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PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

August 25, 1840.—W. H. Lloyd, Esq., in the Chair.

Specimens were exhibited of five new species of Kangaroo, forming part of the collection made by Mr. Gould, who had just returned from Australia, after an absence of two years and a half spent in the investigation of the habits and œconomy of the animals of that continent.

The first of these Kangaroos to which Mr. Gould drew attention was a large species, but little inferior in size to the *Macropus major*, inhabiting the summits of the mountain ranges in the interior of New South Wales. Mr. Gould observed, that it is a most powerful animal, and very dangerous to approach. The unusual strength and size of the limbs suggested the specific name of *robustus*, and Mr. Gould accordingly characterized it as

MACROPUS (PETROGALE*) ROBUSTUS. *Macr. artubus anticis magnis et prærobustis; vellere e fusco cinereo, apud partes inferiores pallidiore; tarsi fuscis; digitis anticis nigris; antipedibus, et carpis, nigris; capite fuliginoso leviter tincto; utraque genâ lineâ albescente notatâ; gulâ, guttureque albidis; caudâ superne fuscâ, subtus pallidiore.*

* The *Petrogale* of Gray is probably identical with *Heteropus* of Jourdan.

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	unc.	lin.
Longitudo ab apice rostri ad caudæ basin.	47	0
———— caudæ	25	6
———— tarsi digitorumque (sine unguibus).	11	0
———— ab apice rostri ad basin auris	8	0
———— auris	3	7

Fœmina differt vellere ex argenteo cinereo, corpore subtùs ferè albo. Long. corporis cum capite, 33 unc.; caudæ, 26; tarsi digitorumque, 10 unc. 2 lin.

The second species has a remarkably elegant appearance, being of a slender delicate form, and adorned with two white stripes, which commencing at the *occiput*, run down the back of the neck on to the shoulders, where they are recurved. Mr. Gould proposed to designate this species

MACROPUS FRÆNATUS. *Macr. elegans, et gracilis; vellere molli brevi, colore e fusco cinereo; corpore subtùs albo; ab occipite utrinque super humeros linedã angustã albã currente; interspatio obscuro, et apud occiput nigrescente: caudã tuberculo parvo corneo ad apicem instructo, pilis nigrescentibus abscondito; tarsis, artibusque anticis ferè albis, digitis pilis obscuris paulò adspersis.*

	unc.	lin.
Longitudo ab apice rostri ad caudæ basin.	23	0
———— caudæ	20	0
———— tarsi digitorumque (sine unguibus).	5	6
———— ab apice rostri ad basin auris	4	2
———— auris	2	3

Hab. Interior of New South Wales.

The third species is about the same size as the last. The most remarkable character in this animal consists in its having a nail at the tip of the tail: this nail is hidden by the tuft of hair with which the end of the tail is furnished, and greatly resembles a finger-nail, both in texture and form, but is of a black colour. The name proposed for this species was

MACROPUS UNGUIFER. *Macr. corpore gracili, caudã perlongã; vellere perbrevis, et mediocritèr mollis: colore fulvo, parte corporis anteriore, et collo albescentibus; capite ferè toto, nec non artibus abdomineque albis: notã fuscã longitudinali, apud dorsum; caudã albiddã, apicem versus, pilis longis et fuscis indutã, ad apicem cum ungue nigrescente, ferè magnitudinem et figuram unguis exhibente, ut in digito hominis videtur, instructã.*

	unc.	lin.
Longitudo ab apice rostri ad caudæ basin.	25	0
———— caudæ	26	0
———— tarsi digitorumque (sine unguibus).	7	0
———— ab apice rostri ad basin auris	4	0
———— auris	2	6

Hab. North-west coast of Australia.

To the fourth species, having two crescent-shaped white marks on the shoulders, Mr. Gould gave the name of

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MACROPUS LUNATUS. *Macr. capite brevi, auribus magnis; artubus anticis parvis; tarsi mediocriter elongatis et gracilibus; colore cinereo, collo humerisque ferrugineo pallidè tinctis; corpore subtus e cinereo albo; lineâ arcuatâ albâ in utrinque latus, ab humeris extensâ.*

	unc.	lin.
Longitudo ab apice rostri ad caudæ basin. . . .	18	0
———— caudæ	0	0 ?
———— tarsi digitorumque (sine unguibus). . .	4	6
———— ab apice rostri ad basin auris	3	0
———— auris	2	0

Hab. West coast of Australia.

The fifth species resembles the Common Hare in size, and in the texture of the fur; so much so, indeed, that a portion of its skin could not be distinguished from that of a Hare. The fore-legs and feet of this animal being very small, Mr. Gould proposed to describe it as

MACROPUS LEPORIDES. *Macr. pro magnitudine et velleris colore nec non texturâ, Lepori timido assimilis; capite breviusculo; antibrachiis pedibusque parvulis; caudâ breviusculâ et gracili; corpore supernè nigro, fusco et flavido variegato; apud latera, et circum oculos colore pallidè fulvo prævalente; abdomine e cinereo albo; artubus anticis ad basin nigris.*

	unc.	lin.
Longitudo ab apice rostri ad caudæ basin. . . .	19	6
———— caudæ	13	0
———— tarsi digitorumque	4	9
———— ab apice rostri ad basin auris	4	0
———— auris	2	0

Hab. Interior of Australia.

Mr. Gould also exhibited a remarkable spiny Lizard, allied to the Agamas, which he had procured from Swan River.

Mr. Gould then called the attention of the Members to an extraordinary piece of Bird-architecture, which he had ascertained to be constructed by the Satin Bird, *Ptilonorhynchus holosericeus*, and another of similar structure, but still larger, by the *Chlamydera maculata*. These constructions, Mr. Gould states, are perfectly anomalous in the architecture of birds, and consist in a collection of pieces of stick and grass, formed into a bower; or one of them (that of the *Chlamydera*) might be called an avenue, being about three feet in length, and seven or eight inches broad inside; a transverse section, giving the figure of a horse-shoe, the round part downwards. They are used by the birds as a playing-house, or "run," as it is termed, and are used by the males to attract the females. The "run" of the Satin Bird is much smaller, being less than one foot in length, and moreover differs from that just described in being decorated with the highly-coloured feathers of the Parrot tribe; the *Chlamydera*, on the other hand, collects around its "run" a quantity of stones, shells, bleached bones, etc.; they are also strewed down the

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centre within. Mr. Gould spent much time in observing the habits of those birds, and was fully satisfied that the "runs" were actually formed by them, and constructed for the purposes described.

Sept. 8.—James Whishaw, Esq., in the Chair.

An extensive series of new species of the genus *Cardium* was exhibited by Mr. Cuming, and the following account by Mr. G. B. Sowerby, Jun., of their characters, was read.

CARDIUM SINENSE, Conch. Illustr. f. 35. *Card. testá rotundatá, posticè subrostratá paulò ringente, ad marginem subexpansá, omninò (anticè præcipuè) minutissimè granulatá, pallidè fulvá; costis 23 validis, rotundatis, quarum 8 postremis angustioribus, posticè subangulatis, fimbriatis; margine dorsali inflato; ventrali internè fortissimè dentato.*

Long. 1·55; lat. 1; alt. 1·40 poll.

Hab. ad mare Sinense, et ad insulas Philippinas, invenit H. Cuming. Slightly resembling *C. Asiaticum*, from which it is distinguished by having larger and fewer ribs, and a small fringe on the posterior ribs. Found in sandy mud.

CARDIUM STRIATULUM, Conch. Illustr. f. 16. 45. *Card. testá tenui, rotundatá, posticè subrostratá minutissimè radiatim striatá; pallidè fulvá rubro radiatim fasciatá; intus albá, fasciis binis rubris radiatá; striis postremis denticulatis; epidermide fuscá.*

Long. 1· ; lat. 0·60; alt. 0·90 poll.

Hab. ad Australiam et ad Novam Zelandiam. G. Bennett legit. The pink-striped bands which give so much brilliancy to this shell when in a young state, are scarcely to be traced in the older specimens. The doubt as to their identity, which this circumstance at first created, was only removed by the most careful comparison.

CARDIUM AUSTRALE, Conch. Illustr. f. 12. *Card. testá obliquè ovatá, tenui, albá, purpureo-rubro fuscoque præcipuè ad umbones maculatá, purpureo ad latera fasciatá; umbombus lævibus; lateribus marginibusque tenuissimè sulcatis; cicatrice ab apice ad marginem posticum decurrente.*

Long. 1·20; lat. 0·85; alt. 1·30 poll.

Hab. ad Australiam, et ad mare Sinense.

This species differs from *C. tenuicostatum* and *C. papyraceum* in its proportions, being longest from the apex to the ventral margin; and also from the latter in the narrowness of the posterior ribs, and in having a distinct groove on the posterior side. Since the application of the above name, specimens have been met with in Mr. Cuming's Collection, named *C. sauciatum* by Dr. Beck, who, however, to the best of our knowledge, has not published it.

CARDIUM RINGICULUM, Conch. Illustr. f. 11. *Card. testá longitudinalitè ovali, tenui, utrinque hiantè; posticè elongatá, subaspersá; costis anterioribus angustis, inconspicuis; tribus centralibus latis, planulatis ad marginem valdè dentatis; decem postremis angustioribus, paulò elevatis, ad marginem dentatis.*

Var. *testá pallidè flavidá.*

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Long. 1.55; lat. 1; alt. 1.40 poll.

Hab. ad mare Sinense, et ad insulas Philippinas, invenit H. Cuming. Slightly resembling *C. Asiaticum*, from which it is distinguished by having larger and fewer ribs, and a small fringe on the posterior ribs. Found in sandy mud.

CARDIUM STRIATULUM, Conch. Illustr. f. 16. 45. *Card. testá tenui, rotundatá, posticè subrostratá minutissimè radiatim striatá; pallidè fulvá rubro radiatim fasciatá; intus albá, fasciis binis rubris radiatá; striis postremis denticulatis; epidermide fuscá.*

Long. 1; lat. 0.60; alt. 0.90 poll.

Hab. ad Australiam et ad Novam Zelandiam. G. Bennett legit. The pink-striped bands which give so much brilliancy to this shell when in a young state, are scarcely to be traced in the older specimens. The doubt as to their identity, which this circumstance at first created, was only removed by the most careful comparison.

CARDIUM AUSTRALE, Conch. Illustr. f. 12. *Card. testá obliquè ovatá, tenui, albá, purpureo-rubro fuscoque præcipuè ad umbones maculatá, purpureo ad latera fasciatá; umbombus lævibus; lateribus marginibusque tenuissimè sulcatis; cicatrice ab apice ad marginem posticum decurrente.*

Long. 1.20; lat. 0.85; alt. 1.30 poll.

Hab. ad Australiam, et ad mare Sinense.

This species differs from *C. tenuicostatum* and *C. papyraceum* in its proportions, being longest from the apex to the ventral margin; and also from the latter in the narrowness of the posterior ribs, and in having a distinct groove on the posterior side. Since the application of the above name, specimens have been met with in Mr. Cuming's Collection, named *C. sauciatum* by Dr. Beck, who, however, to the best of our knowledge, has not published it.

CARDIUM RINGICULUM, Conch. Illustr. f. 11. *Card. testá longitudinalitè ovali, tenui, utrinque hiantè; posticè elongatá, subaspersá; costis anterioribus angustis, inconspicuis; tribus centralibus latis, planulatis ad marginem valdè dentatis; decem postremis angustioribus, paulò elevatis, ad marginem dentatis.*

Var. *testá pallidè flavidá.*

centre within. Mr. Gould spent much time in observing the habits of those birds, and was fully satisfied that the "runs" were actually formed by them, and constructed for the purposes described.

Sept. 8.—James Whishaw, Esq., in the Chair.

An extensive series of new species of the genus *Cardium* was exhibited by Mr. Cuming, and the following account by Mr. G. B. Sowerby, Jun., of their characters, was read.

CARDIUM SINENSE, Conch. Illustr. f. 35. *Card. testá rotundatá, posticè subrostratá paulò ringente, ad marginem subexpansá, omninò (anticè præcipuè) minutissimè granulatá, pallidè fulvá; costis 23 validis, rotundatis, quarum 8 postremis angustioribus, posticè subangulatis, fimbriatis; margine dorsali inflato; ventrali internè fortissimè dentato.*

Long. 1.55; lat. 1; alt. 1.40 poll.

Hab. ad mare Sinense, et ad insulas Philippinas, invenit H. Cuming. Slightly resembling *C. Asiaticum*, from which it is distinguished by having larger and fewer ribs, and a small fringe on the posterior ribs. Found in sandy mud.

CARDIUM STRIATULUM, Conch. Illustr. f. 16. 45. *Card. testá tenui, rotundatá, posticè subrostratá minutissimè radiatim striatá; pallidè fulvá rubro radiatim fasciatá; intus albá, fasciis binis rubris radiatá; striis postremis denticulatis; epidermide fuscá.*

Long. 1; lat. 0.60; alt. 0.90 poll.

Hab. ad Australiam et ad Novam Zelandiam. G. Bennett legit. The pink-striped bands which give so much brilliancy to this shell when in a young state, are scarcely to be traced in the older specimens. The doubt as to their identity, which this circumstance at first created, was only removed by the most careful comparison.

CARDIUM AUSTRALE, Conch. Illustr. f. 12. *Card. testá obliquè ovatá, tenui, albá, purpureo-rubro fuscoque præcipuè ad umbones maculatá, purpureo ad latera fasciatá; umbombus lævibus; lateribus marginibusque tenuissimè sulcatis; cicatrice ab apice ad marginem posticum decurrente.*

Long. 1.20; lat. 0.85; alt. 1.30 poll.

Hab. ad Australiam, et ad mare Sinense.

This species differs from *C. tenuicostatum* and *C. papyraceum* in its proportions, being longest from the apex to the ventral margin; and also from the latter in the narrowness of the posterior ribs, and in having a distinct groove on the posterior side. Since the application of the above name, specimens have been met with in Mr. Cuming's Collection, named *C. sauciatum* by Dr. Beck, who, however, to the best of our knowledge, has not published it.

CARDIUM RINGICULUM, Conch. Illustr. f. 11. *Card. testá longitudinalitè ovali, tenui, utrinque hiantè; posticè elongatá, subaspersá; costis anterioribus angustis, inconspicuis; tribus centralibus latis, planulatis ad marginem valdè dentatis; decem postremis angustioribus, paulò elevatis, ad marginem dentatis.*

Var. *testá pallidè flavidá.*

Var. *testá ad latus posticum rubro tinctá.*

Hab. ad insulam Ceylon.

A pretty little species, differing from *C. bullatum* in the strongly toothed posterior margin.

CARDIUM SICULUM, Conch. Illustr. f. 31. *Card. testá tenui, subquadrátá, ventricosá, anticè angustá, posticè latá, subangulatá; albá, fusco maculatá; costis numerosis, planulatis, 5 anticis crenulatis; interstitiis angustis.*

Long. 0·50; lat. 0·40; alt. 0·45 poll.

Hab. ad mare Siculum.

CARDIUM ARCTICUM, Conch. Illustr. f. 26. *Card. testá ovali compressá, subæquilaterali; costis 27, angulatis, subcrenulatis; epidermide crassá, olivaceo-fuscá, ad umbones ætate erosá; ligamento elongato; cardine dentibus centralibus obsoletis, lateribus distantibus.*

Long. 1·55; lat. 0·90; alt. 1·40 poll.

Hab. ad mare Arcticum.

Differing from *C. Gröenlandicum*, in having ribs, and from *C. Ice-landicum*, in being less ventricose and in the ribs being angular.

CARDIUM PAUCICOSTATUM, Conch. Illustr. f. 20. *Card. testá rotundatá, ventricosá, subæquilaterali, tenui; albido-flavicante, fusco undatá; costis 16, planulatis, lævibus, distantibus, tuberculis acutis in medio armatis; interstitiis planulatis.*

Long. 1·30; alt. 1·30; lat. 1 poll.

Hab. ad mare Adriaticum (Malta).

This species differs from *C. echinatum* in being comparatively smooth, and having very few ribs, with wide interstices.

CARDIUM MULTISPINOSUM, Conch. Illustr. f. 38, 38 a. *Card. testá rotundatá, ventricosá, tenui, posticè paulò hiante, pallidè fulvá, ad margines roseá, intùs albá; costis 33 lævibus, utrinque angulatis; spinis numerosis, acutis; interstitiis granulatis, ad marginem elongatis; margine dorsali tumidá.*

Long. 2·10; lat. 1·70; alt. 2·20 poll.

Hab. ad insulam Mindanao, Philippinarum. H. Cuming legit.

In shape and general appearance, this beautiful shell resembles *C. Asiaticum*, from which, however, it differs widely, in having small spines on the ribs instead of the fringe. Found in sandy mud, at 25 fathoms.

CARDIUM EXASPERATUM, Conch. Illustr. f. 37. *Card. testá ventricosá, rotundato-subquadrátá, albá, ad margines roseo-tinctá; tenuiter sulcatá; inter sulcos spinis numerosis acutis ornatá.*

Long. 1· ; lat. 0·70; alt. 0·95 poll.

Hab. ad oras Australiæ (Swan River).

An extremely delicate and beautifully wrought shell, and quite distinct from others of the group to which it belongs.

CARDIUM VARIEGATUM, Conch. Illustr. f. 57. *Card. testá ovali, subventricosá, roseá, aurantiaco, rubro-fusco-albo-que maculatá; costis 48, quarum anticis rotundatis, crenulatis; posterioribus*

Var. *testá ad latus posticum rubro tinctá.*

Hab. ad insulam Ceylon.

A pretty little species, differing from *C. bullatum* in the strongly toothed posterior margin.

CARDIUM SICULUM, Conch. Illustr. f. 31. *Card. testá tenui, subquadrátá, ventricosá, anticè angustá, posticè latá, subangulatá; albá, fusco maculatá; costis numerosis, planulatis, 5 anticis crenulatis; interstitiis angustis.*

Long. 0·50; lat. 0·40; alt. 0·45 poll.

Hab. ad mare Siculum.

CARDIUM ARCTICUM, Conch. Illustr. f. 26. *Card. testá ovali compressá, subæquilaterali; costis 27, angulatis, subcrenulatis; epidermide crassá, olivaceo-fuscá, ad umbones ætate erosá; ligamento elongato; cardine dentibus centralibus obsoletis, lateribus distantibus.*

Long. 1·55; lat. 0·90; alt. 1·40 poll.

Hab. ad mare Arcticum.

Differing from *C. Gröenlandicum*, in having ribs, and from *C. Ice-landicum*, in being less ventricose and in the ribs being angular.

CARDIUM PAUCICOSTATUM, Conch. Illustr. f. 20. *Card. testá rotundatá, ventricosá, subæquilaterali, tenui; albido-flavicante, fusco undatá; costis 16, planulatis, lævibus, distantibus, tuberculis acutis in medio armatis; interstitiis planulatis.*

Long. 1·30; alt. 1·30; lat. 1 poll.

Hab. ad mare Adriaticum (Malta).

This species differs from *C. echinatum* in being comparatively smooth, and having very few ribs, with wide interstices.

CARDIUM MULTISPINOSUM, Conch. Illustr. f. 38, 38 a. *Card. testá rotundatá, ventricosá, tenui, posticè paulò hiante, pallidè fulvá, ad margines roséa, intùs albá; costis 33 lævibus, utrinque angulatis; spinis numerosis, acutis; interstitiis granulatis, ad marginem elongatis; margine dorsali tumidá.*

Long. 2·10; lat. 1·70; alt. 2·20 poll.

Hab. ad insulam Mindanao, Philippinarum. H. Cuming legit.

In shape and general appearance, this beautiful shell resembles *C. Asiaticum*, from which, however, it differs widely, in having small spines on the ribs instead of the fringe. Found in sandy mud, at 25 fathoms.

CARDIUM EXASPERATUM, Conch. Illustr. f. 37. *Card. testá ventricosá, rotundato-subquadrátá, albá, ad margines roseo-tinctá; tenuiter sulcatá; inter sulcos spinis numerosis acutis ornatá.*

Long. 1· ; lat. 0·70; alt. 0·95 poll.

Hab. ad oras Australiæ (Swan River).

An extremely delicate and beautifully wrought shell, and quite distinct from others of the group to which it belongs.

CARDIUM VARIEGATUM, Conch. Illustr. f. 57. *Card. testá ovali, subventricosá, roséa, aurantiaco, rubro-fusco-albo-que maculatá; costis 48, quarum anticis rotundatis, crenulatis; posterioribus*

Var. *testá ad latus posticum rubro tinctá.*

Hab. ad insulam Ceylon.

A pretty little species, differing from *C. bullatum* in the strongly toothed posterior margin.

CARDIUM SICULUM, Conch. Illustr. f. 31. *Card. testá tenui, subquadrátá, ventricosá, anticè angustá, posticè latá, subangulatá; albá, fusco maculatá; costis numerosis, planulatis, 5 anticis crenulatis; interstitiis angustis.*

Long. 0·50; lat. 0·40; alt. 0·45 poll.

Hab. ad mare Siculum.

CARDIUM ARCTICUM, Conch. Illustr. f. 26. *Card. testá ovali compressá, subæquilaterali; costis 27, angulatis, subcrenulatis; epidermide crassá, olivaceo-fuscá, ad umbones ætate erosá; ligamento elongato; cardine dentibus centralibus obsoletis, lateribus distantibus.*

Long. 1·55; lat. 0·90; alt. 1·40 poll.

Hab. ad mare Arcticum.

Differing from *C. Gröenlandicum*, in having ribs, and from *C. Ice-landicum*, in being less ventricose and in the ribs being angular.

CARDIUM PAUCICOSTATUM, Conch. Illustr. f. 20. *Card. testá rotundatá, ventricosá, subæquilaterali, tenui; albido-flavicante, fusco undatá; costis 16, planulatis, lævibus, distantibus, tuberculis acutis in medio armatis; interstitiis planulatis.*

Long. 1·30; alt. 1·30; lat. 1 poll.

Hab. ad mare Adriaticum (Malta).

This species differs from *C. echinatum* in being comparatively smooth, and having very few ribs, with wide interstices.

CARDIUM MULTISPINOSUM, Conch. Illustr. f. 38, 38 a. *Card. testá rotundatá, ventricosá, tenui, posticè paulò hiante, pallidè fulvá, ad margines roseá, intùs albá; costis 33 lævibus, utrinque angulatis; spinis numerosis, acutis; interstitiis granulatis, ad marginem elongatis; margine dorsali tumidá.*

Long. 2·10; lat. 1·70; alt. 2·20 poll.

Hab. ad insulam Mindanao, Philippinarum. H. Cuming legit.

In shape and general appearance, this beautiful shell resembles *C. Asiaticum*, from which, however, it differs widely, in having small spines on the ribs instead of the fringe. Found in sandy mud, at 25 fathoms.

CARDIUM EXASPERATUM, Conch. Illustr. f. 37. *Card. testá ventricosá, rotundato-subquadrátá, albá, ad margines roseo-tinctá; tenuiter sulcatá; inter sulcos spinis numerosis acutis ornatá.*

Long. 1· ; lat. 0·70; alt. 0·95 poll.

Hab. ad oras Australiæ (Swan River).

An extremely delicate and beautifully wrought shell, and quite distinct from others of the group to which it belongs.

CARDIUM VARIEGATUM, Conch. Illustr. f. 57. *Card. testá ovali, subventricosá, roseá, aurantiaco, rubro-fusco-albo-que maculatá; costis 48, quarum anticis rotundatis, crenulatis; posterioribus*

valdè angulatis, lævibus ; postremis subplanulatis, tuberculis obliquis ornatis.

Long. 1·70 ; alt. 1·80 ; lat. 1·20 poll.

Hab. ad insulam Leyte, Philippinarum. H. Cuming legit.

The ribs are much more numerous and close than in *C. muricatum*, and *C. Radula* is described as having the ribs angular on both sides, which is not the case with this species.

CARDIUM UNICOLOR, Conch. Illustr. f. 29. 42. *Card. testá ovali ventricosá, posticè subelongatá, paulò emarginatá, albá, purpureo obscurè maculatá, epidermide fuscá tenui indutá ; costis numerosis, anticis, mediis, et posterioribus rotundatis, minutè crenulatis ; extremis planulatis.*

Long. 1·50 ; lat. 1·10 ; alt. 1·70 poll.

Hab. ad ins. Ticao. H. Cuming legit.

Found in sandy mud, at five fathoms. A slightly mottled variety is brought from the Brazils.

CARDIUM IMPOLITUM, Conch. Illustr. f. 6. 66. *Card. testá crassá, cuneiformi, subæquilaterali ad marginem dorsalem angustiore, ad ventralem rotundatá ; albá, fusco obscurè maculatá, posticè purpureo-fasciatá ; costis 35 impolitis, subcrenulatis ; epidermide fuscá.*

Long. 1·50 ; lat. 1·10 ; alt. 1·90 poll.

Hab. ad mare Sinense.

Remarkable for its wedge-like, nearly equilateral shape.

CARDIUM OXYGONUM, Conch. Illustr. f. 9. *Card. testá ovali, subventricosá, ad umbones angustá ; albá, rubro fuscoque maculatá, intùs albá ; costis 35, quarum 18 anterioribus validis, acutangulatis, ad latera antica atque ad angulos crenulatis ; deinde 9 posterioribus acutangulatis ad angulos crenatis, ad latera lævibus ; extremis angustis, lævibus, tuberculis obliquis ornatis.*

Long. 1·20 ; lat. 0·90 ; alt. 1·40 poll.

Hab. ad mare Sinense.

This species resembles *C. maculosum* of Wood in form, but in sculpture it more nearly approaches *C. angulatum* of Lamarck, from which, however, it is distinguished by being narrower towards the umbones, less ventricose, and having the ribs more distinctly angulated.

CARDIUM SUBELONGATUM, Conch. Illustr. f. 61. *Card. testá ovali, subventricosá, elongatá, crassá, posticè paulò hiante ; albá, fusco rubroque maculatá, epidermide flavicante indutá ; costis 32, quarum anticis biangulatis, crenulatis ; mediis lævibus, biangulatis ; posticis rotundatis, lævibus, tuberculis obliquis ornatis.*

Long. 1·85 ; lat. 1·40 ; alt. 2·35 poll.

Hab. ad Sanctæ Thomæ insulam (Ind. occidentalis).

The above name has been given, to indicate the near alliance between this species and the true *C. elongatum* of Brug., with which it has been confounded. Our shell resembles some of the figures to which Lamarck refers for his *C. marmoreum*, and which Bruguière quotes for *C. elongatum*. It is much longer and smoother than the

valdè angulatis, lævibus ; postremis subplanulatis, tuberculis obliquis ornatis.

Long. 1.70 ; alt. 1.80 ; lat. 1.20 poll.

Hab. ad insulam Leyte, Philippinarum. H. Cuming legit.

The ribs are much more numerous and close than in *C. muricatum*, and *C. Radula* is described as having the ribs angular on both sides, which is not the case with this species.

CARDIUM UNICOLOR, Conch. Illustr. f. 29. 42. *Card. testá ovali ventricosá, posticè subelongatá, paulò emarginatá, albá, purpureo obscurè maculatá, epidermide fuscá tenui indutá ; costis numerosis, anticis, mediis, et posterioribus rotundatis, minutè crenulatis ; extremis planulatis.*

Long. 1.50 ; lat. 1.10 ; alt. 1.70 poll.

Hab. ad ins. Ticao. H. Cuming legit.

Found in sandy mud, at five fathoms. A slightly mottled variety is brought from the Brazils.

CARDIUM IMPOLITUM, Conch. Illustr. f. 6. 66. *Card. testá crassá, cuneiformi, subæquilaterali ad marginem dorsalem angustiore, ad ventralem rotundatá ; albá, fusco obscurè maculatá, posticè purpureo-fasciatá ; costis 35 impolitis, subcrenulatis ; epidermide fuscá.*

Long. 1.50 ; lat. 1.10 ; alt. 1.90 poll.

Hab. ad mare Sinense.

Remarkable for its wedge-like, nearly equilateral shape.

CARDIUM OXYGONUM, Conch. Illustr. f. 9. *Card. testá ovali, subventricosá, ad umbones angustá ; albá, rubro fuscoque maculatá, intùs albá ; costis 35, quarum 18 anterioribus validis, acutangulatis, ad latera antica atque ad angulos crenulatis ; deinde 9 posterioribus acutangulatis ad angulos crenatis, ad latera lævibus ; extremis angustis, lævibus, tuberculis obliquis ornatis.*

Long. 1.20 ; lat. 0.90 ; alt. 1.40 poll.

Hab. ad mare Sinense.

This species resembles *C. maculosum* of Wood in form, but in sculpture it more nearly approaches *C. angulatum* of Lamarck, from which, however, it is distinguished by being narrower towards the umbones, less ventricose, and having the ribs more distinctly angulated.

CARDIUM SUBELONGATUM, Conch. Illustr. f. 61. *Card. testá ovali, subventricosá, elongatá, crassá, posticè paulò hiante ; albá, fusco rubroque maculatá, epidermide flavicante indutá ; costis 32, quarum anticis biangulatis, crenulatis ; mediis lævibus, biangulatis ; posticis rotundatis, lævibus, tuberculis obliquis ornatis.*

Long. 1.85 ; lat. 1.40 ; alt. 2.35 poll.

Hab. ad Sanctæ Thomæ insulam (Ind. occidentalis).

The above name has been given, to indicate the near alliance between this species and the true *C. elongatum* of Brug., with which it has been confounded. Our shell resembles some of the figures to which Lamarck refers for his *C. marmoreum*, and which Bruguière quotes for *C. elongatum*. It is much longer and smoother than the

valdè angulatis, lævibus ; postremis subplanulatis, tuberculis obliquis ornatis.

Long. 1·70 ; alt. 1·80 ; lat. 1·20 poll.

Hab. ad insulam Leyte, Philippinarum. H. Cuming legit.

The ribs are much more numerous and close than in *C. muricatum*, and *C. Radula* is described as having the ribs angular on both sides, which is not the case with this species.

CARDIUM UNICOLOR, Conch. Illustr. f. 29. 42. *Card. testá ovali ventricosá, posticè subelongatá, paulò emarginatá, albá, purpureo obscurè maculatá, epidermide fuscá tenui indutá ; costis numerosis, anticis, mediis, et posterioribus rotundatis, minutè crenulatis ; extremis planulatis.*

Long. 1·50 ; lat. 1·10 ; alt. 1·70 poll.

Hab. ad ins. Ticao. H. Cuming legit.

Found in sandy mud, at five fathoms. A slightly mottled variety is brought from the Brazils.

CARDIUM IMPOLITUM, Conch. Illustr. f. 6. 66. *Card. testá crassá, cuneiformi, subæquilaterali ad marginem dorsalem angustiore, ad ventralem rotundatá ; albá, fusco obscurè maculatá, posticè purpureo-fasciatá ; costis 35 impolitis, subcrenulatis ; epidermide fuscá.*

Long. 1·50 ; lat. 1·10 ; alt. 1·90 poll.

Hab. ad mare Sinense.

Remarkable for its wedge-like, nearly equilateral shape.

CARDIUM OXYGONUM, Conch. Illustr. f. 9. *Card. testá ovali, subventricosá, ad umbones angustá ; albá, rubro fuscoque maculatá, intùs albá ; costis 35, quarum 18 anterioribus validis, acutangulatis, ad latera antica atque ad angulos crenulatis ; deinde 9 posterioribus acutangulatis ad angulos crenatis, ad latera lævibus ; extremis angustis, lævibus, tuberculis obliquis ornatis.*

Long. 1·20 ; lat. 0·90 ; alt. 1·40 poll.

Hab. ad mare Sinense.

This species resembles *C. maculosum* of Wood in form, but in sculpture it more nearly approaches *C. angulatum* of Lamarck, from which, however, it is distinguished by being narrower towards the umbones, less ventricose, and having the ribs more distinctly angulated.

CARDIUM SUBELONGATUM, Conch. Illustr. f. 61. *Card. testá ovali, subventricosá, elongatá, crassá, posticè paulò hiante ; albá, fusco rubroque maculatá, epidermide flavicante indutá ; costis 32, quarum anticis biangulatis, crenulatis ; mediis lævibus, biangulatis ; posticis rotundatis, lævibus, tuberculis obliquis ornatis.*

Long. 1·85 ; lat. 1·40 ; alt. 2·35 poll.

Hab. ad Sanctæ Thomæ insulam (Ind. occidentalis).

The above name has been given, to indicate the near alliance between this species and the true *C. elongatum* of Brug., with which it has been confounded. Our shell resembles some of the figures to which Lamarck refers for his *C. marmoreum*, and which Bruguière quotes for *C. elongatum*. It is much longer and smoother than the

former, and does not agree with the description. The true *C. elongatum* is described by Brug., from a specimen in the collection of M. de Lamarck, as an elongated, ventricose shell of 39 or 40 ribs, and attaining a large size. It seems to have been a matter of dispute between the two conchologists, whether the above-named species were identical. We were unable to meet with a shell agreeing with Bruguière's description, until the arrival of Mr. Cuming with fine specimens sufficiently characteristic to set the matter at rest. The present species has fewer ribs and is less ventricose.

CARDIUM ENODE, Conch. Illustr. f. 51. *Card. testá ovali, ventricosá, posticè subexpansá, fortissimè dentatá; pallidè fulvá rosco fasciatá, intùs albá, sub umbonibus flavidá, ad marginem purpureá; costis 38, planulatis, anticis levitè crenatis; interstitiis angustissimis.*

Long. 2·30; lat. 1·60; alt. 2·60 poll.

Hab. ad insulam Ceylon.

Much more spread than *C. elongatum*, with the ribs flatter, and terminating in very strong overwrapping teeth.

CARDIUM SUBRUGOSUM, Conch. Illustr. f. 34. 71. *Card. testá crassá ovali ventricosá, ætate posticè subacuminatá; costis 33, quarum 25 anterioribus rotundatis, crenulatis; extremis lævibus vix elevatis; epidermide fuscá.*

Var. testá albá, purpureo maculatá.

Var. testá posticè albá, anticè flavidá.

Long. 2·30; lat. 1·70; alt. 2·40 poll.

Hab. ad insulam Ceylon.

The ribs are not so deep as in *C. rugosum*, and the eight posterior ones are so little raised as to leave the surface nearly smooth.

CARDIUM ALTERNATUM, Conch. Illustr. f. 64. *Card. testá obliquè ovali, compressá, posticè subexpansá, albá, luteo vel fusco-flavescente fasciato-maculatá; epidermide fusco indutá; costis 32, anticis crenulatis, subangulatis; deindè posterioribus angulatis anticè lævibus; extremis muricatis; interstitiis convexis, utrinque sulcatis.*

Long. 2·40; lat. 1·30; alt. 2·60 poll.

Hab. Ticao, Philippinarum. H. Cuming legit.

A beautiful pale-coloured specimen of this species has existed for some time in the well-selected cabinet of Miss Saul, who, however, possesses no information as to its locality. With this we have been supplied by Mr. Cuming, who collected some richly coloured individuals from the above-mentioned island: they were found in coral sand, on reefs, at low water.

CARDIUM ATTENUATUM. *Card. testá lævi, cuneiformi, compressá, obliquè elongatá, posticè subcomplanatá, omninò obscurè striatá, ad marginem dentatá; flavá, rubro maculatá, maculis posterioribus validis; intus albá.*

Long. 1·80; lat. 1·20; alt. 2·60 poll.

Hab. ad insulam Ceylon.

A good figure of this species is found in Wood's 'General Con-

former, and does not agree with the description. The true *C. elongatum* is described by Brug., from a specimen in the collection of M. de Lamarck, as an elongated, ventricose shell of 39 or 40 ribs, and attaining a large size. It seems to have been a matter of dispute between the two conchologists, whether the above-named species were identical. We were unable to meet with a shell agreeing with Bruguière's description, until the arrival of Mr. Cuming with fine specimens sufficiently characteristic to set the matter at rest. The present species has fewer ribs and is less ventricose.

CARDIUM ENODE, Conch. Illustr. f. 51. *Card. testá ovali, ventricosá, posticè subexpansá, fortissimè dentatá; pallidè fulvá rosco fasciatá, intùs albá, sub umbonibus flavidá, ad marginem purpureá; costis 38, planulatis, anticis levitè crenatis; interstitiis angustissimis.*

Long. 2·30; lat. 1·60; alt. 2·60 poll.

Hab. ad insulam Ceylon.

Much more spread than *C. elongatum*, with the ribs flatter, and terminating in very strong overwrapping teeth.

CARDIUM SUBRUGOSUM, Conch. Illustr. f. 34. 71. *Card. testá crassá ovali ventricosá, ætate posticè subacuminatá; costis 33, quarum 25 anterioribus rotundatis, crenulatis; extremis lævibus vix elevatis; epidermide fuscá.*

Var. testá albá, purpureo maculatá.

Var. testá posticè albá, anticè flavidá.

Long. 2·30; lat. 1·70; alt. 2·40 poll.

Hab. ad insulam Ceylon.

The ribs are not so deep as in *C. rugosum*, and the eight posterior ones are so little raised as to leave the surface nearly smooth.

CARDIUM ALTERNATUM, Conch. Illustr. f. 64. *Card. testá obliquè ovali, compressá, posticè subexpansá, albá, luteo vel fusco-flavescente fasciato-maculatá; epidermide fusco indutá; costis 32, anticis crenulatis, subangulatis; deindè posterioribus angulatis anticè lævibus; extremis muricatis; interstitiis convexis, utrinque sulcatis.*

Long. 2·40; lat. 1·30; alt. 2·60 poll.

Hab. Ticao, Philippinarum. H. Cuming legit.

A beautiful pale-coloured specimen of this species has existed for some time in the well-selected cabinet of Miss Saul, who, however, possesses no information as to its locality. With this we have been supplied by Mr. Cuming, who collected some richly coloured individuals from the above-mentioned island: they were found in coral sand, on reefs, at low water.

CARDIUM ATTENUATUM. *Card. testá lævi, cuneiformi, compressá, obliquè elongatá, posticè subcomplanatá, omninò obscurè striatá, ad marginem dentatá; flavá, rubro maculatá, maculis posterioribus validis; intus albá.*

Long. 1·80; lat. 1·20; alt. 2·60 poll.

Hab. ad insulam Ceylon.

A good figure of this species is found in Wood's 'General Con-

former, and does not agree with the description. The true *C. elongatum* is described by Brug., from a specimen in the collection of M. de Lamarck, as an elongated, ventricose shell of 39 or 40 ribs, and attaining a large size. It seems to have been a matter of dispute between the two conchologists, whether the above-named species were identical. We were unable to meet with a shell agreeing with Bruguière's description, until the arrival of Mr. Cuming with fine specimens sufficiently characteristic to set the matter at rest. The present species has fewer ribs and is less ventricose.

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Long. 2·30; lat. 1·60; alt. 2·60 poll.

Hab. ad insulam Ceylon.

Much more spread than *C. elongatum*, with the ribs flatter, and terminating in very strong overwrapping teeth.

CARDIUM SUBRUGOSUM, Conch. Illustr. f. 34. 71. *Card. testá crassá ovali ventricosá, ætate posticè subacuminatá; costis 33, quarum 25 anterioribus rotundatis, crenulatis; extremis lævibus vix elevatis; epidermide fuscá.*

Var. testá albá, purpureo maculatá.

Var. testá posticè albá, anticè flavidá.

Long. 2·30; lat. 1·70; alt. 2·40 poll.

Hab. ad insulam Ceylon.

The ribs are not so deep as in *C. rugosum*, and the eight posterior ones are so little raised as to leave the surface nearly smooth.

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Long. 2·40; lat. 1·30; alt. 2·60 poll.

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Long. 1·80; lat. 1·20; alt. 2·60 poll.

Hab. ad insulam Ceylon.

A good figure of this species is found in Wood's 'General Con-

chology,' accompanied by the following erroneous statements: first, that it is *C. biradiatum* of Brug.; and second, that *C. biradiatum* of Brug. is only a variety of the British species (*C. serratum*), which is improperly named *C. lævigatum* by him and some other authors. From the apex to the ventral margin, it measures longer in proportion than any other species.

CARDIUM ELENENSE, Conch. Illustr. f. 58. *Card. testâ tenui, lævi, ovali, posticè subacuminatâ pallidè fulvâ, fusco et purpureo minutè maculatâ, intùs fuscâ rubro fasciatâ; umbonibus inconspicuis, purpureo maculatis.*

Long. 0·75; lat. 0·50; alt. 0·75 poll.

Hab. ad Sanctam Elenam. H. Cuming legit.

Very nearly resembling *C. Brasilianum*, but not coloured in radiating lines, as in that species, and not so much elongated at the posterior ventral margin. Found in sandy mud, at seven fathoms.

CARDIUM LYRATUM, Conch. Illustr. f. 40. *Card. testâ ventricosâ, rotundatâ, subæquilaterali, pallidè fulvâ, epidermide rubro-purpureâ indutâ, intùs aureâ; anticè decussatim plicatâ; costis numerosis; anticis tenuissimis; mediis validioribus; posterioribus distantibus, angulatis.*

Long. 1·70; lat. 1·40; alt. 1·70 poll.

Hab. Dumaguete, ins. Negroes, Philippinarum.

The *C. Æolicum* of Born (*C. pectinatum*, Linn., according to Brug.) has a space on the posterior side of the shell entirely free from ribs in either direction. Bruguière describes it as characterised by "trois faces distinctes," of which the first (*the posterior*) is "lisse, sans côtes ni striés," and the figures in Chemnitz represent the same peculiarity. In the shell before us, the whole of the posterior side is covered with radiating ribs, no space being left smooth. In other respects it exactly resembles the "Janus" celebrated by ancient naturalists, and it is now almost as frequently met with in cabinets. The difference between the two species has been long observed, although they have not hitherto been separately described. Mr. Cuming has taken specimens of this species in sandy mud, at the depth of seventeen fathoms.

CARDIUM PARVUM, Conch. Illustr. f. 33. *Card. testâ ovali, subquadratâ, posticè subangulatâ, anticè rotundatâ, pallidè fulvâ, fusco rubescente angulatim maculatâ; costis numerosis, subplanulatis; sulcis angustis.*

Long. 0·50; lat. 0·40; alt. 0·43 poll.

Hab. ———?

CARDIUM FORNICATUM, Conch. Illustr. f. 50. *Card. testâ subquadratâ, posticè angulatâ, anticè rotundatâ; albâ, purpureo-maculatâ, intùs aurantiacâ, ad margines purpureo-rufescente maculatâ: costis 35, quarum anteriorum 23 biangulatis, imbricatis, ad latera minutissimè spinoso-crenulatis.*

Long. 1· ; lat. 0·75; alt. 1· poll.

Hab. ———? Mus. F. J. Stainforth.

A very beautiful shell, in some respects resembling *C. medium*,

chology,' accompanied by the following erroneous statements: first, that it is *C. biradiatum* of Brug.; and second, that *C. biradiatum* of Brug. is only a variety of the British species (*C. serratum*), which is improperly named *C. lævigatum* by him and some other authors. From the apex to the ventral margin, it measures longer in proportion than any other species.

CARDIUM ELENENSE, Conch. Illustr. f. 58. *Card. testâ tenui, lævi, ovali, posticè subacuminatâ pallidè fulvâ, fusco et purpureo minutè maculatâ, intùs fuscâ rubro fasciatâ; umbonibus inconspicuis, purpureo maculatis.*

Long. 0·75; lat. 0·50; alt. 0·75 poll.

Hab. ad Sanctam Elenam. H. Cuming legit.

Very nearly resembling *C. Brasilianum*, but not coloured in radiating lines, as in that species, and not so much elongated at the posterior ventral margin. Found in sandy mud, at seven fathoms.

CARDIUM LYRATUM, Conch. Illustr. f. 40. *Card. testâ ventricosâ, rotundatâ, subæquilaterali, pallidè fulvâ, epidermide rubro-purpureâ indutâ, intùs aureâ; anticè decussatim plicatâ; costis numerosis; anticis tenuissimis; mediis validioribus; posterioribus distantibus, angulatis.*

Long. 1·70; lat. 1·40; alt. 1·70 poll.

Hab. Dumaguete, ins. Negroes, Philippinarum.

The *C. Æolicum* of Born (*C. pectinatum*, Linn., according to Brug.) has a space on the posterior side of the shell entirely free from ribs in either direction. Bruguière describes it as characterised by "trois faces distinctes," of which the first (*the posterior*) is "lisse, sans côtes ni striés," and the figures in Chemnitz represent the same peculiarity. In the shell before us, the whole of the posterior side is covered with radiating ribs, no space being left smooth. In other respects it exactly resembles the "Janus" celebrated by ancient naturalists, and it is now almost as frequently met with in cabinets. The difference between the two species has been long observed, although they have not hitherto been separately described. Mr. Cuming has taken specimens of this species in sandy mud, at the depth of seventeen fathoms.

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Long. 0·50; lat. 0·40; alt. 0·43 poll.

Hab. ———?

CARDIUM FORNICATUM, Conch. Illustr. f. 50. *Card. testâ subquadratâ, posticè angulatâ, anticè rotundatâ; albâ, purpureo-maculatâ, intùs aurantiacâ, ad margines purpureo-rufescente maculatâ: costis 35, quarum anteriorum 23 biangulatis, imbricatis, ad latera minutissimè spinoso-crenulatis.*

Long. 1· ; lat. 0·75; alt. 1· poll.

Hab. ———? Mus. F. J. Stainforth.

A very beautiful shell, in some respects resembling *C. medium*,

chology,' accompanied by the following erroneous statements: first, that it is *C. biradiatum* of Brug.; and second, that *C. biradiatum* of Brug. is only a variety of the British species (*C. serratum*), which is improperly named *C. lævigatum* by him and some other authors. From the apex to the ventral margin, it measures longer in proportion than any other species.

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Long. 0·75; lat. 0·50; alt. 0·75 poll.

Hab. ad Sanctam Elenam. H. Cuming legit.

Very nearly resembling *C. Brasilianum*, but not coloured in radiating lines, as in that species, and not so much elongated at the posterior ventral margin. Found in sandy mud, at seven fathoms.

CARDIUM LYRATUM, Conch. Illustr. f. 40. *Card. testâ ventricosâ, rotundatâ, subæquilaterali, pallidè fulvâ, epidermide rubro-purpureâ indutâ, intùs aureâ; anticè decussatim plicatâ; costis numerosis; anticis tenuissimis; mediis validioribus; posterioribus distantibus, angulatis.*

Long. 1·70; lat. 1·40; alt. 1·70 poll.

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Long. 0·50; lat. 0·40; alt. 0·43 poll.

Hab. ———?

CARDIUM FORNICATUM, Conch. Illustr. f. 50. *Card. testâ subquadratâ, posticè angulatâ, anticè rotundatâ; albâ, purpureo-maculatâ, intùs aurantiacâ, ad margines purpureo-rufescente maculatâ: costis 35, quarum anteriorum 23 biangulatis, imbricatis, ad latera minutissimè spinoso-crenulatis.*

Long. 1· ; lat. 0·75; alt. 1· poll.

Hab. ———? Mus. F. J. Stainforth.

A very beautiful shell, in some respects resembling *C. medium*,

but not so angular, and having the ribs richly ornamented by vaulted imbrications in the centre, and very minute crenulations raised into points at the sides. Unfortunately, we possess no information respecting the locality.

CARDIUM IMBRICATUM, Conch. Illustr. f. 48. *Card. testá crassá, ventricosá, anticè rotundatá, posticè subquadratá, angulatá; albá, intus aurantiacá, purpureo maculatá: costis 28, quarum 19 anterioribus valdè imbricatis, postremis sublævibus, subangulatis, imbricatis propè umbones, angulatis, fornicatis, propè marginem ventralem obtusis.*

Long. 1·20; lat. 1·05; alt. 1·30 poll.

Hab. ad oras Australiae (Swan River).

Like *C. medium* in general form, but having vaulted imbrications on the ribs. These are much thicker and larger than in *C. fornicatum*, and the sides of the ribs are not crenulated as in that species.

CARDIUM SUBRETUSUM, Conch. Illustr. f. 24. *Card. testá albá, obliquè subquadratá, ventricosá, posticè subcarinatá, acuminatá; anticè subrotundatá; post angulum complanatá, levitèr sulcatá; costis ante angulum sex, tuberculatis; interstitiis punctatis; ante umbones cavernulá cordiformi, intus levitèr callosá.*

Long. 0·90; lat. 1·20; alt. 1·30 poll.

Hab.

Thus we have three species presenting the character in common, of having a callosity within a heart-shaped cavity, close under the umbones, namely, the true *C. retusum*; the var. "(2.) testá punctis sanguineis pictá" of Lam., which has been named *C. auricula* by Forskäll, and the present species, which resembles the original *C. retusum* in general appearance, but it is more elongated and smoother behind the angle, the cavity is not so deep, and the callosity is more strongly marked.

CARDIUM FRAGILE, Conch. Illustr. f. 68. *Card. testá rotundatá, tenui, lævi, subequilaterá, posticè paulò inflatá, albá, fusco-lineatá, epidermide fulvá indutá; intus albá ad marginem rubescente; ad umbones flavá; margine levitèr sulcato.*

Long. 1·05; lat. 0·65; alt. 1· poll.

The only specimen at present known is in the collection of the Rev. F. J. Stainforth. We have no information as to its locality.

CARDIUM FOVEOLATUM, Conch. Illustr. f. 65. *Card. testá subrotundato-ovali, compressá, albá, costis 43, quarum 25 anterioribus rotundatis, crenulatis, deinde posterioribus 10 lævibus, subangulatis, extremis concavis, ad latera crenulatis.*

Long. 1·45; lat. 0·90; alt. 1·55 poll.

Hab. ad oras Australiae (Swan River).

The last ribs on the posterior side are hollow, with crenulations crossing them so as to form little pits. This species belongs to the same section as *C. muricatum*, but it is much flatter and has a greater number of ribs.

but not so angular, and having the ribs richly ornamented by vaulted imbrications in the centre, and very minute crenulations raised into points at the sides. Unfortunately, we possess no information respecting the locality.

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GEOLOGICAL SOCIETY.

Nov. 18, 1840.—Mr. Lyell's memoir "On the Geological Evidence of the former existence of Glaciers in Forfarshire," was read.

Three classes of phænomena connected with the transported superficial detritus of Forfarshire, Mr. Lyell had referred, for several years, to the action of drifting ice; namely, 1st, the occurrence of erratics or vast boulders on the tops and sides of hills at various heights, as well as in the bottoms of the valleys, and far from the parent rocks; 2ndly, the want of stratification in the larger portion of the boulder formation or till; and 3rdly, the curvatures and contortions of many of the incoherent strata of gravel or of clay resting upon the unstratified till*. When, however, he attempted to apply the theory of drifting ice over a submerged country to facts with which he had been long acquainted in Forfarshire, he found great difficulty in accounting for the constant subterposition of the till with boulders to the stratified deposits of loam and gravel; for the till ascending to higher levels than the gravel, and often forming mounds which nearly block up the drainage of certain glens and straths; for its constituting, with a capping of stratified matter, narrow ridges, which frequently surround lake-swamps and peat-mosses; and for the total absence of organic remains in the till.

Since, however, Professor Agassiz's extension to Scotland of the glacial theory, and its attendant phænomena, Mr. Lyell has re-examined a considerable portion of Forfarshire, and having become convinced that glaciers existed for a long time in the Grampians, and extended into the low country, many of his previous difficulties have been removed. There are, nevertheless, facts connected with the ridges of stratified materials resting upon till, which he is unable to explain. He also states, that though he had for years inferred from the evidence of fossil shells sent to him from Canada by Capt. Bayfield, that the climate of North America, in the latitude of Quebec, was far more intensely cold at one period than it is now†, yet, that his thoughts had been diverted from the consideration of a long-continued covering of snow on the Scottish mountains, by the knowledge that the climate of Great Britain, during the several tertiary epochs, was warmer than it is at present. He is of opinion that, during a period immediately antecedent to the existing, several oscillations of temperature may have occurred in the northern hemisphere.

Forfarshire, Mr. Lyell divides geologically into three principal districts: 1st, the Grampians, composed of granite, gneiss, mica-slate, and clay-slate, flanked by a lower range of vertical beds of old red sandstone, associated with trap; 2ndly, the great synclinal trough of Strathmore, occupied by the middle and newer mem-

* See Mr. Lyell's paper on the Norfolk Drift, *Phil. Mag.*, May 1840, and the Abstract of the paper in the *Proceedings of the Society*, vol. iii. p. 171.

† See *Proceedings*, vol. iii. p. 119 [or *L. & E. Phil. Mag.* vol. xv. p. 399].

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Since, however, Professor Agassiz's extension to Scotland of the glacial theory, and its attendant phænomena, Mr. Lyell has re-examined a considerable portion of Forfarshire, and having become convinced that glaciers existed for a long time in the Grampians, and extended into the low country, many of his previous difficulties have been removed. There are, nevertheless, facts connected with the ridges of stratified materials resting upon till, which he is unable to explain. He also states, that though he had for years inferred from the evidence of fossil shells sent to him from Canada by Capt. Bayfield, that the climate of North America, in the latitude of Quebec, was far more intensely cold at one period than it is now†, yet, that his thoughts had been diverted from the consideration of a long-continued covering of snow on the Scottish mountains, by the knowledge that the climate of Great Britain, during the several tertiary epochs, was warmer than it is at present. He is of opinion that, during a period immediately antecedent to the existing, several oscillations of temperature may have occurred in the northern hemisphere.

Forfarshire, Mr. Lyell divides geologically into three principal districts: 1st, the Grampians, composed of granite, gneiss, mica-slate, and clay-slate, flanked by a lower range of vertical beds of old red sandstone, associated with trap; 2ndly, the great synclinal trough of Strathmore, occupied by the middle and newer mem-

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GEOLOGICAL SOCIETY.

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The superficial detritus of Forfarshire, Mr. Lyell divides into three deposits: 1st, the thin unstratified covering on the Grampians, derived from the disintegration of the subjacent strata, with a slight intermixture of pebbles traceable to rocks at a higher level, not far distant; 2ndly, the unstratified materials enclosing boulders which occur at the base of the hills on both sides of every glen, and not due to taluses formed by landslips, but constituting terraces of transported debris, with a nearly flat top, and sometimes with two steep sides, one towards the river, and the other of less height towards the mountain; and 3rdly, the stratified gravels, sands and clays which overlie the unstratified detritus. Mr. Lyell confines his observations principally to the second and third divisions.

The terraces or lateral mounds very generally increase in width and depth as they descend from the higher to the lower glens, attaining in the latter sometimes a thickness of 100 feet, and occasionally so great a breadth as to leave only sufficient room for the river to pass. The inferior part is always unstratified, consisting of mud and sand, in which large angular and rounded fragments of rocks are imbedded. These boulders are more and more rounded as their distance increases from the hills whence they could have been detached; but they are more frequently flat-sided than pebbles which have been rounded by water; and they become more diversified in character by the junction of every tributary glen. In the upper part the mounds often consist of 40 to 80 feet of the same materials as the lower, but regularly stratified. Mr. Lyell then proceeds to illustrate his subject by describing in detail the phenomena presented by the valley of the South Esk and those of its tributaries.

The South Esk springs from a shallow lake nearly 3000 feet above the level of the sea, and twenty miles from Strathmore. For six miles the river flows through a district composed partly of gneiss, traversed by veins of granite or eurite, and partly of granite. The fragments derived from this high region may be traced downwards continuously for twelve miles to Cortachie; and as a proof that the detritus forming the lateral mounds has followed the same downward course, Mr. Lyell states that it preserves throughout, as well in the main as in the lateral glens, an uniformly grey colour; while the detritus of the lower zone of mica-slate is invariably tinged red, this colour being also imparted to the debris of the still lower portions of the glens, notwithstanding the intermixture of pale brown

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materials obtained from the clay-slate of that district. Another proof of the detritus not having been drifted upwards, is the absence in the higher portions of the glens of the blocks of pure white quartz which abound in the region of mica-schist, and have been derived from the numerous veins and beds of quartz belonging to that formation. The chief exception to this arrangement is a boulder of conglomerate in the bed of the Proson, evidently derived from hills two miles to the south, but which are considerably above the level of the glen. A few other similar exceptions have been noticed, but the distances to which the stragglers have been traced are inconsiderable. The phenomena exhibited by the lateral mounds, Mr. Lyell states, agree well with the hypothesis of their being the lateral moraines of glaciers; and he adds, that he had never been able to reconcile these phenomena, particularly the want of stratification, with the theory of the accumulations of the detritus during submergence, and the removal by denudation of the central portions of a deposit which had by that means filled the glens. The distribution of an enormous mass of boulders on the southern side of Loch Brandy, and clearly derived from the precipices which overhang the Loch on the three other sides, is advanced as another proof in favour of the glacial theory. It is impossible to conjecture, Mr. Lyell says, how these blocks could have been transported half a mile over a deep lake; but let it be imagined that the Loch was once occupied by a glacier, and the difficulty is removed. Loch Whorral, about a mile to the east of Loch Brandy, is also surrounded on its north, east and western sides by precipices of gneiss, and presents on its southern an immense accumulation of boulders with other detritus, strewed over with angular blocks of gneiss, in some instances twenty feet in diameter. This moraine is several hundred yards wide, and exceeds twenty feet in depth, terminating at the borders of the plain of Clova in a multitude of hillocks and ridges much resembling in shape some terminal moraines examined by Mr. Lyell in Switzerland.

The great transverse barrier at Glenairn, where the valley of the South Esk contracts from a mile to half a mile in breadth, and is flanked by steep mountains, Mr. Lyell formerly regarded as very difficult of explanation. Seen from below, this barrier resembles an artificial dam 200 feet high, with numerous hillocks on its summit. On the eastern side it appears to have been denuded to the extent of about 300 yards by the Esk. Its breadth from north to south is about half a mile. The lower part, 30 feet in depth, laid open in the river cliff, consists of impervious, unstratified mud, full of boulders; but the total vertical thickness of this deposit is stated to be from 50 to 80 feet; and the upper part of the barrier is composed of from 50 to 100 feet of very fine stratified materials. It is not possible, Mr. Lyell observes, to account for the accumulation of this barrier by the agency of water, particularly as no tributary joins the Esk at this point; but if the barrier be supposed to be the large terminal moraine of a receding glacier, then its form and position, he says, are easily to be understood. M. Agassiz, in his work on glaciers, shows, that when these masses of ice enter a nar-

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At Cortachie, about four miles below the barrier of Glenairn, the South Esk enters the country of old red sandstone, and a mile and a half lower it is joined by the Proson, and a mile yet lower by the Carity. In the district in which these streams unite there is a considerable thickness of unstratified matter full of Grampian boulders, and covered for the greater part with stratified gravel and sand. In some cases the latter exhibit the diagonal laminæ common in subaqueous formations; and in others the strata are so contorted, that a perpendicular shaft might intersect the same beds three times. In the latter instances the surface of the subjacent red boulder clay has not partaken of the movement by which the stratified deposit was contorted; and in consequence Mr. Lyell ascribed the effect, when he first beheld it in 1839, to the lateral pressure of large masses of drifted ice repeatedly stranding upon a shoal of soft materials*. In the middle of the tract between the South Esk and the Proson is a dry valley, and to the south of this valley, near the Proson, an excavation was made ten years ago, which exposed extremely contorted beds overtopped by others perfectly horizontal, having been formed by tranquil deposition after the disturbance of strata previously deposited. The phenomena exhibited by the till in this district, Mr. Lyell conceives, might be well accounted for by supposing the union of three or four large glaciers; but he considers it difficult to explain the accumulation of the overlying stratified materials, the top of which must be 600 feet above the level of the sea, and facing the Strath. In following out the narrow ridge which intervenes between the Proson and the Carity, during last October, in company with Dr. Buckland, the latter drew the author's attention to a spot half a mile south-west of the House of Pearsie, where the surface of a porphyry rock was polished, furrowed and scratched. The quarrymen of Forfarshire also state as a general fact, that rocks of sufficient hardness, when first laid bare, are smooth, polished and scored; and Mr. Blackadder has found on the Sidlaw Hills large boulders of sandstone grooved and polished. Another general fact mentioned by Mr. Lyell is, that the unstratified boulder-clay becomes more and more impervious in the lower part of the Grampian glens, not in

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Mr. Lyell then describes the phenomena of the second district, or Strathmore. Though this district may be considered as one great strath, yet it is divided into many longitudinal ridges and valleys. The former, sometimes 300 feet in height, are for the greater part parallel to the strike of the old red sandstone, and are generally covered to the depth of sixty or more feet with till and erratics, derived from the Grampians and the subjacent strata. This covering is so general, that the structure of the district can be detected only in the ravines through which the principal rivers pass. The till constitutes invariably the oldest part of the detritus. The boulders which it contains sometimes exceed three feet in diameter: on the north muir of Kerriemuir is a block of trap-rock, six feet by five feet, and near it is a mass of mica-schist, nine feet long by four feet wide and three high. The till has been ascertained by Mr. Blackadder to fill, in many places, deep hollows in the sandstone, which would become lakes or peat-mosses if the till were extracted. This distribution of the detritus, Mr. Lyell observes, may be explained on the supposition that, if the cold period came on slowly, the advance of the glaciers would push forward the detritus accumulated at their termination, and fill up, wholly or in part, the lakes or other cavities which they would encounter in their progress. Along most of the river-courses, and in the lowest depressions of Strathmore, the till is covered by stratified sand and gravel.

One of the most remarkable peculiarities of the transported materials of Forfarshire and Perthshire is a continuous stream, from three to three and a half miles wide, of boulders and pebbles, traceable from near Dunkeld, by Coupar, to the south of Blairgowrie, then through the lowest part of Strathmore, and afterwards in a straight line through the lowest depression of the Sidlaw Hills from Forfar to Lunan Bay, a distance of thirty-four miles. No great river follows this course, but it is marked everywhere by lakes or ponds, which afford shell-marl, swamps, and peat-mosses, commonly surrounded by ridges of detritus from fifty to seventy feet high, consisting in the lower part of till and boulders, and in the upper of stratified gravel, sand, loam and clay, in some instances curved or contorted. The form of the included spaces is sometimes oval, sometimes quadrangular. The finest examples are in the lower tract, which has the Dean for its southern boundary, and the road from the bridge of Ruthven to the south of the grounds of Lindertis for its northern. The Grampian boulders are throughout the same; but there are associated with them masses of actinolite schist, which Mr. Blackadder has ascertained could be derived only from the valley of the Tay. The fragments of secondary rocks belong to the formations of the districts in which they occur. Though the country occupied by these marl-loch lakes is not traversed longitudinally by any river, yet it is so low, that if the transported matter were removed, a very slight depression would cause the sea to flow from

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In Forfarshire Mr. Lyell never succeeded, as in the above case in Sweden, in finding marine shells in the ridges of sand; nor does he remember to have seen in Sweden transverse ridges at right angles to the north and south. The glacier theory, the author states, appears to offer a happy solution of the problem of the marl-loch gravels, the longitudinal banks being regarded as lateral and medial moraines, and the transverse ridges as terminal. The chief objections are the stratification of the upper part of the banks, and the necessity of assuming a glacier thirty-four miles in length, with a fall of only 300 or 400 feet of country.

It has always appeared to Mr. Lyell and Mr. Blackadder remarkable, that the marl-loch gravels at Forfar are nearly 100 feet above the tract of till which separates them from the valley of South Esk, in Strathmore. In the present configuration of the country, water could not deposit the Forfar gravels without extending to the South Esk, the detritus of which is distinct, and separated by a low district of till without gravel. The only explanations of these phænomena Mr. Lyell considers to be either that the till is the moraine of a glacier, or that there has been a local change of relative levels of

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Another line of stratified detritus ranges at a higher level from the Loch of Lundie, along the Dichty Water, to the sea at Moray Firth, a distance of thirteen miles; and it is stated that many others might be enumerated. It is only on the coast to the east and west of Dundee, at heights varying from twenty to forty feet, that stratified clay and gravel have been found by Mr. Lyell to contain marine shells, all belonging to known existing species, except a *Nucula*. Although these remains prove a certain amount of upheaval subsequent to the deposition of the till, or to the commencement of the glacial epoch, including an equal movement in the interior, still Mr. Lyell objects to a general submergence of that part of Scotland, since the till and erratic blocks were conveyed to their present positions; as the stratified gravel is too partial and at too low a level to support such a theory; and he would rather account for the existence of the stratified deposits, by assuming that barriers of ice produced extensive lakes, the waters of which threw down ridges of stratified materials on the tops of the moraines. With respect to the geological age of the beds containing the marine shells, Mr. Lyell is of opinion that it is synchronous with that of the older of the recent formations on the Clyde, examined by Mr. Smith of Jordan Hill, and Mr. E. Forbes; and with respect to the age of the till and stratified gravel last formed, he is of opinion that it is very modern, because these accumulations constitute exclusively the dams of certain marl-lochs to the very bottom of the sediment formed, in which all the Testacea and skeletons of quadrupeds, as well as the remains of plants which have been found, are of existing species.

The third district, or that of the Sidlaw Hills, claimed Mr. Lyell's attention more particularly on account of the Grampian boulders with which it abounds. This range, whose greatest height is 1500 feet above the sea, is composed of anticlinal strata of grey sandstone, belonging to the old red sandstone, with associated trap. It is covered, as well as the whole of the country between Strathmore and the Tay, with the impervious till, containing Grampian boulders and fragments of the subjacent grey sandstone. The finest instances of erratics observed by Mr. Lyell occur on Pitscanly Hill, 700 feet, and the adjacent hill of Turin, 800 feet above the level of the sea. About forty feet below the summit, on the southern side of the former, is a block of mica-slate thirteen feet long, seven broad, and seven in height above the ground. Four smaller and equally angular masses, from three to six feet in diameter, lie close to its north end, as if severed from it. One of the nearest points at which this gneiss occurs *in situ*, is the Craig of Balloch, fifteen miles distant, on the northern extremity of the Creigh Hill, and between these points intervenes the great valley of Strathmore and the hills of Finhaven. Other Grampian boulders, from three to six feet in diameter, occur on the hills between Lumley Den and Lundie, at the height of 1000 feet; and Mr. Blackadder has found fragments of mica-schist one foot in

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In conclusion, Mr. Lyell offers some remarks on the conditions under which glaciers may have existed in Scotland, and the differences between them and those of the glaciers of Switzerland. He states that the glaciers of the latter country being situated 11° further to the south, they can present but an imperfect analogy with permanent masses of ice in Forfarshire, and that it is to South Georgia, Kerguelen's Land and Sandwich Land that we must look for the nearest approach to that state of things which must have existed in Scotland during the glacial epoch. In those regions of the southern hemisphere the ice reaches to the borders of the sea, and the temperature of summer and winter being nearly equalized, the glaciers probably remain almost stationary, like those of the Alps in winter, and can be diminished by only the first two of the three causes which tend to check an indefinite accumulation of snow in Switzerland; viz. 1st, evaporation without melting; and 2ndly, the descent of glaciers by gravitation, considered by M. Agassiz to be not very influential:—the third cause, the descent of glaciers arising from alternate liquefaction and freezing, he conceives must be wholly suspended in these regions.

As the tertiary strata prove that a warm climate certainly preceded the assumed glacial epoch in the northern hemisphere, and as a mild climate has since prevailed, Mr. Lyell says, there are three distinct phases of action to be considered in studying the supposed glaciers of Scotland: 1st, the coming on of the epoch; 2nd, its continuance in full intensity; and 3rd, its gradual retreat. At the commencement of the first condition, only the higher mountains would send down glaciers to be melted in the plains below, as at present in Switzerland, and in Chili between the 40th and 50th degrees of latitude. The ice would therefore thus be constantly advancing and retreating, but progressively, century by century, gaining ground, in consequence of diminishing summer heat; and pushing its terminal moraines forward, it would fill up lakes and other inequalities, till it finally reached the sea. During the second condition, when the motion of the ice would be very small, there would be, Mr. Lyell states, vast accumulations of snow filling the plains and valleys to a great height, and leaving bare only the higher peaks and precipices of the mountains. From these points, he conceives the erratic blocks were detached and conveyed almost imperceptibly along the surface of the frozen snow to great distances. Lastly, at the breaking up and gradual retreat of the glaciers during the third period, he is of opinion, the boulders were deposited in the various situations in which they are now found, and that moraines, or lateral and transverse mounds, were successively deposited, and lakes formed by which stratified materials were accumulated in certain positions.

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diameter on the summit of Craigowl, the highest point of the Sidlaw Hills, and exceeding 1500 feet above the level of the sea.

In conclusion, Mr. Lyell offers some remarks on the conditions under which glaciers may have existed in Scotland, and the differences between them and those of the glaciers of Switzerland. He states that the glaciers of the latter country being situated 11° further to the south, they can present but an imperfect analogy with permanent masses of ice in Forfarshire, and that it is to South Georgia, Kerguelen's Land and Sandwich Land that we must look for the nearest approach to that state of things which must have existed in Scotland during the glacial epoch. In those regions of the southern hemisphere the ice reaches to the borders of the sea, and the temperature of summer and winter being nearly equalized, the glaciers probably remain almost stationary, like those of the Alps in winter, and can be diminished by only the first two of the three causes which tend to check an indefinite accumulation of snow in Switzerland; viz. 1st, evaporation without melting; and 2ndly, the descent of glaciers by gravitation, considered by M. Agassiz to be not very influential:—the third cause, the descent of glaciers arising from alternate liquefaction and freezing, he conceives must be wholly suspended in these regions.

As the tertiary strata prove that a warm climate certainly preceded the assumed glacial epoch in the northern hemisphere, and as a mild climate has since prevailed, Mr. Lyell says, there are three distinct phases of action to be considered in studying the supposed glaciers of Scotland: 1st, the coming on of the epoch; 2nd, its continuance in full intensity; and 3rd, its gradual retreat. At the commencement of the first condition, only the higher mountains would send down glaciers to be melted in the plains below, as at present in Switzerland, and in Chili between the 40th and 50th degrees of latitude. The ice would therefore thus be constantly advancing and retreating, but progressively, century by century, gaining ground, in consequence of diminishing summer heat; and pushing its terminal moraines forward, it would fill up lakes and other inequalities, till it finally reached the sea. During the second condition, when the motion of the ice would be very small, there would be, Mr. Lyell states, vast accumulations of snow filling the plains and valleys to a great height, and leaving bare only the higher peaks and precipices of the mountains. From these points, he conceives the erratic blocks were detached and conveyed almost imperceptibly along the surface of the frozen snow to great distances. Lastly, at the breaking up and gradual retreat of the glaciers during the third period, he is of opinion, the boulders were deposited in the various situations in which they are now found, and that moraines, or lateral and transverse mounds, were successively deposited, and lakes formed by which stratified materials were accumulated in certain positions.