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I

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

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1877.

"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. . . . The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.

ALERE FLAMMAM.

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FOURTH SERIES.]

"................. per litora spargite muscum,
Naiades, et circùm vitreos considite fontes:
Pollice virgineo teneros hìc carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasii Ecl.

No. 115. JULY 1877.

I.—*On the Distribution of Birds in North Russia.—II. Longitudinal Distribution of Species North of* 64° 30′ *N. lat., or the* NORTHERN DIVISION. By J. A. HARVIE BROWN, F.Z.S., Member of the British Ornithologists' Union.

INTRODUCTORY REMARKS.

WHILE I was preparing the following paper it was suggested to me that I should include the northern portions of Scandinavia and Finland, as well as Iceland, Spitzbergen, and Novaja Zemlja, as then the distribution of species in the whole of the portions of the Western Palæarctic region north of 64° 30′ N. lat., as far as recorded, would be shown in one tabular view.

I have given the matter due consideration; and although I have at hand most of the materials necessary for such a comparison, I have come to the conclusion that the more satisfactory way will be first to complete the tabulation of records in Russia, as far south as 60° or 59° N. lat., and *then* to compare the faunas of the countries north of the Baltic and north of the parallel of 60° N., and to show, under each, the northern and southern, as well as the western and eastern, distribution.

It was, again, suggested to me that I should confine my present tabulation to the districts which have been pretty fully worked; but upon consideration of this I concluded that, as my paper is intended not only to show what has been done ornithologically in North Russia, but also what remains to be done, it would serve my purpose better to include the comparatively unworked districts also, with certain reservations. One of these reservations is, the withholding of the recorded faunal value of the species, in many instances, beyond the record of first value (viz. simple recorded presence: *vide* explanation of symbols, further on), as, for instance, in the *N.W. District*. By doing this the continuity of the Table will not be affected, while at the same time all past work, with the exception of these reservations, will be placed, once for all, within easy reach. Further elucidation of the fauna can thus at any time in future be worked into the present Tables without altering their form or permitting them to get out of date.

With regard to the northerly distribution of insectivorous species in Russia and in Norway, it will only be necessary here to institute the general comparison that they will be found, with not very many exceptions, to reach localities in Russia situated from four to six degrees of latitude south of that which they reach in Norway.

In the 'Ann. & Mag. of Nat. Hist.' for April 1877, I have already treated of the latitudinal distribution of the birds of North-east Russia. Since this part of my paper was sent to press, I have been able to consult most of the authors who have treated of the birds north of 64° 30′ N. lat. and to compare their records. As already mentioned, however (*loc. cit.* p. 279), these materials are still insufficient to admit of an accurate knowledge of the minutiæ of latitudinal distribution, owing to the large extent of unexplored country. The present part of my paper therefore does not profess to exhaust the subject or even to approach completeness, but is merely a stepping-stone towards fuller records. In other words, I have thought it advisable to collect our already acquired knowledge of North-Russian species, and place it in a more accessible form.

To enable me to do this easily, and on a uniform plan, I have, in the first place, divided North Russia into two great divisions, which I propose to call the "NORTHERN" and the "SOUTHERN DIVISIONS." The former, with which we have more particularly to do at present, is included between the parallels of 64° 30′ N. lat. and 70° N. lat. The Southern (which I propose to make the subject of a later part of this paper) is that portion south of 64° 30′ N. lat., and between that and 60° N. lat., or about the latitude of St. Petersburg, but also including the whole of the Government of Vologda.

Further, for purposes of comparison, I have divided the "NORTHERN DIVISION" into *three Districts*, which I name and define as follows:—

1st. "*The N.W. District of the Northern Division.*"—Included between 30° and 40° E. long. (and north of 64° 30′ N. lat., which latter parallel passes through the Gulf of Onega). This includes the whole of the Kola peninsula, and all west of the White Sea up to the frontier of Russian Finland. By reference to the list of authors given further on, it will be seen that our materials for this district are far from complete (*vide* also *infrà*, page 4).

2nd. "*The North-Central District of the Northern Division.*"—Included between 40° and 50° E. long. (and north of 64° 30′ N. lat., but including the district immediately around Cholmogory). This includes the delta of the river Dvina and the country east of the White Sea as far as the watershed of the Pëza and Zylma rivers (or the plateau of the Timanskai Mountains), also the island of Kolguef in the Arctic Sea. Our materials for this portion are fuller than for either of the other two districts.

3rd. "*The N.E. District of the Northern Division.*"—Included between 50° and 65° E. long. (and N. of the parallel of 64° 30′ N. lat.). This includes the country from the headwaters of the Zylma (or plateau of the Timanskai Mountains) eastward, the valley of the Lower Petchora river to the Ural Mountains; and north-eastward to the Kara Sea and the range of the Paechoi Mountains, and including the Island of Waigats and adjoining seas*.

In the second place, I have under each district entered the records of the authors who have treated more or less of the birds of the NORTHERN DIVISION; and I now proceed to give a list of these, with the titles of their papers, in chronological order. The capital letters affixed to the notice of each indicate the extent of each author's field-work, or the districts in connexion with which he has written. I defer a criticism of the doubtful records until towards the close of the paper, merely indicating here the number of species recorded or added to the fauna by each author. The numbers 1 to 17, preceding the following notices, are used for reference in the Table further on.

* I have similarly divided the southern division into three districts, but I need not at present name or define them.

NORTHERN DIVISION.

List of Authors, &c.

1.

1840. Middendorff, Von. "Bericht über die orn. Ergebnisse der naturhist. Reise in Lappland während des Sommers 1840." (Beiträge zur Kenntniss des Russ. Reiches, Bd. viii. pp. 187–258.) N.W.

This is a most important paper. A set of useful Tables gives the faunal value of 75 species in Russian Lappland. In my Tables further on, however, I have preferred for the present entering only the simple record (thus, |), awaiting further elucidation of the fauna of the N.W. District. I would here refer also to Von Middendorff's larger work, 'Sibirische Reise,' Band iv. 4to, pp. 785–1094, for much interesting matter connected with Northern Palæarctic species. (*Cf.* 'Ibis,' 1870, p. 274.)

2.

1842. Bystrov-Brandt. "List of Skins of Mammals and Birds sent by Herr Bystrov of Mezén to Zool. Mus. of Academy." (Bull. de la Soc. de l'Académie de St. Pétersbourg, vol. x. p. 350.) N.C.

A list of 62 species of birds is given, skins of which had been forwarded from Mezén.

3.

1844. Blasius, J. H. 'Reise in europ. Russland.' Braunschweig, 1844.

This I have not been able to consult. It refers, however, I believe, more directly to the southern division.

4.

1850. Lilljeborg, W. "Bidrag till Norra Rysslands och Norriges Fauna, samlade under en vetenskapelig resa i desser lander 1848." (K. V. Ak. Handl. 1850, ii.) N.W., N.C. (and S.W.).

1852. Idem. "Beiträge zur Ornith. des nördlichen Russlands und Norwegen." ('Naumannia,' 1852, part ii.) Translation of the last into German.

This is an important contribution. Records of 125 species are given. Of these, 36 occur in the N.W., 73 in the N.C. (and 78 are recorded from the S.W.).

5.

1856. Hoffman-Brandt. "Bemerkungen über die Wirbelthiere des nördlichen europäischen Russlands, besonders des nördlichen Urals. Ein Beitrag zur näheren zoologisch-geographischen Kenntniss Nord-Ost-Europa's.—Vögel:" by J. F. Brandt, p. 61, contained in 'Das nördliche Ural und das Küsten-Gebirge Paechoi,' by Hoffman (vol. ii. p. 61). St. Petersburg, 1856*.

Seventy species are mentioned as occurring in the districts visited by the Ural Expedition; but of these, nineteen only are recorded as occurring north of 64° 30′ N. lat.

6.

1856. Hoffmannsegg, Graf. "*Limosa cinerea* im ihren Sommerverhalten." (Allg. deutsche Naturhistor. Zeitung im Auftrage Gesellsch. Isis in Dresden, neue Folge, Band ii. p. 238.) N.C.

7.

1856. Hencke. "Kurzer Bericht über eine oologische Excursion bei Archangel." (Ibid. p. 236.) N.C.

Graf Hoffmannsegg and Herr Hencke also visited the Petchora; but the above short papers are all the published records of their discoveries I have been able to find.

8.

1871. Meves. "Orn. iaktt. till större delen samlade under en resa i Nordvestra Ryssland; sommaren 1869." (Œfvers. af Kongl. Vetensk. Akad. Förhandl. 1871, part 6, Stockholm.) N.C. (and S.).

Idem. Translation of the above into English by M. Hjaltalin; in MS.

A most valuable paper. Dr. Meves records in all 201 species from N.C. and S.W. districts. Of these, 131 are from the N.C., and 162 are recorded as occurring in the S.W.

9.

1872. Th. v. Heuglin. "Notes on the Birds of Novaya Zemlia and Waigats Island." ('Ibis,' 1872, p. 60†.)

Many references are here made to the birds of Waigats

* It may be as well that I should here mention that much also has been due to the exertions of earlier travellers in Northern Russia, amongst whom I would instance Herr v. Baer, who has written upon the animal life of Novaja Zemlja, and also the traveller Schrenck, who passed through Siberia in Europe, from west to east, and travelled from Kolva on the Ussa into the Northern Ural. A fuller reference to the work of these and other naturalists and travellers will be found in the introductory portion of the above paper, into which, however, Prof. Brandt has already worked the principal results, so that they call for no further notice in this place.

† Also "Nachtrag zur Orn. von Novaja Zemlja und der Waigatsch-Insel" ('Journal für Orn.' 1872, p. 464) and "Nachrichten über Novaya Zemlya. Auszug aus einem Schreiben an Hrn. v. Middendorff" (Bull. Ac. Imp. St. Pétersb. xvi. p. 566, Mél. Biolog. viii. pp. 220–225).

Island and the mainland near Yugorsky Strait, also of Waigats Strait; V. Heuglin mentions 38 species as occurring at these localities.

10.

1873. Goebel, H. "Beiträge zur Kenntniss der Ornis des Archangel'schen Gouvernements." (Journal für Ornithologie, 1873, Jan., no. 121, pp. 406–422.) N.C.

167 species are recorded as occurring in the N.E. district; but, as will be shown further on, a good many of these have more or less doubt attaching to them*.

11.

1873. Palmén, Prof. J. A. Finlands Foglar, hufvudsakligen till deras drägter beskrifna af Magnus von Wright, &c. Vol. ii. Helsingfors, 1873. N.W., N.C. (and S.W.)

In this volume all notices have been carefully collected by Prof. Palmén as to the distribution of the birds (Gallinæ, Grallæ, and Anseres) of Finland, as far to the eastward as the river Wig and Onega Sea, in the S.W. district, and including the whole of the peninsula of Kola, in the N.W. District; and to it I am greatly indebted for data for my N.W. District, as Prof. Palmén quotes all previous writers, including Middendorff and Lilljeborg, and other reports from naturalists who have visited the country—Sahlberg and Malmberg and others. By the courtesy of Prof. Palmén I am also made aware that Lieut. H. Sandeberg†, a Swedish naturalist, has last year (1876) done very good ornithological work in Kola, and that he also collected in the neighbourhood of Archangel. The results, however, are not yet made public.

Amongst the families treated of in the above work‡ by Prof. Palmén, there are records of 90 species altogether which range into Russia. Of these, 58 are recorded from the N.W.,

* The following paper by Herr Goebel refers mostly to the Southern Division, and will come to be quoted when I treat of the latter; I have not considered it necessary to refer directly to it in the present connexion:—1871, Goebel, H., "Eine Reise von Petersburg nach Archangelsk über Tver, Jaroslav, Vologda und Ustjug vom 8. May bis 1. Juni 1864" ('Journal für Ornithologie,' pp. 20–27, 1871).

† Since the above was sent in to press, in a letter dated "Stockholm, 20th April," addressed to Prof. Newton, Lieut. Sandeberg writes that he found 53 species of birds new to the peninsula of Kola, last year. He starts again shortly for further exploration in Kola, and, time permitting, in Kanin and Kolguef.

‡ The same subject is dealt with more fully by Prof. Palmén in a later paper in the 'Journal für Orn.' for 1876, p. 40:—"Die geogr. Verbreitung der Hühner-, Sumpf- und Wasser-Vögel im faunistischen Gebiete Finlands." The particulars in 'Finlands Foglar' are for the most part brought up to date in this later paper; and it also ought to be consulted in this place.

22 are given from the N.C., and 50 are recorded as occurring in the S.W.

12.

1873. ALSTON and HARVIE BROWN. "Notes from Archangel." ('Ibis,' Jan. 1873, p. 54.) N.C. (and S.W.).

We record in this paper in all 148 species from the N.C. and S.W., but mainly from the former. Some of these, however, hold a somewhat doubtful value, for reasons stated further on, viz. under notice no. 14, "List of Birds in the Government Museum, Archangel" (*vide infra*), and under the notes to the species (*vide* p. 17). 131 are recorded from the N.C., and 17 from the S.W.

13.

1876. H. SEEBOHM and HARVIE BROWN. "Notes on the Birds of the Lower Petchora." ('Ibis,' 1876, Jan., Apr., July, and Oct.)

1876. HARVIE BROWN. "Notes of a Journey to, and Ornithological Observations on the Lower Petchora." (Proc. Roy. Phys. Soc. Edinb. 1875–76, p. 81.)

1876. IDEM. "Remarks on Migratory Movements of Birds on the Lower Petchora." (Proc. Nat.-Hist. Soc. Glasgow, vol. iii. p. 44.)

1876. SEEBOHM. Articles in Dresser's 'Birds of Europe,' part xlvii. *et seqq.*

1876. IDEM. "On the Migration of Birds in North-east Russia." (Rowley's Orn. Misc. vol. i. part iv. p. 239.)

1877. HARVIE BROWN. "On the Distribution of Birds of North Russia. I. On the Distribution of Birds on the Lower Petchora, &c. (Annals & Mag. Nat. Hist., April.)

1877. SEEBOHM and HARVIE BROWN. Appendix to "Notes on the Birds of the Lower Petchora," printed separately and issued along with separata of 'Ibis' paper *ut sup.*

In this Appendix errors in identification and synonymy are corrected, the parallel discoveries of Messrs. Finsch and Brehm are recorded, as also those of Capt. Feilden; a *résumé* of the work accomplished in North Russia and an indication of what remains to be done are given, and also an announcement of shortly expected papers upon our subject.

113 species are recorded from the N.E. district, taking into account the corrections made in the Appendix.

14.

1876. "List of the stuffed Specimens of Birds in the Government Museum at Archangel," in MS. (155 species from the Archangel Government.)

All these, I have been repeatedly assured by Government officials, were undoubtedly procured in the Archangel Government. We may not, however, in all cases be justified in giving the species represented an unequivocal right to be included in the fauna of the NORTHERN DIVISION, as many may, and no doubt have been procured in the Government south of our present limit of 64° 30′ N. lat., and may more correctly come to be included in the fauna of the southern division. Besides, in the absence of a catalogue, there are one or two more which I am inclined to reject altogether from the fauna, for reasons which I will explain when I come to treat of the doubtful species at the end of this paper.

15.

1876. PIOTTUCH. Partial Lists of Collections sent home to England, bearing dates of 1875 and 1876, by Piottuch, collector at Archangel.

These lists only add, however, two records*; but they verify some of the previous records, which would otherwise remain doubtful.

16.

1876. MR. F. C. CRAEMERS informs me also that he has added two species †, specimens of which are now in Mr. H. E. Dresser's collection. I am indebted also to Mr. Craemers for copies of the above partial lists of Piottuch's collections. M. Piottuch, however, has collected since 1872, but I have not seen all the lists.

Besides the above I find also the following :—

17.

1853. SCHRADER. "Beobachtungen über die Vögel Lapplands." (Journal für Orn. 1853, p. 242 ‡.) At page 243–44 a list of 20 species which were found by him in Russian Lappland.

18.

1876. DR. THEEL. "Note sur les oiseaux de la Nouvelle-Zemble." (Annales des Sc. Nat. 1876, tome iv. article 6.)

* *Pratincola rubicola?* and *Somateria spectabilis.*

† *Buteo desertorum* and *Fregilus graculus.*

‡ Among the references in the Tables I am obliged to leave this out in its proper chronological order, and to enter it at the end as No. 17, as also the following, which I only refer to in the "Notes:"—

1876. Dr. B. RADAKOFF. "Hand-Atlas der geogr. Ausbreitung der im europäischen Russland nistenden Vögel zusammengestellt von Dr. B. Radakoff" (H. Berghaus's 'Atlas der Thier-Geographie,' Moscou, 1876). For notice of this, *vide* 'Ibis,' 1877, April, p. 225. The text will appear in Russian and be at once translated into German on its completion.

Explanation of the Symbols and Arrangement in the following Table.

Absent, or unrecorded, or insufficient data, a blank space. Present, | . Rare, ·|·. Common, ||. Very common, ††. Exceedingly abundant, ‡‡. Once, twice, or thrice occurred, recorded, identified, shot, added to the fauna, ✓, ✓✓, ✓✓✓. Occasional, *. Locally distributed, ⊙. Generally distributed, ○. Very doubtful records: the names of the species and the records enclosed in brackets; the number of the species omitted in the printing ( ) (vide *F. sacer* of Tables). Less doubtful records: the names of the species and the records NOT enclosed in brackets, and the number of the species *retained* and printed, but a query in the columns, ?.

Table showing comparative Distribution of the Fauna in the three DISTRICTS *of the* NORTHERN DIVISION *and the Faunal Value of the Species in each.*

Species.	N.W.	N.C.	N.E.	References to Authorities in foregoing List.	References to Notes at p. 17 *et seqq.*
1. Aquila chrysaëtus, (*L.*)		|	✓	2, 10, 12, 13, 14.	
2. Haliaëtus albicilla, (*L.*)	|	||	||	1, 8, 10, 12, 13, 14, 15, 18.	
3. Pandion haliaëtus, (*L.*)		|	✓	4, 8, 10, 12, 13, 14.	
4. Buteo vulgaris, *Bechst.*		|		4, 8, 10, 12, 13, 15.	1
5. —— desertorum, *Daud.*		✓✓✓		16.	2
6. —— lagopus, *Brünn.*	|	|	|	1, 2, 4, 5[1], 10, 13.	
7. Pernis apivorus, (*L.*)		*		4, 10, 12, 14.	
8. Milvus ictinus, *Savig.*		?		12 ?	3
9. —— migrans, *Bodd.*		||		4, 8, 10.	
10. Falco gyrfalco, *Schleg.*	|	|	|	4, 5, 8, 10, 12, 14.	4
(—— sacer ?)		( )		(10.)	4
12. —— peregrinus, *L.*		|	||	4, 5, 8, 10, 12, 13, 14, 15.	
13. —— subbuteo, *L.*		||	✓	8, 10, 12, 13, 14, 15.	
14. —— vespertinus, *L.*		|		4, 8, 12, 14, 15.	
15. —— æsalon, *L.*		|	‡‡	1, 2, 4, 8, 10, 13, 14.	
16. —— tinnunculus, *L.*		|		10, 14, 15.	

[1] *Vide* Midd. no. 5, p. 201. Recorded as far north as 71½° ?

Species.	N.W.	N.C.	N.E.	References to Authorities in foregoing List.	References to Notes at p. 17 *et seqq.*
17. Accipiter palumbarius, (*L.*)..	|	|	✓	2, 8, 10, 12, 13, 14, 15.	
18. —— nisus, (*L.*)............	|	|	✓	4, 8, 10, 12, 13, 14.	
19. Circus cyaneus, (*L.*)........		||	||	4, 8, 12, 13.	
20. —— æruginosus, (*L.*)		|		8, 10?, 14?	5
21. Surnia ulula, (*L.*)	|	|	|	1, 2, 5, 8, 10, 12, 14, 15.	
22. —— nyctea, (*L.*)	|	||	||	1, 2, 5, 8, 9, 10, 12, 13, 14, 15.	
23. Glaucidium passerinum, (*L.*)		|		8, 10, 12, 14, 15.	
(Athene noctua, *Retz.*)		( )		(10.)	6
25. Nyctale Tengmalmi, *Gmel.* ..	|	|		10, 14, 15.	
26. Syrnium uralense, (*Pall.*) ..	|	|		8, 10, 12, 14, 15, 17.	
27. —— lapponicum, (*Retz.*).....		|		8, 10, 12, 14, 15.	
28. Asio otus, (*L.*)		?		10?, 14?, 15?	7
29. —— accipitrinus, (*Pall.*)	|	||	||	2, 8, 10, 12, 13, 14, 15.	
30. Bubo ignavus, (*Forst.*)	|	||	✓✓	2, 8, 10, 12, 13, 14, 15.	
31. Dryocopus martius, (*L.*)	|	|	|	2, 8, 10, 12, 13, 14, 15.	
32. Picus major, *L.*	|	|		1, 8, 10, 12, 14.	
33. —— minor, *L.*	|	||	||	1, 8, 10, 12, 13, 14, 15.	
34. —— leuconotus, *Bechst.*		?		8?, 10?, 12?, 14?	8
35. Picoides tridactylus, (*L.*)	|	|	||	2, 8, 10, 12, 13, 14, 15.	
36. Gecinus canus, (*Gmel.*)......		*		12, 14[1].	9
37. Yunx torquilla, *L.*..........		*		8, 10, 14.	
38. Cuculus canorus, *L.*	|	||	||	1[2], 2, 4, 8, 10, 12, 13, 14, 15.	
39. Sitta europæa, *L.*		·|·		10, 12, 14, 15[3].	10
40. Corvus corax, *L.*	|	††	††	1, 4, 8, 10, 12, 13.	
41. —— corone, *L.*............		✓		12.	11
42. —— cornix, *L.*	|	‡‡	‡‡	1, 4, 8, 10, 12, 13, 15.	
43. —— frugilegus, *L.*	|	·|·		1[4], 5, 8, 12.	
44. —— monedula, *L.*		††	✓✓	1[4], 4, 8, 12, 13, 14, 15.	
45. Fregilus graculus, (*L.*)	|	|		16.	12
46. Nucifraga caryocatactes, (*L*).		*		10.	13
47. Pica caudata, (*L.*)..........	|	||	||	1, 4, 8, 10, 12, 13, 14, 15.	
48. Garrulus infaustus, (*L.*)	|	††	††	2, 4, 10, 12, 13, 14, 15.	
49. —— glandarius, (*L.*)		·|·		8, 10, 14.	

[1] And F. C. Craemers *in lit.*
[2] Page 233.
[3] And Herr A. G. Nordvi *in lit.*
[4] Page 223, footnote.

Species.	N.W.	N.C.	N.E.	References to Authorities in foregoing List.	References to Notes at p. 17 *et seqq.*
50. Sturnus vulgaris, *L.*		*		14, 15.	
51. Lanius excubitor, *L.*		|		1, 2, 8, 10, 12, 14.	
52. —— collurio, *L.*		?		12 ?, 14 ?	14
53. Passer domesticus, (*L.*)		‖	‖	4, 5, 8, 10, 12, 13, 15.	
54. —— montanus, (*L.*)		††	††	4, 8, 10, 13, 14.	
55. Pyrrhula major, *Brehm*		|	·|·	4, 5, 8, 10, 12, 13, 14, 15.	
56. Carpodacus erythrinus, (*Pall.*)		·|·	◣◣	4, 12, 13 14, 15.	
57. Corythus enucleator, (*L.*)	|	‡‡	‡‡	1, 2, 5, 8, 10, 12, 13, 14, 15.	
58. Loxia curvirostra, *L.*		‖		8, 10, 12, 14, 15.	
59. —— bifasciata, (*Brehm*)		‖		4, 8, 10, 12, 14, 15.	
60. Coccothraustes vulgaris, *Pall.*		◣			15
61. Fringilla cœlebs, *L.*	|	‖		4, 8, 12, 17.	
62. —— montifringilla, *L.*	|	‖	‖	1, 2, 4, 8, 10, 12, 13, 15, 17.	
63. Carduelis elegans, (*L.*)		·|·		8, 10, 14.	
64. —— spinus, (*L.*)		|		4, 8, 10, 12, 14.	
65. Linota cannabina, (*L.*)		|			
66. —— linaria, (*L.*)	|	‖	‡‡	1, 2, 4, 8, 10, 12, 13, 14, 15.	16
67. —— exilipes, (*Coues*)		‡‡	‡‡	13.	16
68. —— flavirostris, (*L*)		·|·		10, 15.	17
69. Emberiza melanocephala, *Scop.*		?		10 ?, 12 ?, 14 ?	18
70. —— aureola, *Pall.*		‡‡	‡‡	4, 5[1], 8, 10, 12, 14, 15, 22.	
71. —— citrinella, *L.*	|	‖	·|·	4, 8, 10, 12, 13, 14, 15, 17.	
72. —— rustica, *Pall.*		·|·		8, 10, 12, 14, 15.	
73. —— pusilla, *Pall.*		‡‡	‡‡	2, 4, 5, 8, 10, 12, 13, 14, 15.	
74. —— schœniclus, *L.*		††	††	4, 8, 10, 12, 13, 15.	
75. Plectrophanes nivalis, (*L*)	|	‡‡	‡‡	1, 2, 5, 8, 9, 10, 13, 14, 15.	
76. —— lapponicus, (*L.*)	|	‖	‡‡	1, 8, 10, 12, 13, 14, 15, 18.	
77. Alauda arvensis, *L.*	|	‖	·|·	8, 10, 12, 13, 17.	
78. —— alpestris, *L.*	|	|	‡‡	1, 2, 4, 8, 9, 10, 12, 13, 14, 15, 18.	
79. Anthus trivialis, (*L.*)		‖	◣	4, 8, 10, 12, 13.	
80. —— pratensis, (*L.*)		|	‖	1, 2, 8, 10, 13, 14, 15.	
81. —— cervinus, *Pall.*		·|·	‡‡	4, 9, 12, 13, 15, 18.	
82. —— obscurus, *Penn.*	|			1, 4, 17.	
83. —— Gustavi, (*Swinhoe*)			‖	13.	19

[1] Abundant in North Ural, Midd. p. 1046, footnote 7.

Species.	N.W.	N.C.	N.E.	References to Authorities in foregoing List.	References to Notes at p. 17 *et seqq.*
84. Budytes viridis, (*Gmel.*)	|	||	||	2, 4, 8, 10, 12, 13, 14.	
85. —— citreolus, *Pall.*			‡‡	13.	
86. Motacilla alba, *L.*	|	||	||	1, 2, 4, 8, 10, 12, 13, 14.	
87. Cinclus melanogaster (*Temm.*)	|	|		8, 10, 12, 14, 15.	
88. Oriolus galbula, *L.*		*		12.	20
89. Turdus merula, *L.*		⚑		12.	
90. —— torquatus, *L.*	|			4.	
91. —— pilaris, *L.*	|	††	||	1, 2, 4, 8, 10, 12, 13.	
92. —— fuscatus, *Pall.*			⚑⚑	5.	21
93. —— viscivorus, *L.*	|	?		1, 4?, 8?, 10?	22
94. —— iliacus, *L.*	|	||	||	1, 2, 4, 8, 10, 12, 13, 14.	
95. —— musicus, *L.*		|		4, 10, 12.	23
(Erythaca rubecula, (*L.*)		( )		(10.)	24
97. Cyanecula suecica, (*L.*)	|	|	‡‡	1, 2, 8, 10, 12, 13, 14, 15.	
98. Ruticilla phœnicura, (*L.*)	|	||	|	2, 4, 8, 10, 12, 13, 14, 17.	
99. Saxicola œnanthe, (*L.*)	|	|	||	1, 2, 4, 10, 13, 14, 15.	
100. Pratincola rubetra, (*L.*)		||		10, 12, 14, 15.	
(—— rubicola, *L.*)		(⚑)		(15.)	25 }
102. —— indica, *Blyth*		?	||	13.	25 }
103. Accentor modularis, *L.*	|			17.	
104. Sylvia garrula, *Briss.*		·|·		4, 8.	
105. —— rufa, (*L.*)		|		4, 8.	
106. Sylvia salicaria, (*L.*)		||		4, 8, 12.	Obs.
107. Hypolais icterina, (*Vieill.*)		?		2?	26
108. Acrocephalus schœnobænus, (*L.*)		††	††	4, 8, 12, 13.	Obs.
109. Phylloscopus trochilus, (*L.*)	|	||	‡‡	4, 8, 10, 12, 13, 15.	
110. —— tristis, *Blyth*		?	††	13.	29
(—— neglectus, *Hume*)			(⚑)	(13.)	27
112. —— Gætkii, *Seebohm*			⚑	13.	28
(—— collybita, (*Vieill.*))		( )		(4), (10).	29
(—— sibilatrix, (*Bechst.*))		(|)		(12.)	30
115. —— borealis, *Blas.*[1]		||	⚑	8, 12, 13, 15.	

[1] *Vide* Postscript, p. 30.

Species.	N.W.	N.C.	N.E.	References to Authorities in foregoing List.	References to Notes at p. 17 *et seqq.*
116. Parus major, *L.*		*		8, 10, 14.	
117. —— cæruleus, *L.*		*		8, 10, 14.	31
118. —— ater, *L.*	|	(|)		1, ,8 10?, 14.	31
119. —— borealis, *De Sélys*	|	††		1, 2, 4, 8, 10, 12, 14.	
120. —— kamschatkensis, *Bp.*			||	13.	
121. —— cinctus, *Bodd.*		||	||	8, 10, 12, 13, 14, 15.	
122. —— cristatus, *L.*		·|·		8, 12.	
123. Acredula caudata, (*L.*)		·|·		14, 15.	
124. Ampelis garrula, *L.*		||	·|·	8, 12, 13, 14, 15.	
125. Muscicapa grisola, *L.*	|	||		4, 8, 10, 12, 15, 17.	
126. Hirundo urbica, *L.*	|	·|·		8, 12, 17.	
127. —— rustica, *L.*	|	·|·		1, 4, 8, 12, 13.	
128. —— riparia, *L.*	|	‡‡	||	1, 2, 4, 8, 12, 13, 14.	
129. Cypselus apus, (*L.*)	|	·|·		4, 12, 14, 17.	
130. Caprimulgus europæus, *L.*		*		12.	
131. Columba palumba, *L.*		·|·		4, 8, 10, 12, 14.	
132. —— œnas, *L.*		?			32
133. —— livia, *Briss.*		|	?	14.	
134. Syrrhaptes paradoxus, *Pall.*		[illegible]		10, 12, 14.	
135. Lagopus albus, (*Gm.*)	|	‡‡	‡‡	1, 2, 4, 5, 8, 10, 12, 13, 14, 15.	
136. —— mutus, *Leach*	|	( )	|	1, 5, 9 (10) (14).	33
137. Tetrao urogallus, *L.*	|	||	||	1, 2, 5, 10, 12, 13, 14, 17.	
138. —— urogallo-tetrix, (*Sund.*).	|			17.	34
139. —— tetrix, *L.*	|	||	[illegible]	1, 2, 5, 10, 12, 13, 14, 15, 17.	
140. —— bonasia, (*L.*)	|	††	||	1, 2, 4, 5, 8, 10, 12, 13, 14, 15.	
141. Coturnix communis, *Bonnat.*	|	?		1, 11, 12, 14.	35
142. Glareola pratincola, (*L.*)		[illegible]		14.	
143. Charadrius pluvialis, (*L.*)	|	||	††	1, 2, 4, 8, 9, 10, 12, 13, 14, 18.	
144. Squatarola helvetica, *Briss.*		·|·	††	8, 10, 12, 13, 14.	
145. Eudromias morinellus, (*L.*)	|	|	|	4, 5, 8, 9, 10, 13, 14, 18.	
146. Ægialites hiaticula, (*L.*)	|	||	††	1, 2, 4, 8, 9, 10, 12, 13, 14, 15.	
147. —— curonicus, *Besecke*		|	·|·	8, 13, 14.	
148. Vanellus vulgaris, *M. & W.*		*		8.	
149. Hæmatopus ostralegus, (*L.*).	|	††	††	1, 2, 4, 8, 10, 12, 13, 14.	

Species.	N.W.	N.C.	N.E.	References to Authorities in foregoing List.	References to Notes at p. 17 *et seqq.*
150. Strepsilas interpres, (*L.*)	|	*		1[1], 10, 12, 14, 15.	
151. Grus communis, *Bechst.*	|	‖	≣	2, 5[2], 8, 10, 12, 13, 14, 15.	
152. Platalea leucorodia, *L.*		*		8, 11, 14.	
153. Numenius phæopus, (*L.*) ..	|	‖	≣	4, 8, 10, 13, 14.	
154. —— arquata, (*L.*)		‖		4, 8, 10, 12, 14.	
155. Limosa ægocephala, (*L.*) ..		*		10, 12, 14, 17.	
156. —— lapponica, (*L.*)	|	·|·	✓	1, 10, 12, 13, 14.	
157. Scolopax rusticola, (*L.*)		·|·		8, 10, 14.	
158. Gallinago major, (*Gm.*)		|	‡‡	5[3], 12, 13, 14.	
159. —— gallinaria, (*Gm.*)		·|·	‖	2, 4, 8, 10, 12, 13, 14.	
160. —— gallinula, (*L.*)	|	·|·		2, 8, 10, 14.	
161. Calidris arenaria, (*L.*)		·|·	·|·	8, 9, 10, 12, 13, 14.	
162. Tringa canutus, *L.*	|	·|·		1, 8, 10, 14, 15.	
163. —— maritima, *Brünn.*	|	·|·	‖	1, 4, 9, 10, 14, 18.	
164. —— subarcuata, (*Güld.*) ..		·|·	✓	12, 13.	
165. —— alpina, *L.*	|	|	‡‡	1, 9, 10, 12, 13, 14, 18.	
166. —— minuta, *Leisl.*		|	††	3, 9, 10, 12, 13, 14, 18.	
167. —— Temminckii, *Leisl.*	|	††	‡‡	1, 8, 10, 12, 13.	
168. Limicola platyrhyncha, *Tem.*	|	✓		8.	
169. Totanus canescens, (*Gm.*) ..		‖	‖	2, 4, 8, 10, 12, 13, 14, 15.	
170. —— fuscus, (*L.*)	|	·|·	‖	1, 10, 13, 14, 17.	
171. —— calidris, (*L.*)	|			1.	
(Totanus stagnatilis, *Bechst.*)		( )		(14.)	36
173. —— glareola, (*L.*)	|	††	††	2, 4, 8, 10, 12, 13, 14, 15.	
174. —— ochropus, (*L.*)		|		10, 12.	
175. Terekia cinerea, (*Güld.*)	|	‡‡	††	1[4], 2, 4, 8, 10, 12, 13, 14, 15.	
176. Actitis hypoleuca, (*L.*)	|	‖ ⊙	·|· ⊙	2, 4, 8, 12, 13.	
177. Machetes pugnax, (*L.*)	|	‡‡	‡‡	1, 2, 5, 10, 12, 13, 14, 15.	
178. Recurvirostra avocetta, *L.* ..		✓		14.	
179. Himantopus candidus, *Bonnat.*		✓		14.	
180. Phalaropus hyperboreus, (*L.*)	|	|	‡‡	1, 2, 9, 10, 13, 18.	
181. Crex pratensis, *Bechst.*		✓		10.	37

[1] In this connexion also see Von Heuglin ('Ibis,' 1870, p. 62) regarding the occurrence of this species in Novaya Zemlia.

[2] "Brandt found it in 68° N." (*fide* Midd. p. 1029 of 'Die Thier. Sib.,' footnote 11.

[3] *Fide* Midd., Die Thier. Sib. p. 1030, footnote 2.

[4] Footnote, page 221.

Species.	N.W.	N.C.	N.E.	References to Authorities in foregoing List.	References to Notes at p. 17 *et seqq.*
182. Ortygometra porzana, (*L.*) . .		ǁ		10, 12, 14.	
183. Gallinula chloropus, (*L.*) . .		*		10, 12, 14.	
184. Fulica atra, *L.*		*		8, 10, 14.	
185. Anser cinereus, *Meyer*	ǀ	?		12 ?, 17.	38
186. —— segetum, *Gm.*	ǀ	ǁ	‡‡	9, 10, 12, 13, 14.	
187. —— albifrons, *Bechst.*		ǀ		1, 10, 12, 14.	
188. —— leucopsis, *Bechst.*		ǀ		1[1], 10.	
189. —— brenta, *Pall.*		ǀ	‡‡	9, 10.	
190. Cygnus olor, *Gm.*		ǀ		10.	
191. —— musicus, *Bechst.*	ǀ	ǀ	††	1, 8, 9, 10, 13, 14.	
192. —— minor, *Pall.*			ǁ	10, 13.	
193. Spatula clypeata, (*L.*)	ǀ	††	·ǀ·	2, 4, 8, 10, 12, 13, 14, 15.	
194. Anas boschas, *L.*	ǀ	ǁ		1, 2, 8, 10, 12, 14.	
(—— strepera, *L.*)		( )		(8), (10), (12), (14).	39
196. —— penelope, *L.*	ǀ	ǁ	‡‡	1, 2, 4, 8, 9, 10, 12, 13, 14, 18.	
197. —— acuta, *L.*	ǀ	††	‡‡	1, 2, 4, 8, 12, 13, 14, 15.	
198. —— circia, *L.*		·ǀ·		10, 12, 14.	
199. —— crecca, *L.*		††	††	1, 2, 4, 8, 10, 12, 13, 14.	
200. Fuligula cristata, (*L.*)	ǀ	ǁ	⫽	2, 4, 8, 10, 12, 13, 14, 17.	
201. —— marila, (*L.*)	ǀ	·ǀ·	ǁ	2, 4, 8, 10, 12, 13, 14, 15.	
202. —— ferina, (*L.*)		ǀ		2, 4, 10, 12, 14.	
203. —— nyroca, (*Güld.*)		ǀ		8, 12, 14.	
204. —— glaucion, (*L.*)	ǀ	ǀ	ǀ	2, 4, 8, 10, 12, 13, 14, 15.	
205. —— glacialis, (*L.*)	ǀ	ǀ	‡‡	1, 2, 8, 9, 10, 12, 13, 14, 18.	
(Histrionicus torquatus, (*L.*))	(ǀ)			(11.)	40
207. Somateria mollissima, (*L.*) . .	ǀ	ǁ	ǁ	1, 4, 8, 9, 10, 14.	
208. —— spectabilis, (*L.*)		·ǀ·	ǀ	9, 15.	
209. —— Stelleri, (*Pall.*)	ǀ			11.	40 *b*
210. Œdemia nigra, (*L.*)	ǀ	‡‡	‡‡	2, 4, 5, 8, 9, 10, 12, 13, 14, 15.	
211. —— fusca, (*L.*)	ǀ	ǁ	⫽	1, 4, 9, 10, 12, 13, 14.	
212. Mergus merganser, *L.*		ǀ	·ǀ·	8, 9, 10, 12, 13, 14, 15.	
213. —— serrator, *L.*	ǀ	ǀ	ǁ	10, 12, 13, 14, 18.	
214. —— albellus, *L.*	ǀ	ǀ	ǁ	2, 10 12, 13, 14, 15.	
215. Podiceps griseigena, (*Bodd.*)	ǀ	ǀ	ǁ	10, 12, 14, 17.	
216. —— auritus, *L.*		ǀ		10.	

[1] Page 237.

<table>
<tr><th>Species.</th><th>N.W.</th><th>N.C.</th><th>N.E.</th><th>References to Authorities in foregoing List.</th><th>References to Notes at p. 17 et seqq.</th></tr>
<tr><td>(Podiceps cristatus, (L.))....</td><td></td><td>( )</td><td></td><td>(10.)</td><td>41</td></tr>
<tr><td>218. Colymbus arcticus, L........</td><td>|</td><td>‡‡</td><td>††</td><td>2, 8, 10, 12, 13, 14, 18 ?</td><td></td></tr>
<tr><td>219. —— glacialis, L............</td><td>|</td><td></td><td></td><td>9 ?, 11[1], 18 ?</td><td></td></tr>
<tr><td>220. —— septentrionalis, L. ....</td><td>|</td><td>††</td><td>||</td><td>1, 2, 4, 8, 9, 10, 12, 13, 14, 15.</td><td></td></tr>
<tr><td>221. Alca torda, L. ....</td><td>|</td><td></td><td></td><td>4.</td><td></td></tr>
<tr><td>222. Mormon arctica, L. ....</td><td>|</td><td></td><td></td><td>1, 4, 14.</td><td></td></tr>
<tr><td>223. Uria troile, (L.) ....</td><td>|</td><td>|</td><td></td><td>4, 10.</td><td></td></tr>
<tr><td>224. —— lomvia, (L.) ....</td><td>|</td><td></td><td>?</td><td>9 ?, 10.</td><td></td></tr>
<tr><td>225. —— grylle, (L.) ....</td><td>|</td><td></td><td></td><td>1, 2, 4, 8, 10, 14.</td><td></td></tr>
<tr><td>226. Mergulus alle, (L.) ....</td><td>|</td><td></td><td>|</td><td>9, 11.</td><td></td></tr>
<tr><td>227. Procellaria glacialis, L. ....</td><td>|</td><td></td><td></td><td>1, 4.</td><td></td></tr>
<tr><td>228. Stercorarius pomatorhinus, Tem.</td><td>|</td><td>|</td><td>|</td><td>9, 10, 11, 12, 18.</td><td></td></tr>
<tr><td>229. —— crepidatus, Gm. ......</td><td>|</td><td>·|·</td><td>||</td><td>2, 9, 13, 15.</td><td></td></tr>
<tr><td>230. —— parasiticus, L.........</td><td>|</td><td>·|·</td><td>‡‡</td><td>1, 8, 9, 10, 13, 18.</td><td></td></tr>
<tr><td>231. Rissa tridactyla, (L.) ......</td><td>|</td><td></td><td></td><td>1, 4.</td><td></td></tr>
<tr><td>232. Larus glaucus, Brünn. ....</td><td>|</td><td>|</td><td>|</td><td>2, 4, 9, 10, (11), 13, 14, 18.</td><td>41b</td></tr>
<tr><td>233. —— leucopterus, Fab. ....</td><td>|</td><td>·|·</td><td></td><td>10.</td><td></td></tr>
<tr><td>234. —— eburnea, (Gm.) ......</td><td></td><td>|</td><td>·|·</td><td>9, 10, 14.</td><td></td></tr>
<tr><td>235. —— marinus, L............</td><td>|</td><td>|</td><td>·|·</td><td>1, 4, 10, 12, 13, 14.</td><td></td></tr>
<tr><td>236. —— fuscus, L..............</td><td>|</td><td>|</td><td>?</td><td>2, 8, 9 ?, 12.</td><td>42</td></tr>
<tr><td>237. —— argentatus, L..........</td><td>|</td><td>|</td><td></td><td>4, 10, 12.</td><td>41b</td></tr>
<tr><td>238. —— affinis, Reinh. ....</td><td></td><td>††</td><td>‡‡</td><td>9 ?, 12, 13.</td><td>42</td></tr>
<tr><td>239. —— canus, L. ....</td><td>|</td><td>††</td><td>‡‡</td><td>1, 2, 4, 8, 10, 12, 13, 14.</td><td></td></tr>
<tr><td>240. —— ridibundus, L..........</td><td></td><td>·|·</td><td></td><td>10, 12.</td><td></td></tr>
<tr><td>241. —— minutus, Pall.........</td><td></td><td>|</td><td></td><td>4, 8, 10, 12, 14.</td><td>43</td></tr>
<tr><td>242. Sterna macroura, Temm. ..</td><td>|</td><td>||</td><td>||</td><td>1[2], 2, 4, 8, 9, 10, 12, 13, 14, 18.</td><td></td></tr>
<tr><td>(—— fluviatilis, Naum.)....</td><td></td><td>( )</td><td></td><td>(4)</td><td>44</td></tr>
<tr><td>244. Hydrochelidon fissipes, (L.)</td><td></td><td>|</td><td></td><td>14.</td><td></td></tr>
<tr><td>245. —— nigra, (L.) ....</td><td></td><td>|</td><td></td><td>14.</td><td></td></tr>
<tr><td>246. Sula bassana, (L.) ....</td><td>|</td><td></td><td></td><td>4.</td><td></td></tr>
<tr><td>247. Phalacrocorax carbo, (L.) ..</td><td>|</td><td>|</td><td></td><td>1, 4, 14.</td><td></td></tr>
<tr><td>248. —— graculus, (L.)........</td><td>|</td><td></td><td></td><td>1.</td><td></td></tr>
<tr><td>249. Emberiza pithyornis, Pall...</td><td></td><td></td><td>✓</td><td>[3]</td><td></td></tr>
</table>

[1] *Vide* Gillett, 'Ibis,' 1870, p. 308: possible occurrence in Novaya Zemlya?
[2] Page 220.
[3] Midd. 'Die Thier. Sib.' p. 1046, footnote 7.

NOTES AND CRITICISMS OF DOUBTFUL RECORDS IN PART II.

Having now indicated the total number of species recorded as belonging to the fauna, and having marked as doubtful and requiring further confirmation some of these records, it may be as well to state my reasons for excepting these from the thoroughly authentic list, so that, should I be in error, the species may all the more easily be reinstated at any future time.

In the Table, and also in the following notes, decidedly doubtful records, resting upon what appear to me insufficient data, are enclosed in brackets and have no number preceding them.

Besides the above there are others which are open to a certain amount of doubt, and, though recorded as occurring or having occurred in the Archangel Government, may have been procured from localities south of our present limits. As already mentioned above (p. 9), these species in the Table and in the following notes are retained in the numbering, and are not enclosed in brackets, but are marked with a query (?) in the columns.

(1) *Buteo vulgaris*, Bechst. No. 4 in Table.

Prof. Newton, writing in 1871 (Yarrell's 'British Birds,' vol. i. p. 112), puts the recorded northern range of this species as "between Lake Onega and Archangel," on the authority of Lilljeborg, and says:—"From this point its course is not so easily traced, few of the Russian ornithologists having met with it except in the southern provinces of their country." In our collection of North-Russian birds I have a Common Buzzard shot by myself at Ijma, near Archangel, in 1872; and Alston had a young bird taken from a nest at the same locality (*vide* 'Ibis,' 1873, p. 58).

(2) *Buteo desertorum*, Daud. No. 5 in Table.

This was added to the fauna of the north-central district by Mr. F. C. Craemers, who received one specimen from Archangel, since when two more, one in adult dress, were sent by Mr. Piottuch, all three being now in Mr. H. E. Dresser's collection.

(3) *Milvus ictinus*, Savig. No. 8 in Table.

I am unwilling to altogether relinquish the record given by my friend Alston and myself ('Ibis,' 1873) of the occurrence of this species at Archangel, but perforce must do so in part,

* Herr Meves (J. für Orn. 1875, p. 432) states that this species is not uncommon in the Government of Perm, near Kungur.

as I find it unsupported by any other observers before or since: while applying the rule to other people's records, I must, of course, apply it to our own where the least doubt occurs. We did not *handle* any specimens of Kites at Archangel; but the deeply forked tail and very rufous colour of one that was fired at and wounded, and which fell to the ground, but recovered and made off, was what induced our *perhaps* too positive record in 1873. I have since then made the acquaintance of both species in another country (Transylvania), and morally I feel convinced of the correctness of our Russian observations; in accordance with the rule, however, I attach a query to the record*.

(4) *Falco gyrfalco*, Schleg. No. 10 in Table.

Herr Goebel also includes *Falco sacer* (sic); but *Falco gyrfalco* is doubtless intended, as he does not elsewhere take notice of the last-named species, although it is included in the collection in the Archangel Museum. Herr Meves also mentions having obtained an egg of this species (*Falco gyrfalco*) taken in Kañin.

(5) 19. *Circus æruginosus* (L.)? No. 20 in Table.

Meves shot a specimen at Kasnosoffskaya, which locality I identified with Knaschestrowskaya, near Archangel (Stieler's Hand-Atlas, No. 31).

(6) (*Athene noctua*, Retz.) No number.

Herr Goebel's record of this species is the only one I can find. I did not observe any specimen of it in the Archangel Museum in 1875; nor have any specimens been sent home, that I can hear of†.

* Our record, however, is strongly supported by Dresser (B. of Europe, part xl.), who says, "In Russia it certainly occurs as far north as Archangel, where my collector informs me it is not rare."

† I wish here to say a few words in connexion with my criticisms of some of Herr Goebel's records. I wrote some months ago to Herr Goebel, care of Professor Cabanis, Berlin, for further information concerning some of the species by him recorded as occurring or breeding in the Archangel district. Up to this time (the date of going to press) I have had no communication from him, so am unwillingly obliged to send in the MS. as it stands. I hope, however, at some future opportunity to treat more fully of the breeding-zones of birds in North Russia, when I may be able more critically to examine the records of breeding species. Meanwhile I will only mention here some of the records which appear to me to require fuller authentication, which, I believe, it is quite possible Herr Goebel may be able to supply, as he states that many of the eggs purchased or otherwise obtained by him at Archangel have pencil notes

(7) *Asio otus* (L.). No. 28 in Table.

Same category as No. 19.

(8) *Picus leuconotus*, Bechst. No. 34 in Table.

Same category as No. 19.

(9) *Gecinus canus*, Gmel. No. 36 in Table.

I am assured that this species has occurred several times close to Archangel, by Mr. F. C. Craemers, who also informs me that there are specimens in a gentleman's possession in Archangel which were killed there.

(10) *Sitta europæa*, L. No. 39 in Table.

Herr Nordvi, in a letter to me dated March 1876, informs me that Graf Hoffmannsegg found the eggs of this species near Archangel, verifying other observations of its occurrence in our present division. Piottuch has also sent home specimens of the bird amongst his earlier collections since 1872.

(11) *Corvus corone*, L. No. 41 in Table.

There is one specimen of this bird in Herr Heinrich's collection, which was shot at Archangel. It appears to have escaped the notice of Herr Meves and Herr Goebel, or to have been obtained subsequent to their visit to Archangel (*vide* 'Ibis,' 1873, p. 65).

(12) *Fregilus graculus* (L.). No. 45 in Table.

Auct. F. C. Craemers (*in lit.*).

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upon them, presumably in Herr Hencke's handwriting. It would have added considerably to the permanent value of Herr Goebel's already useful paper had he supplied fuller notes on the breeding-records given by him. That some are admittedly very doubtful, Herr Goebel himself points out. I would instance the record of the Gadwall breeding at Archangel, eggs in the museum being marked "Archangel," while the birds are labelled "Astrackan." I proceed to enumerate those which appear to me especially to require confirmation, or fuller (published) record, *as breeding species* :—

Lagopus mutus. See my notes on this species.
Nucifraga caryocatactes. *Vide* notes.
Erythaca rubecula. "
Tringa minuta. }
Calidris arenaria. } "
Anser albifrons. "
Somateria mollissima. "
Anas strepera. "

(13) *Nucifraga caryocatactes* (L.). No. 46 in Table.

The record of this species by Herr Goebel as occurring in large flocks ("ungeheure Schaaren") and remaining only a few days at Archangel, on and after the 29th August, 1864, is of special interest, finding its parallel in various other similar invasions of the species into different parts of Europe in unusual numbers, notably in 1844 and 1847. The invasion recorded by Herr Goebel, however, would appear to have been restricted in its extent, as I cannot find any special mention made of their appearance in other northern countries during 1864. I consider that the breeding of this species north of 64° 30′ N. lat. requires further published authentication.

(14) *Lanius collurio*, L.? No. 52 in Table.

Same category as No. 19.

(15) *Coccothraustes vulgaris*, Pall. No. 60 in Table.

One specimen of this species was got by Seebohm and myself in the German cemetery at Archangel on the 14th March, 1875.

(16) *Linota linaria* (L.), and *L. exilipes* (Coues). Nos. 66 & 67 in Table.

Vide Part I. of this paper ('Annals,' table at p. 285, nos. 30, 31 of list).

(17) *Linota flavirostris* (L.). No. 68 in Table.

Several specimens have been sent home by Piottuch, which were obtained at Archangel in summer; and Mr. F. C. Craemers informs me that specimens are in both his own and Dresser's collections. Mr. Dresser, however, says nothing of the occurrence of this species so far north in Russia (*vide* 'Birds of Europe,' part 53). Herr Goebel records it as breeding, but apparently on the sole evidence of his having obtained eggs supposed to have been correctly named and marked by Herr Hencke. All the more doubt attaches to these and various other records of breeding given by Herr Goebel, because the eggs he obtained, which were marked by Hencke, appear to have been brought together from various localities. It is possible that this species may breed in small numbers within our limits, judging from records of its occurrence in summer as far and further to the north in other parts of Europe (*op. cit.* part 53). I do not, however, find record of it in the SOUTHERN DIVISION in any of the papers I have at present access to.

(18) *Emberiza melanocephala*, Scop. No. 69 in Table.

Same category as No. 19.

(19) *Anthus Gustavi* (Swinhoe), P. Z. S. 1863.
No. 83 in Table.

Vide Appendix to "Notes on Birds of the Lower Petchora" (issued with separate copies, 1877), where it is shown that our supposed new Pipit (*Anthus Seebohmi*, Dresser) has since been identified with *Corydalla Gustavi* of Swinhoe, we having examined specimens of Swinhoe's types from Northern China. (*Vide* also 'Ibis,' 1877, p. 128.)

(20) *Oriolus galbula*, L. No. 88 in Table.

Same category as No. 19.

(21) *Turdus fuscatus*, Pall. No. 92 in Table.

Concerning the occurrence of this species in Europe and within our limits I cannot do better than quote from Brandt's paper before mentioned. "Two specimens of this species so much sought after by collectors of European birds and whose summer residence may be considered to be Northern Asia (not exactly Arctic Asia) and Central Asia, but not, as Pallas says, Dauria, the Selenga, the Tunguska, and Upper Jenesei only, were shot on the 6th July near the sources of the Petchora under the 62° of N. latitude; a third was shot near Mansantansse-tump, between 64° and 65° N. lat."

I cannot discover this latter locality upon Stieler's Atlas; but as the Ural Expedition for the most part followed the western slope of the Ural, it is reasonable to suppose that it occurred within our limits. In any case those obtained near the sources of the Petchora will admit the species to the fauna of the Southern Division.

(22) *Turdus viscivorus*, L. No. 93 in Table.

We have no *direct* evidence of its occurrence north of 64° 30′ N. lat., Meves merely saying that it was found by him "in many large flocks in the *department* of Archangel." (The italics are mine.)

(23) *Turdus musicus*, L. No. 95 in Table.

I enter this on the authority of Lilljeborg first, and then on Goebel's (1873). The latter author records finding a nest of this species containing four eggs, at Archangel, in June 1864. In 'Journal für Orn.' 1869, p. 318, Herr Goebel makes mention of having taken the eggs of a Siberian species of Thrush in the Archangel Government in June 1865, the eggs like small specimens of those of *T. musicus*, and shot the female; but he makes no mention of this rarity in the paper published in the same journal in 1873. Without an examination of this latter specimen and its eggs, we have no data upon which to admit it, as Herr Goebel does not give it any name.

(24) (*Erythaca rubecula* (L.).) No number.

The only records of the occurrence of this species are given by Herr Goebel, who twice instances its breeding at Archangel, and records that he himself took or obtained the eggs when there. I cannot help regretting, however, that he does not, in this and in many other instances, more fully authenticate his observations, in cases especially where previous writers have failed to observe the species under consideration. I may add that the Robin has never been recorded, to my knowledge, from North Russia (within our present limits) since Herr Goebel's records; and I am obliged therefore, reluctantly, to place it amongst the most doubtful records.

(25) (*Pratincola rubicola* (L.), and *P. indica*, Blyth.) No. 102.

After careful searching I find that only one record of any Stonechat has been given from the north-central district, viz. that of "*P. rubicola*," in the lists of Piottuch's collections, alongside with "*P. rubetra*." The species obtained on the Petchora by Seebohm and myself, however, being *P. indica*, I believe that upon examination this specimen will be found to belong to the latter, and probably occurred at Archangel in autumn on migration. I therefore place *rubicola* in the table in brackets, and place a query opposite *indica* in the column for the N.C. District. This appears to be further justified by the absence in any lists I have examined of *P. rubicola* or *P. indica* in the Scandinavian peninsula or in Finland, and by their further absence in the Southern Division of North Russia.

I may here mention that an easy means of distinguishing *P. indica* from *P. rubicola* will be found on comparing the axillary feathers under the wings of the two species, the prevailing colour in *indica* being black, but in *rubicola* white—*indica* having the axillaries faintly and narrowly edged with white, *rubicola*, on the other hand, having them distinctly and broadly edged with white, which gives them a much whiter appearance.

The statement, therefore, in my paper in 'Proc. Roy. Phys. Soc. Edinb.' (1875–76, p. 81) is premature and unfounded.

Obs.—(*Sylvia salicaria* (L.)). Prof. Newton mentions (Yarrell, vol. i. p. 421) that "Herr Meves found it pretty numerous at several places in North-west Russia." All Herr Meves's records of it, however, apply to localities south of our limits. I would therefore take the opportunity of pointing out that the expression "N.W. Russia" in this and other instances must not be considered equivalent to our "N.W. District."

(26) "*Sylvia hypolais*" (sic). No. 107 in Table.

This record by Bystrov-Brandt is the only one I can find of the occurrence of what it may be presumed is intended for *Hypolais icterina* (Vieill.) so far north. One skin is mentioned in the "List" as having been sent from Mezén; but all other records I find of its occurrence are from localities considerably to the southward of our limits. Judging from analogy, I am inclined to consider that this must have been an exceptional instance of its occurring so far north in Russia, as its range in Norway only reaches to 67° N. (Collett). *Vide* Introductory Remarks in this paper.

Obs.—*Acrocephalus dumetorum*, Blyth (*Salicaria magnirostris* (Lillj.)). I can hardly admit this within our limits yet, though it is possible that it may be found as far north as Archangel. Lilljeborg records it as occurring "between Kargopol and Cholmongory;" but I find no positive record of its occurrence *at* the latter locality.

(27) (*Phylloscopus neglectus*, Hume.). No number.

This species is now found to have been erroneously admitted to our list of "Birds of the Lower Petchora," as the specimen which was thought to belong to this species turns out to be merely a pale variety of *P. tristis*, and not true *P. neglectus* ('Ibis,' 1876, p. 503, and Appendix to our paper "Notes on Birds of the Lower Petchora," issued with the separate copies).

(28) *Phylloscopus Gaetkii*, Seebohm, 'Ibis,' Jan. 1877, p. 92 (=*P. major*, Tristram, *nec* Forster). No. 112 in Table.

We are now able to add this to the European list and to the fauna of the N.E. District, as the bird mentioned by us in 'The Ibis,' 1876, p. 26, has been assigned to it (*vide* also Appendix to our paper in 'The Ibis' issued with separata).

(29) (*Phylloscopus collybita*, Vieill.) No number.

I find records of this species by Lilljeborg and Goebel unsupported by other evidence of its occurrence so far north. Mejakoff gives it as rather rare even in the south of the Vologda Government *; but Meves gives it as tolerably common in the S.W. District. I consider its occurrence in the NORTHERN DIVISION very doubtful.

Lilljeborg's description is too vague for purposes of satisfactory identification, but seems to me more nearly to answer to that of *P. tristis*, which species is more likely to occur there in autumnal migration than *P. collybita*. In Norway the latter has been recorded as far north as 67° N. lat. (Collett, 1876); but I cannot find any record of its occurrence in the north of Finland. Goebel records "*P. rufa*" three times, and mentions having once found the eggs; but there is nothing in his records to satisfy us that they should not have been applied to another species. I have concluded, then, to place *P. collybita* in brackets and to place a ? opposite *P. tristis* in the column for the N.C. District.

(30) (*Phylloscopus sibilatrix* (Bechst.).) No number.

I cannot now find any specimens of this species in our collections from Archangel, although Alston and I recorded its occurrence in 1873; nor can Alston apparently now corroborate our record. I therefore enclose it in brackets, *vide* Postscript, p. 30.

(31) *Parus cœruleus*, L. *Parus ater*, L. Nos. 117 & 118 in Table.

Herr Meves records these two species, but not from personal observation, and probably quoting Goebel. Herr Goebel includes *P. cœruleus* from his own observation; but his record of *P. ater* appears to be founded on the single example in the museum. I prefer here to give the latter a doubtful claim to having occurred north of 64° 30′ N. lat.

(32) *Columba œnas*, L. No. 132 in Table.

Same category as No. 19.

(33) *Lagopus mutus* (Leach). No. 136 in Table.

The line of the eastern range of this species must still be

* Bull. de la Soc. Imp. des Nat. de Moscou, 1856, p. 630.

considered doubtful. Professor Palmén ('Finlands Foglar,' vol. ii. p. 44) records it from the mountainous country near Lake Imandra, between Kandalax and Kola. Lilljeborg, quoting Middendorff, says (K. V. A. Handl. 1850, p. 320), "It seems to become rarer and rarer in Russian Lapland towards the White Sea; he seems to consider, therefore, that its eastern boundaries are here." Herr Goebel records that large numbers of this bird are brought to the annual fair at Pinega from the district of Kem; but I think it is more than probable that these came to Kem in the first instance from a much more westerly locality, or from the localities above taken notice of. At all events the presence of specimens in the Pinega market sent from Kem does not entitle the species to a place in the Archangel fauna (*i. e.* N.C.); nor does the presence of a specimen in the museum suffice. Goebel also includes it amongst the eggs procured, but gives no authentication. I think it exceedingly doubtful that it exists on the east shore of the White Sea except in a frozen state, unless it may occur in Kanin. Of its occurrence on the west shore of the White Sea we have records in 'Finlands Foglar,' vol. ii. p. 44 (Triostrov, near the mouth of the Ponoj river, in 67° N. lat.).

In the N.E. District we have records of *Lagopus alpinus*, Nilss., from the Northern Ural (Hoffman), in 66° N. lat., and from Waigats, by Von Heuglin, of a *Lagopus*, probably of this species.

(34) *Tetrao urogallo-tetrix*, Sund. (*v.* Collett's 'Birds of Northern Norway,' p. 50). No. 138 in Table.

Under the name of *Tetrao medius*, Schrader includes this hybrid in his list of birds found in Russian Lapland. The name *T. urogalloides*, Nilsson, for a long time has been that in most general use, but has been taken up by Middendorff for a totally different species from Kamtschatka. Linnæus named a Tetrao *hybridus*, but it remains uncertain to which hybrid this name was applied. Sundevall re-named this bird *Tetrao urogallo-tetricides* in 1869; but Collett very properly explains away the termination *-ides* (*tom. cit.* p. 50), and suggests the name standing at the head of this notice. This name should, I think, stand, *i.e.* if a hybrid is deserving at all of such distinction.

(35) *Coturnix communis*, Bonnat. No. 141 in Table.

In 'Finlands Foglar' the Common Quail is recorded from Lutvajärvi, 65° N., near the Finnish frontier, a specimen having been procured there on June 29, 1839 ('F. F.' p. 55); and Alston and myself saw two specimens in the flesh at Suzma, on the south coast of the White Sea, about 90 versts west from Archangel. Its occurrence in the N.C. District is not actually on record, although those seen by us were not far removed from the western boundary of it.

(36) (*Totanus stagnatilis*, Bechst.) No number.

I find this included in a list of the birds in the museum made by me in 1875; but I think there must have been some mistake, as I have no recollection of seeing a specimen there, and I find no other notice of its presence nor evidence of its occurrence in the NORTHERN DIVISION.

(37) *Crex pratensis*, Bechst. No. 181 in Table.

The only one on record appears to be the solitary specimen noticed by Goebel (J. für Ornith. 1873). In 1872, when we were at Archangel, Alston and I imitated the cry in presence of our boatmen, who appeared readily to recognize it ('Ibis,' 1873, p. 67). As Meves, however, and also Lilljeborg seem to consider it rare at even much more southerly localities, it is possible that we may have misunderstood our men, or our men may have misunderstood us. We have, however, the above single positive record of its occurrence, and so can admit it to a place in this list.

(38) *Anser cinereus*, Meyer. No. 185 in Table.

Mr. Alston and I record this species as occurring in the N.C. District; but I consider now that some doubt attaches to this record. It is possible, however, that it may be reinstated in the N.C. District, as Schrader has recorded it from the N.W.*, and it is said to occur in East Finmark and to breed in West Finmark at Tamsö†. Herr Goebel also records the possible ("?" *sic*) occurrence of it to the southward (J. für Orn. 1871, p. 22 footnote).

(39) *Anas strepera* (L.). No number.

Extreme doubt attaches to even the occurrence of this species within our limits; and, as Herr Goebel has pointed out, still more attaches to the record of its breeding, or having bred—the eggs in the museum at Archangel being marked "Archangel," while the birds are labelled (or catalogued?) from Astrakan. This error or uncertainty seems to have arisen

* J. für Orn. 1853, p. 244.
† Sommerfeldt (Dresser, 'Zoologist,' 1867, p. 773).

in earlier and been perpetuated in later records (*cf.* Meves, p. 780; Alston and Harvie Brown, p. 71). Meves notes having once seen this species at Ladoga Canal; so it is just possible stray examples may occur as far north as Archangel. Meanwhile, however, it must only hold the value indicated by the brackets.

(40) *Histrionicus torquatus* (L.). No number.

The only record appears to be that by A. v. Nordmann, who reports having seen one pair on the coast near Kem ('Finlands Foglar,' vol. ii. p. 480). Until further record appears, I have enclosed it in brackets. The occurrence is possible, but must be considered extremely improbable. It has been recorded also as occurring in Northern Norway; but Mr. Collett attaches great doubt to the authenticity of the record ('Map of Norway,' letterpress: Christiania, 1876*).

(40*b*) *Somateria Stelleri*, Pall. No. 209 in Table.

Nordvi records this species as breeding in Russian Lapland; but Meves (J. für Orn. 1875, p. 433) gives good reasons for doubting it.

(41) *Podiceps cristatus* (L.). No number.

Its recorded presence rests solely upon a clutch of four eggs, brought to Herr Goebel by a person employed by him to gather eggs. Herr Goebel does not inform us that they were authenticated by the bird being shot; nor can the measurements or shape of these eggs, as given by him, be considered alone sufficient for their authentication. I cannot admit this without more minute and careful authentication. It does not occur in Norway north of 61° (Collett, 1876, 'Map of Norway'); and it would appear to be scarce in the SOUTHERN DIVISION of North Russia, judging from the paucity of records.

(41*b*) *Larus glaucus*, Brünn. No. 232 in Table.

Dr. Meves has evidence that *L. argentatus* is the only species of Gull breeding on Solovetsk, from Lieut. Sandeberg himself. Prof. Palmén's record, therefore, stands as very doubtful.

(42) *Larus affinis*, Reinh. No. 238 in Table.

Were the Gulls seen in Yugorsky Strait and on Waigats not much more likely to be of this species than *Larus fuscus*? I think so. (*Vide* Von Heuglin, 'Ibis,' 1872, p. 65.)

* I have received the letterpress and the map through the kindness of Mr. Collett.

(43) *Larus minutus*, Pall. No. 241 in Table.

In the Table I have entered this species on the authority of Lilljeborg and Meves. Herr Meves relates that though he had no opportunity of visiting the locality near the fort at Archangel, he saw two skins of specimens shot there by Herr Iversen. In 1872 Alston and myself had no opportunity of visiting this locality, except in passing, and we could not gain any satisfactory evidence of their presence there. My impression is, that evidence is wanting of their occurring and breeding every year. It seemed also not to be known to the natives.

(44) (*Sterna fluviatilis*, Naum.) No number.

Auct. Lilljeborg, who gives it as common at Archangel. I cannot find any other record; and as he includes *Sterna arctica*, Temm. (=*St. hirundo*, L. partim, *vide* Mr. H. Saunders on the Sterninæ, P. Z. S., June 1876, p. 650, =*St. macrura*, Naum.), as only frequenting Skuretzkaia in Kola, whereas it is abundant on the outer islands of the Dvina delta, I think some confusion must have arisen, and that the occurrence of *St. fluviatilis*, Naum., requires further confirmation.

Summary of Distribution Table in Districts (up to date).

(Spaces are left in the columns for future summaries.)

	N.W.				N.C.				N.E.			
	Total records.	Very doubtful.	Less doubtful.	Total authentic.	Total records.	Very doubtful.	Less doubtful.	Total authentic.	Total records.	Very doubtful.	Less doubtful.	Total authentic.
Up to date 1877	122*	(1)		121	224	(12)	12	200	128	(1)	3	124

* As before mentioned, I have avoided for the present much criticism of the records in the N.W. district, owing to the incompleteness of our present data.

In the whole of the Northern Division of North Russia we have records of	249 species.
Of these there are of extremely doubtful value in the fauna	12 ,,
And of less doubtful nature	7 ,,
Leaving authentic records of	230 species.

A great deal still remains to be done, especially in the N.E. and N.W.* districts, and also in some parts of the N.C., before we can form an accurate idea of the longitudinal distribution. I have elsewhere more particularly indicated those portions of North Russia in which useful work might be done (Appendix to "Notes on the Birds of the Lower Petchora," issued with separata). It is believed, however, that the tabular treatment of the subject above given will admit of future additions and corrections being made at any time, and that future generalizations will be made somewhat easier.

In my next section I hope to be able to treat of the fauna of the Southern Division, and to compare the Northern and Southern together. Then, having treated of the whole of North Russia north of 60° N. lat., a comparison may be instituted between the faunas of all the countries of the Western Palæarctic Region north of the aforesaid parallel, and useful results may be arrived at regarding the distribution of species in Northern Europe.

I offer this *plan of work* to naturalists, and especially to workers in geographical distribution, in the hope that some-

* There appears to be good reason to believe that the northern portions of the Kola peninsula are not thickly populated by birds, and might not indeed repay a visit, if *only collecting* were intended. (A comparison, however, of even the limited fauna of the Kola tundras with that of the tundras further east and west could not fail to have considerable interest for the student of geographical distribution.) In a work entitled 'En Sommer i Finmarken, Russisk Lappland og Nord Karelen,' Christiania, 1871, p. 211, the author (Prof. J. A. Friis) describes the banks of the river Kola as almost destitute of bird-life, although they are covered with luxuriant vegetation in summer. On the banks of the Tana Elv, further to the westward, and about 300 miles from the fjord, there is a singular dearth of bird-life, as I am informed by a friend who for many years has fished that river; and the same remark applies to the Enare lake and the district around it. Prof. Newton informs me, however, that the contrary is the case as regards the lower reaches of the Tana Elv. The southern half, however, of the Kola peninsula, south of the limit of pine-growth [*vide* Dr. A. Petermann's maps; Stieler's Hand-Atlas, no. 51, Ost-Europa, Bl. 2. Nordost-Russland (Gotha, Justus Perthes, 1876); *or* map in Prof. Friis's work above alluded to], will probably be found to possess a richer and more varied fauna. For further remarks on the work done and the work to be done, I refer my readers to our Appendix to our "Notes on the Birds of the Lower Petchora."

thing may be found in it worthy of imitation, however much may be considered faulty or imperfect. What is desired by naturalists I have taken as my text in the first part of this paper—"a uniform method of registration;" and that is what *I* desire, however far short of perfection my own plan may be considered*.

In conclusion, I wish especially to thank Prof. Newton for his ever ready and obliging communications in this connexion, and I have also to acknowledge with thanks letters from the following gentlemen, in answer to inquiries made regarding the distribution of the birds of Northern Europe, viz. to Herr A. G. Nordvi of Vadsö, Dr. Meves of Stockholm, Prof. A. J. Friis and Herr R. Collett of Christiania, and to Prof. Palmén of Helsingfors. To the courtesy of the two latter gentlemen I am greatly indebted for much useful information bearing upon my subject, as well as for copies of several books and papers upon the birds of Finland and Norway. I need scarcely add that I shall be most grateful for any assistance these or other naturalists will afford me in my subject in the future.

[To be concluded with Part III.]

Postscript.

Phylloscopus borealis, Blas. No. 115 in Table.

Dr. Meves informs me (*in lit.*) that this interesting species has been found last summer (1876) in Northern Onega, and also in the Kola peninsula, by the collectors employed by Lieut. Sandeberg.

Erratum in Part I.

Page 285. Transpose the names *Plectrophanes lapponicus* (L.) and *Plectrophanes nivalis* (L.), Nos. 35 and 36. The records applied to the former in both Tables belong to the latter, and *vice versâ*.

II.—*Notes on Carboniferous Polyzoa.* By R. Etheridge, jun., F.G.S.

[Plate II. a.]

A large collection of Carboniferous Polyzoa has lately been made by Mr. James Bennie for the Geological Survey of Scotland, from Mid and East Lothian. From my notes on this collection I extract the following descriptions.

* For the guidance of those, if such there may be, who approve of this method, I may mention here that the minor details of work, such as collecting the records and tabulatiug them for use, will be found in a paper read by me before the Glasgow Natural-History Society, and which, I understand, will shortly appear in their Proceedings for Session 1876–77, entitled "On uniformity of Method in recording Natural-History Observations, especially as regards Distribution and Migration," &c.

Genus Fenestella (Miller), Lonsdale, 1839.

(Murchison's Silurian System, p. 677; King, restricted, Perm. Foss. England, 1850, p. 35.)

Fenestella arctica, Salter, var. *scotica*, var. nov. (Plate II. A. figs. 1 & 2.)

Fenestella arctica, Salter, Belcher's Last of the Arctic Voyages, 1855, vol. ii. p. 385, t. 36. f. 8.

Spec. char. "Portions of foliaceous plane fronds, which must have measured several inches across. The branches are thicker than broad, rounded on the non-poriferous face, slightly but regularly zigzag, and fully a third of a line broad; they are regularly radiating and bifurcating over the general surface; irregular, and some of them much thicker, below. Fenestrules broad, oval, a line long, and fully twice the width of the branches. They are very regular in size and shape, those at the bifurcation of the branches being similar and equal to the rest. Non-poriferous face very slightly striated, appearing smooth to the eye; pores ——?"

Obs. I have lately had an opportunity of examining some examples of this species from the Arctic regions, collected by Captain H. W. Feilden, R.A., naturalist to the late Arctic Expedition, which has enabled me to name certain examples of a *Fenestella* from our Lower Limestone group which I had placed on one side for investigation. The diagnosis given within inverted commas comprises the characters assigned by Mr. Salter to his species; but when a description can be drawn up from Captain Feilden's specimens the specific characters will have to be much augmented and better defined. The essential characters of the species, however, as defined by Salter, are the zigzag interstices, giving rise to hexagonal fenestrules, and their extreme regularity and similar disposition. The variety has essentially all the characters of the species [the Arctic form], but simply on a finer and smaller scale; the hexagonal fenestrules are much smaller, and perhaps the interstices and dissepiments proportionally wider as compared with the size of the former. These data are certainly not of specific value, but will serve well as varietal characters. The fine striæ of the non-poriferous face of the Arctic form are not visible on the variety; that surface of the latter appears to be quite plain.

Without doubt there is a close resemblance between *F. arctica*, Salter, and *F.* (*Retepora*) *prisca*, Goldfuss. However, neither in the figure given by Dr. Goldfuss*, nor in that given

* Petrefacta Germaniæ, vol. i. t. 36. f. 19.

by Prof. H. A. Nicholson*, are the interstices so sharply zigzag, but more undulating; the fenestrules also are a long oval, and lack the characteristic hexagonal form of *F. arctica.* It must, however, not be forgotten that these fenestrules are described by Prof. M'Coy as "very obscurely hexagonal"†.

Locality and Horizon. Currielee Quarry no. 2, Tyne Water, Edinburghshire, impure limestone, 20 to 30 feet above the no. 2 limestone of the Lower Carboniferous Limestone group.

Collector. Mr. James Bennie.

Genus GLAUCONOME (Goldfuss), Lonsdale, 1839.

Glauconome, Goldf. (pars) Petrefacta Germaniæ, p. 217 (*G. disticha*); Lonsdale, 1839, Murchison's Silurian System, p. 677; M'Coy, 1844, Synop. Carb. Foss. Ireland, p. 198.

Acanthocladia, King, 1849, Ann. Nat. Hist. 2nd ser. iii. p. 389; 1850, Permian Foss. England, p. 47.

Penniretepora, D'Orb. 1849, Prod. de Pal. i. p. 45.

Gen. char. Polyzoarium shrub-like or dendriform, with non-anastomosing bilaterally symmetrical stems and branches, all more or less in one plane; celluliferous on one face only. Main stem giving off occasional secondary stems, similar and equal to itself. Branches varying in length, simple or bilaterally branched, passing from the stems at a right angle or an angle less than a right angle. Cell-apertures arranged on the stems and branches in longitudinal series, the latter usually separated from one another by a keel or dividing ridge more or less developed according to species; cell-mouths with plain or elevated margins, sometimes radiately denticulated. Celluliferous face sometimes ornamented with faint striæ and small nodes variously arranged on the longitudinal keels. Reverse striated or otherwise ornamented.

Obs. The term *Glauconome* was first used by Münster in Goldfuss's fine work for four‡ species of cylindrical Polyzoa having cell-apertures distributed on all sides of the polyzoarium, viz. *G. marginata, G. rhombifera, G. tetragona,* and *G. hexagona,* of which the first may be taken as the type. A fifth species was subsequently added under the name of *G. disticha*§. The date of publication of the 'Petrefacta Germaniæ,' or, at any rate, of that part of it containing the descriptions and figures of the forms in question, is variously

* Report Pal. Province of Ontario, 1874, i. p. 101.
† Brit. Pal. Foss. p. 76.
‡ Petrefacta Germaniæ, p. 100, t. 36.
§ Ib. p. 217, t. 65. f. 15.

given. By Agassiz* it is said to be 1826, by D'Orbigny at the end of 1829†, and by Stoliczka 1827‡. The four first-described species were referred by De Blainville § and Milne-Edwards ‖ to the genus *Vincularia*, Defrance, published in the 'Dictionnaire des Sciences Naturelles' in 1829 ¶; and, in fact, not only were the species referred by these authors, but they appear to have made the genera synonymous, retaining, however, the latter term *Vincularia*. The fifth Palæozoic species, previously mentioned, was shown by Mr. Lonsdale to possess characters at variance with those assigned by Münster to the four earlier-described forms, insomuch that it possessed cell-apertures opening on one face of the polyzoârium only. For this type Lonsdale retained the abolished name *Glauconome* and generically redefined it**. It has been so used by Prof. M'Coy and other British palæontologists, and in truth, forms a very convenient Palæozoic genus. In his Index Palæontologicus ††, Dr. Bronn committed the mistake of mixing up, under the name *Glauconome*, the four vinculiform species of Münster, the fifth (retained by Lonsdale as typical of the redefined genus), and some others—an error which, however, was rectified in the 'Lethæa Geognostica'‡‡, where *Glauconome* is limited and definitely placed as a synonym of *Vincularia*, Defrance. D'Orbigny rejected the name *Glauconome* and made it a synonym of *Vincularia*, Defrance, for three reasons—chiefly on account of uncertain date of publication, because it was announced (as he thought) later than *Vincularia*, and, lastly, the term had already been preoccupied by Gray for a genus of Mollusca§§. He further states that the plate upon which the figures were delineated was unaccompanied by text, and that *Glauconome* "fut peut-être publié à la fin de 1829, certainement après le genre *Vincularia* de Defrance." On the other hand, Prof. W. King has passed over the claims of Lonsdale's redefinition of *Glauconome* as to generic rank, and proposed in its place the name *Acanthocladia*, which has been pretty generally adopted by continental writers on Permian palæontology, although not universally so. The Chevalier d'Eichwald has also split up

* Nomenclator Zoologicus, Polypi, p. 12.
† Pal. Franç. Terr. Crét. v. p. 58.
‡ Pal. Neu-Seeland, 1865, pp. 144, 145.
§ Man. d'Actinologie, 1834, p. 454.
‖ Lamarck's Hist. Nat. Animaux s. Vertèb. 2nd ed. ii. p. 193 (*fide* Lonsdale).
¶ T. lviii. p. 214.
** Murchison's Silurian Syst. 1839, p. 677.
†† Nomenclator, 1848, p. 531.
‡‡ Band iii. Theil 5, p. 99.
§§ Pal. Franç. Terr. Crét. v. p. 59.

Glauconome into two sections: as defined by Lonsdale he has referred it to *Acanthocladia*, King, whilst another portion, embracing the Tertiary species of Münster, is made equivalent to *Vincularia*, Defrance*. Lastly, Dr. Stoliczka†, so far as I understand him, appears to consider *Glauconome*, Münster, identical with *Salicornaria*, Cuvier, 1817‡, and not with *Vincularia*, which he retains as a separate genus§.

It will be apparent from the foregoing remarks that considerable difference of opinion has existed both as regards the date of publication of *Glauconome*, Münster, and its value as a genus. I think it is tolerably clear that its publication took place between the years 1826–29; probably Dr. Stoliczka is near the mark in saying 1827, notwithstanding D'Orbigny's statement to the contrary. Such being the case, it would have precedence over *Vincularia*, Defrance; and this I think it undoubtedly has, instead of becoming a synonym of that genus, as placed by De Blainville, Milne-Edwards, D'Orbigny, Bronn, and others. This has been brought forward with much force by the late Dr. Stoliczka.

It was probably in view of this confusion that Prof. W. King proposed the name *Acanthocladia*; and it becomes an open question whether we ought not to employ it for such forms as those now under consideration instead of *Glauconome*, Lonsdale. On the other hand the latter has become so universally used for Polyzoa of the type of *G. disticha*, Münster, especially in this country and America, and has amongst continental writers so much fallen into disuse (whether rightly so or not is the question) for those of the type of *G. marginata* and *G. hexagona*, that I think we may, pending further information, adopt Lonsdale's redefinition for Palæozoic forms of the *G. disticha* type. This will become perfectly feasible if, as Dr. Stoliczka says, *Glauconome*, Münster (as typified by *G. tetragona*), is equivalent to *Salicornaria*, Cuvier; but of this I have not seen any confirmation. If, on the contrary, Dr. Stoliczka is not correct in this, then *Glauconome* must be regarded as having priority over *Vincularia*. From this point of view *Glauconome*, Lonsdale, becomes *nil*, and *Acanthocladia*, King, will have to be adopted for the Palæozoic forms. The whole question, however, requires further elucidation.

Synonymous with *Glauconome*, Lonsdale, and *Acanthocladia*, King, is D'Orbigny's *Penniretepora*, a more extended descrip-

* Lethæa Rossica, 1860, i. pp. 384, 399.
† Pal. Neu-Seeland, 1865, p. 144.
‡ Règne Animal. iv. p. 75.
§ Pal. Neu-Seeland, 1865, p. 152.

tion of which, than the original, will be found in the 'Cours élémentaire de Paléontologie' *.

Dr. J. E. Gray used the term *Glauconome*, in 1828 or 1829, for a freshwater genus of Veneridæ †, but afterwards appears to have abandoned it; and either he or Bronn proposed in its place that of *Glaucomya* or *Glauconomya* ‡.

Glauconome elegantula, sp. nov. (Pl. II. A. figs. 3–6.)

Spec. char. Polyzoarium bipinnate; main stem and secondary stems zigzag, giving off at each angle a simple lateral branch inclined upwards. Obverse of the stems and branches angular; reverse rounded or flattened, with longitudinal microscopic striæ. Cell-apertures arranged in a single line on each half of the angular stems and branches, those of one line alternating with those of the other; on the stems there are three between every two branches on each side; on the branches they are in an unbroken series; in all the margins are level with the general surface of the stem or branch, as the case may be, as there is no evidence of any rim or projecting lip.

Obs. This very small and elegant species of *Glauconome* has come under my notice both from the Carbonifer ous series of the north of England and south of Scotland. I first observed it on some shale sent to me by Mr. Hugh Miller, F.G.S., and afterwards in greater quantity on the surface of weathered shale collected by Mr. Bennie. The figured specimen is simply pinnate, but we have in the Survey collection a bipinnate example, from which the above description is taken. When the outer layer is removed from the non-celluliferous face the bases of the cells are seen following one another in close succession and in an unbroken line (figs. 5 & 6), and would give rise to the idea that a similar disposition would be found on the obverse. On the latter, however, the cells are arranged in two alternating lines, one on each of the angular faces—the first cell, as it rises from the basal layer, passing to the right, the second to the left, the third to right again, and so on throughout the whole stem. Having failed, after a careful search, to find any published description of a *Glauconome* suitable for the reception of this form, I have assigned to it the above name.

* 1852, vol. ii. p. 104.

† Spicilegia Zoologica, 4to (1828 or 1829 ?), No. 1, p. 6.

‡ Bronn, "Index Pal." 'Nomenclator,' 1848, p. 531; Woodward, 'Man, Mollusca,' 2nd ed. p. 477; Stoliczka, 'Pal. Indica,' iii. p. 91; Pictet, 'Traité de Pal.' iii. p. 462.

Localities and Horizon. Carboniferous shale, Hopeshield Burn, near Mount Farin, Northumberland, probably near the horizon of the Scar Limestone; shale above the no. 1 or 2 limestone, Lower Carboniferous Limestone group, Harelaw Quarry, near Longniddry Station, Haddingtonshire.

Collectors. Mr. Hugh Miller, F.G.S., and Mr. James Bennie.

Genus Thamniscus, King, 1849.

(Annals Nat. Hist. 1849, iii. p. 389).

Thamniscus pustulata, R. Eth., jun.

Polypora? pustulata, R. Etheridge, jun., Mem. Geol. Survey Scotland, Expl. 23, 1873, p. 102.

Thamniscus Rankini, Young and Young, Annals Nat. Hist. 1875, xv. p. 335, pl. 9 bis.

Obs. In 1874 I described, in the explanation to sheet 23 of the one-inch Geological-Survey Map of Scotland, certain fragments of Carboniferous Polyzoa which I believed to be new, with the remark "if it be a new species of *Polypora*, I would propose for it the specific designation of *P. pustulata.*" I also pointed out that the disposition of the cells and mode of branching were exceedingly like those seen in the type species of *Thamniscus*, *T. dubius*, Schl., and suggested that it might be a species of this genus.

Since my notice of the fossil appeared, the Messrs. Young have obtained a comparatively perfect example, and have shown that it should be more properly referred to *Thamniscus*, as I surmised; but at the same time these authors have altered the name to *T. Rankini*—quite an unnecessary proceeding; for I gave a perfectly intelligible description, and my specific name is to all intents and purposes a good one.

Genus Rhombopora, Meek.

Rhombopora, Meek, 1872, Hayden's Final Report of the U.S. Geol. Survey of Nebraska, p. 141.

I would draw the attention of British palæontologists to the above genus of the late Mr. Meek, referred by him to the "Polypi" (Actinozoa), but which will, I think, probably prove to be a Polyzoon. The genus was established for small ramose corals with "non-septate, short, tubular cells radiating obliquely outward and upward on all sides from an imaginary axis; cell-mouths rhombic or rhombic oval, and very irregularly arranged in longitudinal and oblique spiral rows, the former of which are sometimes separated by more or less flexuous longitudinal ridges; interspaces usually rather thick, and not pierced by transverse pores, but occupied by very minute, non-septate longitudinal cells that are closed and represented at the surface by minute granules or spinules."

Mr. Meek considered that *Millepora rhombifera*, Phill., *Vincularia ornata*, Eichw., and *Favosites serialis*, Portlock, might, "with much confidence, be included in this genus." The first of these has been shown by the Messrs. Young to be a species of their genus *Rhabdomeson*; but with regard to the others I am not in a position to form an opinion. Mr. Meek concluded his description with this remark:—"Although some species of this genus [*Rhombopora*] have been referred to Goldfuss's genus *Vincularia*, they are widely removed from the typical Cretaceous species of that genus." I think it probable that *Rhombopora* will be found a very convenient one for numerous small Polyzoa of our Carboniferous and, perhaps, Silurian rocks, the generic affinities of which have often been a stumbling-block to authors. The relation of *Rhombopora* to *Vincularia* requires investigation; but I would in the mean time suggest an examination (to those who have well-preserved specimens) of the following species:—*Vincularia ornata*, Eichw.; *V. muricata*, Eichw.; *V. Benniei*, mihi; *Ceriopora hamiltonensis*, Nicholson; *Millepora interporosa*, Phill.; *M. oculata*, Phill.; *M. spicularis*, Phill.; and *M. similis*, Phill.

Rhombopora has been adopted by Dr. Toula * for certain forms from the Permio-Carboniferous rocks of Spitzbergen.

EXPLANATION OF PLATE II. A.

Fig. 1. *Fenestella arctica*, Salter, var. *scotica*, R. Eth., Lower Carboniferous Limestone group, Currielee Quarry, Edinburghshire. Nat. size.

Fig. 2. A small portion, much enlarged, non-poriferous face, to show the zigzag interstices and hexagonal fenestrules.

Fig. 3. *Glauconome elegantula*, R. Eth., Lower Carboniferous Limestone group, Harelaw Quarry, Haddingtonshire; poriferous face, somewhat enlarged.

Fig. 4. A portion of fig. 3, much enlarged.

Fig. 5. Another specimen of the same, striated or non-poriferous face, nat. size., Harelaw Quarry, Haddingtonshire.

Fig. 6. A portion of fig. 5, much enlarged.

(I am indebted to Mr. Wilson for the drawings.)

* Sitz. d. k.-k. Akad. d. Wissenschaften zu Wien, 1875, lxxi.

III.—*Arctic and Antarctic Sponges &c.* By H. J. Carter, F.R.S. &c.

[Plate I.]

On the 5th of May, 1877, I had the pleasure to receive from Dr. Günther, on behalf of the British Museum, for examination, five small jars containing sponges &c. collected by the naturalists of the last Arctic expedition; and certainly the contents of these jars, although apparently trifling, are particularly worthy of examination, since it is not the evidence which the four entire specimens of sponges that they contain presents which makes them interesting, but the number of other minute objects about the specimens and the microscopic contents of the sand which has fallen from them to the bottom of the jar. Altogether, too, their comparison with similar results already in the British Museum, which were obtained from the Antarctic regions and Spitzbergen respectively, renders it desirable that they should be specially noticed.

Jars Nos. 1, 2, and 3 are from Capt. H. W. Feilden's collection, and contain as follows:—

No. 1. Specimens of a siliceous sponge (*Semisuberites*, n. sp.) growing upon the outer shell of a large *Balanus*, which itself bears other organisms that will be hereafter mentioned; also two horny sprigs of a Hydrozoon bearing parasitically Foraminifera and Diatomaceæ. The whole, further, labelled "Smith Sound, Cape Napoleon, 50 fths., Aug. 1876."

No. 2. Specimens of a siliceous sponge (*Halichondria panicea*, Johnston), an *Actinia*, and a sprig of a colourless, horny, branched Polyzoon. The whole labelled "Lat. 79. 25, F. Pierce Bay, 15 fths. B. T. 29. 50.—10. 8. 75."

No. 3. Specimen of a calcareous sponge only, viz. *Sycon raphanus*, Sdt. Labelled "Lat. 79. 25, F. Pierce Bay, 15 fths. B. T. 29. 50.—10. 8. 75."

Jars Nos. 4 and 5 contain specimens collected by Mr. Hart.

No. 4. Specimens of calcareous sponges, viz. one each of *Ute glabra*, Sdt., and *Leucosolenia coriacea*, Bk., together with sprigs of branched horny and calcareous Polyzoa respectively. Labelled "Aug. 11th, '75."

No. 5. Three portions of a *Melobesia* (*M. polymorpha*). Labelled "10–20 fths."

On a particular examination of the contents of these jars the following report has been written, beginning with

JAR No. 1.

Sponge, *Semisuberites arctica*, n. sp. (Pl. I. fig. 1, *a–c*.)

General form funnel-shaped, hollow, with a long round stem (fig. 1, *a*), diminishing in size to the point of attachment; mouth subcircular, margin thick, round, undulating (fig. 2, *e*). Colour light grey. Surface reticulate, even. Pores external, microscopic; vents internal, large, plentifully and uniformly scattered over the inner surface of the funnel (fig. 2, *d*). Internal structure loose, light, composed of acuate spicules united together by sarcode into bundles which, crossing each other, produce the usual areolated tissue of sponge. Spicules of one kind only, viz. skeleton, but of two forms, viz.:—1, acuate, slightly curved towards the large end, smooth, and gradually diminishing towards the smaller one, which is rather abruptly pointed; average largest size 1-48th by 1-3000th inch in its greatest diameters (fig. 3, *a*): 2, the same, but with a slight subterminal inflation (fig. 3, *b*). Size of largest specimen (fig. 1) about 3 inches long by $1\frac{3}{4}$ inch across the brim of the funnel.

Hab. Marine, Arctic regions. Growing singly or in plurality on hard objects.

Loc. Smith Sound, Cape Napoleon, in 50 fths.

Obs. There is much interest attaching to this sponge in many ways. First, it is almost identical in elementary structure with *Halichondria sanguinea*, Johnston (Brit. Spong. 1842, p. 133), originally described, with a figure of its spicule, by Dr. Grant in 1826, under the name of *Spongia sanguinea* (Edinb. Phil. Journ. pl. 121. fig. 9), which together with his *Sp. papillaris* are the two commonest sponges on this coast (Budleigh-Salterton, Devon), where they can be found at all tides in great abundance a little below high-water mark. Secondly, Dr. Bowerbank, from the orange-colour and cork-like tissue of *Halichondria sanguinea*, the tendency of its spicules to a pin-like form, and the fact that, in one instance, he found the identical form of flesh-spicule which characterizes *Vioa Johnstonii*, Sdt., and (as I hope soon to show) several other sponges of this kind (Brit. Spong. vol. i. pl. iii. fig. 72, p. 239), points out that both *Semisuberites arctica* and *Halichondria sanguinea* belong to the family Suberitida, of which I also hope soon to give a full account with all hitherto described species in its different groups. Thirdly, a similar specimen of the same sponge, but much larger, from Spitzbergen (fig. 2), was presented to the British Museum by the Rev. A. E. Eaton in 1873, which may easily be found by the register number

73. 10. 35. 1, and its unmistakable whale-ship odour. It is $6\frac{1}{2}$ inches long and $3\frac{1}{4}$ inches across the long diameter of the mouth, whose sides appear to have been partly brought into contact by compression, although the brim is cleft. Fourthly, one of the sponges dredged up by Sir James Ross at $74\frac{1}{2}°$ south latitude, in 300 fths., is also a Suberite. This, too, is in the British Museum, and will be described in the account of the Suberitida to which I have alluded.

Besides the specimens of *Semisuberites arctica* in this jar, there are two branched sprigs of the Hydrozoon *Eudendrium ramosum* (Hincks, Brit. Hyd. Zoophytes, Atlas, pl. xiii.), each about three inches long; and these, again, are more or less covered with parasitic Foraminifera of the rotaline type (chiefly *Pulvinulina*), a great variety of Diatomaceæ, and here and there an acervular calcareous Polyzoon; while the *Balanus*-shell on which the sponges grew bears the beautiful little nutant horny Polyzoon *Pedicellina gracilis* (fig. 1, *e* and fig. 5) in great plurality on its creeping stoloniferous stem, and here and there the little Infusorium *Lagotia viridis* of Strethill Wright (Edinb. New Phil. Journ. 1858), *Freia ampulla*, Clap. et Lachm., abundant here (Budleigh-Salterton) and on the sedges of the brackish marshes in the island of Bombay—thus, like the little *Protococcus nivalis*, flourishing equally in the arctic regions and in the torrid zone, where I found it in 1849 (see my paper "On the Red Colouring-matter in the Salt-pans of Bombay," Journ. Bomb. Asiat. Soc. vol. iii. pt. 2, p. 32).

Having obtained some of the sea-bottom from the jars in the British Museum holding the sponges dredged up in the Antarctic Sea by Sir James Ross, to which I have alluded, and also mounted it in balsam for microscopical examination, I did the same with the sea-bottom from the jar containing *Semisuberites arctica* from Smith Sound, when I found that the two so far agreed that there was not a Coccolith or a Rhabdolith to be found in either, and that, while the sea-bottom from the antarctic regions contained hardly any *Globigerinæ*, that from Smith Sound contained none at all. In other respects, as regards microscopic organisms, they were much alike, excepting that, whereas in the antarctic sand Radiolaria of the genera *Haliomma* and *Dictyocha* abounded, I only found one *Dictyocha* in the sand from Smith Sound.

Now the sea-bottom accompanying Sir James Ross's specimens came from 300 fths. in $74\frac{1}{2}°$ south latitude, while that from Smith Sound was from 50 fths. in about 79° north latitude—that is, off Cape Napoleon.

From Dr. Wallich's observations in H.M.S. 'Bulldog,' in

1860, we learn that "between Greenland and Labrador, along the belt traversed by the arctic current, and in a southerly direction along the coast of Labrador, it (*Globigerina*) is either absent or occurs only in" very "limited quantity" ('Deep-sea Researches on the Biology of *Globigerina*,' p. 5: Van Voorst, 1876); while the most northern sand in which I have observed Coccoliths came from the Atlantic, between the north of Scotland and the Faroe Islands, where they are very abundant in the deep sea; but then, again, they, as well as Coccospheres, are tolerably plentiful about the sponges that grow on the rocks of this shore (Budleigh-Salterton).

Dr. Wallich (*l. c.*) also states that he found *Globigerinæ* present in sea-bottom from "50 to 3000 fths.;" but while Coccoliths are abundant on the sea-shore here, I have never met with *Globigerinæ*; so that it may be questioned whether *their* chief habitat does extend to such shallow water. Be this as it may, the deep-sea bottom of the Atlantic is almost entirely composed of *Globigerinæ* and *Coccoliths*, where the deciduous ones are often agglomerated into tests for the so-called "Arenaceous Foraminifera" and minute Annelids; but in the sea-bottom of Smith Sound, where there are neither, these tests are as often made up of the minute frustules of Diatomaceæ, like those of some of the freshwater arenaceous *Difflugiæ*. Also in Smith Sound minute *Melosiræ* appear to be preferred, probably from their being most plentiful there; while they are as often found in the stomachs of the Polyzoa, but never a *Coccolith* or a *Globigerina*, so far as my observation has been extended.

Lastly, I should mention that a small *Alcyonium* is attached to the *Balanus*-shell (fig. 1, *f*). It is globular, about $\frac{1}{4}$ inch in diameter, and consists of a botryoidal group of melon-shaped cells (fig. 4) of different sizes, according to their age, below $\frac{1}{22}$ of an inch in diameter, the whole growing from a contracted, corrugated base. The polyps are encased with the usual spicular coat, which is extended into each tentacle, of which there are eight; so that this *Alcyonium* probably belongs to the verruciform species, *Nephthya* of Savigny. Some of the cells had their polyps exserted.

In the mounted sand are also present the remains of many other sponges, viz. the perfected flesh-spicule of *Melonanchora elliptica* (Ann. 1874, vol. xiv. p. 212, pl. xiii. fig. 9), the larger spicule of *Corticium abyssi* (ib. 1873, vol. xii. p. 18, pl. i. figs. 3–5), also large bihamates (*fibulæ*), probably of an *Esperia*, and many other spicules whose forms, although different, do not characterize any sponge in particular.

Jar No. 2.

Contains specimens of *Halichondria panicea*, Johnston (*Spongia papillaris*, Grant), of the coast, but with larger spicules and the histodermal coat peculiar to the deep-sea form ; a small *Actinia*; and a sprig of a branched, colourless, horny Polyzoon.

Jar No. 3.

Contains a single specimen only, viz. a calcareous sponge (*Sycon raphanus*, Sdt.).

Jar No. 4.

Contains one specimen each of the calcareous sponges *Ute glabra*, Sdt., and *Leucosolenia coriacea*, Bk. (*Ascetta coriacea*, Häckel); also sprigs of three kinds of branched Polyzoa, one calcareous.

Jar No. 5.

Contains three fragments of *Melobesia polymorpha* only, which was sessile.

I have mentioned all the other organisms which these jars contain besides the sponges to show that the sea-bottom, both in the arctic and antarctic regions, at least so far as regards the latitudes mentioned, is as pregnant with life as that of any other part of the globe, at the same time that it has its peculiarities.

The specimens have been examined and returned to the British Museum without delay.

EXPLANATION OF PLATE I.

Fig. 1. *Semisuberites arctica*, n. sp., growing on the outer shell of a *Balanus*. Natural size. Smith Sound. Lateral view. *a*, stem; *b*, funnel-shaped head; *c*, margin; *d*, *Balanus*-shell; *e*, *Pedicellina gracilis*; *f*, *Alcyonium*; *g g*, stems of *S. arctica* broken off; *h*, dotted line indicating opposite border of mouth.

Fig. 2. The same, from Spitzbergen. Natural size. Lateral view. *a*, stem; *b*, funnel-shaped head; *c*, pore- or external surface; *d*, vents on internal surface; *e*, rounded margin.

Fig. 3. The same, spicules magnified on the scale of 1-12th to 1-1800th inch. *a*, acuate form; *b*, subpinlike form.

Fig. 4. Single cell of *Alcyonium*, fig. 1, *f*, magnified.

Fig. 5. Head of *Pedicellina gracilis*, magnified, to show the organs of the interior. *a*, stem; *b*, calycle; *c*, oral orifice surrounded by tentacles; *d*, anal orifice; *e*, stomach; *f*, tentacles.

IV.—*Descriptions of Asiatic Diurnal Lepidoptera.* By Frederic Moore, F.Z.S.

Fam. **Danaidæ.**

Danais nipalensis.

Male. Upperside dull ferruginous black: fore wing with the basal internal half bright ferruginous, intersected by the black veins; an oblique subapical narrow series of five white spots, the second, third, and fourth elongated, the fourth longest, the fifth subconical; a series of two median submarginal and four marginal small white spots: hind wing with the spaces between the veins to beyond the disk ferruginous, intersected by broad black-margined veins. Cilia alternate black and white. Head, thorax, and legs black, spotted and streaked with white. Abdomen ferruginous. Underside paler ferruginous black, marked as above.

Exp. $3\frac{7}{8}$ inches.

Hab. Katmandu, Nepal (*General Ramsay*). In coll. F. Moore.

Nearest to *D. chrysippus*, from which it may be distinguished by the absence of all white markings, except the narrow oblique subapical series on the fore wing.

Danais gautama.

Female. Black with bluish-white markings: fore wing with two long streaks within base of cell and three short streaks at its end; a series of five narrow streaks beyond end of the cell; six discal spots; two lengthened narrow streaks starting from base between lower median and submedian veins, and a spot beyond, the upper streak broken near its end; three small spots before the apex and a marginal row of spots; a short streak at base of hind margin: hind wing with three streaks within the cell; an elongated discal series of streaks, and two outer marginal rows of small spots.

Exp. $3\frac{3}{8}$ inches.

Hab. Henzada, Rangoon district, Burmah (*Watkins*). In coll. F. Moore.

Most nearly allied to *D. septentrionis*, Butler, but differs in the shape of the fore wings (these in *D. gautama* being shorter), the two basal streaks within base of the cell, the wider interspaces between the discal and marginal spots, and in the form of the streaks below the cell; on the hind wing it has an additional central streak within the cell, and the discal streaks between the veins are broad.

Danais nilgiriensis.

Fuliginous black: fore wing with a bluish-white striated streak within the cell; three subapical costal spots, below which are two narrow streaks, the lower elongated; five spots within the disk; an elongated, black-centred, triangular streak between lower median and submedian veins; a submarginal series of seven spots, the lower, second, and third with a dentate point outward; a short marginal row of small dots from posterior angle: hind wing with a bluish-white, narrow, fusiform streak within the cell; five contiguous small narrow spots outside the cell; three long narrow abdominal streaks; a submarginal series of spots, the upper two largest, the third dentate, the others small; a marginal row of smaller spots. Head, thorax, and legs black, spotted and streaked with white. Abdomen blackish above, grey beneath. Underside paler, markings as above.

Exp. $3\frac{2}{8}$ inches.

Hab. Coonoor, Nilgiris (*Dr. Day*). In coll. F. Moore.

Euplœa coreoides.

Male and *female* dark velvety olive-brown, palest externally. *Male.* Upperside—fore wing with a prominent submarginal and marginal series of small white spots; two elongated silky impressed marks between lower median and submedian veins: hind wing with broader series of white oval and rounded submarginal and smaller rounded marginal spots. Underside paler; marginal spots as above; both wings with small white spot at end of the cell and contiguous series beyond.

Female with marginal spots as in male, the submarginal series on both wings above and the discal series on fore wing beneath being larger.

Exp. ♂ $3\frac{2}{8}$, ♀ $3\frac{4}{8}$ inches.

Hab. Malabar (Nilgiris and Wynaad). In coll. F. Moore.

Has much the appearance of *E. core*, figured by Cramer (which is also found in the same locality), but may be distinguished from that species by the two elongated silky impressed marks in the male, the male of *E. core* having but a single short narrow mark.

Euplœa lankana.

Male. Upperside dark velvety olive-brown, palest externally: fore wing with a submarginal and marginal row of very small indistinct whitish spots; two elongated silky impressed marks between the lower median and submedian veins: hind wing with a submarginal and marginal row of whitish spots, the former oval from the anal angle and duplex anteriorly, the latter smaller and round. Underside paler; marginal white spots the same, those on fore wing more prominent; both wings with a small white spot at end of cell, and a contiguous series beyond.

Exp. 3 to $3\frac{5}{8}$ inches.

Hab. Ceylon. In coll. F. Moore.

This species stands in the British Museum cabinet as the *E. core* of Cramer, and is referred to as such in Mr. Butler's monograph (P.Z.S. 1866, p. 276). It is allied to *E. coreoides*, but differs from it in the shape of the wings, the fore wing being broader, shorter in the hind margin, and more trigonal in form; the hind wing also is somewhat longer hindward and less rounded on the outer margin.

Euplœa asela.

This is the Ceylon representative of *E. core*, and differs from typical specimens from India in the male and female being above and beneath of a paler olive-brown, having both rows of marginal spots very small, partly obsolete, and of an olive-white colour, those on the hind wing also being smaller and less prominent.

Exp. $3\frac{2}{8}$ inches.

Hab. Ceylon. In coll. F. Moore.

Euplœa sinhala.

Male. Upperside dark velvety olive-brown: fore wing with a short, broad, oval, silky impressed mark between the median and submedian veins, a submarginal row of small ochreous-white spots and marginal lower row of minute spots: hind wing with a broad median flesh-coloured patch; costal border broadly cinereous; a submarginal series of oval ochreous-white spots and marginal series of small round spots. Underside pale olive-brown throughout: fore wing with hind margin broadly cinereous, the sexual mark dusky; a series of whitish spots outside the cell; both wings with a submarginal and marginal series of spots as above.

Exp. $3\frac{2}{8}$ inches.

Hab. Ceylon. In coll. F. Moore.

Euplœa irawada.

Male. Upperside dark blackish brown: fore wing glossed with brilliant steel-blue; a lilac-blue spot at lower end of the cell, and a contiguous discal series of six similar spots; a marginal upper series of six small white spots and a marginal lower row of white dots; an elongated, silky, impressed streak between lower median and submedian veins: hind wing with a flesh-coloured patch extending over upper part of the cell; anterior margin broadly cinereous; a submarginal row of pale oval spots and a marginal row of small round spots. Underside brown: fore wing suffused in the disk with black; hind margin broadly and an elongated lower discal spot cinereous white; second discal spot and cell-spot blue; upper spots minute, marginal rows of white spots distinct: hind wing with marginal row of distinct white spots, submarginal row partly obsolete; a small blue spot at end and a contiguous series outside the cell.

Hab. Henzada, Rangoon district, Burmah (*Watkins*). In coll. F. Moore.

Exp. $3\frac{4}{8}$ inches.

Hestia malabarica.

Allied to *H. belia*, but differs on the fore wing in the costa being black-streaked, the cell-spot more compact, there being also a contiguous but distinct spot situated outside the cell nearer the base and between the costal and subcostal veins; the discal series of spots turns to the costa more abruptly and nearer to the end of the cell; these spots are more conical and have no contiguous patches on the veins; the marginal series of vein-marks are on long peduncles. On the hind wing the spots are somewhat smaller. Abdomen above with a broad dorsal black band.

Exp. 5 to $5\frac{4}{8}$ inches.

Hab. Malabar, S. India. In coll. F. Moore and British Museum.

"Found in woody places on the western coast, especially on the thick-wooded mountain-passes up the Western Ghats and Nilgiris."

Fam. **Nymphalidæ.**

Parthenos cyaneus.

Form and pattern of *P. gambriseus* from Silhet, but of larger size, the ground-colour throughout the wings greyish blue, the white spots on fore wing prominent, the two elongated subapical spots entire and not broken at their costal end; the two median transverse black bands broken up into spots, the discal series of longitudinal streaks very narrow, and the submarginal lunules also narrow.

Exp. ♂ $3\frac{3}{4}$, ♀ $4\frac{1}{4}$ inches.

Hab. Ceylon. In coll. F. Moore.

Parthenos virens.

Form and pattern of *P. gambrisius*, ground-colour of the wings light brassy green: fore wing with the white spots as in *P. cyaneus*; black markings not so prominent, but somewhat confluent and leaving little interspaces between the marginal series, the submarginal row on hind wing being very broadly conical.

Exp. $3\frac{3}{4}$ inches.

Hab. Calicut, Malabar coast. In coll. F. Moore.

Neptis sangaica.

Male and *female*. Upperside black, markings white: fore wing with short discoidal streak and large contiguous spot, a discal transverse curved series of broad spots, and a marginal row of prominent small lunular spots; hind wing with broad subbasal incurved band, and a broad outer maculated band. Underside dark ferruginous; fore wing with black-bordered markings as above; hind wing with black-bordered markings as above, also two short basal white streaks, an ill-defined white lunular line between the two broad bands, and a narrow whitish line on the extreme outer margin.

Exp. ♂ 2, ♀ $2\frac{3}{8}$ inches.

Hab. Snowy Valley, Province Chekiang. In coll. W. B. Pryer and F. Moore.

Most nearly allied to *N. alompra* from Assam, and quite different from *N. eurynome*, may be distinguished by the absence on both the upper and underside of the hind wing of the narrow submarginal white lunular line.

Athyma Pryeri.

Male. Near to *A. Helmanni* from the Altai, but differs from the same sex of that species in its larger size, the fore wing being more produced at the apex, this wing above having the markings more prominent and longer, and a distinct marginal row of white streaks; the band on the hind wing is also broader, and there is a very prominent marginal row of white streaks. Underside similarly but more prominently marked; the marginal white streaks on hind wing also prominent (these being nearly obsolete, both above and beneath, in *A. Helmanni*), with broader interspace between them and the median band.

Exp. $2\frac{1}{4}$ inches.

Hab. Snowy Valley, Province Chekiang. In coll. W. B. Pryer.

The markings in this form have much the appearance of those in *A. sulpitia*, Cram.

Fam. **Pieridæ.**

Appias mahana.

Male. Allied to *A. indra*, but on upperside differs in having the apical black border less prominent, narrower, extending to a less distance posteriorly (terminating before reaching the lower median vein), and containing five rather large speckle-bordered spots, one between every two veins. Underside—apex of fore wing whitish buff, brown-speckled, bordered by a short black-speckled curved streak: hind wing whitish buff, brown-speckled throughout, a series of these speckles also forming ill-defined, uninterrupted, transverse streaks; discocellular black spot prominent.

Exp. $2\frac{1}{4}$ inches.

Hab. Darjiling (*A. Grote*). In coll. F. Moore.

Appias narendra.

Allied to *A. indra* and *A. Lucasi.*

Male. Upperside—fore wing with broad black apex showing two white spots; hind wing with a narrow black-speckled margin, the speckles also slightly extending up each vein. Underside—apex of fore wing buff-brown, black subapical band broad: hind wing buff-brown, densely speckled with brown scales, a series of these forming irregular, uninterrupted, zigzag, transverse streaks; discocellular spot small, black.

Exp. $2\frac{1}{8}$ inches.

Hab. Ceylon. In coll. F. Moore.

Terias cingala.

Upperside yellow; fore wing with broad brown outer marginal band; hind wing with narrow brown marginal band. Cilia brown. Underside pale yellow; hind wing with two slightly perceptible dusky transverse streaks.

Exp. $1\frac{4}{12}$ inch.

Hab. Ceylon. In coll. F. Moore.

Form of wings as in *T. venata*, but differs in having the marginal band on fore wing scalloped and broadly terminating at posterior angle as in *T. drona.* From *T. rama* (the Ceylonese ally of *T. venata*) it differs also in the same manner, as well as being without a black discocellular streak on the underside of fore wing and the three subbasal brown spots and two prominent transverse streaks on the hind wing.

Terias pallitana.

Upperside yellow: fore wing with broad apical marginal brown band, scalloped and terminating abruptly above the posterior angle of the wing as in *T. læta*: hind wing with a broad apical brown patch terminating in a marginal line to anal angle. Underside paler, without markings. Form of wing as in *T. drona.*

Exp. $1\frac{2}{8}$ inch.

Hab. Kattywar (Bombay). In coll. F. Moore.

Teracolus pallens.

Form and pattern of *T. eucharis.* Upperside—fore wing with large pale orange apical patch, narrowly black-bordered on its outer margin and extending slightly for a short distance along the veins: hind wing without marginal spots. Underside pale buff-yellow on apex and hind wing: fore wing with slight dusky brown, recurved, apical transverse streak, and short apical streak on hind wing.

Exp. $1\frac{3}{8}$ to $1\frac{5}{8}$ inch.

Hab. Bombay (*Dr. Leith*); N. Canara (*Ward*). In coll. F. Moore.

Ixias kausala.

Male and *female*: upperside pale yellow; cilia pale orange: underside buff-yellow; base of fore wing lemon-yellow. *Male*: Fore wing with broad triangular pale orange subapical band, intersected by black crossing veins; the band bordered on its inner edge by a narrow blackish-speckled margin encompassing a small orange spot at end of cell: hind wing without marginal border, having only a few blackish speckles at anterior angle. Underside: fore wing with a small black-speckled discocellular spot; hind wing with small dusky brown spot on anterior margin and two similar spots below it and near the angle; a few pale brown striæ interspersed between the veins.

Female. Upperside with subapical band pale orange on its lower portion only, the costal portion being yellow, the lower portion with a transverse series of four blackish spots, one between each vein, the upper portion bordered by a broad black discocellular streak, the interspace between this and the lowest black spot marked only by a few blackish speckles; hind wing as in male. Underside with discocellular spot prominent, and the transverse row of spots brown with whitish centres; the brown spots on hind wing also with whitish centres.

Exp. $1\frac{3}{4}$ inch.

Hab. Kussowlie, N.W. Himalaya. In coll. F. Moore.

Ixias agniverna.

Allied to *I. marianne,* but is smaller. The male above has the black inner border of the discal red patch very narrow, this border in the female being entirely absent on the lower portion of the patch. In both sexes the marginal border of the hind wing is also much narrower. Beneath, both sexes are of a much deeper yellow, and the orange on the fore wing brighter, the subapical series of spots on fore wing have orange-coloured centres, and all the spots on hind wing have clear white centres, those of the submarginal series being very prominent.

Exp. ♂ $1\frac{5}{8}$, ♀ $1\frac{6}{8}$ inch.

Hab. Ramgurh District, Hazareebagh (Chota Nagpore), Bengal. In coll. F. Moore.

Ixias satadra.

Male. Upperside yellow, tinged with green at base and on costa: fore wing with broad black apex, occupying more than half the wing; subapical band narrow, central, curved, brick-red, crossed by black veins; lower veins also broadly black-speckled along their edges, and a series of these speckles forming across the middle of the band a slightly distinct transverse streak; hind wing with rather broad maculated marginal band. Underside clear yellow; a marginal dot between each vein: fore wing with small distinct discocellular black spot and an outer transverse series of indistinct blackish speckles, and black-speckled patch at posterior angle; hind wing with a transverse discal series of yellowish brown spots, the anterior spot and two before the apical angle most prominent.

Exp. 2 inches.

Hab. Simla District, N.W. Himalaya (*Captain Hellard*). In coll. F. Moore.

Fam. **Lycænidæ.**

Curetis acuta.

Nearest to *C. bulis,* Bd.; differs in both sexes in the acute prolongation of the apical angle, and obliquity of the outer margin, of the fore wing, darker colour; the golden (in the male) and white (in the female) portion on both wings less prominent, being confined to a smaller space on the middle of the wing.

Exp. 2 inches.

Hab. Shanghai (*Holdsworth*). In coll. F. Moore.

Curetis truncata.

Female. Brown, fore wing indistinctly paler towards the base; hind wing whitish narrowly on anterior margin and slightly at the apex. Underside less prominently marked than in *C. acuta.*

Exp. $1\frac{6}{8}$ inch.

Hab. Shanghai (*Holdsworth*). In coll. F. Moore.

Distinguished by the short, truncate fore wings, the outer margin being slightly convex, the shorter abdominal border, and also truncated outer margin.

Aphnæus elima.

Wings acute at apex; anal lobe prominently distended. *Male*: upperside brown, posterior half of fore wing and middle of hind wing glossed with smalt-blue; fore wing with a not very prominent subapical reddish patch, in which are two brown spots; abdominal margin pale testaceous; anal lobe reddish testaceous. *Female* brown; fore wing with large triangular maculated red patch; hind wing with reddish discal streak and anal lobe. Underside dull pale testaceous; transverse spots and bands very pale, being defined only by outer margins, each traversed by a silver streak; no marginal row of dots.

Exp. ♂ $1\frac{1}{8}$, ♀ $1\frac{2}{8}$ inch.

Hab. Manpuri, N.W. India (*C. Horne*). In coll. F. Moore.

Most nearly allied to *A. ictis*, from which it may be known by the less prominent apical red patch, the difference in colour and less apparent markings of the underside.

Aphnæus formosanus.

Most nearly allied to *A. zoilus*, but differing in its larger size, broader black borders, and smaller red anal lobe. On the underside the bands are the same in number, but broader and more confluent, both in the fore and hind wings; the red anal lobe has also much smaller black spots.

Exp. $1\frac{4}{8}$ inch.

Hab. Formosa. In Coll. W. B. Pryer.

Dipsas birupa.

Male. Upperside metallic green, both wings broadly margined with brown.

Female. Upperside dark brown; fore wing slightly tinged with blue at base; two subapical bluish white spots. Underside greyish fawn-colour; both wings with transverse, pale-bordered, brown discocellular streak, a straight discal and a lunular submarginal band; the discal band on fore wing short, the discal band on hind wing straight till where it reaches the sinuous angle; two anal, black-centred, bright orange spots. Cilia whitish.

Exp. $1\frac{3}{10}$ inch.

Hab. Masuri, N.W. Himalaya (*Capt. Lang*). In coll. F. Moore.

Distinguished from *D. ziha* (of which, at present, I know only the female) in the underside being differently coloured, the submarginal band on fore wing being uniform in colour and without the terminal spots, and in the discal transverse band on hind wing being quite straight to where the sinuous portion turns off to abdominal margin.

Fam. **Hesperidæ.**

Pamphila Mencia.

Male and *female.* Upperside dark glossy olive-brown: fore wing of male with a curved discal series of five small yellowish spots, and with a contiguous oblique prominent narrow streak; two small spots also at end of the cell: hind wing with a discal series of three indistinct spots. Female differs in the absence of the oblique narrow discal streak on fore wing and the spots on the hind wing. Underside paler, longitudinally streaked with grey; spots the same; sexual streak on male not visible.

Exp. $1\frac{6}{10}$ inch.

Hab. Shanghai. In coll. W. B. Pryer and F. Moore.

In this species the wings are much broader than in *P. sinensis* (Mabille), and the hind wing is not lobed as in that species.

V.—*Report on the Crustacea collected by the Naturalists of the Arctic Expedition in* 1875–76. By Edward J. Miers, F.L.S., F.Z.S., Assistant in the Zoological Department, British Museum.

[Plates III. & IV.]

The Crustacea collected by the naturalists of H.M.SS. 'Alert' and 'Discovery,' although not including many novelties, are of great interest on account of the high and hitherto unexplored latitudes reached by the late Arctic Expedition. The number of species may appear small in comparison with the results of the late German expedition to the North Pole, or with those published in the Preliminary "Report of the Biological Results of the Cruise of the Valorous:" but in the case of the latter expedition the collections were made on the coast of Western Greenland and in Davis Straits, many degrees to the southward, and under conditions much more favourable to the production of animal life; and as regards the former, the species actually collected in the Polar Sea were few in number compared with those obtained on the east coast of Greenland.

In accordance with a suggestion of Captain Feilden, the following account of the collections of Crustacea is confined to the species collected between lat. 78° and 84° N. The few specimens of Crustacea brought home by the Expedition from localities south of 78° N. lat. which were in the collection intrusted to me, can be omitted without in any degree detracting from the chief interest of this report as an account of the fauna of a region hitherto unexplored by the carcinologist.

The most northerly species collected is *Anonyx nugax*, one of the commonest and most abundantly distributed of the Arctic Amphipoda, and first made known to science a hundred years ago by Phipps (Voy. toward the North Pole). Of this species a fine adult male example, and several smaller ones, were collected by Captain Markham and Lieut. Parr, at 83° 19′ N. lat., in May 1876, at a depth of 72 fathoms (bottom mud, containing Foraminifera). The next most northerly species, a large specimen of the well-known *Hippolyte aculeata*, was found on the shore of Dumb-bell Harbour, Grinnell Land, in lat. 82° 30′ N.

The following are the principal stations at which Crustacea were collected by the naturalists of the 'Alert' and 'Discovery':—

Floeberg Beach, the winter quarters of H.M.S. 'Alert,' from September 1875 to July 1876, in 82° 27′ N. lat. Captain Feilden states that the only means of obtaining Crustacea at this point was by letting down baited nets through the firehole, and in July through cracks made in the floe.

Discovery Bay, winter quarters of the 'Discovery,' in 81° 44′ N. lat. The Crustacea collected at this locality were obtained by dredging at a depth of $5\frac{1}{2}$ to 25 fathoms, in August 1875–76. (The bottom rocky.)

Cape Fraser, Grinnell Land, in 79° 44′ N. lat. Crustacea were collected at a depth of 20 fathoms, in August 1876. (Bottom stony.)

Dobbin Bay, Grinnell Land, in 79° 40′ N. lat. The Crustacea were collected at a depth of 30 fathoms, in August 1876. (Bottom consisting of stones and mud.)

Cape Louis Napoleon, a prominent headland of Grinnell Land, in lat. 79° 38′ N. The Crustacea were obtained at a depth of 25 fathoms, in August 1876.

Franklin-Pierce Bay, Grinnell Land, in 79° 29′ N. lat. Crustacea were collected at a depth of 15–20 fathoms, in August 1875.

Dr. Lütken, in his valuable "List of the Crustacea of Greenland," published in 1875, in the 'Manual of Instructions for the Arctic Expedition,' enumerates 184 species of Crustacea and Pycnogonida; and Norman, in the 'Report on the 'Valorous' Expedition,' gives 249 as the number of species belonging to the West-Greenland fauna alone, no fewer than 113 species having been collected in Davis Straits and on the west coast of Greenland by that Expedition. Only 31 species were collected by the Arctic Expedition in Smith Sound and the seas to the northward; whence it is evident that in the highest latitudes there is a great decrease in the number of *species* of Crustacea, which is but partially compensated for by the increase in number of the *individuals* of certain well-known species which attain a much larger size than specimens of the same species collected in lower latitudes. From the Table appended it appears that this decrease is mainly in the orders Amphipoda and marine Ostracoda. Of the latter group no species were collected by the naturalists of the 'Alert' and 'Discovery.'

The following Table exhibits, (I.) the number of species obtained during the 'Valorous' cruise on the west coast of Greenland and in Davis Straits; (II.) the number mentioned by Buchholz as occurring on the south and west coasts of Greenland; (III.) the number obtained by the British Arctic Expedition north of lat. 78° N. in Smith Sound and on the coasts of Grinnell Land:—

	I.	II.	III.
Brachyura	3		
Anomura	1		
Macrura	11	6	9
Stomatopoda	..	1	1
Cumacea	6		
Isopoda	7	2	4
Amphipoda	39	21	12
Phyllopoda	3	1	1
Ostracoda	34		
Copepoda	2	1	1
Cirripedia	4	1	1
Pycnogonida	3	3	2
	113	36	31

Of actual novelties not many were obtained during the expedition. A marked variety (which may prove to be a distinct species, although I do not consider it as such) of *Arcturus baffini*, a new species of parasitic Copepoda of the genus *Lernæopoda*, occurring upon the gills of the new Charr described by Dr. Günther under the name of *Salmo arcturus*, and a variety of the well-known *Nymphon hirtum*, complete the list.

One of the most interesting species obtained is the extraordinary Isopod, *Munnopsis typica*, Sars, originally discovered at great depths in the fjords of Norway and at the Lofoten Islands, and since obtained at a depth of 100 fathoms in Davis Straits, during the cruise of the 'Valorous.' Of this species several specimens were obtained off Capes Fraser and Napoleon at 20–50 fathoms. *Cetochilus septentrionalis*, which was collected abundantly south of Smith Sound, was not found north of the entrance to that channel; but specimens of a delicate species of Phyllopoda, which I refer to the *Branchinecta arctica* of Verrill, were collected by Mr. Hart in a small freshwater lake and in a stream under ice so far to the northward as Discovery Bay.

Geographical Distribution.—This has been already discussed in some detail by Buchholz (*l. c.*). The Crustacean fauna of Greenland, Spitzbergen, and the Scandinavian peninsula has been so thoroughly elucidated of recent years, through the labours of the Danish, Swedish, and Norwegian naturalists, that it is not surprising that a large proportion of the Arctic species (including, as will be seen from the following Table, nearly all collected by the British expedition) should have been recorded from these localities. Comparatively few Arctic species inhabit the North British seas; nor is it probable that their number will be greatly increased, the Crustacea of the Shetlands having been carefully investigated by the Rev. A. M. Norman, in his recently published report on the dredging-operations carried on in these islands, and that of the coast of Scotland generally by the researches of local naturalists.

For our knowledge of the Crustacea inhabiting the coasts and islands of Arctic America, we have for data only the reports appended to the earlier British voyages to the Arctic regions, and for those of North-eastern Asia, Brandt's account of the Crustacea in Middendorff's 'Sibirische Reise,' vol. ii. While a large number of the species inhabiting the northern seas of Europe and Eastern America are probably restricted in their range to the North-Atlantic basin, I believe, when the Crustacea of the north coasts of America and Asia become better known it will be found that the hardier species, which

Geographical Distribution of the Crustacea collected by the Arctic Expedition North of Lat. 78° N.

Names of the Species collected.	Greenland†.	Arctic America‡.	Iceland.	Spitzbergen.	Scandinavia.	Britain.	N.E. Asia.	Other localities.
DECAPODA.								
Cheraphilus boreas	*	*	*	*	*	..	*	California.
Sabinea septemcarinata	*	*	..	*	*	*	*	
Hippolyte Gaimardii	*	*?	*	*	*			
—— spinus	*	*	..	*	*	*		
—— turgida	*	..	..	*	*			
—— Phippsii	*	..	..	*	*			
—— polaris	*	*	..	*	*			
—— borealis	*	*	..	*	*			
—— grœnlandica	*	*	..	..	..	..	*	
STOMATOPODA.								
Mysis oculata	*	..	..	*				
ISOPODA.								
Arcturus baffini	..	*	*	*	..	..	..	Färö Islands.
—— ——, var. Feildeni	..	..	..	..				
Gyge hippolytes	*	..	..	*	*	*		
Phryxus abdominalis	*	..	..	*	*	*		
Munnopsis typica	..	..	..	*	*	..	..	Davis Straits.
AMPHIPODA.								
Anonyx nugax	*	*	*	*	*	*	*	
—— gulosus?	*	..	*	*	*	*	..	South Europe?
Onesimus Edwardsii	*	..	..	*	..	*		
Atylus carinatus	*	..	..	*				
Acanthozone hystrix	*	*	..	*	*			
Halirages fulvocinctus	*	..	..	*	*			
Gammarus locusta	*	*	*	*	*	*	*	South Europe.
Gammaracanthus loricatus	*	*	..	*	*			
Amathilla pinguis	*	..	..	*				
Eusirus cuspidatus	*	..	..	*	*			
Tritropis aculeata	*	*	..	*	*			
Ægina spinosissima	*	*?	..	*	*	..	..	Great Manan, Colorado.
PHYLLOPODA.								
Branchipus (Branchinecta) arcticus	*	*						
COPEPODA.								
Lernæopoda arcturi, n.								
CIRRIPEDIA.								
Balanus porcatus	*	..	*	*	*	*	..	Maine, Massachusetts; China?
PYCNOGONIDA.								
Nymphon hirtum	*	*	..	*				
—— ——, var. obtusidigitum								
—— Strömii	..	..	..	..	*			

† Including the Crustacean fauna of the southern, western, north-eastern, and eastern coasts. For information with respect to the particular species inhabiting these coasts I must refer to the table given by Buchholz (*l. c.*).

‡ With particular reference to the northern coasts and islands adjacent. These localities are important as showing the tendency to a circumpolar distribution observable in many species, and are not given by Buchholz. Further particulars are mentioned in the text.

increase in size and number as regards individuals in the highest latitudes, range over a zone comprehending the whole circumpolar or *Arctic* region, as has been already suggested by Dana, in the second volume of his work on the Crustacea collected by the United-States Exploring Expedition under Commodore Wilkes (pp. 1554, 1579), corresponding to the *Antarctic* region of the same author.

It has been thought useful to give, in the synonyma, full references to the earlier British Polar voyages and Arctic expeditions wherein lists of the Crustacea collected are published; but reference is only made to the principal works of the Danish and Scandinavian naturalists, by whose labours our knowledge of the lower orders of the Crustacea has been so greatly increased.

A small collection of Crustacea made by A. C. Horner, Esq., while on board the yacht 'Pandora,' which has been placed in my hands for examination, contains only two species collected north of lat. 78°, *i. e.* three specimens of *Atylus carinatus*, and four very small specimens of an Amphipod, perhaps belonging to the genus *Pherusa*. Both these species were collected at a depth of 7 fathoms on a clay bottom, in Pandora Habour, Smith Sound, in lat. 78° 17′ N.

DECAPODA.

Crangonidæ.

Cheraphilus boreas.

Cancer boreas, Phipps, Voy. North Pole, p. 190, pl. xii. fig. 1 (1774).
Cancer homaroïdes, O. Fabr. Fauna Grœnlandica, p. 241 (1780); Mohr, Isl. Naturh. p. 108. no. 245, pl. v. (1786).
Crangon boreas, Fabr. Ent. Syst. Suppl. p. 410 (1798); Sabine, Parry's 1st Voy. Append. no. x. p. 57 (1821); Ross, Append. Capt. Parry's 3rd Voy. p. 120 (1826); 4th Voy. p. 205 (1828); Ross and Owen, Crust. in Append. Ross 2nd Voy. p. lxxxi (1835); M.-Edw. Hist. Nat. Crust. ii. p. 342 (1837); Kröyer, Nat. Tidsskr. iv. p. 218, pl. iv. figs. 1–14 (1842–43); Brandt, Crust. in Middendorff's Sibirische Reise, p. 114 (1851); Bell, Crust. in Belcher, 'Last of the Arctic Voyages,' ii. p. 402 (1855); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarfahrt, ii. p. 271 (1874).
Cheraphilus boreas, Kinahan, Proc. Royal Irish Acad. viii. p. 68 (1864).

Coll. Feilden: Discovery Bay, lat. 81° 44′ (both males and females), at depth of 25 fathoms; Cape Napoleon, one male example, at 25 fathoms; Franklin-Pierce Bay, one female, at 15 fathoms: temperature of water 29°·50.

In the large series of this species collected, the females are uniformly larger than the males and more robust, the frontal lobe, the spines at the antero-lateral margins of the carapace, and the teeth of the median dorsal carina less prominent and acute; the outer lamina of the antennæ is of a more broadly oval shape; the inner ramus of the first to fifth pairs of the postabdominal appendages, which in the male is quite small, in the female is, with the outer ramus, flattened and largely developed, and furnished with long marginal cilia, to which the ova adhere by the viscous matter which retains the whole mass *in situ*. The length of the largest female slightly exceeds 4 inches (103 millims.); that of the largest male is only $2\frac{2}{3}$ inches (68 millims.). The dark purple longitudinal stripes on the segments of the postabdomen are generally much more distinct in the males than in the females.

This species is found in great abundance throughout the high northern and Arctic latitudes—occurring upon the Scandinavian coasts, Greenland, Iceland, Spitzbergen, the north coast of North America (Port Bowen, Igloolik, Felix Harbour, Melville Island), and Kamtschatka. California, I may add, is mentioned as a habitat of this species by Owen and Ross in the Appendix to Ross's Second Voyage, on the authority of specimens collected during the voyage of the 'Blossom.'

Sabinea septemcarinata.

Crangon septemcarinatus, Sabine, Append. no. x. of Capt. Parry's 1st Voy. p. 58, pl. ii. figs. 11–13 (1821); Ross, Append. Capt. Parry's 4th Voy. p. 205 (1828); Milne-Edw. Hist. Nat. Crust. ii. p. 343 (1837); Brandt, Crust. in Middendorff, Sibirische Reise, p. 114 (1851).

Sabinea septemcarinata, Owen and Ross, Crust. in Append. Ross's 2nd Voy. p. lxxxii (1835); Miers, Ann. & Mag. Nat. Hist. (ser. 4) xix. p. 133 (1877).

Sabinea (*Crangon*) *septemcarinata*, Kröyer, Nat. Tidsskr. iv. p. 244, pl. iv. figs. 34–40, pl. v. figs. 41–44 (1842–43).

Coll. Feilden: Discovery Bay, 25 fathoms, abundantly, both males and females; Cape Napoleon, 25 fathoms, three specimens, males.

Coll. Hart: Dobbin Bay, at a depth of 30 fathoms, one specimen, a female with ova.

The differences between the sexes in *S. septemcarinata* are less marked than in the preceding species. The females are but little larger than the males; and the rami of the appendages of the postabdomen differ but slightly in the two sexes (see Kröyer, Nat. Tidsskr. *l. c.* figs. 43, 44). In small specimens the fourth segment of the postabdomen has a small spine at its infero-lateral angle, which is usually absent in the adult. Among the large number of specimens collected there is but a single female with ova. Length of this, the largest specimen, 2 inches 6 lines (nearly 64 millims.).

This species is probably as widely, but less abundantly distributed than *C. boreas* throughout the circumpolar region. It occurs on the coasts of Arctic America (Igloolik, Felix Harbour), the Shetlands, Norway, Greenland, and Spitzbergen; and its range extends eastward to Kamtschatka (Ryan).

ALPHEIDÆ.

Hippolyte Gaimardii.

Hippolyte Gaimardii, Milne-Edw. Hist. Nat. Crust. ii. p. 378 (1837); Kröyer, Nat. Tidsskr. 1 R. iii. p. 572 (1840–41); Monogr. Fremst. Slægt. Hippolyte's nordiske Arter, p. 74, pl. i. figs. 21–29 (1842); Goës, Œfv. Vet. Akad. Förhandl. p. 168 (1863).

Hippolyte gibba, Kröyer, Nat. Tidsskr. 1 R. iii. p. 572 (1840–41); Monogr. Slægt. Hippolyte's nord. Arter, p. 80, pl. i. fig. 30, pl. ii. figs. 31–37 (1842).

? *Hippolyte Belcheri,* Bell, Crust. in Belcher, 'Last of the Arctic Voyages,' ii. p. 402, pl. xxxiv. fig. 1 (1855).

Coll. Hart: Franklin-Pierce Bay, 13–15 fathoms, one female specimen.

A single specimen (female with ova) was collected by Mr. Hart. Length 2 inches 2 lines (55 millims.). The front margin of the carapace is armed with two spines—one below the eyes, and one (very small) at the junction of the anterior and inferior margins of the carapace. The rostrum slightly exceeds in length the scale of the antennæ, is slightly directed upward at the distal extremity, and is $\frac{9}{4}$-toothed, the teeth on the upper margin becoming more crowded toward the distal extremity. The third segment of the postabdomen is without a compressed dorsal carina. The eyes are obconical. The outer maxillipeds do not reach to the apex of the antennal scale.

The dorsal tubercle or carina is, according to Goës (*l. c.*), generally characteristic of the males of this species, to which he refers the *H. gibba* of Kröyer and *H. Belcheri* of Bell.

Hippolyte Gaimardii is very generally distributed on the high-northern coasts and islands of Europe. It has been recorded from the shores of Norway, Finmark, Spitzbergen, Iceland, Greenland; also Arctic America, if the *H. Belcheri* of Bell belong to this species. Its author describes it as having but "a single tooth at the outside of the orbilar notch."

Hippolyte spinus.

Cancer spinus, Sowerby, Brit. Miscell. p. 47, pl. xxiii. (1806).

Alpheus spinus, Leach, Ed. Encycl. vii. p. 431 (1813–14); Linn. Trans. xi. p. 347 (1815).

Hippolyte Sowerbæi, Leach, Mal. Pod. Brit. pl. xxxix. (1815–17).

Hippolyte Sowerbei, Owen and Ross, Crust. in Append. Ross 2nd Voy. p. lxxxiii, pl. B. fig. 2 (1835); Kröyer, Monogr. Fremst. Slægt. Hippolyte's nord. Arter, p. 90, pl. ii. figs. 45–54 (1842).

Hippolyte Sowerbyi, M.-Edw. Hist. Nat. Crust. ii. p. 380 (1837).

Hippolyte spinus, Bell, Brit. Crust. p. 284 (1855).

Coll. Feilden: Discovery Bay, 5 specimens, at 25 fathoms.

This species is distinguishable at first sight by its compressed lamellate rostrum, the high and stongly dentated median dorsal carina, &c. As in *Hippolyte turgida,* there are four spines upon the anterior margin of the carapace, two of which are placed above the eye-peduncle. The length of the largest specimen is 2 inches 4 lines (59 millims.). All the specimens in the collection are females; but only one bears ova.

H. spinus occurs on the British and Scandinavian coasts, at Greenland, Spitzbergen, and on the shores of Arctic America (Felix Harbour).

Hippolyte turgida.

Hippolyte turgida, Kröyer, Monogr. Fremst. Slægt. Hippolyte's nordiske Arter, p. 100, pl. ii. figs. 57–58, pl. iii. figs. 59–63 (1842); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarf. p. 273 (1874).

Coll. Feilden: Discovery Bay, 25 fathoms, one specimen, female; Franklin-Pierce Bay, one specimen, female with ova.

Coll. Hart: Cape Fraser, 20 fathoms, one female example.

This species is remarkable on account of the turgid form of the body, and the convexity of the dorsal surface of the carapace. From *H. polaris* (with some varieties of which species it might be confounded on first comparison) it is distinguished by the existence of an additional spine upon the anterior margin of the carapace above the eye-peduncle. The only perfect example obtained (a female) has the rostrum $\frac{1.1}{6}$-toothed. Length about 1 inch 10 lines (47 millims.).

Goës, who had examined 100 specimens of this species, did not find a single male in the series; and he considered it to be the female of the *Hippolyte Phippsii* of Kröyer. By Buchholz the differences are not regarded as sexual, as he states that he had observed two male individuals of *H. turgida,* and a female of *H. Phippsii*; but he nevertheless considers the two forms probably varieties of one and the same species.

Although this species has not been noted by any of the earlier Arctic voyagers, it may not improbably, in some instances, have been confounded with *H. polaris*, to which, as stated above, it bears some external resemblance.

Its occurrence has been recorded on the coasts of Greenland, Spitzbergen, and Norway.

Hippolyte Phippsii?

? *Hippolyte Phippsii,* Kröyer, Nat. Tidsskr. 1 R. iii. p. 575 (1840–41); Monogr. Fremst. Slægt. Hippolyte's nordisk. Arter, p. 106, pl. iii. figs. 64–68 (1842); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarf. p. 274 (1874).

Coll. Hart: Cape Fraser, 20 fathoms, one specimen.

A single specimen of a species of *Hippolyte* is in the collection, which I refer with but little hesitation to this species. The only point in which it differs from Kröyer's diagnosis is in the absence of the second minute supraocular spine; and this may well be a point of less than specific importance.

The rostrum is slender and straight, of the form figured by Kröyer (*l. c.*), and has ten very small teeth on its upper and five near the distal extremity of its inferior margin. Length nearly 1 inch 4 lines (33 millims.).

This species is found on the shores of Finmark, Spitzbergen, and Greenland.

Hippolyte polaris.

Alpheus polaris, Sabine, Append. Parry's 1st Voy. no. x. p. 60, pl. ii. figs. 5–8 (1821); Ross, Append. Parry's 4th Voy. p. 206 (1828).

Hippolyte polaris, Ross and Owen, Append. Ross's 2nd Voy. Zool. Crust. p. lxxxv (1835); M.-Edw. Hist. Nat. Crust. ii. p. 376 (1837); Kröyer, Monogr. Fremst. Slægt. Hippolyte's nordiske Arter, p. 116, pl. iii. figs. 78–81, pl. iv. fig. 82 (1842); Bell, in Belcher, 'Last of the Arctic Voyages,' ii. p. 401 (1855); Goës, Œfv. Vet. Akad. Förhandl. p. 169 (1863); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarf. p. 275 (1874).

Coll. Feilden: Discovery Bay, 25 fathoms, abundant; Cape Napoleon, five specimens; Franklin-Pierce Bay, 15 fathoms, two specimens.

Coll. Hart: Franklin-Pierce Bay, 13–15 fathoms, several specimens; Dobbin Bay, 30 fathoms, one specimen.

In this species there are three or four spines in a median series on the back of the carapace, and three spines upon its anterior margin, one above and one below the eyes, and one at the junction of the anterior and inferior margins. The rostrum is toothed above and below, and acute at the extremity, which is directed somewhat upward. The number of teeth on the upper and lower margins, however, is very variable, averaging 7–9 on the upper, and 3–4 on the lower margin. In one specimen the rostral teeth $=\frac{10}{5}$, in another $\frac{6}{3}$. Kröyer, in the diagnosis of this species in his monograph of the genus *Hippolyte* (p. 121), gives $\frac{6-7}{2-3}$ as the number of the rostral teeth; but this is somewhat below the average. The length of the largest specimen (a female with ova) is 2 inches 7 lines (66 millims.). In this specimen the rostral teeth $=\frac{9}{6}$.

I have observed no distinctive sexual characters in the individuals collected, although a greater number were obtained of this species than of any other in the genus. There are a large number of females with ova; and perhaps all the specimens are of this sex. According to Buchholz, who observed a nearly equal number of specimens of both sexes, the females are generally larger than the males, and have the upper antennæ shorter.

This species occurs abundantly on the coasts of Greenland and Spitzbergen, and is also found on the shores of Norway and the Province of Finmark and Arctic America (Melville Island).

Hippolyte borealis.

Hippolyte borealis, Owen, Append. Ross's 2nd Voy. Crust. p. lxxxiv, pl. B. fig. 3 (1835); M.-Edw. Hist. Nat. Crust. ii. p. 372 (1837)

Kröyer, Monogr. Fremst. Slægt. Hippolyte's nordiske Arter, p. 122, pl. iii. figs. 74–77 (1842); Bell, in Belcher, 'Last of the Arctic Voyages,' ii. p. 400 (1855); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarfahrt, p. 276 (1874).

Coll. Feilden: Discovery Bay, at 25 fathoms, several specimens; Cape Napoleon, at 25 fathoms, two specimens; Franklin-Pierce Bay, at 15 fathoms, three specimens.

Coll. Hart: Franklin-Pierce Bay, 13–15 fathoms, four specimens; Dobbin Bay, 30 fathoms, one specimen.

This species is characterized by its elongate, slender, horizontal rostrum, the upper margin of which is straight and entire; upon the lower margin, near the apex, there are usually 3–4 small teeth; in several specimens there are 5, in one or two specimens only 2 teeth on the lower margin. There are two spines on the anterior margin of the carapace, one above and one below the eye. Length of the largest specimen collected, 2 inches 3 lines (57 millims.).

There is not among the specimens of this species a single female with ova; it is probable that all are of the male sex. No females were collected by the German Arctic Expedition, under Captain Koldewey; and Goës (Œfv. Vet. Ak. Förhandl. 1863, p. 170) states that he has never observed any among the large number of specimens examined by him.

By Goës (Œfv. Vet. Ak. Förh. p. 170, 1863) this species is considered identical with *H. polaris*; and by Buchholz (*l. c.*) it is not thought to be more than a variety. That the differences between the two forms are not sexual, as might have been surmised, would seem to be proved by the fact that Buchholz mentions the occurrence of males and females of *H. polaris* in nearly equal numbers. For the present I think it desirable to regard the two forms as distinct species. The differences are at least as great as those between many other species of the genus; and no strictly intermediate varieties have been observed.

The geographical range of *H. borealis* is the same as that of *H. polaris*.

Hippolyte grœnlandica.

Astacus grœnlandicus, J. C. Fabricius, Syst. Ent. p. 416 (1775).

Cancer aculeatus, O. Fabr. Fauna Grœnlandica, p. 289 (1780).

Alpheus aculeatus, Sabine, Zool. in Append. Parry's 1st Voy. p. 59, pl. ii. figs. 9, 10 (1821); Ross, Append. Parry's 3rd Voy. p. 120 (1826); 4th Voy. p. 206 (1828).

Hippolyte aculeata, Owen and Ross, Crust. in Append. Ross's 2nd Voy. p. lxxxiii (1835); M.-Edw. Hist. Nat. Crust. ii. p. 380 (1837); Owen, Crust. in Beechey's Voy. 'Blossom,' p. 88 (1839); Kröyer, Monogr. Fremst. Slægt. Hippolyte's nordiske Arter, p. 126, pl. iv. figs. 83–98, pl. v. figs. 99–104 (1842); Brandt, in Middendorff, Sibirische Reise, Krebse, p. 118 (1851); Bell, Crust. in Belcher, 'Last of the Arctic Voyages,' p. 401 (1855).

Hippolyte armata, Owen, Crust. in Beechey's Voy. 'Blossom,' p. 88, pl. xxvii. fig. 2 (1839), ♀.

Hippolyte cornuta, Owen, Crust. Beechey's Voy. 'Blossom,' p. 89, pl. xxviii. fig. 2 (1839), ♂.

Coll. Feilden: Dumb-Bell Harbour, lat. 82° 30′, one female specimen.

Coll. Hart: Franklin-Pierce Bay, 13–15 fathoms, one male specimen.

In this species the rostrum is short and slender, there is a strongly 4-dentate median dorsal carina, three strong spines on the anterior margin of the carapace, and the segments of the postabdomen are strongly spined upon their inferior lateral margins. The largest specimen collected has the rostrum, anterior to the front margin of the carapace, $\frac{2}{2}$-toothed; the length of this specimen is 2 inches 10 lines (72 millims.). In the male, length 2 inches 4 lines (59 millims.), the segments of the postabdomen (especially the second segment) are narrower on the sides, and the lateral spines much longer.

H. grœnlandica occurs on the coasts of Greenland, Arctic America (Port Bowen, Melville Island), and in the seas of Kamtschatka and Okhotsk.

STOMATOPODA.

Mysidæ.

Mysis oculata.

Cancer oculatus, O. Fabr. Fauna Grœnlandica, p. 245. no. 222 (1780).
Mysis Fabricii, Leach, Trans. Linn. Soc. xi. p. 350 (1815).
Mysis oculata, Kröyer, Nat. Tidsskr. ii. p. 255 (1838–9); 3 R. i. pp. 13, 41 (1861); Voy. en Scand. Crust. Atlas, pl. viii. fig. 2; Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarf. p. 284 (1874).

Coll. Feilden: Cape Napoleon, 25 fathoms (temperature of water 29°·2).

The single specimen collected is in a very much mutilated condition. Its length is nearly 10 lines (20 millims.).

It occurs on the coasts of Greenland and Spitzbergen.

ISOPODA.

Arcturus baffini.

Idotea baffini, Sabine, Append. Capt. Parry's 1st Voy. p. 50, pl. i. fig. 4–6 (1821); Ross, Append. Capt. Parry's 3rd Voy. p. 117 (1826); 4th Voy. p. 203 (1828).
Arcturus tuberculatus, Latr. in Cuvier's Règne Animal (ed. 2), iv. p. 139 (1829).
Arcturus baffini, Westwood, Trans. Entom. Soc. Lond. i. p. 72 (1836); M.-Edw. Hist. Nat. Crust. iii. p. 123, pl. xxxi. fig. i. (1840); Bell, in Belcher, 'Last of the Arctic Voyages,' ii. p. 408 (1855).

Coll. Feilden: Cape Napoleon, at 25 fathoms, two specimens, male and female.

Coll. Hart: Dobbin Bay, 30 fathoms, one male and one female; Franklin-Pierce Bay, 13–15 fathoms, four males and one female; same locality, depth not stated, two females and many young.

Two very distinct varieties of this species are in the collection.

In one, which may be considered the typical, and which is probably also the commonest condition of the species, the body is of a compact, robust form; the head, and each of the segments of the body, is armed with a pair of conical erect spines, which are smaller upon the posterior segments; on the terminal segments, in lieu of spines, are two small tuberculiform prominences. The coxæ of the last three pairs of legs project laterally, and are acute at the extremity. The spines vary considerably in size; in the largest individual, a female, obtained by Mr. Hart at Franklin-Pierce Bay, length nearly 2 inches 6 lines (63 millims.), the spines on some of the segments are reduced to little more than prominent tubercles. This specimen bears a thickly clustered brood of young upon the peduncles of the large outer antennæ; in these young individuals scarcely any traces exist of tubercles or spines; they average $3\frac{1}{2}$ lines in length.

Var. *Feildeni*. Pl. III. fig. 1.

Coll. Feilden: Floeberg beach, 82° 27′ N. lat., very abundant, males, females, and young; near winter quarters of H.M.S. 'Alert,' 82° 26′ 22″ N. lat., one specimen.

In this variety, to which belong the specimens from Floeberg beach, the head and first four segments of the body are smooth, or with only the most obscure indications of tubercles; on the fifth to seventh segments, and on the first two postabdominal segments is a pair of small tubercles occupying the place of the prominent spines of the preceding variety; the terminal segment is usually quite smooth; the coxæ of the last three pairs of legs are less prominent and acute than in that which I have considered the typical form of the species. In the young animals (of which a large number were collected), the tubercles on the first four segments are sometimes clearly distinguishable. Adult specimens of both sexes were collected, the males in greater abundance. It is worthy of note, that among all the specimens collected at this locality not one exhibits any approach to the variety from Cape Napoleon.

This variety cannot, however, be regarded as a distinct species, on account of the tendency to variation in the length of the spines of the preceding form; there is, moreover, in the collection of the British Museum a specimen from Baffin's Bay, in which the spines upon all the segments are reduced to tubercles.

This common Arctic species occurs on the northern coast of America (Port Bowen), at Spitzbergen, the Färö Islands, and Iceland.

Gyge hippolytes.

Bopyrus hippolytes, Kröyer, Kongl. Dansk. Vidensk. Selsk. Afhandl. vii. p. 306, pl. iv. fig. 22 (1838); Voy. en Scand. Atlas, Crust. pl. xxviii. fig. 2 ♂ & ♀; M.-Edw. Hist. Nat. Crust. iii. p. 283 (1840).

Gyge hippolytes, Spence Bate and Westwood, Hist. Brit. Sessile-eyed Crust. ii. p. 230 (1868); Buchholz, in Koldewey, Zweite deutsche Nordpolarfahrt, Crust. p. 286 (1874).

Coll. Feilden: Discovery Bay (on *Hippolyte polaris*).

A male and female example of this curious Bopyrid Crustacean occurred in the collection, parasitic upon a specimen of *Hippolyte polaris*, and occupying the position in which it is usually found, *i. e.* a cavity beneath the carapace, at the angle formed by the junction of the posterior and lateral margins (*vide* Buchholz, 'Zweite deutsche Nordpolarfahrt,' Crust. p. 286). This cavity was nearly filled with the minute yellowish ova of the parasite. The animal agrees in all respects with the excellent figure given by Kröyer (Voy. en Scandinavie, pl. xxviii. fig. 2), except that in the minute male I have examined the body is more closely articulated, and the sutures defining the first two postabdominal segments are distinctly visible under the microscope. The length of the female is nearly 5 lines (10 millims.), that of the male about 1 line (2 millims.).

The *Gyge hippolytes* occurs, if we may judge from the few recorded localities, over a very extended geographical area; its existence has probably been unnoticed in many instances by the earlier observers. It occurs on the coasts of Greenland and Spitzbergen (on *Hippolyte polaris*), Norway (on *H. Sowerbœi*), and the British coasts, at Galway (on *H. varians*) and Cornwall.

Phryxus abdominalis.

Bopyrus abdominalis, Kröyer, Nat. Tidsskr. iii. pp. 102, 289, pls. i., ii. (1840); Voy. en Scand. Crust. Atlas, pl. xxix. fig. 1.

Phryxus hippolytes, Rathke, Nova Acta Nat. Curios. xx. p. 40, pl. ii. figs. 1–10 (1843).

Phryxus abdominalis, S. Bate and Westwood, Hist. Brit. Sessile-eyed Crust. ii. p. 234 (1868); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarfahrt, p. 287 (1874).

Coll. Feilden: Discovery Bay, male and female, on *Hippolyte polaris*; Cape Napoleon, male and female, on *H. polaris*.

Coll. Hart: Franklin-Pierce Bay, 13–15 fathoms, five males and five females.

The females in the collection were found in the usual position beneath the second and third postabdominal segments of the *Hippolyte*, and the minute male was in each instance detected upon the body of the female.

It occurs frequently on the coasts of Norway and Finmark (on several species of *Hippolyte* and *Pandalus annulicornis*), Greenland (on *H. turgida*), Spitzbergen, and the northern, eastern, and southern coasts of Britain (on *Hippolyte pusiola*, *H. Barleei*, and *Pandalus annulicornis*). Its range is evidently quite as extended as that of the foregoing species.

Munnopsis typica.

Munnopsis typica, Sars, Forhandl. Vidensk.-Selsk. Christiania, p. 84 (1861); Bidrag til kundskab om Christiania-Fjordens Fauna, p. 70, pls. vi., vii. (1868).

Coll. Feilden: Cape Napoleon, two male specimens at a depth of 25 fathoms, temperature of the water 29°·2; at 50 fathoms one male specimen.

Coll. Hart: Cape Fraser, 20 fathoms, one female specimen.

The specimens collected of this very remarkable species, which has been fully described and illustrated by the late Dr. M. Sars in the memoir above referred to, are unfortunately all much mutilated; in none are the antennæ and slender and greatly elongated legs of the third and fourth pairs in a perfect condition.

The largest specimen, the female from Cape Fraser, has the ovigerous plates greatly developed, and is about 9½ lines (18 millims.) long.

This species has been found at a depth of 50–100 fathoms in the Christiania Sound, and at a depth of 250 fathoms at the Lofoten Islands. It is also recorded by Buchholz (Crust. in 'Zweite deutsche Nordpolarf.' p. 285, note) from Spitzbergen, and was obtained during the cruise of the 'Valorous,' in lat. 69° 31′ N., long. 56° 1′ W., at a depth of 100 fathoms.

[To be continued.]

VI.—*Note on Lists of Arctic Hydroida and Polyzoa published in the 'Annals' for February* 1874 *and January* 1877 *. By the Rev. Thomas Hincks, B.A., F.R.S.

In the first of the papers referred to above I have given an account of some Hydroids which were obtained by Dr. Wallich, as I supposed, off the coast of Iceland. In the second some Polyzoa which formed part of the same gathering were catalogued and several new species described.

The bottle containing the dredging, which was placed in my hands by Mr. Busk, was labelled legibly, "Off Reykjavik, in 100 fathoms, amongst icebergs grounded and drifting," or to this effect; and I had no reason whatever to suspect inaccuracy. Since the publication of the second paper, however, Dr. Wallich, whose attention had not been previously directed to the matter, has informed me that there has undoubtedly been some blunder, inasmuch as there is no water of the depth off Reykjavik, nor are there any icebergs †. He has kindly examined his journals, notes, &c. for the purpose of removing, if possible, the doubt as to the locality; and his conclusion is that the material with which I have dealt in my

* "On Deep-water Hydroida from Iceland," Annals, Feb. 1874, p. 146; "On Polyzoa from Iceland and Labrador," Annals, Jan. 1877, p. 97.

† Dr. Wallich writes (*in litt.*), "At Rekiavik Harbour I dredged *not* from the ship, but from a boat. In no part of the harbour did I find deeper water than about 20 fathoms. I do not believe there is much deeper water within half a mile of the little town; and beyond this range I did not go. The harbour is a bay in no sense comparable to a fiord, the shore being sloping, and flat, low islands scattered here and there. A berg *could* not get into the harbour. Even outside the mouth of the bay, southward of Cape Rekianess, no icebergs are ever in these days met with."

papers was obtained *off Frederickshaab, Davis Straits*, in 100 fathoms, and amongst bergs grounded and drifting, as stated on the label. How the name Reykjavik came to find its way into the place which should have been occupied by the name Frederickshaab it is impossible to say with certainty. As in other cases Dr. Wallich appears to have written on his labels the date, with the depth and other particulars, but without the name of the place, it is possible he may have done so in the present instance, and that when the bottle was made over to Mr. Busk the wrong name may have been inserted by mistake. However this may be, there can be no doubt, I think, that the Hydroida and Polyzoa which I have catalogued and described are Greenlandic and not Icelandic. All the evidence points in this direction. *The date on the bottle containing them is that of Dr. Wallich's visit to Frederickshaab, where he dredged once amongst icebergs, in 100 fathoms.* The label exactly resembles one that was attached to undoubted Frederickshaab specimens, in all but the name of the place, bearing the same particulars, written in the same fashion, on the same kind of paper, and in partially faded ink. Dr. Wallich's recollection also favours this view. He distinctly remembers that in the single haul off Frederickshaab a large quantity of plant-like Hydroids came up; and they actually formed the chief element of the contents of the bottle that passed into my hands.

On the whole there seems to be little room for doubt; and I must beg those who may refer to my papers for the locality to credit the species recorded in them to Frederickshaab instead of to Reykjavik.

While dredging in Reykjavik Harbour, Dr. Wallich took up a *small quantity* of Hydroida &c. in 15–20 fathoms, which he has been good enough to send me for examination; and I am thus enabled to publish a short list of undoubted Icelandic species.

Hydroida and Polyzoa from Reykjavik Harbour.

Campanularia volubilis, *Linn.*
Calycella syringa, *Linn.*
Lafoëa grandis, *Hincks.*
—— quadridentata, *Hincks.*
Filellum serpens, *W. Thomson.*
Sertularella polyzonias, *Linn.*, var. gigantea.
—— tricuspidata, *Alder.*
Menipea ternata, *Ellis and Sol.*
Scrupocellaria scabra, *Van Ben.*
Caberea Ellisii, *Fleming.*
Membranipora lineata, *Linn.*
Lepralia trispinosa, *Johnston*, var.
—— hyalina, *Linn.*
Cellepora plicata, *Smitt.*
Crisia eburneo-denticulata, *Smitt.*
Idmonea atlantica, *E. Forbes.*
Discoporella verrucaria, *Fabr.*

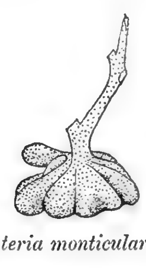
All the species here recorded were also taken at Frederickshaab.

VII.—*On the Branched Form of the Apertural Prolongation from the Summit of* Carpenteria monticularis. By H. J. Carter, F.R.S. &c.

In my paper on Foraminifera ('Annals,' 1877, vol. xix. pl. xiii. fig. 11) I have represented what appeared to me to be an embryonic form of *Carpenteria monticularis*, besides two forms of the matured test (fig. 9, *a*, *b*); and by referring to the former it will be observed that there is a tubular prolongation of the aperture from the summit, whose margin (or, at least, that portion of it which remains entire) shows that it was inflated *i. e.* thickened and rounded, as in the aperture of *Polytrema miniaceum* ('Annals,' 1876, vol. xvii. pl. xiii. fig. 6, *c*, &c.).

In the figure of the matured form (*a*) the margin was also inflated and smooth, while that of "*b*" presented a jagged edge, from which a portion had evidently been broken off.

Just now, on a small branch of *Oculina rosea* (*loc.* unknown), I have met with a matured specimen of *Carpenteria monticularis* like that of "*a*" (*l. c.*), in which the aperture is prolonged into a tubular form that at first divides into two branches, one of which has been broken off just after the division; but the other, which remains, may be assumed to indicate what the former might have been. After a certain distance the remaining branch sends off *three* divisions, two of which have been broken off, while the third extends upwards for some distance, where the jagged form of its extremity also indicates that this is not its original termination, which probably had an inflated smooth margin. Thus in this specimen of *Carpenteria monticularis* the tubular pro-



Carpenteria monticularis, × 8.

longation of the aperture at the commencement divided into two branches, which were afterwards subdivided (see woodcut, magnified about eight diameters).

By its side was another matured form like "*b*" (*l. c.*), in which the tubular prolongation was also divided into two branches, *both of which* had been broken off; while close by are several embryonal forms of *Polytrema miniaceum*, which also end respectively in an erect tubular prolongation of the aperture, terminated by an inflated and everted margin like that of fig. 6, *c* (*l. c.*), whose form, at first single, becomes multiplied as the *Polytrema* increases in size.

The erect, branched, tubular extension of the aperture in *C. monticularis* therefore shows what Max Schultze had anticipated when he modestly said:—"Perhaps my observations on *Polytrema*, which indicate the remarkable affinity between that genus and *Carpenteria*, may serve to shake Carpenter's faith in his opinion" ('Annals,' 1863, vol. xii. p. 419).

The entire tubular extension of the aperture in *C. monticularis* to which I have alluded is a little more than 1-12th inch long, 1-45th inch in diameter at the fixed end, and 1-138th inch in diameter at the free extremity of the ultimate branch, which, as before stated, has been broken off.

It first commences in an undivided portion, about 1-36th inch long, which then bifurcates, when one of the branches is broken off, but measures, like the other at this point, 1-72nd inch in diameter. The branch which has *not* been broken off is then continued on for 1-50th inch, when it sent off a branch which is now indicated by a projecting aperture with inflated margin, that may or may not have ever been longer than it now is; just after which the continuation of the tube divides into two other branches of unequal size, one of which, viz. the largest, has also been broken off just after the bifurcation, where it is 1-72nd inch in diameter, while the other is continued on for about 1-33rd inch, when it also ends in a broken extremity where the wall of the tube is about 1-1800th inch thick and the tube itself 1-138th inch in diameter, which, from this diminished size, I should think, must have been very near its original termination.

The tubular branched prolongation is cylindrical and circular throughout, and increases gradually in the thickness of the wall as well as in the diameter of the tube from the free ends to the fixed one. Moreover it is more or less filled with linear spicules, some of which appear to be incorporated longitudinally with the inner part of the wall of the tube; while throughout also it is sparsely punctate with the tubulation common to the foraminiferal test. So that altogether *C. monticularis* thus bears a considerable resemblance to *Polytrema*; and commencing in the embryonic form (fig. and *l. c.*) with a single tubular prolongation (which, as the *Carpenteria* increases in size, becomes branched and thus multiplied), it also becomes even more subdivided than the branching in *Polytrema.*

What, therefore, takes place in the tubular prolongation of the aperture in *C. monticularis* may also be the case in *C. balaniformis* and in *C.* (*Polytrema*) *utricularis*; but being so delicate that the slightest force almost breaks it off, there is very little chance of a specimen of either coming into our possession with the tubular prolongation even in the imperfect state of that above mentioned; hence the rarity. While in the living state, where broken off, the margin becomes smoothed down, rounded, and thus inflated by the animal, which form presents a marked contrast with the jagged appearance occasioned by fracture after death. Thus a natural and a fractured margin may be readily distinguished. When the tubular prolongation of either *Polytrema* or *Carpenteria* is preserved, it will probably be found to arise from the specimens being situated in depressions which have protected them from coming into contact with such force as must have broken it off; for the tubular prolongation of the embryonic *Polytrema* cannot be touched with the point of the finest hair-pencil without risk of breaking; and therefore, when found in a dusty state (which is generally the case), no attempt to clean it in this or any way should be made, or the probability is that the delicate extremity, with the few sponge-spicules that generally project from it, will be destroyed.

VIII.—*On the* Salenidæ, *Wright.*—Part I. *Observations on the Morphology of a Recent* Salenia. By P. Martin Duncan, F.R.S., Pres. Geol. Soc.

[Plate II. B.]

Having been lately engaged in studying the comparative morphology of the group of Salenidæ, some interesting and rather important points in the structure of a recent specimen probably referable to *Salenia varispina*, A. Agassiz, have come to light.

The Salenidæ, according to Wright, form a natural family of the Echinoidea Endocyclica, their characteristics being "the peculiar structure and great development of the apical disc, which, besides the five genital and five ocular plates, has an additional or suranal plate developed in the centre of the disc immediately before the anal opening; this plate in some genera is single, in others it is composed of from one to eight elements" *. Found in strata of the Jurassic formation and in those of the Cretaceous, the group is represented in the Nummulitic and in the Australian Cainozoic deposits † (probably Miocene). It still survives; and two species of the genus *Salenia* have been described from the result of deep-sea dredging—one by Mr. A. Agassiz, under the name of *Salenia varispina*, and another by Lovén as *Salenia Goesiana* ‡. Wright first explained the correct position of the anal plate, by discovering the madreporic plate and appreciating its relation to the longitudinal axis of the body of *Salenia*; and Lovén's admirable researches on the antero-posterior axis and the asymmetry of the ambulacra have confirmed the truth elaborated by our great authority on British fossil *Echini*. In his 'Revision of the *Echini*,' pt. ii. p. 258, A. Agassiz made the important generalization, which has been so admirably worked out by Lovén, that "the structure of the abactinal system in young *Echini* explains most unexpectedly the homology of the subanal§ plate of Salenidæ." He stated that the subanal plates have no special function, are not special plates found in the group of Salenidæ alone, but are simply an embryonic feature retained in the adult; and he concludes that "this feature, which seemed so characteristic of a small group of *Echini*, is one which *alone* has no primary systematic value, so that we must, I think, hereafter consider the Salenidæ simply as a subfamily of the Cidaridæ." Mr. Agassiz gives an admirable description of the species of *Salenia* which Count Pourtales dredged up off Florida in 275 fathoms; and as the buccal membrane was preserved he could notice that his determination to abolish the Salenidæ, Wright, and to form a subfamily of the Cidaridæ was not without its difficulties; for the serial continuation of the ambulacral tubes does not take place through imbricated scales in the actinal membrane. He instances, however, the Diadematidæ as presenting, in *Diadema* and *Asthenosoma*, similar differences.

The general and minute structures, the nature and homologies of the anal plates, and the classificatory position of the Salenidæ are thus full of interest; and I propose to notice in

* Wright, Palæont. Soc. Publ. vol. xxiv. p. 144.

† Tate, Quart. Journ. Geol. Soc. vol. xxxiii. p. 256.

‡ A. Agassiz, "*Echini* of the Eastern Coast of the United States," Illust. Cat. Harvard Coll. no. vii. 1872, p. 261; Lovén, "Études sur les Echinoïdes," Kongl. Svenska Vetenskaps-Akad. Handlingar, Bd. ii. no. 7, p. 27.

§ = suranal of Wright.

this first communication two morphological points, one of which bears on the question of classification to a certain extent, and the other adds to our knowledge of the structures of the appendages of the test.

The specimen of a recent *Salenia* which I have studied is in the possession of Prof. Huxley, and was dredged up during the expedition of H.M.S. 'Challenger'; owing to his kindness I have been permitted to wash the apical disk carefully and to examine the form at my leisure. The specimen has its extraordinary spines upon it, and the actinal membrane is preserved; the apical disk is perfect, and the relative position of the permanent anal plate can be decided.

On careful and gentle washing under a microscope, much mud and *Globigerinæ* were removed from the peristome and anal plate and membrane. The result was that sphæridia were noticed in each ambulacrum; and short-stemmed globose-headed pedicellariæ, like those seen on the actinal membrane by A. Agassiz, were found distributed along the ambulacra between the rows of spines, and almost invariably between the numerous blunt spines of the apical disk. They were noticed also sparingly in the interambulacra.

The sphæridia of this *Salenia* (a variety of *S. varispina*?) are to be found in each ambulacrum; two are situate between the spines nearest the peristome and its edge, one in advance of the other, and they are flanked by the last two tentacles, which are rather convergent. The sphæridia are unequal in size, but have an elongated globose shape, not very unlike a stout form of those of *Strongylocentrotus dröbachensis.* Each is placed on a short and narrow stem, and is seated on a minute tubercle, and the smaller one is nearest to the smallest terminal spine of the ambulacrum. They are brilliantly glassy in appearance, and a faint longitudinal striation and a pigment-spot are visible on some. They are strikingly visible over the granular test, which has minute pigment-spots; and (considering that the *Salenia* only measures $\frac{3}{10}$ inch across the test) they are large. One other sphæridium is visible slightly higher up, and just within the range of the pores and external to the larger ambulacral spines. It is longer and larger than the others, but presents all the usual characters of these interesting structures. In height the medium-sized sphæridium is about $\frac{1}{200}$ inch, and is rather less thick than the smaller globose-headed pedicellariæ; but its short graceful stalk and base are very much shorter than those of these last-mentioned appendages to the test. The sphæridia and pedicellariæ are less transparent than in *Strongylocentrotus.*

In noticing the different characters which are common to sphæridia and true spines, Lovén very justly observes that there is a certain resemblance between the club-shaped radioles of certain extinct Cidaridæ and the sphæridia of some other groups. Considering the great diversity of the shape of the spines in modern *Saleniæ* it is therefore very necessary to be assured that the bodies just described are not young spines. But their glassy appearance, their remarkable position at the peristome end of the ambulacra alone, and their absence from the interambulacra tend to prove that their resemblance to the sphæridia of *Echini* is on account of their being identical structures. Very minute globular spines of *Salenia* are striated and prickly on the top.

Hitherto sphæridia have not been found in the Cidaridæ, and therefore their presence in the *Salenia*, with the absence of a series of imbricating buccal plates perforated by tentacles, removes the genus and probably its congeners from their present classificatory position.

The pedicellariæ were noticed by A. Agassiz on the buccal membrane; but he did not find them on the test. Those in the specimen before me are very regularly placed, and their white, blunt, globose heads contrast very strongly with the spinose ornamentation of the apical disk especially. Their pedicle is moderately stout, often slightly bent, irregular in its calibre, and never sufficiently long on the apical disk to permit of the head being raised much above the level of the surrounding structures. The head somewhat resembles those so common on the buccal membrane of *Echinus norvegicus*, but it is more globose and the texture is denser. Some are found on the small plates of the periproct. The pedicellariæ with the longest stalks are in more or less regular series in the ambulacra between the rows of club-shaped spines. In the interambulacra the scanty pedicellariæ have often long stalks and small globose heads, becoming finer towards their top.

EXPLANATION OF PLATE II. B.

Fig. 1. Peristomial end of an ambulacrum, with sphæridia, spines, and tentacles, magnified. A pedicellaria is in the background.

Fig. 2. Sphæridium, magnified.

Fig. 3. The upper sphæridium, magnified.

Fig. 4. Part of the apical disk and pedicellariæ, magnified.

Fig. 5. Pedicellaria from an ambulacrum, magnified.

Fig. 6. Pedicellaria from an interambulacrum, magnified.

IX.—*On a small Collection of Orthopterous Insects of the Families* Phasmidæ and Mantidæ *from Australia and New Britain, with Descriptions of four new Species.* By Prof. J. Wood-Mason, Deputy Superintendent, Indian Museum, Calcutta.

The insects described in the following pages have all been recently received by me from my valued correspondent Mr. Charles French, of the Royal Botanic Gardens, Melbourne, South Australia, who is responsible for the correctness of the localities here given.

The occurrence in New Britain of near allies of two species from the Fiji Islands is of particular interest.

Family **Phasmidæ**.

1. *Bacteria Frenchi*, n. sp.

♀. Slender, cylindrical, uniform dark brown. Head slightly narrowed from before backwards, and armed right between the eyes with a pair of minute spines. A most distinct raised median dorsal line runs along the whole length of the body. Mesonotum and metanotum granulated, some of the granules being developed into minute spines, especially on the former. Both divisions of the metanotum and the dorsal arcs of the five basal segments of the abdomen each with a small rounded lobe at the hinder extremity. Abdomen above sparingly obsoletely granulated, and with three smooth longitudinal ridges on each side of the middle line on all the segments except the last two, on to which the three median ones only are continued, and gradually attenuated from the base of its fifth segment to its extremity; two terminal segments strongly carinate, especially the last, which is acute-angled at the extremity; sixth ventral segment with an obtuse rounded process at its hinder end. The operculum, which is longitudinally but slightly convex, rounded at the free end, and carinate along its apical half, reaches only to about the middle of the last dorsal segment. Cerci minute, invisible from above. Legs simple; first joint of the tarsus in all rather longer than the rest taken together.

Total length 2 inches 5 lines; antennæ 9·75 lines; head 1·25 line; prothorax 1 line; mesothorax 6·25 lines; metathorax 4 lines; abdomen $13 + 3{\cdot}5 = 16{\cdot}5$ lines; fore femur 7 lines, tibia 7·5; intermediate femur 6 lines, tibia 7·5; posterior femur 7·5 lines, tibia 9; breadth about 1 line.

Hab. North Australia (*C. French*). A single specimen, preserved in alcohol.

The insect (*B. tenuis*, Hope, MS.) figured by Westwood, on pl. xxvii. fig. 2 of his monograph, as the male of *B. cœnosa* is possibly the opposite sex of this species, slight indications of lobes at the ends of the segments of the abdomen being to be seen in Westwood's figure.

2. *Phibalosoma novæ-britanniæ*, n. sp.

♀. Closely allied to *P. pythonius* and to *P. apollonius*, both from the Fiji Islands. It has the spiny thorax of the latter, and the abdomen of the former. It differs from *P. pythonius* not only in its spiny thorax and shorter antennæ, but also in the form of the fifth, sixth, and seventh dorsal segments of the abdomen, which gradually widen from the base to the apex, so that the abdomen has in this part conspicuously serrated margins; and from *P. apollonius* not only in the form of the abdomen, but apparently also in its almost completely triquetrous four posterior thighs and tibiæ, all of which have a row of sharp spines along the middle of the under surface, and in having the first joint of all the tarsi longer and slenderer. The mesosternum has two parallel rows of spines along the middle, of which no mention is made by Westwood in his description of the latter. The fore legs are unfortunately wanting.

Total length 8·5 inches; antennæ 24·5 lines; head 6·5 lines; prothorax 4·5 lines; mesothorax 20·5 lines; metathorax 12·5 lines; abdomen 4 inches 3 lines + 9 lines + operculum 7 lines = 5 inches 7 lines; intermediate femur 20, tibia 20, tarsus 9·75 lines; posterior femur 22, tibia 24, tarsus 11 lines.

Hab. New Britain (*C. French*). A single specimen, preserved in alcohol.

3. *Phyllium novæ-britanniæ*, n. sp.

♀. Closely allied to *P. lobiventre* from the Fiji Islands, which it resembles in the form and ornamentation of the mesonotum, in the granulation of the head, legs, and margins of the segments of the body, in the structure of the legs and tegmina, and, finally, in size, but from which it differs in the rudimentary condition of the lobe on the inner side of the fore tibiæ, and, conspicuously, in the form of the abdomen; this widens gradually to the middle of the third segment, whence its sides converge slightly and gradually to the middle of the sixth segment, which curves inwards to the base of the seventh, this with the last two forming a triangular mass with slightly hollow sides.

Total length 2 inches 4·5 lines; head 2·75 lines; prothorax

2·25 lines; mesothorax 2 lines; abdomen 13·5 + 4·75 = 18·25 lines; breadth of abdomen at base 5·25, at angulation of third segment 13·5, at junction of fifth and sixth 11, at junction of sixth and seventh 7·5 lines; length of tegmina 18·5, breadth of tegmina 7·25 lines.

Hab. New Britain (*C. French*). A single gravid female, preserved in alcohol.

Family **Mantidæ**.

Subfamily HYSTEROMANTINA.

4. *Orthodera prasina*, Burmeister.

Orthodera prasina, Burmeister, Handb. d. Entom. Band ii. 2te Abtheil. S. 529 (1838).
Mantis rubrocoxata, Serville, Hist. Nat. des Ins. Orthoptères, p. 203, ♀ (1839).
Mantis Hobsonii, Le Guillou, Rev. Zool. Soc. Cuv. t. iv. p. 293 (1841).
Bolidena Hobsonii, Blanchard, Voy. de l'Astrolabe et la Zélée, Zool. t. iv. p. 356, pl. i. fig. 7, ♀ (1853).

Hab. A single female, preserved in alcohol, from North Australia (*C. French*).

5. *Orthodera marginata*, Saussure.

Orthodera marginata, Saussure, Mélanges Orthopt. 4ᵉ fasc. p. 8, pl. 8. fig. 1, ♀ (1872).

Hab. A single specimen of the female, preserved in alcohol, from North Australia (*C. French*).

6. *Archimantis armatus*, n. sp.

♀. Robust. Prothorax with its lamellar lateral margins coarsely toothed from end to end; under surface of neck covered with coarse spiniform tubercles, one of which, larger than most of the rest, is placed immediately in front of the insertion of each fore leg. Organs of flight reaching a little beyond the extremity of the second segment of the abdomen: tegmina opaque throughout, except along the sutural margin and the anal area, which are hyaline; the stigma has a black-brown spot at either end: wings with the marginal area alone opaque, the rest perfectly hyaline. Terminal joint of cerci broadly rounded off at the extremity, not pointed. Anterior coxa furnished with 6–8 blunt spines, between some of which are one or two smaller ones; tibia with 17 teeth on the inner and 11–13 on the outer edge.

Total length 104 millims.; prothorax 37·5, of which the neck is 10; width of prothorax at supracoxal dilatation 7·33; height of head 7, breadth of head 10·5; length of mesonotum and metanotum taken together 18·5, of abdomen 47·5, of cerci 12, breadth of cerci 1·33; length of fore coxa 20, femur 24, tibia (straight portion) 10, first tarsal joint 8; length of intermediate femur 24, tibia 24, first tarsal joint 5·5; length of posterior femur 30, tibia 34, first tarsal joint 9; length of tegmina 33, of stigma 6, breadth of tegmina 10.

Hab. A single specimen, preserved in alcohol, from North Australia (*C. French*).

7. *Tenodera australasiæ*, Leach.

Mantis australasiæ, Leach, Zool. Miscellany, p. 78, tab. xxiv. ♀.

Hab. North Australia (*C. French*). A single specimen, in alcohol.

Subfamily PROTEROMANTINA.

8. *Phthersigena Kraussii*, Saussure.

Haania Kraussii, Saussure, Mél. Orthopt. 4e fasc. p. 75, pl. 8. fig. 26.

Hab. Two adult and two immature females from North Australia (*C. French*).

Calcutta, May 4, 1877.

X.—*On* Ovulites margaritula. By Professors W. K. PARKER and T. R. JONES.

IN the 'Ann. & Mag. Nat. Hist.' for April 1860, ser. 3, vol. v. pp. 292, 293, we described the little egg-shaped and pearl-like Foraminifer, named *Ovulites margaritula* by Lamarck, and its elongate varieties. At that time we referred it to the *hyaline* group of Foraminifera; but we have lately discovered that it belongs to a different series. Some specimens in particular are beautifully smooth, polished, and subtranslucent, like the most delicate of the *Peneroplides*; and we mistook this for the "clear, smooth, glassy appearance" belonging to the *hyaline* Foraminifers. Far more usually the specimens are quite opaque and *porcellaneous*; and this appearance we wrongly referred to fossilization.

Whether ovoid, clavate, or cylindrical, *Ovulites* is really one of the Dactyloporidæ. D'Orbigny placed *Ovulites* next to *Dactylopora* among his *Monostegia* (in 1851), but these comprise some very heterogenous kinds.

The apertures with which the shell-wall of *Ovulites* is perforated are not the tubules of a *hyaline* Foraminifer (though homologous with them), but the passages for large bulbous threads of sarcode, such as in *Dactylopora* pass from the internal mass, at regular intervals, as single or multiple stolon-like threads. These may or may not swell into ganglion-like beads, occupying chamberlets in the thickness of the wall, and communicating with the exterior, more or less freely, by further threads of sarcode. In *Ovulites* the thread-like process was swollen before it reached the surface, and either communicated with the exterior by a small aperture in the shell, or was covered in on the outside. Each of these little processes from the large inner sarcodic mass was invested with its own shell-matter, forming a minute, subhexagonal, perforated block, fitting side by side, with hundreds of others, to form the ovoidal or cylindrical shell. This may be open at both ends, like a distomatous *Lagena*.

The external pores in *Ovulites* are elliptical or suboblong, smaller, in proportion, than in *Dactylopora* and more irregular, and they are bounded by the sutural subhexagonal outlines, or areolation, above indicated. In other words, the general wall consists of more or less six-sided, close-fitting plates, set edge to edge, and each pierced with an elliptical aperture, leading to a round chamber and narrow passage, opening on the inner side. The subhexagonal blocks are homologous with the longitudinally perforated needle-prisms of *Nummulina*, in which each pseudopodial thread is invested with its prismatic coat (as Dr. Carpenter has explained, 'Introd. Foram.' p. 256); and the whole, fitting closely side by side, constitute the shell-wall. In *Globigerina*, also, this prismatic structure is well known, and has been figured by Dr. Wallich in 'The Atlantic Sea-bed,' part i. pl. 6, and in his 'Biology of *Globigerina*' (1876, 8vo, Van Voorst). Here the thick and deeply areolated shell, shown by fig. 6, is homologous with some *Dactyloporæ*, in which the bulbous threads of sarcode, penetrating the shell, thicken into beads (see fig. 9, *Orbulina*); and these external beads, becoming continuous, invest all the structure (fig. 7), and produce a secondary shell-growth, not only as in *Orbulina* and *Globigerina*, but in *Pulvinulina*, *Lagena* even, and many other Foraminifers. The isolation of small pyriform or flask-like morsels of sarcode in the shell-wall of *Globigerina* (*op. cit.* p. 75, figs. 17, 18, 19; see also 'Proc. Roy. Soc.,' February 1875, p. 236) is evidently homologous with the enclosure of sarcode lobes in the walls of the Dactyloporidæ. Dr. Carpenter has already remarked that in *Dactylopora* and *Globigerina* there is a corresponding absence of stolonal communication between the chambers ('Introd. Foram.' p. 182); and we may add that *Globigerina* furnishes the intermediate and connecting link between the areolated structure of *Dactylopora* and the finely prismatic tissue of the Nummuline shell.

In some cases, especially in the thin rod-like form of *Ovulites*, external pores cease to exist, the apertures being encroached on and closed by delicate shell-matter; and only minute irregular wrinkles remain on the surface. In a short, thick, biclavate (dumb-bell) Ovulite the relatively large chamberlets are closed with translucent films. Some subcylindrical *Ovulites* approach very closely in character to the smallest pipe-like *Dactyloporæ* (*Gyroporella?*, Gümbel) with vesicular wall-chambers.

With their large internal mass of sarcode and its numerous simple or complex lateral processes, the allied groups of *Acicularia*, *Ovulites*, and *Dactylopora* (*Haploporella*, *Dactyporella*, &c., Gümbel*) may be regarded as opaque calcareous frameworks in sarcode, just as the Polycystines have a siliceous skeleton in their sarcodic mass. The Dactyloporidæ are thus clearly distinguishable from the Miliolidæ and other *porcellaneous* Foraminifera, as indicated by one of us in the 'Monthly Microscop. Journ.' for February 1876, pp. 65, 89.

May 25, 1877.

MISCELLANEOUS.

Zoology of the 'Challenger' Expedition.

To the Editors of the Annals and Magazine of Natural History.

As, in a letter upon this subject in the number of the 'Annals and Magazine of Natural History' for May last, Dr. Martin Duncan, writing as President of the Geological Society, has stated that he speaks "at the instance of a very considerable number of Members of learned Societies," we the undersigned wish to state that we do not agree in the strictures passed by Dr. Duncan upon the manner in which Sir C. Wyville Thomson has distributed the specimens collected by the 'Challenger' Expedition for description.

So far as we have had an opportunity of judging, we are perfectly satisfied that Sir C. Wyville Thomson, in the arrangements which he has made as regards these collections, has acted consistently with the best interests of science.

It was, in our opinion, Sir C. Wyville Thomson's duty to secure the aid of the most competent naturalists without regard to their nationality; and, even if it were proper that national jealousies should be imported into science, Sir C. Wyville Thomson can hardly

* Abhandl. k. bayer. Akad. Wiss. 1872.

be reproached on this score, when it is considered that two thirds at least of the naturalists whose aid he has obtained are Englishmen.

Geo. J. Allman.	F. DuCane Godman.
Geo. Busk.	Jos. D. Hooker.
William B. Carpenter.	T. H. Huxley.
Charles Darwin.	St. George Mivart.
Francis Day.	A. M. Norman.
H. E. Dresser.	Osbert Salvin.
W. H. Flower.	P. L. Sclater.
A. H. Garrod.	Tweeddale.

To the Editors of the Annals and Magazine of Natural History.

Gentlemen,—As I have read, in a late number of 'Nature,' that a most interestingly signed declaration of approval of Sir C. W. Thomson's administration will be sent to you for publication, I venture to express my sincere regret that I should be opposed to the opinions it contains. I believe that the best interests of science are served by fostering, and not by depreciating and discouraging, national talent; and I imagine catholicity in science, in the sense in which it is supposed to be realized by Sir C. Wyville Thomson's action in the matter, to be a mischievous delusion. I would observe that as the groups collected by H.M.S. 'Challenger' have very different values in respect of the higher physical and biological questions which it was the primary object of the expedition to investigate, the numerical comparisons urged in Sir Wyville Thomson's favour by the editorial "We" of 'Nature' are of no force.

Moreover, as in the great Austrian, German, French, and Scandinavian expeditions the results were almost without exception worked up at home, the Americans and Sir C. Wyville Thomson had better follow the same common-sense plan.

Irreconcilable as I am to Sir C. Wyville Thomson's administration, I wish to express my sorrow if I have written any words which may be personally offensive to him.

Yours &c.,

June 22, 1877. P. Martin Duncan.

The Locomotor System of Medusæ.

In the seventeenth volume of the present series of this journal (p. 246) we printed, from the 'Proceedings of the Royal Society,' the report of a paper by Mr. Romanes on the above subject. In publishing his memoir in the 'Philosophical Transactions,' Mr. Romanes appended to it a postscript referring to an anticipation of his results published by Prof. Eimer of Tübingen. The latter gentleman writes to us to complain that no notice of the contents of this postscript appears in our pages; but this, of course, was impossible, our publication being antecedent to Mr. Romanes's acquaintance with Dr. Eimer's memoir, which, he informs us, appeared in the 'Sitzungsberichte der phys.-med. Gesellschaft zu Würzburg,' in December 1873.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FOURTH SERIES.]

No. 116. AUGUST 1877.

XI.—*On the Structure of* Peripatus novæ-zealandiæ. By Capt. F. W. Hutton.

To the Editors of the Annals and Magazine of Natural History.

Gentlemen,—

I do not wish to enter into a discussion with Mr. Moseley about *Peripatus*; for the differences between us can only be settled by further observation, and, as I am just commencing the removal of the museum collection into a new building, it will be some time before I can devote further attention to the subject; but as he has accused me, both in 'Nature' (Nov. 1876) and the 'Annals and Magazine of Natural History' (Jan. 1877), of publishing imperfect observations, and of drawing and describing structures which have no real existence, I must ask you to allow me to say a few words in self-defence.

My paper was published before I knew that Mr. Moseley had examined any specimens of *P. novæ-zealandiæ* and found some of them to be males. I do not doubt for a moment that Mr. Moseley has seen males; and my failure in this respect may perhaps be due to my having selected large specimens for dissection. But that *P. novæ-zealandiæ* is also hermaphrodite I feel quite sure, notwithstanding Mr. Moseley's *ex cathedrâ* statement to the contrary. All the figures in my plate were drawn with a camera, except figs. 1 and 8, which are diagrammatic; and in fig. 8 the testes and vasa deferentia were copied from camera drawings, of which I enclose the originals*; and as I have been working with a microscope for nearly fifteen years it is not likely that I should publish any facts which I had not taken the trouble to verify.

After all, the difference between us on this point seems to be owing to one or the other having turned the ovary inside out. I state in my paper that the ova are developed on the interior of the ovary, and that the testes (probably the same as the masses of spermatozoa of Mr. Moseley) lie below it, outside, but quite separated from it. Mr. Moseley in his paper (which, thanks to the kindness of Mr. Travers, I have been able to see) says that the masses of spermatozoa are inside the ovary, while the ova are developed in sacs "hanging from the margin of the ovary," and that he has found spermatozoa "amongst the ovisacs on the exterior of the ovary" (p. 768). I leave it to him to explain these curious facts.

Mr. Moseley says that my figures are "most crude and imperfect." This I allow; for I have not the advantage of being able to employ a professional artist, or even of correcting proofs. But I maintain that they are accurate, which cannot be said of all of Mr. Moseley's. For example, in pl. lxxv. figs. 7, 8, and 10, the eyes are placed on the side of the head halfway between the mouth and the antennæ; whereas they are really situated on the top of the head, at the base of the antennæ, as shown in my plate, fig. 6. I will not be so rude as to say that Mr. Moseley "must have been entirely deceived in imagining he saw" them in that position; but I think that he has allowed his theory to run away with him.

I do not see why "cross fertilization would never occur," if there are males; but even if it were so, we ought not to let a theory interfere with our observation of facts.

I quite understand the importance of determining the existence of foot-jaws in *Peripatus*, if such exist; but I think it more important to state the facts exactly as they appear to me.

But there are other points of difference between us which Mr. Moseley has not mentioned, which, if not of such high theoretical interest, are still important as tests of accuracy of observation. For instance, I say (p. 366) that the ovary is placed above the stomach, while Mr. Moseley says (p. 766) that it lies "below that viscus." Again, Mr. Moseley's tracheæ are evidently the equivalents of my spiral fibres. Now both these points can be easily tested by the examination of specimens preserved in alcohol; for the supposed tracheæ will be found in abundance on the lower portion of the oviducts.

* [We hold these camera drawings at Mr. Moseley's disposal, should he wish to inspect them.—Eds.]

Mr. Moseley also describes the slime-glands as "a series of elongate ramified tubes," while I describe them as a single branched tube. These glands in *P. novæ-zealandiæ* are certainly very unlike Mr. Moseley's figure (pl. lxxii. fig. 1). They may be different in the two species; but Mr. Moseley does not mention it when pointing out the differences between them.

In conclusion I wish to thank Mr. Moseley for his courtesy in telling me exactly what I saw, what I did not see, and what I imagined I saw; but he will, I hope, excuse me if I still continue to use my own eyes in preference to looking through his.

I am, &c.,
F. W. HUTTON.

Otago Museum, Dunedin, N. Z.
March 20, 1877.

XII.—*New Species of Heterocerous Lepidoptera of the Tribe* Bombyces, *collected by Mr. W. B. Pryer chiefly in the District of Shanghai.* By FREDERIC MOORE, F.Z.S.

Fam. Ægeriidæ.

Ægeria howqua.

Wings hyaline; anterior and posterior margins, apex, narrow discocellular band of fore wing, and veins of both wings black. Cilia cinereous brown. Body blue-black; collar and three narrow segmental bands on abdomen yellow, the bands on alternate segments from the base; anal tuft broad and slightly yellow-fringed. Palpi black above, white beneath. Body beneath streaked with white. Legs black; tibiæ and tarsi white-streaked.

Exp. $\frac{5}{8}$ inch.

Hab. Shanghai. In coll. W. B. Pryer.

SORONIA, n. gen.

Fore wing long, narrow; subcostal vein five-branched, first, second, and third arising before end of the cell, fourth and fifth beyond; cell long; discocellulars sinuous; two radials; median vein two-branched, the branches short; submedian extending along hind margin. Hind wing long, trigonal, apex pointed, exterior margin very oblique, straight, anal angle rounded; subcostal vein two-branched; median vein three-branched, the branches arising together before end of the cell, discocellular straight; submedian and internal veins joined together near the base. Body short, stout, naked; abdomen pointed. Legs short; tibiæ thickly pilose above, armed with two pairs of spurs beneath. Antennæ slender, setaceous. Palpi rather long, slightly pilose.

Soronia cuprealis.

Fore wing dark cupreous; hind wing hyaline, slightly speckled with cupreous brown externally. Cilia fuliginous black. Body black; collar and band across thorax yellow. Abdomen with three yellow segmental bands, the upper near base, the two lower near apex; tip of abdomen beneath yellow, the two following segments banded with white. Palpi and streak on side of head white. Legs black above, white beneath. Antennæ black.

Exp. 1 inch.

Hab. Shanghai. In coll. W. B. Pryer.

Melittia sangaica.

Wings yellowish hyaline; fore wings with the borders, a narrow apical and a discocellular band, and the veins of both wings black; a short veinlet within the cell; marginal border of hind wing narrowly lined with black. Base of fore wing and abdominal border yellow-speckled. Cilia blackish cinereous. Body purplish black; collar and thorax behind golden yellow; abdominal segments with narrow yellow band; abdomen beneath yellow. Antennæ black above. Palpi yellow, black-fringed; fore legs yellow beneath, black above; femora and tibiæ of mid legs clothed beneath with yellow hairs, above with black, ochreous, and a few white hairs; tarsi black; hind legs densely clothed with long hairs, black beneath, yellow above, and ochreous on outer side of tibiæ.

Exp. $1\frac{4}{5}$ inch.

Hab. Shanghai. In coll. W. B. Pryer and F. Moore.

Melittia longipes.

Wings hyaline; fore wing with purplish black anterior and hind margins, apical band, broad patch at end of the cell, and veins of both wings; hind wing with slight cupreous brown outer margin and abdominal border. Cilia of both wings cinereous brown. Antennæ black above, speckled with lilac-white. Body black; abdomen ochreous-speckled, segments with narrow lilac-white band. Front of thorax above with ochreous collar. Palpi white, fringed at tip with black. Abdomen white. Fore and mid legs clothed above with short black and ochreous hairs, largely interspersed with white hairs; tarsi naked, black; hind legs very long, femora clothed with longish white hairs, and tibiæ with long tufted black hairs, interspersed above with a few ochreous red and white hairs; tarsi clothed with very short tufted black hairs.

Exp. 1 inch.

Hab. Shanghai. In coll. W. B. Pryer and F. Moore.

Fam. **Agaristidæ.**

Seudyra subflava.

Upperside—fore wing with the apex and a broad band along hind margin dark chestnut-brown, washed with violet, the former traversed by a median longitudinal red-pointed black streak, and crossed by a whitish-speckled sinuous line; intermediate space from the base ochreous grey, profusely speckled with dark brown, the veins grey-lined; a transverse subbasal and a double discal distorted recurved ochreous-grey line; a small orbicular and large reniform pale-bordered spot; a marginal row of black lunular spots: hind wing dark golden yellow, with a marginal golden-brown irregular-bordered band, which is broken at anal angle and ascends some distance upwards, the band traversed by a narrow yellow marginal lunular line; a small black spot in middle of cell; cilia grey. Thorax chestnut-brown, grey-speckled. Abdomen and legs golden yellow, with a short basal dorsal brown tuft. Underside pale golden yellow; both wings with a small black spot in the middle of the cell, and the fore wing with a larger spot at end of cell; fore wing also with a pale narrow chestnut-brown decreasing band curving across outer margin from apex; hind wing with a much less distinct and smaller band.

Exp. $1\frac{7}{8}$ inch.

Hab. Snowy valley, Province Chekiang. In coll. W. B. Pryer.

This species is most nearly allied to *S. venosa*, from Darjiling, and may be distinguished by the entirely different underside.

Fam. **Zygænidæ.**

Pryeria, n. gen.

Fore wing long, narrow, apex produced, outer margin very oblique; costal vein moderately stout, extending to two thirds of the wing; subcostal slender, five-branched, first branch arising from before the end of the cell and terminating before the apex, second and fifth branches at end of cell, third and fourth very short, emitted from near end of second at apex;

cell long, rather broad at its end; discocellular veins short, oblique, sinuous, emitting a recurrent discoidal veinlet, which extends within the cell to its base; two radials arising close together from upper discocellular; median vein running close to subcostal at base, three-branched at equal distances apart; a submedian and an internal vein curving from base to above posterior angle at equal distances apart between median and the outer margin, and joined together at their middle by a short transverse veinlet: hind wing short, somewhat oval; costa convex, apex acute; abdominal margin short; costal vein short, subcostal slender and extending to apex; cell broad; discocellulars long, sinuous; a discoidal veinlet emitted from angle of lower discocellular, and extending within to the end of the cell; median vein three-branched; submedian and internal veins joined together near base and extending to above posterior angle. Body short, densely pilose; abdomen with long apical tufted hairs. Antennæ broadly bipectinate, plumose. Legs long, slender; femora and tibiæ slightly pilose. Somewhat allied to *Phauda*, Walker.

Pryeria sinica.

Wings hyaline, fuliginous, sparsely covered with short, delicate, hair-like scales; base of fore wings tinged with golden yellow. Thorax with a few golden hairs on each side. Abdomen golden yellow, tuft black. Antennæ, thorax, and legs black.

Exp. 1 inch.

Hab. Shanghai. In coll. W. B. Pryer.

Fam. **Chalcosiidæ.**

Erasmia sangaica, n. sp.

Male. Black: fore wing with an ochreous-yellow, subbasal, transverse, oblique, irregularly sinuous band which is incurved hindward; an irregular oblique interrupted discal series of blue-bordered white spots, and two similar spots beyond nearer the apex; some metallic green and blue streaks at base of wing: hind wing with a round subapical and irregular median discal series of blue-bordered white spots; an indistinct ochreous spot near base of anterior margin; abdominal margin broadly streaked with steel-blue. Thorax metallic blue; abdomen and legs greenish grey. Underside as above; ochreous spot on hind wing prominent.

Exp. $3\frac{2}{8}$ inches.

Hab. Chinkang, near Shanghai. In coll. W. B. Pryer.

Fam. **Lithosiidæ.**

Lithosia alba.

Male and *female.* Upperside pure silky white. Underside—fore wing cinereous brown, cilia white: hind wing as above. Antennæ and legs brownish cinereous.

Exp. 1 inch.

Hab. Shanghai. In coll. W. B. Pryer and F. Moore.

Miltochrista decussata.

Female. Yellow, palest on hind wing; fore wing with two median transverse narrow black cross lines, small basal spots, a transverse discal sharply pointed sinuous line, and a submarginal parallel series of short streaks. Thorax spotted with black. Underside paler, base of costa and subapical streaks on both wings blackish. Legs with black bands.

Exp. $1\frac{1}{12}$ inch.

Hab. Shanghai. In coll. W. B. Pryer.

Miltochrista sinica.

Pale ochreous red, palest on hind wing; fore wing with a narrow transverse median nearly straight blackish line, some spots at base, and longitudinal short discal streaks, one being on each vein, a spot at end of cell, and a marginal row of spots. A black spot on each side of thorax. Underside paler, markings indistinct. Legs streaked with black.

Exp. $\frac{6}{8}$ inch.

Hab. Shanghai. In coll. W. B. Pryer and F. Moore.

Setina albosericea.

Female. Silky yellowish white, costal edge and cilia yellow: fore wing with a black spot at the base, two median transverse oblique series, and a marginal series of black spots: hind wing with two less distinct black spots at apex. Thorax, head, antennæ, legs, and abdomen beneath yellow; thorax and abdomen above whitish; two black spots on middle of thorax. Underside pale yellow, spots indistinct.

Exp. $1\frac{3}{8}$ inch.

Hab. Shanghai. In coll. W. B. Pryer.

Setinochroa sanguinea.

Fore wing dark vermilion-red, edge of costa and outer margin lined with black; a submarginal series of black spots; cilia brown: hind wing reddish black, with basal and marginal red streaks; abdomen blackish above; antennæ, spot on vertex, and legs blackish. Underside red, margins and apical streaks only black.

Exp. $\frac{7}{10}$ inch.

Hab. Shanghai. In coll. W. B. Pryer and F. Moore.

Fam. **Arctiidæ.**

Spilosoma mandarina.

Male. Upperside deep buff colour: fore wing with an oblique discal continuous linear series of small black vein-divided narrow spots, and a short median submarginal series of smaller similar spots; a small dot near base of submedian vein: hind wing suffused with red on abdominal border; with two vein-divided prominent black spots near anal angle, a small dot near apex, and a prominent rounded spot at end of cell. Abdomen above crimson, with dorsal and two lateral rows of black spots. Underside slightly suffused with red on base of fore wing; markings as above, but more prominent; also a large black cell-spot on fore wing. Antennæ, front of head, sides of thorax, palpi at tip, pectus, and legs above black. Palpi at sides, fore femora, and tuft at sides of thorax beneath crimson.

Exp. $2\frac{2}{10}$ inches.

Hab. Shanghai. In coll. W. B. Pryer and F. Moore.

Spilosoma howqua.

Upperside pale buff-colour. *Male*: Fore wing with an oblique lower discal series of black spots, each spot crossed by a vein, a spot near base of hind margin, and an upper submarginal series of smaller spots: hind wing with a submarginal series of four larger vein-divided black spots, and a smaller spot at the end of the cell. Abdomen above red, with indistinct dorsal and two lateral rows of black spots; a blackish stripe down middle of thorax. Underside paler, markings as above but more confluent; fore wing tinged with ochreous red along anterior margin; a small black spot at end of cell, tuft at base of wing and a short streak on hind margin near the angle. Antennæ, front of head, tip of palpi, tibiæ, and tarsi black; pectus dark brown; fore and mid coxæ and femora, and sides of palpi at base red.

Female with markings on upperside of fore wing less distinct; on hind wing as in male. Underside as in the male, excepting that the spot at end of cells is larger and the tuft obsolete at base of fore wing.

Exp. ♂ $1\frac{4}{8}$, ♀ $1\frac{6}{8}$ inch.
Hab. Shanghai. In coll. W. B. Pryer and F. Moore.

Spilosoma erubescens.

Female. Upperside pale pinky buff-colour; fore wing with two small black spots from hind margin near the angle; hind wing buff-white, broadly suffused with pale crimson on abdominal border. Abdomen above crimson, with dorsal and a lateral row of black spots. Underside—fore wing whitish on hind margin, base of costa and middle of wing suffused with crimson; an indistinct median discal oblique series of dusky spots, and a small spot at end of cell: hind wing broadly suffused with crimson on abdominal border and narrowly along base of anterior margin; a small indistinct dusky spot at end of cell. Front of head, palpi at tip, and pectus dark brown. Antennæ, fore and mid legs above, and spots on hind legs black; femora of all the legs, and tuft at side of thorax beneath, crimson.

Exp. $1\frac{6}{8}$ inch.
Hab. Shanghai. In coll. W. B. Pryer.

Alpenus flammeolus.

Female. Upperside pale purple-tinged ochreous red; edge of anterior margin and cilia of both wings yellow: fore wing with two median transverse recurved series of brown spots with pale borders, a single similar spot at upper end of cell, two indistinct spots below the apex and one near posterior angle: hind wing with a pale divided spot at end of cell. A dorsal series of small black spots on abdomen. Underside paler; fore wing showing only the cell-spot, the two spots below the apex, and the hind wing a prominent cell-spot and an indistinct spot near outer margin between the lower median and submedian veins. Front of head, palpi, legs, and body beneath yellowish. Antennæ, tip of palpi, and streaks on fore and middle legs above brown.

Exp. $1\frac{4}{8}$ inch.
Hab. Snowy valley, Province Chekiang. In coll. W. B. Pryer.

Fam. **Notodontidæ.**

Cerura menciana.

Upperside—fore wing fuliginous grey, veins black; two small black spots at the base, an angular transverse subbasal series of spots, followed by a contiguous transverse tortuous double line, which is twice broken at its costal end; a discal series of longitudinal, elongated, double dentate lines; a marginal row of narrow streaks (one being between each vein): hind wing cinereous white, veins black; a blackish streak crossing end of cell, and a marginal row of prominent black spots. Thorax grey, spotted with black; abdomen above and a lateral row of spots black, beneath and tip above white. Underside cinereous white, veins blackish; markings on fore wings indistinct.

Exp. ♂ $2\frac{1}{8}$, ♀ $2\frac{6}{8}$ inches.

Hab. Shanghai. In coll. W. B. Pryer and F. Moore.

Allied to *C. erminea.* Differs in having narrower and longer wings, sharper dentate markings between the veins, and more prominent basal spots.

Cerura sangaica.

Upperside pale vinous grey: fore wing with a broad subbasal transverse black-speckled band, bordered by ochreous speckles, and preceded by a basal row of black dots; a paler but similar band across the disk, a marginal row of black round spots: hind wing with a marginal row of black round spots, and an indistinct spot at end of cell. Body with greyish black bands. Underside as above, but paler.

Exp. $1\frac{5}{8}$ inch.

Hab. Shanghai. In coll. W. B. Pryer.

Most nearly allied to the North-American *C. cinerea.*

Stauropus basalis.

Upperside pale greyish brown; base of both wings greyish ochreous, divided on the fore wing by a transverse discal bent line; this wing also has a slight narrow streak at end of cell, a submarginal and marginal rows of grey-speckled black points: hind wing with a blackish marginal line. Underside as above, except that the base is paler; abdomen beneath and legs below whitish.

Exp. $1\frac{1}{4}$ inch.

Shanghai. In coll. W. B. Pryer.

Phalera flavescens.

Phalera flavescens, Brem. & Grey, Lep. Nord-China, p. 14 (1853).

Male. Upperside whitish testaceous: fore wing with a large basal, duplex, silvery grey and black spot divided transversely by a red ochreous bar; four similar-shaped spots of the same colour ascending outer margin from posterior angle, the former spot having the grey portion towards base of wing, the latter series towards outer margin; two indistinct lunular wavy yellow lines ascending towards costa from middle of hind margin: hind wing yellowish at base; an indistinct brownish recurved fascia from anal angle. Abdomen ochreous yellow. Antennæ, palpi at sides, and fore legs above brownish. Underside pale glossy whitish testaceous.

Exp. 2 inches.

Hab. Shanghai. In coll. W. B. Pryer.

Lophopteryx sinensis.

Upperside dark umber-brown: fore wing slightly black-speckled, crossed by blackish sinuous subbasal and discal bands; a pale greyish streak obliquely from lobe of hind margin and speckles along the outer veins: hind wing with a short black-and-grey-speckled streak at anal angle. Underside pale brown.

Exp. ♂ $1\frac{2}{8}$, ♀ $1\frac{3}{8}$ inch.

Shanghai. In coll. W. B. Pryer and F. Moore.

Ceira straminea.

Male and *female.* Upperside—fore wing pale straw-yellow, indistinctly speckled with darker yellow at the base; an oblique discal transverse series of brown points terminating at apex, where they are partly confluent; a marginal row of similar points; hind wing whitish cinereous. Body yellow. Legs brown above, yellow beneath. Underside pale straw-yellow; fore wing in the male brownish cinereous in the middle.

Exp. $1\frac{7}{8}$ inch.

Hab. Japan. In coll. W. B. Pryer and F. Moore.

Pterostoma sinica.

Male. Upperside—fore wing pale dull testaceous, with slightly darker narrow longitudinal streaks between the veins; a median series of short chestnut-brown streaks, a submarginal and marginal sinuous line of same colour; inner lobe of hind margin black-and-grey fringed: hind wing brown. Body pale testaceous; abdomen with brownish dorsal tufts. Underside pale testaceous: fore wing longitudinally clouded with brown: hind wing with two outer series of short longitudinal brown streaks between the veins; a narrow marginal brown line and a clavate spot at end of cell.

Exp. $2\frac{2}{8}$ inches.

Hab. Shanghai. In coll. W. B. Pryer.

Allied to *P. grisea*, Brem. et Grey, from the Amur Land.

Fam. **Liparidæ.**

Pantana sinica.

Male greyish white: fore wing with the base, anterior and outer margins broadly bordered with fuliginous brown; a black-speckled irregular-shaped spot between the veins beneath the cell. Thorax fuliginous brown; front of head and palpi ochreous yellow. Abdomen and legs greyish white. Pectinations of antennæ dark brown, shafts grey.

Exp. $1\frac{2}{8}$ inch.

Hab. Shanghai. In coll. W. B. Pryer and F. Moore.

Near to *P. baswara* of Java, but smaller, the hind border of fore wing unmarked, and the hind wing without any marginal brown border.

Lœlia sangaica.

Male. Upperside pale greyish ochreous, whitish ochreous at base of hind wing; fore wing with a short series of six black dots curving hindward from the apex; base of thorax and abdomen whitish. Pectinations of antennæ fuliginous, shaft whitish; front of head, palpi, and legs brownish ochreous. Underside paler, without spots.

Exp. $1\frac{2}{8}$ inch.

Shanghai. In coll. W. B. Pryer.

This species is closely allied to *L. cœnosa* and to *L. sinensis*, Walk.

Redoa alba.

Female. Pure white throughout: wings covered with glossy silky scales, which are disposed on the fore wings in numerous slightly raised transverse folds; a small black-speckled oblique spot at end of cell in fore wing.

Exp. $1\frac{3}{8}$ inch.

Hab. Shanghai. In coll. W. B. Pryer.

The wings in this species are broader than in *R. sinensis*, and differ in the corrugated character of the fore wing.

Redoa sinensis.

Male and *female.* Pure white; wings covered with glossy silky scales; fore wing with an indistinct blackish-speckled spot at end of the cell. Front of head, palpi, bands on femora and tarsi ochreous yellow. Pectinations of antennæ pale brown.

Exp. ♂ $1\frac{2}{10}$, ♀ $1\frac{3}{10}$ inch.

Hab. Shanghai. In coll. W. B. Pryer and F. Moore.

Fam. **Limacodidæ.**

Parasa tessellata.

Male. Upperside—fore wing with a broad median transverse green band, the outer margin of which is bordered by a brown wavy line; the base of wing obliquely vinous brown, outer border yellow, tessellated with brown speckles, and bordered by a narrow brown cilial line and edge: hind wing yellow; edge of cilia brown. Thorax and front of head green; abdomen ochreous yellow. Antennæ, palpi, and legs brown. Underside pale dull greenish yellow, borders brownish. Nearest to *P. consocia*, Walk.

Exp. $1\frac{4}{8}$ inch.

Hab. Shanghai. In coll. W. B. Pryer.

Parasa sinica.

Male and *female.* Upperside—fore wing with a median transverse green band, a large spot at base of costa and broad outer marginal band dark greyish brown: hind wing cinereous; edge of cilia at anal angle dark greyish brown. Thorax and top of head green; abdomen cinereous. Front of head, palpi, and legs brown. Underside greenish cinereous, edge of cilia brown. Near to *P. hilaris*, Westw.

Exp. $\frac{9}{10}$ inch.

Hab. Shanghai. In coll. W. B. Pryer and F. Moore.

Miresa pallivitta.

Male and *female.* Upperside—fore wing bright ochreous brown, greyish externally; a narrow whitish line obliquely from apex to middle of hind margin; hind wing cinereous brown. Cilia darker. Underside pale brown. Near *M. nararia.*

Exp. $\frac{7}{8}$ inch.

Hab. Shanghai. In coll. W. B. Pryer and F. Moore.

Setora sinensis.

Male. Upperside dark umber-brown: fore wing with a median greyish brown band, narrow on the costa and very broad on hind margin; outer margin slightly glossy brown. Front of head, thorax, and legs greyish; legs brown-streaked. Underside uniform brown.

Exp. $1\frac{3}{5}$ inch.

Hab. Shanghai. In coll. W. B. Pryer.

Allied to *S. nitens*, which is also found in North China.

Fam. Drepanulidæ.

Drepana japonica.

Upperside pale vinous lavender-grey; two narrow brown-bordered, yellow, obliquely transverse bands on both wings, the outer band crossing from apex to middle of abdominal margin, the inner band from middle of costa to one third the latter; costal edge and apex of fore wing ochreous yellow; cilia bordered with an inner brown line; a slight curved brown streak on fore wing and a small spot on hind wing at the end of the cell. Prothorax, tip of abdomen, and a band near its base ochreous yellow. Antennæ and front of head, and legs above, brown. Underside pale brownish ochreous, darkest on fore wing.

Exp. $1\frac{4}{8}$ inch.

Hab. Japan. In coll. W. B. Pryer.

Fam. Cossidæ.

Phassus sinensis.

Male and *female*. Upperside pale vinous greyish brown: fore wing with pale-bordered blackish spots on the costa; a triangular blackish-brown patch from base of cell extending beneath and broadly to its end, which is marked at the base by a bright yellow spot, and at the end by an oblique straight broad yellow streak and a few speckles; streaks on hind margin and discal and marginal band composed of grey chalybeate streaks between the veins, the transverse interspaces brown: hind wing paler and slightly diaphanous, apical border with chalybeate streaks. Underside paler, markings indistinct.

Exp. ♂ $2\frac{1}{8}$, ♀ $3\frac{4}{8}$ inches.

Hab. Shanghai. In coll. W. B. Pryer and F. Moore.

XIII.—*Description of four new Species of Birds from the Indian Region.* By Arthur, Marquis of Tweeddale, F.R.S.

Megalurus ruficeps, sp. n.

♀. Lower surface white, faintly tinged with cream-colour on the breast. Flanks pale earthy brown. Under tail-coverts pale dingy isabelline rufous; thigh-coverts of a more decided rufous. Space before the eye and supercilium, passing well behind the eye, greyish white. Forehead, head, and nape pure bright uniform rufous. Back olive-grey, each feather broadly centred by a longitudinal stripe of brown. Uropygium and upper tail-coverts uniform olive-grey. The base of the long and lax uropygial feathers pure dark grey, the tips only being olive-grey. Rectrices above dull ruddy brown, obsoletely barred with narrow brown lines. Quills brown, externally margined with ferruginous olive. Lesser wing-coverts olive-grey; greater tinged with ferruginous.

Wing 2·75 inches, tail 5·25, tarsus 1·0, culmen 0·56.

Obtained by Mr. A. H. Everett at Monte Alban and at San Mateo, in Luzon, during February. Only one example has the sex noted on the label; but as the dimensions of the other individual coincide, it is probably also a female, the dimensions of the males in this genus exceeding those of the females.

Niltava leucura, sp. n.

♂. Crown and nape blue, glossed with pale lazuline, most conspicuous on the forehead and supercilium. Lores and narial plumes black. Back, uropygium, and upper tail-coverts dead lazuline blue. Chin, throat, and breast grey, washed with lazuline blue, which shades into white on the abdomen. Ventral region and under tail-coverts pure white. Flanks bluish ash. Quills brown, margined above with dark blue. Wing-coverts like the head. Wing-lining and axillaries grey. Outer pair of rectrices brown, pure white at the base; next two pairs with the outer webs brown, washed with blue, the base of each and nearly the whole of the inner webs pure white; the fourth pair brown on the inner web and with three fourths of the basal part of the outer web pure white; fifth pair brown, washed with blue on the outer webs; middle pair blue. Bill black; legs light brown.

Wing 3·50 inches, tail 3·0, tarsus 0·87, culmen 0·62.

Obtained by Mr. Limbourg at Taoo, 5000 feet elevation, in Tenasserim.

Dicæum xanthopygium, sp. n.

♂. Above, cheeks, and wing-coverts dark bluish slate-grey. An isolated dorsal patch crimson. Uropygium yellow. Chin, throat, and upper part of breast yellow. Remainder of breast, abdomen, and flanks orange. Ventral region, thigh-coverts, and under tail-coverts yellow tinged with green. Rectrices and quills dark brown; the primaries narrowly margined with white, the secondaries with olive-green.

Wing 1·96 inch, tail 1·06, tarsus 0·50, culmen 0·38.

Discovered by Mr. A. H. Everett at Monte Alban, in Luzon.

Oxycerca Everetti, sp. n.

♂ and ♀. Chin and throat dark brown; breast, flanks, and thigh-coverts warm nutmeg-brown. Abdomen and vent pure white, some of the lower breast-feathers being marked with brown, and some of the flank-feathers being white on their inner webs, brown on their outer, and with white shafts. Under tail-coverts very dark brown or black. Above, wings, and coverts brown, each feather, except the frontal and upper tail-coverts, having a conspicuous pure white central line along the shaft, very prominent on the wing-coverts. Some of the upper tail-coverts tipped with ochre. Rectrices brown, the middle pair broadly margined, the laterals less so, with yellow and greyish yellow. Inner edges of the quills pale rufous seen from underneath.

Wing 1·87 inch, tail 1·75, tarsus 0·56, culmen 0·38.

Several examples of this species were obtained by Mr. A. H. Everett at Monte Alban and San Mateo, in Luzon. The sexes do not differ in plumage. A representative form of *O. leucogaster*.

XIV.—*Report on the Crustacea collected by the Naturalists of the Arctic Expedition in* 1875–76. By EDWARD J. MIERS, F.L.S., F.Z.S., Assistant in the Zoological Department, British Museum.

[Continued from p. 66.]

AMPHIPODA.

Anonyx nugax.

Anonyx nugax, Phipps, Voy. North Pole, Appendix, p. 192, pl. xii. fig. 2 (1774).

Gammarus nugax, Sabine, Append. Capt. Parry's 1st Voy. p. 51 (1821).

Talitrus nugax, Ross, Append. Capt. Parry's 3rd Voy. p. 119 (1826); Append. 4th Voy. p. 205 (1828).

Lysianassa lagena, Kröyer, Dansk. Vidensk. Selsk. Afh. vii. p. 237, pl. i. fig. 1 ♀ (1838); M.-Edw. Hist. Nat. Crust. iii. p. 21 (1840); Bell in Belcher, 'Last of the Arctic Voyages,' Crust. p. 406 (1855).

Lysianassa appendiculosa, Kröyer, *l. c.* p. 240, pl. i. fig. 2 ♂ (1838).

Lysianassa appendiculata, M.-Edw. Hist. Nat. Crust. iii. p. 21 (1840); S. Bate, Cat. Amphip. Crust. Brit. Mus. p. 67, pl. x. fig. 8 ♂.

Anonyx ampulla, Kröyer, Nat. Tidsskr. 2 R. i. p. 578 (1844); Voy. en Scand. Atlas, pl. xiii. fig. 2; Brandt, in Middendorff's Sibirische Reise, ii. p. 131 (1851).

Anonyx lagena, Spence Bate, Cat. Amphip. Crust. Brit. Mus. p. 77, pl. xii. fig. 7 ♀ (1862); Boeck, Skandin. og Arktiske Amphip. i. p. 152 (1872); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarf. p. 300 (1874).

Coll. Feilden: Floeberg Beach, at 10 fathoms, male and females; fire-hole at lat. 82° 24′; and at lat. 83° 19′ at 72 fathoms.

Coll. Hart: Winter quarters of H.M.S. 'Discovery,' at 11 fathoms, two males and four females.

My observations scarcely agree with those of Hr. Buchholz and other authors as regards the rare occurrence of the males of this very common and well-known Amphipod. Of about thirty-six adult specimens collected twelve are undoubtedly males, whereas Hr. Buchholz, after a careful search, found only two examples of this sex in the series obtained by the German expedition. The adult males of this species may generally be distinguished from the females by the far longer flagella of the inferior antennæ, which, when drawn back, reach to the posterior margin of the seventh segment of the body; in the adult females they do not greatly exceed in length the flagella of the superior antennæ, but there are male examples in which this character is less strongly marked. I have not observed any marked differences in the two sexes in the form of the segments of the body and appendages. The length of the largest male, from lat. 83° 19′ N. is $1\frac{1}{2}$ inch (38 millims.); of the largest female, from Floeberg Beach, nearly 1 inch 9 lines (44 millims.).

This species is one of the commonest and most abundantly distributed of the Amphipoda inhabiting the high northern latitudes; it is said by Ross, in Parry's 3rd Voyage (*l. c.*), to be "by far the most numerous of the Crustacea inhabiting the Arctic Seas;" and it is, as has been already stated, of especial interest as being the only species obtained at lat. 83° 19′ N., the most northerly point attained by the Expedition at which animals were collected.

Its range extends along the shores of Arctic America; and it occurs in the White Sea and on the coasts of Greenland, Iceland, Spitzbergen, Norway, and Britain, and in the sea of Okhotsk.

Anonyx gulosus? Pl. III. fig. 2.

Anonyx gulosus, Kröyer, Nat. Tidsskr. 2 R. i. p. 611 (1844–45); in Gaimard, Voy. en Scand. Atlas, Crust. pl. xiv. fig. 2; Spence Bate, Cat. Amphip. Crust. Brit. Mus. p. 370 (1862); Boeck, Skand. og. Arktiske Amphip. p. 157, pl. v. fig. 4 (1872).

Anonyx norvegicus, Lilljeborg, Œfv. Kongl. Vet. Akad. Förhandl. 1851, p. 22.

? *Anonyx Holbölli*, Spence Bate, Cat. Amphip. Crust. Brit. Mus. p. 75, pl. xii. fig. 4 (1862).

Three specimens were collected by Mr. Hart, from the largest of which the following description is taken:—

The body (for one of the group to which this species belongs) is not robust, and is everywhere distinctly punctulated. The head is subacute, but not produced at its antero-lateral angle. The segments of the postabdomen have their antero-lateral angles rounded; and the second and third segments have their postero-lateral angles acute, but not reflexed; the fourth and fifth segments have their posterior margins entire. The eyes are visible, but almost colourless. The superior antennæ in the adult are about half as long as the inferior, and the first (exposed) joint is longer than the second and third taken together; the first joint of the flagellum is about as long as the three following; the accessory flagellum 6–7 jointed, the first joint not much longer than the succeeding. The last two joints of the peduncle of the inferior antennæ are of about equal length, these antennæ are less than half the length of the body of the animal. The first pair of legs are slender and rather long, the wrist and palm subequal, each more than twice as long as broad; the palm not narrowed, but very slightly enlarged towards its distal extremity, which is obliquely truncated, and armed with a series of minute stiff hairs and longer cilia; the finger arcuate and with a subapical tooth; the second pair of legs is long and very feeble, the palm ovate and ciliated on the margins, with a very small finger. The coxa of the fourth pair of legs is not wider at its proximal extremity than that of the preceding pair, but about twice as wide at its distal extremity; the posterior margin is deeply excavated. The basa of the last three pairs of legs are ovate-oblong, those of the last pair rather the broadest at base. The rami of the appendages of the fourth to sixth segments of the postabdomen are subequal and acute. The terminal segment (telson) is more than twice as long as broad at base, narrowing slightly distally, cleft nearly to its base, the apex of each lobe notched at its outer angle, the notch bearing a single cilium. Colour whitish with greenish spots, which are most distinct upon the coxæ and bases of the legs. Length of the largest specimen a little over 1 inch (26 millims.).

Coll. Hart: winter quarters of H.M.S. 'Discovery,' at a depth of 11 fathoms.

I have referred the specimens collected by Mr. Hart with some doubt to the *Anonyx gulosus* of Kröyer, as the antero-lateral margin of the head is less broadly rounded, and the accessory flagellum is longer than that of *A. gulosus* according to Boeck's diagnosis. In the form of the first and second pairs of legs and of the terminal segment they agree well with the descriptions of *A. gulosus*, and particularly in the presence of a tooth on the inner margin of the dactyl, which is mentioned by Lilljeborg as characteristic of that species. From *A. pumilus* they differ in the shorter antennæ, and in the absence of a tooth on the posterior margin of the fifth postabdominal segment.

Anonyx gulosus has been recorded from Greenland, Spitzbergen, Iceland, the coasts of Scandinavia, and Britain.

Onesimus Edwardsii. Pl. III. fig. 3.

Anonyx Edwardsii, Kröyer, Naturh. Tidsskr. 2 R. ii. pp. 1, 41 (1846); Voy. en Scand. Crust. Atlas, pl. xvi. fig 1.
Lysianassa Edwardsii, Goës, Œfv. Vet. Ak. Förhandl. p. 520 (1865).
Onesimus Edwardsii, Boeck, Forhandl. Vidensk. Selsk. Christiania, p. 113 (1871); Skandin. og Arktiske Amphip. ii. p. 167, pl. vi. fig. 4 (1876).

Coll. Feilden: Discovery Bay, at $5\frac{1}{2}$ fathoms, lat. 81° 44′, one specimen; Floeberg Beach, at 10 fathoms, males and females, abundantly.

The eyes in the specimens that I refer to this species are large, red, and subreniform when present; but are in some specimens scarcely distinguishable, and in others entirely absent. The first joint of the flagellum of the superior antennæ is short, not exceeding in length the two or three following joints taken together, or even less, and not quite equalling in length the first joint of the accessory flagellum. In the first pair of legs the palm is but little longer than the wrist and obliquely truncate; the second pair of legs has a short, distally enlarged and truncated palm and small arcuate finger in both sexes. The third joint of the last three pairs of legs is not dilated, the fifth joint a little shorter than the two preceding taken together; the rami of the last pair of uropoda are very short, about as long as the terminal segment. The antero-lateral angle of the head is considerably produced anteriorly. The third segment of the postabdomen is slightly produced upward and subacute at its postero-lateral angle; the terminal segment is broadly semi-oval, with a raised marginal line, very slightly emarginate at its distal extremity, but without a median fissure. The whole animal is coarsely punctulated.

Of this species adult examples of both sexes were collected; of sixteen specimens from Floeberg Beach, in spirits, six are males. Of the females, one example only bears ova. Length of the largest male nearly 10 lines (21 millims.); of the largest female 11 lines ($23\frac{1}{2}$ millims.).

The specimens collected differ from Boeck's diagnosis in one particular; the third segment of the postabdomen is slightly produced upward at the postero-lateral angle. Nothing is said of the form of this segment by Kröyer in his description of the species or in the Latin diagnosis that follows. In Kröyer's figure of the species in the Atlas of the 'Voyage en Scandinavie,' the postero-lateral angle of this segment is represented as not produced upward, but acute. There is, however, a manifest inconsistency between the diagnosis of Boeck and the figures in the Atlas referred to; *e.g.* in *Onesimus plautus* the third postabdominal segment is described by Boeck as "sursum productus acutus," but figured by Kröyer as broadly obtuse and rounded at the postero-lateral angle.

Onesimus Edwardsii has been recorded from Greenland, Spitzbergen, and Britain.

Atylus carinatus.

Gammarus carinatus, Fabr. Ent. Syst. ii. p. 515 (1793).
Atylus carinatus, Leach, Zool. Miscell. iii. p. 22, pl. lxix. (1815); M.-Edw. Hist. Nat. Crust. iii. p. 68 (1840); Spence Bate, Cat. Amphip. Crust. Brit. Mus. p. 134, pl. xxv. figs. 1–3 (1862); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarf. p. 357, pl. x. (1874); Boeck, Skandinaviske og Arktiske Amphipoder, ii. p. 324 (1876).
Amphithoë carinata, Kröyer, Kongl. Dansk. Vidensk. Selsk. Afh. vii. p. 256, pl. ii. fig. 6 (1838); Voy. en Scand. Atlas, Crust. pl. xi. fig. 1; M.-Edw. Hist. Nat. Crust. iii. p. 41 (1800).

Coll. Feilden: Discovery Bay, at depths of $5\frac{1}{2}$ and 25 fathoms.

In the adult males of this species, at least in such specimens as I have observed, the body is slender, the palm of the first pair of legs more elongate and narrowed distally, and the lobes of the terminal segment narrower and separated by a wider and deeper fissure. The length of the specimen (a male) obtained at 25 fathoms depth (the only one which, being preserved in spirits, could be accurately measured) is 1 inch 1 line (nearly 28 millims.).

Atylus carinatus occurs on the coasts of Greenland and Spitzbergen and in Davis Straits.

Acanthozone hystrix.

Acanthosoma hystrix, Owen & Ross, Append. Ross's 2nd Voy. Zool. Crust. p. xci, pl. B. fig. 4 (1835); Bell, in Belcher's 'Last of the Arctic Voyages,' Crust. p. 406 (1855).
Amphithoë hystrix, Kröyer, Kongl. Danske Vidensk. Selsk. Afh. vii. pl. ii. figs. 6 & 7 (1838); M.-Edw. Hist. Nat. Crust. iii. p. 40 (1840).
Paramphithoë hystrix, Bruzelius, Kongl. Vet. Akad. Handl. iii. p. 71 (1859); Spence Bate, Cat. Amphip. Crust. Brit. Mus. p. 147, pl. xxviii. fig. 1 (1862).
Acanthozone cuspidata, Boeck, Forhandl. Vidensk. Selsk. p. 184 (1870); Skandin. og Arktiske Amphip. p. 229 (1876), *nec* Lepechin.
Acanthozone hystrix, Miers, Ann. & Mag. Nat. Hist. (ser. 4) xix. p. 137 (1877).

Coll. Feilden: Discovery Bay, one specimen; Franklin-Pierce Bay, two specimens.

Coll. Hart: Franklin-Pierce Bay, 13–15 fathoms, three specimens.

Two of the specimens collected are adult males, another is an adult female. The length of the largest specimen from Franklin-Pierce Bay slightly exceeds 1 inch 2 lines (30 millims.).

In the elaborate plate that illustrates this species in the 'Zweite deutsche Nordpolarf.' (*l. c.*) the rostral spine is represented as conical, straight, and acute, and the basos joint of the sixth and seventh pairs of legs as armed with four strong spines upon its posterior margin. In all the specimens of both sexes that I have examined the rostral spine is laterally compressed and bent near its base, projecting horizontally forwards, and there are but two spines upon the posterior margins of the basos joint of the sixth and seventh pair of legs.

It is probable, therefore, that a distinct species is figured by Buchholz in the plate referred to.

This species has been recorded from the shores of Arctic America (Felix Harbour, Igloolik), Greenland, Spitzbergen, Finmark, and Norway.

Halirages fulvocinctus.

Amphithoë fulvocincta, Sars, Forhandl. Vidensk. Selsk. Christiania, p. 141 (1858); Spence Bate, Cat. Amphip. Crust. Brit. Mus. p. 381 (1862).

Pherusa tricuspis, Stimpson, Proc. Ac. Nat. Sci. Phil. p. 138 (1863).

Paramphithoë fulvocincta, Goës, Œfv. Vet. Akad. Förhandl. p. 525, fig. 15 (1865); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarf. p. 367 (1874).

Haliruges fulvocinctus, Boeck, Forhandl. Vidensk. Selsk. Christiania, p. 196 (1870); Skandinaviske og Arktiske Amphipoder, ii. p. 342, pl. xxiii. fig. 11 (1876).

Coll. Feilden: Discovery Bay, at 25 fathoms, one specimen; Floeberg Beach, one specimen.

Both of the specimens collected are in an imperfect condition: one is, I believe, an adult female; the other is a younger animal. The length of the larger specimen (that collected in Discovery Bay) is about $10\frac{1}{2}$ lines (20 millims.).

Halirages fulvocinctus has been recorded from the coasts of Greenland, Spitzbergen, and Finmark.

Gammarus locusta.

Cancer locusta, Linn. Syst. Nat. ed. 12, p. 1055 (1766).

Gammarus locusta, Fabr. Ent. Syst. ii. p. 516 (1793); Leach, Trans. Linn. Soc. xi. p. 359 (1815); M.-Edw. Hist. Nat. Crust. iii. p. 44 (1840); Spence Bate, Cat. Amphip. Crust. Brit. Mus. p. 206, pl. xxxvi. fig. 6 (1862); Spence Bate and Westwood, Hist. Brit. Sessile-Eyed Crust. i. p. 378 (1863); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarf. p. 343 (1874); Boeck, Skandinav. og Arktiske Amphipoder, ii. p. 366 (1876).

Gammarus arcticus, Leach, in Scoresby, Account of Arctic Regions, i. p. 541, pl. xvi. fig. 14 (1820).

Gammarus boreus, Sabine, Append. Capt. Parry's 1st Voy. p. 51 (1821); Ross, Append. Capt. Parry's 3rd Voy. Crust. p. 119 (1826); Append. Parry's 4th Voy. p. 204 (1828); Ross & Owen, Crust. in Append. Ross's 2nd Voy. p. lxxxviii (1835); Bell, Crust. in Belcher's 'Last of the Arctic Voyages,' p. 405 (1855).

Gammarus Duebeni, Lilljeborg, Œfv. Kongl. Vet. Ak. Förhandl. p. 22 (1851).

Gammarus mutatus, Lilljeborg, Kongl. Vet. Ak. Handl. p. 447 (1853).

Gammarus sitchensis, Brandt, Crust. in Middendorff's Sibirische Reise, ii. p. 137 (1851).

Coll. Feilden: Floeberg Beach, at depth of 10 fathoms, twenty-five specimens; crack between the floes in lat. 82° 24′, three specimens.

Of sixteen adult, or nearly adult, specimens from Floeberg Beach, which, being preserved in spirit, could be acurately examined, ten are males. Of the six females, all but one carried a number of young animals beneath the lamelliform ciliated plates developed from the inner side of the first five pairs of legs. In the younger animals these plates are present, but much less markedly developed, being slender and substyliform.

The length of the largest male is 1 inch 4 lines (34 millims.), that of the largest female about 1 inch $2\frac{1}{2}$ lines (31 millims.). The hands of the first and second pairs of legs (gnathopoda) are much more powerful in the male than in the female: the palm of the second pair in the female is of a suboblong shape; in the male it is ovate, and narrowed towards the distal extremity, like that of the first pair of legs.

This very common species probably occurs upon the coasts of all the circumpolar region of the globe. In Europe its range extends southward to the Mediterranean and the Black Sea.

Gammaracanthus loricatus.

Gammarus loricatus, Sabine, Append. Capt. Parry's 1st Voy. p. 53, pl. i. fig. 7 (1821); Ross, Append. Capt. Parry's 3rd Voy. p. 118 (1826); Append. Parry's 4th Voy. p. 204 (1828); Ross & Owen, Crust. in Append. Ross's 2nd Voy. p. lxxxix (1835); Kröyer, Kongl. Dansk. Vid. Selsk. vii. p. 250, pl. i. fig. 4 (1838); M.-Edw. Hist. Nat. Crust. iii. p. 52 (1840); Bell in Belcher's 'Last of the Arctic Voyages,' Crust. p. 405 (1855).

Gammaracanthus loricatus, Spence Bate, Cat. Amphip. Crust. Brit. Mus. p. 202, pl. xxxvi. fig. 2 (1862); Boeck, Skandinav. og Arktiske Amphipoder, ii. p. 400 (1876).

Coll. Feilden: Floeberg Beach, at 10 fathoms, two males and two females.

The two males collected are much smaller than the females. Length of largest male nearly 1 inch 6 lines (38 millims.), of largest female about 1 inch 11 lines (49 millims.).

Gammaracanthus loricatus is found upon the shores of Arctic America (Port Bowen, Prince Regent's Inlet) and Scandinavia; also in lakes of the latter-mentioned region and of Finland, and at Greenland and Spitzbergen and in the White Sea.

Amathilla pinguis.

Gammarus pinguis, Kröyer, Kongl. Dansk. Vidensk. Selsk. vii. p. 252, pl. i. fig. 5 (1838); M.-Edw. Hist. Nat. Crust. iii. p. 50 (1840).

Amathia pinguis, Spence Bate, Cat. Amphip. Crust. Brit. Mus. p. 200 (1862).

Amathilla pinguis, Boeck, Vidensk. Selsk. Forhandl. p. 218 (1870); Skandinav. og Arktiske Amphip. ii. p. 411 (1876); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarf. p. 353, pl. ix. fig. 2 (1874).

Coll. Feilden: Crack between floes at lat. 82° 24′, one specimen.

The single specimen collected has been dried, and is in an imperfect condition. There can, however, be no doubt about its identification. Length $\frac{1}{2}$ inch (about 13 millims.).

This species is found upon the coasts of Greenland and Spitzbergen.

Eusirus cuspidatus.

Eusirus cuspidatus, Kröyer, Nat. Tidsskr. 2 R. i. p. 501, pl. vii. fig. 1 (1844–45); Voy. en Scand. Crust. Atlas, pl. xix. fig. 2; Spence Bate, Cat. Amphip. Crust. Brit. Mus. p. 154, pl. xxviii. figs. 6, 7 (1862); Goës, Œfv. Vet. Ak. Förh. p. 529 (1865); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarf. p. 313, pl. iii. fig. 12 (1874); Boeck, Skandin. og Arktiske Amphip. ii. p. 502 (1876).

Coll. Hart: Franklin-Pierce Bay, 13–15 fathoms, one female specimen.

The single example in the collection is fully adult and bears ova. Length 1 inch $7\frac{1}{2}$ lines (41 millims.).

The basos joint of the sixth and seventh pairs of legs is considerably narrowed to its distal extremity. The second and third segments of the abdomen have the posterior margins rounded and very finely serrated. This species has been described at great length and figured by Buchholz, *l. c.*; but either the figure is carelessly executed as regards many details, or it represents a very distinct species. The rostrum is represented as much longer than in the specimens I have seen, the coxa of the fourth pair of legs with its inferior margin straight (not rounded as in the examples I have examined), the second and third segments of the postabdomen with the posterior margins strongly angulated, &c.

This species has been found at Greenland, Spitzbergen, Finmark, and Norway.

Tritropis aculeata.

Oniscus aculeatus, Lepechin, Acta Acad. Sci. Petropolitana, p. 247, pl. viii. fig. 1 (1780).

Talitrus Edwardsii, Sabine, Append. x. in Capt. Parry's 1st Voy. p. 54, pl. ii. figs. 1–4 (1821); Ross, Append. Capt. Parry's 3rd Voy. p. 119 (1826); Append. Capt. Parry's 4th Voy. p. 209 (1828).

Amphithoë Edwardsii, Owen & Ross, Crust. in Append. Ross's 2nd Voy. p. xc (1835); Kröyer, Voy. en Scand. Atlas, Crust. pl. x. fig. 1.

Amphithonotus Edwardsii, Spence Bate, Cat. Amphip. Crust. Brit. Mus. p. 151, pl. xxviii. fig. 5 (1862).

Amphithonotus aculeatus, Goës, Œfv. Vet. Akad. Förhandl. p. 526 (1865); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarf. p. 316, pl. iv. (1874).

Tritropis aculeata, Boeck, Forh. Vid. Selsk. p. 158 (1870); Skand. og Arktiske Amphipoder, p. 511 (1876).

Coll. Feilden: Discovery Bay, at 25 fathoms, one male, four females; Cape Napoleon, at 25 fathoms, three males, seven females; Floeberg Beach, at 10 fathoms, two males, five females; Franklin-Pierce Bay, at 15 fathoms, thirteen specimens (dried).

Coll. Hart: Franklin-Pierce Bay, 13–15 fathoms, twelve females;

Cape Fraser, 20 fathoms, three young females (?); Dobbin Bay, at 30 fathoms, one female.

About fifty specimens in all were collected of this species, of which only six are males. The length of the largest male is 1 inch 5 lines (36 millims.), that of the largest female, a specimen bearing ova, nearly 1 inch 9 lines (44 millims.).

None of the females in the collection carry any young animals; but the greater number have ova in a greater or less degree of development. In the youngest females in the collection, from Cape Napoleon, length 1 inch $\frac{1}{2}$ line, in which no ova are present, the ovigerous lamellæ are small, much smaller than the branchial leaflets, but they are rapidly developed, and become ciliated as the animal increases in age; in the largest females, with fully ripened ova, they considerably exceed the branchial lamellæ in size, and completely infold and conceal the ova. These latter at first present the appearance of a whitish mass scarcely a line in length, but when ripe are of a reddish- or orange-yellow colour, and completely fill the cavity beneath the pereional segments.

This species is one of the commonest of the Amphipoda inhabiting the northern seas. It has been found, often in great abundance, on the shores of Arctic America (Port Bowen, Igloolik), Greenland, Spitzbergen, Finmark, and in the White Sea.

Ægina spinosissima.

Ægina spinosissima, Stimpson, Syn. Invert. Grand Manan, p. 44 (1853).
Caprella spinifera, Bell, in Belcher's 'Last of the Arctic Voyages,' ii. p. 407, pl. xxxv. fig. 2 (1855); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarf. p. 338 (1874).
? *Ægina echinata*, Boeck, Forh. Skand. Nat. p. 670 (1860); Vidensk. Selsk. Forh. p. 271 (1870); Skand. og Arktiske Amphip. ii. p. 680, pl. xxxviii. fig. 6 (1876).
Caprella spinosissima, Spence Bate, Cat. Amphip. Crust. Brit. Mus. p. 361, pl. lvii. fig. 3 (1862).

Coll. Feilden: Cape Napoleon, 25 fathoms, temperature of water 29°·2, one small male specimen.

Coll. Hart: Dobbin Bay, 30 fathoms, one large male specimen.

The largest specimen, length nearly 2 inches 2 lines (54 millims.), is very robust, of a green colour, and with but very few small spines and many indistinct very small tubercles; the second pair of legs has the hand armed upon its inferior margin with two very strong teeth, and a third small tooth close to the distal extremity; the finger is strong and very much curved; the first joint of the first pair of postabdominal appendages is short and much broader than the second joint.

The smaller specimen, length a little over 11 lines (24 millims.), is of a whitish colour, purplish brown at the bases of the spines, which are numerous, especially on the back. The hand of the second pair of legs is nearly of the same form as in the preceding, but the finger is less arcuate; the basal joint of the second pair of legs not broader than the second joint.

In the specimens I have before me the teeth on the inferior margin of the palm of the second pair are not only much larger than in *Æ. echinata*, but the palm itself is not tuberculated as in that species, as figured by Boeck (*l. c.*). It is possible that the two forms are distinct; but the variation in the spines of the body and its limbs are known to be very great in some species of the genus.

Probably the specimens referred by Ross in Parry's 3rd and 4th Voyages to *Caprella scolopendroides*, and which he describes as having "a great number of small spines along the back," should be referred to *Æ. spinosissima*. They were collected at Port Bowen and Low Island.

This species has been recorded from the coasts of Greenland, Spitzbergen, and Norway; and if, as I believe, the species of Stimpson is identical, from the Grand Manan at the entrance of the Bay of Fundy.

ENTOMOSTRACA v. GNATHOPODA.

Phyllopoda.

Branchipodidæ.

Branchipus (Branchinecta) arcticus. Pl. IV. fig. 1.

Branchipus (Branchinecta) arcticus, Verrill, Amer. Journ. Sci. & Arts, ser. 2, xlviii. p. 253 (1869).
Branchinecta arctica, Packard, in Hayden, U.S. Geol. & Geogr. Survey, p. 621 (1874); Amer. Naturalist, xi. p. 53 (1877).

Coll. Hart: Discovery Bay, in a small freshwater lake and in a stream under ice.

Several specimens were collected, including males and females, of a species of Phyllopoda, which I refer to the *B. arcticus* of Verrill. Of these species I have only seen the descriptions in the journals above quoted, not having been able to meet with Verrill's full Report on the American Phyllopoda in the volume for 1869 of the American Association for the Advancement of Sciences and Arts. These specimens possess the elongated claspers, with serrated basal joints, and elongated egg-pouches of the species of *Branchinecta*, and are distinguished from the *Branchipus paludosus* of Müller, also from Greenland (if his figure in the 'Zool. Danica,' pl. xlviii., be correct), by the much shorter lanceolate caudal appendages. In *B. paludosa* these are represented as very slender, acuminate, and half as long as the abdomen.

These specimens differ slightly from the descriptions of *B. arcticus* and *grœnlandicus*, as will appear from the following description. If distinct (which may be possible, although I think it more probable that the three forms are varieties of one and the same species), the species may be designated *B. Verrilli.*

The antennæ are slender, linear, and nearly as long as the basal joint of the claspers. The large prehensile antennæ, or "claspers," as they are called by Verrill, are nearly half as long as the body, two-jointed, the basal joint as long as the second, nearly straight, and of the same thickness throughout, with a not very prominent rounded lobe at the distal extremity on the inner side; this, and the distal half of the inner margin, armed with a series of ten or a dozen small teeth or spines. The second joint is smooth, slightly tapering to its distal extremity and concave on its inner surface. The branchial feet are eleven in number, and the lobes on the inner margin are beautifully fringed with long, close, flexible hairs; the fifth and sixth pairs are the longest; and the others decrease regularly in size. The vesicular body is narrow oblong-oval; the terminal lobe of the second joint is regularly oval in shape. The caudal appendages lanceolate, small; margins with slender setæ, which become longer as they approach the distal extremity. The specimens are smaller than that collected by Dr. Packard, averaging only 12 millims. in length.

Verrill's specimens of this species were from Labrador; and if, as is thought possible both by Packard and Verrill, this species be not distinct from the *B. grœnlandicus* and *B. coloradensis*, it must have a very extended geographical range.

Specimens of *B. grœnlandicus* are mentioned by Packard as having been obtained during the late American expedition of the 'Polaris' at Polaris Bay, between lat. 81° 20′ and 81° 50′.

Copepoda.

Lernæopodidæ.

Lernæopoda arcturi, sp. n. Pl. IV. fig. 2.

Coll. Feilden: Floeberg Beach, parasitic on the gills of *Salmo arcturus*, Gthr.

On the new charr collected by Capt. Feilden, and recently described by Dr. Günther, were many specimens of a parasitic Lernæoid crustacean, which I cannot certainly identify with any previously recorded, and of which the following is a description:—

The cephalothorax is narrow-ovate, nearly or quite as long as the abdomen, which is ovate, turgid on its dorsal surface, and smooth, there being no trace of articulations or of the tubercles which are so characteristic of *Basanistes huchonis*; the ovaries are about as long as the abdomen. The oral aperture is circular and not prominent. The inner antennæ are very small and apparently two-jointed. The outer antennæ are stout, broad at base; the terminal joint is produced on its inner side into an ovate lobe, which is ciliated on the margins, and bears on its outer side a two-jointed accessory appendage, the terminal joint of which is conical and acute; hence the outer antennæ appear bifid at the extremity; the palpi at the base of these organs are very small.

The first pair of maxillipeds are robust; the basal portion is stout, and tapers slightly towards the distal extremity, the terminal joint is much slenderer, and bears at its extremity a small unguiform lobe. The second pair of maxillipeds are cylindrical and about as long as the cephalothorax, with a thickened marginal rim at the distal extremities, which are united, and terminate in a large membranous conical *bulla*, which is imbedded in the body of the animal to which the parasite adheres.

The nearest ally of this species is evidently the *Lernæopoda Edwardsii* of Olsson, Acta Universit. Lund., p. 36 (1868), from Norway, from which it differs in the somewhat shorter ovaries and abdomen and the form of the claw of the first maxilliped. This species has not been figured; and a comparison of specimens might prove the *L. arcturi* to be identical with it. From the *L. carpionis* of Kröyer, to which it is also nearly allied, it differs in the form of the bulla of the second maxilliped, &c.; from the *L. salmonea* of Mayor (Bull. Soc. Philom. p. 24, 1824), which Olsson, who had not seen Mayor's original description, considers synonymous with his *L. Edwardsii*, but which is probably a different species, in the smooth abdomen, and, if Milne-Edwards's figure be correct, in the form of the head, ovaries, &c.

The *Achtheres Carpenteri*, described by A. S. Packard, junr., from a trout in the East River, Colorado (Rep. U.S. Geol. and Geogr. Survey, 1874, p. 612), to judge from the outline figure which accompanies the very brief description, resembles this species. The abdomen, however, is said to possess indications of division into three segments, which are not indicated in the figure.

CIRRIPEDIA.

Balanidæ.

Balanus porcatus.

Balanus porcatus, Da Costa, Hist. Nat. Test. Brit. p. 249 (1778); Darwin, Monogr. Cirripedia, Balanidæ, p. 256, pl. vi. fig. 4 (1854); Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarf. p. 396 (1874).

Coll. Feilden: Cape Napoleon, from a depth of 50 fathoms, five specimens, 25 fathoms, two specimens; Richardson Bay, 80° 2′ N. lat., 70 fathoms, one specimen.

Coll. Hart: Franklin-Pierce Bay, 13–15 fathoms.

The largest specimen collected has a greatest height of rather over 1 inch 1 line (28 millims.), and greatest diameter of nearly 1 inch 2 lines (29 millims.). The specimens from Cape Napoleon agree well with *B. porcatus* in the sharply and strongly ribbed parietes of the shell, the radii of which are parallel to the base, and in the characters of the opercular valves. The small specimen from Richardson Bay, height 7 lines (15 millims.), greatest diameter 6 lines (nearly 13 millims.), I was at first inclined to think might be *B. crenatus*, on account of the very oblique and narrow radii; but the characters of the opercular valves are those of *B. porcatus*, the apex of the terga being produced and acute, and the spur placed close to the basiscutal angle.

This species occurs on the coasts of Greenland, Iceland, Spitzbergen, Norway, Finmark, and Britain—also on the shores of Maine and Massachusetts, and perhaps at China (see Darwin, *l. c.*)

PYCNOGONIDA.

Nymphonidæ.

Nymphon hirtum.

? *Nymphon hirtum,* Fabr. Ent. Syst. iv. p. 417 (1794); Kröyer, Nat. Tidsskr. 2 R. i. p. 113 (1844–45); Voy. en Scand. Atlas, Crust. pl. xxxvi. fig. 3; Buchholz, Crust. in Koldewey, Zweite deutsche Nordpolarf. p. 397 (1874).

Nymphon hirsutum, Sabine, Append. Capt. Parry's 1st Voy. no. x. p. 48 (1821); Ross, Append. Capt. Parry's 3rd Voy. p. 117 (1826); Append. Parry's 4th Voy. p. 203 (1828).

Nymphon hirtipes, Bell, in Belcher's 'Last of the Arctic Voyages,' Crust. p. 401, pl. xxxv. fig. 3 (1855).

Coll. Feilden: Franklin-Pierce Bay, five specimens; Discovery Bay, one specimen; Floeberg Beach, at depth of 10 fathoms, two specimens.

Coll. Hart: Franklin-Pierce Bay, 13–15 fathoms, three specimens.

I have referred the specimens collected with some doubt to *N. hirtum,* as in Kröyer's figure of that species not only is the animal represented as much slenderer, but also the chelæ of the mandibles have the fingers much shorter and scarcely denticulated on their inner margins. In the specimens before me the fingers are very slender, somewhat curved at the tips, and armed with a row of spinules on their inner margins. In some examples the immobile finger is shorter than the other, as in the form to which Bell (*l. c.*) has assigned the name of *N. hirtipes,* which does not otherwise differ from the present species, except in the absence of hairs upon the segments of the body, and can hardly be regarded as distinct from it.

Fourteen specimens in all were collected of this species; of these, two are adult females with ova. Length of largest specimen about 6½ lines (14 millims.), greatest length between tips of legs when extended nearly 3 inches 3 lines (82 millims.); of the largest ova-bearing female, nearly 6 lines (12 millims.), greatest length between legs 2 inches 11 lines (74 millims.).

In the males of this species the whole animal is more robust, the joints of all the legs, as stated by Buchholz (*l. c.*), thicker and more compressed; in the females the second joint of the legs is proportionally longer than in the males. I may add that in the two ova-bearing females in the collection the fifth joint of the third (ovigerous) pair of appendages is dilated and geniculated near its distal extremity, the angle being armed with a tuft of stiff hairs, which evidently serve as points of attachment for the ova. It is probable that this peculiarity of structure only attains its greatest development in females in which the ova are present.

This species appears to be a common inhabitant of the high northern latitudes, and has been recorded from the coasts of Greenland, Spitzbergen, and Arctic America (Port Bowen, Northumberland Sound).

Nymphon hirtum, var. *obtusidigitum*. Pl. IV. fig. 3.

Among the specimens from Franklin-Pierce Bay is a single example, which differs from the males of the foregoing variety only in the legs being cylindrical, not dilated and compressed, and in the form of the chelæ of the mandibles. These have the fingers arcuate, meeting only at the tips, which terminate in small knobs. The chelæ are slender, not globose, as in the form figured by Bell, in Belcher (*l. c.*) p. 409, pl. xxxv. fig. 4, under the name of *N. robustum*, and that recently described by Heller as *N. hians* (Sitz. der k.-k. Akad. Wien, Naturw. lxxi. p. 610, 1875), in which species the fingers although arcuate are represented as acute. The second joint of the legs is short, as in the males of *N. hirtum*. Length rather more than 5 lines (11 millims.); greatest width between legs about 2 inches 7 lines (66 millims.).

Nymphon Strömii.

Nymphon Strömii, Kröyer, Nat. Tidsskr. 2 R. i. p. 111 (1844); Voy. en Scand. Crust. Atlas, pl. xxxv. fig. 3.

Coll. Feilden: Floeberg Beach, lat. 82° 27′, at depth of 10 fathoms, three specimens, and at lat. 81° 56′, one specimen; Cape Fraser, at a depth of 80 fathoms, bottom hard, one adult and three young specimens.

One (the largest) specimen collected is a female with ova; length $6\frac{1}{2}$ lines (16 millims.), greatest width between legs 5 inches 6 lines (140 millims.). All the specimens obtained are more or less imperfect.

The examples obtained by Captain Feilden of this fine species agree in all respects with the figure given by Kröyer in the Atlas of Gaimard's 'Voyage en Scandinavie,' above quoted. The female (at least the example I have examined) has not the peculiar dilatation of the fifth joint of the third pair of appendages noted in the female of *N. hirtum.*

This species is usually (as stated by Kröyer *l. c.*) glabrous; but in one or two specimens there are a few scattered hairs upon the legs. The chelæ in the adult are very large, with long fingers armed with spines upon their inner margins; the third and fourth joints of the second pair of appendages are subequal and together much longer than the second joint; the seventh joint of the legs is long and slender, a little longer than the eighth joint.

Kröyer gives Norway, with doubt, as the habitat of his specimens of this species.

EXPLANATION OF THE PLATES.

Plate III.

Fig. 1. *Arcturus baffini*, var. *Feildeni*; natural size.

Fig. 2. *Anonyx gulosus*?, slightly enlarged: *a*, head and antennæ (lateral view); *b*, maxilliped; *c*, *d*, hands of first and second pairs of legs; *e*, end of postabdomen, showing the form of the third segment; *f*, terminal segment and last pair of uropoda; all much enlarged.

Fig. 3. *Onesimus Edwardsii*, slightly enlarged: *a*, head and antennæ (lateral view); *b*, maxilliped; *c*, *d*, hands of first and second pairs of legs; *e*, end of postabdomen, showing form of third segment (lateral view); *f*, terminal segment and last two pairs of uropoda; all much enlarged.

Plate IV.

Fig. 1. *Branchipus* (*Branchinecta*) *arcticus*, greatly enlarged: *a*, one of the large prehensile antennæ; *b*, one of the branchial feet; *c*, caudal appendages; all still further enlarged.

Fig. 2. *Lernæopoda arcturi*, greatly enlarged: *a*, outer antennæ; *b*, first maxilliped; further enlarged.

Fig. 3. *Nymphon hirtum*, var. *obtusidigitum*, natural size: *a*, mandible; *b*, *c*, one of the appendages of the first and second pairs; enlarged.

XV.—*Descriptions of new Species of Heteropterous Hemiptera collected in the Hawaiian Islands by the Rev. T. Blackburn.* —No 1. By F. Buchanan White, M.D., F.L.S.

Cydnidæ.

Geotomus subtristis, n. sp.

G. subovatus, piceo-niger, subnitidus, pronoti margine postico, scutelli apice, pedibus antennisque piceis, harum articulorum apicibus et toto articulo ultimo, necnon tarsis piceo-luteis; membrana sordide albida, apicem abdominis paullo superante. Marginibus capitis et lateralibus thoracis paucis pilis sat longis ciliatis. Capite obtusiuscule rotundato, margine antico subreflexo, lobis lateralibus parce punctulatis, lobo centrali ad apicem haud angustato; antennarum articulo secundo quam tertius paullo breviore, tertio, quarto, quintoque subæquilongis, duobus ultimis fusiformibus. Pronoto antice et ad latera irregulariter rudeque punctato; disco lævi, fovea parva in medium, et pone medium fovea majore rude punctata utrinque instructo; lobo postico 5 vel 6 rugis transversis plus minus punctulatis instructo; angulis posterioribus lævibus

nonnihil elevatis. Scutello leviter transverse rugoso, dense punctato, apice lato, lævi et subimpresso. Hemelytris dense et distincte punctatis, punctis clavi et suturarum cubitalis radialisque in ordines longitudinales dispositis; corii disco minus rude punctato, margine apicali subsinuato.
Long. $3\frac{1}{2}$, lat. 2 m. m.

Geotomus jucundus, n. sp.

G. subovatus, castaneus, subnitidus, pronoti, scutelli et corii discis, pedibusque nonnihil, antennis tarsisque multo, dilutioribus; membrana apicem abdominis paullo superante flavido-ochracea fusco-nebulosa. Marginibus capitis, lateralibus thoracis et costalibus corii ad basin pilis nonnullis sat longis ciliatis. Capite obtusiuscule rotundato, haud vel vix punctulato, margine antico subreflexo, lobo centrali ad apicem haud angustato; antennarum articulo secundo quam tertius paullo breviore, tertio, quarto quintoque subæquilongis, duobus ultimis fusiformibus. Pronoto obscure et remote punctulato, pone medium utrinque levissime foveolato; angulis posterioribus nonnihil elevatis. Scutello subdense punctato, præsertim ad latera, apice lato lævi et subimpresso. Hemelytris dense et distincte punctatis, punctis clavi et suturarum cubitalis radialisque in ordines longitudinales dispositis, margine apicali subsinuato.
Long. 3, lat. $1\frac{3}{4}$ m. m.

Anthocoridæ.

Triphleps persequens, n. sp.

T. niger, nitidus, pilis brevissimis pallidis vestitus, antennis hemelytris pedibusque flavido-testaceis; antennarum articulis primo ultimoque, rostro (articulo ultimo ad basin excepto) cuneo, femoribus ad basin tarsisque ad apicem plus minus pallide piceo-brunneis; oculis rufo-brunneis; membrana subfusca. Antennarum articulo secundo vix incrassato; capite (collo excepto), pronoto scutelloque rugulosis; pronoti lobo postico hemelytrorumque parte coriacea leviter punctatis.
♂ long. 2 m. m.

T. obscuro affinis, sed minor, antennæ graciliores, &c.

Cardiastethus mundulus, n. sp.

C. pallide rufo-brunneus, pilis longis ochraceis subdense vestitus, capitis vertice, antennarum articulo primo, pronoti disco, corii disco, cuneo femoribusque plus minus, corpore subtus oculisque valde, saturatioribus; membrana brunneo-fusca; corio ad basin embolioque flavidis. Antennis subgracilibus, articulis 2 ultimis filiformibus; pronoti lobi antici callo canaliculis 3 longitudinalibus instructo, calli margine postico bisinuato; lobo pronoti postico clavoque punctatis; femoribus anticis incrassatis, tibiis anticis curvatis.

♂ long. $2\frac{3}{4}$ m. m.

Nabidæ.

Nabis innotatus, n. sp.

N. elongatus, sordide pallido-testaceus, fere immaculatus; antennis, pronoti lobo antico linea geminata cicatriculisque, sterno ventreque vitta longitudinali utrinque pallide fusco-brunneis; oculis, ocellisque rufo-brunneis; pronoti lobo postico vittis 3 scutelloque unica longitudinalibus indistinctissime griseo-brunneis; rostri apice imo unguiculisque piceis; abdominis dorso macula utrinque sanguinea. Capite quam pronotum paullo breviore; antennis $\frac{4}{5}$ corporis æquilongis, articulo primo capiti ante ocellos subæquilongo; pronoti margine postico longitudini subæquilongo, quam margo anticus duplo longiore, lateribus lobi antici leviter, lobi postici valde retrorsum dilatatis, hoc elevato et ante marginem posticum subreflexum anguste depresso; femoribus anticis capite pronotoque simul sumptis brevioribus; membrana alisque apicem abdominis superantibus.

♂ long. 6, lat. $1\frac{1}{2}$ m. m.

N. viridulo affinis.

Nabis subrufus, n. sp.

N. elongatus, rufo-brunneo-testaceus, antennarum articulis 2 ultimis, capitis vertice et lobo centrali, tuberculis antenniferis, oculis ocellisque, pronoti collo loboque postico, hemelytrisque saturatioribus; antennarum articulo secundo annulo ad apicem, capitis vertice et marginibus lateralibus vittaque utrinque pone oculos, pronoti collo linea longitudinali, lobo postico scutelloque vitta centrali, lobo antico cicatriculis, sterno vittis 2 utrinque lateralibus, femoribus omnibus maculis parvis, hemelytris ad venas, macula corii ad apicem, membranaque fuscis, hujus venis saturatioribus; hemelytris venis, femoribus ad apicem annulo lato, tibiarum annulis nonnullis, necnon unguiculis rufis vel rufo-brunneis; connexivo sordide sanguineo, immaculato. Antennarum articulo primo quam caput fere $\frac{1}{4}$ longiore; femoribus anticis capite pronoto scutelloque simul sumptis longioribus; pronoto margine postico longitudine paullo longiore, quam margo anticus fere duplo longiore; lateribus lobi antici subparallelis, lobi postici valde divergentibus; hemelytris alisque apicem abdominis superantibus.

♂ long. 8, lat. 2 m. m.

Nabis (?) *lusciosus*, n. sp.

N. oblongo-ovatus, brunneo-testaceus, capite postice, pronoto scutelloque linea longitudinali (in lobo pronoti antico geminata retrorsum divergente), antennarum articulo secundo annulo ad apicem, capite subtus, corpore vitta lata laterali utrinque et vitta angusta centrali subtus, segmentis genitalibus vitta supra et macula postice, femoribus maculis nonnullis, tibiis interne (anticis 3, posticisque 4) maculis nigris; capitis clypeo nitido, et macula vertice subrufis; antennarum articulo tertio basi apiceque exceptis, quartoque, tibiis anticis intermediisque subincrassatis ad apicem late, tibiisque posticis ad apicem fusco-brunneis; antennarum articulo primo ad apicem, secundoque, necnon tarsis omnibus subbrunneis; abdomine dorso ad medium fusco-nigricante; connexivo lato, testaceo, interne sanguineo, angulis anticis exterioribus nigricantibus; hemelytris apicem abdominis superantibus, venis brunneo-cingulatis; corii costa exteriore pone medium macula, et margine apicali maculis 3 longis nigro-brunneis; membrana testaceo-brunnea, venis late fusco-brunneis; femoribus anticis prope apicem fusco-subannulatis. Antennarum articulo primo capiti subæquilongo; capite quam pronotum paullo breviore; femoribus anticis capiti pronotoque simul sumptis fere æquilongis; pronoto in medio levissime constricto, lobo antico convexo, lobo postico subplano, margine postico quam margo anticus duplo longiore, longitudini subæquali. Alis ocellisque deficientibus, nisi 2 calli plani subnitidi in capitis vertice positi hos repræsentant.

♂ long. 9, lat. (pone medium abdominis) $2\frac{1}{2}$ m. m.

Emesidæ.

Luteva insolida, n. sp.

L. brunneo-fusca, capite, pronoto vittis 2 obscuris longitudinalibus, femoribus anticis ad apicem, femoribus tibiisque intermediis et posticis ad majorem partem plus minus saturatioribus; hemelytris subfuscis fusco-reticulatis, venis brunneo-fuscis; pedum intermediorum femoribus ad apicem tibiisque ad basin anguste pallidis, geniculis fusco-brunneis; pedum posticorum femoribus ad apicem tibiisque ad basin late niveis; oculis nigro-brunneis. Pronoto lobo postico canaliculato quam lobus anticus fere $\frac{1}{3}$ longiore; femoribus anticis spinulis brevibus subtus armatis, dimidio basali spinis 4 vel 5 longioribus præterea instructis.

♂ long. 7, expans. hemelytrorum 10 m. m.

Hebridæ.

Merragata, nov. gen.

Genus *Hebro* maxime affine. Antennæ breves, capite paullo longiores, 5-articulatæ; articulus primus curvatus, apicem capitis attingens, secundus clavatus primo æquilongus, tertius minutus, quartus clavatus secundo æquilongus sed gracilior, quintus longissimus crassissimusque, fusiformis.

Merragata hebroides, n. sp.

M. nigra, opaca, pilis brevibus numerosis suberectis pallidis vestita; capite (vitta transversali ante oculos excepta), pronoti disco macula rotundata utrinque, et margine postico ad medium, corii venis cubitali radialique rufo-ferrugineis; antennis pedibusque brunneo-luteis, illarum articulo ultimo, horum tarsis ad apicem fusco-brunneis; clavo fere toto, corioque inter venas duas albis; clavi margine apicali male definito membranaque fuscis, hac maculis 4 albidis ornata.

Long. 2 m. m.

Corixidæ.

Corixa Blackburni, n. sp.

C. angusta, nitida, haud evidenter rastrata, ochroleuca nigronotata, pilis adpressis cum setulis brevissimis erectis intermixtis vestita; pronoto lineis 11 transversalibus, hemelytris lineolis anguloso-undulatis, clavo ad basin apicemque lineis parallelis subintegris, nigris; corii limbo exteriore interrupte ochroleuco; membranæ sutura vix discreta, margine angustissime ochroleuco; corii area marginali pallida, ad basin nigricante, ad basin apicemque externe nigro-marginata, apice imo lineolis transversis nigris notato; capite brunneo, vertice angulato; sterno ad medium ventreque subfuscis; abdominis dorso infuscato basi apiceque brunneo-nigris, connexivo pallido; tarsis intermediis ad apicem et posticis articulo ultimo fusco-brunneis.

♂ palis oblique obovatis breviter acuminatis, tibiis anticis superne triangulariter dilatatis; fovea frontali obovata oculos vix superante.

♂ long. 4 m. m.

C. pygmææ Fieb. affinis.

XVI.—*Descriptions of new Species of New-Zealand Myriopoda.* By F. W. Hutton, Professor of Natural Science in the University of Otago.

Henicops impressus, sp. nov.

Head broadly ovate, narrowed towards the front, with an elevated margin behind, and an impressed curved transverse line, convex backward, on the top before the eyes; space between the antennæ concave. Dental lamina with eight acute teeth. Antennæ tomentose, with 34–36 joints. Segments 15 (without the head), alternately large and small; but the small segment between the 7th and 8th and between the 14th and 15th absent; each segment with a raised margin. Above olive-brown, generally more or less marbled with black; legs pale bluish; feet yellow. Under surface of head and region of anus reddish. Some scattered hairs on the legs. Length ·6 inch.

Loc. Dunedin and Queenstown.

Himantarium ferrugineum, sp. nov.

Head subquadrate, longer than broad; anterior margin slightly convex, sides nearly straight, posterior margin straight. Antennæ approximated, moniliform, finely pubescent. Body composed of about 110 segments, which retain nearly the same breadth throughout. Basal article of the last pair of legs deeply and coarsely punctate, both above and below. Præanal scale rather attenuated behind and with a straight margin. Entirely pale red, antennæ rather lighter. Legs smooth. Length 4·3 inches, breadth ·1 inch.

Loc. Wellington and Otago.

Himantarium morbosum, sp. nov.

Head elongate, convex on the sides; anterior margin sinuated, posterior straight; its length equal to about twice its breadth. Antennæ approximated, moniliform, hairy. Body composed of about 40 segments. Basal article of the last pair of legs smooth above, punctured below. Præanal segment rather longer than broad. Præanal scale rounded. Pale reddish yellow; head and antennæ ferruginous. Legs hairy. Length 1·85 inch, breadth ·07 near the head, tapering posteriorly.

Loc. Wellington and Dunedin.

Iulus (Spirostreptus) striatus, sp. nov.

Head smooth, emarginate anteriorly. Antennæ tomentose, 7-jointed, the 2nd joint the longest, the 3rd to the 6th subequal. Segments 47, the posterior half of each with fine distant longitudinal striæ on the dorsal and lateral surfaces; anterior portion smooth. Lateral margin of first segment rounded. Præanal segment terminating in a slightly obtuse rounded point, not passing the anal valves. Upper surface brown, paler below. Length ·4 inch.

Loc. Dunedin.

Polydesmus (Oxyurus) serratus, sp. nov.

Antennæ tomentose, 7-jointed, the 2nd and 3rd joints equal and longer than the 4th and 5th, the 7th very small. Top of the head pentagonal; face with a few scattered hairs, smooth. Segments smooth, the sides of each produced into a strong keel, which extends backward on each side in an acute curved angle. Præanal segment terminating in a blunt point, with scattered white hairs; the inferior semicircular, slightly toothed. Dirty white, with a more or less distinct brown dorsal stripe; under surface white. Length ·4 inch.

Loc. Dunedin.

Polydesmus (*Oxyurus*) *Worthingtoni*, sp. nov.

Antennæ tomentose, 7-jointed; the 2nd joint much longer than the 3rd or 4th, which are subequal. Segments 18 or 19, the same as in the last; but the angles on each side spring more suddenly from the posterior margin. Præanal plates as in the last. Dark reddish brown. Length ·65 inch.

Loc. Queenstown.

Polydesmus (*Strongylosoma*) *macrocephalus*, sp. nov.

Antennæ 7-jointed, all the joints finely pubescent; 4th and 5th the shortest. First segment smaller than the head; lateral margins rounded. Segments smooth, very slightly keeled on each side. Præanal segment terminating in a blunt point without any hairs; the inferior semicircular with a longitudinal keel. White with pale brown spots and vermiculations. Length ·6 inch.

Loc. Dunedin.

Craspedosoma trisetosum, sp. nov.

Antennæ 7-jointed, reaching back to the 7th segment; first and last joints short, the 3rd longest. Eye-patch pyriform, with the eyes in four rows. Segments 32, finely granulated on the back, and with a depressed longitudinal line down the centre; the lateral margins straight; each segment with three long bristles on each side, springing from tubercles, of which the lowest is the largest. Antennæ and legs with short hairs. Head yellowish, with a dark band between the antennæ; eyes and antennæ dark brown; segments blackish brown, each with oblique bands of olive before and behind the setiferous papillæ; legs pale yellow, marked with dark brown on the last two or three joints. Length 1 inch.

Loc. Dunedin.

Sphærotherium leiosomum, sp. nov.

Head sparingly, coarsely, irregularly punctured, with a deep central transverse depression at the posterior margin and a few short bristles in front. Antennæ slightly setose, six-jointed, the last joint cylindrical, rounded at the tip. Nuchal plate smooth, but uneven, with a slight central depression in front and an anterior marginal ridge. Dorsal plates covered with very fine shallow punctures. First dorsal segment with a distinct lateral marginal ridge; last dorsal segment arched, slightly compressed, its margin entire and not ridged; intermediate segments with the lateral extremities broad, rounded in front and rectangular behind, with a rough triangular excavation at the anterior lateral angle; the 10th and 11th segments broader than those before them. Black, shining, more or less marbled with dark testaceous. Length ·75 inch, breadth ·4 inch.

Loc. Dunedin.

Differs from *S. De Lacyi* (White, Ann. & Mag. Nat. Hist. 3rd ser. iii. p. 406) in colour, in not being posteriorly attenuated, and in the head being much broader and shorter.

Obs. The types of all these species are preserved in the Otago Museum, Dunedin.

XVII.—*List of Lepidoptera recently collected by Mr. Walter Davis in Peru, with Descriptions of a new Genus and several new Species.* By Arthur G. Butler, F.L.S., F.Z.S., &c.

The interesting little collection of which this is an account was made by Mr. Davis at odd moments snatched from the prosecution of his study of the botany of the country.

Although the families Erycinidæ and Lycænidæ are unrepresented and only two species of Hesperiidæ have been obtained, the remaining families of the Rhopalocera are fairly represented, several rare and new species having been collected. Amongst the more striking forms may be mentioned the very scarce and beautiful *Agrias sardanapalus*, *Catagramma Felderi*, and two species of *Callithea*.

In order to render this enumeration as convenient as possible for reference, I have followed the arrangement adopted in Mr. Druce's List of Peruvian Butterflies in the 'Zoological Proceedings' for 1876.

RHOPALOCERA.

Nymphalidæ.

DANAINÆ, Bates.

MECHANITIS, Fabr.

1. *Mechanitis egaënsis*, var.

Mechanitis egaënsis, Bates, Trans. Linn. Soc. xxiii. p. 531, pl. 56. fig. 7*a* (1862).

Ucayali.

One example, differing from Bates's figure in the narrower zigzag band of primaries.

LEUCOTHYRIS, Butler and Druce (*Ithomia*, pt., Druce).

2. *Leucothyris astrea.*

Papilio astrea, Cramer, Pap. Exot. i. pl. 22. D (1775).

Ucayali.

3. *Leucothyris perspicua.*

Leucothyris perspicua, Butler, Trans. Ent. Soc. (1877).

Ucayali.

MELINÆA, Hübner.

4. *Melinæa phasiana.*

Melinæa phasiana, Butler, Trans. Ent. Soc. 1870, p. 489.

♂ ♀. Ucayali.

MORPHINÆ, Butler.

MORPHO, Fabricius.

5. *Morpho cæruleus.*

Arcuatus cæruleus, Perry, Arcana (1811).

Pozzuzo (October 1876).

6. *Morpho alexandrovna.*

Morpho alexandrovna, Druce, Trans. Ent. Soc. 1874, p. 155.

Ucayali.

Brassolinæ, Bates.

Opsiphanes, Westwood.

7. *Opsiphanes tamarindi.*

Opsiphanes tamarindi, Felder, Wien. ent. Monatschr. v. p. 111. n. 107 (1861).

Pozzuzo.

Only one male of this species was obtained.

Acræinæ, Bates.

Actinote, Hübner (*Acræa*, pt., Druce).

8. *Actinote sodalis*, n. sp.

Allied to *A. amida*, but the basal half (almost to external angle) of primaries rose-red; the subapical band shorter, more oblique, and considerably narrower; secondaries jet-black to the base; abdomen spotted with orange; primaries below with the red areas precisely as above, the band being coloured like the basal area, the ground-colour yellowish instead of reddish, with the veins black. Expanse of wings 2 inches 2 lines.

Ucayali.

A. sodalis is a very distinct species allied to *A. amida*, *griseata*, *callianira*, and one or two other named forms; but it differs considerably from all of them. Mr. Davis obtained eight examples.

Heliconinæ, Bates.

Heliconius, Latreille.

9. *Heliconius doris.*

Papilio doris, Linnæus, Mant. Plant. p. 536 (1771).

Ucayali.

10. *Heliconius estrella.*

Heliconius estrella, Bates, Trans. Linn. Soc. xxiii. p. 560 (1862).

Ucayali.

A slight variety, the yellow band of primaries being rather wider than usual, and placed rather further from the apex; in these respects it tends to approach *H. Bartletti*, which, if the extreme variability of this genus be unquestionable, should be considered a modification of *H. estrella*. Is it the form described by Felder as *H. aglaope*? The description of the latter agrees better with *H. estrella* than with *H. thelxiope.*

EUEIDES, Hübner.

11. *Eueides aliphera.*

Cethosia aliphera, Godart, Enc. Méth, ix. p. 246 (1819).

Ucayali.

NYMPHALINÆ, Bates.

COLÆNIS, Hübner.

12. *Colænis dido.*

Papilio dido, Linnæus, Syst. Nat. i. 2, p. 782 (1767); Clerck, Icones, pl. 30. f. 2 (1764).

Rio Mairo (17th October, 1876).

13. *Colænis julia.*

Papilio julia, Fabricius, Syst. Ent. p. 509 (1775).

Ucayali

14. *Colænis delila.*

Papilio delila, Fabricius, Syst. Ent. p. 510 (1775).

Ucayali.

ERESIA, Boisduval.

15. *Eresia heliconoides*, n. sp.

Wings above black-brown; primaries with two or three streaks at the base, and a broad patch just beyond the end of the cell, deeply incised upon the median nervure, rose-red; body black: wings below brown, nervures and folds black; primaries with a cuneiform basal patch not reaching the subcostal vein, but divided by the median vein, reddish tawny; a broad red patch just beyond the end of the cell as above, but not incised upon the median nervure; secondaries reddish towards the base, yellowish at apex; pectus spotted with creamy yellowish. Expanse of wings 2 inches 2 lines.

Ucayali.

Evidently a mimic of *Actinote sodalis*, but more like some species of *Heliconius* of the *H. elimæa* group. It is allied to *E. acræina*, but differs in the coloration of the secondaries and the base of the primaries. Two examples were obtained.

16. *Eresia nauplius.*

Papilio nauplius, Linnæus, Mus. Lud. Ulr. p. 309 (1764).

Ucayali.

Eunica, Hübner.

17. *Eunica bechina.*

Cybdelis bechina, Hewitson, Exot. Butt. i. *Cybd.* pl. 2. f. 10 (1852).

Ucayali.

18. *Eunica pomona.*

Faunia pomona, Felder, Reise der Nov. Lep. iii. pl. 52. figs. 11, 12 (1867).

Rio Mairo.

19. *Eunica amelia.*

Papilio amelia, Cramer, Pap. Exot. ii. pl. 136. B, C (1779).

Ucayali.

Epicalia, Westwood.

20. *Epicalia acontius.*

Papilio acontius, Linnæus, Mant. Plant. p. 537 (1771).

Ucayali.

Nica, Hübner.

21. *Nica sylvestris.*

Nica sylvestris, Bates, Journ. Entom. ii. p. 204 (1864).

Ucayali.

Eubagis, Boisduval.

22. *Eubagis ærata.*

Eubagis ærata, Butler, Trans. Ent. Soc. 1877.

Ucayali.

Callicore, Hübner.

23. *Callicore clymena.*

Papilio clymena, Cramer, Pap. Exot. i. pl. 24. E, F (1775).
Callicore neglecta, Salvin, Ann. Nat. Hist. ser. 4, vol. iv. p. 176 (1869).

Rio Mairo.

The form called *C. neglecta* differs in an extremely variable character; so that I have been unable to consider it distinct.

24. *Callicore lidwina.*

Callicore lidwina, Felder, Wien. ent. Monatschr. vi. p. 114 (1862).

Pozzuzo.

CATAGRAMMA, Boisduval.

25. *Catagramma Felderi.*

Catagramma Felderi, Hewitson, Exot. Butt. iii. *Cat.* pl. 10. figs. 68, 69 (1864); iv. *Cat.* pl. 12. f. 96 (1868).

Pozzuzo.

26. *Catagramma excelsior*, var.

Catagramma excelsior, Hewitson, Exot. Butt. ii. *Cat.* pl. 7. figs. 49, 50 (1858).

Morado (October 1876).

Mr. Davis states that this is rare; he only obtained one example, which differs from the typical form in the darker and narrower orange belt of primaries. Hewitson's second representation of *C. excelsior* is evidently a distinct thing; I cannot imagine why nobody has named it. I would propose that it be called *C. inferior*.

27. *Catagramma peristera.*

Catagramma peristera, Hewitson, Exot. Butt. i. *Cat.* pl. 2. figs. 15–17 (1853).

Ucayali.

28. *Catagramma hystaspes.*

Papilio hystaspes, Fabricius, Spec. Ins. ii. p. 57 (1781).

Ucayali.

29. *Catagramma cynosura.*

Papilio cynosura, Doubleday and Hewitson, Gen. D. Lep. pl. 28. fig. 2 (1847).

Rio Mairo.

CALLITHEA, Boisduval.

30. *Callithea Degandii.*

Callithea Degandii, Hewitson, Exot. Butt. ii. *Call.* pl. 2. figs. 6–8 (1858).

Puerto del Mairo (October 17, 1876).

Seven examples of this rare species were obtained.

31. *Callithea Davisii*, n. sp.

Callithea Markii (part), Hewitson, Exot. Butt. ii. pl. xxxii. fig. 5 (1857).

Ucayali.

This species, which I have only seen from Peru, is certainly distinct from the Ega form called *C. Markii*. We have long had two examples (from Peru) in the Museum; Mr. Davis has brought three others; and I have seen specimens in various private collections. The species of *Callithea* being rarely seen, Mr. Davis made a point of obtaining as many examples as he could.

PANDORA, Westwood.

32. *Pandora prola*.

Pandora prola, Doubleday and Hewitson, Gen. Diurn. Lepid. pl. 43. f. 5 (1850).

Pozzuzo.

Only one example of this fine species was obtained.

AGERONIA, Hübner.

33. *Ageronia amphinome*.

Papilio amphinome, Linnæus, Syst. Nat. i. 2, p. 779 (1766).

Pozzuzo.

MEGALURA, Blanchard (*Timetes*, Druce).

34. *Megalura norica*.

Timetes norica, Hewitson, Exot. Butt. i. *Tim.* pl. i. figs. 3, 4 (1852).

Ucayali.

35. *Megalura crethon*.

Papilio crethon, Fabricius, Gen. Ins. p. 252 (1777).

Ucayali.

36. *Megalura hermione*.

Timetes hermione, Felder, Wien. ent. Monatschr. v. p. 97 (1861).

Sarayacu.

MARPESIA, Hübner.

37. *Marpesia peleus*.

Papilio peleus, Sulzer, Gesch. Ins. pl. 13. fig. 4 (1776).

Rio Mairo (October).

Victorina, Blanchard.

38. *Victorina sulpitia.*

Papilio sulpitia, Cramer, Pap. Exot. iv. pl. 328. A, B (1782).
Ucayali.

Heterochroa, Boisduval.

39. *Heterochroa Davisii*, n. sp.

Allied to *H. erotia*, but smaller, with more falcate primaries; the orange band not united to costa externally, the third spot being absent; the outer margin of the band also not angulated in the same way between the first and second median branches, but narrowing gradually; no red spot above anal angle: underside altogether duller, the bands pale brown, with dark brown margins; the submarginal spots greyish; the disk of secondaries occupied by a broad brown band, through the centre of which runs a blackish stripe, and bordered with reddish brown; two external series of pale spots as in primaries, the outer series white and lunular. Expanse of wings 2 inches 5 lines.

Ucayali.

Also allied to *Heterochroa urraca* (which, I think, may possibly be *H. erotia* ♂), but differing in the same particulars.

Apatura, Fabricius.

40. *Apatura griseldis.*

Apatura griseldis, Felder, Wien. ent. Monatschr. vi. p. 117 (1862).
Ucayali.

41. *Apatura selina.*

Apatura selina, Bates, Journ. Entom. ii. p. 334 (1865).
Ucayali.

Aganisthos, Boisduval.

42. *Aganisthos odius.*

Papilio odius, Fabricius, Syst. Ent. p. 457. n. 60 (1775).
Rio Mairo.

43. *Aganisthos acheronta.*

Papilio acheronta, Fabricius, Syst. Ent. p. 501. n. 249 (1775).
Ucayali.

PREPONA, Boisduval.

44. *Prepona antimache.*

Morpho antimache, Hübner, Verz. bek. Schmett. p. 49 (1816).

Ucayali.

AGRIAS, Doubleday.

45. *Agrias sardanapalus.*

Agrias sardanapalus, Bates, Proc. Ent. Soc. ser. 2, vol. v. p. 111 (1860).

Cashiboya, elevation 550 feet (November 1876).
One very fair example of this species was obtained.

MEGISTANIS, Westwood.

46. *Megistanis deucalion.*

Megistanis deucalion, Felder, Wien. ent. Monatschr. iv. p. 238 (1860).

Ucayali.

There are no representatives in the collection of the families Erycinidæ and Lycænidæ; probably they were disregarded on account of their insignificant size.

Papilionidæ.

PIERINÆ, Bates.

CATASTICTA, Butler.

47. *Catasticta corcyra.*

Euterpe corcyra, Felder, Wien. ent. Monatschr. iii. p. 327 (1859); Reise der Nov. Lep. ii. pl. 23. f. 8 (1865).

Ucayali.
Evidently not an uncommon species in Peru.

RHODOCERA, Boisduval.

48. *Rhodocera menippe.*

Mancipium fidelis menippe, Hübner, Samml. exot. Schmett. (1806–16).

Rio Mairo (October).
Very abundant.

Callidryas, Boisduval.

49. *Callidryas philea.*

Papilio philea, Linnæus, Syst. Nat. i. 2, p. 764 (1776).

Ucayali.

Phœbis, Hübner.

50. *Phœbis hersilia.*

Papilio hersilia, Cramer, Pap. Exot. ii. pl. 173. C, D (1779).

Ucayali.

51. *Phœbis argante.*

Papilio argante, Fabricius, Syst. Ent. p. 470 (1775).

Ucayali.

52. *Phœbis trite.*

Papilio trite, Linnæus, Syst. Nat. i. 2, p. 763 (1766).

Ucayali.

Aphrissa, Butler.

53. *Aphrissa statira.*

Papilio statira, Cramer, Pap. Exot. ii. pl. 120. C, D (1779).

Rio Mairo.

Pieris, Boisduval.

54. *Pieris demophile.*

Papilio demophile, Linnæus, Syst. Nat. i. 2, p. 761 (1766).

Rio Mairo (October 18, 1876).

55. *Pieris phaloë.*

Pieris phaloë, Godart, Enc. Méth. ix. p. 156 (1819).

Ucayali.

Appias, Hübner.

56. *Appias margarita.*

Mylothris margarita, Hübner, Samml. exot. Schmett. (1816–41).

Rio Mairo (October 18, 1876).

DAPTONURA, Butler.

57. *Daptonura peruviana.*

Pieris peruviana, Lucas, Rev. Zool. p. 327 (1852).

Ucayali.

DISMORPHIA, Hübner.

58. *Dismorphia theugenis.*

Leptalis theugenis, Doubleday, Ann. Nat. Hist. ser. 2, vol. i. p. 124 (1848).

Ucayali.

PAPILIONINÆ, Bates.

PAPILIO, Linn.

59. *Papilio crassus.*

Papilio crassus, Cramer, Pap. Exot. ii. pl. 112. C (1779).

Rio Mairo.

60. *Papilio protesilaus.*

Papilio protesilaus, Linnæus, Mus. Lud. Ulr. p. 209 (1764).

Ucayali.

61. *Papilio theramenes.*

Papilio theramenes, Felder, Wien. ent. Monatschr. v. p. 74 (1861).

Cayaria.

62. *Papilio cinyras*, var.

Papilio cinyras, Ménétriés, Cat. Mus. Petrop. Lep. ii. pl. 7. fig. 3 (1857).

Rio Mairo.

Agrees with the form occurring at Villa Nova.

Hesperiidæ.

PYRRHOPYGA, Hübner.

63. *Pyrrhopyga fluminis.*

Pyrrhopyga fluminis, Butler, Cist. Ent. i. p. 176 (1873).

Ucayali.

64. *Pyrrhopyga hospita*, n. sp.

Allied to *P. zonara*, but the bands of primaries rather narrower; the basi-internal area of secondaries occupied by a discoidal spot and three to four narrow divergent internomedian streaks of pale blue; the discal band widely separated from the internal streaks, continuous and slightly tapering to near the anal angle: body silvery pale blue, the thorax longitudinally striped and the abdomen transversely banded with black; head black, spotted with white. Expanse of wings 2 inches 7 lines.

Ucayali (several examples).

HETEROCERA.

Zygænidæ.

EUCHROMIINÆ, Butler.

HISTIÆA, Walker.

65. *Histiœa proserpina.*

Euchromia proserpina, Hübner, Zutr. exot. Schmett. figs. 221, 222.

Ucayali.

Melameridæ.

PACHIOSIA, n. gen.

Allied to *Micropus*, but with the subcostals of secondaries emitted together from the end of the cell, instead of from a well-marked footstalk; the discocellulars more angulated, the first median branch emitted nearer to the second. Type *P. flaveolata*, Cramer.

66. *Pachiosia flaveolata.*

Phalæna flaveolata, Cramer, Pap. Exot. i. pl. lxxxviii. C (1779).

Ucayali.

A very common and well-known species.

Dioptidæ.

STENELE, Walker.

67. *Stenele calida.*

Stenele calida, Butler, Ill. Lep. Het. p. 56, pl. xix. fig. 3 (1877).

Ucayali.

Uraniidæ.

URANIA, Fabricius.

68. *Urania leilus.*

Papilio leilus, Linnæus, Syst. Nat. ii. 1, p. 750 (1766).

Rio Mairo; Pozzuzo.

NYCTALEMON, Dalman.

69. *Nyctalemon empedocles.*

Papilio empedocles, Cramer, Pap. Exot. iii. pl. cxcix. A, B (1782).

Cayaria, Ucayali.

This species is readily distinguished from *N. lunus* by the pale central band being intersected by a brown stripe.

XVIII.—*Notes on a Paper by R. H. Traquair, M.D., F.G.S., F.R.S., on the Structure of the Lower Jaw in* Rhizodopsis *and* Rhizodus, *in the 'Annals and Magazine of Natural History,'* vol. xix. 4th ser. p. 299. By THOMAS ATTHEY.

IN the first volume of the fourth series of this magazine were published "Notes" on *Rhizodopsis*, by my late friend Mr. Albany Hancock and myself, in which the præmaxilla is described as a long, narrow, wedge-shaped bone, with a row of small teeth along the margin, and two laniaries—one large, the other small, the latter placed in front of the former and near to the symphysis.

Since then a large number of specimens of the cranium of *Rhizodopsis*, several showing the præmaxilla *in situ*, have been obtained from the black shale at Newsham.

From three of the largest of these the matrix has been carefully and entirely cleared away, so that all the bones can be well seen. In these specimens the maxilla and our præmaxilla evidently form the margin of the upper jaw, along which is placed a row of small teeth, with two laniaries, one smaller than the other and lying near to the symphysis, quite as in our description.

The outline and the outer surface of the mandible are also well defined, with the row of small teeth along its alveolar border interlocking with or being overlain by those of the maxilla and præmaxilla.

On upwards of half a dozen mandibles in my collection with their inner surfaces exposed, there is distinctly to be seen the row of small teeth along their upper margins, with the large laniary in front and the other three laniaries behind; these are placed at about equal distances from each other.

On not one of these mandibles do I find the slightest indication of a suture which might divide the bones bearing the laniary teeth.

If, as the author of the above-named paper states, our præmaxilla is the alveolar border or dentary piece of the mandible detached from that bone, how does it happen that in all the large series of mandibles of *Rhizodopsis* in my collection the alveolar border or dentary piece with teeth, which is supposed to represent our præmaxilla, is not wanting in any specimen, whilst the præmaxilla, which is much more common in our coal-field than either the maxilla or the mandible, is absent from a good many of the more perfect specimens of *Rhizodopsis* (which is, from the lax connexion of this bone with the cranium, what might have been expected)?

Of the largest specimen the maxillæ measure 1·4 inch in length; their upper margins are injured; the lower, bearing the row of small teeth, are intact.

The præmaxillæ, articulating with the front of the maxillæ, unite together on the median line, forming the fore part of the mouth below the snout; each bone is 1·6 inch in length and 0·2 inch in height next the symphysis, gradually diminishing backwards.

That we have here the real præmaxilla is beyond a doubt.

XIX.—*Description of a new Species of* Phasmidæ *from India.* By Prof. J. Wood-Mason, Deputy-Superintendent, Indian Museum, Calcutta.

Necroscia menaka, n. sp.

♀. Body elongate, stoutish, of tolerably uniform width throughout. Head large, oblong, parallel-sided; vertex divided by three notches into four tubercles. Pronotum shorter and narrower than the head, flat, with a few minute granules. Mesothorax slightly tapering from the insertion of the legs forwards, granulate above and below and on the sides; its dorsal arc longitudinally carinate, granulate along the top of the ridge and at the edges. Abdomen tapering slightly from the base to the emarginate apex, which carries a longitudinally carinate semioval plate; its terminal segments, dorsal and ventral, constructed much as in *Necroscia salmanazar*, *N. maculicollis*, and *N. sparaxes*, in all three of which also the sixth ventral segment is furnished at its hinder extremity with a peculiarly shaped process, which serves as the *point d'appui* for the claspers of the male during copulation. Legs long and stout; the fore tibiæ and the femora and the tibiæ of the two posterior pairs subtriquetrous and carinate along the middle of the under surface. Tegmina oval, with but a slight compressed conical elevation of the carina. Wings reaching about to the end of the fifth abdominal segment; the costal area luteous brown, like the body and legs; the costal vein divided at the middle of its length, the two branches uniting again near the extremity; posterior area milk-white, conspicuously tessellated with dark smoky-quartz-colour, all the transverse veinlets being broadly and distinctly margined on each side with this colour.

Total length 3 inches 7 lines; head 3·25 lines, prothorax 2·5, mesothorax 7·25; abdomen 1 inch 8 lines + 4 = 2 inches; antennæ 2 inches 5 lines; wings 1 inch 10 lines; tegmina 5·5 lines; fore femur 12·75 lines, tibia 14·5, tarsus 6·75; intermediate femur 8·5 lines, tibia 9·5, tarsus 5; posterior femur 13·5 lines, tibia 14, tarsus 5·75.

Hab. Southern slopes of the Khasi hills.

Closely allied to *N. salmanazar*, Westw. (Monogr. Phasm. p. 153, pl. xvi. fig. 6), ♀, from the Philippines.

Calcutta, June 26, 1877.

XX.—*On the Mollusca collected during the Arctic Expedition of* 1875–76. By EDGAR A. SMITH, Zoological Department, British Museum.

THE chief interest attaching to the Mollusca obtained during the Arctic Expedition arises from the collections being made at localities further north than any which had been previously investigated.

It is somewhat disappointing, considering that unexplored regions were searched, that only a single new form was procured.

The entire collection consists of thirty-four species. This may appear a very small number; but the difficulty experienced in collecting in such northern climates in a great measure accounts for such small results. It by no means proves that there is any great scarcity of molluscan life in the regions investigated. In all probability, further research will discover many more known forms, thus showing that the fauna northward does not change very materially from that existing further south in Davis Straits.

In the report of the 'Valorous' Expedition, Dr. Gwyn Jeffreys gives it as his opinion that the molluscan fauna of West Greenland is rather European than American. On the contrary, the small collections brought home by the present expedition lead to an exactly opposite conclusion; for, of the thirty-four species obtained, at least sixteen are found off the Atlantic coast of the United States, whilst only four or five have been recorded from European seas, and the remainder, as far as our present knowledge extends, are exclusively Greenlandic.

Great praise is due to the two naturalists of the expedition, Captain H. W. Feilden, of H.M.S. 'Alert,' and Mr. H. C. Hart, of the 'Discovery,' for the careful manner in which the particulars regarding the specimens are preserved. To save repetition, the exact position of the principal stations at which Mollusca were dredged is here appended:—

Dumb-bell Harbour, 82° 30′ N. lat.
Discovery Bay, 81° 41′ N. lat.
Dobbin Bay, Grinnel Land, 79° 40′ N. lat.
Franklin-Pierce Bay, 79° 25′ N. lat.

I. Gastropoda.

Pleurotoma (*Bela*) *violacea*, Mighels & Adams,

Proc. Bost. Soc. Nat. Hist. 1841, i. p. 50; Boston Journal of Nat. Hist. 1842, p. 51, pl. 4. f. 21; Gould, Invert. Mass. 1870, p. 353, f. 622 (as *Bela violacea*).
Defrancia Beckii, Möller, Naturhist. Tidsskrift, 1842, p. 86.
Pleurotoma grœnlandica, Reeve, Conch. Icon. f. 343 (from type).
Var. = *Defrancia cylindracea*, Möller, *l. c.* p. 85.
,, = *Defrancia livida*, Möller, *l. c.* p. 87.
,, = *Pleurotoma borealis*, Reeve, *l. c.* fig. 277.

Hab. Discovery Bay, 5 fathoms (*Feilden*).

Only one rather elongated specimen was obtained.

Fusus (*Sipho*) *tortuosus*?, Reeve,

Belcher's Last Arctic Voyage, vol. ii. p. 394, pl. 32. f. 5 *a, b*.
? *Buccinum Sabinii*, Gray, Parry's Voy. 1821, p. 240.
Var.? = *Fusus spitzbergensis*, Reeve, Belcher's Last Arctic Voyage, ii. pl. 32. f. 6 *a, b*.

Hab. Shore of Hayes Sound, 79° N. lat. (*Feilden*); Dobbin Bay, 30 fms. (*Hart*).

It is with considerable doubt that I associate the two specimens from the above localities with this species, as their form is very different from the type shell as delineated in Reeve's figure; here the aperture, together with the basal canal, has a length of exactly half the shell, whilst in one of the specimens before me it occupies more than three fifths of the entire length. The second specimen is intermediate with regard to this character; and this induces one to conclude that the differences in length of the mouth and canal and the proportion of them to the height of the spire are not at all reliable characters in this group of the genus. In other respects there seems to be no difference, the sculpture and epidermis being of precisely the same character.

In Dr. Gray's collection there is a tablet containing some specimens of this species labelled *Sabinii*; but none of them can be his type, for all are larger than the dimensions given; and it must ever remain uncertain whether his species is undoubtedly the same as *F. tortuosus*. Dr. Gwyn Jeffreys considers that the same species is described by Gray and Reeve, and among the synonyma gives *F. spitzbergensis*, Reeve, *F. ebur*, *F. togatus*, and *F. Pfaffi*, described by Mörch. The first of these is, in all probability, merely a strongly sculptured form of this species; and the others are only known to me from description.

Buccinum hydrophanum, Hancock.

Ann. & Mag. Nat. Hist. 1846, xviii. p. 325, pl. 5. fig. 7; Reeve, Conch. Icon. vol. iii. f. 103.

Tritonium grönlandicum, Chemn., var. *a*, Mörch, Mollusc. Grönlandiæ, 1857, nos. 94–5.

Tritonium hydrophanum, Hancock, Mörch, Arctic Manual, 1875, p. 128. no. 106.

Hab. Franklin-Pierce Bay (*Feilden* and *Hart*); Dobbin Bay, 30 fms. (*Hart*).

This species varies considerably with regard to the length of the spire, as may be seen by comparing the figures by Hancock and Reeve. The convexity of the whorls is likewise subject to much variation, the examples from the above localities having them remarkably rotund, more so than Hancock's figure represents them. This author describes the epidermis, "pale yellow;" and Reeve gives it, "pale green;" and some young specimens from Dobbin Bay, the only ones possessing the epidermis, have it of a brownish olive colour.

This species has also been obtained from the west coast of Davis Straits and at Olrik, 200–300 fms. (*Mörch*).

Buccinum Belcheri, var.,

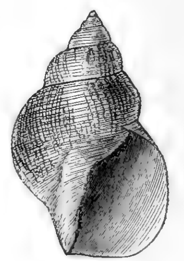
Reeve, Belcher's Last Arctic Voyage, vol. ii. p. 394, pl. 32. f. 7 *a*, *b*.

Shell ovately conical, very thin, purplish brown, with a few paler streaks here and there; whorls $5\frac{1}{2}$, very convex, spirally distinctly ridged, the ridges being alternately larger, longitudinally rather coarsely striated by the lines of growth, and very obsoletely plicated; mouth irregularly ovate, large, occupying more than half the entire length of the shell, of the same colour as the exterior, terminating inferiorly in a short, slightly recurved canal; columella oblique, scarcely arcuated, smooth, shining, whitish towards the base; epidermis thin, olivaceous, and laminated slightly on the principal distinct incremental lines or raised lirulæ; operculum circularly ovate, with the nucleus rather central.

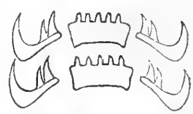
Length 33 millims., diam. 17; aperture 19 millims. long and 11 wide.

Hab. Dobbin Bay, 30 fms. (*Hart*).

The dentition of the animal of this species closely resembles that of *Buccinum grœnlandicum* and *Neptunea antiqua*, as represented by Troschel's figures in his work 'Das Gebiss der Schnecken,' vol. ii. pl. vi.



The above description was already prepared under the supposition that the specimen before me was distinct from *B. Belcheri*, when, through the kindness of Dr. Gwyn Jeffreys, I was enabled to compare it with the type of that species. It is less elongated, has a rather shorter spire; and the body-whorl is more ventricose. The columella also is less arcuate and more oblique, and the spiral ridges and lines of growth are more pronounced. The type does not display such regularity in the alternation of large and small transverse ridges as the variety. A specimen of this species from Finmark, in the collection of Mr. Jeffreys, very closely resembles the shell from Dobbin Bay.



Buccinum Belcheri.

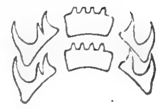
Like the rest of the genus this species is subject to great variation. The type specimen is comparatively smooth and without plications beneath the suture; others are strongly plicated, and have the spiral ridging much raised.

Buccinum sericatum, Hancock,

Ann. & Mag. Nat. Hist. 1846, vol. xviii. p. 328, pl. v. f. 6.

Hab. Dobbin Bay, 30 fms. (*Hart*).

The radula of this species is remarkable for the unequal dentition of the side plates, one of which is a trifle the narrower and is furnished with only two fangs: they are subequal in length; but the inner one is slightly the stouter. The other lateral plate has three teeth, of which the outermost is longest, the median smallest and at the base joins the inner fang. The median plate bears four small conical denticles.



Radula of *Buccinum sericatum.*

The only example of this species is a young shell. It agrees in all respects with Hancock's admirable description, except that the cilia of the epidermis are apparently closer together than in the type, in which they are said to be "not much crowded," whilst in the specimen before me there are about three in the space of a millimetre. The surface of the shell beneath the remarkable epidermis is very curiously wrinkly-striated. The operculum is roundish, greenish yellow on the inner side, and dirty yellow exteriorly; and the nucleus is rather less central than in *B. Belcheri.*

This species is considered a variety of *B. grœnlandicum,* Chemnitz, by Jeffreys (see 'Annals & Mag. Nat. Hist.' April 1877, p. 323).

Taking into consideration the remarkable difference of the epidermis and of the radula, I think there can be no doubt of the specific distinctness of the two forms. Besides these differences there are others of form and sculpture.

Trichotropis tenuis, sp. nov.

Shell very thin, light, semitransparent, glossy white, globosely turbinate, widely and openly umbilicated, clothed with a dirty-yellowish epidermis, produced on the keels of the whorls into close-set, very short, bristle-like filaments, and rather coarsely obliquely striated, or rather lamellated, marking periods of growth; whorls 6, the two apical ones smooth and rounded, the three following beautifully sculptured with raised oblique lines of growth and minute spiral striæ, keeled and angulated a trifle above the middle, convexly sloping above the keel and nearly straight beneath it; last whorl large, encircled with three faint keels, two near the middle and the third at the base, bordering the umbilicus; aperture subcircular, occupying about $\frac{6}{11}$ of the entire length of the shell, whitish within, streaked with irregular, curved, yellowish-olive stripes; the peristome is continuous, thin, with the epidermis produced beyond its extreme edges; columella white, arcuate, with a slight shallow channel at its base.

Greatest length 33 millims., diam. of last whorl above the aperture 18, greatest diam. 30; aperture $18\frac{1}{2}$ long, nearly 17 wide.

Hab. Off Cape Louis Napoleon, Grinnel Land, 79° 38′ N. lat., in 25 fms.

Only a single specimen of this grand new *Trichotropis* was obtained. It is very different from any hitherto described, being remarkable for its circular aperture, conical spire, and extreme fragility. The entire surface under the epidermis is beautifully sculptured with oblique raised lines or lirulæ, and minutely striated in a spiral direction between them; and the raised keels are also similarly striated. The central keel of the last whorl is also visible on the upper ones, and is situated just above the suture.

Trichotropis tenuis.

Dr. Gwyn Jeffreys, who has seen the specimen, considers it a very abnormal form of *T. bicarinata*. Several other conchologists agree with me that it certainly is specifically distinct. The character of the epidermis is different, since it is not produced into such very long ciliations as in the old species. The keels are very slightly prominent; the space between them is convex, and not concave; and, finally, the growth of the shell appears to be quite regular, and does not display any appearance of distortion, such as is usually observable in abnormal growths of most species.

Trichotropis borealis, Broderip and Sowerby,

Zoological Journal, iv. 1829, p. 375; Sowerby, Thesaurus Conch. iii. p. 321, pl. 285. f. 1–3; Forbes and Hanley, Brit. Moll. pl. 101. f. 5–6; Jeffreys, Brit. Conch. vol. iv. pl. 4. f. 2, v. pl. 79. f. 6; Sow. Conch. Icon. xix. f. 1 *a–c*.

Trichotropis costellatus, Couthouy, Bost. Journ. Nat. Hist. vol. ii. 1839, pl. 3. f. 3; Sow. Thes. Conch. iii. pl. 285. f. 6; Conch. Icon. xix. f. 13.

T. acuminata, Jeffreys, Brown, Illust. Conch. ed. 2, pl. 57. f. 15.

T. atlantica (Beck), Möller, Naturhist. Tidsskrift, 1842, p. 85.

Fusus umbilicatus, Brown, Wernerian Memoirs, viii. pl. 1. f. 2.

F. Laskeyi, Macgillivray.

Trichotropis inermis, Hinds, Voy. Sulphur, pl. xi. f. 13–14; Sowerby, Thesaurus Conch. iii. pl. 285. f. 14; Conch. Icon. xix. f. 11.

Hab. Discovery Bay, 5 fms.; Dumb-bell Harbour (*Feilden*).

The specimens from the above localities agree precisely in shape and sculpture with that form of this species which was described by Hinds from shells found at Sitka, under the name of *T. inermis*. It is said to differ from *T. borealis* in the epidermis wanting the filamentous prolongations which usually obtain in this genus. In the British Museum there are several specimens of *T. borealis* which show various degrees in the development of the epidermal filaments; and others, in bad condition, do not display evidences of their former presence. With regard to "strong ridges [on the body-whorl] at rather distant intervals, marking the termination or commencement of the periodical stages of growth" (*Hinds*), I should add that this character is frequently, indeed generally, present in typical specimens of *borealis*, and therefore I think that these two characters upon which Hinds establishes his species are not definitely specific. *T. cancellata*, Hinds, considered by Jeffreys to be synonymous with this species, appears to me sufficiently distinct.

I take this opportunity of correcting an error or two which occur in the monograph of this genus in the 'Conchologia Iconica.' Mr. Sowerby figures (pl. ii. fig. 6) a species under the name *flavidula*, Hinds, 'Voyage of the Sulphur.' The correct name of this species, which was described by Hinds in the 'Proceedings of the Zoological Society,' 1843, p. 18, and not in the 'Sulphur,' is *flavida*. The following species—*T. cedo-nulli*, *T. conica*, and *T. quadricarinata*—are quoted by Sowerby ('Conchologia Iconica') as existing in the British Museum. On comparing the monograph in that work with that in the 'Thesaurus,' it will be seen that the figures in the former, with the exception of *T. clathrata*, which is additional, are merely copies of those in the latter.

None of these three species are now in the Museum; but whether at the time of the preparation of the first monograph they were in the Cumingian collection I cannot say. If such were the case, I suppose they must have been lost *before* that collection was deposited in the Museum, or they certainly would now be with the other species of the genus. The fact of Sowerby (in the 'Conch. Icon.' August 1874) asserting their presence in the national collection is no guarantee of their existence there, because, besides his well-known inaccuracy, in this instance having merely copied his old monograph, he *presumes* that the shells exist in the Museum. *T. Kuzeri* in both works should be *T. Kröyeri*, Philippi.

Velutina (Morvillia) zonata, var. *grandis*.

Velutina zonata, Gould, Invert. Mass. ed. 1, p. 242, f. 160, ed. 2, p. 335, f. 606; De Kay, Moll. N. Y. pl. 23. f. 253; Reeve, Conch. Syst. pl. 147. f. 3, 4.
Morvillia zonata, Gray, Guide Moll. Brit. Mus. p. 45.
Velutina (Morvillia) zonata, Mörch, Arctic Manual, 1875, p. 126.

Hab. Franklin-Pierce Bay (*Hart*).

The only specimen was taken out of the stomach of *Phoca barbata*, and is in very bad condition. This variety is so very much larger than the ordinary size of the species that it almost appears that it must be distinct. It measures 21 millims. in length, being about double that of Gould's figure. Hancock mentions one from the west coast of Davis Strait, which was about five eighths of an inch (or 16 millims.) long.

Natica affinis, Gmelin,

Syst. Nat. p. 3675; Mörch, Moll. Grönl. 1857, no. 56.
Natica clausa, Broderip and Sowerby, Zool. Journal, vol. iv. p. 373; Beechey's Voyage, pl. 34. f. 3; Reeve, Conch. Icon. ix. f. 113; Gould, Invertebrata Mass. f. 167, (ed. 2) f. 612.
N. consolidata, Couthouy, Bost. Journ. Nat. Hist. vol. ii. 1839, p. 89; Philippi, Conchylien, pl. 1. f. 11.
N. septentrionalis, Beck, Möller, Naturhist. Tidsskr. 1842, p. 80.
N. borealis (Beck), Gould, *l. c.* p. 238, (ed. 2) p. 343.
Var. =*N. janthostoma*, Deshayes, Mag. de Zool. 1841, pl. 45; Reeve, Conch. Icon. ix. f. 79 *a, b*.

Hab. Dobbin Bay, 30 fms., bottom stones and mud (*H. C. Hart*, Aug. 1876).

Only a single small specimen was obtained, which is remarkable for having the spire rather more elevated than usual.

There is another species figured by Philippi, on plate i. figs. 2 and 3, under the name *affinis*, which is totally distinct from the present one.

In the description of this species Gould expressly remarks that it is "marked by striæ of growth *only*," and that the epidermis is "thin, bony." I presume that the last word should be *horny*; for there is nothing *bony* in the nature of the epidermis. As regards the sculpture, I find that all specimens I have examined distinctly show spiral striation, which, however, is very minute, and can only be seen by the aid of a lens. The animal is briefly described by Jeffreys in the 'Annals & Mag. Nat. Hist.' April 1877, p. 318. The variety (*N. janthostoma*) is usually rather more globular than normal specimens; and the umbilicus is frequently scarcely filled up by the callosity, as in arctic examples. *N. occlusa*, Searles Wood, a fossil from the Red Crag, an allied species, yet probably is distinct on account of its much more produced spire.

Trochus (*Margarita*) *umbilicalis*, Broderip and Sowerby,

Zoological Journal, 1829, iv. p. 371.
? *Trochus grönlandicus*, Chemnitz, Conch. Cab. v. pp. 12 & 108, f. 1671.

Hab. Franklin-Pierce Bay, 15 fms.; Mushroom Shore, 82° 29′ N.

This species is also reported by Jeffreys, 'Annals & Mag. Nat. Hist. 1877, March, p. 237, from "Discovery Bay, and fossil in Kane valley," from specimens collected by Captain Feilden during the expedition. These specimens were not sent to the Museum.

Trochus (Margarita) glauca, Möller,

Naturhist. Tidsskrift, 1842, p. 81.
Margarita Harrisoni, Hancock, Ann. & Mag. Nat. Hist. 1846, xviii. p. 325, pl. 5. figs. 4, 5.

Hab. With the preceding species at Franklin-Pierce Bay.

Trochus (Margarita), sp., jun.

Hab. Cape Fiasco (*Feilden*).

This shell may be but a young specimen of *Margarita striata* of Broderip and Sowerby; but it differs from typical examples in the spire being comparatively small in proportion to the body-whorl, the base of which is almost destitute of revolving striæ; the umbilicus is larger and not bordered by a thickish ridge as is usually the case in this species.

Chiton (Tonicia) marmoreus, Fabricius,

Fauna Grœnlandica, p. 420; Gould, Invert. Mass. ed. 2, 1870, pp. 261, 262, fig. 524.
C. lævigatus, Fleming, Reeve, Conch. Icon. iv. sp. 179.
C. fulminatus, Couthouy, Bost. Journ. Nat. Hist. ii. 1838, pl. 3. f. 19.

Hab. Franklin-Pierce Bay, 15 fms., temperature 29°·50 (*Hart* and *Feilden*).

Lepeta cæca, O. F. Müller.

Patella cæca, O. F. Müller, Zool. Dan. Prodr. p. 237; Middendorff, Reise Sibirien, p. 183, pl. xvi. f. 6.
P. cerea, Möller, Naturhist. Tidsskrift, 1842, p. 89; Reeve, Belcher's Voyage, p. 395, pl. 32. f. 1 *a–c*.
P. candida, Couthouy, Bost. Journ. Nat. Hist. ii. 1838, p. 86.

Hab. Franklin-Pierce Bay, 15 fms.; Cape Fraser, 30 fms.; and Richardson Bay, 70 fms. (*H. W. Feilden*).

The animal of this species (var. *concentrica*) has been briefly described by Middendorff, *l. c.* p. 186, and also by Dr. Jeffreys in the 'Ann. & Mag. Nat. Hist.' 1877, March, p. 231.

Bulla (Cylichna) alba, Brown,

Volvaria alba, Brown, Illustrations Recent Conchol. ed. 2, pl. 19. f. 43, 44; Jeffreys, British Conch. iv. pl. 417, v. pl. 63. f. 6 (*Cylichna alba*).
Bulla corticata, Beck, Möller, Naturhist. Tidsskrift, 1842, p. 79.
B. triticea, Couthouy, Bost. Journ. Nat. Hist. 1838, ii. p. 88, pl. 2. f. 8.

Hab. Discovery Bay, 5 fms. (*Feilden*).

Bulla (*Cylichna*) *striata*, Brown,

Illustr. Recent Conch. ed. 2, p. 57, pl. 19. f. 41, 42.
B. scalpta, Reeve, Belcher's Last Arctic Voy. vol. ii. p. 392, pl. 32. f. *a–c*.

Hab. Found with the preceding species.

Onchidiopsis grœnlandica, Bergh,

Kongelige Danske Vidensk. Selsk. Skrifter, 1853, iii. p. 346, pl. ii.

Hab. Franklin-Pierce Bay, 13–15 fms., stony bottom *Hart*).

It is interesting to find this curious species, which was described by Bergh from South-Greenland specimens, ranging so far north as the above locality.

Eolis salmonacea, Couthouy,

Boston Journ. Nat. Hist. 1838, ii. p. 68, pl. 1. fig. 2; Gould, Invert. Mass. ed. 2, pl. 18. f. 264, 265.

Hab. Discovery Bay (*Feilden*).

A single small specimen of this very pretty animal was found at the above spot. It is remarkable how easily the dorsal branchiæ fall off with the slightest touch.

II. Conchifera.

Tellina (*Macoma*) *tenera*, Leach.

Macoma tenera, Leach (not Say), Appendix Ross's Voy. 1819, p. 175.
Tellina proxima (Brown), Sowerby, Beechey's Voy. 1839, p. 154, pl. 44. f. 4; Hanley in Sowerby's Thesaurus, vol. i. p. 313, pl. 66. f. 264, pl. 59. f. 115; Philippi, Abbild. Conch. ii. pl. iii. f. 4.
T. sordida, Couthouy, Bost. Journ. Nat. Hist. 1838, vol. ii. p. 59, pl. iii. f. 11 (nec Phil. *l. c.* f. 6 = *T. calcarea*, Chemn.).
? *T. crassula*, Desh. Proc. Zool. Soc. 1854, p. 354.

Hab. Discovery Bay, 5 fms. (*Feilden*).

Only an old worn shell obtained.

Lyonsia arenosa, Möller.

Pandorina arenosa, Möller, Naturhist. Tidsskrift, 1842, p. 93.
Lyonsia gibbosa, Hancock, Ann. & Mag. Nat. Hist. 1846, xviii. p. 338, pl. v. f. 11, 12.
Anatina striata, Gray, quoted by Gould, Invert. Mass. ed. 2, 1870, p. 6.

Hab. Discovery Bay, 5 fms. (*Feilden*).

Mr. Hancock quotes as a synonym of this species *Anatina striata*, Gray, as described in the appendix to Ross's Voyage. The shell collected by Ross, in the British Museum, obtained "in a mass of ice," has a second name attached to the tablet on which it is placed—*Lyonsia arctica*, Gray. Neither of these names were ever published.

The form described by Hancock appears to differ slightly from *L. arenosa* of Möller; for the umbones are situated more centrally, and consequently the anterior side is longer, as is seen in Hancock's figure. In Beechey's 'Voyage,' on plate 43 (fig. 3), a shell is figured, which possibly is the identical one collected by Ross; for it is exactly the same size, although the colour is different.

Cardium islandicum, Linn.,

Chemnitz, Conch. Cab. vi. pl. 19. f. 195; Gould, Invert. Mass. f. 58, (ed. 2) f. 450.
C. ciliatum, Fabricius, Fauna Grœnl. p. 410.
C. pubescens, Couthouy, Bost. Journ. Nat. Hist. 1838, ii. pl. 3. f. 6.
C. arcticum, Sowerby, Conchol. Illustr. f. 26.
C. icelandicum (Chemn.), Reeve, Conch. Ic. ii. f. 54.

Hab. Dobbin Bay, 30 fms. (*Hart*).

Axinus Gouldii?, Philippi,

Zeitschrift f. Malacozool. 1845, p. 74.
Lucina flexuosa, Gould, Invert. Mass. (ed. 1), p. 71, f. 52.
Cryptodon Gouldii, Invert. Mass. ed. 1870, p. 100, f. 406.

Hab. Discovery Bay, 5½ fms. (*Feilden*).

The shells associated with this species differ somewhat from the description given by Gould in having, besides "the widened groove," a lanceolate depression or posterior lunule which extends from the umbones down the dorsal slope. It is also very similar to *A. croulinensis*, Jeffreys.

Nucula inflata, Hancock,

Ann. & Mag. Nat. Hist. 1846, xviii. p. 333, pl. v. f. 13, 14; Sowerby's Thesaurus, iii. pl. 229. f. 115, 116.

Hab. Discovery Bay, 5½ fms. (*Feilden*).

Leda pernula, Müller,

Hanley in Sowerby's Thes. Conch. iii. pl. 228. f. 56–58.
"*Arca Martinii*, Bolten; *Leda macilenta*, Steenstrup and Möller; *Nucula rostrata*, Mart., Lam.; *Nucula fluviatilis*, Sowb." Mörch, Mol. Grœnland. p. 21.
Nuculana pernula, Mörch, *l. c.*
N. elongata, Daudin, *teste* Hanley.

Hab. Discovery Bay, 5½ fms. (*Feilden*).

Leda minuta, var., Fabricius,

Thesaurus Conch. iii. pl. 228. f. 61, 62.
Nucula parva, Sow. Conch. Ill. f. 7; *L. complanata*, Möller.

Hab. Richardson Bay, 80° 2′ N. lat., 70 fms. (*Feilden*).

The specimens from the above locality have the transverse costæ rather finer than is usual.

Leda glacialis, Leach.

Arca glacialis, Wood, Index Test. Suppl. p. 6, pl. 2. f. 6.
Nucula truncata, Brown, Illust. Conch. ed. 2, p. 84, pl. 33. f. 13.
N. portlandica, Hitchcock, Reeve, Belcher's Last Arctic Voyage, vol. ii. p. 396, pl. 33. f. 3 *a–b*.
Leda siliqua, Reeve, A. Adams, Proc. Zool. Soc. 1856, p. 48; Reeve, Belcher's Voy. pl. 33. f. 4.
Nucula (Portlandia) arctica, Mörch (non *N. arctica*, Gray), Arctic Manual, 1875, p. 132.
Leda (Nucula) arctica, Jeffreys, Brit. Conch. ii. p. 158.

Hab. Discovery Bay, 5 fms. (*Feilden*).

In a young example of this species the posterior beak is scarcely observable.

Both Dr. Mörch and Gwyn Jeffreys consider this species the *Nucula arctica* of Gray.

In Parry's 'Voyage,' 1821, Appendix, p. ccxli, Gray describes his species as "oval-elliptical, smooth, very slightly concentrically wrinkled; epidermis yellowish green, glossy." The form "oval-elliptical" and the smooth, glossy epidermis appear to me sufficient to show that the shell described by Gray is different from that which it is considered to be by Mörch and Jeffreys; and these characters are decidedly applicable to the shell which Hanley, in his excellent monograph in the 'Thesaurus Conchyliorum,' has referred to Gray's species.

Again, Gray writes, "shell behind slightly produced, gaping, edge entire." Both shells may be said to be slightly produced; but certainly only the *true arctica* (that is, as determined by Hanley) shows a slight gape; for in the other shell (*glacialis*) there is not the faintest trace of an opening at the produced or beaked end. Dr. Mörch, in the 'Arctic Manual,' p. 132, quotes *N. arctica*, Gray, Parry's 'Voyage,' and Wood's Index, Suppl. t. 6.

The last reference is evidently a mistake, and it should be pl. 2, *Arca*, fig. 6; and on referring to the text of the Supplement, p. 6, the name referring to the figure is *glacialis*.

Astarte semisulcata, Leach.

Crassina semisulcata, Leach, Append. Ross's Voy. p. 175; Sowerby, Thesaurus Conch. ii. pl. 167. f. 21, 22 (as *A. lactea*); not *A. semisulcata*, Philippi, Abbild. ii. pl. i. f. 10.

Astarte lactea, Brod. & Sow. Zool. Journ. iv. p. 365; Beechey's Voyage, pl. 44. f. 12; Sow. Thesaurus, pl. 167. f. 23; Reeve's Conch. Icon. xix. f. 18.
Crassina corrugata ?, Brown, Recent Conchol. ed. 2, p. 96, pl. 40. f. 24.
A. Richardsoni, Reeve, Belcher's Voy. vol. ii. p. 397, pl. 33. f. 7.

Hab. Dumb-bell Harbour (*Feilden*); Discovery Bay, 5 fms. (*Feilden* and *Hart*).

The blackness of the epidermis in *A. lactea* is due, I think, to the specimens having been collected when dead; for all the shells with this kind of dark epidermis are old and worn, and evidently have been untenanted by the living animal for some time.

Astarte striata, Leach.

Nicania striata, Leach (non Brown), Ross's Voyage, Appendix, p. 176; Thomson's Annals of Philosophy, xiv. p. 204.
Astarte Banksii, Gray (non Leach), Beechey's Voy. p. 152, pl. 44. f. 10 (fig. 9 is the true *C. Banksii*); Sowerby's Thesaurus, ii. p. 781, pl. 167. f. 8; Conch. Icon. xix. sp. 7; Mörch, Arctic Manual, p. 132.
Var.=*A. globosa*, Möller, Naturhist. Tidsskrift, 1842, p. 93; Reeve, Belcher's Voy. pl. 33. f. 6 *a*, *b*.

Hab. Franklin-Pierce Bay, 15 fms. (*Feilden* and *Hart*).

The shell figured and described by Gould (Invert. Mass. ed. 2, 1870, p. 125, f. 438) under the name of *A. Banksii* of Leach, is not the species characterized by that author. I should suppose that Gould did not consult Leach's description in the appendix to Ross's 'Voyage,' as he does not quote the page, but probably followed Sowerby in the determination of the species ('Thesaurus Conch.' ii. p. 781, pl. 167. f. 8), who probably was misled in the identification of this shell by the figures in the Appendix to Beechey's 'Voyage.' In this work figure 10 on plate 44 is referred to in the text, p. 152, under the name of "*Astarte Banksii* ?, Gray, in Brit. Mus.," and figure 9 on the same plate is said to represent "*Astarte striata* ?, Gray, in Brit. Mus."

The description of *Banksii* given by Leach runs thus, "glabriuscula polita, sub umbonibus impresso-excavata;" and that of *striata* as follows, "concentrice striata, sub umbonibus cordato-impressa."

Of these two species there are specimens in the British Museum received from Captain Ross, which, in all probability, are the actual types described by Leach, and which at once show that the figures of the two species in Beechey's 'Voyage' are reversed—fig. 9, in fact, representing the true *Banksii*, and fig. 10 the true *striata*. The former is a smooth, glossy shell ("glabriuscula polita"), and only marked with very fine concentric striations or lines of growth, which do not at all approach to riblets or fine costations, as in most other species of this genus; in fact the surface is not more striated than in the American *A. quadrans* of Gould; and the epidermis is yellowish olive.

On the contrary, *A. striata* has a dull surface and is distinctly but finely ribbed, and the epidermis darker and of a brownish olive colour. It may be but a variety of the *A. compressa* of Montagu, as suggested by Jeffreys ('Brit. Conch.' ii. p. 316); but besides the usually finer ribbing, the form is generally more elongate transversely and less triangular. Another closely allied species is *A. fabula* of Reeve, from which it differs in being differently sculptured. The transverse ribbing in Reeve's shell is very peculiar towards the umbones, and quite coarse in comparison with that on the other portion of the surface.

Another distinctive character is the length of the anterior muscular scar. I have examined a good series of both species; and I find that in *A. fabula* it is constantly longer than in *striata*, of course in shells of similar size. This is well shown in Reeve's figures (in Belcher's 'Voyage') of the two species. I think it very probable, judging from the description and figure, that Gould's *A. Banksii* is the *A. fabula*, Reeve.

Astarte fabula, Reeve,

Belcher's Last Arctic Voy. 1855, vol. ii. p. 398, pl. 33. f. 5 *a*, *b*.
A. Banksii, Gould (non Leach), Invert. Mass. ed. 2, 1870, p. 125, fig. 438, probably.

Hab. Dumb-bell Harbour and Discovery Bay (*Feilden*).

This species may be recognized by the peculiar ribbing near the umbones. In this region the ribs are more strongly developed than on the rest of the surface of the valve, and are not produced quite to the margins, so that in looking at the shell with the umbones towards the eye the dorsal areas appear comparatively smooth.

? *Astarte Warehami*, Hancock,

Ann. & Mag. Nat. Hist. 1846, xviii. p. 336, pl. 5. f. 15, 16.

Hab. Franklin-Pierce Bay, 13–15 fms., bottom stony (*H. C. Hart*); Richardson Bay, 80° 2′ N. lat., 70 fms. (*H. W. Feilden*).

I do not feel quite sure of the accuracy of the identification of the specimens before me. They differ slightly in form from Hancock's figure, being less elliptical by reason of the anterior end being less produced; but with regard to the ribs and epidermis they agree exactly with the author's excellent description—the former being "fine, close, regular," and the latter pale greenish yellow. These shells, in shape, can certainly be matched with some specimens of *A. striata*, and do not appear to vary in any thing except the difference of colour of the epidermis, which in the latter species is brown or olive-brown. This species is considered the same as *A. fabula* by Jeffreys.

Mya truncata, Linn.,

Forbes and Hanley, Brit. Moll. pl. x. f. 1–3 ; Jeffreys, Brit. Conch. iii. pl. 3. f. 1, vol. v. pl. 50. f. 2 ; Gould, Invert. Mass. ed. 2, f. 376 ; for list of other figures see Gray's Cat. Brit. Moll. 1851, p. 68.
Var. *pelagica*, King, Ann. & Mag. Nat. Hist. 1846, xviii. p. 242.
Junior=*M. ovalis*, Turton, Brit. Biv. pl. 3. f. 1, 2.
=*Sphænia Swainsonii*, Turton, Brit. Biv. pl. 19. f. 2.
Var.=*Mya uddevalensis*, Forbes, Hancock, Ann. & Mag. Nat. Hist. 1846, xviii. p. 337.
M. præcisa, Gould, Proc. Bost. Soc. Nat. Hist. 1850, vol. iii. p. 215 ; Atlas, Wilkes Explor. Exped. pl. 33. f. 498 *a, b*.

Hab. Discovery Bay, 5 and 25 fms. (*Hart* and *Feilden*) ; Dobbin Bay, 30 fms. (*Hart*).

All the specimens from these localities have the posterior marginal slopes directed inwards or towards the base of the shell, which peculiarity is characteristic of the variety *uddevalensis*. One shell is remarkable on account of the abruptness of the truncation and its narrowness, the width being only 6 millims. more than the length (30 millims.).

Saxicava arctica, Linn.

For the synonyma of this species see Brit. Mus. Cat. Brit. Anim. part vii. pp. 86–89.

Hab. Discovery Bay, 5 fms. (*Feilden*) ; Franklin-Pierce Bay (*Hart* and *Feilden*) ; Dobbin Bay, 30 fms. (*Hart*).

Some specimens from Franklin-Pierce Bay are remarkable on account of their great solidity, the depth and distinctness of the muscular scars, and the purplish brown colour which stains both the inside and exterior of the valves.

Mr. Hart found dead examples at Cape Frazer at an elevation of 10 feet above sea-level.

Modiolaria lævigata, Gray.

Modiola lævigata, Gray, Appendix Parry's Voy. 1821, p. 245 ; Reeve, Conch. Icon. x. sp. 53, f. 66.
Mytilus lævigatus, Wood, Index Test. Suppl. pl. 2. f. 5.
Modiolaria discors, Gould (non Linn.), Invert. Mass. ed. 2, 1870, p. 192, fig. 489 (var. *lævigata*).

Hab. Franklin-Pierce Bay, 15 fms. (*Feilden* and *Hart*).

This species is considered by some authors a variety of the British *M. discors.* There are, however, certain differences in form, colour, and sculpture which appear to me sufficient to distinguish the two species. The present is a larger species, transversely more elongate and proportionally narrower, the difference in width of the anterior and posterior ends being less marked. The striæ on the hinder area, in adult specimens, are distinct only towards the umbones, and gradually become obsolete towards the margin of the valves, which, on this account, are smooth and not denticulated within as in *discors.* The epidermis of *lævigata* is brown on the greater portion of the shell, becoming pale olive or brownish green towards the umbones.

The figures in Gould's Invert. Mass. 1870, are evidently reversed; fig. 490, on page 193, represents his idea of *discors*, and not the variety *lævigata*, which is figured on the previous page. Whether the American shell is the same as the British species is somewhat doubtful; but, judging from Gould's figure and specimens in the British Museum, they appear to be different, the form being certainly distinct.

Pecten (*Pseudamusium*) *grœnlandicus*, Sowerby,

Thesaurus Conch. i. pl. xiii. f. 40.
P. vitreus, Gray (non Chemnitz), Parry's Voy. 1819, appendix, p. 245.

Hab. Off Cape Louis Napoleon, 25 fms.; Hayes Point, 35 fms. (*Feilden*); Discovery Bay, $5\frac{1}{2}$ fms. (*Feilden* and *Hart*).

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

Jan. 25, 1877.—Dr. J. Dalton Hooker, C.B., President, in the Chair.

Description of the Living and Extinct Races of Gigantic Land-Tortoises.—Parts III. & IV. The Races of the Aldabra Group and Mascarene Islands. (Conclusion.) By Dr. Albert Günther, F.R.S.

In continuation of, and concluding, the researches into the history of the Gigantic Land-Tortoises, read before the Royal Society on June 20, 1874, and published in the 165th volume of the Philosophical Transactions, the author treats in Parts III. and IV. of the Tortoises of the Aldabra Group and Mascarenes.

By the addition of the valuable materials obtained by one of the naturalists of the "Transit-of-Venus" Expedition to Rodriguez, and by the Hon. Edward Newton in Mauritius, as well as by the aid of supplementary information received from other sources, the author has been enabled to show in the present parts of his paper that the round-headed division of Tortoises is confined to Aldabra and never extended to the Mascarenes proper, and that the Tortoises from the latter islands can be externally, though not osteologically, distinguished *as a whole* from the Galapagos Tortoises, as will be seen from the following synopsis:—

I. Nuchal plate absent. Frontal portion of the skull flat. Fourth cervical vertebra biconvex. Pelvis with broad symphysial bridge.

A. Gular plate double; sternum of moderate extent .... GALAPAGOS TORTOISES.

B. Gular plate single; sternum short .. MASCARENE TORTOISES.

a. Carapace thin, thickened towards the margins; centre of the last vertebral plate raised into a hump, which is separated from the penultimate vertebral by a transverse depression: *Tortoises of Mauritius* (*T. triserrata*, *T. inepta*, *T. indica*, *T. leptocnemis*).

b. The entire carapace extremely thin and fragile, all the bones very slender: *Tortoise of Rodriguez* (*T. Vosmœri*).

II. Nuchal plate present. Frontal portion of the skull convex. Third cervical vertebra biconvex. Pelvis with narrow symphysial bridge. Gular plate double. Carapace thick. ALDABRA TORTOISES (*T. elephantina*, *T. Daudinii*, *T. ponderosa*, *T. hololissa*).

Feb. 22, 1877.—Dr. J. Dalton Hooker, C.B., President, in the Chair.

On the Structure of *Magelona*. By W. C. M'INTOSH, M.D., F.R.S.E., F.L.S.

This annelid was first discriminated * by Dr. George Johnston, of Berwick; but as his description (under the name *Mæa mirabilis*) was not published till 1865, the above-mentioned title, given to the same type, from the Island of St. Catherine, off the coast of Brazil, by Dr. Fritz Müller, has the priority. It is a comparatively small form, its slender body being divided into two well-marked regions; while anteriorly two long papillose tentacles are attached to the base of a remarkable spathulate, eyeless snout, which it dextrously uses to perforate sand near low-water mark at St. Andrews and other sandy shores on both east and west coasts.

* From specimens procured by the distinguished botanist, Dr. Greville.

The structure may be examined under the following heads :—

Cuticle.—This chitinous transparent layer is densest on the snout and anterior region of the body, both being much exposed in the boring-operations. Throughout the rest of the body it attains its maximum thickness over the nerve-cords in the ventral median line. No cilia occur anywhere on its surface, and only faint indications of pores exist in certain regions. Fine motionless palpocils abound all over the cuticle.

The *Hypoderm* forms a very large proportion of the tissues of the flattened snout, the whole region outside the four muscular compartments being occupied by it; so that, in transverse section, it assumes on each side the shape of a long lanceolate process, which much resembles a leaf with its midrib and veins. Throughout the anterior and posterior regions of the body it forms a complete sheath, with various thickenings, and at the tip of the tail ends in two lateral styles, the glandular tissue of which (as in the dorsal and ventral processes) is arranged in a very regular manner. In minute structure the hypoderm much resembles the Nemertian cutis, presenting under pressure in the fresh animal a series of flask-shaped glands or cells, from which the contents escape as clear or granular globules. Moreover, it contains a vast number of bacillary cells, some of which have pigment and a large clear globule. In the hypoderm lie the nervous system and neural canals.

Muscular System.—The four longitudinal muscles of the spathulate snout are arranged within a curious framework of chitinous basement-tissue, which in section assumes various shapes—in front being like a pair of spectacles, then a figure of eight, and for a considerable distance very much resembling a crown. This framework exercises an important influence on the functions of the part. The central pair of muscles are confined to the snout; the lateral pass behind the mouth to constitute the ventral longitudinal pair. In the preoral chamber are a strong transverse muscle (acting as the chief approximator of the sides) and a vertical muscle. The muscles of the body-wall (besides the pair mentioned) are circular, longitudinal dorsal, vertical, oblique, external or lateral vertical and transverse ventral. Anteriorly all are powerfully developed for the peculiar functions of the region, viz. the compression of the blood-channels and the thrusting out of the proboscis. The muscles of the ninth body-segment are modified so as to form great constrictors, which have a slightly spiral arrangement. In addition to those of the body-wall, anteriorly, are the long and short retractor muscles of the proboscis, and various bands acting on the buccal and pharyngeal regions. In the posterior division of the body the transverse ventral muscles become atrophied; but the dorsal and ventral longitudinal muscles, though constricted at the ninth segment, extend throughout; and the other muscles of the body-wall are likewise present.

Digestive System.—A T-shaped slit leads into the buccal region, then follow pharynx, œsophagus, ventricular division, and intestine; while to the junction of the first and second is attached the proboscis. The pharyngeal division is furnished with complex muscular layers and convoluted internal surface, and it is thrust into the base of the proboscis in full expulsion. It is probably the homologue of the *proventriculus* in such Annelids as the Syllidæ. The proboscis, again, is an instance of the separation and modification of a part of the digestive canal to aid in the ceaseless perforations in the sand. Its internal surface is covered by a thick, transparent chitinous layer, devoid of pores. The relaxation of its own retractors, and the contraction of the muscular anterior region of the body, cause it to yield readily to a powerful stream of blood sent from behind; and it smoothly unrolls from the margin of the lower lip like a very supple membrane. This extrusion goes on until the brownish mass of the pharyngeal region approaches the front of the first body-segment, when its muscular coil slips into the base of the proboscis, like a plug, assisting to retain the blood therein, and giving firmness to the whole organ. Thus, in its progress forward, the flattened snout of the annelid is thrust amongst the fine sand which it haunts (with an undulating and insinuating motion) till it has advanced about its own length; then the proboscis is ejected to its full extent like an india-rubber dilator, so as to make a suitable channel for the occupation of the body, while again pressing onward the exploratory snout. All the retractile arrangements are next brought into play; the fan-shaped vertical muscular fibres pull in the last extruded region, the short and long retractors act on the entire organ, and the withdrawal of the pharyngeal protrusion makes an open channel for the backward stream of blood, which rushes into the vessels of the anterior region of the body out of the returning organ, further constricted by its own circular muscular coat. There is no differentiation between the succeeding œsophageal and ventricular regions, the glandular internal tunic in each being alike. The latter ceases, after a marked constriction, at the beginning of the tenth body-segment; and thereafter the intestine, which has much more lax glandular tissue and abundant fatty globules, proceeds to the dorsal anus near the tip of the tail. The walls of this region are richly furnished with capillaries; and cilia are very evident on the internal surface near the tail.

Circulatory System.—An interesting feature is the fact that the blood is a densely corpusculated fluid, the corpuscles having a pinkish colour. There are two large dorsal vessels which arise, near the tip of the tail, from the bifurcation of the ventral trunk. They pass forward along the dorsal arch of the alimentary canal, receiving in each segment a large branch from the ventral trunk and numerous capillaries from the intestinal wall, until the posterior border of the tenth segment is reached. At this part their dilated walls are supplied with powerful muscles, which, on the relaxation of the great muscles of the ninth segment, enable them to perform the functions of contractile chambers or "hearts," and by vigorous systole send the blood forward in a swift stream along the single dorsal vessel of the anterior region. On arriving at the base of the snout the vessel ends in the efferent branch to the tentacle on each side. The current rushes along the latter (nearly at right angles to the dorsal trunk) to the tips, sending off in each a web of circumferential capillaries throughout the greater part of its length, and terminating in the afferent vessel, which proceeds backward, collecting, as it goes, the capillary streams, and then ends by turning forward at the base of the snout as the efferent cephalic vessel. The latter has no evident capillaries, but bends round at the tip of the flattened organ to terminate in the afferent cephalic vessel. A curious change takes place in the majority of those *Mageloncæ* which are provided with the convoluted lateral organs of the body, mentioned further on, in autumn. The cephalic vessels are much abbreviated, and the direction of the current at the base of the snout is somewhat modified. The blood from the head and anterior region collects into a series of large vascular meshes which occur in the anterior region of the body, and in which the current is for the most part under the control of the greatly developed muscles of the body-wall. Thus it happens, as formerly indicated, that the contraction of the latter, and of the special muscular apparatus which closes the communication with the posterior region at the ninth segment, drives the blood forward to unroll the proboscis. This muscular arrangement in the anterior region and the muscular walls of the vessels themselves at the posterior part of the same division of the body send the current through the relaxed barrier at the ninth segment into the muscular ventral blood-vessel of the posterior region, and onward to the tail, where the trunk ends by bifurcating into the two dorsal vessels. In each segment a lateral branch leaves the ventral trunk at the anterior dissepiment, turns round and proceeds backward to the next dissepiment, and terminates in the branch to the dorsal vessel. Further, as first observed by Dr. Fritz Müller, a sac-like dilatation takes place shortly after the commencement of the latter, and it fills at intervals, the distention being followed by a contraction which sends the blood onward by the branch to the dorsal vessel.

In vigorous specimens, the currents of the blood are as swift and beautiful as in the tails of young salmon and other translucent vertebrates. When examined in the *liquor sanguinis* of the living animal (as in a favourable view of a healthy tentacle) the blood-corpuscles show a pale nucleus.

Nervous System.—The central mass of the nervous system lies in front of the preoral chamber in the fork of the median muscles, and consists of the ordinary ganglion-cells with connective-tissue bands. No eyes or other sense-organs exist, though the animal is extremely sensitive to light and other stimuli, and lives in regions where there is abundance of sunshine. Two main nerve-trunks proceed backward in the hypoderm—at first outside, then under, and finally to the inner border of the ventral longitudinal muscles. At the commencement each is accompanied by a neural canal (the "tubular fibre" of the late M. Claparède); but, before leaving the anterior region of the body, the canals glide inward and coalesce into a single large median one. The whole central nervous system is hypodermic.

So far as present examination goes, the Annelida present four conspicuous modifications in regard to the position of the great nerve-trunks:—

(1) Some have the trunks situated within the muscular layers, or in a central hiatus between the ventral longitudinal muscles, the transverse band between the latter as well as the hypoderm being external.

(2) The cords (as in *Magelona*) are distinctly hypodermic in position, the oblique muscles of the body-wall being attached to a transverse band above them, or to the summit or sides of the area containing them.

(3) The trunks may be embraced by the closely approximated (almost connate) ventral or other longitudinal muscles which overlap the nerve-area.

(4) This group is formed by those in which the cords are separate throughout, being

(*a*) in the substance of the ventral longitudinal muscles,

or (*b*) below or at the edge of the same muscles and within the circular coat.

The neural canals, as far as examined, occur in about thirteen families.

Tentacles.—These remarkable organs extend to about two inches, but are capable of even greater elongation. They are composed of cuticle, hypoderm, basement-tissue, circular and longitudinal muscular coats, the latter having a raphe at each pole in transverse section. Each forms a hollow contractile process furnished with a series of large cylindrical papillæ along the anterior border, a series of central longitudinal muscular fibres giving the latter appendages a sucker-action. The afferent vessel is attached to the raphe next the papillæ, the efferent to the raphe at the smooth border. The entire organ is reproduced with considerable rapidity.

Reproductive Organs.—The ova and spermatozoa are present in each sex in great abundance in the posterior region of the body, and attain perfection in summer and autumn. On the sides of the body, also, peculiar convoluted organs occur in processes composed of the cuticle, hypoderm, and basement-tissue.

The systematic position of *Magelona*, with its peculiar external form and internal structure, was a source of uncertainty to Dr. George Johnston, the only author who attempted its consideration in this respect. So puzzled was he that he placed it (as *Mæa mirabilis*) at the end of his Catalogue for the British Museum, under a family specially constituted for itself (viz. Mæadæ). In the Catalogue of the Fauna of St. Andrews it was located between the Chætopteridæ and the Spionidæ; but the results of further investigation clearly relegate it to the latter group*. It leans, indeed, wholly to the Spionidæ in minute structure, and especially to such forms as *Prionospio* and *Heterospio*; though it is true that in the marked regional distinctions, and the great length of the posterior division of the body, it approaches *Spiochætopterus*. While it conforms to the Spionidæ in the structure of its body-wall and bristles, it differs in regard to the absence of the dorsal branchiæ; and further, the short, pinnate and ciliated anterior branchial organs of *Prionospio* appear to be the nearest approach to its elongated tentacles. In the mechanism of its proboscis and in the structure of its snout and circulatory organs, again, it presents features *sui generis*.

GEOLOGICAL SOCIETY.

February 21st, 1877.—Prof. P. Martin Duncan, M.B., F.R.S., President, in the Chair.

"Note on a Specimen of *Diploxylon*, from the Coal-formation of Nova Scotia." By J. W. Dawson, LL.D., F.R.S., F.G.S.

The author described the occurrence in Coal-measure sandstone at the South Joggins of an erect stump of a Sigillarian tree 12 feet in length. It originated in a coaly seam 6 inches thick, and terminated below in spreading roots; below the coal-seam was an underclay 3 feet 4 inches thick, separating it from an underlying seam of coarse coal. The stem, which tapered from about $2\frac{1}{4}$ feet in diameter near the base to $1\frac{1}{4}$ foot at the broken end, was a sandstone cast, and exhibited an internal axis about 2 inches in diameter, consisting of a central pith cylinder, replaced by sandstone, about $\frac{2}{5}$ inch in diameter, and of two concentric coats of scalariform tissue, the inner one $\frac{1}{25}$ inch in thickness, the outer constituting the remainder of the axis. The scalariform tissue of the latter was radially arranged, with the individual cells quadrangular in cross section. A few small radiating spaces partially filled with pyrites obscurely represented the medullary rays, which were but feebly developed: the radiating bundles, passing to the leaves, ran nearly horizontally; but their structure was very imperfectly preserved. The cross section, when weathered, showed about twenty concentric rings; but these under the microscope appeared rather to be bands of compressed tissue than true lines of growth. The thick inner bark was replaced by sandstone, and the outer bark represented by structureless coal. On a small portion of one of the roots the author traced the remains of stigmarioid markings. From the above characters the author identified this tree with *Diploxylon* of Corda, and stated that it was the first well-characterized example of this type of Sigillarians hitherto found in Nova Scotia. The author

* Proc. Roy. Soc. Edinb. 1875–76, vol. ix. no. 94, p. 123.

compared the structure of this stem with that of other Sigillarians, and remarked that it seemed to come within the limits of the genus *Sigillaria*, but to belong to a low type of that genus, approaching *Lepidodendron* in structure—those of the type of *S. elegans*, Br., and *S. spinulosa*, Renault, being higher in organization, and leading towards the still more elevated type described by him in 1870. He further discussed the supposed alliance of these trees with Gymnosperms, and the probability of the fruits known as *Trigonocarpa* being those of *Sigillaria*, and expressed the opinion that the known facts tend to show that there may be included in the genus *Sigillaria*, as originally founded, species widely differing in organization, and of both Gymnospermous and Acrogenous rank.

March 7, 1877.—Prof. P. Martin Duncan, M.B., F.R.S., President, in the Chair.

"On the Vertebral Column and Pelvic Bones of *Pliosaurus Evansi* (Seeley), from the Oxford Clay of St. Neot's, in the Woodwardian Museum of the University of Cambridge." By Harry Govier Seeley, Esq., F.L.S., F.G.S., Professor of Geography in King's College, London.

In this paper the author described some bones obtained by J. J. Evans, Esq., in the lower part of the Oxford Clay at Eynsbury, near St. Neot's. They consisted of thirty-seven vertebræ, twenty-one of which are cervical, and apparently complete that series. These presented the characters of the cervical vertebræ of the typical Pliosaurs of the Kimmeridge Clay. The remains of the pelvis included a pubic bone showing a close correspondence in form with those of the Pliosaurs of the Kimmeridge Clay of Ely, and an ischium.

2. "Supplementary Notes on the Fauna of the Cambridge Greensand." By A. J. Jukes-Browne, Esq., B.A., F.G.S.

This paper was supplementary to one communicated to the Society by the author in 1875, in which he maintained that the Upper Greensand does not extend further in a north-westerly direction than West-End hill, near Cheddington, in Buckinghamshire, that the Cambridge Greensand is merely a nodule-bed at the base of the Chalk Marl, resting unconformably upon denuded Gault, to the upper part of which the greater portion of the fauna belongs, and that the remainder of the Fauna, belonging to the deposit itself, consists of species proper to the Chalk Marl rather than to the Upper Greensand. The object of the paper was to indicate certain additions to, and corrections in, the list of fossils upon which these conclusions were supported. The following Gault species were indicated as not previously identified in the Cambridge Greensand:—*Nautilus arcuatus*, Desh.; *N. inæqualis*, Sow.; *Turrilites elegans*, D'Orb.; ? *T. Emericianus*, D'Orb.; *Ornithopus histocheila*, Gardn;

Brachystoma angularis, Seeley; *Turbo Pictetianus*, D'Orb.; *Pleurotomaria regina*, Pict. & Roux; ? *P. Itieriana*, Pict. & Roux; *Pecten Raulinianus*, D'Orb.; *P. subacutus*, D'Orb.; and *Lima Rauliniana*, D'Orb. The author described as new species *Turrilites nobilis*, *Nautilus*, sp. nov., *Natica levistriata*, *Nerïta nodulosa*, and *Lima interlineata*, and noted several corrections in the nomenclature adopted in his former list.

MISCELLANEOUS.

On the first Development of a Starfish. By M. H. Fol.

In a former note I endeavoured to show how the phenomena described by M. O. Hertwig in the sea-urchin may be compared to those which have been observed in other animals. Nevertheless the direct and continuous observation of these phenomena in some creature allied to the urchin could alone furnish a positive answer to these questions. With this object in view I made a fresh study at Messina, during the months of December and January last, of these earliest phenomena in *Asterias glacialis*.

The mature ovule possesses a large germinal vesicle and a very distinct germinal spot. The vitellus is granular, destitute of vitelline membrane, but enveloped in a mucilaginous layer, which is itself surrounded by a pavement epithelium. As soon as the ovule gets into the sea-water this epithelium is detached; the germinal vesicle then shrivels, the distinctness of its contours is lost, and in a manner it fuses in the vitellus. Its contents are never expelled, as was supposed by M. E. van Beneden. The germinal spot also loses its distinct outline, becomes paler, often changes its form, gradually diminishes, and finally dissolves. All that can now be seen in the vitellus are two light spots, one of which, very ill-defined, still occupies the place where the germinal vesicle was, while the other, which is of an ovoid form, approaches the surface. The use of reagents reveals at this moment the presence of a double protoplasmic star; and I shall in future give to these united double stars the name of *amphiaster*.

This first amphiaster often presents in its neutral plane bodies of irregular form, which I have reason to regard as relics of the membrane of the germinal vesicle. The last remains of the germinal spot are still visible at a certain distance from this amphiaster; but I shall not venture to assert that no fragment of the germinal spot can enter into the composition of the amphiaster. I incline to think that this first stellate figure is still not the one that gives origin to the polar corpuscles, but that, on the contrary, it divides in the interior of the vitellus, and that its peripheral aster alone gives origin to the amphiaster which will be expelled. However this may be, the vitellus soon presents only a superficial spot, which produces the two polar corpuscles in the manner so well described by M. C. Robin. The use of picric acid shows the presence of an amphiaster which divides in such a manner that the peripheral aster becomes the first polar corpuscle; then the interior aster changes into a new amphiaster, the peripheral half of which constitutes the second polar corpuscle, whilst its interior half is converted into a little spot. This spot increases rapidly, at the same time advancing towards the centre of the vitellus, and changes into a true pronucleus furnished with one or two nucleoli. This female pronucleus stops before attaining the centre of the ovule, which now enters upon a new period of inactivity.

All the modifications that the vitellus has hitherto undergone have been occasioned by the mere contact of sea-water without any fecundation. They occur in exactly the same manner whether the ovum is fecundated or not. This fact is not new; but it needed to be confirmed by repeated experiments.

The ovule thus modified by a stay in sea-water is in the state best fitted to receive fecundation. If it is not fecundated it will remain unchanged for some hours, and then begin to decompose slowly. I have never seen it develop by parthenogenesis. Leaving out of consideration for the moment the abnormal cases which occur when the ovum is fecundated before or after the favourable moment, and when it is altered in any manner, we may pass in review the phenomena of normal fecundation.

The spermatozoids, on coming into contact with the ovum, remain with their bodies stuck into the mucous envelope. Soon one of them succeeds in making its way through half the thickness of this layer; and immediately the vitellus presents some extremely remarkable modifications. Before any contact has taken place between the spermatozoid and the vitellus, the protoplasm of the latter accumulates on the side which looks towards the nearest spermatozoid, and then forms a thin hyaline layer which coats the granular vitellus; then this transparent layer rises in its centre into a boss, which advances to meet the male element. The boss changes into a cone; and we soon see a delicate thread of protoplasm establishing communication between the apex of the cone and the body of the spermatozoid. The latter elongates, and, so to speak, flows into the vitellus. The tail, or, we may rather say, the vibratile cilium, alone remains outside, where it may be still distinguished for several minutes.

During this time the superficial hyaline layer gains more and more in extent, and finally envelops the whole vitellus. At the moment when the communication with the spermatozoid is established, this layer becomes very distinctly differentiated, and begins to detach itself from the surface of the vitellus to form a vitelline membrane. The differentiation of this membrane gains the whole circumference of the vitellus, commencing from the point of fecundation, where there remains a sort of little crater. In a perfectly mature and very fresh ovum all these phenomena succeed one another with such rapidity that access to the vitellus is barred to all spermatozoids which are only a few seconds later than the first one. The penetration takes place at any point of the surface of the vitellus. I am of opinion that the normal fecundation of the starfish is effected by means of a single spermatozoid to each ovum; in the sea-urchin this fact is perfectly evident.

The point of penetration becomes the centre of a male star or aster; in the middle of the aster there is formed an aggregation or male pronucleus, which amalgamates with the female pronucleus exactly in the same manner as is observed in the sea-urchin. I need not, therefore, refer to it particularly.

From what precedes it results that the disappearance of the germinal vesicle and spot and the expulsion of the rejected materials are mere phenomena of the maturation of the ovule, and that the female pronucleus has no genetic connexion with the nucleolus of the ovule, and, lastly, that the spermatozoid exerts upon the vitelline material not only an attraction of contact, but even an attraction at a distance.—*Comptes Rendus*, Feb. 19, 1877, p. 357.

On the Fecundation of the Egg in the Echinus. By M. J. Perez.

Every new fact relating to the fecundation of the egg being of considerable importance, it is essential not to regard it as definitively acquired in science until it has been subjected to careful checking. It is for this reason that I think it my duty to make known the observations that I have made upon the egg of *Echinus esculentus*, with the purpose of verifying the remarkable facts announced by M. H. Fol, in a note published in the 'Comptes Rendus' of the 19th February last.

I have twice had the opportunity of observing, at a point of the surface of the ovum, the projection described by M. Fol, and which that naturalist regards as raised by an *attraction at a distance* exerted by the spermatozoid nearest the vitelline sphere; but I found it impossible to ascribe to it the least importance in the act of impregnation. In fact, in one of the cases observed by me, no spermatozoid was at any moment opposite to this eminence up to the time of its disappearance by the rising of the vitelline membrane. In the second case a spermatozoid immersed in the mucous layer nearly at the middle of its thickness, after remaining motionless for a few seconds, moved briskly down to the apex of the projection. I saw no delicate prolongation of the latter emitted towards the spermatozoid; nor (and this is still more important) did I see the spermatozoid *flow*, according to M. Fol's expression, into the vitellus. It remained motionless, applied to the surface. Scarcely was it fixed there when another spermatozoid, following the same road as the first one, passed through the thickness of the mucous zone in two or three bounds, and also laid itself upon the surface of the little elevation. Two more spermatozoids took the same course, but stopped about midway; a fifth joined these, and then, after a few wrigglings, disengaged itself and disappeared.

I watched persistently the two spermatozoids that adhered to the apex of the little elevation; and my eye did not miss them for a moment. Their two bodies, laid side by side, always remained at the surface of the ovum; and their tails were to be seen extended in the course which they had followed. Soon the vitelline membrane detached itself from the vitellus, and the projection ceased to exist; but the two spermatozoids were still to be seen, elevated with the membrane, and quickly conveyed by it to a great distance from the yelk. The ovum was fecundated; but no spermatozoid had penetrated into its interior.

One remark will be useful. In this observation the plane of vision passed through the centre of the ovum; and the protuberance was exactly in this plane, at the equator of the ovum. If one of the spermatozoids had carried its body a little higher or a little lower by creeping upon the slope of the projection, this body, projected upon the latter, would have disappeared, whilst the tail might have remained visible beyond. In this way we should have the exact image of a spermatozoid penetrating into the ovum and leaving its tail out, just as M. Fol states he observed it.

The rising of an eminence at the surface of the ovum, in my opinion, has no connexion with fecundation. It is a simple accident which depends solely upon a solution of continuity in the mucous envelope (which is very frequent at least in the sea-urchin), constituting a point of weakest resistance at the surface of the ovum, and, in consequence, a corresponding deformation of the vitelline sphere. It will thus be understood why, of all the points of this sphere, the deformed part, when one exists, is usually the first attacked by the spermatic filaments. This deformation, reduced to a slight prominence in the case described by M. Fol and in that above mentioned by me, sometimes acquires exaggerated proportions, which, however, have no injurious effect upon the fecundation.

More than this, the penetration, as understood by M. Fol, clashes with an anatomical impossibility. That naturalist assumes, in fact, that the unfecundated ovum is destitute of vitelline membrane, and that this envelope originates only under the influence of fecundation. Now it is incontestable that it exists even in the very young ovum while the latter is still not granular: in this it is easy to observe it directly; and the endosmotic action of pure water renders it still more evident. In the mature but unfecundated ovum of the *Echinus* a slight pressure, which clears its contents, suffices to show all round it a continuous uniform envelope, with a double contour, contrasting by its refringency and its orange-rose colour with the subjacent vitellus. It measures about $\frac{8}{10000}$ millim. in thickness. When subsequently distended and removed from the vitellus, in consequence of impregnation, it becomes thinner and paler. The act of fecundation, therefore, does not determine the formation of the vitelline membrane, which existed long before; as regards this envelope, its only effect is to cause its inflation and its separation from the vitellus.

The presence of a proper membrane around the unfecundated ovum of the sea-urchin seems to me to be indubitable. We are not to imagine in this case a thin layer of hyaline non-granular protoplasm presenting only the appearance of a membrane. At the first glance a distinctly marked double contour renders any such interpretation impossible. If, therefore, it be supposed that the penetration of the spermatozoid is indispensable for fecundation, we have to inquire how it can get through such an obstacle, especially if we assume that this penetration can be effected at any point of the surface of the ovum.—*Comptes Rendus*, March 26, 1877, p. 620.

On some Abnormal Fecundations in Starfishes. By M. H. Fol.

In a former note I described the modifications undergone by the mature ova of *Asterias glacialis* when they are merely placed in sea-water, and the phenomena of an artificial fecundation performed with ova already freed from their polar materials. Let us now try the fecundation of the ova immediately after their escape from the ovary, or at least before the expulsion of the first polar corpuscle.

The details of the penetration of the zoosperms into the vitellus are very nearly the same as in the normal case. The principal difference is that the vitelline membrane is only very slowly formed and elevated round the point where the penetration is effected; instead of rapidly gaining the whole surface of the vitellus, it only extends over a portion of the periphery. Hence other spermatozoids have time to penetrate successively at different points of the surface of the ovule; and they continue to do so until the vitellus is completely enclosed in a membrane impermeable to the zoosperms.

The extent and rapidity of formation of the portions of the membrane which are differentiated round each point of penetration are very variable, and are less in proportion as the normal conditions are more widely departed from. In such cases I have counted as many as fifteen zoosperms in a single vitellus; and this number decreases as we operate under more normal conditions.

The body of the zoosperm flows into the vitellus; and at this point there is formed a clear spot surrounded by radiating filaments. This is the male aster. These male asters, starting from various points of the surface of the vitellus, travel slowly in the direction of its centre. Except as regards the number of asters, all this is in conformity with the normal case. If the fecundation takes place before the disappearance of the germinal vesicle, the male centres remain for a considerable time in a latent state, and it is only at the moment when the first polar corpuscle begins to issue, sometimes even already at the moment when the waste amphiaster is formed, that the male asters show themselves, each at a little distance from the spot where a zoosperm has penetrated. Several of the radiating filaments extend from the centre of the star to the point of the surface of the vitellus where the contact took place, a point which is still recognizable by the presence of a small scar. It is no doubt these filaments that M. O. Hertwig has mistaken in the urchin for the tail of the spermatozoid.

The male asters gain in distinctness as they depart from the margin of the vitellus; and in their centre is formed a little mass of protoplasm, which we may call a *male pronucleus.* The male pronucleus nearest to the female pronucleus amalgamates with the latter, which immediately becomes the centre of a system of radiating filaments; then this combined nucleus unites again with a second, and sometimes even with a third, male pronucleus. At other times the female pronucleus divides, at the very moment of its formation, into two or three fragments, which then unite with so many male centres. The male asters never unite with each other; it would appear that they repel one another and are attracted by the female centre until the moment when the latter is neutralized by its union with two or three male centres.

The segmentation of these ova is very irregular. When the male centres are numerous the vitellus forms at once as many rounded bosses as it contains male asters, each boss having an aster in its centre; then these bosses become spherules, which continue dividing dichotomously. From this results a very irregular blastosphere and a monstrous larva.

In cases in which the number of male centres in very restricted, and the female pronucleus is divided into two or three nuclei, these always remain distinct. At the moment of the first segmentation each becomes converted into an amphiaster, and the vitellus divides at once into four or six spherules. I have not observed the segmentation in the ova, the single nucleus of which is the result of the combination of the female pronucleus with several male asters. Perhaps we must refer to this category the ova (which I have often met with) in which the nucleus is at once resolved into a tetraster—that is to say, four asters united to each other.

Can a vitellus which has received two zoosperms be developed in a normal manner? I do not venture to deny this absolutely; but I have always observed the contrary; I have always seen these ova produce a double number of segmentation-spherules, and finally become monstrous larvæ. Is not this fact fitted to put us on the track of a whole category of double monsters?

Analogous phenomena are presented in ova fecundated at maturity, but proceeding from animals which have suffered in captivity. Having fecundated some ova derived from a very sickly parent, I saw the zoosperms penetrate in numbers into each vitellus, and their bodies remain intact in the midst of the vitelline substance, although they were surrounded by some ill-marked radiating lines. They all travelled in the direction of the germinal vesicle, which disappeared; but the development went no further.

With this exception, I have never succeeded in discerning the body of the zoosperm in the interior of the vitellus. I do not think that it persists; I much rather believe that the male centre is the product of the fusion of this body with a little vitelline protoplasm. The attraction that the zoosperm exerts upon the vitelline substance, and especially upon the female pronucleus, seems to me to be placed beyond doubt by observations that I have described. The mutual repulsion of the male centres appears to me to be a corollary of their attraction for the female centre, just as the repulsion exerted upon one another by the two poles of an amphiaster is the corollary of the attraction they exert upon the surrounding protoplasm.—*Comptes Rendus*, April 2, 1877, p. 569.

On two new Genera and Species of Lizards from South America and Borneo. By Dr. Steindachner.

The genus *Tejovaranus* forms a transition towards the family Ameividæ, and is distinguished from the typical Varanidæ, which belong to the eastern hemisphere, by the presence of pterygoid teeth, by the elongate cordate form of the tongue, which has no sheath at the base, and by the size of the mental and rostral scutes and of the upper and lower labial scutes. Ventral scutes flat, quadrangular, in regular transverse rows, like the small slightly convex dorsal scutes. *Tejovaranus Branickii* is marked like *Tejus teguexin*, Linn., and has a large light-yellowish brown spot on the nape.

The genus *Lanthonotus* is characterized by the absence of an external ear. The head is depressed, oval, covered with very small, partly keeled scutes; the back bears several rows of large tubercles, upon each of which lies, as if imbedded, a keeled horny scute; the tongue is elongate cordate, papillose, without a sheath. The extremities and the toes are short, and the eye remarkably small. In the author's opinion, the genus *Lanthonotus* is the representative of a distinct family, which would most closely approach the Mexican Helodermidæ.

Lanthonotus borneensis is tile-red on the back, and marked with brown on the yellow ventral surface. The skin of the back forms innumerable slight verruciform elevations, among which there are six, and in some parts eight, longitudinal rows of large tubercles, each of which bears a keeled scale. The flat ventral scutes are pointed behind and slightly imbricated. The tail is roundish.—*Anzeiger der kais. Akad. der Wiss. in Wien*, July 5, 1877.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[FOURTH SERIES.]

No. 117. SEPTEMBER 1877.

XXI.—*Contributions to Micro-Palæontology.*—I. *On the Genus* Tetradium, *Dana, and on a British Species of the same.* By H. ALLEYNE NICHOLSON, M.D., D.Sc., F.R.S.E., and ROBERT ETHERIDGE, Jun., F.G.S.

Genus TETRADIUM, Dana, 1846

(Wilkes's Expl. Exped. Zoophytes, p. 701).

The genus *Tetradium* was founded by Prof. Dana for the reception of a fossil of uncertain locality in the collection of Yale College, New Haven; and the following characters were ascribed to it:—"Coralla massive, consisting of four-sided tubes and cells, with very thin septa or parietes; cells stellate, with four narrow laminæ."

At a subsequent date, Prof. J. M. Safford described four species of corals from the Lower Silurian rocks, which he referred to this genus (Amer. Journ. Sci. and Arts, ser. 2, vol. xxii. p. 236); and he supplemented Dana's description with the following remarks:—"The tubes in the different species vary from one quarter of a line to nearly one line in breadth; they are very long, and are most frequently united throughout laterally, forming massive coralla, resembling more or less those of *Favosites* and *Chætetes*; sometimes, however, they are united in single intersecting series, as in *Halysites catenulata*, Linn.; not unfrequently, too, the tubes are isolated, or only united at irregular intervals, thus forming loose fasciculated coralla, resembling certain forms of *Syringopora*."

Prof. Safford further states that the *isolated* tubes are nearly quadrangular, with more or less rounded angles, and with a slight external longitudinal depression opposite to each of the four septa; the walls are more or less rugose; and increase is by fission of the old tubes. Only one specimen was seen in which tabulæ could be detected; and in this they were confined to one end of the mass, and were distant from one another about twice the width of the tubes.

The genus *Tetradium* is regarded by Safford as intermediate between the Favositidæ and the Rugosa, the quadripartite character of the corallites placing it in the latter group.

The late Mr. Billings (Geology of Canada, 1863, p. 139, fig. 71) figures and quotes *Tetradium fibratum*, Safford, from the Birdseye, Black-River, and Trenton Limestones of Canada; but as no description is appended, it is difficult to form any opinion as to the correctness of this identification, though the few specimens we have from the Trenton Limestone would apparently bear it out.

Lastly, one of the present writers described *Tetradium minus*, Safford, from the Hudson-river formation of Ohio and Canada, and provisionally referred a coral from the Trenton Limestone of Canada to *T. fibratum*, Safford (Nicholson, Pal. Ohio, vol. ii. 1875, p. 222, and Rep. Pal. Ontario, 1875, pp. 10, 28).

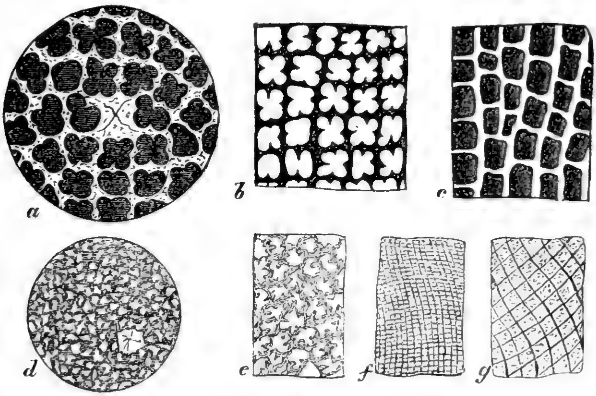
The above constitute all the notices of *Tetradium* which we have been able to meet with, apart from mere enumerations of species of the genus in lists of fossils. Though the characters of the genus are extremely well marked, and the species are far from uncommon in the Lower Silurian strata of North America, no mention of the genus is made in the classical works on fossil corals by Milne-Edwards and Haime (Pol. Foss. des Terr. Pal. and Brit. Foss. Corals), nor by Fromentel (Introduction à l'étude des Pol. Foss.).

The remarks which we wish to make upon the genus may be most fitly based upon a brief description of the American *T. minus*, a species of which we have had the opportunity of making a careful microscopical examination, and which may be regarded as in all respects a characteristic representative of the genus.

Tetradium minus, Safford.

Tetradium minus, Safford, Amer. Journ. Sci. and Arts, ser. 2, vol. xxii. p. 238; Nicholson, Palæontology of Ohio, 1875, vol. ii. p. 222; Nicholson, (Second) Report on the Pal. of Ontario, 1875, p. 28.

Spec. char. Corallum massive, hemispherical, or amorphous, often of large size, composed of closely approximated slender tubes, which diverge from the base or from an imaginary axis, and which are not arranged in superimposed layers. Increase by fission of the old tubes. Corallites of great length (sometimes three inches or more), generally about a third of a line in diameter, their shape usually irregularly four- or five-sided. Septa varying in number from one to four, most commonly the latter, rarely five. Tabulæ complete, mostly about three in the space of 1 line. Walls thick, imperforate.



a, a small portion of a transverse section of *Tetradium minus*, magnified about ten diameters. The section is a transparent one; and the visceral chambers of the corallites, being filled up with the matrix, appear black, whilst the walls are composed of crystalline calcite; in the centre of the section is a vacant space filled with calcite (a water-canal?). *b*, portion of polished transverse section of same, not so highly magnified; in this section the visceral chambers appear as light spaces and the walls are dark. *c*, portion of a longitudinal section of the same, showing tabulæ. *d*, portion of a transparent transverse section of *Tetradium Peachii*, Nich. and Eth., jun., magnified about twenty diameters. Near the bottom of the section a water-canal (?) is seen cut across. *e*, portion of transverse section of the same, magnified still further. *f*, portion of the longitudinal section of the same, magnified about fifteen diameters. *g*, portion of the same, enlarged still further.

Obs. The large and massive corallum of this species, at first sight, recalls to mind the most bulky of the species of *Chætetes*, from which, however, it is at once distinguished by the possession of distinct septa. These structures are sometimes difficult to make out in portions of the corallum, especially in simply weathered surfaces; nor can they be readily detected in oblique sections of the corallites. They seem, indeed, to have been very readily broken away; and as the outer portions of the corallites are very generally filled up with the matrix, they are commonly destroyed, along with the tabulæ, in the exterior parts of the corallum. They can, however, be always readily detected in thin sections taken across the corallites, provided these are not quite superficial and are directly transverse to the long axes of the tubes. The number of the septa (fig. *b*), varies, but is most generally four; sometimes only three or two are present, occasionally only one, and rarely as many as five. In form the septa are quite short, extending only a very small distance towards the centre of the visceral chamber, attenuated towards their inner edges, but much thickened towards their bases. This structure, along with an apparent plication of the wall to correspond, gives to the transverse section of the corallites a characteristically petaloid form (figs. *a*, *b*), which sometimes alters to a reniform, rhomboidal, or trefoil figure. The walls are thick and devoid of mural pores, exhibiting the curious peculiarity that, as seen in transparent transverse sections, they are composed of crystalline calcite instead of granular carbonate of lime as is ordinarily the case. Whether this is due to some secondary alteration to which the specimens have been subjected, or not, it is difficult to say; but there is no ground for supposing that these, any more than the other fossils in the same beds, have suffered from any changes of a metamorphic nature. The corallites are very long and basaltiform, increasing by fission, and often showing a concentric arrangement round secondary centres. As a general rule, the corallites do not appear to grow to the same length; so that the surface of the corallum, instead of being uniformly rounded, is often very uneven, in consequence of the unequal development of neighbouring groups of tubes. It is also not uncommon for the secondary centres of development above spoken of to become tubular, whether by the absorption of a central corallite or otherwise, giving rise in transverse sections to approximately circular hollow spaces (fig. *a*), which become filled up with the matrix or with calcite. The tabulæ (fig. *c*) are exceedingly well developed and quite complete, averaging three or four in the space of 1 line. No general epitheca, so far as we have been able to observe, is present. The corallites, lastly, though closely contiguous, are not amalgamated by their walls; so that a rough fracture exposes the exterior of the walls, and not the interior of the visceral chambers.

Form. and Loc. Common in the Cincinnati group of Waynesville, Ohio, and the Hudson-river formation of the river Credit and of Manitouwaning, Canada.

Collected by, and in the cabinet of, Prof. Nicholson.

Characters and Affinities of the Genus Tetradium.

From a consideration of the characters of *T. minus*, as above discussed, the following diagnosis of the genus *Tetradium* may be framed:—

Corallum massive, subhemispheric or irregular in form, composed of long prismatic corallites, in close contact, but not amalgamated by their walls, and not arranged in superimposed strata in the typical forms. No mural pores; septa distinct, few in number, typically four, short, not reaching the centre of the visceral chamber, seeming as if formed by inflections of the wall. Calices generally petaloid, as are the corallites in transverse section. Tabulæ numerous, complete. Increase by fission of the old tubes.

It will be seen from the above definition that *Tetradium* is clearly what is generally understood as a "Tabulate" coral, and that it is not referable to the Rugosa. Its septa, though quite distinct, are hardly more developed than can be observed in well-preserved specimens of *Halysites* or *Syringopora*, or even *Favosites* itself, and are certainly no more so than in most of the Alcyonarian group of the Heliolitidæ. Moreover the septa are quite unlike those of the Rugose corals in general, and, from their distinct production by inflection of the walls of the corallites, they assume the character of "pseudo-septa." The quadripartite character of the tubes can also not be relied upon as allying the genus with the Rugosa, since the septa, though generally four in number, vary from one to as many as five.

Amongst the other groups of corals which have been generally referred to the miscellaneous division of the "Tabulata," it is difficult to find one to which *Tetradium* could be referred with entire propriety. From the Alcyonarian family of the Heliolitidæ the present genus is distinguished by the fact that the corallites are all of one size, and there is no tubular "cœnenchyma." With the Halysitidæ the genus has some decided affinities, which are increased by Prof. Safford's observation that the corallum sometimes resembles that of *Halysites* or of *Syringopora* in form. We have not, however, noticed this mode of growth in any of the specimens which have been examined by us; and the corallum in general is quite similar in form to that of the massive species of *Favosites* or *Chætetes*. Under any circumstances, should the genus be ultimately referred to this family, it will be in the immediate neighbourhood of *Halysites* itself that it must find its place; and we are disposed to think that our present knowledge will perhaps allow of no better provisional arrangement.

From the Favositidæ, at any rate, *Tetradium* is sharply separated by the imperforate walls of its corallites; and the only other group that needs consideration in this connexion is that of the Chætetidæ. In general form and appearance there is the closest possible resemblance between the present genus and some of the massive forms of *Chætetes* or *Monticulipora*; but the peculiar septa of the former are quite sufficient to distinguish them. The only species of *Chætetes* which possess any structures at all comparable with the septa of *Tetradium* are *C. radians*, *C.* (*Alveolites*) *septosus*, and *C.* (*Alveolites*) *depressus*. The so-called septal processes of these forms, however, are not present in all the corallites of a given corallum, they are variable in number and development, and, as we have elsewhere given reasons for believing, they appear rather to be caused by the fission of the old tubes than to be of the nature of septa.

Upon the whole, therefore, it is perhaps safest to regard *Tetradium* as an ally of *Halysites*, with some affinities to *Chætetes*, and thus forming a connecting link between the families of the Halysitidæ and Chætetidæ.

Tetradium Peachii, Nich. & Eth., jun.

Alveolites? sp., R. Eth. jun. Proc. Roy. Phys. Soc. Edinb. 1874–75, p. 51.

Alveolites? *Peachii*, R. Eth. jun. (MS.), Coll. Geol. Survey of Scotland, Mus. Science and Art, Edinb.

Spec. char. Corallum massive, exceedingly dense and compact, composed of excessively minute, closely approximated corallites, about a thirty-fifth of a line in diameter. The corallites have an undulating course, and are sometimes disposed in superimposed layers, or arranged concentrically round minor centres. Corallites thick-walled, irregularly circular or oval in transverse section, with a few (three or four?) short septa, which are often thickened at their bases. Tabulæ numerous and complete. Corallum perforated by irregular tubes (water-canals?) from a fortieth to a fiftieth of an inch in diameter or less.

Obs. We are only acquainted with this very remarkable coral as occurring in the pebbles of Silurian limestone which are found in the Old Red conglomerate at Habbies Howe, in the Pentland Hills. That these pebbles are of Upper-Silurian age cannot be doubted, as they contain *Halysites catenularius*, *Heliolites*, *Phacops*, and other characteristic fossils of this period, though no similar limestone has hitherto been recognized in the Upper Silurian formation of Scotland. The limestone pebbles are grey, pinkish, or mottled, composed largely of comminuted organic remains, or coarsely oolitic. The coral under consideration presents itself under the form of whitish or flesh-coloured masses, an inch or more in diameter, and of irregular shape. These masses break with a conchoidal fracture, the texture being so extraordinarily dense and compact that examination of unprepared specimens with a hand-lens reveals absolutely no structure whatever, except that a disposition of the mass in concentric layers may be seen, or the aperture of some of the larger canals above spoken of may be detected occasionally. Even polished specimens yield little better results, and the aid of the microscope is necessary to elucidate the unprecedentedly minute structure of the skeleton. The examination of thin transparent sections with the microscope is also attended with unusual difficulties, to some extent due to the infiltration of the delicate tissue with imperfectly translucent calcite, but also largely caused by the fact that the hand-lens is unavailable in determining beforehand in what directions to cut slices. Hence it is a mere matter of chance whether sections in the desired planes can be obtained; and out of a large number of sections we have only succeeded in preparing two which are in any portion strictly at right angles to the long axes of the corallites. It need not, therefore, be a matter of surprise if we are unable to speak as to certain points connected with the structure of this coral with all the precision that might be desirable.

Before making a microscopical examination of this coral we were disposed to think that it might turn out to be one of the exceedingly dense Stromatoporoids, still undescribed, which we have met with in the Upper Silurian of North America; but the investigation of thin sections leaves no doubt as to its being a genuine coral. Nor can there be much doubt as to its position; for it must certainly be placed either in *Tetradium* or in *Chætetes*. The decision between these two genera rests on the question as to the presence or absence of the septa characteristic of the former; and this question, owing to the extreme tenuity of the corallites, their dense infiltration with calcite, and the difficulty of obtaining sections accurately transverse to the tubes, we have found a very hard one to determine with certainty. Some of our transverse sections certainly do not exhibit any septa; but these are probably more or less oblique, and under these circumstances the septa cannot be detected even in the large and typical forms of *Tetradium*. On the other hand, in two sections (figs. *d*, *e*) the corallites not only show short and distinct septa, but also exhibit the petaloid appearance so characteristic of *Tetradium*. As this positive evidence is of much greater weight than the apparent want of septa in the other sections, we feel satisfied that we are right in referring our specimens to *Tetradium*, of which they constitute the only recorded British species, and the most delicate of the hitherto described species of the genus. The number of septa seems to be generally from three to five; but it is very difficult to determine this point satisfactorily, as the granular walls of the minute tubes become almost undistinguishable from the infiltrated calcite, if a higher magnifying-power than a one-inch objective be employed.

In longitudinal sections the corallites are seen to have the form of delicate wavy tubes (figs. *f*, *g*), running parallel to one another, and often arranged in a succession of superposed layers. The corallites are crossed by numerous complete tabulæ, placed about the diameter of the tubes apart. As the tabulæ appear to be very generally placed at the same level in contiguous tubes, the longitudinal section looks under the microscope like a piece of finely-woven cloth (fig. *f*), and it is sometimes difficult to determine which of the two sets of intersecting lines are the walls of the corallites and which are the tabulæ. Whether the corallites are amalgamated by their walls or not, and what is their mode of increase, are points which we have been unable to decide. The diameter of the corallites is not absolutely uniform; but appears to be generally between one three-hundredth and one four-hundredth of an inch. Both in longitudinal and in transverse sections, but especially in the latter, are observed certain peculiar canals (fig. *d*), which have a diameter of about a fiftieth of an inch and are placed at variable intervals. They do not appear to take any very uniform course, though generally more or less parallel with the corallites, which are sometimes concentrically disposed around them; and they are so constant in their occurrence that they must unquestionably belong to the coral. In a small section six lines long and three lines wide, nine of these canals are cut across; but they are seldom as close-set as this. They strongly call to mind certain canals which are to be observed in many of the Stromatoporoids; and their function can hardly be other than that of conveying water from the exterior to all parts of the dense corallum. They would appear, therefore, to have a merely physiological value.

Specimens of *Tetradium Peachii* were first brought under the notice of one of us (R. E., jun.) by Messrs. Henderson and Brown (Edinb. Geol. Soc.), who collected examples at the Habbies Howe. The organic nature of the spheroidal masses was first detected by our friend Mr. C. W. Peach, A.L.S., after whom we name the species. The original specimens of this coral, with several others obtained from the Habbies-Howe conglomerate, having been kindly placed at the disposal of the above (R. E., jun.), a short note was communicated on the subject to the Royal Physical Society of Edinburgh*.

In the note in question, *T. Peachii* was referred to provisionally as a species of *Alveolites*, with the remark, "if it is an *Alveolite* it is even finer in texture than the very fine Carboniferous species *A. depressa*, Flem."

Form. and Loc. In pebbles of Silurian limestone contained in the Old Red Standstone conglomerates of Habbies Howe, Pentland Hills, near Edinburgh.

Collected by, and in the cabinet of, Messrs. Brown, Henderson, and R. Etheridge, jun.; also coll. Geol. Surv. Scotl. Mus. Sci. and Art, Edinb., collected by Mr. J. Bennie.

XXII.—*Description of an apparently new Species of* Lamprocolius. By D. G. Elliot, F.R.S.E.

Lamprocolius glaucovirens.

A velvety black mark on the front extending between the eyes; top of head, occiput, and back of neck light metallic grass-green, which graduates into a cold dark blue upon the back. Auriculars metallic dark blue, similar to the back, but less brilliant, edged with coppery red. Throat and upper part of breast dark purplish blue, changing to dark greenish blue along the sides, where it touches the grass-green of the nape; this greenish blue colour also extending like a band across the upper part of the breast, enclosing the purplish-blue throat entirely. Centre of lower part of the breast bright metallic coppery red; abdomen and thighs cold greenish blue. Primaries have the outer webs shining bluish green, inner webs dark brown with a greenish gloss, the tips light metallic grass-green. Secondaries have their basal half metallic grass-green like the tips of the primaries, then are crossed by a conspicuous broad velvety black bar; remainder cold dark blue, with the exception of the inner webs of the two innermost secondaries, which are light metallic grass-green like the basal portion. The coverts are metallic green, each feather tipped on the outer web with a velvety black spot, forming two rows across the wing. Shoulders metallic bronzy green.

* *Loc. cit.* pp. 50–52.

Axillaries dark cold prussian blue. Rump, upper and under tail coverts uniform shining light grass-green, without any bluish reflections. Tail has the base bluish green, and the apical portion for about an inch shining grass-green like the tail-coverts, without any purple reflections whatever; remaining portion bluish black, indistinctly barred on edge of outer web with shining bluish green. Total length 12 inches, wing $6\frac{3}{8}$, tail $5\frac{1}{2}$, culmen $\frac{3}{4}$, tarsus $1\frac{1}{8}$.

I am indebted to M. A. Milne-Edwards for the opportunity of examining the bird here described, which belongs to the collection of the Paris Museum. The only species of the genus it can be compared with is the *L. splendens*, Vieill., with which it has apparently been confounded, but from which it differs greatly in its style of coloration as well as in size. The type of *L. splendens* is fortunately in the Paris Museum, in excellent preservation, without any of its bright hues having faded or changed, as is proved by comparing it with other specimens of the same species in the gallery, more recently obtained. The general appearance of the *L. glaucovirens* is dark blue, relieved by the green of the top of the head and nape and also of the wing-coverts and shoulders. The back, throat, breast, secondaries, and tail are very differently coloured from those of *L. splendens*, and the two species when placed side by side are readily distinguished from each other. To enable it to be more easily recognized from its ally, I give a description of the prominent differences as exhibited by the two species.

Lamprocolius glaucovirens.	*Lamprocolius splendens,* Vieill.
Throat and upper parts of breast dark purplish blue.	Throat and upper part of breast bright violet.
Under wing-coverts dark prussian blue.	Under wing-coverts violet-blue.
Abdomen and thighs greenish blue.	Abdomen and thighs bluish violet.
Back dark blue.	Back bright violet.
Black bar on wings without purple lustre.	Black bar faint, overshadowed by violet reflections.
Upper and under tail-coverts uniform metallic light grass-green without any violet reflections.	Upper and under tail-coverts dark violet-blue, with the tips bluish green.
Rectrices bluish green at base, then bluish black, and tipped with shining grass-green.	Rectrices purple-violet, darkest in the centre of the feather, and tipped with purplish blue.
Length 12 inches, wing $6\frac{3}{8}$, tail $5\frac{1}{2}$, culmen $\frac{3}{4}$, *tarsus* $1\frac{1}{8}$.	Length $11\frac{1}{2}$ inches, wing $6\frac{1}{4}$, tail 5, culmen $\frac{5}{8}$, *tarsus* $\frac{7}{8}$. (*Type.*)

The specimen which serves as the type of my description was sent to the Paris Museum from the Gaboon by M. Avinenc in 1875.

XXIII.—*Description of an apparently new Species of Ground-Hornbill.* By D. G. Elliot, F.R.S.E. &c.

Bucorvus pyrrhops.

Bill black, with an orange-coloured plate on the side of the maxilla near the base, as in *B. abyssinicus.* Casque rises from base of maxilla, extends backwards over the eye, and then curves forward, terminating in a round opening in front, similar to that of *B. abyssinicus*, but smaller. Space all around the eye, extending backward nearly to the occiput, bare of feathers, and also the skin beneath the feathers on the top of the head, at least upon the forehead, orange-red. Bare skin of the sides of the neck, beneath this orange-red colour, and throat dark blue; the gular sac is orange in front, orange-red behind; and this latter colour runs up for a short distance on the posterior side of the blue skin of the neck. Entire plumage of body lustrous black; the primaries pure white. Irides pearly white. Length of bill from the angle of the mouth 17 centims.; height of casque 2 centims.; height of bill without casque 5 centims.; tail 29 centims.; tarsus 14 centims. The bird is fully adult.

Hab. Region of the Congo, West Africa.

The specimen from which the above description is taken is now living in the Zoological Gardens at Rotterdam, and was brought to my notice by Mr. Keulemans, who, when lately in Holland, made a sketch of the head, which he sent to me. I am indebted to the Directeur, Monsieur A. A. von Bemmelen, for permission to describe it, as well as for the measurements, which he kindly sent me, taken from the living bird. This species seems to be most nearly allied to the *B. abyssinicus*; but, besides its smaller size, it can readily be distinguished from that well-known bird by the totally different coloration of the bare skin on the head and neck. From information which I have received since the publication of the second part of my Monograph of the Bucerotidæ, I am led to believe that there are probably four species at least of Ground-Hornbills. Professor Bocage writes me, in answer to a request for information regarding the specimens he had received from M. Anchieta from Angola, that without exception (and he had examined more than a dozen of the birds) there was *no trace whatever of the orange plate upon the maxilla.* The coloration of the bare skin of the head and neck is also very different, being entirely yellow mixed with orange or red in the males, and with a small lengthened dark blue spot at the angle of the mandible. A female had upon the gular pouch a large spot of blue-black. The young had the bare skin yellowish red, without any admixture of blue. The measurements given by Prof. Bocage in the P. Z. S. 1873, p. 702, show that his examples are larger than the *B. pyrrhops*.

The four species may be distinguished as follows :—

A. With a coloured plate at base of maxilla.
  a. Casque curved, rounded on top, circular opening in front.
    a'. Bare skin of face and neck prussian blue, gular pouch scarlet .... 1. *B. abyssinicus.*
    b'. Bare skin of face orange-red, of neck dark blue; gular pouch orange .... 2. *B. pyrrhops.*
B. Without a coloured plate at base of maxilla.
  a. Casque nearly straight on top, oval opening in front; all the bare skin on head and neck yellowish orange or red, with a blue spot at base of mandible .... 3. *B. guineensis.*
  b. Casque compressed laterally, entirely closed in front; bare skin all blue? .... 4. *B. caffer.*

The distribution of the species is somewhat as follows:—

The *B. abyssinicus* is a native of Abyssinia and Sennaar in Eastern Africa. *B. pyrrhops* is from the region of the Congo, but the extent of its dispersion unknown, although it is proble that this district may be its southern limit, as the *B. guineensis* is found in Angola and the region north of Damaraland; and, lastly, the *B. caffer* is met with in Damaraland and the Zambesi district, and the country lying to the south as far as the Cape. The above distribution can only be given as approximately correct; for our present knowledge does not enable us to define the dispersion of any of the species in the interior of the continent, our acquaintance with most of them having been formed from the specimens obtained at different points comparatively near to the coast-line.

XXIV.—*On a Melobesian Form of Foraminifera* (Gypsina melobesioides, *mihi*); *and further Observations on* Carpenteria monticularis. By H. J. Carter, F.R.S. &c.

In my paper on the "Polytremata" ('Annals,' 1876, vol. xvii. p. 185, pl. xiii. figs. 18, 19) I have given a description and figure of a species of Foraminifera having a "*Melobesia*-like" growth, with a striking resemblance to *Polytrema* in the polygonal reticulation and foraminated interstices presented by the surface. And in my paper "On the Locality of *Carpenteria balaniformis*" (*ib.* 1877, vol. xix. p. 215, pl. xiii. figs. 19–22) I have described and figured the structure of the spheroidal form of *Tinoporus vesicularis*, Carp., stating that it was "inexplicable" to me how Dr. Carpenter could have adopted De Montfort's name "*Tinoporus*" for a genus whose affinities are with *Polytrema* rather than with *Calcarina*, of which last De Montfort's *Tinoporus baculatus* is evidently a species. We have only to place the Red-Sea variety, viz. *Calcarina calcar*, D'Orb., beside the Philippine *Tinoporus baculatus* to instantly see the gradation of form between *T. baculatus* and *Calcarina Spengleri*, even if the sections of *T. baculatus*, as I have before stated, did not prove this. The spines on all the *Calcarina*-like Foraminifera are mere prolongations of the marginal cord and septa combined, both of which are the same in structure, as may be proved by the latter being successively developed (in front of the last-formed chamber) from the marginal cord. Thus the spines, no doubt, possess the same kind of canal-system as that of *Operculina*, &c.; but while in *Calcarina calcar* the marginal cord opposite each chamber sends forth a spine, and the three or four last-formed chambers are visible on the basal side, as in *Calcarina Spengleri*, there are fewer and larger spines in *Tinoporus baculatus*, where, too, the three or four last-formed chambers are concealed from view by surface-structure.

Now *Tinoporus vesicularis*, Carp., has no distinct trochoidal spire of chambers, and nothing like a marginal cord; hence it has no canal-system, nor has it, as I have before stated, the peculiar pseudopodial canal-system of *Polytrema*; in short, it is nothing but a mass of cells growing exogenously in a laminar form from a more or less confused group in the centre, which has no communication with the exterior excepting through the foraminated plates of the respective cells.

Hence, to adopt the name of "*Tinoporus*" for a totally different genus of Foraminifera like that of *Tinoporus vesicularis*, Carp., is a mistake, which leading to confusion induces me to propose in its stead that of "*Gypsina*," whence we get *Gypsina vesicularis*, Carp., with the spheroidal variety illustrated in my paper of 1877 (*l. c.*).

This brings us to *Gypsina melobesioides*, which is but my *Polytrema planum* in a more extended form. Hitherto all the Foraminifera have been characterized by their individuality. Whole beds of *Operculina* and *Globigerina* respectively, extending for many square miles together, present nothing beyond single and separate individuals of these two genera as plentiful and distinct as grains of sand; but in *Gypsina melobesioides* they are all united together into a continuous incrustation extending over several square inches; in fact my *Polytrema planum*, which in name now becomes quite as inappropriate as "*Tinoporus*," must also be suppressed for *Gypsina melobesioides*, since it is but a small specimen of the latter, and no *Polytrema* at all, as the sequel will show.

There is a very common sponge to be obtained from the shores of the Mauritius, which evidently belongs to my group "*Otahitica*," but differs from the typical structure of the Psammonemata in being composed of simple fibre *coated*, instead of "cored," with foreign bodies, wherefore a subgroup will have to be formed for this and the like sponges, which might be termed "*Sarcopsammosa*." Be this as it may, this sponge is found growing on old coral detritus, from a point, which, increasing in size, soon divides into several roundish stems, each of which becomes compressed, and, again dividing, anastomoses with the neighbouring branches, finally terminating in thin, spatuliform, leafy expansions, each of which is surrounded by a somewhat inflated margin. The surface of the branches thus flattened and lacinulated is traversed on each side by a superficial vein-work or reticulation, which is the excretory canal-system; and the whole thus presents the character of the well-known *Spongia othahetica* of Solander and Ellis, whose colour, when dry and shore-washed, is whitish yellow, like that of cream. For this sponge and its like I would propose the generic name of "*Mauricea*," and for the species *M. lacinulosa*.

Like many other sponges it is frequently more or less infested by small parasitic *Balani*, which, ensconced in little round processes of sponge substance open at the summit, are supplied from the sponge itself and more or less scattered over its branches; while the stems are as often beset with *Polytrema*, *Planorbulina*, and worm-tubes.

It is these stems which are covered in the present instance with *Gypsina melobesioides*, continuously, to the extent of three inches from the base. There are 8–10 stems, averaging in their round part a quarter of an inch in diameter, and in their flattened or compressed form above about half an inch in their longest diameter. The thickest part of the incrustation, which has very much the appearance of the white saccharine layer spread over bridecakes (hence the name *Gypsina*), but with a faint bluish tint like that of snow, owing to the crystalline transparency of its cell-structure, is about one forty-eighth of an inch; and the number of layers of which this is composed varies from ten to twenty. I need not go into the minute structure of *Gypsina melobesioides*, which is precisely the same as that of *Polytrema planum* and the spheroidal variety of *Tinoporus vesicularis*, to which I have alluded—

excepting that the aperture pointed out conjecturally in the former belonged to another animal, as no such thing exists in the specimen of *Gypsina melobesioides* under consideration, where the cavities of the cells are, as usual, lined by sarcode (assuming a dark brown colour when dry), but communicate with the exterior in no other way than that mentioned, viz. through the foraminated plates of the cells.

In its mode of extension *Gypsina melobesioides* is very like *Melobesia lichenoides*, spreading under a thallaceous form with a thin margin; but it is easily distinguished from *Melobesia* by the closed cells of the latter, and especially by the conceptacles, if there are any present. It is also, in appearance, very like the white crust of a *Gorgonia*, from which it is also easily distinguished by the latter being composed of the usual form of spino-tuberculated spicule.

Thus we have at last come upon a thallophytic species of Foraminifera, whose cells being foraminated instead of closed points out the usual distinction between animals and plants, while, like many other lower animals, it still presents a plant-like form. Where are we to look for the "single nucleus" here?

There is a fossil variety of *Gypsina* from the Miocene of Jamaica, of which specimens have been submitted to me for examination by Mr. H. B. Brady, who, following Dr. Carpenter's nomenclature, has called it "*Tinoporus pilaris*" (Survey Mem. Geol. Jamaica, pt. ii., West-Indian Survey, p. 334). This does not appear to differ in any way from the living spheroidal variety except in its greater size, the largest sent being just one sixth of an inch in diameter.

Carpenteria monticularis.

With reference to my communication "On the Branched Form of the Apertural Prolongation from the Summit of *Carpenteria monticularis*" ('Annals,' 1877, vol. xx. p. 68), I might further observe that *Squamulina scopula* and its variety *ramosa* ('Annals,' 1870, vol. v. p. 309, pl. iv., & p. 389) appear to me to be the *arenaceous* representatives of the *Carpenteriæ*. Like *Carpenteria* they have a multilocular conical base, each utricle of which opens at the summit into a common tube, that is prolonged upwards into a single or branched form, according to the species; while the extremities of the branches are beset with projecting spicules, pincushion-like, which are often simulated by the accumulation of spicules in the free ends of the branches both of *Carpenteria* and

Polytrema. For *Oculina rosea*, in the paper first mentioned, read *Stylaster sanguineus*.

I have also lately found pieces of coral-detritus rock both from Jamaica and the Mauritius, almost covered with fragments of *Polytrema miniaceum* and *Carpenteria utricularis*, mixed together indiscriminately, thus presenting respectively in their broken summits a very similar appearance, especially where each utricle of the *Carpenteria* (which is often the case) appears to have been provided with its own branched tubular prolongation.

XXV.—*On a Fossil Species of Sarcohexactinellid Sponge allied to* Hyalonema. By H. J. Carter, F.R.S. &c.

About the 23rd of June last I had the pleasure to receive from Mr. James Thomson, F.G.S. &c., of Glasgow, for delineation and description, if thought desirable, a box of fossils from the Carboniferous rocks of Scotland, which "for many years" Mr. Thomson had regarded as belonging to the sponges; and among these is a fragment of rock bearing 4–5 inches of the anchoring lash of spicules respectively of two specimens of apparently the same sarcohexactinellid sponge, which Mr. Thomson views provisionally as having belonged to a "*Hyalonema*." Besides these there are other specimens of this kind mixed up with sexradiate spicules of various forms; but particularly a fragment where some of these spicules are evidently nearly *in situ*, which leaves no doubt in my mind that this was a portion of the body of a sarcohexactinellid sponge.

I had, through the great kindness of Dr. J. Millar, become possessed, about a year since, of some of these hexactinellid spicules, as well as fragments of the linear spicules, which I *now* find to have come from anchoring ones similar to those of the "lash" just mentioned; and these were of the same kind as those exhibited before the British Association at Glasgow last year, where they were called "*Acanthaspongia Smithii*."

The name of *Acanthaspongia siluriensis* was proposed by M'Coy for the fossil remains of a sponge in the collection of Mr. R. Griffith, F.G.S., obtained from the sandstone of Cong, county Galway; and the specimen (for there is no figure of it) is described ('Synopsis of the Silurian Foss. of Ireland,' p. 67, 1846) as consisting of "a lengthened oval mass, about two inches long and three fourths of an inch wide, of crowded spicules, varying in length from two lines to more than half an inch," resembling "the letter X in shape, four of the rays being always very distinct and disposed in that form; but [the author continues] there also seems to have certainly been one similar ray extending upwards and another downwards from the centre, considering the other four horizontal; the rays are round and tapering, smooth and apparently hollow."

Hence there is nothing more to be learnt from this description than that the fossil was part of a hexactinellid sponge; while among the specimens sent me formerly by Dr. J. Millar, and lately by Mr. Thomson, there are the hexactinellid spicules of the body *in situ*, the long, linear anchoring spicules, in at least three specimens of the "lash" or "glass cord," *in situ*, and fragments of the fluked ends of the anchoring spicules of the same "lash" probably, but *separate*; so that in these we have distinctly all the skeleton-spicules that a hyalonematous sponge could present, excepting the flesh-spicules, which we do not expect to find here any more than in any other fossil sponge, they, from their extreme minuteness, not being able to survive the effects of fossilization. At the same time it is hardly to be conceived that, if one species of sarcohexactinellid sponges existed at this period and in this locality, there were not more; and therefore the difficulty will be to put those spicules together which originally belonged to the same species.

Thus we have the undoubted discovery of the fossilized remains of a sarcohexactinellid sponge like *Hyalonema* from the Carboniferous limestone of "Cunninghambedland, Dalry, Ayrshire," stated by Mr. Thomson to come from "the upper thin bed of limestone which is usually found in the upper sections of our lowest Carboniferous Limestone."

It is probable that both the *Acanthaspongia* of M'Coy, described in 1846, and the *Protospongia* of Salter, figured and described in 1864, were also the remains of sarcohexactinellid sponges; while those of the vitreohexactinellids have long since been known, although only just now, in the striking illustrations of Prof. K. A. Zittel, of Munich, and Mr. W. J. Sollas, of our own country, together with their descriptions respectively, brought before the public in the most elaborate, impressive, and satisfactory manner; but not until now, to my knowledge, have the fossilized remains of a *sarco*hexactinellid sponge been thus indisputably proved to exist, and that, too, at a period far antecedent to any of the remains of the vitreohexactinellids hitherto described.

At first, when Dr. Millar kindly sent me the "hexactinellid spicules," they appeared to me, in form and size, to be so unlike any of the present day with which I am acquainted, that I could only liken them to calcareous forms of the arenaceous Foraminifer called *Astrorhiza.* But on receiving more of these spicules, together with their associates (chiefly the remains of encrinitic stems), I thought that they might be the pedicellariæ of some unknown fossil Echinoderm. Finally I yielded to an acknowledged authority, who stated that there was nothing among the Echinodermata, living or fossil, to be compared to them; and then I came to the conclusion that we should never know any thing more satisfactory about them until they had been found in connexion with the organism to which they originally belonged, when the receipt of Mr. J. Thomson's specimens decided the matter in the way above stated. I must observe that Dr. Millar throughout kept to the view that they were the remains of a hyalonematous sponge, as has now been proved.

Pending my being able to delineate and describe Mr. Thomson's interesting specimens, among which there are the remains too of another sponge, apparently of a different kind, I think it right to make this communication.

XXVI.—*Description of a new Species of* Batrachostomus *from Central Borneo.* By Dr. F. Brüggemann.

Batrachostomus adspersus.

Bill strongly vaulted; hair feathers of the lores well developed, curved and remarkably rigid; forehead with a conspicuous tuft of recurved hair feathers almost as in *B. crinifrons*: wings comparatively long and pointed; fourth quill longest; fifth, sixth, third, and seventh successively a trifle shorter; second much shorter, slightly surpassed by the eighth; first nearly one inch shorter than the second: tail elongate, its feathers narrow, shortly pointed, rather obtuse at the top, the outermost pair reaching only to one third of the whole length; the next pair twice as long as the first; the following pairs forming the rounded apex: toes long, slender; nails weak, feebly curved.

Above pale greyish brown, inclining to rufous on the smaller wing-coverts and rump, everywhere most densely covered with delicate, irregular, transverse markings of a brownish black colour. Each of the feathers of the upper head, neck, and back with a small buffy-white terminal spot, and before it with a blackish triangular one. Scapularies white, slightly washed with fulvous, and marked with scarce, blackish, irregular lines formed by narrow bars and edgings of the feathers. Quills dark greyish brown, their outer webs pale buff, marked with distant rufous bars, the latter being bordered with brown. Tertiaries and tail-feathers pale sand-colour, transversely mottled with dark brown. Tail with eight transverse subtriangular bars of a more rufous ground-colour, which are in markings and extension equal to the paler interspaces and separated from these by a narrow dark brown border. Hair feathers of the head blackish. Lores and eyebrows almost uniform pale buff. Throat with a large buffy-white spot showing some brown markings. Fore neck coloured like the back; rest of under surface pale buff, sparingly variegated with brown. Under wing-coverts brown, mottled with buff; axillaries buffy white; under surface of quills and tail-feathers similar in its markings to the upper surface, but much paler and more greyish. Bill, feet, and nails light horn-colour.

Total length about 250 millims.; length of wing 132 millims., of tail 143, of bill 20; width of bill at the gape 35; length of tarsus 15, of middle toe 15.

Hab. Moeara Teweh, interior of S.E. Borneo. The specimen above described was collected by Dr. George Fischer, who presented it to the Darmstadt museum. In a former paper on Bornean ornithology (Abh. Ver. Brem. v. p. 456) I have referred it doubtfully to *B.* "*stellatus*," Salvad. (*B. stictopterus*, Cab. & Heine). The latter species having since been found in the same locality by Dr. Fischer and submitted to me for examination, I at once discovered that identification to be quite erroneous; for although the bird is almost of the same size as *B. stictopterus* and *B. javanensis* (Horsf.), it is at first glance distinguished from them by its greyish, mottled, really *caprimulgine* plumage, and also by structural details. The true *B. stellatus* (Gould) is, according to the original description, quite different from either of these species.

Besides *B. adspersus* and *B. stictopterus*, Dr. Fischer has also obtained the large *B. auritus* (Vig.) at Moeara Teweh. To the latter species the *Podargus Vincendoni* (Jacq. & Puch.), established on a specimen from Banjermassing, is perhaps referable, although the description does not perfectly agree with Vigors's bird.

XXVII.—*On the Distribution of Birds in North Russia.*— Part III. *On the Longitudinal Distribution of the Birds of the* SOUTHERN DIVISION (*between* $64\frac{1}{2}°$ *N. and* 58°–60° *N.*), *and a Comparison of the Faunas of the* TWO DIVISIONS; *with Summaries.* By J. A. HARVIE BROWN, F.Z.S., Member of the British Ornithologists' Union.

IN the last part of this paper ('Annals,' July 1877, p. 1) I have treated of the distribution of species recorded by authors in the NORTHERN DIVISION. I now propose to work out, as far as my materials permit, and upon the same plan, the distribution of the species recorded in the SOUTHERN DIVISION.

The SOUTHERN DIVISION, as I have before indicated (*l. c.* p. 2), is that portion of North Russia south of $64\frac{1}{2}°$ N. lat. extending to 60° N. lat. in the S.W., to the southern boundary of the Vologda Government, or about 59° N. lat., in the S.C., and including part of the Perm Government, south to 58° N. lat. and east to its eastern boundary in Asia, in the S.E. I have found this southern boundary the most convenient in consulting the various records of authors. It would doubtless have made it more regular in appearance to have included the Government of Novgorod and the northern half of that of Viatka; but at present the materials to which I have access do not admit of my doing so. Moreover, if we consult the map lately issued in Mr. Mackenzie Wallace's work on Russia, vol. ii.*, which shows the "Zones of Vegetation," it will, I think, be acknowledged that Novgorod will more naturally come to be entered in comparing a more southerly belt of land. Should it, however, be considered by any as belonging naturally to my SOUTHERN DIVISION, the records can at any time be added when the materials are forthcoming.

When Dr. A. Brandt has completed a list of the books and papers treating of the fauna of Russia, upon which, he informs me, he is engaged, the materials, I have no doubt, will become more accessible than they are at present, and the minutiæ of distribution will be more easily worked out.

I propose to subdivide this DIVISION in a similar way to that adopted for the NORTHERN DIVISION, viz. into *Three Districts*, which I proceed to name and define as follows:—

* 'Russia.' Cassell, Petter, and Galpin: London, 1876.

1st. "*The S.W. District of the* SOUTHERN DIVISION."—Included between 30° and 40° E. long. (and between 60° and 64° 30′ N. lat.). This includes, in the west, Viborg in Finland and the lake-districts of Onega and Ladoga, and, for convenience, the *whole* of the Olonetz Government with a portion of the Archangel Government.

2nd. "*The S.C. District of the* SOUTHERN DIVISION."—Included between 40° and 50° E. long. (and between 64° 30′ N. lat. in the north, and the southern boundary of the Vologda Government, about 59° N. lat., in the south). This includes the main portion of the water-system of the Dvina south of Cholmogory and the upper valley of the Mezén.

3rd. "*The S.E. District of the* SOUTHERN DIVISION."—Included between 50° E. long. and the eastern boundary of the Perm Government, 60°–65° E. long. (and between 58° and 64° 30′ N. lat.). This includes the remaining portion of the Vologda Government eastward to the Ural, a part of the Archangel Government, and part of Perm—in other words, may be held as including the head-waters of the Petchora and Dvina rivers, and the sources of the Kama flowing southwards.

As with the NORTHERN DIVISION, I have tabulated the records of the authors who have treated of the birds of the SOUTHERN DIVISION; and I give below a list of these with the titles of their papers*, indicating the extent of the authors' field-work, or the districts in connexion with which they have written, by capital letters (S.W., S.C., or S.E.) affixed to the notice of each.

In addition, in a second Table, I propose to institute a comparison between the faunas of the two DIVISIONS as far as recorded, thus showing a general outline of latitudinal as well as longitudinal distribution.

The cross-references by numbers between the following list and the Table, and *vice versâ*, are continuous from the former 'List of Authorities' for the NORTHERN DIVISION; but authorities who have treated of the birds of both DIVISIONS *retain* the original numbers as given in the former list. Thus the newly added authorities for the SOUTHERN DIVISION are numbered from 19 onward.

* I entered the records in the Tables rather in the order in which I was able to consult the authors than in strict chronological order; but this is perhaps of minor importance.

SOUTHERN DIVISION.

List of Authors, &c.

3. Blasius (original No. 3, Part II., 'Annals,' July 1877, p. 4).

Notices of some of the birds met with in his travels are given; but I have not considered it necessary to refer directly to his work in the Tables.

4. Lilljeborg (or. No. 4, *l. c.* p. 4).

5. Hoffman-Brandt (or. No. 5, *l. c.* p. 4).

In most cases the exact number of specimens obtained of each species is mentioned in this paper; but as these do not necessarily indicate the comparative scarcity or commonness of the species, I have not reproduced these minute statements in every case.

8. Meves (or. No. 8, *l. c.* p. 5).

11. Palmén (or. No. 11, *l. c.* p. 6).

Under this heading I quote, however, the more recent and fuller paper also which is mentioned under the author's name in Part II. (*l. c.* p. 6, note). Both of his works in this connexion, however, have been referred to throughout and come under No. 11*.

19.

1856. Mejakoff, A. "Catalogue des oiseaux observés dans le gouvernement de Wologda." (Bull. Soc. Imp. Nat. Mosc. xxix. 1856, pp. 625–635.) S.C.

A list of 143 species, along with short notes on some of them, from observations made for the most part in the districts of Wologda, Gresoviets, Kadnikov, Welsk, and part of that of Totma, in the south of the government.

* Also Kessler, 'Material till Kannedom om Onegasjön och Olonetzkiska gouvernmentets hufvudsakligen i zoologiskt hänseende," St. Petersburgh, 1868 (the original in Russian).

Kessler's records I have not been able to insert. Perhaps some one acquainted with the Russian language will kindly supply these.

I am informed, however, by Prof. J. A. Palmén that the districts in question (in the neighbourhood of the Swir river and between Lakes Onega and Ladoga) have been very fully worked by Herr Richard Sievers of Helsingfors, in 1875, and also the Wig lake and district in 1876; and I understand from Herr Sievers that he intends to publish the results of his investigations this autumn (1877). Later, I propose to offer an Appendix to this paper, bringing the data for the two Divisions up to date. It will not be in tabular form; but the data will be easily transferred to my original papers by those who possess copies.

20.

1871. Goebel, H. "Eine Reise von Petersburg nach Archangelsk über Tver, Jaroslav, Vologda und Ustjug vom 8. Mai bis 1. Juni 1864." (Journal für Ornithologie,' 1871, pp. 20–27.) S.C.

88 species are noted from the S.C. District (some, however, of doubtful record), besides others from the Archangel district*.

21.

1853. Zerrenner, Dr. Carl. "Erdkunde des Gouvernements Perm." (Fumf. Absct.-Vogel. &c. Seite 309–319.) S.E.

Some 26 species are mentioned, besides domestic species, from localities within our limits, and notes on them given.

22.

1870. Sabanäeff, Leonida. "Preavaritelnoï Oscherk Faunoï Posvonoschnoëch Srednyago Oorala." (Bull. Mosc. xlii. 1870, pp. 185–197.) S.E.

From a translation of the above paper on the avifauna of the Ural, by Mr. F. C. Craemers, and obligingly put at my disposal by Seebohm, just before his departure for the Yenesei, March 1, 1877, I am able to fill up the list of species in the S.E.

Sabanäeff mentions 176 species as occurring at localities within our limits, besides 24 others which very possibly may occur also, though at present they are only recorded from localities close to our southern boundary in Perm, or have been recorded from our Northern Division.

23.

1875. Meves, W. "Brutplätze seltener europäischen Vögel." (Journal für Orn. 1875, pp. 428–434†.)

References are made in this paper to occurrences of species in the Northern Division of Russia, as well as in the Ural

* *Vide* also No. 10 of original list for another paper by Herr Goebel, relating to the same journey after reaching Archangel.

† Dr. Meves of Stockholm informs me that he has ready for publication a detailed account of his journey to the South-eastern Ural, which, when published, will doubtless clear up many points which I am obliged to leave doubtful in this paper. His researches, however, scarcely include any part of our Southern Division, having more direct reference to those portions between 57° and 55° N. lat.

south of Perm, and on the Kama river, and will prove useful in studying the distribution of species in the east of Russia in Europe*.

The following Tables are given to show:—1st, the faunas, as far as at present recorded, of the three districts of the SOUTHERN DIVISION; and, 2nd, that of the NORTHERN DIVISION as compared with that of the SOUTHERN DIVISION. This latter must be considered in its present state as somewhat arbitrary, and cannot be held to clearly represent the faunal relations of the two DIVISIONS: nor can we expect to institute an exact and faithful comparison until our knowledge of the faunas of the *terræ incognitæ* of these DIVISIONS becomes more complete.

In Table I., as with the NORTHERN DIVISION, I have given a place to every record, whether fully authentic or not; and later I have treated of the doubtful records and rare occurrences in *notes*, to which references are given in the Tables. Under these notes, also, will be found references to Table II.

In Table II., in cases where I have considered the data insufficient to generalize from, as regards the ascertained faunal value of the species *throughout* the DIVISIONS, I have, in some cases, only entered the symbol for simple "presence," and in other cases, where required for further elucidation, the additional symbols for "locally" (⊙) and "generally distributed" (○). Further exploration in the unworked parts of the DIVISIONS will help us to arrive at more accurate and minute registration in this comparison than is at present attainable.

The Seasonal Distribution in Table II. is shown as far as I have data. Where I have no data, or where doubt occurs, I omit it (*vide* Symbols).

* Besides the above, the following papers should be mentioned as bearing upon our subject. Where necessary I have referred to these in footnotes.

General subject.

1874. PALMÉN, Prof. J. A. Om foglarnes flyttningsväger. Helsingfors.
1876. IDEM. 'Ueber die Zugstrassen der Vogel;' von J. A. Palmén, Docent der Zoologie an der Universität Helsingfors. Mit einer lithographirten Tafel. Leipzig: Engelmann, 1876. (*Vide* also 'Nature,' 1877, p. 465.)
1856. MIDDENDORFF, VON. 'Die Isepiptesen Russlands,' &c. Petersburg.
1868. SABANÄEFF, L. "Materialoï dlia Faunoï Jaroslavski guberni." (Bull. Soc. Imp. Nat. Mosc. 1868, pp. 234–279, 487–524, and vol. xli. pp. 202–243, 383–405.)
1870. FISCHER, VON. "Die Vögel des St. Petersburger Gouvernement." (Der Zool. Garten, von Dr. F. C. Noll, Bd. x. S. 336, and Bd. xi. S. 344.)

Explanation of the Symbols and Arrangement in the following Tables.

Insufficient data, or unrecorded, or ascertained absence, a space left blank. Present, |. Rare, ·|·. Common, ||. Very common, ††. Very abundant, ‡‡. Once, twice, or thrice seen, and added to the fauna without doubt, ▰, ▰▰, ▰▰▰. Generally distributed, ○. Locally distributed, ⊙. Sporadical, accidental, ∗. Resident, R. Summer visitant, S. Migrant, passing northwards in spring, ∧. Migrant, passing southwards in autumn, ∨. Winter, W.

Species which are of extremely doubtful occurrence in any part of the North of Russia (which can scarcely be admitted at all to the fauna) have their names enclosed in brackets and are not numbered (example, *Falco sacer*, in Table). Those species which were thus enclosed in the last part of this paper as of extremely doubtful occurrence in the Northern Division, but which can distinctly be admitted to the fauna of the Southern Division *have the brackets removed*, and become entitled to a number preceding them (vide *Totanus stagnatilis*, in Table). As in Part II. the number of the authority who gives a doubtful record (for the Southern Division) is also enclosed in brackets, thus (20).

In the "Reference to Authorities" column, I have also thought it advisable to use square brackets upon occasions, especially round Sabanäeff's No. 22, thus [22]. This indicates the probable or possible occurrence of certain species within the limits of the Southern Division, according to authors' showing, which species are known to occur close to our southern boundary, or which are known to have occurred north of our northern boundary. As this cannot, however, admit them to positive record, I do not give them place in the district columns. In other words, the square brackets simply indicate such species as may still be expected to occur in the Southern Division.

In the column for the consecutive numbers which precede the names of the species:—

Roman (or ordinary thin) type distinguishes such species as are common to the two Divisions; and with these are included such as have certainly occurred in one *or* other Division (*but in which is still uncertain*[1]).

Clarendon (or thick) type is used to distinguish the species which occur in the Northern Division, but not in the Southern.

Old-cut type (*e. g.* 3) is used to distinguish those which occur in the Southern Division, but not in the Northern. Doubtful records are not taken notice of in these distinctions.

And, as already explained, such species as are totally rejected have no number printed before them.

[1] For a list of these, *vide* Summaries, *infrà*, page 201.

Tables showing (1) *Distribution of the Fauna in the three* Districts *of the* SOUTHERN DIVISION (Table I.),
(2) *Comparison of the Faunas of the* NORTHERN *and* SOUTHERN DIVISIONS (Table II.).

Table I.						Table II.	
Species.	S.W. 30° to 40° E., between 60° and $64\frac{1}{2}$° N.	S.C. 40° to 50° E., between 59° and $64\frac{1}{2}$° N.	S.E. 50° to 60° E., between 58° and $64\frac{1}{2}$° N.	Reference to Authorities in foregoing List.	Reference to Notes.	Northern Division.	Southern Division.
1. Vultur fulvus, *Briss.*			|	22.			∗ s.
2. Aquila chrysaëtus, (*L.*) [1]		|	|	20, 22.		| ○ r.	·|· r.
3. —— clanga, *Pall.*	✓		|	22, 23.	1		·|· ⊙ s.
4. Haliaëtus albicilla, (*L.*)	|	||	|	8, 19, 20, 22.		|| s.	|| s.
5. Pandion haliaëtus, (*L.*)	|	||	|	5, 8, 20, 22.	2	| s.	|| s.
6. Buteo vulgaris, *Bechst.*	·|·	||	|	4, 8, 19, 20, 22.		| s.	|| s.
7. —— desertorum, *Daud.*				22.		∗	
8. —— lagopus, *Brünn.*		|		19, 20, [22]	3	|| ○ s.	| ⊙ s.
9. Pernis apivorus, (*L.*)	||		|	4, 8, 22.	4	∗ s.	| ⊙ s.
(Milvus ictinus, *Savig.*)[2]				[22].	4	?	
11. —— migrans, *Bodd.*	|	||	||	4, 8, 19, 20, 22.		|| s.	|| s.
12. Falco gyrfalco, *Schleg.*			|	22.		| r.	| r.
(—— sacer?)						( )	
14. —— peregrinus, *L.*			|	5, 22.		|| s.	| ⊙
15. —— subbuteo, *L.*	|	|	|	4, 5, 8, 19, 20, 22.		|| s.	|| ○ s.
16. —— vespertinus, *L.*	||	||	|	4, 8, 19, 20, 21, 22.		·|· s.	|| s.

				8, 19, 20.		†† s.	·|· s.
18. —— tinnunculus, *L.*	‖	‖	|	8, 19, 20, 21, 22.	5	·|· s.	‖ s.
19. Accipiter palumbarius, (*L.*)	|	‖	‖	8, 19, 20, 22.		|	‖ r.
20. —— nisus, (*L.*)	|	·|·	|	8, 19, 20, 22.	6	| s.	|
21. Circus cyaneus, (*L.*)	‖	|	|	4, 5, 8, 19, 22.		‖ s.	‖ s.
22. —— æruginosus, (*L.*)	|	( )		8 ?, 19.	7	* s.	·|·
23. Surnia ulula, (*L.*)	‖	|	|	5, 8, 19.		| r.	| r.
24. —— nyctea, (*L.*)	|		|	8, 22.		‖ s.	·|·
25. Glaucidium passerinum, (*L.*)		|		19.		·|·	·|· r.
(Athene noctua, *Retz.*)						( )	
27. Nyctale Tengmalmi, *Gmel.*	|	|	|	8, 19, 22.		|	| r.
28. Syrnium uralense, (*Pall.*)		|	††	19, 22.		| r.	†† ⊙ r.
29. —— lapponicum, (*Retz.*)		|		19, 20.		| r.	·|· r.
30. Asio otus, (*L.*)[3]			| ?	22 ?		?	| ?
31. —— accipitrinus, (*Pall.*)	‖	|		8, 19.		‖ s.	‖ r.
32. Bubo ignavus, (*Forst.*)		|	·|·	19, 21, 22.		‖ r.	·|· r.
33. Dryocopus martius, (*L.*)	|	|	|	4, 5, 8, 20, 21, 22.		| ○ r.	| ○ r.
34. Picus major, *L.*	‖	|	|	4, 5, 8, 19, 20, 21, 22.		·|· r.	‖ r.
35. —— leuconotus, *Bechst.*	*	|	?	4, 5 ?, 8, 19, 20, 22, [23][4].	8	?	·|· r.
36. —— medius, *L.*		|	|	19, 22.			·|· s.
37. —— minor, *L.*		|		19, 20.	8	‖ r.	·|· r.
38. Picoides tridactylus, (*L.*)	‖	·|·	·|·	5, 8, 19, 22.		‖ r.	·|· r.
39. Gecinus viridis (*L.*)		·|·		19.			·|·
40. —— canus, (*Gmel.*)		|		19.		*	|

[1] *Aquila chrysaëtus*, at Bogoslaffsk, under name *Aquila nobilis* (see note 1, obs.).
[2] *Milvus ictinus*, *vide* notes on this species in Northern Division.
[3] *Asio otus* (22), "probably ranges as far north as 59° N. lat. in S.E.
[4] *Picus leuconotus* [23], refers really to *P. cirris*, Pall., junior (*vide* notes).

Species.	Table I. (*continued*). S.W. 30° to 40° E., between 60° and $64\frac{1}{2}$° N.	S.C. 40° to 50° E., between 59° and $64\frac{1}{2}$° N.	S.E. 50° to 60° E., between 58° and $64\frac{1}{2}$° N.	Reference to Authorities in foregoing List.	Reference to Notes.	Table II. (*cont.*). Northern Division.	Southern Division.
41. Yunx torquilla, *L.*	?		|	8 ?, 19, 22.	9	* S.	·|· S.
42. Cuculus canorus, *L.*	||	|	||	4, 8, 19, 21, 22.		†† S.	†† S.
43. Sturnus vulgaris, *L.*	?	|	·|·	8 ?, 19, 21 ?, 22.	10	* S.	·|· S.
44. Passer domesticus, (*L.*)	||	|	|	4, 5, 8, 19, 20, 22.	11	|| R.	|| R.
45. —— montanus, (*L.*)	||	|		4, 8, 19, 20 [22].	12	†† R.	|| R.
46. —— petronius, (*L.*)		|		19.			·|· S.
47. Pyrrhula major, *Brehm*	|	|	|	5, 8, 19, 22.	13	|| ?	| ○ R.
48. Carpodacus erythrinus, (*Pall.*)	|	|	||	4, 8, 19, 20, 22.		·|· S.	|| ○ R.
49. Corythus enucleator, (*L.*)[1]	?	?	|	5, 8.		†† S.	·|· ⊙
50. Loxia curvirostra, *L.*[2]	|	|	|	5, 8, 19, 21, 22.		|| R.	|| R.
51. —— bifasciata, (*Brehm*)						|| R.	
52. —— pityopsittacus, *Bechst.*	?	|		8, 19, 20.			| R.
53. Coccothraustes vulgaris, *Pall.*	*			8,			*
54. —— chloris, (*L.*)	|	|		8, 19, [22].			| S.
55. Fringilla cœlebs, *L.*	||	|	|	4, 5, 8, 19, 20, 22.		|| S.	|| S.
56. —— montifringilla, *L.*	||	|	|	4, 5, 8, 19, 20, 22.		|| S.	|| S.
57. Carduelis elegans, (*L.*)	|	·|·	·|·	8, 19, 21, 22.		·|·	·|· R.
58. —— spinus, (*L.*)[3]	|	|	||	4, 8, 19, 20, 21.		·|· S.	|| S.

61. Sitta europæa, *L.*		|	||	5, 19, 22.		·|· s.	||
62. Certhia familiaris, *L.*	|	|	|	8, 19, 22.			| ○ s.
63. Corvus corax, *L.*	‡‡	‡‡	|	4, 5, 8, 19, 21, 22.		†† R.	‡‡ R.
64. —— corone, *L.*[4]	|	?	|	4, 20 ?, 22.	15	|	·|·
65. —— cornix, *L.*	||	|	|	4, 8, 19, 21, 22.		‡‡ R.	‡‡ R.
66. —— monedula, *L.*	||	||	||	4, 8, 19, 21, 22.	16	†† R.	‡‡ R.
67. —— frugilegus, *L.*[5]	||	||	||	8, 19, 21, 22 ?	17	·|· s.	†† s.
68. Fregilus graculus, (*L.*)							
69. Nucifraga caryocatactes, (*L*).		|| *	††	5, 19, 22.	18	* V	‡‡ ⊙
70. Pica caudata, (*L.*)[6]	||	||	||	4, 5, 8, 19, 20, 21.		|| R.	|| R.
71. Garrulus infaustus, (*L.*)	·|·	|	||	4, 5, 8, 19, 20.		†† R.	|| R.
72. —— glandarius, (*L.*)		|	|	19, 20, 21 [22].	19	·|·	|| R.
73. —— Brandtii			||	23.	19		||
74. Lanius excubitor, *L.*	|	|	·|·	5, 8, 19, 22.	20	| ⊙ s.	| ○
75. —— collurio, *L.*[7]	·|·			8, [22], [23].			| s.
76. Linota cannabina, (*L.*)	||	|	††	8, 19, 22.		| s.	| s.
77. —— linaria, (*L.*)	|	|	|	5 ?, 8, 19, 20, 22.		‡‡ s.	|| s.
78. —— exilipes, (*Coues*)			?	5 ?, 22 ?.	21	‡‡ s.	?
79. —— flavirostris, (*L*)						·|· s.	
80. Emberiza melanocephala, *Scop.*						?	?
81. —— aureola, *Pall.*[8]	|		††	4, 5, 8, 22.		‡‡ ⊙ s.	|| ⊙

[1] *Corythus enucleator*, Hoffman-Brandt (5), at $64\frac{1}{2}°$, only record in S.E.
[2] *Loxia curvirostra*, Goebel (10), resident in Northern Division.
[3] *Carduelis spinus*, Goebel (10), seen as early as the 24th April near Archangel.
[4] *Corvus corone*, von Midd. 'Die Thier. Sib.' p. 1029 &c. note 3: *loc.* Ladoga, S.W. District.
[5] *Corvus frugilegus*, Sabanäeff (22), said to occur at Ijma, 64° N., S.E. District.
[6] *Pica caudata*, Zerrenner (21), occurs in S.E.; only record for S.E. District.
[7] (*Lanius collurio*, Meves (*in lit.*), should stand for *L. phœnicurus*, in 23, S.E.)
[8] *Emberiza aureola*, Midd. (D. Th. Sib. p. 1046, note 5), †† in North Ural, N.E. District.

Species.	S.W. 30° to 40° E., between 60° and $64\frac{1}{2}$° N.	S.C. 40° to 50° E., between 59° and $64\frac{1}{2}$° N.	S.E. 50° to 60° E., between 58° and $64\frac{1}{2}$° N.	Reference to Authorities in foregoing List.	Reference to Notes.	Northern Division.	Southern Division.
	TABLE I. (*continued*).					TABLE II. (*cont.*).	
82. Emberiza citrinella, *L.*[1]	‖	‖	‖	4, 5, 8, 19, 22.		‖ R.	‖ R.
83. —— rustica, *Pall.*	|	|	|	5, 8, [22].	22	| s.	|
84. —— pusilla, *Pall.*	‡‡		|	4, 5, 8, [22].		‡‡ ○ s.	‡‡ s.
(—— pithyornis, *Pall.*)[2]			( )	( )		( )	( )
86. —— schœniclus, *L.*	|	|	‖	8, 19, 22.	23	‖ s.	‖ s.
87. Plectrophanes nivalis, (*L.*)		|	††	19, 22.	24	‡‡ s.	‖ ∧ ∨ ?
88. —— lapponicus, (*L.*)		|	††	19, 22.	24	‡‡ s.	‖ ∧ ∨ ?
89. Alauda arvensis, *L.*	‖	|	|	8, 19, 20, 21, 22.	25	‖ ○ s.	‖ ⊙ s
90. —— arborea, *L.*	|	÷		8, 19, 20.			÷ s.
91. —— alpestris, *L.*	÷	|		19, [22].		‖ s.	| ⊙ ∧ ∨
92. Anthus trivialis, (*L.*)	|	÷	††	4, 5, 19, 22.		| s.	‖ s.
93. —— pratensis, (*L.*)	|		‖	4, 8, 22.		‖ s.	‖ s.
94. —— cervinus, *Pall.*						‡‡ s.	
95. —— spipoletta, (*L.*)			|	5, 22.			| ⊙ s.
96. —— obscurus, *Penn.*						|	
97. —— Gustavi, (*Swinhoe*)						‖ ⊙ s.	
98. Budytes viridis, (*Gmel.*)	‖	‖	?	4, 8, 19, 22 ?		‖ s.	| s.
99. —— flavus, (*L.*)[3]	|	?		[22 ?].	26		| s.
[illegible]						‡‡ ⊙ s.	

102. —— alba, *L.*	‖	‖	‖	4, 5, 8, 19, 22.		†† s.	†† s.
103. Cinclus melanogaster, (*Temm.*)			|	5, 21, 22.		|	|
104. Oriolus galbula, *L.*[4]	·|·	|	|	4, 8, 19, 22.		* s.	·|·
105. Turdus merula, *L.*						✓	
106. —— torquatus, *L.*				[22].		| s.	
107. —— pilaris, *L.*	‖	|	‖	4, 5, 8, 19, 20, 21, 22.		†† s.	‖ s.
108. —— viscivorus, *L.*	‖	|	‖	4, 8, 20, 22.		?	‖ s.
109. —— iliacus, *L.*	‖	|	‖	4, 8, 19, 20, 22.		‖ s.	‖ s.
110. —— fuscatus, *Pall.*[5]			††	5, 22.		|	†† ⊙
111. —— musicus, *L.*[6]	·|·	|	††	4, 5, 8, 19, 20, 22.		·|· s.	‖ s.
112. Erythaca rubecula, (*L.*)[7]	‖	|	|	8, 19, 20, 22.		( )	| s.
113. Cyanecula suecica, (*L.*)	|	|	††	5, 8, 19, 20, 22.		‡‡ s.	‖ s.
114. Ruticilla phœnicura, (*L.*)	‖	|	|	4, 5, 8, 19, 20, 22.		‖ s.	‖ s.
115. Saxicola œnanthe, (*L.*)	‖	|	|	4, 5, 8, 19, 20, 22.		| s.	‖ s.
116. Pratincola rubetra, (*L.*)	‖	‖	‖	4, 8, 19, 21, 22.		‖ s.	‖ s.
(—— rubicola, (*L.*))			?	5 ?, 22 ?	27	( )	( )
118. —— indica, *Blyth*			|	5 ?, 22 ?		‖ ⊙ s.	?
119. Accentor modularis, *L.*	·|·	|	‖	8, 19, 22.		| s.	| s.
120. —— montanellus, *Pall.*			✓	22.			✓
121. Sylvia garrula, *Briss.*		‖	|	8, 19, 22.		·|· s.	s.
122. —— rufa, (*L.*)	‖	|	?	4, 8, 22 ?		| s.	| s.
123. —— atricapilla, (*L.*)	‖			8.			‖ ⊙ s.

1 *Emberiza citrinella*, resident near Pinega, *auct.* Goebel (No. 10). n. ? in south of Vologda (Mejakoff, No. 19).
2 *Emberiza pithyornis*. Midd. (*op. cit.* p. 1046, note 7) says that Pallas found this species in the Ural. I find no other record.
3 *Budytes flavus*—Dresser (B. of Europe, part xl.), *loc.* "Wiborgs Län."
4 *Oriolus galbula*, 61½° N. lat., on the Kama (Middendorff, 'Die Isepiptesen Russlands,' p. 44).
5 *Turdus fuscatus*: for notes see Part II., 'Annals,' July, p. 21.
6 *Turdus musicus*, see Part II., *l. c.* p. 21.
7 *Erythaca rubecula*, see Part II., *l. c.* p. 22.

Species.	TABLE I. (*continued*). S.W. 30° to 40° E., between 60° and $64\frac{1}{2}$° N.	S.C. 40° to 50° E., between 59° and $64\frac{1}{2}$° N.	S.E. 50° to 60° E., between 58° and $64\frac{1}{2}$° N.	Reference to Authorities in foregoing List.	Reference to Notes.	TABLE II. (*cont.*). Northern Division.	Southern Division.
124. Sylvia salicaria, (*L.*)	‖		|	4, 8, 22		‖ s.	| s.
125. Ianthia cyanura, (*Pall.*)			‖	22.			‖ ⊙
126. Hypolais icterina, (*Vieill.*)	‖	|	|	4, 8, 22.		?	| s.
127. —— caligata, (*Licht.*)			|	22.			| s.
128. Acrocephalus dumetorum, *Blyth.*	|		‖	4, 8, 22 ?, 23.	28	?	‖ s.
129. —— palustris, (*Bechst.*)			‖ ?	22 ?	28		‖ ?
130. —— arundinaceus, (*L.*)			‖	22.			‖ s.
131. —— streperus, (*Vieill.*)		|		19.			| s.
132. Calamodus schœnobænus, (*L.*)	‖	|	‡‡	4, 8, 19, 22.		‡‡ s.	†† s.
133. Potamodus fluviatilis, (*Gould*)	|			8.			| ⊙ s.
134. Daulias luscinia, (*L.*)[1]	‖	‖	|	4, 8, 19, 22.	29	( )	‖ s.
135. Locustella nævia, (*Bechst.*)	|		( )	8 ?, (22).			| s.
136. —— Hendersoni, *Cass.*[2]			|	22.	30		| s.
137. —— lanceolata, *Temm.*	|			8.		| s.	| s.
(—— certhiola, *Pall.*)	( )		( )	(8).	Obs.		( )
139. Phylloscopus trochilus, (*L.*)	‖	|	|	4, 5, 22.		†† s.	‖ s.
140. —— tristis, *Blyth*			?	22 ?, [23].		‖ s.	?
141. —— collybita, (*Vieill.*)	‖	÷	?	4, 8, 19, 22 ?	31	( )	‖ s.
(—— neglectus, *Hume*)						( )	

143. —— Gætkii, *Seebohm*						✓ s.	
144. —— sibilatrix, (*Bechst.*)		|	|	19, 22.		( )	| s.
145. —— borealis, *Blas.*	|			8, 22.		·|· s.	| s.
146. Regulus proregulus, *Pall.*[3]	( )		|	(8), 22.	32		| ⊙ s.
147. —— cristatus, *Charleton*	||	|	|	8, 19, 22.			|
148. Troglodytes parvulus, *Koch*	|	|	?	8, 19, 22 ?	33	?	| ⊙
149. Parus major, *L.*		|	||	19, 20, 22.		*	| R.
150. —— ater, *L.*		|	|	19, 22.		( )	| s.
151. —— cyaneus, *L.*			††	22.			††
152. —— cæruleus, *L.*	|	|		8, 20.		*	|
153. —— borealis, *De Sélys*	||	|	||	8, 19, 20, 22.		†† R.	|| R.
154. —— kamschatkensis, *Bp.*						|| ⊙ R.	
155. —— cinctus, *Bodd.*	|		|	5, 8, 22.		|| R.	| R.
156. —— cristatus, *L.*	·|·		|	8, 20.		·|· R.	| R.
157. Acredula caudata, (*L.*)	|	|	||	8, 20, 22.		·|· or ⊙	|
158. Ampelis garrula, *L.*	|	||	|	8, 19, 22.		|| s.	||
159. Muscicapa atricapilla, *L.*	·|·			8.			·|· s.
160. —— grisola, *L.*	||	‡‡		8, 19, 20.		|| s.	†† s.
161. Hirundo urbica, *L.*	|	|	|	4, 19, 20, 22.		·|· s.	| s.
162. —— rustica, *L.*	||	|	||	4, 8, 19, 20, 22.		·|· s.	|| s.
163. —— riparia, *L.*	‡‡	||		4, 8, 19, 20, [22].		‡‡ s.	‡‡ s.
164. Cypselus apus, (*L.*)	||		|	8, 22.		·|· s.	|| s.
165. Caprimulgus europæus, *L.*	||	||	|	8, 22.		* s.	|| s.
166. Columba palumba, *L.*	||	|	|	19, 22.		·|· s.	|| s.
167. —— œnas, *L.*[4]	?	·|·	|	8 ? 21.	34		·|·

[1] *Daulias luscinia*, (L.). Schrenck's record at Archangel doubted by Midd. (*op. cit.* p. 1048, footnote).
[2] *Locustella Hendersoni* was the species obtained by Sabanäeff (*auct.* Dresser, *in lit.*).
[3] *Regulus proregulus*, Pall.,=*Phyllopneuste Middendorfii*, Meves,=*Sylvia coronata*, Midd., and *S. coronata*, Radde.
[4] *Columba œnas* at Onega Sea, *auct.* Kessler (*vide* note).

Table I. (*continued*).						Table II. (*cont.*).	
Species.	S.W. 30° to 40° E., between 60° and 64½° N.	S.C. 40° to 50° E., between 59° and 64½° N.	S.E. 50° to 60° E., between 58° and 64½° N.	Reference to Authorities in foregoing List.	Reference to Notes.	Northern Division.	Southern Division.
168. Columba livia, *Briss.*			|	22.			|
169. —— turtur, *L.*		÷	|	19, 22.	35		÷ s.
170. Syrrhaptes paradoxus, *Pall.*						//	
171. Lagopus albus, (*Gm.*)	|	|	‡‡	5, 8, 19, 20 ?, 22.		‡‡ r.	‡‡ r.
172. —— mutus, *Leach*[1]			‖	5, 21, 22.		| ⊙ r.	‖ ⊙ r.
173. Tetrao urogallus, *L.*	|	|	|	5, 8, 19, 20, 21, 22.		‖ r.	‖ r.
174. —— urogallo-tetrix, (*Sund.*)		|	|	19, 22.	36	| r.	| r.
175. —— tetrix, *L.*		|	|	5, 19, 20, 22.		| r.	‖ r.
176. —— bonasia, (*L.*)	|	|	‖	5, 8, 19, 20, 22.		†† r.	‖ r.
177. Perdix cinerea, *Charl.*[2]	|		|	8, 19, 22.			| r.
178. Coturnix communis, *Bonnat.*	|	‖	|	8, 19, 22.	37	÷ s.	| s.
179. Glareola pratincola, (*L.*)						⌊ s.	
180. Squatarola helvetica, *Briss.*		|	|	19, 22.		†† s.	‖ ∧
181. Eudromias morinellus, (*L.*).	|		|	5, 8, 22 ?		| s.	| s.
182. Charadrius pluvialis, (*L.*)	|	|	|	5, 8, 11, 19, 20, 22 ?		†† s.	‖ s.
183. Ægialites hiaticula, (*L.*)	|	|	|	4, 8, 20, 21, 22.		‖ s.	| s.
184. —— curonicus, *Besecke*	|	|	‖	4, 5, 8, 11, 19, 20, 22.		÷ s.	‖ s.
185. Vanellus cristatus, *M. & W.*[3]	‖	††	|	4, 8, 11, 19, 20, 21, 22.		* s.	‖ s.
186. Hæmatopus ostralegus, (*L.*)[4]		|	|	19, 20, 21, 22.		†† s.	÷ s.

187. Strepsilas interpres, (*L.*)						·|· s.	
188. Grus cinerea, *Bechst.*	‖	|	|	4, 8, 11, 19, [21], 22.		‖ s.	‖ s.
189. Ardea cinerea, *L.*	|	·|·		4, 8, 11, 19.			·|· s.
190. Botaurus stellaris, (*L.*)	|			4, 8, 11.			·|· s.
191. Ciconia nigra, *L.*[5]		|		19, 21, [22].			| s.
192. Platalea leucorodia, *L.*						* s.	
193. Numenius arquata, (*L.*)	‖	|		4, 8, 11, 19.		‖ s.	‖ s.
194. —— phæopus (*L.*)	|	|	|	8, 11, 19, 20, 22.		‖ s.	| s.
195. Limosa ægocephala, (*L.*)[6]	|		|	8, 21, 22.		* s.	| s.
196. —— lapponica, (*L.*)	|	?	?	8, 11, 20 ?, 22 ?		| s.	·|· s.
197. Scolopax rusticola, (*L.*)	|	|	‖	8, 11, 19, 22.		·|· s.	‖
198. Gallinago major, (*Gm.*)[7]	|	‖	‖	5, 8 ?, 11, 19, 22.		†† s.	†† s.
199. —— gallinaria, (*Gm.*)	‖	‖	‖	8, 11, 19, 20, 22.		‖ s.	‖ s.
200. —— gallinula, (*L.*)[8]	|	|	|	5, 11, 19, 22.		·|· s.	| s.
201. Calidris arenaria, (*L.*)	|			11.		·|· s.	
202. Tringa canutus, *L.*			|	22.		·|· ∧	
203. —— maritima, *Brünn.*						·|· s.	
204. —— subarquata, (*Güld.*)	?	|		8 ?, 20.		·|· s.	·|· ∨
205. —— alpina, *L.*[9]	|		|	11, 22.		‡‡ s.	| s.
206. —— minuta, *Leisl.*	|	|	|	11, 20, 22.	38	‖ ⊙ s.	| s.

1 *Lagopus mutus*, vide Part II. 'Annals,' July 1877, p. 24.
2 *Perdix cinerea*, Ladoga Sea, 62° N. lat., *auct.* Midd. (Die Th. Sib. p. 1029, footnote 9).
3 *Vanellus cristatus.* Also *auct.* Zerrenner (21).
4 *Hæmatopus ostralegus.* For a peculiar nesting-site in the S.E. see Zerrenner (21).
5 *Ciconia nigra*, south of the Government of Perm, *, *auct.* Zerrenner (21).
6 *Limosa ægocephala*, only a migrant passing north, *auct.* Zerrenner, in the S.E. (21).
7 *Gallinago major.* Also 67° N. lat., *auct.* Midd. (Die Th. Sib. p. 1030, footnote 2).
8 *Galinago gallinula* breeds in North Division, *auct.* Goebel (No. 10).
9 *Tringa alpina* breeds on Olva River, *auct.* Teplonhoff, *fide* Sabanäeff (22).

Table I. (continued).						Table II. (cont.).	
Species.	S.W. 30° to 40° E., between 60° and $64\frac{1}{2}$° N.	S.C. 40° to 50° E., between 59° and $64\frac{1}{2}$° N.,	S.E. 50° to 60° E., between 58° and $64\frac{1}{2}$° N.,	Reference to Authorities in foregoing List.	Reference to Notes.	Northern Division.	Southern Division.
207. Tringa Temminckii, *Leisl.*	|	|	|	8, 20, 22.	38	‡‡ s.	| s.
208. Limicola platyrhyncha, *Tem.*						⌞ s.	
209. Totanus canescens, (*Gm.*)	|	|	|	8, 11, 19, 20, 22.		ǁ s.	| s.
210. —— fuscus, (*L.*)	|		|	8, 11, 22.		ǁ ⊙ s.	| s.
211. —— calidris, (*L.*)	|	|	|	8, 11, 19, 22.		·|· s.	ǁ s.
212. —— stagnatilis, *Bechst.*	|		|	22.		( )	| s.
213. —— glareola, (*L.*)	|	|		8, 20, 22.		†† s.	| s.
214. —— ochropus, (*L.*)	|	|		8, 19, 20, 22.		| s.	| s.
215. Terekia cinerea, (*Güld.*)	|	|	|	4, 11, 19, 20, 22.		‡‡ s.	| s.
216. Actitis hypoleucus, (*L.*)	ǁ	|	ǁ	5, 8, 11, 19, 20, 22.		ǁ ⊙ s.	ǁ ○ s.
217. Recurvirostra avocetta, *L.*						⌞ s.	
218. Machetes pugnax, (*L.*)	ǁ	|	|	8, 11, 19, 20, [22].		‡‡ s.	ǁ ∧
219. Himantopus candidus, *Bonnat.*						⌞ s.	
220. Phalaropus hyperboreus, (*L.*)			|	22.		‡‡ s.	†† ⊙
221. Crex pratensis, *Bechst.*	·|·	|	|	4, 8, 11, 19, 22.		⌞ s.	| s.
222. Ortygometra porzana, (*L.*)	ǁ	|	|	4, 8, 11, 19, 22.		ǁ s.	ǁ s.
223. Gallinula chloropus, (*L.*)		|		19.		*	| s.
224. Fulica atra, *L.*	|	|	|	11, 19, 21, 22.		*	ǁ s.
225. Anser cinereus, *Meyer*[1]	|	?	|	11, 20 ?, 21, 22.	39	?	ǁ ⊙ ∧

226. —— segetum, *Gm.*	|	|		11, 19.		‡‡ s.	| ∧ ∨
227. —— albifrons, *Bechst.*		|	|	19, 20, 22.		| s.	| ∧ ∨
228. —— erythropus, (*L.*)		|	|	19, 22.		| s.	| ∧ ∨
229. Bernicla leucopsis, (*Bechst.*)	‖	?	|	11, 19, 20 ?, 22.	40	| s.	‖ ∧ ∨
230. —— brenta, *Pall.*			?	22 ?		‖ s.	?
231. Cygnus olor, *Gm.*		|		19, [22].		·|· s.	| s.
232. —— musicus, *Bechst.*[2]	|	|	|	8, 11, 19, 20, 21, 22.		†† s.	| s.
233. —— minor, *Pall.*				[22].		‖ s.	
234. Spatula clypeata, (*L.*)	‖	|		4, 8, 11.		‡‡ s.	| s.
235. Tadorna casarca, (*L.*)			[illegible]	11, 22.			·|· ⊙
236. Anas boschas, *L.*	‖	|	‖	4, 8, 19, 20, 22.		‖ s.	‖ s.
237. —— strepera, *L.*[3]	|		|	8, 11, 22.		( )	| s.
238. —— penelope, *L.*	‖	‡‡	|	4, 5, 8, 19, 20, [22].		‡‡ s.	†† s.
239. —— acuta, *L.*	‖	|	‖	4, 5, 8, 11, 19, 20, 22.		‡‡ s.	‖ s.
240. —— circia, *L.*	|	|	‖	4, 8, 20, 22.		·|· s.	‖ s.
241. —— crecca, *L.*	‖	|	††	4, 5, 8, 19, 20, 21, 22.		†† s.	†† s.
242. Fuligula cristata, (*L.*)	‖	|	|	4, 8, 11, 20, 22.		‖ s.	| s.
243. —— marila, (*L.*)[4]	|	?	|	8, 20 ? 21, 22.		·|· s.	| s.
244. —— ferina, (*L.*)	·|·	|		4, 8, 20 [22].		? s.	·|· s.
245. —— nyroca, (*Güld.*)				8 ?, [22].		| s.	?
246. —— glaucion, (*L.*)	‖	††	|	4, 5, 8, 19, 20, 22.		‖ s.	†† s.
247. —— glacialis, (*L.*)	|		‖	8, 11, 22.		‡‡ s.	‖ ⊙ s.
248. Histrionicus torquatus, (*L.*)			|	22.		([illegible]) s.	| s.
249. Somateria mollissima, (*L.*)						‖ s.	

[1] *Anser cinereus, vide* Part II.,. 'Annals,' July 1877, p. 26.
[2] *Cygnus musicus* is occasionally resident or wintering in Perm, *auct.* Zerrenner (21).
[3] *Anas stepera, vide* Part II., 'Annals,' July 1877, p. 26.
[4] *Fuligula marila* ‖, *auct.* Zerrenner (21).

Table I. (*continued*).						Table II. (*cont.*)	
Species.	S.W. 30° to 40° E., between 60° and $64\frac{1}{2}$° N.	S.C. 40° to 50° E., between 59° and $64\frac{1}{2}$° N.	S.E. 50° to 60° E., between 58° and $64\frac{1}{2}$° N.	Reference to Authorities in foregoing List.	Reference to Notes.	Northern Division.	Southern Division.
250. Somateria spectabilis, (*L.*)						·|· s.	
251. —— Stelleri, (*Pall.*)						| s.	
252. Œdemia nigra, (*L.*)	|		|	5, 11, 22.		‡‡ s.	‖ s.
253. —— fusca, (*L.*)	·|·		‡‡	11, 22.		‖ s.	‖ s.
254. Mergus merganser, *L.*				22.		| s.	| s.
255. —— serrator, *L.*	|	|	·|·	8, 19, 20, 22.		‖ s.	| s.
256. —— albellus, *L.*	|		††	8, 11, 20, 22.		‖ s.	‖ s.
257. Podiceps griseigena, (*Bodd.*)	|			8, 11.		| s.	| s.
258. —— auritus, *L.*	|		|	5, 8, 11, [22].		| s.	| s.
259. —— cristatus, (*L.*)	|		?	8, 21, [22].		( )	| s.
260. —— minor, *Lth.*	|	|		8, 11.			| s.
261. Colymbus arcticus, *L.*	·|·		|	4, 11, 22.		‡‡ s.	| s.
(—— glacialis, *L.*)	( )			(12).			( )
263. —— septentrionalis, *L.*	|		|	4, 8, 11, 22.		†† s.	| s.
264. Alca torda, *L.*						| R.	
265. Fratercula arctica, *L.*						| R.	
266. Uria troile, (*L.*)						| R.	
267. —— lomvia, (*L.*)						| R.	

268. —— grylle, (*L.*)						|	
269. Mergulus alle, (*L.*)						|	
270. Stercorarius pomatorhinus, *Tem.*						|	
271. —— crepidatus, *Gm.*						||	
272. Lestris parasiticus, *L.*						‡‡	
273. Rissa tridactyla, (*L.*)						|	
274. Larus glaucus, *Brünn.*						|| s.	
275. —— leucopterus, *Fab.*	|			11.		÷ s.	| s.
276. —— eburneus, (*Gm.*)						÷	
277. —— marinus, *L.*						|| s.	
278. —— fuscus, *L.*	|			8, 11.		| s.	| s.
279. —— argentatus, *L.*		|		19, 20.	41	| s.	| s.
280. —— affinis, *Reinh.*	||			8, [22].		‡‡ s.	|| s.
281. —— canus, *L.*	||	|	|	4, 5, 8, 11, 20, 22.		†† s.	|| s.
282. —— ridibundus, *L.*	÷	|	††	4, 8, 11, 19, 20, 22.		÷ s.	†† ⊙ s.
283. —— minutus, *Pall.*	‡‡		|	4, 8, 11, 22.		÷ s.	‡‡ s.
284. Sterna macroura, *Temm.*		|	÷	4 11, 19, 20, 22.		†† s.	| s.
285. —— fluviatilis, *Naum.*	|			4, 8, 11 ?		( )	| s.
286. Hydrochelidon fissipes, (*L.*)						| s.	
287. —— nigra, (*L.*)						| s.	
288. Sula bassana, (*L.*)						| s.	
289. Phalacrocorax carbo, (*L.*)						| R.	
290. —— graculus, (*L.*)						| R.	

B. Summary up to date for Southern Division*.

We have in the whole of the Southern Division of North Russia records of 242 species. Of these there are three of very doubtful nature, which are distinguished in the column for the Southern Division in Table II. by being enclosed in brackets, and nine more, which must be considered more or less doubtful also. This leaves records of 230 species, which may for present purposes be classed as authentic. These records (authentic and doubtful) are distributed in the three districts as follows:—

(N.B. Spaces are left in the columns for future summaries.)

Southern Division.

	S.W. District.				S.C. District.				S.E. District.				S. Division.
	Authentic.	Doubtful.	Very doubtful.	Total	Authentic.	Doubtful.	Very doubtful.	Total.	Authentic.	Doubtful.	Very doubtful.	Total.	Total Authentic.
Up to date. 1877	168	7	3	178	158	8	0	166	176	14	2	192	230

C. Summary for whole of North Russia.

In North Russia, north of the boundaries defined we have total records of 290 species. Of these there fall to be deducted 9† species of more or less doubtful nature. This leaves records of 281 species, which may be considered authentic. These 281 *authentic* records are distributed in the Divisions as follows:—

* For Summary A, see Part II. *l. c.* p. 28.

† Viz. *Milvus ictinus*, *Falco sacer*, *Athene noctua*, *Pratincola rubicola*, *Locustella certhiola*, *Phylloscopus neglectus*, *Colymbus glacialis*, *Acrocephalus palustris*, and *Emberiza pithyornis*.

TOTAL IN NORTH RUSSIA, 281.

Northern Division...... 230 | Southern Division...... 230.

Found in both.	In North, *not* in South.	In South, *not* in North.	Uncertain in which Division.
177	48	54	2*

NOTES AND CRITICISMS OF DOUBTFUL RECORDS IN PART III.

(1) *Aquila clanga*, Pall. No. 3 in Tables.

Barely reaches 60° N., as Sabanäeff (22) † tells us that it is not found further north than Bogoslaffsk, which is just under the 60th parallel. In the S.W. District we have record of one specimen shot in September 1871, at Oschta, on the Onega Sea, and which is now in the University Museum, St. Petersburg, where it was seen by Meves (23, p. 433).

Obs.—*Aquila nobilis*, Pall., perhaps occurs at Bogoslaffsk (*vide* No. 22, Sabanäeff). Both forms (*A. nobilis*, Pall., and *A. chrysaëtus*, L., = *fulva*,) are included in Säbanäeff's list—the former, however, recorded from a more northerly locality (Pavda) than the latter. I have not considered it necessary, however, to separate them. For further remarks on the different forms of *A. chrysaëtus*, L., *vide* Dresser's "Notes on Severtzoff's 'Fauna of Turkestan'" ('Ibis,' 1875, p. 99).

(2) *Pandion haliaëtus* (L.). No. 5 in Tables.

This species is recorded by Mejakoff (19) as very common in the neighbourhood of Lake Koubenskoie, but rather rare in the northern districts. Meves found it between Ladoga and Archangel; Alston and I found a nest at Archangel ('Ibis,' 1873); and Seebohm and I found it at Habariki, on the Petchora. It is, according to Mejakoff, only a summer visitant even in the south of Vologda.

(3) *Buteo lagopus*, Brünn. No. 8 in Tables.

Sabanäeff says, quoting Hoffman-Brandt, "Further to the north [than the Ekaterineburg district, J. A. H. B.] it again

* Viz. *Asio otus, Emberiza melanocephala.* There are several others which ought, perhaps, to be classed with these, such as *Himantopus candidus, Avocetta recurvirostra*, and a few more. Such can be deducted from the number in column 1 (in above summary) and added to those in column 4.

† The numbers here and elsewhere in these notes refer to the "List of Authorities," as in the Tables.

reappears in the Ural Mountains." I find, however, no positive record of it in our SOUTHERN DIVISION, Hoffman's record applying to between 66° and 67° N. lat. Sabanäeff's record is therefore only given in the column of "Reference to Authorities," and is enclosed in *square* brackets [22]. Von Baer (Bull. Ac. Sc. N. St. Pétersb. t. iii. no. 22) records it even as far north as Kostin Schar (71½° N. lat.); but Middendorff considers this doubtful (No. 1, p. 201, footnote). Seebohm and I found it, however, on the Petchora up to 66° 13′ N. lat. (No. 13, and *vide* Part I., 'Annals,' April 1877, p. 283).

(4) *Pernis apivorus* (L.). No. 9 in Tables.

Lilljeborg (4) records it as common in all the woods from Ladeinapole to the Dvina; Meves (8) saw a solitary example at Schlusselburg; but it is not included at all by Mejakoff in his list (19).

Obs.—*Milvus ictinus*, Savig. Sabanäeff (22) states that he has seen several "red kites" amongst hundreds of *Milvus ater* flying towards some dead animals in the Kaslinsk Ural (further to the S.E. of our limits). Read also notes on this species in Part II.

(5) *Falco tinnunculus*, L. No. 18 in Tables.

Its northernmost range would appear to be just within our limits in the S.E. District. Sabanäeff (22) tells us that it increases in numbers towards the south from that latitude. Dr. Radakoff ('Hand-Atlas der geogr. Ausbreitung,' *Falco tinnunculus*; *vide* Part II. of this paper, 'Annals,' July 1877, p. 8) marks its distribution north to Bogoslaffsk*.

(6) *Accipiter nisus* (L.). No. 20 in Tables.

This species is recorded by Mejakoff as rarely seen in the south of Vologda, and then only at the commencement of winter. These are probably birds migrating southwards from more northerly localities, where, however, as far as at present known, they are far from common (*vide* Part II., 'Annals,' July 1877, p. 10), very few records being given of their occurrence to the northward.

* Regarding its distribution in the north of Europe and Asia *vide* Middendorff ('Die Th. Sib.' p. 1028, footnote 3), quoting from 'Naumannia,' 1854, p. 67, where it is stated that *F. tinnunculus* goes to the neighbourhood of the 'Eismeer' in Siberia as in Europe. Dr. Radakoff shows this in his map of the species in Norway and in North Siberia.

(7) *Circus æruginosus* (L.). No. 22 in Tables.

Goebel (10) includes this amongst those seen (?) at or near Archangel; and Meves (8) observed it both near Archangel (*vide* Part II. *notes*, 'Annals,' July 1877, p. 18) and at Ptino-Ostrov, in Ladoga Sea.

(8) *Picus minor*, L. No. 37 in Tables.

Sabanäeff (22) says of this species that it does not apparently go so far north as *P. major* and *P. leuconotus* in the Ural, nor does he consider it so common there as these other species. Seebohm and I, however, found it common on the Lower Petchora as far north as Viski (67° 15′ N.), to the exclusion of other species of Woodpecker (*vide* Part I., 'Annals,' April 1877, p. 284).

Obs.—*Picus leuconotus*, L., *Picus cirris*, Pall. (Sundev.), with unspotted white underside, and the under tail-coverts suffused with pale red, was found not commonly in the Ural by Meves (No. 23, p. 432). We have, however, no distinct authority to admit this form into our present district, Herr Meves not having been so far north in Perm *. The statement in Meves's paper [23], that he found typical *P. leuconotus* in S.E. Russia, is a mistake, owing to a misprint for N.W. Russia (Meves, *in lit.* April 1877).

(9) *Yunx torquilla*, L. No. 41 in Tables.

The only record I am at present able to find for the S.W. is the one given by Meves as shot at Cholmogory; but as this comes to be included in the N. DIVISION, I mark it with a query here. Mejakoff records it as rather rare in the south of Vologda, in the S.C. District, having only shot two specimens.

(10) *Sturnus vulgaris*, L. No. 43 in Tables.

Has occurred at St. Petersburg (Meves, 8, and Fischer, Die Vögel des St. Petersburger Gouv.); but its range northwards is only occasional (*vide* Part II. *l. c.*). It appears just to reach our fauna in 60° N. in the east, at Pavda (Sabanäeff, No. 22).

* His route was by St. Petersburg, Moscow, Perm, Kungur, Ekaterineburg, and thence southward to the river Mjes; and his researches were confined to the districts lying between 57° and 55° N. lat.

(11) *Passer domesticus*, L. No. 44 in Tables.

The somewhat peculiar comparative distribution of these two species has elsewhere been remarked upon ('Ibis,' 1876, p. 114; *vide* also Proc. Glasg. Nat. Hist. Soc. 1876, pp. 49, 53). For northern range in the N.E. see Part I. of this paper (*l. c.* p. 285).

(12) *Passer montanus* (L.). No. 45 in Tables.

Is remarked as being more plentiful than *P. domesticus* at Ustjug, in the S.C. District, by Goebel (20, p. 24), the contrary of Seebohm's and my experience throughout the district between Vologda and Archangel, in March 1875*. Herr Goebel's observations were made between May 8 and June 1. Sabanäeff (22) excludes it from the northern parts of Perm; but, on the other hand, Seebohm and I found it plentiful at Ust Zylma and north as far as Kuya (67° 45′), whilst even a straggler was obtained at Stanovaya Lachta, still further to the northward (*vide* Part I. *l. c.* p. 285).

(13) *Pyrrhula major*, Brehm. No. 47 in Tables.

Mejakoff (19) records this as occurring in the south of Vologda only in winter, arriving in September and leaving in March. It is doubtful, therefore, if we can consider it as a resident species at Ust Zylma (65° 26′ N. lat.). Seebohm and I found it common there, on our arrival, in the middle of April, and still more commonly about 25 versts to the south-west at Umskaia. In the Ural, Hoffman (5) found it in 64½° N. lat. Being one of the species which winter only a very short distance south of its breeding-haunts, and with Mejakoff's note to guide us, we may perhaps rightly consider that it had preceded our arrival at Ust Zylma by a fortnight or three weeks. At Archangel we met with this species as early as the 18th March. It seems to be rare in the South-east Ural (Sabanäeff, 22).

(14) *Upupa epops*, L. No. 60 in Tables.

This is recorded as occurring at Pavda by Sabanäeff (22); and he mentions one as having been shot. He remarks, however, that it is not found there every year. Dr. Radakoff (*tom. cit.*, *Upupa epops*, *vide* Part II., 'Annals,' July 1877, p. 8) does not extend its distribution beyond Ekaterineburg in his map of the species.

* J. A. H. B.'s Journals in MS., 1875.

(15) *Corvus corone*, L. No. 64 in Tables.

Auct. Goebel (No. 20, p. 24)? Middendorff also says ("Die Thierwelt Sibiriens," p. 1029, footnote 3) that it is found at Ladoga Sea, quoting 'Naumannia,' 1852, p. 103; and Lilljeborg saw one at Ladeinopole (No. 4, p. 288), in the S.W. District.

(16) *Corvus monedula* and *C. dauricus*, Pall. No. 66 in Tables.

Sabanäeff (22) separates these as species, and shows that their distribution is somewhat different, *Corvus monedula* being rarer in the north and more abundant in the south (in the Bashkir birch-woods) and *C. dauricus*, Pall. (= *C. collaris*, Drummond), being commonest in the north. I have not, however, thought it advisable to separate them. I have marked *C. monedula* resident in the NORTHERN DIVISION. It is, however, only a summer visitant to the N.E. District, but has of late years increased its distribution northwards and eastwards considerably. It is only of late years that it came to Mezén; and now it even winters there.

(17) *Corvus frugilegus*, L. No. 67 in Tables.

Is said also to occur at Ijma, 64° (22). One specimen was brought to us at Ust Zylma in 1875. A flock was seen, and specimens shot, at Archangel by Alston and myself (12); and though only a summer visitant to the SOUTHERN DIVISION, it would appear to be pushing its range northward. It was also observed by Middendorff on the Sommarudden coast of the White Sea in the N.W. District (1).

(18) *Nucifraga caryocatactes* (L.). No. 69 in Tables.

Compare Mejakoff's (19) statement with notes in NORTHERN DIVISION (Part II. *l. c.* p. 20). Its appearance at all in North Russia seems to be only sporadical, occurring in some seasons in flocks, and staying only a short time. Sabanäeff, however, records it as extremely abundant throughout Perm, especially in the north. There it is a summer visitant; but in Vologda, Mejakoff seems to consider it only an occasional migrant.

(19) *Garrulus glandarius* (L.). No. 72 in Tables.

I have also observed this species in travelling from St. Petersburg to Archangel, but not numerous. Sabanäeff

(22) says it is of wide distribution in Perm, but gives no positive record of its occurrence in the north of the Government. Meves, however, found *Garrulus Brandtii*, Eversm., not far from Perm and in the Ural (No. 23, p. 432); so Sabanäeff's record may perhaps be held to apply to this Eastern species. Zerrenner ('Erdk. des Gouv. Perm') states that it is rare, but present in all the districts of Perm; but it is doubtful if the record applies to *G. glandarius* vera, or to *G. Brandtii.*

(20) *Lanius excubitor*, L. No. 74 in Tables.

Generally considered as a bird of passage in the south of Vologda (Mejakoff), but has been shot by him both in February and November.

Obs.—Meves met with the Eastern form (*Lanius Homeyeri*, Cab.) between Kungur and Perm, not uncommonly (No. 23, p. 431). *Vide* also Dawson Rowley's Ornith. Misc. vol. ii. part vii. p. 272, for further remarks on this species by Col. Prjevalsky ("Birds of Mongolia").

Obs.—Dr. Meves has asked me to point out that the specimen of *Lanius phœnicurus*, Pall. (23, p. 428), was only a very red young ♂ of *L. collurio.* A query in his MS. had been omitted in the letterpress.

(21) *Linota exilipes*, Coues. No. 78 in Tables.

Sabanäeff (22) includes two species of Redpole as occurring in Perm, viz. *L. linaria* (L.) and *L. borealis*, Vieill. (? Audubon); and Hoffman likewise includes two species as occurring in the Northern Ural, viz. *L. linaria*, L., and *L. rubra*, Gesner. The second mentioned species of both authors will no doubt be referable to *L. exilipes*, Coues. Both *L. linaria*, L., and *L. exilipes*, Coues, are early spring migrants to the Northern Division.

(22) *Emberiza rustica* (Pall.). No. 83 in Tables.

Recorded for the S.C. District by Blasius (*auct.* Meves, 8, p. 744). The range of this species does not appear to be exactly defined in the S.E., although Sabanäeff (22) gives it as abundant in Perm, on the river Olva; and Hoffman (5) records a single example brought home by the Ural Expedition.

(23) *Emberiza schœniclus*, L. No. 86 in Tables.

Meves distinguishes specimens of the Reed-Bunting obtained by him in Perm as *Cynchramus intermedius* ?, which have the rump unspotted and plain grey. A comparison of specimens is required before it can be established as a species or otherwise.

(24) *Plectrophanes nivalis* (L.). No. 87 in Tables.

Fuller data are wanted to establish this as a breeding species in the S.E. Ural, though the probability is that they do breed in limited numbers (22). We have no data wherewith to establish it as a resident, as a passing migrant, or as a winter visitant; and the same remarks apply to the following species, *P. lapponicus*. For present purposes it may be as well to consider it only a migrant.

(25) *Alauda arvensis*, L. No. 89 in Tables.

According to information received by Sabanäeff (No. 22), this species has only lately appeared at Ijma, in 64° N. lat. Seebohm and I met with it very rarely at Ust Zylma (65° 26′ N.), where only one was obtained, and again at Viski (67° 15′ N.), where a second was procured, the only ones met with in the N.E. District (*vide* Part I., 'Annals,' 1877, April, p. 285.

(26) *Budytes viridis* (Gmel.) and *Budytes flavus* (L.). Nos. 98, 99 in Tables.

The range of these two species is as yet somewhat difficult to define. Mejakoff says *Budytes flavus* (Gmel.) occurs only in summer in the south of Vologda. This will, I believe, turn out to be really *Budytes flavus* verus. Sabanäeff's records (22) in Perm will more correctly apply perhaps to the northern form, *B. viridis* (Gmel.). Dresser ('Birds of Europe,' part xl.) found *B. flavus* verus in Viborg, within our S.W. District, and Von Fischer (*l. c.* p. 348) records it as breeding commonly in the St.-Petersburg Government.

(27) *Pratincola rubicola* (L.). No number in Tables.

Where this name is recorded by authorities in their papers on N. Russia, I have every reason to believe that it is almost invariably applicable to the eastern representative form, *P. indica*. Sabanäeff, for instance (No. 22), mentions it in the S.E. Ural; but the species found in Perm by Meves was *P. indica*, with, as he informs me, black axillaries.

(28) *Acrocephalus dumetorum*, Blyth, and *Acrocephalus palustris* (Bechst.). Nos. 128, 129 in Tables.

Sabanäeff (22) includes the latter as common in the S.E Ural, and as having occurred at Pavda (58° N. lat.); but he makes no mention of *A. dumetorum*, Blyth. Meves (23), on the other hand, speaks of *A. dumetorum* as common in the Ural, but says nothing of the presence of *A. palustris*, although he takes pains to notice the close resemblance of the two species and to discriminate between them. Again Dresser ('Birds of Europe,' part liii.) identifies two birds obtained by Sabanäeff in the Ural somewhat south of our limits, viz. at Ekaterineburg and Sinara, as belonging to *A. agricola*, Blyth, =*A.* (*Salicaria*) *capistratus*, Severtzoff, who found it east of the Caspian ('Ibis,' 1876, p. 84). Yet, again, Severtzoff (*l. c.*) mentions that *A. palustris* verus was also obtained on the east of the Caspian. There is then perhaps a possibility of all these three occurring within our districts. At present, however, I consider that most of the records refer to *dumetorum*; and in this Dresser, whom I consulted on the subject, agrees. I admit also *palustris* with a query, and for the present reject *agricolus*.

Since the above was written, a very clear account of the *Salicariæ* of Dr. Severtzoff has appeared from Seebohm's pen, in the 'Ibis,' 1877, p. 151.

Obs.—*Calamodus aquaticus* (Lath.). There is no positive record of its occurrence within our limits; but as Meves (23) found it in the S.E. Ural, it may perhaps be looked for yet in the Perm Government, further to the north.

(29) *Daulias luscinia* (L.). No. 134 in Tables.

Authors differ concerning its abundance or otherwise; but judging from their records, we may consider it common where recorded. The supposed occurrence of this species so far north as Archangel, however, recorded by Schrenck, is very rightly doubted by Middendorff ('Die Thierw. Sib.' p. 1048, footnote 6).

(30) *Locustella Hendersoni*, Cass. No. 136 in Tables.

Dresser informs me, *in lit.*, that the Grasshopper Warbler of the Ural is not our bird, but the small bright-coloured Indian bird, *L. Hendersoni*—which fact he has known for some time from specimens in his possession collected by Sabanäeff. This is then an addition to the European fauna.

Obs.—*Locustellæ certhiola*, Pall. Dresser writes me that he is doubtful of the occurrence of this species in S.E. Europe, although Temminck gives "Eastern Russia" as a locality.

(31) *Phylloscopus collybita* (Vieill.). No. 141 in Tables.

For reasons before given when treating of the NORTHERN DIVISION, it seems desirable that specimens of the Chiffchaff obtained in N.W. Russia should be carefully compared with type specimens of *P. tristis*, as there is a possibility of confusion existing between the two species. The probability is, however, that the former does occur in West Russia, reaching to perhaps 63° or 64° N. lat., but that specimens occurring further north than that belong to the Eastern species. *Vide* Part II. of this paper, 'Annals,' July 1877, p. 24; Lilljeborg, p. 273; and Mejakoff, p. 630, who gives it (under the name *Ficedula rufa*, Lath.) as rather rare even in the south of the government in the South-central District. Sabanäeff (No. 22) considers this statement of Mejakoff's as strange; but the species found by Meves east of Moscow was *P. tristis*, not *P. collybita*, which is the one Sabanäeff includes.

(32) *Regulus proregulus*, Pall. No. 146 in Tables.

The only record I find is Sabanäeff's, the bird from which Meves described his *Phyllopneuste Middendorfii* and figured it (8) being in the Petersburg Museum from Ochotsk. It is *numbered* 58, however, in Meves's list (p. 758), which is apt to mislead; and the same remark applies to his No. 59, also only seen in the Museum, and one or two more, which were better included under "Observations."

(33) *Troglodytes parvulus*, Roch. No. 148 in Tables.

Said by Sabanäeff (22), on the authority of a native, to occur at Ijma (64° N.), where it is known by the name "*pista*." I consider that more proof is wanting. Dresser says his collector at Archangel reports it as occurring there in summer; but I doubt it.

(34) *Columba œnas*, L. No. 167 in Tables.

Although recorded as occurring at Onega Sea (Kessler) and quoted by Meves (8), Sabanäeff (22) appears to doubt whether it really occurs in the S.W. District.

(35) *Columba turtur*, L. No. 169 in Tables.

Barely establishing itself upon the southern boundary of our present division, Mejakoff doubting whether it goes further north than 60° N. lat. (No. 19, p. 632), and his being the only record I can at present find of its occurrence in the S.W.

or S.C. Districts. The Turtledove recorded as abundant in Perm by Eversmann (quoted by Sabanäeff, No. 22) may yet prove to belong to the Eastern form, *Turtur orientalis*, Lath.

(36) *Tetrao urogallo-tetrix*, Sund. No. 174 in Tables.

Sabanäeff accounts for the presence of this hybrid by the unusual number of ♂ *T. urogallus* killed in spring leaving a great predominance of females, and was informed by a native of Ijma (64° N. lat.) that as many as five small birds are found in every hundred killed. At Ust Zylma Seebohm and I found that the natives there did *not* kill the males in spring, as they were not considered good for food, but only the females, of which numbers were brought to us for sale in April.

(37) *Coturnix communis*, Bonnat. No. 178 in Tables.

Recorded by Sabanäeff (No. 22) as occurring at Vorhoturie; and he was informed of its occurrence at Ijma (64°) by a native, but considers this latter record of doubtful value. Its numbers would appear to vary considerably in different years, even in the extreme south of Vologda. Mejakoff mentions the years 1853, 1854, and 1855 as great Quail years; but in the year previous (1852) they did not appear at all.

(38) *Tringa minuta* and *T. Temminckii*. Nos. 206, 207 in Tables.

Sabanäeff states positively that the former breeds in the neighbourhood of Ekaterineburg, and even believes it to breed in the south of that government, and states also that they breed in the Government of Jaroslav and even of Moscow. In Pavda *T. Temminckii* is called "meyeneck," *i. e.* male of *T. minuta*.

(39) *Anser cinereus*, Meyer. No. 225 in Tables.

Records of this in S.W. seem to be doubtful—*v.* Palmén (11), Goebel (20); but it would appear to be common in the S.E. (Sabanäeff), where it is stated by Zerrenner (21) to breed, and also to winter a little to the southward and eastward of our limits. This, however, seems open to doubt.

(40) *Anser leucopsis*, Bechst. No. 229 in Tables.

The only record in S.W. and S.E. by Goebel (20), and in the S.E. by Sabanäeff (22). In the N.C. District, Middendorff records having seen this species (No. 1, p. 237).

(41) *Larus argentatus*, L. No. 279 in Tables.

Records of this species in the S.W. District will, I believe, be found to apply to the yellow-legged race—*Larus affinis*, Reinh. (*Larus cachinnans*, Pall.), which was the only Herring-Gull recognized by Alston and myself when travelling to Archangel in 1872, and having the dark mantle, although we confounded the two species, and made no mention of it in our paper (12) at that time. *Larus argentatus* will, I think, be found to occur only in the North-west and North-central Districts, more sparingly in the latter, abundantly in the former—as, for instance, at Solovetsk, where they are carefully protected and tended by the monks. Those gulls found to the southwards will, I believe, be found to belong to *Larus affinis*; or if *Larus argentatus* be found, it will only be in diminishing numbers. We must look to Herr Sievers's forthcoming report for more light on this subject.

Nor do I feel certain that many of the records of *Larus fuscus* do not apply really to the dark-mantled *Larus affinis*. The bird seen in Novaya Zemlya by Von Heuglin was probably *Larus affinis*, and not, as he records, *Larus fuscus*. Meves (23), speaking of the same species under the name "*Larus leucophæus*, Licht. (=*Larus cachinnans*, Pall.)," says that Dresser has figured the southern form with much paler mantle than that found by him (*vide* 'Birds of Europe,' part xxii). Seen at a distance *Larus affinis* could easily be mistaken for *Larus fuscus*, from its very dark mantle, the colour of the legs not being always discernible. Both Meves and Sabanäeff obtained it in the S.E. Ural; but I do not find distinct records of it from present published accounts within our limits. There cannot be much doubt, however, that it is found along the whole range of the Ural, to its furthest breeding-places on the Petchora, whilst it probably goes even as far as Novaya Zemlya.

Concluding Remarks.

Having thus presented in tabular form the distribution of the Birds of North Russia in six defined districts, I would, in conclusion, endeavour to point out that some such tabular method is more likely to ensure uniformity in record, if adopted by naturalists, than if each author, after writing his more lengthy account of the fauna of any given district, country, or continent, or Zoographical Division, left to the work of his successors the tedious and often difficult operation of reconciling all his ideas of "faunal values" with those of other authors. It is impossible, I think, too urgently to advocate the text at the head of the first part of this series of papers, quoted from Mr. Wallace's 'Distribution of Animals,' however far short of its requirements I may myself have reached. Uniformity of method in recording natural-history observations, especially as regards distribution and migration, is a desideratum which, I hold, is only second in importance to uniformity of nomenclature. I confess, however, that I see little hope of such a uniformity being established, unless the subject be taken up by an influential body of naturalists, discussed and formally sanctioned and adopted, and advocated in somewhat the same manner as 'The British-Association Rules for Zoological Nomenclature.' This accomplished, however, upon a firm basis, the future work of naturalists in these branches (distribution and migration) could not fail to be made easier and smoother; and thereby science would be materially aided and advanced, and our knowledge of distribution more rapidly extended. If I have, in the very smallest degree, contributed towards its attainment, or have even awakened a desire in others for such a uniformity of method, I shall feel that all the labour expended on the above papers has not been entirely fruitless.

It only remains for me to thank kind friends and correspondents for the assistance they have rendered me in the course of my work, hoping that, so far as it is carried out, it will meet with their approval, as a contribution to our knowledge of the distribution of species in Europe.

Erratum in Part II.

Page 13 (Tables), in the column for the N.E. District insert the symbol opposite *Hirundo rustica* (*auct.* 13).
Page 18, delete 19 before *Circus æruginosus.*
Page 19, under *Asio otus,* instead of "same category as No. 19," read "The actual occurrence north of 64° 30′ N. lat. is doubtful;" and thereafter, wherever the words "same category as No. 19" occur, viz. under (8), (14), (18), (20), (32), read "same category as (7)."
Page 24, delete "*vide* Postscript, p. 30."

XXVIII.—*On British Polyzoa.*—Part I. By the Rev. Thomas Hincks, B.A., F.R.S.

The first part of this paper is devoted to brief descriptions of a number of new forms, which I hope shortly to illustrate more fully and to figure in my forthcoming 'History of the British Marine Polyzoa.'

Suborder **Cheilostomata**, Busk.

Genus Membranipora, De Blainville.

1. *Membranipora nodulosa*, n. sp.

Zooœcia small, oval, margin slightly raised, granular, unarmed; more than half the area covered in by a minutely granulated calcareous lamina; orifice occupying rather more than a third of the area, arched and somewhat contracted above, lower margin straight, obscurely trifoliate; at the base of each cell a very large, prominent, smooth nodule, usually subtriangular in shape: *ooœcia* very small and shallow, rounded, smooth.

Colonies forming small and very inconspicuous crusts.

Localities. Coast of Antrim (*Hyndman*); South Devon, off Brixham (*T. H.*).

Distinguished from *M. Rosselii*, to which it is allied, by the much smaller size and *oval form* of the cell, the continuous and very slightly granular margin, and the large and conspicuous intercellular bosses or nodules.

2. *Membranipora aurita*, n. sp.

Zooœcia ovate, somewhat expanded below, disposed with great regularity in quincunx; area with a membranous covering, no calcareous lamina; margin plain, on one side, about halfway down, a blunt, short spine; immediately above each cell, or the ovicell, when present, two raised avicularia, one on each side, with a pointed mandible, usually directed upwards and slightly outwards: *ooœcia* subglobose, partially immersed, with a strong rib on the front, rising to a point above and inclosing a triangular space.

Colonies forming large, subcircular patches, resembling the most regular lacework.

Localities. Antrim (*Hyndman*); Cornwall and South Devon (*T. H.*); Northumberland (*Alder*).

Distinguished from *M. Flemingii* by the more regularly ovate form of the cell, the entire absence of a calcareous lamina, the triangular figure on the front of the ovicell, and the perfectly regular quincuncial arrangement of the cells.

3. *Membranipora flustroides*, n. sp.

Zooœcia large, in regular lines, set closely together, oval; margin with 12–14 massive, flattish, sometimes subclavate, sometimes bifid spines, which bend inwards and meet across the area, with the exception of the two uppermost, which stand erect; an oval avicularium on a somewhat quadrate area at the top of many of the cells, slanting upwards, with a semicircular mandible: *ooœcium* very small and inconspicuous, smooth, elevated in front, forming a hood-like covering over the extreme end of the cell.

Colonies forming large, subcircular patches, with a somewhat lobate edge.

Localities. Antrim (*Hyndman*); Guernsey; off the Deadman, Cornwall, 60 fathoms; South Devon (*T. H.*).

The massive, often subclavate spines, and the avicularium, which is of the Flustrine type, distinguish this fine species from the other spiniferous *Membraniporæ.*

The name was suggested by the Rev. A. M. Norman, who has also observed this form and recognized it as new.

Genus Lepralia, Johnston.

Lepralia marmorea, n. sp.

Zooœcia ovate, short and rather broad, disposed in lines, punctured round the edge; surface coarsely granular; orifice suborbicular, with a loop-like sinus on the lower margin; peristome raised, not thickened; a very broad plate or denticle set deeply within the mouth; a little below the orifice an elongate avicularium, immersed, with a pointed mandible directed downwards: *ooœcium* —— ?

Locality. Cornwall probably, on stone (*T. H.*).

The walls of the cells are thick, and the surface, which is covered with rather large granules, has a somewhat polished and marble-like appearance.

Lagenipora, n. gen.

Colonies consisting of a number of cells immersed in a common calcareous crust: *zooœcia* decumbent, contiguous, the front wall solid; oral extremity produced, tubular, with a terminal orifice.

The chief characteristic of the genus is the common calcareous crust, in which the cells composing the colony are more or less immersed. The zoarium is not a mere collection of cells laid side by side in a certain order, but consists of a calcareous matrix in which a number of zooœcia are imbedded, and by which they are united into one commonwealth. The cells themselves bear a close resemblance to those of *Cylindroporella*, but are destitute of the large tubular pore on the front wall, which is so striking a character of the latter genus.

Lagenipora socialis, n. sp.

Crust whitish, granulated, of irregular figure: *zooœcia* flask-shaped, the lower part immersed, the upper part (in adult cells) produced into an erect tubular neck; orifice circular, terminal, frequently with a number of spinous processes on the upper margin; surface granular, except on the erect portion, which is smooth: *ooœcia* small, rounded, smooth, set far back behind the tubular neck of the cell.

Colonies forming small, rather thick, white crusts.

Locality. Hastings, on the shells of *Pecten maximus* (*Miss Jelly*).

Suborder **Ctenostomata**, Busk.

I retain in this paper the established genera; but the Ctenostomata require careful revision, and some of the groups as at present constituted can hardly be maintained.

Genus VALKERIA, Fleming.

1. *Valkeria caudata*, n. sp.

Stem creeping: *zooœcia* biserial, opposite, elongate, subcylindrical, truncate at the top, slightly narrowed below, and produced at the base into a short, pointed, caudate process; disposed in companies along the creeping stem: *polypide* with eight tentacles; destitute of a gizzard.

This well-marked form may be at once recognized by the spur-like process below, which is very conspicuous in the youngest cells. The cell is attached at a point near the base, and the caudate extremity bends outwards. I have failed to detect a gizzard in *V. caudata*; but this portion of the structure is not always recognizable in preserved specimens. I place it provisionally in the genus *Valkeria*, hoping shortly to revise the classification of the Ctenostomata.

I am indebted to Mr. Leipner, of Clifton, for specimens of this species, beautifully mounted, and showing the polypides expanded as in life.

2. *Valkeria citrina*, n. sp.

Stem erect, slender, dichotomously branched: *zooœcia* clustered, somewhat spirally disposed, oval, small, and delicate: *clusters* short, placed immediately below each bifurcation, occupying about the upper half of the internode or less; cells not densely crowded: *polypides* of a citron-colour, with eight tentacles, and furnished with a gizzard: *shoots* clustered, of delicate habit, forming bushy tufts.

Locality. On rocks near low-water mark, and dredged in shallow water off the Capstone, Ilfracombe.

Distinguished from *V. pustulosa*, its nearest ally, by its smaller size and more delicate habit, by its short and not very dense clusters of cells, which do not extend much below the joint, while those of the kindred species are elongated and compact and occupy a large proportion of the internode, and by the exquisite colour of the tentacles and other portions of the polypide.

3. *Valkeria gracillima*, n. sp.

Stem creeping, rather stout and sinuous: *zooœcia* disposed in groups of varying size at intervals, slender, elongate-oval when contracted, flask-shaped when the polypide is extended, rounded off below, of a light horn-colour: *polypides* with eight tentacles and a powerful gizzard.

Hab. Creeping over *Corallina officinalis.*

This species is not characterized by any very marked feature, but is sufficiently distinct from any form with which I am acquainted. The cells originate on the sides of the creeping stem, but are not as regularly biserial and opposite as in *V. caudata*; they are also more delicate, of rather smaller size, and less cylindrical than those of the latter species. The groups of cells are small, usually consisting of about three or four. The gizzard is very conspicuous.

I am indebted to Mr. Leipner's kindness for the opportunity of describing this species also.

Genus ARACHNIDIUM*, Hincks.

Arachnidium clavatum, n. sp.

Zoarium forming an irregular network: *zooœcia* clavate, elongate, enlarged above, rounded at the top, and tapering off below; orifice small, placed near the upper extremity.

Locality. On the tests of Ascidians, Shetland.

Distinguished from the only other species, *A. hippothooides*, by its elongated, clavate cells, and the absence of the fibrous processes round the margin. The cells are also larger and more definite and constant in shape. The *papilla* marking the orifice seems to be smaller and less prominent than in the last-named species.

A. clavatum spreads over the tests of Ascidians from Shetland, for which I am indebted to Mr. J. G. Jeffreys.

* The generic name was published at first as *Arachnidia*—wrongly, inasmuch as it represents the Greek ἀραχνίδιον, dim. of ἀράχνιον, a spider's web.

Genus Alcyonidium, Lamouroux.

1. *Alcyonidium disjunctum*, n. sp.

Zoarium incrusting: *zooœcia* elongate-ovate, disposed in linear series, which bifurcate at intervals and occasionally anastomose; the lines of cells bordered by a gelatinous crust; aperture small, placed near the anterior extremity; cells often massed together.

Locality. Unknown. My specimens were received from Mr. Alder. The cells differ much in shape from those of *A. mytili*, Dalyell, whilst the habit of the two forms is totally dissimilar.

The cells are much elongated and are linked together in single series, and on each side runs a margin of the gelatinous crust. The series bifurcate frequently, two lines originating from the summit of a cell. At the bifurcation the crust forms a web-like expansion between the two series. Every here and there collections of cells occur, from which the single series are given off.

I have only had the opportunity of examining dried specimens of this form; and there is therefore a possibility that in some points the characters may not be adequately represented.

2. *Alcyonidium lineare*, Hincks, MS.

This species is included by Mr. Alder, under the above name, in his 'Catalogue of the Zoophytes of Northumberland and Durham.' I had corresponded with him about it, and had so named it in my letters; but no description of it has been published beyond the brief notice which he has given in the catalogue. In the meanwhile my specimens of it have unfortunately perished, and I can add but little from my notes or from memory to what he has written.

It may be thus characterized:—*Zooœcia* oval, with prominent tubular apertures, immersed in a gelatinous crust, disposed in linear series, which generally branch from a central mass.

Localities. On mussel-shells from the Dogger Bank (*T. H.*); Cullercoats, from deep water (*Alder*).

Smith, in his 'Review of the Scandinavian Polyzoa,' ranks this species as a hippothooid "form" of *A. hirsutum* (Fleming). But the zooœcium, which Prof. Smith will be the first to recognize as the important element, is widely different in the two, and separates them conclusively, apart from the very characteristic and apparently constant habit. The tubular aperture is very prominent and directed horizontally upwards, and projects at the extremity of the cell instead of standing erect, as it does in *A. hirsutum*. To the best of my recollection, the apertures are turned slightly outwards; and I find, from a note made at the time of its first occurrence, that it resembles an *Alecto* in habit.

As it is said to be not uncommon on shells from deep water off the Northumberland coast, we may hope to hear of it again before long.

Species new to Britain.

Hippothoa flagellum, Manzoni.

This species, described by Manzoni from the Mediterranean and the Italian Tertiaries, occurs abundantly on our shores and is widely distributed. It has, no doubt, been confounded with *H. divaricata*, to which it bears a general resemblance, but from which it is separated by a very important character, in addition to other minor differences. The orifice is subovate, somewhat elongate, rather broader above than below, whereas that of *H. divaricata* is semicircular, with a straight lower margin and a central notch. The cells are also shorter (less produced below) and in every way smaller; and the connecting fibre is very long and slender.

XXIX.—*Note on the Radical Fibres of the Polyzoa.*

By the Rev. Thomas Hincks, B.A., F.R.S.

In 'Nature' for June 21, 1877, I find a brief notice of a paper on British Polyzoa, by Mr. Peach, presented to the Linnean Society by Mr. Busk, in which the interesting observation is recorded, that "the tubulous roots" of *Scrupocellaria scruposa* are armed with spines, by which it attaches itself to sponges. Much remains to be written of the filamentary appendages by which the members of certain genera attach themselves, and their modifications. Mr. Peach's observation shows that in *S. scruposa*, as in others of its tribe, these organs exist under two forms at least. Commonly they are present as smooth, slender fibres, which adhere to solid bodies by means of a terminal enlargement or disk. It now appears that under certain conditions they take on a different character, are clothed with spines, and act as grapnels by means of which the polyzoon fastens itself to the soft substance of the sponge. I have not noticed these facts in the case of *S.*

scruposa; but I have long been aware that they enter into the history of another member of the same genus, the common *Scrupocellaria reptans** of authors. I will insert here the passage relating to this subject which I had prepared for my forthcoming 'History of the British Marine Polyzoa.' It is taken from the account of *Scrupocellaria reptans*:—"The radical fibres are present under two forms, and enable the species to adapt itself to very different habitats. In one they are simple tubes, originating, as all similar appendages do in this group, at the base of the vibracular cell; and from the free extremity a number of fibrils are given off, that anastomose and form circular reticulated disks, by which the polyzoon is firmly attached to the surface of the rock or the frond of the seaweed. These disks may remind us of the rootlets by which the ivy clings to its support. The radical tubes are not merely produced towards the base of the zoarium, but along the course of the branches, which, as they increase in length, are firmly attached by them at intervals; and in this way the polyzoon creeps, like a plant, over the surface on which it grows. But a modification of the merely adherent appendage is also met with; and it would seem that the particular form which the radical fibre assumes is very much determined by the nature of the base on which the polyzoon is developed. In its second form it is covered for about two thirds of its length with sharp, recurved, hook-like processes, and is converted into an admirable prehensile organ. It is now a veritable grapnel, by means of which the polyzoon can lay firm hold of the stems of zoophytes or the more delicate algæ, or, plunging it into the soft sarcode, find a safe home upon the sponge. Dredging on one occasion in Salcombe Bay I took up a piece of some cotton material which was overgrown by *S. reptans*. On the uneven fibrous surface the adhesive disks would have been almost useless; a few only were developed; but the toothed processes were present in profusion, and had worked their way in amongst the threads of the fabric, which had become entangled about the hooks, and so anchored the tufts securely. On a specimen beside me, growing on the flat surface of a *Laminaria*-frond, I can find not a single grapnel; but the disks are finely developed and of large size."

In *Cellularia plumosa* we meet with another interesting modification of the radical fibres. In this species they occur

* I have restored this species to the genus *Scrupocellaria*, instead of referring it with Busk to the *Canda* of Lamouroux, because it is furnished with the lateral avicularia which are characteristic of the former genus. They are small and feebly developed, and have hitherto escaped observation; but they exist.

on certain portions of the shoots, as rather short and stout processes, which give off towards the free extremity a number of tendril-like claspers, by means of which, we may suppose, the slender tufts cling to some neighbouring support. They are also present in the more usual form of simple tubes, and in this condition form a dense and tangled mass of rootlets at the base of the shoots.

We know that some foreign species are also furnished with hooked fibres such as we find on *Scrupocellaria reptans*; and in all such cases we have, no doubt, a similar adaptive modification of the simpler structure.

XXX.—*On a new Genus of Hydroids from the White Sea, with a short Description of other new Hydroids.* By C. Mereschkowsky.

[Plates V. & VI.]

During the summer of 1876 I undertook a journey to the White Sea, the zoology and botany of which are almost completely unknown, with the object of studying its fauna as thoroughly as possible, my attention being principally devoted to the study of invertebrated marine animals. My expectations were fully realized; for this sea, hitherto completely unexplored and almost entirely separated from the Arctic Ocean, afforded me numerous and highly interesting specimens of types differing from those generally observed.

Amongst these I may mention a new and interesting Hydroid, which I now propose to describe.

In the part of the White Sea called the Bay of Onega, at small depths (5 fathoms), and where the bottom is slimy, specimens of *Tellina solidula* are frequently found, with the edge of the shell covered with an agglomeration of small animals of a light yellowish colour, giving off long, thin, floating filaments. On observing this mass more carefully I discovered that it was a colony of hydroids, of the suborder Athecata or Gymnoblastea (Pl. V. fig. 1). They are always to be found on the same Mollusca, and, on all those I have observed, on the same part of the shell. Their hydrorhiza consists apparently of a continuous mass, and not of detached filaments as in most other hydroids (Pl. V. fig. 2, *c*). It appears that the structure of the hydrorhiza is not developed to the same degree as that of the *Hydractinia*, but consists simply of a mass of cœnosarc containing a considerable quantity of thread-cells, and of a thin chitinous membrane, covering this mass and expanding into the hydranth and its short stems (Pl. V. fig. 2, *d*). The hydrorhiza is of a dark greyish colour, and is not covered with spines as in *Hydractinia*. The hydranths proceed from the hydrorhiza; and between them are placed the gonophores (Pl. V. figs. 1, 2).

The principal interest of this hydroid is concentrated in the hydranth, which is of an almost cylindrical shape, rather thinner towards the lower, and abruptly truncated at the upper part. It is attached to the hydrorhiza without the aid of any well-defined hydrocaulus, unless we consider as such the thick chitinous membrane covering the inferior part of the hydranth (Pl. V. fig. 2, *d*), and which, in fact, is but the continuation of the perisarc. The length of a full-grown specimen is 2 millims. The mouth (Pl. V. fig. 2, *a*), a simple regular round aperture, opens at the summit of the body, its diameter being equal to that of the body. I have been unable to detect any trace of a joint, or, in fact, any thing separating the body from the hypostome. The only tentacle (Pl. V. fig. 2, *b*) the hydranth is provided with is attached to the upper third of the body, from which it springs at a small angle: its base is several times the thickness of its extremity; and it grows gradually thinner to about half its length. The extremity is not bulbous. The length of the tentacle increases with age, and in full-grown specimens attains two or three times the length of the whole body. Such prodigiously long tentacles had never been previously remarked in any species of hydroids, and this phenomenon finds an explanation in the following circumstances:—1st, that the hydroid being provided with a single tentacle, the whole nutritive force is concentrated in it, instead of being distributed amongst several, as in other cases; 2nd, that the hydroid being compelled to secure aliments and to defend itself against its natural foes, this organ assumes naturally an abnormal development under the greater activity it is called upon to exercise.

As to the histological structure, Pl. VI. fig. 8 gives a transverse section of the hydranth, showing that it differs in no way from the ordinary structure. We see the mass of the ectoderm, with the nuclei of the cells imperfectly defined; in the ectoderm a considerable number of thread-cells (shown in fig. 5) are dispersed all over the tentacles and the body, particularly on the upper part and round the buccal orifice. This layer of ectoderm is succeeded by a mass of mesoderm forming the muscular substance of the animal; and this is to be remarked on the surface, on account of its being striated; and, lastly, we remark the endoderm formed by small circular cells, disposed in several layers. The lobed aspect remarked in the interior is to be attributed, I think, to immersion in alcohol.

I will now pass to the description of the gonosome or generative bodies. Their number is less than that of the trophosomes (Pl. V. fig. 1); but they are of larger size (length from 2 to 3 millims., breadth about 2 millims.). The gonophores are oval, truncated at the upper ends, and grow thinner towards their lower extremity, where they lengthen into a short and slender stem, by means of which they are attached (Pl. V. fig. 2, *e*). There are never any blastostyles on the hydrorhiza.

On observing more attentively the gonophores, I have remarked that they consist of a very thin, transparent, and colourless membrane (Pl. V. figs. 3, *a*, 4, *c*) enveloping a small medusa, which is found there in the different stages of its development.

It is probable that this thin membrane is formed by a continuation of the chitinous envelope of the hydrorhiza. I had not the opportunity of studying a full-grown medusa which had already detached itself from the main body; but its general features may be inferred from an examination of the newly formed gonophores. I here give two figures showing the structure of the medusa. In Pl. V. fig. 3 we see a rather mature gonophore pressed by a covering-plate, with the slit-sided umbrella and with the velum; Pl. VI. figs. 12 and 13, show the transverse section of the same gonophore.

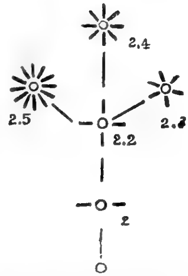
I have not paid any particular attention to minuteness and refinement in the delineation of these histological details, my principal aim having been to point out the general distribution of the different parts and organs of the medusa, and not their histological structure.

By these figures we see that the medusa is composed of a bell (Pl. V. fig. 3, *b*), the sides of which are crossed by four radiating canals (Pl. V. fig. 3, g^1, g^2, g^3, g^4), indicated by bands of a darker shade, passing into four tentacles (Pl. V. fig. 3, f^1, f^2, f^3, f^4); these four radiating canals unite at their base in one circular canal (Pl. V. fig. 3, *h*), from which spring a row of tentacles in the intervals of the four principal tentacles. These latter having been developed at an earlier period, are the largest of the tentacles, of which there are in all sixteen (Pl. V. fig. 6).

From the upper part of each of these radiating canals, at the place where they transform themselves into the digestive cavity of the manubrium (which, I confess, I was not able to detect), proceed two sacs, the canals passing between them

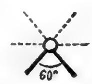
(Pl. V. fig. 3, d^1, d^3, d^5, d^6, d^7, d^8, and figs. 12, 13 of Pl. VI.). I feel no hesitation in ascribing to these eight sacs the functions of the sexual organs in which are contained spermatozoa and ova. My determination of them rests on the following grounds:—1. The medusæ, on account of the simplicity of their organization, cannot have any other organs than the radiating canals, the manubrium, the tentacles, and the sexual organs; and as these sacs can be neither of the three first-named organs, it is evident that they must be considered as the sexual organs. 2. On account of the analogy existing between this hydroid and several species of the Geryonidæ (for instance, *Aglaura Peronii*), in which the sexual sacs, by their form and disposition, bear a great resemblance to the sacs with which we are at present occupied. 3. On account of their contents consisting of two sorts of granules—one set being 0·00047‴ in diameter, and the others (evidently produced by the division or the segmentation of the first) being about 0·000235‴. These small granules, obviously spermatozoa in an immature state, are formed, as is well known, by the division of the mother cell into several segments. The existence of such sacs is not often to be observed in the Hydroids, and the originality of the Hydroid now under study is thereby increased. The structure of the medusa is set forth very conspicuously by my two figures (Pl. V. fig. 3, and Pl. VI. figs. 12, 13), drawn from nature by the aid of a camera lucida, and not in the slightest degree diagrammatic.

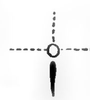
The young gonophores show a little difference in their construction from those just described. The cross section shows only four sacs (Pl. VI. fig. 14); but if we take these gonophores at a more developed state, the cross section underneath shows eight sacs (Pl. VI. fig. 12)—in the centre four (Pl. VI. fig. 13), but with an interruption at the middle, and in the upper part four without an interruption. From this it follows that at the beginning there appear four sacs, and this number afterwards, by longitudinal division, increases to eight. Moreover the sexual sacs present an interesting peculiarity in their division; that is, the more advanced divisions of two sacs lie opposite each other; and this appearance was noticed by me not once, but on every cross section I made (Pl. VI. fig. 7, a, b). It appears to be one of the many facts showing that the fundamental number of hydroids is not four, as is usually admitted, but only two, and that all the remaining numbers are nothing else but $2 \times n$, from which it follows that six and ten are not an exception to the rule, but merely 2×3 and 2×5. For such facts, pointing to the number 2 as the basis, refer for instance to the history of the development of some species of Hydroids and Medusæ, from which it is seen that among the Hydroids, for instance, *Clavatella prolifera*, which has in its normal state six tentacles, in its youth has only two; the same with *Perigonimus bitentaculatus*, which perhaps is an embryonic state of another hydroid; to these belong also *Perigonimus quadritentaculatus* (which has two more tentacles developed), *Acharadria larynx*, and the Medusa *Polyxenia leucostyla* (the tentacles of which, as observed by Metchnikoff, make their appearance at first two in number, and afterwards increase by twos). A number of facts in the history of the development of the Medusæ also show that at the commencement there appear only two tentacles, and afterwards gradually two at a time are added, as for instance in:—*Oceania languida*, Ag. (*Campanulina*, V. Ben.); *Lafoëa calcarata*, Ag.; *Melicertum campanula*, Esch.; *Staurophora laciniata*, Ag.; *Stomotoca atra*, Ag.; *Campanulina acuminata*, Ald.; different species of the genus *Perigonimus*, the tentacles of which do not accumulate; also in the *Æginopsis mediterranea*, *Zanclea implexa*, *Saphenia balearica*, *S. bitentaculata*, *S. diadema*, *Oceania diadema*, *Octochila bitentaculata*. Finally, from a number of facts mentioned by Ehrenberg and Brandt, it is seen that the departures from the normal number often present such numbers as are the product of 2 multiplied by 5, 7, 9, 15, &c. (10, 14, 18, 30, 170). Most frequently after the number 4 we meet with the number 6, which is evidently 2×3; whereas the numbers 3, 7, 17, which are not divisible by 2, are seldom met with. The same is seen in *Podocoryne carnea*, which has 4, 6, 8, 10, and 12 tentacles, as is very clearly shown in the drawings of Hincks. *Cladonema radiatum*, which is described by all authors as having ten radiating canals (2×5), in England, according to the researches of Allman, is always found with eight (2×4) canals. *Clavatella prolifera* often has eight instead of six tentacles (in the hydranth). From all these facts, to which I shall allude more particularly another time, it follows that the fundamental number (that is, the number which first appeared, and through the repetition of which were produced all the numbers which we now meet) of the Hydroids as well as of other Medusæ (and all Cœlenterata, in opposition to the Echinodermata, in which five is the number) is 2; and if we accept as real the biogenetical law, it follows that the forefathers of the present Hydroids had only two tentacles, and that, in consequence of the repeating of the number two 2, 3, 4, 5 times and so on, there appeared other morphological types.



This can be explained by the annexed diagram, showing the genealogy of the types.

As regards the systematic position of this Hydroid, it undoubtedly forms a distinct genus, which I propose to name *Monobrachium.* The species I propose to name *Monobrachium parasitum*, the reason being explained below. If we seek to place it in one of the families known to us, it does not properly belong to any of them, in consequence of its unsymmetrical single tentacle, and is therefore analogous to another interesting hydroid, *Lar sabellarum*, Gosse. I consider it the best course to form for the above-mentioned hydroid a separate family, Monobrachiidæ. Such a new family will find its justification in the great analogy which exists between the two Hydroids, which, therefore, I now proceed to explain. In the first place I take into consideration the analogy of the mode of life of *Lar* and *Monobrachium.* They are both met with always on the same species of animals,—*Lar* on the tube of a worm (*Sabella*), *Monobrachium* on the *Tellina solidula*, and always on the same place, that is, where there are more currents and therefore conveyance of food, upon which the hydroid feeds. *Lar* is always found at the mouth of a sand-tube, from which proceeds the worm, causing a strong eddy with its gills; and the *Monobrachium* on the end of the mollusk (Pl. V. fig. 1). This fact is very important, as it indicates a cause for the appearance of these two Hydroids, and consequently it is the cause of the remaining analogies. And actually, if we compare *Lar* and *Monobrachium* with other Hydroids, it appears that they have the least number of tentacles—*Monobrachium* one, *Lar* only two; therefore it is evident that here the organization is defined. But we cannot regard *Lar* or *Monobrachium* as lower forms from which the higher have been developed, because in the Hydroids, almost without exception, we perceive a symmetrical placing of the parts, so that it is evident such unsymmetrical forms as *Lar* and *Monobrachium* could not be the stock. After the form like *Protohydra Leuckartii*, some form ought to be reckoned having two symmetrically placed tentacles, such as, for instance, *Atractylis bitentaculata* (—o—). Besides this the fully developed medusæ of both Hydroids cannot be regarded as of primitive forms; and every thing shows that as *Lar* and *Monobrachium* are products of degradation, they had at first a greater number of tentacles, and that their mode of life, their parasitism, so to speak, on other animals, by which they profit in seeking their food, was the cause that some of the tentacles, from not being required, were thrown off. Actually the strong eddies formed by the worm as also by the siphons and the foot of the *Tellina*, infallibly bring portions of food, which falling into the mouth of the hydroid do away with that necessity for a great number of tentacles which existed when they led a different kind of life; and thus there appears another analogy between the two hydroids—a more complex form of medusa in comparison with a trophosome reduced to a more retrograde form. And it is clear that the medusa when parted from the trosophome loses those conditions in which the trophosome continues to grow: it is subject to new conditions nearly like those of other medusæ; it swims freely on the surface; and for the struggle of life it requires a good organization. The third analogy is the asymmetry clearly indicated in both the hydroids. The type of the medusæ may serve to show the condition of the trophosome before its degradation. As regards *Lar*, it might be thought that it proceeded from a hydroid which had at first six tentacles; and this supposition reposes on the fact that the medusa has six radial canals and six tentacles, as also on the disposition of its only pair of tentacles, which are not symmetrically placed one opposite the other, but nearly at an angle of 60°, exactly as it would be if from a sexradial type four were taken away (see figure). In this manner the family Laridæ forms a separate branch from the type 2×3. Analogically to this I think it follows that, after all that has been said, *Monobrachium parasitum* forms a separate family, Monobrachiidæ, as a branch detached from the type 2×2, as its medusa has only four radiating canals (see figure). The genealogical tree opposite may elucidate the place of *Monobrachium* among the other types.





This Hydroid may be briefly characterized as follows:—

Order HYDROIDA.

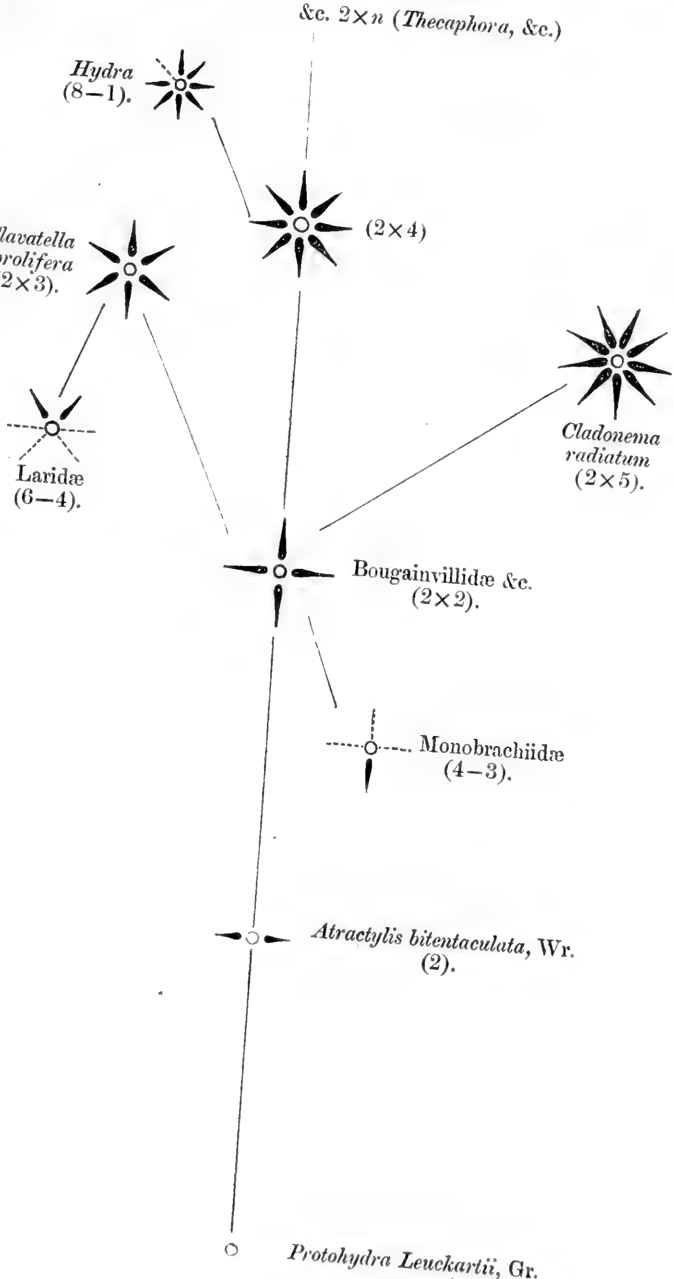
Suborder ATHECATA.

Fam. **Monobrachiidæ**.

Hydrocaulus not developed; hydranth with a single filiform tentacle; central mouth without lobes. Gonophores medusiform planoblasts with four radiating canals.

MONOBRACHIUM, n. g.

Hydrorhiza consisting of a continuous expansion, not composed of a mass of anastomosing stolonic tubes; hydranth


&c. 2×n (Thecaphora, &c.)
Hydra (8−1).
(2×4)
Clavatella prolifera (2×3).
Cladonema radiatum (2×5).
Laridæ (6−4).
Bougainvillidæ &c. (2×2).
Monobrachiidæ (4−3).
Atractylis bitentaculata, Wr. (2).
Protohydra Leuckartii, Gr.

cylindrical, truncated above, with a single filiform tentacle, placed higher than the middle of body. Gonophores without blastostyles, medusiform planoblasts; medusa with four radiating canals, sixteen tentacles, and eight well-developed generative sacs, two from each radiating canal.

Monobrachium parasitum, nov. sp.

Trophosome. Hydrocaulus about one fourth or one fifth of the hydranth, formed by a chitinous tube springing from the hydrorhiza, which covers the end of the *Tellina-solidula* shell. Hydranth 2 millims. in length, cylindrical, without a hypostome, truncated at the summit, which is provided with a simple, regular, round aperture.

The single filiform tentacle very long, from three to four times the length of the body, is placed at the upper half of the body at a small angle.

Gonosome. Stem of the gonophore short and thin. The medusa has eight generative sacs of the same length as the bell.

In one of the next numbers of this Journal I will describe a few more equally interesting genera and species of Hydroids from the northern seas of Russia. Thus, for instance, I have two Hydroids from the White Sea which belong to the order Thecaphora (family Sertularidæ), of which I form a separate genus (*Polyserias*); their hydrothecæ are arranged not as usual in two, but in six or even more rows. One of them (Pl. VI. figs. 15, 16) I have named *Polyserias Hincksii*, in honour of the Rev. T. Hincks, whose writings on the Hydroida are deservedly held in high estimation; another species of the same genus, of which the hydrothecæ are joined to the stem as in *Thuiaria*, I name *Polyserias glacialis*. I found several other species of this genus in the collection of Hydroids in the St.-Petersburg Museum of the Academy of Sciences, brought from the Sea of Ochotsk and Kamtschatka. Another interesting genus, also from the White Sea, was found by Professor Wagner of the St.-Petersburg University, to which I have given the name *Oorhiza*. It is distinguished by having sporosacs with only one egg rising from the hydrorhiza without the aid of a blastostyle, by which it differs from *Hydractinia*, which always has blastostyles. In all else there is very little difference from *Hydractinia* or *Podocoryne*; therefore it belongs to the family Hydractiniidæ. A species of *Sertularia* is interesting, from having its hydrorhiza continuous, formed by the confluence of the separate threads. I shall name this species, which is also from the White Sea, *Sertularia albimaris*.

EXPLANATION OF THE PLATES.

Plate V.

Fig. 1. *Tellina solidula* with a colony of *Monobrachium parasitum*, magnified: *a*, a young *Protohydra*-like specimen; *b*, gonophore.

Fig. 2. Three specimens of fully matured hydranths and a gonophore, more magnified: *a*, the oral orifice of the body; *b*, its single tentacle; *c*, chitinous membrane, covering the cœnosarc and forming a continuous hydrorhiza; *d*, a slightly developed hydrocaulus; *e*, gonophore.

Fig. 3. A gonophore pressed by a covering-plate: *a*, chitinous membrane covering the medusa; *b*, umbrella of the medusa; *c*, the short pedicle of the gonophore; d^1 d^2, a pair of sexual sacs; d^5 d^6 d^7 d^8, the same; d^3, sac only, the other is omitted; g^1, g^2, g^3, g^4, the four radiating canals; f^1, ,f^2, f^3, f^4, the four principal tentacles, into which are continued the radiating canals, and between which are disposed the other twelve tentacles.

Fig. 4. A gonophore less compressed by a covering-glass: $a^1 a^2$, two radiating canals, very distinctly seen; b^1, b^2, b^3, b^4, four tentacles, the first developed; *c*, chitinous membrane.

Fig. 5. A gonophore with the eight sexual sacs seen through the coverings.

Fig. 6. The same gonophore seen from above; the sixteen tentacles are seen.

(All the figures excepting figs. 1 and 2 are drawn by the camera lucida.)

Plate VI. (drawn by the camera lucida).

Figs. 7, 8, 9, 10. Transverse sections of the hydranth.

Fig. 11. A thread-cell.

Fig. 12. Transverse section of a gonophore in an advanced state of development, with the umbrella, the four radiating canals, and the eight sexual sacs.

Fig. 13. Transverse sections of the same gonophore, but at a higher part of it, where the original four sacs are not yet quite divided longitudinally into eight. *a* and *b* are the two opposite sacs at a more advanced stage of longitudinal division than the two other sacs.

Fig. 14. The same from another gonophore, not yet so mature as in figs. 6, 7, but made at the same part of it as the section presented in fig. 6.

Fig. 15. *Polyserias Hincksii*, nat. size.

Fig. 16. The same, magnified.

XXXI.—*The Post-tertiary Fossils procured in the late Arctic Expedition; with Notes on some of the Recent or Living Mollusca from the same Expedition.* By J. Gwyn Jeffreys, LL.D., F.R.S.*

Mr. Edgar Smith, of the British Museum, has published, in the 'Annals and Magazine of Natural History' for this month

* Communicated by the author, and read at the Plymouth Meeting of the British Association, 20th Aug. 1877.

(August 1877), a list of the recent or living Mollusca brought home by Capt. Feilden and Mr. Hart, the Naturalists of the last of our Arctic voyages; and I propose to supplement that list with a notice of the Post-tertiary fossils collected not only by the Naturalists, but also by Lieut. Egerton and Dr. Moss, two of the officers of H.M.S. 'Alert.'

I cannot help sharing Mr. Smith's expression of disappointment with the conchological results of the Expedition. The number of Post-tertiary as well as of recent species of Mollusca is very scanty. In analogous or apparently similar cases of so-called "glacial" and raised sea-beds in Great Britain, Scandinavia, and Canada, which I have examined, I collected in two or three hours a greater number of fossil species than those procured in the Expedition. However, great allowance must be made for the difficult circumstances under which the specimens were collected in such very high latitudes; and I have no doubt that the Naturalists did their best. The fossil specimens brought home by the Naturalists are in the Museum of Economic Geology, under the charge of the Palæontologist, Mr. Etheridge, and in the British Museum; Lieut. Egerton presented his specimens to the Geological Society; and Dr. Moss kindly placed his at my disposal.

The subject of the present communication is especially interesting to geologists, because it is closely connected with the history of those former conditions and changes of climate which left so many traces in Europe and North America, in the form of raised beaches and sea-beds. The investigation of the organisms, particularly of the Mollusca, imbedded in those deposits becomes highly important for the study of the Post-tertiary or Quaternary epoch, as well in a geographical as in a hydrographical point of view.

The extent of oscillation to which the earth's crust in the northern hemisphere has been subjected, during a comparatively recent period, is remarkably exemplified in the case of *Saxicava rugosa*. The large arctic form of this species in a fossil state has been dredged between the Hebrides and Faroes, at the depth of 2070 feet (345 fms.); the same form is abundant on the surface at Montreal; and it has been found on Moel Tryfaen at the height of 1360 feet: a difference of 3430 feet between depression and elevation is thus shown. The usual habitat of *S. rugosa* is shallow water, although I have a specimen from 1230 fms. or 7380 feet, and fragments from 1622 fathoms or 9732 feet. The last-mentioned depth, added to the height of the Moel Tryfaen sea-beach, gives a measurement of 11,092 feet, being nearly equal to two thirds of the height of Mont Blanc.

The position of the stations where these fossils were found in the Arctic Expedition is as follows:—

No. 1. N. lat. 82° 27′, W. long. 61° 42′. Shell Flats, 200 feet above the present level of the sea; sandy mud, interstratified with layers of moss (Moss).
No. 2. N. lat. 82° 32′. North of Dumbbell Harbour, 23rd July, 1876 (Egerton).
No. 3. N. lat. 82° 33′. Kane Valley; mud beds, 40 feet (Feilden).
No. 4. N. lat. 82° 35′. Blackcliff Bay, "in great quantities at all heights up to 100 feet above present sea-level;" Port Foulke, "300–400 feet above present sea-level" (Egerton).
No. 5. Plain between Polaris Bay and Newman's Bay, 600 feet (Hart).
No. 6. Franklin-Pierce Bay; "ancient mud beds, 180 feet" (Hart).
No. 7. Cape Frazer; "10 feet above sea-level" (Hart).
No. 8. Bivouac Plain; "old-sea bottom" (Hart).
No. 9. Floeberg Beach; "mud banks, 200 feet" (Hart). The latitude is not marked; but Dr. Moss tells me this station is near No. 1.
No. 10. Plain, Musk-ox Bay; "100 feet" (Hart).
No. 11. Near Simmond's Isle, towards Cape Joseph Henry; "40 feet, October 1875 (Feilden).
No. 12. Isthmus, Cape Joseph Henry (Feilden).

The last station was the most northern.

To avoid repetition, the number of the station and the name of the discoverer only will be given. The letters "ft." signify the height in feet above the present level of the sea, and "fms." the depth in fathoms of six feet; "l. w." stands for low-water mark at spring-tides. The fossil species of Mollusca are 18, of Actinozoa 1, of Foraminifera 1, and of marine plants 1, being altogether 21 species.

MOLLUSCA.

Conchifera.

Pecten Grœnlandicus, G. B. Sowerby.

Pecten Grœnlandicus, G. B. Sowerby, Thes. Conch. part ii. p. 57, pl. xiii. f. 40 (1842).

Station No. 1 (Moss); No. 9 (Feilden).
Recent. Arctic Ocean (Parry): Spitzbergen (Torell): Fin-

mark, 40–150 fms. (Lovén, Sars): White Sea and coasts of Russian Lapland (Middendorff): Gulf of St. Lawrence, 150 fms. (Whiteaves): 'Porcupine' Expedition, 1869, 420–542 fms., young; 1870, Bay of Biscay, 257–539 fms., young: Arctic Expedition, $5\frac{1}{2}$–35 fms. (Feilden and Hart).

FOSSIL. Tangy Glen, W. Scotland (Robertson and Crosskey): E. Scotland, 30–40 ft. deep: Elie, a few ft. below the surface (Jamieson).

The shell is certainly not "equivalve," as Sowerby described it. It is the *P. vitreus* of Gray in the 'Supplement to the Appendix of Parry's First Voyage,' but not Chemnitz's species of that name.

Leda pernula, Müller.

Arca pernula, Müll. in Beschäftigungen naturf. Freunde, vol. iv. p. 35.

Var. *falcula*. Shell sickle-shaped, longer (from the beak to the front margin) and flatter than the variety *Jacksonii* of Gould or *buccata* of Steenstrup; the "*rostrum*" or point is short, blunt, and more or less upturned in the adult; front margin curved.

St. No. 1 (Moss).

RECENT. Spitzbergen (Torell, Eaton): Wellington Channel (Belcher). The typical form and other varieties inhabit both sides of the North Atlantic as well as the North Pacific, at depths of from 20 to 150 fms.: 'Porcupine' Exp. 1869, 251 fms.; 1870, Bay of Biscay, 305–517 fms.: 'Valorous' Exp. 15–175 fms.: Arctic Exp., $5\frac{1}{2}$ fms. (Feilden).

FOSSIL. Post-tertiary or "glacial" beds in the North of England, N. Wales, Ireland, Scotland, Scandinavia, and Canada, surface to 320 ft.: Moel Tryfaen, 1330–1360 ft. (Darbishire).

Variable in shape and sculpture. Having many synonyms, or polyonomatous.

Leda frigida, Torell.

Yoldia frigida, Tor. Bidr. t. Spitzbergens Molluskfauna, p. 148, t. 1. f. 3 (1859).

St. No. 3 (Feilden).

RECENT. Spitzbergen, 30–60 fms., and Greenland, 250 fms. (Torell): Iceland (Mus. Copenhagen): Finmark, 200–300 fms. (Sars): Shetland, 60 fms. (J. G. J.): Gulf of St. Lawrence, 150 fms. (Whiteaves): 'Porcupine' Exp., 1869, 114–1360 fms.; 1870, Bay of Biscay, 227–1095 fms.: 'Valorous' Exp., 175 fms.

Yoldia nana of M. Sars.

Arca glacialis, Gray.

Arca glacialis, Gray, Suppl. App. Parry's Voyage, p. ccxliv (1824).

St. No. 9 (Feilden).

Recent. Arctic Ocean (Parry): Wellington Channel (Belcher): 'Bulldog' Exp., 1622 fms. (Wallich): Iceland (Mus. Copenh.): Spitzbergen (Torell): Scandinavia, 60–300 fms. (Malm and others): Shetland, 80–85 fms. (J. G. J.): 'Lightning' Exp., 189 fms.: 'Porcupine' Exp., 1869, 164–422 fms.; 1870, Bay of Biscay, 45–690 fms.; Mediterranean, 60–1456 fms.: Ægean (Forbes, *fide* M'Andrew): Mediter., 30–300 fms. (Stefanis, Nares, and others).

Fossil. Norway, 20–240 ft. (Sars and others): Sicily (Philippi and others): Maine Co. (Lyell).

Synonyms: *A. obliqua*, Philippi, 1844; *A. lactea*, Malm, 1853 (non Linné); *A. Korenii*, Danielssen, 1859.

Axinus flexuosus, Montagu; var. *Gouldii.*

Tellina flexuosa, Mont. Test. Brit. p. 72.

St. No. 1 (Moss).

Recent. (Type and varieties.) N. Atlantic, Mediterranean, and Adriatic, 3–450 fms.: Gulf of Mexico, 91 fms. (Pourtales): Swedish Exp., 1868, 540 fms.: 'Lightning' Exp. 550 fms.: 'Porcupine' Exp., 1869, 96–557 fms.; 1870, Bay of Biscay, 20–1095 fms.; Mediterr., 5-110 fms.: 'Valorous' Exp., 7–410 fms.: Arctic Exp., $5\frac{1}{2}$ fms. (Feilden): N. Pacific (P. Carpenter).

Fossil. (Type and varieties), Scandinavia, Scotland, Monte Mario, Sicily, Canada, and Maine, 0–320 ft.: Coralline and Belgian Crags.

The varieties *Gouldii*, *Sarsii*, and *polygona* are connected by intermediate gradations; the last-named variety is the most aberrant.

Astarte borealis, Chemnitz.

Venus borealis Linnæi, Ch. Conch. Cab. vol. vii. p. 26, t. 39. f. 412, 414 (in ind. Schröter *V. borealis*); not *V. borealis*, L.,=*Lucina borealis.*

St. No. 1 (Moss); No. 4 (Egerton); Nos. 5, 8, and 10 (Hart); No. 11 (Feilden).

Recent. Arctic Ocean and N. Atlantic, southwards to the Danish coasts, 2–80 fms.: Swedish Exp., 1868, 1300 fms. (fragment): 'Valorous' Exp., 12–1450 fms.: Arctic Exp., $5\frac{1}{2}$ fms.: N. Pacific (Midd.).

Fossil. N. and W. England, Wales, Ireland, Scotland, Scandinavia, and N.E. America, surface to 440 ft.: Macclesfield, 500–600 ft., and Moel Tryfaen, 1330–1360 ft. (Darbishire): Port Kennedy, Greenland, 100–500 ft. (Walker).

Synonyms very numerous. A specimen dredged in Discovery Bay by Capt. Feilden corresponds with the variety *elliptica* of *A. sulcata*.

Astarte fabula, Reeve.

Astarte fabula, Reeve, in Belcher's Last of the Arctic Voyages, vol. ii. p. 398, pl. xxxiii. f. 5, *a*, *b* (from type !).

St. No. 3 (Feilden).

Recent. Wellington Channel (Belcher): E. Greenland (Möbius): Spitzbergen (Torell, Eaton): Arctic Exp., 5½–15 fms. (Feilden).

I am now satisfied that *A. Warhami* of Hancock is not this species, but the same as *Crassina depressa* of Brown = *A. crebricostata*, Forbes, = *A. Richardsoni*, Reeve.

Neæra subtorta, G. O. Sars.

Neæra subtorta, G. O. Sars, MS., Jeffr. in Ann. Nat. Hist. Dec. 1876, p. 496.

St. No. 3 (Feilden).

Recent. Vadsö (G. O. Sars): Bergen (Koren): Hammerfest (M'Andrew): Spitzbergen (Torell): 'Lightning' Exp., 550 fms.: 'Porcupine' Exp., 1869, 62–125 fms.: 'Vöringen' Exp., 400 fms. (Friele)!

This pretty little shell differs from *N. obesa* of Lovén in being not only much smaller, but more gibbous or swollen, and in having a shorter and upturned *rostrum*, which appears twisted when viewed edgewise. *N. exigua* is more slender and delicate, besides being peculiarly sculptured. *N. pellucida* of Stimpson is distinct from any of the above.

Saxicava rugosa, Linné.

Mytilus rugosus, Linn. Syst. Nat. ed. xii. p. 1156.

St. No. 4 (Egerton); Nos. 6, 7, and 10 (Hart); No. 12 (Feilden).

Recent. Probably in every sea throughout the world, from the upper part of the laminarian zone to the line of soundings: 'Bulldog' Exp., 1622 fms. (fragment): 'Lightning' Exp., 170–550 fms.: 'Porcupine' Exp., 1869, 90–1230 fms.; 1870, Bay of Biscay, 20–717 fms.; Mediterr., 25–92 fms.: 'Valorous' Exp., 3–60 fms.: Arctic Exp., 5½–30 fms. (Feilden).

Fossil. Universally distributed in the fossiliferous "Drifts" and "glacial" beds of Europe (including Sicily) and N. Asia and America; also Coralline and Red Crag. Heights 0–1360 ft., the last being at Moel Tryfaen.

Mya truncata, Linné.

Mya truncata, L. S. N. p. 1112, ed. xii.

St. No. 4 (Egerton); Nos. 5, 6, and 10 (Hart); No. 12 (Feilden).

Recent. Seas of Northern Europe, Asia, and America, l. w.–100 fms.: 'Valorous' Exp., 3–80 fms.; fragments, 175 fms.: Arctic Exp., $5\frac{1}{2}$–30 fms. (Feilden). The most southern localities recorded are the Bay of Biscay on the authority of Beltrémieux and others, and the Adriatic on that of G. v. Martens and of Danicli and Sandri. The variety *Uddevallensis* or *abbreviata* is more especially arctic, although I have dredged it in Belfast Bay and on the coast of Essex.

Fossil. Every raised beach and sea-bed in Europe, Iceland, and N. America, from 2 to 1360 ft.: Crimea, subfossil (Siemascho): Port Kennedy, 100–500 ft. (Walker): 'Porcupine' Exp., 65 fms. = 390 ft.: Norwich, Red, Coralline, and Antwerp Crags. The usual fossil form is the variety *Uddevallensis*.

Gastropoda.

Trochus umbilicalis, Broderip and Sowerby.

Margarita umbilicalis, Brod. & Sow. in Zool. Journ. vol. iv. p. 371 (1829).

St. No. 1 (Moss); No. 3 (Feilden).

Recent. Arctic Seas (Parry and others): 'Valorous' Exp. 20 fms.: Arctic Exp., $5\frac{1}{2}$–15 fms. (Feilden). See also Ann. Nat. Hist. for March 1877, p. 237.

Trichotropis borealis, Broderip and Sowerby.

Trichotropis borealis, Brod. & Sow. in Zool. Journ. vol. iv. p. 395.

St. No. 3 (Feilden).

Recent. Arctic Seas in both hemispheres, Sitcha Isle, Iceland, Faroe I., Norway, Dogger Bank, Scotland, and Ireland, U. S. America, Canada, and Labrador, 5–150 fms.: 'Lightning' Exp., 530 fms.: 'Valorous' Exp., 57–175 fms.: Arctic Exp., $5\frac{1}{2}$ fms., and Dumbbell Harbour (Feilden).

Fossil. Bridlington, Moel Tryfaen (1330–1360 ft.), Wexford, Scotland, Norway (0–80 ft.), Sweden, Canada, and Labrador: Coralline Crag.

Buccinum hydrophanum, Hancock.

Buccinum hydrophanum, Hanc. in Ann. Nat. Hist. vol. xviii. p. 325, pl. v. f. 7 (1846).

St. No. 2 (Egerton).

Recent. Davis Strait (Warham and Harrison, *fide* Hancock): Wellington Channel (Belcher): ? White Sea and coasts of Russian Lapland (Baer, Middendorff as *Tritonium Grœnlandicum*, var. *hydrophana*): Arctic Exp., Franklin-Pierce Bay (Feilden and Hart); Dobbin Bay, 30 fms. (Hart).

Trophon clathratus, Linné.

Murex clathratus, L. S. N. ed. xii. p. 1223.

St. No. 12 (Feilden).

For the range of this common Northern species and its variety *truncata*, as well recent as fossil, see the 'Annals of Natural History' for April 1877, p. 325. I may add that the typical form in a fossil state occurs at Macclesfield and Moel Tryfaen (500–1360 ft.), and that *Fusus costatus* of Hisinger and *F. imbricatus* of James Smith are among the synonyms. In co. Antrim the variety lives between tide-marks.

Pleurotoma tenuicostata, M. Sars.

Pleurotoma tenuicostata, Sars in Vid. Selsk. Forh. p. 259 (1868).

St. No. 1 (Moss); fragment only.

Recent. See Ann. Nat. Hist., April 1877, pp. 329, 330. And add 'Bulldog' Exp., 1622 fms.

Pleurotoma exarata, Möller.

Defrancia exarata, Möll. Ind. Moll. Grœnl. p. 12.

St. No. 1 (Moss); fragment.

Recent and Fossil. See Ann. Nat. Hist., April 1877, p. 332. And add "East-Anglian Middle Glacial deposits" (Wood and Harmer).

Pleurotoma Trevelyana, Turton.

Pleurotoma Trevellianum, Turt. in Mag. Nat. vol. viii. p. 351 (1834).

St. No. 3 (Feilden).

Recent and Fossil. For the geographical and geological distribution of this species see Ann. Nat. Hist., April 1877, p. 332. Sars dredged it at the depth of 400 fms., and has recorded it as fossil at heights of 50–240 ft. It occurs in the Red and Iceland Crags.

Cylichna alba, Brown.

Volvaria alba, Brown, Ill. Conch. G. B. & I. pl. xxviii. f. 43, 44 (1827).

St. No. 3 (Feilden).

RECENT and FOSSIL. See Ann. Nat. Hist., April 1877, p. 333. In the 'Porcupine' Expedition of 1869 it was dredged between the Hebrides and Faroes in 114 fms.; and in the expedition of 1870 a closely allied species, if more than a variety, came from depths of 227 and 539 fms. in the Bay of Biscay. Arctic Exp., 5½ fms. (Feilden).

CŒLENTERATA.

ACTINOZOA.

I am informed by Dr. Moss that Capt. Feilden found in the mud-bank at Blackcliff Bay several specimens of the *corallum* or axis of a species of *Pennatula*, about six inches in length.

PROTOZOA.

FORAMINIFERA.

Cornuspira foliacea, Philippi.

Orbis foliaceus, Phil. Faun. Moll. Sic. vol. ii. p. 147, t. xxiv. f. 25.

St. No. 3 (Feilden).

RECENT. Catania (Philippi): N. Atlantic (J. G. J.).

FOSSIL. Palermo (Philippi): Lincolnshire and Cambridgeshire Fen-clays (Parker and Jones).

CRYPTOGAMIA.

MARINE ALGÆ.

Melobesia polymorpha, Linné.

Millepora polymorpha, L. S. N. ed. xii. p. 1285.

St. No. 12 (Feilden).

RECENT. All the coasts of the N. Atlantic (including Greenland), and probably a much more extensive area of the ocean.

In connexion with the present communication I would take the opportunity of making a few remarks on Mr. Edgar Smith's list of the recent Mollusca procured by the Naturalists of the Arctic Expedition.

These remarks, although critical, chiefly relate to the selection or adoption of specific names, and do not affect the value of his excellent paper. Such difference of opinion among zoologists as to the limits as well as names of species is not only notorious, but useful. We are all actuated by the same motive, viz. the honest and careful investigation of those branches of natural history to which we devote our attention; and I can truly give Mr. Smith the fullest credit for the ability and zeal which characterize his work. .

Modiolaria discors, Linné; var. *lævigata*.

Modiola lævigata, Gray in Suppl. to App. of Parry's Voyage, p. ccliv (1824).

At least half a dozen species might be made out of the varieties of *M. discors*, if we regard size, shape, and the comparative number or absence of radiating striæ as specific characters. I have examined many hundred specimens from different places, and can scarcely find two precisely alike.

Leda arctica, Gray.

Nucula arctica, Gray, *l. c.* p. ccli.

Mr. Smith has followed Broderip and Sowerby in referring this to the species known as *N. limatula* of Say (1831), which is probably *N. lanceolata* of J. Sowerby (1817). But I must adhere to my former opinion that Gray's species is the same as the *N. truncata* of Brown (1827). Gray gives the "length (from front to back) half an inch; depth (from umbones to the opposite edge) a quarter;" he describes his shell as "very slightly concentrically wrinkled" and "obliquely truncated behind," all of which characters suit Brown's species. *Leda limatula* is three times as long and deep, according to Gray's mode of admeasurement; it is not "concentrically wrinkled," nor "truncated behind." As to Gray's shell being placed in his division "behind slightly produced, gaping," his *N. rostrata* (*L. pernula*) is placed in another division, "behind much produced, gaping." All these three species of *Leda* "gape" more or less at the hinder extremity. Torell, in his admirable treatise on the Mollusca of Spitzbergen, has fully demonstrated that Gray's *N. arctica* is identical with Brown's *N. truncata*. Each of the above specific names has several aliases.

Saxicava rugosa, Linné.

I prefer retaining this specific name for the following reasons. We find, in the 12th edition of the 'Systema

Naturæ' three names given for the same species, viz. *Mya arctica*, *Solen minutus*, and *Mytilus rugosus*. None of them appeared in any of the prior editions. The only reference made to other works is in the case of *Mytilus rugosus*, where Lister's 'Animalia Angliæ' is quoted; and there can be no doubt that the quotation is correct. Hanley regarded *Mytilus rugosus* and *Mya arctica* as distinct species; and in his 'Ipsa Linnæi Conchylia' he says, as to *Mytilus rugosus*, that the only shells in the Linnean collection "contained in the box thus marked in the cabinet are worn full-aged specimens of *Saxicava arctica* or *Hiatella oblonga* of Turton." This species has no end of other synonyms.

Trichotropis tenuis, Smith.

In *Littorina litorea* and *Fusus antiquus* the same kind of distortion is observable. The mouth of the shell becomes more rounded or circular, and the base is more or less umbilicated. The earlier growth of the shell is quite regular in distorted specimens of the common periwinkle and almond-whelk; and usually the last whorl only in such specimens is abnormal, probably in consequence of the mantle being then injured. I must venture to regard the present so-called species as a monstrosity of *T. bicarinata*.

Buccinum sericatum, Hancock.

Mr. Smith's description and figure of the radula do not quite agree with the description given by Mr. Jabez Hogg in my preliminary report of the 'Valorous' cruise (Proc. Roy. Soc. no. 173, p. 201), nor with his drawing, which were taken from a full-grown specimen of what I consider the same variety of *B. Grœnlandicum*. The only difference consists in one of the lateral plates shown in Mr. Smith's figure having two fangs instead of three; and it may be accounted for by Mr. Smith's specimen being young. I suspect that the figures in Troschel's 'Gebiss der Schnecken,' Bd. ii. L. ii. T. vi. f. 12 and 13, have been accidentally reversed, and that f. 12 belongs to *B. glaciale* and 13 to *B. Grœnlandicum*. As to the epidermis, I concur with Dr. Mörch in the remarks which he published in the last number of the 'Journal de Conchyliologie,' p. 267, viz.:—' L'épiderme des Buccins et des Fuseaux est extrêmement variable et n'offre qu'à peine des caractères spécifiques constants. Ainsi, le Buccin ondé possède, tantôt un épiderme lisse et mince, tantôt un épiderme cilié et épais. La première forme se trouve chez les individus qui vivent sur un fond rocailleux; la dernière sur ceux qui habitent un fond vaseux. Il me semble hors de doute que ces deux formes constituent une seule et même espèce." See also my remarks on the epidermis of *Fusus Sabini* in the 'Annals of Natural History' for April 1877, p. 327. It is impossible to form a satisfactory opinion as to the discrimination of species and varieties without having had an opportunity of examining and comparing a great number of specimens from many localities. That opportunity has fallen to my lot with respect to *B. Grœnlandicum* and its varieties.

Fusus Sabini, Gray.

Buccinum Sabinii, Gray in Suppl. App. Parry's Voyage, p. ccxl, = *Fusus Sabini*, Gray, Zool. Beechey's Voyage (1839).

Our arctic species agrees with Gray's description in every particular except size, which he gives as "axis three-fourths of an inch, diameter three-eighths;" and it must be borne in mind that he says, "the specimen brought home appears to be young." My largest specimen is double the above size, being an inch and a half long and three fourths broad.

I will complete Mr. Smith's list by giving a few more stations from the Arctic Expedition, as well as by adding another species.

1. *Leda minuta*, Müller.

Franklin-Pierce Bay, 15 fms. (Feilden).

2. *Trochus helicinus*, Fabricius.

Franklin-Pierce Bay (Feilden).

3. *Trochus umbilicalis*, Broderip and Sowerby.

Discovery Bay, $5\frac{1}{2}$ fms. (Feilden).

4. *Trochus olivaceus*, Brown (1827).

Trochus argentatus, Gould (1841).
Margarita glauca, Möller (1842).
Margarita Harrisoni, Hancock (1846).
And apparently *M. albula*, Gould (1862).

These specimens were deposited in the Museum of Economic Geology.

Mr. Smith says that the arctic collection of shells leads to the conclusion that the Mollusca of West Greenland are American rather than European, because "of the 34 species obtained, at least 16 are found off the Atlantic coast of the United States, whilst only 4 or 5 have been recorded from

European Seas, and the remainder, as far as our present knowledge extends, are exclusively Greenlandic." Now I find, by analyzing his list, that out of the 34 species no less than 28 have been recorded as European and American, 2 as European and not American, 1 as American and not European, and 3 as exclusively Greenlandic.

The Crustacea collected in the Arctic Expedition have been most carefully worked out by Mr. Miers, of the British Museum, and published in the 'Annals and Magazine of Natural History' for July and August 1877. The result shows that out of 30 species of Crustacea brought home, 28 are European (Iceland, Spitzbergen, Scandinavia, Britain), and 16 only are American; 12 species are Greenlandic and European, but not American; and 2 only are Greenlandic and American (one of the latter doubtful), but not European.

There can be no question that marine animals, especially those of the Invertebrate kind, abound in the Polar Ocean as far north as it has been explored. All writers on the natural history of the arctic seas agree in this; and I can personally testify to the fact, with respect to Davis Strait, in comparison with other parts of the North Atlantic. In the late Arctic or Polar Expedition Capt Markham and Commander Parr found several specimens of a shrimp-like crustacean (*Anonyx nugax* of Phipps) and Foraminifera at the depth of 72 fathoms in 83° 19′ N. lat. The expedition did not get further than 83° 20′ 26″, being about a mile and half beyond the place where those marine animals were found. Professor Torell, in his essay on the Mollusca of Spitzbergen (which lies between 76° 30′ and 81° 7′ N. lat.), says that the seas there teem with life, and that phosphorescent animals on the surface are so numerous that, while sailing during the night, one could clearly distinguish a ray of light in the dark wake of the ship. Scoresby had given a similar account of the luminosity of the arctic seas in equally high latitudes. Sir George Nares, in his official Report of the Arctic Expedition, did not allude to the subject—although he mentioned that early in June, 1876, ducks and geese passed in small flocks of about a dozen, flying towards the N.W. from the winter quarters of the 'Alert,' in 82° 24′ N. lat.; and it must be recollected that these ducks and geese subsist entirely on marine animals. I am therefore at a loss to know upon what grounds Sir Rutherford Alcock, the President of the Royal Geographical Society, stated, in his Address on the 28th of last May, as a "fact that animal marine life almost ceases to exist in the ice-covered Polar sea," and that "the Palæocrystic sea is a sea of solitude." Possibly his statement is capable of explanation. He did not notice the 'Valorous' Expedition, which yielded no inconsiderable results by way of addition to the marine fauna of the arctic seas, and to which the President of the Royal Society had done justice in his annual address eighteen months previously.

XXXII.—*Description of a new Species of* Helix.

By Edgar A. Smith, Zoological Department, British Museum.

Helix (*Merope?*) *Barnaclei.*

Testa imperforata, conoideo-globosa, levis, tenuiuscula, nitidissima, fulva, nigro-fusco bifasciata; spira conoidea, vix convexa, apice obtusiusculo; anfractus $4\frac{1}{2}$, convexiusculi, sutura distincta alba sejuncti, lineis incrementi arcuatis sculpti, ultimus subventricosus ad aperturam breviter deflexus, ad peripheriam albus obsolete carinatus, infra in medio impressus; apertura obliqua, irregulariter lunato-triangularis; peristoma leviter incrassatum, reflexum, albidum, extus castaneo marginatum, margine columellari recto, calloso albo.

Diam. max. 24 millim., min. 21; alt. 15.

Testa junior ad peripheriam anfr. ultimi acute carinata et fascia lata alba, nigro marginata, cincta, anguste perforata.

Shell imperforate in the adult state (narrowly umbilicated when immature and acutely angled at the periphery), conoidally globose, with a very shining surface, of a rich fulvous or deep fawn-colour; the upper whorls become gradually paler than the last, and towards the apex are semitransparent horn-colour and encircled by a single narrow dark brown line just above the suture, which is white; this line becomes much broader upon the body-whorl, which has a second similar band beneath the more or less white periphery; this is obsoletely keeled or angulated near the upper end of the lip, the keel vanishing altogether on the last half of the whorl; whorls $4\frac{1}{2}$, a little convex, having no other sculpture than the arcuate lines of growth (except in young shells, where they are obsoletely spirally striated), the last somewhat ventricose, very shortly deflexed at the aperture; beneath paler or horn-colour and a little concave in the middle or umbilical region; the aperture is very oblique, very irregularly triangular-lunate, white within, banded with black and brown (the latter not visible exteriorly); lip not much thickened on the outer and basal margins, narrowly expanded and reflexed, whitish, and margined on the outside with a chestnut band; the columellar margin white, almost straight, thicker than elsewhere.

Hab. Hawai, Sandwich Islands.

This very pretty species closely resembles *H. fringilla* of Pfeiffer, which inhabits the Admiralty Islands. Indeed it is so nearly related to it, that were I not certain of the correctness of the locality whence it was obtained, I should have hesitated to describe it as new.

It is, however, a thinner, lighter, and smoother shell, the spire is a trifle higher and less obtuse, the whorls a little more convex, more regular, the penultimate proportionally smaller, and the last larger and not showing that decided constriction behind the lip which is so characteristic of Pfeiffer's species. The lip, too, is thinner and without the least trace of a tooth-like projection on the columellar edge. Specimens of *fringilla* in fine condition exhibit distinct spiral striæ on the entire surfaces; such sculpture is only just traceable in young examples of the present species.

One of these young shells has a particularly beautiful appearance, owing to the broad white band at the periphery, which is margined on both sides by a dark brown stripe, contrasting prettily with the ground-colour, which is bright fulvous or rich fawn.

Three specimens, one adult and two immature, have been presented to the British Museum by Mr. H. Glanville Barnacle, whose name I feel much pleasure in associating with this species, since to him is owing its discovery.

This form of *Helix*, being so different from any other hitherto found at the Sandwich Islands, led me to think that there must be some mistake with regard to the alleged habitat. I therefore wrote to Mr. Barnacle upon the subject, whose reply runs as follows :—" I am perfectly certain that the specimens I have were grown on the Sandwich Islands, and some of them had the snails in them. Whilst stationed at Kailua I used at times to go shooting at some brackish ponds about 8 miles away; and whilst going quietly amongst the broad reeds to shoot a duck I saw one of the shells about halfway up a reed. I took it and found two or three more that day, and now and then others, but not many. Few Europeans go to these ponds, as it is impossible to find them without a guide over the lava, for there is no road. Some I found with the snail, others without; those with the animal I put into a cigar-box and filled it up with sea sand; and so the animals died out, and then I washed them."

This circumstantial account removes all doubt respecting the true home of this shell. Notwithstanding its close affinity to *H. fringilla*, the remoteness of the habitats of the two species and the extreme isolation of the Sandwich Islands are sufficient reasons in themselves to determine the specific distinctness of these snails.

MISCELLANEOUS.

On the Structure of the Lower Jaw in Rhizodopsis *and* Rhizodus.

To the Editors of the Annals and Magazine of Natural History.

Gentlemen,—Though most cordially appreciating the valuable services rendered to science by the researches, into the fossil Vertebrata of the Northumberland Coal-field, of the late distinguished naturalist, Mr. Albany Hancock, in conjunction with Mr. Thomas Atthey, I may nevertheless be permitted to record my entire dissent from the opinions published by them with regard to the so-called "præmaxilla" of *Rhizodopsis*.

Having read Mr. Atthey's "Notes" in the last number of the 'Annals,' all I need say on the matter is that my paper "On the Structure of the Lower Jaw in *Rhizodopsis* and *Rhizodus*" was not written without due and careful examination of the subject, and that since then I have seen no reason to change my opinion.

I am, yours &c.,

Edinburgh, August 7, 1877. R. H. Traquair.

Note on the Genus Pœoptera. By Dr. F. Brüggemann.

From an inspection of several skins of *Pœoptera lugubris* in the British-Museum collection, I have come to the conclusion that this bird is identical with the recently described *Myiopsar cryptopyrrhus* of Cabanis. As the specific name "*lugubris*" was applied to it by a mistake, and thus the species had properly no name of its own until 1876, it will stand as *Pœoptera cryptopyrrha*. The natural affinities of this form (which has been placed amongst the fly-catchers, chats, and glossy starlings by the several authors) appear to me to be with the Dicruridæ.

I have communicated the above identification, together with these remarks, to Mr. R. B. Sharpe, to whom it was new, and who has kindly inserted it in his 'Catalogue of Birds,' vol. iii. p. 281.

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[FOURTH SERIES.]

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XXXIII.—*On the* Salenidæ, *Wright.*—Part II. *Observations on the Morphology of Recent* Saleniæ, *and Description of a new Species.* By P. Martin Duncan, F.R.S., Pres. Geol. Soc.

[Plate VII.]

In the first part of this essay* I noticed the sphæridia and pedicellariæ of a specimen of a recent *Salenia* which I considered to be probably referable to the species described by A. Agassiz, and named by him *Salenia varispina*; and now I proceed to the comparison of the other structures of the test in the recent forms. But before doing so it is necessary to consider the zoological position of the specimens.

The specimen just noticed, and which has its spines and buccal membrane intact, was covered here and there with deep-sea ooze, in which were many *Globigerinæ*. This sticky substance enveloped the pedicellariæ, filled up the spaces between the papillæ on the apical disk, and only permitted a general view of the abactinal system. Long and careful manipulation at intervals has got rid of sufficient ooze, so that the correct structural relation between this form and that described and figured by A. Agassiz can now be decided. I now find that, although there are some differences in the nature of the buccal membrane and in the numbers of the primary tubercles of the two forms which may be accounted for by their being

* Ann. & Mag. Nat. Hist., July 1877.

of different ages, there is a marked distinction between their apical systems which has nothing to do with age and which transcends any variation. The new form is a true *Salenia* in respect of the position of the extra or subanal plate and of the anal opening; but the form described and figured by A. Agassiz has, as he has noticed, the characters of *Hyposalenia* (that is to say, of *Peltastes*), and it presents in the figure altogether abnormal characters as one of the Salenidæ*. The *Salenia Goesiana*, Lovén, small as the only specimen is, still has all the generic characters of the true *Saleniæ*, and thus is more closely allied to the new form than to *Salenia varispina*. The questions arise, then, Are the new form and *Salenia varispina* varieties of a type, or are there three recent species of Salenidæ? In endeavouring to reply, the value of the generic attribute of *Peltastes* interferes to a certain extent, and it must be admitted that the figures given by A. Agassiz indicate as great a difference between his and the other forms of recent Salenidæ as there is between some of the fossil species of *Salenia* and of *Peltastes*. If it can be admitted that it is within the variability of a species of *Salenia* for the anus to assume the position usually supposed to be characteristic of the genus *Peltastes*, there is no necessity for the alteration in generic title of *S. varispina*; but as yet there is no right to assume it. Under the circumstances, indisposed as we ought to be to alter the generic position of a previously described species and to found a new species on one specimen alone, it appears nevertheless advisable to place the interesting form described by A. Agassiz in the genus *Peltastes*.

The recent Salenidæ may be therefore arranged as follows; and as this communication will deal with the Tertiary forms also, it is as well to introduce their names:—

SALENIDÆ.

Peltastes varispina, Agass. sp.	Recent.
Salenia Goesiana, Lovén.	Recent.
Salenia profundi, nobis.	Recent.
Salenia tertiaria, Tate †.	Australian Cainozoic.
Salenia Pellati, Cotteau ‡.	Biarritz Nummulitic.

The specific characters of the new species will be given

* "The abactinal system has the structure of that of *Salenia*; but the position of the anal system is that of *Hyposalenia*." (A. Agassiz, 'Rev. *Echini*,' 1872, p. 261. Compare his plate iii. f. 8–14 with this statement.)

† Prof. R. Tate, F.G.S., Quart. Journ. Geol. Soc. vol. xxxiii. p. 258, 1877.

‡ M. G. Cotteau, Revue et Mag. de Zool., Mai 1860, p. 212 (Paris).

further on, and after the examination of the morphology of the other recent forms.

To resume the morphology of *Salenia profundi*. The peristome is moderately large and wide, and it bears the ratio of 1·75 to 2·75 to the widest part of the test. It is circular in outline; and the cuts for the gills are small; moreover the edge of the test is slightly everted so as to form a faint marginal ridge. The remains of the gills are to be seen in the specimen; and they are bifid, appearances of a trifid arrangement being visible in some (fig. 10). The actinostome (the opening for the teeth), circular in outline, is at the end of a conical projection of the buccal membrane; its edge is plain, and there are faint indications of imbrication close to it, but not elsewhere on the membrane. This membrane has a rather large surface; it is plain, except close to the actinostome, and presents a remarkably glistening appearance interrupted by minute pigment dots; and this appearance is produced by its containing in its upper layers minute geometrical scales of carbonate of lime separated by less-silvery-looking tissue, and the whole speckled with dark purple pigment. This silvery plain surface reaches to the edge of the peristome, and it becomes continuous with the superficial ornamentation of the test, which, without having the separate microscopic plates, is white, glistening, and pigmented.

Moreover the membrane so covers the ten buccal plates that their place can only be suggested by the presence of the five pairs of buccal tentacles and their associated pedicellariæ: it is continued up onto the base of each tentacle, and it gives origin to the stalks of the pedicellariæ (fig. 9). The buccal tentacles in five pairs are situated at rather more than one third of the distance from the peristome to the actinostome; and one pair is opposite to each ambulacrum. Each tentacle has an elongate and elliptical sucker with fine radiating lines of slight depression at the edge, and a stout stem, which is marked with transverse circular constrictions and also by a few longitudinal striæ which are continuous with those of the edge of the sucker. Each pair of tentacles has two pedicellariæ close to them; and these are situated between and rather internal to them. The pedicellariæ are glistening and icy in appearance; the rather long peduncle is stoutish and is swollen slightly here and there; and at the free end is a rounded knob for the articulation of the cavity of the head. This is broad, tapering, short; and the jaw-slit is short and nearly free from any raggedness. The bifid nature of the pedicellariæ is seen in one instance where the head seized the sucker of the neighbouring tentacle in its death-grasp.

The ends of the teeth are closely applied to each other, and there is no space between their visible sides in the solitary specimen; they are bluntly and broadly keeled externally and have angular ends.

No mention is made by Lovén of the buccal membrane of *Salenia Goesiana*; but A. Agassiz writes as follows regarding that of *Peltastes varispina*:—"The imbricated buccal membrane is covered thickly with plates arranged somewhat as they are in *Echinocidaris*. The ten buccal plates placed halfway between test and teeth are sparingly covered with pedicellariæ" (*op. cit.* p. 261). In *Salenia profundi* the imbrication is of the faintest close to the actinostomial opening, and does not exist elsewhere, and no plates are visible; but as *Echinocidaris*=*Arbacia*, in which genus the buccal membrane is bare, it is probable that there is no great amount of imbrication in the interesting specimen described by A. Agassiz. The actinal cuts are small in the three recent Salenidæ.

Most of the spines being in place in the specimen of *Salenia profundi*, only a few tubercles can be examined; but they are invariably, whether in the interambulacra or in the ambulacra, imperforate. The large primary tubercles of the interambulacra have large bosses; and their crenulation resembles a circular series of nodules around their bases. This appearance, differing from the usual crenulation, is shown to exist in *Salenia Goesiana* by the help of Lovén's magnificent delineation (Lovén, 'Études,' pl. xix. fig. 164). It differs from that drawn by A. Agassiz.

No crenulation is found around the ambulacral tubercles in the two species of *Salenia*; but the following quotation from the 'Revision of the *Echini*' makes it doubtful whether it is not found in the varispine species:—"The primary tubercles of both areas are imperforate, *but distinctly crenulated*." A careful examination of the plate in illustration does not satisfy the eye that there is crenulation in the ambulacra.

The number of the tubercles in the interambulacra of *Salenia profundi* and *Salenia Goesiana* is not more than ten, counting all of both rows; but, although A. Agassiz does not give the number, it is evident from his drawings that there are more than ten in his species. It must be remarked that the size of the specimen described by A. Agassiz is larger than that of the other two forms, and that the increased number of tubercles may be a matter of growth. It is impossible, however, to restrict the number of coronal plates to a "few," or the number of principal tubercles to ten in the genus *Salenia* (see 'Revision of *Echini*,' p. 258); for in the Australian

Tertiary form there are as many as fifteen primary tubercles in an interambulacrum. But, on the other hand, it is evident that the number of primary tubercles is indicated long before the test assumes its largest size.

The recent Salenidæ now under examination have all two rows of small secondary tubercles in each median interradial space; and in this they differ remarkably from the Australian Tertiary *Salenia*, but resemble the Nummulitic species.

A row of small secondaries is placed just outside the poriferous zone in *Salenia profundi*. The ambulacral tubercles of *Salenia profundi* are very decidedly smaller than the largest of those of the interambulacra; they are small, numerous, in two vertical rows; and two or three near the peristome are slightly larger than the others. They are placed so that there is a free vertical space between the rows, in which are placed the vertical set of pedicellariæ. Omitting the remarks about the pedicellariæ and the larger tubercles, the same arrangement prevails in the other Salenidæ as yet known from the deep sea. The ambulacra are narrower than the interambulacra in all, and they slightly diminish in breadth at the peristome.

As the test of the specimen of *Salenia profundi* is not denuded, it is impossible to estimate the number of the pores in the poriferous zone; but the presence of some tentacles close to the peristomial end of the ambulacra indicates that the pores are in simple series and comparatively few in number. In this the species conforms to the description of the varispine form by A. Agassiz, and also to that of *Salenia Goesiana*. There would appear to be a single pair of pores to each ambulacral plate; and, as far as I can determine, each plate has an ambulacral tubercle parallel with the pores. This is not what occurs in the Tertiary forms or in those of more ancient date; for in them there is a pair of pores in relation with each ambulacral tubercle, and also a pair intermediate and in relation with a space between the successive vertically arranged tubercles. The tentacles of *Salenia profundi* are stout, not very long, and present a stem and disk. The stem is constricted here and there transversely; and the circular disk is occasionally ragged at the margin or is marked there by slight furrows. The base of the tentacle is often pigmented. Lovén states that in *Salenia Goesiana* the pores are in simple series and are surrounded by an oval "enceinte" with raised edges. This is not apparent in the other recent Salenidæ, but it is not without its analogue in some fossil forms.

A. Agassiz was struck with the varied nature of the spines of the form he described from the Florida Expedition; and hence its appellation. He writes (*op. cit.* p. 261), "The primary spines are enormous, twice the diameter of the test in length, of a brilliant white colour and of all shapes. Some of them are uniformly tapering, others swelling at about one third the distance from the base, others flattened and curved, but all longitudinally striated and loosely covered with sharp spines irregularly arranged along the body of the spines. The secondary spines, as well as the greater number of the spines of the ambulacra, as far as the ambitus, are short club-shaped, sometimes curved and flattened, longitudinally striated, with slight serrations. These short spines give to the median interambulacral and ambulacral zones the aspect of the corresponding zones of *Cidaris*, but they are not, as in *Cidaris*, arranged in a circle around the base of the primary spines. These small spines, as well as the whole abactinal area, are covered with prominent dark violet pigment-cells, standing in striking contrast to the white primary spines." In the plate (pl. iii. figs. 8 and 14, *op. cit.*) A. Agassiz delineates this remarkable variety of spines. Lovén does not notice spines at all; and hence we may suppose that his specimen was denuded.

In the specimen of *Salenia profundi* the spines are all preserved, and are of great interest, both on account of their variety and ornamentation.

The few largest primary tubercles situated above the ambitus and close to it bear very long spines, which are $\frac{11}{10}$ inch long, or very nearly four times the length of the diameter of the test (fig. 11). These largest spines are slender, and taper off gradually towards the end, but are slightly swollen midway and towards the succeeding quarter of their length. Usually they are nearly straight, cylindrical, and pin-shaped. They are finely ridged longitudinally, there being ten or twelve low long ridges with corresponding grooves, and the ridges are very minutely aciculate or serrate. They are not flat or much bent; and the spinules on them are in regular whorls at stated intervals. The spinules are numerous in each whorl, and are bent, the point being outwards and nearly parallel with the spine. The whorls succeed a plainly striated region close to the base of the spine above the socket, and are closer together than further up. Then they become fewer and smaller, and finally disappear near the tip, where the delicate ridges or flutings become finer and are either excessively minutely serrate or the termination has a cellular appearance under a moderate magnifying-power. Pigment granules are seen on the lowest part only of the largest spines; but most of the fine ornamentation is covered with a fluffy adventitious matter.

Other long spines, shorter than the above, are more slender, and the whorls of spinules are not so numerous; but there is still a faint pigmentation on and just above the milled ring. A third set of spines are shorter and more slender than these last; and a fourth, noticed close to the peristome, in the ambulacra and just above the sphæridia, are still smaller, slightly bent, with or without whorls of spinules, and with the pigmentation carried along further on the longitudinal ridges (fig. 6).

The next group of spines are very remarkable, and they are all short. Some are large at the milled ring, and stout and conical, looking like aborted great spines; they are marked with lines of pigment to the tip. Others are smaller and have serrate edges to the ridges and the same kind of ornamentation (fig. 5). In all these kinds of spines the milled ring is large and faintly crenulate.

Finally there are numerous flat club- or stout spatula-shaped short spines on the ambulacra and median interambulacra. These are situated on small tubercles, which are not crenulate; and the milled ring of each spine is a mere expansion: usually the shaft is constricted for a space and then expands gradually and rounds off close to the tip (fig. 4). Some are rod-shaped (but this is not common); and some are bent laterally; and in all, lines of pigment run longitudinally and conform to the outline, having a dotted appearance here and there. Some of these spines are found on the anal membrane, which covers the plates there (fig. 2); and they are evidently connected with minute tubercles. A vertical row of these spines, many being small and thin, covers the tubercles just outside the poriferous zone in the interambulacra. Finally, above the ambitus it will be noticed that in one or two places the club-shaped spines do assimilate in position to those of the Cidaridæ, and environ more or less the bases of the great tubercles. The vertical rows of these spines, both in the ambulacra and in the median space of the interambulacra, diverge at their tips, and present the appearance so well illustrated by A. Agassiz (fig. 4).

The comparison of these spines and those described by A. Agassiz with the fossil forms will be made in the next communication; but it is as well to remark that the resemblance is only in the variety of the spines in a slightly clubbed condition in the fossils and in some of them being bent.

The abactinal system of *Salenia profundi* differs materially from the form described by A. Agassiz, and less so from *Salenia Goesiana*. I agree with Lovén, Wright, and Cotteau, and have always taught, that the position of the madreporic plate is forwards and to the right; and I am impressed with the truth of the observations and demonstrations of the great Scandinavian naturalist relating to the distribution of the pores and tubercles at the peristomial margin with reference to the antero-posterior axis of the test. A. Agassiz maintains the exactly opposite opinion, and places the madreporic plate posteriorly and to the left. As the question has been ably advocated by the above-mentioned authors, it is only necessary to refer to their works on the subject. But it is by no means easy to distinguish the madreporic plate from the others in most Salenidæ; yet a guide to its position may be found in the fact that the anus proper infringes upon two generative plates, which in the genus *Salenia* are posterior, or rather one is posterior and the other posterior and to the right; hence the madreporic plate will be found immediately anterior to this last-mentioned plate. If the test be so placed that the generative plates are in this position, an ocular plate (that to the left of the madreporic plate) will be directly anterior, and a line drawn through its middle and carried directly backwards will run along the suture between the madreporic plate and the left anterior generative plate, and will pass over the so-called sub- or suranal plate and reach the margin of the anus.

In the new species of *Salenia* the abactinal system, more or less pentagonal, covers nearly the whole of the abactinal surface: it is irregularly convex, and the highest point is not quite central, and is situate in a part of the raised margin of the eccentric anal orifice where it is in contact with the subanal plate (subanal meaning before the anus) (fig. 8). This convexity, accompanied as it is by an eccentric position of the anus, which, moreover, slopes backwards and to the right, renders any delineation of the apical disk, except as a diagram, very incomprehensible. The subanal plate is central, the anal opening infringing on its posterior and right part; and it slopes away from the raised margin of this opening. The posterior and the right posterior generative plates, which with the subanal plate contribute to the anal opening, are narrow, the orifice reaching not very far from their outer edges. To complicate the comprehension of the disk, the whole surface is studded with papillæ,—not embryonic spines; for they are not placed on tubercles, but are minute wart-like projections of the test, usually smallest at the base and rounded at the top, the whole surface being reticulate, mulberry-looking, and pigmented with dark-violet grains in the furrows (fig. 3). Some are thin, and some are longer than others; some, especially in the margin of the anus, are broad; and many are crowded in the ocular plates. They are separated by slight spaces, in which are short pedicellariæ; and they hide the generative and ocular pores. As water soaks in easily when placed on the plates, there is no doubt that the pores are there; but the madreporic plate has no evidence of its peculiar body. The madreporic plate is slightly longer in the antero-posterior direction than the others; it has a group of close and rather tall, rounded processes of the test in the middle; and its free edge is slightly convex, and is rendered irregular by the outward projection of some similar growths. It is pentagonal, and the outer edge is shorter than that connected with the generative plate behind and the subanal plate. Next in size is the left anterior generative plate: it is irregularly covered with the peculiar processes; and pedicellariæ are between them. The generative plate behind this one is narrower and longer, and is covered with the same kind of ornamentation and pedicellariæ. The posterior plate of all is very narrow; for the anus infringes much upon it. The remaining generative plate is irregular in shape, generally narrow; and, like that last mentioned, is covered with the peculiar processes and pedicellariæ.

The two plates last mentioned are the smallest, and they contribute to the formation of the anal opening.

The subanal plate, in front and to the left of the anus, is irregularly geometrical in outline, is aslant, curved, and ornamented like the others. It is smaller than the madreporic plate.

There is no projection of the outer edges of the generative plates upon the test beyond the line of the ocular plates; and they are ragged from ornamentation.

The sutures are marked by distinct purple pigmentation; they are slight furrows; but no lateral slits or pores are noticed.

The ocular plates differ in size. The front one and the right in front are the largest; all are very irregular in their shape on account of the ridges and processes upon them (fig. 3). In some there is a prominent outer angle, and then the free edge is nearly straight and nodular, and the right posterior is very close to the anal margin. The smallest ocular plates are the posterior. The pedicellariæ are well seen in some.

The anus is large (fig. 2), nearly circular, and but slightly elliptical; it is eccentric in the right posterior direction; and its raised margin is nearly complete. It infringes on the subanal, the posterior, and the right posterior generative plates, and is behind and to the right of the centre of the apical system. The subanal plate, irregularly pentagonal, limits about one third of the anus; and the suture between the posterior plate and the subanal crosses the raised margin, as does that between the subanal and posterior right generative plate. The margin thus incised is composed of processes from the subanal and the generative plates just mentioned, and is ragged from the presence on it of the peculiar broad processes already noticed. The anal membrane covers in the anus, except at a small spot rather to the right of and behind the centre; and there are at least two imperfect concentric rows of embryonic spines and ornamental processes on the membrane, the opening being in the midst; pedicellariæ exist there also (fig. 2).

With regard to the species described by A. Agassiz, that author may be thus quoted from the 'Illustrated Catalogue of the Museum of Comparative Zoology at Harvard College—No. VII. Revision of *Echini*,' pts. i. and ii. p. 262:—"The abactinal system covers nearly the whole of the abactinal part of the test; the anal system is eccentric. There is a marked difference in the size of the genital plates, the three posterior ones being much larger than the two anterior ones; the reverse is the case with the ocular plates. In the largest genital plate there is a trace of the madreporic body, corresponding to the position of the axis assigned to it by Forbes, Müller, and Wright, which cuts the symmetrical axis of the subanal plate at an angle. This is the case also with the angle made by the axis of the madreporic body and the first anal plate of young *Echini*; the position of the axis passing through the anal plate has no definite relation to the madreporic body. The anal opening is covered by small plates, as in other *Echini*.

"The whole abactinal system is studded with embryonic spines, which are longest along the exterior edge of the abactinal system, thus separating it most distinctly from the test. The sutures between the plates are sharply cut with deep pits at the angles of junction of the genital and subanal plate and of the ocular and genital plates. The three larger genital plates have also pits in the middle of their line of junction with the subanal plate. The genital openings are large, placed in the middle of the plates."

A. Agassiz gives slightly magnified views of the specimen from which his description was taken; and the abactinal region is shown with the surrounding spines in one figure, and separate and only connected with an interambulacrum and a whole or a part of an ambulacrum in a second (*op. cit.* pl. iii. figs. 8, 11). These beautiful lithographs show that the form is exceptional amongst the genus *Salenia*; for the anal opening infringes on one generative plate instead of on two, and four generative plates are in contact with a fixed anal plate which extends on all sides but one around the anal opening. The bulk of the subanal plate is close to and on the side of the madreporic plate; and the almost circular anal opening is eccentric and its position, as A. Agassiz remarks, as in the test of *Hyposalenia* ("The abactinal system has the structure of *Salenia*; but the position of the anal system is that of *Hyposalenia*," *op. cit.* p. 261). *Hyposalenia* = *Peltastes*.

Taking the drawing of A. Agassiz's form (plate iii. figs. 8, 11, Revis. *Echini*) and placing the ocular plate to the left of the madreporic body directly in front, a line drawn through this plate will enter the suture between the madreporic and left front genital plates, and will infringe on the subanal plate; carrying it on, the line will cross the anus leaving the bulk of it to the *left*, and will then cross the posterior genital plate. The anus is very nearly central as regards the antero-posterior axis, and only slightly to the left; but it is behind the anterior half of the apical disk. In this position the two anterior genital plates are the largest, and the two posterior ocular plates are the largest. The subanal plate is of great size, and occludes the right posterior plate as well as the left posterior. The anus is marked with ornamentation, and the plates appear to radiate; only the posterior plate and the subanal limit the anus. The disk is pentagonal and large; and were it that of a fossil form the species would be placed in the genus *Peltastes*; its differences from that of *Salenia profundi* are very evident.

Lovén thus describes the apical system of his *Salenia Goesiana*:—"The apical system is very large, occupying the greater part of the upper surface; the subanal plate is pentagonal; and the generative plates are very large, hexagonal, with a slightly pronounced seventh angle, corresponding with the reentering angles of the last interradial (interambulacral) plates. The madreporic plate is larger than the others; and the anal orifice is formed by almost equal portions at the expense of the subanal plate and of the posterior and right posterior generative plates. It is oval and has a raised margin. The ocular plates are pentagonal, remote from the anus, and their pore is close to the external edge. All the surface of the apical system is crowded with a great number of tolerably long sessile prominences, which are cylindrical, with a rounded, swollen, reticulate punctate and lobed summit; they are close on the periproct, which is furnished with them. The diameter of the individual is 3·5 millims.; and the madreporic body is visible from within, but not the generative pores."

Lovén's exquisite drawings show the raised anal margin with its crowd of processes, and the similar bodies on the plates. They are more pronounced than in *Salenia profundi*, less close, but identical in structure; they are not rudimentary spines. The form is a true *Salenia*; and the ovoid anus is eccentric, posterior, and to the right. The large size of the right and left and posterior plates is remarkable, and, with the difference of the ornamentation and the number of papillæ, distinguishes the species, partly, from *Salenia profundi*.

In concluding this part of this essay it is necessary to point out the specific characters of *Salenia profundi*.

Salenia profundi, sp. nov. (Pl. VII. figs. 1–11.)

The test is depressed, the inferior surface being flat and the upper slightly convex. The greater part of the upper surface is occupied by the apical system; the peristomial space is large, and the rest of the test is crowded with tubercles and their spines. There are ten primary tubercles (some very large and some small) in the two vertical rows in each interambulacrum; their spines are of different lengths, some more than four times the diameter of the test, others less, and some very short and conical. The longer spines, often slightly bent, are pin-shaped, with a large milled ring and a constriction beyond. There are two vertical rows of secondary tubercles in the median interambulacral spaces, and one row between the primary tubercles and the poriferous zone. All these have short club-shaped, straight or curved or broad spatula-shaped spines, striated and pigmented.

The ambulacra are narrow, and there are two vertical rows of tubercles closely packed, just within the poriferous zones; and their spines resemble those of the small tubercles of the interambulacra. Other tubercles near the peristome support cylindrical spinulose spines; all are ornamented with pigment granules. The pores are few in number, in simple series, a pair corresponding with each tubercle. Pedicellariæ are amongst the spines, and are short and blunt-headed and bifid.

Sphæridia exist, two close to the peristome and one higher up in each ambulacrum.

The surface of the test is pigmented with dots and granules of dark purple. There are ten buccal plates, the opening for the teeth (actinostome) is small. Teeth triangular and slightly keeled; buccal membrane plain, and only slightly imbricated near the teeth.

Cuts slight; branchiæ bifid or trifid. Pedicellariæ in pairs near the buccal tentacles.

The anus, with a raised margin, is eccentric posteriorly and to the right, and is formed at the expense of the hexagonal subanal plate and the posterior and right genital plates, which are the smallest. The disk is pentagonal, and the madreporic plate is slightly the largest. Next in size is the plate to the left. The ocular plates are well developed, the three anterior being the largest. The anus has a membrane, and under it plates supporting small spines. All the surface of the apical system is crowded with short, blunt, cylindrical, round-tipped, reticulate, and lobose processes, between which are pedicellariæ; the processes are found on the anal margin, on the anal membrane, and they project from the free surface and edges of the plates.

EXPLANATION OF PLATE VII.

Fig. 1. *Salenia profundi*, Dunc., $\times \frac{3}{2}$.
Fig. 2. Anal opening, magnified.
Fig. 3. An ocular plate and part of a generative plate, magnified.
Fig. 4. Club-shaped spines and a pedicellaria, magnified.
Fig. 5. A short serrate spine, magnified.
Fig. 6. A spine at the peristome end of an ambulacrum, magnified.
Fig. 7. A tentacle of a pore, magnified.
Fig. 8. Diagram of the apical disk.
Fig. 9. A pair of buccal tentacles, pedicellariæ, and membrane, magnified.
Fig. 10. A gill.
Fig. 11. A large spine, slightly magnified.

XXXIV.—*Studies on Fossil Sponges.*—I. *Hexactinellida.* By Karl Alfred Zittel*.

Systematic Position of the Hexactinellida.

Among the numerous discoveries of O. Schmidt in the department of spongology, none has acquired such widely influential importance, from a palæontological point of view, as the establishment and definition of the orders Hexactinellida and Lithistida†. Wyville Thomson‡ had indeed previously indicated the relationship of the Ventriculites of the English Chalk to certain living siliceous sponges; but it was only after Schmidt had shown that the so-called "glass-sponges" (*Vi-*

* Translated by W. S. Dallas, F.L.S., from a separate copy of the memoir in the 'Abhandlungen der k. bayer. Akad. der Wiss.' II. Cl. Band xiii. 1877, communicated by the author.

† 'Grundzüge einer Spongienfauna des Atlantischen Gebietes,' Leipzig, 1876.

‡ 'The Depths of the Sea,' Royal Dublin Society, April 1869, and 1873, p. 483.

trea) of Wyville Thomson included two fundamentally different types, the Hexactinellida and Lithistida, each of which possesses numerous fossil precursors, that a foundation upon which one may go on building was afforded to palæontology.

As I have already shown in a previous memoir*, the suggestions of these naturalists were but little attended to by palæontologists, who continued as before to stick to the unsuccessful systems of D'Orbigny and Fromentel; and although timid attempts had already been made by Étallon†, F. A. Römer‡, and most recently by Pomel§ to take into account the structural conditions even in fossil sponges, these remained without results, owing to the macroscopic method of investigation which had been hitherto almost exclusively employed.

In the meanwhile the knowledge of the recent Hexactinellida and Lithistida has been so essentially advanced by Carter‖, W. Marshall¶, Saville Kent**, Bowerbank††, Wyville Thomson‡‡, Wright§§, and others, that these orders of sponges, comparatively late as was their discovery, are now amongst the most carefully studied.

As to the separation of the Hexactinellida and Lithistida, which had been united by Gray as Coralliospongia, by W. Thomson as Vitrea, and by Bowerbank as "Siliceo-fibrous Sponges," no noteworthy difference now exists between most students of living sponges. The differentiation of the two orders is indeed remarkably sharp, and may be carried out with equal certainty for the fossil forms.

In the Hexactinellida the siliceous skeleton consists of elements founded almost without exception upon three axes crossing each other at right angles; while in the Lithistida the axes generally come together at an angle of 120°‖‖, and in this way chiefly form quadriradiate bodies, which are united

* "Ueber Cœloptychium," Abh. d. k. bayer. Akad. II. Cl. Band xii. Abth. iii. 1876.

† 'Actes de la Société Jurassienne d'émulation pendant 1858,' Porrentruy, 1860, p. 129.

‡ "Die Spongitarien des norddeutschen Kreidegebirges," Palæontographica, xiii. 1864.

§ Paléontologie de la Province d'Oran, 5e fasc. Spongiaires, 1872.

‖ Ann. & Mag. Nat. Hist. 4th ser. vol. xii. 1873, pp. 349 and 437.

¶ Zeitschr. für wiss. Zool. Bd. xxv. Suppl., and Bd. xxvii. p. 113.

** Monthly Microsc. Journ. 1870, vol. iv. p. 241.

†† "Monograph of the Siliceo-fibrous Sponges," Proc. Zool. Soc. 1869, pp. 66 and 323; 1875, pp. 272, 503, 558; and 1876, p. 535.

‡‡ Ann. & Mag. Nat. Hist. 4th ser. vol. i. 1868, p. 119; Depths of the Sea, 1873; and Phil. Trans. 1869, p. 701 (on *Holtenia*).

§§ Quart. Journ. Microsc. Sci. vol. x. 1870, p. 4.

‖‖ Not 130°, as stated in my monograph on *Cœloptychium*, p. 45, in consequence of a misprint.

with each other in a peculiar manner, as will be shown in a subsequent memoir.

Together with the triaxial and quadriaxial fundamental forms, uniaxial spicules occur in abundance both in Hexactinellida and Lithistida, as well as multiaxial siliceous bodies more isolatedly *.

O. Schmidt, Carter, and Marshall find no close relationships between the Hexactinellida and the other existing sponges. The order is quite isolated, and shows no transitions towards other families in any direction. It is true that Saville Kent at first thought he had found a point of union between Hexactinellida and Tethyida in the genus *Dorvillia* † ; but it afterwards turned out ‡ that the six-rayed spicules observed by Kent had got accidentally into the body of the sponge, and that consequently the genus *Dorvillia* had to disappear from our literature, as a synonym of *Tethya*.

The fossil Hexactinellida are no less sharply separated than the living ones from all other sponges, and especially even from the Lithistida. This statement contradicts the opinions expressed in my monograph of *Cœloptychium* §, which I founded upon the occurrence of free siliceous structures in the skeleton of *Cœloptychium*. I believed then that, from the occurrence and the state of preservation of these multiform bodies, I might conclude that the genus *Cœloptychium* possesses spicules of uniaxial, triaxial, quadriaxial, quinquiaxial, and multiaxial type; but the continuation of my studies on fossil sponges taught me that it is only in rare cases that the free siliceous structures are still so intimately united to the coherent skeleton that they can be made available for systematic purposes.

In certain localities we frequently find perfectly different sponge-bodies filled with the same spicules; and an examination of the surrounding rock almost always shows a superabundance of the corresponding structures. Petrogenetically sponge-spicules in general play a much more important part than has hitherto been supposed ||.

As regards the free siliceous spicules figured in my monograph of *Cœloptychium*, I believe now that I may refer the forms represented on pl. vii., and especially the irregular ones with the short axial canals, for the most part to definite

* The latter have been demonstrated with certainty only in Lithistida.

† Monthly Microsc. Journ. 1870, p. 293.

‡ Ann. & Mag. Nat. Hist. 4th ser. vol. vii. 1871, p. 37, and vol. x. 1872, p. 209.

§ *Loc. cit.* pp. 34, 49, 53.

|| See also Rutot, Ann. de la Soc. Malacologique de Belgique, ix. 1874.

Lithistid genera. The majority of the anchorates and quadri- and octoradiates figured in pl. vi. may also belong to the same order.

In general, I am now inclined to adopt Carter's views, and to ascribe to a multifarious origin the free siliceous structures which occur, probably as accidental additions floated into the Cœloptychian framework. By this means, as a matter of course, the basis is taken away from my systematic conclusions*, founded upon the nature of the free spicules.

O. Schmidt, in a phylogenetic Table †, derives the living Hexactinellida from the fossil Ventriculitidæ. If the latter denomination is used merely to express a difference of age, there is nothing to be objected to this. But as a systematic conception the Venticulitidæ, at least in the sense adopted by O. Schmidt, must disappear, as they in every respect belong to the true Hexactinellida.

Nor can the so-called "Vermiculatæ," which O. Schmidt regards as the precursors of the Lithistida, be with any more propriety separated from the latter. The designation Vermiculatæ, moreover, would have to be suppressed for the further reason that among the fossil sponges "with vermiform tissue" there are not only true Lithistida, but also Calcispongiæ with anastomosing fibres.

Whether the Lithistida have proceeded as a lateral branch from the Hexactinellida, as W. Marshall ‡ seeks speculatively to show to be probable, must for the present remain an open question. From the palæontological point of view scarcely any thing can be adduced in favour of this hypothesis; for, although little that is reliable has been published on the distribution of the fossil Lithistida, yet they were certainly by no means first developed in the Cretaceous period, as Marshall supposes. I am acquainted with many typical Lithistida from the Jura; nay, they even appear as an independent stock (*Aulocopium*), side by side with the Hexactinellida, as early as the Silurian epoch.

Hitherto, therefore, the investigation of living and fossil Hexactinellida appears to demonstrate a sharp demarcation on all sides of this order.

State of Preservation of the Fossil Hexactinellida.

Considering the surprising morphological agreement of many fossil and recent forms, it must appear rather strange

* *Loc. cit.* p. 53. † *Loc. cit.* p. 83.

‡ "Ideen über die Verwandtschaftsverh. der Hexactinelliden," Zeitschr. für wiss. Zool. xxvii. p. 134.

that their close affinities have been hitherto entirely misunderstood by palæontologists. The chief cause of this consists in the former defective, purely macroscopical method of investigation adopted by palæontologists. On the other hand, however, it must not be concealed that, until quite recently, with the exception of *Farrea*, only those forms of living Hexactinellida (*Hyalonema*, *Euplectella*) were known which, as the most highly differentiated offshoots of the entire group, show the least agreement with its fossil representatives. To this must be added, further, the extremely peculiar state of preservation of very many fossil Hexactinellida, which of necessity must have given rise to erroneous conceptions of the chemical composition of these sponge-bodies. A glance at palæontological literature, therefore, even in the most recent times, shows us the most divergent opinions as to the original constitution of the fossil sponges, to which we have here to give a close consideration.

By the older authors (Guettard, Parkinson, Münster, Goldfuss, &c.) the petrified sponges were regarded either as transformations of horny skeletons or as originally calcareous skeletons. Toulmin Smith described the original condition of the Ventriculite as "membranaceous." D'Orbigny, Etallon, Quenstedt, Pictet, and Fromentel regard nearly all fossil forms as calcareous sponges (Petrospongia). Of the authors who have more recently been active in the spongological province, Pagenstecher, Capellini, Rosen, Sinzow, Harvey Holl, Kayser, &c. adopt the opinion that the fossil skeletons are calcareous or siliceous pseudomorphs of a body originally composed of horny fibres. Only F. A. Römer and A. Pomel ascribe a siliceous skeleton to at least a number of fossil forms.

This uncertainty as to the original chemical constitution may well excite our surprise, especially as we have to do with a substance so resistant as silica. That certain sponges from the White Chalk of England and North Germany (*e. g.* from the Quadratus Marls of Ahlten, Coesfeld), and especially from the Malm of the Franconio-Swabian Jura can be freed from the containing rock by treatment with dilute muriatic acid so completely that the skeletons appear quite clean, as if just taken out of the sea, has long been known, at least for the Jurassic forms. But these beautiful skeletons were generally none the less regarded as products of the metamorphosis of horny or calcareous sponges. The reason for this assumption was, that in the deposits which contain such sponges many other fossils with originally calcareous shells (Mollusca and Echinoderms) generally occur silicified. Moreover it was found that in many cases half or a small portion of a sponge-body could be admirably prepared by treatment with dilute acid, whilst the whole remainder of the mass, although apparently of the same constitution, was completely dissolved. By the preparation of thin slices it was ascertained that such completely soluble sponges in fact possess a skeleton consisting of calcspar.

In the Franconio-Swabian and Swiss Jura, sponges which perfectly agree morphologically with the living Hexactinellida are more frequently furnished with a calcareous than with a siliceous skeleton. At other localities, on the contrary, as near Nattheim, Oerlingen, Muggendorf, Engelhardsberg, &c., the sponges, like all the other fossils, appear in a roughly silicified state, which, however, has evidently been produced under the influence of the process of fossilization.

In the Upper Cretaceous deposits of Ahlten, Linden, and Lemförde, in Hanover, and of Coesfeld, in Westphalia, the Hexactinellid sponges are likewise almost without exception siliceous. But while the skeletons from Nattheim and the last-mentioned Jurassic localities have acquired a semicrystalline, rough texture, and, when examined under the microscope, no longer exhibit the finer structural characters (such as axial canals and ornamentation of the fibres), the Cretaceous forms behave under the microscope exactly like macerated skeletons of living Hexactinellida.

A corresponding constitution is also possessed by the siliceous parts of those sponges in which a portion of the skeleton consists of calcspar, or which are derived from beds in which calcareous and siliceous skeletons occur together. Here belong especially the forms from the true Spongitenkalk of the White Jura, γ and δ, in Swabia and Franconia. In such cases it can hardly be determined beforehand whether when treated with acids the skeleton will be completely destroyed or beautifully macerated. The siliceous skeletons here obtained, sometimes in a beautiful state, sometimes quite fragmentary, yield but little to the living Hexactinellida as regards the preservation of the finest ornamentation and the distinctness of the axial canals. Optically, however, they show a peculiar behaviour.

Thus, if small fragments obtained by corrosion or thin slices be mounted in Canada balsam, or in any other resin with a similar coefficient of refraction, a very indistinct image is obtained when they are examined by the microscope. The outlines are not sharply marked, and scarcely any of the more delicate ornamentation makes its appearance. The object stands out but little from the enclosing substance, and evidently presents exactly the same conditions of refraction as the Canada balsam. But, on the contrary, if we treat the same object with glycerine or water, the image leaves nothing to be desired in the matter of clearness and sharpness. All preparations derived from such sponges must therefore be mounted in glycerine. Many Cretaceous sponges from the North-German and Bohemian Pläner, in which also only particular parts of the skeleton still consist of silica and remain after the action of muriatic acid, behave in the same way.

With living siliceous sponges, as also with fossil skeletons from the above-mentioned localities of the Cretaceous formation, where the hexactinellid sponges always present a siliceous composition, Canada-balsam is the best medium for mounting preparations. On the other hand, if living or Cretaceous sponges which furnish beautifully clear images in Canada balsam are put into glycerine, the same phenomenon is observed as when the Jurassic sponges are treated with Canada balsam. The image loses all its sharpness and clearness; and, indeed, under some circumstances it is so obliterated that with tolerably bright illumination scarcely any thing can be seen.

In correspondence with these remarkable phenomena, there is also a divergent behaviour under polarized light. All recent siliceous sponges, whatever the form of the parts of the skeleton may be, consist of simply refractive, amorphous silica. This is the case also with many Cretaceous forms, which must be mounted in Canada balsam. But if we bring a preparation of the Jurassic forms above described, mounted in glycerine or water, under the polarizing apparatus, the most vivid colour-phenomena are obtained on turning the Nicol's prism. The fragments of the framework or spicules show the spotted many-coloured iridescence so characteristic of quartz, and, indeed, often quite as strongly as small quartz-grains, which may have got accidentally into the preparation. I know of no other similar optical behaviour in organized silica. Sometimes, indeed, in Diatomaceæ or Radiolaria, we observe faint colours on the rotation of the prism, but never a phenomenon of such intensity as in the case of these Jurassic or Cretaceous sponges. Between this decidedly doubly refractive silica and the unaltered amorphous silica there are, however, many stages of transition. The siliceous sponges from the Quadratus chalk of Linden, near Hanover, for example, are visible both in Canada balsam and in glycerine; and with these, in a certain position of the prism, slight colour-phenomena are also obtained in the polarizing microscope.

This singular optical behaviour indicates distinctly that in the older siliceous sponges a physical alteration has occurred, by which the originally singly refractive silica has been converted into doubly refractive silica. Whether this phenomenon has been produced by strong fission and numerous small clefts or by a change in the position of the molecules, as in the slow conversion of amorphous into crystalline sugar, or whether chemical influences have intervened in this case, I am unable at present to decide*. At any rate, however, the optical properties of the above-mentioned fossil siliceous sponges prove that a certain alteration has taken place in the substance of the skeleton. This fact is further confirmed by their constitution in other respects.

When examined by direct light, they do not appear with a bright glassy lustre and transparent, like living siliceous sponges, but dull, white, and opaque. Of the thin concentric layers of which the siliceous structures of the sponges are composed, nothing can be detected even under the highest powers; and the whole surface is more or less corroded by innumerable small depressions and elevations. It is true that by means of Canada balsam or glycerine the originally turbid fragments may be rendered completely or more or less transparent, but still without attaining the limpidity of the recent glass-sponges.

As these phenomena are most strikingly observed at those localities where at the same time fossil Hexactinellida or Lithistida occur with calcified skeletons, the idea of a physical alteration presents itself irresistibly. The behaviour with caustic alkalies also leads to the same conclusion. Thus, whilst amorphous silica dissolves pretty readily in solution of potash or soda, the Jurassic Hexactinellida with double refraction are but little attacked even by strong boiling, and only dissolve after long digestion, when they leave a very small residue. The less altered Cretaceous siliceous skeletons with single refraction are a little more easily soluble.

The opinion has been orally expressed by those whose opinion is worthy of consideration, that among the fossil sponges there may have been forms which indeed perfectly agreed morphologically with certain existing Hexactinellida or Lithistida, but in which the skeleton was originally composed not of silica but of carbonate of lime.

A microscopic examination of the calcified Hexactinellida at once does away with this notion. In the case of a sponge from the White Jura of Streitberg, for example, half calcified, half siliceous, if we examine a thin slice of the calcified por-

* Similar optical phenomena in flint, which, however, certainly, like the singly refractive menilite, has originated from amorphous silica, lead to the assumption of a metamorphosis of the same kind even in the massive siliceous segregations in the chalk.

tion, we find that the trabeculæ, which cross each other at right angles and form cubical meshes, consist of crystallized calcspar. In their general form the calcareous parts of the skeleton are undistinguishable from the siliceous parts; but while in the latter the axial canals are most distinctly preserved in the interior of the trabeculæ, the calcareous parts prove to be completely solid: the calcspar forms a homogeneous, undifferentiated mass. The absence of the axial canals in the calcareous and their presence in the siliceous parts of one and the same sponge-body, appear to me to furnish incontrovertible proof that silica formed the *original* substance of the skeleton, and that the Hexactinellida and Lithistida composed of calcspar have changed their chemical constitution only in consequence of the process of fossilization; calcspar has consequently taken the place of the amorphous silica which was originally present.

This somewhat unusual pseudomorphosis implies that previous to the penetration of the carbonate of lime the siliceous skeleton was dissolved and carried away. Considering the comparatively easy solubility of amorphous silica in water impregnated with alkaline substances, this process presents nothing startling, especially if we consider what an extended surface the siliceous parts, furnished with axial canals and composed of concentric layers, presented to the solvent.

The occurrence of Hexactinellida and Lithistida in which either a part or the whole of the siliceous framework has been removed, and in which the place of the siliceous fibres is occupied by hollow tubules, forming a network of meshes in the penetrated mass of rock, is, in fact, quite an ordinary phenomenon. Toulmin Smith has already described examples of it from the White Chalk of England; and this state of preservation shows itself still more frequently in the sponges from the ferruginous and sandy Upper Chalk of Saratow, in Russia. By treatment with dilute acid, separate and, indeed, generally small parts of the skeleton of such sponges are beautifully macerated, whilst by far the greater part of the fossil is entirely dissolved. Examination with the lens then shows immediately that in the soluble parts the siliceous framework is replaced by fine cavities, which furnish a true picture of the original skeleton*.

Not unfrequently the cavities produced by the removal of the siliceous fibres are entirely or partially filled with rust-

* Upon this point see Rosen, 'Ueber die Natur der Stromatoporen,' Dorpat, 1867, pp. 16 *et seq.* That the explanation of this state of preservation attempted by Rosen is erroneous, must appear from the above statements.

coloured hydrated peroxide of iron. This state of preservation is especially frequent in the North-German and Bohemian Pläner; rarer in sponges from the White Chalk, the Sandstone of Saratow, and the White Jura.

The filling of the cavities with crystallized calcspar occurs chiefly in the Spongitenkalk of the Upper Jura in Switzerland, Württemberg, Bavaria, and Poland. Here there are localities in which the whole of the siliceous frameworks are entirely converted into calcspar (Würgau, Boll, Oberbuchsiten); whilst in others (*e. g.* Schauergraben near Streitberg, Wodna near Cracow) the original siliceous substance is preserved, but has acquired the optical nature already mentioned.

If we regard the above explanation of the different states of preservation as correct (and, from the morphological identity of the fossil and living Hexactinellida, other hypotheses which ascribe to the sponges under consideration an originally horny or calcareous skeleton are plainly inadmissible), the question arises, what has become of the dissolved silica of the sponge framework?

In the White Chalk this question offers no particular difficulties. The occurrence of massive flint nodules is pretty generally explained by a concentration of the silica obtained by the lixiviation of siliceous organisms and especially of sponges. In the Spongitenkalk of the White Jura also such siliceous segregations are not entirely wanting, although they are present in less abundance than in the White Chalk. In certain regions, indeed (the sponge-beds of Boll, Streitberg, &c.), we seek in vain for flint-nodules; and nevertheless in such localities, side by side with but slightly altered siliceous skeletons, there are numerous specimens converted into calcspar. In such cases the dissolved silica was frequently employed in the silicification of other fossils; for it is exactly in the immediate vicinity of sponges that we find the most shells of Mollusca and Echinoderms converted into silica. Moreover the dissolved silica appears to be distributed through the rock in another form. Thus in the treatment of entirely or partially calcified Jurassic sponges we frequently obtain, in the residue of corrosion, innumerable rounded rough siliceous disks, furnished with deep impressions, or perfectly irregular vermiform bodies *.

Besides the states of preservation already described, we sometimes find the whole sponge-body penetrated by iron-pyrites, and partly converted into brown ironstone. Such

* Such a body is figured by Oscar Schmidt (Spong. Atl. Oc. Taf. ii. fig. 19).

examples, like the roughly silicified specimens, only present us with a picture of the external form; they are quite unfitted for the investigation of the structural characters.

Attempts at Classification by Saville Kent, Carter, and Marshall.

All previous attempts to express the relationships of the Hexactinellida in a systematic classification were necessarily confined to the living representatives of the group, on account the complete want of knowledge of the minute structure of the fossil forms. As Bowerbank includes under the "Fibro-siliceous Sponges" both the Hexactinellida and the Lithistida, and his monograph, which appeared in small divisions, really consists only of descriptions of species, it cannot receive any particular consideration here.

The first attempt at a system is due to Saville Kent*. According to this author the Hexactinellida are divisible into two suborders:—

Coralliospongia, Gray.

Sponge-body with a skeleton consisting of interwoven or isolated spicules, never reticulate and coherent. Gemmules without spicules.

Calicispongia, S. Kent.

Sponge-body with an anastomosing or coherent reticulate skeleton. Reproductive gemmules membranous, without spicules.

W. Marshall † has already given expression to the doubts that exist as to the systematic estimation of the gemmules, about which so little is known. With fossil forms this character is, of course, useless. But the grouping of the genera also appears not to be natural. Thus in the first suborder we have *Euplectella* and *Habrodictyon*, together with *Farrea* and *Aphrocallistes*; whereas the first two evidently show much nearer affinities to *Hyalonema*, *Askonema*, *Holtenia*, &c. That the Lithistid genus *MacAndrewia*, Gray, still finds a place among the Coralliospongia, is probably due to an oversight.

A complete revision of the living Hexactinellida known up to the year 1873, with a systematic arrangement, was published by Carter in two excellent memoirs on Hexactinellida

* Monthly Microsc. Journ. vol. iv. p. 242.
† *Loc. cit.* xxv. p. 146.

and Lithistida *. This distinguished Spongologist in the first place points out the distinction between the "skeleton-spicules," which form the true siliceous skeleton and usually possess a tolerably uniform character, and the so-called "flesh-spicules," which are always freely imbedded in the sarcode and are generally remarkable for their minute size and extraordinary multiplicity of form.

Carter divides the Hexactinellida into the following three groups †:—

1. Vitreohexactinellida. Spicules united by silicified fibre.

Dactylocalyx, *Myliusia*, *Euplectella aspergillum*, *Aphrocallistes*, *Aulodictyon*, *Farrea*, *Sympagella.*

2. Sarcohexactinellida. Spicules united by amorphous sarcode.

Askonema, *Crateromorpha*, *Rossella*, *Habrodictyon*, *Hyalonema*, *Pheronema*, *Meyerina.*

3. Sarco-vitreohexactinellida. Spicules united partly by siliceous fibre, partly by amorphous sarcode.

Euplectella cucumer.

The first two families break up into several subdivisions, characterized partly by the external form of the sponge-body and partly by the nature of the "flesh-spicules" and especially of the so-called "rosettes."

It will be seen that Kent and Carter, in the limitation of their primary groups, lay the first importance on the question whether the skeleton consists only of isolated spicules, or the different parts are amalgamated with each other and form a coherent framework. But, many as are the advantages that Carter's classification possesses over that of Saville Kent, it cannot satisfy us when forms so evidently allied as *Euplectella aspergillum*, *Habrodictyon*, and *Euplectella cucumer* are placed in three different families. A further defect of Carter's system appears to me to be that too much importance is ascribed to the nature of the flesh-spicules, and too little to that of the true skeleton.

W. Marshall's first memoir ‡ is divided into a general and a special part. In the former Marshall in the first place gives a critical revision of the previous works on the Hexactinellida, then a description of their external form and distribution, which he follows with a very careful description of the sarcode

* Ann. & Mag. Nat. Hist. 1873, ser. 4, vol. xii. pp. 349 & 437.

† Ibid. 1873, xii. p. 357, and 1875, xvi. p. 199.

‡ "Untersuchungen über Hexactinelliden," *l. c.* Bd. xxv.

and skeleton of these sponges. The section treating of the siliceous skeleton possesses especial interest. In this Marshall demonstrates that all Hexactinellida consist of spicules which in their form follow the axial system of an octahedron. The multifariously complicated or reduced siliceous structures may be derived from the cleavage or abortion of individual rays or entire axes.

In the simplest forms, the rod spicules, the cruciform arrangement of the three rectangularly crossing axes very frequently still shows itself in the axial canals. These axial canals are therefore of particular importance in the Hexactinellida. Marshall describes in detail the characters which the axial canals and their cylinders, where such are present, display in the different forms. In general the axial canals are considerably wider in the Hexactinellida with coherent frameworks than in those with isolated spicules.

Marshall has further paid particular attention to the union of the siliceous parts in the sponge-body. This is effected, according to Marshall, in three ways: 1, the spicules are united only by sarcode and remain isolated; 2, they *are soldered together*; or, 3, they *grow together*.

In the "soldering" (*Verschmelzung*) the spicules are only superficially cemented together by layers of siliceous substance, the axial canals remaining isolated and never flowing together. In *Euplectella aspergillum* the cementation takes place by laminar new formation of silica, which establishes bridge-like unions between two neighbouring spicules. In *Farrea*, *Aphrocallistes*, and *Eurete*, two approximated axial canals are generally surrounded by a common siliceous cylinder. Carter had already called attention (in opposition to Bowerbank) to this peculiarity; but while the English spongologist denies the occurrence of connected axial canals in neighbouring spicules in the Hexactinellida, Marshall thinks he has observed a connected canal-system in the united sexradiates in a single form (*Sclerothamnus*). This phenomenon is described as "growing together" (*Verwachsung*), and a special phylogenetic significance is ascribed to it.

In the special part the detailed description of a new *Euplectella* (*E. Oweni*) with free spicules is of the most interest, because here Marshall most convincingly shows that the cementation of all the spicules or of individual spicules in *E. aspergillum* and *E. cucumer* possesses only a quite secondary significance, and that in the three forms the closest agreement prevails in all essential characters (in the external form and the form and arrangement of the skeleton- and flesh-spicules), so that their generic separation is quite inadmissible.

By this demonstration Carter's classification of the Hexactinellida is essentially shaken. Marshall, in a second memoir*, endeavours to replace it with a new one. In this he lays great stress on the growing together of the axial canals in *Sclerothamnus*. He conceives the Hexactinellida as having originated from sponges like *Olynthus*, in which parallel lines of sarcode, crossing each other at right angles, were formed in the syncytium, and thus produced a latticework with cubical meshes. This sarcodic latticework was afterwards solidified by deposition of silica; and, according to Marshall, there were formed originally connected frameworks with continuous axial canals (*Sclerothamnus* and fossil Hexactinellida?), which subsequently broke up more or less completely into separate sexradiate spicules.

In accordance with this conception, Marshall divides the Hexactinellida into two groups:—

1. Synauloïdæ.

The lumen of the tubes of the different spicules is continuously connected like the latter themselves, so that the whole latticed tissue of the sponge is permeated by a likewise connected tubular system.

Sclerothamnus, Marsh.

II. Asynauloïdæ.

The lumen of the different spicules is never connected; each spicule, so far as the central fibre is concerned, is an independently developed individual.

The Asynauloïdæ are again divided into three families:—

a. *Monakidæ*, with a single form of spicule, the pure sexradiate. *Eurete*, Marsh.

b. *Pleionakidæ*, with the principal mass of the skeleton consisting of pure, fully developed sexradiates, but with these brush-forked spicules, or rosettes, or both. The cubical form predominates in the meshes of the skeleton.

1. Spicules not soldered together: *Lanuginella*, *Askonema*.
2. Spicules soldered together: *Farrea*, *Dactylocalyx*, *Periphragella*, *Aulodictyon*, *Fieldingia*, *Aphrocallistes*.

c. *Pollakidæ*. Hexactinellida with numerous forms of spi-

* "Ideen über die Verwandtschaftsverhältnisse der Hexactinelliden," *l. c.* Bd. xxvii.

cules, with a special dermal skeleton and lining to the stomach-cavities, usually with a root-tuft. The simple square form predominates in the meshes, especially of the dermal skeleton.

Holtenia, Crateromorpha, Rossella, Sympagella, Placodictyon, Euplectella, Habrodictyon, Labaria, Pheronema, Semperella, Hyalonema.

No one will fail to recognize the advantages possessed by the grouping of the genera proposed by Marshall. The establishment of the family Pollakidæ especially seems to me an exceedingly happy idea. It undoubtedly embraces the most differentiated, multifarious, and elegant Hexactinellida, which depart most widely from their precursors. Although there was nothing to prevent the preservation of these forms, no remains of them have hitherto been found in the fossil state. The whole group appears to be confined to the present epoch; and its late appearance would consequently indicate even for the Hexactinellida a progressive development from the imperfect to the more perfect.

In other points, indeed, I am not able to adopt Marshall's conceptions. If the assumption were correct that a latticework consisting of soft sarcodic threads preceded the solid Hexactinellid skeleton, the older fossil Hexactinellida must necessarily have belonged, as indeed Marshall presupposes, to the Synauloïdæ. But this is by no means the case. My investigations of the fossil forms show that the connected latticeworks without exception consist of sexradiates soldered together, the axial canals of which certainly often lie one over the other, and then apparently form coalescing tubes; but in reality they are always separate, and usually, as in the existing genera *Farrea*, *Eurete*, and *Aphrocallistes*, lie side by side in such a manner that the axial threads belonging to the different sexradiates appear distinctly separated. This condition of the fossil forms induced me to make a renewed examination of the genus *Sclerothamnus*, for a fragment of which I am indebted to the kindness of Dr. Marshall. The optical conditions of the material at my disposal are unfortunately very unfavourable, inasmuch as the axial canals only make their appearance under a certain illumination, and even then very indistinctly. But after boiling the skeleton in sulphuric or nitric acid the excessively fine canals surrounded by axial cylinders appear rather more distinctly; and we may then ascertain that in *Sclerothamnus* also the latticework has been produced by the soldering together of distinct sexradiates, the axial canals of which meet each other and frequently lie over one another in such a fashion that they *apparently* form a single tube, although they do not actually coalesce. But this renders the section Synauloïdæ superfluous*, and *Sclerothamnus* enters the group Pleionakidæ.

There remain therefore the three sections of the Monakidæ, Pleionakidæ, and Pollakidæ, which are based upon the greater or less differentiation of the parts of the skeleton.

Whether there are any Monakidæ among living Hexactinellida seems to me to be doubtful. Of the only genus referred to this position, namely *Eurete*, Semp., only a "very much bleached and washed specimen" exists. Now, as the connected siliceous skeleton agrees perfectly with *Farrea*, and Bowerbank † has proved that in *Farrea fistulata* (which is perhaps identical with *Eurete simplicissima*, Marsh.) "spicula are present in great numbers wherever the skeleton is covered with dark brown sarcode, but that not a single spicule is to be seen where the sarcode is wanting," I regard the group of the Monakidæ in Marshall's conception as doubtful.

To the palæontologist every classification founded upon the free spicules is useless, as only in very rare cases can the connexion between Hexactinellid skeletons and the neighbouring "flesh-spicules" be proved. Moreover, as I have already shown in my monograph on *Cœloptychium*, uncommonly few spicules of the Hexactinellid type occur among the free fossil siliceous structures. Especially I have never been able to detect any trace of "rosettes, fir-trees, and broom-forks," and of the other certainly very minute and very fragile forms upon which Carter particularly relies in the separation of his genera.

If, however, a preponderant systematic importance is given to the "flesh-spicules," not only the fossil Hexactinellida, but also all those existing forms, the skeletons of which are washed and no longer clothed with sarcode, remain undeterminable.

But, leaving out of consideration this practical objection, there are internal reasons opposed to any such principle of classification. The flesh-spicules form, to a certain extent, the external adornment of the sponge-body; they may be compared with the plumage of birds and the dermal coverings of fishes, reptiles, and mammals. If we take our stand on the ground of the transmutation theory, we certainly have before us in the flesh-spicules those parts of the sponges which change most readily by adaptation, and therefore most easily throw off

* Dr. Marshall, as he informs me by letter, has also convinced himself of this fact, and will withdraw the Synauloïdæ in a memoir very shortly to be published.

† *Op. cit.* part iii. (April 6th, 1875) p. 276.

the original type. It is quite otherwise with the skeleton-spicules. Even their well-chosen name indicates that a similar significance belongs to them as to the bony framework of the Vertebrata. The skeleton-spicules of the Hexactinellida form the most conservative part of the body of these characteristic sponges. With extraordinary tenacity they stick to the fundamental type of the sexradiate; and although in the highest ramifications of the stem, the Pollakidæ, many aberrant forms are produced by reduction of the rays, they can always be referred back to the sexradiate.

[To be continued.]

XXXV.—*On some new and little-known Spiders from the Arctic Regions.* By the Rev. O. P. Cambridge, M.A., C.M.Z.S., &c.

[Plate VIII.]

The spiders comprised in the following notes have been received at various times during the last few years:—two from Spitzbergen, from the Rev. A. E. Eaton; others from Mr. E. Whymper, from North Greenland; and, more lately, those found by Capt. H. W. Feilden and Dr. Hart during the Arctic Expedition in search of the North Pole, in the years 1875–76.

Descriptions and notes of four of the species received from Mr. E. Whymper in 1870 (two of them, *Erigone Whymperi* and *Dictyna borealis*, being considered new to science) were printed about six or seven years ago; but their publication, as part of an intended faunistic work on North Greenland, appears to have been postponed *sine die.* Of the thirteen species here recorded, five belong to the genus *Erigone*, Sav., two to *Linyphia*, two to *Lycosa*, and one each to the genera *Dictyna*, *Tegenaria*, *Thanatus*, and *Tarentula*. Three species of *Erigone*, one of *Linyphia*, the *Tegenaria*, *Dictyna*, and *Tarentula* appear to be undescribed.

Araneidea.

Fam. Dictynides.

Gen. Dictyna, Sund.

Dictyna borealis, sp. n. Pl. VIII. fig. 1.

Adult female, length $1\frac{1}{2}$ line, length of the cephalothorax $\frac{3}{4}$ line; relative length of the legs 1, 2 ?, 4, 3.

Cephalothorax yellow-brown, the sides and hinder part being strongly suffused with blackish brown, leaving a short, broad, longitudinal, central, yellow-brown band on the fore part of the upperside; this band is a little constricted near the middle, and has two dusky longitudinal lines on its fore part; the normal grooves and indentations are perceptibly, but not strongly, marked; the caput is rounded above, highest behind the eyes, and slopes gradually on all sides. The whole cephalothorax is more or less clothed with greyish and yellowish hairs, disposed somewhat in longitudinal lines on the upperside forwards, and becoming rather bristly near and below the eyes. The clypeus is low, its height being less than half that of the facial space; it is a little prominent and rather upturned at its lower margin.

The *eyes* are disposed in two transverse rows curved away from each other (*i. e.* the foremost row has its convexity directed forwards, and the hinder row backwards); or they may also be described as in four pairs; those of each lateral pair are contiguous to each other and seated obliquely on a small tubercle; the foremost eyes of these pairs appear to be the largest of the eight, and those of the fore central pairs the smallest; the intervals between the four eyes which form the front row are as nearly as possible equal, while the two hind central eyes are a little further from each other than each is from the end one on its side. The four central eyes form a square whose foremost side is the shortest.

The *legs* are rather paler in colour than the cephalothorax, and broadly, but obscurely, banded with dusky brown; they are strong, but not very long; those of the first pair are the longest, those of the second are very little, if at all, longer than those of the fourth, and the third pair are the shortest; they are furnished with hairs only; each tarsus ends with three claws; and there is, no doubt, a "calamistrum" on the outer side of each of the metatarsi of the fourth pair; though this portion of the only remaining leg of the fourth pair in the example described had been denuded of its armature, and the calamistrum could not, therefore, be seen.

The *palpi* are short, and similar to the legs in colour and armature, the digital joints terminating with a small black curved claw.

The *falces* are rather long, very strong at their bases, and (when looked at in front) curved, the convexities of the curves directed outwards; their colour is yellow-brown, and they are furnished with greyish yellow bristly hairs; the fang is small and rather weak.

The *maxillæ* are rather long, strong, and greatly inclined towards the labium, over which their extremities almost meet; they are also slightly curved, enlarged, and rounded on their outer sides towards their extremity.

The *labium* is of a subtriangular form, truncated at the apex, the width at the middle being, however, rather greater than at the base.

The *sternum* is oval, pointed behind, of a yellow-brown colour, margined with black, and with an indistinct blackish central longitudinal marking.

The *abdomen* is oval, very convex above, and projects moderately over the base of the cephalothorax; its ground-colour is dull yellowish, clothed rather thickly with short greyish hairs; the central longitudinal line of the upperside is occupied by a long dark band, broadest in the middle, with angular points on its sides, and pointed both at the fore margin of the abdomen and just above the spinners, where it ends. The fore part of the band is black, the rest dark yellow-brown margined with black (the margins differing in breadth and intensity) and comprising indistinctly the ordinary transverse angular lines or chevrons in its area. The rest of the upper surface is thinly speckled with black; and the sides are marked with blackish and somewhat oblique lines and markings; the underside is similar in colour to the upper, and has a central longitudinal blackish line, with another, broken and less conspicuous, on each side. The spinners are short and strong; and at the base, immediately in front of the two inferior ones, is the transverse inframamillary organ always found correlated (at least in the female sex) with the calamistra of the metatarsi of the fourth pair of legs.

A single example taken in July 1867 near the Illartlek glacier, North Greenland, was received from Mr. E. Whymper in 1870. It is closely allied to, but, I think, distinct from, *Dictyna hamifera*, another Arctic spider, described by Dr. T. Thorell in 1872.

Fam. **Agelenides.**

Gen. Tegenaria, Latr.

Tegenaria detestabilis, sp. n.

Adult female, length $3\frac{3}{4}$ lines.

This spider is very closely allied to *T. Derhamii*, Scop., resembling it in general form and structure; it is, however, smaller, paler in colour, and the falces are not prominent at their base in front as in that species.

The whole spider is of a pale dull brownish yellow colour, the cephalothorax being rather the darkest. The markings on the abdomen appear to be of the same character as those of *T. Derhamii*; but they were almost obsolete, being only visible just above the spinners. The palpi and legs are furnished with numerous long hairs and some long, but not very strong, spines; the abdomen also is clothed with numerous long coarse hairs.

The only example examined had been damaged by an attempt at preservation in turpentine, whereby the eyes were too much concealed to admit of any critical examination; they appeared, however, to resemble very nearly those of the species before mentioned. For the same reason the exact form of the genital aperture was scarcely plain; but it seemed to differ decidedly from that of *T. Derhamii*. And, on the whole, I think it is of a hitherto undescribed species.

The example above described was found in Lieut. Giffard's cabin, in Dobbin Bay, on the 28th of August, 1876, during the Arctic expedition under Capt. Nares.

Fam. **Theridiides.**

Gen. Erigone, Sav.

Erigone Whymperi, sp. n. Pl. VIII. fig. 2.

Adult male, length $1\frac{1}{4}$ line.

The cephalothorax is of a deep, shining, black-brown colour; the caput is convexly elevated, and the abdomen is of a dull but glossy black; the legs are yellow-brown, tinged with reddish brown; and the palpi are of a similar colour, the digital joint, however, is darker, and the palpal organs are deep red-brown.

This spider is very nearly allied to several others, such as *E. longipalpis*, Sund., *E. dentipalpis*, Wid., *E. atra*, Bl., *E. remota*, L. Koch, *E. arctica*, White, and *E. psychrophila*, Thor., all of which it closely resembles in form and general structure; it is, however, smaller than the last two species; but, in the absence of a lengthened series, size is scarcely to be depended upon, as I have found that several of the above species vary considerably in regard to the size of different individuals. The present may be distinguished from all those mentioned above, as well as from some others also closely allied, in several minor points of structure, and especially by the form of the radial joint of the male palpus and the structure of the palpal organs. From *E. dentipalpis*, Wid., *E. promiscua*, Camb., and *E. syriaca*, Camb., it may be separated at once by the absence of a small tooth-like spine on the underside of the radial joint; from *E. spinosa*, Camb., it may be distinguished easily by the direction of the prominent spur beneath the fore extremity of the cubital joint; in the present species this spur has a slightly backward direction, while in *E. spinosa* it is directed strongly forwards: the same difference is also observable in *E. psychrophila*, Thor., in which the long curved form of this spur affords another remarkable distinction from *E. Whymperi*. From *E. remota* the present spider differs at a glance in the comparative shortness of the palpi, though it is perhaps more nearly allied to this species than to either of the others; while from all the above-mentioned species the form (before alluded to) of the radial joint of the palpus will readily distinguish it: this joint, slender at its junction with the cubital joint, enlarges gradually to its anterior extremity, where it is divided, or continued, into two principal lobes or projections; the longest but least strong of these is situated behind and is pointed at its extremity, of a somewhat conical or subangular form, and curved inwards towards the palpal organs; the other projection is formed by the production of the upper extremity of the joint, rather on the inner side, into a broad, strong, obtuse lobe, on the outer and upper margin of which is a prominent, somewhat angular point, which has a slenderish, slightly curved, blunt-pointed, prominent appearance from some points of view. On the outer side of the radial joint are a few black bristles, of which several form a small cluster near its outer extremity.

The digital joint is large, rounded at its base on the upper side, and gradually tapering to its extremity; it is longer than the radial joint, and comprises the palpal organs, which are well developed and complex.

The *eyes* are nearly equal in size and are rather closely grouped together; the four forming the hinder row are equidistant from each other; the two central eyes of the front row are near together but not quite contiguous to each other; each is separated from the lateral eye on its side by an interval about equal to that which divides the two hind central eyes. The four central eyes form very nearly a square, the fore side being the shortest; those of each lateral pair are almost contiguous and are situated upon a slight tubercle.

In both sexes the lateral margins of the cephalothorax are armed with tooth-like spines, those in the female being the least conspicuous; this lateral armature is usual in the males of this group, but rare, so far as I am aware, in the females. At this moment I do not remember its presence in any other species; but possibly it may exist in some other species, with the females of which I am not acquainted. The margins of the cephalothorax in *E. spinosa* are granulose only.

This spider was received in 1870 from Mr. E. Whymper (with whose name I have connected it). It was found in two localities of North Greenland in June and August 1867, at and near Jacobshavn, among moss floating on the surface of freshwater pools near the seashore.

Erigone arctica. Pl. VIII. fig. 3.

Micryphantes arcticus, White, Sutherland's Journal, &c. ii. Appendix, p. ccx, figs. 11, 12.

I have concluded a specimen of this group, received from Spitzbergen (from the Rev. A. E. Eaton) in June 1874, to be the *Micryphantes arcticus* of Adam White (*l. c. supra*). It is very similar and very nearly allied to *E. longipalpis*, Sund., but differs from it in various slight particulars, especially in the much shorter radial joint when compared in length with the cubital; the digital joint of the palpus is also proportionally smaller; and the spider itself was rather larger than any example I have yet seen of *E. longipalpis*.

Erigone psychrophila. Pl. VIII. fig. 4.

Erigone psychrophila, Thor. Œfvers. af Kongl. Vet.-Akad. Förhandl. 1871, p. 689.

So far as a crushed specimen enables me to judge, this spider is larger than *E. longipalpis*, Sund., but closely resembles it in colours, general structure, and appearance. One very remarkable character, however, is furnished in the male by the great length and curved form of the spur beneath the fore extremity of the cubital joint of the palpus. This joint considerably exceeds in length the radial; and the spur alluded to is directed forwards, strongly curved, and tapering to a rather fine point; its length considerably exceeds that of the joint to which it is attached; and its point extends to the middle of the palpal organs, which appeared to be less complex than those of *E. longipalpis* and others. The specimen from which these notes were taken had been crushed in the process of mounting on a microscopic slide; so that possibly the apparent near contact of the extremity of the spur with the palpal organs may have arisen merely from the mode of mounting. The great length and form of the spur alluded to distinguishes this species from all others of the group as yet known.

This spider was one of those found in the late Arctic Expedition. There was, however, no note connected with the specimen above described, indicating the exact locality of its capture; but two females, much crushed and injured in mounting, though probably of this species, were labelled 82° 33′ N. lat., June 21 and 24, 1876, and perhaps this may have been also the locality in which the male was found.

Both sexes have been found in Spitzbergen, *vide* T. Thorell, *l. c. suprà.*

Erigone provocans, sp. n. Pl. VIII. fig. 5.

Adult male, length 1 line.

The *cephalothorax* is of a short oval form, very nearly round; the lateral constrictions on the margins of the caput are scarcely perceptible, and the normal grooves and indentations are not strong. The occiput is rather gibbous, and has two or three slender erect bristles on it, but it has no distinct or abrupt elevation. The margin of the clypeus is rounded, and the height of it is about half that of the facial space. The colour of the cephalothorax is yellowish brown, the sides much suffused with a darker hue, and marked with some fine radiating lines indicating the ordinary thoracic grooves; a dark line also runs from the hind central eyes to the hinder part of the thorax, enlarging in a diamond-form at the posterior part of the occiput.

The *eyes* are very small, but in the usual general position; they form a transverse oval figure, each line being equally curved in an opposite direction. Those of the hind central pair are smallest, and separated from each other by about two eye's diameters, the interval between each of them and the lateral of the same row on its side being considerably greater. The fore centrals are contiguous to each other, and with those of the hind central pair form a short oblong figure, whose anterior side is shortest; those of each lateral pair are seated rather obliquely and contiguously on a strongish tubercle; the foremost of the lateral eyes appear to be the largest of the eight.

The *legs* are slender and tolerably long, their relative length being, as far as could be ascertained, 4, 1, 2, 3; their colour is a pale yellow-brown; and they are furnished with fine hairs and a very few slender erect bristles.

The *palpi* are similar in colour to the legs, not very long, but tolerably strong. The cubital and radial joints are very short, the latter spreading out on all sides in a sort of mushroom shape; the digital joint is of an oval form, and its length equals, or perhaps exceeds, that of the cubital and radial joints together; the palpal organs are tolerably complex, with several curved spines and spiny processes towards their fore extremity.

The *falces* are neither very long nor strong; they are slightly divergent, and have a strong backward inclination, being also of a rather paler colour than the cephalothorax.

The *maxillæ* are very short, rather strong, and slightly inclined to the *labium*, which is also very short and broad, and, with the *sternum* (which, however, is darker), of the same colour as the cephalothorax.

The *abdomen* is of tolerable size, of a regular oval form, and projects considerably over the base of the cephalothorax; it is of a black-brown colour, probably very glossy in life, and clothed with short hairs.

The *female* is larger than the male, but resembles it in form and colours. The form of the genital aperture is simple, but characteristic.

Adults of both sexes were found during the late Arctic Expedition in latitude 82° 27′ and 82° 33′ in June 1876.

Erigone vexatrix, sp. n. Pl. VIII. fig. 6.

Adult female, length rather more than 1½ line.

This spider resembles *E. provocans* very closely in the profile of the cephalothorax, as well as in its colours, but, besides being much larger, the lateral marginal constrictions at the caput are distinctly marked; the eyes also differ somewhat in relative position, the intervals between those of the hinder row being equal. The falces are much stronger, less directed backwards, and (in profile) are considerably prominent at their base in front. The legs also are stronger, especially the femoral joints; they have more numerous slender erect bristles, and are of a clearer yellow-brown colour than those of *E. provocans*. The abdomen is oval, jet-black, glossy, clothed with coarse hairs, and projects considerably over the base of the cephalothorax. The genital aperture is of a semicircular form, situated in front of a roundish prominence.

This spider was found during the late Arctic Expedition at Discovery Bay by Dr. Hart, M.D.

Gen. Linyphia, Latr.

Linyphia sobria.

Linyphia sobria, Thor. Œfvers. af K. Vet.-Akad. Förh. 1871, p. 688.

An adult of each sex was received from Spitzbergen, where they were found by the Rev. A. E. Eaton and kindly sent to me in June 1874.

This species is nearly allied to *L. tenebricola*, Wid., though perhaps more nearly still to *L. leprosa*, Ohl., being larger than *L. tenebricola*; but it differs decidedly from both these species as well in the structure of the male palpal organs as in the form of the genital aperture of the female.

Linyphia turbatrix, sp. n.

This spider is similar in size to *L. tenebricola*, and resembles it also very nearly in colours and markings; the adult female, however, may be at once distinguished by a rather slender prominent bent process directed backwards from the larger process connected with the genital aperture.

Two adults (both females) were received in 1872 from Mr. E. Whymper, by whom they were found in North Greenland. The male is unknown to me.

Fam. **Thomisides.**

Gen. THANATUS (Koch).

Thanatus formicinus ?

Araneus formicinus, Clk. Aran. Suec. Stockholm, 1757.
Aranea rhomboica, Walck. Faun. Par. ii. p. 228, et *Thomisus rhomboicus*, Tabl. d. Ar. p. 38.
Thomisus rhomboicus, Hahn, Die Arachn. i. p. 111, tab. xxviii. fig. 83.
Philodromus formicinus, Sund. 1832, p. 229.
Philodromus rhombiferens, Walck. Ins. Apt. i. p. 559.
Thanatus formicinus, Koch, Uebers. des Ar.-Syst. i. p. 28.

An immature female of what I believe to be this species was sent to me by Mr. E. Whymper in 1870. It was found by him near Jakobshavn, North Greenland, towards the end of June. Although found in Sweden, and generally distributed throughout Europe, Western Asia, and North Africa, *Thanatus formicinus*, Clk., has never yet been recorded in the British Islands.

Dr. T. Thorell (Œfv. af K. Vet.-Akad. Förh. 1872, p. 157) describes a *Thanatus* from Disco Island, Greenland (*Thanatus arcticus*, sp. n.), with which the spider I have above recorded is perhaps identical.

Fam. **Lycosides.**

Gen. LYCOSA, Latr. (ad partem).

Lycosa glacialis.

Lycosa glacialis, Thor. Œfvers. K. Vet.-Akad. Förh. 1872, No. 2, p. 159.

Numerous examples, some adult, but mostly immature, of both sexes of this spider were received in 1870 and 1872 from Mr. E. Whymper, by whom they were found in various localities in North Greenland. Three examples, much shrivelled and damaged, were contained among the Arctic-Expedition Arachnids found by Capt. Feilden; but I believe them to be of this species: these were labelled "Hayes Sound, N. lat. 79°;" and two examples, one of each sex, were among those found by Dr. Hart in Discovery Bay. In the unpublished descriptions of N.-Greenland spiders, before referred to, this spider is recorded as *Lycosa septentrionalis*, Westr.; and *L. saccata*, O. Fabr. Fauna Grœnl. no. 208, is placed among its synonyms. I am, however, now convinced that these determinations are erroneous (see the next species here recorded).

The *adult male*, which was unknown to Dr. Thorell, resembles the female in general colours and characters; but the femora and tibiæ of the legs are more or less suffused and marked with dark brown. The *palpi* are strong, their colour is like that of the legs; the digital joint is large and equals in length that of the radial and cubital joints together, its colour is black-brown, and (together with the radial joint) it is pretty thickly clothed with hairs. The palpal organs are well developed; their hinder half consists of a strong, roundish, prominent, corneous lobe, surmounted by a strong, pointed, spiny process with a somewhat angular point at the middle of its fore margin: the point of this process is directed outwards; and in front of it, near the outer margin of the digital joint, are two other smaller spines, close together; one of these is strongly hooked or reaphook-shaped, the other is a small, simple, slightly curved, pointed spine; on the outer side of these is the prominent curved termination of a strong process which has its origin on the inner side of the joint. There is no claw at the extremity of the digital joint.

Both sexes of this spider may be at once recognized by the bifid termination of the ordinary central yellow stripe at the thoracic junction of the cephalothorax. This stripe has generally the form of a barbed arrow-head with its point directed backwards. The next spider, however (*Lycosa grœnlandica*, Thor.), has also a shortened central thoracic stripe, but it is less distinctly bifid than in the present species, in which the two limbs of this portion are considerably divergent. In *L. grœnlandica* also the lateral stripes on the cephalothorax are broken up into several distinctly separated markings of different sizes, while in *L. glacialis* they are continuous.

Lycosa grœnlandica.

Lycosa grœnlandica, Thor. Œfvers. af K. Vet.-Akad. Förh. 1872, No. 2, p. 157.
Aranea saccata, O. Fabr. Fauna Grœnl. p. 228.

Immature examples of both sexes and one adult female of this fine spider were received from Mr. E. Whymper (by whom they were taken in North Greenland) in 1872.

It is nearly allied to *L. amentata*, Clerck, but is larger and more brightly and distinctly marked, and the genital aperture is very different. From *L. glacialis* it may be easily distinguished, not only by the difference of the thoracic stripes (noted above in the description of that species), but also by its distinctly annulated legs.

This spider does not appear to have been met with during the late Arctic Expedition.

Genus Tarentula, Sund.

Tarentula exasperans, sp. n. Pl. VIII. fig. 7.

Adult male, length $3\frac{2}{3}$ lines.

The *cephalothorax* is oval, rounded behind, and gradually narrowing to the fore extremity; the lateral constrictions at the caput are slight; and the sides are of a gradually sloping character, somewhat depressed towards the lower margins. It is of a deep black-brown colour: the central longitudinal stripe is broad and distinctly marked; it runs from the foremost of the four large eyes quite through to the hinder extremity, towards which it narrows gradually; the margins of this stripe dilate in a curved form just behind the ocular area; the inner part of this portion is marked with dark brown, the rest of the stripe being of a reddish yellow colour, and the whole of it clothed with short greyish-white hairs: the lateral stripes are very indistinct, being chiefly marked by short greyish-white hairs.

The *eyes* are in the ordinary position; the line formed by the posterior pair is longer than that of the middle pair, but not very greatly; the foremost row is the shortest; and the interval between the two central eyes is greater than that between each and the lateral eye next to it; the four large eyes form very nearly a square, its posterior side being the longest.

The *legs* are tolerably long and strong; those of the fourth (or hinder) pair are the longest, and those of the third pair the shortest; they are of a dark brown colour (the femoral joints being of the deepest hue), and are furnished with hairs, bristles, and spines: there are faint traces of annulation on the hinder legs; but numerous short grey hairs give the prevailing tinge of colour to them all.

The *palpi* are moderate in length and strength; they are of a dark blackish brown colour and furnished with hairs and a few strong bristles, especially on the radial joint, which is equal in length to the cubital, though not quite so strong; the digital joint is not very large; it is, however, longer than the radial, but not so long as the radial and cubital joints together; the palpal organs are simple, with a short, curved, pointed, strongish spine towards the fore extremity on their outer side; the digital joint has no claw at its anterior extremity.

The *falces* are tolerably long, moderately strong, straight, conical, and a little directed backwards towards the sternum; they are of the same colour as the cephalothorax.

The *maxillæ*, *labium*, and *sternum* are of the normal form, and of a deep brown colour.

The *abdomen* is oval, broadest behind, somewhat truncated at its fore extremity, and considerably convex above, especially at the fore part; the upperside is clothed pretty densely with short grey pubescence; the normal elongate marking on the fore half is reddish yellow-brown before, but black-brown on the hinder part; it has a sharp prominent point near the middle on each side; and the hinder extremity is truncated, with its outer corners elongated in a pointed form. A longitudinal row of alternate black and greyish white spots runs from outside the termination of the anterior marking to the spinners; and within the area comprised by these two rows of markings are several short, indistinct, dark, angular bars or chevrons in a longitudinal line. The underside is dark brown, also clothed with short grey pubescence; the spinners are very short and moderately strong, the inferior pair being the shortest and strongest.

This spider, which appears to me to have been hitherto undescribed, was found by Dr. Hart, during the late Arctic Expedition, in Discovery Bay. It may be distinguished readily by the form of the central longitudinal thoracic stripe.

List of Spiders.

Dictyna borealis, sp. n.
Tegenaria detestabilis, sp. n.
Erigone Whymperi, sp. n.
—— *arctica*, White.
—— *psychrophila*, Thor.
—— *provocans*, sp. n.
—— *vexatrix*, sp. n.
Linyphia sobria, Thor.
—— *turbatrix*, sp n.
Thanatus formicinus, Clerck.
Lycosa glacialis, Thor.
—— *grœnlandica*, Thor.
Tarentula exasperans, sp. n.

EXPLANATION OF PLATE VIII.

Fig. 1. *Dictyna borealis*, sp. n., ♀: *a*, profile of cephalothorax; *b*, fore part of caput and falces; *c*, *maxillæ*, *labium*, and *sternum*; *d*, spinners; *e*, natural size of spider.

Fig. 2. *Erigone Whymperi*, sp. n., ♂: *a*, profile without legs; *b*, fore part of caput and falces; *c*, *d*, *e*, palpus of ♂ in different positions; *f*, genital aperture of ♀; *g*, natural size of spider.

Fig. 3. *Erigone arctica*, White: *a*, left palpus of ♂, from the outer side; *b*, natural length of palpus.

Fig. 4. *Erigone psychrophila*, Thor.: right palpus of ♂, from the inner side above.

Fig. 5. *Erigone provocans*, sp. n.: *a*, spider, enlarged; *b*, profile without legs; *c*, left palpus, from beneath on the outer side; *d*, natural length of spider.

Fig. 6. *Erigone vexatrix*, sp. n., ♀: *a*, spider, enlarged; *b*, profile without legs; *c*, fore part of caput and falces; *d*, genital aperture, in perspective; *e*, ditto, in front; *f*, natural length of spider.

Fig. 7. *Tarentula exasperans*, sp. n., ♀: *a*, spider, enlarged; *b*, palpus and palpal organs; *c*, natural length of spider.

XXXVI.—*On the Changes produced in the Siliceous Skeletons of certain Sponges by the Action of Caustic Potash.* By W. J. Sollas, M.A., F.G.S., formerly Scholar of St. John's College, Cambridge.

[Plate IX.]

Amongst the various problems which have arisen in the difficult study of the sponges, that as to the exact nature of the skeletal network of such genera as *Farrea*, *Dactylocalyx*, and *Aphrocallistes* has not been one of the most easily solved.

Bowerbank, who was the first to express an opinion on the subject, regarded the vitreo-hexactinellid network as the exact representative amongst the Silicea of the horny network of the kerataceous sponges. In the latter he had previously distinguished two marked types—one in which the horny fibres are solid throughout (*Spongia officinalis*), and another in which the axis of the fibre is occupied by a hollow canal (*Verongia*). The same difference he now stated to exist amongst the siliceous-netted sponges, and upon it separated the genera *Dactylocalyx*, *Iphiteon*, and *Myliusia*, the fibres of which he regarded as solid, from certain other genera (*Kaliapsis*, *Farrea*, and *Purisiphonia*), which he considered to possess canaliculated or "fistulose" fibre. The interpretation next advanced appears to have originated with the late Dr. Gray, and was adopted with wider application by Professor Sir Wyville Thomson *, who,

* 'Annals and Magazine of Natural History,' February 1868, p. 114.

in 1868, stated it as his opinion that the network of the siliceous-netted sponges was produced by an anastomosis, fusion, or coalescence of sexradiate spicules with one another.

This opinion was at once endorsed and supported with various new observations by Oscar Schmidt. The objection urged by Dr. Bowerbank to Gray and Thomson's view was, that true spicules never evince any tendency to fuse together: thus in 1869 he states that he has "never yet seen a case of the anastomosis of spicula. The normal condition of these organs is never to anastomose, however closely they may be packed together."

So the question stood till 1873, when it was reserved for Dr. Carter to bring these opposing views into harmony, and so to explain in the most beautiful manner the real structure of the netted Hexactinellidæ. In a paper on the Hexactinellidæ and Lithistidæ he proves, from observations of very young specimens, that at first the netted sponge *Aphrocallistes* possesses no other skeletal elements but separate free sexradiate spicules, and that the formation of a network is a subsequent process brought about as growth advances by the envelopment of the free spicules in a coating of siliceous material, which, running over each and from one to another of them, at length involves them all in continuous siliceous fibre. The network of *Aphrocallistes* and of other netted sexradiate sponges is accordingly a composite structure, not simply fibrous in the sense that the horny skeleton of a washing-sponge is so, nor, on the other hand, simply spiculose, as if it consisted of ankylosed spicules merely, but spiculo-fibrous like the network of the Chalinids; only in this case the simple acerate spicules of the Chalinidæ are represented by sexradiate ones, and the horny substance of their fibre is replaced by siliceous material.

This interpretation was supported by the fact that the original spicules on which the fibre of the network is built become absorbed some time after the death of the sponge, and so reappear in the interior of the fibre as hollow sexradiate casts, which in time, however, may, with continued internal absorption of the fibre, so increase in size as to become continuous axial canals, in which state they seem to have been observed by Dr. Bowerbank, and so came to be regarded by him as a proof of the existence of normally fistulose fibre amongst the siliceous sponges. It is important to add that, besides casts of ordinary sexradiates, Carter also observed those of other forms, notably of the curious besom-shaped spicule which is so characteristic of *Aphrocallistes*.

As regards the cause of the absorption by which the imbedded spicules are again revealed, Carter says no more than that it is a chemical question, and that in consequence he leaves it to the investigations of the chemist. It was partly with the hope that I might be able to throw a little light on this subject that the following investigation was undertaken.

The spicular silica of sponges has for a long time been known to be somewhat soluble in caustic potash, so that spongologists seldom, if ever, employ this reagent to remove from sponge-skeletons the organic matter associated with them—a use for which otherwise it would be well fitted. Considering this, it appeared to me that in caustic potash we possess a valuable means for the analytical treatment of sponge-spicules, so as to be able to dissect them into their structural elements, and to reproduce in them those characters which they exhibit in the deciduous state both recent and fossil.

Specimens of various vitreo-hexactinellids were accordingly procured, and subjected to a microscopical examination to make sure that they were in the fresh state, or, in other words, had not begun to be excavated by internal spicular casts. This ascertained, they were next exposed to the action of strong boiling caustic potash for varying intervals of time. The changes thus produced will now be described.

Dactylocalyx subglobosus.

The solid fibres of this sponge soon exhibit delicate canals, which start from the broken ends of the fibres, and radiate, as a rule, from the nodes of the skeletal network, each stellate group of canals forming a single sexradiate system with its centre generally situated in or about the centre of a node. The canals are at first very small and may be regarded, I think, as representing simply the enlarged axial canals of the imbedded sexradiate spicules. This stage of solution we may call stage 1. As the boiling continues, the canals progressively enlarge and come to occupy a very considerable portion of the interior of the fibre, till at length they appear to coincide with the walls of the imbedded spicule on which the fibre is constructed (stage 2). That the canals do at length really represent the original spicule is shown by the reappearance of the besom-shaped spicule in *Aphrocallistes.* Finally the canals extend so far and widely as to touch and open into each other and thus channel the fibre continuously or render it truly "fistulose" (stage 3). This is the condition in which the skeletons of the vitreo-hexactinellids are usually found when fossil, though it is by no means rare to find the preceding stage well represented also. It is moreover the state in which the only known specimens of *Farrea occa* and *F. facunda* exist, and which occurs sometimes in *Aphrocallistes Bocagei* and, according to Bowerbank, in *Purisiphonia Clarkei*, while the second stage is exhibited in skeletons of *Aphrocallistes Bocagei*, *Dactylocalyx pumiceus*, and *D. crispus* (O. S.), which, however, like the genera *Iphiteon* (Bk.) and *Myliusia*, are usually found in the fresh state and consequently with solid fibres.

As regards the characters of the canals themselves, they are in my specimens exclusively sexradiates; but they differ in a marked manner from the loose separate sexradiates which do not become involved in the siliceous fibre; for while the latter are always rectangularly triaxial, the involved spicules are neither rectangular nor triaxial at all, except in the rarest cases. Each arm of an imbedded spicule may make any angle with its fellows; there is no constancy in this respect, nor any approach to it. This will be seen by reference to fig. 1, Pl. IX., and is even more strikingly exhibited in some specimens which are not here figured.

It would seem as though the free sexradiate spicules of the sponge lost their usual rigid regularity and became instead perfectly pliable to all the changes in direction of the siliceous fibre as soon as they became involved in it, the fibre governing the direction of their rays to the complete subordination of their intrinsic tendency of growth.

On the other hand the centre of each sexradiate spicule appears in most cases, but not in all, to determine the position of a node of the fibrous skeleton, each node corresponding in position to the centre of an imbedded spicule. The exceptions are where three arms of a sexradiate are bent in one direction approximately parallel to each other, and the other three in the opposite direction, so that the whole spicule comes to be imbedded in one and the same straight fibre (fig. 1).

Fig. 1.

Here, then, a sexradiate exists without a corresponding skeletal node; and more frequently still it happens that a node may exist independently of the presence of a sexradiate centre, *ex. gr.* where three or more arms of adjacent sexradiates join together.

It need not be added that though the nodes of the skeleton are generally determined by the presence of sexradiate spicules, they are not on that account necessarily sexradiate themselves, since by the coincidence in direction of two or more arms of one spicule, or by the addition of rays from an adjacent spicule, a node may become four-, five-, six-, seven-, or even eight-rotulate.

The siliceous cement which, with the included spicules, forms the skeletal fibre does not scale off under the action of potash in concentric layers, as happens in the case of true spicules, but dissolves away amorphously both in the interior and on the exterior of the fibre, without in the latter case producing those hemispherical pit-like markings which cover the exterior of many deciduous recent and fossil spicules, and which in some cases have been shown by Mr. Carter to result from the depredations of some algoid parasite.

Fine longitudinal striations, however, are generally observable along the fibre, and may perhaps indicate a lamellar structure; in one or two instances I have seen indications of more rapid solution at a point (*p*) midway between the spicular canal and the periphery of the fibre, thus (fig. 2), as though along the line where the siliceous cement first covered over the contained spicule.

Fig. 2.

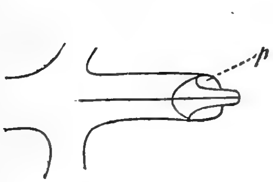
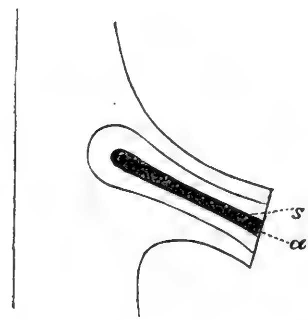


Fig. 3.



The appearance shown in fig. 3 seems to result from a change in the refractive index of the spicular component of the fibre; for the included spicule (*s*) is quite distinctly defined from the surrounding fibre and is yet composed of solid silica, which opposes the expansion of a well-defined thread of air (*a*) contained in its relatively narrow axial canal.

Long before the spicular canals in the interior of the fibre have become fully developed by the action of the potash, the minute "rosettes" of the sarcode have completely disappeared in solution, so that before stage 2 is passed a careful search with high powers fails to reveal even the slightest trace of them.

The free sexradiates follow shortly after; but the spines of the fibre remain for some time longer, and do not disappear till the last stage of solution has been reached or has even become far advanced.

Aphrocallistes Bocagei, Dactylocalyx pumiceus, Farrea densa, Myliusia callocyathes.

The sponges next submitted to experiment were the four just named, of which *A. Bocagei* and *D. pumiceus* have been found both fresh and in the deciduous state, and consequently with fibres both channelled and solid, while the two latter, like *D. subglobosa*, are known only in the fresh condition with solid glassy fibres. In all, however, results were obtained on boiling with caustic potash precisely similar to those already described in the case of *D. subglobosa*. The canals of the imbedded spicules were enlarged and made visible; the enlargement continued till the entire spicule was dissolved out; and finally the spicular casts ran together and the fibres became hollow tubes: the rosettes and loose sexradiates soon passed into solution; while the spines of the fibre persisted for a considerable time, traces of them remaining when the canals had attained their fullest development.

The attached sexradiates of many vitreo-hexactinellids, when the siliceous cement has only just commenced to spread over them, are frequently capitate at the extremities of their rays, as though the enveloping silica had been fluid and accumulated in greater quantity at the points of the rays than along their sides, as, in fact, the sarcode from which the silica is deposited may have done. Curiously enough, the casts of the spicular rays excavated in the siliceous fibre frequently terminate in the same capitate manner; and it is possible that when they do so the retrogressive metamorphosis of the fibre has brought it back to exhibit in an inverse form the same early stage as that to which we have just alluded.

Euplectella aspergillum.

The axial canals of both its free and combined spicules were first developed; and a concentric laminar structure was next exposed both in them and in the cementing material, which here only binds the spicules into bundles without absolutely enveloping them. As in time the cementing silica becomes wholly dissolved away in places, the spicules it unites together are to a great extent set free; and the composition of the longitudinal and transverse fibres formed by them is then made manifest.

Hyalonema Sieboldii.

Mr. Higgin, of Liverpool, gave me a beautiful specimen of one of the anchoring spicules of this sponge; it was perfect from one end to the other, including the barbed head and denticulated scalar lamina. The great length and size of this spicule had previously led me to imagine that, although apparently nothing but a simple spicule, it might yet upon investigation be found to consist of several spicules imbedded in a siliceous fibre.

A careful examination was therefore made to determine this point; with sharp scissors the spicule was divided into convenient lengths and then boiled in potash. The axial canal soon became clearly visible and could be continuously traced from one end of the spicule to the other; it was obviously quite simple, and radiated once only, viz. in the barbed head, where it forms a sexradiate cross: no other canal in addition to this could be detected in the spicule, which thus, contrary to my expectation, was proved to be not spicular fibre but a simple spicule after all. With the development of the axial canal several faint lines or cracks, circumferential in direction, appeared on the exterior of the spicule, and were immediately traversed by others running longitudinally; the outermost layer then peeled off in strips between the circumferential cracks; and as the process continued, other laminæ were exposed and similarly scaled away. The ends of the various lengths of the divided spicule soon lost their cylindrical form and became conical, the alkali dissolving backwards the successive concentric laminæ of which the spicule was composed, the outermost first and consequently most extensively, and the rest in successive order, till at length the original strand on which all the rest had been formed was exposed as a single thread with an axial canal which, as happens in all similar cases, was expanded towards its termination, funnel-shaped (as in fig. 5, Pl. IX.).

Nothing can exceed the elegance with which caustic potash exposes the concentrically lamellar structure of this spicule: each individual lamella is so perfectly separated from its fellows that one can count the number of which the spicule is composed at various points of its length; thus in the figure (Pl. IX. fig. 5) ten laminæ are to be seen.

The sponges next examined belong to other orders than that of the Hexactinellidæ.

Geodia arabica.

In spicules with sharp points, like the anchoring and acerate spicules of this sponge, the axial canal extends to within a very short distance of the pointed extremity; so that as the spicule yields to the action of the potash and the fine point is quickly dissolved away, the axial canal is soon exposed and the potash finds easy access to the interior of the spicule. The axial canal then rapidly begins to enlarge, and soon expands into a funnel-shaped termination towards its extremities, or where the potash first enters. The sides of this funnel-shaped expansion, when viewed with a high power, do not appear in optical section as simple straight lines, but are very finely "stepped" all the way down, each step representing very obviously the exposed edge of one of the concentric lamellæ of which the spicule is made up. The concentrically lamellar structure of these and all other true spicules is, indeed, beautifully revealed by this method of solution, more perfectly and in a far clearer way than by the process of charring the spicule with heat, as in the flame of a spirit-lamp.

As solution proceeds, the points of the spicules become entirely removed, and a fusiform acerate spicule becomes almost cylindrical from the loss of its conical ends: but the different lamellæ never dissolve at the same rate; some always resist longer than others; so that at every stage of solution the spicule presents a lamellar appearance. The outermost lamella frequently endures the longest, forming a hollow sheath of infinite tenuity, which frequently splits longitudinally so as to form two or more long narrow strips or ribbons; and these, in some instances, curl backwards and outwards in a very singular way. A fossil spicule in this last state would not be readily recognized for what it actually was, and has been, indeed, on more than one occasion a source of considerable difficulty to myself in studying the spicules of the Cambridge coprolites.

The anchoring spicules undergo just the same changes as the acerates; but their short conical arms dissolve much faster interiorly than the longer shafts, because the edges of a greater number of concentric lamellæ are exposed over a shorter length than in the shaft, and so present in the same space a larger number of *points d'appui*, so to speak, for the action of the caustic potash.

The spicules which undergo the most remarkable alteration, however, are the "globo-stellates," which Bowerbank mistook for ovaria. The interior of these, at first optically homogeneous, soon exhibits a radiate structure starting from the centre (Pl. IX. fig. 6), and with its separate rays terminating at unequal distances short of the exterior; as solution continues a small cavity is developed in the centre, the radiate structure is better displayed and extends much further towards the circumference (Pl. IX. figs. 9, 8), the small cavity continuously enlarges till at length it occupies the whole interior of the globo-stellate *, leaving only a thin outer film, perforated in places and much resembling a broken egg-shell. If Bowerbank had under his observation globo-stellates which had suffered this change under the influence of atmospheric solvents, he might well be forgiven for falling into the error he did respecting them.

By careful observation, it will in most cases be found that the potash obtains entrance to the interior of these spicules by way of the "hilum" which characterizes all of them. One can sometimes look down and through the hilum into the cavity excavated within; and frequently one may observe by a lateral view a canal from the hilum in direct continuity with the inner cavity (Pl. IX. figs. 8, 9, 11). It is very noteworthy that while solution has proceeded to such an extreme extent in the interior of the globo-stellates, the exterior is, on the other hand, often scarcely affected. Originally the outer surface is ornamented by spines, which divide at their summits into four or five smaller spines, and which are united together by lateral ridges into a compact network; the chief result of the action of the potash on the exterior is apparently to dissolve away these connecting ridges, and so to leave the spines in isolation and much better exposed for an examination into their minute characters (Pl. IX. figs. 12, 13). The reason for the difference in the rates of solution within and without these structures appears to lie in the fact that when once the potash has reached the centre of a globo-stellate, it is able to attack the ends of the rays of which it is composed and to penetrate between their sides, while it finds it more difficult, apparently impossible, to insinuate itself between them when acting on the outside; thus the surface over which the potash in the interior acts is many times larger than that exposed to the influence of that without, and in consequence the internal solution is necessarily much more rapid. In some few cases I have observed globo-stellates with all their spines removed from the exterior, so as to present a smooth surface: in these the way to the interior appears to

* It often happens that the central cavity of such globo-stellates contains a white opaque kernel-like spherule (Pl. IX. fig. 7, *s*), the nature of which was at first very puzzling to me; for though I suspected it to be an air-bubble, I could get no metallic lustre from its surface with reflected light. By pressing on the covering-glass immediately over one of these spherules, however, with a pointed piece of wood, it was found possible to crush the globo-stellate containing it; for the globo-stellates when partly dissolved are very brittle and break easily. There then remained only transparent fragments of the broken shell and an indubitable glistening air-bubble lying in their midst. By carefully performing the operation one could, indeed, see the air-bubble issue from the globo-stellate at the moment of fracture.

have been sealed up; at all events no internal solution had taken place.

The small stellates and other delicate spicules of this *Geodia* dissolve and disappear at a very early stage, so that none of them are to be seen in my slides amongst the partially dissolved larger spicules.

Pachymatisma Johnstonia.

In the cylindrical spicule of this sponge the ends of the axial canal are much further removed from the extremities, and consequently better protected than they are in the case of the acerates we noticed in *Geodia*; but since neither end of the canal is better protected than the other, we find as a rule that both are exposed at about the same time, and so in the majority of these spicules the action of potash is to remove both ends and develop the axial canal from each extremity, in just the same way as in the case of the acerates of *Geodia* (Pl. IX. figs. 16, 17).

I may here take the opportunity to record a very abnormal occurrence in connexion with these spicules, that, viz., of two of them existing in a state of complete ankylosis. The axial canals in this ankylosed structure have been made very visible by the caustic potash, and can be seen crossing each other at one point without intercommunication, so that each spicule possesses its own distinct canal quite separate from that of its fellow, and neither can be regarded as a mere process of the other. The fact of their ankylosis is easily determined by mere inspection (Pl. IX. fig. 18). Bowerbank's dictum, that spicules never ankylose together, not even by morbid growth, is thus seen not to be of universal application*.

The globo-stellates behave very much as those of *Geodia*; but in the examples I have had before me one or two additional phenomena have been observed. In the first place the hemispherical pits which are so common on fossil spicules are here produced artificially by the action of the caustic potash in great abundance, marking the spicules all over with regular excavations of just the same size and appearance as those which are seen in the fossil examples (Pl. IX. figs. 10, 11). The same hemispherical pits also appear on the acerate and large anchoring spicules of *Geodia arabica* after boiling with potash; in these cases the successive laminæ of the spicule are exposed in circles concentric with the circumference of the excavation (Pl. IX. fig. 15).

Next, in one or two instances a thin structureless exterior

* See also O. Schmidt, Spong. d. Küste v. Algier, p. 16, Taf. iii. fig. 2.

film separated itself from the interior mass of a globo-stellate, which everywhere remained free within it. The film was not smooth, but wrinkled all over so as to fit exactly on to the spines it once covered, dipping into the depressions between them and rising over their summits (Pl. IX. fig. 14, *f*). Is this film the silicified wall of the cell in which the spicule has been developed? or is it the last coating of silica which the spicule had received? If the latter be the true interpretation, the phenomenon is but a repetition of what we have already observed in the case of elongated spicules, where the outermost lamella frequently remains after solution as a mere sheath about the rest of the spicule within it.

In this sponge the potash is more frequently able to attack the component rays of the globo-stellates from the exterior than in *Geodia arabica*, and hence the solution in a radial direction sometimes proceeds both from within outwards and *vice versâ* simultaneously.

The stellates of *Pachymatisma* appear to have greater power of resistance than those of *Geodia arabica*, since a slide showing many of the globo-stellates of the former reduced to the condition of thin shells also contains instances of its stellates which have survived solution, and, indeed, appear but little the worse for it. With this fact may be coupled another, viz. that stellates similar to those of *Pachymatisma* have been seen by me in the fossil state amongst a number of other spicules which I am now describing from the Chalk of Trimmingham, Norfolk.

Trachya, sp.

The staple spicule here is a large acuate, the rounded end of which affords great protection to the corresponding termination of the axial canal within it, while at the pointed end only a thin layer of silica intervenes between the axial canal and the surrounding potash. It hence happens that at the rounded end the canal remains closed and the concentric lamellæ of the spicule are there with difficulty dissolved away; while at the pointed extremity the canal is entered by the potash at once, the edges of the concentric lamina are exposed and rapidly attacked, and the spicule is eaten back from the point towards the butt, so that it is soon nearly all destroyed, the part that remains often being only the butt-end, which even then preserves the blind termination of the canal unbreached from behind (Pl. IX. fig. 19, *b*).

At the round end the potash removes the concentric lamellæ from without inwards, so that the innermost project furthest (Pl. IX. fig. 19, *b*); at the pointed end the potash acts from within outwards and the outermost lamellæ usually endure longest (fig. 19, *a*).

The smaller spicules of this *Trachya* have been entirely dissolved by the solution, which has merely analyzed the larger ones.

Halichondria incrustans and *H. panicea.*

The flesh-spicules (anchorates and tricurvates) of the former species soon passed into solution; and in the skeleton-spicules of both, the axial canals very quickly appeared and rapidly enlarged. A concentric lamellar structure was exposed as in the cases we have previously described; but in these small spicules the number of component laminæ appears to be very small, not above two or three at the most. One has to be careful in attending to the solution of these spicules, not to let them boil too long; otherwise they may all dissolve away: a boiling sufficient to develop the spicules of the *Trachya* of the preceding paragraph completely dissolved all or nearly all the spicules of a specimen of *H. incrustans*. From this one might conclude that a search for fossil spicules of so small a size as these would not, unless under very favourable circumstances, be likely to be attended with success.

This concludes the account of the observations on the action of caustic potash which I have thought it worth while to record; and it only remains to add a few words by way of application and explanation. And first as to the curious fact that solution appears to proceed much more rapidly in the interior than on the outside of spicules or spicular fibre, so that very frequently we find the exterior of a spicule persisting as a thin shell of apparently the same diameter as it had originally, while interiorly every thing has been dissolved away. It may be said that the difficulty here is more apparent than real, since the internal solution takes place under circumstances very favourable for observation, while that of the exterior is less easily made manifest. When it reveals itself in the edges of eroded laminæ (Pl. IX. fig. 19, *a* & *b*) it is obvious enough; but in most instances its effects cannot so readily be estimated. There is no doubt some truth in this; but in many cases the difference in the rate of the internal and external solution is too great to be accounted for in such a manner. Capillarity will not help us much; for it could only lead to the introduction of the potash into the fine axial canal and between the successive concentric lamellæ of the spicule, and assist solution so far only as it might do so by bringing the solvent agent into every accessible crevice of the dissolving substance. In many cases the explanation is to be sought in the structure of the spicule itself, the edges of its component layers or component rays being more readily reached from within than from without, as, for instance, along the axial canal of a linear spicule and around the central cavity of a globo-stellate.

In the case, however, of the spicular fibre of *Dactylocalyx* and its congeners, the internal solution is still in excess, though no exfoliation of lamellæ appears in them to take place. Possibly the interior, and therefore older, silica of the fibre has suffered some change with age, by which its solubility has been increased; but in the absence of any thing better than mere speculation it will be as well to wait for an explanation till one is met with in the natural course of future observations.

We may next observe that the solution we have accomplished in the laboratory also occurs on the large scale in nature, *ex. gr.* at the bottom of the sea, where deciduous spicules soon become partially dissolved, with the production in every detail of the characters we have just described, and are afterwards silted up to exhibit these characters in a fossil state. But while in caustic potash we have a substance which will dissolve some kinds of silica with the production of a definite chemical compound, viz. potassic silicate, we do not know, on the other hand, of the presence of any reagent in sea-water which is capable of effecting the same result; the only widely diffused solvent there, with which we are acquainted, excepting the water itself, is carbonic acid; and no one has yet shown that this acid is capable of dissolving any kind of silica, or that water alone, given time enough, is incompetent to the task. That one or other of these substances does in certain cases dissolve that kind of silica which is soluble in caustic potash is shown, however, by the changes produced by rain-water on the freshly fractured surfaces of black flints; a comparatively short exposure of these to atmospheric agencies soon causes them to lose their black translucent appearance, and to become opaque and white, owing, as a microscopic examination proves, to the removal of some of the silica from the exposed face, so as to render it at first irregularly pitted and subsequently porous. The only agent to which this removal can be attributed is rain-water; but since this consists both of pure water and carbonic acid, we are still unable to say whether the presence of carbonic acid is a necessary condition to this solution or not. As to the efficacy of one or other of these substances, however, this observation leaves us in no doubt; and since both carbonic acid and water occur together at the bottom of the sea, we have there just the conditions under which the solution of silica must necessarily take place; and when, in the course of some years, this solution has been accomplished, it will have produced just those changes in deciduous spicules which we have succeeded in bringing about in a few minutes*.

Summary.

1. By boiling with caustic potash, spicular silica passes into solution.

2. In dissolving sponge-spicules, solution takes place both on the outside of the spicule and internally about the sides of its axial canal.

3. In vitreo-hexactinellid fibre, the internal solution at first reproduces as hollow casts the forms of the spicules upon

* If for the sake of hypothesis we assume, according to all analogy, that carbonic acid is the essential ingredient in atmospheric or sea-water for the solution of dissolvable silica, and that some loose compound of silica and carbonic acid is formed by its action, we may then be able to formulate in an intelligible manner the replacement of spicular silica by carbonate of lime, a change of which a large number of examples are now known to spongologists. Given, for instance, a solution of calcic dihydric carbonate (bicarbonate of lime) containing but a very small excess of free carbonic acid, such as might naturally be expected to exist in a bed composed of fragments of calcic carbonate (*e. g.* in a bed of chalk), and its action on spicular silica might then be represented as follows:—

$$\text{(i) } \underset{\text{(Sponge-spicules.)}}{\text{Dissolvable silica}} + \underset{\text{Calcic dihydric carbonate.}}{(CO)_2(OH)_2(CaO_2)}$$

$$= \underset{\text{(Dissolved silica.)}}{\text{Compound of silica and carbonic acid}} + \underset{\text{Calcic carbonate.}}{CO(CaO_2)}$$

Thus calcite would become pseudomorphic after siliceous spicules, and silica would pass into solution. But we also know from observation that the reverse solution frequently takes place; this we may represent in the following equation:—

$$\text{(ii) } \underset{\text{Calcic carbonate, } ex.\ gr. \text{ coral.}}{CO(CaO_2)} + \underset{\text{(Dissolved silica.)}}{\text{Compound of silica and carbonic acid}}$$

$$= \underset{\text{Calcic dihydric carbonate.}}{(CO)_2(OH)_2(CaO_2)} + \text{Silica deposited.}$$

Hence these reactions belong to that numerous class known to chemists as reversible; and it follows that the dissolved silica set free by the first reaction (i) might be again deposited on coming into contact with the carbonate of lime in excess in the surrounding bed, according to the reaction given in equation (ii); and thus, in one and the same sponge-skeleton, the solution of spicular silica, its replacement by carbonate of lime, and the redeposition of the dissolved silica might be proceeding simultaneously. In some such manner may the mineral arrangements which I have described in *Stauronema* and *Pharetrospongia* have been brought about.

which the fibre has been formed, and afterwards enlarges and unites these together so as to form a continuous canal in the axis of the fibre.

4. The "rosettes" and other flesh-spicules of the Hexactinellids pass into solution before the hollow sexradiate casts have been definitely produced. This explains the fact that these spicules have never yet been observed in the fossil state.

5. The spines and tubercles of vitreo-hexactinellid fibre persist up to a very late stage of solution, and considerably outlast the rosettes and flesh-spicules.

6. Except in the case of *Euplectella*, the vitreo-hexactinellid fibre does not exhibit a tendency to scale off into concentric layers when undergoing solution.

7. In ordinary spicules the caustic potash insinuates itself between the faces of the component lamellæ, which thus dissolve not only at their edges, but over their whole surface, and in consequence become separated from each other and so display the true structure of the spicule.

8. The globe-stellate spicules dissolve chiefly from within outwards: a central cavity is formed with hollow rays proceeding from it; this cavity continuously enlarges towards the exterior till the siliceous substance surrounding it becomes reduced to a mere film.

The unbuilding of these spicules thus proceeds exactly in the same way as their building-up; the growing hollow cavity with its rays is an exact negative image of the solid sphere with its fine projecting spines that passes at length into the adult globo-stellate form.

9. The solution which suffices to analyze the various layers of a large spicule from each other destroys altogether small spicules, such as those of *Halichondria panicea*.

10. The external solution of the spicules may take place with comparatively greater rapidity at some points than others on the surface, which thus becomes excavated by a number of hemispherical pittings.

11. Dead spicules are soluble also in water containing carbonic acid; and thus arises a correspondence in the characters of spicules artificially treated with caustic potash and those which are dredged up from the sea-floor or obtained in a fossil state.

EXPLANATION OF PLATE IX.

Alterations produced in spicular structures by boiling in caustic potash solution.

Fig. 1. *Dactylocalyx subglobosus.* Skeletal network, exhibiting casts of sexradiate spicules (× 104).

Fig. 2. *Aphrocallistes Bocagei.* Two nodes of the network, with two sexradiate casts, each with one ray prolonged to form the interior of one of the long spines of the interior of the netted tube (×140).
Fig. 3. Capitate termination of a spicular cast in the fibre of *D. subglobosus* (×435).
Fig. 4. *Farrea densa.* A node of the network, exhibiting casts of three imbedded spicules (×104).
Fig. 5. *Hyalonema Sieboldii.* Cut end of a length of the anchoring spicule, with the lamellar structure revealed by solution (×104).
Figs. 6 to 9. *Geodia arabica.* Globo-stellates in various stages of solution: *h*, hilum; *r*, radiate structure; *c*, central cavity; *s*, contained air-bubble (×140).
Figs. 10 & 11. *Pachymatisma Johnstonia.* Globo-stellates: *p*, hemispherical excavations (×140).
Figs. 12 & 13. *Geodia arabica.* Spines of a globo-stellate separated by solution: fig. 12, seen in elevation; fig. 13, in plan (×435).
Fig. 14. *P. Johnstonia.* Globo-stellate: *f*, thin structureless external film of silica, separated from the rest of the spicule within it (×140).
Fig. 15. Hemispherical excavations on the exterior of an acerate spicule of *Geodia arabica*: *a*, one showing the circular outcrop of the concentric lamellæ round its walls (×140).
Figs. 16 & 17. Ends of cylindrical spicules of *Pachymatisma Johnstonia* (×435).
Fig. 18. Abnormal structure, showing two spicules of *P. Johnstonia* ankylosed together (×140).
Fig. 19. *Trachya*, sp. Acuate spicule: *a*, originally pointed end; *b*, rounded end (×435).

XXXVII.—*Notes on Stony Corals in the Collection of the British Museum.* By Dr. F. Brüggemann.

III. A Revision of the Recent Solitary Mussaceæ.

Of the above-named group, which is equivalent to the *Lithophylliacées simples* of Milne-Edwards and Haime, there appear to exist at least four genera comprising living species. They may be tabulated in the following manner:—

A. Without a distinct epitheca .... 1. Scolymia.
B. With an epitheca.
  a. Edges of the larger septa roughly lacero-dentate, the outermost teeth the strongest .... 2. Cynarina.
  b. Edges of the septa equally dentate.
    1. Columella large, spongious .... 3. Antillia.
    2. Columella small, trabecular........ 4. Homophyllia.

Taking other characters into view, another arrangement can be made:—

A. Coral fixed to the ground, with an expanded base.
  a. Costæ roughly spinose .... 1. SCOLYMIA.
  b. Costæ denticulate .... 4. HOMOPHYLLIA.
B. Coral free in old age, with a pointed or rounded base.
  a. Costæ roughly spinose .... 2. CYNARINA.
  b. Costæ denticulate .... 3. ANTILLIA.

A third mode of differentiating them is this:—

A. Calicle and columella nearly circular .... 4. HOMOPHYLLIA.
B. Calicle more or less circular; columella oblong, with a longer and shorter axis.
  a. Coral cylindro-turbinate or columniform 1. SCOLYMIA.
  b. Coral turbinate .... 2. CYNARINA.
C. Calicle and columella decidedly bilateral, both of them with a longer and shorter axis ...... 3. ANTILLIA.

Most of the genera exhibit more affinities to some of the compound Mussaceæ than to each other; they might also be shortly defined thus:—

1. *Scolymia*, as a solitary *Mussa* without an epitheca.
2. *Cynarina*, as a solitary *Mussa* with a thick epitheca.
3. *Antillia*, as a solitary *Trachyphyllia* with a thick epitheca.
4. *Homophyllia*, as a solitary *Isophyllia* with a delicate epitheca.

I. SCOLYMIA.

Caryophyllia, Milne-Edwards and Haime, Compt. Rend. xxvii. p. 491.
Scolymia, Haime, Mém. Soc. Géol. Fr. (2) iv. p. 279, note.
Lithophyllia, Milne-Edwards and Haime, Hist. Nat. Cor. ii. p. 290.

Coral cylindro-turbinate, cylindrical, or almost prismatical, in all ages attached to the ground by an expanded base, without a distinct epitheca. Costæ prominent, roughly spinose, the uppermost spines being the strongest. Calicle shallow, circular, rarely oblong, rectangular or lobate. Septa of first and second cycles with their free edges lacero-dentate, the teeth increasing in size from within outwards. Columella oblong in outline, consisting of thin trabeculæ, its surface finely papillose or imbricate.

The Lamarckian name *Caryophyllia* having been previously restricted to another genus of stony corals, J. Haime proposed in 1852 to use for the present group the generic appellation of *Scolymia*, a name which Jourdan had applied to it in the Lyons Museum. There were not sufficient reasons to rename the genus subsequently; the name *Scolymia had* been published, whether by Haime or by Jourdan himself is no matter; and it is dissimilar enough to *Scolymus* (a genus of Mollusca) to prevent confusion. The family will be more appropriately termed *Mussaceæ*, from its principal genus *Mussa*, which is, moreover, of earlier date than either *Scolymia* or *Lithophyllia*.

I cannot concur in Count de Pourtalès's opinion (Deep-Sea Corals, p. 70) that the species of *Lithophyllia* will turn out to be younger stages of other corals—a suggestion already indicated by Esper, who united the *Sc. lacera* with a species of *Mussa*. *Sc. dubia* is indeed dubious in this respect; but as to *Sc. lacera*, *cubensis*, and *lacrymalis*, these are certainly permanent solitary forms. Some other species ought to be excluded from this genus, viz.:—

1. *Lithophyllia radians*, Duchassaing and Michelotti, Mem. Accad. Tor. (2) xxiii. p. 171, pl. vii. figs. 3, 4. According to the description and figure, the coral is much elevate, the septa are moderately dentate; the columella is very small, almost rudimentary. As these characters do not occur in the true *Scolymiæ*, the species in question may perhaps belong to another genus; but it seems to be established on a single specimen only.

2. *Lithophyllia cylindrica*, Duch. & Mich. *op. cit.* xix. p. 344, pl. ix. figs. 17, 18. The magnified figure shows the coral covered with a well-defined epitheca, the septa much exsert, rounded, their edges with small subequal teeth. I am inclined to consider this an early stage of an *Antillia*; it bears a general resemblance to a coral from Borneo which I shall proceed to describe as the young of *Antillia constricta*.

3. *Lithophyllia multilamella*, Duch. & Mich. *op. cit.* xxiii. p. 171, pl. viii. fig. 12. Most probably Pourtalès was correct in pronouncing this the young of an *Isophyllia*. It is, however, not identical with the *Isophyllia multilamella* of Pourtalès (Cat. Mus. Comp. Zool. iv. p. 70); for Duchassaing and Michelotti state, "les lamelles sont éloignées d'un millimètre," while Pourtalès's *Isophyllia* has from thirteen to fifteen septa in the space of a centimetre.

4. *Caryophyllia australis*, M.-Edw. & Haime, Ann. Sc. Nat. (3) xi. p. 239. The French authors have at first, with some hesitation, included this coral in the present genus; afterwards (Polyp. Foss. Terr. Paléoz. p. 87) they refer it to *Isophyllia*. As it differs materially from both these genera, I have made it the type of a new one.

The species of *Scolymia* known to me may be thus characterized:—

A. Costal spines directed upwards; surface of columella spongious; six cycles of septa.
  a. Primary and secondary septa thickened throughout their whole length, with a narrow cavity within; costal spines fistular; calice oblong or rectangular; coral very short .... 1. *Sc. cubensis.*
  b. Septa of first cycles only thickened towards the wall, solid, as are also the costal spines.
    1. Calicle circular, rarely oblong; the larger septal teeth and the costal spines rather obtuse .... 2. *Sc. lacera.*
    2. Calicle strongly lobate; the larger septal teeth and the costal spines acutely pointed .... 3. *Sc. dubia.*

B. Costal spines directed outwards, or even downwards; columella dense, with subimbricate surface.
  a. Five cycles of septa; larger septal and costal teeth spiniform, much pointed .... 4. *Sc. vitiensis.*
  b. Four cycles of septa; larger septal and costal teeth knob-like, obtuse .... 5. *Sc. lacrymalis.*

1. *Scolymia cubensis.* B.M.

Caryophyllia cubensis, Milne-Edwards & Haime, Ann. Sc. Nat. (3) Zool. xi. p. 238.
Lithophyllia cubensis, M.-Edw. & Haime, Hist. Nat. Cor. ii. p. 292; Duch. & Mich. Mem. Accad. Tor. (2) xix. p. 343, pl. v. fig. 10.

Hab. Cuba; St. Thomas.

Pourtalès describes his *Lith. cubensis* as having the spines of the younger septa branching, sometimes coalescing and perforated; he unites doubtfully with it *L. argemone* and *L. cylindrica*, both of which are stated to have circular calicles. As these characters are more conspicuous in *Sc. lacera*, I am led to believe that his specimens may belong to the latter.

2. *Scolymia lacera.* B.M.

Madrepora lacera, Pallas, Elench. Zooph. p. 298; Esper, Pflanzenth. i. p. 148 (pt.), Madrep. pl. xxv. fig. 2.
Caryophyllia lacera, M.-Edw. & H. Ann. Sc. Nat. (3) xi. p. 237.
Lithophyllia lacera, M.-Edw. & H. Hist. Nat. Cor. ii. p. 291; Duch. & Mich. Mem. Accad. Tor. (2) xix. p. 343.
Lithophyllia argemone, Duch. & Mich. Mem. Accad. Tor. (2) xix. p. 344, pl. ix. figs. 11, 12, pl. x. fig. 15.
Lithophyllia "cubensis," Pourtalès, Cat. Mus. Comp. Zool. iv. p. 70.

Hab. Curaçao (*Pallas*); St. Thomas (*Duch. & Mich.*); Tortugas (*Pourtalès*); Bermuda (*Pourtalès*).

With this species I have identified the *Lithophyllia argemone*, as the description and figures show no differences from

Sc. lacera, except an inferior size and a less developed columella, characters indicating merely a younger age of the specimens. The authors state that the principal septa are very distinct from each other (?) and from the smaller ones. This peculiarity is indeed expressed in fig. 15 on pl. x.; but it is not represented in fig. 11 on pl. ix.*). In *Sc. lacera* the principal septa are sometimes more, sometimes less, distinct from those of the following orders. The development of the sixth cycle is also variable in this species, as already mentioned by the accurate observer Pallas :—" Lamellæ majores centro contiguæ; at his interjectæ plerumque quinæ (raro plures), longitudine et altitudine sensim minores."

3. *Scolymia dubia.* B.M.

Fungus marinus &c., Seba, Thes. iii. p. 199. no. 2, pl. cviii. fig. 2.
Lithophyllia dubia, Duch. & Mich. Mem. Accad. Tor. (2) xix. p. 344, pl. ix. fig. 15; Pourtalès, Cat. Mus. Comp. Zool. Cambr. iv. p. 70.

Hab. St. Thomas; Gulf-stream, Looe Key (*Pourtalès*).

4. *Scolymia vitiensis.* B.M.

Coral short cylindrical, somewhat enlarged towards the calicle. No distinct epitheca. Costæ not well pronounced, scarcely prominent, armed with strong pointed spines which are directed outwards. Calicle rounded, slightly oblong and irregular, very shallow, the free edges of the septa being only slightly inclined. Septal systems indistinct. Septa most delicately and densely granulate on their surfaces, belonging to five complete cycles; those of the first three orders subequal, thick, their three inner edges with a small number (about five) of large teeth, the innermost and outermost of which are pointed, whereas the one or two intermediate are obtusely rounded at the top. Septa of fourth cycle much thinner, with more numerous, subequal, obtuse teeth, those of the fifth very narrow and short, partly rudimentary, their edges irregularly denticulate. Columella very dense, with subimbricate surface, the trabeculæ being enlarged to horizontal somewhat crimpled lamellulæ. Endothecal dissepiments much developed; exotheca wanting.

Hab. Feejee Islands (*F. M. Rayner*).

The single specimen measures nearly 3 centims. in height, and 4 centims. in its largest diameter; it is broken at the base,

* This figure is evidently meant to represent part of the calicle of fig. 12, although it is quoted by the authors as showing some magnified calicles of *Solenastrea micans*.

so that I cannot give any particulars about its mode of adherence. The costæ are closely covered for the greater part of their length with a thin, rose-coloured, calcareous crust, which seems to be rather a nulliporine growth than a true epitheca.

The species is easy to tell from the following; its affinities are more with the American forms, from all of which it differs in the absence of the sixth cycle, the small number of the larger septal teeth, and the direction of the costal spines.

5. *Scolymia lacrymalis.* B.M.

Caryophyllia lacrymalis, M.-Edw. & Haime, Ann. Sc. Nat. (3) Zool. x. p. 320, pl. 8. fig. 1; *iid. op. cit.* xi. p. 238.
Lithophyllia lacrymalis, M.-Edw. & H. Hist. Nat. Cor. ii. p. 292.

Hab. Philippine Islands (*M.-Edw. & H.*); Borneo (*Sir E. Belcher*, in B.M.).

In a young specimen (produced by intracalicinal gemmation) there are only three cycles of septa; the columella is low and consists of a few coarse trabeculæ.

II. Cynarina*.

Agreeing in all respects with *Scolymia*, except that the coral is free when adult, turbinate, and covered with a thick epitheca. From *Antillia* it differs in having the costæ roughly spinose; the free edges of the larger septa lacero-dentate, the septal teeth increasing in size from within outwards, the calicular fossa very shallow; the calice circular in the adult, compressed in the young (the reverse being the case in *Antillia*). From *Homophyllia* it is likewise distinguished by the structure of its costæ, septa, and fossa; besides, *Homophyllia* is always fixed by its base, and shows a very thin, appressed epitheca, whereas the latter is thick and only loosely adherent in *Cynarina*.

I am acquainted with only one species referable to this genus.

Cynarina Savignyi. B.M.

Coral turbinate, somewhat ventricose, ponderous, free. Outside of wall covered till near the edge with a thick epitheca, through which, however, the costæ and their spines are visible. Costæ unequal, prominent, roughly spinose; scabrous from being covered with minute pointed granules. Calicle circular, extremely shallow; the free edge of the larger septa

* From *Cynara*, a genus of phanerogamous plants, in allusion to *Scolymia*.

is almost horizontal; at their inner extremity they fall off suddenly and nearly perpendicularly to the columella, thus marking a well-defined columellar fossula. Five complete cycles, most regularly developed. Septa strongly projecting, covered all over with scattered pointed granules; those of the first three orders subequal, rather thick, with their free edges irregularly lacero-dentate, a deeper incision being marked half of their length; their teeth few in number (about six), those in the outer half generally closely united to a large projecting lobe. Septa of fourth cycle much thinner, narrower, and a little shorter, their edges with crowded, narrow, and pointed teeth; septa of fifth cycle very thin, about half as long as those of the preceding, their edges minutely dentate. Columella oblong, with even surface, densely spongious, its trabeculæ rather thick, irregularly branched and confluent. Endotheca well developed; exotheca apparently none.

Height 4 centims.; diameter of calicle $3\frac{1}{2}$ centims.

Hab. Red Sea, Gulf of Suez (B.M.; *R. MacAndrew* in B.M.).

Of this species, the Museum contains a considerable series of specimens; yet I have taken the description from a single example, because this is the only one which is fully adult and at the same time beautifully regular in its septal apparatus. In the young specimens, the calicle is oval and deeper, the columella scantily developed, papillose. They are attached by a narrow base to dead shells, nullipores, and the like; but they soon become quite free; and then, *vice versâ*, shells and serpulæ are usually attached and agglutinated to their epitheca. The regular development, as described above, is perhaps almost exceptional; in other (more than half-grown) specimens the calicle is irregular in outline, often strongly compressed. In the latter case the fossa is much deeper, and the edges of the wall are not on the same level, being more elevate at the extremities of the shorter axis. The shape and dentation of the septa is also, of course, much influenced by the general shape of the coral: in the compressed specimens their edges are almost perpendicular instead of being horizontal, and nearly entire, with the exception of the uppermost parts.

I have named this species after the excellent French naturalist J. C. Savigny, because he was the first to discover it; he has also figured it in the 'Description de l'Egypte,' Polypes, pl. 4. fig. 2, 1–3. The young specimen (fig. 2, 3) agrees exactly with some in the museum collection. In fig. 2, 1, part of the epitheca is destroyed, and thus the costæ appear to be bare; the septal teeth are rather too much pointed. Fig. 2, 2 is more exact in this respect.

Savigny's figure was either mistaken or overlooked by subsequent authors. Audouin (Explic. somm. d. Planch. Savign. p. 233) declares it to represent a *Caryophyllia*, perhaps the young of *C. carduus.* Ehrenberg (Corall. Roth. Meer. p. 92) refers to it under his *Caryophyllia lacera*, remarking that he himself had not found this coral in the Red Sea. M.-Edwards and Haime have not mentioned it anywhere*.

III. Antillia.

Antillia, Duncan, Quart. Journ. Geol. Soc. xx. p. 28.

Coral short, turbinate, in the earliest stages fixed to the ground by a short pedicel, afterwards free, pointed at its base. Epitheca well developed, moderately appressed, generally with transverse ringlets of growth. Costæ prominent, equal, denticulate. Calicle more or less oblong, with a longer and a shorter axis. Septa much projecting, rounded at their summits, with their free inner edges uniformly and minutely serrato-dentate; the inner thirds of the larger septa sometimes separated by an emargination as paliform lobes. Columella large, oblong, spongious. Animal with a single row of numerous, small, verruciform tentacles, an even, more or less granulate disk, and a single, oval or linear mouth.

This genus was originally established on some fossil West-Indian corals differing from *Montlivaltia* in the possession of a well-developed columella. It has become necessary to draw up a more precise definition of the genus in order to differentiate it sufficiently from its recent allies. It proves to be widely distributed in the coral seas; there are at least four living species belonging to it.

1. *Antillia Lonsdalei.*

Antillia Lonsdaleia, Duncan, Proc. Zool. Soc. 1876, p. 438, pl. xli. figs. 1, 2.

Hab. Japanese seas, in moderate depth.

Prof. Duncan has referred this coral as a variety to a fossil

* The following is a revised index to the Madreporaria figured by Savigny in 'Description de l'Egypte,' Polypes:—

Pl. 3. fig. 4. *Alveopora dædalea* (Forsk.).

Pl. 4. fig. 1. *Antillia Geoffroyi* (Audouin); fig. 2. *Cynarina Savignyi*; fig. 3. *Stylophora digitata* (Pall.); fig. 4. *Montipora crista galli* (Ehrenb.); fig. 5. *Cyphastræa Savignyi*, M.-Edw. & H.; fig. 6. *Alveopora fenestrata* (Lam.).

Pl. 5. fig. 1. *Siderastræa Savignyana*, M.-Edw. & H.; fig. 2. *Goniopora Savignyi*, Dana; fig. 3. *Astræa Savignyi* (M.-Edw. & H.); fig. 4. *Cœloria arabica* (= *C. labyrinthiformis*, M.-Edw. & H.).

species from St. Domingo (*A. Lonsdaleia*, Duncan, Quart. Journ. Geol. Soc. xx. p. 30, pl. iii. fig. 4), from which iti stated to differ only in its general shape.

2. *Antillia explanata.*

Antillia explanata, Pourtalès, Ill. Cat. Mus. Comp. Zool. Cambr. viii. p. 42, pl. viii. figs. 4–6.

Hab. Barbadoes, in 75 fathoms depth.

3. *Antillia Geoffroyi.* B.M.

Turbinolia Geoffroyi, Audouin, Descr. Egypt. Expl. Planch. p. 233 (ex Savigny, *op. cit.* Polypes, pl. 4. fig. 1); Dana, U.S. Expl. Exped. Zooph. p. 190, note.

Trachyphyllia Geoffroyi, M.-Edw. & Haime, Ann. Sc. Nat. (3) xi. p. 276; *iid.* Hist. Nat. Cor. ii. p. 341; Häckel, Arab. Korall. p. 45, pl. ii. fig. 2.

Hab. Red Sea; Gulf of Suez (*R. MacAndrew* in B.M.).

This coral is exceedingly variable. The calicle is rounded in the youngest specimens, afterwards it becomes either broad explanate (and then the coral is always very short) or compressed, even linear, much more so than in the species of *Flabellum.* The proportion between the shorter and longer axis varies, in middle-sized specimens, from 1 : 2 to 1 : 5. When the calicle is open it is generally irregularly constricted in its sides, and there are indications of paliform lobes, although these are never much pronounced; in the compressed specimens they are, of course, wanting.

The present species has been regarded by the French monographists as the young of a compound coral allied to *Trachyphyllia amarantum.* This is a mistake: the young *Trachyphylliæ*, of which there are several examples in the Museum collection, begin to divide at a very early period, and exhibit the same irregular plications as the adult; they have also no trace of an epitheca. On the contrary, all the numerous specimens of *A. Geoffroyi* before me are quite simple, without any inclination to divide; the animals (preserved in spirit) show constantly a single mouth, however elongate the calicle may be; the epitheca is always present and neatly defined, although less extensive in the young.

Savigny's and Milne-Edwards's specimens were evidently not "very young," but fully adult, and, to judge from their enormous size, probably very aged. The only mode of asexual propagation I have noticed in this species is that by means of intracalicular budding; in one specimen this has repeatedly taken place, and thus three calicles are placed one in the other, not unlike the fossil *Cyathophyllum.*

The *Manicina "areolata"* of Ehrenberg (Abh. Berl. Akad. 1832, i. p. 327), quoted here by M.-Edwards and Haime, is, from the description, quite different, and may be a true *Trachyphyllia.*

4. *Antillia constricta.* B.M.

Coral short, turbinate, straight, with pointed base, apparently free. Calicle much longer than broad, oblongo-elliptical, with the sides in their middle deeply and regularly constricted in the direction of the short axis, giving to the outline nearly the shape of an 8; each of the four corners with a very slight indication of an additional constriction. Epitheca well developed, covering half the height of the wall; the latter rather thin, with scanty but conspicuous exotheca. Costæ subequal, prominent, almost cristiform, their edges with a single series of crowded small and acute teeth. Edge of the calicle not on the same level, much elevate in the constricted middle parts, lowest at the extremities of the longer axis. Fossa deep. Septa most regular, belonging to six complete cycles: primary, secondary, and tertiary ones subequal, thick, well projecting, obtusely rounded on their summits; their lateral surfaces covered with remote granules, which are arranged towards the inner edge in oblique rows running to the marginal teeth; their free inner edges in the upper half straight, with small crowded acute teeth, then suddenly dilated to a large paliform lobe, which is separated by a deep, acute or rectangular emargination, and has its edge entire. Septa of fourth cycle smaller and thinner, with irregularly and coarsely dentate edge, the paliform lobe less pronounced and somewhat toothed; those of fifth and sixth cycles lacerately toothed, without paliform lobes. Columella well developed, linear in outline, with even, more papillose than spongious surface, dense, consisting of thin, filiform, subparallel trabeculæ, most of which are evenly furcate at the top. Height of coral 40 millims., longer axis of calicle 65 millims., shorter axis 45 millims., shortest diameter (in the constricted middle parts) 25 millims.

Hab. Borneo (*Sir E. Belcher*).

The above description is taken from a single specimen; but there is another coral (without indication of locality) in the collection which seems to represent a more advanced stage of growth of the same species: it is higher and heavier; the epitheca ascends to five sixths of the height; the costæ are thicker and more roughly dentate; the four smaller constrictions in the corners of the calicle are very conspicuous. In all other respects it agrees with the type specimen, except that the calicle is wider and the paliform lobes less pronounced; but these may be individual peculiarities, whereas the before-mentioned differences are undoubtedly signs of a more advanced age.

In a young specimen from Borneo, the coral is attached by a narrow base, the calicle is rounded oval, with scarcely a trace of constriction in the middle of its sides; there are only four cycles of septa, which are thin, broad, and much exsert, without paliform lobes.

Lastly, there is in the collection also a specimen in spirit from North Australia (collected by J. B. Jukes; "dredged in 10 fathoms depth") which appears to be specifically identical with the Bornean type.

A. constricta differs from *A. Geoffroyi* and *A. Lonsdalei* in the shape of its calicle, the regular development of the septal cycles, and the strong paliform lobes; from the former, besides, in its strictly symmetrical form, in its narrow costæ, and in the structure of its columella, the latter being in *A. Geoffroyi* truly spongious and consisting of irregularly branched and coalescing lamellar trabeculæ.

IV. Homophyllia.

Coral neatly turbinate, with a narrow, somewhat expanded base. Outside of wall covered almost to the edge with a thin closely adherent epitheca, through which the costæ are distinctly perceptible. Costæ crowded, perfectly equal, prominent, minutely denticulate. Calicle circular, deep. Edges of septa with crowded, narrow, subequal teeth. Columella very small, rounded in outline, coarsely trabecular.

This genus is here established for the reception of the *Caryophyllia australis* of Milne-Edwards and Haime, which the authors had united with the *Scolymiæ*, remarking at the same time that, by its epitheca and small columella, it made an approach to *Thecophyllia* (=*Montlivaltia*). In addition to this, the general shape of the coral, the deepness of its calicle (caused by a scanty development of the endothecal dissepiments), and especially the structure of the costæ and septa will justify its generic separation; otherwise it would be necessary to unite all the simple Mussaceæ into one genus. The differences from *Cynarina* have been given above; from *Antillia* it is distinguished by its circular development throughout, by being attached by means of an expanded base in all ages, by its thin and closely adherent epitheca, by the mode of dentation of its septa, and by its small columella.

Homophyllia australis. Types, B.M.

Caryophyllia australis, M.-Edw. & Haime, Ann. Sc. Nat. (3) Zool. x. p. 320, pl. 8. fig. 2; *iid. op. cit.* xi. p. 239.

In this species the septa are moderately prominent, rather thin, of uniform thickness throughout their whole length, and delicately scabrous from the presence of numerous very small pointed granules. The septal systems are quite distinct. There are six cycles, the last of which is incomplete. The primary and secondary septa are equal; the teeth of their edges are much crowded, middle-sized, narrow, straight, rather obtuse; those in the middle part of the septal edge are, on the average, the longest; they decrease in length towards the circumference and centre of the calicle. The tertiary septa are much like the preceding, only a trifle narrower, with fewer and longer teeth; those of the fourth cycle are similar, but they do not reach the columella. The septa of the fifth and sixth cycles are only half as long as those of the fourth, and scarcely dentate on their edges. The columella is much reduced and low, its surface subpapillose.

Very young specimens (4 to 8 millims. in diameter) are broadly attached and very short cylindrical, almost discoid. The epitheca is present from the beginning.

Height of the adult 20 millims.; diameter of calicle as much as 30 millims.

Hab. Port Lincoln (*J. B. Harvey* in B.M.). The statement "Chinese seas" (*M.-Edw. & H.* 1857) is doubtful, and requires confirmation.

Milne-Edwards and Haime, in their later works, have mistaken this coral for the young of a West-Indian *Isophyllia*; the description of *Isophyllia* "*australis*" (Hist. Nat. Cor. ii. p. 375) has nothing to do with the species now under consideration. The latter is found growing socially on rocks; and occasionally it happens that two neighbouring specimens touching each other become intimately united by their walls. Such is the case in one of the type specimens; and it is most likely that from the observation of this spurious compoundness (which is only caused by contact, not by fissiparity) Milne-Edwards and Haime arrived at their erroneous conclusion. There can be no doubt that *Homophyllia* remains solitary at all ages. The young *Isophylliæ*, moreover, are quite different: they are expanded, convex, with flat under surface and lamelliform costæ; they divide in a curious manner, according to the septal systems. E. de Pourtalès first noticed this kind of development in his *I. guadulpensis*

(Cat. Mus. Comp. Zool. iv. p. 71); but it seems to occur also in a more or less regular way in all the other species.

From this peculiar mode of growth, as well as from the dentation of the septa, the loosely trabecular spreading columella, the general shape and aspect of the corallum, &c., the West-Indian *Isophylliæ* appear to me, by the way, to be a natural generic group which should not be blended with *Symphyllia*, as has been proposed by Pourtalès. *Symphyllia*, in its turn, cannot be separated from *Mussa*; there are, as Verrill (in Dana, Cor. & Cor. Isl., App. p. 336) has already observed, such numerous transitions, not only as regards the species, but also the individual coralla, and even parts of individuals, that, although admitting the justice of Lütken's contrary remarks (Zool. Rec. for 1872), I can see no possibility of keeping these two genera apart. As to the West-Indian so-called *Symphylliæ*, I agree with De Pourtalès that *these* should stand in the same genus with *Isophyllia*. Duchassaing and Michelotti have described as *Symphyllia* not only species of true *Isophyllia*, but also of *Ulophyllia* (which genus is certainly of West-Indian origin) and possibly of *Mycetophyllia*. The differences between all these genera are, indeed, precarious enough. The innermost septal teeth in *Isophyllia* are frequently prolonged to join the trabeculæ of the columella; I would therefore prefer to return to Milne-Edwards and Haime's former classification, and to withdraw again *Isophyllia* in favour of *Ulophyllia* (the latter being prior in date). Perhaps also *Mycetophyllia* cannot be maintained. I am not acquainted with its type species; but there is a West-Indian coral in the Museum collection showing the septal dentation of *Ulophyllia crispa* and the superficial calicles of *Mycetophyllia*; besides, the development of the endotheca is said to be very different in degree in the two species of *Mycetophyllia*. To *Ulophyllia*, in its former, more extensive sense, the following specific names are referable:—

1. *Meandrina crispa*, Lamarck; *Oulophyllia crispa*, M.-Edw. & H.
2. *Oulophyllia Stokesiana*, M.-Edw. & H.
3. *Oulophyllia? spinosa*, M.-Edw. & H. 1849; *Isophyllia spinosa*, M.-Edw. & H. 1857.
4. *Isophyllia* "*australis*," M.-Edw. & H. 1857 (not *Caryophyllia australis*, M.-Edw. & H. 1848 and 1849!).
5. *Symphyllia guadulpensis*, M.-Edw. & H.
6. *Isophyllia* "*guadulpensis*," Pourtalès; *Isophyllia* "*rigida*," Verrill, 1864. The strong costæ are not sufficient to identify the *Symphyllia guadulpensis*, as they are equally

well, and perhaps even better, developed in *I. sinuosa*; moreover the dentation of the septa in the original *S. guadulpensis* seems to be different.

7. *Astræa rigida*, Dana; *Prionastræa rigida*, M.-Edw. & H.; *Isophyllia rigida*, Verrill, 1872.
8. *Mussa dipsacea*, Dana; *Symphyllia dipsacea*, M.-Edw. & H.; *Isophyllia dipsacea*, Verrill.
9. *Madrepora sinuosa*, Ell. & Sol.; *Isophyllia sinuosa*, Verrill. The original diagnosis given by Ellis and Solander is rather meagre; but as the name has got a precise meaning now by Verrill's good description, it must be accepted for this well-marked species.
10–20. *Symphyllia strigosa*, *S. anemone*, *S. conferta*, *S. Aglae*, *S. helianthus*, *S. Thomasiana*, *S. aspera*, *S. cylindrica*, *S. Knoxi*, *S. marginata*, *S. verrucosa*, Duchassaing & Michelotti, 1860.
21. *Lithophyllia multilamella*, Duch. & Mich. 1864.
22. *Isophyllia "multilamella,"* Pourtalès*.

For want of sufficient material, I must leave the discrimination of the actual species to future researches. It is more than probable that at least half the number of the above names will prove to be merely synonyms.

XXXVIII.—*On* Bellidia Huntii, *a Genus and Species of Crustacea supposed to be new.* By Philip Henry Gosse, F.R.S.

[Plate X.]

Family **Alpheadæ.**

Bellidia (gen. nov.), Gosse.

Internal antennæ very little above the external: composed of two filaments forming a right angle.

External antennæ with the basal plates very large.

Feet: first pair small, didactyle, consimilar. Second pair long, very slender, didactyle; both arm and wrist many-jointed.

Eyes not covered by the carapace.

Abdomen bent abruptly.

Tail-plates large, all undivided.

* *Mussa fragilis*, Dana, referred to *Isophyllia* by Verrill, is, according to the description, a *Colpophyllia*.

Bellidia Huntii, Gosse.

As this is the only species known, no diagnosis can be given; but it may be thus described:—

Beak simple, small, rounded, smooth, acute.

Internal antennæ of two filaments, the one projecting, the other erect and strongly ciliated on one side (*e*); seated very little above the external pair.

External antennæ one third as long as the body. Basal plates very large; in form one-fourth of a long ellipse; a single tooth in the outer edge, near the tip (*b*).

First pair of feet small and short, both didactyle, consimilar; the thumb gibbous, solid; the movable finger somewhat shorter, slender, finely pointed, much curved, colourless, and translucent (*d*).

Second feet moderately long, very slender, didactyle; hand minute; both arm and wrist many-jointed.

Outer foot-jaws long, strong, foot-shaped; the terminal joint armed with strong teeth on the upper edge.

Eyes not covered by any vault of the carapace, but projecting above the rostrum.

Abdomen abruptly bent, much as in *Hippolyte*; attenuated rapidly (*a*).

Legs moderately long; all monodactyle.

Tail-plates large; the outermost showing no trace of transverse division (*c*).

Length three quarters of an inch from end of rostrum to end of tail.

The specimen was a female, heavily laden with advanced spawn: the ova large, globular, densely attached to the fringes of the false feet, and thus increasing the apparent depth of the animal.

Colour: a dark rich lake-crimson, marked, on the cephalothorax and abdomen, with well-defined vertical stripes of brilliant opaque white, imparting a zebra-like aspect to the creature. The head bears two longitudinal stripes of white on each side. The entire length of the back is dark red, with a broad white stripe running down the median line. All the limbs red. The ova of a dark sea-green hue.

With considerable affinity to the family Crangonidæ on the one hand, and to the Palæmonidæ on the other, this little creature is separated from the former by the chelæ, from the latter by the rostrum. It must be placed in the Alpheadæ.

With *Alpheus* it agrees in the minute rostrum and in the outer tail-plate being entire. From *Alpheus* it differs in the equality and consimilarity of the hands, and in the unshielded condition of the eyes.

With *Nika* it agrees in the multiarticulate arms as well as wrists of the second feet, and in several minute characters. From *Nika* it differs in *both* the hands of the first feet being didactyle, and in the outer tail-plate being entire.

With *Athanas* it agrees in the unshielded eyes, and in several other characters. From *Athanas* it differs in the inner antennæ having three filaments, and in the outer tail-plate being entire.

This elegantly shaped and brilliantly coloured little shrimp was dredged by Arthur R. Hunt, Esq., F.G.S., in about 6 fathoms, off the Shag Rock*, at the northern end of Torbay, on the 10th of August, 1877. During this summer I had enjoyed the privilege of numerous dredgings in Torbay with him in his convenient little yacht the 'Gannet;' and we had both lamented the paucity of results. On this particular day we had been occupied at the south-west corner of the bay; and my friend, having landed me at Torquay with my *opima spolia*, proceeded to the Shag Rock to spend another hour in dredging alone. The result proved unwontedly rich. Besides many examples of *Comatula rosacea*, adult, and in the crinoid condition variously advanced, and some other interesting things, he obtained two creatures, which he at once saw to be unfamiliar, and which proved to be, both of them, new to the British fauna, and, as I believe, each of them a type of an undescribed genus. The one was the elegant shrimp above described; the other was the nudibranch mollusk that forms the subject of the following paper. Surely it was a most noteworthy reversal of fortune that two new generic forms should reward a single dredge-haul!

My friend, after he had preserved the specimens alive for a few days in his own aquarium, kindly presented them both to me. The *Bellidia* continued awhile in health and vigour, manifesting, in its alternations of active motion and still repose, a resemblance to the little Crangons. The liftings from vessel to vessel, the confinement in small cells for microscopic examination, and the manipulations to which it was unavoidably subjected in order to define and figure it, careful and tender as I was in performing these, were, however, fatal to it; for it

* Mr. Hunt gives me the locality more exactly thus:—"In about 6 fathoms on a submerged rock, off Meadfoot Sands, that extends from the Shag Rock, in the direction of the Thatcher, to the well-known sunken rock, Morris's Rogue."

soon died*. The specimen, preserved in spirit, I am about to deposit in the British Museum.

I wish to dedicate this genus to the venerable author of 'A History of the British Stalk-eyed Crustacea,' to whom I personally owe a life-long debt of esteem, and gratitude, and love†. And the species to the friend to whom science is indebted for its fortunate discovery.

EXPLANATION OF PLATE X.

a. *Bellidia Huntii*, magnified $\frac{4}{1}$.
b. The anterior organs, viewed from above.
c. The tail-plates.
d. The left hand.
e. One internal antenna.

XXXIX.—*On* Hancockia eudactylota, *a Genus and Species of Mollusca, supposed to be new*. By Philip Henry Gosse, F.R.S.

[Plate XI.]

Family **Tritoniadæ**.

Hancockia (gen. nov.), Gosse.

Body linear, scarcely palliate.

Head, beneath, produced on each side into a broad, flat, many-fingered oral tentacle.

Dorsal tentacles two, with laminated bulbs, retractile within sheaths.

Branchiæ three pairs, foliate, pinnatifid, infolding, remotely seated on the subpalliate margin of the back.

Foot linear, grasping.

Hancockia eudactylota, Gosse.

The only known species.

Body (*a*, *b*) about half an inch in length when crawling,

* My friend favours me with the following note:—"*Bellidia* is doubtless a rocky shrimp, not a sandy one; and its colours would match the beautiful red weeds among which it is found. I believe it was off a mass of red weed that I picked the *Hancockia* (see the following memoir), and the very minute *Aplysia* found on the same occasion, which I afterwards showed you."

† I had at first written the word as "*Bellia*;" but I find that this form is already occupied in zoology. As I do not choose to relinquish my tribute of affection to my friend, I adopt another termination.

one sixteenth of an inch in width, linear, parallel-sided, nearly opaque, of an olive-colour, much paler beneath. An internal mass seen through the skin and flesh, between the first branchiæ, most conspicuous in the lateral view (*a*), of a rich brown hue, is doubtless the liver. The whole upper surface is clothed, more especially toward the posterior portion, with a transparent skin, nearly colourless under transmitted, but of a light bluish-green hue under reflected light. This envelops the dorsal tentacle-sheaths and the exterior of the branchial leaves, and forms a loose web in the angles caused by the projection of these organs, and gathers in loose irregular folds over the ridge on each side from which they spring. This membrane is everywhere studded with subconical tubercles of denser substance. The under parts are destitute of this membrane.

Oral tentacles (*c*) large and conspicuous, each terminating in a conical process, whose flat bottom is applied to the ground in crawling, and from whose edge radiate three or four long fingers, alternating with as many rudimentary ones, the whole bearing a striking resemblance to the foot of a triton or frog. These hands of outstretched fingers are constantly used, in crawling, to feel the way: the fingers contract suddenly, in various degrees, every instant; and by their movements it is indubitably seen that these tentacles are very sensitive organs of touch.

Dorsal tentacles proceeding from the shallow trumpet-like extremities of large erect sheaths (*d*), which are thick, columnar, and very mobile. The sheaths are composed of the common dense tissue for the greater portion of their length; but this rises into points near the extremity, whose interspaces are filled by a more delicate pellucid web, forming the trumpet-mouth, which again is furnished with subconical points along its edge. From the centre of this trumpet-mouth projects the tentacle (*e*), in form of a short clavate column, with a basal bulb, which under high magnification divides into oblique leaves. The tentacle-tip usually reaches beyond the level of the trumpet-mouth, to the extent of about half of the latter's diameter; but it can be retracted wholly out of sight, without any sensible change of form in the sheath. The length of the sheath alone is more than the greatest width of the body.

Branchiæ three on each side, springing from a sort of pallial-ridge clothed with the loose membrane already alluded to. They appear at first sight to be stout ovate processes with short thick peduncles. But prolonged examination reveals that each is a broad thick leaf (*f*), of nearly circular outline, whose edge is deeply incised, so as to form five pairs and a terminal one, of irregularly notched leaflets. In general, the two sides of this leaf are incurved toward each other (*g*), facing outwards, so that the points meet and overlap loosely, frequently opening irregularly. Their appressed surface is delicate and transparent; their exterior rough and tuberculous, and of a blackish hue.

Head distinct; the mouth (*c*) opening as a longitudinal slit.

Foot parallel-sided, nearly as wide as the body when the animal is crawling on a flat ground; but able to bring its lateral edges together, to grasp such an object as a linear sea-weed. It ends in an abrupt blunt point, which reaches a little behind the body.

This genus seems to find its place in the family Tritoniadæ, very near to *Scyllæa*, which it resembles in form, and colour, and general facies; but from which it signally differs in the possession of well-formed elaborately-furnished oral tentacles, and by the deeply incised, infolding branchial lobes. I have not attempted to dissect my unique example; thus my acquaintance with its anatomy is limited to so much as can be discerned from without.

This minute, but very interesting nudibranch was dredged by Mr. A. R. Hunt, near Torquay, on Aug. 10, 1877; as I have more particularly described in my memoir on *Bellidia Huntii*, p. 315 *supra*. It was very readily kept in captivity for nearly three weeks, bearing rather rough treatment with impunity; and it died at last only by an accident. It would crawl rapidly on sea-weeds, and occasionally would float foot upward at the surface. On one occasion, as it was thus self-suspended at the surface of the water, I noticed that the flotation was not performed by the expanded foot, as I had supposed, and as is usual with similar mollusks; for the edges of the foot were actually in mutual contact throughout, and thus this organ was reduced to a mere line. The thought occurred, that possibly a narrow film of air might be inclosed within the folded foot; and I watched with interest till the animal should sink, to observe whether any tiny bubble would arise from it. I waited till it began to crawl on the bottom, and till I could see clearly the tip of the foot projecting behind, whereby I was sure that this organ was wholly flattened; but no pellicle of air appeared.

On another occasion, when thus floating, the foot was expanded, and the broad palms of the oral hands were in contact with the circumjacent air.

After I had kept my little captive about a week, I found floating at the surface of the water a mass of spawn-ribbon, forming two complete figure-of-eight coils (*h*), in which a multitude of ova were irregularly scattered, much as in the spawn of *Doto*, as represented by Alder and Hancock (Br. Nudibr. Moll. fam. 3, pls. 5, 6).

A week later still these ova had become so many actively-revolving embryos. Each chorion, of an oval form, enclosed a single embryo, which rapidly rotated by means of long cilia. The ciliated organs were thick uncouth masses, rather than the flattened symmetric lobes of the infant *Doris* and *Eolis* (as figured by A. & H.); and the shell appeared more irregular, and much less nautiloid. Some of the embryos were much larger and apparently more advanced than their fellows.

This specimen, as the preceding, I hope to present, duly preserved in spirit and labelled, to the British Museum.

The generic name is given in honour of the late Albany Hancock, one of the conjoint authors of the very beautiful "Monograph of the British Nudibranchiate Mollusca."

The *nomen triviale* (well-fingered) alludes to the curious appendages of the oral tentacles, and glances also at the digitate incision of the branchial leaves.

It is not without a strong sense of the evil of "thrusting uncalled-for synonyms into the nomenclature of science" that I venture to give names to these forms; and my misgiving is the greater because my position, remote from the centres of literature, and my protracted abstention from descriptive natural history, have too much shut out from my cognition the advance of science. The creatures described were, however, so novel to me, and so attractively interesting, that I can only venture and hope.

EXPLANATION OF PLATE XI.

a, b. Hancockia eudactylota, viewed laterally and dorsally, magnified $\frac{4}{1}$.
c. The anterior parts, from beneath.
d. A dorsal tentacle and sheath.
e. The same, obliquely from above, without the sheath.
f. A branchial leaf (drawn diagrammatically).
g. The same, in its ordinary condition.
h. Spawn.

XL.—*Descriptions of twenty-three new Species of* Hesperidæ *from his own Collection.* By W. C. Hewitson.

Myscelus Orthrus.

Alis utrinque rufis: anticis basi marginibusque fuscis punctis novem hyalinis albis: posticis dentatis macula hyalina, fasciisque tribus macularibus rufis.

Upperside rufous, the base and margins darker. Anterior wing with several transparent spots—three before the middle, three beyond these (one of which is minute), one on the costal margin, and two near the apex. Posterior wing with one transparent spot followed by three bands of rufous spots.

Underside as above, except that the base of both wings is dull white.

Exp. 2 inches.

Belongs to the group of *nobilis* and *Santhilarius*, and has the outer margin of the posterior wing strongly dentated.

Myscelus Typhaon.

Alis rufo-fuscis: anticis maculis undecim hyalinis maculisque rufis: posticis punctis duobus hyalinis, fascia lata rufa punctis quinque atris notata: his infra griseo suffusis.

Upperside rufous-brown. Anterior wing with several transparent spots—one below the middle of the costal margin large and quinquefid, one (minute) below it, one outside of it, one on the costal margin bifid, and four near the apex; a series of rufous spots outside of these. Posterior wing with a white spot at the base, a large transparent white spot before the middle, a small spot between it and the costal margin; a pale rufous band below these marked by a series of five spots, the two outside ones of which are transparent and bordered by a second series of indistinct brown spots.

Underside as above, except that both wings have the base white, the outer margins dark brown, irrorated with grey-white, and that the posterior wing has two pale yellow spots near the costal margin below the middle.

Exp. $2\frac{2}{10}$ inches.

Belongs to the group of *nobilis* and *Santhilarius*, but is of the form of *Eudamus* and is not dentate on the outer margin of the posterior wing. It is quite unlike any other species.

Eudamus Helixus.

Alis utrinque fuscis: anticis punctis septem hyalinis punctoque flavo: posticis punctis duobus fasciaque brevi flavis: his infra fascia media alba.

Upperside red-brown. Anterior wing with the base rufous; seven transparent spots—two before the middle, one of which is in the cell, two beyond the middle, and three near the apex;

a pale yellow spot near the inner margin. Posterior wing produced at the anal angle; two pale yellow spots before the middle, and a short ochreous band beyond the middle.

Underside. Anterior wing as above, except that there is a white spot where the wings meet. Posterior wing crossed obliquely at the middle by a band of white; the costal margin irrorated with lilac; the inner margin white.

Exp. $1\frac{8}{10}$ inch.

Nearest to *E. Phœnice*.

Eudamus Halesius.

Alis fuscis: anticis basi virescente fascia media sexpartita hyalina alba punctoque subapicali albis: posticis virescentibus margine postico fusco: his infra griseis puncto basali fasciisque duabus nigris.

Upperside dark brown. Anterior wing with the base green-blue: crossed at the middle by a sexpartite irregular band of transparent white spots, marked near the apex by a minute transparent white spot: a white spot on the fringe near the anal angle. Posterior wing dull green-blue, protruded at the anal angle; the margins dark brown, the fringe marked by three white spots.

Underside. Anterior wing as above, except that there is a subapical band of grey, and that the white band is extended to the anal angle. Posterior wing grey, with a spot at the base, a band of three spots before the middle (the middle spot minute), a band of two spots below these and the anal angle black.

Exp. $1\frac{1}{2}$ inch.

Hab. Cayenne.

Belongs to the *Naxos* group.

Pterygospidea simula.

Alis utrinque fuscis: anticis punctis novem hyalinis albis, quatuor in medio, quinque sub apicem positis: posticis fimbria aurantiaca: posticis subtus punctis decem fulvis.

Upperside dark brown. Antennæ white. Anterior wing with several transparent spots—four near the middle (two of which are large and two minute, one outside of and one below the larger spots), and five near the apex (three near the costal margin and two below them). Posterior wing with the fringe orange-yellow.

Underside as above, except that the posterior wing has several orange spots—two before the middle and eight after, chiefly near the anal angle.

Exp. $2\frac{1}{10}$ inches.

Hab. Sumatra (*Buxton*).

Belongs to the *Leucocera* group.

Pterygospidea badia.

Alis utrinque fuscis: anticis fascia media transversa punctisque quatuor subapicalibus hyalinis albis: posticis fimbria aurantiaca: posticis subtus macula media flava.

Upperside dark brown. Anterior wing with a central narrow band and four white spots near the apex (one of which is very minute and considerably below the rest) transparent white. Posterior wing with the fringe orange.

Underside as above, except that the posterior wing has a central yellow spot. Antennæ with a white ring near the point.

Exp. $2\frac{1}{10}$ inches.

Hab. Darjeeling (*Atkinson*).

Pterygospidea Shema.

Alis utrinque rufo-fuscis: anticis punctis duodecim hyalinis: posticis infra punctis nonnullis flavis.

Upperside dark brown. Anterior wing with several transparent spots—one (minute) before the middle, six near the middle (one of which is on the costal margin), two (the largest) below this, two small ones below these, and one outside of them, and five near the apex.

Underside as above, except that there are two yellow spots near the anal angle of the anterior wing, and several on the posterior wing, two of which are before the middle, one in the middle, two near the inner margin, and a submarginal series of seven.

Exp. $1\frac{11}{20}$ inch.

Hab. Cayenne and Calabar.

The Calabar specimens do not differ from those of Cayenne except in having the two central spots of the anterior wing united in one large spot, and in having the spots on the underside of the posterior wing white instead of yellow.

Also one of the *Leucocera* group.

Pterygospidea Meditrina.

Alis anticis aurantiacis maculis subbasalibus, maculaque prope marginem interiorem aurantiacis, apice fusco maculis duabus aurantiacis, margine postico fusco punctis flavis: posticis fuscis punctis submarginalibus fulvis.

Upperside semitransparent yellow, with the costal and inner margins, three or four spots at the base (touching), and a square spot on the inner margin dark brown; the apex dark brown, crossed by a bifid yellow spot; the outer margin dark brown, marked by a series of yellow spots. Posterior wing dark brown, marked below the middle by three spots (one large and square) and by a submarginal series of spots all orange-yellow.

Underside as above, except that there is no submarginal series of yellow spots on the anterior wing, and that the base of the posterior wing and some spots near it are yellow.

Exp. $1\frac{7}{10}$ inch.

Hab. Fernando Po (*Rogers*).

Pterygospidea Boadicea.

Alis rufo-fuscis: anticis macula magna centrali maculisque tribus subapicalibus aurantiacis: posticis macula magna subapicali aurantiaca: his infra fuscis punctis sparsis flavis.

Upperside rufous-brown, with a large central semitransparent yellow spot, bordered, except on the inner margin, with black: three subapical transparent yellow spots and a submarginal series of rufous spots. Posterior wing dark brown, rufous at the base, with a large apical orange spot.

Underside. Anterior wing as above, except that it has no submarginal rufous spots. Posterior wing dark brown, with some indistinct spots near the base, a central spot, and a series of submarginal spots all ochreous.

Exp. $1\frac{13}{20}$ inch.

Hab. Gaboon (*Rogers*).

Pterygospidea Tergemira.

Alis rufis: anticis macula subbasali, fascia media quinquepartita, macula, punctisque quinque subapicalibus hyalinis flavis: posticis marginibus fuscis: his infra margine costali fulvo nigro maculato punctis nonnullis fulvis.

Upperside rufous, the nervures black. Anterior wing with several transparent yellow spots—one near the base, five forming a central transverse band, one beyond these, three near the apex (which is dark brown), and two below them. Posterior wing with several spots near the costal margin, and the outer margin dark brown.

Underside dark brown. Anterior wing as above. Posterior wing with the costal margin, which is marked by three black spots, and some small spots below it yellow.

Exp. $2\frac{1}{20}$ inches.

Hab. Fernando Po (*Rogers*).

Ancistrocampta Suthina.

Alis utrinque fuscis: anticis fascia lata media hyalina fasciaque subapicali angusta fulvis.

Both sides dark brown. Anterior wing crossed transversely by two transparent bands of yellow, divided by nervures of the same colour: the first band at the middle, from the costal margin to near the anal angle, broad and of equal breadth, the second near the apex narrow. The body underneath black.

Exp. 2 inches.

Hab. Ecuador (*Buckley*).

Nearly allied to *A. Syllius* of Felder.

If *Syllius* of Felder is the same as *Hiarbas* of Cramer, with which Mr. Kirby has placed it, Cramer's figure is a very bad one.

Phareas Berytus.

Alis utrinque fuscis: anticis macula basilari aurantiaca; fascia media tripartita fasciaque subapicali sexpartita hyalino-albis: posticis disco albo.

Upperside dark brown. Anterior wing with a triangular scarlet spot at the base: crossed obliquely by two transparent bands—one at the middle tripartite, the other near the apex sexpartite. Posterior wing with a large white spot before the middle.

Underside as above, except that there is a small white spot at the base of the anterior wing, and that the white spot of the posterior wing is much larger.

Exp. $1\frac{17}{20}$ inch.

Most nearly allied to *P. Talaus.*

Cyclopides Eburones.

Alis anticis supra fuscis immaculatis, infra macula tripartita apicali alba.

Upperside dark uniform brown.

Underside dark brown, irrorated with white. Anterior wing with a large trifid white spot near the anal angle, and above it towards the apex three indistinct pale spots.

Exp. $1\frac{1}{20}$ inch.

Bolivia (*Buckley*).

Cyclopides Ligilla.

Alis supra fuscis: anticis macula tripartita media maculaque subapicali hyalinis: posticis macula media magua flava: anticis infra margine costali et postico rufis: posticis rufis, maculis nonnullis flavis.

Upperside dark brown. Anterior wing with a large trifid central spot, and one near the apex also trifid, both transparent yellow. Posterior wing with a large central spot and the fringe yellow.

Underside. Anterior wing as above, except that the costal and outer margins are rufous yellow, and that there is a pale yellow spot near the apex and one on the outer margin; below less distinct. Posterior wing rufous, with several yellow spots—one from the base, one on the costal margin, a large central square spot, two between it and the inner margin, a trifid spot at the apex, and one or two near the outer margin.

Exp. $1\frac{3}{10}$ inch.

Cyclopides Eryonas.

Alis utrinque fuscis: anticis supra maculis tribus hyalinis flavis: posticis macula media fulva: anticis infra fascia quadripartita subapicali flava: posticis macula basilari, macula media maculisque quatuor submarginalibus flavis.

Upperside dark brown. Anterior wing marked by three transparent spots—one at the centre bifid, one outside of this, and one near the apex minute and bifid. Posterior wing with a central orange-yellow spot.

Underside dark brown. Anterior wing as above, except that the central spot is extended towards the inner margin and that there is a quadrifid band of orange-yellow near the apex. Posterior wing with several yellow spots—one at the base, one in the centre (as above, but larger), and a submarginal band of spots; those at the apex and anal angle larger than the other two.

Exp. $1\frac{1}{10}$ inch.

Hab. Chiriqui (*Ribbé*).

Cyclopides Evages.

Alis utrinque fuscis: anticis maculis quinque (macula subapicali trifida) hyalinis flavis: posticis macula magna media fulva.

Upperside dark brown. Anterior wing with five transparent pale yellow spots—one in the cell, three forming a longitudinal band, and one (trifid) near the apex. Posterior wing with a large central semitransparent orange-yellow spot.

Underside as above, except that the two spots of the band of the anterior wing nearest the inner margin are united in one.

Exp. $1\frac{1}{10}$ inch.

Hab. Bolivia (*Buckley*).

Cyclopides Oxaites.

Alis utrinque fuscis: anticis maculis tribus hyalinis albis: posticis macula magna media flava: posticis infra macula media superna maculisque octo flavis.

Upperside dark brown. Anterior wing with three transparent white spots—one (bifid) large and central, one near the apex (trifid), and one below it. Posterior wing with a central large pale yellow spot.

Underside as above, except that the anterior wing has some suffused pale spots near the apex; that the posterior wing has a spot near the base, a spot near the apex, and four or five smaller submarginal spots all pale yellow.

Exp. $1\frac{1}{20}$ inch.

Hab. Bolivia (*Buckley*).

Cyclopides Diraspes.

Alis supra fuscis: ambabus macula media fulva: alis infra, anticis apice, posticis omnino flavis.

Upperside dark brown. Both wings marked by a central spot of yellow.

Underside. Anterior wing dark brown, with the base, a central band, and the apex and outer margin pale yellow. Posterior wing pale yellow.

Exp. $1\frac{1}{10}$ inch.

Hab. Rio de Janeiro.

Cyclopides Orsines.

Alis supra fuscis: anticis maculis septem (macula subapicali trifida): posticis maculis quatuor: posticis infra rufis, fasciis duabus rufo-fuscis.

Upperside dark brown; the fringe rufous. Anterior wing with seven pale yellow spots—one near the inner margin before the middle, one in the cell, four forming a longitudinal band, and one near the apex trifid. Posterior wing with four pale yellow spots—one before the middle, and three (one bifid, one minute) forming a transverse band below the middle.

Underside. Anterior wing with the spots as above, the base yellow, the apex rufous. Posterior wing rufous, crossed transversely by two bands of darker colour, bordered with dark brown.

Exp. $1\frac{1}{10}$ inch.

Cyclopides Calaon.

Alis rufo-fuscis: anticis punctis quinque hyalinis flavis: posticis maculis duabus, fascia maculari transversa fimbriaque flavis: posticis subtus rufis, macula fasciisque duabus albis.

Upperside rufous-brown. Anterior wing with five transparent yellow spots—one in the cell, two between the median nervules, one (bifid) near the inner margin, and one subapical (trifid). Posterior wing with a spot on the costal margin, an oblong spot in the cell, a short transverse macular band, and the fringe rufous.

Underside. Anterior wing as above, except that the base and apex are rufous-yellow. Posterior wing rufous-brown, with an oblong spot in the cell, and a transverse band of spots below it bordered with black, both white; two spots on the costal margin and a band of pale yellow near the outer margin.

Exp. $1\frac{5}{20}$ inch.

Hab. Ecuador (*Buckley*).

This species belongs to the *Paniscus* group.

Cyclopides Chersias.

Alis rufo-fuscis fimbria flava: anticis maculis quatuor magnis: posticis una aurantiaco-flava: alis infra flavis margine interno anticarum fusca.

Upperside rufous-brown with the fringe yellow, some ochreous rays from the base; a spot in the cell and a band of three large spots beyond the middle all orange-yellow. Posterior wing with a large spot of yellow beyond the middle.

Underside yellow, clouded with brown on the costal margin of the anterior wing.

Exp. $1\frac{3}{20}$ inch.

Hab. South Africa.

Form of *C. Makomo*. In colouring nearest to *C. Camertes*.

Cyclopides Derbice.

Alis supra fuscis, maculis quinque, posticis tribus, fulvis: anticis infra apice flavo nigro notato: posticis flavis, punctis atris plurimis.

Upperside dark brown. Anterior wing with five orange-yellow spots—one (a large one) in the cell, one at the apex trifid, one between this and the outer margin, one divided by the second median nervule, and the fifth near the inner margin. Posterior wing with three orange-yellow spots—one partly in the cell bifid, and two below it.

Underside. Anterior wing as above, except that the costal margin from the base to the middle is orange, and that the nervures near the outer margin are yellow. Posterior wing yellow, spotted throughout with black: a band of black near and parallel to the inner margin.

Exp. $1\frac{1}{10}$ inch.

Hab. Nyassa (*Thelwall* and *Simons*).

Nearest to *C. Makomo.*

Cyclopides Dardaris.

Alis utrinque fuscis: anticis macula media triangulari punctisque tribus minutis hyalinis albis: posticis punctis duobus albis in medio positis: ambarum infra marginibus flavis: posticis punctis nonnullis flavis.

Upperside dark brown, with the fringe rufous-white. Anterior wing with four white transparent spots—one central (rather large, triangular, bifid), the other three very minute, two near the apex, and one below them. Posterior wing with two small central white spots.

Underside as above, except that both wings have the outer margin and the end of the nervures yellow, and that the posterior wing is marked by several yellow spots.

Exp. $\frac{8}{10}$ inch.

Hab. Mexico.

XLI.—*Capture of a Right Whale in the Mediterranean.* By Alban Doran.

An interesting monograph has been recently published by Professor Capellini of Bologna, entitled "Della Balena di Taranto, confrontata con quelle della Nuova Zelanda e con talune fossili del Belgio e della Toscana." From a perusal of this treatise it appears that on Feb. 9th of this year a whale was observed in the Gulf of Taranto by Mr. Ferdinand Hueber. This gentleman called the attention of some sailors to the cetacean; and it was at length killed close to the town of Taranto, after being repeatedly fired at and finally disabled by a dynamite cartridge.

The authorities referred to the minister of Public Instruction, who, after much deliberation, made over this interesting specimen to the University of Naples; but while it was in process of maceration, Signor Capellini was permitted to make and publish some valuable observations.

This whale was a young female, 12 metres in length, of rather slender outline, the rostrum rather curved, the baleen-plates short. The stomach was quite empty, and its mucous membrane thrown into folds.

The cranium measured about 2·50 metres, the vertebral column about 9·50 metres; similar proportions, remarks the author, are seen in Gray's *Macleayius australiensis.* It had 7 cervical, 14 dorsal, and 36 lumbar and caudal vertebræ—in all 57.

Professor Capellini observes that Van Beneden had admitted the existence of a distinct recent species of *Balæna*, differing from the *B. australis* and *B. antipodum* of the southern hemisphere. This is the "black whale," well-known to whalers; yet no skeleton of this species has been examined by any anatomist. The Tarentine whale probably, in the opinion of the author, belongs to the above undescribed species. After details, presently to be more fully noticed, he thus epitomizes the characters of the "*Balæna tarentina*:" —

"Head and fins different in form from the same in *B. biscayensis* and *mysticetus*; colour entirely black; parasites of the rostrum and lips of the same species as in the whales of the southern hemisphere; nasal bones of the typical form seen in whales of that hemisphere; baleen-plates 240 in number, short in every measurement; vertebræ 57. The vertebræ of the cervical region incompletely ankylosed, the condyles of the atlas bevelled on their inner aspects, corresponding to the spinal canal; the fourth, fifth, and sixth cervical vertebræ have a fissure several millimetres deep on the lower aspect of their bodies, the seventh is free; the scapula is broader than long."

In describing the skull, Professor Capellini states that, though smaller, it reminded him of the cranium of *B. australis*, and, better still, that of *Macleayius australiensis*, Gray, from which it seems to differ in trifling points only. The occiput is like that of the author's new fossil genus *Idiocetus*, in which the atlas is intermediate between the same in *Balæna* and *Balænoptera.* It measures from its anterior extremity to the upper border of the foramen magnum 0·62 metre. There is a distinct occipital crest. The frontal bone projects 12 centims. from the anterior extremity of the occipital bone to the posterior border of the nasal. The nasal bones present the characters described by Professor Flower as typical in *Eubalæna*, and still more remind Professor Capellini of the same bones in *Macleayius*. They are short and broad, concave anteriorly, and quite unlike those of *B. mysticetus*.

The tympanic bone of this *B. tarentina* differs from that of *B. australis* in the form of the curve of the inner margin and in the form of the columellar projection on the lip close to the meatus; moreover it is gibbous behind as in *B. japonica*, but less inflated than in *B. australis*, still less than in *B. antipodum*. The petrous bone is of the ordinary *Balæna* type. The malleus is lost; but Signor Capellini figures the incus and stapes, which are of the same form as specimens of the corresponding bones in *B. australis* and *mysticetus* in the museum of the Royal College of Surgeons of England. Judging from the engraving, the incus has no affinities to the highly characteristic representative of that ossicle in *Balænoptera* and nearly all other cetaceans.

The mandible of *B. tarentina* does not very closely resemble that of *B. australis*, but is similar to the same bone in the fossil *Idiocetus Guicciardini* and in *Balænotus*. Its rami are well bowed outwards anteriorly, as in the other right whales. The myloid groove is much deeper than in any other existing *Balæna*, recalling a character observed in the fossil *Balænotus* of Belgium and Tuscany. The length of each ramus, following the external curve, is 2·50 metres; the height of each condyle 0·24 metre. There are six mental foramina on each side; the distance between them diminishes regularly towards the most posterior. The longest baleen-plates measured by Professor Capellini are 0·76 metre long, following the curve of their inner margin. They form two masses of 240 plates each, the longest, of which the measurement has just been quoted, were in the middle of each mass. The author declares that they are in pattern unlike those of any other whale, although he has inspected the large collection of baleen-plates at Vienna.

The seventh cervical vertebra is quite free. This region (except in that respect) much resembles the same in Gray's *Macleayius*; only, instead of the complete freedom of the atlas seen in that New-Zealand whale, the first cervical vertebra in *B. tarentina* is distinct above, but ankylosed to the second below, as in *Idiocetus*. The axis and the four succeeding vertebræ are also fused inferiorly only; the separation above is very distinct between the fourth and fifth and the fifth and sixth; such is the case in *Balænotus* and *Balænula*. There is a peculiar fissure running along the under surface of the bodies of the last four ankylosed cervical vertebræ; this is deepest at the most posterior.

The scapula is somewhat intermediate in type between that of *Balæna* and *Balænoptera*, more particularly *B. Sibbaldi.*

Professor Capellini expresses a strong belief that this whale came from the southern seas, not only from its australoid characters, but also on account of the southern species of parasites on its body, and from its stomach being empty and wrinkled through long fasting (*aggrinzito per lungo digiuno*), showing that it had wandered far from its natural feeding place. As every rule has exceptions, so, remarks the Italian Professor, we may believe that these great vertebrates, with their powerful and rapid means of locomotion, may, though as a rule very local in their habitat, under exceptional circumstances, pass over from their side of the equator and invade the seas of the opposite hemisphere. The Tarentine whale offers a "splendid example" of this fact.

The monograph is accompanied by two plates, representing the bones described in the text, and by a coloured engraving of the whale from a water-colour taken after its capture by Mr. Hueber.

I understand that Professor Van Beneden has recently suggested that the whale above described is *Balæna biscayensis.*

XLII.—*Notes on the Pearly Nautilus* (Nautilus pompilius). By George Bennett, M.D., F.L.S.*

In the Address to the Biological Section of the British Association by J. Gwyn Jeffreys, LL.D., F.R.S., he says, "But *Nautilus* and *Spirula* are believed by some to be deep-water forms. This must be a mistake. Although the animal of that common species *Nautilus pompilius* has rarely been met with, the shells are often found on beaches in the Indian Ocean and South Pacific; and I am not aware of any instance of a deep-water mollusk being cast on shore." In this remark I perfectly agree, and I offer the following notes confirmatory of my opinion. In 'Nature' (11th Feb. 1875) there is a paper entitled "News from the 'Challenger,'" in which it is mentioned, "On the 24th of July we stopped off Matuka Island and landed a party of surveyors and naturalists; and while they were taking observations and exploring

* Read at the Plymouth meeting of the British Association, and communicated by the author.

on shore we trawled in 300 fathoms, and received among other things a fine specimen of the Pearly Nautilus (*Nautilus pompilius*), which we kept living in a tub of water for some time, in order to observe its movements and attitudes." With reference to this interesting capture of a living Nautilus, I very recently received a letter from Prof. Rolleston, dated Oxford, 18th March, 1875, in which he says, "I have just been through a long journal of Moseley's, relating all his experiences and observations on board the 'Challenger,' between Sydney, New Zealand, Fijis, and Cape York. I have compared his account of the capture of his Nautilus with your account of the capture of yours. The 'Challenger's' Nautilus appears to have been obtained from a depth of 320 fathoms on a coral bottom; and it must have been much discomposed by the great differences in pressure to which its upheaval subjected it; but they got it up alive, however discomposed, and they had consequently the opportunity of observing how it behaved. It propelled itself after the manner of the Cephalopods, backwards, if that may be an allowable Hibernicism; but what would not have been expected was the arrangement of its tentacles, each pair of which had a definite and divergent direction—one pair, for example, looking directly downwards, and two other pairs around the eyes being arranged so as to protect that organ as it were. This it was, Moseley says in his Journal, which gave the most characteristic appearance to the creature. But pleased as they all were on board the 'Challenger' with this novel sight, I can understand that you had a feeling of still greater freshness when you had, as the first of scientific observers, the animal in your hands in 1829! How much was based upon the discovery! how much was cleared up by it!"

The extraordinary depth at which the 'Challenger's' specimen of the living Nautilus was obtained far exceeded that which would have been anticipated both from previous accounts and observed facts, the natives capturing them in their traps at from 3 to 5 fathoms, when the experienced and keen eye of the native would be able to descry them in their usual position, clinging to some prominent ledge, with the shell turned downwards on the coral reefs. It is more than probable that the Nautilus, not being considered a deep-sea mollusk, was obtained by the trawl as it passed near the reef, or when the creature was floating at a certain depth, but not on the surface, as when my specimen was captured, and it was thus brought up by the trawl-net. I was informed by an observer on board the 'Challenger' that the captured Nautilus, as it swam about in the tub, propelled itself by ejecting water from a tube (the funnel?), after the manner of the cuttlefish and other Cephalopods. However, leaving the depth to which it can descend a matter for further inquiry, a question arises, By what power is the animal enabled to regulate its movements of ascent and descent in the water? The use of the chambers in the shell is still a matter of speculation; they are most probably air-chambers destined to assist the specific gravity of the animal; and possibly they may generate nitrogen gas. Professor Owen says, "In acquiring the camerated structure of the shell the Nautilus gains the power of rising from the bottom, and the requisite condition for swimming, by the exhalation of some light gas into the deserted chambers it attaches to its otherwise too heavy body, a contrivance for ascending in its atmosphere, as we ascend into ours by the aid of a balloon. But the Nautilus, superior to the human aeronaut, combines with the power of elevating and suspending itself in the aqueous medium, that of opposing its currents and propelling itself at will in any direction. It possesses the latter essential adjunct to the utility of the balloon as a locomotive organ, by virtue of the muscular funnel, through which it ejects into the surrounding water, doubtless with considerable force, the respiratory currents." He also says, "It appears that the proportion of the air-chambers to the dwelling-chamber of the Nautilus and its contents is such as to render it of nearly the same specific gravity as the surrounding water. The siphon which traverses the air-chambers communicates with the pericardium, and is most probably filled with fluid from the aquiferous cavity." To whatever depth these animals are capable of descending, and whatever may be the amount of pressure they can endure, they no doubt can readily ascend to the surface of the ocean by the means explained by Prof. Owen; and we well know they can float upon the water, as proved by the specimen I captured at Erromanga, and can crawl upon the reefs, as verified by the natives, who thus catch them in their baskets (drawings of which and mode of capture are given in my 'Gatherings of a Naturalist'). They are also now well known to be thrown on shore during heavy gales, and are then sought for and secured as an article of food by the natives, who consider them good eating. They have also been found thrown upon the coral reefs, as in an instance mentioned by my friend Dr. M'Donald, R.N., who, in his paper on the Anatomy of *Nautilus umbilicatus* (rightly *macromphalus*, because *umbilicatus* is not found at the Isle of Pines?), says, "H.M. steamvessel 'Torch,' having visited the Isle of Pines in the month of July 1854, one of the officers had the good fortune to pick up a recent specimen of *Nautilus* *umbilicatus* on the outer reef of Observatory Island. The creature had most probably been thrown up by the waves, and remained within a ledge of coral rock when the spring tide receded. The natives frequently find Nautili entrapped in this way; but we could not prevail upon them to bring us the recent animals, although a liberal remuneration was offered. The specimen was alive when brought on board, but it was too much exhausted to exhibit any active movements when placed in a vessel containing sea-water. On touching the tentacula they curled up, or moved about irregularly, and the muscular fibres of the funnel-tube contracted slowly, without, however, producing respiratory currents." Prof. Owen says, alluding to my Nautilus, "The dissection of this unique specimen established the claims of the *Nautilus pompilius* to rank in the highest class of Mollusca, and at the same time brought to light so many important modifications in the Cephalopoda type of structure as to necessitate the establishment of a new order for its reception."

The number of tentacles with which the Pearly Nautilus is provided amounts to not less than ninety, of which thirty-eight may be termed digital, four ophthalmic, and forty-eight labial. In specimens there is a slight difference in the number of the tentacula.

XLIII.—*On a new Insect Pest at Madeira.* By T. Vernon Wollaston, M.A., F.L.S.

Considering how terribly the island of Madeira has suffered from the depredations of the *Phylloxera*, whole tracts on which the vine until lately flourished having been completely laid waste, it seems a thankless task to have to place on record yet another scourge which has lately made its appearance in that otherwise highly favoured land, and which, although fortunately of a much less alarming nature, threatens at any rate to make itself felt. I would by no means wish to compare it with *either* of the calamities (as represented by the *Oïdium* and the *Phylloxera*) which have overtaken the vine; but the history of the Colorado Beetle will suffice to convince us that other plants, which administer more or less to our comfort, and which constitute an appreciable item of commerce, may so far become the prey of insect parasites that their cultivation is ascertained at last to be a matter of such difficulty that it has practically to be abandoned.

In the instance to which I am alluding it is the various species of banana which have been permanently attacked; and although it may seem at first sight that no great loss would accrue were the banana to be ultimately swept away, yet those who know Madeira best will at once acknowledge that a very serious item of profit would be taken from the poorer inhabitants should the plant (under its numerous modifications and varieties) ever become extinct.

It is a beetle of the Rhynchophorous department (in other words, a weevil) which has found its way during the last few years into the banana-grounds of Madeira; and my attention was first directed to it during the spring of 1876 by Senhor J. M. Moniz, who had taken several examples in the decayed *roots* of an old *Musa sapientum* in his garden in Funchal. After the information which I had thus received from Senhor Moniz, I lost no opportunity of examining the rotten banana stems whenever they chanced to come in my way, and obtained the insect both in the Fazenda of the Quínta d'Ornellas and in that of Dr. Grabham at the Val; but it is to Captain Kemp that we are indebted for our principal knowledge of its economy and devastations. Happening to possess a large number of banana plants, some of them proceeding from roots of a considerable age, Captain Kemp took the trouble to examine closely many of the stems, which had all the appearance of being in an unhealthy condition; and the result was, that he not only detected the larvæ far away in the interior, but likewise many of the grooves channelled-out by the perfect insect in eating its way to the surface. As for the perfect insects themselves, Captain Kemp obtained them in fabulous numbers,—though principally adhering to the undersides of the moist and putrid trunks which had been either blown or cut down on the immediate spot; and I may add that, directed by him, I myself picked up more than fifty of them in the course of a few minutes. Here, then, we can have no doubt that a very vigorous enemy has shown itself, which, unless kept in check, may (and probably will) in the course of a few years affect the banana crops in Madeira most unmistakably. Considering with what extreme care the Funchal district was explored, from about twenty to thirty years ago, by Mr. Leacock, Senhor Moniz, the late Mr. Bewicke, the Rev. R. T. Lowe, myself, and others, I think it is not too much to assert that so large and conspicuous a beetle as the one which we are now discussing could not have escaped our united researches; and I have no hesitation therefore in expressing my belief that its introduction into the island must have taken place *since* (probably long since) that period.

Whence it came is a matter for inquiry; but if fresh banana plants are ever imported, those who have been the means of importing them will be best able to answer this question.

But it is now time that I should state what the creature is which is answerable for so much mischief to the plants in question, and which bids fair to become a nuisance at Madeira which cannot well be ignored. It is a large and black Calandrid (and therefore of the same *family* as the common, but comparatively minute, weevils of the rice and corn), but belonging to Schönherr's extensive genus *Sphenophorus*. The exact *species* appears to have been described by Fahræus in 1845, in the 8th vol. of the 'Gen. et Spec. Curc.,' under the name of *Sphenophorus striatus*; and the country which he cited for its *habitat* is Brazil. There can be no doubt that it belongs to a somewhat American type of form; and it is highly probable therefore that Brazil may have been its aboriginal area. But be this as it may, the insect now, although certainly not cosmopolitan, has acquired for itself a wide intertropical range,—for I have examined individuals at the British Museum (emanating from no less than *three* different sources) which were brought from India, and others (which seemed *hardly* to differ) from Tasmania and Japan. I have no doubt, therefore, that its *modus vivendi* and powerfully developed wings have greatly facilitated its introduction into many countries (sufficiently warm) of the civilized world, and that, where plants are exported and interchanged, conditions are constantly arising favourable for its accidental transport. And, moreover, we have yet to learn that the banana is the only plant to which it is liable to become attached.

The following short diagnosis, drawn out from Madeiran and Brazilian examples, may suffice to characterize the species:—

Genus Sphenophorus.

Schönherr, Curc. Disp. Meth. 327 (1826).

Sphenophorus striatus.

S. ellipticus, niger; capite parvo, nitido, impunctato; rostro prothoraceque nitidiusculis; illo modice arcuato, ad (et præsertim ante) basin, *i. e.* ad antennarum insertionem, ampliato-robusto, inde ad apicem angustiore subcylindrico, postice dense et grosse sed antice parcius ac multo levius punctato; hôc longiusculo, suboblongo, basi truncato, apice transversim constricto, et ubique (sed præsertim versus latera) dense grosseque punctato; elytris plus minus cinereo-indutis, profunde varioloso-sulcatis, interstitiis antice nitidis calvis ac uniseriatim punctulatis; pygidio (profunde punctato), femoribus versus apicem, tibiis, tarsisque plus minus cinereo indutis.

Long. corp. lin. 5–6.

Calandra striata, Petit, *in litt.*
—— ——, in Dej. Cat. (edit. 3) 329 (1837).
Sphenophorus striatus, Fahræus, in Schönh. Curc. viii. 251 (1845).

Hab. in Brasilia, Madera, India orientali, et (nisi fallor) Japonia et Tasmania; truncos *Musæ* destruens.

The larva of this weevil is a thick fleshy grub, ovate or fusiform in outline, without legs, and of a dirty white, though with an obscure darker line (obsolete in parts) down the dorsal region. Its head is shining, of a pale reddish brown, and studded with a few erect hairs; and there are also a few erect hairs towards the anal extremity.

Teignmouth, Sept. 17, 1877.

XLIV.—*Remarks on Prof. E. Haeckel's Observations on* Wyvillethomsonia Wallichii *and* Squamulina scopula. By H. J. Carter, F.R.S. &c.

I have just received the first number of the 'Jenaische Zeitschrift für Naturwissenschaft,' published on the 20th March last; and in this I find that Prof. E. Haeckel has identified his *Haliphysema echinoides* (p. 16, Taf. ii. f. 127) with Dr. Perceval Wright's *Wyvillethomsonia Wallichii* (Quart. Journ. Micr. Sci. 1870, vol. x. p. 7, pl. ii.); also that he has identified his *Gastrophysema scopula* (p. 24) with my *Squamulina scopula* ('Annals,' 1870, vol. v. p. 309, pl. iv. figs. 1–3).

Now, as I had already identified *Wyvillethomsonia Wallichii*=*Dorvillia agariciformis,* Kent,=*Tisiphonia agariciformis,* Sir Wyville Thomson, with one of the sponges dredged up on board H.M.S. 'Porcupine' in the Atlantic Ocean ('Annals,' 1876, vol. xviii. p. 471), unmistakably, and have stated with respect to its plentifulness (p. 405) that "there is hardly a specimen [of *Tethya cranium*] among the sponges dredged up by the 'Porcupine' which has not one or more in various degrees of development adhering to it (the same might be said, almost, of *Tisiphonia agariciformis*),"—I must protest against this ignorance!

Further, as regards *Squamulina scopula,* I have found the original specimen, called by the late Dr. Bowerbank "*Halyphysema Tumanowiczii,*" and given to him by Mr. Tumanowicz, among the former's collections now in the possession of the British Museum; and the two are identical; so that here, again, I must "protest" against Prof. Haeckel's unjustifiable contradiction!

In October 1870 ('Annals,' vol. vi. p. 346) I published a "Note on the Branched Variety of *Squamulina scopula*," wherein it is stated that I was in a position "to afford positive evidence, from my own observation," of the foraminiferal nature of *Squamulina scopula* and its variety *ramulosa*. This "positive evidence" was deduced from the pseudopodous extension of the sarcode being exactly like that represented by Max Schultze in his memorable illustrations ('Ueber den Organismus der Polythalamien,' "Foraminiferen," Taf. 2–4, 1854), in addition to what I had before published respecting the test &c. of *Squamulina scopula*.

Again, in my paper on the "Polytremata" ('Ann.' March 1876, vol. xvii. p. 202), just a year before the number of the 'Jenaische Zeitschrift' to which I have alluded was published!) is the following passage:—

"The internal sarcodic contents [of *Squamulina scopula*] and the peculiar form presented by the extended pseudopodia during active life being identical with that of a foraminiferous animal." Now Haeckel regards it as a 'polyp' which he names '*Gastrophysema*.' It is useless to criticize such vacillation.

The "peculiar form presented by the extended pseudopodia" was that to which I have alluded; and this is so totally different from the tentacles of a polyp, while it is so preeminently characteristic of the Foraminifera, that the merest tyro in such matters ought to be able to distinguish between the two—so much so, indeed, that were the characteristic form of the test absent, that of the pseudopodia when extended in active life is almost sufficient to indicate the kind of animal.

With Prof. Haeckel all this goes for nothing, apparently, as in a footnote to p. 5, I am held up to derision in the following terms:—"Wie ausserordentlich willkührlich, unlogisch und kritiklos Carter in seinen Arbeiten verfährt, habe ich schon in meiner Monographie der Kalkschwämme gezeigt,"—having previously noticed that my *Difflugia bipes*, which I have described in the same paper with *Squamulina scopula* (pl. v. figs. 7–9), is a *Cyphoderia*, not from the form of the pseudopodia, but from the structure of the test, thus placing the structure of the latter before the form of the living animal, which, in *Difflugia bipes*, is as characteristic of a *Difflugia* as that of *Cyphoderia* is allied to *Gromia* (see Max Schultze's excellent representations, *op. cit.* Taf. 1).

Again, Prof. Haeckel's illustrations of his genera *Haliphynema* and *Gastrophysema* (*op. cit. l. c.*) appear to me to be more fitted for a "caravan" at a fair than for scientific purposes. And when we come to the latter genus (p. 24, Taf. iv.–vi.), with which my *Squamulina scopula* is identified, we find that the cavity of the body does *not* extend to the discoid foot (the pseudopolythalamous nature of which tubulated into the body of the erect portion is the most striking feature of its foraminiferal nature), but is altogether absent.

What are we to say of this? Are we to infer that it has been omitted by mistake, or are we here to apply my words, which Prof. Haeckel (at p. 6) has also held up to derision, viz. :—"Mental operations are seldom so correct as visual ones"?—words which I applied to one who had mistaken the polyps on the cord of *Hyalonema Sieboldii* for the "oscula" of this sponge; or are we to say, as a German naturalist wrote to me in a similar case, "One knows not ("ob man darüber lachen oder sich ärgern soll") whether one ought to laugh or to be angry."

Such a course may suit Prof. Haeckel for his "*Gastraea-Theorie*," but not those who want to possess an accurate knowledge of species, which, I presume, would be the test of a candidate's knowledge under examination, before that of the Gastræa-theory!

It may do very well for Prof. Haeckel to puff off his *Gastraea-Theorie*" at another's expense, with a "flourish of trumpets" and huge caravan-like diagrams (not a bit less frequent in this country than in Germany); but it does not make me the less regret that any part of the 'Challenger' collections should have ever been placed in his hands for description and illustration.

XLV.—*Descriptions of Ceylon Lepidoptera.* By F. Moore, F.Z.S.

Rhopalocera.

Fam. **Nymphalidæ.**

Neptis disrupta.

Female. Upperside black: fore wing with whitish discoidal streak and triangular terminal spot; three spots from middle of hind margin and a fourth smaller spot beyond the triangular discoidal spot; between this series and a submarginal series of somewhat conical spots is a discal series of indistinct pale dusky oblique spots; a linear marginal row of narrow indistinct dusky streaks: hind wing with a discal white maculated band, a quadrate spot on abdominal margin near the base, and two narrow parallel spots and streak on anterior margin; a linear row of marginal white streaks. Underside dull ferruginous, with black-bordered white markings as above, and black confluent spots across disk of both wings.

Exp. $2\frac{1}{8}$ inches.

Hab. Ceylon. In coll. F. M. Mackwood.

Fam. **Lycænidæ.**

Lampides lithargyria.

Male. Upperside greyish silvery-blue, with very narrow marginal black border: hind wing with two triangular spots from anal angle. Cilia white, with dusky marginal inner line. Underside white: fore wing with broad greyish brown spot at end of the cell, a transverse discal maculated band with a contiguous spot at upper end, a narrower submarginal band, and very indistinct marginal lunules: hind wing with two prominent black costal spots, two greyish brown subbasal spots, a broad spot at end of the cell, a curved discal macular band, a marginal series of lunular spots enclosed by a broad dentate band, the penultimate spot being black and bordered above with ochreous.

Exp. $1\frac{2}{10}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Allied to *L. kandarpa*, Horsf. (also from Ceylon), but of an entirely different colour above and beneath, and the markings of underside all much broader. Also allied to *L. platissa*, H.-S., from Australia.

Lampides viola.

Male. Upperside dark violet-blue; both wings with narrow black marginal line. Cilia whitish at the edge. Underside violet-grey; both wings with six broken very pale narrow delicate whitish bands, the two inner and outer bands on the fore wing short: a small black anal and large subanal spot, speckled with blue and ochreous-bordered. Female smalt-blue in middle of the fore wing: hind wing with indistinct marginal row of pale-bordered black spots.

Exp. ♂ $\frac{9}{10}$, ♀ 1 inch.

Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Lampides coruscans.

Male. Upperside brilliant glistening cobalt-blue: fore wing with very narrow black speckle-bordered marginal band: hind wing with narrow black marginal line and speckled black spots. Cilia black, with whitish outer edge on fore wing and inner white line on hind wing. Female greyish blue: fore wing with black outer band, which is confined to the apex and outer margin: hind wing with blackish anterior border and submarginal dentate band enclosing marginal row of black spots. Underside pale leaden-grey: fore wing with two narrow white transverse discal lines, a short upper intermediate streak, a short outer line, a double marginal row of white dentate marks with blackish intermediate space, and marginal line: hind wing with several interrupted narrow white transverse lines, a submarginal prominent double dentate line with black intermediate space, and marginal line; a large subanal ochreous-bordered black spot.

Exp. $1\frac{2}{10}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Allied to *L. pluto*, but of a less glittering colour and without the broad black band in the male.

Lampides prominens.

Male. Upperside violet-blue, with very narrow indistinct brown marginal line.

Female paler, the basal part brilliant greyish blue: fore wing with the costal border and outer margin broadly black: hind wing with the costal border broadly black, and a marginal row of black spots enclosed by a lunular line. Underside pale greyish brown, crossed by five prominent dark-bordered white, slightly waved bands, an intermediate short band at end of the cell, and two marginal blackish-interspaced bands, the inner one sinuous: hind wing crossed by six broken white bands; two marginal blackish-interspaced sinuous bands; a large subanal and small anal black spot, both silvery-speckled and ochreous-bordered. Allied to *L. beroë*, Feld.

Exp. $1\frac{2}{10}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Polyommatus lavendularis.

Male. Upperside dark lavender-blue, with an extremely narrow black outer marginal border.

Female brighter, but paler blue: fore wing with the base of the costa and an outer band black: hind wing with black anterior border and marginal row of prominent pale-bordered black spots. Cilia white, with inner black border. Underside greyish white: fore wing with dusky-black streak at end of the cell, a discal series of oblique spots, and marginal row of small spots enclosed by a dentated line: hind wing with three black subbasal spots, a curved series of seven discal spots, and a marginal row of spots enclosed by a dentate line.

Exp. ♂ $1\frac{1}{10}$, ♀ $1\frac{3}{10}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Allied to *P. puspa*, Horsf.; differs from Ceylon specimens above in its uniform colour and absence of the broad black borders.

Polyommatus lanka.

Male. Very dark blue. Cilia white, with blackish inner marginal border. Underside white: fore wing with a dusky brown streak at end of the cell, a submarginal transverse linear row of four linear spots, a spot near the costa, and a marginal row of dentate spots: hind wing with two equidistant brown spots on anterior border, a spot within and streak at end of cell, a curved discal series of five spots, two lunate marks on abdominal border, and an outer marginal row of dentate spots. Tibiæ and tarsi with black bands. Near to *P. kasmira.*

Exp. $1\frac{3}{10}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Polyommatus singalensis.

Feld. Verh. z.-b. Ges. 1868, p. 282.

Male. Light blue. Cilia white with blackish inner border. Underside white: fore wing with dusky brown streak at end of the cell, a submarginal series of five slightly-recurved dentate spots, a spot near the costa, and a marginal row of small spots enclosed by an inner row of dentate lunules: hind wing with three subbasal spots, a spot on costa beyond middle, a spot within and streak at end of the cell, a curved discal series of five irregular-shaped spots, a curved streak above anal angle, and marginal row of small spots enclosed by dentate lunules. Tibiæ and tarsi black streaked above. Near to *P. kasmira.*

Exp. $1\frac{4}{10}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Fam. **Hesperidæ.**

Tagiades minuta.

Male and *female*. Upperside dark olive-brown. Cilia of hind wing white, of fore wing slightly whitish at posterior angle. Underside—fore wing greyish white on middle of hind margin : hind wing greyish white, except along exterior border; a small blackish spot at end of the cell, and a median discal series of spots; outer margin brown-speckled. Palpi, body, and legs beneath grey-white. Legs above brown.

Exp. ♂ $1\frac{1}{8}$, ♀ $1\frac{2}{8}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Heterocera.

Fam. **Zygænidæ.**

Phacusa thoracica.

Wings transparent: fore wing with narrow purple-black costal and hind border, a broad band at the apex, a triangular patch on exterior margin, and a broad spot at end of the cell: hind wing with narrow purple-black anterior and outer borders. Head and thorax above purple-black; hind part of thorax above and entire thorax beneath brilliant red; abdomen steel-blue above, green below. Antennæ with white tip. Femora brown; tibiæ and tarsi varied blue and green.

Exp. $1\frac{1}{10}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Fam. **Chalcosidæ.**

Eterusia cingala.

Male and *female*. Fore wing dark olive-green, with a broad basal whitish blue-bordered band, crossed by a blackish-green streak; a discal recurved series of yellowish spots and a larger spot at end of the cell: hind wing with the base and a broad outer band black, the veins and marginal border blue; a series of yellow spots before the apex, which are indistinct in the male; middle band yellow. Thorax blue-black, lower part of abdomen yellow, tip black. Underside as above, veins blue-lined.

Exp. ♂ 2, ♀ $2\frac{1}{2}$ inches.

Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Most nearly allied to *E. Œdea* from China.

Fam. **Nyctemeridæ.**

Dondera, n. g.

Fore wing elongate, narrow, costa arched, apex somewhat acute, exterior margin very oblique: hind wing long and narrow, extending beyond angle of fore wing, apex very convex, abdominal margin short. Body moderate. Antennæ long, slender, bipectinated. Palpi slender, porrect, naked. Legs long, slender, naked, middle and hind tibiæ spurred. Venation similar to that of *Nyctemera lacticinia*.

Dondera alba.

Female. Upperside pure white throughout both wings. Head, thorax, and palpi with black spots. Abdomen and body beneath pale ochreous, with broad, dorsal, black segmental bands and lateral spots. Underside uniform greyish brown, the cilia being white.

Exp. 2 inches.
Hab. Ceylon. In coll. F. M. Mackwood.

Fam. **Arctiidæ.**

Creatonotus continuatus.

Male and *female.* Upperside—fore wing ochreous, with an unbroken black streak extending from base below the cell to near the apex, a black streak within the cell and between all the upper veins, and a shorter streak from posterior angle: hind wing in male fuliginous, with darker maculated border, in female pale ochreous, with suffused blackish discal streaks, cell-spot, and darker black marginal spots; a broad black streak along thorax and short dorsal bands. Body ochreous above, brownish black beneath. Legs brownish black; fore and middle femora above ochreous. Underside of wings as above.

Exp. $1\frac{5}{8}$ inch.
Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Fam. **Liparidæ.**

Artaxa citrina.

Male and *female.* Pale yellow; fore wing in male brighter yellow, and with a short oblique series of blackish-speckled spots from the middle of hind margin to beneath end of the cell. Abdomen bright yellow, tuft paler.

Female. Uniform pale yellow, without markings. Underside—costal border bright yellow.

Exp. ♂ $\frac{5}{8}$, ♀ $1\frac{1}{8}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Artaxa cervina.

Male. Fore wing brownish ochreous, with two transverse median pale yellowish slightly wavy lines: hind wing pale brownish fawn-colour. Body brownish ochreous. Underside dark brownish fawn-colour, outer borders yellowish. Legs brownish above.

Exp. $\frac{6}{8}$ to $\frac{7}{8}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Most nearly allied to *A. varians*, Walker, but is a much smaller insect and of different-coloured wings.

Chærotricha decussata.

Female. Ochreous yellow, palest on hind wing and abdomen: fore wing very sparsely irrorated with prominent black scales; two indistinct grey recurved median bands crossing each other below the cell; a small black spot at end of the cell. Underside uniform ochreous-yellow.

Exp. $1\frac{7}{8}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Near to *Ch. plana* (*Artaxa plana*, Walker); distinguished by its smaller size and by the cross bands on the fore wing.

Fam. **Psychidæ.**

CHALIA, n. g.

Wings quite transparent, naked; abdominal border fringed with fine hairs: fore wing short, broad, arched at the base, rounded at apex and at posterior angle; cell broad, upper part longest; subcostal vein five-branched, the branches very short, first and second arising before end of the cell, fourth and fifth at equal distances from lower side of third, and terminating below the apex; discocellulars inwardly oblique, lower bent inward at half its length; discoidal veinlet emitted from angle of lower discocellular and anastomosing with subcostal near end of the cell; one radial emitted from lower end of upper discocellular; median vein four-branched, the two lower branches from before end of cell, curved, third at end of cell, fourth short and emitted at half the length of the latter; submedian vein recurved to two thirds its length, thence straight to posterior angle, throwing off an upper branch: hind wing short, broad, rounded at apex and anal angle; cell broad; subcostal vein arched at the base, extending to apex; upper discocellular straight and erect, lower bent inward at its middle, and emitting a discoidal veinlet which extends to base of the cell; median vein three-branched; submedian and internal vein straight. Body slender, densely pilose, the hairs standing out in lateral tufts; abdomen extending beyond hind wings. Antennæ deeply bipectinated. Legs slender.

Chalia Doubledayi (type).

Oiketicus Doubledayi, Westwood, P.Z.S. 1854, p. 235, pl. 34. f. 4.

Hab. Ceylon.

Manatha, n. g.

Wings short, broad, covered with brown scales: fore wing trigonal; costal vein extending to beyond half of wing; subcostal vein five-branched, first and second branches arising from before end of cell, third and fifth at end of the cell, fourth from below third at half its length, and terminating at the apex; cell broad and cleft at its end; discocellulars long, upper bent inward at near its middle, and emitting from its end a discoidal vein within the cell, which extends towards its base and there throws off a lower short branch; lower discocellular very oblique; one radial starting from angle of upper discocellular; median vein four-branched, two lower branches from before end of the cell, the upper branch short and arising from the third, beyond end of the cell; submedian vein bent upward near base of the cell, sending forth a lower branch from half its length, which branch is also bent hindward, and has a second lower parallel branch or internal veinlet, to which it is joined at the angle by a short cross branch: hind wing slightly pointed at the apex, exterior margin rounded; costal and subcostal veins running parallel to below apex, and joined together by a short cross oblique branch before end of the cell; cell broad, short at its upper and long at its lower end; upper discocellular bent outward at its middle, from the angle of which starts the radial; lower discocellular long and parallel to end of the median; median vein four-branched, disposed as in fore wing; a straight submedian and two internal veins. Thorax rather broad, clothed with closely adpressed hairs. Abdomen attenuated, extending beyond hind wing. Antennæ short, bipectinated. Tibiæ clothed with long hair, tarsi nearly naked.

Type *Manatha albipes*.

Manatha albipes.

Male. Wings brown; body fuliginous brown. Antennæ and legs darker brown; tarsi pure white.

Exp. $\frac{9}{12}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood.

Habitaculum fusiform, small, silky, slightly covered with pieces of thin bark or lichen, the specimen under examination having the heads of six (or more) young [? parasitic] larvæ protruding from the upper end—one (the largest) from an extended sac in the middle, the others from separate sac-like openings below and around the upper one; from the lower end of this same example protrudes the empty pupa-case from which the male insect had escaped.

Fam. **Lasiocampidæ.**

Tagora murina.

Male. Upperside greyish fawn-colour: fore wing crossed by a darker upper broad, subbasal, curved, zigzag-bordered band, several discal narrow lunular lines, and a contiguous straight double outer line; the outer border of wing broadly greyish and dotted on the veins: hind wing crossed by a very indistinct darker discal lunular line and straight outer band. Underside brown, with indistinct lunular discal lines, outer straight narrow band, and submarginal dots.

Exp. 3 inches.

Hab. Ceylon. In coll. F. M. Mackwood.

Lebeda variegata.

Male. Upperside dark dull ferruginous brown. Cilia grey: fore wing with a broad basal and discal ochreous band, the former with zigzag border and variegated with brown wavy markings, a large oval upper patch, and a small pure white spot, the discal band with lunular brown inner border and zigzag black-spotted outer border, the interior being traversed by ferruginous lunular lines; middle of the wing and posterior angle suffused with grey. Thorax and front of head grey. Palpi, pectus, and legs blackish ferruginous. Anal tuft blackish. Underside darker ferruginous brown; both wings with two indistinct dusky oblique bands.

Exp. $2\frac{3}{4}$ inches.

Hab. Ceylon. In coll. F. M. Mackwood.

Fam. **Limacodidæ.**

Thosea cervina.

Male. Upperside greenish fawn-colour: fore wing with a transverse discal narrow slightly curved dark brown band; a black spot at end of the cell. Underside uniform brown; a white spot at base of antennæ and on fore tibiæ.

Exp. $1\frac{2}{8}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood.

Belippa ferruginea.

Male and *female.* Ferruginous. Cilia purplish cinereous: fore wing washed with chalybeous scales at the base, disk, and the apex; crossed by a subbasal darker sinuous band, a black-speckled spot at lower end of cell, and a large white-speckled black spot at apex of wing: hind wing paler ferruginous, with a small black-speckled spot at apex, and a short streak at anal angle. Abdomen with a slight dorsal black segmental fringe. Underside paler than above, the black apical spot on fore wing prominent, those on hind wing less so. Tibiæ with a terminal black streak.

Exp. ♂ $1\frac{2}{8}$, ♀ $1\frac{}{8}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood and F. Moore.

Fam. **Cossidæ.**

Zenzera nigra.

Female. Black; both wings and thorax numerously speckled with white. Wings narrow, acute at the apex. Body long and slender.

Exp. $1\frac{4}{8}$ inch.

Hab. Ceylon. In coll. F. M. Mackwood.

XLVI.—*On a Collection of Lepidoptera obtained by the Rev. S. J. Whitmee from Lifu (Loyalty Group), with Descriptions of the new Species.* By Arthur G. Butler, F.L.S., F.Z.S., &c.

The present collection is interesting, not only as containing several beautiful novelties and examples of one or two of the rarer species of the Pacific Ocean, but from the close affinity of the butterflies to those of New Caledonia—many of the species, indeed, being identical. Of course, this is just what one might have expected; but still it is very satisfactory to know the truth, since it proves the local constancy of the species.

Rhopalocera.

Family **Nymphalidæ**.

Danainæ, Bates.

Danais, Latreille.

1. *Danais pumila*, Boisduval (No. 12).

Previously received from New Caledonia and Maré.

2. *Danais affinis*, Fabricius.

Quite common.

3. *Danais archippus*, Fabricius (No. 24).

Said to be rare in Lifu, but common in Samoa.

Euplœa, Fabricius.

4. *Euplœa torvina*, Butler (No. 7).

Previously known from Aneiteum.

5. *Euplœa Whitmei*, n. sp. (No. 4).

Allied to *E. Eschscholtzii*, but olivaceous brown, fading away externally into a broad greyish border: primaries with a small white spot near the costa just beyond the end of the cell, three still smaller, placed obliquely near the apex, and two of about the same size on the median interspaces; secondaries with a discal row of small spots and a submarginal row of smaller spots in couples: body black-brown, head spotted with white. Wings below even paler than above: primaries with a small ┌-shaped spot in the cell, and two or three smaller spots beyond it, all lilacine white; remaining spots as above, traces of three or four white submarginal points near external angle: secondaries with a spot in the cell, four decreasing spots above it and two below it, all lilacine white; remaining spots as above: body below black, pectus white-spotted. Expanse of wings 2 inches 7 lines.

Readily distinguished from all its allies by its pale colouring and the punctiform character of all the white spots of primaries. It seems to be a common and perfectly constant species.

Satyrinæ, Bates.

Melanitis, Fabricius.

6. *Melanitis Solandra*, Fabricius.

Common, and exhibiting three marked variations of pattern in the coloration of the under surface.

Nymphalinæ, Bates.

Charaxes, Ochsenheimer.

7. *Charaxes clitarchus*, Hewitson.

Previously known from New Caledonia and Maré. The present is the only really fairly perfect example that has yet been seen.

Junonia, Hübner.

8. *Junonia villida*, Fabricius.

Common.

Diadema, Fabricius.

9. *Diadema nerina*, Fabricius.

In addition to the typical form there are two female varieties—one in which the orange internal patch of primaries is replaced by a small pale brownish spot, and the pale submarginal spots have almost died out, the other a modification of the normal variety *D. proserpina*, Cramer, tending to approach *D. pallescens*; of the latter I only found one example, which may therefore possibly be a cross between *D. nerina* and *D. pallescens*.

10. *Diadema pallescens*, Butler.

Evidently rare in Lifu, its head quarters seem to be Fiji.

11. *Diadema octocula* ♀, Butler.

Two examples of what appeared to be this insect: but I saw them with the wings closed; so that they may be referable to the next species. It has previously come from Vaté and Totoya.

12. *Diadema elsina*, n. sp. (No. 9).

Allied to *D. octocula*, but readily and constantly distinguished by the following characters. Primaries shorter, the orange or tawny belt beyond the cell considerably darker and narrower and with straight margins joining a submarginal streak of the same colour, which tapers from the internal margin, almost to the upper discoidal vein, and encloses a small black ocellus near external angle: secondaries with the broad discal tawny area much deeper in colour, uniform in both sexes, but crossed by similar black ocelli; outer border much narrower and intersected by a tawny line. Primaries below differing principally in the width and straightness of the oblique tawny band; secondaries with the outer border more regular and usually clouded with brown to just beyond the ocelli. Expanse of wings ♂ 2 inches 10 lines, ♀ 3 inches 3 lines.

I have examined four or five examples of this species.

13. *Diadema lifuana*, n. sp. (No. 9).

Allied to the two preceding species, but smaller, darker, and with differently ornamented primaries.

♂. Above dark chocolate-brown; a tapering submarginal streak of dull deep tawny, enclosing a large black spot near external angle: secondaries with a broad, regular, deep, tawny discal belt, crossed by black veins and traversed by a series of eight rather small black spots; outer border chocolate-brown, bounded within by a well-marked black edge: body dark chocolate-brown. Wings below chocolate-brown, becoming paler towards the outer margin; a rather thick undulated submarginal line and a narrower marginal line, both black: primaries with the subcostal area black in the cell and crossed by two greyish white spots; a pale brown diffused streak across the end of the cell, and beyond it a subcuneiform pale testaceous patch, its broadest part in the costal nervure, diffused externally and fading away as it reaches the lower radial nervure; two subapical white spots, and six black spots with bluish-white centres crossing the disk: secondaries with the disk, from its centre to the outer margin, abruptly testaceous, tinted internally with pink, crossed in the middle by a series of eight rounded black spots with white pupils and broad pyriform chocolate zones; a white subanal litura between the submarginal and marginal lines:

body below smoky brown, palpi white at the sides and black below. Expanse of wings 2 inches 9 lines.

♀. Paler than the male, the primaries with a tapering dull ochraceous streak from the costa just beyond the end of the cell to near the second median branch, and six white dots, from the costal vein to the second median interspace, parallel to the outer margin; an indistinct black spot above the subanal one; the submarginal streak replaced by an ill-defined dusky patch; the apical area smoky brown, with the outer border darker: secondaries with the broad discal belt bright ochreous, and the outer border uniformly dark chocolate-brown; secondaries altogether paler, with the markings more strongly defined than in the male; otherwise similar. Expanse of wings 2 inches 10 lines.

This can, I think, scarcely be a variation of the preceding species; the absence of the well-marked oblique belt in the male and the restricted and differently formed belt in the female are very characteristic; the borders of the secondaries in the two sexes are also very unlike those of *D. elsina.*

Cyrestis, Boisduval.

14. *Cyrestis Whitmei*, n. sp.

Pure white, ornamented with colours and markings nearly as in *C. achates*, but intermediate in character between that species and *C. nivea*: it differs from *C. achates* as follows:—

The blackish lines across the basal area more slender and straighter; the bluish-centred belt across the cell of primaries less oblique and with its sides parallel, the lines closing the cell (one of which represents the lower discocellular) also more parallel; the apical portion of the outer border broader, with the two ocelli upon it less distinctly made out and with white pupils; the outer border darker and rather narrower; the bluish-centred stripe which crosses the lower part of the disk of primaries and the disk of secondaries uniform with the white stripe which follows it, so as to do away with the appearance of incipient ocelli, which at once strikes the eye in *C. achates*; the subanal ochreous patch in primaries smaller; the secondaries distinctly shorter, the anal angle being less produced; the caudal appendage more slender; the streak from the apex to the anal angle dark brown, but slightly washed with ochraceous below the third median branch; only a single slender submarginal black line from the apex to the base of the tail, but from there to the second median branch two regular thick black stripes. Expanse of wings 2 inches 1 line.

This is a well-marked species, of the size and with the aspect of *C. nivea*, but in its ornamentation more nearly agreeing with *C. achates*.

ATELLA, Doubleday.

15. *Atella egistina*, Quoy and Gaimard (No. 10).

This species appears to be extremely common at Lifu; it occurs also at Maré. I was at first disposed to regard it as a variety of *A. Bowdenia* (see P. Z. S. 1875, p. 614).

ACRÆINÆ, Bates.

ACRÆA, Fabricius.

16. *Acræa andromacha*, Fabricius.

As pointed out by Herr Schmeltz, I was correct in my original notice of this species as an inhabitant of the Islands of the South Pacific; it does not, however, appear to be common.

Family **Erycinidæ.**

LIBYTHEINÆ, Bates.*

LIBYTHEA, Fabricius.

17. *Libythea quadrinotata*, n. sp.

Primaries dark brown, shining and tinted with ochraceous towards the base, with a diffused ochraceous patch on the inner margin; a spot in the end of the cell, and a large patch (crossed by the second median branch) on the disk, pinky white, edged with ochraceous; a bifid subcostal white spot beyond the cell, and a subsinuate bifid discal spot towards the apex, white: secondaries with the basal area sordid subochraceous; external area dark brown; a broad fascia, very wide on the abdominal margin, and gradually narrowing to near the apex, and a subapical spot above its extremity, ochreous: body above brownish olivaceous. Primaries below grey, the cell ochraceous; the four spots as above, but all white, the discal area enclosed by them dark brown: secondaries lilacine greyish, speckled with red-brown and crossed, near the base of the

* Mr. Scudder proposes to regard this as an abnormal group of the *Nymphalidæ*; but I cannot agree with him in this.

median branches, by a paler belt: body below sordid whitish. Expanse of wings 2 inches 3 lines.

A very distinct species, not nearly allied to any other yet described.

Family **Lycænidæ.**

LAMPIDES, Hübner.

18. *Lampides caledonica*, Felder.

Closely allied to *L. platissa*, but smaller.

19. *Lampides florinda*, n. sp. (No. 16).

♂. Wings above ultramarine blue: primaries with a narrow dark brown outer border; fringe white externally: secondaries with the costal area brown, the outer border macular, narrowly dark brown, the spot above the tail black, surmounted by a narrow orange lunule; fringe white, spotted with brown; body above grey. Wings below chalky white, with a marginal blackish line; a submarginal series of small dots mostly brown, surmounted by a lunulated slender brown line; an irregular chain-like series of brown-bordered sordid spots (the series of secondaries angulated) across the disk; the cells closed by a double brown litura: primaries with a double line across the cell, and a brown-edged spot beyond the centre of the costa: secondaries with a slightly angular series of brown-edged spots from the costa across the cell; one or two brown lines on the abdominal margin; a black spot surmounted with orange above the tail, and a smaller one near anal angle; all the brown-edged spots on the under surface with snow-white borders: body below snow-white. Expanse of wings 1 inch 1 line.

A very distinct species.

Family **Papilionidæ.**

PIERINÆ, Swainson.

ELODINA, Felder.

20. *Elodina pseudanops*, n. sp. (No. 13).

Wings above smoky brown: primaries darker than the secondaries; an oblique pale sulphur-yellow patch crossing the end of the cell, and divided at its inferior extremity (which is rounded) by the second median branch, its anterior margin sinuated; fringe testaceous: secondaries with a large semicircular sulphur-yellow patch, dentated externally, from the subcostal nervure, across the end of the cell, to the second median branch; fringe white, tinted with testaceous towards anal angle: head white, with red eyes; antennæ black and white above, tawny below; thorax olivaceous, abdomen brown. Primaries below sulphur-yellow; the disk crossed by a broad C-shaped black belt; apex, apical costa, and outer margin silvery white, inner margin broadly grey: secondaries silvery white; the disk crossed by two or three red-brown spots; a similar discocellular spot: body below white, tibiæ and tarsi sulphur-yellow, tarsal claws blackish. Expanse of wings 1 inch 5 lines.

Not unlike the females of some species of *Anops* and *Holochila.*

TERIAS, Swainson.

21. *Terias sulphurata,* Butler.

Occurs also at Maré.

22. *Terias sinapina,* n. sp. (No. 1).

Wings above bright sulphur-yellow: primaries with the costal margin narrowly black; a rather broad external border, irregularly notched internally towards apex, bisinuated (to the depth of rather more than a millimetre) between the median branches: secondaries with black dots at the end of the veins, connected towards the apex by marginal black scales: body above olivaceous. Wings below bright sulphur-yellow, all the veins terminating in black dots; primaries with a few brown scales in the cell, and a few more forming an imperfect annulus on the upper discocellular; secondaries with an irregular double discocellular brown line surrounded by an annular series of spots formed of little groups of brown scales: body below yellow. Expanse of wings 1 inch 7 lines.

Somewhat like *T. Desjardinsii* of Africa.

23. *Terias lifuana,* n. sp.

Allied to the preceding species, but smaller, with the outer border of primaries rather narrower and much less distinctly bisinuated, also with the markings of the under surface much more strongly defined. Expanse of wings 1 inch 5 lines.

Not like any other species known to me.

CATOPSILIA, Hübner.

24. *Catopsilia lactea*, Butler.

Previously known from Erromanga, the Solomon group, and Australia.

APPIAS, Hübner.

25. *Appias ega*, Boisduval.

A common Australian species.

BELENOIS, Hübner.

26. *Belenois terranea*, n. sp.

♂. Wings above creamy white, the base grey: primaries with the costa grey towards the base, but becoming black at the end of the costal vein; apical area black, slightly excised internally between the subcostal branches, deeply excavated between the lower radial and third median, and between the first and second median branches, crossed by five externally acuminate creamy white spots: body grey, with the head and prothorax red-brown. Primaries below creamy white, becoming chalky towards the inner border; apical area sordid sandy brown, sinuated internally and tapering to the first median branch; the costa earthy brown, emitting, beyond the cell, a transverse projection, below which are three semi-connected black spots on the disk: secondaries pale earthy brown, with a discal series of five darker spots; abdominal and anal margins yellow: body white, clothed with reddish testaceous hairs. Expanse of wings 2 inches 4 lines.

Allied to *B. periclea*.

27. *Belenois peristhene*, Boisduval.

Previously known from New Caledonia, Erromanga, Aneiteum, and New Ireland.

PAPILIONINÆ, Swainson.

28. *Papilio gelon*, Boisduval.

Originally described from New-Caledonian examples.

29. *Papilio abstrusus*, Butler.

The type was from Maré.

30. *Papilio Montrouzieri*, Boisduval.

The type was from New Caledonia.

Family **Hesperiidæ**.

HESPERIA, Fabricius.

31. *Hesperia atrox*, n. sp.

Wings above shining chocolate-brown; primaries tinted with testaceous towards the base, with four sordid whitish hyaline spots (arranged like eyes, nose, and mouth) across the centre of the wing; secondaries, with the exception of the costal and external borders and the veins, testaceous; head and thorax olivaceous, the crest and upper surface of palpi blackish; abdomen black, banded with testaceous: wings below chocolate-brown; primaries with hyaline spots as above, the lowermost spot extended to the internal margin; secondaries with the external area slightly paler than the rest of the wing; a large blackish anal patch, surmounted by a whitish spot; legs and antennæ below reddish. Expanse of wings 2 inches.

HETEROCERA.

Family **Sphingidæ**.

SPHINGINÆ, Butler.

PROTOPARCE, Burmeister.

32. *Protoparce distans*, Butler.

A common species in New Zealand.

Family **Catephidæ**.

COCYTODES, Guénée.

33. *Cocytodes modesta*, Guénée.

The blue spots in secondaries are of a rather purer colour than in the Javan type; but otherwise there seems to be no difference.

Family **Ophideridæ**.

OPHIDERES, Boisduval.

34. *Ophideres dioscorea*, Fabricius.

Doubtless a modification of *O. fullonica*.

Family **Ommatophoridæ**.

Speiredonia, Hübner.

35. *Speiredonia simplex*, n. sp.

Wings above olive-brown, shot with lilacine towards the external margin, with the outer border broadly paler, limited internally by a pale-edged, dusky, irregular, discal band diffused on its inner margin; a dark brown submarginal lunulated line, and a second similar marginal line: primaries with the basal two thirds of the costal area whity brown, regularly banded with broad dull blackish transverse patches; a double irregular streak crossing the end of the cell and separating into two diverging double blackish lines below the median vein; a large 3-shaped black-edged marking beyond the cell, its lower half enclosing a purplish spot streaked with blue and spotted with white, so as to form an incipient ocellus: secondaries crossed in the middle by a zigzag blackish line, bordered on each side by a pale brown line: body greyish brown, with the segmentations of the abdomen paler, the head and tegulæ clouded with testaceous. Wings below shining brown, crossed in the centre by a dusky narrow band interrupted in the secondaries by two blackish spots; primaries woolly towards the base, a whitish spot near external angle: secondaries crossed near the base by a second indistinct dusky band; a submarginal series of whitish spots; fringe grey: body below grey, the coxæ of legs whitish. Expanse of wings 2 inches 6 lines.

This species in the comparative simplicity of its markings resembles the genus *Dasypodia*.

Family **Boarmiidæ**.

Boarmia, Treitschke.

36. *Boarmia lichenina*, n. sp.

Wings above grey mottled with brown; the disk reddish, the outer border white speckled with black and crossed by yellowish veins; cells closed by brown-edged white lunate spots; two central transverse dentate black lines—those of the primaries wide apart, with a dusky line between them connecting the lunate spot with the costal and inner margins; a multisinuate white line, bordered on each side with dark grey, separating the discal and external areas; a marginal series of black spots between the veins; fringe white, speckled with brown: body whitish, the abdomen narrowly banded with brown. Wings below white, with a large rounded black spot at the end of each cell; an elbowed discal line across each wing: primaries with the external area broadly blackish, interrupted at apex and on the second median interspace by white quadrate spots; fringe white: secondaries with crenate white outer border, indicated by an internal blackish discal streak; black marginal dots less distinct than above: body below white. Expanse of wings 1 inch 8 lines.

A well-defined species.

BIBLIOGRAPHICAL NOTICE.

Researches on the Fossil Remains of the Extinct Mammals of Australia; with a Notice of the Extinct Marsupials of England. By Richard Owen, C.B., F.R.S. Two vols. 4to. Erxleben: London, 1877.

This work may be regarded as a supplementary volume to the original edition of Cuvier's 'Recherches sur les Ossemens Fossiles' (4to, 1821). In that work but one extinct species had been referred to the marsupial order, viz. the famous *Didelphys gypsorum* (vol. iii. pl. lxxi.), and the osteology of the existing species is not described as in the case of the placental Mammalia of which the fossil evidences are there so richly illustrated. The author of the present work has accordingly added descriptions and figures of the osteology and dentition of the existing Marsupialia to those of the fossil remains of the extinct species; the characteristics of the bony structure and teeth of the wombats and kangaroos are shown in detail. As in the great work of Cuvier, the several memoirs by which the discoveries and determinations of the fossils were first made known are reproduced with additional matter and in systematic order. A chapter is premised on the fossil Marsupials of England, with figures illustrative of twenty-eight species, referable to fifteen genera. Of the extinct Marsupials which have left their remains in Rhætic, Oolitic, and Purbeck deposits in England, some exemplify or prefigure, in a singular and interesting manner, genera and species of Marsupials which have left their remains in the comparatively recent drift-deposits and in the caves of Australia.

The author, quoting the remark of Cuvier, "Quant aux genres propres à l'Australasie, on n'en avoit jamais découvert parmi les fossiles d'Europe" ('Recherches sur les Ossemens Fossiles,' 4to, 1821, vol. iii. p. 292), remarks "it needed to go far below the tertiary beds to find the mammalian fossils most allied to those of Australia" (Preface, p. vi). He then states, "The teeth representing the Rhætic *Microlestes* find their nearest resemblance in the disproportionately small hind molars of *Thylacoleo*. The *Plagiaulax* of the Purbeck beds pushes the correspondence to the shape and disproportionately large size of the incisors and sectorials; and the foremost large laniariform teeth are reduced to a pair in both the pleistocene paucidentate Carnivore of Australia and its smaller British predecessor from the Upper Oolite. The multidentate marsupial Ferines from near the Lower Oolite (*Amphitherium, Amphilestes*, e. g.) are represented by the rare and singular still existing Australian genus *Myrmecobius*. The mandible and mandibular dentition of the typodentate carnivore *Phascolotherium*, a British extinct genus of like antiquity, find their characters more nearly repeated in *Thylacinus* and *Sarcophilus* than in any ex-Australian genera." The author subsequently sums up the evidences of existing Australian forms of vegetable and animal life which recall or repeat characters of the extinct forms revealed by fossils from British Mesozoic strata.

The Australian fossils which form the main subject of the present work are of the marsupial order, and are referred to the two suborders *Polyprotodontia*, or those with lower incisors more than two in number, and *Diprotodontia*, or those in which the lower incisors are limited to two in number.

The first suborder is represented by species of *Sarcophilus* and *Thylacinus*, some larger than the existing species, others of the same size, but from Australian localities where they have ceased to exist, the genera being represented by living species now confined to Tasmania. An extinct bandicoot (*Perameles tenuirostris*) is also referred to the Polyprotodont group. The suborder *Diprotodontia* is divided into two sections, *Sarcophaga* and *Poëphaga*.

In the first section the remains of *Thylacoleo* are described and figured in detail, and the physiological deductions therefrom are fully discussed (pp. 107–184). The *Poëphaga* are distributed, according to the characters of the limbs, into the tribes *Gravigrada, Fossoria*, and *Saltigrada*. The first of these tribes is represented by the genera *Diprotodon* and *Nototherium* (pp. 189–287), the species of which, of the size of the rhinoceros and ox, are all extinct.

The tribe *Fossoria* is still represented by the wombat, but formerly included species of the size of a tapir (*Phascolonus gigas* &c.), with modifications generically distinguishing them from the existing *Phascolomys*.

To the tribe *Saltigrada* the author refers seven extinct genera, besides representatives of the existing *Macropus*, some of which exceeded the largest living kangaroos in size. Not fewer than eighteen extinct species are characterized, and in part restored, of the larger Saltigrades, besides species of the smaller existing genera *Hypsiprymnus* and *Bettongia*.

After a survey of the 522 pages and 132 plates recording these 'Researches on the Fossil Mammals of Australia,' to which the author has devoted part of his annual labours since 1836, he might well be pardoned in indulging "in the flattering thought that the chances were small of future discoveries of new species of large extinct marsupial quadrupeds in the Australian continent." But he checks himself by the following remark:—"Warned, however, by the rate of progress of the science of palæontology since the demise of its Founder, in 1832, I deem it more probable that a like lapse of time after the issue of the present volumes will have been attended by such rich results to the young and ardent naturalists of Australia as to show that their predecessor at home had but 'skimmed the cream,' and given them the broad outlines of a picture of ancient animated nature which their labours will fill in and finish."

In the descriptions and plates of the present work, devoted not only to the characteristic fossils of the extinct families, genera, and species, but also to the dentition and osteology of the still existing types, the generations issuing from the colonial schools, colleges, and universities of Australia, of whom some may be irresistibly led, like those of the present generation of Anglo-Americans, to investigate and interpret the phenomena of an environing nature, will find an instrument which will facilitate and accelerate their endeavours to reconstruct the strange forms of mammalian life which once traversed the Australian plains and scrubs and have long since passed away from that continent.

In Prof. Owen's aim to elucidate the palæontology of the colonies of Great Britain the present work maintains the character and claim on favourable reception of that on the Fossil Reptilia of South Africa, noticed in the 'Annals' for June 1876.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

April 12, 1877.—Dr. J. Dalton Hooker, C.B., President, in the Chair.

"On the Rapidity of Growth and Variability of some Madreporaria on an Atlantic Cable, with remarks upon the rate of accumulation of Foraminiferal Deposits." By Prof. P. Martin Duncan, F.R.S., Pres. Geol. Soc.

A telegraph-cable was laid off the north-west of Spain in 1870, and a portion of it was recovered in 1876, in long. 9° 4′ W. and lat. 44° 6′ N. The depth from which the recovered portion came was from 522 to 550 fathoms; the ground was conglomeratic, and there was a deposit there of sticky foraminiferal mud. Much coral-growth had occurred on the cable, and when it was fished up some living and dead forms, together with *Echini*, Pectens, and mud, came up from off the surrounding sea-floor.

The growth on the cable consisted of numerous individuals of *Desmophyllum Crista-Galli* of different sizes, and of many bush-shaped coralla of *Lophohelia prolifera*, var. *gracilis*; there were also small masses of *Solenosmilia variabilis* (nobis), a new *Am-*

phihelia, and a specimen of *Caryophyllia cylindracea* (Reuss), which were not attached, but which must have been fixed close by to stones.

As the date of the sinking of the cable was known, and as six years had elapsed, it was possible to estimate the rapidity of the growth of the coral on it, and also to come to some more or less satisfactory conclusions regarding the rate of the deposition of the foraminiferal ooze in that situation. Moreover a glance at the numerous specimens showed that they presented variations and abnormalities of structure well worthy of examination, and which might relate to the inadvisability of retaining some of the specific and generic determinations in the ancient and recent coral faunas.

The height of the tallest* *Desmophyllum* taken from the top of the cable, to which its base is strongly adherent, is $1\frac{2}{3}$ inch. It is a fine and well-grown individual, being $1\frac{1}{5}$ inch in its calicular length, and its hard part weighs $\frac{1}{5}$ oz. There are no indications of ooze having covered the base, and the granulation of the basal surface is perfect and free from any evidence of erosion.

The smallest specimen found on the cable has its calicular edge rather on one side and oblique, and it is $\frac{4}{10}$ of an inch above the attached base. It shows no trace of ooze; the other specimens, intermediate in size, usually present an excessively broad base below the peduncle, and in some it extends for nearly $\frac{1}{2}$ inch on all sides. It consists of a layer of carbonate of lime, granular above and attached below to the outer coating of the cable.

Stunted bush-shaped masses of *Lophohelia* adhered by broad bases to the cable, and extended along it for many inches. The corallites composing the masses were crowded together to the height of an inch from the cable, and a few reached upwards about $\frac{3}{4}$ of an inch above the rest. Some had grown up obliquely, and others had their calices turned downwards, so that their margins were not $\frac{1}{10}$ of an inch from the cable. They must have always been above the ooze.

Gemmation appears to have occurred four times in the tallest corallites, commencing on the parent when it attained a certain size: probably the parent growth occupied one year; and there were four consecutive yearly buddings.

From these details it may be gleaned that the upward and general rate of coral-growth at 550 fathoms is rapid in relation to that noticed in Europe in the same family in shallower water. In height the growth amounts to a minimum of 0·29 inch in the year, and in mass it is very considerable.

The amount of sedimentary deposit, consisting of the tests of Foraminifera, sponge-spicules, and minute particles of siliceous minerals, has been inappreciable on the cable during six years. A few Foraminifera in crevices in the bases of a few specimens are

* The *Desmophylla* and *Lophoheliæ* are essentially oceanic deep-sea corals; they have none of the exotheca which distinguishes the rapidly growing littoral reef-building forms.

the only signs of its presence. But that there was plenty of sticky ooze close by is evident; for some was brought up by the apparatus, and it had got into parts of the calices of some of the living corals. Moreover a mass of conglomerate which was brought up, and which consisted of water-worn gneiss boulders cemented together, had some of the mud entangled in it; and most of the calices of the dead corals which were brought up at the same time, but which were not attached to the cable, contained a small quantity of foraminiferal and siliceous matter.

It is possible that the motion of the tentacles and of the cilia of the corals prevented the accumulation of sediment in their neighbourhood; but the tall peduncles of some of the *Desmophylla* would place their calices far out of the way of matter collecting on the base. Moreover the part of the cable on which the coral grew may have been laid on masses of stone above the level of the deposit. But the facts that the calices of the living *Amphihelia* brought up, and which was not growing on the cable, contained no deposit, and that the dead *Solenosmilia* and a short *Caryophyllia*, neighbours to the form just noticed, had very small amounts in their calices, which had long been dead, and had been worn by *Achlya penetrans* and some Spongida, are of themselves sufficient to disprove a rapid rate of accumulation. The presence of some most fragile outgrowths from the Lophohelian corals which supported and partly enclosed the stems of some Hydroida contra-indicate the existence of a current sufficient to move sticky ooze.

It may be considered, then, that the deposit of minute sedimentary matter and of pelagic Foraminifera is excessively slow in its rate of accumulation at 550 fathoms on this part of the Atlantic floor, and that it is very much slower than the contemporaneous coral-growth.

An examination of some of the deep-sea corals of the true *Globigerina*-ooze area will afford a corresponding observation; and we may assume that in the White and Red Chalks of England the Madreporaria grew vastly more quickly than the deposit accumulated which subsequently environed and overwhelmed them. One of Lonsdale's discoveries was that of an *Amphihelian*-looking mass from the Chalk of Gravesend*; its bulk was considerable, and yet many of the calices were close to the base, and they were those of young buds. Again, in the Red Chalk the corals are often widely open and short and were probably very slow growers. All these considerations tend to the impression that the chalk of old, whatever may have been its original nature, accumulated extremely slowly.

The variability of the specimens of *Desmophyllum Crista-Galli* which were found on the cable is very great; and in some instances it is sufficient to permit of a specific distinction being made according to the strict classificatory rules. Doubtless had the specimens

* Suppl. to Brit. Foss. Corals, Cretaceous, Palæont. Soc. By P. M. Duncan.

been separated, and had they been assumed to have come from different localities, new species would have been made of them.

Several specimens are very costulate, and there are crests to all the larger costæ; in some there are wart-like growths in those situations, and in these forms the calice is sometimes widely open, or very compressed, or normally slightly so at its orifice.

In at least one fourth of the specimens the shape of the corallum, instead of being subturbinate and compressed above the round pedicel, is tall and cylindrical; and there are no costal ridges of any importance. Moreover the size of the calices and septa varies in this series.

Some specimens, otherwise normal, have very broad basal expansions out of all proportion with the height. But the most interesting variation is noticed in those specimens which have widely open calices and exsert septa; for, added to these specific structures, are costal crests, ridges, processes, and root-like projections coming from the body, peduncle, and base. These projections are either free at their end or are attached to some support; sometimes the growths are in relation to the costal line, and in others they cannot be maintained to be so, and they are either smooth, granular, or like shagreen. There is no epitheca on the coral, and the root-like projections are therefore growths of the ectoderm. Some act as supports; but most have been produced by the irritation of an Annelid, which, after boring out of the cable, came in contact with the coral, which endeavoured more or less successfully to cover it up.

Those processes which are beyond the reach of Annelids and which act as supports singularly resemble those root-like growths which are of generic or specific importance in many groups of Madreporaria.

Flabellum, *Rhizotrochus*, *Rhizophyllum*, *Omphyma*, &c. are genera which possess such root-forming species. But the root-like processes of *Flabellum* have a higher physiological interest than those of *Desmophyllum*; for some finally separate the base of the coral from its attachment by their downward growth-pressure; nevertheless the development of root-processes by the cable-covering *Desmophylla* is suggestive and important, although some are morbid growths.

The cylindroid specimens would most probably be considered specifically distinct from the others were they found away from them or in strata. They are very suggestive; for in palæontology the shape of the corallum, the contour of the calice, and the relative size of the septa are often considered to establish species; and such genera as *Trochocyathus*, *Trochosmilia*, and *Montlivaltia* amongst Mesozoic corals, and *Cyathophyllia* and *Zaphrentis* amongst the Rugosa, teem with specific names which are not established on better grounds than that of the cylindroid *Desmophyllum*.

The *Lophohelicæ* on the cable present great bud variation; and the young and old corallites are of many different shapes, from the turbinate to the tubular. But the most important structural peculiarities are of two kinds :—first, the annelid growth has determined outgrowth of the coral which has covered in the worm-tube ; and second, the establishment of some Hydrozoa on the ectoderm of the coral has sometimes produced the formation of tubes of coral-structure which environ the stalk of the offender and form a useful support to it.

Finally it may be remarked that all the Madreporaria which were brought up with the cable from off this area have an unusual ornamentation.

I have to thank Sir James Anderson for the specimens and for the details of the recovery of the cable.

MISCELLANEOUS.

On some Points in the Embryology of Annelids. By M. C. Barrois.

The investigations, of which I now give a summary, were made in the years 1873–76, and completed during the present year.

The first fact relates to the discovery of a new type, common at Roscoff during the month of April, which must be referred to the interesting group of the Gastrotricha. It possesses the form and general aspect of the Ichthydinæ ; but its skin is divided superficially into several segments furnished with incomplete ciliary circlets, which cause it to resemble the larva of an annelid. The digestive tube consists of three divisions, of which the first bears a very characteristic muscular pharyngeal inflation, which I have also met with in a small Syllidian, *Nerilla antennata.* The specimens were in full reproduction at the period when I collected them ; the genital organs form a series of glands, as in the Rhabdocœli. The sexes are separate : the males possess two testes, situated one to the right, the other to the left of the stomach, and which are followed by two seminal vesicles which pass to a single penis ; the female organs consist of two great masses, situated at the same part as the testes of the male ; and these ovarian masses, like the testes, are separated by a sort of dissepiment which divides the body of the animal into two parts.

Copulation occurs ; then the ova are deposited ; and in order to study them it is only necessary to collect them at the bottom of the vessel. The segmentation is like that of annelids generally : a gastrula is formed by epibolism ; then the internal mass is concentrated behind, while the anterior part becomes clear and the ventral surface thickens into an embryonic band ; the posterior fatty mass will form the stomach, the clear anterior part the œsophagus, and the embryonic band the muscular layer. The latter, the investigation of which would possess special interest, represents the embryonic band of the Annelids in a still very rudimentary state. The remainder of the development is reduced to the formation of the oculiform points, a general elongation, the appearance of cilia, &c.

In the arrangement of the generative organs this species approaches the Turbellaria; the presence of its circlets of cilia and that of the embryonic band, on the other hand, approximate it to the group of Annelids; and among the latter, *Nerilla antennata* appears more particularly to approach it in the arrangement of the pharyngeal inflation, and also perhaps of the generative glands. Claparède has already described another type, also allied to the Annelids (*Hemidasys aguso*), but in its other relations rather approaching the Rotifera. We see, therefore, that the three groups of the Rotifera, Annelids, and Turbellaria become confounded at the base in the common trunk of the Gastrotricha; and the more particular analogies which the Syllidians possess with the latter (*Nerilla*) show that they must be placed at the base of the Annelids.

The embryogeny of the group Syllidea has been retarded by the strange nature of the mode of gestation, which has been taken by certain authors for a gemmation upon the parapodes. I have ascertained in a great number of species that there was never any thing in it in common with gemmation; the number of embryos fixed upon each [pair of] parapodes always corresponds exactly with the number of ova developed in each metamere; in those species which have only one embryo upon each parapode, we see in like manner only two ova in each metamere. I have traced the escape and the complete development of these ova. At a certain period of their development we see the vitelline membrane become confounded with the external integument of the embryo; the latter then appears to be fixed directly upon the parapode; and it is this that has led to the belief in gemmation. The most remarkable fact in the development of the ova thus fixed is the complete absence of any larval form; the relations of the Syllidea to the Gastrotricha allow us to suppose that this absence constitutes the primitive state, and that the state of larva (Trochosphere), afterwards so important, is only derivative. One is accustomed to regard the *vermiform state* of the embryos of Annelids (Oligochæta) as constituting a derivative state; and it is not uninteresting to remark that side by side with this *derivative vermiform* state (Oligochæta) there exists a *primitive vermiform* state (Syllidea), by means of which the embryogeny of the Chætopods is related to that of the Gastrotricha and the inferior worms. In this state the embryonic band (too little known among the Chætopods, in which I have constantly met with it) always exists, and still continues to form the essential fact of the development; it only begins to be reduced in the Roscoff type.

To these observations on the lower forms of embryogeny in the Annelids, I may add a few words on the higher forms, some of which have been too widely separated from the ordinary type: *Mitraria*, among others, may very well be brought back to the general type.

Thus I have several times found at Saint-Vaast a passage form in which the posterior half of the body was reduced by burying itself in the anterior part, which was margined at the base by the ciliary circlet. This fact quite naturally leads us to regard the *Mitraria* as produced by the same process a little more strongly marked; the second period of development, in which Metschnikoff has seen the segmented body coming to form a more or less considerable hernia beyond the anterior parts, which at first covered it completely, would then be nothing but the inverse of the first, and a simple return to the normal form.—*Comptes Rendus*, July 30, 1877, p. 297.

On a new Genus of the Family Tritoniidæ. By M. A. Vayssière.

Among the numerous Gasteropod Mollusca collected in the Gulf of Marseilles, I have observed a curious Tritoniid which I do not find described anywhere, and which certainly merits special mention. This animal was captured on the 26th April last, between Carry and Cape Méjeau, at a depth of 50 metres, on a muddy bottom, nearly at the limit of the coralligenous bottom.

It so much resembled some *Dendronoti* which I had received at the same time in its external aspect, in its size (7–8 centims.), and in its coloration, that I at first confounded it with them. When I perceived my error the animal was too much decomposed to allow a sketch of it to be made; nor could I completely examine its external characters: the anterior region of the integuments, however, was still in a pretty good state. But a dissection was sufficient to bring to light the important anatomical peculiarities which determine me to establish a new generic group for this mollusk.

I may be permitted to dedicate this new genus to my teacher, Prof. Marion, as a very feeble testimony of the gratitude I owe him for the constant kindness with which he directs me in my natural-history studies.

Genus Marionia.

Corpus elongatum, lateribus compressis, altius quam latius, pallio nullo. Caput subinferius, obtectum velo parvulo, ramoso; maxillis corneis. Stomachus cultriformibus dentibus armatus. Tentacula duo dorsalia ramusculis tenuibus condensis superne cincta. Branchiæ ramosæ, linea unica utrinque dorsi insertæ. Orificia generationis et ani ad latus dextrum sita.

The general coloration of this mollusk was ochre-yellow, with numerous vinous spots. Its dendritic branchiæ were shorter and less divided than those of *Dendronotus*.

The tentacles, instead of presenting, as in the latter, towards their upper part a certain number of ridges and lamellæ, showed a mass of ramifications, very like much-attenuated branchiæ, pressed close together, and only allowing to project the terminal, much lessened portion of the tentacular axis. These organs were of a paler tint than the dorsal surface, and bore numerous white points.

The genital orifices are on the right side of the animal, at the level of the tentacles; the anal aperture is on the same side, but towards the middle of the body.

The external differences recognizable between this animal and *Dendronotus*, therefore, only relate to the arrangement of the terminal portion of the tentacles. The internal anatomical characters are much more important. The genus *Marionia* is not without relation to *Scyllæa*.

The buccal bulb is more voluminous than that of *Dendronotus*; and the corneous maxillæ are comparatively longer.

The œsophagus, which is very long, opens into a first dilatation, which is the gizzard; it is in the interior of this cavity that we find nearly forty cultriform teeth, placed side by side, and forming a complete ring. This character occurs among Nudibranchs only in the genus *Scyllæa*. A less dilated, but much longer region follows the gizzard; it may be regarded as forming the true stomach. The intestine, which follows it, opens, as already stated, upon the right side of the body, near the middle part.

We find in the division of the liver into two glands a further character which approximates our mollusk to the genus *Scyllæa*. The more voluminous of the two hepatic glands forms a compact mass completely enveloped by the hermaphroditic gland—a peculiarity which does not occur in *Dendronotus*, where the hermaphroditic gland forms a distinct organ resting on the liver. The second hepatic gland, which is much smaller than the other, is completely isolated; it is placed to the right beneath the gizzard.

These two excretory organs pour their product, each by a different orifice, into the masticatory stomach, above the armature, and immediately below the extremity of the œsophagus. We find this arrangement also in the *Scyllææ*; only, in place of two orifices, in this type we distinguish three, at which the ducts of six or seven hepatic glands terminate.

We should have further to cite numerous differences between the genus *Marionia* and *Dendronotus*, both in the form of the nervous centres, and in the number and arrangement of the annexed organs of the generative apparatus.

Although imperfect, all these data show that the genus *Marionia*, notwithstanding a great external resemblance to the *Dendronoti*, differs from those mollusks by its internal organization. The armature of the stomachal region is an important character, establishing a relationship with the *Scyllææ*. We may say that *Marionia* is a *Dendronotus* with the stomachal armature of *Scyllæa*. The discovery of this new type consequently justifies the place assigned by Woodward to *Dendronotus* in the family Tritoniidæ.—*Comptes Rendus*, July 30, 1877, p. 299.

THE ANNALS

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XLVII.—*On* Pteroplax cornuta, *H. & A.* By THOMAS ATTHEY.

[Plates XII. & XIII.]

IN the 'Annals and Magazine of Natural History,' ser. 4, vol. i. 1868, appeared "Notes on the Remains of some Reptiles and Fishes from the Shales of the Northumberland Coal-field," by my late friend Mr. Albany Hancock and myself.

In those notes were described two crania of *Pteroplax cornuta*, the upper surface of the smaller one being figured of about two thirds the natural size (pl. xv. fig. 1); subsequently the matrix having been more carefully removed from the surfaces of both crania, two well-defined sutures on each have been brought to light, and are seen to divide the bone which had been named postfrontal into three distinct parts—namely, the postfrontal proper, the postorbital, and the squamous.

In the present communication I propose to describe and figure, of the natural size, the upper surface of the smaller and the under surface of the larger cranium, also some ribs and vertebræ, three bones of an extremity, and some scutes, all of which most probably belonged to the same amphibian.

The crania have undergone immense pressure and are consequently much flattened. Together with the other bones they are from the black shale, a stratum varying from 3 to 4 inches in thickness, overlying the Low Main seam of coal at Newsham Colliery, near Blyth, Northumberland.

Upper surface of the smaller cranium (Pl. XII. of natural size and as seen after careful removal of the matrix).—A rib is seen lying along upon the left side of the cranium; and near its distal end a fragment, which may have belonged to it, partially overlaps the left occipital region; a third piece, the vertebral end of a rib, lies under the fore part of the skull.

It is worthy of remark that the premaxillary, nasal, prefrontal, and maxillary bones, which naturally form the anterior end of the cranium, are absent from all the three skulls of *Pteroplax* as yet known. Such a deficiency has never been met with in skulls of *Loxomma* or *Anthracosaurus*. The skull of *Pteroplax*, as we find it, consists of frontals, parietals, so-called supraoccipitals, postfrontals, postorbitals, squamous, occipitals, epiotics, and quadrate bones, all firmly united by suture.

Dimensions.—The skull thus composed measures in length, from the median line in front to the posterior ends of the epiotic horns, $6\frac{1}{2}$ inches, and from the same point to the posterior margin of the occiput on the median line 5 inches. The distance from this last point to the point of the right epiotic horn is very nearly 2 inches, and that between the points of those horns $2\frac{9}{10}$ inches. Breadth of the skull at the occipital margin $2\frac{1}{2}$ inches, at the broadest part $2\frac{9}{10}$ inches, between the posterior ends of the orbital curves $2\frac{1}{2}$ inches, between the anterior ends of the same 1 inch, over the anterior broken ends of the frontals rather more than 1 inch.

The pitted sculpturing is irregularly disposed over the surface, the pits varying much in form, size, and depth, being on the whole smaller and less deep than those of the crania of *Loxomma* and *Anthracosaurus*; on the parietal bones they are prolonged into grooves radiating from the centres of ossification on each side of the parietal foramen. The pits are most strongly marked on the postfrontals and postorbitals, and are largest and groove-like on the frontals. On these bones there is besides a channel or groove at each margin, studded with pits, probably a mucus-groove. The pits on the frontals are all inclined forwards, and look as if they served to lodge blood-vessels. None of the small punctures which exist at the bottom of the pits in *Loxomma* are visible in the pits of *Pteroplax*, any more than in those of *Anthracosaurus*.

The orbits appear to have been large for the size of the skull; their internal, concave, osseous margins, formed of the postfrontal and postorbital bones, alone remain to testify to this. They are placed where the skull rapidly tapers to the elongated frontal region. The rest of their outline was probably partly membranous or ligamentous and cartilaginous.

The prolonged and narrow anterior end of our specimen terminates abruptly at a somewhat oblique transversely fractured surface.

The frontal bones constitute nearly the whole of this narrow part of the skull, which appears slightly deviated from the straight line, as if it had received after death a blow on the left side of the anterior end, which had started the posterior end somewhat from its articulation with the parietal bones. This part is rather broader at its distal end than elsewhere.

The frontals are united to each other on the median line; behind and at each side of that line they form a retreating angle, into which are received the united ends of the parietals; external to this they articulate with the postfrontals, the posterior extremity of each frontal being received into an angle formed by the parietals and postfrontals.

The parietals occupy the chief part of the middle region of the cranium, and are of a triangular form, the base being posterior. In the middle of the median suture is the oval parietal foramen. It is large, being $\frac{2}{10}$ inch in length and rather more than $\frac{1}{10}$ inch in breadth; it is surrounded by an elongated oval space, which is somewhat elevated, the bone here being thick and strong; and outside of this is a depression of the same form, gradually rising outwards to the ordinary level of the surface of the skull. At the anterior part of the parietals the median suture has an irregular course to the left, no doubt a mere individual irregularity. On their outer borders these bones articulate, from front to back, successively with the postfrontals, the postorbitals, the squamous, the epiotic, and the so-called supraoccipitals which lie behind them.

The postfrontals are narrow, curved, and elongated, pointed in front, where they abut upon the frontals, and broader behind, where they meet the postorbitals; their internal borders, irregularly convex, articulate with the frontals and parietals; their external borders form the greater part of the concave and smooth inner margin of the orbits.

The prefrontals, which may have formed the anterior part of the inner margin of the orbits, and *the lachrymals* are absent.

The postorbitals, articulating in front with the postfrontals, internally with the parietals, and posteriorly with the squamous, are short thick bones which form the posterior part of the inner orbital margin, and present an external projection which marks the termination of that margin and to which, as well as to the similar process on the postfrontal, ligaments and other structures forming the outer wall of the orbit were attached. Behind these projections the borders of the postorbitals, as they go to join the squamous, are concave.

The squamous, a little larger than the last, are four-sided: the external side is convex, longer than the others, and the upper surface is convex like that of the postorbitals; these bones join in front with the last named, internally with the parietals, and behind with the epiotics. The surface-pitting is much less strongly marked on the squamous than on the two bones in front of them.

The supratemporals, the jugals, and the quadrato-jugals are not visible on the upper surface of either of our specimens.

The epiotics complete the ring of bones around the sides of the parietals, and form the posterior external angles of the cranium; these angles are produced backwards, in a conspicuous and remarkable manner, into what have been called horns, whence *Pteroplax* has received its specific name *cornuta*. The parts of the skull from which these horns project are thick and strong, standing up in a ridge, which from above the base of the horn passes forwards and then, curving inwards, is merged into the upper surface of the occiput, its external side gradually subsiding to the level of the other bones.

The epiotics are narrow bones wedged in, as it were, between the so-called supraoccipitals and the squamous and reaching the parietals; they also form a portion of the occipital surface, and with it and their horns give attachment to muscles stretching down the neck.

The so-called supraoccipitals or superior occipitals are rather narrow, elongated transversely, joining each other on the median line, and, hemmed in by the epiotics, overhang the occipital surface; their external posterior angles are more or less acute; below they articulate with the exoccipitals and the quadrates.

The occipital surface, concave vertically, is much arched from side to side, owing greatly to the epiotic horns, and presents the same slightly overhanging border that we see in the other two Labyrinthodonts of this district. Three occipital protuberances exist, one at the upper margin, another near to or at the base of the skull, the third, which is small, just below the first. These are bisected by the median suture. From a little distance on each side of these projections the vertical concavity of the surface is divided by a rather rough ridge into an upper and a lower groove; and in each runs a delicate rather obscure suture; the upper unites the so-called supraoccipitals to the exoccipitals, the lower these latter bones to the quadrates.

The true occipital is undistinguishable, and the basioccipital probably absent. The height of the occipital surface near its middle is $\frac{3}{10}$ inch; at its outer part at the base of the horns, where the bones are very strong, and have been able to resist pressure better than other parts, it is $\frac{5}{10}$ inch.

Upper surface of the larger cranium.—This has not been figured. Having been carefully cleared of the matrix it shows all the sutures; but the bones are badly preserved and the pittings almost all obliterated. The following are its dimensions:—from the median line of the anterior broken end to the point of the epiotic horns 7 inches, from the same point along the median line to the posterior edge of the occiput $5\frac{1}{2}$ inches, from the middle point of occipital border to point of left epiotic horn $1\frac{1}{4}$ inch, between the epiotic horns $3\frac{9}{10}$ inches. The breadth of the skull at the occipital margin $3\frac{6}{10}$ inches, over the posterior margin of the parietals $3\frac{8}{10}$ inches, between the posterior points of the orbital curve $3\frac{4}{10}$ inches, between the anterior points of the same $1\frac{7}{10}$ inch; the breadth of the broken anterior end of the frontals is nearly one inch.

The right epiotic horn is broken off at the end; otherwise the outline of this cranium is on the whole nearly the same as that of the smaller specimen; it is rather broader, and perhaps belonged to an older animal: the frontals are worn as it were in front; but the right side appears to have the normal length, whilst the left is shortened.

Under surface of the larger cranium (Pl. XIII. fig. 1).—In this the entire under surface of the cranial vault can be seen; all the parts below are gone; the median suture of the vault throughout with the parietal foramen is visible; the palate, maxillary, and premaxillary bones are wanting, and may have been more or less cartilaginous or loosely attached; the presphenoid and sphenoid median ridge and the basioccipital, which are seen in the skulls of *Loxomma* and *Anthracosaurus*, are also gone. The quadrates at the base of the epiotic horns are the only bones of the base of the skull that remain. The horns are a good deal damaged. The articular condyle for the mandible is not to be seen. The under surface of the frontal bones is grooved on each side of a median ridge, along their whole length, as if they had formed the roof of a double nasal cavity extending from the snout to the throat.

The parietal foramen is large, open, and funnel-shaped, widening out greatly as it passes through the thickness of the cranium; it is here $\frac{6}{10}$ inch long and $\frac{4}{10}$ inch broad, whilst on the upper surface of the skull it is only $\frac{1}{4}$ inch long by $\frac{2}{10}$ inch broad. Its margin is surrounded, except in front, by a sharp ridge of bone, from which pass off laterally smaller ridges, which, dividing, enclose small smooth depressions that extend to near the margin of the cranium. The wall of the cranium is very thick around the foramen; and from this to the occiput there extends on each side a broad raised space with a depression outside of it; the region of the posterior external angle is thick and very strongly ossified, as are also the epiotic horns. At the posterior end of the orbital curves, and corresponding to a part of the postorbital bones at their under surface, is a rough pitted space which looks like the articular surface for another bone, which is lost, but which may have formed the posterior border of the orbits.

It is possible this skull may have been much decomposed before its entombment.

The dentition of *Pteroplax* has yet to be discovered; and no mandible has yet been obtained.

Vertebræ.—These are not figured, being imperfect. On a piece of black shale $5\frac{1}{2}$ inches long by $3\frac{1}{2}$ inches broad, in my collection, are imbedded three vertebral centra and portions of two vertebral processes. Two of the centra are much less than the third, which measures in height $\frac{9}{10}$ inch, in breadth $1\frac{1}{10}$ inch, in length $\frac{1}{4}$ inch; its sides are slightly excavated, it is biconcave, and has a small notochordal foramen. One of the processes, a transverse one, is $\frac{6}{10}$ inch long by the same in breadth, and is much crushed. A zygapophysis is present, but too much injured to admit of description. The remaining process is of about the same size and in the same condition.

Ribs.—On the same piece of shale there are fragments of three ribs; the proximal ends of two are present, and, though much flattened, show well the head and tubercle; the distal end of the third exists, but is much flattened. It is the under surface, somewhat concave, which is exposed. In close relation with the head are three portions of ribs: one large fragment, showing head, tubercle, and groove, lies on the left side of the cranium; another fragment with head and tubercle lies obliquely under the cranium; a short piece of the sternal end of a rib rests in part on the occiput.

These are shown in Plate XII. The first is $5\frac{1}{2}$ inches long by $\frac{3}{10}$ inch broad; it is well and regularly arched; the curve of the bone is continued as far as the head, which ends in a concave articular surface; the tubercle, $\frac{4}{10}$ inch posterior to the head, ends likewise in a concavity for articulation. A groove runs along the under surface from near the tubercle for two thirds of the length of the rib; beyond this the surface is flattened.

The head, tubercle, and part of the groove are seen on the rib which lies under the cranium. Nothing is worthy of note with regard to the third fragment, which may be a part of the first-named.

These ribs, lying in contact with the skull of *Pteroplax*, must be taken as having belonged to the same animal.

The ribs imbedded on a piece of shale cannot, perhaps, be proved to have belonged to *Pteroplax*; but they are of the same size, and are in other respects very like those on and under the cranium, and were found in the same part of the mine.

If this inference be correct, then the vertebræ lying with the ribs on the piece of shale are, there can be little doubt, vertebræ of *Pteroplax*.

Bones of an extremity.—These are figured on Plate XIII. fig. 3, and are only three in number, small and dislocated from their normal relation, but still very near to each other; they lie surrounded by many scutes on a slab of shale 8 inches by $5\frac{1}{2}$ inches. They appear to be the terminal bones of a digit, but whether of an anterior or posterior limb is not easy to determine. They diminish in size like digital bones: the biggest is 1 inch long and $\frac{1}{2}$ inch wide; the next is shorter and more slender; the third or smallest is pointed at the further end; with this exception the ends of these bones are concave and the sides contracted at the middle.

Scutes.—On the last-mentioned slab, and on its counterpart measuring $5\frac{1}{2}$ inches by $4\frac{1}{2}$ inches, are imbedded altogether 104 scutes, lying in the same plane, but scattered about without any order; besides these I have only one other scute on a small bit of shale in my collection.

These scutes vary in size from 1 to $\frac{3}{4}$ inch in length; and from $\frac{1}{6}$ inch at the anterior end, which is rounded, they taper to a rather sharp point behind; their upper surface on the whole is convex and their under surface concave from end to end. On their upper surface is a strong ridge nearer to one margin than the other; the former is the thicker edge and also the longer, whilst the surface slopes gradually to the other side, which is quite thin. Two of these scutes are represented in Pl. XIII. fig. 2.

It is presumed that the above are the scutes of *Pteroplax*, as they are different in form from the scutes of the two other larger Labyrinthodont Amphibia, and are also much smaller and of more delicate make, and we know of no other animal-remains in our coal-field to which they could belong. They are from the same part of the mine as the other remains herein noticed, and bear a certain proportion of size to the crania described.

The small size of the crania, their form and the smaller number of bones entering into their formation than into those of *Loxomma* and *Anthracosaurus*, and the invariable absence of the snout, maxillaries, and mandibles are the chief characteristics of *Pteroplax cornuta*. The inferior parts of the skull being also wanting in both our instances renders it probable that *Pteroplax* had a skull much less completely ossified than either of the two animals above named, and that it partook more than they did of a batrachian or piscine character.

That it had two pairs of limbs, feet or paddles, is very probable, and that it was an air-breather is evidenced by the form, length, and breadth of the ribs, and perhaps also by the grooved state of the under surface of the frontal bones.

Of its body we know nothing beyond the scanty vertebræ, fragments of ribs, and scutes.

If, with the desire to form something approaching to a definite idea of the comparative size of our three Labyrinthodonts, we suppose the length of the animal to be seven times that of the skull, which is about the proportion in *Keraterpeton Galvani* (a comparatively short species), and if we allow two inches for the lost part of the larger specimen of *Pteroplax*, the skull of this animal, from the end of the snout to the end of the occiput, will be 7½ inches long, and the whole length of the body 4 feet 8 inches.

By the same rule of the body being seven times the length of the head we find that *Loxomma Allmanni*, with a skull 12½ inches long, must have measured 7 feet 7 inches; and in like manner *Anthracosaurus Russelli*, with a skull of 13½ inches, must have had a total length of 8 feet 2 inches. The correctness, however, of this rule is questionable; and it is not easy to say what was the length of the tail in each case.

As was noticed in the 'Annals and Magazine of Natural History' for August 1876, the præmaxilla figured in a previous number as that of *Pteroplax*, and the teeth, as since shown by an examination of their minute structure under the microscope, as well as four or five fragments of mandibular bones, which had been described as "most probably belonging to the same large Labyrinthodont amphibian," all belong to *Loxomma Allmanni*; whilst the vertebræ and sternal plates, also figured and described as belonging to *Pteroplax*, are probably remains of *Anthracosaurus Russelli*.

My acknowledgments are due to my friends Dr. Embleton and Mr. William Dinning—to the former for his assistance in the above description, and to the latter for the accurate and beautiful drawings illustrative of that description.

EXPLANATION OF THE PLATES.

Plate XII.

Upper surface of the smaller cranium of *Pteroplax cornuta*, of the natural size; the portions of ribs mentioned in the text as lying upon and under the cranium are seen. *Fr*, frontal bone; *Pt.Fr*, postfrontal; *Pt.O*, postorbital; *Pa*, parietal; *Sq*, squamous; *Ep*, epiotic; *Q*, quadrate; *Ex.O*, exoccipital; *S.O*, so-called supraoccipital. The parietal foramen and the epiotic horns are sufficiently evident.

Plate XIII.

Fig. 1. Under surface of the larger cranium of *Pteroplax cornuta*, of the natural size. *Fr*, frontal bone; *Pt.Fr*, postfrontal; *Pt.O*, postorbital; *Sq*, squamous; *Ep*, epiotic; *Q*, quadrate; *Oc*, occipital.
Fig. 2, A, B. Scutes: A upper, B under surface.
Fig. 3, A, B, C. Three digital bones.

XLVIII.—*Characters of new Genera and of some undescribed Species of Phytophagous Beetles.* By Joseph S. Baly, F.L.S.

Fam. Sagridæ.

Orsodacna variabilis.

O. elongata, convexa, pube subdepressa grisea vestita, subtus cum antennis nigra, thorace rufo, ad latitudinem fere æquilongo, lateribus pone medium constrictis, disco subremote rude punctato; capite elytrisque viridi- aut cæruleo-æneis; antennis pedibusque pallide piceis, femoribus obscurioribus.
Var. A. capite elytrisque obscure nigro-violaceis, æneo vix micantibus.
Var. B. elytris apice fulvis.
Var. C. antennis elytrisque obscure fulvis, illis æneo tinctis.
Long. 2–3 lin.

Hab. Kurdistan.

Head trigonate; vertex strongly but not closely impressed with large punctures; space between the antennæ transversely excavated; lower portion of clypeus and mouth fulvo-piceous, apex of jaws nigro-piceous; antennæ rather more than half the length of the body, pale piceous, more or less stained with fuscous. Sides of thorax constricted behind the middle, obtusely rounded in front; disk sparingly clothed with coarse suberect hairs, remotely impressed with large, deep punctures. Scutellum semiovate, smooth, impunctate. Elytra broader than the thorax, parallel, convex, depressed along the suture;

clothed with suberect griseous hairs, coarsely and much more closely punctured than the thorax; slightly excavated and irregularly and transversely wrinkled below the basilar space.

The present species differs from *O. mespili* and *humeralis* in its shorter and more coarsely punctured thorax, and in the absence of the smooth longitudinal space on the vertex and front, present in both the other species.

Fam. **Crioceridæ.**

Syneta Adamsi.

S. elongata, griseo-pubescens, sordide fusco-fulva, supra dense punctata, antennis, pedibus elytrorumque margine tenui fulvis, pectore piceo, oculis nigris; thorace crebre punctato, lateribus obtuse angulatis, irregulariter dentatis; elytris rude striatim punctatis, singulatim costis elevatis quatuor instructis, costis prima et secunda minus distinctis, tertia fere obsoleta.

Long. $2\frac{2}{3}$–3 lin.

Hab. Vladimir Bay, Mantchuria; Tsu Sima, Japan. Collected by Mr. A. Adams.

Head coarsely punctured, lower portion of clypeus smooth, impunctate. Thorax transverse, coarsely punctured; sides obtusely angled, irregulately dentate. Elytra strongly punctate-striate; each with four longitudinal costæ—the second and third only slightly raised and often nearly obsolete, the third only visible towards its apex, the fourth strongly raised.

Nearly allied to *Syneta betulæ*, but differing from that insect in the obtusely angled sides of the thorax.

Fam. **Cryptocephalidæ.**

Genus Tappesia.

Corpus elongatum, modice convexum, pube squamiformi depressa parce vestitum. *Caput* ad oculorum marginem posticum in thoracem insertum, vertice tumido; *oculis* remotis, ovatis, intus vix sinuatis; *antennis* gracilibus, longitudine thoracem paullo superantibus, articulis ultimis quinque vix dilatatis. *Thorax* transversus, lateribus integris; margine postico minute serratulo; lobo basali obtuso, obsolete sinuato. *Scutellum* planum, pentagonum, apice non elevatum. *Elytra* oblonga, lateribus vix lobatis. *Pedes* mediocres, modice robusti; *unguiculis* appendiculatis. *Prosternum* oblongum, planum, margine antico deflexo, margine postico obtuso, angulis posticis obtuse angulatis.

Type *Tappesia Saundersi.*

Tappesia may be known from *Elaphodes* by the form of the prosternum, by the absence of the angular notch at the apex of the basal lobe of the thorax, by the larger and differently shaped scutellum, by the more prominent head, and, lastly, by the elongate form of the body; from *Ochrosopsis* and allied genera it is separated by the differently shaped eyes, by the short antennæ, by the entirely different form of the prosternum, and by the nearly entire basal lobe of the thorax.

Tappesia Saundersi.

T. elongata, subparallela, modice convexa, subnitida, brunnea, piceo variegata, pube squamiformi adpressa flava et albida parce vestita; antennis pedibusque piceo-fulvis, illarum articulis ultimis quinque apice infuscatis, femoribus piceo tinctis; thorace crebre ruguloso-punctato; elytris crebre punctatis, ad latera et ad apicem obsolete striatim sulcatis.

Long. 2 lin.

Hab. Gawler Town, South Australia.

Head piceous, swollen on the vertex, closely rugose-punctate; clypeus transverse, bounded on either side by an oblique ridge, its lower portion, together with the labrum, rufo-piceous: antennæ slender, much less than half the length of the body; five outer joints very slightly dilated. Thorax twice as broad as long at the base; sides rounded at the extreme base, thence obliquely converging and rounded to the apex; basal margin concave and faintly bisinuate on either side, median lobe moderately produced, obtusely angulate, its apex truncate, obsoletely sinuate; upper surface obliquely but slightly depressed on either side behind the middle, closely punctured; interspaces finely rugulose. Scutellum nigro-piceous, scarcely broader than long. Elytra oblong, not broader than the thorax, faintly excavated behind the scutellum, closely punctured; towards the apex and on the outer disk of each elytron are a number of faint longitudinal sulcations, which correspond to the punctate striæ found in most species of Cryptocephalidæ: in the present instance they are not more distinctly punctured than the rest of the surface, but their interspaces are slightly convex.

Ditropidus Wallacei.

D. breviter ovatus, valde convexus, nitidus, subtus niger, pedibus obscure fulvis, femoribus posticis quatuor piceis; supra metallico-purpureus, labro antennisque fulvis, his extrorsum piceis; thorace minute subremote punctato; elytris sat fortiter punctato-striatis, striis sulcatis, interspatiis lævibus, convexiusculis, iis ad latera convexis.

Long. 1 lin.

Hab. Mysol. Collected by Mr. Wallace.

Head impunctate, impressed on the face with a faint longitudinal groove, sparingly clothed with fine adpressed hairs; clypeus obscure piceous, its apical margin concave-emarginate; jaws rufo-piceous; eyes rotundate-ovate, slightly notched; antennæ scarcely longer than the thorax, five lower joints fulvous, the rest piceous. Thorax rather more than twice as broad as long at the base; sides quickly rounded and converging from base to apex; basal margin bisinuate on either side, median lobe moderately produced; above transversely convex, impressed transversely just in front of the basal lobe; minutely and rather distantly punctured; lateral margin dilated at the base. Scutellum broadly ovate, its apex acute. Elytra regularly sulcate-striate, the striæ impressed with linear punctures, interspaces on the inner disk faintly, those on the outer disk strongly convex.

Ditropidus Jacobyi.

D. breviter ovatus, valde convexus, subtus niger, nitidus, pedibus fulvis, posticis piceo tinctis; supra rufo-flavus, capitis vertice, antennis extrorsum thoracisque disco piceis; thorace profunde, minus crebre punctato, punctis oblongis; elytris nigro-piceis, distincte punctato-striatis, striis sulcatis; interspatiis leviter convexiusculis, ad apicem et ad latera convexis.

Long. $\frac{3}{4}$ lin.

Hab. Gawler Town, South Australia.

Head impunctate, sparingly clothed with adpressed hairs; eyes large, reniform, moderately notched, separated above by a narrow space; antennæ equal in length to the head and thorax, slender, five outer joints dilated, pale piceous. Thorax rather more than twice as broad as long; sides quickly rounded and converging from base to apex, anterior angles armed with a minute tooth, hinder angles produced posteriorly, acute; basal margin slightly oblique and faintly bisinuate on either side, the basal lobe rather strongly produced, angulate; upper surface transversely convex, depressed transversely at the base on either side the median lobe; disk impressed, but not very closely, with large deep oblong punctures; extreme apical and basal margins nearly impunctate; the whole of the disk, together with the basal lobe, stained with piceous. Scutellum oblong, its apex obtuse.

Ditropidus lævigatus.

D. breviter ovatus, valde convexus, niger, nitidus, labro, antennis (apice excepto), pedibus, pygidio abdominisque apice flavis; thorace lævi, impunctato; elytris nigro-piceis, apicem versus obscure flavis, tenuiter punctato-striatis, punctis linearibus; interspatiis planis, impunctatis.

Long. $\frac{3}{4}$ lin.

Hab. Northern Australia.

Head minutely granulose-punctate, sparingly clothed with very fine adpressed white hairs; face plane; anterior edge of clypeus subangulate-emarginate; eyes distant; six outer joints of antennæ moderately thickened, black. Thorax more than twice as broad as long; sides obliquely converging and slightly rounded from base to apex; basal margin distinctly bisinuate on either side, median lobe moderately produced; upper surface smooth and impunctate. Scutellum ovate, acuminate. Elytra very finely punctate-striate; interspaces plane, impunctate; striæ near the outer margin very faintly sulcate.

Ditropidus Pascoei.

D. ovatus, valde convexus, niger, nitidus, capite thoraceque rufo-testaceis, antennis (basi excepta) nigro-piceis, pedibus piceis, anticis quatuor pallidioribus; thorace minute aciculato-punctato; elytris nigro-cyaneis, sat fortiter punctato-striatis; interspatiis planis, duobus externis ad apicem leviter convexiusculis.

Long. $\frac{5}{6}$ lin.

Hab. Melbourne, Australia.

Head glabrous, subremotely punctured; vertex impressed with a longitudinal groove; eyes distant; antennæ less than half the length of the body, five outer joints slightly thickened, nigro-piceous. Thorax rather more than twice as broad as long; sides rounded and converging from base to apex; basal margin bisinuate on either side, the median lobe only moderately produced, obtusely angulate; upper surface subremotely aciculate-punctate, the punctures rather coarser and more crowded on the sides. Scutellum narrowly ovate, its apex acute. Elytra rather strongly punctate-striate; interspaces plane, here and there faintly wrinkled; two outer interspaces obsoletely convex.

Ditropidus elegantulus.

D. breviter ovatus, valde convexus, rufo-fulvus, nitidus, thoracis margine basali antennisque (harum basi excepta) nigris, tarsis piceis; capitis vertice, scutello elytrisque obscure cupreis; his punctato-striatis, punctis linearibus; interspatiis planis, duobus externis subcostatis.

Mas mandibulis sat magnis, abrupte curvatis.

Long. $1\frac{1}{4}$ lin.

Hab. Australia.

Head clothed with adpressed white hairs, closely punctured, lower face and clypeus rugose-punctate; front longitudinally concave, obliquely strigose on either side; eyes remote; jaws nigro-piceous; clypeus transverse, its anterior border concave-emarginate, its upper margin subangulate; antennæ nearly half the length of the body, five upper joints dilated, black, second to the sixth stained with piceous. Thorax twice as broad as long; sides rounded and converging from base to apex; basal margin faintly bisinuate on either side, median lobe only moderately produced, obtusely angulate; disk very finely and remotely punctured, the punctures only visible under a deep lens. Scutellum broadly ovate, its apex acute. Elytra distinctly punctate-striate; interspaces plane, two outer ones subcostate. Body beneath stained with piceous.

Ditropidus pictus.

D. breviter subquadrato-ovatus, valde convexus, subtus niger, nitidus, pedibus obscure cyaneo-metallicis, tibiis basi prothoraceque rufo-piceis; supra subnitidus, obscure cyaneus, viridi micans, facie inferiore thoracisque limbo rufo-piceis; antennis rufo-piceis, extrorsum nigris; thorace dense et fortiter aciculato-punctato; elytris distincte punctato-striatis, striis basi impressis, striis quarta et septima apice coeuntibus, punctis piceis; interspatiis leviter transversim rugulosis; obscure fulvis, fascia basali, extrorsum abbreviata, postice irregulariter incisa, suturaque angusta obscure viridi-cyaneis.

Long. $1\frac{1}{2}$ lin.

Hab. Western Australia.

Head sparingly clothed with adpressed white hairs; closely punctured, longitudinally impressed on the vertex and front; clypeus not distinctly separated from the face, its anterior margin concave-emarginate; eyes widely separated; antennæ with the five outer joints dilated, black. Thorax rather more than twice as broad as long; sides quickly converging and slightly rounded from base to apex; basal margin very slightly bisinuate on either side, median lobe produced, nearly rectangular; upper surface closely covered with coarse aciculate punctures, interspaces on the sides thickened, reticulate-strigose.

Ditropidus antennarius, Suffr. MS.

D. breviter ovatus, valde convexus, rufo-fulvus, nitidus, antennis (basi excepta) nigris; thorace tenuiter, sat remote punctato, margine basali nigro; elytris distincte punctato-striatis, striis tertia et decima, quarta et septima, octavaque et nona apicibus per paria coeuntibus; interspatiis planis, remote, tenuissime punctatis, duobus externis leviter convexis; marginibus basali et suturali anguste piceis.

Long. $1\frac{3}{4}$–2 lin.

Hab. Moreton Bay, Australia.

Head sparingly clothed with short, adpressed, white hairs; vertex and front impressed with a longitudinal groove; the former rather closely punctured; the latter semiovate, concave; lower part of face and clypeus rugose; eyes moderately distant; antennæ rather more than half the length of the body; five outer joints moderately thickened, each nearly twice as long as broad, six upper ones black. Thorax twice as broad as long; sides only slightly converging from the base to the middle, thence rounded and converging to the apex; basal margin bisinuate on either side, median lobe moderately produced, obtusely angulate; upper surface finely and subremotely punctured. Scutellum obovate, its apex acute. Elytra distinctly punctate-striate; interspaces plane, minutely punctured; here and there (when seen under a strong lens) transversely rugulose; two outer interspaces very slightly convex. Body beneath and legs more or less stained with piceous.

Ditropidus amabilis.

D. breviter ovatus, valde convexus, piceus, nitidus, antennis basi fulvis; pedibus (femoribus posticis exceptis) abdomineque obscure fulvis, hoc piceo tincto; thorace æneo micante, minus remote, ad latera crebrius punctato, punctis oblongis; elytris flavis, sat fortiter punctato-striatis, punctis piceis; striis quarta et septima, quinta et sexta, octava et nona apicibus per paria coeuntibus; interspatiis planis, ad apicem et ad latera vix convexiusculis.

Long. $\frac{4}{5}$ lin.

Hab. Cape York, Australia.

Head clothed with adpressed whitish hairs; eyes moderately distant; clypeus broader than long, its upper margin angulate. Thorax nearly twice as broad as long; sides obliquely converging and slightly rounded from base to apex; basal margin slightly bisinuate on either side, median lobe produced, obtusely angulate; upper surface distinctly punctured, the puncturing rather coarser and more crowded on the sides. Scutellum ovate, its apex acute. Elytra with its basal margin, together with that of the thorax, narrowly edged with nigro-piceous.

Ditropidus submetallescens.

D. breviter ovatus, valde convexus, piceus, nitidus, supra æneo micans, antennis basi pedibusque (tarsis exceptis) obscure piceo-fulvis; thorace subremote, tenuiter punctato; elytris sordide fulvis, piceo tinctis, æneo vix micantibus, distincte punctato-striatis, punctis piceis; striis quarta et septima, octavaque et nona apicibus per paria coeuntibus, interspatiis planis.

Long. $\frac{2}{3}$ lin.

Hab. Gawler Town, South Australia.

Vertex smooth, nearly glabrous; face between the eyes faintly rugulose, sparingly clothed with adpressed yellowish hairs; clypeus very short, transverse, raised and forming an abruptly elevated ridge; eyes distant; antennæ equal in length to the thorax, the four or five lower joints obscure fulvous, the rest piceous. Thorax more than twice as broad as long; sides slightly converging from the base to beyond the middle, thence obliquely rounded to the apex; basal margin distinctly bisinuate on either side, median lobe produced, nearly rectangular; upper surface distinctly but subremotely punctured, the punctures oblong, rather coarser on the disk than on the sides; interspaces shining, impunctate, faintly strigose (when viewed under a strong lens) on the sides and at the base; extreme basal border edged with nigro-piceous. Scutellum ovate, acuminate at base and apex. Elytra obscure flavous with a faint brassy tinge, stained on the disk with piceous, the extreme sutural and basal margins narrowly edged with nigro-piceous; distinctly punctate-striate; interspaces (when seen under a deep lens faintly wrinkled) plane, hinder half of the two outer ones very slightly convex.

Separated from *D. amabilis* by its nearly glabrous vertex, its shorter, elevated clypeus, and also by its broader and more remotely punctured thorax.

Ditropidus cornutus.

D. oblongo-ovatus, convexus, fulvus, nitidus, antennis extrorsum nigris; thorace subremote punctato, punctis elongatis, hic illic longitudinaliter confluentibus; elytris flavis, fusco maculatis, distincte punctato-striatis, striis quarta et septima, quinta et sexta, octavaque et nona apicibus per paria coeuntibus; interspatiis planis.

Mas mandibulis validis, basi cornu compresso valido incurvato, apice acuto armatis.

Long. 1 lin.

Hab. Australia.

Head rather deeply but not closely punctured; eyes distant; clypeus transverse, not distinctly separated from the face, its antero-lateral angles in the male each produced outwardly into a stout, compressed, truncate process, which forms the lower boundary of a deep channel on the cheek, in which lies the basal joint of the antenna; mandibles in the same sex large, curved, and armed on the upper surface at the base with a large, flattened, acute horn, which curves obliquely upwards and inwards on the face of the clypeus; mandibles in the female normal; antennæ rather longer than the thorax, five outer joints black. Thorax twice as broad as long; sides obliquely converging and slightly rounded from the base towards the apex, more quickly rounded near the latter; basal margin distinctly bisinuate on either side, median lobe produced, nearly rectangular; upper surface impressed with oblong or elongate punctures, interspaces here and there longitudinally strigose; disk often stained with rufous, extreme basal margin edged with black. Scutellum ovate, rounded at the base, its apex acuminate. Elytra rather deeply punctate-striate, interspaces plane, very faintly convex near the apex; disk of each elytron more or less stained with fuscous; extreme basal and sutural margins narrowly edged with piceous.

Ditropidus subcylindricus.

D. subelongatus, subcylindricus, fulvus, nitidus; subtus niger, fulvo variegatus, pedibus fulvis; thorace margine basali, lateribus angustis et disco antico, scutello elytrorumque basi, linea laterali, sutura plagaque communi deltoidea, ad basin adfixa, nigris; thorace tenuissime punctato; elytris tenuiter punctato-striatis, punctis elongatis; interspatiis planis, ad latera leviter convexiusculis.

Var. A. Thorace (margine basali excepto) toto fulvo, elytrorum margine basali anguste nigro, sutura piceo marginata.

Long. $1\frac{1}{2}$–$1\frac{3}{4}$ lin.

Hab. Western Australia.

Head clothed with adpressed white hairs; vertex and front minutely punctured, impressed with a fine longitudinal groove, the latter sometimes with a deep fovea; clypeus transverse, rugulose, its upper margin very obtusely angled; eyes widely separated; five outer joints of antennæ thickened, longer than broad, their apices stained with piceous. Thorax scarcely twice as broad as long; sides obliquely converging from the base to the middle, thence rounded and converging to the apex; basal margin distinctly bisinuate on either side, median lobe moderately produced, obtusely angulate; above subglobose, very faintly punctured; hinder margin narrowly edged with piceous. Scutellum ovate, its apex acute. Elytra parallel, finely punctate-striate; interspaces plane, faintly and transversely rugulose, those near the outer margin slightly convex.

Polyachus bicolor.

P. oblongo-ovatus, convexus, niger, nitidus, capite, thorace pedibusque rufo-testaceis, antennis fulvis, extrorsum nigris; thorace remote punctato; elytris sat fortiter punctato-striatis, interspatiis planis, duobus externis convexiusculis.
Long. $\frac{3}{4}$ lin.

Hab. Gawler Town, South Australia.

Vertex smooth, impunctate; clypeus semiovate, impressed with a few remote punctures; eyes large, subangulate-emarginate, moderately distant, black; antennæ with the six upper joints slightly thickened, the four outer ones black. Thorax about twice as broad as long; sides rounded and converging from base to apex; basal margin slightly bisinuate on either side; median lobe produced, angulate, its apex rounded, entire; upper surface transversely convex; subcylindrical at the apex; apical and basal margins each bordered with a single row of punctures, disk remotely punctured; extreme basal margin narrowly edged with piceous. Scutellum narrowly oblong, its apex obtuse. Elytra strongly punctate-striate; interspaces smooth, impunctate, two outer ones slightly convex.

Very similar in form and coloration to *Bucharis martius*; in addition, however, to the structural difference in the antennæ, it may be at once known by the different form of the basal lobe of the thorax: in *B. martius* it is thickened, its apex being acuminate; in the present insect the lobe is flattened, forming a thin plate, and its apex is rounded.

[To be continued.]

XLIX.—*Note on Lichens.* By G. H. K. Thwaites, F.R.S.

My thoughts have been much occupied of late upon the subject of lichens and their development, and especially with reference to the views of Schwendener and Bornet, and of some other botanists who coincide with them in advocating the theory of *parasitism* as explanatory of the structural composition of lichens.

I have not the least desire, nor have I any intention to impugn the correctness of the descriptions and of the beautiful delineations of Mons. Bornet ('Annales des Sciences Naturelles,' 4e série, tome xvii.); but I must candidly confess that, after prolonged consideration, I cannot bring myself to yield assent to the *interpretation* of the phenomena which he and some other distinguished lichenologists give to them.

It is well known that the ordinary lichen, as generally recognized, discharges, when mature, its fruit (sporidia) from portions of its upper surface, and that at the same time gonidial gemmæ escape spontaneously from other parts of its structure. These two productions (sporidia and gonidia) naturally become scattered about in abundance and in close proximity with one another; thence it follows that they must come into mutual contact not unfrequently, and more certainly so when each of the kinds begins to extend itself by growth. Both sporidia and gonidia are capable of developing for a certain time, each independently and unconnected with the other; and as they retain each its own character of tissue, so different in appearance from that of the other, a casual observer, seeing them not in connexion, may easily arrive at the belief that they are essentially distinct and by no means specifically identical. To him there is therefore a *primâ facie* appearance of parasitic action when he sees the somewhat fungus-like little detached germinating sporidia, when coming into contact with portions of the alga-like gonidia, adhering organically to them, continuing to grow in such connexion, and for a certain time in a seemingly irregular manner. It will be noticed, however, by the candid investigator, that the subsequent more mature development of the combined structures exhibits a very different character. It will be seen, too, that it is essentially different from what is observed in instances of real parasitism, as generally understood; for in these latter the parasite is observed to be nourished at the expense of the organism upon which it is growing, to be injurious to its health, and to impair its beauty and symmetry. But how different, in contradistinction to this, is the result brought about by the so-called *lichen-parasitism*! In this latter we observe that the intimate coalescence of the two above-described organically adhering kinds of tissue (sporidial and gonidial) eventuates in a most beautiful symmetrical structure—the perfect lichen, with its every part manifesting the possession of full health and vigour.

In the presence of these last-mentioned circumstances it really seems to me that those who believe that the two kinds of tissue above referred to belong respectively to two totally distinct species of plants should, consistently with such belief, acknowledge that the phenomenon ought to be looked upon as an example of *commensalism* rather than one of parasitism. And, granting for a moment this to be the correct view, it might surely be reasonably expected that, instead of finding, as we do, *one* perfect symmetrical combined growth, we ought to have exhibited to us *two* independent symmetries, as occurs in true cases of commensalism.

But I will suppose, as I believe to be the case, and as was believed unreservedly in early times by botanists generally, that the lichen is a single autonomous organism, and not a compound of two distinct species of plants. I would look upon the more or less developed sporidial tissue as the reproductive portion, and the gonidia as the vegetative portion of this lichen-structure; and I feel scarcely a difficulty in believing that the mutual organic union of the two is necessary to constitute the complete autonomous lichen capable of producing sporidia. It is true that this procedure of development of a simple species of plant is apparently exceptional and somewhat anomalous; but the acceptance of this view gets rid of the paradoxes necessarily attaching, in the case in question, to that theory of parasitism which has been strongly contended for by some celebrated botanists.

We must not fail to bear in mind that in other families of the lower plants there have been encountered unexpected phenomena connected with their reproduction; and it is only necessary to mention the *Filices* as furnishing a notable instance of such an unlooked-for and startling discovery.

The fact that there are some lichens parasitic upon other lichens is only analogous to what occurs amongst many other families of plants.

Ceylon, Sept. 10, 1877.

L.—*Contributions to Micro-Palæontology.*—II. *On* Prasopora Grayæ, *a new Genus and Species of Silurian Corals.* By H. Alleyne Nicholson, M.D., D.Sc., F.R.S.E., and Robert Etheridge, Jun., F.G.S.

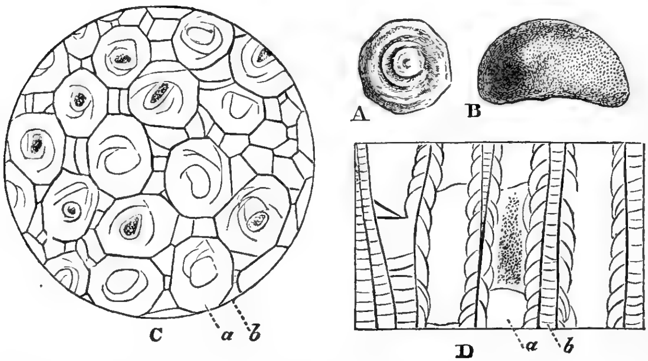
Genus Prasopora, Nich. & Eth., jun.

Gen. char. Corallum compound, forming small hemispheric or concavo-convex masses, composed of numerous prismatic corallites radiating from a wrinkled basal epitheca, and connected by smaller cœnenchymal tubules. Corallites with imperforate walls, destitute of septa, furnished with an exterior zone of vesicular tabulæ surrounding a vacant central tube, which may be crossed here and there by an occasional tabula. Calices showing a central aperture surrounded by a ring-like tabula. Cœnenchymal tubes much smaller than the corallites, prismatic, usually arranged in a single zone round each corallite, and crossed by numerous complete tabulæ. Corallites and cœnenchymal tubes in contact with one another, but not soldered together by their walls.

Obs. The corallum in this genus is composite, and has the general form and aspect of the massive species of *Chætetes* (*Monticulipora*). Its general shape (fig. B) is concavo-convex or hemispherical, the concave or flat base being covered by a concentrically wrinkled and striated epithecal plate (fig. A). From the centre of this the corallites radiate in all directions, those in the middle of the corallum taking a nearly vertical course, while those near the margins are horizontal, or even deflexed, so as to run nearly parallel with the epitheca, corallites holding an intermediate position between these two points being bent at correspondingly intermediate angles. The corallum is made up of comparatively large-sized corallites interspersed with smaller "cœnenchymal" tubules; and the structure of these two elements is very different internally.

The corallites, as shown by microscopic sections, have a unique internal structure. In *longitudinal* sections (*i.e.* in sections parallel with their long axes) they are seen to be divided into a central tube and an exterior tabulate area (fig. D). The central tube is either completely uninterrupted, or is occasionally traversed by a delicate transverse tabula (perhaps at intervals of a line or less), marking a temporary arrest in the process of growth. In some cases the central tube is filled with crystalline calcite; but it is often more or less completely occupied by an infilling of the surrounding matrix; and there are commonly little accumulations of the same material above each of the transverse tabulæ just alluded to. The central tube is surrounded by a zone of tabulæ, which spring from the wall of the corallite, and are then bent downwards so as to become parallel to the long axis of the corallite, finally joining the tabula next below. There is thus formed a series of large circumferential vesicles, the convexities of which are directed upwards and towards the centre of the corallite. When divided fairly through the centre, the internal structure is seen to be as above; but when the section is excentric it passes through the exterior tabulate zone, and the cut edges of the vesicular tabulæ appear as cross lines, looking like ordinary tabulæ. As most of the corallites are curved, an ordinary longitudinal section divides them partly through the centre and partly excentrically, so that part of the tube shows the one set of appearances and part the other.

In order to examine the corallites in *transverse* section it is necessary to cut a slice tangential to the upper surface (slices cut tangential to the lower surface, owing to the deflection and approximate horizontality of the marginal corallites, exhibit oblique longitudinal sections of the tubes). In a properly prepared transverse section (fig. C), the corallites are



A, under surface of a small specimen of *Prasopora Grayæ*, natural size, showing the epitheca. B, side view of another, larger specimen, of the natural size. C, transverse section of the same, enlarged about twenty diameters. D, longitudinal section, similarly enlarged: *a*, one of the corallites; *b*, one of the cœnenchymal tubes. The dark shading in the microscopic sections indicates where the matrix is present.

seen to be of a rounded or more generally hexagonal figure, with thick and well-defined walls. In the centre of each is a rounded or oval opening, representing the section of the central tube of the corallite, filled either with calc spar or with the dark matrix of the enclosing rock. This opening is surrounded by one or more curved lines, which are often tangents to the margin of the central aperture, or are concentric to it, or intersect one another. These lines are the cut edges of the tabulæ which form the exterior zone of each corallite; and they forcibly remind one of the somewhat similar appearance presented by transverse sections of the corallites of *Syringopora*, with their infundibuliform tabulæ. The corallites, in fact, in transverse section present a general resemblance to the bulb of an onion when cut across; and our generic name (Gr. *prason*, a leek) is in allusion to this. The central tube of the corallites is about one third or often more of the total diameter; and the walls of the corallites are destitute of mural pores, and are not fused with one another or with the tubes of the cœnenchyma.

The cœnenchymal tubules are very variable in shape and size; but they are always much smaller than the true corallites, and are mostly oblong, triangular, or trapezoidal in shape (fig. C). They are wedged in amongst the corallites, round which they are usually disposed in a single row; but the zone thus formed is rarely or never complete, each corallite coming into contact at different points with one, two, three, or even four contiguous ones. In some cases, also, there may be a double row of cœnenchymal tubes between the corallites. In internal structure the tubes of the cœnenchyma possess none of the special characters which distinguish the true corallites, longitudinal sections showing them to be simply traversed by numerous close-set, complete tabulæ (*b*, fig. D), generally slightly curved, with their convexities directed downwards. Transverse sections also show them to want the central tube of the true corallites and to be irregular in form. Though we have retained the name of "cœnenchymal tubes" for these, we think it most probable that they are really of the nature of rudimentary corallites, which contained in the living state a series of small and specially modified zooids.

There are no traces of septa or of radial internal processes of any kind, either in the ordinary corallites or in the cœnenchymal tubes of *Prasopora*.

Affinities. The only forms with which it is necessary to compare *Prasopora* are (1) *Chætetes* and *Monticulipora*, (2) *Fistulipora* and *Callopora*, and (3) *Heliolites* and its allies.

The general appearance of the corallum in *Prasopora*, as before remarked, is very closely similar to that of massive examples of *Chætetes*, Fischer, and *Monticulipora*, D'Orb. From the forms included under these names, however, our genus is widely removed by the possession of a well-developed series of cœnenchymal tubules (very different in character from the minute tubuli found in many species of the two former groups), and by the internal structure of the corallites. No species of *Chætetes* or *Monticulipora*, so far as we know, exhibits any thing to be compared with the external zone of vesicular tabulæ and the central tube of the corallites of *Prasopora*.

To *Fistulipora*, M'Coy, and the closely allied or identical *Callopora*, Hall, the present genus is related by the fact that the corallites are surrounded by a greater or smaller number of cœnenchymal tubules. The two former, however, have the tubes of the corallites simply intersected by numerous complete tabulæ (said to be absent in some species of *Callopora*); and neither of them presents any approach to the peculiar structure of the corallites of *Prasopora*, though it is in their neighbourhood that we may at present place the last-named genus.

Lastly, *Prasopora* resembles *Heliolites* and its allies in the fact that the corallites are surrounded by numerous transversely tabulate cœnenchymal tubules; but the total absence of septa and the peculiar structure of the corallites fundamentally separate the former from any member of the Helioporidæ.

Prasopora Grayæ, Nich. & Eth., jun.

Spec. char. Corallum forming small hemispheric or concavo-convex masses, from half an inch to three quarters of an inch in diameter, and from a quarter to half an inch in height. Corallites more or less prismatic, from five to six in the space of one line (counting-in the intervening cœnenchymal tubules as well), thus averaging about $\frac{1}{70}$ to $\frac{1}{80}$ of an inch in diameter. Cœnenchymal tubules exceedingly variable in size and form, but rarely equal to half the diameter of the corallites. Epitheca and internal structure as described in the generic characters.

Obs. For an introduction to this unique and very interesting coral we are indebted to Mrs. Robert Gray, Edinburgh. We would take this opportunity of calling attention to the grand series of fossils comprising Mrs. Gray's collection, which she has made from the Silurian rocks of the Girvan district, and to which access has always been given us in the most obliging manner. To the kindness of Dr. Traquair we owe the opportunity of examining a fine specimen of *Fistulipora* (M'Coy) from the Carboniferous Limestone series of Mid Lothian. This specimen exhibits in a particularly clear manner the characters of that genus, its relation to *Prasopora*, and the manner in which the two differ, viz. the round or oval corallites, separation from one another by an intervening zone of cœnenchymal tubuli of considerable extent, and entire absence of the peculiar calicular tabulæ which form the exterior zone of each corallite in *Prasopora*.

Loc. and Horizon. So far as our present knowledge goes, *P. Grayæ* (nobis) is the only known species of our genus *Prasopora*. It has been obtained by Mrs. R. Gray in moderate quantity at Craighead Quarry, near Girvan, Ayrshire, associated with an otherwise abundant fauna, amongst which may be mentioned a small *Favosites* (apparently the young of *F. aspera*, D'Orb.). The two are so similar in form as to be easily confounded on a superficial examination. The Craighead beds are considered by the Geological Survey of Scotland to be of Caradoc age (1-inch map, Scotland, no. 14).

LI.—*Descriptions of new Species of Heterocera from Japan.* —Part I. *Sphinges and Bombyces.* By ARTHUR G. BUTLER, F.L.S., F.Z.S., &c.

THE cabinets of the British Museum having been recently enriched by the purchase of the private collection of moths made at Yokohama by Mr. Jonas, it has been thought desirable to devote the second part of the 'Illustrations of Typical Specimens of Lepidoptera Heterocera' to the description and representation of the moths of Japan; and since some little time must necessarily elapse before that part will be published, I propose to give brief preliminary diagnoses of new species in the present paper.

Sphingidæ.

1. *Triptogon piceipennis*, n. sp.

Allied to *T. sperchius*, but the primaries much greyer, the lines all distinct, those of the central area much less divergent on the costa, the secondaries of the male deep piceous or purplish brown, of the female paler, becoming gradually redder from the inner margin to the apex; body darker, with well-marked dark longitudinal thoracic crest. Expanse, ♂ 4 inches 6 lines, ♀ 4 inches 11 lines.

Yokohama (*Jonas*).

2. *Hyloicus caligineus*, n. sp.

Allied to *H. pinastri*, but differing in its dark smoky grey colouring, the white markings on the body and the lateral black spots on the abdomen wanting, the transverse bands on the primaries and the secondaries smoky brown, the two longitudinal black dashes on the primaries shorter and more linear. Expanse, ♂ 2 inches 8 lines, ♀ 3 inches 2 lines.

Yokohama (*Jonas*).

Zygænidæ.

3. *Zygæna niphona*, n. sp.

Allied to *Z. dorycnii*, but the carmine spots of primaries greatly enlarged, all excepting the basi-subcostal one confluent; the spot in the cell pyriform, united to the discocellular spot by its projecting elongation; abdomen purplish instead of dark green above, the three subterminal segments carmine. Expanse, ♂ 1 inch 3–5 lines.

Yokohama (*Jonas*).

4. *Procris esmeralda*, n. sp.

Primaries shining emerald-green, more golden at basal and costal areas, fringe smoky grey; secondaries smoky grey, semitransparent, fringe opaque; antennæ and thorax emerald-green; abdomen blackish, dull green at the sides: body below dull green; primaries below smoky grey, the apex and costa dark shining green; secondaries as above. Expanse 11 lines.

Yokohama (*Jonas*).

Apparently allied to "*Ino chinensis*" of Felder, but coloured more like *Procris cognata* ♀ of Herrich-Schäffer (? Rambur).

5. *Northia tenuis*, n. sp.

Wings greyish hyaline, the veins black, outer margins slenderly black; primaries with the costal area and a broad internal border black; secondaries with the apex and a longitudinal streak from the base through the cell black, costal area grey; antennæ steel-blue, with black pectinations; body black, thorax spotted with steel-blue scales; abdomen with the margins of the segments and anal extremity metallic green, below wholly green; wings below with a blue spot at the base; proboscis yellow. Expanse 1 inch 2 lines.

Yokohama, Hakodaté, and Hong-Kong.

Aspect of *Illiberis trista* of Bremer.

Arctiidæ.

6. *Spilarctia imparilis*, n. sp.

♂. Above smoky brown; primaries with a spot at the base, an elbowed series across the middle, an oblique series terminating opposite the end of the cell in a quadrate patch of six spots, and an abbreviated zigzag submarginal series of dots black; secondaries with a submarginal series of large blackish spots; head whitish; back of collar, margins of eyes and abdomen golden orange, the latter with dorsal and lateral black spots; tegulæ with a black spot; body below whity brown. Expanse 1 inch 10 lines.

♀. White; primaries creamy, the black spots very small, many of them wanting; secondaries pure white, spotless; body white, the margins of the collar and eyes and the dorsal surface of the abdomen golden orange, the latter with a central row of black spots; anus creamy white; tegulæ with a black spot. Expanse 2 inches 3 lines.

Yokohama.

The male is near to *S. brunnea*; but the female resembles

S. subfascia more nearly. Mr. Jonas assures me they are sexes.

7. *Spilarctia mollicula*, n. sp.

♀. Pinky cream-colour; primaries with a dot at the centre of costa, a spot at the superior angle of the cell, and another in the discoidal interspace blackish; secondaries with a spot on upper discocellular, a second near the apex, and three (submarginal) near the anal angle blackish; margins of collar and eyes and anterior coxæ rose-red; abdomen rose-red, testaceous at the anal extremity; three or four dorsal black dots; wings and body below creamy whitish, the smaller spots indistinct. Expanse 1 inch 11 lines.

Hakodaté (*Whitely*).

8. *Euprepia phæosoma*, n. sp.

♀. General pattern and coloration of *E. caja*, but the white banding of primaries more simple, the secondaries paler at the base, with spots fewer and not yellow-bordered, the anterior half of the collar red, with a white spot at the lateral angles; the outer margin of the tegulæ white; the abdomen brown, with rose-red hind margins to the segments. Expanse 2 inches 8 lines.

Yokohama (*Jonas*).

Readily distinguished by the colour of the body.

THANATARCTIA, n. gen.

Allied to *Phragmatobia*, but the primaries trigonate, the lower radial and third median branches springing from one point and close to the second median branch, the anterior margin of the cell of secondaries less receding, the antennæ of male widely pectinated.

Type *T. infernalis*.

9. *Thanatarctia infernalis*, n. sp.

Wings and thorax black-brown; margins of collar, eyes, palpi, and the pectus rose-red; abdomen rose-red, with a macular dorsal black line. Expanse 1 inch 5 lines.

Hakodaté (*Stevens*).

RHYPARIOIDES, n. gen.

Agrees in neuration with *Rhyparia* and *Diacrisia*, but differs from the former in its much more slender body, and from both in the serrated rather than pectinated antennæ of the male.

Type *R. nebulosa.*

10. *Rhyparioides nebulosa*, n. sp.

Primaries sordid buff, testaceous, or gravel-colour, the internal area of the male clouded with grey to the median vein; a central elbowed grey line or band, terminating in two black spots on the costal area; end of the cell grey, with a black dot at the superior angle; three costal subapical black dashes, followed by a more or less defined zigzag greyish discal band or streak limiting the outer border; fringe spotted with black; secondaries bright rose-red, spotted with black, as in *Rhyparia purpurea*; thorax coloured like the primaries; abdomen rose-red, with dorsal and lateral series of black spots; under surface nearly as in *Rhyparia purpurea.* Expanse 2 inches 1 line.

Yokohama (*Jonas*), Hakodaté (*Whitely*).

Apparently allied to the species named "var. *amurensis*" by Bremer.

Lithosiidæ.

11. *Miltochrista pulchra*, n. sp.

Primaries ochraceous, covered with scarlet spots and streaks, as in *M. striata*, and crossed at nearly equal distances by four series of black dots, the first and third series distinct and arched, the fourth series composed of small linear dashes; two black dots at the base; secondaries pink, deepest in colour externally, fringe whitish; thorax rosy, dotted with black; abdomen pink; primaries below bright rose-colour without spots. Expanse 1 inch 3 lines.

Yokohama (*Jonas*).

12. *Miltochrista calamina*, n. sp.

Primaries stramineous, deepest at the costal and outer borders, a dot at base, a second at the end of the cell, and an irregular discal series black; the base of costa, an irregular transverse line near the base, and a deeply dentated line beyond the middle brown; secondaries paler than the primaries: body whitish, the head and collar stramineous; a black humeral dot; primaries below with the base of costal area blackish, a dash in the cell and a blurred band beyond it grey; five black dots in a subapical series; body below stramineous. Expanse 11 lines.

Yokohama (*Jonas*).

Allied to *M. excurrens*.

13. *Miltochrista aberrans*, n. sp.

Very like *M. miniata*, but with three black dots at the base and two slender lines crossing one another over the basal area, the irregular discal line more acutely dentated, and the series of black spots beyond it more elongated. Expanse 1 inch.

Yokohama (*Jonas*).

This species differs from *M. decussata* of Moore in the rosy borders to the wings.

14. *Miltochrista rosaria*, n. sp.

Close to *M. miniata*, but differing in that the subbasal ⋦-shaped line of primaries is replaced by a ε-shaped line, and is followed by a transverse sharply defined irregular black line from the costa to the inner margin; secondaries much paler, almost white. Expanse 1 inch.

Yokohama (*Jonas*).

MELANÆMA, n. gen.

Allied to *Miltochrista*, but differing in its broadly pectinated antennæ, and the shorter fork of the subcostal vein of secondaries.

15. *Melanæma venata*, n. sp.

Wings above creamy whitish; primaries with the base of the costa and a spot near the base black; veins deep slate-colour; costal and outer borders broadly rosy; secondaries with the veins grey, outer border slightly rosy; thorax and anal extremity of the abdomen rosy, the remainder of the abdomen cream-colour: wings below nearly as above, but more uniform in colouring; body below ochraceous; legs banded with black; venter dotted with brown. Expanse 1 inch 4 lines.

Yokohama (*Jonas*).

16. *Lithosia ægrota*, n. sp.

Closely allied to *L. griseola*, but differing in the broader stramineous costal border of primaries, the clear stramineous secondaries; and the primaries below deep grey, with the apical two thirds of the costal margin, a broad sharply defined external border, the whole of the secondaries, and body rich creamy yellowish. Expanse 1 inch 5 lines.

Hakodaté (*Whitely*).

Excepting in the more uniform colouring of the abdomen and secondaries, more like *L. complana.*

17. *Lithosia adaucta*, n. sp.

Also allied to *L. griseola*, but considerably larger (the size of *L. fumeola*), darker with clear creamy stramineous secondaries and paler abdomen; otherwise similar. Expanse 1 inch 9 lines.

Hakodaté (*Whitely*).

The largest example of *L. griseola* that we possess measures 1 inch 6 lines in expanse; but the coloration of the secondaries would at once distinguish the two species.

18. *Lithosia pavescens*, n. sp.

Nearly allied to *L. helveola*, but the wings pale buff, the secondaries slightly paler at abdominal margin; the fringe whitish instead of yellow. Expanse 1 inch 2 lines.

Hakodaté (*Whitely*).

L. helveola has a dusky border and bright yellow fringe to all the wings.

19. *Lithosia lævis*, n. sp.

Allied to *L. helveola*, but considerably larger; the wings opaque, pinky whitish, with a well-marked sericeous ochraceous outer border; primaries below brownish, with the costal and outer margins ochraceous; secondaries stramineous, becoming ochraceous towards the base of the costal and the apex of the outer margins; body above pale buff, with the head, shoulders, and prothorax ochreous; below ochreous; legs slaty grey above, the tibiæ and tarsi greyish brown below. Expanse 1 inch 6 lines.

Yokohama (*Jonas*).

Also allied to *L. insolita.*

20. *Œonistis dives*, n. sp.

Nearly allied to *Œ. quadra*, but the primaries of a much deeper colour, the male with the external sericeous border of a deep leaden-grey colour and of less than half the width; the female with the primaries longer, bright orange; the secondaries in both sexes paler. Expanse ♂ 1 inch 9 lines, ♀ 1 inch 10 lines.

Yokohama (*Jonas*).

The wings of this species are somewhat narrower than those of *Œ. quadra.*

21. *Æmene fasciata*, n. sp.

Primaries white, crossed in the centre by an irregular grey band bounded on each side by a series of black spots; the base of the costa, two large basicostal spots, and four dots on the basal area black; four spots forming an imperfect discal series (the largest on the costa), an apical spot on the fringe, a second spot near the centre of the fringe, and two marginal dots between them black; secondaries grey, the fringe white with a central brownish spot; body white, the shoulders and tegulæ black-spotted: underside grey, with white fringe, a dusky spot at the end of each discoidal cell; primaries with two and secondaries with one spot on the fringe; body whity brown, legs grey. Expanse 11 lines.

Yokohama (*Jonas*), Hakodaté (*Whitely*).

The example from Hakodaté is paler than the type.

22. *Eugoa grisea*, n. sp.

Primaries silvery grey; two dots at the base, two spots (one on the costa) near the base, two dots placed obliquely at the end of the cell, a diffused dash from the costa to the end of the cell, and a diffused >-shaped marking in a line with it on the internal area, two dots placed obliquely at external angle, and two or three irregularly near the apex black; margin slenderly blackish; fringe sordid white; secondaries pale brown; thorax grey, tegulæ black-spotted; abdomen whity brown; primaries below smoky brown, immaculate, secondaries pale brown; body whitish, the legs greyish in front. Expanse 1 inch 2 lines.

Yokohama (*Jonas*).

Allied to *E. bipunctata* and *E. distributa.*

PTERODECTA, n. gen.

Allied to *Cleosiris*, but the primaries with deeply and widely sinuated apex, forming an acute angle at the extremity of the upper radial; palpi coarser and more densely scaled.

Type *P. anchora.*

23. *Pterodecta gloriosa*, n. sp.

♂. Allied to *P. Felderi* and *P. anchora*, but altogether larger and more brilliant in colour: wings above dark olive-brown, with red fringes intersected by a blackish line; primaries with the costal margin reddish flecked with pink; a broad discal bisinuated arched band, as in *P. Felderi*, brilliant scarlet changing to cadmium-yellow towards the costal margin: body dark brown, reddish in front and below. Primaries below with the costal area and outer border ferruginous, flecked with pink; a large marginal lilacine crescent at the apical sinus; a broad discal band as above, but scarlet changing to saffron-yellow; a bifid spot of the same colour below the cell; discoidal cell mustard-yellow, enclosing two black-edged white dots; internomedian area greyish brown, becoming blackish at the borders of the discal band; a large black spot with cuneiform white centre at the end of the cell: secondaries ferruginous, irregularly banded and striated with deeper colour; a squamose transverse yellow streak enclosing a reniform spot across the end of the cell; three black spots near the base; tips of the veins and a marginal line at apex pink: legs whitish, mottled with purplish brown. Expanse 1 inch 10 lines.

Yokohama (*Jonas*).

One of the most beautiful moths yet discovered; the female is rather smaller and paler below, the body and secondaries being yellowish.

Nyctemeridæ.

Psychogoës, n. gen.

Allied to *Secusio* (*S. annulata*), the primaries considerably broader, with the discoidal cell shorter, the subcostals united at the base, so as to form two prædiscoidal cellules, from the second of which the true branches are emitted, the first branch simple, the second trifurcate, a third branch (the continuation of the main subcostal nervure) emitted from the supero-exterior angle of the cell; the radial emitting a recurrent false vein backwards through the cell to the base; neuration of secondaries almost as in *Secusio*; body rather more slender; palpi extremely short, barely extending beyond the front of the head; antennæ slender, with very short pectinations.

Type *P. aterrima*.

24. *Psychogoës aterrima*, n. sp.

Shining black, the primaries with an oblique narrow snow-white band, abruptly and transversely cut off on the median interspaces; secondaries with the fringe snow-white; primaries below with the basal area greyish, the white band extended downwards towards the external angle; secondaries greyish towards the base, the abdominal margin grey; an angulated central grey line, dotted with white below the middle; fringe white; body below grey, the legs and abdomen banded with white. Expanse 1 inch 7 lines.

Yokohama (*Jonas*).

This species somewhat resembles *Baptria exsecuta*, also from Japan, excepting in its greater size and the absence of the white band on secondaries.

PSYCHOSTROPHIA, n. gen.

Allied to *Bursada*, but the wings much broader, the neuration of the primaries entirely different, and the antennæ shorter and filiform. Primaries with the costal nervure terminating at just beyond the middle of the costa; the subcostal emitting its branches before the end of the cell, the first simple, the second trifurcate; upper radial or third subcostal branch emitted from the supero-exterior angle of the cell, and divided a little beyond it into two branches. Secondaries with neuration much like that of *Bursada*.

Type *P. melanargia*.

25. *Psychostrophia melanargia*, n. sp.

♂. Primaries shining purplish brown; a large cuneiform discoidal patch, an oblique postmedian band, three large spots near the outer border and a little dash on the inner margin ochraceous; secondaries ochraceous, with a subcostal streak from the base and a broad internally angulated outer border shining purplish brown; a bifid apical spot and an anal submarginal zigzag belt ochreous; fringe with a patch of silvery white near the apex of each wing; body blackish, banded with yellow: wings below much paler than above, the bands rather wider; body creamy pale yellow. Expanse 1 inch 7 lines.

♀. Larger than the male, the yellow area, bands, and spots much paler, the basal patch of primaries smaller, the submarginal belt of secondaries broken up into small ochreous spots. Expanse 1 inch 8 lines.

Yokohama (*Jonas*).

Chalcosiidæ.

26. *Pidorus atratus*, n. sp.

Like *P. glaucopis*, but smaller, considerably darker, the white belt of primaries generally wider, but always more oblique and with straight external edge, the apex of primaries below without bluish scales. Expanse 1 inch 11 lines to 2 inches 1 line.

Hakodaté (*Whitely*), Yokohama (*Jonas*).

Liparidæ.

27. *Leucoma auripes*, n. sp.

♂. Allied to *L. vau-nigra*, but larger, without the black line on the discocellulars of primaries, the costal area of the same wings dusky, and the veins clothed with silvery scales; the antennæ longer, with a black belt near the base and with black pectinations; the anterior legs golden yellow, and the tarsi of the remaining legs testaceous. Expanse 2 inches 6 lines.

♀. Larger, the costa of primaries scarcely dusky, the front legs with the femora white below. Expanse 2 inches 9 lines.

Yokohama (*Jonas*).

28. *Artaxa intensa*, n. sp.

Allied to *A. flavinata*. Primaries golden yellow, with a central angulated whitish-bordered band speckled with brown scales, fringe sericeous; secondaries bright ochraceous, whitish on costal area, fringe pale yellow; body yellow, prothorax and centre of tegulæ whitish; wings below altogether paler, creamy whitish, more or less ochraceous beyond the middle, without markings. Expanse, ♂ 1 inch 3 lines, ♀ 1 inch 7 lines.

Yokohama (*Jonas*).

29. *Aroa Jonasii*, n. sp.

♂. Primaries pale sulphur-yellow, a large pale-centred brown spot at the end of the cell, the apex with a reddish brown, depressed, conical, costal spot, from which two small squamose spots are continued obliquely downwards; secondaries sericeous white, yellowish externally; body white, the collar and metathorax pale sulphur-yellow; head and pectinations of antennæ gravel-orange; palpi, tibiæ, and tarsi ochreous: wings below pale sulphur-yellow; primaries with the costa ochreous, apical portion of costal area sordid orange; secondaries with a small ochreous discocellular lunule. Expanse 1 inch 6–11 lines.

Yokohama (*Jonas*).

30. *Lymantria fumida*, n. sp.

Allied to *L. dispar*, the male larger, dark smoky brown; the markings of primaries similar; secondaries darker, uniformly dark smoky brown, the fringe varied with paler spots: wings below like those of *L. dispar* in pattern, but differing in their fuliginous colour. Female with the primaries covered all over with fuliginous scales, which become more sparse towards the outer margin; the lunated discal lines nearer together, the innermost one (running from the end of the cell) barely distinguishable, the second indistinct, the third consisting of broad lunated fuliginous spots; secondaries pale dull sandy yellowish, with a broad submarginal pale brown belt; marginal spots wanting; thorax speckled with fuliginous like the primaries; abdomen pale sandy yellow, the terminal segments bordered with pink: wings below sordid sandy yellowish, with pale greyish submarginal belt; discocellular spot of secondaries blackish. Expanse, ♂ 2 inches 1 line, ♀ 2 inches 10 lines.

Yokohama (*Jonas*).

Also allied to *L. japonica* of Motschulsky, but smaller and darker.

31. *Lymantria aurora*, n. sp.

Male of the form and general coloration of *L. dispar*, but the primaries pale fuliginous brown crossed by three irregular whitish lines near the base and three lunated whitish streaks beyond the middle, the inner streak blurred and indistinct, the outer one submarginal; a whitish dot at the end of the cell; secondaries almost as in *L. dispar*. Female more nearly resembling *L. grandis*; the primaries greyish white, pink at the base, with two zigzag basal blackish lines, the centre of the wing and outer border crossed by lunated dusky belts; a grey spot in the cell and a marginal series of blackish spots; secondaries pale pink, brightest at abdominal margin, a spot at the end of the cell and a submarginal band grey, margin spotted with black; thorax white, abdomen pink with white anal segments; margins of eyes, palpi, and legs rose-red; femora and tibiæ grey below; tibiæ and tarsi banded with black. Wings below greyish, margined with pink and with dusky marginal spots. Expanse, ♂ 2 inches 1 line, ♀ 3 inches 2 lines.

Yokohama (*Jonas*).

32. *Dasychira lunulata*, n. sp.

Primaries silvery white, irrorated with black, crossed near the base by an oblique blackish line commencing in three small, fusiform, black-edged, brown spots, followed by a blackish costal dash; disk crossed by a sinuous lunulated blackish line; a subconfluent series of submarginal blackish lunules: secondaries of male fuliginous, of female sordid whitish; a dusky spot at the end of the cell, and two dusky discal stripes parallel to the outer margin; a marginal row of blackish spots; outer border of male white, fringe white: body white, thorax greyish; abdomen of male with lateral dusky belts; antennæ with ferruginous pectinations. Below sordid white with a black spot closing each discoidal cell; a discal dusky stripe, forking in the male; this sex also with dusky subcostal and median longitudinal streaks; female with dusky marginal spots in the primaries. Expanse, ♂ 2 inches 1 line, ♀ 2 inches 8 lines.

Yokohama (*Jonas*).

[To be continued.]

LII.—*Description of an apparently new Species of Humming-bird of the Genus* Amazilia. By D. G. Elliot, F.R.S.E. &c.

Amazilia lucida.

Adult. Crown of head dark metallic grass-green; upper surface shining grass-green, lighter than the head. Upper tail-coverts golden bronze. Throat, breast, abdomen, and flanks metallic grass-green, a light mouse-coloured spot on the lower part of the abdomen. Thighs white, feathers fluffy. Under tail-coverts dark bronzy brown, edged with white. Wings dark purple. Tail reddish bronze, darkest on the central portion of the feathers along the shafts, with the tips of the lateral rectrices bluish black, their edges reddish bronze. This bluish-black colour almost resolves itself into a subterminal bar, and is especially conspicuous on the underside of the tail. Bill apparently brownish red, perhaps flesh-colour in life, with a dark tip. Total length $3\frac{1}{2}$ inches, wing $2\frac{1}{8}$, tail $1\frac{1}{4}$, culmen $\frac{3}{4}$.

Hab. Stated to be Columbia.

This seems to be a very distinct species, belonging to that section of the *Amaziliæ* to which Cabanis gave the generic term of *Pyrrhophæna*, and apparently comes nearest to the species generally known as *P. Devillei*, Bourc., but differs from it, and, indeed, from every other member of the genus *Amazilia*, by the coloration of the tail and its coverts. The crown resembles somewhat that of the bird called by Mr. Gould *Erythronota Feliciæ*; but there is no further resemblance between them save that, as with several others of these closely allied birds, the underparts are shining green. The genus *Pyrrhophæna* (in which possibly some would place this new species) was proposed by Cabanis and Heine in the 'Museum Heineanum' (Th. iii. p. 35, 1860), without any characters to designate it having been given, to contain about half of those species originally placed in the genus *Amazilia*; and for the remaining portion the term *Hemithylaca* was instituted,—these names to be taken as substitutes for the less-classical ones of *Amazilia*, *Erythronota*, *Saucerottia*, &c., by which various species of this section of the Trochilidæ were generically known. With a tolerably large series of nearly all the known species of these so-called genera to judge from, I cannot satisfy myself that sufficient characters exist in any one of them to warrant its separation into a distinct generic rank from *Amazilia*, the term which was first proposed for them, and by which I prefer to call them. It is to be understood, however, that for generic characters, the style of coloration exhibited by any particular number of individuals, when unsupported by any differences of structure, is not taken into any consideration, since it would appear to be very apt to lead one into difficulties, as is clearly shown, I think, to be the case, judging from the unsuccessful efforts of those authors who have endeavoured to arrange these birds into different genera, whose characters were mainly those of colour.

I have not, therefore, adopted the *Pyrrhophæna* of MM. Cabanis and Heine, even in the restricted sense in which it has been employed by some ornithologists, deeming it a generic term not required to designate even that particular section of Humming-birds to which the new *Amazilia lucida* belongs.

LIII.—*Studies on Fossil Sponges.*—I. *Hexactinellida.* By Karl Alfred Zittel.

[Continued from p. 273.]

Personal Observations.

If it be possible to use the skeleton-spicules as the basis of a system, such a system ought most certainly to express most clearly the inherited peculiarities, and consequently the natural relationships of the Hexactinellida. If less attention has hitherto been paid by zoologists to precisely these true skeleton-spicules than to the flesh-spicules, this was evidently due to the uniformity in their skeletal structure possessed even by rather distant genera. In the flesh-spicules the differences appeared more definitely; and, moreover, they could not but excite the interest of the discoverer most vividly on account of their marvellous beauty. Thus, in the memoirs of O. Schmidt and Carter, we find the flesh-spicules very carefully, and the skeleton but little considered. Greater attention was bestowed upon it by W. Marshall, and especially by Bowerbank, to whom we are indebted for the most thoroughgoing analyses of living Hexactinellida with connected framework, and for numerous figures of unsurpassable truth to nature.

In the fossil Hexactinellida the skeleton-spicules are generally the only ones at all accessible to observation; and for this reason alone particular attention must be paid to them. From a systematic point of view, moreover, they are by no means so unserviceable as has hitherto been often supposed.

The whole development and formation of the skeleton-spicules is governed by the mode in which they unite with each other. In this respect the Hexactinellida divide into two natural and apparently sharply separated groups:—

I. Lyssakina, Zittel.

Forms in which the skeleton-spicules generally remain isolated and are only united by sarcode.

II. Dictyonina, Zittel.

Forms in which the skeleton-spicules are regularly coalescent and form a connected latticework with cubical or polyhedral meshes.

The Lyssakina include the whole of Carter's Sarcohexactinellidæ, but besides these also *Euplectella aspergillum* and *cucumer*. As Marshall has already shown, the cementing together of the skeleton-spicules in the two last-named forms is effected by an excess of silica, which is secreted in the syncytium, and fills up, at least partially, the interspaces of the spicules, which are otherwise occupied by sarcode. The skeleton-spicules themselves are not hampered, either in their development or in their arrangement, by this secretion of silica; and consequently this phenomenon, which I denominate "cementation," can only be regarded as of quite secondary significance. In the Lyssakina a further grouping in accordance with the greater or less differentiation of the flesh-spicules, such as has been proposed by W. Marshall for his Asynauloïda, would be advisable. The few known fossil representatives of this suborder very probably possess only one form of skeleton-spicules, and would therefore have to take their place as Monakidæ in opposition to the Pleionakidæ and Pollakidæ.

The second group, that of the Dictyonina, contains the Hexactinellida with regularly amalgamated sexradiates. In normal development the amalgamation is effected by each arm of a spicule applying itself closely to the corresponding arm of a neighbouring sexradiate, when the two rays are soldered together by a common siliceous envelope which is deposited uniformly around them, and they become so completely amalgamated that their previous independence is indicated only by the presence of two separate axial canals. In this way regular connected latticed frameworks are produced, in which each beam consists of two arms of two different spicules. Frequently, however, irregularities in the arrangement of the openings of the latticework are caused by a sexradiate to a certain extent quitting the ranks, and cementing its arms in an arbitrary fashion to the rest of the framework. If one or two rays of such irregularly placed spicules attach themselves accidentally to the thickened centre of intercrossing of a sexradiate, more than six arms may issue from such a central point. Careful examination, however, always shows that the supernumerary axial canals belong to a neighbouring sexradiate, and usually also that they do not reach the centre of the axial cross. Other irregularities are caused by individual rays bending or changing their direction, when the two arms of one axis no longer run in a straight line.

The spot where the axial canals cross (that is to say, the ideal centre from which all the six arms of a spicule radiate), and where the siliceous tubes meet together, is always indicated by an enlargement, the "crossing-node."

For the classification of the Hexactinellida the constitution of the crossing-nodes furnishes important data. Two modifications occur.

1. The crossing-nodes form a simple stronger or weaker thickening around the enclosed sexradiate axial cross of the central canals (*Farrea*, *Aphrocallistes*, *Craticularia*, *Porospongia*, &c.).

2. The crossing-nodes have the form of an open octahedron. This peculiar structure is produced by the siliceous secretion of the syncytium taking place in smaller quantity at the crossing-nodes. The central canals of the six rays form an axial cross enclosed by very thin tubes in a hollow octahedral space, bounded by oblique siliceous beams, by which the six thickened arms of the coalescent sexradiates are united. Of such oblique uniting beams there are always twelve around a crossing-node; and they are always placed exactly like the

edges of a regular octahedron. From the size of this space, enclosed by solid siliceous rods, the strength of the octahedral edges, and the more or less regular or distorted form of the lumina taking the place of the lateral faces of the open octahedron, valuable systematic characters are to be obtained. When the state of preservation is good, it may be ascertained with perfect certainty that the axial canals pass uninterruptedly through the cavity, and form a very elegant axial cross within it. But as their siliceous envelopes are very thin they are easily destroyed; and the octahedral nodal points then acquire the figure described by O. Schmidt in *Scyphia striata**.

Among living Hexactinellida we are acquainted with latticed frameworks with such octahedral nodal points (lantern-spicules) only in *Myliusia Grayi*, Bow., and *Myliusia Zittelii*, Marsh. MS.; in the fossil forms, however, they are widely diffused (*Cœloptychium*, *Ventriculites*, *Becksia*, *Plocoscyphia*, *Pachyteichisma*, &c.).

A peculiar phenomenon is presented in the genera *Farrea*, *Dactylocalyx*, and *Aphrocallistes* by the exceedingly minute sexradiate stellules, which are firmly attached by one ray to a siliceous fibre of the latticework, but otherwise resemble the other sexradiates of the framework in every respect, and also possess fine axial canals, whilst elsewhere canals are never to be observed in the root-like processes or spines of the siliceous fibres. It is possible that these stellules, with which I am acquainted also in some fossil Hexactinellida, may be young, still undeveloped spicules; but possibly they fulfil the function of the flesh-spicules, although they do not lie free in the sarcode. Bowerbank figures such small spicules in several species of *Farrea*; Carter regards them as after-formations.

In general, the differences presented by the latticed framework of the fossil Hexactinellida are so considerable that in many cases we can determine generically even a small isolated fragment or a preparation. The size of the meshes, the octahedral or solid constitution of the crossing-nodes, the ornamentation of the siliceous fibres with prickles, spines, or root-like processes, as well as the arrangement of the coalescent sexradiates themselves, furnish important systematic data, which vary but little in the same species or even genus.

Nevertheless the one-sided consideration of the microstructure of the framework would lead to no satisfactory result. Many forms differing greatly in other characters possess an almost exactly accordant skeletal structure. Thus W. Marshall has already shown that the framework of *Eurete* agrees

* Atlant. Spong. Taf. ii. fig. 16.

to such an extent with that of many fossil Hexactinellida, that it is sometimes quite impossible to say whether a microscopic preparation is derived from the recent Philippine sponge or from a fossil sponge from Frankish Switzerland. The same phenomenon is presented by several genera of fossil Hexactinellida when we compare them with one another.

Consequently we require other characters for the discrimination of the genera. As the flesh-spicules are usually deficient in the fossil skeletons, the relation of isolated siliceous structures, when any such are present, to the neighbouring skeletons is rarely demonstrable; these can only be regarded as of subordinate value in a system of the Dictyonina which is intended to extend to the fossil forms. The peculiarities presented by the surface of the solid skeleton, the water-canal system, with the ostia belonging to it, and the external form of the sponge-body are more important for this purpose.

1. The surface of the skeletons of Dictyonina differs in many genera in no respect from the inner parts. The lattice-meshes are of the same size; the siliceous trabeculæ are the same in arrangement and nature as the rest of the skeleton; in short, the surface is perfectly naked. This comparatively rare case is known in certain species of the living genera *Eurete*, *Farrea*, and *Myliusia*; among the fossil Dictyonina, *Pachyteichisma* and *Verrucocœlia*, for example, have naked surfaces.

Much more frequently both surfaces, or at the least the outer one, are entirely or partially provided with covering layers (*Deckschichten*) of different constitution. Etallon, Römer, and Pomel have already called attention to the importance of these covering layers (*Perienchym*, Etallon; *Epidermis*, F. A. Römer; *couche pelliculaire*, Pomel).

A frequent form of covering structure is produced thus:—The arms of the outermost layer of sexradiates situated in the plane of the surface are thickened, or widened in the form of laminæ; or they form rough and perforated, rectangularly crossed beams of very dissimilar form, by the emission of lateral branches, which in their turn become soldered together and at the same time thicken. The outwardly directed ray of the sexradiate is always aborted; the inwardly directed one, on the contrary, is united with the latticed framework.

Such covering layers are only slight modifications of the latticework itself. They generally still allow a mesh-like arrangement to be recognized, although the lumina of the meshes may be considerably and very unequally narrowed. According to the greater or less secretion of silica, the surface acquires a coarsely or finely perforated constitution. Nevertheless the arrangement of the subjacent latticed framework may still be recognized in the covering layer from the regular position of the axial canals. (Examples, *Marshallia*, *Callodictyon*, *Pleurope*, *Plocoscyphia*, under surface of *Cœloptychium*, *Craticularia*, &c.)

Sometimes covering layers are produced by the uppermost layer of sexradiates of the skeleton emitting root-like processes, which anastomose with each other, and in this way form a felted tissue consisting of solid siliceous fibres. This either coats the surface of certain parts of the sponge-body, or it only fills the meshes of the uppermost layer of the latticed tissue (*Etheridgia*).

The covering layer attains a greater amount of independence of the true skeleton when it forms a coarsely or finely perforated siliceous membrane in which axial crosses of the size and form of those in the skeleton-spicules lie irregularly dispersed. (*Sporadopyle*, *Craticularia*, *Sphenaulax*, *Sporadoscinion*, &c.).

Independent covering layers originate in quite a different manner when the outer, the inner, or both surfaces of the sponge-body are veiled by a coat of sexradiates, resembling sometimes an extremely delicate spider's web, the sexradiates being variously cemented together either only by their points or by the whole length of the limb (*Casearia*, *Cypellia*, *Tremadictyon*, &c.). In these sexradiates, which sometimes differ very essentially from those of the rest of the skeleton, the outwardly directed ray is also always aborted. In certain genera (*Cypellia*) the large sexradiates of the covering layer are sometimes only united at their tips by slight siliceous bridges; in others they lie like stars imbedded in a thin siliceous membrane which coats the surface of the sponge (*Porocypellia*, *Porospongia*).

In those cases in which the spicules of the covering layer are of a different form from the skeleton-spicules, they no doubt take the place of the flesh-spicules; but whether this is the case when the covering layer is produced only by a thickening of the skeleton itself, appears to be doubtful. The question can only be settled when we know living Hexactinellida with the surface of a similar constitution.

In some fossil Dictyonina (*Cystispongia*, *Lepidospongia*) the outer surface of the sponge-body is coated with a dense siliceous membrane, which is entirely free from axial crosses or enclosed spicules.

These variously developed superficial structures evidently are intended to give the sponge-body greater firmness, and to protect it against assaults from without. The covering layers themselves, moreover, affect the external appearance of the fossil sponges in so high a degree that A. Römer and Pomel have already given them what appears to me to be too much systematic importance.

2. The canal-system for the circulation of the influent and effluent water, with the openings belonging to it, is of more importance physiologically than the covering layers.

In the Hexactinellida the walls of the sponge-body are usually only of small thickness, and they enclose a very wide central space of tubular, cylindrical, or funnel-like form. In the trochiform, infundibuliform, and cylindrical Hexactinellida the wide central space is best conceived as a common stomachal cavity; and consequently such sponges are to be regarded as monozoic bodies; the superior terminal aperture would then be described as the *osculum*. In branched, lamelliform, or nodose bodies, and in such as are composed of mæandriform tubes, the question of individuality is generally hard to settle, as the apertures which have hitherto been usually regarded as oscula are often distributed quite at random and frequently appear scarcely to stand in connexion with gastral cavities (*Guettardia*, *Pleurostoma*, *Pleurope*).

The passages by which the water penetrates into and flows through the sponge-body, in opposition to these oscula and pseudo-oscula, are extraordinarily constant in their character, and thereby furnish excellent systematic data. According to Häckel*, the canal and water-vascular system is the most significant, and physiologically and morphologically the most important system of organs in all sponges. It determines not only the most essential differences in the form of the body in the various groups, but also more or less the structure and form of the skeleton.

In general the canal-system in the Hexactinellida exhibits very simple conditions, which in many respects remind us of those of the Sycones. Usually it is composed merely of a great number of simple, very rarely ramified canals, which penetrate in a radial direction either perpendicularly or obliquely into the wall. Only exceptionally the canals perforate the whole thickness of the wall (*Aphrocallistes*); much more frequently they commence either on the outer or inner surface of the wall, and terminate cæcally immediately within the opposite surface (*Ventriculites*, *Coscinopora*, *Sporadopyle*, &c.). In this way, therefore, the usually round ostia of the two surfaces stand in alternating series.

The circulation of water is effected in the simplest form

* Die Kalkschwämme, i. p. 210.

when, the wall of the sponge-body being thin, the latticed skeleton and the surface are of such coarse meshes that the water can pass in and out unhindered. In this case true canals are superfluous, and in the living state each mesh-opening of the surface of the skeleton probably corresponded to a dermal pore in the syncytium. Examples of Hexactinellida with a coarsely-meshed skeleton without any canals or ostia are presented by the genera *Farrea*, *Eurete*, *Myliusia*, *Marshallia*, and *Callodictyon*.

In certain Hexactinellida the water-circulation may be effected, in the absence of true radial canals, by a strong folding of the wall. For example, there are Ventriculites in which the wall lies in mæandriform folds, between which, on both surfaces, deep longitudinal furrows run from the upper margin of the cup down to the base. These furrows quite suffice for the permeation of the sponge-body; and consequently all radial canals or large superficial apertures may be deficient.

But if in Hexactinellida with mæandriform-folded wall the folds lie close together, and in this way constitute a continuous wall (*Ventriculites*), or if the wall attains an extraordinary thickness (*Pachyteichisma*), the necessity for a canal-system capable of conveying the water into the interior of the skeleton is established. Therefore the cæcal radial canals, the ostia of which are variously distributed on the two surfaces, then make their appearance.

In general it may be recognized as the rule in the Hexactinellida, that the development of the canal-system keeps pace with the thickness of the wall, or with the density of the latticed framework. All genera with a very finely meshed tissue possess canals, even when the wall is reduced to a lamella no thicker than paper (*Leptophragma Murchisoni*).

A very peculiar and complicated canal-system is possessed by some of the most ancient Hexactinellida, with globular, stalkless sponge-bodies (Astylospongidæ). In these remarkable sponges the wall is of very considerable thickness; the central cavity is either entirely deficient or it occurs as a funnel-shaped depression on the upper surface. The whole mass of the sponge-body is traversed by numerous simple canals arranged in radii, running from the periphery towards the centre. These radial canals are crossed by other stronger canals, which are likewise arranged in radial series, but traverse the sponge-body through its whole height, running parallel to the surface. This constitution of the canals, which never occurs in living or mesolithic Hexactinellida, almost exactly represents the water-canal system observed in some

Lithistida. In the Astylospongidæ, however, the canals appear to have exercised no influence upon the microstructure of the skeleton-spicules; for these are as sharply discriminated from the skeleton of the Lithistida as those of the later Hexactinellida.

Besides the true water-vascular system there is in some Hexactinellida also a so-called "intercanal system." The tubular cavities and larger or smaller apertures on the surface to which Häckel* gives this name are produced simply by the peculiar coalescence of certain parts of the sponge-body. Physiologically they have nothing in common with the true canal-system; and they never show any constant characters in their course or their form. What Häckel says of the intercanal system of the Calcispongiæ applies also essentially to the Hexactinellida; and on this subject I may therefore simply refer to the classical monograph of the Calcispongiæ.

In the Hexactinellida an intercanal system occurs only on composite stocks, and, indeed, chiefly when the cormi are composed of tubes which grow labyrinthically through one another and leave irregular interspaces free. The intercanal system is developed in a remarkable manner in *Etheridgia*, *Tremabolites*, *Cystispongia*, and *Plocoscyphia*.

We must be very careful not to confound the apparent stomachal cavities (pseudogastres) and orifices (pseudostomata) formed at the surface by the intercanal system (*Etheridgia*, *Plocoscyphia*, &c.) with true gastral spaces and their apertures. An investigation of the depression will in most cases at once show that such apparent stomachs are not immersed in the true skeletal mass and bounded by a continuous wall, but that they rather represent interspaces of usually irregular form, the walls of which are formed by the outer surface of parts of a sponge-body of different values.

3. Although the external form of the sponge-body is generally subject to the greatest variations and is scarcely taken into consideration in all the more modern systems of living sponges, it nevertheless merits a higher estimation in the case of the vitreous and calcareous sponges with firm, stony skeletons. It is true that we can only exceptionally recognize genera at once from their characteristic external form (*Cœloptychium*, *Euplectella*), as, in general, the same forms are exactly repeated in the Hexactinellida, the Lithistida, and the Calcispongiæ with anastomosing fibres. Moreover it is absolutely impossible to determine generically a cup-shaped, bowl-shaped, funnel-shaped, or cylindrical sponge of the order

* Die Kalkschwämme, i. p. 275.

Hexactinellida without taking into consideration the skeletal structure and the canal-system.

Nevertheless the general form of the body must not be neglected in a natural system as a secondary aid. If the relationships of a Hexactinellid have been established by the investigation of the skeleton and the canal-system, the external appearance generally furnishes excellent characters for the distinction of the genera and species.

Häckel and Carter, who certainly cannot be charged with undervaluing the microscopic structure, and still less with overestimating the value of the external appearance of the sponge-body, have principally distinguished the genera within the larger groups, both of Calcispongiæ and Hexactinellida, by their external form. But what is justifiable in the case of living sponges will also be admissible in that of the fossils.

The general form of the sponge-body, the constitution and thickness of the wall, the size, form, and position of the central cavity, the mode of union in the polyzoic forms, furnish valuable data for classification. Special interest also attaches to the mode of fixation of the sponge to the bottom. The want of a so-called root, or its nature when present, sometimes serves for the recognition of the different genera.

In the fossil Dictyonina beard-like roots, composed of long isolated siliceous spicules, have not yet been detected with certainty. Generally the root forms a stalk-like prolongation, a nodose or lamellar dilatation, or a ramified base to the sponge-body. It consists of siliceous elements, which either agree more or less with those of the rest of the sponge-body in form and arrangement, or the tissue of the root shows a striking difference from the true latticework. The lattice-structure becomes indistinct, and the root consists of long parallel siliceous fibres usually without an axial canal, the production of which from Hexactinellid tissue is generally indicated only by the transverse unions which occur at more or less regular intervals.

I must reserve a detailed description of all the characters hitherto mentioned for a special work upon the fossil sponges which occur in Germany. For this comprehensive monograph a portion of the text and the figures of the microstructure of almost all the genera of Hexactinellida are already completed. I have been forced upon this larger work in part by the lamentable condition of palæospongological literature, but partly also by a feeling of responsibility, which urges me not merely to erect the rough framework of a system upon the sure bases obtained by a new method of investigation, as in the present memoir, but to hand over the building also in a complete state to my *collaborateurs.* It is true that there were greater difficulties in the way of obtaining the material for a thorough investigation of fossil sponges than I had anticipated; for in general these fossils could only boast of having attracted but little attention. In consequence of this circumstance large complete collections are still wanting; even in the richest museums, as a rule, only particular localities are represented in a satisfactory manner. Through the great kindness of many friends *, however, I have already succeeded in obtaining, not only from Germany and Bohemia a great number of the species described by Goldfuss, Münster, F. Römer, Reuss, Geinitz, Schlüter, F. A. Römer, and others, partly in typical original specimens, partly in specimens which were furnished with authentic determinations by the authors, but I also obtained abundant material for comparison from Russia and England through the kindness of M. F. Schmidt of St. Petersburg, Prof. Sinzow of Odessa, M. Constantine Milaschewitsch of Moscow, and Mr. John Edward Lee of Torquay. For the communication of recent Hexactinellida and Lithistida my special thanks are due to Dr. W. Marshall of Weimar, and Dr. H. J. Carter of Budleigh-Salterton.

The following attempt at a system of the Hexactinellida has not proceeded from a desire to transform the existing classifications at any cost; but when the microscopic method of examination which has already proved so admirable in the case of the recent Hexactinellida had been also extended to the fossil sponges, so many new facts and points of view came to light that of necessity more or less profound modifications became requisite in the previous attempts at classification both of the recent and fossil Hexactinellida.

Revision of the Fossil and Recent Hexactinellida, arranged according to their Relationships.

Class SPONGIÆ.

Order **HEXACTINELLIDÆ**, O. Schmidt.

Siliceous sponges with spicules of sexradiate form, isolated

* I hasten here to express publicly my thanks to those gentlemen who in the most liberal manner placed materials for my investigation at my disposal. I have especially to offer my thanks to MM. K. Andræ of Bonn, E. Beyrich of Berlin, W. Dames of Berlin, Theodor Fuchs of Vienna, W. Gümbel of Munich, H. B. Geinitz of Dresden, J. Krenner of Pesth, Ottmer of Brunswick, F. Römer of Breslau, H. Römer of Hildesheim, A. Schlönbach of Salzgitter, C. Schlüter of Bonn, K. von Seebach of Göttingen, and G. Tschermak of Vienna.

or soldered together like a lattice—an axial cross, consisting of three central canals cutting each other at right angles, lying at the foundation of all the siliceous structures. Besides the true skeleton-spicules *, numerous "flesh-spicules," generally of very elegant form, are frequently present.

Suborder I. DICTYONINA.

Skeleton-spicules fused together in such a fashion that every arm of a sexradiate applies itself to the corresponding arm of a neighbouring spicule, when both are surrounded by a common siliceous envelope. The connected skeletons consist of a latticework with meshes of cubical and irregular form. Flesh-spicules present or wanting.

Family 1. **Astylospongidæ.**

Sponge-body very thick-walled, not stalked, free (sometimes, however, attached by a broad base). Water-vascular system consisting of radial canals directed from the surface towards the centre, to which are usually added vertical tubes, which likewise stand to the number of 8–10 in radial series. Latticed framework rather irregular, with solid crossing nodes.

Astylospongia, F. Röm. Silurian.
Palæomanon, F. Röm. Silurian.
Protachilleum, Zitt. Silurian.
Eospongia, Billings. Silurian.

Family 2. **Euretidæ.**

Sponge-body cup-shaped, cylindrical, top-shaped or branched, attached. Skeleton lattice-like, the crossing-nodes of the coalescent sexradiates not perforated. Surface naked, or protected by a thickening of the outer skeletal layer, sometimes coated with a very delicate network of coalesced spicules, which differ but little in form from those of the rest of the skeleton. This meshed outer membrane also veils the ostia. Root-structure similar to that of the rest of the sponge-body Flesh-spicules present or wanting.

* The skeleton-spicules were originally defined by Carter (*l. c.* p. 353) as "large spicules which are only concerned in the formation of the supporting structure or skeleton." In a memoir which has just appeared (Ann. & Mag. Nat. Hist. 1877, vol. xix. p. 121), "On two Vitreohexactinellid Sponges," the denomination "skeleton-spicules" is applied only to the larger *free* siliceous structures of the Hexactinellida. The coalescent sexradiates which form the connected latticed skeleton, and which I have particularly named skeleton-spicules in this memoir, are called by Carter "vitreous fibre."

a. Canal-system well-developed. Ostia of the cæcal radial canals alternate on the two surfaces.

?*Protospongia*, Salt. Silurian.
Calathium, Billings. Silurian.
Archæocyathus, Billings. Silurian.
?*Trachyum*, Billings. Silurian.
?*Steganodictyon*, M'Coy. Devonian.
Tremadictyon, Zitt. Upper Jura.
Craticularia, Zitt. Middle and Upper Jura, Cretaceous, Miocene.
?*Eubrochus*, Sollas. Gault.
Sphenaulax, Zitt. Upper Jura.
Sporadopyle, Zitt. Upper Jura.
**Sclerothamnus*, Marsh. †

b. Canal-system wanting or scarcely developed.

**Farrea*, Bow. Tertiary.
**Eurete*, Marsh.
Verrucocœlia. Upper Jura, Cretaceous.
**Aulodictyon*, S. Kent.

Family 3. **Coscinoporidæ.**

Sponge-body cup-shaped, stellate, or branched, frequently compressed. Radial canals very numerous, simple, straight, blind. Ostia small; skeleton finely meshed, dense, strong, prevented from a regular formation of cubical meshes by the numerous radial canals. Crossing nodes of the sexradiates solid, rarely perforated. Covering layer generally deficient, or formed by thickening of the outermost skeleton-layer.

?*Bothroconus*, King. Permian.
Leptophragma, Zitt. Cretaceous.
Pleurostoma, Röm. Cretaceous.
Guettardia, Mich. Cretaceous, Eocene.
Coscinopora, Goldf. Cretaceous.

Family 4. **Mellitionidæ.**

Sponge-body branched, globular, or lamellar. Wall completely permeated by numerous tubular water-canals, and thereby divided into cells like those of a honeycomb. Skeleton-spicules with solid crossing-nodes. Surface (? naked, or) veiled by a delicate, meshed or porous, siliceous coat, which also covers the apertures of the canals. Root deficient.

**Aphrocallistes*, Gray. Cretaceous, Miocene.
*? *Fieldingia*, S. Kent ‡.

† The genera marked with an * are living at the present day.
‡ Also *Stauronema*, Sollas.

Family 5. **Ventriculitidæ.**

Sponge-body simple or polyzoic, cup-shaped, funnel-shaped, cylindrical, top-shaped or branched. Wall mæandrically folded. Latticed framework with octahedrally perforated crossing-nodes. Canal-system generally well-developed. Radial canals cæcal. Both surfaces with ostia or longitudinal furrows. Covering layer rarely deficient, generally produced by thickening of the outer skeletal layer. Root consisting of elongated siliceous fibres without axial canals, united by transverse bridges.

a. Without root.
Pachyteichisma, Zitt. Jura.
Trochobolus, Zitt. Jura.

b. With root.
Ventriculites, Mant. Cretaceous.
Schizorhabdus, Zitt. Cretaceous.
Tretostamnia, Pomel. Miocene.
Rhizopoterion, Zitt. Cretaceous.
Sporadoscinia, Pomel. Cretaceous.
Licmosinion, Pomel. Cretaceous.
Polyblastidium, Zitt. Cretaceous.

c. Upper margin of the cup with a finely porous covering layer.
Cephalites, T. Smith (p. p.). Cretaceous.

d. Outer surface furnished with a dense siliceous coat.
Lepidospongia, Röm. Cretaceous.

Family 6. **Staurodermidæ.**

Sponge-body top-shaped, cup-shaped, cylindrical, rarely branched. Latticed skeleton more or less regular. Crossing-nodes solid or octahedrally perforated. Outer or both surfaces of the wall furnished with stellate spicules, which differ in form from those of the rest of the skeleton, and are either only loosely cemented to one another, or imbedded in a connected siliceous coat.

a. Canal-system well-developed. Sponge-body cup-shaped, cylindrical or branched.
Cypellia, Pomel. Jura.
Stauroderma, Zitt. Jura.
Porocypellia, Pomel. Jura.
Casearia, Quenst. Jura.

b. Canal-system slightly developed. Sponge-body lamelliform.
Porospongia, D'Orb. Jura.
Ophrystoma, Zitt. Cretaceous.
?*Placochlænia*, Pomel. Miocene.

Family 7. **Mæandrospongidæ.**

Sponge-body consisting of mæandrically tortuous and anastomosing thin-walled tubes or laminæ. Canal-system deficient or scarcely developed. Intercanal-system always present. Covering layer deficient or forming a connected siliceous coat upon the surface.

a. Without special covering layer.
Plocoscyphia, Reuss. Cretaceous.
**Dactylocalyx*, Stutchb.
**Periphragella*, Marsh.
**Myliusia*, Gray (p. p.).
b. With a covering layer.
Tremabolites, Zitt. Cretaceous
Etheridgia, Tate. Cretaceous.
Toulminia, Zitt. Cretaceous.
Camerospongia, D'Orb. Cretaceous.
Cystispongia, Röm. Cretaceous.

Family 8. **Callodictyonidæ.**

Sponge-body cup-shaped. Wall consisting of very regular, wide-meshed latticed framework with octahedral crossing-nodes; canal-system wanting or confined to the covering layer of the outer surface, which is sometimes very thick. In the interior of the wall the circulation of water takes place directly through the meshes of the latticed skeleton.

a. Wall naked.
Callodictyon, Zitt. Cretaceous.
Marshallia, Zitt. Cretaceous.
Becksia, Schlüter. Cretaceous.
b. Outer surface of the wall furnished with a thick covering layer, which agrees in structure with the tissue of the root.
Pleurope, Zitt. Cretaceous.
Diplodictyon, Zitt. Cretaceous.

Family 9. **Cœloptychidæ.**

Sponge-body umbrella-shaped, stalked. Wall thin, deeply folded, the central cavity divided into radial chambers. Upper surface flat or depressed, entirely coated with a connected covering layer, which generally consists of attenuate finely and coarsely porous bands. Canal-ostia only upon the lower surface of the umbrella upon the back of the folds, sometimes also on the stalk. Latticed framework with large regular cubical meshes. The crossing-nodes of the coalescent sexradiates octahedrally perforated; arms of the sexradiates with spinous and root-like processes.

Cœloptychium, Goldf. Cretaceous.

Suborder II. Lyssakina.

Entire skeleton consisting of spicules which are united only by sarcode (exceptionally also by lamellar siliceous matter in an irregular fashion). Flesh-spicules generally present in abundance and much differentiated.

Family 1. **Monakidæ**, Marshall.

Entire sponge-body composed only of homogeneous spicules.

Acanthospongia, M'Coy. Silurian, Carboniferous.
Stauractinella, Zitt. Jura.

Family 2. **Pleionakidæ**, Marshall.

Principal mass of the skeleton formed of pure sexradiates, but with these broom-forks or rosettes.

**Askonema*, Kent.
**Lanuginella*, Schmidt.

Family 3. **Pollakidæ**, Marshall.

Forms of the skeleton- and flesh-spicules very multifarious. Special dermal skeleton and lining of the gastral cavities present. Base generally forming a root-tuft of long siliceous spicules.

**Holtenia*, Schmidt.
**Pheronema*, Leidy.
**Crateromorpha*, Gray.
**Rossella*, Carter.
**Sympagella*, Schmidt.
**Placodictyon*, Schmidt.
**Euplectella*, Owen.
**Habrodictyon*, W. Thomson.
**Labaria*, Gray.
**Semperella*, Marshall (*Meyerina*, Gray).
**Hyalonema* (*Carteria*), Gray.
?*Acestra*, Röm. Silurian.

Conditions of Existence and Distribution of the Fossil Hexactinellida.

In his first, frequently cited memoir, W. Marshall gives a tabular revision of the geographical and bathymetric distribution of the recent Hexactinellida*. According to this, these sponges occur from about 65° N. lat. to about 50° S. lat., and, indeed, at the very considerable depth of from 500 to 4000 feet. The recent Hexactinellida are therefore strictly inhabitants of the deep sea.

This fact may justify us *à priori* in coming to the conclusion that the fossil forms also probably existed under similar circumstances. And, in fact, considering the mode of occurrence of the fossil Hexactinellida we arrive at the same result.

In this respect, indeed, the Palæozoic forms give us no information. The genera at present known in the Silurian (*Astylospongia*, *Palæomanon*, *Protachilleum*, *Eospongia*, *Protospongia*, *Calathium*, *Trachyum*, *Archæocyathus*, *Acanthospongia*, and ? *Acestra*) differ in essential characters from the later Hexactinellida, and possibly required other conditions of life than their successors. In the Devonian and Carboniferous Limestone and in the Dyas our order is as yet represented only by the very insufficiently investigated genera *Steganodictyon* (Devonian), *Acanthospongia* (Carboniferous), and *Bothroconus* (Dyas). In Canada *Archæocyathus* and *Eospongia* occur in the Potsdam, *Calathium* and *Trachyum* in the Quebec group, consequently in the very oldest Silurian (=Cambrian) formations. In Tennessee there are numerous examples of *Astylospongia* and *Palæomanon* in the Middle Silurian Limestone; whilst in Europe the former genus is found in Esthland and Gotland in Upper Silurian deposits, and all over Northern Germany in diluvially transported material. In general the sponges are associated with Brachiopoda, Trilobites, and Pteropoda, and occur in deposits to which one may equally well ascribe a pelagic or a littoral character.

From the Trias and Lias no Hexactinellida are at present known; and even in the Dogger there are only isolated examples of the genera *Tremadictyon* and *Craticularia*, and, indeed, in the Inferior Oolite, in the Bath and Kelloway group.

The Upper Jura exhibits a rich development of Hexactinellida, but only where it occurs in the form of limestone. The "Spongitenkalk" of the White Jura γ and δ, as well as the so-called Birmensdorf beds in Poland, in the Swiss and French Jura, and in the neighbourhood of Niort, are the chief localities for Jurassic Hexactinellida and Lithistida. They also appear quite isolatedly in the Corallian deposits of different localities. They are, however, completely deficient in the muddy or sandy littoral formations of Northern France,

* *L. c.* p. 150.

England, and Northern Germany. If we glance at the rest of the fauna of the "Spongitenkalk," the abundance of Brachiopods, Crinoids, and here and there of Foraminifera, and the absence of true shore-haunting Gastropods and Lamellibranchs, are in favour of the production of these deposits in deep water. The genera diffused in the Upper Jura are *Tremadictyon*, *Craticularia*, *Sphenaulax*, *Sporadopyle*, *Verrucocœlia*, *Pachyteichisma*, *Trochobolus*, *Cypellia*, *Stauroderma*, *Casearia*, *Porospongia*, *Porocypellia*, and *Stauractinella*.

The distribution of the Hexactinellida in the Cretaceous formation leads to a like result. In the older stages they are entirely wanting or only occur singly. They appear in greater abundance only in the Cenomanian group, in which the deposits developed as "Pläner" in the abundance of Foraminifera and the scarcity of littoral animals bear the character of deep-sea formations. North Germany, Saxony, Bohemia, Silesia, and Poland contain the most fruitful localities for Middle-Cretaceous Hexactinellida of the genera *Ventriculites*, *Cystispongia*, *Camerospongia*, *Diplodictyon*, *Plocoscyphia*, *Pleurostoma*, &c.

The greatest variety of fossil Hexactinellida and Lithistida is furnished by the upper division of the Cretaceous formation, but only by such deposits as, like White Chalk and certain Chalk-marls, have long been regarded for many reasons as deep-sea formations. In the littoral Chalk-tuff of Maestricht, in the Coralline chalk of Faxoe, and in the Pisolitic chalk of the Paris basin, Hexactinellida have hitherto been sought in vain. The Cretaceous Hexactinellida are for the most part distinguished from the Palæozoic and Jurassic forms by the octahedrally perforated crossing-nodes of the sexradiates, and belong with but few exceptions to peculiar genera confined to the Cretaceous formation (*Ventriculites*, *Schizorhabdus*, *Licmosinion*, *Sporadoscinia*, *Rhizopoterion*, *Cephalites*, *Lepidospongia*, *Leptophragma*, *Pleurostoma*, *Guettardia*, *Coscinopora*, *Ophrystoma*, *Plocoscyphia*, *Tremabolites*, *Etheridgia*, *Toulminia*, *Camerospongia*, *Cystispongia*, *Marshallia*, *Callodictyon*, *Pleurope*, *Diplodictyon*, *Cœloptychium*). Only the genera *Craticularia* and *Verrucocœlia* are common to it and the Jurassic formation.

The deficiency of true abyssal deposits in Northern Europe during the various phases of the Tertiary epoch may most simply explain the deficiency of Hexactinellida in this formation. With the exception of small fragments of skeleton, possibly belonging to the genera *Farrea* and *Myliusia*, from the Eocene sandstone of Brussels*, and from Miocene sands at Ruditz, in Moravia, and of a Miocene *Aphrocallistes* from Russia, I know of no Tertiary Hexactinellida from Northern and Central Europe.

But even in the South-European Nummulitic formations, to which, at least in part, a deep-water origin is ascribed, it is remarkable that they occur only as great rarities. The only certain evidence of them consists in an Eocene *Guettardia*, which D'Archiac has described from the neighbourhood of Biarritz.

This hitherto unexplained gap, however, is partially filled by A. Pomel's important discovery of numerous Miocene sponges in the province of Oran. Among the North-African Hexactinellida the genus *Craticularia* (*Laocœtis*, Pom.) takes the first place by its astonishing abundance of forms: species of *Aphrocallistes* (*Badinskia*, Pom.), *Tretostamnia*, Pom., and *Placochlœnia*, Pom., as well as a considerable number of Lithistida, are also described.

If, therefore, the fossil Hexactinellida, by their peculiar geological distribution, prove to be deep-sea dwellers almost as clearly as their living relations, we obtain in these organisms an important datum for judging of the mode of formation of geological deposits.

The limitation of the fossil Hexactinellida to deep-sea deposits, however, also necessarily involves their intermittent occurrence, separated by long interruptions. In formations which are at present known only under a littoral facies, there are no Hexactinellida. The different sponge-horizons are therefore also in part separated by enormous intervals of time. Thus, for example, the Silurian forms are immediately followed by the Upper Jurassic (no true spongitic deposits are known in the Devonian, Carboniferous, and Dyas); and these again are separated by a wide interval from the Middle and Upper Cretaceous. This best explains the fundamental differences in the successive sponge-faunas in the Silurian, the Jura, the Cretaceous, and the Miocene. Under these circumstances we ought rather to wonder that there are any genera common to two formations, than that the Jurassic and Cretaceous Hexactinellida, for example, present great differences.

Perhaps there are few divisions of the animal kingdom, capable of preservation, of the phylogeny of which palæontology furnishes so fragmentary a picture. Our entire knowledge of the fossil Hexactinellida is limited to isolated and

* Rutot, *l. c.* pl. iii. figs. 33, 34.

widely scattered remains of a developmental series, the intermediate members of which, perhaps, lie buried in deposits now immersed beneath the sea, or which are to be found only in uninvestigated parts of the earth. That under such conditions the construction of genealogical trees must for the present, at least, remain an equally unprofitable and thankless task need hardly be said.

[To be continued.]

LIV.—*Description of a new Genus and Species of* Cicindelidæ *allied to* Tetracha, *from South Africa* (*Coleoptera Geodephaga*). By CHARLES O. WATERHOUSE.

THE very interesting addition to the family Cicindelidæ here described was obtained by Mr. Thelwall at Lake Nyassa in South-eastern Africa, and, as will be seen from the following characters, is intermediate between *Megacephala* and *Tetracha.*

STYPHLODERMA, gen. nov.

General characters of *Tetracha.* Apical joint of the palpi much more securiform than in *Tetracha.* Elytra rather depressed, elongate-ovate; shoulders completely effaced. Wings none. Anterior tarsi of male with the first three joints only slightly dilated; posterior tibiæ with two or three slight grooves above. Abdomen with seven segments in the male, the penultimate segment emarginate.

The anterior tarsi in the male of this insect resemble those of *Megacephala,* with which it agrees also in being apterous; but in its other characters it agrees more nearly with *Tetracha.* From this latter it differs in the form of the anterior tarsi, in being apterous, and in having the apical joint of the palpi much more securiform.

Styphloderma asperatum, sp. n.

Nigrum, subnitidum; genis æneis, palpis pallide piceis; thorace postice parum angustato, convexo, supra antice posticeque æneo-tincto et tuberculato, disco glabro; elytris elongato-ovalibus, parum convexis, depressiusculis, subviolaceo-nigris, dense rugose asperato-tuberculatis, singulis guttis duabus ferrugineis; tarsis piceis.

Long. $10\frac{1}{2}$ lin., lat. 4 lin.

Head nearly smooth, with a shallow metallic impression at the base of each antenna; cheeks green. Thorax rather narrower than the width of the head across the eyes, convex, narrowed at the base, the anterior and posterior borders metallic, sprinkled with roundish tubercles; the disk gibbous. There is an obtuse tooth at the side just before each posterior angle; the base is gently arcuate, not lobed in the middle. Elytra narrowed at their base, dull black, slightly tinged with blue, the surface densely covered with conical tubercles which are directed backwards; each elytron has a small rusty spot near the base and another near the apex. The elytra are connate.

Hab. S.E. Africa, Lake Nyassa. Brit. Mus.

A female example in Mr. Janson's collection has the elytra more ample, immaculate, and the sutural angle blunted.

LV.—*On a Carboniferous* Hyalonema *and other Sponges from Ayrshire.* By Professor J. YOUNG and Mr. J. YOUNG, F.G.S.

[Plates XIV. & XV.]

THE rotten limestones of Cunningham Baidland, near Dalry, in Ayrshire, were well known to Glasgow geologists, but, singularly enough, the value of their contents was unknown till the spring of 1876, when Mr. John Smith, of the Eglinton Ironworks, Kilwinning, washed the powdery débris and obtained, besides brachiopods, corals, &c., a quantity of sponge-spicules, which he submitted to us for identification. We exhibited Mr. Smith's collection to the British Association at its Glasgow Meeting in Sept. 1876, and in autumn to the Natural History Society. As no siliceous sponges had previously been found in our Carboniferous strata, we referred the spicules provisionally to M'Coy's Silurian genus *Acanthaspongia*. In the same strata *Serpula parallela*, M'Coy, is abundant; and as a continental palæontologist, whose name we have unfortunately lost, had already identified this fossil as a glass sponge allied to *Hyalonema*, we suggested that the spicules and the glass rods might possibly be found to belong to the same organism.

In the 'Catalogue of Western Scottish Fossils,' prepared for the British Association Meeting of 1876, one of us briefly referred to the spicules and our conjecture of their being a part of a *Hyalonema*; but, in defect of direct evidence, the fossils were catalogued "*Acanthaspongia Smithii*, Y. and Y.,=

Hyalonema (*Serpula*) *parallelum*, M'Coy." Soon afterwards we found hexactinellid spicules on the same slab with *H. parallelum* (Pl. XIV. fig. 4), and rods identical with that fossil terminating in anchoring spicules (figs. 15, 16, 17). Nail-like and sexradiate spicules we had previously found in a matted mass (fig. 30).

The plates accompanying this paper were prepared early in the present year, and therefore do not include all the varieties which have since come into our possession through the kindness of Messrs. Smith and Armstrong. Mr. H. J. Carter, who published a preliminary note in the 'Annals' for September, and with whom we have since been in correspondence, has courteously postponed the publication of his second communication till we have made public the results at which we had previously arrived. The present communication has been delayed in the hope of obtaining further information as to the geological and chemical conditions under which the strata were deposited and subsequently altered; but as the accumulation of this kind of evidence is necessarily a slow process, we do not think it right longer to hold back our notes. We shall commence with the form which first secured our attention.

1. *Hyalonema Smithii*, Y. & Y.

Serpula parallela, M'Coy.
Acanthaspongia Smithii, Y. & Y.

Sponge-body unknown. Spicules of three kinds:—*a*, nail-like, some with four tapering, generally unequal, arms, a fifth projecting at right angles to these, others approaching the sexradiate type by the projection of a rounded, sometimes stalked, process opposite to the fifth; *b*, sexradiate, with the arms of various sizes but always projecting, and of various number, either by reduction or by the adhesion of other spicules; *c*, long, smooth, slender, tubular rods (the *Serpula parallela*, M'Coy), tapering towards the extremity and ending in the anchoring hooklets, the tip of the rod being either not, or only slightly, inflated. The rods are of unknown length, the longest fragments found at Trearne being 12 inches, and of various thicknesses from one fortieth of an inch to nearly a line in diameter; the central canal is capillary, making up from one sixth to one eighth of the total diameter. The fragments bearing the anchoring hooklets are from one eighth to five eighths of an inch in length. The sexradiate spicules range from one fourth to one eighth of an inch in diameter; the nail-like spicules from three eighths to one sixteenth of an inch in diameter.

Locality. Cunningham Baidland, Dalry, Ayrshire.

We have referred this sponge to *Hyalonema* rather than to *Rossella*, because the rope is shorter and the spicules are larger, though, on the other hand, the rods are smooth as in *Rossella*, not spinulose as in *Hyalonema*. The combination of characters might be less marked were we able to appropriate to our species the other kinds of spicules proper to it. The sponges previously found in British Palæozoic rocks are M'Coy's Silurian genus *Acanthaspongia*, Salter's Silurian genus *Amphispongia*, and Salter's Silurian genus *Protospongia*, the latter of which is placed by Zittel alongside of *Steganodictyum*, the two former, the first certainly, being referred to the Lyssakina of Marshall, in which *Hyalonema* is placed; but we do not propose to discuss their affinities so long as the information at our disposal is incomplete. We regret, however, that Zittel has (N. Jahrbuch, 1877, p. 371) placed our species in the subgroup Monakidæ of Marshall, and thus removed it from the Pollakidæ, among which *Rossella* and *Hyalonema* are found. While we think *H. Smithii* a good species, we do not say it is the only one. The variety in size of the sexradiate spicules is not necessarily a proof of specific diversity; it may only correspond to variety in age and size of the individuals. Among the many parcels of the rotten limestone which Mr. Smith has distributed, some may yield combinations of spicules *in situ*, throwing light on the specific unity or diversity.

The mode of fossilization of these objects is interesting. The rope is very widely distributed throughout the Scottish Limestones, and in all cases is siliceous; but its condition varies: on the one hand it is only slightly more opaque than the rope of recent forms; on the other, the siliceous material may (figs. 5, 6) have deserted its proper place and be found outside a circular empty tube in whose middle a siliceous rod represents the once empty canal. Again, the concentric lamination of the recent forms may be recognizable (fig. 9) even though the rod be compact, horny, and yellow; while, on the other hand, a rod of botryoidal chalcedony (fig. 10) may represent the once homogeneous cylinder. In fig. 1 some of the dark lines represent spaces from which the rods have disappeared, an irregular congeries of chalcedony spheroids taking their place. Lastly, another though rare modification is that by which (especially in the sexradiate spicules) the siliceous matter assumes a granular form. Evidence of the pressure to which the fossil has been subjected is given by the longitudinal grooves which adjacent rods have imprinted on each other, whether the pressure resulted from compression or from expansion of the silica during metamorphosis.

The following are the localities in which portions of *Hyalonema* are found besides Cunningham Baidland:—Auchenskeoch, Dalry, in shale, rope abundant in 3 or 4 inch lengths, spicules very rare; Howrat Quarry, Dalry, in limestone, rope only; Dockra, Hillhead, and Trearne quarries, near Beith, in limestone, rope; Waterland Quarry, Dunlop, Ayrshire, in weathered limestone, rope and spicules; Brockley, Lesmahagow, in shale, rope; Corrieburn, on the Campsie Hills, in shale, rope; Bathgate, in limestone and shale, rope; Chapel Quarry, near Kirkaldy, Fifeshire, in limestone on nearly the same horizon, rope. Doubtless the rope is found in many other districts, but the spicules, though found in one or two places by the Geological Survey, have only been got in abundance and good preservation in the Dalry district.

2. Haplistion, nov. gen. (Pl. XV. figs. 31–37.)

General form massive, spheroidal, attached (?). Skeleton composed of close-set similar fibres, which are collected into more compact bundles, and end at the surface with truncated extremities, between adjacent oscula or groups of oscula, this arrangement giving the fossil a very rugose aspect. Oscula numerous, inconspicuous, leading into canals which traverse the mass without forming definite cellular planes. No terminal aperture or internal cavity visible.

Species *Haplistion Armstrongi*, n. sp.

Size. Length five eighths, breadth three eighths of an inch.

Locality. Cunningham Baidland.

The three examples figured (the only ones which we possessed last year), a fourth belonging to Mr. Armstrong imbedded in a cake-like flint nodule, and a fifth which we believe identical, found at Arbigland by Mr. J. Thomson, are the only specimens of whose existence we are aware. No spicules have been recognized as belonging to the fossil, though the teazed-out tissue lining the canals in fig. 34 has a tantalizing suggestion of spicules about it. The curiously parallel fibres, which seem to be not spinulose, terminate in the knobs (figs. 32, 33), so as to suggest the possibility of their having once projected free from the surface like the whiskers of *Labaria.* The sponge (figs. 31, 32, 33) is siliceous. Figs. 34–37 represent two which have undergone the change above referred to, having assumed a granular aspect, the distinctness of the component parts being at the same time impaired. It is not, therefore, absolutely certain that we have to do with a siliceous sponge; it may be that a horny sponge like *Dysidea* has become silicified, as have the brachiopod shells in the same deposit. The absence of a central cavity may be due to pressure by which the canals in fig. 34 are reduced in number, and certainly such pressure would affect a horny more readily than a siliceous sponge. The original of fig. 31 is of a greyish-white colour, and under the microscope has the look of grey pumice, so dry and harsh does it seem. We have been unable to separate fibres for examination by transmitted light, and doubt if they are sufficiently translucent to show any thing.

We have dedicated the species to Mr. J. Armstrong, a Glasgow palæontologist, to whom we owe this and many other interesting forms.

3. *A Species of the Group* Gummina.

The spicules (figs. 18, 28, 42, 43) so closely resemble the biternate spicules figured by Schmidt and others from *Corticium candelabrum*, that, though no birotulate spicules have been found, we think ourselves justified in referring these fossils to an allied genus. They are of gigantic size as compared with living forms; but they are so important a feature of the rotten limestone that we would name them provisionally *Chlamys magna*, so as to help future collectors and, it may be, hasten their identification with the parent organism, though the composition of the Gummina renders this last improbable. The drawings for this paper were completed in February last, before we had recognized their probable nature. We have now large series of specimens, which we shall illustrate later.

Locality. Cunningham Baidland.

4. *Incrusting Sponge?*

Plate XV. fig. 41 represents a curiously branched fragment which one of us (Mr. Young) thinks may be an incrusting sponge encasing an organism whose decay has left a hollow cast. These fragments are numerous, and present considerable diversity of form; but their structure is the same, granular and tinged yellow with iron. They have evidently undergone considerable metamorphism.

Mr. Carter has described ('Ann. & Mag. Nat. Hist.' 1873, xii. p. 458) a condition of the vitreohexactinellid sponges in which the vitreous fibre has become hollow by absorption of the hexactinellid spicules, and even of the vitreous fibre itself in part. There is no proof of any Carboniferous sponge belonging to the *Aphrocallistes* group; but it is possible that our fig. 41 may represent a fragment of *Haplistion* incrusted with siliceous matter which had or acquired the granular condition, and which has since been removed, leaving a hollow core to the incrustation (*cf.* Pl. XIV. figs. 5, 6).

5. *Unrecognized Forms.*

We have given a large number of drawings with the view of calling attention to certain forms whose identity is obscure or unknown to us.

A. Figs. 38–40 are of objects which we at first thought to belong to *Haplistion*; but we are now doubtful of the reference. They are silicified plates enclosing irregular cavities. They may be fragments of the skeleton of a hexactinellid sponge whose nail-like spicules have become deformed by siliceous deposit; but the possibility of their radiolarian character has been suggested.

B. The series figs. 42–51 represents objects which have some resemblance to part of the foregoing; but their variety is considerable, and we have not space to illustrate all the types.

C. The stellate spicules (figs. 13, 18, 19, 24, 26, 27, 29) have probably dropped out from other sponges. These spicules are of three kinds:—1, smooth (figs. 13, 18, 19, 26); 2, pustulate (figs. 27, 29); 3, cushioned (fig. 24). It is impossible to refer them to any of the species we have described; they may, indeed, be parts of forms not yet recognized.

Geological Position of the Sponges.

The Carboniferous Limestone in West Scotland is divided into an upper and lower series by a mass of coals, ironstones, and shales, which are in part replaced in North Ayrshire by volcanic rocks. The Lower Limestones are again divided into an upper and lower group by from 10 to 40 feet of shales. The beds at Cunningham Baidland in which the sponges were found belong to the upper member of the Lower Limestones, in which group also volcanic rocks occur. The limestones show, when undenuded, a thickness of 40 feet (R. Craig "On the Carboniferous Basin of Dalry," Trans. Geol. Soc. Glasgow, iii. p. 275); but at Cunningham Baidland the quarry-section shows only between 20 and 30 feet. The rock is very much jointed, traversed by vertical fissures; and slicken-sided faces abound. At the north end of the quarry a narrow dyke of dolerite runs nearly east and west. These limestones are among the most fossiliferous in West Scotland; but the organisms are not equally distributed. Certain layers abound in the remains of Corals of different genera and species; in others Brachiopods, *Productæ*, &c. are the chief feature, along with Polyzoa and Ostracoda; while another group is almost exclusively made up of the remains of large Crinoids. Cephalopods and Gasteropods are rare in this series of limestones; and the teeth of Placoid fishes are only occasionally met with. The Sponge-remains are not confined to a single horizon, though they appear to be more common in the shelly limestone. Neither are they restricted to the purer limestones, being found in the calcareous shales as well. The Central Scottish limestones were not deposited in so deep a sea as that in which the English limestones were laid down; and in the west of Scotland there is evidence of repeated oscillations, whose occurrence goes against the supposition that the water was deep. The shales which separate the sponge-bearing limestones from the inferior division of the Lower Limestone series are argillaceous and bituminous, with beds of foul coal and of volcanic ash; while above the upper division of the same series (that is, above the sponge-bearing beds), as at Trearne, *Stigmaria* and other coal-plants with carbonaceous shales tell of recurrent land and shallow water. From these considerations and from comparison of the list of fossils given by Mr. Craig in the paper above referred to, we do not think the *Hyalonema* lived in such deep water as do some, at least, of its modern representatives—not all, if *H. cebuense*, Higgins, was obtained by diving; for, as Mr. Higgins says, the depth could not, then, have exceeded 60 feet.

It is in the joints and fissures of the Cunningham-Baidland limestone that the sponges and other fossils have been found in most perfect condition amongst the weathered débris of the rock. The limestone in this quarry and generally throughout the district is greyish white; but the rotten limestone of the fissures is dark reddish brown, the colour being found, on analysis, to be due to the presence of iron associated with three or four per cent. of manganese. Distributed throughout the limestone in this and other quarries where it is worked are thin bands and nodular masses of greyish flint which enclose the organisms of the deposit, and which seem to have been formed by chemical segregation from silica in solution. Mr. R. O. Wood has suggested as the source of part, at least, of this silica, the volcanic rocks and ashes which are so plentiful in the superjacent strata; and the existence of thermal springs may also have had a share, as was suggested by Prof. Ramsay in the case of many of our altered Scottish limestones. To the possible presence of thermal springs Mr. Young is inclined to attribute the abundance of corals met with on this horizon throughout the western district. It is worthy of note that some of the apparently good limestones are unfit for the furnace, on account of the quantity of silica which cements the organisms. The masses of flint seem in places to have squeezed the matrix around them as if by expansion. The calcareous organisms enclosed are entirely silicified, the calcite being wholly replaced.

EXPLANATION OF PLATES XIV. & XV.

[All the figures were drawn by camera lucida. Fig. 4 is natural size; the actual sizes of the others are indicated alongside of the figures.

I omitted to tell the lithographers that the plates had been drawn seven months ago, and had not been retouched. Where the finer lines were found to have disappeared the lithographers took every pains to compensate for my neglect.]

A., specimens in Mr. Armstrong's Cabinet; S., in Mr. Smith's; Y., in Mr. Young's.

Fig. 1. *Hyalonema Smithii,* n. sp. Fragment of rope. Cunningham Baidland. Y.

Fig. 2. End view of same specimen.

Fig. 3. *H. Smithii.* A few of the rods, enlarged, to show varying diameters in bundle.

Fig. 4. The same, showing sexradiate spicules alongside of rope. Auchenskeoch. Y.

Figs. 5 and 6. The same, showing removal of rod and replacement of central canal by siliceous rod. Y.

Figs. 7 and 8. The same, transverse section of rods. Y.

Fig. 9. The same, vertical section of rod, showing central canal and striæ answering to concentric layers. Y.

Fig. 10. The same, botryoidal structure. Y.

Figs. 11, 12, 12 *a*, 14, 20, 21, 22, 23. The same, sexradiate spicules of various types. Y.

Figs. 13, 19, 26. The same, stellate spicules, smooth. Y.

Figs. 15, 16, 17, 25. The same, anchoring hooklets. Y.

Fig. 24. Stellate spicule, cushioned. Y.

Figs. 27, 29. Stellate spicules, pustulate. Y.

Figs. 18, 28, 42, 43. *Chlamys magna.* Biternate spicules. Y. and S.

Fig. 30. *Hyalonema Smithii.* Nail-like spicules matted together in position.

Fig. 31. *Haplistion Armstrongi,* n. sp. A.

Figs. 32, 33. The same. Successive enlargement of part of surface of fig. 31. In fig. 33 the simple fibres are well seen, and their truncated ends on the knobs.

Figs. 34, 35. The same. Opposite faces of another specimen, showing oscula and internal canals. A.

Fig. 36. The same. Enlargement of part of fig. 34.

Fig. 37. The same, showing unusually prominent ridges. A.

Figs. 38, 39, 40. Undetermined forms. S.

Fig. 41. Incrusting sponge?, hollow, tubular. Y.

Figs. 44–51. Various branching forms from the rotten limestone. S.

LVI.—*Preliminary Notes on new Fishes collected in Japan during the Expedition of H.M.S. 'Challenger.'* By Dr. A. GÜNTHER, F.R.S., Keeper of the Zoological Department, British Museum.

THE collection of fishes made during the expedition of H.M.S. 'Challenger' having been intrusted to me for examination, I própose to give preliminary diagnoses of the fishes of some of the faunistic districts, as the execution of the plates will, of necessity, retard the publication of the complete account. Typical specimens of the species described will be deposited in the British Museum after the completion of the work.

Centrophorus squamulosus.

Snout much produced, the mouth being nearly midway between the first gill-opening and the end of the snout. The distance between the nostrils is two fifths of the length of the præoral portion of the snout. The labial fold extends a little way along the margins of the mouth. Pectoral short, with the lower angle rounded, not produced. The first dorsal small; its base (without spine) is shorter than that of the second, and nearly one sixth of the distance between the two fins. Spines very small, scarcely projecting beyond the skin. Extremity of the ventral fins below the end of the second dorsal. The scales are tricuspid, with a median keel, and so minute as to give a velvety appearance to the skin. Uniform deep black.

Off Inosima.

Centrophorus foliaceus.

Snout much produced, the mouth being nearer to the first gill-opening than to the end of the snout. The distance between the nostrils is two sevenths of the length of the præoral portion of the snout. The labial fold extends a little way along the margins of the mouth, the angle of the mouth being received in a deep longitudinal slit of the skin. The anterior teeth of the upper jaw triangular, erect; the lateral slightly oblique; they are arranged in two regular rows. No median tooth in the lower jaw. Pectoral short, with the lower angle rectangular, not produced. Dorsal spines strong, nearly as high as the fins. The first dorsal rather lower than the second, but with its base longer, the length of the base (without spine) being two fifths of the distance between the two fins. Extremity of the ventral fin a little behind the dorsal spine. The scales are pedunculated, terminating in three spines, of which the middle is the longest, corresponding to a strong median keel of the scale. Uniform greyish.

Off Inosima.

Raja isotrachys.

Snout rather produced, the anterior margins meeting at nearly a right angle. The width of the interorbital space equals the length of the orbits. The distance between the outer margins of the nostrils equals their distance from the end of the snout. Teeth small, each with a point directed backwards towards the interior of the buccal cavity. Outer pectoral angle rounded; but the margins of the fin would meet at a right angle. Body and tail entirely covered on the upper surface with minute asperities, each with a stellate base. No spines on the superciliary margin. A single small spine in the middle of the back. A series of rather strong spines (eighteen) along the median line of the tail, none on the sides. Upper parts uniform brownish grey; lower parts smooth, brownish black.

Coast of Southern Japan.

Sebastes macrochir.

D. 14 | $\frac{1}{9}$. A. $\frac{3}{5}$ P. 17/5. L. lat. ca. 45.

The height of the body is contained thrice and one fourth in the total length without caudal; the length of the head twice and a half. Scales rather regularly arranged. Eye very large, one third the length of the head, much longer than the snout. Mouth wide; the maxillary extending to behind the middle of the eye. The bands of intermaxillary teeth are of moderate breadth; but those of the vomer, palatines, and mandible are very narrow. Interorbital space flattish, scaleless, narrow, its width being only two fifths of the diameter of the orbit. Occipital region flat, with some rudimentary scales. A series of spines runs along each side of the forehead and occiput. It consists of a spine in front of the orbit, three above it, and two on each side of the occiput. Infraorbital ridge with strong spines. Præoperculum with five pointed spines on the margin. Each ramus of the mandible with five large muciferous apertures. Dorsal spines rather feeble; the third to the sixth are the longest, two fifths of the length of the head. Anal spine stronger, but shorter than the longest of the dorsal. Caudal truncated. The pectoral fin is extremely broad, the five or six lower rays being elongated beyond the extremity of those next above them. Their extremities are somewhat thickened; and they, like the similar outer ventral rays, serve as an organ of locomotion. The pectoral rays extend to the ventral rays beyond the vent. The latter are as long as the head without snout.

Red, with a large black spot on the posterior half of the spinous dorsal, and with another between the anal spines.

Inland Sea.

Sebastes oblongus.

Allied to *S. inermis* and *pachycephalus.*

D. 12 | $\frac{1}{12}$. A. $\frac{3}{5}$. L. lat. ca. 65.

The height of the body is contained thrice and a half in the total length without caudal; the length of the head twice and three fifths. The scales are rather irregularly arranged, and much smaller above than below the lateral line; on the upperside of the head they advance to the nostrils, very minute ones covering even the præorbital. The snout is pointed and much longer than the eye, the diameter of which is one sixth of the length of the head, and equal to the width of the flat interorbital space. None of the spines on the upperside of the head project; and those of the præoperculum are obtuse and denticulated. The teeth form broad villiform bands in the jaws as well as on the vomer and palatine bones. The maxillary reaches to the vertical from the hind margin of the eye. Dorsal spines strong; the fourth to the seventh are the longest, two fifths of the length of the head. Anal spines stronger, but much shorter than the longest of the dorsal. Brownish marbled with darker; lower parts and all the fins with brown spots; an oblique brown streak from the præorbital towards the angle of the præoperculum.

Inland Sea.

Scorpæna miostoma.

Allied to *Sc. zanzibarensis* and *Sc. longicornis,* but with a considerably narrower mouth.

D. 11 | $\frac{1}{10}$. A. $\frac{3}{5}$. L. lat. 45.

Palatine teeth; the vomerine teeth form a simple open V-shaped band. The height of the body is less than the length of the head, which is contained twice and one third in the total length without caudal. Head nearly entirely scaleless. Upper jaw slightly overlapping the lower. Orbital tentacles broad, fringed, shorter than the eye, which equals the length of the snout. Interorbital space deeply concave, with a pair of slight ridges within its concavity. Vertex with a quadrate depression, which is rather broader than long and surrounded by spines. *The maxillary does not extend backwards to below the middle of the eye.* All the cutaneous appendages on the head, body, and fins are well developed. The fourth and fifth dorsal spines are the longest, two fifths of the length of the head, and equal to the second of the anal fin, which, however, is stronger. Eight of the pectoral rays are branched. Body and fins marbled with the usual colours of this genus, but without any peculiar markings. The axil of the pectoral is scarcely spotted; and the lower part of the head is white.

Market of Yokohama.

Polymixia japonica.

D. $\frac{5}{34}$. A. $\frac{4}{16}$. V. 1/6. L. lat. ca. 60. L. transv. 8/17.

The upper jaw projects more beyond the lower than in either of the two other species. The maxillary extends to below the hind margin of the eye, which is one third of the length of the head. Six vertical series of scales on the cheek. Ventral fins short, rather more than one third of the length of the head. Top of the dorsal and extremities of the caudal lobes black.

Off Inosima.

Platycephalus rudis.

D. 1 | 8 | 11. A. 11. L. lat. ca. 70.

The length of the head is one third of the total without caudal; and its width between the præopercular spines is more than one half of its length. All the bones on the upper surface and the scales covering its sides are rough. The space between the eyes is concave, its width being one half of the vertical diameter of the eye. Superciliary edge serrated; ridges with distant spines along the infraorbital and above the operculum, the central ridges of the crown of the head being rather obscure. Opercular ridge not serrated. Three spines at the angle of the præoperculum, the lower of which is the smallest, the upper the longest, but only half the length of the eye. Only the foremost part of the lateral line is spiny. Ventral fins reaching to the anal. Greyish, with black dots on the trunk and operculum. The spinous dorsal and ventral black, the second dorsal and pectoral with blackish dots. Caudal irregularly marbled with blackish.

Market of Yokohama.

Gobius yokohamæ.

D. 6 | 11. A. 11. L. lat. 26.

The height of the body is contained four times and a half in the total length (without caudal); the length of the head thrice and three fourths. Snout obtuse, as long as the eye, the diameter of which is more than one fourth of the length of the head. Eyes very close together; mouth oblique, with the jaws subequal in front, reaching to below the front margin of the eye; a very small canine tooth on each side of the lower jaw; head and occiput naked, but nape covered with small scales. A wide pore in front and behind the interorbital space, and two others behind the eye; they are the openings of the muciferous channels. Seven longitudinal series of scales between the second dorsal and the anal; the ventral fin terminates at some distance from the vent, which is midway between the root of the caudal and the præoperculum. Dorsal fins rather lower than the body; caudal slightly pointed, as long as the head. Light brownish olive, with a series of five brown spots along the lower half of the body, the last being on the root of the caudal and the most distinct; a triangular black spot occupies the lower angle of the operculum; gill-membrane on the throat blackish.

Small as this species is ($2\frac{1}{2}$ inches) it is adult, a female, having the ovaries fully developed.

Yokohama Bay.

Lepidopus tenuis.

D. 126. A. 71.

This species is distinguished at the first glance by the extraordinary slenderness of the body, the depth of which is not much more than one fourth of the length of the head; the latter is two fifths of the length of the trunk, and one seventh of the total. The lateral teeth are comparatively stronger and fewer in number than in *L. caudatus.* The terminal portion of the tail becomes so slender that its entire depth is occupied by the mucous canal of the lateral line, which is very wide. Caudal fin very small. The anterior anal rays are not free, but hidden below the skin. Uniform silvery.

Off Inosima.

Sirembo grandis.

Head rather short and broad, with obtuse snout overlapping the lower jaw. Eye small, about one third the length of the snout, and one eleventh of that of the head. Mouth rather wide, the maxillary extending to behind the eye, barbels none. Teeth of the jaws, vomer, and palatine bones in villiform bands. Nostrils gaping, oval openings, of which the anterior is surrounded by a membranous wall. Præoperculum crescent-shaped, without any armature; operculum with a strong spine above.

Scales minute; also the entire head, even the space between the nostrils, covered with minute scales. Lateral line indistinct for the greater part of its course.

The dorsal fin is, like the anal, enveloped in a thick, scaly skin. It commences with short rays above the middle of the pectoral fin. The pectoral is rounded, broad, and remarkably short, about half as long as the head. Ventrals inserted below the angle of the præoperculum, at some distance behind the symphysis of the humerus. Each ventral filament is bifid, the inner part being the longest. Distance of the vent from the root of the pectoral more than the length of the head.

Brown; darker behind, lighter in front. Fins blackish. Cavity of the mouth grey, peritoneum black.

Total length $29\frac{1}{2}$ inches, length of the head $5\frac{3}{4}$ inches, length of ventral filament 3 inches. Distance of the vent from the snout $12\frac{1}{2}$ inches.

South of Yeddo.

Macrurus macrochir.

1 D. 11. V. 7.

Snout produced, tetrahedral, rather longer than the large eye; a bony ridge runs along the median line of the upper side of the snout, and a fold of the skin along that of the anterior side. Interorbital space slightly convex, its width being somewhat more than the diameter of the eye. Infraorbital ridge low. Mouth rather wide, more lateral than in the other species of this genus. Barbel very small. Teeth "*en carde*," in a narrow band in the upper jaw, and in a single series in the lower. No scaleless fossa on the side of the temple. The two limbs of the præoperculum meet at a somewhat acute angle, which is produced backwards.

The second dorsal spine is smooth and slender; and the second dorsal fin commences at a distance behind the first which is about one half of the length of the head. Pectoral fin remarkably long, extending to the origin of the second dorsal, and equal in length to the head the snout not included. The outer ventral ray not produced.

Scales rather thin, with from eight to ten finely crenulated radiating ridges, which do not project beyond the margin of the scale. There are five scales in a transverse series between the first dorsal and the lateral line. The head is covered with similar radiated scales, but irregular as regards size and arrangement; lower limb of the præoperculum scaly.

Brownish black.

Off Inosima.

Macrurus parallelus.

1 D. 10. V. 7.

Snout much produced, subtrihedral, pointed, nearly twice as long as the large eye. Scales with five or even seven spiny ridges, which are nearly parallel to one another, and of which the middle one is the strongest, terminating in a more or less strongly projecting spine. Head covered all over with irregular, spiny, tubercle-like scales, of which those along the infraorbital crest and along two lines on each side of the crown of the head are the strongest. There are five scales in a transverse series between the first dorsal and the lateral line. No scaleless fossa on the temple. Outer ventral ray produced into a short filament.

Off Inosima.

Coryphænoides longifilis.

1 D. 13. A. 9.

Snout as in a *Gadus*, swollen, obtuse, not projecting beyond the mouth, the jaws being equal. Eye rather large, but shorter than the snout, the length of which equals the width of the interorbital space. Mouth very wide, extending nearly to below the hind margin of the eye. Teeth of the outer series in the upper jaw much stronger than the others; those of the lower strong, in a single series. Barbel minute. Præoperculum with the hind margin not excised, with the angle rounded, and both limbs scaly.

Scales rather thin and small, with about five feeble radiating keels. There are thirteen or fourteen scales in a transverse series between the first dorsal and the lateral line. The second dorsal spine is feeble, somewhat produced, obscurely denticulated in front. The second dorsal fin commences immediately behind the first. Pectoral much prolonged, as long as the head. The outer ventral ray produced into an exceedingly long stiff filament. Brownish black.

South of Yeddo.

Coryphænoides altipinnis.

1 D. 12. V. 9.

The snout is rather short, slightly projecting beyond the mouth, with a prominent tubercle in the middle. Eye large, not much shorter than the snout, or than the width of the interorbital space. Mouth extending beyond the middle of the eye. Teeth of the outer series visibly stronger than the remainder. Barbel shorter than the eye. Præoperculum with the hind margin not excised, and with both limbs densely scaly.

Scales with five radiating spiny ridges, the spines being very small. There are eleven or twelve scales in a transverse series between the first dorsal and the lateral line. Second dorsal spine considerably produced, armed in front with rather distant barbs. The second dorsal fin commences at a short distance behind the first. The outer ventral ray produced into a filament.

South of Yeddo.

Coryphænoides nasutus.

D. 11 | 95. A. 110. V. 10.

Snout obtusely conical, with a rather sharp upper edge, and with a projecting barb in the middle. The snout projects beyond the mouth, the cleft of which does not quite reach to below the middle of the eye. The teeth of the outer series are scarcely stronger than the remainder. Barbel very small. The width of the interorbital space is not quite equal to the vertical diameter of the eye.

The scales are equally rough over the whole of their surface, the spinelets being subequal in size, densely packed, and not arranged in series. There are seven or eight scales in a transverse series between the first dorsal and the lateral line. Second dorsal spine somewhat produced, armed along its anterior edge with barbs pointing upwards and rather closely set. The second dorsal fin commences at a considerable distance behind the first, the distance being equal to the length of the head. The outer ventral ray produced into a long filament.

South of Yeddo.

Coryphænoides asper.

1 D. 11. V. 10–11.

Snout short, slightly projecting beyond the mouth. Eye of moderate size, not much shorter than the snout. Interorbital space flat, wider than the eye. Mouth extending to below the middle of the eye. Teeth of the outer series stronger than the remainder. Barbel rather shorter than the eye. Præoperculum with the hind margin not excised, and with both limbs densely scaly.

Scales with five radiating series of strong and low spines.

There are six scales in a transverse series between the first dorsal and the lateral line. Second dorsal spine considerably produced, armed in front with rather distant barbs. The second dorsal fin commences at a short distance behind the first. The outer ventral ray produced into a filament. Black.

South of the Philippines and Japan.

Coryphænoides leptolepis.

1 D. 10. V. 9.

The snout is rather long; but its front portion projects but slightly beyond the mouth. The eye is comparatively small, about half the length of the snout, and much less than the width of the interorbital space. Mouth wide, extending to below the hind margin of the eye. The teeth of the outer series are much stronger than those of the villiform band. Barbels as long as the eye. The præoperculum with the hind margin excised, and with the angle rounded and produced backwards; in young examples the lower margin is toothed. Lower limb of the præoperculum scaleless.

Scales thin and deciduous; most with five or seven radiating keels, some, especially on the back, nearly or quite smooth. There are seven or eight scales in a transverse series between the first dorsal and the lateral line. Second dorsal spine slightly produced, with barbs in front, which are rather distantly arranged. The second dorsal fin commences at a short distance behind the first. The outer ventral ray produced into a long filament.

Off the coasts of Brazil and Japan, Mid-Pacific.

Coryphænoides villosus.

1 D. 10. V. 7.

Snout compressed, very slightly projecting beyond the mouth, short, not longer than the eye, which is of moderate size. Interorbital space broader than the eye. Mouth rather small, not extending to below the centre of the eye. Infraorbital ridge very obsolete. Teeth in villiform bands in both jaws. Barbel very small and slender.

The scales are armed with erect spines, which give to the body the appearance of being covered with short villosities. A series of stronger spines runs along each side of the base of the second dorsal and anal fins. The second dorsal spine is very slender, smooth; the second dorsal fin commences immediately behind the first. The outer ventral ray produced into a very short filament. Blackish.

South of Yeddo.

Pleuronectes yokohamæ.

D. 68–72. A. 52.

The height of the body is contained twice and one sixth in the total length (without caudal); the length of the head four times. Snout shorter than the eye, the diameter of which is one fifth of the length of the head; lower jaw prominent; maxillary as long as the eye; the upper jaw with a series of fifteen truncated teeth on the blind side, none on the other; eyes separated by a very narrow space covered with rudimentary scales. Scales small, cycloid, imbricate, larger about the lateral line than elsewhere; the anterior curve of the lateral line is strong in an adult specimen, but much more open in a young one; its width equals the length of the pectoral; pectoral more than half as long as the head; ventrals entirely separate; fin-rays smooth; the dorsal commences immediately behind the front margin of the orbit. The free portion of the tail much higher than long. Gill-rakers very short, aboutten on the first branchial arch. Blackish brown, uniform or indistinctly mottled with darker. In the young specimen the rays of the vertical fins are dotted with brown, five or six of them (of the dorsal as well as of the anal) having a broad black ring. In the adult example those fin-rays are uniformly coloured, only traces of the dark rings being still visible.

Yokohama Bay.

Leuciscus hakuensis.

D. 10. A. 10. L. lat. 73. L. transv. 15/14.

The height of the body is one fourth of the total length (without caudal); the length of the head two ninths. The diameter of the eye is one fifth of the length of the head, and two thirds of the length of the snout, or of the width of the interorbital space. The head is remarkably small, with narrow, pointed snout, the cleft of the mouth being oblique and not reaching to the front margin of the eye. Upper jaw overlapping the lower. Origin of the dorsal fin above the root of the ventrals, midway between the snout and the root of the caudal fin; fins generally small and short, the pectoral being not more than one half of its distance from the ventral. Scales very indistinctly striated; there are eight longitudinal series between the lateral line and ventral fin. Pharyngeal teeth 5 | 2, pointed. Coloration uniform.

Lake Hakou.

Family **Bathythrissidæ.**

Body oblong, with rounded abdomen, covered with cycloid scales; head naked; barbels none. Margin of the upper jaw formed by the intermaxillaries mesially, and by the maxillaries laterally. Opercular apparatus complete. Adipose fin none; dorsal fin much elongate, many-rayed; anal fin short. Stomach with a blind sac; pyloric appendages numerous. Gill-apparatus well developed; pseudobranchiæ; gill-openings wide; an air-bladder. Ova very small; ovaries without duct.

Bathythrissa.

Body covered with scales of moderate size. Head narrow, oblong, with the muciferous channels much developed. Eye large. Mouth narrow, coregonoid, with bands of minute teeth imbedded in the thick lips; maxillary with a marginal row of very small teeth. Caudal fin forked, with a dense layer of small scales. Air-bladder with very thick walls, terminating in two short h[illegible]s in front, pointed behind.

Bathythrissa dorsalis.

B. 6. D. 56. A. 12. V. 9. L. lat. 112. L. transv. 8/13. Cæc. pylor. 14.

The general aspect of this remarkable fish is that of a much elongate *Coregonus*, its greatest depth being one fifth of the length of the body (without caudal). The head is low, elongate, one fourth of that length; the large eye, the diameter of which is rather more than one fourth of the length of the head, occupies nearly the middle of its length, slightly encroaching upon the upper profile. The width of the interorbital space is much less than the diameter of the eye. Snout projecting beyond the mouth as in a *Coregonus*; mouth laterally extending to below the anterior nostril; the labial fold of the mandible does not extend across the symphysis. Nostrils close together, separated by a membrane only. The muciferous channel of the infraorbital is longitudinally divided by a straight ridge; angle of the præoperculum somewhat produced backwards; operculum small; sub- and interoperculum narrow.

Scales very regularly arranged; lateral line straight, running along the middle of the tail.

The vent is situated far backwards, its distance from the caudal being less than the length of the head.

The dorsal fin is low, but the anterior rays are somewhat the longest; it commences above the middle of the pectoral, and terminates above the middle of the anal. Also the anal rays are short, the anterior being the longest. The caudal fin is deeply forked, densely covered with scales. The pectorals are more, the ventrals less than half as long as the head. Ventrals inserted midway between the anal and the head.

Upper parts brownish, shining silvery; lower parts silvery, minutely dotted with brown.

Off Inosima.

Salmo macrostoma.

B. 12. D. 13. A. 14. L. lat. ca. 130.

This fish is distinguished by its remarkably pointed snout, the upper jaw being rather the longer, and by its wide oblique mouth. The narrow and slightly curved maxillary extending considerably behind the hind margin of the orbit. The head is small, only one fourth of the total length without caudal. Eye small, nearly one seventh of the length of the head. Teeth rather small; one pair on the head of the vomer is followed by three or four other small teeth, arranged in a series. Præoperculum crescent-shaped, without lower limb. Body rather deep; its depth being equal to the length of the head. There are sixteen or seventeen scales in a series obliquely descending from behind the adipose fin to the lateral line. Dorsal fin but little higher than long. Caudal fin deeply emarginate. Silvery; with nine parr-marks along the lateral line, and with several round spots above and below them on the sides.

Yokohama market.

Aulopus japonicus.

D. 15. A. 9. L. lat. 43. L. transv. $4\frac{1}{2}/6$.

The length of the head is contained thrice and one fourth in the total without caudal. The diameter of the eye equals the length of the snout, and is contained thrice and two thirds in the length of the head. Interorbital space concave, one half of the width of the eye. Maxillary extending to behind the middle of the eye. Body irregularly marbled with blackish.

Market of Yokohama.

Halosaurus affinis.

Snout much produced, but less so than in *Halosaurus rostratus*, its præoral portion being scarcely one half of its length. Eye of moderate size, one third of the postocular portion of the head, and equal to the width of the interorbital space. Maxillary not reaching to the front margin of the eye. The length of the head equals its distance from the root of the ventral, the origin of which is but slightly in advance of that of the dorsal. Nearly all the scales are lost: only some of the lateral line remain; they are much larger than the other scales; and on the tail, where the lateral line approaches the lower profile, these larger scales are separated from the anal fin by one series of small scales only. Otherwise there is the greatest similarity between this species, *Halosaurus rostratus*, and *H. Owenii*.

South of Japan.

Congromuræna megastoma.

The length of the head is two thirds of that of the trunk, the tail being longer than the body; upper jaw much projecting beyond the lower, rather pointed; mouth extending far behind the middle of the eye, which is large, two ninths or one fifth of the length of the head, and nearly two thirds of that of the snout; posterior nostril a wide, round, open aperture; length of the pectoral fin one third of that of the head; the dorsal commences above the root of the pectoral; vertical fins with a light margin; terminal portion of the tail black, extremity of the fin white.

Off Inosima.

Synaphobranchus bathybius.

Mouth and dentition as in *S. pinnatus*. Eye one half or two thirds of the length of the snout. The length of the body is contained only once and a fourth in that of the tail. The dorsal fin commences above or immediately behind the pectoral, which is only one third the length of the head. Epidermoid productions quite rudimentary, lanceolate, imbedded in the skin; cheeks naked. Dorsal and anal fins low, especially the former.

Uniform black.

Middle of North Pacific; south of Yeddo. Midway between Cape of Good Hope and Kerguelen's Land.

Synaphobranchus affinis.

Allied to *S. brevidorsalis*, from which it differs in the following points:—The length of the body is two fifths of that of the tail; root of the pectoral fin midway between the end of the snout and the vent. Dorsal fin commencing at some distance behind the vent. Pectoral of moderate length, rather less than one half of the length of the head. Epidermoid productions rudimentary, lanceolate, obliquely arranged, imbedded in the skin. Anal higher than dorsal.

Blackish brown.

Off Inosima.

Nettastoma parviceps.

Head small, its length being two fifths of the distance between the gill-opening and vent (more than one half in *N. melanurum*). Dorsal fin commencing in advance of the gill-opening. In other respects similar to the Mediterranean species.

South of Yeddo.

Monacanthus modestus.

D. 36. A. 34.

Skin velvety, without spines or bristles on the tail; the height of the body is contained twice and three fourths in the total length (without caudal); upper profile of the head convex, the gill-opening extends downwards to the level of the middle of the root of the pectoral; the dorsal spine is inserted above the posterior third of the eye; it is scarcely half as long as the head, or as its distance from the second dorsal fin; it is armed with four series of very small barbs, the two front series being very close together; the anterior half of the dorsal and anal fins elevated, somewhat higher than the dorsal spine; ventral spine fixed.

Uniform brownish grey; caudal blackish, with the inter-radial membrane whitish and without any cross bands.

Inland Sea.

MISCELLANEOUS.

M. K. A. Zittel on Fossil Hexactinellida.

To the Editors of the Annals and Magazine of Natural History.

Gentlemen,—Permit me to correct a slight mistake that has crept into Prof. Zittel's diagnosis of the scheme I adopted in the year 1870 * for the natural subdivision of the then known Hexactinellid sponge-forms, and which error is reproduced in Mr. Dallas's translation in the last number of the 'Annals.' Of the two groups of the "*Coralliospongia*" and "*Calicispongia*" then instituted by me, it was the former of the two that was made to embrace all those species distinguished by the possession of an "anastomosing

* 'Monthly Microscopical Journal,' vol. iv. p. 252, 1870.

or coherent reticulate skeleton," while with the latter were associated types in which the skeleton consisted of "isolated or loosely interwoven spicules" only. Zittel, as I find by reference to a copy of his original essay, with which he has kindly furnished me, makes it accidentally read exactly the reverse. In my original diagnosis (*l. c.* p. 252) I further proposed to characterize the group of the "*Calicispongiæ*" as possessing spicule-protected gemmules instead of both having "naked membranous gemmules" as rendered by Prof. Zittel.

W. Saville Kent.

4 Marine Terrace, St. Heliers, Jersey,
Oct. 17, 1877.

Phenomena accompanying the Metamorphosis of Libellula depressa.
By M. Jousset de Bellesme.

The author gives an extraordinary account of the mode in which *Libellula depressa* expands to its full size and extends its wings after quitting the pupa-skin. After describing the well-known process of the emergence of the insect, he inquires by what mechanism does the insect inflate itself and increase its volume to such an extent that after issuing from its little envelope it suddenly becomes double its former size.

He states that at this time the function of respiration, which is very active in the adult dragonfly, is not yet set up. There are no movements of inspiration and expiration; the abdomen is cylindrical; and the deep fold in the ventral surface of the abdomen, which he regards as essential to respiration, is not yet in existence. On dissection the air-sacs of the body are found to be empty and flaccid.

Nevertheless the inflation of the dragonfly is effected by air; and if the body is cut through with a pair of scissors it collapses in a moment like a balloon. By taking suitable precautions and dissecting the animal under water, it is found, he says, that the digestive tube here performs a most unusual physiological part. It is so much distended that it absolutely fills the whole interior of the body, pushing the other organs against the integuments. Under the influence of this energetic pressure the blood is pressed forcibly towards the periphery, distends the eyes, and gives the head its definitive form; then passing into the wing, between the two membranes, which up to this time are separate, as M. Blanchard has described them, it accumulates in the wing, unfolds it, and circulates in it, depositing the pigment which is destined to colour it. During this time the integuments, which are distended and bathed by the nutritive fluid, acquire their proper colour and solidity. It is by swallowing the air and storing it in its digestive tube, says the author, that the *Libellula* obtains the force necessary for the accomplishment of most of its transformations; and he thinks there is every reason to believe that the same thing occurs in many other insects.—*Comptes Rendus,* August 20, 1877, p. 448.

On the Termination of the Nerves in the Electrical Apparatus of the Torpedo. By M. C. ROUGET.

The author says that on examining the nervous lamina of the electrical disks of the torpedo on the ventral surface, which receives the ultimate ramifications of the pale fibres, the preparations being unaltered by any reagents, there is constantly to be observed a network formed by the division of the last branches of the pale fibres, which are ramified like stag's horns. The apparent terminations in knobs or free extremities, which may show themselves here and there in all preparations, are seen in enlarged photographs to be manifestly connected with the network by processes which elude direct observation. The solutions of continuity of the meshes which are observed in preparations treated in the fresh state with nitrate of silver or chloride of gold are not constant, and are produced by the injurious or irregular action of the reagent.

Seen on the ventral surface of the nervous lamina, the filaments which bound the meshes are smooth and have their borders regular; but when the completely isolated nervous lamina is examined on its dorsal surface, these filaments present an irregular surface, bristling with processes, which, in some cases, are seen to be arranged in regular series upon the sides of the filaments, so as to resemble the barbs of a feather. These fibrils are of the same substance as the filaments of the network from which they directly proceed; they are elementary nervous fibrils, parallel to each other, and placed perpendicular to the plane of the nervous lamina, from the ventral towards the dorsal surface; and at this end they unite to form an arcade, and constitute a last and truly terminal network, the meshes and filaments of which are scarcely one fourth of the dimensions of those of the network of the ventral surface. The two nervous networks together and the processes which unite them form a reticulated spongy layer, with meshes diminishing in size from the ventral to the dorsal surface, in which the nervous elements anastomose in arcades, and in which not a single free extremity is to be met with. —*Comptes Rendus*, August 27, 1877, p. 485.

Prof. Haeckel's Group of the Physamariæ.

Mr. W. Saville Kent, F.L.S., has remitted us a paper of considerable length, bearing for its title "Remarks upon Professor Haeckel's Group of the Physamariæ" and which, there not being space at disposal this month, will appear in a forthcoming number. These "Physamariæ," including, according to Haeckel's views, Mr. Carter's *Squamulina scopula*, Mr. Saville Kent concludes to be amply demonstrated by Prof. Haeckel's own drawings and descriptions to be true sponges, but at the same time the simplest representatives of their class yet discovered. In this simplicity they are shown to closely correspond with a single spherical "ciliated chamber" or "ampullaceous sac" of certain of the more complex types.

THE ANNALS

AND

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[FOURTH SERIES.]

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LVII.—*Report on the Echinodermata collected during the Arctic Expedition*, 1875–6. By Prof. P. MARTIN DUNCAN, M.B. Lond., F.R.S., Pres. Geol. Soc., and W. PERCY SLADEN, Esq., F.G.S., F.L.S., &c.

[THE Echinodermata collected in Smith's Sound and at the winter quarters of H.M.SS. 'Alert' and 'Discovery' were obtained by the naturalists of the expedition, Capt. Feilden, R.A., and Mr. Hart, under the superintendence of Capt. Sir George Nares, R.N., F.R.S., under no small difficulty. Apart from the trouble of dredging when the tangles froze on coming out of the sea, the proceeding could not be frequently attempted; yet the number of specimens collected was considerable. The collection, consisting of specimens admirably cleaned and preserved in spirit, and of others equally well taken care of in the dry state, was sent to the British Museum. Dr. Günther confided it to me for description and classification; and after I had determined the species, I asked Mr. Percy Sladen, F.L.S., F.G.S., to examine the forms independently and to join me in drawing up this report. Our results were nearly the same; but to my colleague is due the new species of *Asteracanthion*. Dr. Carpenter was good enough to examine and determine the two species of *Comatula*. I am very glad to have this opportunity of thanking Capt. Feilden for his assistance in giving information regarding the depth, temperatures, and localities relating to the specimens.]

The collection is so interesting and the specimens are so variable, that we propose to describe it fully in a separate monograph.—P. MARTIN DUNCAN.]

Localities. To avoid repetition, the following are the positions of the collecting-stations in Grinnell Land mentioned in this report:—

Floeberg Beach (the winter quarters of H.M.S. 'Alert'), lat. 82° 27′ N., long. 61° 42′ W.

Discovery Bay (the winter quarters of H.M.S. 'Discovery'), lat. 81° 41′ N., long. 64° 45′ W.

Richardson Bay, lat. 80° 5′ N.

Cape Fraser, lat. 79° 44′ N.

Hayes Point, lat. 79° 42′ N.

Dobbin Bay, lat. 79° 40′ N.

Cape Louis Napoleon, lat. 79° 38′ N.

Franklin-Pierce Bay, lat. 79° 25′ N.

Synonymy. It has not been the intention in the following citations to supply a complete list of all the different authorities by whom the various determinations have been maintained, but simply to give such references as will be found sufficient to indicate the history or title-warrant of the nomenclature employed. It is hoped that the method of "authorization" which is here adopted will serve not only as an "index of registration," but likewise accord acknowledgment to the original describer—the name of the latter being enclosed within parenthesis, and followed by that of the naturalist who first used the combination as here given.

Although the present report is chiefly confined to a description of the Echinoderms obtained north of lat. 78° N., it has been thought desirable and interesting to include the record of a dredging made by Captain Feilden during the outward voyage, on July 2, 1875, in lat. 65° N. The station was 26 miles from the Greenland coast, and the depth 30 fathoms; bottom rocky, with rounded pebbles. The following Asteroids and Ophiurans were taken here:—*Asteracanthion polaris*, M. & T.; *Solaster endeca* (Linn.), Forbes; *Ophioglypha robusta* (Ayr.), Lym.; *Ophioglypha Stuwitzii* (Lütk.), Lym.; *Ophiopholis bellis* (Linck), Lym.

List of the Echinoderms collected during the Arctic Expedition of 1875–76.

HOLOTHURIOIDEA.

Cucumaria frondosa (*Gunn.*), *Forbes.*

ECHINOIDEA.

Strongylocentrotus dröbachiensis (*O. F. M.*), *A. Ag.*

ASTEROIDEA.

Asteracanthion grœnlandicus, *Stp.*
—— polaris, *M. & T.*
—— palæocrystallus, *nobis.*
Stichaster albulus (*Stimps.*), *Verrill.*
Crossaster papposus (*Linck*), *M. & T.*
Solaster endeca (*Linn.*), *Forbes.*
—— furcifer, *v. Düb. & Kor.*
Pteraster militaris (*O. F. M.*), *M. & T.*

OPHIUROIDEA.

Ophioglypha Sarsii (*Lütk.*), *Lym.*
—— robusta (*Ayr.*), *Lym.*
—— Stuwitzii (*Lütk.*), *Lym.*
Ophiocten sericeum (*Forb.*), *Ljungm.*
Ophiopholis bellis (*Linck*), *Lym.*
Amphiura Holbölli, *Lütk.*
Ophiacantha spinulosa, *M. & T.*
Astrophyton arcticum (*Leach*).

CRINOIDEA.

Antedon Eschrichtii (*Müll.*).
—— celtica, *Barrett.*

HOLOTHUROIDEA.

Cucumaria frondosa (Gunner.), Forbes.

Holothuria frondosa, Gunnerus, Act. Holm. 1767, p. 115, tab. iv. f. 1–2.
H. pentactes, O. F. Müller, Zool. Dan. vol. iii. p. 54, vol. iv. p. 3; Fabricius, Fauna Grönl.; Zool. Samlinger, 2 Heft, no. 249, p. 249.
H. grandis, Forbes & Goodsir, Athenæum, no. 618.
Pentacta frondosa, Jäger, de Holoth. p. 12; Stimpson, Syn. Marine Invert. Grand Manan, p. 16.
Cucumaria frondosa, Forbes, Hist. Brit. Starfishes, p. 209; v. Düben & Koren, K. Vet.-Akad. Handl. 1844, p. 293.
C. fucicola, Forbes & Goodsir, Athenæum, no. 618; Forbes, Hist. Brit. Starfishes, p. 227; in Append. Dr. Sutherland's Journ. of Penny's Voyage.
Botryodactyla grandis, Ayres, Proc. Boston Soc. Nat. Hist. 1854, vol. iv. p. 52.

Coll. Feilden: Baffin's Bay.

A *Cucumaria* with smooth tough body, of subpentagonal ovate form. Ambulacral suckers arranged in five longitudinal series, each being a double row, with the tube feet alternating. Suckers capable of entire retraction. Tentacles ten, pedunculate, frondose, all of equal size.

This Holothurian has a very extensive geographical distribution, being chronicled by Forbes, under the name of *C.*

fucicola, from Assistance Bay (Capt. Penny's voyage), and by Stimpson from Grand Manan in the Bay of Fundy. It is found also on the coast of Massachusetts, Gulf of Georgia (Salenka), San Francisco (Ayres), along the whole Scandinavian coast, Iceland, Færöe Islands, and in the English Channel.

C. frondosa attains great dimensions, the present individual (one specimen only was obtained) being but small; its length is 80 millims., and diameter about 50 millims.

ECHINOIDEA.

Strongylocentrotus dröbachiensis (Müller), A. Ag.

Echinus dröbachiensis, O. F. Müller, Zool. Dan. Prodr. p. 235.
E. sexatilis, Fabricius, Fauna Grönl. p. 368 (non Müller).
E. neglectus, Lamarck, An. s. Vert. iii. p. 49.
E. subangularis, Fleming, Brit. An. p. 479 (non Leske).
E. granularis, Say, Journ. A. N. S. Philad. v. p. 225 (non Lamarck).
E. granulatus, Gould, Rep. Inv. Mass.
Strongylocentrotus chlorocentrotus, Brandt, Prodr. p. 264.
Toxopneustes dröbachiensis, Agassiz, Cat. rais., Ann. Sc. N. vi. p. 367.
T. neglectus, id. ibid.
T. granulatus, id. ibid.
T. Dübenii, id. ibid.
Echinometra dröbachiensis, Gray, Brit. Rad. p. 4.
Echinus chloroticus, Stimpson, Crust. & Echin. Pacif. Sh. p. 86.
Euryechinus dröbachiensis, Verrill, Proc. Bost. Soc. Nat. Hist. x. pp. 341, 352.
E. granulatus, Verrill, Proc. Boston Soc. Nat. Hist. x. pp. 340, 352.
Toxopneustes carnosus, Barn. in Agassiz, Proc. A. N. S. Philad. 1863, p. 357.
T. pictus, Norman, Dredg. Rep. Hebr. p. 314.
T. pallidus, Sars, Nye Echin., Vid. Selsk. Forh. 1871.
Strongylocentrotus dröbachiensis, A. Agassiz, Rev. Echini, pp. 162, 277.

Coll. Feilden: Richardson Bay, 70 fms. (young); Franklin-Pierce Bay, 15 fms., bottom-temperature 29°·5 F.; Cape Napoleon; Hayes Point, 35 fms., bottom-temperature 29°·5 F.

Coll. Hart: Discovery Bay, 15–20 fms., muddy bottom; Franklin-Pierce Bay, 13–15 fms., stony.

Owing to the extensive range of this boreal echinoid, the variations to which it is subject are so great that there are perhaps few other species which include in their synonymy so large a number of modern determinations. Distant observers, depending upon the stability of "local forms," have founded numerous so-called new species, all of which have hitherto, however, proved untenable when due comparison has come to be made with a large series of specimens.

The northern varieties, known as *S. granulatus* (Say), Gould, and *S. chlorocentrotus*, Brandt, fail to present any characters of sufficient importance to warrant their separation from the *dröbachiensis* group, although when isolated and extreme examples are compared the differences at first sight appear very marked.

Similarly with the specimens collected by the recent expedition, separate individuals placed by the side of a single *S. dröbachiensis* from a more southern habitat present superficially a striking divergence.

Of these arctic forms the test is depressed, the spines of the abactinal surface so small (merely miliaries) and so widely spaced that the echinus has quite a naked appearance. The pores are arranged in arcs of 5–6. The primary tubercles are large, only one to each plate, and form prominent vertical rows. The scrobicular areas are wide and bounded by an irregular circlet of tubercles little larger than miliaries; and there are but few other tubercles in addition to these on the plates above the ambitus. Extending from the actinostome to the ambitus there is a moderate-sized secondary tubercle on each side of the primary.

All the specimens present the appearance of stunted growth.

The colour of the test is a varying shade of purplish brown, and that of the spines greenish grey.

On some examples the pedicellariæ are remarkably numerous, especially the large tridactyle form on the abactinal surface.

Good series of specimens were obtained at several stations, and in general facies present great constancy of character.

The largest individual (from Cape Napoleon) measures 43 millims. in diameter, 21 millims. in height, and has twenty primary interambulacral tubercles.

Asteroidea.

Asteracanthion grönlandicus, Steenstrup.

? *Uraster violaceus*, Forbes (pars) (non Müller), Sutherland's Journ. Append.
Asteracanthion Mülleri, Sars ?, var., Steenstrup, Vid. Meddel. 1854, p. 240.
A. Mülleri, Stimpson, Invert. Grand Manan.
A. grönlandicus, Steenstrup, Vidensk. Meddel. 1854, p. 240; Lütken, Vid. Meddel. 1857, p. 29.

Coll. Feilden: Discovery Bay, 25 fms.; Cape Fraser, 80 fms.; Hayes Point, 25 fms.; Franklin-Pierce Bay, 15 fms.

Coll. Hart: Franklin-Pierce Bay, 13–15 fms., stony.

This is a small starfish, with five moderately thick arms. Proportion of disk-radius to arm-radius 1 : 4·5 or 5. Ambulacral spines rather long and cylindrical, arranged (in very irregular alternation) two and one to each plate. The double spines radiate in opposite directions, the single ones standing vertical to the floor of the furrow. Except in young individuals, and near the tip of the arm, the double series are the most numerous, being generally borne by two or three plates in succession. After these follow two or three (according to age) longitudinal series of separate spines, not quite so long as the ambulacral spines, and tapering slightly at their tips. The middle series, when present, are smaller than the others, and placed midway upon the lateral imbricating pieces. At the base of each of the spines of these three series is a circlet of pedicellariæ. The ossicles and interspaces of the calcareous network on the abactinal surface of the rays present a very transversely elongate arrangement, in consequence of which the spinelets springing from the imbricating pieces assume the character (though irregularly) of a transverse position across the arm. The dorsal spinelets, which are much finer and shorter than the ventro-lateral series, are arranged in groups upon the ossicles, and in specimens preserved in spirit are more than half-covered by the thick corrugated skin which invests the body. The pedicellariæ are, as a rule, not very numerous upon the dorsal surface. The papulæ are single. Upon the disk the spinelets are more closely placed; and this, in spirit-examples, gives quite a distinct appearance to that portion of the animal, whilst in some specimens the disk-spinelets are rather longer than those which are found upon the rays.

Dr. Lütken is of opinion that this is the species cited by Forbes under the name of *Uraster violaceus*, from Assistance Bay (Capt. Penny's Expedition) *. It seems probable to us, also, that the *Asterias violacea*, in Sabine's Report on Parry's second voyage, is likewise *A. grönlandicus*, since the *Asterias rubens*, Fab. (non Linné), also there mentioned, is referable to *A. polaris*, M. & T.

Asteracanthion polaris, Müller and Troschel.

Asterias rubens, Fabricius (non Linné), Fauna Grönl. p. 369.
A. minuta, Fabricius, $=$*A. polaris* juv. (*teste* Lütken).
? *A. rubens*, Sabine in Suppl. Parry's Voyage, &c.
? *A. ochotense*, Brandt, Rec. Act. Acad. St. Petersb. 1834, p. 269.
Asteracanthion polaris, Müller & Troschel, Syst. d. Asteriden, p. 16.

Some large specimens were taken on the Torske Bank, Greenland, on the outward journey; and several young exam-

* Vidensk. Meddel. 1857, Overs. Grönl. Echin. p. 29.

ples occurred in Capt. Feilden's dredging in lat. 65° N., 26 miles from the Greenland coast, at a depth of 30 fathoms.

Asteracanthion palæocrystallus, n. sp.

In general appearance this starfish bears a strong resemblance to a *Cribrella*, the rays, five in number, being round and tumid; they are long and taper considerably towards the point. The disk is small, its diameter being proportional to that of the rays as 1 : 5·5. Skin semitransparent, not corrugated, and investing thickly every appendage of the body. Ambulacral pores well-spaced, forming two simple rows of sucker-feet, as in *Stichaster*. Each interambulacral plate bears two very slender spines, which form two regular rows, one radiating towards the furrow, the other to the margin. The spines upon the sides of the arms are much shorter than the ambulacral spines, and comparatively more robust, and are the same in size and character as the spinelets of the dorsal surface. The ossicles of the abactinal network are arranged more quadrilaterally than is usual in *Asteracanthion*; a regular median line passes down each ray, the others running parallel and transverse to this with more or less regularity. Only a single spinelet is given off at each decussation, with an additional one, frequently, on the imbricating ossicle; the spinelets are consequently widely spaced and assume (although somewhat irregularly) a fairly rectilineal arrangement. The spinelets are of the same shape and structure as in *Stichaster*; they are deeply grooved, and have 3–5 denticles proceeding from their truncate and slightly radiate apex. The ambulacral spines have the shafts also denticulate. The pedicellariæ ("croisés," Perrier) are more numerous upon the dorsal surface than the spinelets, amongst which they are placed separately and at intervals apart. These pedicellariæ are large and closely resemble those of *Stichaster*, the fore part of the "jaw" being very gibbous and truncate. The pedicellariæ together with the dorsal spinelets, which are but little longer, are covered with a thick investing membrane, which, in spirit preparations, gives quite a papillate appearance to the starfish.

Upon the disk the spines are somewhat more crowded than upon the rays; and the "eye"-spines at the tip of the rays form a robust terminal fringe. The madreporiform plate is obscure; and of the large simple pedicellariæ there are but very few.

Although this species resembles *Stichaster* in so many respects, the arrangement of the dorsal ossicles is hardly such as would include it within that genus. *A. palæocrystallus* may fairly, however, be regarded as a connecting link between *Asteracanthion* and *Stichaster*.

From the character of the ambulacral spines, the absence of papulæ, and the obscurity of the madreporiform body, we are disposed to regard even the largest specimen we have as being not yet fully developed: it measures 30 millims. in its greatest diameter, and 5·5 millims. across the disk, and was collected by Capt. Feilden in Discovery Bay. Depth 25 fathoms, hard bottom. Another individual from Cape Fraser (80 fathoms) is only 10 millims. in greatest diameter, yet presents all the characters of the larger specimen.

Stichaster albulus (Stimps.), Verrill.

Asteracanthion albulus, Stimpson, Invert. Grand Manan, p. 14.
A. problema, Steenstrup, Vid. Meddel. 1854, p. 240; Lütken, Vid. Meddel. 1857, p. 30.
Stichaster albulus, Verrill, Proc. Boston Soc. Nat. Hist. vol. x.

Coll. Feilden: Franklin-Pierce Bay, 15 fathoms; Proven, 13 fathoms.

A little starfish with small disk and rounded or somewhat arched rays, the number of which is almost invariably six, three rays on one side being, as a rule, very much shorter than those on the other. Proportion of the diameter of the disk to that of the arms 1 : 5 or rather more. The ambulacral furrows are wide, with suckers arranged in two simple rows. On each interambulacral plate are two "ambulacral" spines radiating slightly to the right and left. Closely succeeding to those on the sides of the arms follow a series of three similar spines, but not always a series opposite to each interambulacral plate, owing to the imbricating pieces being more widely spaced. The dorsal ossicles present a regular rectangular arrangement; and the interspaces, which are very small and are occupied by a single papula, form, in consequence, regular longitudinal and transverse rectilineal series. From each intersection springs a small subquadrate group of from three to five short dorsal spines, amongst which are placed one or two pedicellariæ. Towards the sides the pedicellariæ are more numerous. The spine groups are regularly disposed in longitudinal and transverse lines, those of the middle row being more densely packed than the others, thereby forming a more or less distinct median line down each ray. The spinelets are of equal length, and, being closely set, give a smooth velvety appearance to the starfish. From the apices of the spinelets, which are broader than the bases, proceed three or four small denticles.

Only three specimens of this *Stichaster* were obtained in

Franklin-Pierce Bay, and were quite young individuals, the largest measuring 16 millims. in its largest diameter. A much finer example was dredged at Proven on the outward journey, in which the diameters of rays and disk were respectively 30 millims. and 6 millims.

Crossaster papposus (Linck), Müller and Troschel*.

Triskaidecactis papposa, Linck, De Stellis marinis, p. 43.
Asterias helianthoides, Pennant, Brit. Zool. iv. p. 66. no. 72.
A. papposa, Fabricius, Fauna Grönlandica, p. 369.
A. affinis, Brandt, Act. Acad. St. Petersb. 1834, p. 272.
? *A. alboverrucosa*, id. ibid.
Stellonia papposa, Agassiz, Prodr. Monogr. Rad., Soc. Sc. Nat. Neufchâtel, vol. i. p. 191.
Solaster papposa, Forbes (1839), Mem. Werner. Soc. vol. viii. p. 121.
Crossaster papposus, Müller & Troschel (1840), Wiegmann's Archiv, iv. pt. 1, p. 183; Verrill, Proc. Boston Soc. Nat. Hist. vol. x. p. 334.

Coll. Feilden: Discovery Bay, 25 fms., hard bottom; Cape Fraser, 80 fms.; Franklin-Pierce Bay, 15 fms., bottom-temperature 29°·5 Fahr.

Coll. Hart: Franklin-Pierce Bay, 13–15 fms.

In the "Oversigt over Grönlands Echinodermer," Dr. Lütken records † that amongst the specimens of *C. papposus* which he had examined there occurred only one example of the ten-armed variety, those with twelve arms being the most common.

All the specimens of this collection are ten-armed, with the exception of one small and very young example having nine. Its greatest diameter is only 18 millims.

When compared with series of similar size from more temperate waters, the polar specimens are characterized by finer arms, fewer spine-clusters (bearing fewer but very much longer spinelets), the spine-clusters more widely separated from one another, and the ventral spaces almost naked. These points are so striking in some individuals that at first sight one is tempted to consider that we have here a well-marked variety of this almost cosmopolitan starfish. Careful

* The genus *Solaster* of Forbes included the two starfishes known as *Asterias endeca*, Linn., and *A. papposa*, Fabr. (Linck). The morphological differences of these forms are such, however, as to necessitate their being regarded as representatives of two distinct genera. Confining, therefore, Forbes's *Solaster* to his own type (*S. endeca*), Müller and Troschel's genus *Crossaster* (synonym of *Solaster*, Forbes, published a year later) is naturally assigned to the *Asterias papposa* type, Gray's designation *Polyaster* having been appropriated by Ehrenberg (*Polyasterias*) at an earlier date. The propriety of the above limitation was suggested by Dr. Lütken so far back as 1857. (*Cf.* Vidensk. Meddelelser, 1857, p. 35.)

† Vidensk. Meddelelser for 1857, p. 40.

study, however, of the series leads us to the conclusion that no sound distinction can be drawn; and we would offer as a suggestion explanatory of the divergence, that in these arctic forms of *Crossaster* premature phases are more slowly passed through, and that development of detail takes place in a different ratio to the body-growth from that which obtains under more favourable conditions of life.

The largest specimen obtained measures 93 millims. in diameter.

Brandt founded a species, *Asterias affinis*, upon a single specimen obtained in Behring Straits, but which, from the short description given, appears only to have been similar to the specimens before us; and, such being the case, the grounds are not sufficient to warrant the maintenance of his species. In all probability *A. alboverrucosa*, Brandt, is also identical.

A singular instance of the rapacity of this starfish may be here related. The disk of one of the large individuals from Discovery Bay being considerably distended, it was cut open; and the distention was found to result from the creature having gorged a young *Strongylocentrotus dröbachiensis*!, nothing but the clean calcareous plates of the test remaining *. In the stomach of another (very much smaller) specimen was found the shell of *Trochus olivaceus*, Brown (kindly determined by Dr. Gwyn Jeffreys).

Solaster endeca (Linn.), Forbes.

Asterias aspera, O. F. Müller, Zool. Dan. Prodr. no. 2833.
A. endeca, Linnæus, Syst. Nat. (Gmel.), p. 3162.
Stellonia endeca, Agassiz, Prodr. Monog. Rad. p. 25.
Solaster endeca, Forbes, Mem. Werner. Soc. vol. viii. p. 121.

One young specimen, 14 millims. in greatest diameter, was dredged by Capt. Feilden in lat. 65° N., 26 miles from the Greenland coast, at a depth of 30 fathoms.

* The British members of the same species seem to be equally addicted to cannibalism. A few weeks ago one of the writers conveyed by railway a small *C. papposus* along with a specimen of *Astropecten*, in a jar of sea-water. On reaching home, after a journey of about three hours' duration, it was found that the asteroid had, according to their custom when irritated, thrown off portions of two of its arms, and that the *Crossaster* was busily gorging one of these pieces, fully the length of the diameter of its own disk! In the course of an hour the fragment had entirely disappeared. On being disturbed two or three hours afterwards, the *Crossaster* ejected the fleshless skeleton, if such a term may be employed.

In the British Museum is a specimen of *Astropecten hystrix*, Val., from the Mauritius, which had swallowed a large *Conus*, the latter extending even into one of the rays.

Solaster furcifer, v. Düben and Koren.

Chætaster borealis, v. Düben, Œfv. Kongl. Vet.-Akad. Förhandl. 1844, p. 113.
Solaster furcifer, v. Düben & Koren, Kongl. Vet.-Akad. Handl. 1844, p. 243, t. vi. f. 7–10.

Coll. Feilden: Cape Fraser, 80 fms.

A starfish of somewhat depressed form, having five broad flat arms. Proportion of disk-radius to length of arm 1 : 3. The calcareous network of the dorsal surface is very regular; and the spine-clusters or paxillæ, which spring from the intersections, form longitudinal series which run parallel to the median line of the ray; consequently only two or three of the middle series reach to the tip, although from fourteen to sixteen may be counted at the base of the arm. The paxillæ are very compact and have a stout rounded base, nearly twice as wide as high, bearing a crown of spinelets (about fifteen to twenty) in length about equal to the diameter of the base. The spinelets are, as a rule, flat; and from the angles of the apex, which is as broad as or broader than the base, proceed two small denticles, giving the appearance to the spinelet of a two-pronged fork; sometimes the spinelet is triangular, in which case there are three prongs. On the sides of the arms are two rows of large paxillæ or spine-clusters, the lower series being twice the breadth of the upper ones, and these themselves being much larger than the rest of the dorsal paxillæ just described. There are about twenty large marginal paxillæ from the arm-angle to the tip. Each interambulacral plate bears three equal-sized spines, running parallel to the furrow; and exterior to these are three or four spines webbed together into a "comb" and placed obliquely, or even in some cases at right angles, to the ambulacral series; whilst midway between the combs and the margin of the ray are three or four small spines (not sufficient to form a paxilla proper), which stand quite isolated and only extend about one third of the distance from the mouth to the tip of the ray. The madreporiform tubercle is excentral and situated at about one third the distance from the centre to the margin of the disk. The mouth-plates are large and broad, the marginal spines interlocking with one another.

Only two specimens were obtained by Captain Feilden, the largest of which measures 65 millims. in its greatest diameter, and 21 millims. across the disk; the arms at the base are 13 millims. broad.

Pteraster militaris (O. F. M.), Müller and Troschel.

Asterias militaris, O. F. Müller, Zool. Dan. tab. 131 (excl. textu).
Asteriscus militaris, Müller & Troschel, Syst. d. Asteriden, p. 44.
Pteraster militaris, Müller & Troschel, Syst. d. Asteriden, p. 128.

Coll. Hart: Dobbin Bay, 30 fms.

This starfish is readily distinguished from its congeners and the majority of other asteroids by the singular fin-like margin surrounding the arms, by the membranous skin which is spread over the upper surface, as well as by the series of webbed spines which stand, in transverse ranges like fans, by the side of the ambulacral furrow.

The form of the animal is pentagonal, the upper contour of the body high and arched, and the underside flat. Proportion of disk-radius to arm-radius 1 : 2. Each interambulacral plate is furnished with five or six long spines, which are connected together by a membrane into a webbed comb placed transversely to the ambulacral furrow. The outward spine of each comb is double the length of the others, and extends about half its length beyond the edge of the ray. These long spines are also united to one another by a connecting tissue, and thus form the fin-like fringe which surrounds the entire starfish. The ambulacral spines forming the fan-like comb are nearly equal in length, the middle ones being slightly longer.

The body-skeleton is composed of a calcareous network, from each of the cross joinings of which proceeds a spine-fasciculus bearing three or four spinelets. The whole dorsal surface of the animal is covered and concealed by a membranous tissue supported above the body, like a tent-cloth, by the spinelets, to the tips of which it is attached. A hollow infradermal cavity is thus formed. Neither the anus nor the madreporiform tubercle has any special aperture in this investing membrane; there is, however, a single large-sized opening, surrounded by a margin of spines, situated nearly over the dorso-central axis. In and out of this aperture Dr. Stimpson has observed currents of water passing, as in the cloaca of a *Holothuria*, from which fact he was led to regard the functions of the cavity as subservient to respiration *. MM. Koren and Danielssen, however, have pointed out that this intermediate space between the double dorsal skin fulfils a further and more important purpose by becoming a chamber in which the development of the eggs and embryos takes place †.

* Stimpson, "Marine Invertebrata of Grand Manan," p. 15, in Smithsonian Contributions, vol. vi.

† Koren and Danielssen, 'Fauna littoralis Norvegiæ,' Heft 2, p. 58.

Although our knowledge of marsupiation in Echinoderms has recently been largely augmented by the additional instances which Sir Wyville Thomson records as occurring in species from southern seas *, it is most interesting to find so special an adaptation for the purpose in this truly arctic asteroid.

Two specimens only were obtained, being dredged by Mr. Hart in Dobbin Bay. They measure about 60 millims. in their greatest diameter.

OPHIUROIDEA.

Ophioglypha Sarsii (Lütken), Lyman.

? *Asterias ophiura*, Dewhurst, Nat. Hist. Cetacea &c. Arctic Regions, p. 283, 1834.
Ophiura texturata, Forbes, pars (Append. Sutherland's Journal).
Ophiolepis ciliata, Sars, pars, Reise i Lofoten og Finmarken, p. 39; Stimpson, Invert. of Grand Manan, Smiths. Contrib. vi. p. 13.
Ophiura acufera, Agassiz, Proc. Am. Acad. 1851, p. 269 (no descr.).
O. coriacea, Lütken, Vidensk. Meddelelser, Nov. 1854, p. 101.
O. arctica ?, id. ibid.
O. Sarsii, id. ibid., et Add. ad Hist. Ophiuridarum, p. 42.
Ophioglypha Sarsii, Lyman, Ill. Cat. Mus. Comp. Zool. Harvard, i. p. 41; Ljungman, Oph. Viv., Œfv. K. Vet.-Akad. Förh. 1866, p. 307.

Coll. Feilden: Floeberg Beach, 10 fms.; Discovery Bay, 25 fms.; Hayes Point.

An *Ophioglypha* with mouth-shields shield-shaped, longer than broad; length less than, or only equal to, their distance from the margin of the disk. Papillæ of the disk-incision about fifteen, and rather broad. Under arm-plates widely separate, of a very broad, short triangle-shape. Two tentacle-scales. No infrabrachial indentations. Spines rather long, equal in length to the side arm-plates.

This is the most northerly echinoderm brought home by the expedition, a fine specimen with a disk-diameter of 26 millims. having been taken by Capt. Feilden at the winter quarters of H.M.S. 'Alert,' in N. lat. 82° 27′. Other examples of this species were obtained at Discovery Bay, and among them one which is provided with remarkably long arm-spines, being in relative proportion fully twice the length of the spines generally occurring in *O. Sarsii*. In this individual the three spines of the sixth joint measure respectively 2·45 millims., 2·25 millims., 1·4 millim., the under arm-plate being ·7 millim. long, the arm-joint 1 millim., and the disk-diameter 15 millims. The remaining features of the specimen agree too closely with the characters of *O. Sarsii* (Lütk.), Lym.,

* Wyville Thomson, Journ. Linn. Soc. vol. xiii. p. 55.

to warrant its removal, in our opinion, from that species, even as a provisional variety.

In some cases great irregularity is exhibited in the mouth-papillæ, one abnormal example being particularly worthy of notice. In the *Ophioglyphæ* the innermost mouth-papilla generally stands immediately over the teeth, and might be easily mistaken for a tooth, being, in fact, affixed to the tooth-plate and not to the lateral plates. In *O. Sarsii*, as well as in other members of the genus, two additional papillæ are generally associated with it, one on either hand, and are in like manner borne by the ossicle upon which the teeth are placed.

In consequence of this arrangement it has long seemed probable to one of us that these subdental papillæ should be regarded as tooth-papillæ (of which they are in truth the homologues) rather than as mouth-papillæ, so-called, along with which they are commonly counted. One of the specimens taken in Discovery Bay throws considerable light upon this question.

In this individual the dental armature consists of four teeth regularly superposed, following upon which, and occupying the same breadth as a tooth, are three ossicles, which fit to one another wedgewise with sloping sides. Then come two which fit together and correspond in their shape with the irregularities of the upper and under tier, which latter consists of from three to five compact close-fitting papillæ; and these again are succeeded by three or four (in some rays five) moderately long, round-tipped, smaller papillæ, the whole forming a compact mass suggestive, in the highest degree, of ordinary tooth-papillæ, such as occur, for instance, in *Ophiothrix*; and yet in every detail, even to measurements, the specimen conforms to the diagnosis of *Ophioglypha Sarsii*. This individual has a disk-diameter of 22 millims.

Abnormal development of the dental armature in *O. Sarsii*.

Bearing in mind the tendency towards vertical reduplication of the mouth-papillæ in some genera, this cannot fail to be regarded as suggestive of the manner in which primitive tooth-papillæ may have been developed; nor is such an assumption by any means extravagant when the great irregularity of these parts amongst arctic forms is taken into consideration.

Ophioglypha robusta (Ayres), Lyman.

Ophiolepis robusta, Ayres, Proc. Boston Soc. Nat. Hist. iv. p. 134, 1851.

Ophiura fasciculata, Forbes, Append. Sutherland's Journal.

? *O. glacialis*, Forbes.

O. squamosa, Lütken, Vidensk. Meddelelser, Nov. 1854, et Add. ad Hist. Ophiuridarum, p. 46.

Ophioglypha robusta, Lyman, Ill. Cat. Mus. Comp. Zool. Harvard, i. p. 45; Ljungman, Oph. Viv., Œf. K. Vet.-Akad. Förh. 1866, p. 308.

Coll. Feilden: Discovery Bay, 25 fms., hard bottom Richardson Bay, 70 fms.; Hayes Point, 35 fms., bottom-temperature 29°·5, and also at 25 fms.; Franklin-Pierce Bay, 15 fms., bottom-temperature 25°·5.

Coll. Hart: "Winter quarters," Discovery Bay; Franklin-Pierce Bay, 13–15 fms., bottom stony.

An *Ophioglypha* with arms very finely tapering, and disk with regularly arranged scales of nearly equal size. Mouth-shields ovate shield-shaped, length less than, or at most only equal to, their breadth; length much less than the distance from the margin of the disk. Papillæ of the disk-incision very short and stout, often grouped. Under arm-plates broadly heart-shaped; one tentacle-scale.

This species was obtained at various stations, as indicated in the list of localities; and though neither the abundance nor the size of the specimens was remarkable, several good series were collected. The characters which have been regarded as "specific" are remarkably constant; and no essential difference can be traced between these arctic forms and specimens taken from the coast of Maine, U. S., with which they have been compared, excepting that in the northern Ophiurans the arm-spines are longer and somewhat more delicate, and that the outer margin of the under arm-plates is more arched and the reentering angle is far less developed, in certain species being even altogether untraceable. In some large examples the upper arm-plates are very markedly hexagonal.

Although this deviation is very constant, the foundation of "a variety" on the strength of such characters alone is hardly justifiable.

The arm-spines are moderately stout and tapering, the upper one being flattened and much larger than the others.

In most of the specimens under present consideration, the under arm-plates are well separated from one another by the side plates and do not overlap, although in one individual from Discovery Bay the first ten impinge distinctly in consequence of their side arm-plates not meeting. This feature at the basal portion of the arm has been noted by Dr. Lütken as occurring in large specimens from Greenland, whilst he remarks at the same time that in none of the Danish examples examined by him do the under arm-plates touch.

The largest specimen was taken by Capt. Feilden in Franklin-Pierce Bay, the diameter of the disk (dried) being 10 millims.

Ophioglypha Stuwitzii (Lütken), Lyman.

Ophiura Stuwitzii, Lütken, Vidensk. Meddel. 1857, p. 51, et Add. ad Hist. Oph. p. 49.
Ophioglypha Stuwitzii, Lyman, Ill. Cat. M. C. Z. Harvard, i. p. 51.

Two specimens were collected by Capt. Feilden in a dredging made in lat. 65° N., twenty-six miles from the Greenland coast, depth 30 fms.

Ophiocten sericeum (Forbes), Ljungman.

Ophiura sericea, Forbes, Sutherland's Journ. &c. vol. ii. Append. p. ccxv.
? *O. abyssicola*, Forbes, Linn. Trans. vol. xix. p. 146.
Ophiocten Kröyeri, Lütken, Vidensk. Meddel. 1854, et Add. ad Hist. Ophiuridarum, p. 52; Lyman, Ill. Cat. M. C. Zool. i. p. 53.
O. sericeum, Ljungman, Œfv. K. Vet.-Akad. Förh. 1864, p. 360; 1866, p. 307.

Coll. Feilden: Discovery Bay, 25 fms., hard bottom; Cape Fraser, 80 fms.; Hayes Point, 35 fms., bottom-temperature 29°·5.

Coll. Hart: Discovery Bay, 15–20 fms., muddy bottom, also at 11 fms.; Franklin-Pierce Bay, 13–15 fms.

Disk very flat, with margin forming a sharp angle; covered with imbricating scales and a superficial squamo-granular layer, through which only portions of the radial shields and primary plates are visible. No disk-incisions, the disk forming a little arch over the base of the arms. A row of papillæ edges the genital slit, and passes over the arm along the disk-margin continuous with the series from the other side. The first three, or sometimes four, upper arm-plates at the base bear papillæ. Side arm-plates meet below, but not above. One tentacle-scale. Three arm-spines, arranged along the outer edge of the side arm-plate, the two upper spines being much the largest.

The main variation which we have noted in the arctic specimens of this species consists in the greater length of the arm-spines as compared with those of more southern examples. In a specimen 9·2 millims. in disk-diameter the length of the upper arm-spine of the sixth joint was 1·85 millim. (in one case 2·3 millims.!); in another, with a diameter of disk of 8·5 millims., the same spine was 1·8 millim. long, three arm-joints in this individual being exactly 2 millims. In addition to the above, variations occur in the contour of the mouth-shields, and in the larger examples considerable irregularity is also found in the number and position of the mouth-papillæ. Amongst this collection are several specimens having a very decidedly pentagonal form of disk.

In our opinion, none of the above variations can be regarded as of greater morphological significance than growth-phases, or at most individual variations only. The largest specimen obtained was 11 millims. in disk-diameter.

Ophiopholis bellis (Linck), Lyman.

Scolopendroides bellis (scolopendrica), Linck, De Stell. Marinis, p. 52.
Asterias aculeata, Müller, Zool. Dan. Pr. 2841; Zool. Dan. iii. p. 29, t. 99.
Ophiura bellis, Johnston, Mag. Nat. Hist. vol. viii. p. 595.
Ophiolepis scolopendrica, Müller & Troschel, Syst. d. Ast. p. 96.
Ophiocoma bellis, Forbes, Mem. Werner. Soc. vol. viii. p. 126; Hist. Brit. Starfishes, p. 53.
Ophiopholis aculeata, Lütken, Add. ad Hist. Oph. p. 60.
O. bellis, Lyman, Ill. Cat. M. C. Zool. Harvard, i. p. 96.

Coll. Feilden: lat. 65° N., 26 miles from Greenland coast, 30 fms.

Amphiura Holbölli, Lütken*.

? *Ophiolepis Sundevalli,* Müller & Troschel (non Joh. Müller), Syst. d. Asteriden, p. 93.
Amphiura Holbölli, Lütken, Vid. Meddelelser, Nov. 1854, et Add. ad Hist. Ophiuridarum, p. 55; Lyman, Ill. Cat. Mus. Comp. Zool. i. p. 118.
A. Sundevalli, Ljungman, Oph. Viventia, Œfv. K. Vet.-Akad. Förh. 1866, p. 320.

Coll. Feilden: Franklin-Pierce Bay, 15 fms., bottom-temperature 29°·5 F.

An *Amphiura* with disk lobed; radial shields long and narrow; mouth-shields rounded; side mouth-shields large, subtriangular, with the sides reentering and angles rounded. Three pairs of mouth-papillæ, the middle ones placed higher than the others. Under arm-plates pentagonal. One tentacle-scale rounded; arm-spines 3–4.

Only a single specimen of *Amphiura* was taken; and this,

* So much confusion has arisen in consequence of uncertainty as to the identity of the original application of the appellation *O. Sundevalli*, that we prefer to retain Dr. Lütken's name, despite the example of certain recent writers to the contrary.

although it differs slightly from the type form in the relative measurements of certain points of detail, we have little hesitation in assigning to Dr. Lütken's species, the variations, in our opinion, not being of greater importance than such as we should regard as dependent on locality and conditions of life.

The arms are less broad, and take their origin in a more deeply reentering curve of the disk-margin, the radial shields are narrower, and the breadth of upper arm-plates in proportion to their length is less than in the type forms, as the following measurements will indicate:—Diameter of disk 8 millims.; radial shield, length 1·3 millim., breadth ·35 millim.; sixth upper arm-plate, length ·6 millim., breadth ·9 millim.

The spines are hollow cylinders, stout, blunt, and but slightly tapering; the upper spine on each side-plate tapers most. The first fifteen arm-joints bear four spines, the succeeding joints three only.

An interesting feature connected with this specimen is worthy of record, and is one which does not appear to have been noted by previous observers. The central spines are more or less flattened throughout their whole length; and at the tip compression has been carried to such a degree as to form a thin and somewhat expanded head—a peculiarity which is at once suggestive of a characteristic spine-appendage possessed by *A. filiformis*; and although in the specimen under notice this structural feature is by no means so fully developed as in that Ophiuran, it is still sufficiently marked to impress upon the mind the near relationship of the two species and the community of their descent—an hypothesis which is also further strengthened by the association of both the forms in more southern waters.

Ophiacantha spinulosa, Müller and Troschel.

? *Asterias bidentata*, Retzius, Diss. p. 33.
? *Ophiura fragilis*, Sabine in Append. Capt. Parry's Voyage.
? *Ophiocoma bidentata*, Müller & Troschel, Syst. d. Asteriden, p. 99.
Ophiacantha spinulosa, Müller & Troschel, Syst. d. Asteriden, p. 107.
O. grœnlandica, Müller & Troschel, Archiv für Naturgesch. 1844, p. 183.
Ophiocoma arctica, Müller & Troschel, Syst. d. Asteriden, p. 103.
O. echinulata, Forbes, Append. Sutherland's Journal.
Ophiacantha spinulosa, Lütken, Add. ad Hist. Ophiuridarum, p. 65; Lyman, Ill. Cat. Comp. Zool. i. p. 93; Ljungman, Oph. Viventia, Œfv. K. Vet.-Akad. Förh. 1866, p. 326.

Coll. Feilden: Discovery Bay, 25 fms., hard bottom; Cape Fraser, 80 fms.; Franklin-Pierce Bay, 15 fms. Temperature 29°·5 Fahr.

Coll. Hart: Franklin-Pierce Bay, 13–15 fms., bottom stony.

An *Ophiacantha* with disk covered with small round scales, each bearing a small short spinelet. Radial shields very obscure, sometimes quite covered. No disk-incision; and the dorsal membrane is prolonged over the base of the rays. Mouth-shields twice as broad as long, irregular ovate. Side mouth-shields long, narrow, arched and meeting within. Under arm-plates heptagonal or subheptagonal, breadth equal to length. Dorsal arm-plates triangular. Side arm-plates meeting above and below. Spines 7–8, long, thin, and denticulate, placed on a keel.

A greater number of this Ophiuran have been brought home by the expedition than of any other Echinoderm. The specimens range in size from those having a disk-diameter of 15 millims. to the young form of only 3 millims., and consequently form a most instructive series.

The variations dependent on growth are very considerable, so much so that isolated specimens taken from different stages in the series might easily be regarded as affording the types of distinct species.

Conclusive proof has been furnished by the material which we have had at our disposal that the *O. grönlandica*, M. & T., and the *O. arctica*, M. & T., are untenable species, as Dr. Lütken has already pointed out—and, further, that the characters which had hitherto been regarded as of specific value are not, as that eminent authority seems to infer, even variations such as can be regarded as dependent on distribution, but must be considered simply the phases incidental to age, together with ordinary individual variation.

Amongst the specimens procured by the naturalists of H.M.SS. 'Alert' and 'Discovery,' there are many presenting features developed in a manner which might be regarded as "ultraspecific" when compared with the previously recognized modifications of this "form." In the present state of knowledge, however, it seems preferable to comprehend them under *O. spinulosa* of Müller and Troschel, rather than to burden further the nomenclature with novel designations.

The mouth-shields and the under arm-plates in this species are subject to very considerable changes and variation, both in contour and in their relative proportions of length to breadth. In large and adult specimens the number and arrangement of the mouth-papillæ is also irregular; and not only is there a frequent increase in number in the ordinal horizontal series, but there is also a great tendency towards reduplication of certain papillæ in the vertical axis of the Ophiuran. This seems to arise from the longitudinal cleavage of preexisting papillæ.

In young individuals the spinelets of the disk are proportionally long, five or six times their own diameter, and present all the appearances of ordinary embryonic spines. During the process of growth, however, increase is made in thickness only, so that when maturity is attained, and the spinelets, along with the disk, are invested with the semitransparent leathery membrane of the body, the appearance is more that of short stumpy prominences than of actual spines—a deception which at first sight gives a totally different character to the Ophiurans.

Astrophyton arcticum (Leach), *fide* Smith.

Gorgonocephalus arcticus, Leach, 1819, Append. Sir J. Ross's Voyage.
Astrophyton arcticum, Smith, MS.

This Astrophyton was dredged off West Greenland by Mr. A. C. Horner, who accompanied Sir Allan Young in the 'Pandora,' at a depth of 600 fms. in Smith's Sound, lat. 78° 19′ N., long. 74° 30′ W. The present writers have not seen this specimen, and are indebted for the information to Mr. Edgar A. Smith, F.Z.S., of the British Museum, by whom it has been determined and referred to Leach's species. This is particularly interesting, as the original *Gorgonocephalus arcticus*, Leach, was obtained by Sir John Ross in Baffin's Bay, lat. 73° 37′ N., long. 77° 25′ W., at a depth of 800 fms. This was one of the earliest instances of a living organism being dredged from so great a depth.

Crinoidea.

Antedon Eschrichtii (Müller) and *Antedon celtica* (Barrett).

Coll. Feilden: Discovery Bay, 25 fms., bottom hard.

The *Comatulæ* were handed over to Dr. Carpenter for determination; and he has kindly informed us of the occurrence of the above-named species.

Conclusions.

It is clearly manifest that extreme caution should be exercised in drawing conclusions as to the general character of a fauna, on the basis of such scanty material as it is possible for a single expedition to furnish; and the authors feel that the great hesitation which they have in expressing definite opinion is fully warranted by the fact that considerable additions have recently been made to the Echinifauna of Northern-European waters, the details of which have not yet been published; and these investigations may, in all probability, have the result of going far towards rendering present generalizations invalid. To mention one instance alone. Writing on the results of the 'Porcupine' dredgings in 1869, which have not yet been published in full, Sir Wyville Thomson, in his 'Depths of the Sea,' remarks :—Between Scotland and Færöe "we find . . . . every one of the Echinoderms hitherto found on the coast of Scandinavia and Greenland, with the single exception, I believe, of *Ophioglypha Stuwitzii*, a shallow-water Greenland form, among the ophiurids, and of one or two holothurids, which have yet evaded us" (*l. c.* p. 43). It is tantalizing that Sir Wyville Thomson gives no record of the special Asteroids in his agreeably written narrative.

Table showing the general Geographical Distribution of the various Species above mentioned; together with an Indication of those obtained by the previous Arctic Explorers, Captains Parry and Penny.

Parry.	Penny.		Grinnell Land.	Greenland.	Arct. America.	Iceland.	Spitzbergen.	Scandinavia.	N. European.
	*	Cucumaria frondosa	. .	*	*	*	*	*	*
*	*	Strongylocentrotus dröbachiensis	*	*	*	*	*	*	*
?	*	Asteracanthion grönlandicus	*	*	*	. .	*	. .	*
*	. .	—— polaris	. .	*	*				
		—— palæocrystallus	*						
		Stichaster albulus	*	*	*	*	*	. .	*
*	*	Crossaster papposus	*	*	*	*	*	*	*
		Solaster endeca	. .	*	*	*	. .	*	*
		—— furcifer	*	. .	. .	. .	. .	*	*
		Pteraster militaris	*	*	*	. .	*	*	*
*	*	Ophioglypha Sarsii	*	*	*	*?	*	*	*
	*	—— robusta	*	*	*	*	*	*	*
		—— Stuwitzii	. .	*	*				
	*	Ophiocten sericeum	*	*	*	. .	*	. .	*
		Ophiopholis bellis	. .	*	*	*	*	*	*
?	?	Amphiura Holbölli	*	*	*?	. .	*	. .	*
*	*	Ophiacantha spinulosa	*	*	*	*	*	*	*
		Astrophyton arcticum†	. .	*	*				
		Antedon Eschrichtii	*	*	*	. .	*?	. .	*
		—— celtica	*	?	. .	. .	. .	. .	*
		The following were not obtained by this expedition :—							
*	*	Ctenodiscus crispatus.							
	*	Cucumaria Hyndmani=C. Korenii, *Ltk.*							
	*	Chirodota brevis, *Huxley*,=Myriotrochus Rinkii, *Stp.*							
	*	Ophiura glacialis, *Forbes.*							

† This was dredged by Sir John Ross in 1818.

Of these twenty Greenland and Grinnell-Land Echinoderms,

Fourteen are common to America and Europe;
Three are known as American and *not* European;
Two are known as European and *not* American;
One now first recorded from Grinnell Land only.

Analysis similarly shows that fourteen out of the twenty are Grinnell-Landic. And of these,

Eleven are common to America and Europe;
Two are known as European and *not* American;
One from Grinnell Land only.

Reasoning from present information, the writers are of opinion that the character of the Echinifauna under consideration is the effect of local modification acting upon a great polar distribution rather than of intercontinental emigration simply.

LVIII.—*Description of a new Species of Foraminifera* (Rotalia spiculotesta). By H. J. Carter, F.R.S. &c.

[Plate XVI.]

Ever since my description and illustrations of the structure of the shell of *Operculina arabica* were published ('Annals,' 1852, vol. x. p. 161, pl. iv.), I have felt certain that the spiculiform bodies therein described and figured were integral parts of the test, and not occasioned by any particular arrangement of its canal-system as stated by Dr. Carpenter, any more than the bricks of a house are dependent for their form on the position of the gas- and water-pipes. How far I was justified in making this assertion may be learnt from the following description of this new species of Foraminifera.

Rotalia spiculotesta, n. sp. (Pl. XVI. figs. 1–3.)

Parasitic, sessile, flat, subcircular, with irregular margin; colour dark brown in the centre, where the chambers are still filled with dried sarcode, becoming snow-white towards the margin, where they are more or less emptied by its contraction. Chambers commencing from a slightly raised, central, spherical, embryonal or primary cell, in regular spiral succession, soon becoming most irregular both in size and shape, when the spire can be no longer traced, as they descend outwards to a margin so irregularly undulating as to present in some parts narrow conical processes, while in others they are wide and round. Aperture not seen, but probably inferior, as none could be observed above. Test entirely composed of round, smooth, fusiform, transparent, solid, calcareous spicules, whose ends are sharp-pointed or round; varying in size from those of the primary chambers, which are about 2 by ½-1800th, to those of the outer ones, which are 5 by 2-1800ths inch in their greatest diameters respectively; arriving abruptly at their largest dimensions in the third whorl of chambers, beyond which they do not appear to increase in size (Pl. XVI. fig. 2); the whole so interwoven and cemented together by a minutely areolated, calcareous, crystalline, but white-looking structure (fig. 3, *c*), as to form a thin, delicate wall to each of the chambers, whose cavities respectively are either partially empty or filled with the dried animal, as before stated (fig. 2, *a*, *b*, *c*). Size of entire test about 1-15th inch in horizontal diameter (fig. 1); vertical diameter almost inappreciable from its extreme thinness and the adherence of the lower surface to the object on which it has grown; diameter of the primary or embryonal chamber 2-1800ths of an inch.

Hab. Marine, on the base of *Oculina rosea*=*Stylaster sanguineus.*

Loc. East Oceania.

Obs. This remarkable Foraminifer, of which I have only one specimen, was found accidentally on a small fragment of the base of a specimen of *Stylaster sanguineus* in the British Museum, and therefore, if sought for specially, will probably (like the fixed Rotalians generally) be met with more or less abundantly about similar objects from the same region.

The rotalian characters and spicular composition of the test respectively suggest the name; but being adherent to the surface on which it is situated, the position of the aperture, like that of *Rotalia*, is inferred to be inferior, as none can be observed on the upper part. There seems to be no particular arrangement of the spicules, which as often cross each other as they are seen to be only one layer deep, and, with reference to their relative position, lie in all possible directions, seldom appearing above the level of the surface, although evincing, by the occasional projection of one end, or their entire separation about some part which has been broken (like that of the chamber, fig. 2, *a*), the form above described; while the largest belonging to the outer whorls of the chambers, being in length more than twice the diameter of the central or embryonal cell, which is composed of similar spicules only much more minute, show that their size has been increased with the growth of the test, and therefore that they have been formed by the animal, and not brought to it from some other organism. Moreover they are precisely like those seen in the marginal cord and over the septal spaces of

Operculina arabica (*l. c.* fig. 4, and 'Ann.' 1861, vol. viii. pl. xvii. figs. 10, 11), where they are cemented togther by the same kind of areolar calcareous structure, whose cells are so minute, that they can only be just seen in reflected light under one-sixth-of-an-inch compound power with high ocular; hence its white appearance.

After having described and figured such spicules in the cord of *Operculina arabica* in 1852 ('Ann.' *l. c.*), Dr. Carpenter, in 1859 (Phil. Trans. p. 25), stated that it was "due to the peculiar manner in which the homogeneous substance of which it (the marginal cord) is composed is traversed by the set of canals that are correctly described by Mr. Carter as forming the marginal plexus." To this I replied in 1861 ('Ann.' *l. c.* p. 313) that this could not be the case, as in some specimens the spicular structure existed over the septal spaces also, where there is no marginal or any other kind of plexus. Then Dr. Carpenter in 1862 (Introd. to the Study of Foram. p. 257, footnote) rejoined, "So far from finding in this latter statement any reason for modifying my own views, I draw from it additional reason for believing that Mr. Carter has been misled by the method of examination on which he seems to place most reliance."

Here the matter rested with Dr. Carpenter, but not with myself, who, feeling convinced that I was right, could not accept Dr. Carpenter's "views," viz. that solid fusiform bodies such as I have described and figured (*l. c.*), and of which I still retain the preparation unimpaired, could be formed by a "set of canals." Let any histologist try to conceive how a plexus of canals, however disposed, could afford that continuous surface which would be necessary to form a solid, fusiform, calcareous body like the spicule above described, especially over the septal spaces of *Operculina*, where no such plexus exists!

So much for Dr. Carpenter's "views." Now let the above description of this exquisite little organism, together with the accompanying figure 2 (necessarily much enlarged to show the relative size of the primary or embryonic cell, with the length of the largest spicules), testify to the fact that, not only part, but *the whole* of the test may be formed of such spiculiform bodies held together, as above stated, by minutely areolated calcareous structure; while, at the same time, it recalls to mind the chitinous plates formed by the animal of *Euglypha* itself for its own test, and not the heterogeneous material brought from other localities by the animal of *Lituola* and the arenaceous *Difflugiæ* for their tests respectively.

Budleigh-Salterton, 7th October, 1877.

EXPLANATION OF PLATE XVI.

Fig. 1. *Rotalia spiculotesta*, n. sp. Natural size.
Fig. 2. The same, magnified throughout on the scale of 1-24th to 1-1800th inch. *a*, chamber broken open, showing the spicular composition and thin structure of the wall; *b*, cavity of the chamber, showing the spicular structure of the wall from the interior; *c*, dried and contracted sarcode of the animal.
Fig. 3. The same, diagram; portion of the wall of a chamber, magnified upon the scale of 1-12th to 1-1800th inch, to show the form of the spicules and areolated calcareous cement. *a*, spicules separate; *b*, spicules crossing each other; *c*, areolated cement.

LIX.—*Descriptions of new Species of Heterocera from Japan.* —Part I. *Sphinges and Bombyces.* By ARTHUR G. BUTLER, F.L.S., F.Z.S., &c.

[Continued from p. 404.]

Notodontidæ.

33. *Phalera sigmata*, n. sp.

Primaries above white, irrorated with black, brown, and yellow; a patch of raised white scales closing the cell, and followed by a lunulated oblique brown line from costa to inner margin; a discal irregular series of brown-edged, embossed, white lunate spots, followed by an indistinct greyish belt; a series of black Σ-shaped markings along the outer margin; secondaries fuliginous brown, becoming darker externally and ochraceous or testaceous at abdominal margin; thorax white, mottled with blackish scales; abdomen testaceous, with the anal segments whitish; antennæ ferruginous, with testaceous pencil-like pectinations: wings below of the male testaceous, clouded with brown, body testaceous; female rather sandy yellow than testaceous. Expanse, ♂ 2 inches 5 lines, ♀ 2 inches 11 lines.

♂, Yokohama (*Jonas*); ♀, Hakodaté (*Whitely*).

This species has the aspect of *Dasychira*, but the structure of *Phalera*.

34. *Bireta pallida*, n. sp.

♂ ♀. Primaries pale straw-yellow, with a large, pale brownish internal patch, reaching to the first median branch, and a longitudinal streak of the same colour through the end of the cell; an oblique rounded spot of the ground-colour on the lower discocellular; an oblique sinuated line (angulated near the costa) crossing the wing just beyond the middle, and followed below the third median branch by a straight oblique line; an oblique apical dash; a submarginal series of very minute brown dots: secondaries whitish, clouded with pale brown; thorax white, brownish in front, with a central trigonate, scutiform, testaceous patch; body testaceous, anal segments whitish; antennæ with tawny pencils; underside creamy white, the primaries clouded with brown. Expanse, ♂ 1 inch 11 lines, ♀ 2 inches.

♂, Yokohama (*Jonas*); ♀, Japan (*Pryer*).

The markings on the primaries of the male are indistinct. The genus *Bireta* is closely allied to *Ceira*.

35. *Cerura lanigera*, n. sp.

Nearly allied to *C. furcula*, but the discal area of primaries clouded with grey, the central band blackish, constricted in the middle, its inner edge being angulated; the ochreous scales replaced by a few scattered stramineous scales; the outer discal lunate line replaced by well-defined blackish lunate spots; external area (excepting the outer margin) greyish in all the wings: body whiter, with blacker abdominal bands. Underside of wings considerably darker. Expanse 2 inches.

Hakodaté (*Whitely*).

36. *Dicranura felina*, n. sp.

Intermediate in character between *D. erminia* and *D. vinula*; primaries most like those of *D. vinula*, but differing from both species in that the outermost discal line is much more deeply waved, and from *D. erminia* in the deeper waving of both discal lines; the innermost (or third discal) line of *D. vinula* does not extend in this species beyond the first median branch: secondaries white as in *D. erminia*, but with a well-defined, blackish, discocellular lunule: body almost as in *D. vinula*. Expanse, ♂ 2 inches 5 lines, ♀ 2 inches 8 lines.

Yokohama (*Jonas*).

37. *Peridia gigantea*, n. sp.

Nearest to *P. trepida*, but with a broader internal projecting scale-patch than in any other species; above greyish brown: primaries with a broad, subquadrate, subcentral, whitish patch from the costa to the median vein, where it becomes more distinctly testaceous, and is continued as an ill-defined streak below the first branch for half its length and terminates in a

<-shaped marking; orbicular and reniform spots represented by 8-shaped markings, and forming part of the subquadrate patch; basal area to submedian vein crossed by a testaceous streak, intersected and bounded externally by zigzag dusky lines; an oblique whitish costal spot beyond the cell, followed across the disk by whitish dots on the nervures; two or three indistinct subapical whitish lunules running obliquely between the veins; secondaries whitish, with a very broad greyish external border, a central greyish line parallel to the border, apex and one or two subapical spots whitish; tegulæ bordered with black; a black annulus on metathorax; abdomen brown: below sandy whitish; secondaries with two indistinct central parallel greyish lines. Expanse 2 inches 7 lines.

Yokohama (*Jonas*).

Hupodonta, nov. gen.

Allied to *Notodonta* and *Pheosia*, but with broader primaries, having no internal tooth; antennæ broadly pectinated throughout; the scape densely clothed with scales, conical: secondaries densely scaled. Type *H. corticalis.*

38. *Hupodonta corticalis*, n. sp.

General aspect of *Notodonta ziczac*; primaries pale brown, clouded and streaked with darker brown, two pale dashes in a dusky semicircular patch just beyond the cell; costa black, spotted in the centre and towards apex; a cuneiform black internal dash; disk crossed by a grey zigzag line dotted with black on the nervures; outer border first dark brown, followed by a sinuated whitish line, then lilacine, intersected by a submarginal series of black 3-shaped markings, and edged with black; fringe pale brown, with darker external edge; secondaries grey, crossed by pale streaks and lines, which are most distinct near outer margin and edged with dark brown towards anal angle; body pale brown, tegulæ darker; collar and head dark brown, bordered with whitish: primaries below greyish brown, with the interno-median area and outer border paler; secondaries whity brown, crossed by an arched dusky belt, and with basicostal and anal dusky dashes; pectus greyish brown, venter pale brown. Expanse 2 inches.

Yokohama (*Jonas*).

Gonoclostera, nov. gen.

Aspect of *Closteromorpha* of Felder (Nov. Lep. pl. lxxxiii.), but the antennæ broadly pectinated throughout, the primaries less distinctly angulated externally; palpi short and broad, with very minute terminal joint; tibiæ clothed with long hair. This genus should be placed near to *Derrioides*. Type *G. latipennis*.

39. *Gonoclostera latipennis*, n. sp.

Primaries greyish brown, crossed by two diverging lines, the inner one slightly arched, the outer slightly sinuous, a broad triangular patch (enclosed by these lines) becoming gradually darker towards the centre of the wing, apical area dusky; secondaries paler brown, the costal area very light; an indication of a light, discal, transverse, arched line; thorax dark brown, abdomen slightly paler: under surface altogether paler, with two parallel, central, dusky, transverse lines; primaries with the base and a costal spot near apex whitish; secondaries and margins of venter whity brown. Expanse 1 inch 4 lines.

Yokohama (*Jonas*).

GELASTOCERA, nov. gen.

Aspect of *Cleapa*, to which it seems allied, but the antennæ broadly pectinated for rather more than half their length with long bristle-like pectinations; apical two fifths covered with an extremely short pilosity (only visible with a lens); palpi projecting some little distance in front of the head; abdomen very slender. Type *G. exusta*.

40. *Gelastocera exusta*, n. sp.

Primaries ferruginous, with a broad central piceous band, widest on inner margin; external area sordid testaceous; secondaries whitish, slightly ferruginous at outer margin; head and thorax reddish, antennæ brown, abdomen whitish: under surface whitish, with a few scattered ferruginous scales; centre of primaries greyish. Expanse 1 inch 3 lines.

Hakodaté (*Whitely*).

The antennæ are most like those of the genus *Thiacidas*.

Limacodidæ.

PHRIXOLEPIA, nov. gen.

Allied to *Natada*; the wings short and broad; primaries with the inner margin incurved at the base; thorax short, clothed with upright bristling scales; antennæ thickened towards the base, but without pectinations. Type *P. sericea*.

41. *Phrixolepia sericea*, n. sp.

Primaries shining ferruginous or cupreous brown, crossed obliquely by an angulated white line, which, towards the inner margin, is bounded internally by deeper colour and externally by grey; costal margin yellow, fringe white; secondaries shining brown, fringe white; thorax chocolate-brown; abdomen greyish, with yellow anal tuft: under surface shining whity brown; primaries slightly greyish with yellowish costa. Expanse 1 inch 1 line.

Yokohama (*Jonas*).

Drepanulidæ.

42. *Oreta turpis*, n. sp.

♂. Pale shining brown, external area sprinkled with short black lituræ; fringe dark chocolate-brown: primaries crossed obliquely by two contiguous, parallel, discal, greyish lines, which become blackish towards the apex; a short plumbaginous apical streak between the outer line and the margin; the costa at apex and the fringe in the subapical sinus black; secondaries with the costal area pale, apical area rather darker than the rest of the wing; thorax reddish brown; abdomen pale brown, anal tuft yellowish: under surface testaceous, speckled sparsely with grey; fringe brown. Expanse 1 inch 4 lines.

Yokohama (*Jonas*).

43. *Oreta calida*, n. sp.

Laky brown, mottled with black lituræ; the male less red than the female; wings crossed by two central blackish lines, the inner one slightly incurved, and the outer one angulated near the costa of primaries, bounded also by a yellow line running to the apex, and limited externally by a brown streak; apex greyish, with black margin; fringe dark brown; extremity of the cell more or less dusky: secondaries with dark brown fringe; the female with a discal series of black dots, outer border ferruginous. Under surface bright reddish tawny, spotted with grey, and crossed by a discal grey stripe, which is angulated near the costa of primaries; legs red. Expanse, ♂ 1 inch 8 lines, ♀ 2 inches.

Yokohama (*Jonas*), Hakodaté (*Whitely*).

Allied to the preceding species and to *O. suffusa*.

44. *Oreta pulchripes*, n. sp.

Sordid testaceous; wings bordered and clouded with rosy lilacine, and margined with ferruginous, mottled and striated with grey; primaries with two or three costal spots and one near the external angle blackish, crossed by two oblique irregular grey lines, the inner one zigzag, the outer undulated, both angulated near the costa, the outer one bordered externally by a bright yellow line, terminating in an ochraceous patch near the apex; a large ferruginous spot at the end of the cell, enclosing a plumbaginous >-shaped marking; head bright yellow; palpi, frons, and anterior coxæ scarlet; collar greyish, more or less lilacine; abdomen yellow, brightest in the male: under surface cadmium-yellow, densely irrorated with red; primaries mottled with grey, and with a grey submarginal streak; secondaries with a central red streak; legs clothed with scarlet hair. Expanse 1 inch 6–7 lines.

Yokohama (*Jonas*).

45. *Oreta calceolaria*, n. sp.

Sulphur-yellow; wings with central band, basal area, external border of primaries, and a few scales at apex of secondaries reddish brown, mottled with grey and shot with lilacine; palpi and frons plum-coloured; vertex of head and antennæ gravel-yellow; collar lilacine; thorax sordid ochraceous; abdomen testaceous: wings below sulphur-yellow, basal area broadly cadmium-yellow netted with scarlet; primaries with external border red, greyish towards the apex: body stramineous; legs yellow, streaked above with scarlet; anterior coxæ scarlet. Expanse 1 inch 7 lines.

Yokohama (*Jonas*).

Nearly allied to *O. rosea* from Nova Scotia, but much larger and duller in colouring, the central band moreover being of more equal width throughout. It is just possible that the type of *Drepanulides* (?) *rufulus* of Motschulsky may be a rubbed and faded specimen of this species; but it is impossible to tell without seeing it.

46. *Drepana scabiosa*, n. sp.

Above pearly grey: primaries with the costal margin golden orange; a submarginal dark grey stripe; fringe greyish brown; an angulated central transverse series of squamose brown spots, surrounded by sordid white zones: secondaries with a similar spot at the end of the cell, two or three scarcely perceptible parallel discal greyish lines; fringe brown; collar golden orange. Under surface pale stramineous, rather brighter towards apex of primaries; fringe grey. Expanse 1 inch 5 lines.

Yokohama (*Jonas*).

Hypsomadius, nov. gen.

Allied to *Drepana*, but more robust, the head not visible from above; palpi extremely short; the antennæ compressed, the joints imbricated; shoulders square, in a line with the costal margin of primaries: primaries trigonate, produced at apex, outer margin slightly concave; secondaries subtrigonate, the costal margin straight, abdominal margin slightly concave, anal angle produced, outer margin convex; legs clothed with long hair to the end of the tarsi. Type *H. insignis.*

47. *Hypsomadius insignis*, n. sp.

Wings above shining silver-grey, crossed by two lines, the inner one of primaries and the outer one of secondaries irregularly dentate-sinuate, these and the inner one of secondaries testaceous: primaries with the outer line oblique, running to apex, dark red; apical area above the line irrorated with black; fringe dark red; costal margin ochreous: secondaries with the fringe testaceous: body grey, prothorax white, sides of abdomen and anus rosy; head orange, with four lateral patches of crimson scales; legs below whitish; femora whitish above; tibiæ yellow, with a black central spot above, rose-coloured at the sides, the whole of the joints clothed on each side with a long fringe of bright rose-coloured hair, venter crimson. Wings below shining rose-coloured, crossed by innumerable grey lituræ, most densely in the primaries, the latter wings with a grey indistinct oblique line running to the apex; costal margin, apex, fringe, and veins near apex yellow. Expanse 2 inches.

Yokohama (*Jonas*).

Saturniidæ.

48. *Caligula japonica*, Moore.

The pupa of this species, but not the imago, has been described by Mr. Moore. It is nearly allied to *C. simla*, but may at once be distinguished by the inner transverse stripe on both wings, which in the primaries is nearly straight (slightly concave), instead of 3-shaped, and in the secondaries angularly sigmoidal, instead of being regularly convex with an abrupt angle near the abdominal margin. Expanse, ♂ 5 inches 2 lines, ♀ 5 inches 1–5 lines.

Yokohama (*Jonas*).

49. *Caligula Jonasii*, n. sp.

♂. Primaries with whitish costal margin; interno-basal area, limited by an angulated dark red-brown stripe, dull red; discoidal and subcostal areas, and a band immediately beyond the subbasal stripe, and bounded externally by a second similar one, pink; a large black-bordered dull red ocellus enclosing a black spot, its inner third being occupied by red, white, and testaceous lines, at the end of the cell; discal area dull yellowish brown; two apical converging black spots with white and rose-coloured continuations; a broad sinuated submarginal band, angulated and white-edged at external angle; margin yellowish grey; fringe grey, with a pale brown central line: secondaries with the basal two thirds sordid pink, crossed by two central angulated grey stripes, and bounded externally by a third broader one; disk and border as in primaries, but the submarginal band with a continuous white internal edge; an ocellus as in primaries at the end of the cell: head and thorax dark dull red; antennæ testaceous; collar grey with a brown border, abdomen clay-coloured. Wings below with the basal three fourths sordid pink, clouded with pale testaceous, with a central brown stripe; a double zigzag continuous discal line bounding the externo-discal area, which is nearly as above; ocelli almost as above: body below reddish clay-colour; legs and palpi dark dull red. Expanse 3 inches 10 lines.

Yokohama (*Jonas*).

50. *Rhodia fugax*, n. sp.

♂. Allied to *R. newara*, but much smaller, the primaries less falcate; the transverse bands better-defined, greyer, more dentated; the hyaline spots of primaries twice as large, those of secondaries only half as large, the rosy tints replaced by burnt sienna, which colour more or less suffuses the whole external area of the secondaries; the antennæ much darker. Expanse 4 inches 3–4 lines.

Yokohama (*Jonas*).

51. *Tropæa gnoma*, n. sp.

Allied to *T. artemis*, but smaller, of a bluer green; the veins brown instead of white; the fringe whitish, and the tails of secondaries much narrower, longer, and more divergent. Expanse 3 inches 9 lines.

Yokohama (*Jonas*).

Lasiocampidæ.

52. *Trabala cristata*, n. sp.

Nearly allied to *T. niveiceps*, but altogether more ochraceous, the primaries crossed by two pale brown stripes which diverge towards the costa, the inner one at the basal third, and the outer one at the middle of the wing; a nearly straight transverse dark red-brown discal line; two ochre-bordered cream-coloured spots at the end of the cell; crest (formed by the conjunction of the tegulæ) considerably higher and distinctly bordered with yellowish clay-colour; head, collar, ventral surface of the body and secondaries below cream-colour instead of white. Expanse 3 inches 8 lines.

Yokohama (*Jonas*).

53. *Odonestis excellens*, n. sp.

♂. Primaries deep sordid ochreous or gravel-yellow, with a white spot at the end of the cell, outer border broadly and irregularly chocolate-brown; base brownish, enclosing a large subcostal spot of the ground-colour; three equidistant zigzag lunulated brown stripes, the area between the first two brownish; secondaries chocolate-brown, with a central diffused darker band: body deep sordid ochreous; antennæ cream-coloured, with brown pectinations: wings below ochraceous, with three subparallel transverse brown streaks, the two outer ones on the secondaries macular. Female sordid testaceous, with markings as in the male, but far less distinct. Expanse, ♂ 2 inches 10 lines, ♀ 3 inches 6 lines.

Yokohama (*Jonas*).

Allied to *O. sodalis* from China and "*Lebeda*" *undans* from Silhet.

54. *Odonestis superans*, n. sp.

Smoky brown, with a white spot at the end of the cell; primaries with an irregularly sinuous disco-submarginal whitish-bordered dusky stripe, a slender transverse broadly sinuated discal line; male rather paler than the female, the primaries with a large white subcostal spot near the base, an angulated transverse subbasal line, the centre of interno-median area occupied by a broad white nebula: wings below uniform in colouring, with an indication of a diffused darker discal streak across both wings. Expanse, ♂ 3 inches 3 lines, ♀ 4 inches 3 lines.

Yokohama (*Jonas*).

55. *Odonestis spectabilis.*

♀. Like the preceding, excepting that the primaries and thorax are black, and the whitish border of the disco-submarginal stripe is replaced by white spots; no white spot at the end of the cell; the under surface with dusky-streaked external area to primaries and black prothorax; ground-colour of the wings redder. Expanse 4 inches.

Yokohama (*Jonas*).

The costal margin of this species is more arched than in *O. superans*.

56. *Œona segregata*, n. sp.

Primaries black, specked all over with white scales, most noticeably in the female; two central parallel dentate-sinuate oblique white bands, angulated towards costa; a subbasal nebula and a W-shaped series of disco-submarginal spots, reddish and diffused in the male, white in the female: secondaries dark brown, with paler diffused central band and outer border: thorax black, margins of collar and tegulæ grey; abdomen reddish brown; antennæ white, with red-brown pectinations. Underside pale reddish brown; costal margins blackish: primaries with a subcostal diffused white streak near the apex; an indistinct central transverse dusky streak; eight discal spots and the fringe blackish: secondaries crossed from the middle by three broad dusky belts; costa and external border whitish. Expanse, ♂ 2 inches 7 lines, ♀ 3 inches 4 lines.

Yokohama (*Jonas*).

Allied to "*Lebeda*" *hebes*.

Cossidæ.

57. *Hepialus excrescens*, n. sp.

♂. Primaries above pale pinky brownish, reticulated with grey, and sparsely speckled with black; costa with a post-median convex excrescence; margin black-spotted; basal half of the wing, excepting the costal and internal areas, occupied by a large triangular yellowish brown patch, its inferior border edged with whitish; an ill-defined subangulated yellowish-brown discal band; secondaries grey, with the costal and outer margins brown, a black subapical costal spot; body brown: under surface shining brown, costa of primaries spotted with sordid white and blackish. Expanse 2 inches 8 lines.

Yokohama (*Jonas*).

Allied to *H. quadriguttatus* of Grote.

58. *Hepialus æmulus*, n. sp.

♂. Nearly allied to the preceding, but the primaries paler, brownish testaceous, with the external and internal areas and a transverse belt beyond the cell shining silvery greyish; two olivaceous spots in the cell and one below it; secondaries blackish, the external border and apical portion of costa pale with brassy reflections; thorax whitish, with brown borders;

abdomen greyish brown: under surface of wings brown, costal margins whitish, spotted with brown; pectus dark brown, legs paler; venter whity brown; an ochreous tuft on each side at the base. Expanse 3 inches.

Yokohama (*Jonas*).

LX.—*The Post-tertiary Beds of Grinnell Land and North Greenland.* By H. W. Feilden, F.G.S., C.M.Z.S., Naturalist to the late Arctic Expedition; and *Note* by J. Gwyn Jeffreys, LL.D., F.R.S.

In a paper written by Dr. Gwyn Jeffreys, and read at the Plymouth Meeting of the British Association, 20th Aug., 1877, and subsequently printed*, the author directs attention to the Post-tertiary fossils procured in the late Arctic Expedition. My intention now is to supplement that paper by the addition of a few species of Mollusca which had not been submitted to Dr. Gwyn Jeffreys when he published his list, and to add a little information in regard to the structure and extent of these recent deposits, with a notice of the Mammalian and other remains discovered in them.

The localities whence the fossil Mollusca examined by Dr. Gwyn Jeffreys were brought are recorded in his paper, and are numbered by him stations 1 to 12. Nos. 1 and 9 of his list embrace various localities in the vicinity of Floeberg Beach, the winter quarters of H.M.S. 'Alert,' lat. 82° 27′ N., long 61° 42′ W. This list of stations by no means exhausts the whole area over which the Post-tertiary deposits are spread, and from which the collections made by members of the expedition were derived; for at nearly every point visited in Smith Sound and northwards, either on the Grinnell-Land or Greenland shores, where the snow-covering was wanting, evidences of recent elevation were traced.

This elevation of the land in the northern circumpolar regions has long since been brought to the notice of geographers and geologists; and the subject has been treated in a very able and comprehensive manner by Mr. Henry H. Howorth†. The conclusion arrived at by that author is fully confirmed by our observations made in Grinnell Land and North Greenland, which substantiate his opinion that the land which "surrounds the North Pole is undergoing a general

* Ann. & Mag. Nat. Hist. Sept. 1877, pp. 229–242.

† Journ. Roy. Geogr. Soc. 1873.

movement of upheaval; or, to be perfectly correct, we find on it traces in all directions that there has been a movement of upheaval since there was any subsidence."

The evidences of recent elevation in Grinnell Land and North Greenland may be grouped under several headings, namely :—

Mountain-tops and elevated plateaux, having fragments of molluscan remains scattered over their surfaces with ice-borne erratic boulders.

Terminal moraines of ancient glaciers, now elevated above the sea-level, containing numerous molluscan remains.

Series of ancient sea-levels rising tier above tier with great regularity; remains of fossil Mollusca are not unfrequently scattered along these beaches, whilst erratic boulders have been numerously stranded on their slopes and terraces.

Pushed-up mounds or long ridges of gravels, observed at various elevations; whilst similar formations were seen at the sea-level, where the edges of the pack had been driven violently inshore.

Glacial scratches at considerable elevations on cliffs forming the shores of Robeson Channel.

Numerous deposits of sand, mud, and gravel occupying the interiors of valleys, and the bottoms and margins of the fresh-water lakes dispersed over the land. These valleys must recently have been fiords, bays, or arms of the sea; the deposits now resting on their flanks and in the hollows, sometimes attaining a thickness of 200 to 300 feet, were formed by the summer torrents charged with sediment. The same process is going on at the present day; wherever a stream discharges into the sea, the turbid fresh water shows distinctly: whilst the floe with its cargoes of stones and gravel is rotted and destroyed by the comparatively heated fresh water, as a rule the edges of the deltas along the northern shores of Grinnell Land are marked by a line of huge grounded floebergs. On more than one occasion whilst navigating Robeson Channel, these embouchures, though very shallow, proved true harbours of refuge to our vessel, threatened with destruction by the closing-in pack. The quantity of material brought down by these summer torrents during the few weeks of their existence is to be accounted for by the fact that, as a rule, they cut through and wash away the mud and sand beds, which have been formed at earlier stages of upheaval under similar circumstances. I found no evidence of oscillation marking the progress of upheaval in these deposits, but, on the contrary, proof that there have been no periods of subsidence. In every case where these valley mud beds were left intact they are surmounted by beds of gravel. The fine muds and sands must have been deposited in salt water, as is shown by the numerous molluscan remains they contain; whilst the superincumbent unfossiliferous gravels must have been deposited by the streams on the top of the mud beds as the land rose; for the finest material would naturally be borne furthest seaward. Had there been periods of subsidence, we should undoubtedly find the mud and gravel beds intercalating. During upheaval the gravel beds would be deposited, as we find them, above the sands; if periods of subsidence had intervened, mud and sand beds would have been found above the gravels.

The formation of the lakes is obvious. As a bay silts up, and the depth of water at its mouth lessens, the heavy floe driven in from seaward grounds; the almost irresistible pressure of the polar pack exerted on the floebergs buries them deep in the yielding material, which is at the same time forced up into a bar. The process of upheaval continues; the bay becomes a lake; the embankment is soon cut through by the water that seeks an outlet from the lake in summer; the waters of the lake are lowered, and wide margins of mud are exposed. These are frozen and snow-covered for ten months of the year, except where the gales of wind have scooped out the snow and left the ground exposed but frozen as hard as any rock. During the brief summer, when the borders of the lake are exposed, they have the appearance as if the tide had only lately receded; the shells of *Mya truncata*, *Saxicava rugosa*, and *Astarte borealis* are strewed around in great profusion, with large quantities of drift-wood, and in some few instances mammalian remains.

Oscillations of level in these regions since the close of the Tertiary epoch must have occurred on a considerable scale; for I detected Post-tertiary beds resting on undoubted Miocene strata, and extending to an elevation of not less than 1000 feet above their level. The obvious conclusion is, that since the period when a flora analogous in some respects to that now existing in Mexico flourished within 500 miles of the northern axis of our planet, there has been a subsidence of over 1000 feet, and a subsequent upheaval to a similar altitude.

I have thus alluded briefly to the geological structure of these Post-tertiary deposits, in the hope of making the description of the different stations referred to hereafter intelligible to the reader. The stations numbered and described in the following notes are additional to those recorded by Dr. Gwyn Jeffreys*:—

* *Anteà*, p. 231.

Station No. 13. Port Foulke, Greenland, lat. 78° 20′ N. A bed over 100 feet in thickness, lying across a valley, at an elevation of 300 feet, cut through and exposed by a watercourse. Composed of rounded fragments and boulders of granite, gneiss, hornblendic gneiss, basalts, and sandstones, apparently the moraine of a glacier, which must once have submerged at this spot. A fine yellow sand occupied the interstices between the rocks. This sand was full of the shells of *Saxicava rugosa*, with both valves connected, *Mya truncata*, and very sparingly *Cardium islandicum* and *Tellina calcaria.*

Station No. 14. A deposit of stiff clay and pebbles, occupying a depression on the summit of a gneissoid island near Cape Sabine, Ellesmere Land. Elevation 150 feet, most of the testaceous remains fragmentary, consisting of *Mya truncata*, *Saxicava rugosa*, and *Astarte borealis*.

Station No. 15. Twin-Glacier Valley, Hayes Sound, Ellesmere Land. About two miles from the shore, and about the same distance from the edge of the glacier. The stream issuing from the glacier there cuts through beds of fine yellow sands, resting on dolomitic limestone, of probably Silurian age. These beds contained few boulders, but were replete with valves of *Mya truncata* and *Saxicava rugosa*, *Tellina calcaria* being very sparingly scattered through the beds. The section which I examined was remarkably interesting, as it presented an excellent example of contorted bedding, the layers of sand being irregularly deposited and crumpled up by the pressure of berg or floe ice.

Station No. 16. Victoria Head, Bache Island, lat. 79° 14′ N. Terraces from 100 to 200 feet above sea-level, resting on grey fossiliferous limestone of Silurian age. Valves of *Mya truncata* and *Saxicava rugosa* alone found scattered along these terraces.

Station No. 17. Cape Harrison, western side of Franklin-Pierce Bay, Grinnell Land, lat. 79° 24′ N. From the shore to an elevation of 300 feet rose a series of terraces, which slope at an angle of 30 to 35 degrees. These terraces were composed of the débris of the limestone cliffs with clay; valves of *Mya truncata* and *Saxicava rugosa* were alone found. In places where these terraces were broken and the material swept away, the basement rock (a hard Silurian limestone) was marked with ice-scratchings. I could not at the time account for these scratchings on the basement rock and on some of the pebbles in the terraces; but later on we obtained demonstration that shore-ice, acted on by the rise and fall of the tide, picked up the material from the bottom and scratched the imbedded stones, as well as the rocks against which the ice grated. This action of shore-ice I shall advert to more fully in the account of the geology of the expedition.

Station No. 18. Allman Bay, Grinnell Land, lat. 79° 30′ N. On both sides of this bay several lines of parallel terraces stretch for miles, their surfaces from 50 to 100 feet broad; along these terraces are scattered valves of *Mya truncata* and *Saxicava rugosa*. The regularity of these terraces is due to the former presence of the ice-foot, which now permanently encases the shore. My impression is that these terraces have been formed by the sliding down of material, and the banking-up power of the ice casement (the ice-foot of arctic explorers). Perhaps this simple explanation may throw some light on the formation of terraces in other parts of the world, such as the parallel roads of Glenroy in Scotland. During summer the ice-foot is worn by the melting snow-streams into channels; at high tide the sea-water rushes up these cuttings, and, spreading over the ice-foot, works holes through the frozen snow until it reaches the terrace beneath; valves of shells are thus scattered over the terraces.

Station No. 19. Radmore Harbour, Grinnell Land, lat. 80° 27′ N. Series of terraces, similar to No. 18, with the same testaceous remains.

Station No. 20. Watercourse Bay, Grinnell Land, lat. 81° 44′ N. Thick beds of clay, with numerous ice-scratched erratics, resting upon beds of sandstone of Miocene age: fossils *Mya truncata*, *Saxicava rugosa*, *Astarte borealis*, and *Pecten Grœnlandicus*.

Station No. 21. Same locality, 1000 feet higher elevation, resting on azoic slates; same description of beds with similar fossils as No. 20.

Station No. 22. Shift-rudder Bay, Grinnell Land, lat. 80° 50′ N. Valley leading into the interior with great deposits of grey mud containing drift-wood, occupying depressions up to an altitude of 200 feet; where cut by watercourses, the sections showed numbers of *Astarte borealis*, in such good preservation that the epidermis was fresh-looking and the hinge of the valves intact. *Mya truncata*, *Saxicava rugosa*, and *Pecten Grœnlandicus* were the most abundant fossils; but *Astarte fabula* occurred not unfrequently. From this locality Commander Parr, R.N., procured an antler of the reindeer (*Cervus tarandus*), which, I do not doubt, came out of these shell-bearing beds.

Station No. 23. Lincoln Bay*, Grinnell Land, lat. 82°

* *Vide* Parliamentary Papers [C.—1636], 1877, p. 301.

8′ N. Borders of freshwater lakes, consisting of brown mud, frozen at the date of visit, April 26, 1876, elevated about 50 feet above sea-level, evidently a recently elevated fiord. An area of miles was strewed with sea-shells; these consisted largely of *Astarte borealis*, *Saxicava rugosa*, and *Mya truncata*, whilst *Astarte fabula* was not so common. Most of these shells had the two valves attached. It must not be supposed that this whole area was exposed: snow lay deep on many parts of it; but every here and there the wind had scooped out patches and bared places, where I was able to examine the surface-mud and its contents.

Station No. 24. A ravine, some four miles inland from Blackcliff Bay, lat. 82° 30′ N.* Sections of these mud beds showed thicknesses of 100 to 150 feet, surmounted by beds of gravel (or, rather, water-worn pebbles) of great thickness. In addition to *Pecten Grœnlandicus*, *Astarte borealis*, *Saxicava rugosa*, and *Mya truncata*, we here obtained a few specimens of *Trochus umbilicalis*, *Cylichna alba*, and *Siphodentalium vitreum*. Many fragments of marine algæ (*Melobesia polymorpha*) were scattered through these beds, also fragments of rods of *Funiculina quadrangularis*.

Station No. 25. Deposits rising from sea-level to an elevation of 400 feet in the vicinity of Dumbbell harbour, Grinnell Land, lat. 82° 30′ N. In one spot I found the rods of *Funiculina* very abundant, also a bone and a tooth of *Ovibos moschatus*, and a bone of *Phoca hispida*, in addition to *Pecten Grœnlandicus*, *Astarte borealis*, *Mya truncata*, *Saxicava rugosa*.

Station No. 26. Mud beds, Westward-Ho Valley, Grinnell Land, 82° 40′ N. *Pecten Grœnlandicus* common; this shell is extremely friable in a fossil condition, and difficult to extract in an entire state. This species was also common at stations Nos. 1, 3, and 9 of Dr. Gwyn Jeffreys†. Nos. 1 and 9 stations being in close proximity to the winter quarters of H.M.S. 'Alert,' in lat. 82° 27′ N., received especial attention and examination from myself and others.

Station No. 27. Plateaux elevated 800 feet in the vicinity of Floeberg Beach, lat. 82° 27′ N. Valves of *Mya truncata* scattered about sparsely.

From Station No. 3 of Dr. Gwyn Jeffreys I procured fossil remains of *Cervus tarandus*, *Ovibos moschatus*, and *Phoca barbata*, and from Station No. 9 those of *Myodes torquatus*.

* *Vide* Parliamentary Papers [C.—1636], 1877, p. 291.
† Ann. & Mag. Nat. Hist., Sept. 1877, p. 231.

This list of stations where Post-tertiary deposits in Grinnell Land and North Greenland were examined might be indefinitely increased; but I think sufficient has been adduced to show that these deposits received careful and systematic investigation. The paucity of the fossil molluscan fauna in species, as compared with individuals, must be accounted for, not by "the difficult circumstances under which the specimens were collected in such very high latitudes"*, but from physical causes, a demonstration of which I have attempted in a paper I lately contributed to a contemporary magazine†. I am indebted to Dr. Gwyn Jeffreys for the determination of the additional species of Post-tertiary fossil Mollusca included in this paper, and for a revision of the others.

Note. By J. Gwyn Jeffreys, LL.D., F.R.S.

Since the publication, in the 'Annals' for Sept. 1877, of my paper on the Post-tertiary and recent Mollusca procured in the late Arctic Expedition, I have examined more specimens collected by Capt. Feilden; and I now subjoin a list, with reference to his additional stations and to some of those previously given by me.

Conchifera.

Pecten Grœnlandicus (page 231).

Stations Nos. 20, 21, 22, 24, 26.

Leda pernula (p. 232).

St. No. 9.

Leda arctica (p. 238).

St. Nos. 1, 9.

Axinus flexuosus, var. *Gouldii* (p. 233).

St. No. 9.

Cardium Islandicum, Chemnitz.

Cardium Islandicum, Chemnitz, Conch. Cab. vol. vi. p. 200, tab. 19. figs. 195, 196.

St. No. 13.

Circumpolar; frequent in Post-tertiary deposits throughout the north of Europe and America.

* Ann. & Mag. Nat. Hist., Sept. 1877, p. 230.

† Zoologist, 1877, pp. 435–440.

Astarte borealis (p. 233).

St. Nos. 9, 14, 20, 21, 22, 23, 24, 25, 26.

Astarte fabula (p. 234).

St. Nos. 1, 9, 15, 22, 23.

This species is probably the *Nicania Banksii* of Leach, MS., which was figured by the late Mr. G. B. Sowerby in his Supplement to Gray's 'Mollusca of Beechey's Voyage,' (1839), pl. xliv. fig. 10, as "*Astarte Banksii?* Gray in Brit. Mus." Möller included it in his list of Greenland Mollusca under the name "*Nicania Banksii*, Sab." Reeve's publication was in 1855. Sowerby's figure, although it represents the shape, does not show the peculiar sculpture of *A. fabula*.

Tellina calcaria, Chemn.

Tellina calcarea, Chemn. vi. p. 140, tab. 13. fig. 136.

St. Nos. 1, 9, 13, 15.

For the synonymy and range of this common arctic shell and "glacial" fossil see 'British Conchology,' vol. ii. pp. 389, 390, and vol. v. p. 187.

Thracia obliqua, Jeffr., sp. n.

St. No. 1.

A valve measuring an inch and six tenths in breadth by an inch and one tenth in length. It is distinguishable from *Thracia* (*Amphidesma*) *truncata* of Brown, = *T. myopsis*, Beck, in having a more oblique or twisted shape, a straight instead of rounded margin in front, and a more gradual or less abrupt slope to each side; the truncature at the posterior side is broad and regularly curved; and the surface is puckered, as in *Mya truncata*. It wants the flexuosity of *T. pubescens*, but resembles in its outline that species more than *T. truncata*. *T. septentrionalis*, Jeffr. (*truncata* of Mighels and Adams), differs in shape and texture from all the above-named species. Having, however, seen but a single valve, I will not insist on this constituting a new species.

Mya truncata, var. *Uddevallensis* (p. 235.)

St. Nos. 1, 3, 9, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 27.

Station 21 appears, by a memorandum made on the spot, to be no less than 1000 feet higher than Station 20.

Saxicava rugosa (p. 234).

St. Nos. 1, 3, 9, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25.

SOLENOCONCHIA.

Siphodentalium vitreum.

See Ann. Feb. 1877, pp. 155, 156.

St. No. 24.

GASTROPODA.

Trochus umbilicalis (p. 235).

St. No. 24.

Buccinum tenue.

See Ann. April 1877, p. 324.

St. No. 25.

Cylichna alba (p. 237).

St. No. 24.

ACTINOZOA.

Funiculina quadrangularis (p. 237 as *Pennatula*, sp.).

St. No. 24.

Mr. Norman has examined these organisms, and favoured me with the following memorandum :—

"*Funiculina quadrangularis* (Pallas) = *Pavonaria quadrangularis*, Johnston.

"Fragments of the full-grown quadrangular calcareous skeleton-rods. They are in good condition, and much more recent-looking and less decayed than a similar rod which I dredged two months ago to the N.E. of the "Maiden Rock" near Oban. There can be no doubt that this Oban specimen was "recent;" for although I did not dredge it living, it was close to this locality that Mr. M'Andrew obtained the first known British example of this species. *Funiculina quadrangularis* is at present known to range from the Adriatic Sea (Kölliker) to the Minch ('Porcupine' Expedition, 1869) on our own coast, and Kattegat in the Scandinavian Seas (Malm)."

MARINE ALGÆ.

Melobesia polymorpha (p. 237).

St. No. 24.

Leda arctica, *Cardium Islandicum*, *Tellina calcaria*, *Thracia obliqua*, *Siphodentalium vitreum*, and *Buccinum tenue* are additions to my former list, and raise the number of fossil species to 27.

I take this opportunity of also supplementing, but in a less degree, the list of recent Mollusca from the Arctic Expedition.

Brachiopoda.

Rhynchonella psittacea.

Anomia rostrum psittaci, Chemn. viii. p. 106, tab. 78. fig. 713, *a, b, c.*

Franklin-Pierce Bay, lat. 79° 25′ N., 15 fathoms (Feilden and Hart): Cape Napoleon, 25 fms. (Feilden).

Inhabits the Arctic seas in both hemispheres, southwards to Newfoundland and Norway (and perhaps Shetland also), in from 12 to 150 fathoms. It has a rather more extensive distribution in a fossil state, and occurs in our newer Crag and Post-tertiary beds, as well as in Canada. See 'British Conchology,' vol. ii. pp. 22, 23, and vol. v. p. 164, pl. xcix. fig. 4.

Gastropoda.

Trochus umbilicalis (p. 235).

Mushroom Point, 82° 29′ N. lat. (Feilden): Floeberg Beach, 82° 27′ N. lat. (Moss). Not recorded in a recent or fossil state anywhere south of the Arctic circle.

Trochus olivaceus (p. 240).

Cape Frazer, 80 fms.; lat. 79° 44′ N.

In the stomach of a *Crossaster papposus* (Feilden).

For synonymy and range see 'Annals,' March 1877, pp. 237, 238.

Cylichna striata, Brown.

Bulla striata, Brown, Ill. 1827, pl. 38. figs. 41, 42.

Floeberg Beach (Moss).

This high-northern species is the *Bulla occulta* of Mighels and Adams (1841), *B. Reinhardi* of Möller (1842), *B. scalpta* of Reeve (1855), and *B. propinqua* of M. Sars (1858). Recent: Greenland (Möller and others); Wellington Channel (Belcher); New England (Mighels); Spitzbergen (Torell, Eaton); Tromsö (Sars). Fossil: Clyde Beds (Stewart, *fide* Brown); Westbrook, Maine (Gould).

It differs in shape and sculpture from *Bulla solitaria,* Say, $=$ *B. insculpta,* Totten; in the present species the crown or apex is abruptly truncated or flattened, and the striæ are more numerous and irregularly crowded. Dr. Moss sent me with his specimen the following note :—

" When the snow melted into pools on the ice-foot a mile to the north-west of the 'Alert's' winter quarters, a quantity of 'jetsam' thrown up by the sea was found lying on the surface of the ice. It consisted of Laminariæ in every stage of decay, small fragments of coniferous drift-wood very rotten and old, many specimens of *Arcturus*, and a few of *Nymphon*; and here and there the accompanying shells lay sunken into little thimble-shaped pits in the ice. They were extremely fragile, and almost all imperfect. They could not be handled with cold fingers; but with the help of a bit of laminarian frond a few perfect shells were raised and bottled. The shell enclosed in the tube is the only specimen of its sort I could get in a perfect state. I saw several others; but they crumbled at the slightest touch."

I exceedingly regret that my friend Capt. Feilden is under the impression that in my former paper I criticised too severely the conchological results of the Expedition. This criticism I never intended. It is quite true that I expressed disappointment with the conchological results of the expedition; but I must repeat what I said on that occasion :—" I have no doubt that the Naturalists did their best." The memorandum of Dr. Moss, which I have above quoted, shows that the specimens were collected under difficult circumstances. Capt. Feilden evidently spared no trouble, nor flinched from his task with the thermometer many degrees below zero. Judging, however, from the species already recorded, and from their association with other species elsewhere in arctic seas, I cannot help believing that the list of polar Mollusca is far from being exhausted. Shallow water only has hitherto been dredged north of latitude 70° 30′. The paucity of species in the polar seas, if it exists, may be due to the absence of those marine currents which promote and regulate the distribution of species in other seas. Temperature does not appear to restrict the distribution, because individuals are abundant in the highest latitudes, and in the 'Porcupine' expedition of 1869 there was no diminution of species or individuals in the "cold area:" although the normal temperature in the greater part of this area was between 29° and 32° F., more species of Mollusca occurred there than in the adjacent "warm area." The naturalists of the Norwegian expedition found a varied fauna in the coldest parts of the ocean which they have lately explored, between Iceland and Jan Mayen's Isle. The collection of Post-tertiary fossils made in latitudes within ten to seven degrees of the pole is especially interesting to geologists in comparison with the published lists of Post-tertiary fossils from Scandinavia, as well as from the Clyde beds, Kelsea Hill, Bridlington, and other so-called "glacial" deposits in this country. These lists contain many more species than were found in Grinnell Land, and may therefore be regarded as arctic rather than polar. In fact I do not know a single fossiliferous deposit in Europe which is exactly similar to that which Capt. Feilden has so carefully examined throughout such an extensive area.

J. GWYN JEFFREYS.

Ware Priory, 17th Nov., 1877.

LXI.—*Appendix to Papers "On the Distribution of Birds in North Russia" ('Annals,' 1877)—being Additions to the Data for the Southern Division, by Herr Richard Sievers (with Summaries up to Date).* By J. A. HARVIE BROWN, F.Z.S.

I AM much indebted to Herr R. Sievers, of Helsingfors, for generously putting at my disposal particulars in MS. of his journeys in 1875 and 1876, along with a list of the species met with—*first*, along the river Swir, in the summer of 1875 (June 9–July 24), and, *second*, in Northern Onega, Powanetz, the peninsula of Saoneskje, Petrozavodsk, at Lake Wig, Segosero, &c. in 1876 (June 17 to September)*.

These particulars, however, arrived just too late for insertion in Part III. of my paper ('Annals,' September 1877, p. 180); and as Herr Sievers has informed me that his fuller account may be shortly expected, I have thought that the abstract furnished to me by Herr Sievers may be acceptable as bringing the additional information as regards distribution up to date. I beg therefore to offer it in the form of an Appendix to my other papers. Herr Sievers has also informed me of the title of his paper; so that I am able to insert it here, following the same plan as heretofore.

24.

1877. SIEVERS, R. "Ornitologiska anteckningar under resor i gouvernements Olonetz somrarna 1875 och 1876." (Meddelanden af Societas pro Fauna et Flora Fennica, häft ii.)

One hundred and thirty species are mentioned by Herr

* The most northerly locality he reached was the northern shore of Wig Lake, so that all his observations apply to our South-west District.

Sievers, all from our S.W. District; and four others* not observed by himself are given on the authority of Herren Sahlberg and Günther, which gentlemen Prof. Palmén makes mention of and quotes in his 'Finlands Foglar,' making in all one hundred and thirty-four species noticed by Herr Sievers in his communications.

List of Species observed by Herr R. Sievers in the S.W. District.

N.B. Additions to the fauna of the district are indicated by the letters S.W.D. (South-west district) being affixed.

Additions to the fauna of the Division by the letters S.D. added and affixed.

Additions to the fauna of North Russia by the letters N.R. added, and by being numbered "bis."

Those which are not additions to the fauna of North Russia retain the numbers given in Part III.†

The notes appended to the notices of the species are by Herr Richard Sievers. Additional notes in brackets are given on some of the species by me.

2. *Aquila chrysaëtus*, (L.) ·|·. Observed on Segosero. S.W.D.
4. *Haliaëtus albicilla*, (L.). 1? Possibly I saw this species on Onega Sea.
5. *Pandion haliaëtus*, (L.). ‖. Many times observed.
6. *Buteo vulgaris*, Bechst. ‖. Nests.
8. —— *lagopus*, Brünn. ·|· ⚑. Once on Segosero, July 7, 1876.
9. *Pernis apivorus*. ·|· ⚑. Once on the Swir, July 5, 1875. [Lilljeborg (4) gives it as generally distributed between Ladeinopole and the Dvina in the woods. Meves (8) saw it once at Schlusselburg.]
15. *Falco subbuteo*, L. ‖. On Swir, Onega, Wyg-See, Segosero. Breeds. Shot Aug. 8, 1876.
16. —— *vespertinus*, L. ‖. Breeds.
17. —— *æsalon*, L. ·|· ⚑. Only once on Onega.
18. —— *tinnunculus*, L. ·|·. At Segosero and Onega.
19. *Accipiter palumbarius*, L. ⚑. Seen once on Onega.
20. *Circus cyaneus*, (L.). ·|· ⚑. Once on Onega Sea.
25. *Glaucidium passerinum*, (L.). ·|·. Nests at Segosero. S.W.D.
27. *Nyctale Tengmalmi*, (Gmel.). ·|·. Nests on the Swir.
31. *Asio accipitrinus*, (Pall.). ·|·. On the Swir.

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* *Charadrius hiaticula*, *Scolopax gallinula*, *Anas querquedula*, and *Podiceps auritus*. Of those recorded by Lilljeborg and Meves during their stay at Sermaks, Ladeinopole, and Wosnesenski, Herr Sievers did not observe the following—*Fringilla coccothraustes*, *Turdus viscivorus*, *Coracias garrula*, *Locustella fluviatilis*, *Accentor modularis*, *Corvus corone*, *Limosa ægocephala*, *Ardea stellaris*. On the other hand, he adds to Kessler's list of the birds of the Government of Olonetz (*vide* 'Annals,' Sept. 1877, p. 182) these—*Picus leuconotus*, *Podiceps cristatus*, and *Sterna fluviatilis*.

† Owing to an unfortunate slip in arranging and paging the MS. of Part III., the species numbered in the Table 59–73 should in correct order follow No. 42, and those numbered 43–58 should be numbered 58–73. To avoid further confusion, however, I think it is better now to retain the order as given in Part III., erroneous though it be.

32. *Bubo ignavus*, (Forst.). ·|·. North-west from Onega Sea. S.W.D.
33. *Dryocopus martius*, (L.). ·|·. Nests on the Swir.
34. *Picus major*, L. ††. Nests.
35. —— *leuconotus*, (Bechst.). ✓. Once on the Swir.
37. —— *minor*, L. ·|·. Nests.
38. *Picoides tridactylus*, (L.). ·|·. On the Swir and Onega.
41. *Yunx torquilla*, L. ·|·. Only found on the Swir.
42. *Cuculus canorus*, L. ††. Nests.
44. *Passer domesticus*, (L.). ††. Nests.
45. —— *montanus*, (L.). ††. Nests.
47. *Pyrrhula major*, Brehm. ‖. Nests. [In Herr Siever's MS. this is given as *P. vulgaris*, Briss.; but I have ventured to refer the record to the eastern species.]
48. *Carpodacus erythrinus*, (Pall.). ·|·. On the Swir. [When passing in the 'Drischkott' or canal-boat along the southern end of Lake Onega in 1872, Alston and myself observed a fine male of this species perched on the top of a bush on the canal-bank.]
50. *Loxia curvirostra*, L. ⊙. Only found on the Swir.
52. —— *pityopsittacus*, Bechst. Found on Onega, Wyg-See, and Segosero. S.W.D.
55. *Fringilla cœlebs*, L. ††. Nests.
56. —— *montifringilla*. ·|·. On Lind-osero, between Wyg-See and Segosero.
58. *Carduelis spinus*, (L.). ‖. Nests.
63. *Corvus corax*, L. ††.
65. —— *cornix*, L. ††.
66. —— *monedula*, L. ††. Nests.
67. —— *frugilegus*, L. ✓. Seen once on the Swir, June 17, 1875.
70. *Pica caudata*, (L.). ††. Nests.
71. *Garrulus infaustus*, (L.). ††. In the northern districts. Nests.
72. —— *glandarius*, (L.). ·|·. On the Swir and Onega. Nests. S.W.D.
74. *Lanius excubitor*, L. ·|·. Swir, Onega, Segosero.
75. —— *collurio*, L. ⊙. Only on the Swir. Nests.
77. *Linota linaria*, (L.). ‖. Nests.
81. *Emberiza aureola*, Pall. Very ·|·. Only on the south of Wyg-See and in northern Onega.
82. —— *citrinella*, L. ††. Nests.
83. —— *rustica*, Pall. ‖. Nests. Swir, Onega, Wyg-See, Segosero.
86. —— *schœniclus*, L. ††. Nests.
89. *Alauda arvensis*, L. ††. Nests.
92. *Anthus trivialis*, (L.). ·|·. Very rarely found.
93. —— *pratensis*, (L.). ††. Nests.
99. *Budytes flavus*, L. ††. Nests.
102. *Motacilla alba*, L. ††. Nests.
104. *Oriolus galbula*, L. ·|·. Nests. Swir and Onega.
107. *Turdus pilaris*, L. ‖. Nests.
109. —— *iliacus*, L. ‖. Nests.
111. —— *musicus*, L. ‖. Nests.
112. *Erythaca rubecula*, (L.). ‖. Nests.
114. *Ruticilla phœnicura*, (L.). ††. Nests.
115. *Saxicola œnanthe*, (L.). ††. Nests.
116. *Pratincola rubetra*, (L.). ††. Nests.
121. *Sylvia garrula*, Briss. ·|·.
122. —— *rufa*, (L.). ††. Nests.
123. —— *atricapilla*, L. ·|·. Nests. On Swir, in Onega, Petrozavodsk.

124. *Sylvia salicaria*, (L.). ††. Nests.
126. *Hypolais icterina*, (Vieill.). ·|·. Very rare. Only on Ladoga. (Compare records of authorities Nos. 4, 8.)
128. *Acrocephalus dumetorum*, Blyth. ·|·. Nests. Found on the Swir, June 19, 1876.
132. *Calamodus schœnobænus*, (L.). ||. On the Swir. Nests. Found at Petrozavodsk in Onega.
134. *Daulias luscinia*, (L.). ·|·. Very rare. Only on the Swir.
139. *Phylloscopus trochilus*, (L.). ††. Nests.
141. —— *collybita*, (Vieill.). ||. Nests.
147. *Regulus cristatus*, Charleton. ·|·. Onega.
148. *Troglodytes parvulus*, Koch. ·|·. Nests. On Swir and N.W. of Onega.
153. *Parus borealis*, De Sélys. ††. Nests.
155. —— *cinctus*, Bodd. ·|·. Very rare. Nests. On Segosero and Onega.
156. —— *cristatus*, L. ||. Nests.
157. *Acredula caudata*, (L.). ·|·. Very rare. Nests. Only on the Swir.
158. *Ampelis garrula*, L. . One pair found on Segosero, July 6, 1876.
159. *Muscicapa atricapilla*, L. ||. Nests.
160. —— *grisola*, L. ††. Nests.
160 bis. —— *parva*, Bechst. Nests. Found on the Swir, July 14–16, 1875. One ♂ shot at Petrozavodsk in Onega, Sept. 4, 1876. N.R., S.D., S.W.D.
161. *Hirundo urbica*, L. ††. Nests.
162. —— *rustica*, L. ††. Nests.
163. —— *riparia*, L. ||. On the Swir; only once seen in Onega. Nests.
164. *Cypselus apus*, (L.). ††. Nests.
165. *Caprimulgus europæus*, L. ||. "Not rare" on Swir and Onega.
166. *Columba palumba*, L. ⊙. Occurs in districts of Onega Sea.
171. *Lagopus albus*, (Gm.). ? Once seen on Swir by Sahlberg. S.W.D.?
173. *Tetrao urogallus*, L. |. Nests.
175. —— *tetrix*, L. ||. Nests.
176. —— *bonasia*, L. ||. Nests.
182. *Charadrius pluvialis*, (L). |. One small flock on Wyg river.
183. *Ægialites hiaticula*, (L.). |. Segosero. Nests (*auct.* Sahlberg).
184. —— *curonicus*, Besecke. ·|·. Very rare. Nests. Found on Ladoga and Swir, June 22, 1876.
185. *Vanellus cristatus*, M. & W. ·|·. Very rare. On the Swir, July 23, 1875.
188. *Grus cinerea*, Bechst. ||. Nests.
189. *Ardea cinerea*, L. ·|·. Very rare. Once on the Swir, July 23, 1875.
197. *Scolopax rusticola*, L. ·|·. Very rare. Found in autumn at Petrozavodsk in Onega.
199. *Gallinago gallinaria*, (Gm.). ||. In the southern parts. Nests.
200. *Scolopax gallinula*, L. |. Petrozavodsk on Onega (*auct.* Günther), and nests on the Wyg river (*auct.* Sahlberg).
204. *Tringa subarquata*, (Güld.). ·|·. Very rare. Migrating in north-west of Onega, Aug. 22, 1876.
205. —— *alpina*, L. ·|·. Very rare. Once shot on the Swir, on July 19.
206. —— *minuta*, Leisl. Migrates in flocks quickly.

207. *Tringa Temminckii,* Leisl. Migrates in flocks quickly.
209. *Totanus canescens,* (Gm.). ‖. Nests. Not rarely found on the Swir, Onega, Segosero.
213. —— *glareola,* (L.). ‖. Nests.
214. —— *ochropus,* (L.). |. Nests. Found on the Swir and in Onega.
216. *Actitis hypoleucus,* (L.). ††. Nests.
218. *Machetes pugnax,* (L.). ·|·. On Swir, Aug. 20, 1875; in Onega, Aug. 3.
221. *Crex pratensis,* Bechst. ·|·. Very rare. Only on the Swir.
222. *Ortygometra porzana,* (L.). ·|·. On the Swir, July 3, 1875. [Compare records of other authorities 4, 8, 11. In 1872 Alston and I heard the quail-like note of this species in every direction in the marshes on the south of Lake Onega, and traced it commonly as far north as Archangel. Lilljeborg and Meves both testify to its common occurrence.]
226. *Anser segetum,* Gm. ·|·. Very rare. One pair nesting between Wyg-See and Segosero.
232. *Cygnus musicus,* Bechst. ‖. In the northern parts. Nests.
236. *Anas boschas,* L. ‖. Nests.
238. —— *penelope,* L. ‖. Nests.
239. —— *acuta,* L. ✓. Once shot on Onega See (but compare other records, 4, 5, 8, 11).
240. —— *circia,* L. |. On Segosero and Tindie, north-west of Onega. Nests (*auct.* Sahlberg).
241. —— *crecca,* L. ‖. Nests.
242. *Fuligula cristata,* (L.). ·|·. Very rare. Only in September in Onega. [Lilljeborg (4) observed it at Wuitegra and on the Dwina; Meves at Novaja Ladoga, Sermaks, and Archangel, and says "not rare;" Palmén (11, p. 509) treats of it as common in the districts around Ladoga.]
243. —— *marila,* (L.). ‖. In northern Onega See. Nests.
246. —— *glaucion,* (L.). ††. Nests.
247. —— *glacialis,* (L.). ·|·. Very rare. Does not breed. On Segosero, Aug. 4, 1876.
252. *Œdemia nigra,* (L.). |. Nests on Wyg-See and Segosero.
254. *Mergus merganser,* L. ·|·. Nests.
255. —— *serrator,* L. ††. Nests.
257. *Podiceps griseigena,* (Bodd.). ‖. Nests. On the Swir, Segosero, and in Onega.
258. —— *auritus,* Lath. ✓. Once found by Günther at Petrozavodsk.
259. —— *cristatus,* L. ·|·. Very rare. Once seen on the Swir, July 23, 1875.
261. *Colymbus arcticus,* L. ·|·. Nests.
263. —— *septentrionalis,* L. ‖. Nests.
278. *Larus fuscus,* L. ‖. Nests.
281. —— *canus,* L. ††. Nests.
285. *Sterna fluviatilis,* Naum. ‖. Everywhere common on the Swir and Onega See.

An examination of Herr Sievers's results, as shown above, gives the following additions to the fauna of the *district*, of the DIVISION, and of *North Russia*.

North Russia: 1 species added, viz. *Muscicapa parva* (160 bis)*.

* Making up to date authentic total for North Russia of 282.

Southern Division : 1* species added, viz. ditto.

South-west District: 6 or 7† species added, viz. *Aquila chrysaëtus*, *Glaucidium passerinum*, *Bubo ignavus*, *Loxia pityopsittacus*, *Garrulus glandarius*, *Muscicapa parva*, *Lagopus albus* ?.

LXII.—*The Nomenclature of the Groups of* Ratitæ. By Alfred Newton, M.A., F.R.S., V.P.Z.S.

Since Professor Huxley published (Proc. Zool. Soc. 1867, pp. 415–472) the results of his researches on the classification of Birds, no thinking ornithologist can have doubted that the different groups of his "Order" *Ratitæ* are natural and well-defined, any more than that these groups are severally equivalent to the so-called "Orders" of *Carinatæ* as accepted by most ornithologists. But ten years have passed away without any one attempting (so far as I know) to give these groups definite names; and no inconsiderable inconvenience has sprung from this abstinence, to put an end to which I now, with the good-will of Prof. Huxley, venture to bring forward some suggestions on the subject.

I would premise, however, that if, as I believe, these groups are established on a basis even surer than those to which, by the consent of almost all ornithologists, the name of "Order" has been assigned, it would be fitting to apply to the former also the same name. Prof. Huxley, moved by considerations which I fully appreciate, though into them I need not here enter, proposed to treat the whole existing Class *Aves* as composed of but two "Orders," *Ratitæ* and *Carinatæ*. But some deference is due to the views so long entertained by writers who have always been regarded as authorities on the classification of birds; and though, when compared with the "Orders" of other Classes of Vertebrates, the generally received "Orders" of most ornithologists unquestionably fail to exhibit the same trenchant characters, yet very great confusion would follow were we to give up the title we have been accustomed to apply to these groups of Carinate Birds. It seems to me that the easiest mode of escaping this practical difficulty is to raise the groups *Ratitæ* and *Carinatæ* to the rank of Subclasses‡; for

* Making up to date authentic total for Southern Division of 231.

† Making up to date authentic total for South-west District of 174.

‡ This was doubtless intended to have been done by Messrs. Sclater and Salvin ('Nomenclator Avium Neotropicalium,' p. iv); but by an obvious oversight the word "Subordo" is printed in place of "Subclassis," "Subordo" in its proper sense being used on the opposite page and elsewhere.

then their subdivision will not involve the introduction of any radically new notions of taxonomy or nomenclature.

Leaving, then, the "Orders" of *Carinatæ* to take care of themselves, my present business is with the subdivisions of *Ratitæ*; and accordingly I beg leave to suggest that this important though comparatively small group be termed a Subclass, and, following the indisputable characters assigned by Prof. Huxley, that its component parts be named as follows:—

Subclass RATITÆ.

Order I. Struthiones. Fam. *Struthionidæ*.
,, II. Rheæ. Fam. *Rheidæ*.
,, III. Megistanes. Fam. i. *Dromæidæ*, Fam. ii. *Casuariidæ*.
,, IV. Immanes. Fam. i. *Dinornithidæ*, Fam. ii. *Palapterygidæ**.
,, V. Apteryges. Fam. *Apterygidæ*.
,, VI. Æpyornithes. Fam. *Æpyornithidæ*.

Of the names above suggested there is only one (*Immanes*) that can be called new to the literature of ornithology, since *Megistanes* was used in 1816 by Vieillot (Analyse &c. p. 53) for the whole group of Ratite Birds then known, while, according to the received laws of nomenclature, I am strictly within my right in proposing to limit the term to a portion of that group. I would gladly have assigned it to the order containing the Moas, to which its meaning would make it very applicable; but I am forbidden by the consideration that they, being then undiscovered, were not included in it. It may be objected that *Immanes*, being an adjective, should not be used as a substantive; but in anticipation thereto I may cite the precedents of *Ratitæ* and *Carinatæ*.

There is no need for me to dwell on the characters of these Orders and families; for they have been sufficiently set forth by others, except in the case of *Æpyornithes*, for which (as in the case of other fossil forms) we must await further investigation, though there can be hardly any doubt of its distinctness from the rest. The sequence also of the several groups is immaterial to the object I have now had in view, and upon that I say nothing.

Magdalene College, Cambridge,
31st October, 1877.

* On the supposition that the opinions expressed by Dr. Haast (Trans. and Proc. New-Zeal. Inst. vi. pp. 426, 427) can be substantiated; but they have since been disputed by Capt. Hutton (*op. cit.* ix. pp. 363–365), and, for the present, it is advisable to suspend our judgment on this point.

LXIII.—*Studies on Fossil Sponges.*—I. *Hexactinellida.* By KARL ALFRED ZITTEL.

[Continued from p. 424.]

Revision of the Genera of the Fossil Hexactinellida *.

A. DICTYONINA, Zitt.

Family 1. **Astylospongidæ.**

ASTYLOSPONGIA, Ferd. Röm.

Silur. Fauna des westl. Tennessee, p. 8.

Sponge-body globular or thickly disciform, free, without a point of attachment. Central cavity small, slightly depressed, or entirely wanting. Water-circulation system composed of numerous parallel canals running from the periphery towards the centre, and vertical canals parallel to the periphery of the sponge-body. Skeleton consisting of coalescent sexradiates with solid crossing-nodes. Latticed framework irregular, with polyhedral triangular or quadrangular meshes. Usually arms of several neighbouring sexradiates attach themselves to one crossing-node.

Astylospongia præmorsa, Goldf. sp., Röm. *l. c.* i. 1.
A. castanea, Röm. Sil. Fauna von Sadewitz, iii. 3.

PALÆOMANON, F. Röm.

Sil. Faun. des westl. Tenn. p. 12.

Differing from the preceding genus only by the basin-like shape, the wide central cavity, and larger ostia on the sides.

Palæomanon cratera, F. Röm. *l. c.* i. 4.

PROTACHILLEUM, Zitt.

Sponge-body agariciform, stalked; upper surface arched, without a central cavity. Skeleton consisting of large coalescent sexradiates with thickened crossing-nodes.

†*Protachilleum Kayseri*, Zitt., Kayser, Beitr. zur Geol. und Pal. der Argent. Republik, ii. 1, p. 22, Taf. v. fig. 10.

* In the case of the genera furnished with diagnoses, I have myself, with few exceptions, examined the microstructure. Genera of which no original specimens were accessible to me are cited without further remarks, but with a reference to the original description. No synonymy has been attempted; but under each genus one or more typical species are given as examples. When a species was only known to me by figure and description an † is appended to the name. Those species of which I have been able to examine original specimens of a previous author are indicated by an *.

? EOSPONGIA, Billings.

Geol. Surv. of Canada, Palæozoic Fossils, vol. i. p. 19.

Family 2. **Euretidæ.**

PROTOSPONGIA, Salter.

Quart. Journ. Geol. Soc. 1864, vol. xx. p. 238, pl. xiii. fig. 12 *.

CALATHIUM, Billings.

Geol. Surv. of Canada, Palæozic Fossils, vol. i. 1865, pp. 208–211, 335–338, 358.

? TRACHYUM, Billings.

Ibid. p. 211.

ARCHÆOCYATHUS, Billings.

Ibid. pp. 3–5, 354.

? STEGANODICTYUM, M'Coy.

Palæozoic Fossils of the Cambridge Museum, pl. ii. A. figs. 1–4.

TREMADICTYON, Zitt.

Cup-shaped, plate-like, cylindrical. Central cavity wide. Wall on both surfaces with rather large rhomboidal or oval ostia standing in alternating series. Radial canals blind. Root nodose. Latticed skeleton of the wall and root consisting of large but unequal and irregularly formed meshes, the arms of the coalescent sexradiates being frequently thickened or lamellarly dilated. Crossing-nodes solid. Surface of the wall on both sides covered by an extremely delicate meshed net of coalescent sexrediates, which also veils the ostia. Root without ostia and canals.

Scyphia reticulata, Goldf., Taf. vi. 1.
(*S. polyommata*, Goldf.)
Spongites obliquatus, Quenst. Jura, Taf. 81. 97.

CRATICULARIA, Zitt.

Sponge-body simple or branched. Both surfaces with numerous roundish or oval ostia, which stand in vertical and horizontal series and cross each other at right angles; sometimes the ostia of one surface also lie in longitudinal furrows.

* ?*Amphispongia*, Salt. (Mem. Geol. Surv. Explanation of Edinb. Sheet, &c., pl. ii. fig. 3), possibly belongs here, but perhaps to the Lyssakina.

The cæcal radial canals are straight and rather strong. Skeleton consisting of large coalescent sexradiates with solid crossing-nodes, forming a regular open network with cubical meshes. Sometimes a covering web like that of *Tremadictyon* is present.

**Scyphia parallela*, Goldf. Taf. iii. 3.
S. clathrata, Goldf., Taf. iii. 1.
**S. paradoxa*, Münst., Goldf. Taf. xxi. 6.
**S. Beaumonti*, Reuss, Böhm. Kr. Taf. xvii. 12.
†*Laocœtis infundibulata*, Pom. Pal. de l'Oran, pl. i. *bis*, 3, 4.
†*L. dichotoma*, Pom. *l. c.* pl. ii. *bis*, 3, 5.

Eubrochus, Sollas ‡.

Geol. Mag. 1876, p. 398.

Sphenaulax, Zitt.

Top-shaped, cup-shaped, or wedge-shaped. Upper margin truncated. Wall thick, laid in coarse mæandric folds, which, on the outer surface, are separated by deep longitudinal furrows. The folds traversed by cæcal radial canals, the round ostia of which open on the wall of the central cavity, and stand in vertical and horizontal rows, crossing each other at right angles. Skeleton and covering-veil as in *Craticularia.*

Scyphia costata, Goldf. Taf. ii. fig. 10.

Sporadopyle, Zitt.

Cup-shaped, funnel-shaped, or ramose. Outer surface with the ostia scattered or standing in quincunx. Radial canals simple, blind. Inner wall with ostia arranged in rows. Skeleton and superficial layer as in *Craticularia.*

Scyphia obliqua, Goldf. Taf. iii. 5 *a*, *b*, *d*.
**S. texturata*, Goldf. Taf. ii. 5.
**S. secunda*, Münst., Goldf. Taf. xxxiii. 7.
Spongites ramosus, Quenst. Jura, Taf. 83. 1.

Verrucocœlia, Etallon.

Actes de la Soc. Jurass. d'émul. de Porrentruy, 1860, p. 129.

Polyzoic, ramose, frequently with calices arranged like buds around a common stalk. Central cavities tubular, communicating, with a terminal aperture or closed. Canal-system

‡ The genus *Eubrochus* is insufficiently characterized; possibly identical with *Craticularia.*

scarcely developed; ostia very small, irregularly distributed. Surface naked. Skeleton as in *Sporadopyle.* Axial canals of the sexradiates wide.

**Scyphia verrucosa*, Goldf. Taf. xxxviii. 8 *a–d.*
S. gregaria, Quenst. Jura, Taf. 81. 80.
**Polycœlia lævigata*, F. A. Röm. Spongit. taf. xi. 8.

Family 3. **Coscinoporidæ.**

? Bothroconis, King†.

Monogr. of Permian Fossils, Pal. Soc. 1849, p. 14.

Leptophragma, Zitt.

Sponge-body cup-shaped. Wall thin. Both surfaces with numerous small ostia of very fine cæcal radial canals, generally arranged in longitudinal and transverse rows. Skeleton stony, consisting of a dense latticed tissue of rather irregular arrangement. The meshes between the siliceous fibres are of very various forms. Crossing-nodes of the sexradiates solid. Structure of the root agreeing with that of the wall.

**Scyphia Murchisonii*, Goldf. Taf. lxv. 8.
S. striatopunctata, Röm. Kr. 3. 7.
S. angularis, Röm. Kr. 3. 2.
S. fragilis, Röm. Kr. 3. 11.

Pleurostoma, Röm (p. p.).

Nordd. Kr. p. 5.

Sponge-body laminar and cup-shaped or branched, always strongly compressed, with a series of large apertures on the rounded narrow surfaces. Wall thin, on both sides with numerous, irregularly arranged, small ostia. Radial canals simple, blind. Skeletal structure as in the preceding genus.

Pleurostoma radiatum, Röm. Kr. 1. 11 ‡.
P. bohemicum, Zitt., n. sp.

Guettardia, Mich.

Iconogr. Zoophyt. p. 121.

Sponge-body stellately folded. The three to eight folds of

† The position of this genus is very doubtful. According to the figure (Perm. Foss. pl. ii. fig. 7 *a*) it appears to belong to the Hexactinellida. Still more problematical is *Conis*, Lonsd. (Quart. Journ. Geol. Soc. v. pp. 55–65), from Atherfield, which possibly possessed a calcareous skeleton.

‡ *Pleurostoma lacunosum*, Röm., belongs to the family Callodictyonidæ, and is the typical species of the genus *Pleurope.*

the wall reach almost to the centre, and are bounded by two parallel plane walls, which enclose a canaliform space opening into the central cavity. On the blunt edges of the wings there are several large apertures standing one above the other. Both surfaces of the wall are covered with numerous round ostia of fine blind radial canals. Skeleton as in *Pleurostoma.*

Guettardia stellata, Mich. Ic. Zooph. pl. 30 (*excl.* fig. 6).
†*Ventriculites quadrangularis*, Mant. Geol. Sup. xv. 6.
Pleurostoma trilobata, Röm. Spongit. v. 8.
†*Guettardia Thiolati*, D'Arch. Mém. Soc. Géol. Fr. 2e sér. ii. pl. v. 15, pl. viii. 5–7.

Coscinopora, Goldf.

Petr. Germ. i. p. 30.

Cup-shaped, with ramified roots. Wall covered on both sides with numerous quincuncially arranged ostia of straight cæcal radial canals. Skeleton between the canals formed of very irregular latticework, which becomes thickened by intermediate beams both at the surface and in the walls of the canals. Crossing-nodes of the sexradiates in part octahedrally perforated, in part solid. Root consisting of long siliceous fibres united by cross bridges.

Coscinopora infundibuliformis, Goldf. ix. 16, xxx. 10.
C. macropora, Gold. *ibid.* ix. 17.

Family 4. **Mellitionidæ.**

Aphrocallistes, Gray.

Proc. Zool. Soc. 1858, p. 115.

Polyzoic, branched, nodose; the tubular branches closed at the end. Wall consisting of prismatic radial tubes of six-sided form, open at both ends. These perforating radial canals are separated by thin walls of latticed skeleton. The latter consists of coalescent sexradiates, which are prevented from taking a regular arrangement by the canals. The crossing-nodes are imperforate. In the recent species a very delicate latticed web covers the surface and the ostia of the canals; in addition so-called brush-forks are abundantly present as flesh-spicules.

Scyphia alveolites, Röm. Kr. iii. 6.
Aphrocallistes beatrix, Gray, P. Z. S. 1858, p. 115.
A. Bocagei, Wright, Quart. Journ. Micr. Sci. vol. x. p. 4, pl. i.

STAURONEMA, Sollas.

Ann. & Mag. Nat. Hist. 1877, vol. xix.

Sponge-body lamellar, somewhat bent round at the lateral margins, convex on one side, concave on the other, attached by the narrowed base. Wall thick, with numerous straight perforating canals standing in quincunx. The skeleton consists of a very regular latticework of rather large sexradiates, the arms and solid crossing-nodes of which are so considerably thickened that the meshes acquire a small lumen and a rounded form. Both surfaces are coated with a thin siliceous membrane, which is perforated by innumerable, unequal-sized, rounded, or irregularly-formed pores and orifices. This porous covering layer also veils the ostia of the canals.

Stauronema Carteri and *lobata*, Sollas.

Family 5. **Ventriculitidæ.**

PACHYTEICHISMA, Zitt.

Top-shaped or basin-shaped, with very thick walls consisting of perpendicular mæandric folds. On the outer wall the folds are separated by deep, and on the inner wall by shallow, longitudinal furrows. In the interior of the folds there are cæcal radial canals, the round ostia of which stand in longitudinal rows upon the stomach-wall. By friction of the surface the canals are also frequently visible externally. Skeleton consisting of very regularly arranged large sexradiates with octahedral crossing-nodes. Covering layer and root wanting.

Pachyteichisma Carteri, Zitt. (=*Fungit.* Knorr u. Walch, Petref. tab. F. 3, no. 48, fig. 5).
Spongites lopas, Quenst. Jura, 83. 5.

TROCHOBOLUS, Zitt.

Top-shaped or cylindrical, thick-walled, with a rather narrow central cavity. Surface with glebiform elevations, separated from each other by deep furrows. The ostia of the generally tortuous radial canals are situated on the wall of the body-cavity. Skeleton like that of the preceding genus, but the meshes considerably smaller. Covering layer and root wanting.

Trochobolus crassicosta, Zitt., n. sp. (Upper Jura, Streitberg.)
Scyphia texata, Goldf. xxxii. 4.

VENTRICULITES, Mantell.

Fossils of the South Downs, pp. 167–178.

Sponge-body basin-shaped, cup-shaped, cylindrical or funnel-shaped. Central cavity wide. Wall mæandrically folded, the folds either on one or on both sides separated by longitudinal furrows, or pressed close together. Radial canals numerous, rather wide, generally standing in longitudinal rows, always cæcal; their ostia arranged in very various ways, sometimes present on both sides, sometimes replaced on the inner or outer surface of the wall by furrows. Skeleton consisting of coalescent sexradiates with octahedral crossing-nodes: their arrangement more or less irregular; meshes rather large. The surface of the wall and of the canals thickened into a porous covering layer by lamellar dilatation or thickening of the beams of the sexradiates. Root formed of long longitudinal fibres without axial canals, united by cross bridges.

Ventriculites striatus, Toulmin Smith, Ann. & Mag. N. H. 1848, vol. xiii. 6, 13.
**Scyphia Œynhauseni*, Goldf. lxv. 7.
**Cœloptychium muricatum*, Röm. Kr. iv. 16.
Scyphia angustata, Röm. Kr. viii. 10.
**S. Zippei*, Reuss, Böhm. Kr. xviii. 5.

SCHIZORHABDUS, Zitt.

Rod-like, slightly enlarged upwards. The whole wall slit on one side from the margin to the commencement of the root. Both sides furnished with repeatedly divided longitudinal furrows, in which are the ostia of the cæcal radial canals. Root very much elongated, simple, rarely with lateral buds; furrowed on the surface, with numerous vertical tubes in the interior. Microstructure as in *Ventriculites*.

Schizorhabdus libycus, Zitt., n. sp.

TRETOSTAMNIA, Pomel.

Paléontologie de l'Oran, p. 70.

RHIZOPOTERION, Zitt

Sponge-body cup-shaped, passing gradually below into a very thick, elongated stalk, which emits side branches at its base. Both surfaces of the upper cup-shaped part covered with elongated oval ostia of cæcal radial canals standing in alternating longitudinal rows. The radial canals acquire a more and more oblique direction downwards, and finally become converted into vertical tubes, which, in great numbers, traverse the stem and the radial offshoots of the sponge-body. Microstructure of the cup as in *Ventriculites*. The stem- and root-branches consist of elongated siliceous fibres without axial canals, which, by transverse unions, produce a hexactinelloid latticework.

**Scyphia cervicornis*, Goldf. iv. 11, xxv. 11.

Sporadoscinia, Pomel (emend. Zitt.).

Paléont. de l'Oran, p. 84.

Cup-shaped or cylindrical, narrowed downwards, with a short, simple or branched root. Both surfaces of the wall coated with a coherent, sometimes porous, covering layer, in which numerous axial crosses lie imbedded. Sunk into this covering layer there are on the outside irregularly formed ostia of cæcal radial canals; on the inside the ostia stand in alternating rows or in longitudinal furrows. Root slightly developed, with vertical tubes. Microstructure like that of the preceding genus.

Scyphia micrommata, Röm. Kr. ii. 11.
**S. Decheni*, Goldf. lxv. 6.
**Cribrospongia cariosa*, Röm. Spongit. ix. 7.

Licmosinion, Pomel.

Paléont. de l'Oran, p. 89.

Sponge-body laminiform, attached by a short stalk. Both surfaces of the wall furnished with numerous, pretty large, irregularly placed ostia of cæcal canals. Skeleton consisting of octahedrally perforated sexradiates, condensed at the surface into a porous covering layer with axial canals.

**Diplostoma folium*, Röm. Spongit. ix. 6.

Polyblastidium, Zitt.

Sponge-body polyzoic, with numerous buds standing round an elongated axis. The buds are trochiform, truncated at the upper margin, with a rather narrow central cavity. Latticed framework wide-meshed, with octahedrally perforated crossing-nodes. The whole surface coated with a coherent, porous covering layer, with numerous axial crosses. Radial canals and ostia wanting. Numerous isolated rod-like spicules occur in the interspaces of the skeleton.

Polyblastidium luxurians, Zitt., n. sp. (Linden, near Hanover.)

Cephalites, Toulmin Smith (pars)‡.

Ann. & Mag. Nat. Hist. 1848, pp. 46, 279.

Like *Ventriculites*, but with the upper margin of the funnel truncated, somewhat thickened, and coated with finely porous siliceous membrane.

†*Cephalites longitudinalis*, T. Smith, *l. c.* pl. xiv. 1.
†*C. guttatus*, id. ibid. 2.
†*C. paradoxus*, id. ibid. 3.

Lepidospongia, Röm.

Spongit. p. 9.

External form like *Ventriculites*; wall thin, mæandrically folded, on the inside with longitudinal furrows. Outer surface coated with a dense siliceous membrane, which is interrupted by numerous transverse fissures running in a horizontal direction. Skeletal structure as in *Ventriculites*.

Lepidospongia rugosa, Schlüt. Spongitariensch. des Münsterl. i. 1–4.

Family 6. **Staurodermidæ.**

Cypellia, Pomel (emend. Zitt.).

Paléont. de l'Oran, p. 76.

Top-shaped, basin-shaped, or branched, thick-walled, without root. Lattice-tissue irregular; crossing-nodes with apertures or octahedrally perforated. Radial canals generally curved, perforant, with roundish or elongated, irregularly distributed ostia on both sides. Outer surface with large cruciform sexradiates, of which the outwardly directed arms are aborted. These larger spicules are irregularly cemented to one another by either lamellar or filiform siliceous bridges, or they lie in a perforated siliceous membrane which coats the whole surface.

Scyphia rugosa, Goldf. iii. 6.
(*Spongites dolosus*, Quenst. p. 671.)

Stauroderma, Zitt.

Polyzoic. Funnel- or platter-shaped, spread out above, with a shallow central cavity. Wall thick. On the inner (*i. e.* upper) surface with numerous apertures of depressed

‡ I am acquainted with this genus (which, moreover, is understood here in a much narrower sense than by Toulmin Smith) only from the description and figures.

gastral cavities. Outer (*i. e.* lower) surface constituted as in *Tremadictyon.* Latticed skeleton rather irregular, the siliceous trabeculæ often thickened or lamellarly dilated. Crossing-nodes imperforate. The ostia of the radial canals lie on the outer wall; the canals pass obliquely through the wall, then run on for a certain distance below the inner surface, and open in the oscula of the upper surface. Both surfaces veiled by a covering layer consisting of cross-spicules of moderate size cemented together.

Spongites lochensis, Quenst. Jura, Taf. 89. 96. (=*Scyphia Buchi*, Goldf. xxxii. 8.)

Porocypellia, Pomel (emend. Zitt.).

Paléont. de l'Oran, p. 77.

Top- or pear-shaped, small, thick-walled, attached by the pointed lower extremity. Central cavity tubular; its wall with round ostia of simple straight radial canals arranged in longitudinal rows. Latticed skeleton irregular, with octahedral crossing-nodes; the lateral apertures of the hollow octahedra are small and usually unequal, often somewhat distorted. Surface and upper margin coated with a smooth siliceous membrane perforated by large round pores; in this the axes of large sexradiates are imbedded.

**Scyphia pyriformis*, Goldf. iii. 9.

Casearia, Quenst.

Jura, p. 681.

Cylindrical or cup-shaped, pointed below, divided by numerous constrictions into annular segments. Central cavity tubular. Surface coated with a very regular latticed web, consisting of normally coalescent sexradiates with broad and short arms, in which the outwardly directed arm is always aborted. This covering layer penetrates into the wall at the places of constriction, and forms convex floors, by which the individual segments are separated from each other. The ostia of the straight radial canals are veiled both outside and inside by the covering layer. The true latticed skeleton of the wall is remarkably irregular, the coalescent sexradiates grouping themselves without any order around the canals, and, moreover, often possessing lamellarly dilated and distorted arms, in which independent axial crosses are situated. The crossing-nodes are imperforate.

**Scyphia articulata*, Goldf. iii. 8.
Casearia eurygaster, Zitt.

POROSPONGIA, D'Orb.

Cours élém. de Paléont. ii. p. 211.

Lamellarly dilated, more rarely nodular or cylindrical. On the upper surface with more or less numerous circular apertures of gastral cavities. The surface provided with oscula is coated with a finely porous or dense siliceous membrane, in which slightly elevated, very large cross-spicules, as well as numerous small sexradiate axial crosses, are imbedded. Under surface veiled by a delicate meshed net of cemented cross-spicules. The wall consists of sexradiates with solid crossing-nodes regularly amalgamated to form cubical meshes of considerable size. On the lower surface there are small ostia of very short, slightly developed canals.

**Manon marginatum*, Goldf. xxxiv. 9, *g*, *h*.
**M. impressum*, Münst., Goldf. xxxiv. 10.
**Porospongia fungiformis*, Zitt., Goldf. xxxiv. 8, *a*, *b*, *c*.

OPHRYSTOMA, Zitt.

Distinguished from the preceding genus by the covering layer, in which there are only small axial crosses, and by the octahedrally perforated crossing-nodes of the skeleton-spicules.

**Porospongia micrommata*, Röm. Spongit. iv. 14.

? PLACOCHLÆNIA, Pomel, *l. c.* 73.

Family 7. **Mæandrospongidæ.**

PLOCOSCYPHIA, Reuss.

Böhm. Kr. 77.

Sponge-body nodular, globular, or irregular, consisting of mæandrically twisted, anastomosing or communicating tubes or leaves. Upper surface convex, flat or with a central depression. Walls of the tubes very thin, sometimes with small ostia. Skeleton consisting of pretty regularly arranged coalescent sexradiates, with octahedrally perforated crossing-nodes. In some species the lattice-spicules near the surface possess imperforate crossing-nodes.

**Plocoscyphia labyrinthica*, Reuss, Böhm. Kr. xviii. 10.
**Achilleum morchella*, Goldf. xxix. 6.
**Plocoscyphia mæandrina*, Röm. Spongit. x. 8.

TREMABOLITES, Zitt.

Sponge-body nodular or lamellar, consisting of mæandrically twisted, anastomosing, thin-walled tubes or leaves. Upper surface coated with a smooth, finely porous siliceous membrane, in which there are rather large roundish or oval apertures belonging to the intercanal system. Skeleton consisting of coalescent lantern-spicules.

Manon megastoma, Röm. Kr. 1. 9.
Cœloptychium confluens, Fisch. v. Waldh. Bull. Soc. Imp. Mosc. 1843, vol. xvi. pl. xvi. 1.

Etheridgia, R. Tate.

Quart. Journ. Geol. Soc. 1865, vol. xxi. 43.

Hemispherical; on the plane lower surface radial tubes issue from the centre; and these are either united by broad transverse bridges, or lie close together. These tubes send upwards tortuous and anastomosing tubes, which form the hemispherical upper surface. The latter is coated with a smooth, finely porous siliceous membrane; in its vertex there is a deep depression; other apertures of irregular form, likewise belonging to the intercanal system, are distributed over the upper surface quite irregularly. The skeleton of the thin-walled tubes consists of lantern-spicules.

Cœloptychium verrucosum, Fisch. v. Waldh. Bull. Soc. Imp. Nat. Mosc. 1843, vol. xvi. pl. xvi.
C. Goldfussi, Fisch. ibid. 1844, vol. xvii. pl. vii. 2, 3.
†*Etheridgia mirabilis*, R. Tate, *l. c.* pl. v. 1.

Toulminia, Zitt.

Sponge-body cup-shaped, very thick-walled, with a deep central cavity. Root branched. Wall consisting of thin, mæandrically-twisted laminæ. Upper margin truncated, broad, coated with a smooth, finely porous siliceous membrane.

†*Cephalites catenifer*, Toulmin Smith, Ann. & Mag. Nat. Hist. 1848, pl. xiv. f. 14–16.
†*C. compressus*, T. Smith, ibid. xiv. 10.

Camerospongia, D'Orb.

1847, Cours élém. de Paléont. ii. p. 212.

Sponge-body globular, hemispherical, or pyriform. Upper half coated with a smooth, dense or finely porous siliceous membrane, with a circular funnel-shaped depression in the middle. Lower half of the sponge-body with tortuous ribs on the outside. The sponge-body itself consists of thin-walled, mæandrically contorted tubes, which are composed of several layers of regularly arranged coalescent sexradiates, with octahedrally perforated crossing-nodes.

Scyphia fungiformis, Goldf. lxv. 4.
Cephalites campanulatus, Toulmin Smith, *l. c.* pl. xiv. 12, 13.
**Camerospongia Schlönbachi*, Röm. Spongit. 3, 5.

Cystispongia, Röm.

Spongit. 7.

Pyriform, egg-shaped, completely coated with a dense siliceous membrane, which leaves open only one or a few (2–4) large margined orifices of irregular form; these orifices are considerably depressed. In the interior there are mæandrically contorted, very thin-walled, indistinctly radially arranged tubes, the closed ends of which extend into the depressions belonging to the large apertures. The lattice-skeleton of the tubes consists of coalescent sexradiates with imperforate crossing-nodes, and usually presents a very irregular arrangement, in consequence of arms of sexradiates attaching themselves to the crossing-nodes of neighbouring spicules.

Cystispongia bursa, Quenst., Röm. Spongit. iv. 7.

Family 8. **Callodictyonidæ.**

Callodictyon, Zitt.

Funnel-shaped, thin-walled. Central space very wide. Wall even, consisting of several layers of coalescent sexradiates, which form serially arranged quadratic meshes. The crossing-nodes of the sexradiates are octahedrally perforated, the siliceous arms armed with spines. The superficial layer is formed by lamellar dilatation of the siliceous rods of the outer skeletal layers, in which, however, all the meshes remain open for the circulation of water. Canals or ostia are wanting.

Callodictyon infundibulum, Zitt., n. sp. (Upper Cretaceous of Ahlten.)

Marshallia, Zitt.

Like the preceding genus, but the thin wall furnished with a few broad, spiral or longitudinal folds, upon the back of which there are some isolated large apertures.

**Pleurostoma tortuosum*, Röm. Spongit. vi. 1.
**Cœloptychium alternans*, Röm. Kr. iv. 6.

Becksia, Schlüt.

Sitzungsber. d. niederrh. Ges. Bonn, 1868, p. 93.

Sponge-body cup-shaped, at the base with spinous appendages. Central space very wide. Upper part of the thin wall even, towards the base with coarse rounded folds, between which openings are left. These apertures are connected with tubes which unite together in a horizontal hollow ring. The wall of the cup in the tubes consists of regularly arranged lantern-spicules, the arms of which are adorned with spines or root-like processes.

Becksia Sœkelandi, Schlüt. Spongitariensch. des Münsterlandes, p. 20, Taf. i. 5, 6, 7.

Pleurope, Zitt.

Sponge-body narrow, lamelliform, elongated, compressed, with large, round or oval apertures upon the narrow lateral surfaces. Base elongated, consisting of solid longitudinal fibres with transverse unions. The wall of the upper part of the sponge-body is formed of 3–5 regularly arranged layers of coalescent sexradiates with octahedral crossing-nodes, leaving between them large cubical meshes. This lattice-skeleton, however, is coated on the outside with more or less thick layers of the root-tissue; the latter is furnished at the surface with numerous small ostia, and traversed by fine radial canals, which, however, are not continued into the lattice-skeleton. The inside of the wall is naked, and provided with numerous small ostia, which communicate with the meshes of the latticed framework. The root possesses neither ostia nor canals.

Pleurostoma lacunosum, Röm. Kr. i. 12.

Diplodictyon, Zitt.

Sponge-body compressed, broad, with a thick, nodular pedicle and flat base. The narrow sides, as in *Pleurope*, with large rounded apertures. The wall of the compressed cup consists of two different skeletal layers. The inner is formed by regularly coalescent lantern-spicules with very thick smooth arms; the outer one, on the contrary, is composed of irregularly arranged sexradiates with solid crossing-nodes. These sexradiates of the outer surface become more and more strongly developed downwards, and form the material of the whole root. The outer layer of the wall in the upper part of the sponge-body is covered with numerous ostia of radial canals, which reach only to the inner wide-meshed layer. On the inner wall the mesh-openings serve as influent ostia.

**Scyphia heteromorpha*, Reuss, Böhm. Kr. xviii. 1, 2 (non 3, 4).

Family 9. **Cœloptychidæ.**

CŒLOPTYCHIUM, Goldf., see p. 419.

Cœloptychium agaricoides, Goldf., Zitt. Abhandl. k. bayr. Akad. ii. Cl. Bd. xii. iii. p. 59.
C. deciminum, Röm., Zitt. ibid. p. 62.
C. lobatum, Goldf., Zitt. ibid. p. 73.

B. LYSSAKINA, Zitt. ‡.

ACANTHOSPONGIA, M'Coy.

Syn. Sil. Foss. Irel. p. 67 (*Acanthaspongia*).

The great axis of the spicules becomes 5–10 millims. long, the other two are shorter. The crossing-nodes are thickened and solid. The six arms become thinner towards the tip, and swell towards the centre. Axial canals distinctly visible.

†*Acanthospongia silurensis*, M'Coy, *l. c.* p. 67.
A. Smithii, Young, Nature, 1876, p. 481.

STAURACTINELLA, Zitt.

Form of the sponge-body spherical, unstalked. Skeleton consisting of large, simple, isolated sexradiates with arms of unequal length. In general one ray is much elongated (6–8 millims. long). The spot at which the arms cross is scarcely thickened; and generally the arms are of the same thickness throughout their whole length.

Stauractinella jurassica, Zitt.

? ACESTRA, F. Röm.

Fossile Fauna der Geschiebe von Sadewitz, p. 56, t. vii. 7.

The bacilliform bodies are possibly spicules from the root-tuft of a Hexactinellid.

Supplement.

The foregoing Memoir was read on the 13th of January

‡ Possibly the genus *Astræospongia*, Röm., is also to be referred as an aberrant form to the Lyssakina, although the large stellate spicules, consisting of calcspar, of this sponge possess three axes lying in the same plane and besides these a perpendicular (but always rudimentary) axis.

1877, in the Mathem.-Physical Class, and immediately after sent to press. In the beginning of February, the January number of the 'Annals and Magazine of Natural History' for 1877 reached me, which contains a memoir by W. J. Sollas "On *Stauronema*, a new Genus of Hexactinellid Sponges, with a Description of its two Species, *St. Carteri* and *St. lobata.*"

Mr. Sollas describes very fully the external form, the construction, and the microstructure of the lamelliform sponge-body, the lateral margins of which are somewhat bent round, and in conclusion devotes much attention to the state of preservation and the peculiar phenomena of fossilization occurring in these petrifactions. I cannot refrain from referring to this work of Mr. Sollas with particular satisfaction. He is the only palæontologist whose mode of investigation agrees in general with that adopted in the preceding memoir, as also in my monograph of *Cœloptychium*; and it is certainly in favour of its admissibility that two observers, writing quite independently, arrive at the same result in all essential points.

In August 1876, at the general meeting of the German Geological Society at Jena, in a lecture on the organization and classification of fossil sponges*, I indicated, with the aid of numerous drawings made from microscopic preparations, the close agreement of certain living and fossil Hexactinellida, and at the same time discussed the conversion of the originally siliceous skeleton into calcspar†, which is so frequently observed in fossil Hexactinellida and Lithistida. In conversation, many objections to this chemical substitution were expressed to me. It appears to me therefore worthy of notice, that on this question Mr. Sollas expresses precisely the same opinion; his observations with respect to the optical behaviour of the fossil skeletons of Hexactinellida also perfectly agree with mine ‡.

As regards the genus *Stauronema*, which is at present known only from the Gault of Folkestone and the Upper Greensand of the Isle of Wight, it is most nearly allied to *Aphrocallistes*. From Mr. Sollas's detailed description and figures I have been able to draw up the diagnosis of the genus (see p. 506).

In conclusion, I may remark further that Mr. Sollas regards the *Stromatoporæ* § as Hexactinellida, an opinion which I cannot share. The zoological position of *Stromatopora* and *Parkeria* appears to me to be scarcely doubtful after the acute investigations of Carter ‖. According to these the above-men-

* Zeitschr. d. deutsch. geol. Gesellsch. xxviii. p. 631.
† See this Memoir, pp. 264–6.
‡ Sollas, *l. c.* p. 21.
§ *Loc. cit.* p. 2.
‖ Ann. & Mag. Nat. Hist. 1877, vol. xix. p. 44.

tioned genera are neither sponges nor Foraminifera, but the nearest allies of the Hydractiniæ with a calcareous skeleton, and thus attach themselves to the Hydromedusæ. To the same group, according to Lindström*, belongs also the genus *Labechia*, M.-Edw. & H., formerly referred to the order of the Zoantharia tabulata.

LXIV.—*On two new British Nudibranchiate Mollusca.* By the Rev. A. M. Norman, M.A.

Eolis sanguinea, n. sp.

Body narrow, and tapering behind to a very fine point, red, this colour more intense on the anterior portion of the animal as far back as the heart. *Dorsal tentacles* placed near to each other at their bases, smooth, of a blood-red colour, with pale tips. *Oral tentacles* set far apart, somewhat longer than the dorsal pair, red, but paler in colour than the dorsal. *Eyes* situated close behind the dorsal tentacles. *Branchiæ* very numerous, distributed in about eighteen transverse rows; there are as many as twenty branchiæ in the first transverse row, and ten in the sixth or seventh row; they are short, of a blood-red colour, with the central vessel very dark, and their tips, on the other hand, white; they extend forwards round the bases of the dorsal tentacles. The *tail* tapers away to a very fine point behind, which, however, hardly appears beyond the ultimate branchiæ. *Foot* of a pale flesh-colour, with short tentacular points in front. *Length* $1\frac{1}{4}$ inch.

A single specimen of this very beautiful new *Eolis* was taken August 26, 1874, at low water, spring tides, on the islet known as Innislacken, which is situated at the entrance of Roundstone Bay, Connemara.

Eolis sanguinea is a remarkably active little fellow, crawling along with considerable rapidity. It is very distinct from all described species. It belongs to *Eolis* (proper) as distinguished from its subgenera. *Eolis* (proper) includes only three British species—*papillosa*, *glauca*, and *Alderi*. Our new form comes nearest to *E. glauca*, from which it differs in its more attenuated form, in its more numerous transverse rows of branchiæ and more numerous branchiæ in those rows, in its more brilliant body-colour, and its branchiæ being blood-red instead of "sage-green." Although tapering to

* Ann. & Mag. Nat. Hist. 1876, vol. xviii. p. 4.

such a narrow point behind, the branchiæ extend so far back that the extremity of the tail is less seen, perhaps, than in any other species except *Eolis glaucoides*, A. & H.

Lomonotus Hancocki, n. sp.

Body elongated, of a very light pinkish orange tinge, very transparent, so that the internal organs are clearly seen through the skin; white, the front margin of the foot microscopically sprinkled with red specks. *Veil* with two tentacular processes on each side, overhanging the mouth; these processes are orange-coloured below, and above are microscopically sprinkled with red in the same manner as the margin of the foot. *Tentacles* terminating above in a calyx-shaped expansion, formed of five leaflet-like points, from the middle of which rises the small, conical, smooth termination of the tentacle; this conical process is of small size, not exceeding that of the divisions of the calyx-like sheath. *Branchial processes* in the form of a waved raised curtain, surmounted by flat triangular papillæ, passing down each side of the back and uniting behind; the undulations of the curtain consist of three outward and four inwardly directed folds on each side; the fold which is nearest to the head is the largest; the papillæ on this fold are 18–20 in number; the papillæ on all the folds vary considerably in size, but there appears to be always one larger than the rest; they are capable of contraction and dilatation, and are constantly changing their apparent dimensions while the animal is in motion; they are banded with deep dark orange, while the small points in which they terminate are pale orange. *Length* $2\frac{1}{4}$ inches.

I dredged a single specimen of this very fine Nudibranch off Berry Head, Torbay, June 25, 1875.

It approaches both *L. flavidus*, A. & H., and *L. portlandicus*, Thompson, but differs apparently from both in many particulars, and especially in the form of the tentacles, which have a very marked character in the small size of the terminal simple conical process which is projected beyond the calyx-like sheath.

I have named this species after Mr. Albany Hancock, the joint author with Mr. Alder of the great master-work on the Nudibranchiata—the latter unsurpassed in intelligent discrimination and just appreciation of the value of morphological characters, the former a prince among marine invertebrate physiologists. Much as any student must admire the excellency of Mr. Hancock's work, as evidenced in the elaborate, clear, and comprehensive exposition of the anatomy and physiology of the Nudibranchiata, Brachiopoda, &c., it is only those who had the good fortune to have an intimate personal knowledge of himself and of his investigations in his study who can at all realize the indefatigable perseverance, the marvellous laboriousness, the most strict conscientiousness, and withal the deep humility of his great mind. Alas! that both my dear friends should have been taken, and their joint monograph on the British Tunicata remain incomplete! At the time of Mr. Alder's death his part was finished, which related to the description and illustration of the generic and specific forms; and the last years of Albany Hancock's life were devoted chiefly to the elaboration of the structure of this most anomalous and highly interesting class. A large portion of the knowledge thus acquired has unfortunately died with him; but we yet hope to see such portion of the anatomy and physiology as relates to the simple Ascidians, together with a monograph of all the species, published under the kindly editorship and careful supervising hand of the man most competent to undertake it—Professor Huxley.

LXV.—*Descriptions of supposed new Birds from the Naga Hills and Eastern Assam.* By Lieut.-Col. H. H. Godwin-Austen, F.Z.S. &c.

Turdinus nagaënsis, n. sp.

Above dark umber-brown throughout, with no streaking on the feathers of the head. Beneath the same colour, but much paler, with a slight rusty tint shading into and adjacent to the dull whitish centre of breast; chin also whitish.

Irides dark brown; legs and feet light sienna-grey.

Length about 5·7 inches, wing 2·2, tail 2·2, tarsus 0·90, bill at front 0·50, mid toe and claw 0·72, hind toe 0·35, claw 0·3.

This species is very distinct from *T. garoënsis* in its deeper umber coloration and smaller size; particularly is this the case in the size of the legs, feet, and the hind claw. Mr. A. W. Chennell, of the Topographical Survey, obtained this bird in the Eastern Naga hills.

Staphida plumbeiceps, n. sp.

Head ash-grey, purer behind; feathers narrowly edged paler. Back pale olive-brown, a few feathers pale-shafted. Wings umber-brown. Tail darker, the four outer feathers tipped with white, increasing outwards diagonally. Lores pale grey.

The ear-coverts only to just beneath the eye chestnut, the feathers white-shafted. Chin, throat, and all the lower parts white. Flanks pale sepia-grey; under tail-coverts the same, tipped white.

Irides reddish brown. Legs umber.

Length 4·6 inches, wing 2·3, tail 2·05, tarsus 0·7, bill at front 0·3.

This bird is close to *Staphida torqueola*, Swin.; but in that species the chestnut commences at the base of the lower mandible, passes under the eye and round the nape in a broad band of chestnut-brown, and the last three tertiaries are margined white on inner web. This is absent in the Assam bird. Obtained by Mr. M. J. Ogle near Sadya and Brahmakhúnd, Eastern Assam.

In my note-book I find that I obtained one example in the Dikrang valley, Dafla hills, which I shot at camp no. 9; but this was subsequently lost somehow or other, and therefore I did not bring it into the list of birds from the Dafla hills, published in the Journ. Asiatic Society of Bengal.

It is also interesting to record the occurrence near Sadya of *Halcyon pileata* und *Podica personata*.

LXVI.—*On British Polyzoa.*—Part II. *Classification.* By the Rev. Thomas Hincks, B.A., F.R.S.

Order INFUNDIBULATA.

Suborder Cheilostomata.

In attempting the classification of the Cheilostomatous Polyzoa, one of the most important points to be determined is the exact amount of weight which is to be assigned to the colonial habit or mode of growth in constituting the generic groups. Smitt takes the position that the system of classification should be based entirely on the characters of the individual zooœcium; and amongst these characters he assigns the first place to the form of the aperture*.

* "Quod ad hunc ordinem (*Cheilostomata*) in subordines distribuendum attinet, principia sequimur, quæ conjecisse videtur primus Milne-Edwards, quum, in adnotationibus ad *Flustras* apud Lamarck, formam zooœcii solam esse de Bryozois notam dixit, quæ certo limite genera describeret" (Smitt, "Bryozoa marina in regionibus arcticis et borealibus viventia," Œfv. k. Vet.-Akad. Förh. 1867, p. 468). "In its generic character" (he is speaking of his genus *Hippothoa*) "of course we must cast away the form of the colonial growth, founding it upon the form of the zooœcial aperture" ('Floridan Bryozoa,' part ii. p. 40).

I may remark here that Prof. Smitt's method is, of course, inappli-

The opinions of so learned and able an investigator are entitled to the most respectful consideration, and properly carry very great weight with them. No doubt many points may be urged in support of the position which he has assumed; and these he has presented in his various works with much force and ample illustration. But I have been unable to satisfy myself that the extreme view which he adopts in reference to the colonial characters is philosophically just, or (consequently) that the systematic method based upon it is likely to yield a good practical result. As to the latter point, I think I may appeal with some confidence to the writings of Prof. Smitt himself. The agglomeration of diverse forms, to which the application of his theoretic principle has in many cases given rise, cannot certainly be regarded as *natural*, and may fairly be taken as a warning against the entire disregard of colonial characteristics.

After giving the subject the best consideration in my power, it seems to me that to represent at all adequately what may be called the *family relationships* of a tribe like the Polyzoa, in which colonial life is all but universal, more or less account must be taken of the two elements, the zoœcial and the colonial, and that the circumstances of each case must decide what amount of systematic significance shall be assigned to the *latter*. I have no doubt that authors have commonly laid undue stress on trifling variations in the mode of the colonial growth, and have consequently multiplied genera needlessly, and have at the same time obscured the natural relationships.

Another fruitful source of error has been the tendency to make the mere habit of growth, apart from the characters supplied by the structure of the cell, the basis of generic groups. Thus the old genera *Lepralia* and *Eschara* are miscellaneous assemblages of forms which have often little in common but general habit.

Between the two extremes, that of the older classification and that which has found so able an advocate in Prof. Smitt, the true systematic method must, I believe, be sought. The position which I should adopt would be, that whilst the zoœcium is undoubtedly the most important and significant element, the mode in which the cells are combined, the facies of the adult colony, is a point that must be taken account of in forming natural groups. In applying the principle here

cable to the other divisions of the Polyzoa. In dealing with the *Cyclostomata*, for instance, the genera are perforce founded in great part on the mode in which the cells are combined—on the colonial habit.

laid down, the chief weight will be assigned to zooœcial affinity; but cardinal and striking differences in the colonial organization may require the separation (as a matter of classification) of forms agreeing more or less in the character of the cell. I will give one or two illustrations. The *Gemellipora eburnea*, Smitt, forms erect shoots in its adult state, and has its ivory-coloured cells, bearing a general resemblance to those of *Eucratea*, arranged in pairs, back to back, like those of *Gemellaria*, but with a difference. The aperture is nearly round, with a broad sinus below and two small lateral sinuses. The *Gemellipora striatula*, Smitt, which is identical with *Lepralia venusta*, Norman, is an incrusting species, its cells decumbent and adnate, arranged side by side, so as to form a continuous expansion, and presenting in almost every point a very marked contrast to *G. eburnea*. But there is a resemblance in the form of the aperture; and on the strength of this Smitt refers the two to the same genus*. In this case, the shape of the mouth only is taken into account, to the exclusion of the other portions of the cell, and the colonial characters are of course entirely ignored. It can hardly be contended that this is a *natural* alliance in any true sense of the term. It seems to me eminently unnatural; but it is only one of many similar results to which the rigorous application of Prof. Smitt's method has conducted him.

To take another case. The *Membranipora vulnerata*, Busk, is a crustaceous form, spreading in patches of indefinite shape and size, having the front area of its cells completely covered in by a calcareous lamina, and furnished with vibracular cells, which alternate with the ordinary zooœcia throughout the colony†. In the general character of the cells and the position of the vibracula it agrees with the genus *Cupularia*, Lamx.; but the latter possesses a zooœcium of definite form, usually more or less conical or cup-shaped, and is *free*, in all probability, in all stages of its existence, certainly in its adult state. In recent specimens "the entire surface of both the concave and convex surfaces is covered with a continuous chitinous epidermis" [Busk].

Smitt unites *M. vulnerata* with *Cupularia*‡, relying on the general similarity of the cells and vibracula, and ignoring altogether the remarkable difference in the organization of the colonies, and the complete change which has taken place in the conditions of the colonial life. I cannot recognize

* 'Floridan Bryozoa,' part ii. pp. 35, 37.

† In another part of this paper I have constituted a new genus for the reception of this form, which is clearly distinct from *Membranipora*.

‡ 'Floridan Bryozoa,' part ii. p. 14.

in this a *natural* arrangement, and should certainly separate the two forms generically, though quite prepared to admit that genealogically they may be not very remotely connected.

Proceeding to the application of the principle that I have just laid down, the old genus *Lepralia*, founded on mere similarity of habit, without reference to the zoœcial characters, must of course be dismembered and divided into groups, based on the structural peculiarities of the cell. I have suggested a number of such groups in another part of this paper.

As to the question whether forms which exhibit an erect mode of growth should be combined in one genus with those which are crustaceous in habit, I believe that no universal rule can be laid down. One thing seems to me clear—that the tendency to form free expansions, consisting of a single layer of cells, ought not to be accounted a generic diagnostic. The genus *Hemeschara* represents a very trivial variety of habit, and forms a most unnatural group, including as it does very distinct types of cell.

Nor can the development of erect foliaceous expansions, *composed of two layers of cells placed back to back*, by forms which very commonly assume a simply crustaceous habit, be taken as a distinctive character in itself, and apart from structural peculiarities in the zooœcium. *Lepralia Landsborovii* has been transferred to the genus *Eschara*, because it takes on at times such an erect, foliaceous habit, though more usually crustaceous in its mode of growth. But this very trifling and occasional change of *habit* is a very insufficient ground for severing it from the simply incrusting forms to which it is closely allied in zooœcial character (e. g. *Lepralia reticulata*, *L. trispinosa*, &c.).

On the other hand, the habitual formation of erect, well-compacted, more or less dendroid zoaria, which marks the adult or perfect condition of the species, is a character fairly included in the generic diagnosis. The old genus *Eschara* rests on this foundation; but, like *Lepralia*, it will require to be subdivided should it be found to include various distinct zooœcial types. I cannot see that the validity of this character is affected by the fact that in many cases the dendroid zoaria exhibit a tendency to be decurrent at the base, and spread out into a lepralioid crust of varying size. This is no doubt a significant genealogical indication; but if we are to have any distribution into groups at all, I see no reason why forms which have made a great and distinctive advance in colonial development should not be set apart from those which have been left behind at a lower grade. At the same time we should expect them to retain signs of their descent in some part of their developmental history*.

Prof. Smitt makes no account of differences in the mode of growth. Finding a species with the characteristic cell of *Membranipora* and the equally characteristic colonial habit of *Retepora*†, he at once ranks it as a *Membranipora.* But surely the remarkably diverse *plan of the gemmation,* which has resulted in the formation of an erect reticulate zoarium instead of a continuous crust, should count for something. From my point of view, I should regard this form as the type of a distinct genus in the *Membraniporidan* series. I am well aware that there will be many difficulties in seeking to give practical effect to the principles I have briefly indicated; but difficulties neither few nor slight seem to attend every attempt at the classification of the Polyzoa.

To sum up, whilst agreeing with Prof. Smitt in assigning the highest systematic value to the zoœcium, and dissenting entirely from the authors who have founded their genera on mere colonial habit, I hold that the latter should not be altogether disregarded, but that in its more marked modifications it should enter as an element into generic diagnosis. The form of the zoœcial aperture, the architecture and structural composition of the cell, and the plan of the gemmation are all to be taken into account. I have made no reference to the appendicular organs (avicularia and vibracula) as systematic helps. In some sections they are very constant in character and position, and may be employed with propriety as distinctive marks; but amongst the *Membraniporidæ* (Busk) they constitute the most unstable and variable structural element, and are of comparatively little value for systematic purposes.

The polypides amongst the Infundibulata generally offer few marked structural peculiarities. Amongst the Ctenostomata the presence of a gizzard is a true generic character. The peculiar arrangement of the tentacles in *Valkeria uva* of authors, and some other kindred forms, on which I have founded the genus *Campylonema,* is a character of undoubted importance. But, speaking generally, with our present knowledge we do not derive much help from the polypides in constructing our secondary groups.

* Prof. Smitt himself retains the genus *Flustra,* Linn.; but in an early stage of growth *F. foliacea* (and no doubt the same is the case with other species) forms a spreading crustaceous network, often of considerable size, and in this condition is not distinguishable, so far as either the habit or the structure of the cell is concerned, from a *Membranipora.* The genus is really founded on the remarkable colonial characters of the adult.

† *Membranipora sigillata,* Smitt, 'Floridan Bryozoa,' part ii. pp. 8–10.

I am quite prepared for the criticism that some of the divisions which I shall propose are really artificial rather than natural. Must there not always be a large element of artificiality in any scheme for distributing into definite groups the series of natural forms, so variously interconnected and melting as they do at all points one into the other?

Family **Membraniporidæ**, Busk and others.

The large and heterogeneous group of Cheilostomatous Polyzoa composing this family was ranged by Johnston under the two genera *Membranipora* and *Lepralia*. The latter, comprehending an immense number of species, has been maintained by Busk in its integrity; and he has been followed by many other writers on the Polyzoa. D'Orbigny, in his great work the 'Paléontologie Française,' has broken it up in part, and distributed its contents through several genera. Gray, in his 'Catalogue of the British-Museum Radiata,' has introduced a number of new groups to include certain sections of the genus *Lepralia*, a few of which have every claim to stand, while a large proportion are founded upon trivial characters and are wholly superfluous.

But the most elaborate and philosophical attempt to place the classification of these forms on a more natural basis has been made by Prof. Smitt in his 'Critical Review of the Scandinavian Marine Bryozoa.'

Every student of the Polyzoa is deeply indebted to the Swedish zoologist for his minute and thorough and discriminating investigation of the northern species, in all the stages of their growth and development, and through all their varietal modifications, and, whether he may accept all his conclusions or not, for his suggestive views respecting *the true method* of classification. Whilst freely admitting the great value of those views under many of their aspects, I find myself quite unable to accept a large number of the practical results to which they have conducted their author.

In attempting the very difficult task of revising the classification of the *Membraniporidæ*, I have derived the most valuable assistance from Prof. Smitt's writings; but I have been compelled to differ frequently from him as to the definition and composition of the groups which are to supplant the older divisions. In the present paper I merely propose to characterize briefly some of the new genera into which, I believe, the *Membranipora* and *Lepralia* of authors ought to be resolved.

The genus *Lepralia* includes a multitude of forms agreeing in certain general characters, but many of them distinguished from the rest by differences of very great significance. For example, *L. nitida*, Johnston, and *L. Peachii*, Johnston, agree in being adnate and incrusting, and in having cells which are calcareous, decumbent, and contiguous; but they differ widely in the structural composition of the cell (the plan upon which it is built); and to group them together is simply misleading. The definition of the genus, in short, is too general and vague. To make any approach to a natural system our groups must be founded on a careful and minute study of the individual cell in its various stages of growth.

The following seem to me to constitute natural and well-defined groups:—

1. Membraniporella, Smitt.

(*Lepralia*, part, Johnst., Busk, &c.)

Zoarium incrusting; *zoœcia* closed in front by a number of flattened calcareous ribs, more or less consolidated.

Type *Lepralia nitida*, Johnston.

2. Cribrilina, Gray.

(*Lepralia*, part, Johnston &c.)

Zoarium incrusting; *zoœcia* in a single layer, contiguous, having the front more or less occupied by transverse or radiating punctured furrows.

Type *Lepralia radiata*, Moll.

3. Mucronella, nov. gen.

(*Lepralia*, part, Johnston &c.)

Zoarium incrusting; *zoœcia* usually ovate, punctured round the base, with a suborbicular or semicircular aperture, the inferior margin mucronate, a denticle within it; *avicularia* generally wanting.

Type *Lepralia Peachii*, Johnston.

4. Microporella, nov. gen.

(*Lepralia*, part, Johnston &c.
Porellina, Smitt.
Reptoporina, part, D'Orbigny.)

Zoarium incrusting; *zoœcia* with a semicircular aperture, the lower margin straight and entire; a semilunate or circular pore below it.

Type *Lepralia ciliata*, Pallas.

The *Reptoporina* of D'Orbigny includes this group; but as it also embraces a miscellaneous assemblage of forms, it seems better to employ a new name.

5. Mastigophora, nov. gen.

(*Lepralia*, part, Johnston &c.
Hippothoa, part, Smitt.)

Zoarium incrusting; *zoœcia* with a semicircular orifice; the inferior margin straight, with a central sinus; one or more lateral *vibracula*.

Type *Lepralia Hyndmanni*, Johnston.

6. Schizoporella, nov. gen.

(*Lepralia*, part, Johnston &c.
Hippothoa, part, Smitt.)

Zoarium incrusting; *zoœcia* with a semicircular or suborbicular orifice, the inferior margin with a central sinus; *avicularia* usually lateral, sometimes median, with an acute or rounded mandible.

Type *Lepralia unicornis*, Johnston.

7. Lepralia, Johnston (part).

(*Lepralia*, Smitt.)

Zoarium incrusting (or erect?); *zoœcia* with a semi-elliptical aperture, contracted on each side about the middle or below it.

Type *Lepralia Pallasiana*, Johnston.

Smitt has retained Johnston's name for the section of the old genus *Lepralia* with a more or less horseshoe-shaped aperture; and it is clearly right that his decision should be respected. The group seems to be a natural one.

8. Escharella, Smitt (part).

(*Lepralia*, Johnston, part.
Eschara, part.)

Zoarium incrusting, or rising into foliaceous expansions, which are either simple or bilaminate; *zoœcia* with a suborbicular aperture, the lower margin slightly curved inward; the peristome raised and forming a secondary aperture, which is channelled in front; a median avicularium generally placed immediately below the sinus.

Type *Lepralia reticulata*, Macgillivray.

I retain Smitt's name *provisionally* for this large and well-defined group; but I have serious doubts whether the introduction of a new name is not a less evil than the retention of one which has been so variously applied.

9. Cylindroporella, nov. gen.

(*Lepralia*, part, Norman &c.)

Zoarium adnate, incrusting; *zoœcia* having the front wall composed of a single piece, not depressed; oral extremity produced, tubular, with a terminal orifice; an elevated pore on the front of the cell.

Type *Lepralia tubulosa*, Norman.

10. Lagenipora, nov. gen.

(See 'Annals' for September 1877, p. 214.)

Type *L. socialis*, Hincks.

11. Schizotheca, nov. gen.

Zoarium incrusting; *zoœcia* with a suborbicular (primary) aperture, the lower margin slightly sinuated; secondary aperture raised, tubular, notched or dentate in front; *ooœcium* terminal, with a fissure in the front surface; *avicularia* borne on distinct areas and distributed amongst the cells, sometimes wanting.

Type *Lepralia fissa*, Busk.

12. Rhynchopora, nov. gen.

(*Lepralia*, part, Johnston.)

Zoarium incrusting; *zoœcia* with a suborbicular or subquadrangular aperture, the lower margin supporting an uncinate process; a large avicularium (in fully developed specimens) placed transversely below the aperture; *ooœcium* terminal, closed in front by a calcareous lamina.

Type *Lepralia bispinosa*, Johnston.

13. Anarthropora, Smitt (part).

(*Lepralia*, part, Busk.)

Zoarium incrusting; *zoœcia* free and suberect above, aperture transversely elongate, contracted, with an entire and thickened peristome; an avicularium below and above the aperture.

Type *Lepralia monodon*, Busk.

The diagnosis is founded on the adult state. The *primary* aperture is slightly arched above, with a straight inferior margin, and is little if at all elevated.

I quite agree with Mr. Norman* that Smitt has united distinct types in his genus *Anarthropora*; and in conformity

* Rep. Brit. Assoc. 1868, fig. 309.

with his suggestion, and to avoid confusion, I have assigned this name to *L. monodon*.

Many other distinct groups are blended in the genus *Lepralia* of authors; I merely give the foregoing as a sample of the work of redistribution which has to be done, and must reserve the more complete treatment of the subject for some future opportunity.

The genus *Membranipora* also includes a large number of species; but there seem to be few distinct types of structure amongst them.

1. Micropora, Gray.

(*Membranipora*, part, Busk.
Lepralia, part, Norman, &c.)

Zoarium incrusting; *zoœcia* with prominent raised margins; front depressed, wholly calcareous; oral aperture semicircular, enclosed by a calcareous border.

Brit. spec. *Membranipora coriacea*, Esper.
Lepralia complanata, Norman.

2. Setosella, nov. gen.

(*Membranipora*, part, Busk.
Cupularia, part, Smitt.)

Zoarium incrusting; *zoœcia* with raised margins; front depressed and wholly calcareous; aperture semicircular; *vibracular cells* alternating with the zoœcia throughout the colony; *vibracula* setiform.

Type *Membranipora vulnerata*, Busk.

3. Megapora, nov. gen.

(*Lepralia*, part, Busk.)

Zoarium incrusting; *zoœcia* with prominent raised margins; front depressed, wholly calcareous; oral aperture trifoliate; oral valve composed of two portions, a fixed transversely elongate lamina and a movable lip.

Type *Lepralia ringens*, Busk.

Suborder Ctenostomata, Busk.

Smitt has pointed out that the principal character on which this suborder is founded, the operculum of *setæ*, occurs occasionally amongst the Cheilostomata and is not absolutely distinctive. Ehlers questions the validity of this division, and proposes to dismember it, by separating the fleshy forms, *Halcyonellea*, Ehrenb. (*Alcyonidium*, &c.), from the *Vesiculariidæ*. The latter he would constitute a distinct group, characterized by the presence of a jointed stem and the development of the zoœcia by budding from the internodes of this stem. For this group he suggests the name *Bryozoa stolonifera**.

I confess I cannot see that Busk's classification is invalidated by the mere fact that we find in two or three cases amongst the Cheilostomata a structure analogous to the opercular termination of the cell in the *Vesiculariidæ* †. We do not meet with completely isolated groups; and our zoological provinces cannot be shut in by perfectly hard and fast lines. In the absence of any very distinct types amongst the polypides, the structure of the zoœcium seems to offer the best systematic characters; and the principal points selected by Busk have certainly the merit of marking out very natural groups, as sharply defined probably as nature permits. The *opercular valve* of the Cheilostomata involves all the appendicular organs (*avicularia* and *vibracula*), which are so characteristic a feature of this division; *the absence of operculum* distinguishes the multitudinous forms which are constituted by the varied combination and arrangement of simple calcareous tubes; the *setose operculum* is characteristic of a very homogeneous group, the *Vesiculariidæ*, and also of the fleshy forms included in the genus *Alcyonidium*. Ehlers is undoubtedly right in insisting on the marked differences between these two sections in the mode in which the cell is developed by budding. In the former case cells are produced only by budding from a stem or stolon; in the latter they are produced by gemmation from another zoœcium.

This is an important distinction, but it seems to me less significant than the structural peculiarities of the cell on which the suborder Ctenostomata is founded; and I therefore propose to range these two sections under the latter as subgroups.

Amongst the Cheilostomata the zoœcia are developed by gemmation from a stolon in the *Æteidæ*, and amongst the Cyclostomata in the *Crisiidæ* to a certain extent.

In the genus *Eucratea* we have *both kinds of gemmation*: the primary zoœcia are developed on a creeping stolon that

* *Hypophorella expansa*, 'Ein Beitrag zur Kenntniss der minirenden Bryozoen,' von E. Ehlers, p. 126 (sep.), 1876.

† In the genera *Ætea* and *Eucratea* the uppermost portion of the tentacular sheath is composed of a number of delicate rods connected by an attenuated membrane; when the polypide is fully extended, this portion, which is scalloped round the free extremity, is thrown back, and stands out like a frill at right angles to the cell. This may be the homologue of the setose operculum of the Ctenostomata; but it exists in a very rudimentary condition; and as it is associated with the cheilostomatous movable lip, it has lost its significance as a protective covering.

swells out at intervals into ovate expansions from which the cells originate, as in the genus *Ætea*. These give rise to secondary cells, which bud from their upper extremity *.

Even in the genus *Ætea* we meet with one case, at least, in which gemmation from a stolon is combined with gemmation from the cell itself. In *Ætea truncata* the zoœcia are usually developed on a creeping stem, which is sometimes divided by joints into more or less fusiform internodes. But occasionally a long and slender tubular offshoot rises from the back of the primary cell, terminating above in a zoœcium; from this secondary zoœcium another tubular offshoot is in some cases developed, bearing a third cell. Beyond this I have not seen the process of gemmation carried. The tubular stem, proceeding from the dorsal surface of a cell and bearing another cell at its extremity, must be regarded as a kind of pedicel †, and we have therefore in *Ætea truncata* the direct development of cell from cell, as well as the production of zoœcia by budding from a stolon. This seems to be the case amongst the *Crisiidæ* also, according to Ehlers.

In the presence of these facts I cannot regard the Stolonifera as a suborder.

Suborder Ctenostomata, Busk.

Group 1. *Halcyonellea*, Ehr.

Zoarium fleshy; *zoœcia* developed by budding from other zoœcia.

Group 2. *Stolonifera*, Ehlers.

Zoarium horny or membranous; *zoœcia* developed by budding from the internodes of a distinct stolon or stem.

The Stolonifera (= *Vesiculariidæ*, Johnst.) range themselves under two divisions: in one the tentacles form a perfect circle; in the other, two of them are constantly bent outwards and the circle is broken on one side.

For the species in which this remarkable peculiarity was first noticed I constituted the genus *Campylonema*; but I have since ascertained that it has a wider range, and occurs, amongst others, in the well-known *Valkeria uva*, Fleming. It is met with only in species of the simplest structure, which

* In some cases, however, the colony commences with a line of decumbent and adnate cells, assuming the habit of *Hippothoa*, and from these the erect shoots rise. I believe that these decumbent cells must be regarded as the morphological equivalent of the creeping stolon, and that the more or less clavate swellings which occur on the latter, in both *Ætea* and *Eucratea*, are in fact aborted cells.

† The primary cells, it may be noted, are sometimes pedicellate.

are destitute of a gizzard. I have detected it so far in *Campylonema tremula*, mihi, *Valkeria uva*, Flem., *Valkeria cuscuta*, Linn., and *Mimosella gracilis*, mihi. As *Valkeria uva* is the type of Fleming's genus *Valkeria*, his name will supplant my *Campylonema*, now that this species is known to possess the bent tentacles. *Valkeria pustulosa*, Ellis and Sol., *V. citrina*, mihi, and *V. gracillima*, mihi, have the tentacles in a perfect circle and are furnished with a gizzard; they must therefore be referred to another genus.

I propose to classify the Stolonifera as follows:—

Stolonifera, Ehlers.

a. **ORTHONEMIDA**, Hincks.

Polypides with the tentacles disposed in a perfect circle.

With a gizzard.

1. Family **Vesiculariidæ.**

Genera: *Vesicularia*, *Bowerbankia*, *Valkeria* (part), *Amathia.*

Without a gizzard.

2. Fam. **Farrellidæ.**

Genera: *Farrella*, *Avenella*, *Anguinella.*

3. Fam. **Triticellidæ.**

Genera: *Triticella*, Dalyell; ?*Hippuraria*, Busk.

I suspect that the latter genus will prove to be nearly allied to *Triticella*; but until it has been more thoroughly investigated, it can only be placed provisionally in this family.

b. **CAMPYLONEMIDA**, Hincks.

Tentacles not forming a perfect circle, two of the number being always everted; no gizzard.

1. Fam. **Valkeriidæ.**

Genus *Valkeria*, Flem.

2. Fam. **Mimosellidæ.**

Genus *Mimosella*, Hincks.

Ehlers includes in his Stolonifera the *Entoprocta* of Nitsche (*Pedicellina*, *Loxosoma*, and ? *Urnatella*); but I am quite unable to accept this view. The structural and embryological peculiarities of this group are such as to entitle it, in my judgment, to rank as a *subclass*.

LXVII.—*Descriptions of some new Species of Birds.* By ARTHUR, Marquis of TWEEDDALE, F.R.S.

Tanygnathus Everetti, sp. n.

♀. Whole head light green. Throat, breast, and abdominal region the same, with an ochreous tint. Upper back and interscapulars dark green. First primary dark brown, very narrowly margined with green on outer web; remaining primaries brown, with the whole of the outer web green, and, towards the ends, some of the inner webs. Secondaries, and tertiaries above, green. All the wing-coverts green, narrowly margined with yellow. Quills underneath brown. Under wing-coverts green and yellowish green. Rectrices above green, like quills; below pale golden brown. Middle and lower back and uropygium deep turquoise-blue, not sky-blue. Upper tail-coverts green. Bill in dried skin white.

Wing 7 inches, tail 5, tarsus 0·75, bill from gape 1·00.

Obtained by Mr. Everett at Butuan (N. Mindanao).

Ceyx argentata, sp. n.

♀. Chin, throat, upper breast, abdomen, ventral region, major under wing-coverts, and thigh-coverts pure white. Cheeks, sides of head, and ear-coverts black. Lower breast and flanks black, washed with deep blue. Rectrices and under tail-coverts black. Plumage above black. A bold supercilium commencing above the eye and running into the occipital crest, formed by the component plumes being tipped with pale silvery blue. Many of the feathers of the vertex minutely tipped with silvery blue. Occipital crest tipped with pale silvery bluish green, or silvery blue, or the two together. Dorsal plumage and lengthened upper tail-coverts black at base, then silvery bluish green, then pale silvery blue. Wings black. Major coverts each with a terminal silvery-green spot. Loral spot white. An isolated tuft on the sides of neck, white tipped with creamy fulvous. Bill black.

Wing 2·62 inches, tail 1·37, tarsus 0·45, culmen 1·50.

Obtained at Dinagat, a small island immediately north of Mindanao, in June, by Mr. Everett, and one of his most interesting discoveries.

Mulleripicus Wallacei, sp. n.

Mulleripicus fulvus (Quoy & Gaim.), partim, Walden, Tr. Z. S. viii. p. 41. no. 35, ex Macassar.

♂. Differs from typical *M. fulvus* ♂ (ex Menado) by the upper plumage being of a darker shade of slate-grey, by the occiput as well as the forehead and vertex being red, and by the bill being shorter. The eye is surrounded by red, which extends some way behind it, whereas in true *M. fulvus* the white-spotted grey feathers of the occiput commence at the posterior part of the eye, and separate the red of the vertex from that of the face.

♀. Differs from true *M. fulvus* ♀ (ex Menado) by having the white-tipped feathers of the head restricted to the occiput, by the spots being smaller and not so profuse, and by the white dots on the throat being almost obsolete.

	Wing. in.	Tail. in.	Tarsus. in.	Culmen. in.
M. fulvus ♂ ex Menado......	7·12	7·50	1·12	1·96
" ♀ "	6·0	6·62	1·00	1·87
M. Wallacei ♂ ex Macassar	7·00	6·50	1·00	1·75
" ♀ "	6·87	6·40	1·00	1·75

The Macassar examples were collected by Mr. A. Wallace, after whom I venture to name the species. Those from Menado by Dr. B. Meyer.

Mulleripicus fuliginosus, sp. n.

♂. Slaty smoke-grey. Feathers of the forehead, vertex, occiput, chin, throat, and neck with a terminal white or fulvous-white linear mark. Lores, ear-coverts, and ophthalmic region uniform grey. Feathers covering basal walls of mandible and the cheeks crimson.

Wing 6·25 inches, tail 5·25, culmen 1·70, tarsus 1·00.

From Surigao (N. Mindanao), where discovered by Mr. Everett.

Penelopides affinis, sp. n.

♂. Like *P. Panini*, but differs by wanting the perpendicular grooves on the thick lateral plates of the maxilla, which are smooth, by the grooves at the base of the mandible not being recurved, but straight, by the whole bill being much less massive, by the abdominal region and under tail-coverts being of the same colour as the breast, and not rufous, by the upper tail-coverts being black, and not rufous, and by the rectrices having a black band at their insertion.

♀. Bill as in male, and to that extent differs from that of *P. Panini* ♀. The female also differs by having a black band at the base of the rectrices.

	Wing. in.	Tail. in.	Tarsus. in.	True culmen. in.
♂	9·25	9·00	1·75	3·40
♀	8·75	8·37	1·60	3·25

Described from examples obtained by Mr. Everett at Butuan (N. Mindanao).

Pomatorhinus nuchalis, sp. n.

Pomatorhinus leucogaster, Gould, apud Walden, B. Burma, no. 351.

Differs from *P. olivaceus*, Blyth, ex Meetun and Mooleyit (Tenasserim) by the ferruginous of the sides of the neck extending down the flanks, and from *P. schisticeps*, Hodgs.,= *P. leucogaster*, Gould, by its smaller dimensions, and the absence of pure white central streaks on the lateral ferruginous pectoral feathers.

This is the race that inhabits Thayetmyo, the Yoma and Karen hills, and Karen-nee. In examples from all these localities the nape is tinged with rufous; but in Karen-nee individuals the rufous forms a distinct broad demicollar.

This would appear to be the race identified by Mr. Hume (Str. F. iii. p. 121) as *P. schisticeps*, Hodgs., a species which cannot be separated from *P. leucogaster*, Gould, both described from the Himalayas, the stated dimensions of *P. leucogaster* scarcely differing from the actual dimensions of the type specimens of *P. schisticeps* in the British Museum.

Mixornis (?) *capitalis*, sp. n.

♀. Forehead, vertex, and occiput rufous, each feather with a pale fulvous central streak. Space before the eyes and lores dull grey. Cheeks, ear-coverts, and sides of neck ashy, each feather with a pale albescent central streak. Nape, back, and wing-coverts the same, the pale striations on the back being very prominent in consequence of the abnormal length of the dorsal plumage. Uropygium and upper tail-coverts olive rusty grey and unstriated. Rectrices brown; outer pair with the whole outer and apical third of the inner web pale yellowish white; remaining pairs, middle excepted, broadly tipped on both webs with white, middle pairs slightly tipped with white. All the quills brown, narrowly margined externally with fulvous grey, the tertiaries with pale rusty. Basal portion of quills margined on their inner webs with white. Chin and throat rufous and rufous-white. Breast, under wing-coverts, abdomen, vent, and under tail-coverts white, faintly tinged with very pale yellow.

Wing 2·75 inches, tail 2·50, tarsus 0·70, culmen 0·62.

Described from a single individual obtained in the Philippine island of Dinagat by Mr. Everett.

Criniger Everetti, sp. n.

♂ ♀. Above almost golden-yellow brown. Feathers of forehead, vertex, and occiput sublanceolate, brown, margined with golden yellow. Lores yellow. Feathers at base of mandible and cheeks yellow-tipped. Throat, neck, and upper breast brownish ochreous yellow. Chin, lower breast, abdomen, ventral region, axillaries, under tail- and wing-coverts sulphur-yellow. Inner webs of primaries brown. Exposed surface of all the quills and the wing-coverts like back. Inner margin of inner webs of quills pale yellow. Upper surface of rectrices like that of quills. Under surface pale brown, washed with yellow; inner webs margined with pure yellow. Shafts of quills and rectrices ruddy brown above; of quills underneath yellow at base and brown towards the end; of rectrices bright yellow throughout.

	Wing. in.	Tail. in.	Tarsus. in.	Culmen. in.
♂	4·50	4·62	0·87	1·25
♀	4·35	4·25	0·87	1·12

Described from examples obtained by Mr. Everett at Surigao (N. Mindanao).

Hypothymis cœlestis, sp. n.

♀. Azure. Feathers of the head grey at their insertion, and each tipped with glistening azure; a lengthened occipital crest similarly marked. Space before the eye and lores pale blue. Chin, cheeks, throat, sides of neck and upper breast rich velvety turquoise-blue, darker than the blues of the rest of the plumage. Back and upper tail-coverts with grey bases to the feathers, the extremities being blue, which is paler on the upper tail-coverts. Wing-coverts of the same shade of blue as the head. Quills dark brown externally, margined with a paler shade of blue. Lower breast, abdomen, vent, flanks, and under tail-coverts white, tinged with pale greenish blue, most intense on the flanks. Axillaries grey, tinged with pale blue. Rectrices above like the quills; underneath dark brown like under surface of the quills. Shafts of the rectrices brown above, almost white underneath. Shoulder-edge blue.

Wing 2·83 inches, tail 3·00, tarsus 0·62, culmen 0·56.

Described from a specimen obtained in the island of Dinagat (Philippines) by Mr. Everett.

Prionochilus olivaceus, sp. n.

♀. Entire upper surface, wing-coverts, and surface of closed wing uniform pure olive-green, which colour encircles the eye and covers the sides of the neck. Space before the eye, cheeks, sides of throat, and the upper breast grey. Lower breast, abdomen, flanks, and under tail-coverts the same grey washed faintly with olive-green, the mesial line being albescent. Chin and throat white, slightly greyish, forming a broad well-defined greyish white stripe, commencing at the chin and descending to the breast. Axillaries and under wing-coverts pure silky white. Remiges and rectrices dark brown, margined with the olive-green hue of upper plumage.

Wing 2·12 inches, tail 1·25, tarsus 0·62, culmen 0·37.

Described from an example obtained by Mr. Everett in the island of Dinagat (Philippines).

Dicæum schistaceum, sp. n.

♂. Above fuliginous ashy; below ashy white. Remiges and rectrices above dark ashy brown, underneath paler. Under wing-coverts and axillaries pure white. Base of mandible (in dry specimens) yellowish white. Apex and the maxilla pale ruddy brown.

Wings 2·25 inches, tail 1·37, tarsus 0·62, culmen 0·35.

Dicæum Everetti, sp. n.

♂. Above dark olive-green, paler on the cheeks. Chin, throat, and breast pale grey. Remainder of underparts albescent grey tinged with palish yellow. Major coverts narrowly margined with greenish yellow. Quills above dark brown, almost black, with very narrow pale olive-green external margins. Rectrices above like quills, narrowly tipped with an albescent fringe. Under wing-coverts and axillaries pure white. Bill (dry specimen) brown at tip, yellow at base.

Wing 1·94 inch, tail 1·00, tarsus 0·50, culmen 0·37.

These two species of *Dicæum* were discovered by Mr. Everett in the island of Dinagat.

Æthopyga bella, sp. n.

♂. Chin, throat, breast, and uropygium bright sulphur-yellow. Forehead, vertex, minor carpal coverts, upper tail-coverts, and upper surface of rectrices dark metallic green. Occiput, nape, and wing-coverts dark olive. Cheeks, lores, behind the eye, sides of head and neck, interscapulars, and back deep blood-red. Quills almost black, margined with dark olive. Abdomen, flanks, vent, under tail-coverts, and under wing-coverts silky white, more or less tinged with pale yellow, especially on the mesial line, under tail-coverts, and carpal edge. A few blood-red feathers on the upper breast. A metallic violet spot on sides of head. A narrow line of deep blood-red runs along the rami of the mandible. A bold metallic moustache springs from the base of the mandible, and descends the sides of the neck; the upper half violet, the lower half green.

♀. Above, wing-coverts, and edgings to quills olive-green. Uropygium bright sulphur-yellow as in ♂. Space before the eye, cheeks, ear-coverts, chin, throat, and upper breast grey tinged with yellowish olive-green. Lower breast, abdomen, flanks, and under tail-coverts white tinged with yellow. Under wing-coverts white, faintly tinged with yellow. Quills and rectrices dark brown. margined with olive; lateral rectrices tipped with albescent olive.

	Wing. in.	Tail. in.	Tarsus. in.	Culmen. in.
♂......	1·68	1·44	0·50	0·50
♀......	1·62	1·12	0·50	0·50

Described from examples discovered by Mr. Everett at Surigao (N. Mindanao).

This species falls under Mr. Sharpe's subgenus *Eudrepanis*.

Ptilopus? incognitus, sp. n.

♀. Above, tertiaries, and wing-coverts light emerald-green. Forehead, lores, ophthalmic region, cheeks, and ear-coverts grey mixed with dingy green. Chin and throat almost pure white. Neck and sides of neck greenish grey. An ill-defined pectoral band formed of green feathers tipped with ruddy orange; breast ashy green tinged with the same colour. Flanks green. Abdomen mixed green and ashy. Under tail-coverts (which are lengthened) pale creamy white with a brown central streak. Thigh- and tarsal coverts ashy brown. Exposed upper surface of rectrices tinged with golden. Lower surface pale ashy brown, with ill-defined paler tips. Quills dark brown, margined outwardly with dark green. Secondaries with a pale narrow creamy border, still narrower on the major coverts.

Wing 5·25 inches, culmen 0·75, tarsus 0·81, tail 3·75.

Obtained at Butuan (N. Mindanao) by Mr. Everett.

The sexual symbols prefixed to all the descriptions of the Philippine birds are taken from Mr. Everett's labels.

LXVIII.—*Description of a new Species of* Bulimus *from South Africa.* By EDGAR A. SMITH, F.Z.S. &c.

Bulimus (*Pachnodus*) *drakensbergensis.*

Testa angustissime perforata, trochiformis, lineis incrementi obliquis striata, striisque spiralibus minutis obsolete sculpta, tenuis, fragilis, fusco- vel flavo-cornea; spira elevato-conica, apice subobtuso; anfractus 7, convexiusculi, ultimus in medio subacute carinatus, infra carinam parum convexus; apertura vix obliqua, irregulariter subquadrato-rotundata, longitudinis totius $\frac{8}{17}$ adæquans; peristoma simplex, tenue, margine *externo* in medio leviter angulato, haud expanso, *columellari* superne breviter dilatato et reflexo, perforationem angustam fere obtegente.

Long. 17, diam. supra carinam 11; aperturæ long. 8, diam. $6\frac{1}{2}$ millim.

Hab. Eastern slope of the Drakensberg mountains, at Lydenburg Gold-fields, Transvaal, South Africa.

There are two species closely related to each other, *B. natalensis*, Krauss, and *B. arenicola*, Benson, which also exhibit a very near relationship with the present. In substance they are much alike, being thin and semitransparent, and differ principally in form, colour, and the proportion of the whorls.

B. drakensbergensis has a more produced spire than *B. arenicola*, its nearest ally, consists of half a whorl more; the last whorl is smaller, narrower, and less acutely keeled; and the aperture is also smaller. These, together with the difference of coloration, constitute the main distinctions.

The two specimens which I now describe were presented to the British Museum by Mr. G. B. Sowerby, jun.

MISCELLANEOUS.

Remarks on the Yellow Ant.

Professor Leidy remarked that recently, while seeking certain animals beneath stones in the woods near Philadelphia, he had had the opportunity of observing the yellow ant (*Formica flava*) in possession of large numbers of other insects. This fact, in itself common enough, in one respect, was new and of special interest to him, and may be so to others. In one instance a comparatively small colony of the yellow ants had three different insects in their possession, consisting of a species of *Aphis*, a *Coccus*, and the larva of an insect, probably Coleopterous. The *Aphides* were kept in two separate herds, and these were separated from a herd of *Cocci*. The larva was in the midst of one of the former herds. In a larger colony of the yellow ants there was a herd of *Aphides*, which occupied the underpart of one margin of the stone, and was almost ten inches long by three fourths of an inch in breadth. The same colony also possessed a separate herd of *Cocci*, closely crowded and occupying almost a square inch of space. In both colonies the *Aphis* and the *Coccus* were the same. The *Aphis* is pale yellow, with white tubercles on the dorsal surface of the abdominal segments. The *Coccus* is of a dark red hue. Both *Aphides* and *Cocci*, with few exceptions, adhered to the under suface of the stones, and were not attached to roots. They appeared to be carefully attended by the ants which surrounded them. The larva alluded to was almost six millimetres long, was covered on the back with a thick, white, cotton-like secretion. It was also carefully attended by the ants, which were frequently observed to stroke it with their antennæ. The *Aphides* and *Cocci* were all in good condition, but without visible means of subsistence excepting the neighbouring grass-roots partially extending into the earth beneath the stones, to which it is probable they were at times transferred by their masters.—*Proc. Acad. Nat. Sci. Philad.* 1877, p. 145.

On some Points in the Organization of the Bryozoa. By M. L. Joliet.

In a preceding note (April 9, 1877) I have stated the reasons which prevented me from regarding as of a nervous nature the supposed colonial nervous system of the *Vesiculariæ*. The investigations that I have made at the Laboratory of Roscoff since the month of May enable me to extend this opinion to the entire group of the Bryozoa, and have furnished me with the following data as to the nature and function of this tissue.

The so called colonial nervous system exists under various forms, sometimes as a branching trunk, sometimes in the form of a plexus in all the Bryozoa that I have examined; almost throughout it attains a great development, and throughout it is composed of the fusiform cells which I have noticed in *Bowerbankia imbricata*. It is in these cells that are formed the floating corpuscles ("floating-cells," "fett-kroppar" of Smitt) which float in the interior of the chambers; it is at the expense of the same tissue that the polypide with its muscles is developed; and, further, it is in its bosom that both the ova and the mother cells of the spermatozoids are formed.

By its great development, by its presence in all Bryozoa, and by its important and multiple functions, this system deserves to be regarded as a fundamental and constituent tissue of the Bryozoan, quite as essential as the endocyst, for which I propose the name of *endosarc*. In all respects the parenchyma of the stems and stolons of the Pedicellinæ must be assimilated to it.

The endocyst, which, as Smitt has demonstrated, is not organized, and only presents cellular structure at the peripheral extremities, is, so to speak, charged with the vegetative function—the increase of the colony by the formation of new chambers. The special function of the endosarc is to produce the polypides or the reproductive elements. It is itself derived from the endocyst by simple differentiation of the cells of the extremities in course of growth.

My researches have further enlightened me as to the signification of the brown body, as well as on the mode of fecundation of the ovum and the development of the larva in several species.

The brown body is throughout and in all cases the residue of a polypide which previously inhabited the chamber. It is formed by coloured granules, originally contained in the hepatic cells of the stomach, to which are often added débris of alimentary matters, such as Diatomaceæ; and in *Bowerbankia imbricata* the plates and teeth of the gizzard are found in it. Incapable of budding by itself, it is, in the *Vesiculariæ*, relegated into a corner of the chamber when a new bud is developed; on the other hand, in many species (*Lepralia, Eucratea chelata*) it is pushed out of the zoœcium by the new polypide. For this purpose, as Repiachoff has very well observed, the young bud englobes it in a cavity which will subsequently become the stomach, then, when developed, passes it into the rectum, and, at the first expansion, rejects it by the anus.

With regard to the fecundation of the ovum, I am in a position to assert that in *Valkeria cuscuta* the ovum cannot be impregnated by the spermatozoids, which are developed at the same time in the same zoœcium and in the bosom of the same funicle; in order to its segmentation it needs the concourse of spermatozoids coming from another chamber. In fact, so long as there are spermatozoids in the zoœcium that it occupies, the ovum is only sketched out; it increases in size and shows distinctly its germinal vesicle and spot long after all the spermatozoids have been evacuated. The latter may be seen swimming actively in the surrounding water; and the mode in which their access to the ovum is facilitated is very curious. When the ovum becomes distinct the spermatozoids are quickly evacuated, the polypide which accompanied them then shrivels and becomes reduced to the state of brown body, and the chamber completely closes. The ovum therefore becomes mature in a closed zoœcium. When the moment arrives for it to be fecundated, a new bud is developed in its dwelling-place; but the polypide produced from it never attains the adult state; it has no other purpose than to reopen the chamber by developing in it a new opercular apparatus and to lend its muscles to the nascent larva. With this object, after having, notwithstanding its small size, produced all the parieto-vaginal and great retractor muscles, it is atrophied and passes behind the ovum, which, by a mechanism which it would take too long to describe here, is finally placed in its tentacular sheath, in free contact with the surrounding water and consequently with the spermatozoids. By the action of the muscles which are now attached to its envelope, the fecundated ovum, which has become a larva, moves in the chamber, absolutely as a polypide would do; it may even be carried to the entrance, in consequence of the evagination of the sheath; and it is in this way that the ciliated larva is finally evacuated.

I shall notice, in the last place, an embryo which shows that the mode of organization described by Schneider in the *Cyphonautes* is far from being an isolated fact. The embryo of *Flustrella hispida*, Redfern, is bivalved and presents a complex organization. Like the former it finally fuses completely into a mass of homogeneous protoplasm, in the midst of which the first polypide is developed!—*Comptes Rendus*, August 13, 1877, p. 406.

On the Coloration of the Optical Elements in Locusta viridissima. By M. J. Chatin.

The authors who have treated of the structure of the eye in the Arthropoda, as also in the Invertebrata generally, have contented themselves with mentioning the existence of a pigment of variable tint, constituting the fine partitions which separate the bacillar elements; as to the coloration proper to the latter, it has been misunderstood or regarded as accidental. Former investigations*, however, have enabled me to insist upon the importance of this character, the constancy of which the observation of certain Crustacea showed me, and of which Boll's researches soon afterwards fixed the value.

On recently examining repeatedly the eye of an insect very favourable to such studies, *Locusta viridissima*, Linn., I found arrangements which, as will be seen, deserve to be correlated with the facts to which I have just alluded.

The optical bacilli present the aspect of slender filaments in their lower portion, sensibly dilated in their upper region (near the cone); these filaments are contained in brown sheaths, formed by the pigmentiferous tissue mentioned above. If, by means of suitable reagents (alkalies &c) and by gradual solution, we succeed in breaking the web of this tissue, the bacilli appear out of their sheaths of a fine tender rose-colour. This tint, which is lively in the eye excised from the living animal and immediately observed, soon gradually becomes weaker, whilst the bacillus undergoes a granular alteration; it persists, however, longer at the periphery than towards the central region.

This description, which is a summary of the essential details, suffices to show that the bacilli of the *Locusta* present, in their intimate constitution, great similarity to the same parts studied in the Crustacea; their proper coloration is the same in these different types, and seems thus to tend towards a generalization of which I hope soon to be able to furnish further examples, and [the interest of which it is unnecessary to point out.—*Comptes Rendus*, August 20, 1877, p. 447.

On a new Marsupial from Australia. By Prof. R. Owen, F.R.S. &c.

I have received from Australia skins of a male and female small marsupial, combining the dentition of a Hypsiprymnid or kangaroo-rat, with a hind foot of five digits, a small prehensile hallux (I.) being superadded to the four other digits, of which II. and III. are long and slender, IV. and V. of the greater length and strength characteristic of the *Poëphaga*. For this interesting form I propose the generic name *Pleopus*, in reference to the full or type mammalian number of the toes of the hind foot, with the specific name *nudicaudatus*, from the nude scale-clad tail. Figures of the species will be added to the fuller account proposed to be given elsewhere.

* L'Institut, 1876, pp. 125 & 189.

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END OF THE TWENTIETH VOLUME.

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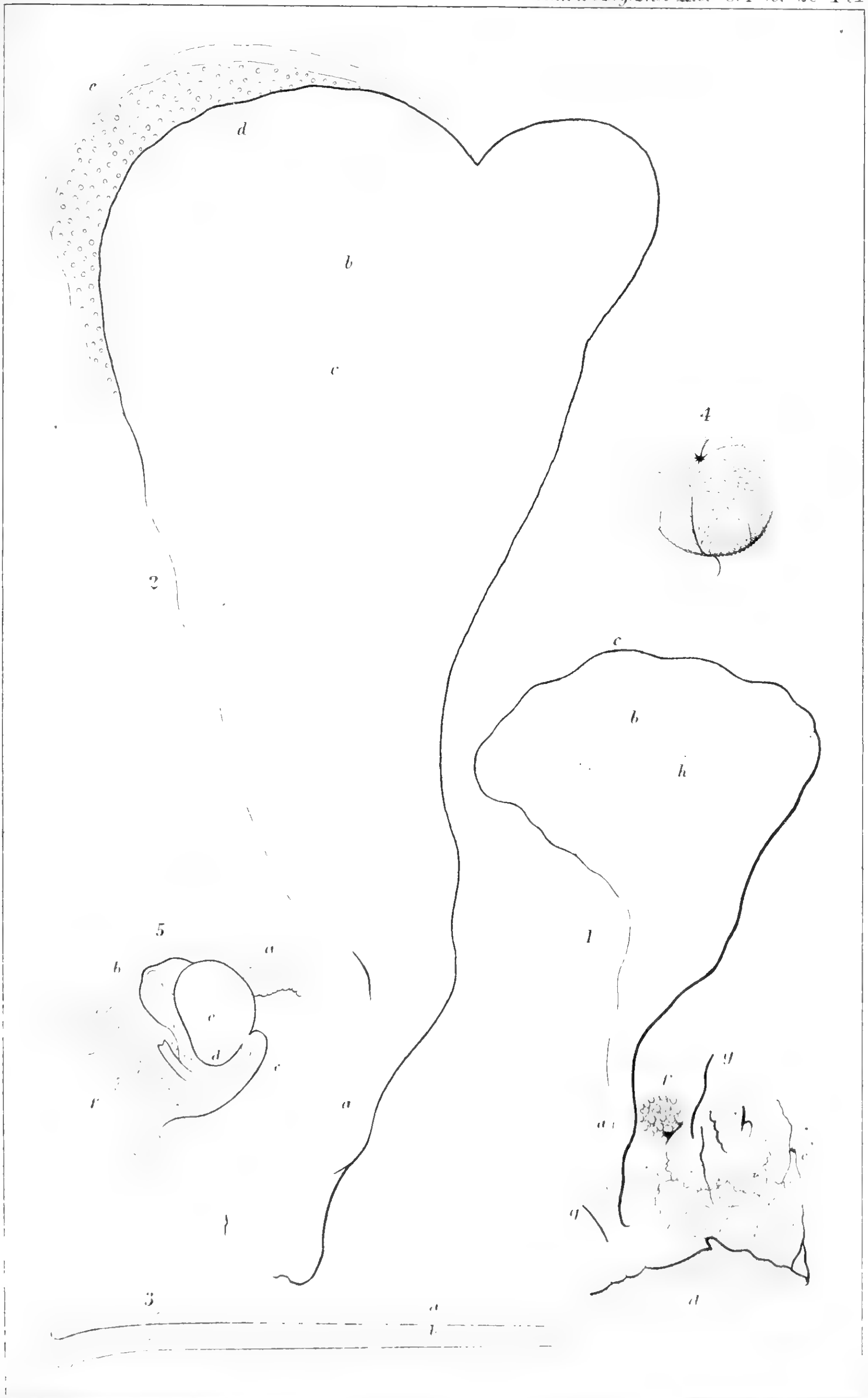
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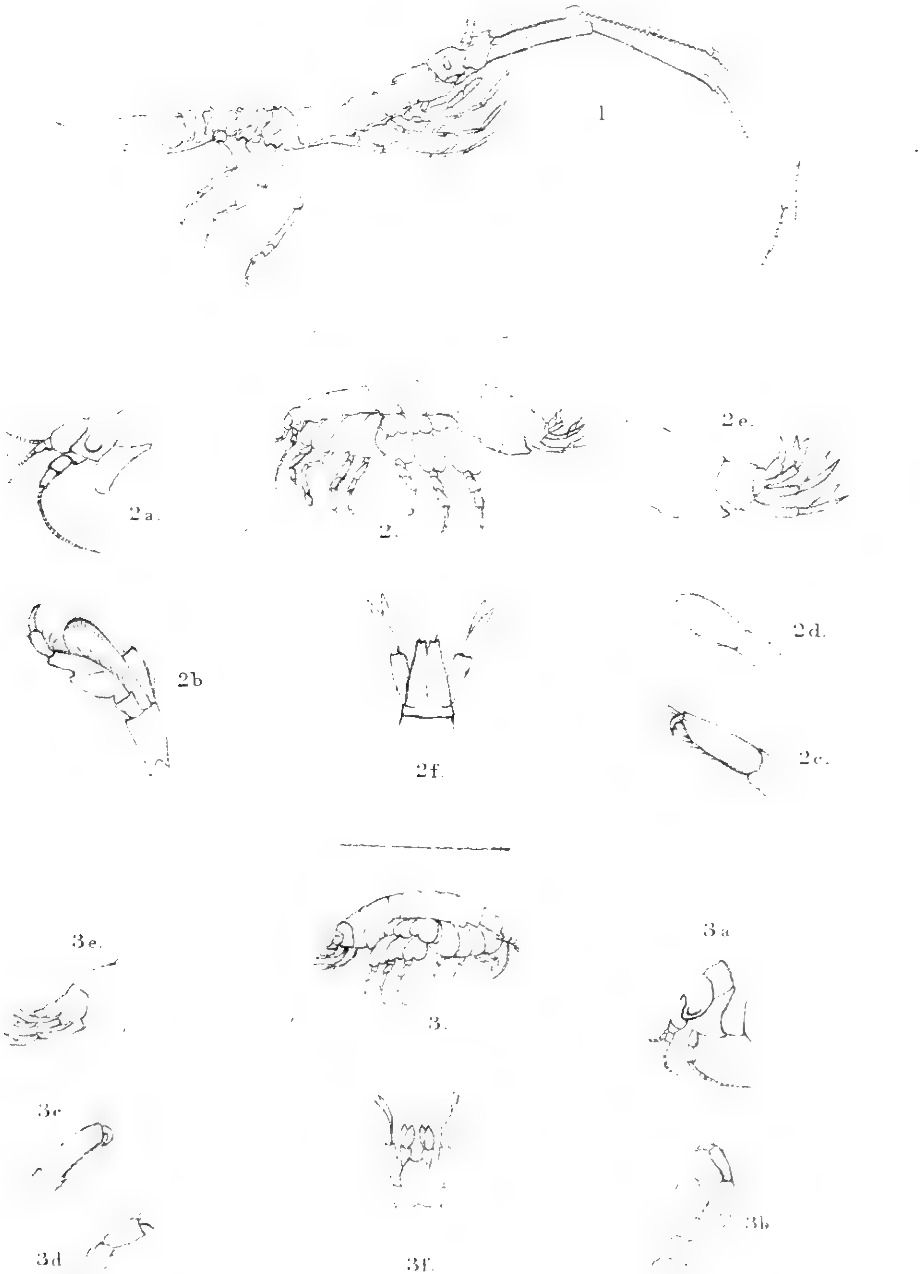

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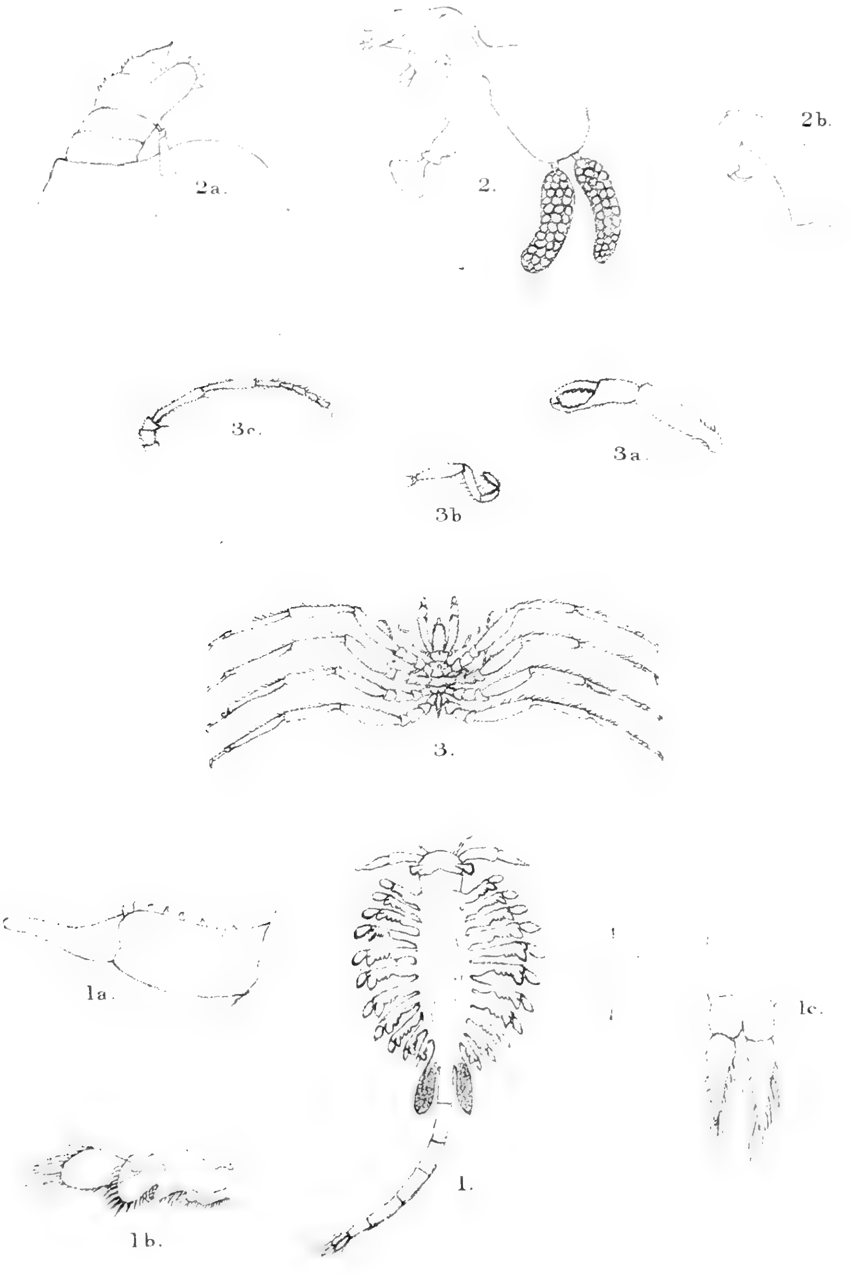

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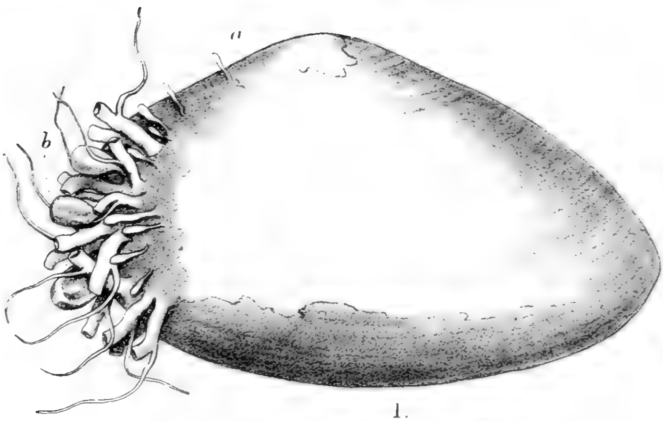

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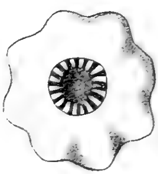

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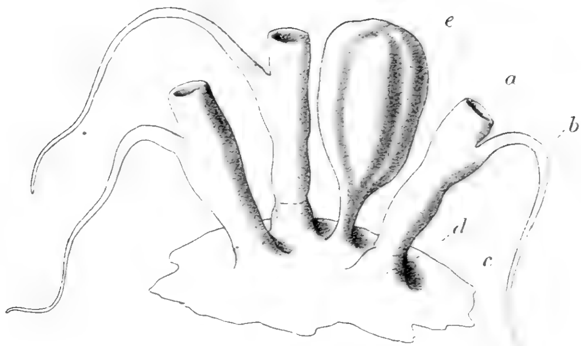

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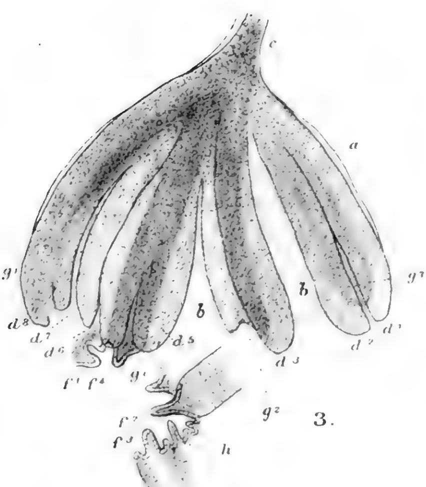

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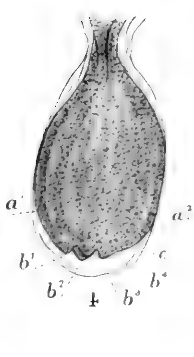

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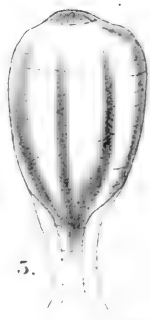

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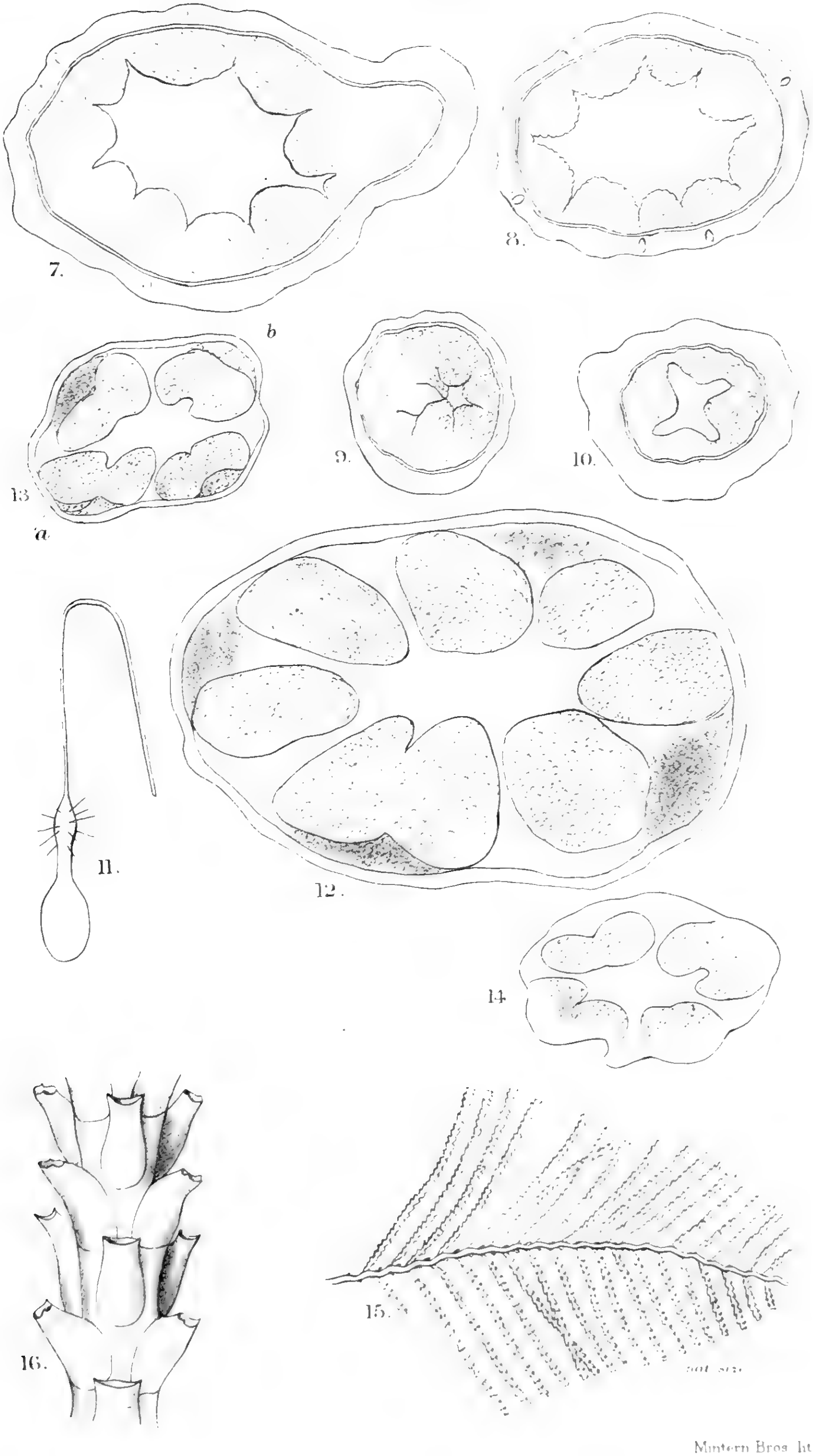

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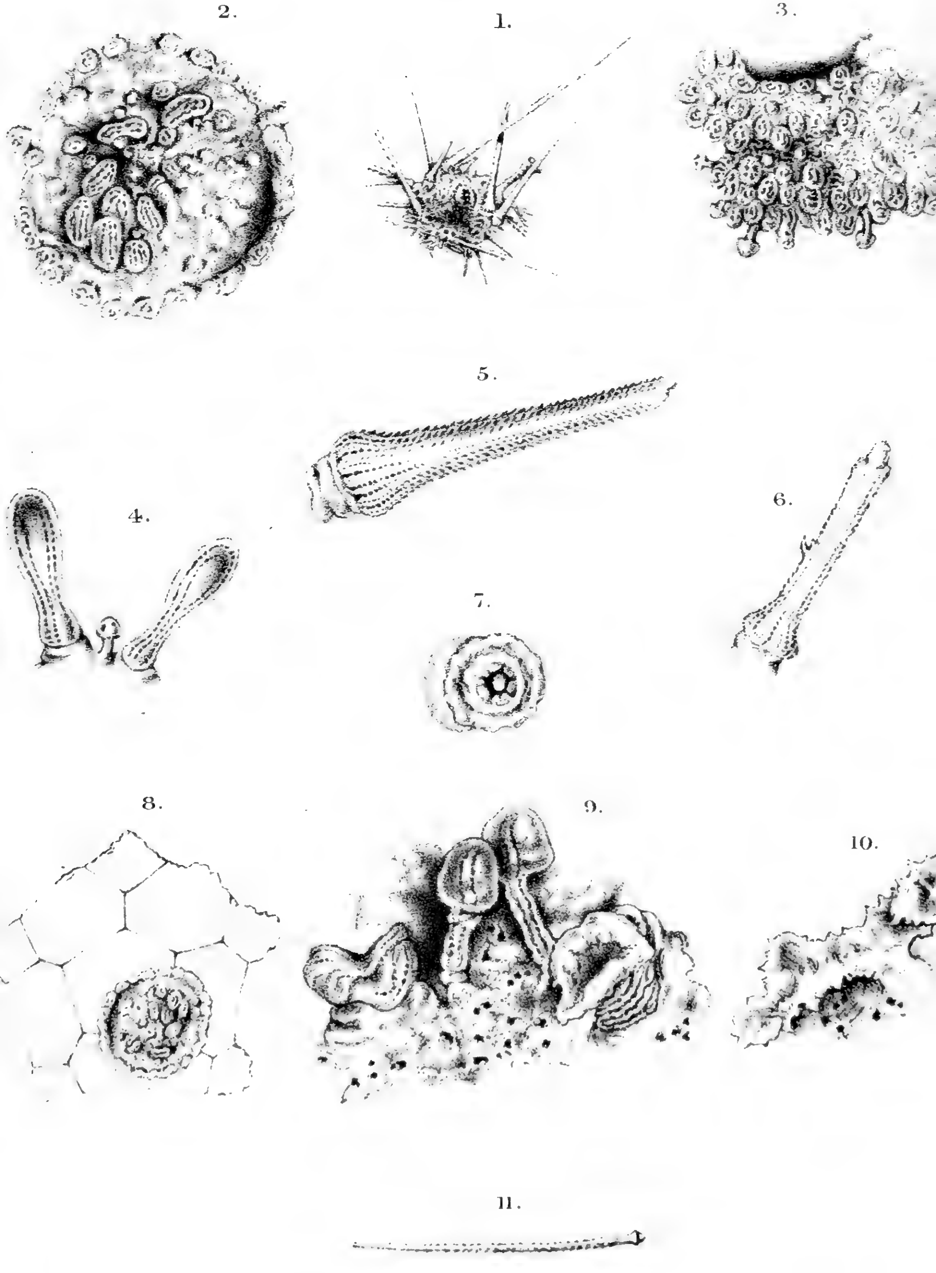

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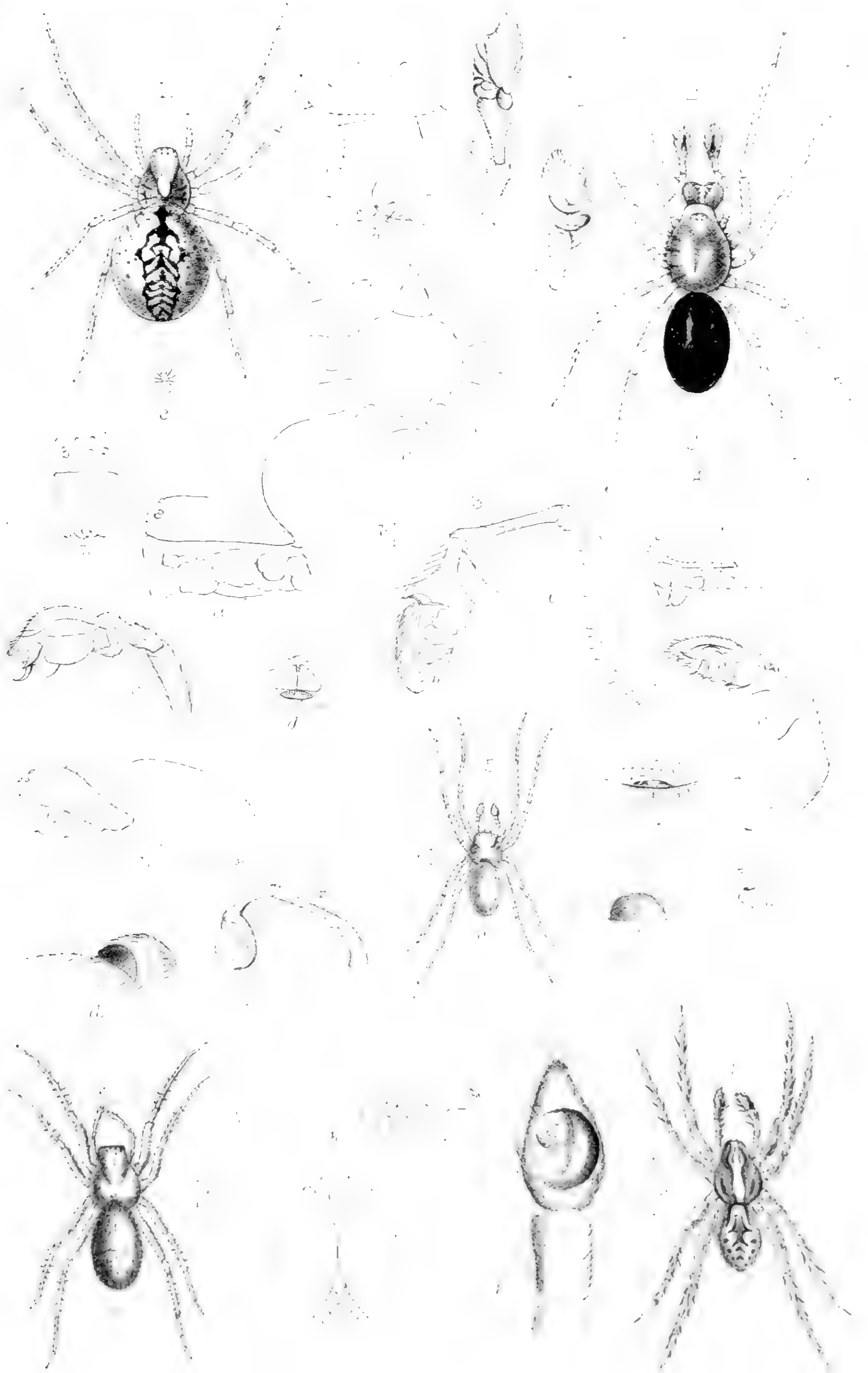

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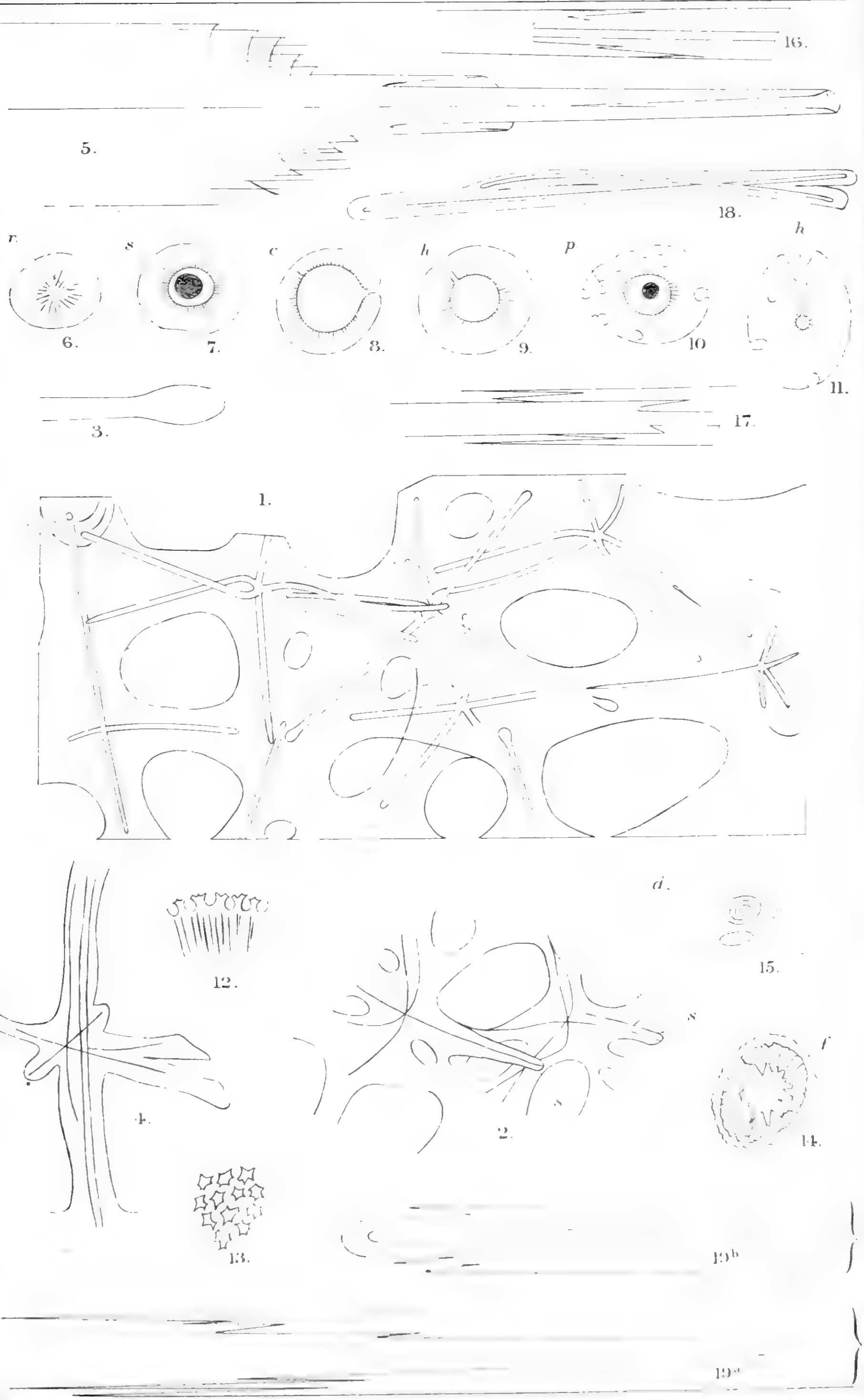
ARCTIC SPIDERS.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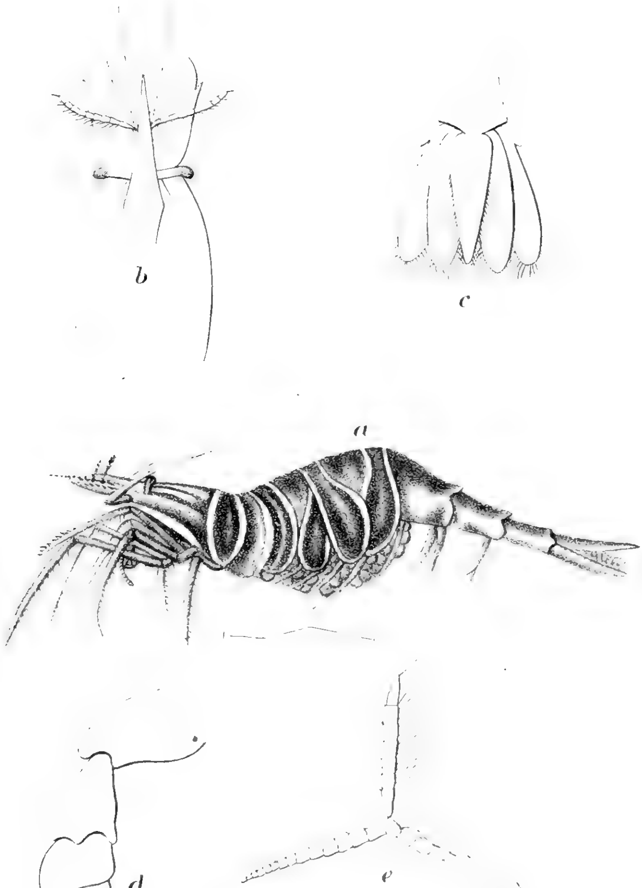

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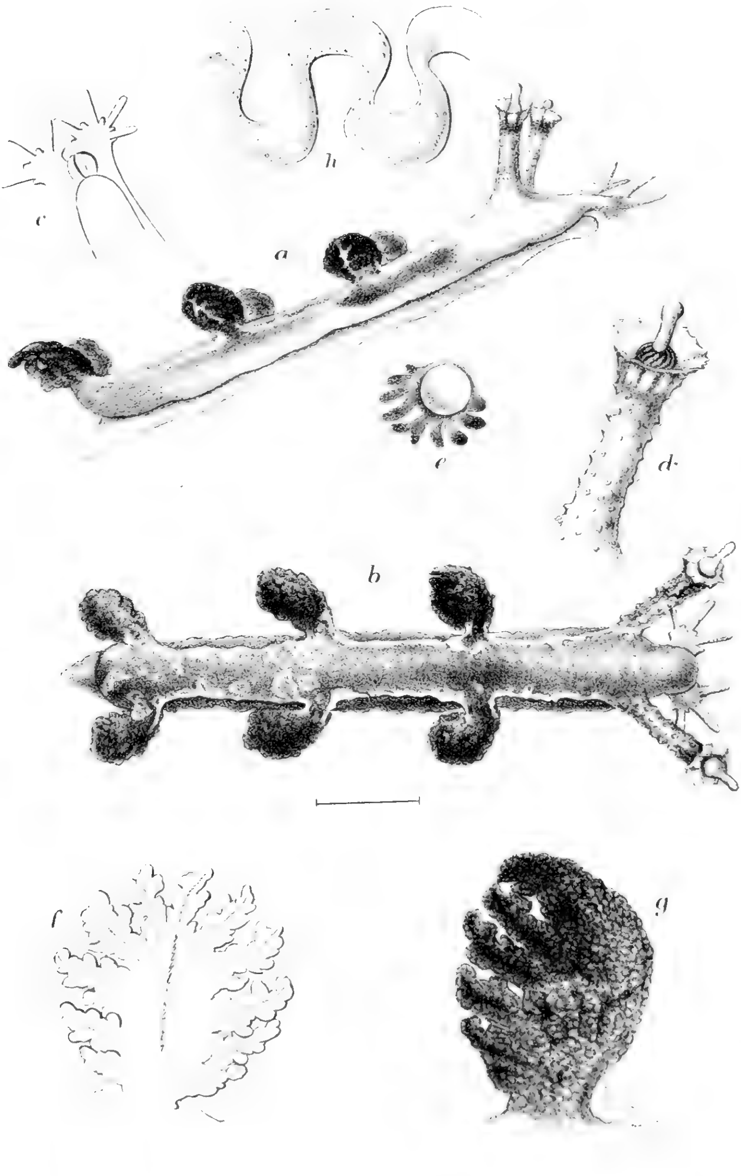

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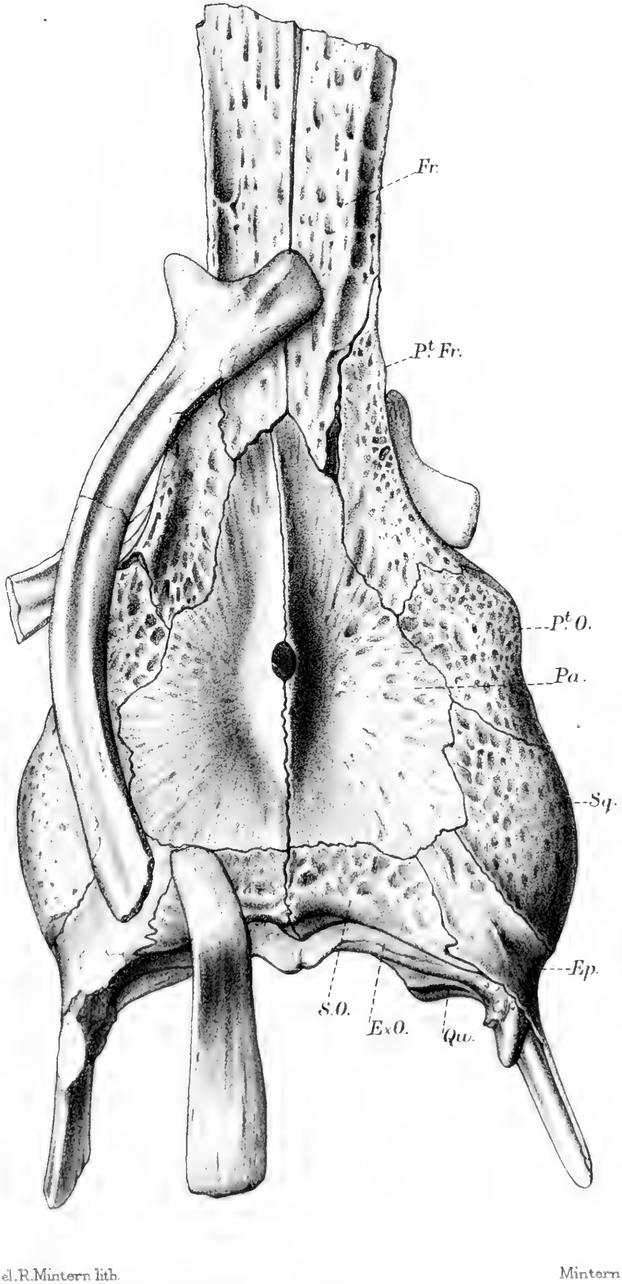

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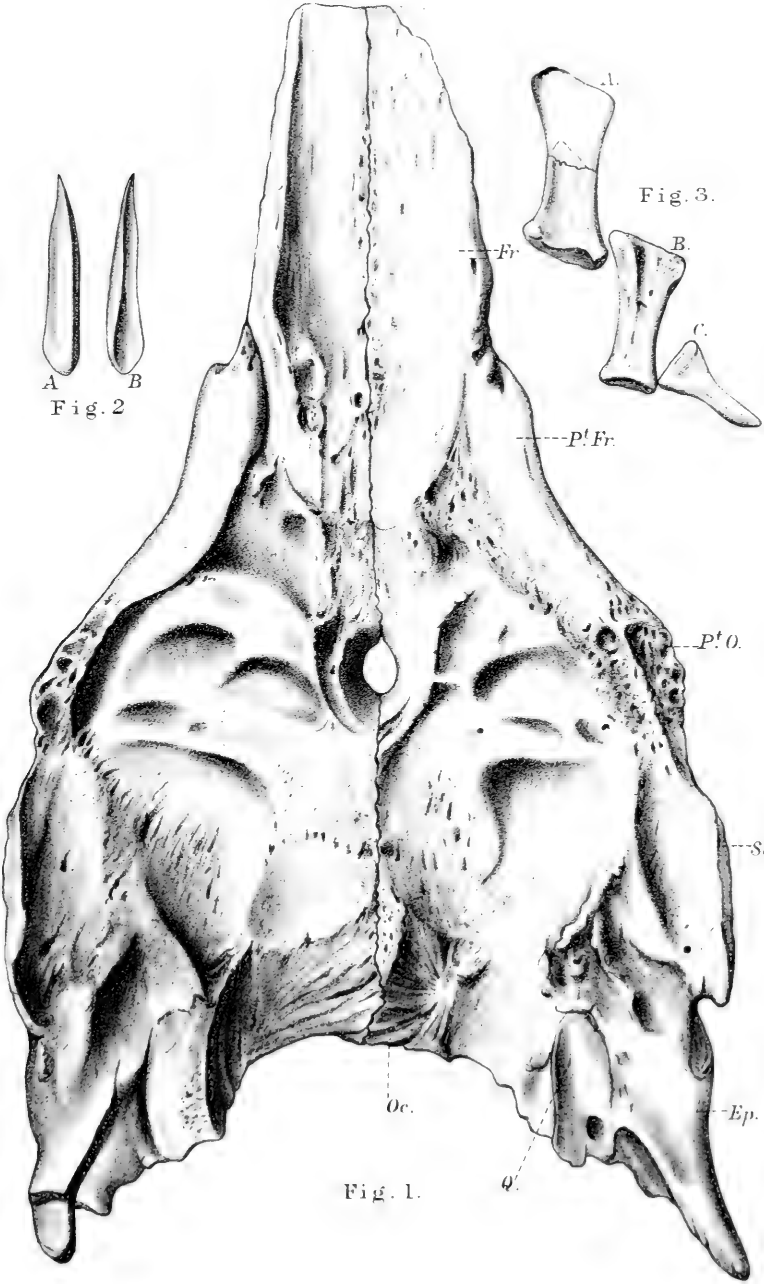
PTEROPLAX CORNUTA. H. & A.

nat. size



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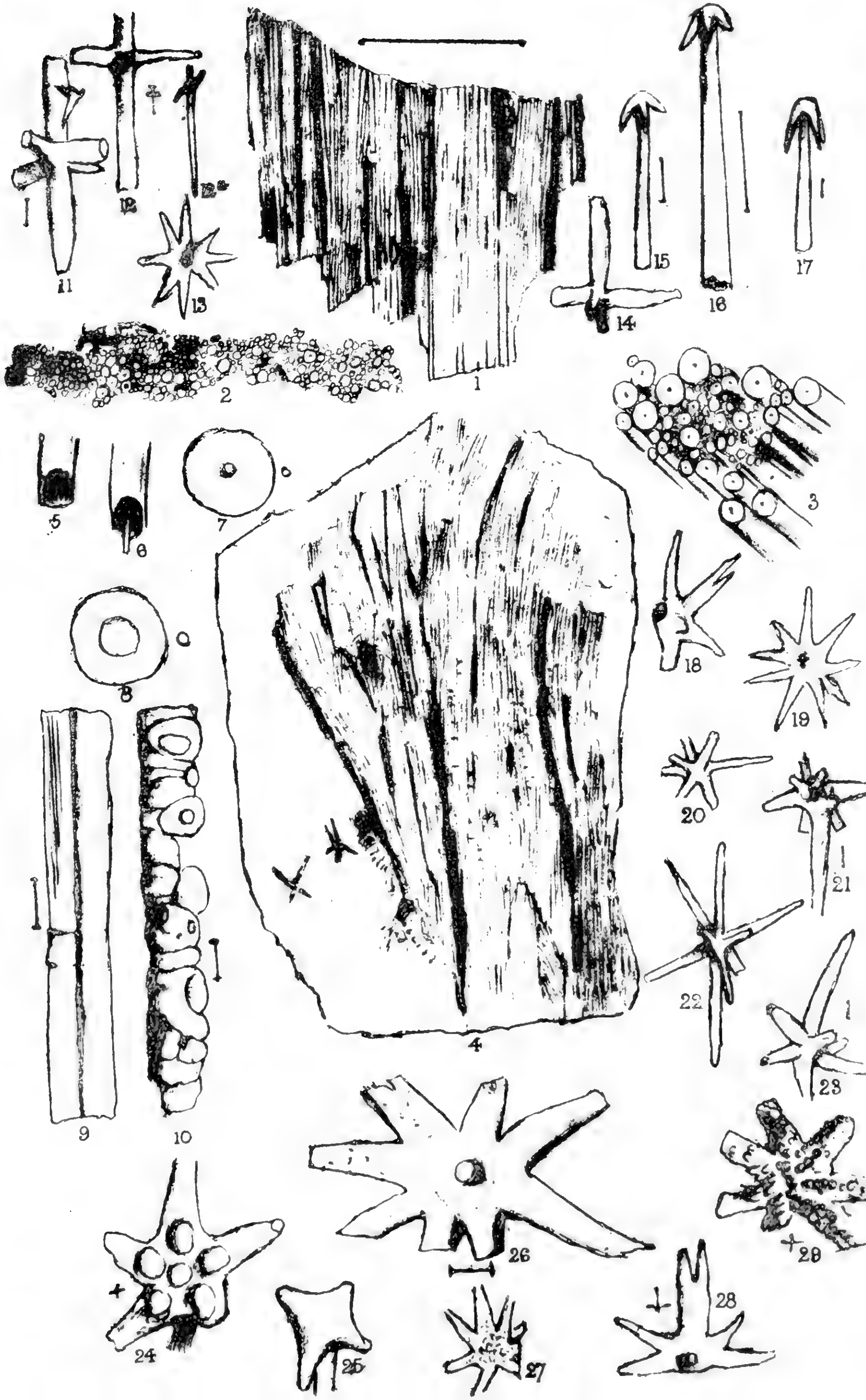
PTEROPLAX CORNUTA, H & A

nat. size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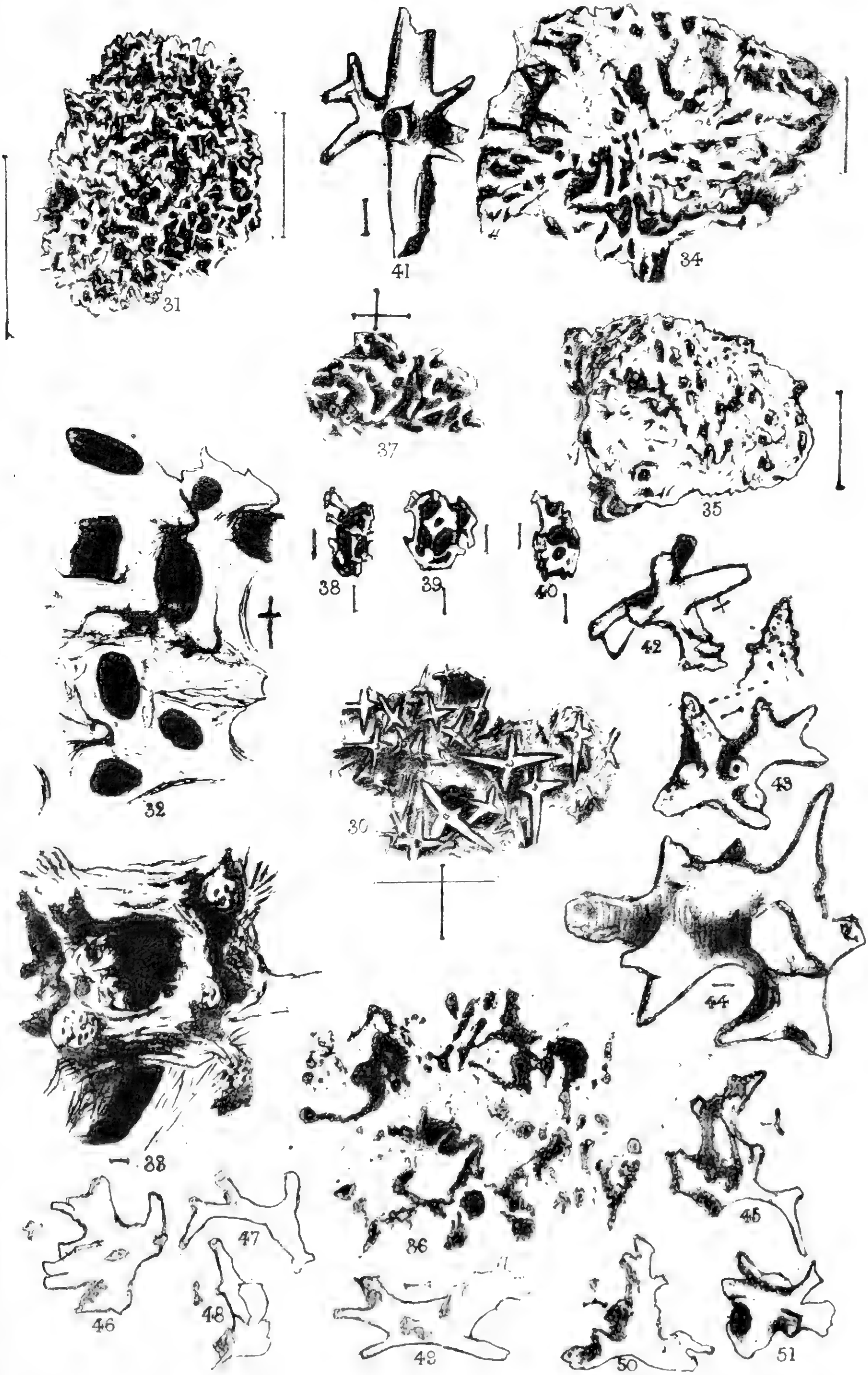

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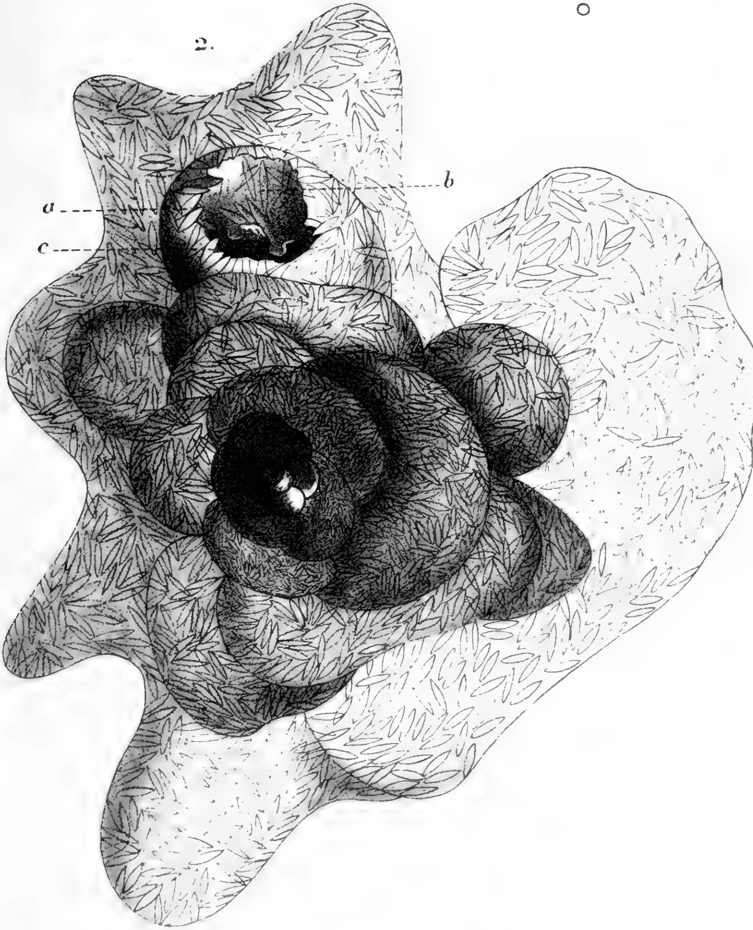

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