	30.37	to S. W. b. S.	65.10	Light airs, variable.
30	—— 26	30.42	N. E.	65.29	Fresh gales, squally.
31	—— 22	30.17	to North.	65.10	Fresh gales, with snow.
April 1	—— —	——	N. E.erly.	65.11	Moderate weather.
2	—— 24	29.56	S. E.	66.49	Strong breezes, snow.
3	10 A.M. 26	29.54	to E. b. N.	67.52	Fresh gales, with do.
4	Noon, 32	28.62	to S. E.	66.59	Very strg gales, thick sn.
5	8 A.M. 28	28.03	N. W.erly.	66.50	Do. calm towards night.
6	8 A.M. 15	29.40	W. N. W.	67.3	Hard gales, squally.
7	9 A.M. 16	29.26	N.	67.32	Strong gales, shrs snow.
8	Midnight 20	29.52	N. N. W.	68.15	Do. snow.
9	—— 25	29.93	to S. S. W.	68.4	Fresh breezes, clear.
10	10 A.M. 36	29.32	Do.	68.58	Latter part of day calm.
11	—— 36	29.76	N. b. W.	70.44	Fresh breezes, little wd.
12	—— 34	29.62	to S. E.	71.20	Fresh gales, noon.
13	9 A.M. 33	29.53	to E. b. S.	72.45	Fresh gales, shrs. snow.
14	11 A.M. 25	29.53	to N. E.	73.20	Do. do.
15	9 A.M. 28	29.90	to E. N. E	73.2	Do. do.
16	Noon 22	29.93	do. to N. b. E.	73.10	Strong gales, cloudy.
17	Midnight 25	30.03	to N. E. b. N.	73.15	Do.
18	8 P.M. 27	30.35	to E. N. E.	73.20	Do.
19	8 A.M. 22	30.18	E. N. E.	73.15	Strong gales, cloudy.
20	Noon, 27	30.22	E. to E. S. E.	72.36	Do. with snow.
21	Midnight 25	30.30	to N. E. b. E.	73.00	More moderate weather.
22	10 A.M. 28	30.48	to S. E.	73.24	Moderate breezes, snow.
23	11 P.M. 25	30.16	S. E. to E.	74.43	Fine moderate weather.
24	Midnight 2[illegible]	29.93	S. W. to N.	75.3[illegible]	Light airs, fresh breezes
25	4 P.M. 15	29.96	N. W. to E.	76.15	Strong breezes, variable
26	Noon, 10	29.94	N. W. b. N.	76.20	Do. with snow.
27	4 P.M. 9	30.26	to N. E.	76.12	Strong gales, snow.
28	11 A.M. 1[illegible]	30.36	to E.	76.20	Light airs.
29	2 A.M. 13	30.12	E.	76.20	Do.
30	—— 24	29.54	do. to N. E.	76.20	Strong gales, snow.

	Thermometer.	Barom.	Winds.	Lat.	Remarks.
May 1	4 P.M. 24	29.23	N. E. to E.S.E.	76.17	Strong gales, shrs. snow.
2	—— 28	29.50	E. S. E. to S.	76.50	More moderate, do.
3	4 A.M. 28	29.40	to S. E.	77.2	Fresh gales, with snow.
4	Midnight 27	29.67	S. E.	77.6	Little wind.
5	Do. 29	29.54	N.erly.	77.20	Fresh gales, with snow.
6	4 P.M. 28	29.73	S. E. to E.	78.00	Strong gales, snow.
7	Midnight 26	30.20	E. to N.	78.00	Moderate gales.
8	4 P.M. 27	30.23	S.S.E. to E.S.E.	78.00	Moderate breezes.
9	4 P.M. 28	30.10	E. S. E. to N.	78.00	Strong breezes, or calm.
10	10 P.M. 18	30.54	North.	77.50	Little wind.
11	Noon, 26	30.45	Calm.	77.50	Calm fine weather.
12	6 A.M. 32	29.73	S. S. W.	77.40	Fresh gales, and foggy.
13	Noon, 25	29.53	Variable.	77.45	Fresh breezes, snow.
14	—— 22	29.47	W.N.W.S.W.	77.50	Fresh, mod. breezes.
15	1 A.M. 20	29.50	Variable.	77.50	Mod. breezes, or calm.
16	6 A.M. 24	29.55	N.W. to N.N.E	77.40	Do. hazy.
17	Noon, 27	29.60	N. N. E.	77.30	Fresh breezes, snow.
18	—— 25	29.60	N. N. E.	77.50	Do. do.
19	6 A.M. 24	29.81	to N. b. W.	77.55	Strong breezes, cloudy.
20	4 P.M. 20	29.80	N.erly.	78.4	Light airs, and cloudy.
21	4 A.M. 26	29.85	Westerly.	78.8	Mod. breezes, snow.
22	8 A.M. 29	29.98	Calm.	78.10	Calm.
23	2 A.M. 29	29.86	W. S. W.	78.13	Mod. breezes, foggy.
24	9 A.M. 21	29.78	N. W. to N.	78.4	Little wind, fair weather
25	Noon, 26	29.70	N.erly.	77.55	Do. do.
26	4 A.M. 22	29.80	N. N. W.	77.50	Strong breezes, snow.
27	3 A.M. 24	30.09	N. N. W.	77.58	Do. do.
28	6 A.M. 25	30.0[illegible]	S. E.	78.30	Little wind.
29	11 A.M. 24	29.90	to N. W. b. N.	78.37	Fresh gales, much snow.
30	Noon, 32	29.93	E. N. E.	78.36	Light airs.
31	Do. 26	29.96	Do.	78.36	Do. inclinable to calm.
June 1	4 A.M. 24	29.99	Do.	78.37	Fresh breezes, snow.
2	Midnight 36	29.9[illegible]	Do.	78.43	Inclin. to calm, foggy.
3	10 P.M. 28	29.97	Inclin. to calm	78.43	Do. do.
4	Noon, 31	29.90	Calm.	78.35	Calm clear weather.
5	6 P.M. 30	29.90	S. W.	78.25	Fresh breezes, hazy.
6	Noon. 32	29.83	S.erly.	78.20	Light br. fog, haze, sn.
7	Noon, 29	29.87	W. S. W.	78.20	Do. do.
8	9 A.M. 29	29.88	S.erly.	78.10	Do. inclinable to calm.
9	Noon, 27	29.78	Variable.	77.50	Inclinable to calm.
10	6 P.M. 27	29.79	N. W.erly.	77.18	Light airs, or mod. br.
11	4 A.M. 30	29.80	S. S. W.	77.6	Strong breezes, foggy.
12	5 A.M. 33	29.83	S. W.erly.	76.37	Fresh gales, and foggy.
13	Noon, 33	29.90	Do.	76.35	Do. with fog.

	Thermometer.	Barom.	Winds.	Lat.	Remarks.
June 14	8 A.M. 34	29.90	S. W.erly.	76.30	Strong breezes, foggy.
15	4 P.M. 34	30.06	S.W. to S.b.E.	75.58	Fresh breezes, do.
16	Noon, 34	29.84	to S. E.	74.00	Fresh gales, and foggy.
17	Noon, 34	29.60	E.erly.	74.2	Strong gales, clear.
18	11 A.M. 38	29.82	E. S. E.	73.47	Strong breezes, foggy.
19	8 A.M. 38	29.90	to S. S. W.	7[illegible]	Little wind, and foggy.
20	9 A.M. 42	30.00	S. W.erly.	72.55	Mod. br and cloudy.
21	Noon, 38	30.00	S. S. W.	72.55	Strong breezes, do.
22	Midnight 38	30.23	to S. b. W.	7[illegible].20	Strong gales, and hazy.
23	—— 37	29.94	Variable.	70.48	Fresh breezes, foggy.
24	—— 39	30.12	S. W. to S.	70.00	Do. do.
25	4 P.M. 42	29.94	S. S. E.	69.23	Little wind, and foggy.
26	Do. 44	30.12	W. N. W.	6[illegible]	Light airs, and foggy.
27	4 A.M. 47	30.18	Incl. to calm	67.[illegible]	Inclinable to calm.
28	Noon, 42	30.06	N. or S.	66.44	Light breezes, foggy.
29	11 P.M. 43	30.07	S. W.erly.	65.47	Fresh breezes, do.
30	11 P.M. 46	30.08	W. S. W.	65.24	Fresh gales, with rain.
July 1	Noon, 5[illegible]	30.00	W. S. W.	64.48	Fresh gales, rain or fog.
2	—— 45	30.17	W.S.W to N.W	63.2	Strong gales, shrs. rain.
3	—— 47	30.15	N. W.erly.	61.26	Mod. strong br. clear.
4	11 A.M. 50	30.10	N. W. to N. E.	60.	Fresh breezes, clear.
5	—— 50	30.07	N. E. b. N	5[illegible]	Mod. breezes, clear wr.
6	Noon, 58	30.20	to W. b. N	57.40	Light br. somets. calm.
7	Noon, 59	30.09	W.b.N.to S.S.W	55.[illegible]	Fresh breezes, variable.

The above Journal was kept, like the former one, with great care. The thermometer was of Fahrenheit's construction; the barometer a marine one, said to be the same which was round the world with the great circumnavigator Captain Cook. On account of the manner of suspension, (in gimbles), and the contraction in the tube, in the greatest storms the height of the mercury may be ascertained to $\frac{1}{40}$th of an inch, and in moderate weather to $\frac{1}{200}$th or $\frac{1}{400}$th part of an inch.

According to this Journal, in the month of May 1808, between the latitudes of 76° 17′ and 78° 36′ North, the medium height of the barometer, observed always at noon, was 29.81 inches, and of Fahrenheit's thermometer, $25\frac{1}{3}$°. The most prevailing winds, during the whole season, in Greenland, were between the North and East quarters.

1809.

	Thermometer.	*Barom.*	*Winds.*	*Lat.*	*Remarks.*
Mar. 19	—— —	30.09	NW.N.W.b.W	58.52	Mod. breezes, and clear.
27	6 P.M. 29	——	S. E.erly.	Zetl.	Fresh gales, with snow.
April 15	9 A.M. 21	29.92	E. N. E.	72.40	Strong br. or fresh gale.
16	9 A.M. 21	29.86	N. E.erly.	72.45	Strong gales, snow.
17	—— 19	29.54	N. E. & var.	72.30	Fresh br. or fresh gales.
18	11 A.M. 21	29.87	N. variable.	72.51	Mod. clear weather.
19	Noon, 25	29. 2	Do. N. N. W.	73.12	Mod. breezes, variable.
20	8 A.M. 23	29.86	NNW oESE.	74.00	Do. do.
21	9 A.M. 32	30.21	W. N. E. S. E.	74.20	Mod. breezes, light airs.
22	11 A.M. 37	30.45	S. E. to S S W.	73.8	Fresh br. fine clear wr.
23	11 A.M. 29	30.43	SSW. to Wb.N.	73.52	Fresh gales, fine weather
24	9 P.M. 27	30.27	W.b.N. to N.W	73.43	Mod. br. shrs. of snow.
25	Noon, 37	29.77	to S. S. W.	73.30	Do. do.
26	—— 3[illegible]	29.28	to S. W.	74.2	Fresh gales, with snow.
27	Midnight 30	29.36	to W. N. W.	74.1	Fresh breezes, squally.
28	9 A.M. 28	29.60	inclin. to calm.	73.52	Inclin. to calm, snow. s.
29	10 A.M. 19	29.63	N. N. E. or E.	74.3	Moderate breezes.
30	9 A.M. 7	29.82	N. E. N.	73.56	Fresh gales, frost rime.
May 1	11 P.M. 12	29.68	E. N. E.	74.15	Mod. br. or fresh gales.
2	10 P.M. 10	29.84	to N. E. b. E.	74.5	Strong gales, frost rime.
3	10 A.M 18 } 11 A.M 23 }	29.87	to E. b. N.	73.54	Strong gales, snow.
4	10 A.M. 36	29.94	to S. b. E.	74.10	Fresh gales.
5	Noon, 36	30.00	to S. b. W.	74.10	Moderate light breezes.
6	10 P.M. 32	29.38	S.E. to W.S.W.	73.49	Light airs.
7	10 A.M. 25	29.53	WSW to NNE	73.48	Fresh gales, fr. br. snow.
8	10 A.M. 27	29.72	to W. N. W.	73.38	Fresh breezes, fr. gales.
9	8 A.M. 21	29.76	to N. E.	73.50	Fresh gales, variable.
10	Midnight 19	29.80	N. E. calm.	74.10	Fresh gales, snow, calm.
11	10 A.M. 13	30.20	N. N. E. N. E.	74.45	Fresh br. snow showers.
12	10 A.M. 16	30.15	N. E. calm.	75.00	Strong breezes, calm.
13	—— 16	30.04	N W. W.	75.8	Fresh mod. br. cloudy.
14	4 A.M. 19	30.00	W. N. & E.erly	75.48	Mod. gales, light br.
15	7 A.M. 20	30.02	E.erly.	76.3	Light airs, inclin. calm.
16	10 A.M. 22	29.78	to E. S. E.	76.4	Do. calm.
17	8 P.M. 30	29.35	to S. E.	76.8	Strong gales, small snow
18	6 A.M. 23	29.79	S.E.N.E.N.W.	76.6	Light airs, or mod. br.
19	Noon, 32	29.65	N. W. S. W.	76.16	Fresh or mod. br. clear.
20	1 A.M. 31	30.03	S.W. to N.N.W	76.30	Fresh br. fog or snow.
21	Noon, 31	30.12	to S. E.	76.26	Mod. breezes, cloudy.
22	4 P.M. 31	29.73	to S. S. E.	76.32	Mod. breezes, foggy.
23	Midnight 21	30 06	to W. b. N.	76.24	trong gales, cloudy.
24	4 A.M. 17	29.98	N.erly, variable	77.8	Mod. light br. variable.

	Thermometer.	*Bar.*	*Winds.*	*L t.*	*Remarks.*
May 25	1 P.M. 20	29.87	North.	77.20	Light airs, variable.
26	P.M. 17	29.87	to N. b. W.	77.20	Strong gales, with snow.
27	4 P.M. 19	29.80	to N. E.	——	Do. do.
28	4 P.M. 19	30.04	N. E.	——	Fresh gales and cloudy.
29	A.M. 20	30.05	N. E.erly.	79.00	Do. do.
30	1 A.M. 20	30.05	to N. N. E.	79.00	Fresh or str. gales, snow.
31	Midnight 23	30.06	N. E.erly.	79.00	Fresh gales, snow shrs.
June 1	Noon, 23	30.02	N. E.	78.56	Fresh gales, and cloudy.
2	5 A.M. 22	30.24	N. E.	79.4	Fresh breezes, cloudy.
3	11 A.M. 28	30.20	Calm E.erly.	79.4	Inclinable to calm.
4	11 A.M. 26	30.10	Easterly.	79.4	Do. or moderate br.
5	11 P.M. 24	30.06	E. N. E.	79.00	Light airs, or do.
6	Noon, 30	29.95	E. N. E.	79.00	Light br. haze, snow.
7	—— 31	29.88	S. E.erly.	79.4	Light br. cloudy do.
8	About 29	29.88	S. S. E.	79.8	Do. calm, snow shrs.
9	3 A.M. 27	29.86	to W. N. W.	79.2	Strong gales, do.
10	8 P.M. 25	29.93	W. S. W.	79.0	Moderate breezes, do.
11	5 A.M. 30	30.06	S. W.erly.	79.2	Do. do.
12	Noon, 29	30.07	to S. S. W.	78.56	Do. slight do.
13	Noon, 31	29.97	S.erly, W.N.W	78.52	Do. fog showers.
14	—— 31	29.82	W. N W. calm	78.50	Light airs, inclin. calm.
15	Noon, 30	29.68	S. S. E.	79.0	Fresh breezes, snow sh.
16	10 P.M. 32	29.50	Do. E.	79.0	Var. thick snow or fog.
17	Noon, 32	29.62	E. S. S. W.	79.0	Mod. fr. br. do. inc. calm
18	Noon, 27	29.90	S. W. N. S. W.	79.30	Moderate breezes, clear.
19	4 P.M. 27	29.91	S. W.erly.	79.30	Strong br. snow showers.
20	In sun's rays, 60	29.67	to East.	79.50	Light airs, inclin. calm.
21	4 P.M. 30	29.81	to S. W. S.	79.50	Do. or fresh breezes.
22	—— 32	29.81	Variable.	79.45	Light br. fog, snow shrs.
23	—— 32	29.82	Variable.	79.45	Do. do.
24	—— 32	29.59	North, &c.	79.57	Mod. br. snow showers.
25	Midnight 34	29.64	Variable.	79.30	Moderate or fresh br.
26	10 P.M. 31½	29.84	N. W. S. S. W.	79.0	Strong br. snow, fog, sh.
27	Noon, 32	29.94	Calm.	78.50	Inclinable to calm.
28	—— 32	29.82	Very variable.	78.48	Light airs, inclin. calm.
29	—— 32	29.80	variable, S.erly	78.36	Light airs or fresh br.
30	1 A.M. 35	29.80	S.erly, N. W.	77.40	Moderate breezes.
July 1	6 P.M. 34	29.75	Variable.	77.30	Do. or light br. variable
2	3 A.M. 32	30.04	Calm.	77.30	Chiefly calm, snow.
3	Noon, 35	30.07	Easterly.	——	Inclinable to calm.
4	4 P.M. 33	30.07	to South.	77.30	Light airs, strong br.
5	Midnight 32	29.80	to N. W.	75.45	Light airs, mod. br. snow
6	—— 32	29.97	to North.	74.20	Fresh br. or little wind.
7	—— 33	29.68	S. b. E. S. W.	73.48	Light breezes, fr. gales.

	Thermometer.	Bar.	Winds.	Lat.	Remarks.
July 8	Noon, 32	29.94	to W. N. W.	72.48	Fresh gales, snow shrs.
9	Noon, 35	29.74	to S. S. W.	71.50	Do. or little wind, rain.
10	Noon, 43	29.73	N. W. and S.	70.32	Strong gales, mod. br.
11	4 P.M. 43	29.37	W.erly, S.S.W.	70.34	Strong breezes, do. gales
12	8 A.M. 36	29.50	to N. W.	69.50	Do. do. snow.
13	Midnight 36	29.90	N. W.	68.21	Fresh gales, cloudy.
14	—— —	29.75	S. W.erly.	67.37	Light breezes, fr. gales.
15	10 A.M. 46	29.60	S. E.erly.	66.33	Fresh gales and rain.
16	Noon, 48	29.55	N. and E.erly.	64.49	Mod. breezes, dry wr.
17	2 P.M. 48	29.64	N. E. and var.	62.54	Fresh gales.
18	8 P.M. 45	29.65	N. E. and N.	60.10	Fresh gales, with rain.
19	—— 48	30.01	N. E. W.erly.	57.38	Do. fresh breezes, rain.
20	Noon, 62	30.30	to N. E.	56.00	Fresh breezes, light airs
21	4 P.M. 62	30.32	Variable.	55.50	Light airs, inclin. calm.
22	Noon, 54	30.29	S. E.erly.	55.00	Do. do.
23	8 A.M. 54	30.08	S. E.erly.	54.30	Light breezes, and clear.

XV. *Observations on the Natural and Medical History of the Zetland Sheep* *.

By Arthur Edmondston, M. D. Fellow of the Royal College of Surgeons, and Member of the Royal Physical, Antiquarian, and Chirurgical Societies of Edinburgh.

(*Read* 10*th March* 1810.)

There is no animal more generally useful to man than the sheep. Its gentle disposition, the facility with which it can be tamed, the delicacy of its flesh, and the richness of its covering, early rendered it essential to human society; and in the progress of arts it constituted a principal source of the wealth of nations. The management of sheep, the improvement of the different races, and the cure of their diseases, have, therefore, become pursuits of general interest; and every fact which

* This paper is an enlargement of what is stated on the same subject by the Author, in his work, entitled, "A View of the ancient and present state of the Zetland "Islands," 2. vols. 8vo. As the additional observations given here, might have been rendered less complete and intelligible by appearing in a detached form, it has been judged proper that the original passages from that work should be reprinted along with them.—Editor.

tends to illustrate these subjects, naturally claims our attention.

It is while uninfluenced by the effects of domestication that we can best observe those instincts which guide animals, and trace the operation of external powers which affect their constitutions. As the sheep in the Zetland Islands, instead of being under the controul of shepherds, are permitted to range according to their inclination, they exhibit in their modes of life, the natural propensities of the species, and we can therefore, in that country, attain a knowledge of some of the peculiarities which actuate the race.

The native Zetland sheep is very small, compared with those of the southern parts of Scotland and England, the carcase not weighing more, on an average, than thirty pounds. It is of a handsome shape, hardy, and very swift and agile. The general length, from the tip of the nose, to the root of the tail, is about thirty-eight inches, and the height, from the top of the shoulder, to the sole of the foot, fourteen inches. The tail seldom exceeds three inches in length. The horns are small, and the ears stand erect. The ram has sometimes four large and beautiful horns. The upper pair gradually diverge a little backwards, and then curve in towards the ears and sides of the head, in a spiral form, somewhat like those on the head of the black-faced heath ram of Yorkshire. The lower pair are nearly of a semicircular shape, with the extremities almost meeting under the throat.

A breed of sheep exactly similar to that in Zetland, appears to exist in Iceland *, and in the Faro Islands; and it is probable, that both have sprung from the same source; and that similar causes and modes of management have continued to preserve the identity between them.

The Zetland sheep are of different colours, as white, grey, black, speckled, and a dusky brown, called *moorit*. The face is generally of the same colour with the body, and is somewhat shorter in proportion, than among the sheep of Scotland. The prevailing colour is white, with but little admixture. The next is the grey. Some are almost entirely black, with only a small portion of white, above one or more of the hoofs. More frequently, the forehead, face and legs, and a part of one thigh, are white, and the rest of the body perfectly black. There is nothing of that uniformity of colour among them, corresponding to what takes place in the black-faced sheep of this country.

The quality of the wool varies very much on the same animal; the thighs and back yielding the coarsest, and the neck and breast the finest wool. Stockings have been made of the wool from 5 d. to 30 s. *per* pair; and it is by no means uncommon to obtain the materials from which both are manufactured, from the same

* Von Troil's Letters on Iceland, p. 136.

animal. Generally speaking, softness and fineness are characteristic properties of Zetland wool, in which respects, it is not surpassed even by the Merino wool.

The ewes yean in the months of April and May, and a few even in March; and they generally drop one lamb each. It is by no means uncommon for a ewe to drop two lambs, and some three. In most parts of the country, the lambs suck as long as their mothers permit them, which is between three and four months. In those districts where it is considered an object to milk the ewes, the lambs are gagged for several hours to prevent them from sucking. This operation is called *kaveling* the lambs.

In Zetland, almost all the sheep run wild on the hills, and they appear to be fond of climbing like goats among the rocks, in search of rich tufts of grass. Many suffer from this practice, by venturing on places from which they cannot return. In winter, the arable land is intentionally thrown open to their incursions; but in summer and autumn, every effort is practised to exclude them from the inclosures. As the dikes, however, are low and ill built, the sheep frequently leap over them, and often seriously injure the crop; and in some parts of the country, it is the custom to chace them from the neighbourhood of the farms by dogs, every night at sunset, while the corn is on the ground. Although large tracts of pasture are common to several farms, yet the sheep which belong to each, seldom stray far beyond their proper limits, and if transported to a distant district, frequently return to the spot of their nativity.

The different owners know the particular individuals which belong to them, by a mark on the ear, and the people can discriminate slight differences of this kind with wonderful accuracy, even at a great distance. In summer, they are driven into a small circular inclosure called a *crue*, for the purpose of taking off the wool. The native sheep are seldom shorn, but about the beginning of June, when the fleece begins to loosen spontaneously, it is pulled off by the hand. This operation is called *rooing* the sheep. They are left very bare after it; but the people say, that the wool on the animal continues much finer when it is removed in this manner, than by the shears. Except for the purposes of rooing, milking, kaveling and marking them, on all other occasions the sheep are caught by dogs trained for the purpose. It is surprising to see with what accuracy a dog singles out the particular sheep from among a flock; and in a short time, the individuals who are not the objects of pursuit, appear to be sensible of the election in their favour, and become comparatively tranquil, while the other is hunted down.

Although thus early accustomed to view the dog as an enemy, they readily associate together; for if a lamb happen to be reared in the house, in consequence of the early death of the mother, it plays and even fights with dogs, and readily joins them in the pursuit of other animals.

The sheep are never taken under cover in the winter time; nor in case of snow, is there any food provided for them. On this latter account, they suffer greatly, having little else to feed upon, for weeks in succession, but the sea-weed growing on the shores, or what has been drifted on the beach by the surf. It is curious to observe with what precision they leave the hills, and betake themselves to the sea-side, at the moment the tide of ebb commences. This I can state to be an absolute fact, although I am utterly unable to explain by what process of sensation or of instinct it is effected. From remaining quiet on the hills, and endeavouring to browse on their summits, a whole flock is seen suddenly to run towards the sea-shore, and on observing the state of the tide, it is found, that the water has just begun to recede.

On the coming on of a storm of snow, they retire to the more sheltered places, which are generally in the neighbourhood of the sea. There they are frequently snown over, and by the subsequent melting and falling down of the snow, are sometimes thrown over the rocks into the sea. On such occasions, they frequently assemble in considerable numbers on the side of a hill, and place themselves in such a manner as that their heads all incline towards the centre. By this arrangement, their breath keeps them warm, and dissolving part of their icy covering, forms a kind of vault above their heads. In this situation, they have been known to remain for many days, during which they appear to maintain life, by eating the wool from off each other's backs.

Such a mode of managing the sheep, no doubt renders them obnoxious to many diseases, and it is certainly an ungrateful return to those who so often have

> —given us milk in luscious streams,
> And lent us *their* own coat against the winter's cold.

Yet, except in seasons when the weather is unusually bad, and the food scanty, they may be said to be comparatively healthy; and the most severe and fatal distempers with which they are afflicted, have been imported into the country, within a period of forty years.

Blindness first made its appearance among the Zetland sheep, in 1770, and it was traced to communication with a ram from Montrose, which laboured under the disease at the time he was brought to the country. This affection consists in the formation of a film over the whole anterior part of the cornea, which produces complete blindness. When the attack is not very violent, it wears off in about a fortnight, and it is observed to disappear more readily, when the animal is left to run at large, than when taken into a house;

But if not protected, it suffers greatly by falling into mossy pits, and over rocks, and from the attacks of birds of prey.

Mr Stevenson, the Reverend Mr Singers, and Mr Hog *, have each assigned causes for this affection, which, as applied to the production of blindness in Zetland, appear to me to be unsatisfactory.

Mr Stevenson ascribes it to the reflection of heat and light, in very sunny and dry weather, as it is observed, he says, to be more frequent when the hills become scorched, and on hard rocky soils, than on dark-coloured hills, covered with heath. The parish of Delting, into which the disease was first introduced, consists almost entirely of dark-coloured mossy hills; and this topographical fact, coupled with the general dampness of the climate of Zetland, tend to shew, that the exciting causes mentioned by Mr Stevenson, never had operated where the disease raged with its greatest malignity.

The Reverend Mr Singers conceives, that this affection may be produced sometimes by the pollen of flowers, irritating the eyes of the sheep, when blown in considerable quantity. In the hilly

* A Treatise on the diseases of sheep, drawn up from original communications presented to the Highland Society of Scotland, by Andrew Duncan *junior*, M. D. *Transactions of the Highland Society*, vol. iii.

pasture of Zetland, there is not the appearance of a flower in the course of many miles; and the few which do yield pollen, occur in the inclosures, from which the sheep are carefully excluded during the summer.

Mr Hog ascribes blindness to continued fatigue and exertion, and endeavours to illustrate his opinion by the examples of the affection occurring in a severe degree in sheep that have been driven a long distance to market. In the Zetland Islands, sheep are never driven more than five or six miles at a time, and that only with a view to assembling them in a crue, for the purposes already mentioned. They are driven in the gentlest manner on such occasions, and not a single instance of blindness has ever been known to ensue from this treatment.

That the different exciting causes enumerated by these gentlemen, when applied in sufficient force, may produce inflammation of the eyes, I have little doubt; but they must be considered as being purely local and adventitious, and can never be supposed to exert an influence beyond the scene of their immediate action. In the Zetland Islands, they are not known to operate, and yet a general disease exists, which exhibits, in its commencement and progress, a train of symptoms similar to that which characterizes the affection which has been ascribed to their presence.

These considerations lead me to conclude, that the belief in Zetland, that blindness was originally imported into the country, and is at present propagated by contagion, is strictly correct. This opinion derives strength from different circumstances. The period of the first appearance of the disease, is fresh within the memory of many, and the fact is related by persons of unquestionable veracity, and accuracy of observation; and it has been found to spread itself from the place where it first occurred, as from a centre. There are several parts of Zetland into which it has never yet found admission, although separated from those in which it rages, by a narrow ferry only. This fact supports the idea of a contagious principle. Were the disease in general the offspring of external causes, occasional instances would certainly be produced, although neither so frequent nor so numerous as in situations where their presence is more uniform.

From a general view of the usual progress of blindness in sheep, as mentioned by different writers on the subject, I am disposed to believe, that the pathology of the different affections is not always well understood. In some cases there is genuine ophthalmia, when the inflammation extends from the conjunctiva all over the lucid cornea. This is among the worst species of the affection, and it requires the most energetic treatment. But in those instances, where "a blue "slough covers the whole of the eye, without any "admixture of red vessels," as mentioned by Mr

Stevenson, I am inclined to believe, that inflammation had never existed. It is not a general quality of inflammation of the eye, which has proceeded the length of forming preternatural membranes, to subside spontaneously in so short a time as a fortnight, nor to be more readily removed when the individual labouring under it is exposed to light and air, than when secluded from their influence.

In some of those lighter attacks, where a blue film appears to cover the cornea, I presume that the appearance is occasioned by the mere distention of the cornea from an increase in the quantity of the aqueous humour. This will produce as perfect opacity as a membrane*. It appears to be produced in the human species, and in horses and dogs, by whatever tends to accelerate the motion of the blood to the head; and analogy leads me to think that it may also be a frequent cause of temporary blindness among sheep. It is best removed by a change of pasture, and repeated doses of purgative medicines.

The *Scab* was first introduced into the parish of Dunrossness, the most southern district in the country, about twenty-four years ago, by two lambs sent from Scotland as a present to a gentleman, with a view of improving the breed of

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* A Treatise on the varieties and consequences of Ophthalmia, p. 173.

sheep in Zetland. The circumstances which favoured the propagation of the disease over the country, are curious and authentic. While the two infected lambs remained in a shed, the gentleman proposed sending a sheep of the Zetland breed to a friend in Lerwick. One was accordingly taken from the hill, bound and ready to be put into a boat, when unfavourable weather coming on, the passage was delayed for several days. In the mean time, the native sheep was put into the same place with the foreign lambs, and communicated with them. When the weather became favourable for the departure of the boat, the sheep intended to have been sent by it, was found to have suffered so much by confinement, that it was not thought sufficiently good, and was returned to the hill, and another taken in its stead. Soon after this, the scab, the presence of which had never been suspected, broke out on the two lambs. They were immediately killed, but the reprieved sheep had already imparted the fatal present to a whole flock; and this disgusting disease has been extending its ravages ever since.

The destructive effects of the scab have been very obvious. Many individuals who had four or five hundred sheep a few years ago, have not now more than half a dozen; and the affection is no doubt heightened by the want of proper remedies for its removal, and the careless management of those affected by it. As the whole sheep of the country run wild among the hills, a single individual may affect multitudes; and the disease once induced, is aggravated by exposure to cold, damp, and scarcity of food.

> Turpis oves tentat scabies, ubi frigidus imber
> Altiùs ad vivum persedit, et horrida cano
> Bruma gelu *.

Dry pasture, and the common mercurial ointment of the shops, are the best remedies for its removal. The ointment should be rubbed on the affected parts, and be well incorporated with the skin.

Inflammation of the stomach and bowels, is a frequent affection among the sheep in Zetland. It is known there by the name of *vinster sickness*. From the suddenness of its invasion, the ambiguity of the symptoms, and the rapidity of their progress, it is generally fatal; and as the mortified part exhibits a black appearance, the people conceive it to be produced by the rupture of a blood-vessel. The slighter degrees of this disease frequently lay the foundation of obstinate dysentery.

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* Georgic. lib. iii. ver. 441.——This observation of the poet, shews the antiquity of the disease, and aggravation of the symptoms by exposure to cold and moisture.

Water sickness, or general dropsy, is also a frequent disease among the sheep. It occurs under the different forms of *anasarca*, or water in the cellular substance immediately under the skin, and *ascites*, or water in the abdomen. This last species of the disease takes place most commonly in wet autumns, continues during the greater part of winter, and sometimes carries off whole flocks. Tapping has been tried, but I believe, never with success.

The *Sturdy*, or dropsy in the brain, is a very common and fatal disease. The operation of trepanning the skull, and extracting the water-bag, which lies upon the brain, has been repeatedly and successfully performed since 1778, by individuals, who never either saw or heard of a treatise on the diseases of sheep. A similar operation has also been successfully performed on the cow.

The disease, known in Zetland by the name of the *shell sickness*, consists in a thickening and concreting of the omentum and larger intestines into small white lumps resembling shells, from which it derives its name. It is common to sheep which feed on wet mossy pastures. They get lean, are disinclined to move much about, and the belly feels unequally hard. The people drive the sheep, when affected with this complaint, to the sea-side, and force them to eat sea-weed, and swallow salt water, as the only cure. These substances operate as purgatives, and may, by that means, contribute to remove the complaint.

The *Rot*, known in Zetland by the name of *mua sickness*, is also one of the diseases with which the sheep are frequently affected. Various opinions have been entertained, respecting the cause and seat of this disorder. Dr Coventry, with great propriety, conceives, that the most common species of it arises from deficient and depraved aliment, and that it somewhat resembles the scurvy in the human species *. I am persuaded, that this view of the subject is correct, as applied to Zetland, where the causes assigned for its production so often exist, and I am inclined to believe, that the affection of the liver should be viewed rather in the light of a secondary symptom. The general debility induced by the combined effects of cold, moisture, and depraved aliment, lays the foundations of glandular obstructions and dropsical affections. The liver suffers with the other organs, and becomes the seat of a peculiar species of hydatid, in which an insect (fasciola hepatica †) is usually contained; but the presence of the insect in the liver, although a frequent concomitant of the rot, is not absolutely essential to its existence.

* Introductory Discourse.

† This insect is of a flat circular form, and often three quarters of an inch in diameter. It flaps vigorously on a table, when removed from its nidus.

Removal of the diseased individuals to dry situations, nutritious food, and the occasional use of mercurial purgatives, are the remedies chiefly to be trusted to; and if employed in the early stages of the disease, seldom fail to effect its cure.

As the other diseases with which the Zetland sheep are affected, present nothing peculiar, either in their progress or consequences, it is unnecessary to enumerate them.

XVI. *On the Mineralogy and local Scenery of certain Districts in the Highlands of Scotland.*

By Dr Macknight.

PART I.

BEN-LEDI, AND ITS ENVIRONS.

(Read 13th January 1810.)

The desire of obtaining some practical information with regard to a branch of science, which has lately excited much interest in this country, having induced me to undertake the task of examining, in a mineralogical point of view, a few of the most remarkable mountains in the Highlands of Scotland, I am now to lay before the Society the result of my observations.

In doing this, I can hardly flatter myself, that what is to be offered, will add much to the stock of knowledge in geognosy, which has already been acquired. It will only form a small contribution towards those individual descriptions of stony masses, and their mutual relations, from the aggregate of which alone, we can hope to extract the principles of accurate science, respecting the structure of the earth.—To relieve the fatigue of continued attention to mineralogical details, notices of the most striking picturesque objects which occurred, will occasionally be introduced.

I have adopted the title of this paper, because I do not venture to propose it, as even approaching to a complete account of the extensive districts over which I passed. The object in view, was to mark the geognostic features on the great scale, of the alpine country which was examined. My remarks, accordingly, are of a general nature, and intended only to pave the way for more particular investigation. A minute oryctognostic detail of all the subordinate beds, veins, and individual minerals which may be discovered, in the leading formations of mountain-rock that are to be noticed, will not, therefore, be expected. It would indeed have required a greater portion of leisure, than I was able to bestow; and must be left to the patience and industry of future inquirers in the same track.

The examination of such objects is necessarily attended with considerable labour and difficulty; but at the same time, it rewards the observer's exertion, by the most striking and instructive views. There is in fact, no department in the study of nature, where the want of observation, conducted with skill, and of description given with fidelity, has been more felt; and till the sagacity of Werner led the way, these requisites for advancing the science can hardly be said to have existed in mineralogy. The extreme difficulty of all investigations into the nature and connection of the different substances which compose the crust of the earth, must be acknowledged. Nevertheless, the doctrines of the Geognosy furnish a clue, which conducts with surprising facility, through the labyrinth of the mineral regions, on the grand scale; and in the light which they afford to the skilful eye, the seeming confusion and irregularity of nature vanish.—What importance may be attached to any information which I am able to communicate, it is not for me to decide. Thus much at least, it will, however, establish, if the clearest testimony of the senses can at all be trusted, that the mode of describing the mineral kingdom, adopted by Werner and his school, is not altogether so full of theory, so unsupported by fact, and so remote from experience, as has been alleged.

CALLENDER.

The first object of my examination was the district in the vicinity of Callender, comprehending Ben-Ledi and the adjacent hills. Callender is about sixteen miles west of Stirling, and lies near the entrance of the Highlands, in this direction.

At the termination of the alluvial soil, which stretches from the coal-formation, along the track of the Forth, to the foot of the mountains, the first rock that presents itself, is a peculiar species of Conglomerate, which forms the ascent and lofty mural precipices to the north of Callender. It is disposed in thin layers or beds, with an inclination of nearly 74°; dip west of north, and direction north of east, about 15°, in general. The neighbouring country to a considerable extent, is composed of this substance; and the uniformity of its dip and direction may be distinctly observed at different places, particularly at the celebrated falls of Brackland, where the water of Kelty, forcing its way through a succession of almost upright beds, forms an interesting and picturesque scene.

This rock is composed of rounded and angular fragments of quartz, mica-slate, clay-slate, greenstone, chlorite-slate, drawing-slate, and other substances, in masses of various sizes and forms, and agglutinated in a basis of clay, which has a deep-reddish colour, from the iron it contains. We therefore infer, that it has been formed from the debris of higher and primitive land. It decomposes in the shape of vast flags. When used for building, it only admits of being dressed with the hammer; but its tenacity enables it to resist long the action of the weather.

The conglomerate now described, is a portion of the great mass of the same substance, which stretches along the foot of the whole range of Highland or primitive country, from the south-west to the north-east of Scotland. It rests, I presume, on Clay-slate, to which it is obviously a subsequent formation, and which it accompanies all along, in the same geognostic position; but from the thick covering of soil, where I happened to pass, I had no opportunity of observing the junction. On the other hand, the conglomerate itself appears to be covered at a lower level, with a species of limestone, possibly flœtz, the beds of which affect a conformable direction and dip, having been discovered in different places, to the south-west and north-east, along its course.

Of these formations, I did not ascertain the relative extent. From what is mentioned in the Statistical Account of Callender, it is probable that each of them occupies about a mile in breadth, of the surface ground.—The beds of Sandstone which are found towards the east of this district, and which contain beds and veins of Greenstone, are probably connected with the commencement of the coal formation.

It will be interesting, in a geognostic view, when more particular observation shall enable us to determine, to what class the Transition or Flœtz, in the series of formations, the Conglomerate of Callender should be referred. Its relative position might naturally lead us to consider it as a species of Grey-wacke, to which indeed it has many relations, both in structure and component parts. Perhaps, however, it may be found to have still a stronger affinity with the old red sandstone, which is often, like this, coarse-granular, and also, in the same manner, sometimes rests on primitive rocks *.

BEN-LEDI.

The next and most striking object of examination in this district, is Ben-Ledi; the first remarkable mountain which presents itself, at this entrance into the Highlands. Ben-Ledi stands to the west of Callender, from which, the distance to its summit, is about six miles. The height from the level of the sea, is reckoned to be nearly 3000 feet; springing suddenly from the flat country, and consequently with a greater elevation from the base, than the generality of the Highland mountains.

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* I have since been informed by Colonel Imrie, that he had traced the Conglomerate of Callender, to its junction, and found that it actually rests on the Old Red Sandstone, which he has, in various places of its course to the north-east, seen interposed between the Conglomerate and the Clay-slate.

In ascending by the eastern shoulder, there is little opportunity of mineralogical observation, as the gronnd is almost wholly covered with pasture, to the very top. The mind, however, is sufficiently interested by the distant view; which grows in beauty with every step of the ascent, till it bursts on the eye with great magnificence, at the summit: comprehending a vast extent of the low country to the east and south, with the windings of the Forth, and the greater number of the conspicuous objects in the Highlands of Scotland, which seem to arrange themselves in the form of a mighty amphitheatre, towards the west and north.—At such an elevation, and with the advantage of fine weather, the effect on the mind is peculiarly delightful, and it is impossible not to feel the most elevating impressions.

Ben-Ledi, viewed from the level country on the east, appears to have a double top, of which the nearest, or southern, is the highest. Here, the the rock is distinctly found to be Mica-slate, of the newer kind, with small scales of mica, and approaching to Clay-slate; but so much weathered, that it is difficult to procure a tolerable specimen. Further to the west, the rock has a greater proportion of quartz, and the scales of mica more distinct; consequently it appears to be of an older formation. On the other hand, towards the north-east, the oldest Clay-slate begins to shew itself, containing a quantity of iron-ochre from pyrites.—Under the second top, which lies in the direction of north-west from the first, mica-slate with brown spar, occurs.

Descending from this, directly towards the south end of Loch Lubnaig, we find the mountain assuming a more precipitous aspect, especially under the highest summit; and a remarkable feature in the form affected by a great proportion of the Highland hills, such as Cruachan and Ben-Nevis, for the first time presents itself; the appearance of a solid or re-entering angle, which opens towards the north-east, and in which the surface is sometimes smooth, but oftener rocky, or broken into cliffs.—By viewing the mountain from the upper part of the vast ravine now mentioned, it becomes evident, that the great central mass of Ben-Ledi, forms a part of the boundary of the mica-slate country on the south-east, and is a portion of the strata, which running from south-west to north-east, are known to compose the whole range of the Highlands in that direction.

These strata are almost vertical; and, in the great bosom or hollow of which we are speaking, exhibit, by decomposition, a strikingly grand and picturesque appearance, which, with the help of imagination, is easily figured into that of the ruins of spires and Gothic cathedrals. The singularly peaked or serrated shape, which the crops of the strata here affect, is occasioned by the waste of the rock, in some places across, and in others along, its line of direction; in which, the alternate or intermediate layers, decomposing, leave the resemblance of deep furrows on the huge fragments, which appear to be separated from the body of the rock. What adds to the effect of the whole, the acclivity of the mountain, on this side, is covered with masses of enormous size, which have tumbled down from the face of the precipice, and lie scattered in the wildest confusion.

Towards the lower part of the acclivity, in this direction, a small stream takes its rise, the bed of which shews the rock much traversed and intersected by veins of quartz and felspar. Here also, some of the strata assume a kind of porphyritic appearance, by the crystals of quartz and felspar, which they contain. Following the descent of this stream, we observe beds of Clay-slate beginning to alternate with the Mica-slate. At length the Clay-slate appears, composing a complete formation, conformable to the strata of the mountain. Of this formation, particular portions, from accidental causes, such as the failure of their support on the lower side, and the shape of the subjacent rock, vary somewhat in their dip and inclination. The whole base of Ben-Ledi, towards the east, is composed of Clay-slate, through which, at this place, the rivulet above-mentioned, works its way, in a succession of the noblest and most beautiful cascades, rushing, as it were, from terrace to terrace, and indenting the rock so deeply, as almost to hide themselves from view. Some of these are much loftier and more splendid, than the falls of Brackland, already noticed.

Along the channel of the same stream, fragments of micaceous rocks are to be found with shining particles of quartz, and an intermixture of hornblende. Some specimens contain a substance, which resembles sparry iron-stone; but on such an occurrence of that mineral, we cannot yet pronounce with certainty. In other specimens which have a brecciated appearance, and which form the connecting link between the common and porphyritic mica-slate, particles are found of a deep-coloured copper-pyrites, the same in kind with what was formerly confounded with gold by the early observers. There is also a fragment, which I picked up here, though not *in situ*, and of which, from its geognostic position, the original mass appears to have been a bed in clay-slate. It is pure granular hornblende, with a small portion of quartz, and a little mica and iron pyrites.

In different places of this formation, veins of lead-ore have been discovered. One of these which I examined, lies about a mile to the south of the rivulet above mentioned, at an elevation of more than 1000 feet above the foot of the mountain. Here the direction of the clay-slate is nearly east and west, inclination 50° south. The vein is said to have yielded at the rate of 20 s. value of silver, for every cwt. of ore, but was found too small for the expence of working. The lead-glance is accompanied by quartz, which so often occurs throughout the whole of this formation; and the vein, so far as it is visible, is from one to five inches wide.—Below the mine, the clay-slate includes iron pyrites; and there is a vein of felspar-porphyry, which traverses the slate, in a direction about 27° north of east: veins of quartz also, with with copper pyrites, occur.

It is through this formation of slate, that the River Teath, in forcing its passage from Loch Lubnaig, along the foot of the mountain, has formed the celebrated Pass of Leny, the only access to the Highlands of Scotland, in this quarter. The scenery here, is well known to be uncommonly striking; and what is remarkable, the action of the water, in scooping out the bed of the river, has at the upper part of the Pass, worn down the mass of the clay-slate, till the strata of mica-slate on which it rested, are laid bare. At a small distance above the water, the clay-slate is found on both sides. The mica-slate in this place, is porphyritic, and so extremely hard, that a neighbouring proprietor, wishing to deepen the bed of the river, for the purpose of gaining ground at the upper extremity of Loch Lubnaig, was obliged, after much labour and expence in blowing the rock, to abandon the operation as impracticable.

On this part of the subject, it is only necessary to remark further, that the clay-slate formation, considered as composing the base and neighbourhood of Ben-Ledi, extends in a conformable position, that is, resting on the mica-slate, from the heights above Loch Lubnaig, through the whole rising grounds towards Loch Vennachar on the south, a distance of more than ten miles. In all this tract, the usual features of a clay-slate country, as smooth and declining, may be observed. We also find, that the outermost part of the formation assumes a kind of deep violet or reddish colour, one of the characters of the newest kind. And thus the structure of this mountain, so far as it has been ascertained, completely justifies one branch of the general doctrine of the Geognosy.

LOCH-KATTERIN.

Continuing to stretch in the usual direction of south-west, the different strata, which compose Ben-Ledi, form at length the rude and splendid scenery of Loch Katterin, so justly admired, and so often visited. The whole of this remarkable district, including Benian on the north, and Ben Venue on the south, objects of singular beauty and grandeur, consist therefore of rocks belonging to the species of mica and clay slate, which present various degrees of induration or compactness, and are much traversed with veins of quartz. Along the side of Loch Vennachar, the clay-slate is repeatedly seen cropping out, and particular portions are quarried for use. Its dip here is towards the south, or opposite to the declivity of the hills, of which it forms the base. This is probably the remnant of a saddle-shaped stratification, of which the portion to the south-east has been worn away.

The singularly rugged and picturesque approach to Loch Katterin, in the course of which the clay-slate which first presents itself, is found gradually passing into mica-slate, has been considered as the effect of some extraordinary convulsion of nature, by which the neighbouring rocks have been broken in pieces, and their huge fragments scattered or piled on each other, in a state of terrific irregularity. In some places, blocks which seem to have been struck off by lightning, may be observed; but in general, a little attention satisfies the eye, that the appearances are nothing else than the natural decay, and wearing down in numberless forms, of the strata preserving their original position.

This romantic scene, by the wildness and grandeur which it exhibits, is not only delightful to the eye of taste, but peculiarly instructive to the curious geognost, and suggests many interesting ideas with regard to the mode in which the phenomena it presents to view, may be conceived to have taken place. From the spot where the traveller first reaches Loch-Katterin, the face of the rock on the right-hand, in advancing along the road which has been made to shew the beauties of the scenery, may be considered as a sort of geological lesson to the amateurs of mineralogy. It presents in general, an almost upright front penetrated with innumerable veins of quartz, which are sometimes straight, oftener undulating, and indeed infinitely diversified in their shapes and appearances. These veins, in most instances, are seen entire, that is, completely included or terminated in the mass of the rock; and lead irresistibly to the idea of cotemporaneous veins, forming an apposite illustration of what has been described and figured by Professor Jameson, in his paper on that subject, formerly read to this Society *.

The rock to which I now refer, is fine slaty, bordering on clay-slate. We then observe, as we proceed, a species of mica-slate, in which the quartz predominates to such a degree as renders it peculiarly tenacious and indestructible. It has a brecciated aspect, and contains small crystals or particles of a matter belonging to to the calcareous tribe, which, when of a brownish colour (probably rhomb-spar) seems to have been mistaken for felspar. From the appearance which this latter substance gives it, the rock has usually been considered as granite, by the people of the neighbourhood; but that mineral, so far as my observation extends, does not occur in the vicinity of Loch-Katterin.—In other beds, the slaty structure is very minute, and the rock is intimately mixed with hornblende of a greyish-green colour, which gives it a distant resemblance to hornblende-slate. We also find beds in which the

* *Antea*, p. 1, &c.

calcareous matter and pyrites decomposing, form specks of reddish-brown.

It is remarkable, that mica-slate, of nearly the same external characters with the indestructible species just described, is found on the north-east side of Ben-Ledi, in a line of direction corresponding to the usual bearing of the strata; from which it is probable, that the same rock runs for a distance of many miles, through Glenfinlas, and the central parts of Ben-Ledi, forming in its course, a variety of serrated and lofty peaks, particularly, I suppose, the inaccessible heights of Benian and its attendants, which to the north-east, crown the striking and picturesque beauties of the Trosachs.

Having finished the account of what I observed in this part of my excursion, I shall now mention a few geological inferences, which appear to follow from the principal facts that have been stated.

I. It may reckoned extraordinary, in what way the beds of conglomerate, first described, have assumed their present upright position. The uniformity, however, of their general direction and inclination, in following the regular course of the primitive strata on which they rest, and of which we shall afterwards speak, renders it impossible to admit the hypothesis of their having been displaced by any irregular or violent agency; and, along with the obvious phenomena of their structure, leads us irresistibly to the conclusion, that they were originally formed as we now see them. Nor will this position appear unnatural, if we reflect on the manner in which the debris of wasting rocks must necessarily arrange itself, in falling down the sides of mountains. For example, let any one look at the face of the steep under Salisbury Craig, and he will easily satisfy himself, how, supposing the presence of a consolidating power, a mass of conglomerate might be gradually formed by a succession of layers from the waste of the rock, with a very considerable inclination. In fact, the acclivity on which the fragments are now accumulated, has in general, an inclination of more than 50°. The same materials under water, by which the action of gravity is diminished, might assume a position still more nearly approaching to vertical; and such is the manner in which we account for the general inclination of the conglomerate at Callender.

We remark at the same time, that particular beds, in the process of waste, losing their support on the lower side, may at length, by the action of the weather, or the force of torrents, have come to stand still more erect, as at the falls of Brackland. Taking the subject in this view,

M. Saussure might perhaps have conceived it possible for the famous puddingstone of Valorsine, to have assumed its actual posture, without an extraordinary convulsion of nature ; and his wonder at what he considered as so unusual a phenomenon, might have somewhat abated.

If we extend the idea which is suggested by the obvious origin of the conglomerate, it will appear, that the structure of every rock, which exhibits the characters of a sandstone, that is, contains fragments or particles of another and higher rock, affords a demonstrative argument in favour of the Geognosy. It has indeed been questioned, whether such formations of stony substances could ever have taken place in water. But from the wonderful discoveries which have lately distinguished the progress of electro-chemical science, and which have brought within the circle of our knowledge, a new world of energies and changes among the elements of nature, there is reason to believe, that all the objections hitherto urged against the theory of aqueous consolidation, as a fact in the mineral kingdom, will at length be completely removed.

II. It is a fact which confirms another part of the Geognosy, that as far as I was able to observe, the mica-slate, which in this quarter of the Highlands, is generally undulated, contains no garnets.—The waved structure, which here exhibits an endless variety of forms and appearances in the slaty rocks of the primitive class, must have taken place, not by the application of an external force subsequent to the process of aggregation in the component particles of the stone, but *during* that process; and must have been determined by the laws of crystallization, chemical affinity, and galvanic influence, as well as by the mechanical power of gravity. This inference naturally presents itself to the geologist, on examining the aspect of the rocks which form Ben-Ledi, and the environs of Loch-Katterin. In looking at the slaty texture edgewise, the slightest inspection satisfies the mind, that the incurvations could not have been produced but by the same cause, whatever it was, which acted in the original formation of the stone.

Besides, it is evident, that the structure is the same, at the greatest *distance* from any mass of a different substance which might be imagined to have acted on the rock by heat or pressure, as in its *vicinity*; and the known laws, by which the propagation of pressure or force among the particles of soft or non-elastic bodies is regulated, render it impossible that undulation on so small a scale could have proceeded from the operation of any agent not at hand. The masses of quartz (which often appear as if closely wrapped round by the substance of the slate, like what might have taken place, had the slaty matter formed around them as a sort of nuclei, by the accretion of successive layers) are, like the veins, of cotemporaneous formation with the rock itself.

III. Ben-Ledi, it appears, is not a mountain, which exhibits on geognostic principles, the whole of the primitive formations in the order of succession. But it suggests the general inference which is founded on a view of the Highlands, from the heights of Braemar on the north-east to the mountains of Dunbartonshire on the south-west. The whole range of alpine country, now mentioned, is composed, as frequently noticed, of parallel strata, running uniformly in that direction; and these strata broken down, and hollowed out in various ways, form the elevations and acclivities of the particular mountains.

Now this fact, which will be further illustrated in future communications, which I shall have the honour of submitting to the Society, seems decisive against the theory of such elevations being produced by a violent power acting from below; as the regular bearings of the strata are incompatible with the supposition of their actual position having been determined by the operation of any irregular or explosive agent. The truth is, that the fact we are considering, is only another and striking instance in addition to those which have been observed by Humboldt, Von Buch, and others, in confirmation of the doctrine respecting the general bearings of the primitive strata, in the crust of the earth.

Such an uniformity of direction on the great scale, it would seem, could have resulted only from the action of powers in nature, which are quiet and regular in their operation; and must be referred to some original law, which later discoveries render it probable, will be found to depend on the constitution of the terraqueous globe with regard to magnetism and electricity. In this interesting point of view, the observation concerning the strata of the Highland mountains, was first made by my friend Professor Jameson, to whom the study of mineralogy in this country is so much indebted.

IV. One remark more will not, I hope, be unacceptable in this Society. It relates to the satisfaction in surveying a country, afforded by the principles of the Geognosy. Compared, indeed, with every other mode hitherto proposed of viewing the mineral mass of the earth, the superiority of Werner's system can hardly, I think, be appreciated in its full value.

PART II.

FROM THE PASS OF LENY TO BALAHELISH.

(Read 3d February 1810.)

I AM now to resume the account of my observations on the Highland districts, which I have had an opportunity of examining.

From the Pass of Leny to Arthudilly on the banks of Loch-Lubnaig, the general rock that meets the eye, is clay-slate, with its usual varieties of character; being the continuation to the north-east of the same formation which has been described at the foot of Ben-Ledi. The road winds beautifully along the margin of the Loch; and in different places of the rising ground on the right hand, slate-quarries appear to have been opened. A little beyond Arthudilly, the oldest clay-slate passes into dark-greenish grey mica-slate; of which the first appearances on the side of the road are interesting, when closely examined. It is undulated and distorted in every conceivable form. Here beds of a somewhat peculiar variety occur; in which there is a mixture of hornblende and mica passing into chlorite, and containing iron-pyrites, as an occasionally imbedded fossil. Strata whose characters correspond with those of the rock at the summit of Ben-Ledi, also are found.

After entering the mica-slate country at the place now mentioned, nothing remarkable appears immediately along the road, before we arrive at Loch-Earn-head. On the north of the water, about a mile from the inn, foliated granular limestone of a bluish-grey colour occurs, disposed in thin strata or layers, and much penetrated with veins of quartz and calcspar. The mica-slate in which it is imbedded, seems to border on clay-slate; but is weathered to such a degree, that I was unable to find a proper specimen, from which I could with certainty give its description.

BEN-VORLICH AND STUIC-A-CHROIN,

—on the south side of Loch-Earn, are mountains of a similar construction with Ben-Ledi, formerly described; lying to the north-east of it, in the common direction of the great strata, and consequently presenting, as might be expected, the usual succession of primitive rocks. From the house of Ard-Vorlich on the edge of the water, the ascent is regular and not difficult, till about a mile and a half from the summit of Ben-Vorlich; where the rock begins to be more uncovered and precipitous, and the geognosy of the mountain may be more distinctly ascertained. Mica-slate and clay-slate are found alternating, and containing beds of felspar-porphyry, greenstone, and limestone. In the structure of the rock at the summit, quartz predominates to a great degree; and some varieties have brown specks, which are owing probably to iron-pyrites decomposing.

The conical shape of Ben-Vorlich, viewed from certain positions to the south-east or north-west, is uncommonly regular. On the south-west, or laterally, it resembles somewhat a semi-ellipse, of which the greater axis is the base. Its height is estimated to be 3300 feet.

In the intermediate ridge betwixt Ben-Vorlich and Stuic-a-chroin, the rocks afford a curious field of examination. Masses of clay-slate are observed in situations where it seems to have once existed in greater quantity. There are also small beds and veins of quartz tinged with chlorite; and the mica-slate exhibits considerable variety of characters in different strata. In some instances it is compact, and in others it is coloured with the matter, sometimes of hornblende, sometimes of chlorite. One striking variety is thick slaty and porphyritic, passing into gneiss. Its crystals of felspar and quartz, by which it is distinguished from the common species in its neighbourhood, are at first extremely minute, but become at length very distinct. Of this kind, many specimens have a strong relation to one of the rocks at the side of Loch-Katterin.—Towards the summit of Stuic-a-chroin, (which appears from the low country, as a long serrated ridge, to the west of Ben-Vorlich and nearly as high,) the porphyritic mica-slate assumes a deep reddish tinge from the oxidation of the iron it contains.

Beyond the district of Loch-Earn-head, we travel still through mica-slate, in which we observe considerable variety, both of structure and of ingredients. Its colour in general, is greenish-grey, and its lustre shining, or even sometimes approaching to splendent.

In the course of a few miles, the valley of Glen-Dochart opens to view. At this place, in comparing the high level we have now reached, with that of the hollows left behind, we are naturally led to remark, that the whole ascent from Callender to Killin, illustrates beautifully the doctrine of the water, in the progress of its gradual diminution, descending from higher to lower valleys, through the mountain hollows, which it has formed.

The first example is the course of the Teath. This is traced to the vale of Balquhidder, of which, the waters, at the eastern point of the oval bason that incloses them, bending southward, fall into the mountain-hollow, or ravine, which forms Loch-Lubnaig. There they had evidently, at a former period, been pent up; but at length, forcing their way at the southern extremity, they descend abruptly through the Pass of Leny, and discharge themselves into the alluvial country, at Callender: having occupied in their progress, three great distinct stages or levels. Higher still, Loch-Earn furnishes the next example. Its waters rushing through the long range of hills to the east, flow more quietly along the valley of Strath-Earn, till at the opposite extremity, they find their passage into the yet lower level of the sea. In the tract of the Tay, which is the remaining instance I proposed to mention, a similar succession of descending stages may be observed. From Strathfillan, the highest inhabited valley in Scotland, the water has worked itself by the foot of Ben-More, into Glen-Dochart. Hence it descends into the magnificent alpine hollow of Loch-Tay; and after suffering this interruption of its stream, runs with a considerable inclination, till it reaches the lower part of the great strath, where it meets the Tummel, and takes its leave of the Highland levels, at the vast opening into the low country, which it has made for itself, through the mass of the mountains, a few miles below Dunkeld.

It is also worthy of observation, that the direction and dip of the primitive strata are sometimes found to vary a little, as we advance from the Pass of Leny, into the interior of the Highlands. This however, is only an effect of local circumstances. The general line of inclination and direction remains uniform; but, in particular places, there is a change of position occasioned by the partial wasting of the rocks, or by some irregularity in the original ground, on which the strata have been deposited.

BEN-MORE.

The hills which accompany the course of the Dochart, have a noble and striking appearance. But amongst the objects which crowd on the eye of the mineralogist, the attention is instantly arrested by the vast and lofty Ben-more; which far overtops the whole of its neighbours, and presents indeed, an extraordinary aspect of magnificence. Ben-More, which signifies the great hill, consists properly of two parts, a greater and a smaller, both of which are of an irregular pyramidal form. The two summits, which are nearly of equal height, can hardly be estimated at much less than 4000 feet from the level of the sea; and the lowest point of the hollow betwixt them, seems to be more than 1000 feet beneath the summit.

These mountains are composed of Mica-slate in different varieties, having the direction and inclination so often noticed. From some appearances of an inaccessible rock, I was led to suppose it a nucleus of gneiss, passing directly through the centre of the smaller mountain, and intermediate hollow, into the mass of the great Ben-more, which lies in the direction of north-east. Accordingly, Ben-more confirms the observation formerly made respecting the structure of the Highland mountains. The mica-slate is nearly conformable to the supposed gneiss, and every where intimately penetrated with veins of quartz, which exhibit an endless variety of form and appearance. Its specific peculiarities will be afterwards noticed as we proceed.

On the shoulder, to the south-east of the lesser mountain, called by the natives, Binean, I had an opportunity of observing the different states of motion and rest, which are known to co-exist, in different strata or elevations of the atmosphere. About a mile from the top, the wind was so strong, that the guide assured me, it was impossible to go up, or to withstand the still greater force of the tempest, which he thought we should have to encounter at the summit. Suspecting, however, that this violence was only local, I resolved to proceed alone; and in a few minutes I felt myself above its reach. The ascent is along a narrow ridge, which near the top becomes extremely steep on both sides. At the summit, there was hardly a breath of air, so that I could quietly collect specimens. In descending again to the level of the breeze, I observed that its strength was much increased by its compression, in rushing through a deep valley, which lies to the westward of the mountain. The guide, I found, had taken shelter under the lee of one of the rocks, where he remained in great anxiety, till venturing at length to leave his retreat, when I had gained the summit, he stood, expecting every moment to see me blown over the precipice. The surprise he expressed, that no accident had happened, was still greater, on hearing that the air at the top had been perfectly calm.

From the appearance of a ridge on the summit of Binean, viewed at a distance, in particular positions, I expected to have found it caped with greenstone or porphyry. Nothing, however, discovered itself to the stroke of the hammer, but shining or splendent mica-slate; which, at the top is fine slaty, and consists almost wholly of pure silvery mica. At some distance beneath, by a due mixture of quartz, it exhibits one of the most perfect and beautiful species of this rock.

The great Ben-More, which resembles a vast irregular pyramid, standing obliquely on its base, presents its most abrupt and precipitous front to the south-west. On this side, its upper regions, naked and bare, refuse accommodation to every inhabitant, except the eagle; and in ascending from the mountain-valley which divides it from Binean, the fatigue of clambering over its steep and broken rocks, which exhibit no variety, was relieved by little that could interest the mind, but the solitary flight of the ptarmigan and his mate, whose greyish hues at this season, (August) finely harmonized with the colours of the decomposing stones.

We reached the summit in the afternoon. And here, it is not easy to imagine a view more truly striking than what we beheld, like a scene of enchantment, which the few last steps of our ascent had spread instantaneously before the eye. The wind had now died away into a gentle breeze; the sky was clear; and the weather delightful. In this state of the atmosphere, the first objects that arrested the attention, were the colours around the setting sun. As they appeared in nature from such a height, these colours were so vivid, that any attempt to convey an idea of their beauty, by the most brilliant pencil or animated description, without the aid of actual sensation, would be hopeless. They had in truth, the richness and blaze of an Italian sky; and the rays of the evening sun, thus refracted into all the variety of iridescent hues, dashing horizontally, with the finest effects of light and shade, amongst the innumerable conical summits which stand to the west, threw over the landscape an exquisite finish of glow and splendour.

The whole range embraced by the eye at the top of Ben-More, renders the prospect undoubtedly one of the most commanding and magnificent in Scotland, perhaps in Britain; hardly inferior, in point of beauty, to those of Ben-Lomond, and Ben-Ledi, and in extent, yielding only to that of Ben-Nevis. It reaches from the upper part of Inverness-shire, on the north, to Arran and Ireland, which may be faintly descried on the south; and from Mull on the west, to Lammermuir on the south-east. There is, indeed, no point of equal elevation placed so nearly in the centre of Scotland. Remote from the lowlands, and from the arms of the sea, by which our coasts are so finely indented, the scene it presents is without the usual appendages of perfect landscape. But what it wants in beauty, is compensated by grandeur; and the absence of the river, the woodland, and the fertile plain, is forgotten, amidst the impressions arising from the vast expanse, in every direction, of alpine country, where the prominent features of ruggedness and sterility are relieved only at intervals, by the verdure of the cultivated glens, with their winding-streams, diminished by distance to the size of shining threads.

In particular, the course of the Dochart which sweeps the base of Ben-More, and of which, from this elevation, more than twenty miles may be comprised in a single glance, presents a remarkable *coup d'oeil.* To complete the effect in this style of the picturesque, the immense sheets of water in Loch-Lubnaig, Loch-Earn, and Loch-Tay, gradually opening and retiring from sight, among the deep and bending hollows of the mountains, form an embellishment of the whole view, more easily conceived than described.

Among the group of mountains which encircles the spectator in this panorama of the Highlands, by far the most striking and beautiful object is Cruachan, lying to the north-west; which springs aloft with singular elegance of outline, from the mass of hills in its vicinity, and which now seemed to project from the brilliant ground of the western sky, like a figure embossed on burnished gold. Few appearances in that kind of alpine landscape, could have a more spirited or charming effect.

With such an expanse of the great and delightful beneath the eye, contemplations of a higher kind could hardly fail to arise in the mind. If the ruins of temples, and the deserted scenes of antient magnificence, patriotism, or learning, have awakened the most interesting recollections, it cannot be unsuitable to the feelings of man, that the sight of impressively magnificent natural objects should lead him to reflect, with the sublimest sentiments of veneration, on the power and wisdom which gave them existence, and which presides over all the stupendous operations of nature.

From the summit of Ben-More, a very interesting and important geognostic fact may be observed. It is, that the leading ridges of the individual mountains throughout the whole of the vast range which stretches before the eye, on all sides, are always conformable to the direction of the strata which compose them. That is to say, the different ridges run from south-west to north-east, shewing, that the relative elevations of these mountains are occasioned by particular strata having been more indestructible than others near them; which, accordingly, in giving way, and gradually wasting, have formed the intermediate valleys and water courses. An attentive eye may even trace the same grand strata, passing from one mountain to another, and not greatly lowered in the hollows which divide the mountains; for the hollows or valleys, parallel to the strata, are in general the deepest, and not those by which the strata are crossed. This fact appears to furnish a strong argument against the theory of such mountains having been elevated individually by the power of fire. The great mass of alpine substances had been already formed by nature, in different grand ranges; and the shaping of the particular mountains, as well as of the smaller mountain-ranges, seems to have been the subsequent effect of decomposition and waste, while the waters of the globe were diminishing in level *.

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* Humboldt conceives, that the direction and acclivity of mountains and mountain-ranges, are phenomena posterior to the existence of the grand strata, which compose the crust of the earth, and out of which he considers these inequalities on the surface, as having been formed. See his opinion on this subject, quoted in page 116. of the excellent translation, by my friend Dr C. Anderson, of Von Buch's Description of the Environs of Landeck.

It may also be noticed, that the remark formerly made on Ben-Ledi, with regard to the form of the mountains as presenting their hollows or bosoms to the north-east, was found to be still more strikingly applicable, in the case of those observed from Ben-More.

Surrounded by objects on which the mind could dwell long with unabating delight, and which fix the spectator by a sort of spell, some time elapsed before I was able to withdraw the eye from what I contemplated as so admirable, in order to employ it in the humbler office of surveying the rock on which we stood at this interesting elevation. It is mica-slate, with distinct layers of pure mica, and of quartz; and approaches so nearly in appearance to the rock found at the other summit, that we cannot avoid the supposition of its being the same rock continued, and of the two mountains having originally formed but one.

At length, reluctantly quitting the scene of the splendid view I have endeavoured to describe, I began to descend with many a lingering look behind. Under the summit, along the ridge to the north-east, the rock, which becomes thick slaty, contains for some time, a greater proportion of its quartz ingredients; but lower down, it displays again the lustre and purity of the higher strata. At this station, veins appear filled with quartz, and containing also, mica, chlorite, and a valuable variety of iron-glance, crystallized in thin tables.

The apparent quantity of this ore, would hardly encourage an attempt to work it. Many of the strata on the same ridge, in decomposing, split in lines that cross the real course of the rock, almost at right angles; a circumstance which is apt to mislead the hasty observer, in estimating the dip and inclination. Towards the base, greyish-black hornblende-rock, slightly porphyritic, is found; and beds of beautiful dark-green hornblende-slate, with a shining lustre, and of red felspar-porphyry, having crystals of felspar, quartz, and mica, present themselves in the situation assigned them by the geognosy.

TYNDRUM AND KING'S-HOUSE.

Leaving Ben-More, we come to Strathfillan, of which the mineralogy may be soon dispatched, as it is every where covered with soil and culture, and offers little to the notice of the scientific traveller, (except a bed of bluish-grey limestone, which is granular-foliated, and of great thickness, not far from Crian-Larich), till we arrive at Tyndrum, where the Clifton lead-mine is not unworthy of attention. Many years have elapsed since it was first opened. The concern succeeded for some time, but at last failed. A few years ago it was resumed, and again abandoned; probably more from the want of capital, than of productiveness in the ore, which seems in general tolerably rich.

The lead-glance is in lamellar distinct concretions; sometimes specular; sometimes small granular; and often crystallized in cubes, more or less truncated on the edges and angles. It is associated with quartz, felspar, copper-pyrites, lamellar heavy-spar, brown-blende, and calc-spar. In some specimens, the quartz appears in six-sided crystals, and in prismatic distinct concretions, which is a somewhat rare occurrence. There is also calc-spar in pyramidal distinct concretions.—The mica-slate, in the neighbourhood of the vein, exhibits an unusual predominance of quartz; and the sides of the vein consist of quartz with a greenish colour, which is probably owing to a tinge of hornblende or chlorite *.

The mode of occurrence now described, appears I think, to differ somewhat from any hitherto mentioned by Werner, as belonging to this class of primitive rocks †.

At Tyndrum, I found a rolled mass of dark coloured hornblende-slate, containing crystals of quartz and felspar, and indicating the existence of a particular bed somewhere near. A few miles beyond Tyndrum, the great strata of mica-

* Mineralogical Queries by Professor Jameson, No. 16.

† Dr Anderson's translation of Werner on Veins, p. 210, &c.

slate seem to be mixed with a portion of fine granular-felspar, and approach to an indistinct species of gneiss, in which quartz is the chief ingredient. This continues till we arrive at Inverouran, beyond which, rolled pieces of gneiss are observed, and we soon begin to perceive the symptoms of an overlying sienite-formation, with its subordinate rocks. A substance then occurs, which, containing hornblende, may be considered as the link betwixt sienite and felspar-porphyry. Farther on, and at the bridge of Baa, we find again quartzy mica-slate. At King's House, the rock which appears in the bed of the river, is felspar-porphyry, with crystals of quartz, felspar and hornblende. Here, too, veins occur of a substance inclining to hornstone-porphyry; and in the neighbourhood, there is mica-slate with veins and layers of quartz and felspar.

About a mile and a half west of King's House, the front of the rock, on the left of the road, has a remarkably fine picturesque effect. Rising abruptly from the plain, and presenting its upright furrowed brow in the shape of rugged projecting columns, it exhibits a rude resemblance to the abutments and ornaments of a Gothic cathedral towering to a point. This beautiful and lofty rock is the commencement of the great ridge which forms the south side of Glencoe.

Beyond King's House, an elegant species of newer granite, with flesh-red crystals of felspar, makes its appearance, as a part of the overlying formation. Then advancing towards Glencoe, in the course of a few miles, we pass along beds of splintery hornstone, compact felspar, sienite, and felspar-porphyry with crystals of hornblende. The hornstone is slightly translucent, and has a dark-greyish colour inclining to black, with a dull lustre. Of these substances, variously disposed, the neighbouring mountains, rugged and precipitous, appear to be composed. And the whole range of the flat country around King's House, as well as the tract for many miles to the east, and south-east, has an unusual aspect of bleakness and sterility, even for the Highlands; affording pasture only for goats. This appearance may be referred to the nature of the rocks, from the decomposition of which it has been produced, and which are known to be more unfavourable to vegetation, than the mica-slate over which we have passed.

The state, however, of the surface, every where covered with debris, and coarse soil, and the inaccessible position of the rocks to be examined, render the geognosy of this district, extremely difficult to be ascertained. As far as could be judged from such an examination as I was able to make, the general disposition of the rock I have mentioned, corresponds with what might be expected on geognostic principles. The beds of hornstone, and felspar-porphyry, appear to be subordinate to the formations of gneiss and mica-slate, and are covered by the sienite.

GLENCOE.

We are now arrived at the line of rocks which form the approach to Glencoe: the celebrated scene of many affecting recollections, and of the most astonishing natural grandeur. The road here runs to the west, and continues in that direction, through the mountain-hollow, with a slight ascent, till we reach a point from which the descent into the glen becomes at last extremely rapid. From this elevation, we begin to descry the alpine objects which are soon to excite our admiration.

The commanding prospects, which had hitherto occurred, derive their advantage and effect from the elevated position of the spectator. But it is not till we advance towards the bottom of the descent in the heart of Glencoe, that the amazing scenery which strikes the eye on both sides, assumes its peculiar character, and displays at once, the whole features of its wildness and sublimity. At this place, the abrupt and rugged fronts of the precipices, alternately advancing and retiring from the eye, in every possible variety of irregular form; the vast lateral recesses to the south, which discover the pointed summits towering behind; the immense mountain-masses, seemingly piled above each other, and terminating at last in the most elegant and lofty spiral peaks, which appear as if touching the skies; and the stream dashing from rock to rock in the centre of the valley: all together compose a group of the rude and striking picturesque, which, if any where equalled, can hardly be surpassed. I was fortunate in seeing Glencoe, both with the beauty of a clear sky, and with the glooming heightenings of broken clouds, and floating mist.

It is to the singularly indestructible texture of the rocks composing its frightful declivities, and high overhanging cliffs, that this famous glen owes its rugged and tremendous aspect. They consist of a peculiarly tenacious compact-felspar, which is porphyritic, and inclining sometimes to hornstone, sometimes to jasper; in beds of different shades of colour, from a greyish-black, resembling basalt, to a kind of brick or flesh red, alternating with each other, and subordinate to the primitive rocks, which in some places may be still distinctly traced. From inspecting a rolled angular fragment, which I found among the debris, it seems probable, that common jasper occurs in veins of these rocks. The darker varieties of the stony masses approach to hornstone: and the whole appear to be caped with porphyry, of the same kind with that which occurs soon after leaving King's House. Of this, indeed, I could form an opinion only from the debris, which cover the faces of the steep ascents to the very top, and thus, in conjunction with the distant appearance, enable us to judge, with tolerable certainty, of the materials at the summit of the inaccessible heights on both sides.

Should this conjecture prove correct, the formations now mentioned will be found connected with that which is afterwards to be described, as composing the summit of Ben-Nevis, and probably extending over the whole intermediate range of alpine country. To confirm the truth of this supposition, it is observable from the top of Ben-Nevis, that the higher parts and acclivities of the mountains, lying in the direction of Glencoe, have uniformly the appearance (that of being covered with a whitish powder or crust) which is known to characterize this species of compact-felspar, in a state of decomposition. And the upper part, indeed the whole of Ben-Nevis itself, will be shewn to be a rock intimately allied to the species felspar.

As we advance towards the lower part of the glen, mica-slate, in different varieties, again appears from beneath the rocks along which we have passed. Beds of flesh coloured granular quartz now occur, and veins of felspar which is porphyritic, and contains fragments of the neighbouring rocks. Near the house of Glencoe, specimens of blackish hornblende rocks, and of dark grey mica-slate, with garnets, occur.

From this description of its rocks and aspect, Glencoe, it appears, may be regarded as truly a scene of wonder, both in a picturesque and in a mineralogical point of view. Nothing, in truth, except Arran, can be more attractive to the zealous mineralogist. In particular, to the attention of the student of geognosy, it has, if possible, still stronger claims, and may be safely announced as instructive equally to the geologist and the geognost, whose provinces, though so often confounded, are in fact essentially distinct. For, without venturing to pronounce that we are yet in possession of what may be received as an unobjectionable theory of the earth, there are, I think, in this interesting tract, the most abundant materials of information, and the richest field, both of inquiry and of speculation, to those who delight in such researches. Although, therefore, on this occasion, I could only observe the leading features of Glencoe, and ascertain its geognostic structure on the great scale; it would furnish ample matter for the study of months, to the diligent inquirer: and his exertions, which, from the precipitous state of the rocks, must be very laborious, not only in detecting the various substances which are to be found, but in tracing their relative positions, would at last be rewarded by the amplest harvest of practical knowledge, and geognostic discovery.

What adds to the interest which this portion of country so justly excites, it presents examples of almost all the leading phenomena, that place in direct opposition to each other, the two theories of the formation of the earth, which at present divide the mineralogical world.—If the recommendation now given should prove the means of directing the attention of mineralogists to Glencoe, and of thus procuring a more particular and complete view of its geognosy, I shall consider this hasty and imperfect sketch, as not entirely without its value to the science.

Glencoe lies nearly east and west. At the bottom of the glen, the mountain-hollow suddenly bends into a northern direction.—It is here, that, in the bosom of the valley, where cultivation begins, and population appears, we come to the scene of the unaccountable event, which is called the Massacre of Glencoe, and of which the motive or necessity, never yet satisfactorily explained, is still hid under a veil of mystery.

This part of the valley, finely wooded and covered with soil, stretches directly towards Loch-Leven, on the banks of which, the road again turns to the west, and brings us, after a few miles, to the great formation of clay-slate, which affords the quarries of Balahelish. It contains different foreign beds, particularly of lime-stone, which, as principle teaches us to expect, is smaller grained than the species found in mica-slate, and which Williams says, has grains of pyrites and lead-ore. Greenstone also has been observed by Colonel Imrie in this formation.

After passing the slate quarries, we discover granite on the road to Balahelish ferry. I regret, however, that particular circumstances prevented me from tracing the phenomena and geognostic relations of the rocks in this district. One remark was the effect of simple inspection. The presence of the slate, as distinguished from the neighbouring rocks, is easily known by the shape, aspect, and verdure of the hills which are composed of it, and which are also found on the opposite side of the ferry. Beyond the region of the clay-slate, the mountains appear towering aloft, and the alpine landscape around Balahelish, embellished with a vast central expanse of water, is uncommonly grand and picturesque.

In order now to place the facts which have been stated, more concisely in their geognostic point of view, let us take a general and rapid survey of the country over which we have passed, from Callender to Balahelish.

On entering the border of the Highlands, we find the newest primitive rocks. Mica-slate, with higher outgoings, and with many of the subordinate beds and substances, which are known as belonging to that formation, then accompany us from Loch-Lubnaig to Inverouran. Rolled fragments afterwards occur, which indicate the proximity of gneiss; and it is probable, that gneiss and granite both exist in the mountains to the west of that district. An overlying formation of sienite next presents itself in the neighbourhood of King's-House: and this continues through a variety of co-relative rocks, till we reach the bottom of Glencoe, when gneiss, mica-slate and clay-slate again appear in their due geognostic position.

It seems, therefore, to be ascertained, that the great formations which have been traced from Callender to Glencoe, occur also in the same relative order, as lying over the subjacent nucleus, on the other side of the primitive country; and that, on the principles of legitimate induction, without any reference whatever to theory, the structure of the Highlands, along the course we have followed, as a matter of fact, corresponds with the system of the geognosy: thus far illustrating the principles of a doctrine which professes only to *describe* nature, in the mineral kingdom.

If, indeed, any order actually exists in the component parts of this department of the material universe, such as is observed over all the rest, it must be discerned, even through the veil of decomposition and waste, wherever there are rocks of different species. It cannot therefore be more extraordinary or unnatural, that the structure of one country on the great scale, should resemble that of another, in the kind and succession of its formations, than that any individual mineral, such as greenstone or felspar, should be found of similar characters in the most widely distant regions of the world; and Werner in truth has only generalized the practical maxims of every miner, with regard to the position and connection of the minerals on which he is employed, by applying, with the most consummate skill, similar observations to the great masses which compose the crust of the earth "It is to Werner," says Mr Daubuisson *, "that this branch of our knowledge almost "entirely owes its existence; and it insures him a "distinguished rank among the men of genius, "who have advanced the science of nature."

* Annales de Chimie, *tom.* 69. *p.* 227.

PART III.

STRONTIAN AND BEN-NEVIS.

(Read 10th March 1810.)

In relating the progress of the mineralogical tour through the Highlands of Scotland, which I have had the honour of describing to this Society, my last paper brought us on, to the clay-slate formation of Balahelish.

On the opposite or north side of Loch-Leven, the same substance, first alternating with, and then passing into, mica-slate, may be distinguished by its usual characteristic features, in the shape of the hills which skirt Loch-Linnhe, on the right hand of the road to Fort-William. In passing along this road, yellowish-white granular quartz, in beds or masses of great size, repeatedly presents itself. The first remarkable instance occurs at a small distance from the ferry, to the west of a hollow on the face of the rising ground, where the rock appears to have been worked for slate. Farther on, granular limestone of a bluish-grey aspect, also is found, much penetrated with quartz and calc-spar. The micaceous strata of this district, appear to maintain their usual direction.

STRONTIAN.

When we pass the ferry at Curran, and the house of Ardgour, on the road to Strontian, we find ourselves in the region of gneiss, which exhibits, along this tract, a great variety of aspects and proportions in its component parts. Frequently it occurs large striped, like ribbon-jasper; or filled with reddish-coloured felspar, in every form of layers, veins, masses, and nodules, which give the rock a very peculiar, and often beautiful appearance. Indeed, in the structure of the rock, much undulation almost every where prevails. About three miles from Strontian, towards the east, granite appears, in various shades of red and grey, depending chiefly on the colour of the felspar.

In the interval, therefore, between Balahelish and Strontian, we have clay-slate, mica-slate, gneiss, and granite, as we were taught to expect, on geognostic principle. Here, accordingly, is an important fact. Something, indeed, approaching to truth, must be admitted by the opponents of the Wernerian school, as belonging to a scheme of description, which is thus justified, by the general similarity of relations, among what are called primitive rocks, even in the farthest separated countries. Hence also, a presumption arises, in favour of the same descriptive system, with regard to the accuracy of its other parts, as equally founded on observation. And if the whole be conformable to nature, a greater degree of regularity will be acknowledged as existing in the formations of the mineral kingdom on the great scale, than some geologists have been willing to allow.

The celebrated vein of lead-glance at Strontian, is near the junction of the granite and gneiss; so that in some places, the wall on the one side is said to be granite, and on the other gneiss. But in general, the ore may be considered as occurring in gneiss; and is associated with iron pyrites, cross-stone, calc-spar, foliated zeolite strontian, and heavy-spar. Of this vein, different branches have been opened.—The mining company have a vein of copper-ore, on the opposite side of Loch-Sunart, which they intend to work. But I could not learn, in what rock it occurs.

These few cursory remarks on Strontian and its vicinity, which present one of the most interesting fields of geognostic investigation to be found in Scotland, I offer only as a mineralogical notice, and as an imperfect answer to Professor Jameson's 39th query *. My time did not admit of dwelling particularly on the examination.—The specimen shewn me by Colonel Imrie, of the trap

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* *Antea*, p. 121.

veins which he found traversing the mining field at Strontian, (*vide* Queries, No. 38) is basalt, of a deep greyish black, with a number of feebly glimmering minute particles, (probably of crystallized felspar and hornblende), and its fracture approaching to imperfect large conchoidal and fine splintery.

I now reached

BEN-NEVIS,

the great and ultimate object of my excursion. In the view of applying the test of nature to the doctrine of the Geognosy, it seemed to be a matter of equal curiosity and importance, to investigate the structure of the most stupenduous and lofty mountain in the United Kingdom. The operation, however, of examining this huge mass of alpine rock is so laborious, that nothing but the most determined and un-yielding perseverance can accomplish the task; and it was not till after many toilsome exertions, that I obtained the data for ascertaining to what formation Ben-Nevis ought to be referred.

SHAPE OF THE MOUNTAIN.

Ben-Nevis, it is well known, belongs to the class of what are called Table Mountains, having its summit round-backed; and viewed from the west, appears to consist of two distinct elevations, the smaller of which is piled above the greater, like a cupola erected on a vast and lofty basis. It rises immediately from the level of the ocean, to the perpendicular altitude of 4350 feet. The ascent, accordingly, even of the base on the north-west, is extremely steep, till we reach the height of 1100, or 1200 feet; after which, a gentler slope for a mile or more, brings us, at the elevation of about 1600, or 1800 feet, to a kind of irregular stage or platform, with a rising ground on each side. This plain inclines upwards, to the right hand; and across it, at some distance, stands the acclivity of the mountain.

At the foot of the acclivity there is a hollow containing a small lake, around which we still find a covering of moss and spongy soil. But soon after beginning to mount up on the left, we find ourselves clambering over naked fragments of rock, with hardly a vestige of vegetation; so that even the lichen is at length no longer discerned. The part of the ascent or face of Ben-Nevis, to which this description applies, is probably from two to three miles of the way to the summit; and the whole distance from the lowest to the highest point, as the ascent from Fort-William is usually performed, may be estimated with tolerable exactness, at somewhat more than five miles.

On the eastern side, which we shall call the back of the mountain, it is encircled by a high ridge, which, after sweeping around the intermediate hollow, joins Ben-Nevis on the south, at the height of nearly 1000 feet below the summit. The mountain, therefore, in this direction, is by no means so precisely defined, as on the opposite side. But, if we conceive an imaginary line passing beneath this ridge, and joining the base at the north and south points, the whole circumference of the mountain at the level of the sea, can hardly be less than 24 or 25 miles.

It is along the course of the hollow, or great ravine just mentioned, that the summit or higher portion of Ben-Nevis forms its celebrated lofty precipice to the north-east and east; from the foot of which the ground descends towards the north, with a comparatively gentle slope, for several miles, till it reaches the valley or level country in which the Lochy flows. Of the summit and its stupendous precipice, the whole figure may be compared to a mighty dome, out of which, immediately below the apex, a portion has been hollowed, by an irregular and almost perpendicular section, having a grand projecting front towards the east, but the greatest altitude on the north-east, close to the summit, where this awful and tremendous precipice forms a vast solid re-entering angle.—Such is a general outline of the shape of Ben-Nevis. As to its

STRUCTURE.

The surface of the mountain is all around furrowed by a number of streams, the courses of which afford great facilities for determining the nature of the rocks that compose its lower parts. After minutely examining these water-courses, and traversing the surface in various directions, the geognostic result of the investigation enables me to say, that this enormous body of rock is an overlying massive formation, in which felspar is the leading ingredient; that the particular rocks of this species, which form the inferior mass of Ben-Nevis, are (conformably to geognostic principle in such a case) varieties of Sienite, passing from the simple granular into the granular porphyritic,—also sienite-porphyry, and porphyritic compact felspar, all of which have in general a reddish aspect; and that the upper part of the mountain, comprehending the summit, with about one-third of the whole ascent, and from 1000 to 1500 feet of perpendicular height, is composed of a substance allied to felspar, which is for the most part porphyritic, and much tinged with the matter of hornblende, giving the mass a deep-green or darkish colour. This rock, into which the compact felspar evidently passes, by the addition of a colouring substance, I must leave to further examination, without presuming to assign it a name or place, in the Wernerian system of mineralogical arrangement.

The portion of the great deposition, which thus assumes a darkish hue, has somewhat the shape of a vast wedge sunk into the body of the mountain, so that from a particular point in the hollow beneath, it may be traced up to the bottom of the precipice, in the form of a fan widely spread. This is perceived, by surveying attentively the north-east front of the precipice, which, as Mr Williams has observed, exhibits a magnificent section of the internal structure of Ben-Nevis. The precipice itself consists almost wholly of the dark-coloured rock; which, above the wedge-shaped mass now described, appears to spread itself horizontally over the subjacent reddish felspar.

The rocks on which the entire mass of Ben-Nevis rests, are Gneiss; and Mica-slate, in some places approaching to clay-slate. These, at different points of the base, may be seen distinctly running beneath the body of the mountain, in the usual direction of the Highland strata. For example, on the level ground between Fort William and the beginning of the ascent, mica-slate is to be traced, passing under the north west corner of the base, and appearing beyond it, in the channels of the rivulets which descend on that side. Along the course of the Nevis also, the strata are observed in many places, crossing the bed, and running directly under the mountain. Nearly opposite to Glen-Nevis house, I found the junction with the superincumbent formation, in the bed of a small rivulet, where the debris of the higher rocks begin to cover the soil of the glen; and a little to the north, on the same side, a considerable front of mica-slate presents itself, at some height above the river. At last, however, after ascending to a considerable elevation, the strata forming this front, disappear beneath the mass of the mountain-base.

This general view of the structure of Ben-Nevis is illustrated by a reference, on the grand geognostic scale, to the nature of the adjoining country, for many miles on the east and south. The probability has already been noticed, (p. 313.) that the range of mountains which extends from Glencoe to Ben-Nevis, consists of an overlying formation, principally of felspar, under a great variety of forms and appearances. This, however, is stated merely in the way of conjecture.——I now proceed to describe more particularly the

ORYCTOGNOSTIC CHARACTERS

of the different rocks which compose Ben-Nevis, as they were observed in the course of prosecuting the investigation along the Base, the Acclivity, the Summit, and the Precipice. In different parts of this extraordinary alpine tract, the various objects which meet the eye, in a picturesque point of view, are too striking to be passed over without remark, as we proceed.

Besides the information to be derived from surveying the more prominent masses, which present themselves around the mountain, I have noticed the facilities of examination that are afforded by the water-courses in every direction. In particular, the base and acclivity may be examined with advantage along the course of five streams, which divide the circumference into the same number of unequal portions, and some of which conduct at length to the dark-coloured rock that forms the summit. These are 1. The Stone-burn, which takes its rise under the precipice to the east, and holds its course nearly northward; 2. The Mill-burn, which issues from the small lake, at the foot of the acclivity, and runs for some distance, almost parallel to the former; and 3. The Claggan-burn, along which is the first part of the common ascent from the west. The 4th stream, to which I allude, is that which directs the course of the traveller, in ascending the acclivity from the small lake just mentioned. It takes its rise from the last spring which we meet with before reaching the summit; and after an unusually precipitous and abrupt course to the south-west, falls into the river, at a short distance from the house of Glen-Nevis. The 5th stream begins immediately under the junction of the great ridge which backs the mountain on the south. Its head lies about a mile westward from that of the Stone-burn first described; and being on the opposite declivity of the ridge, the course of the stream is southward. This rivulet, which, if possible, is still more direct and precipitous in its course, than the fourth stream, falls into the Nevis a few miles above the house.

Of these rivulets, the Claggan-burn is commonly the first which occurs to observation. At the place where it reaches the level country, mica-slate is found, but hardly ascends to any height. The overlying formation soon appears, as we begin to go up the

BASE.

In this formation, the general substance of the rock is a granular aggregate of felspar, hornblende and mica, in various proportions, more or less approaching the description of true sienite. It has at first a greyish aspect; but soon acquires, towards the upper part of the base, a reddish hue, not only from a change in the colour of the felspar, but from its proportion becoming greater, and assuming at the same time, the form of large distinct crystals, which give it a porphyritic character: forming a rock of an unusually fine and beautiful appearance, and more than probably of the same kind with that which was antiently used in Egypt for the pillars and obelisks so famous in history. In the Claggan-burn, there is a vein of granular substance, containing chiefly felspar, with a slight intermixture of hornblende, mica, and quartz. This vein may be traced for a long way up, in the channel of the stream, and seems to have been filled from the higher part of the same formation.

ACCLIVITY.

After passing the small lake, we edge upwards along the face of the acclivity to the left, till we reach a place (beside the 4th stream) which may be estimated at about two thirds of the distance to the top, and where the guide is accustomed to make the travellers whom he attends, rest and refresh themselves *, before they encounter the steepest

* The inn at Fort William is at present in excellent order, and kept by a Lady, whose care and attention render

and most difficult part of the ascent. At this elevation, we have ascended beyond the level of the neighbouring heights, and the splendid prospect which Ben-Nevis commands, begins to unfold its majestic features. The fine sweeps of Loch-Eil, and Loch-Linnhe to the west and south-west, and the greater part of the western isles from Jura to Sky, with the mountains of Mull, Rum, and Canna, the Cullin Hills vanishing in mist, and the arms of the ocean indenting the shores in a great variety of beautiful forms, are here expanded with singular magnificence, like a vast map before the eye.

It is also at this spot that the external character of the formation we are investigating, appears to undergo a remarkable change. On the opposite, or south side of the rivulet, two fronts of the rock *in situ*, projecting from the debris by which they are surrounded, present themselves, the one at the distance of some hundred feet above the other, in the line of ascent. Of these, the inferior is a small-granular sienitic porphyry, with scales of mica, and a reddish colour; but the higher rock is unexpectedly found, on applying the hammer, to consist of a greyish-black substance, sometimes inclining to a deep green, with

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it unexpectedly comfortable, both for provision and for lodging. Macmillan, the guide, is well acquainted with all the localities of the mountain.

an uniform texture, which seems at first sight in its characters and fracture to resemble basalt.

Struck with this unlooked for appearance, and comparing it with what I afterwards found at the summit, I conceived at first, and for some time, that the observation thus made was the discovery of a flœtz-formation, consisting of clinkstone over porphyry-slate and basalt, and resting immediately on sienite. I therefore applied myself with eagerness to find out what might be considered as the junction or line where the transition takes place. But the intermediate space, the bed of the rivulet, and the surrounding acclivity in every direction, are so completely covered with fragments, that the line sought cannot be discovered hereabouts. So that, after spending a long time, and returning on purpose another day to prosecute the search, I was obliged to abandon it without success.

At the same time, although on this face of the mountain, the quantity of debris from the higher rocks is prodigious, and descends probably a little below the upper part of the sienitic mass, the experienced eye can easily trace the horizontal line, where the fragments of the subjacent felspar-porphyry begin to mix with those of the overlying dark-coloured substance. It runs along the acclivity towards the north shoulder, and is evidently but a small distance under the presumed junction. I may further observe, that all the rocks at this part of the ascent, are so little uncovered, and decompose in such a manner, that it is difficult to ascertain whether or no they are disposed in beds, and if they are so, to determine precisely their dip and direction. Splitting, indeed, in rhomboidal masses, they appear in one view to consist of layers or strata, which maintain a pretty regular bearing, east of north, with an inclination of 75°; dip north of west. But another view presents uniform lines of separation in the mass, which suggest the idea of a dip and direction entirely different; a circumstance, which is probably owing to the structure of the stone, as occurring in tabular distinct concretions.

It then struck me, that the junction I had sought in vain, might perhaps be found laid open on the opposite side of the mountain, along the front of the precipice. With this hope, which it will afterwards appear was not unfounded, I consoled myself for the disappointment now suffered, and resumed the ascent, along which, the dark coloured rock soon begins, by the addition of embedded crystals, or concretions, of reddish felspar, to exhibit a porphyritic aspect. These crystals or nodules, are of great size in some places, particularly near the summit, where we observe them as large as a common brick, or even larger, and of a similar appearance and shape. When they are of an ordinary size, and uniformly disseminated through the mass of the rock, as it occurs at different places of the ascent, we have a regular and excellent porphyry, of which the base exhibits the same characters with the blackish rock where it first appears. At the summit itself, the porphyritic structure is less remarkable, and the minute crystals have a pale colour, or disappear entirely.

From the bottom of the acclivity to the top of Ben-Nevis, one uniform character of nakedness and sterility, as already noticed, every where reigns; and it is but rarely that a cliff of the rock is seen struggling to rear its head from the ocean of fragments, with which the great body of the mountain at this elevation, is overwhelmed on all sides. Specimens therefore cannot often be procured from the mass *in situ*; but the debris, more particularly towards the summit, can hardly be far from their original position.

SUMMIT.

The fatigue of ascending is now lessened by the diminution of the steepness; and our attention, on reaching the summit is soon attracted from the broken rocks on which we are treading, to the boundless prospect which bursts upon us, all around. Of this sublime and unrivalled scene, elevation immensity and extent are the leading characters that give the whole its interest. The parts, indeed, appear on too vast a scale to constitute beauty, and the individual objects which contribute to this effect, are too remote to be distinctly seen. Mountain ranges in every direction, and huge masses of arid rock, intermingled with extensive water surfaces, compose the principal features of the view: which here ranges from the Murray Frith, and the mountains of Ross and Sutherland on the north and north-east, to Ben-Lomond on the south, and the island of Colonsa on the south-west, including a distance of nearly 180 miles. A new effect in the way of embellishment, is thus produced. For besides the ordinary groups in an alpine landscape, lakes, islands, and the great ocean enrich the prospect, and fill the eye with a picturesque variety, which is wanting in the grand central view from Ben-More.

The vast hollow which stretches from Fort-George to the Sound of Mull, and along which the Great Canal now begun, is intended to form a communication betwixt the northern and western ocean, is seen at once in all its extent. Among the mountains the most conspicuous, are Ben-Wyvis in Ross-shire, Cruachan, Bendoran; Ben-More in Mull; and Schihallion to the east, which viewed from this position, appears more insulated, than in any other direction, and shews the propriety of its being selected by Dr Maskelyne for his experiments on gravitation.

With all this diversity of magnificent and striking objects to feast the eye, and captivate the mind, the prospect from Ben-Nevis can scarcely be equalled or at least exceeded in majesty and grandeur: it presents a scene on which the imagination may dwell with delight, but of which it is difficult by mere description to convey a just idea.—The feelings excited at this commanding elevation, are not, however, entirely unmingled with sensations of a different kind, when we take our attention from the objects at a distance, to the spot on which we stand. On looking beneath us, a few paces from the summit, we see the edge of a frightful precipice, which cannot be approached without caution, and from which the boldest must shrink with terror. What adds to the danger of the trembling spectator, the edge itself is wholly composed of loose fragments, which a little pressure is often sufficient to displace, and, when of any considerable size, their own weight soon urges down the precipice, with a rushing noise and tremendous crash. This sound, produced by the rattling of the stone, as it impinges successively during its fall, on the projecting points of the perpendicular rock, is reverberated among the surrounding cliffs, and filling the vast adjacent cavity, thunders along the valley below. The effect accordingly on the ear, is grand and impressive; and has occasioned the common but perilous amusement, of heaving stones from the top of the precipice into the dreadful abyss.

It is evident, that in the course of being reduced to its present fragmented state, the height of the rock which forms the summit, and consequently of the whole mountain itself, must have suffered a considerable diminution. Still Ben-Nevis, as is well known, overtops the whole of its neighbours, although many of them are very high. In looking from the summit, on those particularly which lie to the south, it is impossible to avoid being struck with the resemblance, which, from their peculiar shape, they bear to the waves of the ocean agitated by a violent tempest. Such an appearance may give birth in the fertile imagination to a variety of curious geological conjectures. The effect, also, of elevation in diminishing apparent distance, is extremely sensible from Ben-Nevis. Thus, the islands towards the sound of Mull, although at the distance of thirty miles, seem as if placed under our feet. I may further remark, that so far as I could judge from my own sensations, the rarity of the air at this altitude, had no perceptible influence on respiration. Its effect, indeed, must very frequently be counteracted by a circumstance, which probably is not duly attended to, or remarked; that the agitation of the atmosphere, either sensibly or imperceptibly, by those causes which produce its motion, may occasion a state of it, different from what would take place, were the equilibrium according to the laws of statics, to exist as in perfect stillness. The state here alluded to, resembles that which is produced, by shaking together liquors of different specific gravity; the heavier particles may occupy in turn, the higher place, while the motion continues, and a sort of medium density may be the result.

STONE-BURN.

The common ascent, and the summit, of Ben-Nevis, being thus examined, my next object, when I resumed the investigation, was to survey the mountain, on the opposite or precipice-side. This is done by following upwards the course of the two streams, called the Mill-Burn, and the Stone-Burn. For it is only in the channels of these rivulets, that we find the rocks on this side, laid bare for examination. These channels were traced with great attention; and I trust that nothing of importance in their contents escaped my notice.

In ascending, then, from the bottom of these streams, a succession of characters in the appearance of the rocks, similar to that which has been described on the way to the summit, is found to take place. Having observed the mica-slate containing small disseminated shorl, and the beds of gneiss, which running as usual with an inclination of 70°, appear to form the base of the country on the west and north; we meet at first with a species of sienite, in which the prevalence of the hornblende intermixed with mica, and the greyish-white colour of the felspar, give the rock the aspect of grey, and sometimes a tendency in its nature to primitive greenstone. Higher up, the colour of the felspar changes to different varieties of red, and we have porphyritic sienite, with crystals of felspar and scales of mica; which at length passes into a substance resembling sienite-porphyry, and towards the lower part of the precipice, into felspar-porphyry, or rather, to speak more properly, into porphyritic compact-felspar.

It is by no means improbable, that in this portion of the great formation we are describing, which consists of sienite, simple-granular and porphyritic, the rock at some places, by the diminution of its hornblende, and the addition of quartz to the remaining felspar and mica, may approach the characters of newer granite; but none of the specimens I was able to procure, entitle me to pronounce with any certainty that this is the fact. The rock described by Mr Williams in his Mineral Kingdom, as the "elegant reddish granite of Ben-Nevis, and perhaps the most beautiful in the world," appears to be the simple granular-sienite, in which the crystals of felspar are less conspicuous. His porphyry, also, "of a reddish cast," in which he says, "the pale rose, the blush, and the yellowish colours are finely blended through the body of the stone," is the beautiful porphyritic-sienite; and the "porphyry of a greenish colour, with a tinge of brownish-red," which he speaks of, as to be found at about three-fourths of the distance up, seems to be what I have mentioned as composing the summit of the mountain.

Along the stage of our progress upwards, now described, specimens occur, which contain apparent fragments. These obviously illustrate the doctrine of cotemporaneous formation; as the included matters exhibit only a different arrangement of the component parts. The rock itself, as we advance, afterwards begins to be somewhat mixed with the substance of hornblende, not in granular distinct concretions, but intimately diffused throughout the base; and this tinging matter increasing in quantity, at last communicates the blackish colour already noticed, as characterising the whole mass of the precipice and summit. I formerly mentioned my expectation *, that on this side I might find the junction, or rather transition into one another, of these differently coloured rocks; which I had been unable to discover, among the debris on the opposite shoulder of the mountain. In the lower part of the glen, accordingly, the change may be discerned in the face of the precipice, but the place of it is inaccessible. At length, in toiling up the hollow, to my great joy, I found the object of my search; nearly under a ledge of rocks, which crosses the ascent, betwixt the precipice and the stream.—Here, in passing, the eye is arrested, and the mind fixed in astonishment, by the first complete view of an alpine scene, perhaps the noblest of its kind in the British islands.

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* *Anteà*, p. 332.

PRECIPICE.

Imagine a precipitous front of rock, at least 1500 feet high, bending forwards at many of its points, with a threatening aspect, and extending itself to a distance of almost two miles, with enormous projecting masses or abutments, which fill the great re-entering angle of the mountain, and divide it into vast recesses or aisles of the wildest aspect. Of this stupendous and impressive object, the grand and singularly picturesque feature is what may be called the *angularity* of its appearance, both as a whole, and in its subordinate parts. The face of the rock, in the progress of waste and decomposition, is every where furrowed or fretted by lines, which at a distance seem to shape it into innumerable fasciculi of small columns or fluted pillars, resembling columnar distinct concretions. These again are joined together in an endless variety of groups ascending into pointed summits and serrated ridges, which form the most elegant mountain-lines, and which accumulate in the projections and recesses, towering successively behind each other, till the whole terminate at the summit of the mountain. In this manner, the general outline of the precipice, as it strikes the eye in a single *coup-d'oeil*, from the position I have mentioned, may be assimilated to a vast triangle, of which the apex is the top of Ben-Nevis.

Such is the mode of attempting to communicate a faint idea of this truly majestic work of nature. Its magnificence and wildness, indeed, baffle description, and can scarcely be conceived without being seen. From the west, Ben-Nevis appears only an object of immense magnitude, without elegance of outline or picturesque beauty. But on this side, language fails in attempting to paint its awful grandeur and terrific sublimity. It would afford an inimitable subject for the pencil in the rude style, were it not, that a position could hardly be found, to give it in all its picturesque effect, under an angle of less than 60°, which it seems is requisite for that purpose.

After passing the great projection, which terminates the precipice on the east, we find the hollow in the shape of a vast oblong bason, running westward, in a direction almost perpendicular to its former bearing; with the precipice still accompanying it, and forming its boundary on the right hand. At this place, the aspect of rudeness on every side, is peculiarly striking. In the position from which the first part of the precipice is viewed, the eye may be relieved by directing it downwards on the level country, and on the vegetating surface, cheered by the presence of the browzing flocks, which in our ascent we had left behind. Here, however, when we look around, nothing but ruggedness and desolation meets our view; not a vestige appears of what could contribute to the existence or comfort of the living world. If we turn from contemplating the fearful precipice, it is only to the sight of arid fragments, the ruins of nature, which the wandering foot of man or beast has rarely trod; and which seem, as if pouring down in a torrent from the surrounding cliffs, to overwhelm the spectator thrilled with horror at what he beholds.

Nor is the picture exaggerated. This is truly "the region, where nature dwells in awful solitude;" and, except when the tempest, the torrent or the thunder rules the scene, silence reigns, interrupted only by the sound of the eagle, or the murmur of the brook stealing almost unnoticed through the scattered fragments of the rocks. No view of what is grand or deserted in nature, can produce on the mind a more deep and awful impression of that power, "which rends asunder the mountains, breaks in pieces the rocks, and shakes the pillars of the world." It was after witnessing such effects, that the Prophet heard in "the wilderness" the "still small voice," of Omnipotence.

In this "lonely region," my surprise and delight were raised to the utmost, by discovering the line of transition or junction between the different-coloured masses, laid bare on the front of the precipice near its foot, and stretching horizontally for almost a mile. The beginning of the line, at the east projection is accessible by climbing up the broken rocks; and on advancing a little farther in this direction of the hollow, we find it open to a splendid view of the same beautiful appearance, which, along the face of the perpendicular section, exhibits the structure of the whole summit. This line of apparent junction, though horizontal, is not straight, but a minute angular zigzag; and when closely inspected, is found to be, not the separation of two different rocks, but merely the passage of the same rock into a different colour. For, the gradual transition of the one substance into the other, with no change on any of the characters, excepting the colour, demonstrates the identity and continuity of the formation. We see it distinctly at the spot under the north-east front of the precipice, where the transition is first observed; as the specimens shew. Mr Williams, therefore, was misled by the appearance, when he considered the dark-coloured rock as a distinct stratification over granite: both of these substances are equally massive and unstratified.

But as the upper part of this formation has certainly an unusual and unexpected appearance, in a geognostic point of view, I shall now enter a little more particularly into the consideration of its oryctognostic characters, for the purpose of determining its nature and relations.

This rock, as formerly observed, contains in general crystals of felspar. It occurs, however, in different places, without the porphyritic structure: and has then a strong resemblance in some instances to basalt, but more frequently to clinkstone; as at the top, where, if struck with a hammer, many of the fragments or loose pieces, ring like metal. Its fracture exhibits the varieties of the splintery, the flat conchoidal, and the foliated; and its colours, those of the greyish-black, and the dark-greenish-grey. But it does not appear to be ever vesicular, or translucent on the edges; it contains no traces of olivine or augite, so far as my observation extended; nor is the principal fracture slaty in the great, a character without which the porphyritic varieties cannot be considered as porphyry-slate.

True clinkstone and basalt, indeed, are substances which belong to a newer and very different æra of formation, and do not seem to be so purely chemical in their nature as the rock we are considering. But the affinity of external characters now pointed out, illustrates one of the principles of the Geognosy *, and appears strongly to support a conjecture of my friend Professor

* "The resemblance of the newer porphyry to the "newest flœtz-trap formation, is deserving of attention. "The points of agreement are, *in the stone itself*, in the "structure of the rocks," &c. Jameson's Geognosy, p. 138.

Jameson, that clinkstone and felspar are nearly allied: because the geognostic position and relations, along with the splintery fracture, of the Ben-Nevis-rock, demonstrate, that it has a strong affinity to compact-felspar tinged with hornblende; and, from a variety of observations made in Arran, Dumfries-shire, and the vicinity of Edinburgh, Mr Jameson has inferred, that clinkstone-porphyry passes into compact-felspar and clay-stone. The great distinction betwixt the substances of this genus, which belong to the primitive and flœtz periods, seems to be, that the former in general are more crystalline; something akin to the relation which subsists betwixt primitive and transition or flœtz-limestone.

It is more than probably the external similarity here described, which has occasioned Dr Reuss, in his Mineralogical Description of Bohemia, to mention clinkstone as belonging to the primitive rocks; an assertion which does not yet appear to be sufficiently warranted by facts. The clinkstone also, and porphyry-slate, observed by Humboldt in South America, it is not unlikely, may, in many cases, be rocks of a similar description and period of formation. According to this view, as many mountains of an intermediate or considerable height are covered in a manner similar to Ben-Nevis, it would be interesting to inquire whether the same circumstance takes place, with regard to any others of this description, seen in the range of the surrounding country, such as Bendoran, Ben-Loy, Cruachan, Ben-More in Mull, or Ben-Wyvis in Ross-shire. From the appearance of the lofty hill, second in succession to the east of Ben-Nevis, I was satisfied that its summit also is composed of similar rocks; and the case is probably the same, with various mountains to the east and south.

The mineralogical description now given, forms the reply to the 14th query of Professor Jameson *. Ben-Nevis must be considered as an overlying newer primitive formation: the upper part is the second porphyry-formation, and the under is sienite: the whole resting on gneiss and mica-slate, of which the neighbouring country is composed.—After these remarks, which the singular appearances we have considered, seemed to require, I resume my narrative.

On reaching the upper point of the hollow, towards the western termination of the precipice, our progress is obstructed by the lofty ridge which joins the summit on the south; and if we wish to prosecute our investigation, by completing the circuit of the mountain, we must encounter a steep, or rather a precipice, of the most formidable aspect. Having mounted it with much difficulty, and not without danger, as if escaping from a place of confinement, we are still, for a great way, surrounded with fragments of the different rocks already observed.

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* *Supra*, p. 115.

SOUTH DECLIVITY.

Among a variety of interesting objects which now present themselves, there is seen on the opposite side of the Nevis, which washes the southern base of the mountain, a splendid waterfall of not less than 500 feet in perpendicular height. It is also remarkable, that the rock over which the stream rushes, appears, at the distance from which I observed it, to be disposed in regular strata, probably of gneiss or mica-slate, with an inclination towards Ben-Nevis.

At the position thus reached, I found myself in the region of debris which extends along the acclivity of the mountain to the place on the west side, where the change of colour in the rock was first observed without discovering the line of transition. Further research in that direction, did not therefore promise to furnish any additional oryctognostic information. Descending, accordingly, by the course of the fifth or last stream, which was described as running in a direction opposite to that of the Stone-Burn, little occurs to engage the attention of the mineralogist, at least in the general characters of the rock; which seemed, as far as I could observe, to be, for the most part, much the same with those of the substances, at the corresponding heights on the north side, formerly described.

The stream itself, after an extremely rapid descent of two miles, pouring down a smooth front, with an inclination of at least 60°, forms an elegant sheet of water, or fall, of a singular and striking appearance. A little below, it joins the Nevis.—In this sequestered bosom of nature, along with the sublime, to excite wonder, there is a mixture of the beautiful to give delight. "The windings of the river; the verdure of the "trees; the wildness of the rocks; the terrific as- "pect of the hills; the mist flying swiftly on their "tops; the clouds rolling along with velocity; the "lonely situation, remote from human eye; every "thing conspires to make this fall of water one "of the grandest objects in nature *."

GLEN-NEVIS.

The interesting recess just mentioned, lies at the head of Glen-Nevis, in which the various picturesque objects of stupendous rocks, hanging woods, and sounding torrents, compose a beautiful and romantic scenery. As we descend, the river itself struggles at first through rocks and birch-woods, for several miles. It then glides with a smoother stream along the valley, where

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* Statistical Account of Scotland, vol. viii. p. 422. Parish of Kilmalie.

its edges are fringed with plantations and verdure, and many charming views occur. In particular, near the place where the course of the river bends to the west above the bridge, the slaty strata, which here contain veins of quartz, and conformable beds of a kind of felspar, rise from their common level to form a barrier, through which the water, in forcing its way, produces a peculiarly fine effect. The Nevis at length reaches the ocean, under the walls of Fort-William.

In many places along its course, which every where presents an interesting field of mineralogical research, the overlying formation, and subjacent rocks, may be observed. But, at the time when I travelled the upper part of Glen-Nevis, it was too late in the evening for observation; the light having been spent in the fatiguing circuit of the whole mountain, which, on this occasion, was performed in one day. I afterwards returned, and surveyed the lower part of the glen, which furnished the observations respecting it, formerly stated.

On the side of the mountain, nearly opposite to the house of Glen-Nevis, Colonel Imrie found veins of a deep blackish-green substance, which, in all its characters of aspect and fracture, shews its identity with that portion of the summit-rock which is not porphyritic. A vein of lead-ore, four or five inches thick, is mentioned in the excellent statistical account of the parish of Kilmalie, by the Reverend Mr Frazer, as occurring on the west side of Ben-Nevis, with a proportion of sulphur, and (white marcasite or) iron-pyrites containing arsenic.

At some miles distance to the south-east of Ben-Nevis, valuable pebbles, and even gold, are said to be found.

ADJACENT ROCKS.

Having now, in the way of description, been conducted to the summit, and around the base, of this great and stupendous mountain, we shall take a rapid survey of the adjacent rocks towards the west.

The hills which lie betwixt Glen-Nevis and Fort-William, are composed of the slaty strata, so often described, which, crossing the Glen, run directly under the mountain. Along the tract on the west of the Glen, which it was in my power to examine, these strata are filled with beds, and traversed by veins, of compact-felspar, and of quartz, often mixed, and sometimes distinct. At other places, these substances, blended together, form the base of a beautiful porphyry, containing crystals of felspar and hornblende, which vary in magnitude.

Near the house of Glen-Nevis, there is a curious rocking-stone, or mass of mica-slate, of a globular figure, and of great size, which, as usual in such cases, owes its property to the circumstance of being equally poised on a projecting edge or corner of its base. This projection penetrates the earth to a small depth, before it reaches the harder ground, or probably the rock, on which it stands. It is evidenty a rolled mass that had sunk into the soft soil, by which its equilibrium is no doubt assisted. A man's force impressed upon it, makes a point on its summit describe an arch of a few inches.

The vitrified fort on Dundgairdghall, lies about four miles up Glen-Nevis, on the west side. It stands on a summit 1100 or 1200 feet above the level of the river; and its dimensions seem, as nearly as I could judge, to be ninety feet by forty within the walls, which are raised on the edge of the steep, and, till this day, are very distinct. On the description of what is already so well known, I shall dwell no longer than to say, that the vitrified stone appears to have been the particular felspar, (having veins of greenstone, or rather felspar and hornblende, with iron-pyrites), of which the neighbouring rocks are composed, and which might melt into the different forms of slag, presented by the specimens. Whatever hypothesis may be adopted to account for the vitrification of such forts, the position of Dundgairdghall sufficiently corresponds with the opinion of Sir George Mackenzie, lately delivered to the Royal Society on this subject. It had probably been the signal-post or watch-tower of Inverlochy Castle, once the residence of the Scottish Kings, of which, on the north, Dundgairdghall is in sight, while to the south, it commands a view of the lower grounds, towards the entrance of Loch-Linnhe, by which an enemy might approach.

All the strata on the west side of Loch-Linnhe, opposite to Fort-William, and on the north side of Loch-Eil, where the grand Caledonian Canal is now begun, consist of gneiss and mica-slate, which at various places present a great variety of peculiar phenomena in their structure. This is found more particularly on the west side of Loch-Linnhe, where the face of the rock, from the shore to a considerable distance on the rising grounds behind, is singularly penetrated with veins and masses of quartz, felspar, and often calc-spar.

In the upper quarry, at this termination of the canal, some interesting examples of such veins may be observed. They are either granite, or chiefly felspar, or felspar and quartz. The principal vein terminates *below*, in a number of small filaments, but spreads out upwards to a great breadth, overtopping the whole of the stratified matter. An attentive examination of the specimens shews satisfactorily, that most of the appearances now described, belong to the original structure of the rock; in the mass of which, sometimes the quartz, at others the felspar, prevails, to the exclusion of the other ingredients. The veins are filled with materials similar to the overlying formation of which Ben-Nevis consists. In this district, the strata of gneiss are probably the continuation of those observed on the road to Strontian, and, no doubt, still stretch onwards in the same direction, passing Ben-Nevis to the north-east.

What is called the sandstone of Fassafern, and is much used for different purposes of the canal, from its being easily chipped or cut, is a particular kind of mica-slate, consisting chiefly of small granular quartz in layers.

Thus, I completed the examination, in a general view, of Ben-Nevis and its vicinity; during which, I had to regret, that the investigation was not rewarded by the discovery of a greater variety of mineral substances and geognostic facts. In return, however, for this disappointment, I enjoyed the pleasure of never once being interrupted in the prosecution of my inquiry, by bad weather; and I had the advantage of seeing nature on a grand scale, by which, I trust, something is added to the evidence of that view of the mineral kingdom, with which the President of this Society has made us acquainted *.

Although the object of these papers is to record facts without attempting to establish theory,

* System of Mineralogy by Professor Jameson, vol. iii.

it may not be improper, in concluding, to state the grounds on which it appeared to me, that the operation of fire cannot be recognized in the structure of Ben-Nevis.

Had this vast body of mountain been thrown up from below, we might naturally expect, that the strata on which it is erected, should somewhere be found opening or separating, to allow a passage for the ejected matter. Such an appearance, I could not discover. Far otherwise, the strata appear pursuing their course undisturbed, till they run beneath the mountain, and re-appear on the other side. It is also observed, that the different substances of which Ben-Nevis consists, meet in smooth and uniform contact, without any symptom of that disturbed and irregular junction, which the igneous theory alleges.

With regard in particular, to the upper dark-coloured portion of this formation, whatever opinion may be entertained on the subject of its oryctognostic characters, or geognostic relations, its whole phenomena forbid us to consider it as a product of heat. The horizontal direction in which it lies along the subjacent mass of rock, was a natural effect, if the whole be considered as a deposition; but is altogether incompatible with the hypothesis, that if projected upwards, it could have assumed such a position over a substance, which, on the principles of this theory, was itself, also an effect of the same agent. Both these rocks could not have been ejected in a fluid state, because in cooling, they could not possibly have assumed so distinctly their respective characters, as mineral substances. But they exhibit every indication, which can be required as proof, that they have been regularly and successively formed by deposition.

Under the precipice, indeed, where the dark coloured rock is first observed along the channel of the stream, it exhibits veins and nodules of felspar, which may be regarded as igneous phenomena. But the same substance in the same forms, being found in the upper part of the formation, at the distance of many hundred feet in perpendicular height, from the red coloured rock, and having evidently no communication with it by means of veins; and a great proportion of the interposed mass, being entirely destitute of the crystals or veins in question: we are entitled by all the rules of scientific induction to conclude, that the felspar in these cases, forms a part of the original structure of the rock, and has not been intruded into its substance, by the agency of any external force. The mere similarity of what is contained in such veins and nodules, to the rock below, affords no argument for the doctrine of ejection, since mineral substances of the same oryctognostic characters are known to be formed in very different positions and repositories. It is also deserving of remark, that the faces of rock where the veins in question present themselves, are commonly very little inclined. I have never seen them in fronts nearly perpendicular; and must therefore consider them as either cotemporaneous, or filled from above.

Some of the appearances which occur, at the place alluded to, where the surface of the rock is almost horizontal, are plainly owing to the original shape of the subjacent rock; which might have had points, or small projecting ridges, on its nearly horizontal surface, above which the subsequent material being deposited, and afterwards washed or worn away to a smooth superficies, has left the appearance of the veins or nodules, as we now observe them. This idea is completely confirmed by a simple inspection of the splendid perpendicular front which the precipice exhibits on its south side. Here no veins are seen ascending from the reddish rock into the overlying substance. On the contrary, these masses, as already noticed, appear to have been formed successively in perfect quietness, and to have associated in the most amicable manner, without the slightest indication of tumultuous or violent concourse. Nor does the superior include fragments of the inferior substance; for the crystals of felspar, which give it the character of a porphyry, are obviously of cotemporaneous formation with the rock itself.

In this instance, as well as in that of the irregular or waved gneiss on the west side of Loch Linnhe, had the crystals or nodules of felspar and quartz been injected by fusion, the whole mass, whether of stratified or of unstratified matter, must not only have had its structure destroyed by the violence of explosion, but have been rendered as porous in every direction as a sponge: for if the appearances we now observe, did not belong to the original formation of the rock, the supposed material in fusion must have penetrated its substance not less intimately than the matter of perspiration passing through the pores of the body; which is inconceivable. To admit the possibility of injection in this form, we must also admit, according to a known law of nature, that the substance which contains the injected crystals, must have been fused to a higher degree than the mass from which the crystals were thrown up; that is to say, the superior matter, or what was farthest from the cause of the fusion, must have been more fluid than the substance nearest to it, or more immediately under its agency; which is impossible.

If any thing, therefore, in this department of natural science, is capable of proof, we have the evidence of mineralogical demonstration, against the igneous origin of Ben-Nevis.

I have only to add, that though veins of quartz occur frequently in the great mass of this formation, they are seen terminating in every direction. Such veins, occasion no real difficulty, in accounting for the appearances which they present.

APPENDIX.

FROM BEN-LAWERS, THROUGH GLENTILT, TO BRAEMAR.

(Read 7th April 1810.)

As an Appendix to the papers I have had the honour of reading in this Society, I shall conclude the account of my remarks on the Highlands, with a mineralogical notice, respecting the tract from Killin by Logierait to Blair-in-Athole, and through Glentilt to Braemar: along which I passed, without having time to ascertain with greater accuracy, than a rapid survey could afford, the geognostic connection or relative position, of the beds and minerals which occur in this interesting portion of country.

The prevailing rock is mica-slate of different kinds, containing a great variety of the subordinate minerals, which characterize that formation.—At Killin, the river in forcing itself over the edges of the strata, presents an uncommonly striking appearance, which heightens the effect of the beautiful scenery all around. On the acclivity of

BEN-LAWERS,

the strata consist of an older rock, which is rather thick slaty, approaching to gneiss, and which exhibits minute undulation, in many forms. Specks, too, appear of iron-pyrites decomposing. Granular limestone is found at the foot of the mountain near Loch-Tay; and towards the bottom of the north side, clay-slate is said to occur. At the summit, the mica-slate has a yellowish tinge: And we find particular beds in which the granular quartz predominates, almost to the exclusion of every other ingredient. This variety has some resemblance to a sandstone.

The waving structure just noticed, has been mentioned as a proof, that the rock itself had once existed in the state of a flexible and tenacious paste softened by heat. Supposing, however, what is admitted on all hands, that stratified matter, could have been deposited in horizontal or straight laminæ; is it not easily conceivable, and in truth, the necessary result of mechanical laws, that if the depositing solvent were any how agitated into waves or undulæ, the deposition also should exhibit in its form the corresponding effect of such agitation? No appearance is more familiar, than the undulatory arrangement which the particles of sand assume at the side of a running stream, or on the sea-shore, by the mechanical action of the water, more especially, where the motion is obstructed by any obstacle; presenting layers, variously bent, and with every degree of inclination, from the horizontal to the vertical position. All the irregularities of elevation and depression, on the surface of the subjacent rock must also be taken into account. The inflexions in question, are besides on a scale extremely minute, and produce no alteration whatever, on the general direction of the strata.

It may, in passing, be remarked, that from this elevation, which probably exceeds the height of Ben-More by an hundred feet, the prospect, though uncommonly noble and extensive, is hardly to be considered as equally complete with the alpine view from that mountain, formerly described. It commands indeed a longer sweep of Loch-Tay, and a greater range of the low country to the south-east. But the Dochart Hills exclude from the eye, almost the whole of the south-west Highlands, the only objects which at such a distance produce any picturesque effect; and the expanse along the horizon, from east to south, is comparatively less abrupt and interesting. At the same time, so fine a landscape can never be contemplated without admiration and delight, by the eye which is able to mark the grand and the beautiful in nature.

On this occasion, a remarkably interesting circumstance occurred, which is not unfrequent in alpine regions. After some hours of an uncommonly serene and beautiful sky, a sudden haze overspread the atmosphere in every direction. The rapidity of the change was not less surprizing than its effect to the eye; for while the tops of the mountains on every side, were hid in the mist, the view remained clear and distinct underneath, to the utmost distance. It is difficult to imagine an atmospheric appearance of the same kind, more singular and curious, than the aspect of the scene thus diversified. The Highlands resembled a multitude of pyramids, scattered confusedly on a vast plain, and losing their summits in the clouds.

Along the course of the Tay, the rock continues of a similar character, till we reach the neighbourhood of Logierait, where it assumes a shining lustre with a tinge of bluish-grey; and an intermixture of beautiful garnets, having a deep red colour, begins to appear. Beyond Mullenearn, on the road to Blair, gneiss occurs; and if we may judge from the fragments met with in the famous pass of Killicrankie, the rocks which compose it, consist of quartzy mica-slate, with limestone-beds, hornblende-slate, and sienite containing mica.

GLENTILT.

The variety of rocky substances, found in Glen-Tilt, and the peculiar appearances which they exhibit, made me regret, that when I reached it, the time which remained for the examination of so interesting a tract, was extremely limited. In the way of picturesque beauty, it possesses less attraction, than many scenes to be met with in the Highlands. But few districts of the same extent, are more calculated to arrest the attention, and repay the labour, of the mineralogist.

In this direction, we remark as formerly, that the whole range of alpine country, is a grand formation of gneiss and mica-slate, to which all the particular minerals now to be mentioned, are subordinate. Accordingly, the lower part of Glen-Tilt presents mica-slate, tending to gneiss; and in many places, gneiss itself is also seen, passing distinctly into mica-slate. This formation contains repeated beds of limestone: and thin layers of stratified quartz, alternating with those of the mica-slate, cross the channel of the river, in the common direction of south-west and north-east.

In many of the strata, the mica-slate is coloured with hornblende. Veins of quartz and felspar, every where abound.—Higher up, fragments of sienite and newer granite are found in the debris, along the acclivity on the north side. It is, therefore, not impossible, that an overlying formation of these substances may be discovered at the summit of the neighbouring heights.

But of all the rocks which seem peculiar to Glen-Tilt, the most remarkable is a granular aggregate of felspar and hornblende, containing occasionally an admixture of quartz: in which these ingredients, occurring in greater or less abundance, and assuming an endless diversity of proportions, exhibit the mineral which they compose, under many different external aspects of the sienitic and greenstone species. It has, accordingly, from its appearance at some places, been confounded with granite. From this, however, it is completely distinguished, by the presence of hornblende, and the absence of mica; scales of which so rarely occur, that they cannot be considered as any constituent part of the stone.

This substance, when we ascend Glen-Tilt, is first observed in thin layers, alternating with strata of micaceous and quartzy rocks, in the bed of the river, a few miles before we reach the Lodge. It afterwards appears in greater abundance, accompanied still with mica-slate of various aspects, and at other places, with hornblende-rock, and hornblende-slate. In this part of the formation, the matter of hornblende prevails so much, as often to colour, not only the substances composed of quartz and felspar, but even the micaceous strata themselves. The connection, indeed, which exists here, between the hornblende and mica-slate, resembles so nearly what is mentioned by Von Buch, as occurring in the environs of Landeck, that I cannot describe it more exactly than by quoting his description. "Mi-"ca-slate is often seen to pass into hornblende: "the mica-slate begins to be changed into a rock "of a deep greyish-black, which is an intimate "mixture of quartz and mica; then it becomes "harder and more difficultly frangible; the mi-"ca by degrees giving place to the hornblende, "which at last preponderates. At other times, "we do not observe the passage of the one into "the other, and it is simply a bed (with a base "of hornblende) of considerable thickness in the "mica-slate *." Iron-pyrites is an ingredient that pervades occasionally all the rocks to which I allude.

At length, a mass of the granular aggregrate now described, which is of great size, and which Professor Jameson suspects to be Sienitic Greenstone, shews itself in the bed of the

* Translation by Dr C. Anderson, p. 33.

river, about two miles below the Lodge. Here it is accompanied with a bed of coarse quartzy rock. It afterwards appears laid bare by the action of the stream at different places farther up, till we pass the Lodge; and every where, particularly at the bridge, its structure is curious, and its aspect striking. Nor does this substance terminate here, but may be traced, through a distance of eight or ten miles, along the course of the water to the head of Glen-Tilt; where also we still find the quartzy material just mentioned.

By taking the bearings of its successive portions in the neighbourhood of the Lodge, this singular and indestructible rock is found to consist, not of six different veins, as has been stated, but of one vast conformable mass, which prevades the great formation, in a direction that is uniform, and nearly the same with what is common to all the strata; and of which the out-going at some places intersects the channel of the Tilt, though it is covered for the most part with soil or debris. The continuity of the mass, in the general direction of its cropping out, is a fact of which there can be no doubt. But I had not data for completely satisfying myself, whether in reality it is a bed; or a vein lying nearly in the direction of the strata; or possibly a long ridge of rock, previously formed and laid bare, from the subsequently deposited strata, in the course of decomposition and waste. The great presumption, that it is a bed, rests on the conformity of its position, and on the circumstance already noticed, that layers or strata of the same material, but of a smaller size, are found in the lower part of the Glen, alternating regularly with the usual strata of the district.

It rarely happens, that a philosophical opinion, however uncommon, cannot appeal to some phenomena of nature, as seeming to give it the colour of truth. The great bed, by which Glen-Tilt is thus distinguished, has been quoted as a demonstration of the ingenious hypothesis, which ascribes the consolidation of the principal substances in the mineral kingdom, to the action of heat variously modified. That the melted rock had invaded the country, and been introduced into the adjacent shistus, from the bowels of the earth, is assumed as an undeniable fact, without even the form of illustration. A fertile imagination, it is true, might figure the mass, as it strikes the eye, viewing it from the bridge above the Lodge, to have been once in fusion, floating fragments of the neighbouring rocks. The argument, however on this ground, is altogether equivocal, since fragments must have been found in beds and veins, whether they were formed by deposition from above, or by igneous projection from below.—It must also be observed, that a more careful oryctognostical examination, satisfactorily proves, that many substances mistaken for fragments at first view, are really of cotemporaneous formation with the including rock. This observation applies particularly to the mass we are speaking of; in which the veins and nodules of felspar, found terminating in every direction, and the apparent angular masses of hornblende, obviously belong to the natural structure of the stone, and could not possibly have been injected by external force. The existence, in fine, of calc-spar, as a frequent material in this rock, appears decisive against the supposition of its igneous origin.

To the south of the bridge, a large bed of granular limestone runs along the face of the acclivity at a considerable height, and, I suppose, at some distance up the river crosses the channel in a conformable direction. Two miles above the Lodge, the sienitic greenstone contains calc-spar coloured by hornblende. Common primitive greenstone is also found at different places. Further still, and at a small distance from the Tarf-Linn, the hornblende and felspar, in this species of rock, assume a peculiar and distinct granular form, which is sometimes observed on a great scale. Here we find veins consisting of aggregated felspar, quartz and hornblende. Mica-slate then re-appears, with stripes of quartz, immediately below the Tarf-Linn, and seems to form the rock over which the stream there precipitates itself. Beyond the Linn, on the way to Braemar, the rocks are composed, along the channel of the Tilt, of a coarse quartzy substance, which is penetrated with veins of shining quartz, and appears to be very generally mixed with steatite, giving the materials a tinge of green or greenish-white.

BRAEMAR.

After leaving Glen-Tilt, the tract by which we are conducted through the mountains for many miles in this direction, is so covered with soil and debris, as to afford no field of mineralogical examination, before we arrive at the course of the Dee: where the first remarkable substance that meets the eye, is hornstone, with a colour intermediate between greenish-grey, and yellowish-grey, disposed in great beds, and forming the eminences on the left, towards the forest of Braemar. This substance is subordinate to gneiss, and quartzy mica-slate; which are soon discovered as we advance along the course of the stream. At what is called the Linn of Dee, the rock consists of mica-slate; and the rolled fragments which occur near it, shew the vicinity of older granite, composing probably the great mass of the mountain-ranges on both sides of the hollow in which the river flows.

Above Marr-Lodge, we have quartzy mica-slate, and beds of beautiful felspar-porphyry, with crystals of quartz, as well as of felspar. The same minerals continue to occur, till within a mile and a half of Castleton, where a granular-limestone makes its appearance, along with porphyry, and beds of quartz darkened with hornblende. Gneiss, then, seems to prevail.—At last, around the Castleton of Braemar, we find the granite, of which the Grampians are composed, and which, it is probable, runs beneath the whole of Scotland.

Of this granite, it has been supposed, that the great felspar bed of Glen-Tilt forms a branch. I have, however, already noticed, that the latter substance is not a granite; and a simple inspection of the specimens shews at once, that the oryctognostic characters of the rocks in question are entirely distinct.

It is proper to mention, that after passing the Linn of Dee, my observations were made, not along the channel of the river itself, but in the vicinity of the road to Castleton.

These remarks on the mineralogy of Glentilt and Braemar, are calculated rather to excite than to gratify curiosity, with regard to an interesting range of alpine country, which has not yet been examined with the attention it deserves.

XVIII. *Account of North British Testacea.*

By J. Laskey, Esq.

To the Secretary.

Sir, *Seton-House, 23d Jan.* 1809.

Permit me to lay before the Society a list of Testacea collected by me in North Britain. At the same time, I beg leave to offer, for the use of the Wernerian Society, a specimen of each, as far as duplicates are in my cabinet; to which I shall add specimens from the southern shores: And I hope the whole will form a tolerable cabinet of British Testacea. I am induced to take up this subject, from knowing that several papers on North British Zoology have already been submitted to this Society by its Members; and I am in hopes this will help to fill up a chasm, at present vacant. By this catalogue will be seen the riches of the seas and shores of North Britain; they having already produced 129 species of multivalve and bivalve and 142 species of univalve shells, in all 271 species; and no doubt many more may be added, by the zeal of our Members. I have mentioned no shell but what has actually come under my own eye, and now remains in my cabinet. Not having entered into the microscopic species, I am certain a rich harvest awaits any inquirer inclined for this pursuit. It gives me pleasure to acquaint the Members of the Society, that I have added near 50 new species of Testacea to the British *Fauna*, from their native shores; and also having met with several species, to which much doubt was attached, I have now positively fixed them as inhabitants of the British seas. I am, Sir, yours, &c.

J. LASKEY,
Capt. 21st Militia.

I shall deem it sufficient to refer to the Testacea Britannica of Montagu, to Pennant's British Zoology, and Donovan's British Shells, for the synonymes; which shall be signified by the following abbreviations:

M. - - Montagu's Testacea Britannica.
P. - - Pennant's British Zoology.
D. - - Donovan's British Shells.

TESTACEA OR SHELLS.

Animals soft, of a simple Structure, and covered with a calcareous Habitation or Shell.

MULTIVALVIA.

CHITON.

Animal inhabiting the shell a Doris. Shell consisting of several segments or valves, disposed down the back in a longitudinal series.

No.	Name.	Authors.	Habitat, and Remarks.
1.	marginatus.	P. M.	Neighbourhood of Dunbar. Valves of this shell have been procured of three-fourths of an inch in width; but never a living specimen answering to this size.
2.	cinereus.	M.	Ditto, plentiful.
3.	fascicularis.	M.	Ditto, not common.
4,	lævis.	M.	Ditto, very rare.

LEPAS.

Animal a Triton. Shell affixed at the base, and consisting of many erect valves.

I think it necessary to separate this family into two divisions, following the author of Testacea Britannica as my guide.

First Division.—Shell affixed by a tubular fleshy peduncle.

LEPAS.

1. anatifera.	P. D. M.	Shore of Icolmkill, scarce. More plentiful on the sides of the New Bason, Leith.
2. anserifera.	M. D.	Shore of Icolmkill, scarce.
3. cornucopia, or *pousse-pieds*,	M.	Shore of Icolmkill, and on drifted wood near Dunbar, very rare. A fine specimen from Icolmkill is figured by Montagu, in Appendix to Test. Brit.

Second Division.—Affixed at the base.

BALANUS.

1. communis. cornubiensis. balanus.	M. P. D.	Rocks in Frith of Forth, common.
2. punctata.	M.	Ditto, ditto.
3. rugosa.	M.	Ditto, ditto.
4. costata.	D. M.	Dunbar, scarce.
5. striata. intertexta.	P. M. D.	Dunbar and other coasts, common.
6. diadema.	D. M.	Western Isles, sparingly. Known there by the name of *Whale Lice.*

PHOLAS.

Animal an Ascidia. Shell bivalve, divaricated, with several lesser, differently shaped, accessory pieces at the hinge. Hinge recurved, united by a cartilage. In the inside, beneath the hinge, is an incurved tooth.

1. crispatus.	P. D. M.	Leith Roads, Aberlady Bay, and Dunbar.
2. candidus.	P. D. M.	Ditto, ditto.
3. striatus.	D. M.	In drifted wood, Dunbar.
4. dactylus.	P. D. M.	Various parts of the shores of the Frith.

BIVALVIA.

MYA.

Animal an Ascidia. Shell bivalve, generally gaping at one end. Hinge with strong, broad, thick teeth, seldom more than one, and not inserted into the opposite valve.

1. arenaria.	P. D. M.	Dunbar, Aberlady Bay, and other coasts, common.
2. margaritifera.	P. D. M.	Loch Tay. From these shells valuable pearls are often taken.
3. inæquivalvis.	M.	Fine live specimens are taken by the dredge in Leith Roads; and single dead valves are found on many parts of the coast.

MYA.		
4. truncata.	P. D. M.	Dunbar, Aberlady Bay, and other parts of the Frith, common.
5. decussata.	M.	New species, found near Dunbar.
6. nitens *.	M.	New species, Dunbar, very rare. Only one specimen has occurred.
7. ferruginosa.	M.	New species from Porto Bello Sands and near Dunbar, rare.
8. suborbicularis.	M.	Dunbar, seldom found perfect.

LIGULA.

This is a new genus, formed by my friend G. Montagu, Esq; author of Testacea Britannica. In this genus are brought together several shells which by other authors were placed in the two genera Mya and Mactra.

I think it necessary here to notice, to prevent confusion, that the name *Ligula* has been already given to a genus of shells very different from these; of which I am of opinion my friend Mr Montagu was not aware, though I am certain it was the intention of Dr Solander, if he had lived, to have formed this genus. In Monsieur Calonne's Catalogue of Shells, the genus Ligula is formed from several univalve shells, taken from the genera

* Tab. VIII. fig. 4. Natural size.

Murex, &c. This catalogue was compiled by Mr George Humphrys of Leicester Square, London. Montagu defines the characters of Ligula as follow:

Animal an Ascidia. Shell bivalve, equivalve. Hinge with a broad tooth in each valve, projecting inwards, furnished with a pit or cavity for the reception of the connecting cartilage. In some species a minute erect tooth.

LIGULA.

1. pubescens. } declivis. }	M. P. D.	Portobello Sands plentiful; on other parts of the coast rather scarce. Those specimens generally called Mya pubescens, are the fry of the shell denominated by Pennant *declivis*. A specimen of the size of the one described by him has never occurred to me. It is probably a pelagic shell, of a very brittle texture, and not capable of bearing the agitation of the sea, which, in a degree, may account for its not being cast on our shores. *N. B.* In my cabinet there is still one of the original shells, of the Portland Museum, which was a Scottish production.

LIGULA.

2. prætenuis.	M. D.	Portobello Sands, scarce.
3. distorta.	M.	Dunbar.
4. Boysii.	M.	Portobello Sands, not uncommon. These specimens are thicker than those on the southern shores.
5. prismatica.	M.	New shell found by me on Belton Sands, near Dunbar; and also on Portobello Sands, not uncommon.
6. compressa.	D. M.	Shore of Leith.
7. tenuis.	M.	Musselburgh, common at times.

SOLEN.

Animal an Ascidia. Shell bivalve, oblong, open at both ends, furnished with a reflex subulated tooth, often double, not inserted into any groove in the opposite valve.

1. siliqua.	P. D. M.	Dunbar; and in great plenty on the sandy shore of Aberlady Bay.
2. ensis.	P. D. M.	On the same coasts, not uncommon.
3. pellucidus.	P. D. M.	Portobello Sands. At times rather plentiful, and of a large size.
4. fragilis.	M.	Shore near Dunbar, scarce.

SOLEN.

5. vespertinus. Tellina depressa. Tellina variabilis.	M. P. D.	Not uncommon, Dunbar.
6. minutus.	M.	Common in the roots of Fucus digitatus, and other large fuci.

TELLINA.

Animal a Tethys. Shell bivalve, generally sloping on one side. In the forepart of one valve a convex, of the other, a concave fold. Hinge with usually three teeth; the lateral ones smooth in one shell.

1. fervensis. trifasciata. incarnata.	M. D. P.	Dunbar; also very briliant coloured live specimens on the sandy shores of Aberlady Bay, not common.
2. squalida. depressa.	M. D.	Dunbar, scarce.
3. læta. inæquèstriata.	M. D.	Belton Sands, near Dunbar, scarce.
4. donacina. trifasciata.	M. P.	Dunbar, rather scarce.
5. tenuis. planata.	D. M. P.	Tyningham and Portobello Sands.
6. fabula.	D. M.	Belton and Portobello Sands, common.

Tellina.		
7. solidula. } carnaria. }	M. P.	Dunbar and other parts of the coast, with all the varieties of colour.
8. proficua.	M.	Dunbar, rather scarce.
9. carnaria.	D. M.	Dunbar, very rare. One small specimen only occurred.
10. striata.	M.	Dunbar, very rare.
11. crassa. } rigida. }	M. D.	Aberlady Bay, not uncommon.
12. radula.	M.	Aberlady Bay, not uncommon; and Leith Roads.
13. flexuosa. } Venus sinuosa. }	M. D.	Portobello Sands, rather scarce.
14. polygona.	M.	New shell, taken by the dredge off Cramond Island, Frith of Forth, rare.
15. Laskeyi.	M.	New shell, Musselburgh Sands, and Aberlady Bay, very rare.
16. similis.	Sowerby, M.	Very rare, discovered, with Tellina fabula, on Belton Sands, near Dunbar.

CARDIUM.

Animal a Tethys. Shell bivalve, nearly equilateral, equivalve; generally convex, longitudinally ribbed, striated or grooved, with a toothed margin. Hinge with two teeth, alternate, in the middle, near the beak; in most incurved;

and a larger remote lateral one on each side, each locking into the opposite.

CARDIUM.

1.	edule.	P. D. M.	Most of the sandy coasts of the Frith of Forth. The variety known by the name of the *Ross Cockle*, is to be met with near Tyningham Sands occasionally.
2.	echinatum.	P. D. M.	Leith Roads and Aberlady Bay.
3.	ciliare.	P. D. M.	Not uncommon in Aberlady Bay. On examining a great number of these shells, of all sizes, I am convinced C. ciliare is the young of C. aculeatum. I am farther strengthened in this opinion, by that of my friend G. Montagu, Esq; who has made the same observation.
4.	aculeatum.	P. D. M.	Aberlady Bay, by dredging, scarce.
5.	discors.	M.	Off the coast of Dunbar, by the dredge, scarce.
6.	nodosum.	M.	Belton Sands and Dunbar, rather scarce.
7.	rubrum.	M.	Dunbar, found at the roots of a tuft of Corallina officinalis, rare.

Cardium.

8. exiguum.	M.	Musselburgh Sands, scarce.
pygmæum.	D.	
9. fasciatum.	M.	New shell, Dunbar, scarce.
10. spatula.	M.	New shell, dredged in the Frith of Forth, rare.
11. lævigatum.	P. M. D.	A single dead valve has just been found near Gosford-House, Aberlady Bay.

MACTRA.

Animal a Tethys. Shell bivalve, unequal sided, equivalve. Middle tooth of the hinge complicated, with a small hollow on each side. Lateral ones remote, and inserted into each other.

1. solida.	P. D. M.	Portobello Sands, not uncommon.
2. truncata.	D. M.	Musselburgh Sands, not uncommon.
3. subtruncata.	M. P.	Portobello Sands. Pennant has unluckily given this name to our M. stultorum.
4. lutraria.	P. D. M.	Tyne and Portobello Sands, and plentifully in Aberlady Bay.
5. stultorum.	D. M.	Leith Sands and other parts of the coast, plentiful at times.
Tellina radiata.	P.	
6. tenuis.	M.	Musselburgh Sands, rather scarce.

DONAX.

Animal a Tethys. Shell bivalve, with generally a crenulate margin; the anterior margin very obtuse. Hinge with two teeth, and a single marginal one, placed a little behind, rarely double, triple, or wanting.

1. trunculus.	P. D. M.	Rather common on the shores of the Frith.
2. castanea.	M.	Dunbar, very rare.
3. plebeia.	M.	Dunbar, very rare.

VENUS.

Animal a Tethys. Shell bivalve; the frontal margin flattened, with incumbent lips. Hinge with three teeth, all of them approximate, the lateral ones, divergent at the tip.

1. paphia. } fasciata. }	M. D.	Belton Sands, and other parts of the coast, not common.
2. verrucosa. } erycina. }	M. D. P.	Dunbar, scarce. A specimen here dredged of an uncommon size.
3. orbiculata.	M.	New shell, near Dunbar, rare.
4. striatula. } rugosa. }	M. D. P.	Dunbar and Leith Roads; very plentiful on the sandy shore of Aberlady, and

VENUS.

		at Aros in the Sound of Mull.
5. islandica. mercenaria.	M. D. P.	Aberlady, very plentiful. Pennant supposed this species to have been the V. mercenaria of Linné. That shell, though in appearance similar to V. islandica, possesses a large and beautiful purple spot on the inside of each valve; and of this part of the shell the North American Indians form their *wampum*.
6. decussata. literata.	D. M. P.	Aberlady Bay, very plentiful, and other parts of the coast.
7. exoleta.	P. D. M.	Portobello Sands, not uncommon.
8. undata.	P. D. M.	Portobello Sands, at times not scarce.
9. substriata.	M.	New shell; came up with the dredge off Isle of May.
10. ovata.	P. M.	From Dunbar coast, rare, though not uncommon from Leith Roads, of a large size.
11. scotica.	M.	New shell, first described in Transactions of Lin. Soc.; Dunbar and Leith Roads, scarce.

VENUS.		
12. danmonia.	M.	New species, from Leith Roads, scarce.
13. pullastra.	M.	Leith Roads, shores of Aberlady, and Dunbar, not uncommon.
14. perforans.	M.	Dunbar and other shores, not uncommon. A large bed of this species occurred near Gosford-House, Aberlady Bay, imbedded in a black clayey soil; but all dead shells.
15. reflexa *.	M.	New species, Frith of Forth, very rare.
16. laminosa †.	M.	New species. This was taken in deep water off the coast of Dunbar, and nearly resembles, if not really so, the shell figured by Donovan, and named by him Venus cancellata; very rare.
17. guineensis.	M.	New species, taken in deep water, off St Abb's Head, very rare. One specimen was taken alive.
18. subrhomboidea.	M.	Taken same time and place, and is equally rare.
19. aurea.	M.	Frith of Forth, scarce.
20. dysera.	M.	New species, Dunbar, on the coast; and by the dredge, scarce.

* Tab. VIII. fig. 1. Nat. size. † Id. fig. 16. Nat. size.

P. Syme del.t E. Mitchell fc.

VENUS.

21. compressa.	M.	New species, not uncommon on the shore of Dunbar; at other parts of the coast very sparingly.
22. cassina.	M.	New species, dredged in deep water, Frith of Forth, very rare.
23. granulata.	M. D.	Frith of Forth, rare.

CHAMA.

Animal a Tethys. Shell bivalve, rather coarse. Hinge with a callous gibbosity. Teeth obliquely inserted into the opposite valve. Anterior slope closed.

1. Cor *.	D. M.	This exceeding rare shell in the British catalogue, was taken by me alive in the Frith, near St Abb's Head, since which, I picked up part of a broken valve on the shore of Icolmkill, one of the Western Isles.

ARCA.

Animal a Tethys. Shell bivalve, equivalve. Hinge with numerous sharp teeth, alternately inserted between each other.

1. fusca. } Noæ. }	M. D.	This shell appeared not uncommon on my first visit-

* Tab. VIII. fig. 7.

ARCA.		ing part of the shore near Dunbar; but of late I have not met with a single specimen. Pennant, no doubt, meant this shell, when he applied the name of *tortuosa* to a species of ark, which, by the engraving, appears to be the A. pilosa or glycimeris.
2. Noæ.	M.	A very minute specimen, bearing the characters of Noæ, was taken off Dunbar by dredging. I have also taken one similar on the coast of Cornwall.
3. minuta. } caudata. }	M. D.	Dunbar and Leith Roads, not very uncommon.
4. nucleus.	P. D. M.	Dunbar and other parts of the coast, not uncommon.
5. tenuis.	M.	New species, very rare; only one specimen ever occurred, a live shell, Dunbar.
6. rostrata.	M.	Deep water, Frith of Forth, very rare. One live specimen and two dead valves have been taken.

PECTEN.

Animal a Tethys. Shell bivalve, inequivalve, most times ribbed or striated longitudinally. Hinge toothless, with a small subtriangular cavity, aurated.

PECTEN.

1.	maximus.	P. D. M.	Leith Roads, rather scarce. The oyster dredgers assert, that this species is not indigenous in the Frith, but that some years since they were brought from some other parts, and deposited in the Roads; but that they are all dead. I have met also with dead valves in Aberlady Bay.
2.	opercularis. } subrufus. }	M. P. D.	Portobello, Leith Roads, and various other parts of the coast.
3.	pusio.	P. M. D.	Dunbar and other parts, not common.
4.	obsoletus.	P. D. M.	Dunbar, not uncommon. A single dead valve occurred in Aberlady Bay of a very large size, being above one inch in diameter.
5.	glaber.	P. M.	Dunbar, very rare.
6.	similis *.	Laskey.	At first I had doubts respecting this being the Pecten lævis of Montagu; but having since received a specimen from Mr Mon-

* Tab. VIII. fig. 8.

PECTEN.

tagu of the true Pecten lævis, I find it to be distinct. I have therefore for the present named it *similis*. It is a thin semitransparent shell, with unequal ears, of a compressed globose form, perfectly smooth, and beautifully clouded with brown. I have seen shells from the Mediterranean, particularly from Minorca, strongly resembling this specimen; two odd valves of which have only been met with by the dredge in the Frith of Forth.

OSTREA.

Animal a Tethys. Shell bivalve, inequivalve, rugged or plaited. No auricles. Hinge toothless, with a transverse striated cavity.

1. edulis. P. M. Leith Roads, Prestonpans, &c. very plentiful, and forms an article of commerce.

ANOMIA.

Animal an emarginate ciliate strap-shaped body, with bristles or fringe affixed to the upper valve. Arms two, linear, longer than the body, connivent, projecting, alternate on the valve, and ciliated each side; the fringe affixed to each valve. Shell bivalve, inequivalve; one of the valves flattish, the other gibbous at the base, with a produced beak, generally curved over the hinge; one of the valves often perforated near the base. Hinge with a linear prominent cicatrix, and a lateral tooth placed within; but in the flat valve, on the very margin, two bony rays, for the base of the animal.

1. ephippium. P. D. M. Not uncommon, adhering to oysters, stones, &c. Frith of Forth. The variety named by Dr Pulteney *rosea*, I have never met with on the Scotch coast. These shells partake of the form on which they happen to be placed, and a beautiful ribbed variety may be found from their having been affixed to Pecten maximus, or shells of that genus.

ANOMIA.		
2. striata.	P. D. M.	Plentiful, Aberlady Bay. This shell for a long time was believed to be an oyster; but having taken a great number alive, I am confident in saying it belongs to the Anomia genus, of which my friends Messrs Donovan and Montagu are now fully convinced.
3. aculeata.	M.	Not uncommon, Dunbar. I have great reason, from comparison, to believe this is the fry of the last species.
4. cymbiformis.	M.	A new species, first noticed in the Linnean Transactions, by Mr Racket and Dr Maton. Since which time I have met with it at Newhaven, and dredged it in Leith Roads; and I have taken a very deep ribbed specimen from Dunbar. A scarce shell.

MYTILUS.

Animal an Ascidia. Shell bivalve, rough, generally affixed by a byssus or beard of silky filaments. Hinge mostly without teeth, except in a few species; with generally a subulate excavated longitudinal line.

MYTILUS.

1. edulis.	P. D. M.	On all parts of the coast, common.
2. incurvatus.	P. M.	Montagu wishes this species to be reckoned a variety of *edulis*, but I cannot accede to his opinion: the formation of the valves is distinct, and does not vary: their habitat is also totally distinct. This species is generally found single among the gravel, or in holes in rocks, while *edulis* is found in beds of large size; and it may appear strange, that I never discovered *incurvatus* among the immense beds of muscles at Musselburgh, tho' among the rocks at Dunbar they are, though not common, to be found; most of the specimens taken there have a small indent on their frontal margin, which seems also to be characteristic of this species.

MYTILUS.

3. pellucidus. P. D. M. Leith Roads. The fishermen at Newhaven dredge these in great quantities for bait; and it appears remarkable, that few of the common muscle are found amongst them.

4. modiolus. curtus, and umbilicatus. P. M. D. I am perfectly convinced, by strict observation and comparison, that those three "distinct species," as they have been denominated by authors, are but one and the same; for instance, *curtus* is the fry, and *modiolus* the full grown shell. I possess in my cabinet a series of above sixty specimens, from the size of a turnip seed to a full grown shell of above nine inches in length; from whence I draw my reasons. In respect to *umbilicatus*, I am further convinced of its being a lusus, proceeding from accident or otherwise, as, within these few days, I have met with two specimens on the shore of Aberlady Bay, which have begun to form an umbilication, and one has proceeded so far, as to entitle it fully to its name.

MYTILUS.

5. rugosus.	D. M.	Dunbar, Leith Sands, and other parts. Remarkable large specimens are to be found, in the roots of Fucus digitatus.
6. præcisus.	M.	On the same situations, not so common.
7. discors.	M. D.	On do. rather more scarce. I cannot help observing, that the name *discors* should be changed, as I have every reason to believe it was first given, from the general resemblance it bears to the South Sea shell of this name; from which, in its habits, colour, and even form, it is perfectly distinct.
8. discrepans.	M.	Dredged in the Frith of Forth of large size. One in my cabinet is 2 inches in length. Mr Montagu, in his Test. Brit. was the first to point out this shell; but the compilers of the paper on British Testacea, in Lin. Trans. vol. viii. positively assert that *discors* and *discrepans* are of the same species; and that the latter is a mere variety. These gentlemen, at that time, knew nothing of the large growth of this

Mytilus. shell, otherwise I cannot but think they would not have so decidedly made it a variety only. I regret that Mr Racket, one of these compilers, did not find it convenient to avail himself of a view of the collection where this shell stood, with all its variations of growth, from the size of a small pea to the largest size, in 16 gradations.

9. unguliuus.	D. M.	On the shore near Gulon Links, Aberlady Bay, very rare.
10. plicatus.	M.	New shell, Isle of Sky, very rare; only one live specimen having been met with.
11. decussatus.	M.	New species, in sand near Dunbar. Pl. VIII, fig. 17
12. anatinus.	P. D. M.	In the river Tyne, near Lord Haddington's, at Tyningham, and Water of Leith.

PINNA.

Animal a Limax. Shell sub-bivalve, fragile, upright, gaping at one end, and furnished with a byssus or beard. Hinge without teeth; the valves united into one.

1. ingens. } lævis. }	P. M. D.	Found by Dr Walker off Barra, one of the Western isles. A small specimen was found by me at Scalasdale, in the Sound of Mull.

NAUTILUS.

Animal not distinctly known. Shell univalve, divided into several departments, communicating with each other by an aperture or siphunculus.

1. Beccarii.	M.	Portobello Sands, not uncommon.
2. Beccarii perversus.	M.	From same place.
3. linearis.	M.	A new species from Dunbar, rare.

CYPRÆA.

Animal a Limax. Shell univalve, involute, subovate, smooth, obtuse at each end. Aperture effuse at each end, linear, extending the whole length of the shell, and toothed on each side.

1. Europæa.	M.	Rather plentiful at Dunbar, and to be met with sparingly on most parts of the coast. With all the varieties, we are happy to find, Mr Montagu is of the same opinion in respect to this shell and the fry as ourselves. By this means Cypræa arctica, Cypræa bullata, Bulla diaphana, and, in fact, Voluta Jonensis of Pennant,

CYPRÆA.

should be all erased from thc British catalogue as species, and *arctica* should alone stand, as the variety without spots of *Europæa.*

N. B. A specimen of Voluta Jonensis is now in my cabinet, from the Portland Collection; and it is well known. Pennant figured his shell from this collection.

BULLA.

Animal a Limax. Shell univalve, convolute, unarmed with teeth. Aperture a little straitened, oblong, longitudinal, very entire at the base. Pillar oblique, smooth.

1. ampulla.	P. M.	A young specimen of this shell was discovered by me near Dunbar.
2. aperta.	D. M.	Dunbar, not uncommon.
3. catena.	M.	The same as last.
4. flexilis *.	M.	A new species, and very rare. Only two specimens ever occurred, from Tyningham Sands, near Dunbar, after a heavy storm.

* Tab. VIII. fig. 6.

BULLA.		
5. patula.	P. D. M.	On Portobello Sands, very rare.
6. haliotoidea.	M.	Portobello Sands, rather scarce.
7. cylindracea.	P. D. M.	Tyne Sands, scarce. More plentiful near Gosford-House, Aberlady Bay; but mostly dead shells.
8. truncata.	M.	Not uncommon among the sand near Dunbar.
9. obtusa.	M.	Near Dunbar, very rare.
10. hydatis.	D. M.	A small specimen occurred on the sands near Dunbar, very rare.
11. akera. } resiliens. }	M. D.	A young shell was found on the sands at Belhaven, near Dunbar.
12. umbilicata.	M.	A specimen of a large size was taken by the dredge off Dunbar.
13. subtruncata.	M.	A new species from Dunbar, very rare.

VOLUTA.

Animal a Limax. Shell one-celled spiral. Aperture without a beak, and somewhat effuse. Pillar twisted or plaited, generally without lips or perforation.

VOLUTA.		
1. tornatilis.	P. D. M.	Dunbar, Tyne Sands, and Leith Roads, also rather sparingly on many other parts of the coast; not common.
2. catenata.	M.	Dunbar, very rare.
3. denticulata.	M.	Dunbar, very scarce.
4. bidentata.	M.	New species, only met with near Dunbar, rather scarce.
5. hyalina.	M.	New species, Dunbar, rare.
6. alba.	M.	New species, from Dunbar, rare.
7. heteroclita *.	M.	New species, from do. do.
8. Cypræa voluta. Voluta lævis.	M. D.	One small specimen was met with on the shore near Dunbar.

BUCCINUM.

Animal a Limax. Shell univalve, spiral, gibbous. Aperture ovate, terminating in a short canal, leaning to the right, with a retuse beak or projection. Pillar-lip expanded.

1. undatum.	P. M. D.	Common on all parts of the coast.
2. lapillus.	P. M. D.	Likewise very common.
3. macula. minutum.	M. P.	Plentiful at Dunbar, and not uncommon on most parts of the coast.

* Tab. VIII. fig. 12.

BUCCINUM.

4. reticulatum.		P. D. M.	Dunbar, the smaller variety.
5. bilineatum. decussatum.	}	M. P.	Two specimens of this very rare shell have been met with by the dredge in the Frith.
6. minimum.		M.	Dunbar, scarce.
7. terrestre.		M.	Dunbar, sparingly.
8. perdix.		M.	Received among a collection of shells from the shore of Jura. A very small specimen.

STROMBUS.

Animal a Limax. Shell univalve, spiral. Aperture much dilated; the lip expanding, and produced into a groove, leaning to the left.

1. pes pelecani.		P. D. M.	Dredged in Leith Roads; not uncommon on the sandy shore of Aberlady Bay.
2. costatus. turboformis.	}	M. D. M.	On the rocks at the Nuns' Island, Sound of Iona.

MUREX.

Animal a Limax. Shell univalve, spiral, rough with membranaceous sutures. Aperture oval, ending in an entire strait or slightly ascending canal.

MUREX.

1. antiquus. } despectus.	D. M. P.	Aberlady Bay and Leith Roads, not uncommon.
2. carinatus *.	P. D. M.	This exceeding rare shell (in a young state), I met with on the coast near Dunbar: even in this state, it answers fully to the more mature shell figured by Donovan. Pennant's figure is so incorrect, that it can scarcely be made out. This shell ranks as one of the rarest of the British collection, and has been esteemed an unique, till I was fortunate enough to meet with this other specimen. Pennant was the first to figure and describe it, from the Portland cabinet; at the sale of which, it was purchased for the collection of the celebrated Monsieur Callonne, and went to Paris. On the emigration of that gentleman to England, it again came into the market, and became the property of Mr G. Humphrys, Leicester Square, who

* Tab. VIII. fig. 9.

MUREX.

		has refused a very considerable sum for it. The figure, as given by Mr Donovan, is from exact measurement, and I can bear ample justice to its correctness, being well acquainted with the shell.
3. purpureus.	M.	A very rare shell, dredged in Leith Roads.
4. linearis. } elegans. }	M. D.	Dunbar; sparingly.
5. muricatus.	M.	Dunbar, not common.
6. turricula.	M. D.	Dunbar, sparingly, frequently of a pink colour; more common on the sandy shore of Aberlady Bay.
7. sinuosus. } emarginatus }	M. D.	Dunbar, very rare; only a solitary specimen has been met with.
8. rufus.	M.	Dunbar, and the sands near Belhaven.
9. costatus.	P. D. M.	Dunbar, very scarce.
10. gyrinus *.	M.	A new species. Only a single specimen, in a young state, has been taken from the Frith of Forth.
11. gracilis.	M.	Dunbar, scarce.
12. nebula.	M.	Dunbar, scarce.

* Tab. VIII. fig. 10.

Murex.

13. septangularis. septemangulatus.	M. D.	Dunbar and Tyningham Sands, sparingly.
14. tubercularis.	M.	Scarce species. A more rare variety, perfectly white, has been taken off the coast of Dunbar.
15. adversus.	M.	Very rare, taken with the above.
16. reticulatus.	M.	Coast of the Western Highlands.
17. fuscatus. Turbo tuberculata.	M. P.	This very scarce shell was received with a parcel of shells from Jura. It is not the M. fuscatus of the Linnean Transactions; but is the T. tuberculata of Pennant.
18. Bamffius.	D. M.	In a pullus state, not uncommon near Dunbar. Larger specimens are taken by the dredge in Leith Roads.
19. accinctus *.	M.	A new species, dredged in deep water, Frith of Forth, rare.
20. erinaceus.	P. D. M.	Very sparingly at Dunbar and Aberlady Bay.
21. subulatus.	M.	A new species, Sound of Mull, near Scalasdale, rare.
22. proximus.	M.	A new species, rare, on sands near Dunbar.
23. decollatus.	P. D. M.	This shell is supposed by Montagu to be the fry of M. despectus.

* Tab. VIII. fig. 14.

TROCHUS.

Animal a Limax. Shell univalve, spiral, more or less conic. Aperture somewhat angular or rounded. The upper side transverse and contracted. Pillar placed obliquely.

1. crassus. Turbo lineatus.	M. D.	One specimen of this shell was taken by the dredge from deep water, off Dunbar.
2. cinerarius.	P. D. M.	On all parts of the coast, not uncommon.
3. umbilicatus.	P. D. M.	Same as the above.
4. tumidus.	M.	From the rejectamenta of a boat at Newhaven; also from a boat at Prestonpans, scarce.

TURBO.

Animal a Limax. Shell univalve, spiral, solid. Aperture contracted, orbicular, entire.

1. terebra.	P. M. D.	Leith and Portobello Sands, common: on the last place, a variety perfectly white occurs. This variety I at first considered to be bleached shells; but could

TURBO.

		not account for their remaining so sharp and perfect, until I discovered them after a storm alive.
2. clathrus.	P. D. M.	Dunbar, sparingly.
3. clathratulus.	M.	Ditto.
4. elegantissimus.	M.	Ditto.
5. littoreus.	P. D. M.	Common on the rocks on all parts of the coast.
6. rudis.	D. M.	Not so common as the last, though on many situations they are the only species to be seen, and of a large size.
7. canalis.	M.	Not uncommon on the shore near Dunbar. Adheres to the Fucus vesiculosus and other similar fuci.
8. parvus. }	M.	Dunbar, not uncommon.
lacteus. }	D.	
9. costatus.	M.	Coast near Dunbar, rare.
10. striatus.	M.	Dunbar, not common.
11. bryereus	M.	Sands near Belton. This is a variety possessing broader and coarser striæ, rare.
12. interruptus.	D. M.	From same situation, common.
13. subumbilicatus.	M.	Leith Sands and Dunbar, scarce.
14. ulvæ.	P. D. M.	On various parts of the coast, common.

TURBO.

15. cingillus. } vittatus.	M. D.	Dunbar, sparingly.
16. subtruncatus.	M.	A few taken by the dredge off Dunbar.
17. truncatus.	M.	From the same place as the above.
18. jugosus.	M.	Rocks near Dunbar, Leith Sands, and other parts of the coast. Care must be taken not to confound this shell with the fry of Turbo littoreus and rudis, which it much resembles.
19. crassior. } pallidus.	M. D.	Dunbar coast, not uncommon.
20. punctura.	M.	Not uncommon on many parts of the coast.
21. disjunctus *.	M.	A new and rare species, from Belton Sands, near Dunbar.
22. cimex.	D. M.	A worn specimen only has been met with, on Tyningham Sands.
23. semicostatus.	M.	A new shell, Dunbar, rare.
24. unifasciatus.	M.	On the sands near Beltonford, not common.
25. calcar.	M.	New shell, from the shore of Iona, very rare.
26. unidentatus.	M.	New species, from Dunbar, rare.

* Tab. VIII. fig. 3.

TURBO.		
27. ruber.	M.	New species, Dunbar, very scarce.
28. calathiscus.	M.	New species, from Jura, rare.
29. simillimus *.	M.	New shell, from same situation, rare.
30. juniperi.	M.	Upon a hill near Dunbar, rare.
31. tridens †.	M.	This very rare shell is now fixed as a resident of Great Britain, by a live specimen being found by me in Caroline Park, three miles west of Leith.
32. perversus.	M.	In the moss at the base of Salisbury Craigs. This shell is very rarely to be met with elsewhere so fine and perfect. In the mouth, in some of the specimens, a tooth makes its appearance.
33. marginatus ‡.	M.	Among sand from the shell-bank near Dunbar, very rare.

HELIX.

Animal a Limax. Shell univalve, spiral, subdiaphanous, brittle. Aperture contracted, semilunar, or roundish.

* Tab. VIII. fig. 15. † Id. fig. 11. ‡ Id. fig. 13.

HELIX.

1. putris.	D. M.	In a pond near Dunbar, common.
2. lubrica.	M.	Caroline Park, sparingly.
3. obscura.	M.	Dunbar, rare.
4. polita. }	M.	Dunbar, rare.
lævis. }	P.	
5. subulata. }	M.	Dunbar, very scarce.
Turbo subulatus. }	D.	
6. lacuna.	M.	Not uncommon on the shore of Dunbar. The banded variety of this shell is also common on this spot.
7. lævigata	P. D. M.	Portobello Sands, sparingly.
8. labiosa. }	M.	A very rare ribbed variety was met with near Dunbar.
Turbo albus. }	P.	
9. decussata.	M.	Portobello Sands, scarce.
10. fusca.	M.	Musselburgh, rare.
11. aspersa. }	M.	Not uncommon.
hortensis. }	P. D.	
12. nemoralis.	P. D. M.	Common in most parts of Great Britain.
13. contorta.	D. M.	Near Leith, sparingly.
14. alba.	M.	Dunbar, rare.
15. caperata.	M.	Musselburgh, by the road side leading to the Barracks. *N. B.* The apex of these specimens is more eleva-ted than usual.

HELIX.

16. Nana.	P.	Dunbar, scarce. This has been generally supposed to be the fry of Helix cornea. I have doubts on the subject, which will be explained hereafter.
17. Margarita *.	M.	A new species from Dunbar, not uncommon.

NERITA.

Animal a Limax. Shell univalve, spiral, gibbous, flattish at bottom. Aperture semi-orbicular or semilunar. Pillar-lip transversely truncate, flattish.

1. littoralis.	P. D. M.	Common on all the coast.
2. pallidula.	D. M.	Not uncommon at Dunbar.
3. glaucina.	P. D. M.	Portobello Sands sparingly, in Aberlady Bay more common, and at Dunbar the fry plentiful, though the mature shell never above once occurred there.
4. rufa.	M.	Dunbar, rare. This is supposed to be the true Cochlea parva of Da Costa.

* Tab. VIII. fig. 5.

NERITA.

5. nitida. } mamilla. }	D. M.	Dunbar, very scarce.
6. tuberosissima.	M.	A new and elegant species, taken by the dredge in the Frith of Forth. A single specimen only has been met with.
7. lævida.	Laskey.	A new shell found near Dunbar, since the publication of Appendix to Test. Brit. of Montagu. It bears some resemblance to N. glaucina, but has a more produced apex, and is divested of the markings of that shell.

HALIOTIS.

Animal a Limax. Shell univalve, dilated, ear-shaped, with a longitudinal row of orifices along the surface. Spire lateral, and nearly concealed.

1. tuberculata.	P. D. M.	A single broken specimen was found on the Sands of Leith; but I have doubts whether this shell is really indigenous.

PATELLA

Animal a Limax. Shell univalve, sub-conic, shaped like a bason, without a spire.

1. vulgata.	P. D. M.	Common on all parts of the coast.
2. cœrulea.	M.	This shell was, in the second volume of Montagu's Test. Brit. confounded with P. pellucida; and I am happy to find my friend has acquiesced in my arguments to separate them, as well as to erase P. bimaculata, in same volume, from his list of British shells. From the abundance of Patella cœrulea and pellucida, on the shores near Dunbar, the Patella bimaculata of this author also occurred, in all its various transitions, by which means I was enabled to point out the distinctions and error in British Testacea.
3. pellucida.	P. D. M.	Common on various parts of the Frith of Forth.
4. parva.	D. M.	Not uncommon on the shore at Dunbar; scarce on other parts of the coast.

PATELLA.

5. intorta.	P. D. M.	I have been so fortunate, since the first discovery of this rare shell, to dredge two specimens in the Frith of Forth, one of which is now in the collection of North British Testacea in possession of the Wernerian Society.
6. antiquata.	M.	One specimen only has occurred, by deep dredging, Frith of Forth.
7. militaris.	M.	Same as above.
8. fissura.	P. D. M.	Not uncommon on the shore near Dunbar.
9. Ungarica. / Hungarica.	M. D. / P.	Dunbar sparingly, but small. Many specimens of a fine pink colour.
10. chinensis. / albida.	M. / D.	A solitary small specimen has been found near Dunbar.
11. fluviatilis. / lacustris.	M. / P. D.	In a lake near Dunbar. This shell has been confounded with the *lacustris* of Montagu, and the *oblonga* of Lightfoot, as described by him in the Philosophical Transactions. I have never met with Patella oblonga in North Britain.

DENTALIUM.

Animal a Terebella. Shell univalve, tubular, strait, or slightly curved, with undivided cavity, open at both ends.

1. Entalis.	P. D. M.	Dunbar, sparingly; Leith Roads frequently, occurring with the dredge; and not uncommon at Aberlady Bay.
2. glabrum.	M.	A very scarce shell, found near Dunbar.

SERPULA.

Animal a Terebella. Shell univalve, tubular, generally adhering to other substances; often separated internally by divisions, at uncertain distances.

1. spirorbis.	P. D. M.	Common on all parts of the coast.
2. spirillum.	M.	Not so common, but plentiful.
3. granulata.	D. M.	The same as above.
4. lucida.	M.	Frequently found attached to a Sertularia; not uncommon.

SERPULA.

5. tubularia.	M.	Not uncommon on the coast.
6. triquetra.	P. D. M.	In same situation.
7. vermicularis.	M.	A small group came up by the dredge in the Frith of Forth; also Leith Roads, Belhaven, and Portobello Sands.

VERMICULUM.

Shell univalve; shape various: not attached or adhering to other bodies.

1. subrotundum.	M.	Dunbar, amongst the sand.
2. lacteum.	M.	In same situation, scarce.
3. marginatum.	M.	In similar situations, rare.

Since the reading of my paper on the North British Testacea, several shells have been met with not there mentioned, and others have, through the kindness of my friends Mr P. Neill and the Reverend Mr Fleming, been added to my cabinet. Anxious that this Catalogue should be as complete as possible, I beg leave to add these last discoveries as an Appendix to the former.

I think it proper here to mention, that the plate accompanying this Catalogue, contains Shells not to my knowledge before figured, and which are mostly uniques. These, with the exception of one or two, are all described by my friend G. Montagu, Esq; in his excellent work on Testacea, and its Supplement. The Chama Cor is of its natural size; and with confidence I can say, it is the only real British specimen that has been figured by any author.

J. L.

ADDENDA.

VENUS.

Name.	Authors.	Habitat, and Remarks.
V. lactea.	D. M.	A valve of this rare shell was found lately on the shore near Tyningham, the seat of Lord Hadinton, answering in every point to the figure of that shell as given by Mr Donovan, in his British Shells. By some conchologists, it was supposed to be the shell figured by Pennant in his British Zoology, vol. 4. t. 54. fig. 48. A. But this I cannot allow, as many striking differences may be seen, by a comparative view; and I am rather led to suppose the figure of Pennant is a worn specimen of the Venus Cassina of the Linnean Transactions, having lately been favoured by Mr P.

VENUS.

Neill, with a specimen of this last shell, found by him in the Orkney Isles, agreeing *in toto* with Pennant's figure. The oblique slope on the left margin of V. lactea, is a sufficient discrimination from any of the others confounded with it. This shell is the Venus incrassata of Solander, from the Portland cabinet, and is not unusually met with on the Guernsey coast.

BULLA.

Lignaria. P. D. M. Found by Mr Urquhart at Rothiesholm-head, Stronsa, Orkney.

TROCHUS.

T. zyziphynus. P. D. M. Found by Mr Neill in Orkney frequent; and kindly added to my North British collection.

HELIX.

H. octona. } octanfracta.	P. M.	Found by the Reverend Mr Fleming in ditches in Linlithgowshire, who added several specimens to my cabinet.
H. radiata.	M.	Found by the above gentlemen on the trunk of an aged willow, in a garden at Canonmills, near Edinburgh.

XIX. *Remarks on some parts of the Animal that was cast ashore on the Island of Stronsa, September* 1808.

By Dr Barclay.

(Accompanied by several Affidavits, relating to the Animal.)

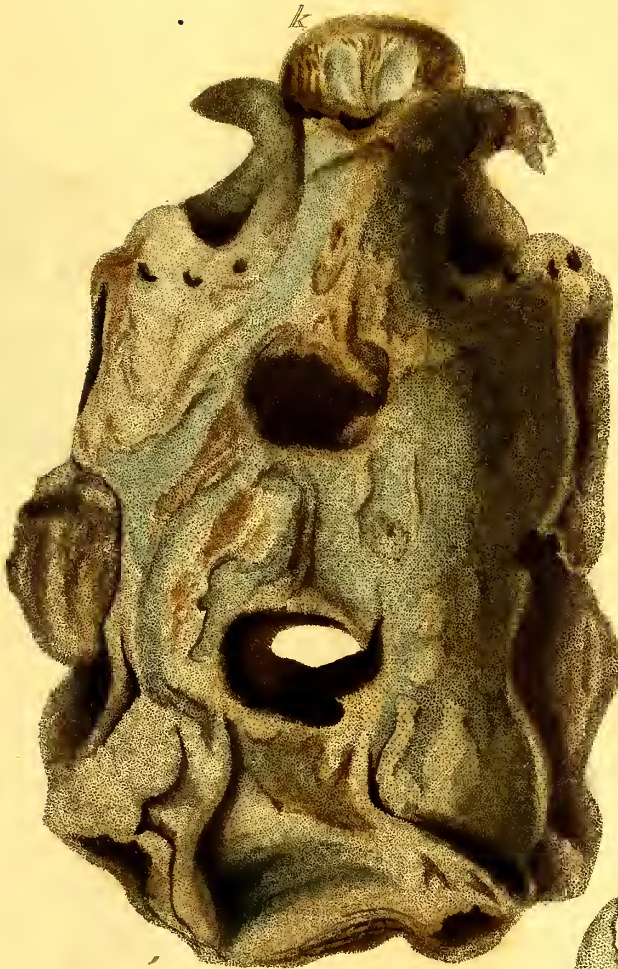
I Had formerly the honour of reading to this Society a description of four of the vertebræ taken from the animal that was cast ashore on the island of Stronsa, one of the Orkneys. The substance of that description was as follows.—These vertebræ, on a cursory view, present a number of the striking characters which are common to the vertebræ of most fishes. They exhibit, each, two hollow cones, joined at the apex * ; these hollow cones, formed of concentric circles †; and these circles the terminations of concentric cylinders, extending between one cone and the other ‡.

A number of the outermost of these cylinders are divided longitudinally, by 40 or 50 sulci or

* Plate x. fig. 4. *b*. † Id. fig. 3. *a*. ‡ Id. fig. 4. *c*.

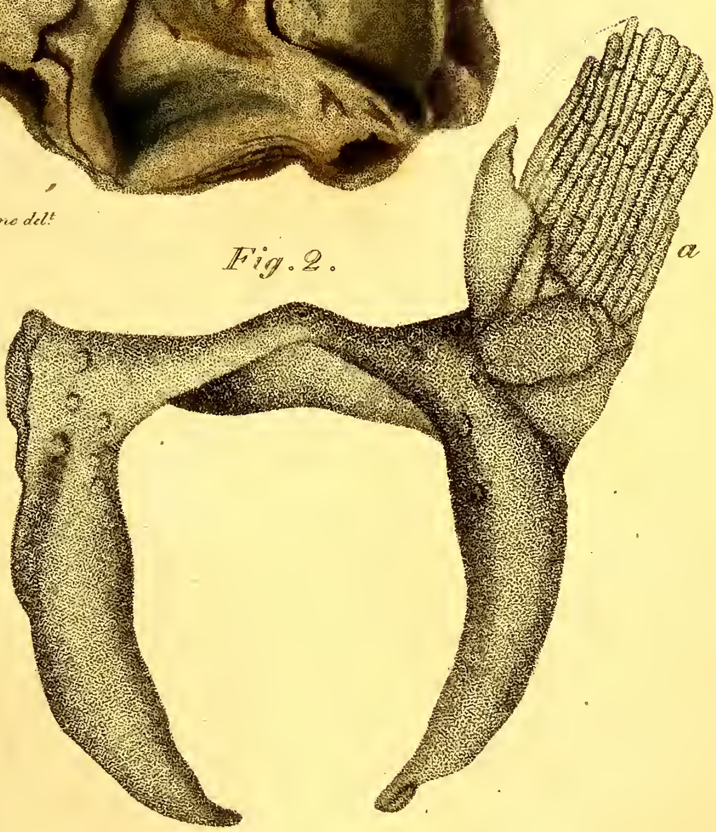
Plate IX

Fig. 1.



P. Syme delt

Fig. 2.



Urquhart delt

E. Mitchell sc.

Fig. 4.

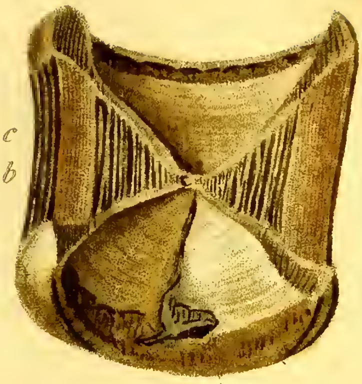


Fig. 3.

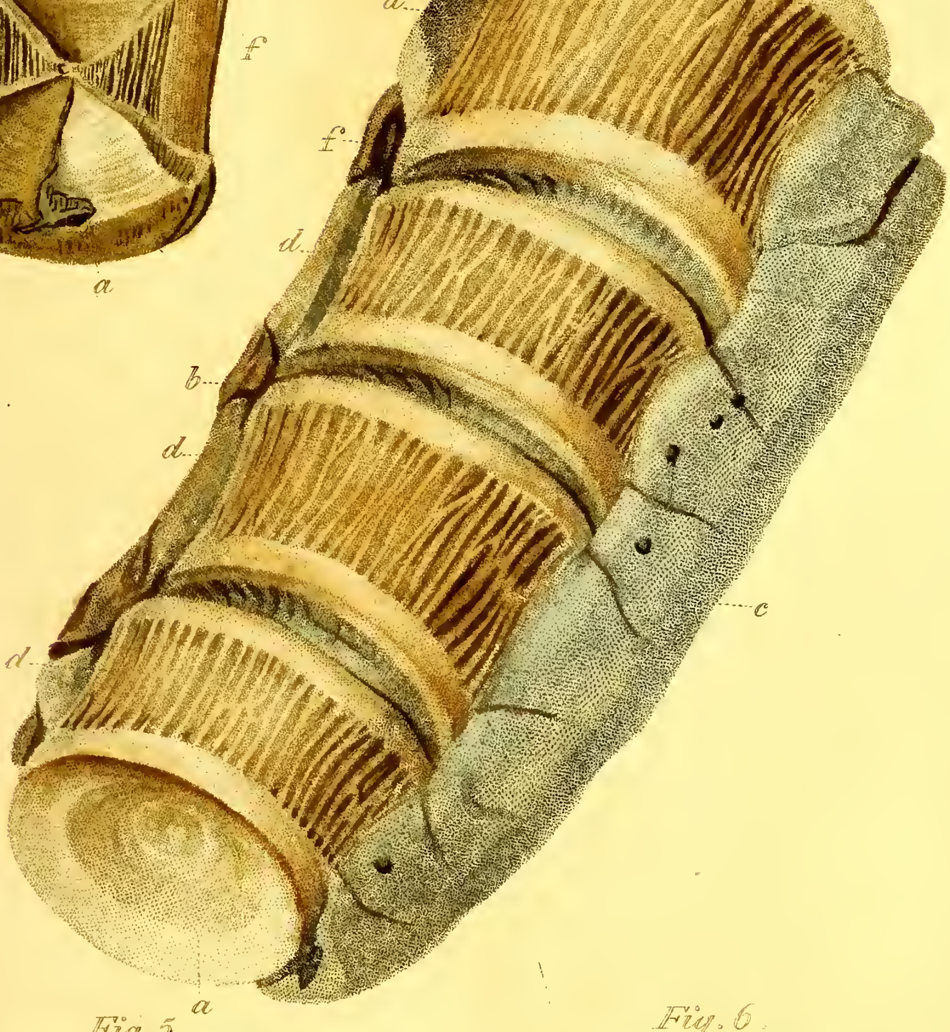


Fig. 5.

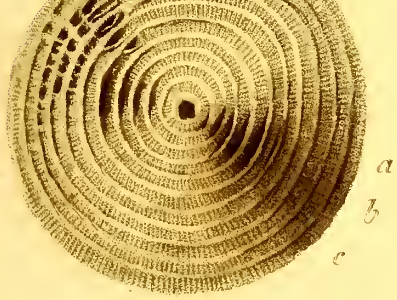


Fig. 6.

P. Syme del.t E. Mitchell sculp.t

fissures, that leave between them thin plates or laminæ *. These laminæ are formed by fibres that radiate from the axis to the circumference of the different cylinders †. The plates of the cylinders are about the thickness of a shilling; and the spaces interposed between two plates, though not always equal, are generally four or five times larger than that which is occupied by the thickness of the cylindrical plate. The cylinders were nearer to one another towards the centre and the circumferences, than in the space intervening ‡.

In four places, two on the dorsal and two on the sternal aspect, the fissures or sulci penetrate through all the cylinders ||. These four deep sulci serve for the attachment of two cartilaginous tubes, that run longitudinally on the vertebral column; the one on the dorsal aspect, containing the spinal marrow, and that on the sternal aspect, the large blood vessels §.

What occasions a singular appearance in these vertebræ, is their want of processes. In the vertebræ of many fishes, we observe nothing like articular processes; but in these vertebræ there are neither transverse nor spinous processes, nor any thing calculated to suggest an idea of them. These vertebræ, therefore, are susceptible of inflection to an equal extent dorsad, sternad, dextrad and sinistrad.

* Plate x. fig. 3. *d.*

† Id. fig. 5. *a, b, c.*

‡ Id. fig. 4. *f.*

|| Id. fig. 6. *b, c, d.*

§ Id. fig. 3. *b, c.*

Another remarkable appearance, and which still may be observed in those vertebræ which are preserved in the Museum of the University, is the difference of diameter, and the difference of length, that occur alternately as you pass in succession from the one to the other; a larger vertebræ being interposed between two that are smaller, and a smaller interposed between two that are larger *. In the first set of vertebræ which I saw, taken from the caudal or sacral extremity, according to what I conceive a most accurate report, (that of Mr Urquhart, a gentleman who saw the animal, and a gentleman, too, of respectability and education, and well-known to our President and Secretary to be ardent in his pursuit of natural history), none of them seemed to taper like a cone, but regularly preserved the cylindrical form, the larger and the smaller vertebræ, as they occurred alternately, gradually becoming less and less than the preceding of the same kind, as they approached the caudal extremity. The cause of this singular structure I cannot explain, unless it be to favour the action of the muscular fibres, which, by this contrivance, must have entered the two contiguous vertebræ at less acute angles than if they had been more parallel to the axis. If this be the reason, the difference of diameter in contiguous vertebræ becomes a substitute for the processes that are wanting, and, like the processes, is made to

* Plate x. fig. 3.

furnish more advantageous levers for the muscles.

In systematic connection, the contiguous vertebræ present to one another the bases of their cones, united by an intervertebral ligament *. The intervertebral space over which it stretches, is from two to three quarters of an inch. The ligament itself is very elastic, and about a quarter of an inch in thickness. It is composed of different strata, and each stratum of circular fibres. These strata form the inner side of the base, where they firmly adhere; are reflected on the inner side of the two cones, towards their apex †; but always thinner as they advance from the base to the apex, forming every where the lining or internal stratum of the two cones.

In the wet state, the ligament where it is reflected on the inner side of the cones, resembles a ligamento-cartilaginous substance in the dried state. This appears under the form of a strong dense membrane.

The cavity formed by the two cones and the ligament was filled with a fluid, opaque, whitish, and fetid; but became less opaque, white and fetid, when exposed to the heat of boiling water. One use of this fluid in the vertebræ of fishes, is well known; it is the ball on which the vertebræ move with the least possible degree of friction, and is infinitely superior to the ball and socket joint in the works of art. There is something similar

* Plate x. fig. 3. *fff*. † Id. fig. 4. *a*.

to this ball and socket joint even in the human species; and, therefore, when the humours become scanty, as in old age, the vertebræ approach on the sternal aspect, the spine grows shorter, and is bent forward. The spine is shortened, too, by a long continuance in the erect posture, which compresses the intervertebral cartilages, opposes the influx, but favours the efflux or the absorption of the intervertebral fluids. A closer analogy, however, to this ball and socket joint of fishes, is to be found in different quadrupeds; and a near resemblance to the ball and socket joint of art, may be seen in the articulation of the femur with the pelvis, and of the humerus with the scapula, in man, and most quadrupeds,—in all the vertebræ of the viper, and in the cervical vertebræ of the horse.

The fluid is supplied by exhaling arteries, and in these vertebræ the arteries seem to have entered by the sulci or fissures. The interstices between the cylinders were filled with a fluid not unlike in colour to that of the joint, but, in point of consistency, more resembling a jelly. This fluid escapes, as well as that of the joint, by evaporation; and this evaporation is the cause that the space between the cylinders appears empty in the dried vertebræ.

The whole osseous part of these vertebræ is uncommonly soft and porous; and as the cartilaginous part predominates, the dimensions of the vertebræ are considerably diminished when they are dried. The base of each cone terminates in a ligamento-cartilaginous ring, about a quarter of an inch in depth, measuring longitudinally *; so that the sulci do not extend between base and base, but between ring and ring.

To these rings, on the inner side, is attached the intervertebral tegument; so that when the vertebræ are pressed together, the rings are interposed, to protect the soft osseous structure. These rings, and the sulci, are admirably represented in Mr Sime's drawing, which exhibits also a striking likeness of the cartilaginous ridges.

Some months after reading the above description of these vertebræ to this Society, I saw in the London Philosophical Transactions a description of two vertebræ of the Squalus maximus of Linnæus, by Everard Home, Esq. These vertebræ of the Squalus maximus, though on a reduced scale, are similar in size to the vertebræ which I have described, and, like the vertebræ of many other fishes, have a general resemblance in articulation and structure; but the figure which Mr Home has given, must have been very carelessly and inaccurately executed, if the vertebræ which he has described, and the vertebræ which you have seen, and may still see in the presses before you, belonged to the same species of animal.

In his figure, we do not observe the concentric cylinders extending from cone to cone, excepting

* Plate x. fig. 3. *g*.

on one side of one of the vertebræ, and that near the axis of the cones. All his other cylinders, instead of extending from cone to cone, terminate at a definite line, and at a small distance from the surface of the cone in which they commence. In the vertebræ taken from the animal of Stronsa, the cones thicken from the apex to the base, as in the squalus; but the thickness of the intervertebral ligament was very different, even after maceration in water.

There are no osseous laminæ radiating from the centre, in Mr Home's figure; and no mention in his verbal description, of the ligamento-cartilaginous rings, and the various sulci extending through the cylinders. Perhaps they existed, though he has not described them; and yet it would be uncandid, without stronger evidence than I have, to suppose such defects in Mr Home's description.

Since reading the first paper of Mr Home, where he treats of the vertebræ of the Squalus maximus, I have seen another, entitled "An Anatomical Account of the Squalus maximus." In this last paper, he seems to be convinced, that the animal of Stronsa is a Squalus maximus. The scale on which he draws his figure of the squalus, is a scale of half an inch to a foot.

Measuring by this scale, the head of his squalus is five feet and a half, from the point of the upper jaw to the gills. The dried and shrivelled head of the animal of Stronsa, measures only twelve inches from the first cervical vertebra to the farthest part that remains of the jaw.

The diameter of the head of the Squalus maximus, from right to left, at the angle of the mouth, was, according to Mr Home, five feet. The broadest part of the head of the animal of Stronsa is, in its present state, only seven inches.

The diameter of the larger vertebræ, near the head, in the squalus, was, according to Mr Home, seven inches. The first cervical vertebra in the animal of Stronsa, is still adhering to the head *, and is only two inches in diameter.

Yet some of the vertebræ of this animal, which are still preserved, are six inches and a half in diameter; and the first vertebræ which I saw, were from four to five and a half inches across.

The smallness of the cervical vertebræ, in the animal of Stronsa, confirms the account of those who saw it, that the animal had a neck. But the Squalus maximus, if Mr Home's figure be accurate, had nothing resembling a neck. And, indeed, Artedi observes, that "omnes pisces qui pulmonibus destituuntur, collo quoque carent: Ergo soli pisces cetacei collum habent †." The presence of a neck, therefore, as peculiar to cetaceous fishes, confirms likewise the account of the spiracula or air-holes, ascribed to this animal of Stronsa.

* Plate ix. fig. 1. *k*.

† Artedi, "Partes Piscium," § 25.

The length of Mr Home's squalus was thirty feet six inches. The length of the animal of Stronsa, by actual measurement, was fifty-five feet, or, exclusive of the head, fifty-four; and yet a part of the tail was supposed to be wanting.

The circumference of the animal of Stronsa was, by actual measurement, about ten feet, meant, I suppose, at the thickest part. If the animal had been cylindrical at that part, the diameter from the dorsal to the sternal aspect must have been about three feet four inches. The diameter of the squalus, at the thickest part, measuring from the dorsal to the sternal aspect, is nearly six feet; its circumference, had it been cylindrical, nearly eighteen feet.

The animal of Stronsa had a mane, extending from the shoulder to near the caudal extremity, (*i. e.* about thirty-nine feet,) after deducting the length of the head and neck, which, when together, were sixteen feet. I have still a specimen of that mane, which I got from Mr Urquhart; and all the specimens which were brought here, confirm the accounts that were sent of it from the Orkneys. The bristles of that mane are not like the radii of a fin, nor, although they were, has the Squalus a fin extending from the shoulder to the tail.

A drawing, which was sent to me by our very active and obliging Secretary, Mr Neill; was executed, I am told, from the original, by Mr

Urquhart; and its accuracy is confirmed by the dried specimens now before us. It represents the sternum, and two parts corresponding to scapulæ, and those organs which are named *paws* *. Mr Home says, that these organs resemble the pectoral fins of his squalus. But the length of the pectoral fins, measuring along the upper margin, is four feet; the length of the paw cannot be determined, as part of it is wanting; the part that remains, measures seventeen inches.

The breadth of the fin, measuring across the radii, is three feet and seven inches; while the greatest breadth of the paw, in its dried state, is only five inches and three quarters.

Those parts which in form resemble the scapulæ, and exhibit articular surfaces at each extremity, were probably ribs.

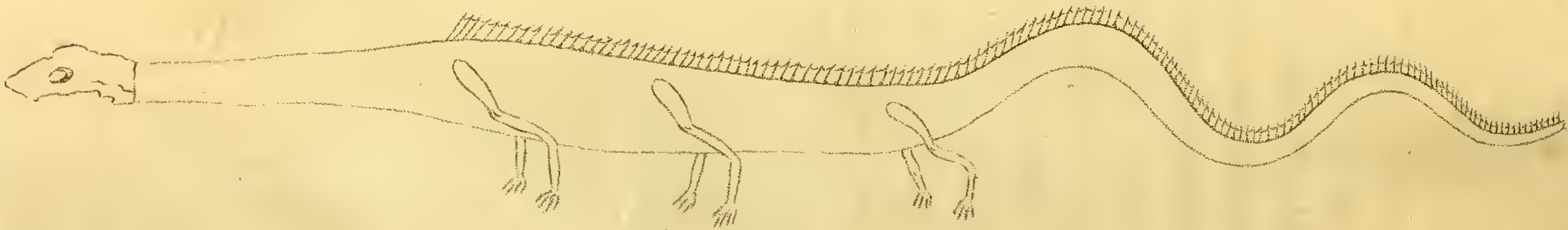
Mr Home concludes by observing, that "it "is of importance to science, that it should be "ascertained, that this fish is not a new animal, "unlike any of the ordinary productions of na-"ture." Of what importance it is to science to admit no new genera or species into our catalogues of natural history, I cannot conceive. But it is certainly of much importance to science, that the naturalist should be cautious not to determine the species of an animal upon vague evidence. Now what evidence had Mr Home that this animal was a squalus, and even to suppose that it was a squalus maximus?

* Plate ix. fig. 2. *a*.

Part of that evidence, founded on the comparison of some organs belonging to the Squalus and the animal of Stronsa, has been already detailed; the remaining part is in the following affidavits. The solemn declarations in these affidavits, it must be confessed, do not always agree, even where they relate to the same things; and part of this difference may have arisen, from the persons who emitted the declarations not being accustomed to the accuracy required in zoological descriptions, —from their having seen the animal separately, at different periods, in different states, and in different positions. Be these declarations, however, true or false, there is nothing in them which, when taken literally, indicates a Squalus or a Squalus maximus. This Mr Home seems willing to admit, and therefore is at some pains to explain how the sight of a Squalus, or, more probably, a Squalus maximus, produced such truly wonderful effects on the senses, the judgment, the imagination, and the veracity of these Orcadians, as to have made their solemn declarations so widely different from nature and from truth. If these odd effects on the minds of the Orcadians, could have proceeded

Mr. Home's Squalus, 36 feet long.

Animal of Stronsa, 55 feet long.



E. Mitchell sculpt.

from nothing else than the sight of a Squalus or a Squalus maximus, Mr Home is certainly entitled to the credit of having discovered, if not a new species of fish, at least a new and remarkable variety of the human species, inhabiting the Orkneys.

Our own opinion is, that the facts before us lead to nothing precise and determinate as to the species or genus of the animal; and that if the characters of genus and species be to rest on such vague and conjectural evidence, as that which proves this animal a Squalus, we may as soon get acquainted with nature through the dreams of cosmogony, or the tales of a tub, as through the observations of natural history.

Outlines of the two animals which Mr Home has considered as of the same species, are given in Plate XI. The outline, however, of the animal of Stronsa, we can easily suppose, is not very accurate; though, accurate or not, it must have had some general resemblance to the original, as it recalled the appearance of the animal to the recollection of those who had seen it.

The story of Pontoppidan's Snake, the account of this animal of Stronsa, and what is related of another animal seen near the coast of Coll, by the

Reverend Mr Maclean *, seem grounds sufficient to awaken the curiosity of naturalists, who, it were to be wished, were always men of accurate discrimination, and sound judgment,—not prone to indulge a passion for the marvellous, nor apt to be infected with the silly conceit, that their knowledge of nature is already so complete, that little of importance remains to be discovered.

* See Mr MACLEAN's letter, subjoined to the affidavits.

THE

AFFIDAVITS.

At Kirkwall, Nov. 10. 1808.

In presence of Dr Robert Groat, Physician in Kirkwall, and Malcolm Laing, Esq; M. P. Two of his Majesty's Justices of the Peace for the County of Orkney,

Compeared Thomas Fotheringhame, house-carpenter in Kirkwall; who solemnly declared, That being in Stronsa during the gales of wind in October last, he went to see the strange fish that was driven ashore in Rothiesholm Bay: That he measured its length with a foot-rule, which was exactly fifty-five feet, from the junction of the head and neck, where there was the appearance of an ear, to the tail: That the length of the neck, from the ear to the shoulder, was ten feet three inches, as nearly as he recollects. And being shewn a drawing of the animal, he declared, That the neck appeared to him to be too long: That the fins or arms, or, as they were called on the island, *the wings* of the animal, were jointed to the body nearer the ridge of the back than they appear in the drawing: That the toes were less spread out, and tapering more to a point, unless when purposely lifted up; but were not webbed unless for the space of an inch and a half in breadth, where they joined each other; and the length seemed to be about eight inches: That he measured one of the wings next the head, which was four feet and a half in length, and in shape, from the first joint to the extremity, it resembled a goose-wing without the feathers: That the hollow between the snout and the upper part of the skull, appeared to him not to be quite so deep as represented in the drawing: That in every other respect the drawing appears to be so exact, that if the fish had not been mentioned, it would have brought it to his recollection: That from the ridge of the back to the belly, the body appeared to be four feet in depth, and the circumference rather oval than round; but that he did not measure either: That the mane or bristles of the back extended from the shoulder to within two feet and a half of the tail, and were of a shining appearance when wet; but shrunk up, and turned yellow, when dried: That the mane was thin, about two inches and a half in breadth towards the shoulder, and two inches in breadth at the tail:

That the skin seemed to be elastic when compressed, and of a greyish colour, without any scales: it was rough to the feeling, on drawing the hand over it, towards the head; but was smooth as velvet when the hand was drawn towards the tail: That the extremity of the tail was about two inches in thickness, and somewhat rounded; and as he saw no part of the bones, he cannot say whether any part of the tail had been broken off or not: That the eyes appeared to be no larger than those of a seal: That there were two spout-holes on each side of the neck, about an inch and a fourth in diameter, and at the same distance from the head as appears in the drawing: That he lifted up the snout, and examined the throat, which was too narrow to admit his hand: That a part of the bones of the lower jaw, resembling those of a dog, were remaining at that time, with some appearance of teeth, which were soft, and could be bent by the strength of the hand: That he observed no nipples, or organs of generation; the belly having been burst open by the violence of the sea: That the stomach was about the size of a ten gallon cask; and the bowels about the bulk of those of a cow: That the bristles of the back, which had been pulled off through curiosity, were luminous in the dark, while they continued wet. And all this he declares to be truth, &c.

(Signed) THOMAS FOTHERINGHAME.

Kirkwall, Nov. 19. 1808.

Compeared JOHN PEACE, tenant in Dounatoun in Rothiesholm; and being interrogated, solemnly declares, That on the 26th day of September last, he went a fishing off the east part of Rothiesholm-head, when he perceived, as he imagined, a dead whale, on some sunk rocks, about a quarter of a mile from the Head: That his attention was first directed to it by the sea-fowl screaming and flocking about it; and on approach of it, in his boat, he found the middle part of it above the surface of the water: That he then observed it to be different from a whale, particularly in having fins or arms, one of which he raised with his boat-hook above the surface of the water: That this was one of the arms next the head, which was larger and broader than the others nearer the tail; and at that time the fin or arm was edged all around, from the body to the extremity of the toes, with a row of bristles about ten inches long, some of which he pulled off, and examined in the boat: That about ten days afterwards, a gale of south-east wind came on, and the surge drove the fish ashore on Rothiesholm-head: That he measured it by fathoms, and found it about nine fathoms, rather more than less; that is, about fifty-four or fifty-five feet in length: That he observed the six arms, or wings as they are called on the island; but perceived no part of the bristles then round the edges of the fins or arms, and supposes, that being in a putrid state, they had been beaten off by the sea, or wasted away: That a small part of the belly was broke up when he saw it then, from which the stomach, as he now supposes it to have been, had fallen out: That the stomach, which he took at first for the penis, was about four feet in length, and about the thickness of a half anker cask: That he supposed it to have been the penis, from the one end of it being joined to the body; but on seeing it after it was opened, he concluded it to have been the stomach, as it resembled the second stomach of a cow: That he did not measure the circumference of the animal, but it appeared to be of the thickness of a middle sized horse round the girth, of twelve or thirteen hands high. And being shewn a drawing of the animal, and desired to point out the resemblance or difference, he declared, That the joint of the foremost leg was broader than represented in the drawing, being more rounded from the body to the toes, and narrower at the upper end than at its junction with the toes: That the limb itself was larger than the hinder ones, and the uppermost joint or shoulder was altogether attached to the body: That in all other respects the drawing appears to him to be an exact resemblance of the fish, as it lay on the beach: That the mane came no farther than the shoulder, and extended to the tail, part of which appeared to have been broken off: That the length of the neck, the situation of the snout-holes, and of the eye; the shape of the snout, the position and distance of the limbs from each other, appear to him to be exactly preserved in the drawing: That the lower jaw was awanting when he saw it: That the fish was of a greyish colour: That he observed no nipples or organs of generation, unless as above mentioned: That the part of the belly which was burst open, and from which the stomach had fallen out, was between the two limbs that are situated in the middle of the animal. And all this he solemnly declares to be truth. And declares he cannot write.

Eodem die.

Compeared Mr GEORGE SHERAR, tacksman of Rothiesholm, in the island of Stronsa; who being interrogated, solemnly declared, That on the 20th of October, being in Rothiesholm-head, he saw the crew of John Peace's boat examining something on the water, which he took to be a dead whale: That about ten days afterwards, a gale of east wind having taken place, he went to see if the whale was driven ashore, and found it in a creek, lying on its back, about a foot under water; and from the view which he had of its figure, length and limbs, his curiosity induced him to return a day or two after the gale had abated, when he found it thrown upon the beach, a little below high-water mark, and lying on its belly, as represented in the drawing: That he returned next morning with a foot-rule, purposely to measure it, and found it to be exactly fifty-five feet in length, from the hole in the top of the skull, (which he has brought to town with him), to the extremity of the tail: That the length of the neck was exactly fifteen feet, from the same hole to the beginning of the mane: That he measured also the circumference of the animal as accurately as he could, which was about ten feet, more or less; and the whole body, where the limbs were attached to it, was about the same circumference: That the lower jaw or mouth was awanting; but there were some substances or bones of the jaw remaining, when he first examined it, which are now away: That it had two holes on each side of the neck, besides the one on the back of the skull: That the mane or bristles were about fourteen inches in length each, of a silvery colour, and particularly luminous in the dark, before they were dried: That the upper part of the limbs, which answers to the shoulder-blade, was joined to the body like the shoulder-blade of a cow, forming a part of the side: That a part of the tail was awanting, being incidentally broken off at the extremity; where the last joint of which was bare, was an inch and a half in breadth: That the bones were of a gristly nature, like those of a halibut, the back-bone excepted, which was the only solid bone in the body: That the tail was quite flexible, turning in every direction, as he lifted it; and he supposes the neck to have been equally so, from its appearance at the time: That he has brought in, to deliver to Mr Laing, the skull, two joints of one of the largest limbs, next the head, with different parts of the back-bone, beside the bones that were formerly sent in: That there were either five or six toes upon each paw, about nine inches long, and of a soft substance: That the toes were separate from each other, and not webbed, as far as he could observe; and that the paw was about half a foot each way, in length and breadth: That a few days thereafter, a gale of wind came on, and drove it to another part of the shore, where it was broken to pieces by the surge, and when Mr Petrie came out to take a drawing of it, no part of the body remained entire: That he endeavoured to convey an idea of the animal to Mr Petrie, by drawing the figure of it as accurately as he could, with chalk, on the table, exactly as it lay upon the shore, after which Mr Petrie made six or seven different sketches or plans of the fish, before he could bring it to correspond, in each minute particular, with the strong idea which he retains of its appearance: That he was the more attentive to its shape, dimensions and figure, in order to be able to give an accurate account of it to any travellers that might come to Rothiesholm; and that he is ready to make oath, that the drawing is an exact resemblance of the fish, as it appeared when he measured it; and corresponds in all particulars with the idea which he entertains of the figure, dimensions, and proportions of the fish: That the substance of the body appeared like coarse, ill-coloured beef, interlarded with fat or tallow, without the least resemblance or affinity to fish; but when put into a lamp, and the lamp placed on the fire, it neither flamed nor melted, but burned away like a gristly substance: That he perceived no teeth in the upper jaw; the lower jaw and tongue being awanting, and the palate also away: That the aperture of the throat appeared to be so wide, that he might have put his foot down through it: That the joints of the limbs were not united by a ball and socket, but were lapped over each other, and united by some means which he does not comprehend: That there were two canals, one above, and another below the back-bone, large enough to admit one's finger, and extending from the vertebræ of the neck, to the extremity of the tail, containing two ligaments, which, he supposed, enabled the animal to raise itself up, or to bend its body in a spiral form: That a tract of strong easterly wind had prevailed, before the body was discovered upon the shore, and that he saw the body on two or three different occasions, after he had measured it, and before it went to pieces. And all this he declares to be truth, &c.

(Signed) Geo. Sherar.

Compeared Mr William Folsetter, tacksman of Whitehall, in the island of Stronsa; who being interrogated, solemnly declared, That having heard that it was a dead whale that had come on shore in Rothiesholm-head, he did not see the body till about the 28th day of October, when it had gone to pieces: That he saw about nine or ten feet of the back-bone, and some bones of the paws, and what was supposed to be the stomach, which last he had the curiosity to open; that it was about four feet long, and as thick as a firkin, but flatter: That the membranes that formed the divisions, extended quite across the supposed stomach, and were about three-sixteenths of an inch in thickness, and at the same distance from each other, and of the same substance, with the stomach itself: That the section of the stomach, after it was opened, had the appearance of a weaver's reed: That he opened about a fourth part of the supposed stomach, which contained nothing but a reddish substance, like blood and water, and emitted a fetid smell: That he was very doubtful at the time whether it was really the stomach or not; but that each end of it had the appearance of terminating in a gut. And all this he solemnly declares to be truth, &c.

(Signed) Wm. Folsetter.

The said Mr George Sherar being again interrogated, declares, That he examined the supposed stomach, after it had been opened by Mr Folsitter, and that he laid it open to the farther end: That there was something like a gut at the end which he opened, about two inches long, with a small aperture: That the stomach had the same appearance from end to end, and contained nothing but a substance like blood and water: That the large bone, of which a drawing was taken, was considered as the collar-bone; and that it was situated with the broad and thick parts downwards, and the open part towards the vertebræ of the back: That he observed no appearance of fins about the neck or breast, or other parts of the body, except the six paws already described. And all this he solemnly declares to be truth, &c.

(Signed) Geo. Sherar.

LETTER from the Reverend Mr MACLEAN of Small Isles.

To the Secretary of the Wernerian Natural History Society.

SIR, *Eigg Island, 24th April* 1809.

Your letter of the 1st instant I received, and would have written in answer thereto sooner, had I not thought it desirable to examine others relative to the animal of which you wish me to give a particular account.

According to my best recollection, I saw it in June 1808, not on the coast of Eigg, but on that of Coll. Rowing along that coast, I observed, at about the distance of half a mile, an object to windward, which gradually excited astonishment. At first view, it appeared like a small rock. Knowing there was no rock in that situation, I fixed my eyes on it close. Then I saw it elevated considerably above the level of the sea, and after a slow movement, distinctly perceived one of its eyes. Alarmed at the unusual appearance and magnitude of the animal, I steered so as to be at no great distance from the shore. When nearly in a line betwixt it and the shore, the monster directing its head (which still continued above water) towards us, plunged violently under water. Certain that he was in chace of us, we plied hard to get ashore. Just as we leaped out on a rock, taking a station as high as we conveniently could, we saw it coming rapidly under water towards the stern of our boat. When within a few yards of the boat, finding the water shallow, it raised its monstrous head above water, and, by a winding course, got, with apparent difficulty, clear of the creek where our boat lay, and where the monster seemed in danger of being imbayed. It continued to move off, with its head above water, and with the wind, for about half a mile, before we lost sight of it.—Its head was rather broad, of a form somewhat oval. Its neck somewhat smaller. Its shoulders, if I can so term them, considerably broader, and thence it tapered towards the tail, which last it kept pretty low in the water, so that a view of it could not be taken so distinctly as I wished. It had no fin that I could perceive, and seemed to me to move progressively by undulation up and down. Its length I believed to be from 70 to 80 feet. When nearest to me, it did not raise its head wholly above water, so that the neck being under water, I could perceive no shining filaments thereon, if it had any. Its progressive motion under water I took to be rapid, from the shortness of the time it took to come up to the boat. When the head was above water, its motion was not near so quick; and when the head was most elevated, it appeared evidently to take a view of distant objects.

About the time I saw it, it was seen about the island of Canna. The crews of thirteen fishing-boats, I am told, were so much terrified at its appearance, that they in a body fled from it to the nearest creek for safety. On the passage from Rum to Canna, the crew of one boat saw it coming towards them, with the wind, and its head high above water. One of the crew pronounced its head as large as a little boat, and each of its eyes as large as a plate. The men were much terrified, but the monster offered them no molestation.—From those who saw it, I could get no interesting particulars additional to those above mentioned.

I remain, Sir, &c.

DONALD MACLEAN.

XX. *On the Topaz of Scotland.*

By Professor Jameson.

[*Read 9th December* 1809.]

It is said that the greater number of the precious stones have been, at different times, discovered in the mountainous districts of Scotland; but hitherto no accurate account of them has been published. This is owing to a deficiency of mineralogical skill, and the interested motives of the discoverers, who have always endeavoured to conceal the knowledge of the spots where these stones have been found. According to the jewellers and lapidaries of Edinburgh, the *ruby* occurs at the Ely in Fifeshire, also near Portsoy in Banffshire, in Inverness-shire, and Aberdeenshire: The *emerald* at the mountains of Cairngorm in Aberdeenshire: The *aqua marine,* or precious beryl, at

Invercauld, and in the Orkney Islands: The *sapphire* in different places of the Highlands, as at Benachie and Invercauld in Aberdeenshire, and Portsoy in Banffshire: The *amethyst* at Invercauld, and in Strathspey, and other parts of Scotland: The *garnet* abundantly in Aberdeenshire, and other parts of Scotland: and, lastly, the *topaz*, is said to occur frequently in Strathspey, at Invercauld in Aberdeenshire, Cairngorm, and in the Isle of Arran.

But are all these true precious stones?—The ruby of the Ely, and the other places already mentioned, cannot be referred either to the spinelle ruby, or the red sapphire, which is the oriental ruby of jewellers. The mineral found at the Ely is not unlike the Cinnamon-stone of Werner, which I consider as a species of the garnet family. The Emerald of Cairngorm and Strathspey, and the Aqua marine of Invercauld, are varietes of precious beryl; and the aqua marine of the Orkney islands, if the specimens in the late Dr Walker's cabinet be truly from that quarter, is also precious beryl. The Sapphire of the Highlands, from the examination of specimens in the possession of Mr Deuchar, is a pale, celandine-green coloured topaz. The Amethyst is the true amethyst of mineralogists. The Topaz of Cairngorm, Isle of Arran, and other places, is rock-crystal of various colours, as yellowish-white, clove-brown, wine-yellow, and orange yellow. The clove brown varieties are named *smoke-topaz;* the orange and wine-yellow varieties are sometimes sold as true topaz. The Garnet is the precious garnet of Werner; the Syrian or oriental garnet of many jewellers.

It thus appears, that precious beryl, topaz, amethyst, and precious garnet, are the only true gems hitherto discovered in Scotland. But the topaz of Scotland has been considered as a variety of sapphire, and its true nature was not understood until lately, when its characters were fully exhibited in a fine series of topaz-crystals of remarkable size, brought from the upper part of Aberdeenshire to Edinburgh, and now in the possession of Mr White, lapidary.

Topaz of Aberdeenshire.

Colour greenish white, and intermediate between mountain-green and celandine-green.

Is slightly opalescent.

The form of the largest crystal is an oblique eight-sided prism, deeply bevelled at the extremity; the bevelling planes set on the acute lateral edges; the proper edge of the bevelment truncated, and the angle formed by the meeting of the bevelling plane and the lateral planes bevelled.

The surface of the crystal is rough, owing to attrition.

Internal lustre splendent and vitreous. Cross fracture distinctly foliated; longitudinal fracture perfect conchoidal. Is semitransparent, inclining to translucent. Harder than precious beryl; but not so hard as spinelle. Specific gravity 3,570, (*Thomson.*)

This crystal weighs 7 ounces 3 pennyweights 18½ grains Troy; and a fragment of a crystal from the same tract of country, now in the possession of Mr Farquharson of Invercauld, weighs 1 pound 3 ounces 8 drams, and 8½ grains Troy weight.

These are the largest topazes hitherto found. In the National Museum at Paris, which is the most extensive in Europe, the largest topaz is one weighing 4 ounces 6 gros *.

The discovery of so valuable a gem in this country, naturally leads us to inquire, in what situation it is found, and whether or not it is likely to occur in considerable quantity. Unfortunately, the data for answering these questions are not complete: we must, therefore, at present rest satisfied with a short statement of the geognostic relations of the topaz of foreign countries, which, when compared with the accounts given of our topaz, will enable us to guess at its probable geognostic situation.

This gem occurs in considerable quantity in the Electorate of Saxony, in a particular species of mountain-rock, denominated, by Werner, *Topaz-rock*, because topaz is one of its essential consti-

* It is said that there is a topaz in the rich collection of Sir John St Aubyn, the size of a fist.

tuent parts. Besides forming an essential ingredient of topaz-rock, it also occurs in it in drusy cavities, along with quartz crystals, and lithomarge. In Bohemia and Saxony, it occurs in veins that traverse gneiss and mica-slate. These veins are generally narrow, intimately connected with the rock they traverse, of very old formation, and contain, besides topaz, also tin-stone, arsenic pyrites, sometimes copper pyrites, apatite, fluor-spar, quartz, and steatite. The Siberian topaz appears to occur in veins in primitive mountains, and probably also in large drusy cavities, in rocks of a very old formation.

About 25 leagues north from Catharinenburgh, in the Uralian Monntains, topaz is found in considerable quantity in a kind of granite, resembling that variety known under the name of *pierre graphique*. There, it is said to occur in drusy cavities, along with quartz and precious beryl. It is also found in the opposite extremity of Siberia, in a mountain named Odon-Tschelon, in the province of Dauria, where it occurs in druses along with precious beryl. The topazes of Odon-Tschelon, and, indeed, of Siberia in general, are generally snow white, frequently celandine-green, and very rarely of a beautiful blue, resembling the sapphire; and some varieties exhibit a kind of opalescence.

The Brazilian, and sometimes also the Saxon topaz, are found in alluvial soil *; and the topaz of Pegu, Ceylon, Hawkesbury River in New Holland, and Cape Barren Island in Basses Straits †, has a similar geognostic situation ‡.

Such are the geognostic relations of the topazes of foreign countries. The topaz of Scotland has hitherto been found only in alluvial soil, along with uncommonly large rock-crystals, and middle-sized crystals of precious beryl, and in a tract of country, as far as we know, entirely composed of primitive rocks; and hence it is highly probable, that its original repository is in primitive country. But in which of the primitive rocks is it probable

* Topaz has lately been found imbedded, in small crystals, in transition rocks.

† Dr Monro *junior* presented me with a rolled piece of topaz, said to be from Hawkesbury river; and Captain Laskey, with a crystal of the same gem from Cape Barren Island, in Basses Straits.

The topaz of Basses Straits, as my learned friend Mr R. Brown informs me, was first discovered by Mr Humphry *junior*, who was some years ago sent out by Government to examine the mineralogy of New Holland and Van Diemen's Island.

‡ In the collection of the Museum of Natural History at Paris, there is a large rock crystal, containing reddish-coloured crystals of topaz from Brazil.

that the topaz is contained, and in what kind of repository does it occur? The tract of country where our topaz is found, is said to be principally composed of granite, and to contain, besides, considerable portions of gneiss and mica-slate. This being the case, it is probable the topaz will be found in one, or possibly in all these different rocks. It may, however, be alleged, that probably the topaz-rock also occurs there, and that the topaz may be derived from it. But the topaz-rock is one of the rarest of the mountain-rocks, and the topaz which it contains has always a yellow colour, and differs somewhat in regular form from the topaz of Scotland; it is also smaller, and is never accompanied with rock-crystal or precious beryl. Hence it is not probable, that the topaz-rock occurs in the district of which we are treating. If, then, the topaz-rock is awanting, it will be inquired, in which of the primitive rocks already mentioned we are to look for it? Some may be of opinion that it occurs in veins, in gneiss or mica-slate, as is the case with the Bohemian, and certain varieties of the Saxon topaz. The want of all the accompanying minerals, as tin-stone, arsenic pyrites, copper pyrites, fluor-spar, &c. render this supposition improbable. But the topaz of Siberia agrees with that found in Aberdeenshire, in having green and white as its most frequent colour; in opalescence; in figure, being generally bevelled at the extremity; in size, the largest topazes being found in Siberia; and in accompanying minerals, which are usually rock-crystal and precious beryl.

Lastly, the Siberian topaz is said to occur in drusy cavities or veins in granite, and in considerable quantity. If this account be correct, we may infer that the Aberdeenshire topaz will be found in drusy cavities or veins in granite, and in considerable quantity.

I trust the conjecture I have now suggested, will induce mineralogists to examine the tract of country where this interesting mineral is found *.

* Since this paper was read to the Society, I have been informed by my friend Colonel Imrie, that the large fragment of topaz in the possession of Mr Farquharson of Invercauld, was broken from a mass of granite.

XXI. *Some remarks upon the Pudding or Conglomerate Rock, which stretches along the whole of the South Front of the Grampian Mountains in Scotland, from where they commence in the West, to where they finish their course towards the East in the German Ocean.*

BY LIEUT-COL. IMRIE.

[*Read 7th April* 1810.]

As this Conglomerate is seen in its greatest mass upon the sea-shore near the town of Stonehaven, I shall there commence my description and observations, and from thence continue them towards the west, at various points.

Between the towns of Stonehaven and Aberdeen, the Grampian mountains finish their course in the German Ocean. In this district of coast, the sea, by its inroads, has displayed a complete section of the various stratifications which here compose those mountains. In consequence of this section being made, the breadth or thickness of each species of rock in the general stratification may be measured without much difficulty, they being here all very nearly vertical in their position.

Immediately to the west of Stonehaven, the conglomerate-rock has been laid open by the sea, and is to be seen in a most enormous mass, of several miles in thickness.

At Fowls Shough, some miles to the west of Stonehaven, it ranges along the coast to great length, in one extended face of precipice of upwards of 120 feet in height, the sea washing its base. From this extent of precipice, it stretches towards the east to Dunnotter Castle, which is situated upon one of its lofty promontories that project into the sea; and from thence it continues to form the bulwark of the coast to the head-land which forms the western promontory of the bay of Stonehaven.

Upon this part of the coast the conglomerate is entirely composed of rounded water-worn stones, from the size of a pigeon's egg to a bullet of a foot and half diameter. These consist of granites, gneiss, porphyries, jaspers, hornblendes, hornstones, and quartz; of these, the quartz and the porphyries are the most predominant. These materials are strongly conglomerated by a highly ferruginated clay, of a reddish-brown colour, mixed with very small particles of quartz, and very minute fragments of silver-coloured mica. The quantity of this cement is not so great as to entitle it to assume the character of a base or principal mass in the composition; it only fills up the interstices among the rounded materials.

The binding quality of this cement is of a very powerful nature; the hardest stones in the composition may in general be more easily broken than removed from their sockets. In this conglomerate, narrow lines, and thin beds of a fine-grained sandstone, frequently occur at various distances. They are from the third of an inch to some feet in thickness. These are stratified, and generally consist of many wafer-like layers: they are in no degree bent in their course, nor indented by the materials forming the Conglomerate: they uniformly stretch in the direction of the conglomerate, and divide its mass into separate beds or layers. These lines of sandstone strongly indicate, that this mass has been deposited at various periods; and they at the same time serve to point out its real stretch and its position; and we learn from these, that its direction at Stonehaven is nearly from north-west to south-east; and in its position it is here very nearly vertical, having only a small degree of dip towards the south-west.

At the promontory which forms the western headland of the Bay of Stonehaven, this conglomerate rests upon a dark-brownish-red sandstone, thinly stratified, its layers seldom exceeding a foot or a foot and a half in thickness. This sandstone has a considerable degree of induration, and is here wrought for the various purposes of masonry.

In its position, it is nearly vertical, and the thickness of the whole of its stratification is about half a mile. In this sandstone, within a few yards of where the conglomerate rest upon it, a bed of greenstone occurs, of about 40 feet thick. It is nearly vertical in its position, and stands between two of the layers of the sandstone, both of which are in contact with it.

Upon the eastern side of the bay of Stonehaven, this red sandstone rests upon a clay-porphyry, the principal mass or base of which consists of an indurated clay, the *fresh* fracture of which is of a purple or lilac-brown colour. Its induration is considerable, but its fracture is rough and earthy. Its imbedded materials are, small particles of transparent quartz, small felspar masses, which sometimes are in crystallised forms, scales of blackish-brown mica, and specks of iron-ochre: but all these are rather thinly scattered in the mass.

At the Burn, about 17 miles to the north-west of Stonehaven, where the river Northesk issues from the Grampians, and flows into the plains of Kincardineshire, the conglomerate, with its adjacent stratified rocks, are laid open for inspection in their whole extent of breadth, by the river crossing their lines of direction nearly at right angles. In this district, the commencement of the aggregation of the conglomerate may be seen, and its progress of accumulation may be traced up to its most combined mass.

The rock, in the plains of Kincardineshire, consists of a brown sandstone. When in the plain, this rock is perfectly horizontal in its position; but as it approaches the undulated ground, forming the south basis of the Grampians, it begins to deviate from its horizontal position; and by a very gradual acclivity, it at last obtains a perfectly vertical position. When it first deviates from its position in the plain, some few rounded masses are found imbedded in its composition, and are generally found in the lower parts of the layers. These rounded masses augment in numbers as the rock augments in its acclivity, and soon after it has gained its vertical position, the principal base of sandstone disappears, and the conglomerate is seen in its greatest mass. The mass here is only about 400 yards thick; it is very nearly vertical in its position, having only a small degree of dip from the mountains, that is to say, it dips to the south. It has here the same narrow lines, and beds of sandstone in it, as have been described in the mass at Stonehaven, and it also here rests upon the same species of red sandstone as it does at that place. This red sandstone, at the Burn, is, in its stratification 260 *feet* thick, and rests upon a clay-porphyry, the bed of which is 220 *yards* thick. This porphyry is perfectly similar in every respect to that which has already been described at Stonehaven.

At the village of Callender, about 80 miles north-west of Stonehaven, and which is similar in its situation to the Burn, with respect to the Grampians, the conglomerate becomes highly prominent and conspicuous. It there forms high mural precipices, which stretch from that village far to the west. It is at Callender vertical in its position, and there, also, it rests upon the same species of red sandstone as it rests upon at Stonehaven, and at the Burn, which are the two other points that I have chosen for description.

That such vast accumulations of water-worn stones should exist, is perhaps not an extraordinary phenomenon; but that these water-worn stones have every appearance of having been deposited by water, must be generally allowed, and how the conglomerate which they form, comes to be vertical in position, seems to me to be a phenomenon most difficult to explain. That some explanations upon this subject have been attempted, I am perfectly aware; but all of these which have as yet come to my knowledge, appear to me to be vague, theoretical, and unsatisfactory.

This species of rounded conglomerate in Scotland, is by no means peculiar to the south front of the Grampians; it is found in various other situations. In Argyleshire, near the former site of ancient Beregonium, I have observed a vast accumulation of it, which stretches to Oban, upon the western coast, and there covers a considerable district of country. But the conglomerate at Oban differs much in its position from that of the Grampians. At Oban it is almost horizontal, and only shews undulation where it has been deposited upon unequal ground. The rounded materials combined in the mass, are of the same species of stones as those which compose the conglomerate of the Grampians: they both consist of masses of the older formations, which, from their hardness, have been enabled to withstand the severe and long attrition which they must have been subjected to before they were deposited in their present situations. The rounded masses at Oban are much larger than those of the Grampians.

The cementing mass of the conglomerate at Oban is also different from that of the Grampians. At Oban, this cement has the appearance of a blackish-grey indurated mud, which is composed of argil, fine-grained sand, black oxide of iron, and some calcareous particles. This cement does not produce a very strong degree of adhesion.

The conglomerate in this district does not, as that on the Grampians, rest upon the old red sandstone, it here rests upon the older rocks of lime and blue clay-slate.

To shew how widely disseminated this waterworn composition is, one more example shall be here given. Near the mouth of Loch Tongue, upon the north-west coast of Sutherland, I found that a small island of the name of Rona was entirely composed of it. The conglomerate of this island is entirely similar in composition, in cement, and in position, to that of the Grampians.

XXII. *On the Strontian Lead-glance Formation.*

By Professor Jameson.

[*Read 3d Feb.* 1810.]

Werner observes, that, in general, the same formations of rocks exhibit similar characters, however distant they may be situated from each other. Thus he found, that the clay-slate formation of Saxony, presented the same mineralogical relations as the clay-slate of Hungary; and the observations of my friends, Dr Macnight and Colonel Imrie, conjoined with those I have had an opportunity of making, prove that the general and particular mineralogical relations of the clay-slate of Scotland, agree with those of the clay-slate of Hungary and Saxony. Humboldt and Sonnenschmid have ascertained the identity of the clay-slate of North and South America, with that observed in different parts of Europe; and the investigations of Pallas, Patrin, and others, have shewn, that the mineralogical relations of the clay-slate of Asia, are similar to those of the clay-slate of Africa, and that these agree with those observed in the clay-slate of Europe and America.

In like manner, it has been observed, that the formations of ores follow nearly the same general law as the formations of rocks. Thus the ninth lead-glance formation, which is composed of lead-glance, poor in silver, with radiated pyrites, rarely with a little blende, and accompanied with heavy spar, fluor-spar, calc-spar and quartz, is found in Derbyshire in England, in Saxony, and in Sweden; and in these different countries it contains * the ores and earthy minerals just enumerated.

The eighth lead-glance formation, which consists of lead-glance rich in silver, yellow blende,

* See Dr Charles Anderson's excellent translation of Werner's admirable Treatise on the Origin and Formation of Veins.

grey copper-ore, common iron pyrites, with brown spar and quartz, occurs at Meissen in Saxony, and Kapnic in Upper Hungary. Many facts of the same kind might be mentioned, and may be found in the writings of Werner, Möhs, Von Buch, Von Humboldt, &c.; all of which agree in shewing, that formations of ores, having precisely the same characters, are found in the most distant countries; so that we need not hesitate in believing, that the same lead-glance formation may occur in countries many hundred, or even thousands of miles distant from each other.

In a practical point of view, this fact of the universality of formations, is of the first importance, by enabling us to apply the experience obtained by the working of a particular formation in one country, to the same formation in all the other parts of the globe where it may chance to be discovered. Thus, if a particular formation of lead-ore is worked to a great extent, so as to afford us a complete knowledge of its various mineralogical relations; and if, on travelling through a country where no mines occur, we discover a vein of lead-ore containing this particular formation, we shall at once know what degree of importance to attach to this discovery. Thus, should the lead-glance formation of the Lead-hills be discovered in other parts of Scotland, we would immediately know, from what has occurred in the mines at Lead-hills, what we have to expect in our newly discovered portion of this formation, not only as to the quantity of ore, but also the general depth at which the greatest quantity of ore may be expected. The probable expence of working the vein would also be known, and many other circumstances, connected with the economy of the mine about to be established.

These few preliminary remarks were judged necessary, before stating an interesting fact which has lately come to my knowledge—it is that of the probable occurrence of the lead-glance formation of Strontian, in Perthshire.

Last summer (1809) several specimens were found on an estate near Dunkeld in Perthshire, which exhibited some of the characters of the Strontian lead glance formation. They were composed of lead- ance, common iron pyrites, heavy spar, calc-spar, and *cross-stone*, and wanted only foliated zeolite and strontian to render it nearly certain that these specimens were derived from a portion of the Strontian lead-glance formation, contained in the part of the country we have just mentioned. Should a careful examination establish the identity of this formation with that of Strontian, it will no doubt prove a source of wealth to the proprietor.

XXIII. *On Cryolite.*

By Professor Jameson.

[*Read* 11*th Feb.* 1809.]

Several years ago, a Danish Missionary brought a collection of minerals from West Greenland to Copenhagen; and among these were a number of specimens of a white-coloured fossil, which passed for lamellar heavy-spar. This substance lay unnoticed for some years, until the Danish naturalist Abildgaard, struck with its resemblance to heavy-spar, and its comparatively low specific gravity, determined to analyse it. He found it to contain alumina, fluoric acid, and a small portion of potash *. Specimens were soon afterwards sent

* From its resemblance to ice, κρύος, it was named Cryolite.

to Klaproth and Vauquelin, who also found it to contain alumina and fluoric acid; but natron in place of potash. It appears, from the analyses of these consummate chemists, that this remarkable fossil contains from 40 to 47 *per cent.* of fluoric acid and water; from 32 to 36 *per cent.* of soda; and from 21 to 23 *per cent.* of alumina. Its external characters have been given by different naturalists, but not with sufficient minuteness; and its geognostic relations have hitherto remained unnoticed. Through the politeness of Colonel Imrie, who presented me with several specimens of this rare mineral, I have been enabled to draw up a description of its external aspect, and to ascertain its accompanying minerals; and from these to infer, with some probability, the kind of repository in which it occurs.

EXTERNAL CHARACTERS.

Its colours are greyish-white, and yellowish-grey.

It occurs massive, disseminated, and in cubical pieces.

Its internal lustre is vitreous; and is shining in one direction, but only glistening in another.

Its fracture is imperfect foliated, with a three-fold rectangular cleavage.

The fragments are cubical, or tabular.

It occurs in distinct concretions, which are thin and straight lamellar.

It is translucent, sometimes inclining to semi-transparent.

Is soft; is scratched by fluor-spar; but it scratches selenite.

It is intermediate, between sectile and brittle.

Is easily frangible.

Specific gravity 2.949.

GEOGNOSTIC RELATIONS.

It occurs, massive and disseminated, in a mass composed of sparry ironstone, lead-glance, iron-pyrites, and common quartz. The sparry iron-stone is in large and coarse granular distinct concretions, and has a yellowish-brown colour internally; but, externally, is tarnished deep blackish-brown: The lead-glance is minutely disseminated: The iron-pyrites is either disseminated or in small dodecahedrons: and the quartz, which is in very small quantity, is greyish-white, and minutely disseminated.

The sparry ironstone is the predominant fossil in the different specimens; the cryolite is in a less proportion; and the lead-glance, iron-pyrites and quartz, are in nearly equal quantity, but form a small portion of the mass. As all these minerals are massive or disseminated, never crystallised, if we except the small, and very few crystals of iron-pyrites, we may conjecture, that they do not occur in open spaces as veins, where there is room for the regular crystallisation, but rather in beds. A more complete suite of specimens, or an examination of the tract itself, where the cryolite occurs, will enable us to determine the accuracy of the conjecture we have just stated, which has been deduced from the examination of but few specimens, and possibly these may not be very characteristic in a geognostic point of view.

XXIV. *On the Veins that occur in the Newest Flœtz-trap Formation of East Lothian* *.

By Dr Ogilby.

[*Read* 19*th November* 1808.]

In a former essay, which I had the honour of presenting to this Society, on the geognosy of East Lothian, I gave a general view of three of the universal formations of minerals which occur in, and form the basis of that county: these are rocks of

* The first part of this valuable paper, which treats of the rocks of the newest trap formation of East Lothian, was returned to the author for revision, but has not again been transmitted to the Society. It will probably appear in the second volume of the Society's Transactions.

transition, independent coal, and newest flœtz-trap formation. As two of these formations had been previously noticed by Professor Jameson, I confined my observations more particularly to the rocks of the trap formation, which I had an opportunity of ascertaining to be superincumbent upon all the other rocks of the extensive district which I examined, and to be situated in an overlying and unconformable position, immediately upon strata of the independent coal; from which it is sufficiently manifest, that this class of rocks is the newest, or of posterior formation to all the others, a point upon which the two prevailing geological theories do not disagree.

Some important remarks were introduced, relative to the oryctognostical alliances of the different members of this series of rocks, the order in which these invariably followed each other, and the variety of interesting transitions to be observed in this portion of the trap formation. I took occasion to mention, that in every instance where there occurred an opportunity of examining the series, and approaching near to the subjacent strata, there was uniformly found, as the lowest or oldest member, a coarse conglomerate rock, consisting of fragments of different minerals of anterior origin; that this substance graduated into amygdaloid, which, in its turn, either passed at once into basalt, or, in some instances, first through claystone; and this either into basalt or compact felspar; and these into porphyry-slate, which forms in every case the summits of the obtuse, conical, and isolated hills throughout the county. A passage into greenstone was indicated, by interposed particles of hornblende observable in the rock, at the top of Traprain and North Berwick Laws.

It was also given as a new and corroboratory illustration of the Neptunian theory, that in those portions of the trap formation where particular circumstances, existing at the moment of consolidation, have given rise to a porphyritical structure of the whole series, similar shades of gradation in the felspar crystals, from mechanic to chemical or crystalline texture, were to be perceived. This very interesting fact, resulted from a minute examination of the successive beds of trap, which begin on the northern bank of the river, near the town of Haddington, and terminate upon the highest point of the Garltons, upon which the signal-post has been erected. Thus, in the bed, which rests immediately upon the trap-tuff, at the Abbey Quarry, and which is both porphyritical and amygdaloidal, the felspar approaches very nearly in its characters to the disintegrated subspecies; yet, at the same time, has distinctly the prismatic form, indicating (if we be allowed to reason from well-known chemical phenomena) a division of its parts in the menstruum from which it was deposited, only so far as the line which may be imagined between mechanical suspension and chemical solution; and such a precipitate, it can easily be conceived, might unite an earthy aspect with a considerable degree of crystalline regularity. From this peculiar state of the felspar on the amygdaloidal rock, I have already observed, that through the superincumbent claystone, basalt and clinkstone, there is a gradual acquisition of lustre, transparency and hardness, passing through common, and ending in glassy felspar, or a variety of adularia, which is undoubtedly a deposition from perfect chemical solution. I had occasion to make what I conceive to be an important remark in the present state of the science, namely, that much more than one-half of the extensive tract of country which I explored, was covered with that assemblage of rocks of the flœtz-trap,—a fact which considerably weakens, if not entirely destroys, an objection of the Huttonians against the universality of this formation, from its supposed non-occurrence in this country. It is now not only a fact, that this formation is extensively distributed in this vicinity; but also that a series exists here perfectly analogous to those at the Scheibenberg, upon which the Wernerian theory of aqueous deposition was particularly founded.

In proposing to lay before the Society, an account of the veins which occur in the trap formation of East Lothian, it was more with the intention of completing the task I had undertaken, than with the expectation of much important result, or any great variety of observation. When it is considered, that the result of the universal formation cannot include veins derived from any of the other great universal formations, this part of my subject must necessarily be very much circumscribed; so that, in reality, we cannot expect any of those repositories in this formation, (considering its relative age to be established), but what may be mentioned under the three following heads: 1*st*, Veins derived from subsequent partial formations, which, however, are of unfrequent occurrence; 2*d*, Veins of the different rocks of the formation, penetrating the older beds; and, 3*d*, Those of cotemporaneous origin.

Without deciding at present to which of these classes the veins which occur in the East Lothian trap rocks belong, I shall enumerate the minerals, and then treat of each very briefly. 1. Greenstone; 2. Jaspers; 3. Quartz; 4. Heavy-spar; 5. Calc-spar.

GREENSTONE.

Two veins of this rock intersect the sandstone strata between North Berwick and Tantallon Castle. One of these veins is small-granular, compact, and porphyritic, and twelve or fourteen feet wide; the other is also small-granular, contains a mixture of sand, and is only a few feet in width. Both of these veins pursue a north-easterly direction, and are nearly vertical; they have numerous veins of calc-spar traversing them.

It cannot be easily said, whether these veins are derived from beds of greenstone belonging to the coal-formation, or from the newest deposite of the overlying trap. I am at present more inclined to the former supposition, on account of having observed beds of greenstone at Gullon, to the westward, conformable with coal strata, and not having yet observed any distinct greenstone in the newest flœtz-trap.

JASPERS.

Numerous veins of this substance occur at the Garlton Hills, Pencraik, near Traprain, and other places; it approaches more nearly in characters, when distinct, to the conchoidal than to the common earthy jasper; the prevalent colour, is a dusky-yellow, with various shades of brown-red, and sometimes black. It is chiefly in those beds of the formation which are intermediate between claystone and porphyry-slate, that I have found these veins to occur; they are in general nearly vertical; and as they descend into the lower beds of the formation, I have observed them to ramify very minutely, and to diminish very much in width,—a fact which is of considerable importance, and of which I have numerous examples in hand specimens.

The collection I have made, shews very plainly the transition of this substance into flint, quartz, calcedony, and into splintery-quartz, approaching to hornstone.

Some specimens from the Garltons, shew a passage into an earthy dull substance, very much approaching to a compact claystone, and even indistinct crystals, approaching to the earthy felspar, occasionally occur in them. This observation of transition, I find anticipated by Professor Jameson, in the first volume of his System, wherein he mentions the distinct passage of claystone into common jasper. These jaspers (the geognostical situation of which is now clearly ascertained) are not of much value for ornamental purposes: though they are susceptible of a good polish, the colours are neither various nor beautiful.

QUARTZ.

Independent of the transition of jasper into this species, I have found small veins of white or greyish-white quartz traversing the trap-formation in every part of the county. Where it has room to expand into crystals, as in drusy cavities, it assumes the usual form; and I have observed in some places very regular dodecahedrons, or double six-sided pyramids, adhering to the walls of the cavity by one of the apices.

HEAVY-SPAR.

Some veins of this mineral occur at the Garltons; they are of the foliated variety, yellowish and brownish-white, and a few inches in thickness; they intersect the same beds as the veins of jasper, and run very nearly in the same direction. The veins I have found at Pencraik, and in other places, are not half an inch wide.

CALC-SPAR.

Small veins of this spar are observable in every part of the formation. At North Berwick, they are found a few inches wide, traversing the trap-tuff. They are yellowish and reddish-white, and the tendency to assume the prismatic form, gives them at the edges a fibrous appearance; and these fibres are, in all the cases examined, perpendicular to the walls of the vein. When a great number of these veins are exhibited together, the principal ones have always the same general direction.

Owing to the covered state of the country, I have not been able to satisfy myself as to the direction, inclination and dip of veins.

It may be worth observing, in a controversial or theoretical point of view, the very unfrequent occurrence of veins of these trap-rocks, or what are very improperly called whin-dikes, intersecting the subjacent strata of this county, one-half of which is covered by trap. We should certainly expect, that if this immense mass of trap, or, as it is sometimes called, whin, was erupted from below by an expansive effort, the regular strata of the country would be rent asunder in all directions, and dikes, interjected beds, contortions, dislocations, and indurations, would present themselves at every step. But what is the fact? The arrangement of the strata is perfectly undisturbed, and not more than three or four dikes are to be seen in the whole country.

As to the appearances of the walls of veins, I am enabled to assert with confidence, and exemplify by specimens, that in the whole of my examination, decomposition and disintegration occur much more frequently than induration or compactness.

XXV. *On the Coal-formation of Clackmannanshire.*

By R. Bald, Civil Engineer, Alloa.

[Read 8th April, and 13*th May* 1809, *and* 7*th April* 1810.]

SECTION I.

The main coal-field of Clackmananshire is situated upon the north-west boundary of the coal-district of Scotland; and, according to all the trials and observations which have been made, it appears, that no series of thick or workable beds of coal are to be found any where farther west and north of the river Forth, although at the same time it is probable, thin seams of coal, or detached beds, may be yet found in that direction.

This coal-field is bounded on the north by that beautiful range of mountains named the Ochils;

upon the south by the river Forth, which divides the county from Stirlingshire; on the west by the Carse of Stirling; and on the east by strata of the coal-formation, extending through the county of Fife to the river Eden, near St Andrew's.

North of the Ochils no mines of coal have been seen, nor any to the west of the Clackmananshire coal-field, north of the Forth. But coal-mines are found in abundance both to the south and east.

The Wood Hill of Alva, the property of James Johnston, Esq; may be considered as the base of the coal-field now to be described.

I. Alluvial Rocks.

From the summit of the Wood Hill to the bottom of the face, where the Alva House court of offices are built, there is little cover of soil; there being much naked rock, and small, loose angular stones broken from the hill strata. At the bottom of the face a great bank commences, composed, to a certain depth, of earth and stones, apparently formed from the mountain face; this bank continues southward till it join the recent alluvial soil formed by the river Devon; which soil extends to very near the Devon Iron-works.

This alluvial soil is very fertile, and is known in Scotland by the name of *Haugh-ground*. It is composed of a mixture of fine sand and clay, and adjoining the hill-foot, it is very much mixed with stones. Shells of the mya, or fresh-water mussel, are found in it, and also trunks of oak trees. One of these oaks, of very great size, is to be seen north from the Devon iron-works.

The depth of this soil has not been ascertained, as no pits or bores have been put down in the line of section. From the south boundary of the recent alluvial soil of the Devon, to the north boundary of the recent alluvial soil of the river Forth, the rock cover is composed of a stiff red coloured clay, commonly known by the name of *Till*. It does not seem to follow any general rule as to thickness. In this district, the swelling arable ground south of the Ochills is frequently entirely composed of this till; but this is not without exceptions. We have seen it in thickness from one foot to a hundred and sixty-two feet. This uncommon depth or thickness occurred in the rising ground immediately north from the town of Alloa.

With respect to the composition of this cover, it appears to be of clay, with sand intimately mixed, so as to render it quite impervious to water: with these are mixed great numbers of small smooth stones, such as occur in the beds of rivers, and also large smooth boulder-stones, of every colour, known by the general name of Whinstone. Besides this mixture, there are to be found a great many small pieces of splint and rough coal, also sandstone of various shades, particularly white and light-red, varieties of argillaceous schistus, termed *Blaes*, and pieces of ironstone. In short, there are to be found, mixed with the till, specimens of almost all the strata of the adjoining coal-field; and it is somewhat remarkable, that these fragments are in general quite sharp in the angles, and very little worn.

In piercing through this cover, few or no sand-beds occur; and the only change perceptible from the Devon alluvial soil to the alluvial soil of the Forth, in the line of section, is in the Meadow Hill, and in the two fields adjoining. In the park north of it, there is a quantity of peat-earth near the surface; and in the Meadow Hill, besides the till, are water-gravel and beds of sand. The Meadow Park is composed of about six feet of loose peat soil, under which is a bed of clean gravel, composed of such stones as are found in brooks immediately adjoining the Ochill Hills. And there is a deep, strong and plastic clay adjoining Brathy Burn.

In this immense bed of till, we have never found the remains of trees, or of any organised body; which seems remarkable.

Where this till was cut through to the great depth of 162 feet, as before mentioned, the lower six inches of it, which rested upon the coal strata, was quite different from all which was above it; it appeared to have been deposited from water in the most quiescent state, as it was divided into the finest laminæ, not thicker than imperial paper; and when a thick piece was taken up, these laminæ could be separated and turned over like the leaves of a book; and their tenacity and flexibility was considerable, being very much similar to fine bread paste, rolled out very thin. This was the only instance we have seen of this sort of clay. After it was dried for about fourteen days, it grew very hard; and when thrown into the fire, decrepitated with much noise. The till, when brought to the surface, is very sterile, and remains long exposed before any plants strike upon it; the common thistle is the first which appears.

From the south boundary of the till cover, the recent alluvial soil of the Forth commences, and continues in the line of section 3720 yards, when it joins the Forth. It is nearly level; part of it is even under high-water mark, and is secured from being overflowed by embankments. Upon an average, it declines from the horizon at an angle of only 15 minutes. This alluvial soil is commonly known by the name of *Carse;* it is composed of clay and a mixture of fine sand, being fit for making bricks and tiles. In general, a few feet below the surface, an inferior clay is found, mixed with light red-coloured clay-pipes, which are probably formed by insects. Below this it is found of a softer consistence, with apparently more sand, and of a dark-blue colour, commonly known by the name of *silt* or *sleech*, that is, sludge. This soil varies in depth, being from a few feet to nearly 100 feet. About a mile west from the harbour of Alloa, a bore was put down near 90 feet ere it reached the rock; and so soft was this silt, that we accomplished two of these bores in one day. It is to be remarked, however, that the surface above this silt is as good, firm, arable land as any in the district. A great extent of this rich carse has been formed on both sides of the river, and is of great value.

There are few or no stones mixed with this soil; but adjoining the till-district large round blocks of greenstone are found at the surface, which are far detached from any great mass or bed of this kind of rock.

Below this soil, and close to the rock strata, we in general find a stratum composed of sand mixed with sea-shells; and the most common kinds of these shells are as follows:

Ostrea edulis,	-	Common oyster.
Mytilus edulis,	-	mussel.
Cardium edule,	-	cockle.
Turbo littoreus,	-	buckie.
Donax trunculus.		
Patella vulgata,	-	limpet.

Of these, the ostreæ are large, and to appearance have been of great age when deposited in their present bed, as some of them are more than half an inch thick, and composed of numerous thin laminæ. The mytili are in general quite soft and friable, and they cannot be taken from their place in general without breaking.

Some time ago, the shell of a common crab was found in the clay near Alloa, when digging an arc for a mill-wheel; and near the same place, entire stags horns and broken pieces have been found; and it is common to find large pieces of oak trees, quite fresh, though of a very dark colour.

These are the particulars which have occurred to me respecting the alluvial rocks or soil that rest on the coal formation, which we are next to describe.

SECTION II.

COAL FORMATION.

Having in the preceding section treated of the alluvial soil which covers the strata of Clackmanan, we shall now give a general description of the strata, the beds of coal, and the great slips which occur in this district.

We have but few opportunities of examining that part of the strata which is next the earth cover, excepting in the quarries which have been opened, and pits which have been sunk: from these, however, we have this general remark to make: That the corners of the strata, under the carse soil, are very much rounded, and apparently water-worn. Under the till or coarse clay, the corners are much more acute, and the strata are cut off, or meet the clay-cover with abrupt faces or steps, which are always formed by a natural crack or fissure, termed by miners a *back* or *cutter*, nearly at right angles to the line of dip.

The coal-formation, or main coal-field of the county, is divided into three distinct fields, formed by two great slips, termed the *Great South Slip* and *Great North Slip*; and the fields are named the North Field, the Mid Field, and South Field, upon all of which great and extensive collieries have been erected.

In the following general description, we must begin about the middle of the North Field, and proceed southward to the Forth; because that part of the North Field betwixt the Devon works and the Ochill mountains, not having been explored with sufficient accuracy, we can only offer some ideas regarding it, assumed upon rational principles.

The strata having been ascertained as far north as that part of the country where the Devon Iron-works are built, we begin at that point. Towards the crop of the strata, the dip is at an angle of

6°, or nearly 1 in 9; farther a dipping, the angle is 10°, or nearly 1 in 6.

The strata which are found alternating with the coal in the three fields, are,

Red-coloured sandstone, from friable to very hard.

Common sandstone, dark-grey colour to nearly a pure white; from a soft and friable state to very hard.

Dark-coloured varieties of slate-clay.

Varieties of red-coloured slate-clay.

Bands and balls of clay-ironstone.

Bituminous shale, comparatively in small proportion.

The workable seams of coal found in the North Field are as follows:

	Yds.	Ft.	In.
To the first coal is in depth	22	0	0
A. A coal, - -	0	3	0
Various strata, -	18	0	0
B. A coal, - -	0	2	6
Various strata, -	12	0	0
C. A coal, - -	0	3	0
Various strata, -	32	0	0
D. A coal, - -	0	3	0
Various strata, -	9	0	0
E. A coal, - -	0	5	0
Various strata, -	9	0	0
F. A coal, - -	0	4	0

		Yds.	Ft.	In.
	Various strata, -	22	0	0
G.	A coal, - -	0	9	0
	Various strata, -	66	0	0
H.	A coal, - -	0	3	0
	Various strata, -	10	0	0
I.	A coal, - -	0	5	6
	Various strata, -	10	0	0
K.	A coal, - -	0	3	6
	Various strata, -	28	0	0
L.	A coal, - -	0	4	6
		238	0	0
	Coals *, - -	0	46	0

The measures are reckoned from the pavement of one coal to the pavement of the next; and the distances are nearly the average, taken at different places of the field.

* There are other thin seams, which at present are reckoned *unworkable*, being under thirty inches thick; but this is an indefinite term, as the thickness of coals reckoned workable, is regulated in precise proportion to the scarcity of fuel in that district of country where coal is wrought. For example, under peculiar circumstances, we have seen a coal wrought of only six inches thick. The seams of coal in Clackmananshire being numerous, and many of these above three feet thick, the lesser seams are at present of no value, and quite disregarded. When the individual strata are treated of, these seams will be taken notice of.

The coal L. is the lowest which has been wrought in the main coal field. The peculiar character of each seam will be afterwards taken notice of.

Each of these coals continues to rise from the dip southward, till it meets the earthy cover or clay, excepting the seams I. K. L. These three coals are cut off by the Great North Slip.

The Great North Slip, from the few points where we have had an opportunity of examining it below ground, makes an angle with the horizon of 60°; it forms a fissure in the strata, varying in width from four inches to nearly four feet. This fissure is filled compactly with pieces of sandstone, slate-clay, and clay ironstone; in short, with a mixture of all the adjoining strata. The sides of the fissure are commonly pretty smooth, and in some places have a glossy or polished surface.

Immediately south, and close to the north slip, the Mid Coal Field commences, and the coals dip at an angle of about 10°, or nearly 1 in 6.

		Yds.	Ft.	In.
	To the first coal, is in depth, -	26	0	0
A.	A coal, - -	0	3	0
	Various strata, -	18	0	0
B.	A coal, - -	0	2	6
	Various strata, -	12	0	0
C.	A coal, - -	0	3	0
	Various strata, -	32	0	0

		Yds.	Ft.	In.
D.	A coal, - -	0	3	0
	Various strata, -	9	0	0
E.	A coal, - -	0	5	0
	Various strata, -	9	0	0
F.	A coal, - -	0	4	0
	Various strata, -	22	0	0
G.	A coal, - -	0	9	0
	Various strata, -	86	0	0
H.	A coal, - -	0	3	0
	Various strata, -	11	0	0
I.	A coal, - -	0	5	0
	Various strata, -	11	0	0
K.	A coal, - -	0	3	6
	Various strata, -	26	0	0
L.	A coal, - -	0	1	8
		262	0	0
	Coal, - -		42	8

The coals also rise from the dip, or from the Great North Slip, southward till they successively meet the clay or alluvial covering. All the coals of this field, from A. to G. inclusive, were wrought long ago, and are now full of water; but the position of these coals and strata are ascertained, by examining the crop of the coals, and from the report of the oldest colliers who live in the district.

Below the coal L. no very accurate borings have been made; and of this we are certain, that no good thick seams of coal have been found lower, but that there are many thin coals is evident, as we see them cropping a little west from the line of section where the alluvial soil of the Forth commences.

The south field of coal begins a little beyond the river Black Devon, immediately south of the Great South Slip, which slip is similar to the Great North Slip. The coals dip at 11°, or nearly 1 in 5.

Immediately under the clay or alluvial cover there is

		Yds.	Ft.	In.
	A coal, - -	0	6	0
	Various strata, -	23	0	0
	A coal, - -	0	2	6
	Various strata, -	7	0	0
E.	A coal, - -	0	5	0
	Various strata, -	53	0	0
G.	A coal, - -	0	9	0
	Various strata, -	20	0	0
	A coal, - -	0	2	6
	Various strata, -	66	0	0
H.	A coal, - -	0	3	0
	Various strata, -	14	0	0
I.	A coal, - -	0	3	6
	Various strata, -	10	0	0
K.	A coal, - -	0	2	8
		193	0	0
	Coals, - -		34	2

No accurate borings have been made below the last coal K.

At about 426 yards southward from the crop of this coal, a reverse dip of the strata takes place; but the angle it makes with the horizon has not been ascertained. This reverse, or south dip continues across the river Forth, and we find that the strata at the Dunmore Colliery, on the other side of the river, correspond with this new inclination. The bearing of this new dip crosses the line of section in an oblique direction, but as there is no visible alteration to be observed at the surface of the ground, we have not yet been able to determine, whether this alteration in the dip is produced by a *slip* or *dike*, or simply by the inflection of the strata, termed by miners a *Saddle*.

We now return to the north point, at the Devon Iron-works, where we began the general description of the strata. There, we have every reason to suppose, that the coals before mentioned continue to dip northward, because we see evidently, that the crops of the strata cross the Devon river towards the hills, with a bold sweep both to the west and east of the line of section.

The cover of earth being deep at the bottom of the Woodhill face, and no operations having been carried on in coal-mining there, we cannot exactly state how the coal-strata dip at that precise spot; but we have every reason to conclude, that they are laid upon the hill face at an angle of

40° with the horizon, and parallel with the hill face, as we find them nearly in that position; but making a greater angle at the Silver Burn Glen, upon the west side of the hill, and in the Westertown Glen on the east side of the hill. Both these glens present a most interesting display of the strata, the water having cut down the several beds of stone, and brought to view the precise junction of the coal-formation with the Ochill hills. These mountains, I conclude, belong to those termed *Transition* according to the celebrated Werner; and the relative position and importance of these rocks in mineralogy, have been ably illustrated by Professor Jameson in his different works.

SECTION III.

OF THE COAL-FORMATION IN THE NORTH COAL-FIELD.

We have now to describe the strata which have been perforated in sinking pits in the Main Coal Field of Clackmananshire.

A point immediately adjoining the Devon Iron-works, on the North Coal Field, is pitched upon, as being the place where the strata have been accurately ascertained, and that to a greater depth than in any other place of the county.

In order to give a clear and distinct view of the structure and materials of the district, the following section has been drawn up in the tabular form. All the various strata are precisely laid down from actual measurement, and in their natural order. On the right hand side are columns of fathoms, feet and inches, shewing the thickness of each individual stratum. There are also two columns, containing the common provincial names of each, with the corresponding systematic or Wernerian names.

The whole depth is 117 fathoms two feet, equal to 704 feet, the fathom containing six feet English measure. The alternating strata are 141 in number.

Below No. 141. no accurate borings have ever been made, upon which any confidence can be placed. In the section are 24 seams or beds of coal, from two inches to nine feet in thickness, the whole of which, when added together, amount to 59 feet 4 inches of coal.

These coals are either slate-coal, or cubical coal; a few of them are altogether slate-coal, but generally they are composed of a mixture of both kinds.

With respect to quality, they are all of the open burning kind, having little or no tendency to cake; and none of the blind or glance-coal is found amongst those now enumerated.

To shew in a still clearer point of view the kinds of strata mentioned in the section, I have herewith sent specimens of the whole, which have been collected upon the spot.

SECTION

OF THE

STRATA

Of the Main Coal-Field of the County of Clackmanan, extending to the depth of 704 Feet.

Numbers.	*Provincial Names.*	*Wernerian Names.*	Fathoms.	Feet.	Inches.
1	Earth or soil, -	Earth or soil, -	0	4	0
2	Red post-stone,	Red sandstone, -	11	2	4
3	Soft blaes, -	Slate-clay, -	0	4	9
4	Ironstone band,	Ironstone bed,	0	0	3
5	Blaes with grey faikes, -	Slate-clay, with slaty sandstone, -	1	2	2
6	*Coal,* -	*Cubical coal,* -	0	1	6
7	Pavement-metal and grey post, -	Indurated clay and grey sandstone, -	0	4	0
8	Hard white post, -	Hard white sandstone,	0	5	2
9	Grey post, -	Grey sandstone, -	0	4	4
10	Blaes, -	Slate-clay, -	1	0	5
11	*Coal,* -	*Cubical coal,* -	0	1	8
12	Pavement-metal, -	Indurated clay, -	0	1	0
13	Blaes with iron balls	Slate-clay, with ironstone balls, -	2	3	0
14	Strong grey faikes,	Grey slaty sandstone,	2	0	3
15	*Coal,* -	*Cubical coal,* -	0	2	0

Nos.	Provincial Names.	Wernerian Names.	Faths.	Feet.	In.
16	Pavement-metal, -	Indurated clay,	0	2	5
17	Hard white post, -	Hard white sandstone	1	3	3
18	Grey faikes, -	Grey slaty sandstone,	1	0	0
19	Black bands, with iron-stone, -	Black slate-clay with iron-stone, -	1	0	4
20	Hard grey-stone, -	Hard grey sandstone,	1	3	4
21	*Coal*, -	*Cubical coal*, -	0	0	2
22	Bandswith iron-stone,	Slate-clay with iron-stone, -	1	3	8
23	*Coal*, -	*Cubical coal*, -	0	3	6
24	Grey metal, -	Indurated clay,	1	4	0
25	Ironstone band, -	Ironstone beds,	0	0	3
26	Strong grey faikes,	Grey slaty-sandstone,	2	0	0
27	Hard white post, -	Hard white sandstone	4	5	0
28	Blaes, -	Slate-clay, -	1	0	0
29	Grey faikes, -	Grey slaty sandstone,	1	0	0
30	Hard grey metal, with faikes, -	Indurated clay, with slaty sandstone,	1	3	0
31	Blaes, -	Slate-clay, -	0	3	0
32	*Coal*, -	*Cubical coal*, -	0	3	0
33	Pavement-metal, -	Indurated clay,	0	1	6
34	Hard grey-stone, -	Hard grey sandstone,	0	5	0
35	Grey-stone, -	Grey sandstone,	2	0	0
36	Ring-stone post, -	White sandstone,	0	3	9
37	Blaes, -	Slate clay, -	0	2	0
38	*Coal-splint*, -	*Slate-coal*, -	0	5	2
39	Pavement-metal, -	Indurated clay,	0	0	9
40	*Coal*, -	*Cubical coal*, -	0	3	1
41	Grey metal, -	Grey sandstone with clay, -	1	3	4
42	Grey-stone, with iron-stone, -	Grey sandstone with ironstone, -	0	4	7
43	*Coal*, -	*Cubical coal*, -	0	2	0
44	Black-band, -	Dark indurated clay,	0	0	2
45	*Coal*, -	*Cubical coal*, -	0	2	2
46	Grey post, -	Grey sandstone, -	1	2	10
47	Hard red-stone, -	Hard red sandstone,	0	1	0

Nos.	*Provincial Names.*	*Wernerian Names.*	Faths.	Feet.	In.
48	Strong grey post, -	Grey sandstone, -	1	3	0
49	*Coal,* -	*Cubical coal,* -	0	2	0
50	Pavement-metal, -	Indurated clay, -	0	1	1
51	Hard white post, -	Hard white sandstone	0	3	0
52	*Coal,* -	*Cubical coal,* -	0	1	11
53	Pavement-metal, -	Indurated clay,	0	1	5
54	Grey faikes, -	Grey slaty sandstone,	1	1	4
55	*Coal,* -	*Cubical coal,* -	0	0	5
56	Soft grey metal, -	Indurated clay, -	0	1	8
57	White post, -	White sandstone,	1	0	0
58	Blaes, with ironstones	Slate-clay, with iron-stone beds, -	0	2	5
59	Black-stone, with iron-stone and parrot blae, -	Dark slate-clay, with iron-stone and bituminous shale,	0	0	8
60	*Coal, splint and rough*	*Slate and cubical coal*	1	3	0
61	Pavement-metal, -	Indurated clay, -	0	2	11
62	Grey post striped,	Grey sandstone striped, -	4	4	6
63	Blaes, -	Slate clay, -	0	1	6
64	*Coal,* -	*Cubical coal,* -	0	2	8
65	Pavement-metal, -	Indurated clay, -	0	2	4
66	Red blaes, -	Red slate-clay, -	0	1	5
67	*Foul coal,* -	*Coal mixed with stone,*	0	0	5
68	Pavement-metal, -	Indurated clay, -	0	3	3
69	White stone, -	White sandstone,	0	1	0
70	Grey faikes, -	Grey slaty sandstone,	0	2	3
71	White stone, -	White sandstone,	0	1	1
72	Blaes, -	Slate-clay, -	0	1	8
73	*Coal,* with a rib of stone in it, -	*Coal* with a bed of dark clay sandstone, -	0	1	4
74	Pavement-metal, -	Indurated clay, -	0	4	7
75	Red stone, -	Red sandstone, -	1	4	3
76	Red stone, hard as flint	Hard red sandstone,	0	2	11
77	Blaes, with ironstone,	Slate-clay with iron-stone, -	1	5	7

Nos.	Provincial Names.	Wernerian Names.	Faths.	Feet.	In.
78	*Coal,* -	*Cubical coal,* -	0	0	6
79	Pavement-metal, -	Indurated clay, -	0	4	10
80	Grey faikes, -	Grey slaty sandstone,	2	3	9
81	Grey stone, with hard bands, -	Grey sandstone, with hard strata, -	0	5	5
82	White stone, with veins of coal, -	White sandstone, with veins of coal, -	1	1	10
83	Red blaes, -	Red slate clay, -	2	1	7
84	Red stone, with a band desperately hard, -	Red sandstone, with a very hard bed, - -	1	4	9
85	Red blaes, -	Red slate-clay, -	1	2	9
86	*Coal,* -	*Cubical coal,* -	0	1	7
87	Striped white stone,	White sandstone striped, -	0	0	11
88	Blaes, -	Slate-clay, -	0	1	3
89	Pavement-metal, -	Indurated clay, -	0	4	3
90	White stone, -	White sandstone,	0	1	2
91	Blaes, -	Slate-clay, -	0	1	3
92	Dogger bands, -	Coarse iron stone strata, -	0	0	7
93	Blaes, -	Slate-clay, -	0	5	6
94	Pavement-metal, -	Indurated clay, -	1	1	7
95	Black blaes, with *coal,*	Dark slate-clay, with coal, -	0	2	3
96	Blaes, -	Slate-clay, -	0	4	1
97	White stone faikes,	White slaty sandstone	0	1	10
98	Grey faikes, -	Grey slaty sandstone,	0	1	0
99	Blaes, -	Slate-clay, -	0	1	5
100	*Coal,* -	*Cubical coal,* -	0	1	5
101	Pavement-metal, -	Indurated clay, -	1	1	9
102	Grey faikes, -	Grey slaty sandstone,	1	1	3
103	White stone, -	White sandstone,	3	5	4
104	*Coal, rough and splint*	*Cubical and slate coal,*	0	5	3
105	Blaes with bands,	Slate-clay, with beds of sandstone,	1	2	0
106	Black blae, -	Dark slate-clay, -	0	1	10

Nos.	Provincial Names.	Wernerian Names.	Faths.	Feet.	In.
107	Hard white stone,	Hard white sandstone	0	0	7
108	Blaes with bands, -	Slate-clay with beds of sandstone, -	0	1	11
109	*Coal splint*, -	*Slate coal*, -	0	2	9
110	Pavement-metal, -	Indurated clay, -	0	1	6
111	Hard blae, -	Hard slate clay,	0	2	5
112	Hard white stone,	Hard white sandstone	0	0	5
113	Strong blae, -	Hard slate-clay, -	0	1	10
114	White stone, -	White sandstone,	1	0	10
115	Hard white stone,	Hard white sandstone	0	1	6
116	Blaes, -	Slate-clay, -	0	0	6
117	Blaes with coal scours	Slate-clay mixed with coal, -	0	2	6
118	Pavement-metal, -	Indurated clay, -	0	5	6
119	Hard ribs, -	Hard stratified sandstone, -	1	0	3
120	Blaes, -	Slate-clay, -	0	1	6
121	Hard White stone,	Hard white sandstone	0	1	9
122	Hard blae, -	Hard slate-clay,	1	0	4
123	White stone, -	White sandstone,	0	5	3
124	Grey Stone, -	Grey sandstone, -	0	1	9
125	Blaes, -	Slate-clay, -	0	0	9
126	Grey stone, -	Grey sandstone,	0	1	10
127	Blaes, -	Slate-clay, -	0	1	2
128	Grey stone, -	Grey sandstone, -	0	3	2
129	Blaes, -	Slate clay, -	0	3	4
130	Hard white stone,	Hard white sandstone	0	0	9
131	Hard hard white stone and blaes, -	Hard white sandstone and blaes, -	0	2	11
132	Hard white stone,	Hard white sandstone	0	3	10
133	Blaes with bands,	Slate-clay, with beds of sandstone, -	0	3	1
134	*Coal*, -	*Cubical-coal & slate-coal*, -	0	2	2
135	Blaes, -	Slate-clay, -	0	4	1

Nos.	*Provincial Names.*	*Wernerian Names.*	Faths.	Feet.	In.
136	*Coal,* -	*Cubical-coal & slate-coal,* -	0	[illegible]	8
137	Pavement-metal,	Indurated clay, -	0	[illegible]	9
138	Hard grey stone,	Hard grey sandstone.	0		5
139	Blaes with white stone bands, -	Slate-clay, with white sandstone beds,	1	[illegible]	11
140	Grey stone, -	Grey sandstone, -	0	1	0
141	Blaes with bands,	Slate-clay, with beds of sandstone,	0	2	4
		Fathoms,	117	1	11

In the middle and south fields, the strata cannot be accurately ascertained to the same depth; but, before concluding the account of this coal district, we shall collect all the facts relative to the stratification of these, that we may compare what analogy there may be in the arrangement of the various minerals in the three different fields formed by the two Great Slips.

The strata of the section lie in the most regular order, almost similar to the leaves of a book, excepting when they are deranged with (what is termed by miners) *troubles*, viz. dikes, slips and hitches; but of these, and the variations of thickness of the same individual strata, we shall treat afterwards.

With respect to the organic remains generally found in coal strata, abundance of them are found in the Clackmananshire coal-field. Those which occur in the earth cover or alluvial soil have already been noticed.

In the strata a great many varieties of the impressions of vegetables and of shells are found. The slate-clay abounds with delicate impressions of moss plants, ferns, and reeds. The indurated clay, with impressions of large plants, the form of which can only be indistinctly traced. The ironstone abounds chiefly with petrified mussels, with a few of the jointed reed species. The sandstone, and in particular what is near a bed of coal, has in general great numbers of the jointed reeds in it, fully formed, that is, of their natural shape, only a little compressed; and the interior of these is commonly covered with coal.

It is remarkable, that in no instance have we found petrified shells in the sandstone strata of Clackmananshire; and in the slate-clay, petrified shells are always composed of ironstone, of which the slate-clay is the matrix or bed. Many of the ironstones are very full of petrified mussels, and some of them seem to be a complete congeries of shells. The immediate roof of the coal is frequently covered with impressions of large trees, which, from their singular appearance, are termed by the miners *plough-furrows*.

Among the vegetable impressions, a great many belong to the class Cryptogamia; but the order or genera are not easily ascertained. It would require a very expert botanist to arrange them systematically. Many of the plants are not indigenous to Great Britain; nay, many of them are not so even to Europe. Among the specimens sent, those of the reed, Arundo, and palm-trees, are peculiar to tropical climates. These facts give rise to many theories respecting the formation and vast changes which have taken place in our globe.

Of the mussels, no recent specimens are now to be found in the district; they are similar to the fresh-water mussel, Mytilus anatinus, but they are less than those now found in the district.

Of these organic remains, I have sent specimens of such of the varieties which have come within my observation.

The stratification of the coal-field immediately adjoining the Ochill Hills will be described in a ure communication.

XXVI. *On the Gaseous Combinations of Hydrogen and Carbon.*

By Thomas Thomson, M. D. F. R. S. E.

[*Read 21st July* 1810.]

The gases formerly distinguished by the name of *heavy inflammable airs*, which are evolved during the distillation of most animal and vegetable substances, differ so much from each other in their properties, that it has been hitherto impossible to reduce them under a small number of species. When burnt, they all yield carbonic acid and water, and of course contain carbon and hydrogen; but the proportion of these bodies formed, and of oxygen consumed during the combustion, varies very much at different times. Many of these gases have been examined with much address by Cruickshanks, Dalton, and Henry. Berthollet also has examined them at different times, and published very ingenious dissertations on their composition.

From a great many experiments on these gases, at different times, and in different states, I have convinced myself that they usually hold an empyreumatic oil in solution, and that the differences in their specific gravity, and other properties, depend very much upon the proportion of oil present. Hence no pure gases, fit for examination, and comparable with each other, can be obtained from those vegetable or animal substances which yield an oil when subjected to heat, as is the case with most of them. To this oil is to be ascribed the great variation in the specific gravity of the gas obtained by distilling pit-coal, as shewn by the experiments of Dr Henry.

When water and carbon are present together, as is the case in most animal and vegetable substances, they act on each other, and give origin to variable quantities of carbonic oxide, which must also very much alter the properties of the gas evolved. To these two causes, namely, the oil dissolved, and the carbonic oxide formed, most, if not all the varieties in the combustible gases, obtained from animal and vegetable substances, are owing.

Berthollet, in a dissertation which he lately published, in the second volume of the *Mémoires d'Arcueil*, has endeavoured to prove that all the heavy inflammable gases contain oxygen as a constituent. He has examined a number of gases obtained by distilling charcoal, and has shewn, that each of them contained a considerable proportion of oxygen. This opinion has likewise been maintained by Mr Murray, in his System of Chemistry.

If any confidence can be put in the preceding observations, it is clear, that this obscure subject can never be elucidated by examining gases from charcoal, or from animal and vegetable substances. The first will always yield carbonic oxide as well as carbureted hydrogen, and the gas from the other bodies will be disguised by the oil held by it in solution.

Analogy is strongly in favour of the common opinion, that there exists a gas composed simply of hydrogen and carbon. Hydrogen, we know, is capable of dissolving every other simple combustible, sulphur, phosphorus, and boracium. It dissolves likewise several of the metals, as arsenic, zinc, tellurium, and potassium. Why then may it not be capable of dissolving carbon?

There is a gas which rises in considerable quantity from stagnant waters during the summer season. It was examined by Cruickshanks and Dalton, and both of them concluded it to be a compound of carbon and hydrogen, without any sensible quantity of oxygen. But as neither of these gentlemen has published a detailed account of their experiments, I thought it worth while to examine the gas anew, in order, if possible, to determine the point in a satisfactory manner. I accordingly collected considerable quantities of it at different times in the neighbourhood of Restalrig, where ponds of muddy water are left stagnant, in order to collect manure. This gas I found to have the following properties.

1. It is colourless, and transparent like air.

2. It has no smell, and no sensible taste, provided it be previously washed in clean water.

3. It always contained a mixture of carbonic acid. The least quantity of this gas present was 5 *per cent.*; the greatest $7\frac{1}{2}$ *per cent.*

4. It always contained a mixture of common air. It is remarkable, that the proportion present was in every case the same, and amounted to 12.5 *per cent.*, or 2.5 *per cent.* of oxygen and 10 *per cent.* of azote. Mr Dalton says, that the gas which he examined contained 20 *per cent.* of azote. This was never the case with the gas from Restalrig; but the common air and carbonic acid gas together sometimes amounted to 20 *per cent.*, and always to near that quantity.

5. After depriving it of its carbonic acid, I found its specific gravity 0.611, that of air being 1.000. But as it contained a mixture of 12.5 *per cent.* of air, it would have been obviously lighter, if this portion had been removed. By calculation

I find, that the specific gravity of the pure gas would have been 0.5554 *.

My method of taking the specific gravity of gases being extremely simple, yet precise, I think it worth while to describe it in this place. It is founded on the well-known fact, that when two gases are mixed, their bulk does not alter. I have a large flask fitted with a stop-cock. I weigh this flask very accurately, then exhaust it, and weigh it again. Let the loss of weight be a. I then fill the flask with the gas whose specific gravity I want, and weigh it again. If the weight of the flask be the same as at first, it is obvious that the gas has exactly the specific gravity of common air. If it be heavier than at first, the gas is heavier than common air; if lighter, the gas is lighter than common air. Suppose the flask lighter than at first, I add weights till the flask is exactly poised. Let the weight added be b. We have the weight of common air to that of the gas as a to $a-b$. And to find the specific gravity, we have this proportion, $a : a-b :: 1 : x =$ specific gravity wanted, or $x = \frac{a-b}{a}$. If the flask is heavier than at first,

* Let $x =$ the specific gravity of the pure gas, $A =$ the quantity of air in the mixture, $a =$ the specific gravity of air, $B =$ quantity of pure gas present, $c =$ specific gravity of the mixture, we have $x = \frac{(A+B)c - Aa}{B}$.

weights are added to the other scale, till it is exactly poised; let these weights, as before, be b, we have in this case $x = \frac{a+b}{a}$. In this process no correction is necessary for temperature, nor the state of the barometer; because air and all gases undergo the same change of bulk, by changing the temperature and the pressure. The gas is always weighed, saturated with moisture. This is corrected when requisite by the table of Dalton. In this way the flask may be easily weighed, true to the $\frac{1}{100}$dth part of a grain; so that you are always sure of the specific gravity of the gas, to the 3d decimal figure. The specific gravity of common air is always taken 1.000, and at the temperature of 60°, barometer at 30 inches; 100 cubic inches of it weigh 30.5 grains. These data enable us to determine the weight of 100 cubic inches of any gas whose specific gravity is known. Mr Dalton found the specific gravity of this gas 0.600. I took its specific gravity more than once, and collected at different times, but never found it heavier than 0.5554.

6. The gas from stagnant water burns with a yellow flame, more readily, and with a larger flame, than any other combustible gas, except olefiant gas, and the vapour of ether.

7. When mixed with oxygen gas, and kindled by an electric spark, it detonates loudly, and undergoes a considerable diminution of bulk. Its

combustibility by this process is confined within very narrow limits. It does not burn unless the bulk of the oxygen rather exceeds its own bulk, and it ceases to burn when the oxygen gas is more than $2\frac{1}{4}$ times the bulk of the inflammable gas. The limits of combustion, according to my trials, are 100 measures of inflammable gas, and 105 or 227 measures of oxygen gas. A mixture of 100 measures of inflammable gas, with 282 or 292 measures of oxygen gas does not burn.

8. A good many experiments on the combustion of this gas with oxygen by electricity, give the following general result: 100 measures of the inflammable gas consume 205 measures of oxygen gas, and 104 measures of carbonic acid gas are formed. This result very nearly agrees with the experiments of Mr Dalton, who found, as I have been informed by Dr Henry, that 100 measures of this gas require for combustion 200 measures of oxygen gas, and form 100 measures of carbonic acid. The following table contains a few of the experiments which I made upon this gas. The others were precisely of the same kind, and coincided with these as nearly as possible.

The oxygen gas used contained 12 *per cent.* of azote. It had been prepared from hyperoxymuriate of potash, and, when recent, contained only 1 *per cent.* of azote. It had been kept above a year in a crystal bottle well stopped; but had been often opened, and portions of it used during the interval. The bottle was now half-full of water. The purity of this gas was tried just at the time of making the following experiments, by exposing it to hydroguretted sulphuret of lime in the usual way. The nitrous gas employed contained, by the test of sulphate of iron, 11.5 *per cent.* of azote. The inflammable gas had been freed from carbonic acid, but it contained 13.5 *per cent.* of common air.

	Measures of inflammable gas.	Measures of oxygen.	Bulk of residue.	Bulk of do. when washed in lime-water.	Measures of nitrous gas added to do.	Bulk of residue.	Bulk of do. washed in sulphate of iron.
1	25	50	31	9	22	24	9
2	25	60	40	17	40	30	12
3	20	55	Does not burn.				
4	25	55	44	38	88	42	18
5	25	50	31	8.5	39	32	10
6	40	35	Does not burn.				
7	40	40	Burns.				

From this table, and our knowledge of the constituents of the gases used, it is easy to deduce the following:

	Gases mixed.				Carbonic acid formed.	Residue.	Composition of Residue.	
	Pure inflammable gas.	Pure oxygen.	Azote.	Total.			Azote.	Oxygen.
1	21.6	44.7	8.7	75	22	9	8.7	0.3
2	21.6	53.5	9.9	85	23	17	9.9	7.1
3	17.3	48.9	8.8	75				
4	2.16	49.1	9.3	80	6	38	9.3	29
5	21.6	44.7	8.7	75	22.5	8.5	8.7	0
6	34.6	31.9	8.5	75				
7	34.6	36.3	9.1	80				

Of these experiments, the 1st, 2d and 5th are the only ones from which the proportion of oxygen consumed, and of carbonic acid formed, can be deduced. They were repeated very often, in order to insure as much accuracy as possible. The following is the result which they give:

Inflammable gas consumed.	Oxygen gas consumed.	Carbonic acid gas formed.	
21.6	44.7	22	
21.6	43.6	23	
21.6	44.7	22.5	
21.6	44.3	22.5	average.
100	205	104	aver. *per cent.*

9. From these experiments it is easy to deduce the composition of this inflammable gas. Its specific gravity being 0.555, 100 cubic inches of it, at the temperature of 60°, and when the barometer stands at 30 inches, will weigh 16.93 grains.

Of the 205 cubic inches of oxygen gas consumed, 104 go to the formation of carbonic acid gas; the remaining 101 cubic inches must have combined with hydrogen during the combustion, and formed water. Hydrogen, in the gaseous state, combines with exactly half its bulk of oxygen gas; therefore the hydrogen, which went to form water in the present case, must have been equivalent to 202 cubic inches.

If we suppose with Saussure, (and it is the supposition least favourable to our present purpose), that carbonic acid gas contains 27.5 *per cent.* of carbon, in that case the carbon contained in 104 cubic inches of it must weigh 13.24 grains. The weight of 202 cubic inches of hydrogen gas is 5.17 grains. Thus we have ascertained, that 100 cubic inches of the inflammable gas from stagnant water, contains, of carbon, 13.24

hydrogen,	5.17
Total,	18.41
But the weight of 100 cubic inches of the gas is only -	16.93
So that the constituents found by analysis, exceed the weight of the gas - -	1.48, or almost 1.5 grain.

This is a clear proof that the gas contains no oxygen. The carbon and hydrogen which we have found it to contain, constitute the whole of its weight. The small excess would nearly vanish, if we were to suppose the specific gravity of the gas to be 0.600, as Dalton found it. It is obviously owing to errors in the analysis, which are unavoidable when minute quantities of gaseous bodies are measured.

10. We may conclude, then, that the gas from stagnant water is entitled to the name of Carbureted Hydrogen, and that it is a compound of very nearly,

	carbon,	72
	hydrogen,	28
		100

Mr Dalton considers it as composed of an atom of carbon, and two atoms of hydrogen; and this very nearly agrees with the above analysis, if we suppose an atom of carbon to weigh 4.5, and an atom of hydrogen to weigh 1; for 72 is to 28 very nearly as 4.5 to 2.

There is another gas which is at present considered as composed of carbon and hydrogen. It was discovered by the associated Dutch chemists, and called by them Olefiant Gas, in consequence of the oily-looking substance into which it is converted, when mixed with oxymuriatic acid gas. The experiments of Cruickshanks, Henry, Dalton, and Berthollet, all coincide to shew, that its only constituents are carbon and hydrogen. Mr Murray, however, in his System of Chemistry, has expressed his suspicion that oxygen is also one of its constituents. He founds his conjecture on the alleged formation of carbonic acid gas when olefiant gas is passed through a red-hot tube. Even if carbonic acid were formed in this case, it would not prove the gas to contain oxygen, unless the experiment be made in such a manner as that all common air is completely excluded; and practical chemists are sufficiently aware of the difficulty of such an exclusion, when the experiment is made in the usual way. Carbonic acid gas never makes its appearance, if the whole common air be previously removed from the tube by means of a current of hydrogen, and if care be taken to separate all the oxygen with which the olefiant gas may be mixed, by means of nitrous gas. It is proper to know, that liquid sulphuret of lime has the property of dissolving olefiant gas in considerable quantity. It cannot, therefore, be used to free the gas from oxygen.

Though the well-earned celebrity of the chemists who have analysed olefiant gas, left little doubt that their analysis was accurate, I thought it worth while to repeat their experiments, in order to add my testimony to theirs.

1. One ounce measure of alcohol, of the specific gravity 0.826, and 3 ounce measures of sulphuric acid, of the specific gravity 1.860, were mixed to-

gether, and boiled in a small retort, almost to dryness; while the gaseous products were received in the usual manner over water. The gases obtained, (not reckoning the common air of the retort, which amounted to about 42 cubic inches), were 146.12 cubic inches of olefiant gas, and 53 cubic inches of carbonic acid gas. The proportion of carbonic acid at first was very small, but it increased as the process went on, and at the end amounted to about one-half of the olefiant gas. The charry matter which remained in the retort, after being well washed and dried on a sand-bath, weighed 68 grains.

2. A portion of this olefiant gas, deprived of its carbonic acid, but containing 16 *per cent.* of common air, was found of the specific gravity 0.9786, that of air being 1.000. Hence the specific gravity of pure olefiant gas is 0.9745. This is heavier than it was found by the Dutch chemists, who state its specific gravity at 0.909. As far as I know, the specific gravity has not been taken before in this country.

3. Being curious to know the nature of the supposed oil, which is formed when olefiant gas is mixed with oxymuriatic acid gas, I filled a large bottle with olefiant gas, and passed a current of oxymuriatic acid gas into it; the wished for substance soon collected at the bottom of the phial. It possessed the following properties.

(1.) It was a liquid of a greenish-white colour, with a slight smell of oxymuriatic acid, which it lost when allowed to stand a sufficient time, exposed to the air. Its taste was sweet and cooling, and it made a strong, though not unpleasant, impression on the palate.

(2.) When dropped into water, it fell to the bottom, and looked like so much melted phosphorus. It continued in that state for some time if left at rest; but when the mixture was agitated, it dissolved in the water. The liquid continued colourless, acquired a sweet and cooling agreeable taste, and a slight aromatic odour. It did not affect vegetable blues, but precipitated copiously with nitrate of silver.

(3.) When dropped into alcohol, the liquid appeared milky at first, but almost immediately became transparent, a complete solution being effected.

(4.) Sulphuric ether dissolved it with great rapidity, and the solution was colourless.

(5.) It did not dissolve in oil of turpentine, but continued in small globules, which attached themselves to the bottom of the vessel.

(6.) It dissolved immediately in nitric acid, without effervescence, or any apparent change in the liquid.

(7.) When dropped into sulphuric acid, a copious effervescence took place, the smell of oxymuriatic acid became evident, and the liquid remained clear.

(8.) When left in an open vessel, it evaporated completely, leaving only a green trace.

From these properties, it is obvious, that the liquid in question does not belong to the class of oils. It is a substance of a nature quite peculiar, and seems to consist of the two gases simply combined together. It has considerable resemblance, at least in taste, to the *pyro-acetic spirit* of Mr Chenevix.

4. When olefiant gas is mixed with thrice its bulk of oxygen gas, it detonates very loudly, when an electric spark is passed through it, and burns with a strong white flame. According to Mr Dalton, it consumes exactly thrice its bulk of oxygen gas, and forms twice its bulk of carbonic acid. My experiments, as will appear from the following table, very nearly coincide with his. The gas used contained 16 *per cent.* of common air, and the oxygen gas was mixed with 11 *per cent.* of azote.

	Measures of olefiant gas.	Measures of oxygen gas.	Residue after combustion.	Do. washed in lime-water.	Measures of nitrous gas added to do.	Residue.
1	20	59	45	10	42	44
2	20	60	45	9	23	27
3	20	57	42	8	23	27

From this table we easily deduce the following:

	Measures of Gases mixed.				Carbonic acid formed.	Residue.	Composition of Residue.	
	Pure olefiant.	Pure oxygen.	Azote.	Total.			Azote.	Oxygen.
1	16.8	53.14	9.06	79	35	10	9.06	2.9
2	16.8	54.04	9.16	80	36	9	9.16	1.8
3	16.8	51.34	8.86	77	34	8	8.86	1.4

This table obviously furnishes us with the following results:

	Olefiant gas consumed.	Oxygen gas consumed.	Carbonic acid formed.	
1	16.8	50.24	35	
2	16.8	52.24	36	
3	16.8	49.94	34	
	16.8	50.8	35	Average.
	100	302	208	Aver. *per cent.*

From these experiments, it is easy to deduce the composition of olefiant gas: 100 cubic inches of it, at the temperature of 60°, and when the barometer stands at 30 inches, weigh 29.72 grains.

Of the 302 cubic inches of oxygen gas consumed, 208 went to the formation of carbonic acid. The remaining 94 cubic inches must have gone to the formation of water, and they must have combined with a quantity of hydrogen, which, if in the gaseous form, would have amounted to 188 cubic inches. Therefore, 100 cubic inches of olefiant gas, are composed of the carbon in 208 cubic inches of carbonic acid, and a quantity of hydrogen equivalent to 188 cubic inches.

Now, the carbon in 208 inches of carbonic acid

weighs - -	26.98 grains.
108 inches of hydrogen gas weigh	4.80
Total,	31.78.
Weight of the olefiant gas,	29.72
Surplus,	2.06

Thus the weight of the constituents found by analysis, exceed that of the olefiant gas by about $\frac{1}{15}$th part;—a clear proof that olefiant gas contains no oxygen. The science of chemistry, in its present state, admits of no stronger proof than what we have now given.

It follows from the preceding analysis, that olefiant gas is composed of about

Carbon, -	85
Hydrogen,	15
	100

Mr Dalton considers it as composed of an atom of carbon and an atom of hydrogen. This comes tolerably near the preceding analysis, if we suppose the weight of an atom of carbon 4.5, and that of an atom of hydrogen 1. For 85 is to 15 very nearly as 4.5 is to 0.8.

6. There is a curious experiment, first made by Cruickshanks, and afterwards repeated by Berthollet, which I thought it worth while to verify. When olefiant gas is mixed with less than its bulk of oxygen, and the mixture is fired by electricity, a quantity of charcoal precipitates, and the bulk of the residue, after the detonation, is much greater than before. The following table exhibits the result of my experiments in this way:

	Measures of olefiant gas.	Measures of oxygen.	Residue after combustion.	Do. washed in lime-water.	Measures of nitrous gas added.	Residue.
1	39.5	28.5	100	94.5	37	121.5
2	40	30	110			
3	40	30	110			
4	40	29	110			

In each of these experiments a quantity of charcoal was precipitated. It remained long suspended in the gaseous residue, quite dry, and made its escape into the air, if the detonating tube was turned up. I attempted to ascertain the weight of this charcoal, but was not successful. It was necessary, in order to collect it on the filter, to moisten it in the first place; and it was found impossible to dissipate the whole of the water, without altering the filter. Hence it was always a great deal too heavy, never weighing less than $\frac{1}{5}$th of a grain.

From the preceding table we easily deduce the following:

	Pure olefiant gas.	Pure oxygen gas.	Azotic gas.	Total.	Carbonic acid formed.	Residue.
1	33.2	26.64	8.16	68	5.5	94.5
2	33.6	27.98	8.42	70		
3	33.6	27.98	8.42	70		
4	33.6	27.08	8.32	69		

In the first experiment, 5.5 measures of oxygen gas went to the formation of carbonic acid, and 3.74 were found uncombined, after the explosion, by the test of nitrous gas. Hence it follows, that 17.4 measures of oxygen gas, combined with 33.2 measures of olefiant gas deprived of a portion of its carbon, and formed a new inflammable gas, amounting to 82.7 measures in bulk, or almost double the bulk of the two gases that went to form it.

The new inflammable gas being examined by a new mixture with oxygen gas, and a new detonation, was found to consume 73 *per cent.* of oxygen gas, and to form 55 *per cent.* of carbonic acid.

Hence the 82.7 measures would have formed - - -	45.5
But 33.2 measures of olefiant gas would have formed - -	69.0
Difference,	23.5

From this it would seem, that about $\frac{1}{4}$th of the carbon removed by the first explosion, is converted into carbonic acid, while $\frac{3}{4}$ths precipitate in the state of a black powder.

33.2 cubic inches of olefiant gas weigh - -	9.87 grains.
The carbon in 23.5 cubic inches of carbonic acid weighs	3.05
Residue,	6.82
17.4 cubic inches of oxygen weigh - -	5.31
Hence the weight of 82.7 cubic inches of the new gas cannot exceed - -	12.13

Hence 100 cubic inches of it would weigh 14.66 grains, and its specific gravity cannot ex- 0.4808.

This is on the most unfavourable supposition, that no water whatever is formed during the first combustion. If water be formed, it is obviously lighter than we have made it. It is clear, therefore, that this new-formed gas, to which the name of Oxycarbureted Hydrogen may with propriety be given, is quite different from carbonic oxide gas, the specific gravity of which is 0.956, or almost double of our new gas.

9.87 grains of olefiant gas are composed of -	1.49 hydrogen.
	8.38 carbon.
	9.87

Hence our oxycarbureted hydrogen gas is composed of -	1.49 hydrogen.
	5.33 carbon.
	5.31 oxygen.
	12.13

or *per cent.* of carbon, - -	43.9
oxygen, - -	43.8
hydrogen, - -	12.3
	100.0

It is not improbable, that this oxycarbureted hydrogen gas is composed of an atom of carbon, an atom of oxygen, and an atom of hydrogen. If that supposition be well-founded, the proportion of oxygen must exceed a little what we have obtained by our analysis. This would probably have been the case, if we had founded our analysis upon any of the succeeding experiments, rather than the first of the preceding table.

The preceding experiments, I flatter myself, entitle us to conclude, that *two* gaseous compounds of hydrogen and carbon exist. To the first we may give the usual name of Carbureted Hydrogen; to the second the name of Supercarbureted Hydrogen, as it contains very nearly twice as much carbon as the first gas does. There exists also a gaseous compound, consisting of oxygen, carbon, and hydrogen; but it differs in its properties from all other inflammable gases hitherto examined. The reason why the inflammable gases from vegetable and animal substances differ so much from each other is, that they usually hold an oil in solution, and are mixed with variable quantities of carbonic oxide gas.

XXVII. *A List of Fishes found in the Frith of Forth, and Rivers and Lakes near Edinburgh, with Remarks.*

By P. Neill, F. A. S. & Sec. W. S.

[*Read 16th July* 1808.]

The following list is by no means presented to the Society, as even approaching to complete. It contains only such fishes as have fallen under my own observation, during the space of a very few years past. Some species mentioned by Sir Robert Sibbald and other writers, as having been found in the Frith, but which I have not met with, are therefore purposely omitted. Very few indeed of the rarer fishes will be found to occur in this catalogue: but most of these are only occasional visitants: and if the publication of this list tend to incite others to communicate their discoveries, its principal object will be accomplished.

To the Linnean and English appellations, the Scottish names have been added, wherever they appeared peculiar; and these last are printed in Italics.

PISCES.

APODES.

MURÆNA.

M. *Anguilla,* Common Eel.

Abundant in the lakes of Duddingstone and Lochend, and in the rivers Leith and Almond; and likewise often taken in the Frith.

M. *Conger.* Conger-eel; *Hewe-eel* of Sir Robert Sibbald; or *Heevil.*

This species is sometimes, but not very often, found in the Frith. The largest I have seen was about six feet long. They are tenacious of life: I have seen one alive and vigorous in the Edinburgh market, although it had been ten hours out of the water.

ANARHICHAS.

A. *Lupus.* Sea-wolf, or Wolf-fish; *Sea-Cat* of Scotland.

This is pretty common about the rocky coast at the mouth of the Frith, and is often brought to market. Mr Pennant says, he did not observe in the wolf-fish any lateral line; but he had described from a specimen which had been kept for some time; for, in the newly caught fish, the lateral line is sufficiently obvious. In our market, the fish seldom exceeds two feet in length: it has, however, been got in the mouth of the Frith above five feet long. Its stomach is often found nearly filled with fragments of large and small whelks and crabs, (Buccinum undatum, Turbo littoreus, Cancer pagurus, C. depurator, and others.)

AMMODYTES.

A. *Tobianus.* Sand-lance; *Sand-eel; Hornel.*

In the summer months, the sand-lance may be taken in great numbers, by digging in the wet sands near the *Black Rocks,* in front of Leith Harbour, at ebb-tide. The largest sand-lances are called by the fishermen *hornels.*

[That the Sword-fish, XIPHIAS *Gladius,* occasionally enters our Frith, appears from the authority of Sir Robert Sibbald, who describes one caught there, which was exhibited in Edinburgh as a show.—No species of the genus OPHIDIUM has yet occurred to me.]

JUGULARES.

CALLIONYMUS.

C. *Lyra*. Dragonet; *Chanticleer*, or *Gowdie*.

Mr Pennant and other authors, describe *two* species of Callionymus as natives of our seas;—the Gemmeous Dragonet, *C. Lyra*; and the Sordid Dragonet, *C. Dracunculus*. They bear a considerable resemblance to each other; the Gemmeous Dragonet being distinguished chiefly by the great length of the first ray of the dorsal fin, by being somewhat superior in size, and by the brilliancy of its colours. Mr Stewart remarks, that "it is not certain but the Sordid Dragonet is a mere variety of the Gemmeous *." Dr Shaw says, that "C. Dracunculus is so nearly allied to C. Lyra, that it may perhaps be doubted whether it may not be in reality the same animal in a less advanced state †." Mr Donovan, however, in his elegant, and generally accurate work, on British Fishes, considers them as "certainly distinct ‡." Professor Gmelin seems to have been the first to suspect that the difference might depend on the sex of the animal; and, in adopting from Pennant the *Callionymus Dracunculus* in-

* "Elements of Natural History," vol. ii. p. 325.

† "General Zoology," vol. iv. part i. p. 117.

‡ "Natural History of British Fishes," vol. iv. plate 48.

to his edition of the "Systema Naturæ," he subjoins a query, "An solo sexu a Lyra diversus?" To this, I think, I am able to answer in the affirmative. Although the Dragonet is mentioned by English authors as being a rare fish on their coasts, it is rather common near the mouth of the Frith of Forth. Both sorts are there found, in water from 12 to 20 fathoms deep. They are often caught on the haddock lines, which are baited with muscles: they are, however, seldom brought ashore, the fishermen despising them. Having, some summers ago, expressed a wish to the Newhaven fishermen, that they would procure for me a few *gowdies* (as they call them), I soon found myself overstocked with specimens. In the course of dissecting and preserving some of each, it struck me as remarkable, that the gemmeous dragonets were all males, and the sordid dragonets all females. I now considered it as a fortunate circumstance, that numbers were brought to me, —presuming that if I should find the gemmeous dragonets to be uniformly *milters*, and the sordid dragonets to be uniformly *spawners*, I might be permitted to conclude, that they are only male and female of one and the same species. I accordingly opened every specimen which I received, to the amount of some dozens; and the result entirely supported that opinion. Both sorts were brought to me nearly in equal numbers; and from the fishermen I learned, that they were taken promiscuously on the same lines. The *Callionymus Dracunculus* falls therefore to be dropped as a species; but it seems unnecessary to change the specific name *Lyra*, which happily enough alludes to the lengthened first ray of the dorsal fin *of the male*, which is bent in shape of a lyre.

GADUS.

G. *Æglefinus*. Haddock.

Formerly abundant in every part of the Frith; but of late years found only in the bays of Leven and Aberlady, near its mouth.

G. *Morhua*. Cod.

Cod-fish, not of the largest size, are sometimes found plentifully on the coast of Fife. The young are called *Codlings*, *Red-ware cod*, and *Tanny cod*.

G. *Luscus*. Bib.

This is occasionally caught in the Frith, in the spring and summer; but it is not a common species.

G. *Merlangus*. Whiting.

This is taken in the spring and summer months, in considerable numbers.

G. *carbonarius*. Coal-fish.

The fry of this species is exceedingly common on our coast from June to August, as it is indeed on every part of the coast of Scotland. In summer, the bason of the New Wet Dock, at Leith generally swarms with the fry. The number of different provincial names bestowed on this species is amusing, and sometimes indeed rather perplexing. Here the fry are called *podleys;* in Orkney and Shetland they are called *sillocks.* When a year old, the coal-fish begins to blacken over the gills, and on the ridge of the back; and we have then a new series of names: among the Hebrides, *cuddies;* in Sutherland, *glassocks;* in Orkney, *cooths;* and in Shetland, *piltocks.* When full grown, they are quite black, and have still other names bestowed on them, as *colmeys, sethes, seys,* and *grey-lords.* The coal-fish seems to abound in the whole North Sea, to the highest latitudes. It was the only kind of fish found by Lord Mulgrave at Spitzbergen *.

G. *Pollachius.* Pollack; *Lythe.*

Not common here.

G. *virens.* Green Gadus of Dr Shaw.

This is not unlike the young coal-fish; but its back is green, the lateral line quite straight, and the tail more deeply forked. It is taken in our Frith during summer.

G. *Molva.* Ling.

This species scarcely ever enters the Frith; but it is found off the Isle of May in the spring months.

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* Phipps' Voyage.

G. *tricirratus.* Three-bearded Cod; Rock-ling.

This kind is common among the sea-rocks near the beach, and is taken along with the viviparous blenny. It has generally been considered by naturalists as only a variety of G. *Mustela*, or Five-bearded cod; but Pennant and Donovan have rightly established it as a distinct species.

G. *Brosme.* *Tusk*, or Scotch Torsk.

Very rarely taken about the mouth of the Frith, and brought to the Edinburgh market.

BLENNIUS.

B. *Gunnelus.* Spotted Blenny, or Butter-fish.

This is perhaps not uncommon; but it is never brought to market, and it is not easily taken, as it escapes very nimbly. It is found at ebb-tide in small pools among rocks, covered with the larger sea-weeds.

B. *viviparus.* Viviparous Blenny; *Greenbone.*

Here this species sometimes gets the names of *Eelpout* and *Guffer*, but more frequently *Greenbone*, from the backbone becoming green when the fish is boiled. It is very common among the rocks and sea-weeds all along our shores. Though not a delicate morsel, it is often brought to market. In the month of February 1807, I saw a large female in the fish-market, from which several dozens of young ones escaped alive. Dr Shaw tells us, that the viviparous blenny sometimes attains the size of twelve inches; but this female was fifteen inches long. He says further, that the relative size of the young, at the time of their exclusion, may be judged of from his plate; but I must remark, that, in the plate, they are proportionally much too small. Although, in the instance above mentioned, the parturition was probably premature, the first that were excluded were between four and five inches long; whereas, according to Dr Shaw's proportional size, they ought not to have been two inches in length.

THORACICI.

Gobius.

G. *minutus*. Spotted Goby.

Sometimes taken in the shrimp-nets at Figget Whins and Portobello.

Cottus.

C. *cataphractus*. Pogge or Armed Bullhead; *Lyrie; Sea Poacher; Pluck; Noble.*

This is often taken in oyster-dredges and herring-nets, but is detested by the fishermen.

C. *Scorpius*. Fatherlasher, or Lasher Bullhead; *Lucky-proach.*

This species is very common. It is sometimes eaten by the fishermen; but is seldom brought to market.

[I recollect to have seen a specimen of the Cottus Gobio, or Miller's-Thumb, alive in Edinburgh; but it may have been brought from a distance.]

ZEUS.

Z. *Faber.* Doree; *John Dory.*

This is rarely met with in our Frith: it has sometimes been entangled in trawl-nets in Goulan Bay.

Z. *Luna.* (Z. *Opah*, Shaw). Opah, or King-fish.

Sir Robert Sibbald, in his "Prodromus," published in the beginning of the 18th century, describes a specimen of this uncommon and resplendent fish, as having been taken "near the North Ferry." In the "Philosophical Transactions," and in "British Zoology," we have accounts of the occurrence of three specimens on the coasts of our island. The first was found near Leith in 1750; the next was cast ashore near Newcastle in 1769; the third was taken at Brixham in Torbay in 1772. Mr Donovan, in his "Natural History of British Fishes," mentions the subsequent occurrence of other three specimens on the coast of Scotland, one of which is in his own collection. Others still have occurred. A few years ago, a very fine one was taken off Cramond, and it is now in the museum of Patrick Walker, Esq; of this Society. Another was, about the same time, found near Burntisland, but not preserved; and a third was stranded on the beach at the little village of East

Inch-haven near Arbroath, and carried to the town of Dundee as a spectacle.——I have no doubt, further, that the opah has often been found on our shores, without being noticed by any naturalist. During a visit to Orkney in 1804, I was surprised to find it accurately described to me as having been several times cast ashore, during storms, in the island of Sanda, and once at the Bay of Scalpa, about a mile from Kirkwall.

PLEURONECTES.

P. *Hippoglossus.* Holibut; *Turbot.*

In our market this is generally, though very preposterously, named the *turbot;* the proper turbot, at the same time, getting another name, that of *rawn-fleuk.*

P. *Platessa.* Plaise.

This is one of the most common of our flat-fish. When small, they are called *fleuks;* when large, *Dutch plaise.*

P. *Flesus.* Common Flounder, or Fresh-water Flounder; *Mayock-fleuk.*

This is extremely common, and nowhere does it abound more than in Leith Harbour. It seems to delight in places having a clayey bottom.

P. *Limanda.* Dab.

This species is also very common on our shores, and is almost every day to be seen in our market. It is often emphatically distinguished by the fish-dealers as the *saltie,* or *salt-water fleuk.*

P. *microcephalus.* Smear-dab; *Sand-fleuk.*

This is taken off Seton Sands, and in Aberlady Bay.

P. *Solea.* Sole.

This is well known as the richest and most savoury of flat-fish. A few small soles are occasionally brought to our market in the summer months; but a large sole is never to be seen there. This is probably much owing to want of enterprise in our fishermen; soles of a tolerable size being not uncommon in all the bays near the mouth of the Frith.

P. *maximus.* Turbot; *Rawn-fleuk; Gunner-fleuk.*

This species, as already remarked, is here commonly denominated the *rawn-fleuk,* from its being thought best for the table when in *rawn* or roe: it is sometimes also called *Bannock-fleuk,* on account of its round shape.

P. *rhombus.* Brill, Pearl, Mouse-dab; *Bonnet-fleuk.*

This is likewise found in Aberlady Bay. Sometimes it occurs of a considerable size, resembling a young turbot.

SPARUS.

S. *Raii.* Toothed Gilthead.

"Only three specimens," says Mr Donovan *, "of this rare fish appear to have been hitherto discovered. The first was found on the sands near

* In his Catalogue, &c.

the mouth of the Tees, on the 18th September 1681, and described by Mr Ray." The second is Mr Donovan's specimen, which was found on the shore, near St Andrew's, in Scotland, in 1782. "A third has been since observed in Devonshire, and is recorded in the Linnean Transactions." Several additional specimens of this rare species of gilt-head have of late years been taken in the Frith of Forth.

LABRUS.

L. *Tinca.* Ancient Wrasse, or Old Wife; *Brassy.*

The *brassy* is found, in the summer months, on the *hettle* or rocky grounds. It is not common here.

L. *trimaculatus.* Trimaculated Wrasse.

Several of this elegant species are taken every summer in the Frith of Forth. The fishermen incorrectly name them the *Sea-perch.* I have never known the proper Sea-perch, Perca marina, to have been caught in our Frith.

PERCA.

P. *fluviatilis.* Common Perch.

Abundant in the lakes of Duddingstone and Lochend.

P. *Labrax.* (P. *punctata,* Gmelin). Basse.

This is a neat looking fish, not very common in our Frith, but sometimes occurring in the summer months. In the stomach of one I found a sand-lance, and a couple of the small fry of the father-lasher.

GASTEROSTEUS.

G. *aculeatus.* Banstickle, or Three-spined Stickleback.

Common in all clear ditches. Occasionally, after heavy rains, shoals of banstickles are washed down the rivulets into the Frith. Here they seem to thrive wonderfully; those which I have found in the salt water being about three times larger than those in fresh-water ditches.

G. *Spinachia.* Large or Fifteen-spined Stickleback.

This is sometimes found in pools, at ebb-tide, in rocky places of the coast.

G. *pungitius.* Ten-spined Stickleback.

Not so common as the Fifteen-spined.

TRIGLA.

T. *Gurnardus.* Grey Gurnard; *Crooner*, or *Crointer.*

The *crooner* is very common here. It derives this appellation from the circumstance of its so forcibly emitting air through its gill-covers, on being taken out of the water, as to produce a stridulous noise, like the purring or *crooning* of a cat. It is known by a variety of other names, as *Captain*, *Hardhead*, *Goukmey*, and *Woof.*

SCOMBER.

S. *Scomber.* Common Mackerel.

Small shoals of mackerel are occasionally found about the mouth of the Frith, in the summer and autumn months.

[S. *Trachurus,* Scad, Horse-mackerel, or *stour-mackerel,* is said sometimes to have been found in the Frith; but I have not met with it.]

ABDOMINALES.

COBITIS.

C. *barbatula.* Loche.

This appears to be rather an uncommon fish in the English rivers; but it is frequent in the Water of Leith, and other rivers of Scotland in general.

SALMO.

S. *Salar.* Salmon.

This is occasionally taken in the Frith, during July and August, the season of the fish's periodical visit to the sea.

S. *Trutta.* Salmon Trout; Bull Trout; or Sea Trout.

This is very common, especially about the mouths of the Esk and the Almond.

S. *Fario.* Common Trout.

This is still found in the Water of Leith, though unquestionably rendered scarce, by the establishment of distilleries, and other manufactures, on its banks.

S. *Eperlanus.* Smelt; *Spirling*, or *Sparling.*

The large variety, or sea-smelt, is not uncommon in the Frith: the small kind ascends the river Forth in vast quantities in the spring months, to spawn, and it is brought to market plentifully in March and April.

[The stalls of our market exhibit two other species of Salmo, brought from Lochleven: the S. *Levenensis* of Dr Walker, or Lochleven Trout; and the S. *alpinus*, Red Char, or *Gerletroch.*]

Esox.

E. *Lucius.* Common Pike; *Ged.*

This inhabits Duddingstone Lake; but is not often seen. The numerous perches, which greedily devour the roe of the pike, are supposed nearly to have extirpated the breed.

E. *Belone.* Sea-Pike; Gar-Pike; *Guard-fish.*

This is occasionally taken in the entrance of the Frith.

E. *Saurus.* Saury-Pike; *Gowdnook.*

This fish appears to have been unknown to Linnæus, Gmelin, or Bloch. Mr Ray, however, evidently alludes to it as known in his day, on the coast of Cornwall, by the name of Skobster or

Skipper. It seems to be rare in the southern or English seas; but it is not uncommon in the north of Scotland, and almost every autumn it enters the Frith of Forth in considerable shoals. Here it is named *Gowdnook*, *Gowdanook*, or *Gaufnook*, and sometimes *Egypt-herring*. It appears to be a stupid inactive fish. When the sauries run up our Frith in numbers, they do not, like other fishes, retire from the shallows at the ebbing of the tide, but are then found by hundreds, having their long noses stuck in the sludge, and are picked up by people from Kincardine, Alloa, and other places. Mr Pennant mentions, that great numbers of sauries were thrown ashore at Leith by a storm, in November 1768.—This fish is very indifferently figured by Pennant; it is pretty correctly represented by Mr Racket, in the "Linnean Transactions," vol. 3. In this last case, however, as well as in the former, the specimen seems, unluckily, to have had the points of the long slender jaws broken off, probably by accident in the carriage inland. When complete, they are bent a little upwards, like the bill of the avoset: so striking, indeed, is the resemblance, that to Mr Racket's specific character *, after the words "rostro subu-

* "Esox, *Saurus*. Rostro subulato, maxillis medio hiantibus.

"Dorsum viridi-cœrulescens. Venter argenteus.

lato," might perhaps be added, "instar avosettæ avis rostri." Here, it may be proper to remark, that La Cepède's figure, in the Continuation of Buffon, is correct in this particular *.——Mr Racket informs us, that his figure is of the natural size; and it measures 12½ inches. The fish had not, however, been of full growth. One specimen in my possession is 15 inches long; and Mr P. Walker has a specimen fully 18 inches in length. Mr Pennant may be considered as mistaken, therefore, when he mentions 11 inches as its mean length. The character given by Mr Racket, "pinnulis utrinque sex versus caudam," is not invariable. In the specimens which I have examined, there were only five spurious fins above, while there were six beneath. Indeed, Mr Racket's figure is correct in this respect, and at variance with his description. The number of finlets,

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Mandibula superior paululum recurvata. Pinna dorsalis et analis opposita; pinnulis utrinque sex versus caudam. Cauda bifida."

* Mr Donovan's figure of the saury, in the *fifth* volume of his "British Fishes," (published since this list was laid before the Society), is, I find, also correct in this respect. He has likewise improved the specific character, by describing the jaws as "subascendentes;" and most of his observations coincide with mine.—[*Oct.* 1810.]

however, is apt to vary in all fishes which possess them.

ATHERINA.

A. *Hepsetus*. European Atherine.

This I have repeatedly found washed ashore about Figget Whins, after easterly winds.

MUGIL.

M. *Cephalus*. Common or Grey Mullet.

This is found, but not very frequently, at the mouth of the Esk: it is chiefly got in the spring months, along with salmon-trout.

CLUPEA.

C. *Harengus*. Herring.

The food of the herring has often been considered as a problem, the stomach being generally found empty. I therefore think it worth while to mention, that on one occasion, I found in the stomach and œsophagus of a large female herring, no fewer than five young herrings (not sprats), the lower partly dissolved, the others entire. It can hardly be doubted, therefore, that, when they have it in their power, herrings feed on very solid food, since they are occasionally voracious enough to devour even their own species. Their more common food may be of a softer and gelatinous nature, and therefore rapidly dissolved in the stomach.—It has been thought that "no bait will tempt the herring *." This, however, is a mistake: it has been known to bite at an artificial fly; and when in Shetland, in 1804, I met with people who had occasionally taken herrings, when fishing for *piltocks*, or coal-fish, with limpet-bait.

C. *Pilchardus.* Pilchard; *Pilcher; Gypsey-herring.*

Pilchards come into the Frith chiefly at the head of the annual shoal of herrings, and they are seldom seen in our market after October.

C. *Sprattus.* Sprat; *Garvie-herring.*

It is a prevalent opinion among the fishermen of Newhaven, that this is nothing else than the young of the common herring. It is certainly not easy to point out invariable marks of discrimination; for the serratures in the abdomen of the sprat are less marked in the larger specimens, and might be supposed to become obliterated in the full-grown fish. A surer criterion of distinction may be found in the relative position of the dorsal and ventral fins: if a straight line be dropped from the forepart of the dorsal-fin perpendicularly downwards, it will, in the true herring, fall a little in front of the ventral fins; but, in the garvie, it will fall a little behind the same fins. Gar-

* Mr Skrimshire's "Essays."

vies are sometimes taken with small trawl-nets, at the mouth of the Almond, and sold in the Edinburgh market at the rate of 1 d. a dozen.

CYPRINUS.

C. *Phoxinus*. Minow.

Common in the Water of Leith; and the only species of this numerous genus to be found in this neighbourhood. About a dozen of kinds of Cyprini inhabit the rivers, canals, and ponds of England;—the Barbel, Carp, Gudgeon, Tench, Crucian, Dace, Roach, Rud, Chub, Bleak, Red-eye, and Bream. Of these, only the Rud, and the Roach or *Braise*, are to be found in Scotland. The Goldfish, Cyprinus auratus, is now naturalized in some of our ponds.

AMPHIBIA NANTES.

BRANCHIOSTEGI.

CEPHALUS. (Tetrodon.)

C. *brevis*. (Diodon Mola of Dr Shaw.) Short Sunfish.

This singular looking, and rare fish, has been several times taken in the Frith of Forth within these few years. A specimen was caught near the mouth of the Almond river in the autumn of

1800, and is still preserved in the museum of P. Walker, Esq; at Coats. Another was caught shortly after. A third was taken near Inch Colm in July 1806, and brought to me. The fishermen informed me, that when they observed it, it was swimming slowly along, sidewise, with its back-fin frequently above water. It seemed to be a stupid dull fish: it made little or no attempt to escape, but allowed one of the sailors to put his hands under it, and lift it fairly into the boat. The sunfish has been generally mentioned as remarkable for its phosphorescence; but this specimen did not exhibit that phenomenon so distinctly as a haddock or a herring.—It is perhaps scarcely necessary to observe, that the Diodon Mola of Gmelin is a very different species from that here alluded to, and, indeed, is found only in tropical seas.

SYNGNATHUS.

S. *Acus*. Sea-needle; Needle-fish; *Gaugnet*.

This is found lurking among the sea-weeds, in shallow water, very common.

S. *Typhle*. Shorter Pipe-fish.

Found along with the preceding, to which it is nearly allied.

S. *Ophidion*. Sea Adder.

This is occasionally found among the rejectamenta of the Newhaven boats.

CYCLOPTERUS.

C. *Lumpus.* Lump-fish; Lump-sucker; *Padle.*

This is brought to market in the spring months, nets being set for it on the Sands off Portobello. The male (called by our fishermen *Cock-padle*), is, for the table, at that season much preferable to the female, (which is named the *Hush*, *Hen-padle*, and in Fife the *Bagaty*). The female is generally of a larger size than the male; and, later in the year, it is nearly of equal quality.

LOPHIUS.

L. *piscatorius*, (L. *Europæus* of Dr Shaw); Frog-fish; Toad-fish; *Mulrein.*

The uncouth appearance of this animal has procured it many expressive English and Scottish names. Besides Frog-fish and Toad-fish, it is often called Sea-devil; and, from its lying buried in the sand, and moving its tentacula or cirri, like worms, in order to entice its prey, Mr Pennant styles it the Angler. Here, it is named the *Mulrein*, or *Mareillen;* sometimes the *Merlin-fish.* In the North Isles of Scotland, it is very characteristically termed the *Wide-gab*, the mouth being hideously large, extending entirely across its disproportionately great head, which is bigger than all the rest of the body.

CHONDROPTERYGII.

ACIPENSER.

A. *Sturio.* Common Sturgeon.

One or two specimens are generally found every summer, about the mouth of the Almond, or of the Esk. Those brought to our market seldom exceed seven or eight feet in length; but in some of our rivers, they are got twelve or fourteen feet long, often tearing to pieces the salmon-nets in which they are accidentally entangled.

SQUALUS.

S. *Canicula.*

This is sometimes likewise an unwelcome intruder into the nets, among which, being of a large size, he makes great havock.

S. *Catulus.* Spotted Dog-fish.

This is sometimes, though not often, entangled in the skate-nets.

S. *Mustelus.* Smooth Hound; *Murloch.*

This is occasionally found, along with the Piked Dog-fish.

S. *Cornubicus.* Porbeagle Shark.

This is rather uncommon in the Frith. A specimen was accidentally taken in a net in June 1804, and brought into Newhaven. It was about six feet in length; two feet longer than the one described by the Bishop of Carlisle, in the 3d volume of the "Linnean Transactions." Before I saw the specimen, it was cut open, and the liver removed. It was a female. On opening the animal, no fewer than thirty young ones appeared, fifteen in each of two bags. These were all from twelve to fourteen inches in length, fully formed, and apparently ready for exclusion.—Another specimen, also a female, was entangled in a herring-net, near Queensferry, in October 1808. It was still larger than the former, measuring, from the tip of the snout to the extremity of the tail, nearly eight feet.—This species is generally considered as synonymous with the Beaumaris Shark of Mr Pennant; but it does not perfectly accord with the characters of the *Squale long-nez* of La Cepède, which has been considered as another synonime. It seems to be the same species which the late Dr Walker found in Loch Fyne many years ago, and which he then rightly considered as a non-descript.

S. *maximus*, (of Dr Shaw). Basking Shark; *Sail-fish.*

This species seldom enters the Frith. One was observed by some Newhaven fishermen in summer 1808, about a mile off the shore of Figget Whins, between Leith and Portobello. This species is common in the Scottish seas, in the summer months. On the west coast it is well-known by the names of *sail-fish* and *cairban;* in the north of Scotland it is called *pricker*, and *brigdie*.

S. *Acanthias*. Piked Dog-fish; *Sea-dog*.

Great numbers of sea-dogs generally attend the shoals of herrings that enter the Frith. They often gnaw through the nets, and devour the herrings inclosed.—Here, the dog-fish is commonly neglected as food, and cast to the dunghil. In the north of Scotland it is often eaten. The flesh of the male has a rank and offensive smell compared with that of the female: the latter is therefore preferable for food. In the Pentland Frith, and among the Orkney Islands, vast numbers are yearly caught, for the sake, chiefly, of the oil which they afford. The fish is there named the *hoe*.

S. *Squatina*. Angel-fish, or Monk-fish.

This ugly animal, for its common name must be understood ironically, is unlike the other sharks, and approaches, in general structure, to some of the ray-tribe. A specimen, rather more than four feet long, was taken in the Frith, in a skate-net, sunk off Kinghorn, about thirty years ago, and carried to Dr Monro by the Newhaven fishermen. It is still preserved in the Doctor's museum. A larger specimen, taken also in the Frith, was in the collection of the late Dr Walker. This is the Mermaid-fish of Artedi, and has probably given rise to some of the many stories which we read and hear concerning mermaids.

The front being somewhat round, and the eyes placed pretty near to each other ;—a lively imagination, especially if influenced by fear, might easily trace some resemblance to a plump human face.

RAIA.

R. *Batis.* Skate or Flaire.

This is pretty common. By the fish-dealers here it is often called *Blue-skate*, *Grey-skate*, or *Dinnen-skate*, to distinguish it from the Thornback, which is more plentiful in the Frith, and is also accounted a skate. It is easily known from the other common rays, by the middle of the back being destitute of spines. The male has not only his pectoral fins studded with spines, but he possesses long sharp-edged appendages on the lower part of his body, with which he lays hold of the female; the fishers call these appendages *skate-sheers*, from their resemblance to the blades of a pair of scissars. On large specimens, I have often found the Hirudo muricata, fixed on the belly, and leaving a bloody inflamed mark at the spot from whence I detached it. In the females, two horny capsules, containing each a young skate, may often be found nearly ready for exclusion; and, at the same time, two others not so far advanced, and a multitude of rudiments of capsules, in a soft state. On opening a capsule nearly ripe, I have more than once found the young skate surrounded with a whitish liquor, like rich cream, of a bland taste; the eyes of it were very large and ugly; the animal moved its tail slowly from side to side, but shewed no other motion.

R. *oxyrhinchus.* Sharp-nosed Ray; *White-skate; Friar-skate; May-skate*, or *Mavis-skate*.

This is now and then got, when the nets are *shot* near the mouth of the Frith. It is generally of a pretty large size, of a whitish colour, and very thin, the thinnest proportionally of the ray tribe. Its spontoon-shaped nose readily distinguishes it.

R. *rubus.* Rough ray; *Hommelin.*

This occurs sometimes, especially when trawl-nets are employed, which sweep along the bottom. It resembles the thornback; but has pointed teeth, while those of the thornback are obtuse.

R. *clavata.* Thornback; *Thorny-back.*

This is the most common species of ray here, and the one most generally sold in our market under the name of *skate*,—which is here a generic denomination for the ray-tribe. It is readily distinguished from the true skate, by a row of strong spines running down the back. The young both of the thornback and the skate are denominated *Maiden-skate:* those of the latter are sometimes, however, distinguished by the name of *Dinnies.*

R. *Cuvieri.* Cuvier's Ray,

A single specimen of this rare fish was taken in the trawl-nets which were for some time employed in fishing for sole and turbot in the Frith of Forth, in summer 1808; and it therefore falls to be added to the British Fauna. This species was first found on the coast of France in 1792, described by La Cepède, and by him named in honour of Cuvier, the celebrated comparative anatomist at Paris. It is strikingly distinguished by having an upright oval-shaped dorsal fin in the middle of the back. The specimen having been kept for me some days, by Mr Prior, fishmonger, who observed it among a large cargo of thornbacks and rough-rays; before I saw it, it was in a putrescent state, and the traces of the dark spots on the back were merely visible. When laid flat on a table, with the pectoral fins spread out, the fish was of a rhomboidal or diamond shape. It was nearly twelve inches broad, and a little more in length.

[I understand that the White-horse, Raia fullonica, has been seen in the market; but I have never met with it.]

PETROMYZON.

P. *marinus.* Spotted Lamprey; *Lamper-eel.*

This is found in the Frith, near the mouths of the Almond and the Esk, in the spring season, but not in any considerable quantity.

P. *fluviatilis.* Lesser Lamprey; *Nine-eyed-eel.*

This is abundant in the rivers Leith, Almond, and Esk. The popular name *Nine-eyed-eel* arises from the spiracles being taken for eyes.

XXVIII. *Catalogue of Animals, of the Class Vermes, found in the Frith of Forth, and other Parts of Scotland.*

By Professor Jameson.

[*Read 9th Dec.* 1809.]

* MOLLUSCA.

Tritonia. Lamark, Müller, Bosc.

T. *papillosa*, Bosc. Leith Shore.
verrucosa, Bosc. Leith Shore, and Shetland Islands.

Doris.

D. *Argo*, Lin. I observed several specimens of this beautiful species on the rocks near the Beacon at Leith.

Ascidia.

A. *rustica*, Müller. Adhering to roots of the Fucus digitatus on Leith Shore.

Ascidia.

A. *prunum*, Müller. Adhering to fuci, Leith Shore.

conchilega, Müller. Adhering to fuci, Leith Shore.

Mammaria.

M. *mammella*, Müller. Adhering to fuci, but rare, Leith Shore.

Lineus.

L. *longissimus*. (*Black-worm* of the Newhaven fishermen). On the oyster-banks, not uncommon. Noticed many years ago by my friend Mr Neill; afterwards transmitted by the late Mr Simmonds to Mr Sowerby, who has figured and described it under its present name in his "British Miscellany."

Nereis.

N. *mollis*, Müller. This rare species occurs seldom in this neighbourhood. I have also met with it on the shores of Shetland.

lamelligera. Deep water in the Frith, brought up by the oyster-dredges. Mr Neill.

Aphrodita.

A. *scabra*, Lin. Leith Shore.

aculeata, Lin. Leith Shore.

Aphrodita.

A. *punctata*, Bosc. *squamata*, Lin. Pallas, Misc. Zool. cap. 7. fig. 14. Leith Shore, and Orkney and Shetland Islands.
imbricata. Leith Shore, and Orkney and Shetland Islands.

Amphitrite.

A. *ventilabrum*, Müller. Near Queensferry.
cristata, Müller. Leith Shore.

Holothuria.

The following species of this genus were found in the Frith of Forth by Mr Neill.

H. *pentactes*, Pennant.
—— *sp. nov.* Lin. Trans. vol. ix. t. vii. fig. 4 *.

Medusa.

M. *æquorea*, Müller. Orkney and Shetland Islands.
aurita, Lin. Orkney and Shetland Islands.

Actinia.

A. *rufa*. Leith Shore, also Orkney and Shetland Islands.
crassicornis. Orkney and Shetland Islands, also the Western Islands.
gemmacea, Ellis. Leith Shore.
truncata, Müller. Shetland Islands.

* First found on the coast of Devonshire, and described and figured, as above, by Col. Montagu.

** TESTACEA.

Chiton.

C. *ruber*, Fabricius. I found this rare species on rocks in the island of Unst.

*** CRUSTACEA.

Echinus.

E. *Cidaris*, Lin. I found this rare species in the island of Fulah, the most western of the Shetland islands.

lacunosus, Lin. Dredged in the Frith of Forth.

spatagus, Lin. Leith Shore and Shetland Islands.

placenta. Isle of Fulah. Very rare.

Asterias.

A. *papposa*, Lin. Leith Shore.

rubens, Lin. Leith Shore, and the islands of Scotland.

equestris. Newhaven. Mr Neill.

glacialis, Lin. Leith Shore, common.

aculeata, Lin. Orkney islands.

sphærulata, Lin. Newhaven, common.

ophiura, Lin. Leith Shore, Shetland islands.

caput-medusæ, Lin. In the sea off the Mainland, one of the largest of the Shetland islands; *argus* of the Shetland islands.

**** CORALLIA.

Millepora.

M. *compressa.* Shetland islands.
truncata, Lin. Shetland islands.
cellulosa, Lin. Shetland islands, and in the island of Fulah.
polymorpha, Lin. Orkney and Shetland islands, and Hebrides.
pumicosa. Leith Shore and Shetland islands.

Cellepora.

C. *pumicosa.* Leith Shore.

Isis.

I. *hippuris.* Said by the late Dr Walker to occur on the east coast of Scotland, and also in the Orkney islands.

Gorgonia.

G. *lepadifera.* Found on the coast of Aberdeenshire, and coasts of Shetland islands.
viminalis. Said by Dr Walker to occur in Shetland; and, according to Mr Sowerby, occurs in Mount's Bay, Cornwall; and Colonel Montagu found it plentiful on the coast of Devonshire *.

* Sowerby's Miscellany, p. 81.

GORGONIA.

G. *flabellum*. Leith Shore; found by the late Mr Mackay.

TUBIPORA.

T. *catenularia*. Orkney and Shetland islands.
serpens. Ibid.
fascicularis. Ibid.

SPONGIA.

S. *ventilabrum*, Lin.? In the islands of Unst and Fulah, I picked up several specimens of a sponge, which agrees in many characters with the *Spongia ventilabrum* of Linnæus. It has the reticular woody veins, the same kind of spongy covering, and the same general fan-like shape as the Sp. ventilabrum. The reticular woody fibres point out this as one of the species by which the Sponges are connected with the Gorgonias. It is said by some naturalists, that certain varieties of this species are funnel-shaped: it would seem, however, that these supposed varieties belong to a distinct species, which may be characterized thus: SPONGIA ZETLANDICA, *venis lignosis reticularis, obtectis poro favagineo*. This funnel-shaped sponge is distinguished from *Spongia infundibuliformis* of Linnæus, by its reticular woody veins, which are wanting in the other, and

SPONGIA.

by the nature of the spongy substance which covers and connects these veins, which in this species can be rubbed between the fingers when dry; whereas the sponge of the Linnean species is of a flexible elastic nature when dry, and its general consistence approaches to that of the common officinal sponge.

infundibuliformis, Lin.; S. *crateriformis*, Pallas. This species is distinguished from that last described, by the want of woody fibres, and the nature of its sponge; but it never splits and assumes the foliaceous aspect, as mentioned by Gmelin. I found it on the shores of the island of Unst.

pulchella, Sowerby *. This delicate sponge occurs on the shores of several of the Western Isles, where it was first noticed by the late Dr Walker.

tomentosa. Leith shore, and Shetland islands.

stuposa. Above Queensferry, and Leith shore.

palmata. Orkney and Shetland islands. *Mermaids' glove* of the Shetlanders.

compressa, Fabricius. Bressay Sound, Shetland.

ALCYONIUM.

A. *schlosseri*. Leith Shore.

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* Sowerby's British Miscellany, p. 87.

Alcyonium.

A. *cydonium.* Island of Fulah and Unst.
lyncurium. Island of Fulah.
gelatinosum. Leith Shore.
digitatum. Leith Shore.

Flustra.

F. *foliacea.* Leith Shore; Orkney and Shetland islands, and Hebrides.
truncata. Leith Shore; Orkney and Shetland islands, and Hebrides.
pilosa. Adhering to fuci, Leith Shore.
carbasea. Leith Shore.
arenosa? Leith Shore.
hispida. Leith Shore.
membranacea. Adhering to fuci; Leith Shore, and Orkney islands.
lineata. Orkney islands.

Tubularia.

T. *indivisa.* Leith Shore; Orkney and Shetland islands.
ramosa. Leith Shore; found by the late Mr Mackay.

Corallina.

C. *officinalis.* Leith Shore; Orkney and Shetland islands, and Hebrides.

SERTULARIA.

The following species occur on Leith Shore :

S. *rosacea.* On shells and corallines.

pumila. On Fucus serratus.

operculata. Generally adhering to shells.

abietina. Very common on oyster and muscle shells.

cupressoides.

cupressina. Found in deep water, and detached on the shore.

argentea.

rugosa. Adhering to Flustra foliacea, and other corallines.

volubilis. Adhering to flustræ and fuci.

halecina. Common on oyster shells.

thuya. Dredged from deep water.

falcata. Covers the concave shells of the common oyster.

antennina. From deep water in the Frith.

cuscuta. Adhering to fuci.

filicula.

muricata. Adhering to fuci.

uva. Adheres to fuci and corallines.

lendigera. Adhering to fuci and corallines.

geniculata. On Fucus saccharinus and F. digitatus.

dichotoma.

spinosa.

setacea. On scallop shells.

polyzonias.

loriculata.

SERTULARIA.

fastigiata.
avicularia. Not common.
scruposa.
ciliata. On other sertulariæ, fuci, and sponges.
eburnea. On shells, fuci, and corallines.
nigra. Coast of Aberdeenshire; Mr Brown.

**** ZOOPHYTA.

PENNATULA.

P. *phosphorea.* Frith of Forth.
mirabilis, Müller. Prestonpans Bay.

HYDRA.

H. *lutea?* Bosc. Adhering to fuci; Frith of Forth.

CORYNA.—Bruguiere.

C. *squamata,* Müller. I found this beautiful species on the shore of the island of Burra, and on the Holm of Cruster, in Bressay Sound, in Shetland. It was adhering to the Fucus digitatus.

XXIX. *List of Insects found in the Neighbourhood of Edinburgh.*

By Mr C. Stewart. M. W. S.

[*Read* 8*th* *April* 1809.]

I am about to lay before the Society a catalogue of insects found in the neighbourhood of Edinburgh. But in doing this, it must not be understood that I pretend to give any thing like a complete list. Such, in any region, however small, is not to be accomplished by a single person; at least not without greater attention to the subject, and for a much longer period, than I ever had it in my power to bestow on it.

The study of entomology in this place has, I believe, been less cultivated than any other branch of natural history. It can indeed be successfully prosecuted only by the young, the active, and the vacant; and more than any other objects in the three kingdoms, it requires a strong and acute eye. It is at first, to most people, but little captivating; or, rather, particularly to delicate people, it has in it somewhat repulsive, and even disgusting. It has likewise little of use to recommend it. The principal economical insect is the bee; and though a number of insects may be eaten, yet none can be said to serve as food, except some species of cancer. The principal of those in use in the arts, are the silk-worm and the cochineal; and though a number were formerly used in medicine, yet I believe that number is now greatly reduced, and, except cantharides, used only occasionally, and in small quantity. To the naturalist, however, this study soon recommends itself. The subjects of it, when collected, are prepared with little trouble; they are easily kept, and take up but little room in a cabinet: and whether we consider their figure, their structure, their history, or their most wonderful manners and economy, they claim a distinguished place in the System of Nature, and in this view of them, the study is exceedingly important.

The neighbourhood of Edinburgh has, I believe, no peculiar insects, and produces very few rare ones. It is rather unfriendly to the collector. Perhaps in a place where insects are so perpetually disturbed in their retreats, by the incessant overturning of the soil, so necessary and unavoidable near a large city, this may not be surprising.

This circumstance may be sufficient to account for the little attention that has been paid to insects by the naturalists of Edinburgh; for I do not know of any person who has ever made any considerable collection here. The late Dr Walker had a pretty large cabinet of Scots insects; but I believe he made no collection previous to his leaving the neighbourhood of Edinburgh, and when he returned to it, he had lost that energy necessary for the purpose, or it had been turned to other branches of natural history. My own collection was made in the course of one or two seasons, when the inclination was strong, and my sight good. But it was made only at hours of leisure, seized as they could be obtained, without choice, and consequently often unfavourable for the purpose. The properest places were likewise hardly accessible to me, and the breeding of the insect from the caterpillar, which is the best way of obtaining good specimens, was, in my situation at that time, inconvenient. From these circumstances, it is evident that the following list must be very defective. All that can be said for it is, that the insects there enumerated are to be found in the neighbourhood of Edinburgh; but that they are all, or even the hundredth part, of the insects that are there to be found, especially if we take into account the minuter species, I cannot assert. It may, however, be of use to a beginner, by assisting him in the knowledge of the more common insects. In this list, as in nature, the great orders of Coleoptera and Lepidoptera are conspicuous. In the latter, particularly in the genus papilio, not only this neighbourhood, but Scotland in general, is remarkably poor; and yet the Treasurer of this Society * has added one, I believe, even to the number of British papilios. The genus of Phalæna is exceedingly numerous, and though a very natural genus, it has been, for the sake of convenience, broken by Fabricius and other entomologists, into a number of genera. The individuals here are many of them so delicate, that it is difficult to take a specimen on the wing, without injury to its specific characters, and consequently, it is not easy to ascertain them properly. I have collected a number of species of this genus, which I could not include in the following list, being so imperfect that the species cannot with certainty be made out. With regard to the numerous species of Aphis, Acarus, Pediculus, &c. I have given no enumeration at all. However important these may be in the economy of Nature, I believe they are seldom kept in cabinets, or made an object of much attention with the mere entomologist.

An asterisk is prefixed to the few species that can be accounted rare.

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* Patrick Walker, Esq.

COLEOPTERA.

Scarabæus
- fimetarius.
- hæmorrhoidalis.
- conspurcatus.
- Fossor.
- terrestris.
- stercorarius.
- quisquilius.
- quadrimaculatus.
- horticola.
- rufipes.

Dermestes
- lardarius.
- Pellis.
- domesticus.
- violaceus.
- sexdentatus.
- Scarabæoides.

Ptinus
- pertinax.
- Fur.

Hister
- unicolor.

Gyrinus
- natator.

Anthrenus
- Scrophulariæ.

Silpha
- Vespillo.
- littoralis.

Silpha
- atrata.
- thoracica.
- rugosa.
- pulicaria.

Cassida
- viridis.

Nitidula
- pedicularia.
- bi-pustulata.

Coccinella
- bi-punctata.
- 5-punctata.
- 9-punctata.
- 13-punctata.
- 14-punctata.
- oblongo-guttata.
- 6-pustulata.
- 14-guttata.

Chrysomela
- Betulæ.
- fastuosa.
- vitellinæ.
- polygoni.
- polita.
- marginella.
- oleracea.
- tabida.
- nemorum.

HISPA
pectinicornis.
CURCULIO
badensis.
granarius.
Pini.
* Abietis.
argentatus.
Ligustici.
cervinus.
incanus.
Viscariæ.
Salicis.
CERAMBYX
anglicus.
LAMPYRIS
noctiluca.
CANTHARIS
fusca.
melanura.
ænea.
ELATER
obscurus.
pectinicornis.
CICINDELA
riparia.
aquatica.
DYTISCUS
nævius.
marginalis.
semistriatus.
cinereus.
sulcatus.

DYTISCUS
minutus.
glaber.
bi-punctatus.
maculatus.
CARABUS
hortensis.
leucophthalmus.
violaceus.
purpurascens.
ruficornis.
nigricornis.
striatus.
vulgaris.
viridanus.
latus.
melanocephalus.
cephalotes.
ferrugineus.
sex-punctatus.
cupreus.
granulatus.
madidus.
ustulatus.
quadrimaculatus.
TENEBRIO
Molitor.
caraboides.
PIMELIA
mortisaga.
quisquilia.
MELOE
Proscarabæus.

MORDELLA
aculeata.
STAPHYLINUS
murinus.
olens.
maxillosus.
brunnipes.
STAPHYLINUS
politus.
hypnorum.
riparius.
FORFICULA
auricularia.

HEMIPTERA.

BLATTA
orientalis.
GRYLLUS
domesticus.
campestris.
varius.
bi-guttulus.
grossus.
viridulus.
quadratus.
CICADA
lateralis.
viridis.
spumaria.
albifrons.
Ulmi.
Rosæ.
NOTONECTA
glauca.
striata.
NEPA
cinerea.
CIMEX
lectularius.
scarabæoides.
Baccarum.
juniperus.
bicolor.
Hyosciami.
apterus.
striatus.
lacustris.
pabulinus.
lævigatus.
dolobratus.
APHIS
Rosæ; and a great many other species.
CHERMES
Pini; ditto.
COCCUS
hesperidum; ditto.
THRIPS
physapus.
minutissima.

LEPIDOPTERA.

PAPILIO
Brassicæ.
Rapæ.
Napi.
Cardamines.
Pamphilus.
Hyperanthus.
Io.
Mæra.
Ægeria.
Semele.
Jurtina.
Urticæ.
C album.
Atalanta.
Euphrosyne.
Argus.
Artaxerxes.
Idas.
Phleas.
Linea.
Sylvanus.

SPHYNX
Populi.
Tiliæ.
Ligustri.
Atropos.
Filipendulæ.

PHALÆNA
Vinula.
* bucephala.

PHALÆNA
Caja.
lubricipeda.
camelina.
graminis.
putatoria.
* piniaria.
repandata.
cuspidata.
oblongata.
atomaria.
betularia.
wavaria.
plumbaria.
chærophyllata.
grossulariata.
cratægata.
bilineata.
populata.
chenopodiata.
comitata.
prunata.
alchemillata.
fluctuata.
didymata.
ocellata.
rectangulata.
bidentata.
tricuspidata.
olivata.
viridana.

PHALÆNA
avellana.
rosana.
asperana.
heracleana.
cynosbana.
marginalis.
forficalis.
proboscidalis.
pallens.
Pronuba.
segetis.
Chenopodii.
Chrysitis.
Gamma.
* Bractea.
interrogationis.
Psi.
Chi.
exoleta.
gothica.

PHALÆNA
oxyacanthæ.
polyodon.
oleracea.
iota.
trinervia.
longicornis.
Pisi.
Cerago.
Euonymella.
pratella.
tapetzella.
Cembrella.
pellionella.
lapella.
nisella.
didactyla.
pentadactyla.
hexadactyla.
Humuli.

NEUROPTERA.—HYMENOPTERA.

LIBELLULA
vulgatissima.
grandis.
Virgo.
Puella.

EPHEMERA
vulgata.
nigra.
bioculata.
horaria.

PHRYGANEA
bicaudata.
nebulosa.
striata.
nigra.
variegata.
longicornis.
flavicornis.
ciliaris.

HEMEROBIUS
lutarius.
Perla.
Chrysops.

PANORPA
communis.

CYNIPS
Rosæ.
quercus-folii.
viminalis.

TENTHREDO
viridis.
Vitellinæ.
nitens.
lucorum.
Pini.
Abietis.
Salicis.
livida.
sylvatica.
Cynosbati.

ICHNEUMON
extensorius.
luctatorius.
persuasorius.
fossorius.
manifestator.

ICHNEUMON
delusor.
titillator.
pugillator.
luteus.
ramidulus.
puparum.
glomeratus.

SPHEX
fusca.

CHRYSIS
ignita.

VESPA
vulgaris.
parietum.
fossoria.
vaga.
muraria.

APIS
mellifica.
terrestris.
muscorum.
hypnorum.

FORMICA
rufa.
fusca.

DIPTERA.

OESTRUS
Bovis.
Equi.

OESTRUS
hæmorrhoidalis.
Ovis.

TIPULA
rivosa.
crocata.
oleracea.
hortorum.
triangularis.
variegata.
pratensis.
regelationis.
punctata.
plumosa.
littoralis.
motitatrix.
monilis.
pusilla.
febrilis.
vernans.
phalænoides.
culiciformis.
minutissima.
lunata.

MUSCA
Chamæleon.
trilineata.
anilis.
pellucens.
meridiana.
Cæsar.
vomitoria.
carnaria.
domestica.
argentata.

MUSCA
grossa.
tremula.
larvarum.
canicularis.
meteorica.
putris.
pumilionis.
aurata.
* semi-argentata.
polita.
stercoraria.
hyosciami.
solstitialis.
scolopacea.
pendula.
nemorum.
tenax.

TABANUS
autumnalis.
pluvialis.
cæcutiens.

CULEX
pipiens.
pulicaris.
ciliaris.

EMPIS
livida.

STOMOXYS
calcitrans.
irritans.
rostrata.

ASILUS
forcipatus.
Oelandicus.

HIPPOBOSCA
equina.
hirundinis.
ovina.

APTERA.

PODURA
plumbea.
nivalis.

TERMES
fatidicum.
pulsatorium.

PEDICULUS.
A great number of species.

PULEX
irritans.

ACARUS
baccarum.
muscorum.
holosericeus; and many other species.

PHALANGIUM
Opilio.

ARANEA
Diadema.
redimita.
domestica.
viatica.
saccata.
scenica.

CANCER
Mœnas.

CANCER
Depurator.
Pagurus.
Araneus.
horridus.
Bernhardus.
araneiformis.
Gammarus.
Squilla.
Crangon.
Pulex.
Locusta.
stagnalis.

MONOCULUS
quadricornis.
Pulex.

ONISCUS
Asilus.
Asellus.
Armadillo.

SCOLOPENDRA
forficata.

JULUS
terrestris.
sabulosus.
oniscoides.

XXX. *Account of the Balæna Mysticetus, or Great Northern or Greenland Whale.*

By Mr W. Scoresby *jun.*, M. W. S.

[*Read 3d Feb.* 1810.]

The whale, when full grown, is from 50 to 65 feet in length, and from 30 to 40 in circumference, immediately before the fins *. It is thickest a little behind the fins, and from thence gradually tapers towards the tail, and slightly towards the neck. It is cylindrical from the neck until near

* It is said that the whale was formerly much larger than it is at present, being sometimes 100 or 120 feet long: but the accuracy of this statement is to be questioned; for the largest I ever heard of being caught did not exceed 70 feet in length; and this was reckoned a very uncommon individual. Of about 200 which I have seen taken, not one measured 65 feet in length, although many of them were full grown.

about the junction of the tail and body, where it becomes ridged.

The head has a triangular shape. The bones of the head are very porous, and full of a fine kind of oil. When the oil is drained out, the bone is so light as to swim in water. The jawbones, the most striking portions of the head, are from 20 to 25 feet in length, are curved, and the space between them is 9 or 10 feet, by 18 or 20. They give shape to the under part of the head, which is almost perfectly flat, and is about 20 feet in length, by 12 in breadth. The tongue is of great size, and yields a ton or more of oil. The lips, which are at right angles to the flat part of the base of the head, are firm and hard, and yield about two tons of oil.

To the upper jaw is attached the substance called *whalebone*, which is straight in some individuals, and in others convex. The laminæ or *blades* are not all of equal length; neither are the largest exactly in the middle of the series, but somewhat nearer the throat; from this point they become gradually shorter each way. In each side of the mouth are about 200 laminæ of whalebone. They are not perfectly flat; for besides the longitudinal curvature already mentioned, they are curved transversly. The largest laminæ are from 10 to 14 feet in length, very rarely 15 feet in length. The breadth of the largest at the thick ends, or where they are attached to the jaw, is about a foot. The Greenland fishers estimate the size of the whale by the length of the whalebone: where the whalebone is six feet long, then the whale is said to be a *size fish.* In *suckers*, or young whales still under the protection of the mother, the whalebone is only a few inches long. The whalebone is immediately covered by the two under lips, the edges of which, when the mouth is shut, overlap the upper part in a squamous manner.

On the upper part of the head there is a double opening, called the *spout-holes* or *blow-holes.* Their external orifices are like two slits, which do not lie parallel, but form an acute angle with each other. Through these openings the animal breathes.

The eyes are very small, not larger than those of an ox; yet the whale appears to be quick of sight. They are situated about a foot above where the upper and under lips join.

In the whale, the sense of hearing seems to be rather obtuse.

The throat is so narrow as scarcely to admit a hen's egg.

The fins are from 4 to 5 feet broad, and 8 or 10 feet long, and seem only to be used in bearing off their young, in turning, and giving a direction to the velocity produced by the tail.

The tail is horizontal; from 20 to 30 feet in breadth, indented in the middle, and the two lobes pointed and turned outwards. In it lies the whole strength of the animal. By means of the tail, the whale advances itself in the water with greater or less rapidity; if the motion is slow, the tail cuts the water obliquely, like forcing a boat forward by the operation of *skulling;* but if the motion is very rapid, it is effected by an undulating motion of the rump.

The skin in some whales is smooth and shining; in others, it is furrowed, like the water-lines in laid paper, but coarser.

The colour is black, grey, and white, and a tinge of yellow about the lower parts of the head. The back, upper part of the head, most of the belly, the fins, tail, and part of the under jaw, are deep black. The forepart of the under jaw, and a little of the belly, are white, and the junction of the tail with the body grey. Such are the common colours of the adult whale. I have seen piebald whales. Such whales as are below size, are almost entirely of a bluish-black colour. The skin of suckers is of a pale bluish colour. The cuticle, or scarf-skin, is no thicker than parchment; the true skin is from three-fourths to an inch in thickness all over the body.

Immediately beneath the skin lies the *blubber*, or fat, from 10 to 20 inches in thickness, varying in different parts of the body, as well as in different individuals. The colour, also, is not always the same, being white, red, and yellow; and it also varies in denseness. It is principally for the blubber that the Greenland fishery is carried on. It is cut from the body in large lumps, and carried on board the ship, and then cut into smaller pieces. The fleshy parts and skin connected with the blubber are next separated from it, and it is again cut into such pieces as will admit of its being passed into casks by the bung-hole, which is only three or four inches in diameter. In these casks it is conveyed home, where it is boiled in vessels capable of containing from three to six tons, for the purpose of extracting the oil from the *fritters*, which are tendinous fibres, running in various directions, and containing the oil, or rather connecting together the cellular substance which contains it. These fibres are finest next the skin, thinnest in the middle, and coarsest near the flesh.

The following table shews the quantity of oil a whale of each size of bone will produce at a medium:—

Bone in Feet.	Oil in Tons.
1	$1\frac{1}{2}$
2	3
3	$3\frac{1}{2}$
4	4
5	$4\frac{1}{2}$
6	$5\frac{1}{2}$
7	7
8	9
9	11
10	13
11	16
12	20

The blubber of a sucker, when very young, frequently contains little or no oil, but only a kind of milky fluid; in which case, when the animal is deprived of life, the body sinks to the bottom, as also does the blubber when separated from it; while the body and blubber of larger individuals, always swim. Though the preceding statement be exceedingly near the truth, yet exceptions occur; for I have known a whale of $2\frac{1}{2}$ feet bone produce 10 tons of oil, and one of 12 feet bone estimated at only 9 tons; such instances are much rarer than to see one of $2\frac{1}{2}$ feet bone produce 4 or 5 tons of oil.

The flesh of the young whale is of a fine red colour; that of the old approaches to black, and is coarse, like that of a bull, and is said to be dry and lean when boiled, because there is but little fat intermixed with the flesh:—

The following are the dimensions of two different whales, taken with accuracy.

	Ft.	Inch.
First. The longest laminæ of whalebone,	10	10
Full length, - -	51	
Length of the head, -	16	
Diameter of the body, -	6	
Behind the fins, -	9 or 10	
Length of the fin, -	7	
Breadth, - -	4	
Breadth of the tail, -	20	

	Feet.
Depth from the indented part, where the two lobes join, to the junction with the body, - -	4
Diameter of the body at its junction with the tail, perpendicularly, -	$2\frac{1}{2}$
And horizontally, -	2
Second. The largest laminæ of the whale-bone, - -	$11\frac{1}{2}$
Extreme length, -	58
Circumference just behind the fins, 30 or	35
Length of the under-part of the head,	19
Breadth, - -	12
Length of the jaw-bone, -	23
Length of the fin, -	9
Breadth of the tail, -	24

Thickness of the blubber at a medium 9 or 10 inches, and of a red colour.

Estimated to produce 19 or 20 tons of oil.

The food of the whale is generally supposed to consist of different kinds of sepiæ, medusæ, or the clio limacina of Linnæus; but I have great reason to believe, that it is chiefly, if not altogether, of the squillæ or shrimp tribe; for, on examining the stomach of one of large size, nothing else was found in it; they were about half an inch long, semi-transparent, and of a pale red colour. I also found a great quantity in the mouth of another, having been apparently vomited by it. When the whale feeds, it swims with considerable velocity under water, with its mouth wide open; the water enters by the fore-part, but is poured out again at the sides, and the food is entangled and sifted as it were by the whalebone, which does not allow any thing to escape.

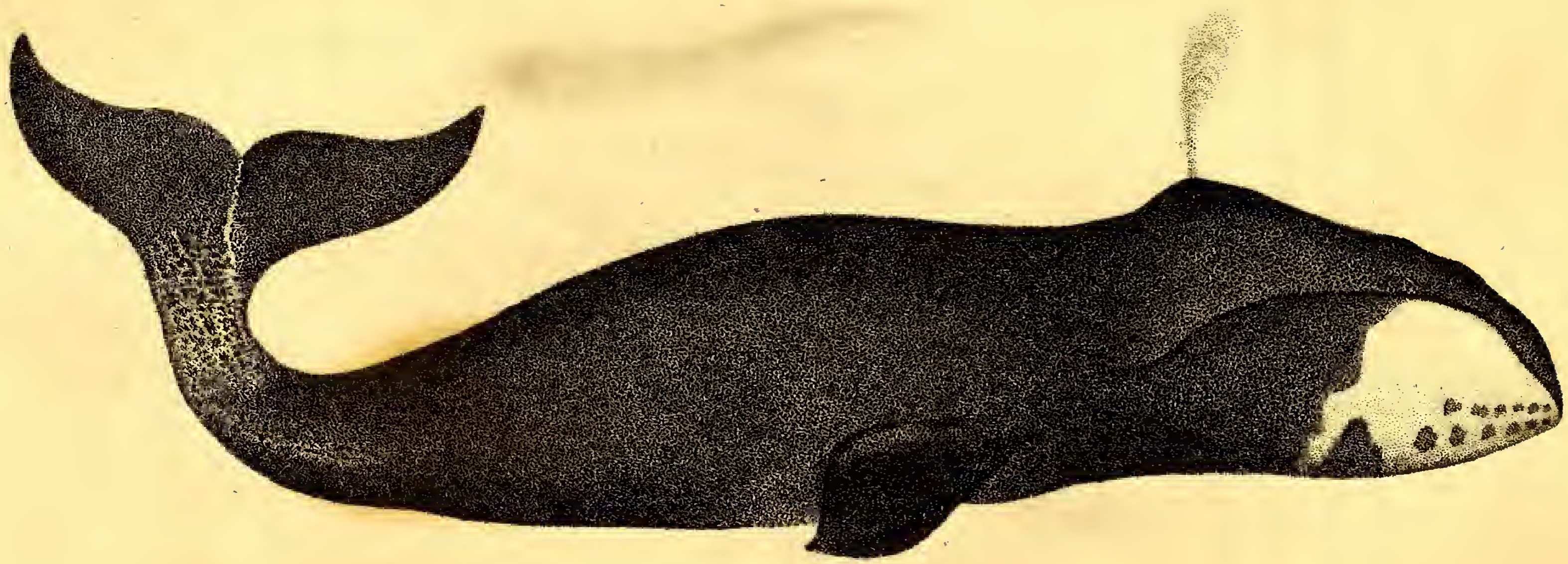
It seldom remains longer below the surface than twenty or thirty minutes; when it comes up again to blow, it will perhaps remain ten, twenty, or thirty minutes at the surface of the water, when nothing disturbs it. In calm weather, it sometimes sleeps in this situation. It sometimes ascends with so much force, as to leap entirely out of the water; when swimming at its greatest velocity, it moves at the rate of seven to nine miles an hour.

Its maternal affection deserves notice. The young one is frequently struck for the sake of its mother, which will soon come up close by it, encourage it to swim off, assist it, by taking it under its fin, and seldom deserts it while life remains. It is then very dangerous to approach, as she loses all regard for her own safety in anxiety for the preservation of her cub, dashing about most violently, and not dreading to rise even amidst the boats. Except, however, when the whale has young to protect, the male is in general more active and dangerous than the female, especially males of about nine feet bone.

The principal enemies of the whale are the sword-fish and thrasher. It is probable that the shark is also an enemy to the whale, for it attacks the dead carcase; and the whale is seen to fly those quarters of the sea where the shark abounds.

Hitherto no accurate representation of this vast animal has appeared in the writings of zoologists. The drawing here engraved I executed in Greenland, and its accuracy was proved, by finding that it agreed in every particular with the numerous individuals I afterwards met with in the Arctic Ocean.

Plate XII. to front P. 586.



W. Scoresby Jun.r del.t

Engr.d by F. Mitchell

XXXI. *Summary of Experiments and Observations on the Germination of the Gramineæ.*

By JOHN YULE, M. D. Coll. Reg. Med. Soc. &c.

[*Read in part* 11*th March* 1809.]

ALTHOUGH the reproductive property of these plants is in a manner proverbial *, no naturalist has as yet accurately traced the steps by which Nature effects this singular result. Many interesting facts, indeed, respecting the first appear-

* M. Duhamel relates the following, among other instances : " Un seul grain d'orge qui étoit levé par hazard, a produit 200 epis, et environ trente petits tuyaux qui n'avoient point d'epis. Les grains d'un epi de moyenne grandeur, en continoit 24, ainsi un *seul grain*, mis en bonne terre, a produit 4800 grains." *Traité de la Culture de Terres*, tom. ii. chap. i. p. 22.

ances, or the germination of seeds in general, have been made known by Malpighi and Grew, and more lately by Gærtner; but these eminent naturalists, having treated incidentally only of the germination of the seeds of the gramineæ, and the object of their experiments having been limited chiefly to the first period of this interesting process, the question respecting the more advanced periods still remained to be solved *. Having therefore occasionally repeated some of the experiments of M. Gærtner, I was induced to carry them somewhat farther; and thirteen months ago, I had the honour to state to the Society a circumstance illustrative of this subject, namely, the presence of a substance between the base of the first *seminal bulb* (*a*) and the scutellum of these seeds, differing in structure and use from both, and serving a purpose analogous with the tuberous substance interposed between the bulbs and roots of the *Liliaceæ*, and other monocotyledonous tribes. This substance Linnæus † considered as part of the root of these plants; from which, however, it differs essentially, being in reality an organ destined to contain an indefinite number of embryo plants,

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* At this time I was unacquainted with the experiments of MM. Mirbel, Poiteaux and Richard on this subject. The last work I have not been able to obtain.

† "*Radix* constat caudice et radicula. *Bulbus* est hy-"bernaculum caudici descendente insidens." *Philosophia Botanica*, p. 38. & 50.

a greater or less number of which are subsequently evolved, by the joint agency of the roots and leaves.

My experiments were made with the seeds of the different species of grain commonly cultivated *; but as the result on the whole was similar, those only in which the seeds of Triticum were used shall be stated.

Soon after a grain of wheat is committed to the damp earth, it swells, becoming more plump and soft. A protuberance appears at the lower part † of the convex side, which, shooting downwards in the direction of the axis of the seed, bursts through the Testa and the under part of the sheath which envelopes the *Seminal Germ* (*b*). This radicle is followed by two others, one on each side; and at the same time, the first stem, in the form of a small bulb, shoots upwards from the Tuber, which unites it with the scutellum, in the concavity of which it lies previous to the commencement of germination. Plate XIII. fig. 1. represents these parts a short time after germinating; the convex back of the scutellum being separated from the farinaceous perisperm in which it was embedded, and from which it absorbs the first aliment of the infant bulbs. Fig. 2. represents the first plant after

* *Hordeum distichum*, and *hexastichum*, *Avena sativa*, *Triticum hibernum*.

† The *base* of a seed is understood to be that part by which it is connected with the receptacle of the maternal plant.

piercing the sheath, with a second bulb shooting from the Tuber like the first. Fig. 3. four plants of the second month, with their respective sheaths, now withered, shot from the same part, the Testa and inner coat of the seed remaining attached to them.

THE COTYLEDON.

M. Malpighi, above a century ago, described this organ *; and M. Gærtner has accurately figured it in the seeds of various genera, and proposes it as characteristic of the Gramineæ †; but he is evidently undecided as to its nature, describing it at first as the Vitellus of the seed, and afterwards naming it *Scutellum Cotyledoneum*. Both M. Jussieu ‡ and Mr Brown ‡, whose opinions are always entitled to great respect, account it the Cotyledon of the seed. I have removed, repeatedly, the border of the Cotyledon, and the first seminal bulb only continued to grow to the height of five inches in this state, but seemed somewhat sickly, although not finally killed by the operation. The use of this organ is evidently to protect the Tuber and embryo bulbs, and to absorb, and probably to assimilate, the nutritious matter of the perisperm for

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* *Anatom. Plantar.* tom. ii. p. 50.

† *De Fructibus et Seminibus Plantarum*, Præf.

‡ *Genera Plant.* Ord. 2, 84. Paris, 1789; and *Prodromus Floræ Nov. Holland. et Insulæ Van Diemen*, vol. i. p. 168. Lond. 1810,—two works in which the candour and great learning of their respective authors are equally conspicuous.

PL. XIII. P. 590.

P. Syme del. J. Anderson Sculp!

their use. On removing, in several instances, this organ, with the first bulb attached to it (Plate XIII. fig. 1.) from the perisperm, during the first stage of germination, and planting it in rich damp mould, one plant only germinating, attained the length of six inches, but in a sickly state, and then generally died: some of these, however, survived, and I am convinced. under more favourable circumstances, would have arrived at maturity; but these experiments plainly proved, that, by thus abstracting its natural aliment, the Seminal Germ is enfeebled, and consequently fewer plants evolved. It is surprising that M. Mirbel should have confounded the *Cotyledon* with the *first leaf* of these plants, from which it differs totally in situation, structure, and consistence. "Le cotyledon "est visiblement le premier feuille, engaignante "aussi bien que celles qui paroitront ensuite *." Now although, previous to germination, the border of this organ is in many instances folded over the *first bulb*, yet the *second*, shooting from the opposite side, (Plate XIII. fig. 2.), is altogether unconnected with it. On the other hand, the kernelly brittle substance of the cotyledon distinguishes it at once from the fibrous and more perfectly organized structure of the leaves, and sheaths of the evolved bulbs.

THE SHEATHS OF THE SEMINAL BULBS.

These sheaths invest the bulbs like the scabbard of a sword. They are pierced, first by the radicles,

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* *Annales du Museum*, 7 année, T. 13. p. 148.

and afterwards, in the progress of vegetation, by the point of the first leaf, (Pl. XIII. fig. 2.) which previously appears of a green colour through their substance. M. Gærtner names the sheath "*va-*" "*gina cotyledonia,*" (as he observed only one); but in reality the sheaths have no analogy with the scutellum or Cotyledon: every one of the seminal bulbs having one proper to itself, whereas there is but a single Cotyledon. On the other hand, these sheaths have the closest analogy with the involucra of the buds of the stem, with this difference, however, that the latter (in such genera as I have examined, as Avena, Arundo, and Poa,) are open towards the point; whereas the sheaths of the seminal bulbs are entire, until pierced by the first leaf.

THE SEMINAL TUBER.

M. Mirbel, in a memoir read before the Institute of France *, on the Germination of the Gramineæ, notices this part, without however ascertaining its use. "La plumule et la radicule sont "unies par l'intermediaire d'un nœud charnu; ce "renflement se prolonge a sa base en un petite "sac, dans lequel est renfermé la radicule." This "nœud charnu," however, as I have already

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* *Annales du Museum*, t. xiii. 2d & 3d cahiers, 7 année. M. Gærtner also indistinctly refers this organ to the "indivisæ cotyledones:"—"nihil aliud sunt "quam *ipse scapus embryonis.*"—Præf. chap. xlix.

observed), serves a purpose much more important in the economy of these plants, than producing the radicles, or "les racines articulaires," as M. Mirbel terms them. The seminal Tuber is indeed analogous with those of the stem, both being the organs in which the bulbs of these plants are formed and matured; but the "racines articulaires" of M. Mirbel are in reality young plants, (Pl. XIII. figs. 2. and 3.), the roots of the Gramineæ being invariably fibrous. Offsets from the seminal tuber indeed sometimes put on the appearance of roots; but a closer examination, as they advance in size, proves them to be the stems of young plants*. It is singular that M. Poiteau, in a memoir in other respects highly valuable, published in the same Journal, (cahiers 3. and 4.), should have mistaken the rudiment of the second seminal bulb (Pl. XIII. fig. 2.) for another cotyledon, and from this circumstance inferred, that the Gramineæ were nearly related to dicotyledonous plants: "Si les graminées se rapprochent les cyperacées par

* It is in a great measure by means of these lateral shoots, and their tubera, that bushes, consisting of from sixty to several hundred stems, originate from one seed. The production of these offsets is frequently accidental: If the seed be buried under a stone, or an indurated lump of clay, the seminal bulbs cannot shoot to the surface, but stems are sent off, in a horizontal direction, as in Triticum repens, until they effect their escape upwards.

" le porte, les feuilles, et les fleurs, elles s'en eloig-" nent considerablement par leur embryon, qui " paroit avoir tres grand rapport avec celui de di-" cotyledones *." But having traced the growth of this supposed cotyledon from its first becoming visible, to its final developement as a plant, and taking for granted, as admitted by M. Poiteau himself, the analogy of the scutellum of the Gramineæ with the double cotyledon of dicotyledonous plants, I should on the contrary conclude, that no other tribe is more decidedly monocotyledonous: nor is the distinction less evident in other parts of the seminal germ and evolved plants. In the first, there is neither rostellum nor plumula squamosa, and in the second neither concentric circles nor reticulated wood; their stems consisting of cylinders entirely hollow, except where interrupted by the tubera, in the tropical species chiefly, approaching to the density of common wood. In short, neither the arborescent Ferns, as described by M. Plumier, nor the Palms, as was demonstrated by the late venerable Daubenton †, or the Smilaceæ, Liliaceæ, and various other tribes, accurately examined by M. Defontaines, do in fact afford a more striking

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* *Annales du Museum*, (Lu à la classe de Sciences Physiques, de l'Institute, 31. Octobre 1808).

† *Mém. de l'Academ. de Sciences*, 1790; on the Date Palm.

contrast with dicotyledonous plants than the Gramineæ.

Supposing the description of the parts of the seminal Germ I have given is correct, it is plain, that the definition of these by the celebrated author of the Philosophia Botanica does not apply to those of the Gramineæ *. Not to mention that the seminal germ in the latter contains several distinct bulbs or plantules, two of which are visible during the first period of germination, the organ from which these germinate is altogether omitted. But allowing that the term " plumula squamosa" were applicable to the sheathed stem of the bulbs, there is, as already observed, no " rostellum simplex descendens," the under part of their sheaths (in Triticum homogeneous with the inner coat of the seed), investing the fibrous roots for a time only, soon decays, permitting the latter to diverge, and to descend deeply into the soil. In short, this definition, including the Germ of dicotyledonous seeds chiefly, is inapplicable to that of the Gramineæ, and probably of the Cyperaceæ, Irideæ, Liliaceæ, and other kindred tribes. " Sed *demon-*" *stratio* longè est optima experientia :—nam si " traducatur ad alia quæ similia existimantur, nisi

* " Corculum novæ plantæ rudimentum ; plumula " pars corculi squamosa adscendens ; rostellum pars cor- " culi simplex descendens."—*Phil. Bot.* p. 52.

"rite et ordinè fiat illa traductio, res fallax "est*."

THE TUBERA OF THE STEM

in these plants resemble in every respect that of the seminal germ, which is in fact the first of the series. These are most numerous towards the lower part of the stem, which, in most of the genera, is more or less procumbent; in some species, as in Triticum repens, creeping under the soil, and in others, as Agrostis stolonifera, along the surface, but always becoming more or less erect when the panicle or spike is about to make its appearance, the tapering stalk of which shoots from the last tuber of each series. I have already observed, that the involucra of the bulbs of the stem being divided, differ from the entire sheaths of those of the seminal germ. They resemble imperfect leafits, which soon wither. The bulbs, protected by the sheathing base of the leaves of the maternal plant, first germinate from the tubera at the lower part of the stem, where they first arrive at maturity; those in the upper part seldom producing branches, unless there is sufficient moisture to promote the emission of roots. In such species, however, as have prostrate stems, whether subterraneous or not, plants are at all times produced. In the rainy autumn of last year, I counted fifty branches from

* *Nov. Organ.* lib. I. p. 392.

one tuber of the T. repens; no root was produced, the stem being raised from the soil. In April last, I planted a part of the stem, nine inches in length, of Poa trivialis, in a moist situation, the lowest tuber just beginning to send forth roots. At midsummer, *one hundred and seventy plants and branches* were produced, covering about a square yard of surface!

In the more erect species, (as the Cerealia), the stem generally dies, after producing ripe seeds; and these have therefore, though inaccurately, been accounted annual or biennial: but this is by no means uniformly the case, and a more exact attention to what really happens, renders it probable, that the whole of the Gramineæ are, under certain circumstances, perennial *.

Plate XIV. fig. 4. represents a specimen of T. hibernum, with young plants of the third year shot from the tubera of the stubble of the past season. This property is common to the cultivated species of barley and oats, which I have repeatedly observed produce plants during a moist autumn from the stubble, when the field had been sown with hay seeds; and in those spikes whose shoots were observable among the crop early in the following season, the seeds ripened some time sooner than those of

* Poa rigida is the only exception I have hitherto met with: whether this be owing to the dry situation in which it grows, remains to be ascertained.

the spring sown grain. Such shoots bear transplantation remarkably well: some of them, after being kept in a moist state, in a tin-box, for upwards of a week, were in May planted in a garden at Warriston, and in the beginning of August produced ripe seeds.—I am perfectly aware that these facts are rather curious than of apparent utility. Of this the practical farmer is the best judge.

VIVIPAROUS GRASSES.

There is yet another manner in which these interesting plants, so necessary to the subsistence of man and animals in general, are reproduced. The grasses, in the opinion of Linnæus, form nearly a sixth part of the plants which adorn the surface of the earth; but there is reason to suppose that the proportion is much greater. In the climates of the temperate zone, nine-tenths of the plants spontaneously produced, exclusive of the cultivated species, are Gramineæ or Cyperaceæ. In exposed alpine situations, as on the summits of our highland mountains, it may well be imagined, that the seeds of the hardiest species seldom ripen, and that the mountain verdure, in addition to various Cyperaceæ, is chiefly supported by offsets from the stems of the Festucæ, Airæ, and Poæ. In many

Pl. XIV. P. 599.

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instances, however, living plants are produced from tubera in the panicle itself, without the intervention of seeds. I have repeatedly examined these plants, both as they appear on their native mountains, and when transplanted into the more genial soil of the garden. Plate XIV. fig. 5. represents the first shoot from the panicle of a mountain species of Aira, which seems to be a variety of A. flexuosa of "Flora Britannica *."

This is the general appearance of the first plant of the viviparous spikelet in this species, towards the middle of June, on first shooting from the rolled base of the uppermost leaf of the maternal plant. The calycine valves are somewhat enlarged, but never put on the appearance of leaves. In most instances, the external valve of each floret only vegetates, serving as the first and second leaf of the first plant. Plate XIV. fig. 6. represents two plants of a viviparous spikelet of another species of Aira, viz. A. cæspitosa, in the month of July, (from my friend Mr Neill's garden at Canonmills, where it has grown several years without forming seeds), with a second plant shot by the side of the other, bent down, in order to shew that both valves of a floret sometimes remain, like the other

* The specimen in my possession is apparently variety β of Flora Britannica, become viviparous. In most respects, the A. levigata, figured as a new species, 2102, English Botany, resembles this grass.

parts of fructification, abortive. On the other side, the external valve of the floret, now become the first leaf, is folded down, to shew the inner valve, in its original state. On examining a viviparous specimen of Poa alpina, brought among other plants last summer from Iceland by Sir George Mackenzie and his party, I found, in several instances, both valves of the florets, on each side, in the lowest part of the spikelet, like the other parts of fructification, abortive, and a plant shot from between them; the germination of buds from the panicle taking place independent of the conversion of the floret-valves into leaves. It is evident, that Linnæus had formed no settled opinion as to the nature of this process: "Germen," he observes, "in folia immediatè procrescat *." And afterwards, "Numne germen absque fœcundatione in rudimento novi germinis excrescat †?" Now, supposing this question were answered affirmatively, What is the nature of this new germen, producing a progeny without pollen? It must necessarily differ from the first: For "Ovum non fœcundatum germinare, negat omnis experientia ‡." In fact, no new germen is formed. But the resources of Nature, or ra-

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* *Amœnitates Acad.* vol. vii. Fundamenta Agrostograph. (Henrico Gaghn.)

† *Nova genera Graminum,* (Erico Næzen.)

‡ *Philosophia Botan.* v. 138.

ther the Great Author of life, are unlimited! On the summits of mountains, and in the frozen regions of the poles, vegetable life is necessarily languid. The parts of fructification, therefore, either are imperfectly formed, or entirely abortive. Were seeds even produced, from the deficiency of light and heat, they could scarcely be perfected: but for the evolution of buds, the stronger influence of the sun is not wanted; and it is highly probable, that the few plants that linger in a half torpid state, in those dreary abodes of almost perpetual winter, are reproduced by buds only.

In the viviparous grasses, I have traced the origin of these buds, which shoot from succulent tubera like those of the stem, terminating the peduncle within the calycine valves. In short, the PROPER RECEPTACLES of these plants, not only as in ordinary circumstances, produce the parts of fructification, but when these are, through the influence of climate, rendered abortive, supply their place by an indefinite number of buds or bulbs, in the same manner as the tubera of the stem, with which the Receptacles of these plants have the closest analogy.

Of the production of bulbs from the receptacle, we have several instances, in different genera of the Liliaceæ; but this process is most evident in various species of Allium. In these, not only the common, but the Proper Receptacles of individual florets, are studded with numerous bulbs, the florets becoming generally abortive. In many instances, I have observed three of these bulbs only, corresponding with the three cells of the capsules of this genus; and, from their external appearance, supported by peduncles, I at first supposed them to be the latter, containing ripe seeds; but on a closer examination, I found the receptacles crowded with bulbs, and others germinating from the tubera of those first evolved.

The plant in Mr Neill's garden retains the size and original aspect of A. cæspitosa, the panicle itself being above twelve inches in length; the calycine valves and peduncles of the young shoots being smooth; and the hairs, so evident at the base of the floret-valves in fig. 5., are wanting in this species. Nor does the mountain plant, when cultivated, according to Mr Don, attain one-half the size of A. cæspitosa. There can be no doubt, therefore, of two distinct species of Aira being viviparous; but notwithstanding the respectable authority of Dr Smith, I should hesitate to consider either of them but as varieties of the common plants.

The number of shoots from one panicle is in some instances incredible. They soon become too great a burden for the maternal stalk, which, bending under the daily increasing weight, falls towards the earth and soon dies, leaving its offspring to shift for themselves. Numerous roots now shoot from below, and more bulbs germinating laterally, the progeny from the Proper Receptacle of a single floret, in a moist season, towards the end of November, has the tufted cæspitose appearance characteristic of the maternal plant.

In calling your attention to these facts, I have, as carefully as possible, observed Nature with my own eyes, endeavouring at the same time to follow the advice of a great master in physical science: "Sit nec NOVITATIS, nec ANTIQUITATIS sectator; "nec contradicendi licentiam, nec auctoritatis ser-"vitutem amplectatur."

EXPLANATION OF TERMS.

(*a*) The first *Seminal Bulb.* I have ventured to use this term in preference to *Corculum, Plantula seminalis*, and *Embryo*, which seem to me to convey an incorrect idea of what is merely the first bulb of the seed in these plants. Priority of evolution certainly does not imply the derivation of the existence and form of the secondary bulbs from the first one, as these terms would seem to take for granted. In fact, the seeds of plants, by a false analogy, have been imagined to resemble, more than they really do, the ova of animals. The latter, however, except in certain anomalous cases, contain only one individual; whereas the seeds of plants, in numerous instances, contain several individuals. In the Gramineæ, and there is reason to suppose in various conterminous Tribes, these individuals germinate from the kernelly substance, which I have termed the *Seminal Tuber.*

(b) In these plants, the *Seminal Germ* includes the Scutellum or Cotyledon, and the Tuber, with one or more bulbs, (one only being visible at first), germinating from it, with their respective stems and radicles, (Plate XIII. fig. 1. and 2.)

XXXII. *Account of the Coal Formation at Durham.*

By Thomas Mackenzie, Esq.

[*Read* 19*th November* 1808.]

The district on which the city of Durham is situated, is composed of flœtz and alluvial rocks. The alluvial substances are sand and coal; and of these the former is the most abundant. The flœtz rocks belong to the series denominated by Werner the Independent Coal Formation *, and which has been considered as the oldest of the coal formations †. My investigations did not extend so far

* Jameson's Mineralogy, vol. iii. p. 179.

† It would appear from the Notes in Dr Anderson's Translation of Von Buch's account of Landeck, that this

as to enable me to ascertain its relations with any of the older formations that may occur in a greater or lesser distance from this district. The beds and strata do not differ from those that occur in this formation in other parts of the globe where it has been hitherto found: thus, it contains sandstone, bituminous shale, slate-clay, clay-ironstone, greenstone, limestone, and coal. The limestone is sometimes vesicular, and the vesicles are lined with crystals of calcspar; and the clay-ironstone frequently contains impressions of ferns. The sandstone is sometimes intermixed with coal, and contains portions of clay-ironstone, in the form of branches and reeds.

In several places, the strata and beds are traversed by veins, composed of a clayey basis, including fragments of sandstone, and sometimes small portions of lead-glance. Veins of greenstone are said to occur in some parts of the district, but I had not an opportunity of seeing any of them.

The following section of the formation, as seen on the banks of the river Wear, and which cor-

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point is not yet ascertained. If a coal formation, as mentioned by Karsten, and other mineralogists, does occur under the old red sandstone, we may expect to find many extensive deposits of this valuable mineral, in the red sandstone that skirts so great an extent of the Highlands of this country, and which in particular abounds so much in the county of Caithness.

responds to that in the pit named Keepier, will afford a more particular illustration of the coal formation of this district. It contains all the rocks occurring in the district, except limestone, which is frequently found immediately below the soil, in beds of considerable thickness. I have given both the names applied to the various rocks by the colliers, and those employed by Werner and by Professor Jameson in his System of Mineralogy.

Section of the Coal-Formation at Durham.

Fathoms.	NAMES.		Thickness.		
	COLLIERS.	WERNERIAN.	Fath.	Ft.	In.
1 2	Soil, &c. -	- -	2	0	0
3	Broken post, -	Much rent sandstone,	1	0	0
4	Grey metal, -	Very friable sandstone,	1	0	0
5	Post, - -	Sandstone, -	1	0	0
6	Grey metal, -	Friable sandstone,	1	0	0
	Whinstone, -	Greenstone, -	0	3	0
7 8 9 10 11 12 13 14	Coarse post,	Coarse sandstone,	8	0	0
15 16 17 18 19 20 21	Fine post, -	Fine sandstone,		0	0

Fathoms.	NAMES. Colliers.	NAMES. Wernerian.	Thickness. Fath.	Thickness. Ft.	Thickness. In.
22 23	Post, mixed with coal,	Sandstone, containing carbonized casts of vegetables,	2	0	0
24	A limestone coal,		0	3	2
	Thill,	Bituminous shale,	0	0	6
		Slate-clay,	0	0	6
25	Grey metal,	Friable Sandstone,	1	0	0
	Ironstone,	Clay-ironstone,	0	0	2
26	Grey metal, with ironstone galls,	Friable sandstone, containing galls of ironstone,	2	0	0
27	Coal,	Slate-coal,	0	0	10
28	Blue metal,	Slate-clay, containing ironstone galls,	1	0	0
	Coal,	Slate-coal,	0	0	8
29	Blue metal,	Slate-clay,	0	2	0
	Ironstone,	Clay-ironstone,	0	0	2
30	Blue metal,	Slate-clay,	1	0	0
31 32 33 34 35 36 37 38 39	Girdles, (post),	Sandstone, having a slaty structure,	9	3	0
	Main coal,	Slate-coal, having a considerable portion of pitch-coal intermixed,	0	4	0
40	Thill,	Bituminous shale,	0	0	3
	Splint coal,	Slate-coal, earthy matter intermixed,	0	0	4
	Thill, &c.				
			40	0	7

Main Dip, about 1½ in 9 towards E.

Side Dip, about ½ in 9 towards S.

XXXIII. *Meteorological Observations on a Greenland Voyage, in the Ship Resolution, in the Year* 1810.

By Mr William Scoresby *jun.*

[*Read 24th November* 1810.]

In the following Table, the column of Thermometer, or Temperatures, shows the mean temperature of two, three, or four observations, as specified by the figures preceding the height of the thermometer.

This mark *, applied to the Latitude, signifies that it is by observation of some of the heavenly bodies, consequently accurate.

The column of Longitude cannot be much depended upon.

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Dates.	Lat.	Longitude	Therm. Nos.	Therm. Deg.	Bar. at noon.	Winds.
Apr. 9.	74° 6′	14° 37′ E.	3	12	29° 97′	N E.erly
10.	73 41	16 0 E.	3	11	30 10	N E.erly, S E
11.	74 16	14 47	3	18	29 96	to E S E
12.	73 42*	14 0 E.	3	20	29 80	E.erly
13.	73 59	16 0 E.	3	7	29 97	to N E.erly
14.	74 50	11 30 E.	3	$14\frac{2}{3}$	30 08	N E to N N E
15.	75 4	9 38	2	12	30 20	N N E to S E
16.	75 46	9 14	3	$12\frac{2}{3}$	30 17	Always calm
17.	76 6	9 30	3	$7\frac{2}{3}$	29 97	Very variable
18.	76 18	8 50 E.	3	$4\frac{2}{3}$	29 92	N N W. W S W
			mast hd. $\frac{1}{4}$			
19.	76 16*	9 0 E.	3	$10\frac{2}{3}$	30 07	W.erly, calm
20.	76 22	9 0 E.	3	$19\frac{1}{3}$	29 72	S E & S to E
21.	76 37	11 0 E.	4	17	29 58	E to N E, &c.
22.	76 17	11 0 E.	3	6	29 97	N or N N W
23.	76 16	10 50	3	$13\frac{2}{3}$	30 02	N.erly, variable
24.	76 20	10 30	4	23	30 23	Calm, S E
25.	76 30	11 10	3	26	29 40	to N W.erly
26.	76 25	11 15	3	$18\frac{2}{3}$	29 57	Ditto
27.	77 10	10 20	3	$20\frac{2}{3}$	29 80	N W or N.erly
28.	77 0	10 40 E.	3	16	29 90	N W or W.erly
29.	76 50	10 0 E.	3	16	29 92	W S W. S W, &c.
30.	76 41*	9 30 E.	3	$17\frac{2}{3}$	30 03	Always
May 1.	76 58	10 0 E.	3	$14\frac{2}{3}$	30 04	N N W. to E, &c.
2.	77 10	10 0 E.	3	$10\frac{2}{3}$	29 97	S S E to E N E
3.	77 39*	10 10	3	14	29 99	N E.erly or N
4.	77 30	9 50	3	$13\frac{2}{3}$	30 05	N E.erly
5.	77 14	10 0 E.	3	16	29 98	N E.erly, variable
6.	77 20*	9 50 E.	3	$23\frac{2}{3}$	29 64	Ditto
7.	77 28*	10 0 E.	3	23	29 50	Do. and N.erly
8.	77 10	9 50	3	$19\frac{2}{3}$	30 00	Do do
9.	77 30	8 0 E.	3	$18\frac{1}{3}$	30 18	N.erly
10.	77 50	5 40 E.	3	$18\frac{2}{3}$	30 27	Do. variable
11.	78 15	5 35 E.	2	$20\frac{1}{2}$	30 34	Variable, calm
12.	78 15	5 30 E.	3	23	30 33	W or N E.erly
13.	78 25	5 50 E.	3	18	30 34	N E to N

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Dates.	Strength of Winds.	Of the Clouds. Time.	Modifications.	Aqueous Meteors, &c.
9.	Strong or hard gales		Cirro-cum. &c.	Snow showers.
10.	Fresh or lt. breezes	Allday	Nimbus.	Show. uncryst. sn.
11.	Lt breees, str. gales		Nimbus.	Show. cryst. snow.
12.	Strong gales		Nimbus.	Ditto
13.	Do. or mod. breezes			Some show. snow.
14.	Fresh gales, squally		Nimbus.	Show. cryst. snow.
15.	Do or light airs		Nimbus.	Do and uncrystal.
16.	Light airs, or calm		Nimbus.	Showers of do.
17.	Fr. breezes, squally		Nimbus.	Ditto
18.	Fr. gales, lt. breezes		Nimbus.	Ditto
19.	Lt. breezes or calm		Cirro-stratus.	Chiefly fair.
20.	Lt. breezes, fr. gales	8 Am.	Cirro cumulus.	A few sh. cryst. sn
21.	Strong gales	Morng.	Cirrus.	Constant cryst. sn.
22.	Fr. or light breezes	11 Pm.	Cirrus, &c.	Frost rime, fair.
23.	Light breezes, var.		Cirro-cumulus.	Fair, pretty clear
24.	Do. or fresh gales	10 Am.	Cirrus, &c.	Snow show. or fair
25.	Strong gales or calm		Cirrus, &c.	Coarse cryst snow.
26.	Do. or mod. breezes		Cirro cumulus	A very little snow.
27.	Light or fr. breezes	Allday	Nimbus.	Show. cryst. snow.
28.	Mod. or light do.		Nimbus.	Ditto
29.	Do. calm or fr. br.		Nimbus.	Much sn. uncryst.
30.	Light or fr. breezes	Allday	Nimbus.	Thick snow show.
1.	Do calm or str. gales	Morng.	Nimbus, &c.	Much cryst. snow.
2.	Str. gales, lt. breezes	Noon.	Stratus.	Snow showers.
3.	Lt. breezes, st. gales	Noon.	Cirrus, nimbus.	Do. crystallised.
4.	Str. gales, mod. br.	9 Pm.	Stratus, cumul.	A few snow show.
5.	Lt. airs, brisk gales	1 Am.	Cumulus.	Do. roughly cryst.
6.	Fresh or strong gales		Cirrus, nimbus.	Clear or cloudy.
7.	Ditto			Cloudy, snow. sh
8.	Fresh gales.	Allday	Nimbus.	Snow show. cryst.
9.	Ditto	Do.	Nimbus.	Do. do.
10.	Mod. or fr. breezes	Morng.	Nimbus.	Do. do.
11.	Lt. airs, and calm			Fair and clear.
12.	Calm or fr. breezes	10 Pm.	Nimbus.	Chiefly fair.
13.	Brisk or strong gales	Allday	Nimbus.	Cryst. snow in sh.

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Dates.	Lat.	Longitude	Therm. Nos.	Therm. Deg.	Bar. at noon.	Winds.
May 14.	78° 48'*	5° 30' E.	3	$15\frac{2}{3}$	30° 35'	N or N b W
15.	79 0	5 0 E.	3	$17\frac{1}{3}$	30 07	N.erly
16.	78 45	4 30 E.	3	$19\frac{1}{3}$	29 66	N b W or N N E
17.	78 30	4 0 E.	3	$16\frac{2}{3}$	29 87	N E.erly
18.	78 25	4 10 E.	3	17	29 89	N E.erly, variable
19.	78 35*	5 0 E.	3	$17\frac{2}{3}$	29 84	Ditto
20.	79 5*	4 0 E.	3	$19\frac{2}{3}$	29 97	N N E & variable
21.	79 15	3 0 E.	3	21	29 88	Do W.erly, var.
22.	79 20	3 30 E.	3	21	29 64	S W.erly
23.	79 15	3 50 E.	2	23	29 58	Do N E or E
24.	79 0	4 0 E.	3	$16\frac{1}{3}$	29 91	N E.erly
25.	78 45*	4 10 E.	3	$13\frac{2}{3}$	30 02	Do to N N W
26.	78 53*	3 40 E.	3	$13\frac{1}{3}$	29 95	to N W
27.	78 57	3 28 E.	3	$16\frac{1}{3}$	29 72	N E.erly, variable
28.	78 50	3 0 E.	3	$14\frac{2}{3}$	29 98	E.erly, variable
29.	78 45	2 50 E.	2	15	30 12	Do N E.erly, &c.
30.	78 50	2 50 E.	2	$27\frac{2}{3}$	29 75	S S W
31.	79 0	2 50 E.	2	28	29 47	N.erly
June 1.	78 34*	3 0 E.	3	22	30 04	N b W. S.erly
2.	78 24	4 0 E.	2	27	29 86	E S E to N E
3.	78 20	3 30 E.	2	21	29 89	N E to N b E
4.	78 15	3 0 E.	2	19	29 94	N.erly
5.	78 12	3 20 E.	3	21	29 90	to N E.erly
6.	78 8	3 20 E.	2	24	29 77	N.erly
7.	78 4	3 10 E.	2	$25\frac{1}{2}$	29 73	N N E or N
8.	78 0	3 10 E.	2	$24\frac{1}{2}$	29 74	N b E to N N W
9.	77 55*	3 0 E.	2	$28\frac{1}{2}$	29 64	N W.erly
10.	77 54	3 5 E.	2	26	29 73	Do variable
11.	77 48*	3 0 E.	3	$31\frac{1}{3}$	29 83	N N W & W b N
12.	77 47	3 10 E.	2	32	29 87	to S W.erly, var.
13.	77 47	3 10 E.	3	32	29 86	S W.erly, variable
14.	77 50	3 0 E.	3	$32\frac{1}{3}$	30 09	Very variable
15.	77 55	3 10 E.	2	$31\frac{1}{2}$	30 15	Do calm
16.	77 59	3 40 E.	2	29	30 25	S W or W.erly
17.	78 4	3 30 E.	2	$30\frac{1}{2}$	30 20	Ditto
18.	78 7	3 20 E.	3	$30\frac{2}{3}$	29 75	Do variable

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Dates.	Strength of Winds.	Of the Clouds. Time.	Of the Clouds. Modifications.	Aqueous Meteors, &c.
14.	Brisk or strong gales	10 Am.	Cirrus, &c.	Cryst. snow in sh.
15.	Do. or strong gales	10 Am.	Cir.-cum. &c.	Show. cryst. snow.
16.	Ditto	6 Am.	Cirrus, nimbus.	A few ditto
17.	Ditto	most d.	Cirrus, nimbus.	Ditto
18.	Fresh breezes	Allday	Nimbus.	Show. cryst. snow.
19.	Ditto	Morng.	Nimbus.	Some ditto
20.	Do. or light breezes	Noon.	Cirro-cum. &c.	Some ditto
21.	Lt. airs, or mod. br.	4 Am.	Cirro-cumulus.	Fair, pretty clear.
22.	Mod. breezes, fr. gales	most d.	Nimbus.	Show. cryst. snow.
23.	Calm, or do.	Allday	Nimbus.	Do. rough cryst.
24.	Brisk gales	Do.	Nimbus.	Do. cryst. snow.
25.	Brisk do. & squally	Morng.	Nimbus.	Do. do.
26.	Fr. gales or lt. br.	6 Am.	Cirrus, &c.	Some do. do.
27.	Light airs	3 Pm.	Cirrus, &c.	Do. perfect cryst.
28.	Incl. to calm, lt. br.	2 Am.	Nimbus.	Chiefly fair.
29.	Fr. breezes, lt. airs		Nimbus.	Some snow show.
30.	Fresh gales		Nimbus.	Snow showers.
31.	Calm or fresh gales	Midnt.	Nimbus.	Chiefly fair & cl.
1.	Do. do.	Noon.	Cirrus.	Fair and clear.
2.	Mod. br. light airs		Cirro-stratus.	Show. rough cryst.
3.	Ditto	Morng.	Nimbus, &c.	Do. small uncryst.
4.	Moderate breezes	most d.	Ice blinks.	Fair.
5.	Ditto	Ditto	Nimbus.	Some showers sn.
6.	Light breezes	Ditto	Nimbus.	Do. rough cryst.
7.	Mod. br. str. gales	Morng.	Cirro-cumulus.	Chiefly fair.
8.	Brisk or str. gales	10 Pm.	Cirro-cum. &c.	Showers of snow.
9.	Fresh gales	most d.	Nimbus.	Ditto
10.	Calm or mod. br.	Morng.	Nimbus.	Some few ditto
11.	Light breezes	4 Pm.	Cirro-stratus.	Fair.
12.	Do. & mod. breezes	Night.	Nimbus.	Hazy showers.
13.	Light airs			Fine clear weather.
14.	Lt. or mod. breezes	1 Am.	Cirro-stratus.	Some fog showers.
15.	Light airs or calm			Fair.
16.	Do. or mod. breezes		Nimbus.	A very little snow.
17.	Fresh gales	Allday	Nimbus.	Small snow show.
18.	Do. or mod. breezes	Eveng.	Nimbus.	Fog or snow show.

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Dates.	Lat.	Longitude	Therm. Nos.	Therm. Deg.	Bar. at noon.	Winds.
June 19.	78° 0	3° 45′ E.	3	$29\frac{1}{3}$	29° 61′	N W to N
20	77 58	3 38 E.	3	33	29 60	N.erly, calm
21.	78 0	3 44 E.	3	29^{3}	29 63	Calm, N E b E
22	77 50	4 10 E.	2	$27\frac{1}{2}$	29 80	N E.erly to N b W
23	76 55	7 30 E.	2	$30\frac{1}{2}$	30 06	N W or W.erly
24.	76 40	6 30 E.	3	$33\frac{2}{3}$	29 94	to S.erly
25.	76 10	7 0 E.	3	$31\frac{2}{3}$	30 14	N E to S E.erly
26.	75 40	6 10 E.	2	$32\frac{1}{2}$	29 62	to S W or W
27.	75 0	8 30 E.	2	32	29 86	N W to S W

In the foregoing Table, the column of the Modification of the Clouds is conducted in the manner advised by Luke Howard, Esq; in his "Essay "on the Modifications of Clouds," published in Nicholson's Journal for 1803. Some short explanation of the terms employed seems necessary.

1. *Cirrus* consists of parallel diverging fibres, extensible in all directions; being the highest and least dense clouds.

2. *Cumulus* is a conical heap, increasing upwards from a horizontal base; forming the densest clouds.

3. *Stratus*, a wide continuous horizontal sheet, increasing from below; such as mists, &c.

These

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Dates.	Strength of Winds.	Of the Clouds.		Aqueous Meteors, &c.
		Time.	Modifications.	
19.	Strong or lt. breezes	2 Am.	Cirrus.	Some snow show.
20.	Light breezes, calm			Fair.
21.	Calm or mod. breezes		Ice blinks.	Fair, but cloudy.
22.	Mod. or fresh breezes		Ditto	Fair and clear.
23.	Fr. or mod. breezes			Do. clear.
24.	Light airs or calm		Nimbus.	Show. cryst. snow.
25.	Do. to fresh gales	Noon.	Nimbus.	Ditto
26.	Fresh breezes or do.		Nimbus, &c.	Snow or fog show.
27.	Str. gales, mod. br.		Nimbus.	Small snow show.

These Mr Howard considers as simple modifications. The intermediate modifications are,

4. *Cirro-cumulus*, small roundish masses, in horizontal arrangement, close together.

5. *Cirro-stratus*, horizontal attenuated undulated masses, or groups of such small clouds.

6. *Cumulo-stratus*, the above blended with the cumulus; or the cirro-stratus forming a broad base to the cumulus.

7. *Cumulo-cirro-stratus*, or *Nimbus*, the rain-cloud; a horizontal sheet, having the cirrus above, and the cumulus entering it laterally and from beneath.

XXXIV. *Analysis of Compact Felspar from Pentland Hills.*

By Charles Mackenzie, M. D.

[*Read 24th November* 1810.]

The country around Edinburgh, in a mineralogical point of view, is one of the most interesting in Scotland. No fewer than three of the universal formations occur within a few miles of the city, namely, *transition*, *oldest coal*, and *newest flœtz trap*. Much of the lower and flatter part of the country is occupied with *coal* and *newest flœtz trap* formations; but the higher parts contain, besides these, considerable portions of *transition rocks*. The Pentland Hills, from which the felspar that forms the subject of this paper was obtained, constitute the highest ground near Edinburgh, rising in some places, Loganhouse Hill, for example, to the height of 1700 feet above the level of the sea. This elevated tract, according to the examination of Professor Jameson, contains transition and flœtz rocks of different kinds. The transition formation constitutes the fundamental rock, which consists of *grey wacke*, *grey wacke-slate* or *transition-slate*, displayed in vertical strata. Over these, apparently in an unconformable and overlying position, occur rocks of *conglomerate*, *sandstone*, *trap-tuff*, a *tuff* with a *base of claystone*, *claystone*, *compact felspar*, *porphyroid*, or *porphyritic claystone*, *clinkstone*, *basalt* and *greenstone*. It does not appear that Professor Jameson has hitherto ascertained whether these flœtz strata constitute one or more different flœtz formations.

One of the most striking rocks in the above described series is the *compact felspar*, which occurs so abundantly in some places as to form nearly the whole mass of several hills. The specimen employed for analysis exhibited the following characters.

Its colour was flesh red, its fracture minute foliated, its internal lustre glimmering, its fragments sharp-edged; it was translucent on the edges, semi-hard, brittle, fragile; its specific gravity was 2.497.

The Pentland Hills exhibit the first known example of compact felspar constituting mountain-masses. The same subspecies occurs also in *primitive* country, in beds, from one to eight or ten feet thick, as at Coriarick, and other parts of the Highlands of Scotland. It occurs also in *transition* mountains in the south of Scotland. But in neither of these situations is it so abundant as in the flœtz formation which we have just mentioned.

As this rock is interesting in an economical, as well as mineralogical point of view, being employed as an ingredient in porcelain, I was induced to undertake its analysis, and performed it, about three years ago, in Dr Thomson's laboratory, with as much attention to accuracy as possible.

The analysis was conducted in the usual way. Hence it is not necessary to particularize the experiments. The constituents obtained were the following :—

Silica, - -	71.17
Alumina, - -	13.60
Lime, - -	0.40
Iron, - -	1.40
Manganese, - -	0.10
Potash, - -	3.19
Volatile matter, - -	3.50
	93.36
Loss,	6.64
	100.00

This result approaches very nearly to a previous analysis of common felspar by Vauquelin. Our compact felspar agrees very nearly in its composition with the variety known to the Chinese under the name of *petunse*, which forms a principal ingredient in their porcelain. The quantity of iron which our felspar contains, renders it unfit for the finer kinds of porcelain.

In several of the lateral valleys in the Pentland range, there occurs a greyish and yellowish-white coloured *claystone* *, which agrees in many of its characters with compact felspar. This mineral should be analysed, as there is a probability of its containing the same constituent parts as felspar, with the exception of the iron; and if so, it would answer for the finest kinds of porcelain.

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* This *porphyroid*, or porphyritic claystone, bears a striking resemblance to the *porphyroid* of Auvergne, which Faujas de St Fond, Delametherie, Haüy, Cordier, and Von Buch, consider as a volcanic product.

ADDITIONS AND CORRECTIONS.

CORRECTIONS AND ADDITIONS BY COLONEL MONTAGU.

Ziphotheca tetradens, p. 81., *et seq.*

A very young specimen of this curious fish was found alive on the shore in Slapton Bay, on the south coast of Devon, about four miles east of the Start Point, on the 7th of February in the present year, (1810.) I regretted not having seen it alive, but it was quite fresh and perfect when brought to me the day after it was taken, and is now in high preservation in spirits. It measures about ten inches in length, and half an inch in breadth, at the broadest part, just behind the head, and where its thickness does not much exceed one-eighth of an inch. It differs in nothing but size from that before described: the characteristic larger teeth are conspicuous, and the two ventral scales peculiar to the species, are also obvious, by the assistance of a glass: the dorsal and anal fins are so fine in this young specimen, and lie so close, that they are not easily discovered, unless they are lifted up by some pointed instrument: the caudal fin is very small, but perfect: the under jaw projects full as much in proportion as in the larger fish: the whole skin is covered with a silvery cuticle, which is easily separated by gentle friction, and adheres to the fingers; it is not of that high polish observed in some of the scaly fishes, and is a little wrinkled; there are also several slight longitudinal depressions on the sides, that give a striped appearance in some points of view. In proportion to its length, the *Ziphotheca tetradens* is perhaps the most compressed species of fish hitherto known, the *Leptocephala Morisii* excepted.

How are we to account for this very young specimen being found in our seas, unless the spawn had been deposited on our coast? and if, as we may now conclude, this fish actually inhabits our seas, it is curious that it should never before have been discovered.

Fasciola trachea, p. 194. *et seq.*

Page 194. *bottom, read*, "This disease is pro-"duced by a species of fasciola lodging within "the trachea, frequently extending from the la-"rynx to the bronchi, or divarication of the wind-"pipe, but never that I have observed in the "lungs."

I have this summer (1810), for the first time, had my young turkeys slightly affected with a vermicular disease, resembling that observed in the common fowl, but that it never arrived at that critical crisis gaping, from which few birds recover, and was only attended with a cough, or sudden expulsion of air from the lungs. A specimen dissected which died of another complaint, proved the vermes to be exactly the same as those described to inhabit the trachea of other poultry: three of the fasciolæ were discovered in the usual part.

From the account given by Dr Wiesenthal, Professor of Anatomy at Baltimore in America, (noted by the Editors of these Transactions, p. 199.) of a similar disease incident to the turkey of that country, it is evidently produced, not by the same species of vermis, but by a different one, destitute of the essential specific character—the lengthened arm; neither does the animal appear to inhabit the same part, or at least it is not confined to the trachea, since we are told, that "a feather stript "to within a little of the point, being introduced "into the mouth, and twisted round, the animals "are frequently entangled and withdrawn." The seat of this disease should seem to be confined to the œsophagus, and therefore the worms may appear in the pharynx, and even in the mouth, and cause an irritation in the larynx, without entering the trachea; and if so, would certainly be within the reach of immediate remedy: whereas no substance can be applied to the trachea internally; even a single drop of oil introduced within the larynx, I have found to be certain death in diseased chickens.

It may be worth remarking in this place, that a complaint similar to that in domestic poultry, is known by husbandmen to affect calves; and I have been credibly informed, that death frequently ensues from the violent irritation produced. The remedy, as I am assured, is that of confining the animal affected in an apartment fumigated with frankincense, turpentine and brimstone, (the latter, however, must certainly be in small proportion, and exhibited with care), and that it never fails.

May not the fumigation of tobacco, or the smoke of other less pungent vegetables, cause the worms in the trachea of poultry to quit their hold, and be driven out by the violent expulsion of air in coughing?

Sheep are frequently affected with violent coughs; may not irritation be caused in a similar manner, without primary pulmonary affection? May not the lungs become diseased in consequence, and cause death? This may be worth a strict investigation, in an animal so nearly connected with human comforts.

CORRECTIONS AND ADDITIONS BY MR MAUGHAN.

List of Rare Plants found near Edinburgh, p. 215. *et seq.*

ATROPA

Belladonna. Found abundantly on Inchcolm, July 1810, where it was originally observed by the late Mr John Mackay. This is an excellent habitat, and certainly much preferable to that given at p. 222.

PHELLANDRIUM

aquaticum, p. 225. This plant, which I had suspected to be extirpated, again appeared last summer (1810) in the ditches near Corstorphine, where I then gathered specimens.

MELAMPYRUM

sylvaticum, p. 234. In giving Auchindenny and Roslin woods, as habitats for this very rare plant, I have been inadvertently led into a mistake. The species hitherto found in these woods is, I am persuaded, nothing else than M. *pratense*. I only detected my error in the month of August 1810, when I had an opportunity of observing the true M. *sylvaticum* for the first time, in the Forest of Blackhall, Kincardineshire, along with Dr Brine and my ever to be lamented friend the late Professor JAMES BEATTIE of Aberdeen, whose premature death, on the 4th of October last, has deprived this country of a man equally versed in the principles and practice of the science of Botany, two qualities seldom found united in the same individual. His assiduity as a practical botanist, was rewarded by the discovery of LINNÆA *borealis*, CAREX *Davalliana*, and C. *Micheliana*.

Asplenium

marinum, p. 242. Observed in the crevices of rocks on Inchcolm, by *E. J. Maughan*, in July 1810.

ADDITION BY CAPTAIN LASKEY.

Account of North British Testacea, p. 372. add,

Chiton *ruber*. Found on stalks of Fucus digitatus near Dunbar.

ADDITION BY PROFESSOR JAMESON.

On the Topaz of Scotland, p. 448.

Another Topaz has been found near Invercauld, in Aberdeenshire. Its weight, as communicated to me by Colonel Imrie, is 3420 grains, or 7 ounces 2 pennyweights and 12 grains: Its specific gravity 3.56. It is said, that a distinct crystal, heavier than the preceding one, has been found in the same county, and is now in the possession of a gentleman in Aberdeen.

DONATIONS.

Dr ANDERSON :—Translation of Von Buch's Landeck, and Werner on Veins.

R. BALD, Esq:—Collection of Rocks of the Coal-Formation of Alloa.

Dr BARCLAY :—Muscular System; and other works.

Professor BARTON of Philadelphia :—Discourse on some of the principal Desiderata in Natural History; Some account of the Siren Lacertina; Supplement to a Memoir concerning the Fascinating Faculty which has been ascribed to the Rattlesnake, and other American Serpents; Facts, Observations and Conjectures relative to the Generation of the Opossum of North America.

Count de BOURNON :—Mineralogy, 3 vols. 4to.

Dr BRUCE, New York :—First Number of American Mineralogical Journal.

Reverend Mr FLEMING ;—Collection of Rocks of the Island of Papa Stour.

Colonel IMRIE :—Collection of Rocks of the Grampians.

Professor JAMESON:—Mineralogy of the Western Islands; External Characters; System of Mineralogy; Series of Rocks, illustrating the Geognosy of Arran.

J. LASKEY, Esq:—Collection of North British Testacea.

Dr

Dr Macknight :—Rocks collected during his Journey through the Highlands.

Gilbert Meason, Esq:—Bones of the Orkney Animal.

G. Montagu, Esq:—Testacea Britannica, coloured ; Ornithological Dictionary.

Charles Stewart, Esq:—Elements of Natural History.

Dr Thomas Thomson :—Elements of Chemistry.

Dr Wright,—an Ornithorhynchus.

CORRIGENDA.

Page	line			
14.	2.	*for* Tourneforte	*read*	Tournefort
38.	1.	— erectæ.	——	erecti.
id.	2.	— revolutæ.	——	revoluta.
39.	*After l.* 21. *add*, SPECIES, Asclepias gigantea et procera.			
40.	11.	*for* KANAKK	*read*	KANAHH
49.	8.	— Peckeley.	——	Pecheley.
50.	18.	— *Palis. Hor.*	——	*Beauv. Flor.*
53.	14.	— Suffrutæ	——	Suffrutices
55.	10 & 16	— apice	——	apici
57.	14.	— apice	——	apici
60.	7. &c.	— *H.*	——	*Fl.*
71.	ult.	*add*, et Syria.		
75.	10.	— Arnhenis	——	Arnhem's
278.	24.	— are probably	——	seem to be
280.	3	— gronnd	——	ground
——	14.	— such an elevation,	——	such a height,
288.	21.	— may reckoned	——	may be reckoned
304.	21.	— presides	——	preside
——	27.	— range which stretch	—	ranges which stretch
310.	27.	— rock	——	rocks
423.	7.	— tegument;	——	ligament;
452.	The note to be deleted.			

ENGRAVINGS, &c.