

fifty) crustaceous spines, bluntish, and with a short coriaceous bristle at the end; caudal ring on its dorsal surface with twenty-two long outstanding crustaceous spines tipped like the others, each of the lateral margins with two rows, like combs, of crustaceous spines, which meet behind and terminate at the end of the lateral spines—two of the four which arm the hinder margin of the caudal ring. This hinder margin has three notches, the middle one deepest, their projecting sides ending in the spines, the sides of which are pectinated with smaller spines. Segment of raptorial leg before the claw rather slender, not bulged at the end beneath. The claw minutely serrulate on the inside near the tip. From the indications of marbling in the dried specimen, this curious *Gonodactylus* is most probably finely and variedly coloured when alive.

February 12th, 1861.

John Gould, Esq., F.R.S., V.P., in the Chair.

Dr. P. L. Sclater exhibited a specimen of a Caprimulagine bird closely allied to, if not identical with, *Cosmetornis vexillaria* (Gould), from the collection of Edmund Gabriel, Esq., H.B.M.'s Commissioner at Loanda in Angola. This bird had been presented to Mr. Gabriel by the captain of a vessel, who stated that it had flown on board his ship off the west coast of Africa. Of the only two previously examined specimens of this species, one (Mr. Gould's type, now in the British Museum) was said to have come from Socotra; and the other, in Sir William Jardine's collection, had likewise been taken on board a vessel in the Mozambique Channel.

Dr. Sclater also exhibited, on behalf of Capt. Abbott, the hoof of a bull (*Bos taurus*, var. *domesticus*) from the Falkland Islands, in which the hoof was abnormally lengthened, one of the toes turning upwards and curving round backwards. Captain Abbott, the owner of the specimen, stated that such malformations were not uncommon among the wild cattle in the Falklands, and were considered attributable to their always living on the soft boggy ground there everywhere prevalent.

Mr. Bartlett exhibited living examples from the Society's Menagerie of two singular hybrid Ducks—one pair being the produce of the Summer Duck (*Aix sponsa*) and Pochard (*Fuligula ferina*), and the other of the Summer Duck and Castaneous Duck (*F. nyroca*).

The following papers were read:—

1. ADDITIONS AND CORRECTIONS TO THE LIST OF THE BIRDS OF THE FALKLAND ISLANDS. BY PHILIP LUTLEY SCLATER, M.A., Ph.D., SECRETARY TO THE SOCIETY.

Some specimens of birds brought home from the Falklands by Captain Abbott (whose name is so well known in connexion with the natural history of these islands) on his recent return to this country, and some information kindly communicated to me personally by the same gentleman, have enabled me to make several additions to, and corrections of, my "Catalogue of the Birds of the Falkland Islands," as communicated to the Society in November last*.

1. *BUTEO ERYTHRONOTUS* (P. Z. S. 1860, p. 384).

Capt. Abbott's marked specimens of this bird and *B. varius*, together with his observations on them in a state of nature, seem to prove that there are two of these singular species of Buzzards in the Falklands, in both of which the sexes are dissimilar. Capt. Abbott fully confirms D'Orbigny's views of the red-backed bird (*B. erythronotus* of King) being the female of the grey-backed, just as they are figured in the plates to the Birds of D'Orbigny's 'Voyage' (pl. 3. figs. 1 & 2) under the name *Buteo tricolor*. Meyen has also given a very recognizable figure of the male bird, when not quite adult, under the name *Aquila braccata* (Act. Acad. L.-C. Nat. Cur. xvi. Suppl. tab. 8, p. 65). The immature bird of this species is barred transversely below, each feather being crossed by two or three narrow deep-brown bands. In *Buteo varius*, according to Capt. Abbott's observations, the adult male is uniform blackish grey above and below, in which stage it is probably the *Falco poliosoma* of Quoy and Gaimard, and *Buteo unicolor* of D'Orbigny. The adult female has the red back of the female of the former species, and much resembles it in its upper surface; but below, instead of being pure white, it is deep blackish grey or lead-colour, with the whole of the belly deep chestnut-red like the back. Capt. Abbott has recently brought home two marked females so coloured, now in Mr. Gurney's collection, and had previously sent to England a male example of this bird, which he found breeding, and of which he obtained the eggs, as described by Mr. Gould (P. Z. S. 1859, p. 94). The young of this bird, instead of being transversely barred as in the former species, is marked below with elongated sagittate spots, in which stage it is the true *B. varius* of Gould, and is well figured in Cassin's work before alluded to (pl. 3. fig. 1), under the name given to it by Mr. Gould.

Should Capt. Abbott's views as to the distinctness of these two species and the variations of their respective plumages be correct, which I have every reason to believe is the case, the following will be the correct synonymy of the latter bird, which I have called *B. varius*.

BUTEO POLIOSOMA.

Falco poliosoma, Quoy & Gaim. Voy. Uranie, p. 92, pl. 14 (♂ adult.).

* See P. Z. S. 1860, p. 382.

Buteo unicolor, D'Orb. Voy. Ois. p. 109 (♂ adult.).

Buteo varius, Gould, P. Z. S. 1837, p. 10; Cassin, U. S. Expl. Exp. Atlas, pl. 3. fig. 1, juv.

2. *CHRY SOMITRIS MAGELLANICA* (Gm.).

Capt. Abbott has presented me with a skin of this species, shot out of a flock of five or six in September 1860—the only occasion on which he has met with this bird. The species is said to be very common on Keppel Island, sixty miles N.W. of East Falkland.

3. *ATTAGIS MOLOUINA* (Bodd).—*Tetrao falklandicus*, Gm.

Captain Abbott has obtained one example of an *Attagis* in East Falkland, probably referable to this species.

4. *HOPLOPTERUS CAYANUS* (Lath.).

Two examples of this Plover have been observed in East Falkland, and one of them was shot and sent to England.

5. *PLATALEA AJAJA*, Linn.

Two examples of this Spoonbill have been obtained in the Falkland Islands; but it can be regarded only as a rare straggler.

6. *FULICA* — ?

A species of Coot has been once obtained by Capt. Abbott in East Falkland, and the specimen was sent to England.

7. *CHLOËPHAGA POLIOCEPHALA*, G. R. Gray.

This near ally of the "Brent-Goose" of the settlers in the Falkland Islands—the species which I have termed *C. rubidiceps* (P. Z. S. 1860, p. 387, pl. 173)—occurs occasionally in the Falkland Islands as a straggler from the coast. Capt. Abbott has brought home several specimens.

8. *MICROPTERUS PATACHONICUS*, King, P. Z. S. 1830, p. 15.

Capt. Abbott maintains stoutly the specific difference of this bird (which is called the "Flying Loggerhead" in the Falklands) from the common *M. cinereus*. I have not yet been able to meet with specimens of the two species for exact comparison; but *M. cinereus* is said to be quite unable to fly, while *M. patachonicus* can do so well and strongly.

9. *EUDYPTES DIADEMATUS*, Gould, P. Z. S. 1860, p. 419.

Capt. Abbott obtained one single specimen only of this bird, from which Mr. Gould's description was taken. It was found in a "rookery of Rock-hoppers" (*Eudypetes nigrivestis*).

10. *EUDYPTES NIGRIVESTIS*, Gould, P. Z. S. 1860, p. 418. — *Aptenodytes chrysocome*, Abbott, Ibis, 1860, p. 337.

According to Mr. Gould's views, the common "Rock-hopper Pen-

guin" of the Falkland Islands is of this species, and quite distinct from the true *E. chrysocome* of Forster, which is an inhabitant more particularly of the Australian seas. As, however, Capt. Abbott has obtained a single specimen of the true *Eudypptes chrysocome* in the Falklands, the latter bird must also be retained in the list as a straggler.

11. *EUDYPPTES ANTARCTICUS* (Forster): Voy. Erebus & Terror, Birds, pl. 26.

Capt. Abbott obtained a single specimen of this Penguin in Berkeley Sound, East Falkland. It was by itself in the bay when procured. This example is now in Mr. Gould's collection.

The Penguins which occur in the Falkland Islands appear therefore to be no less than eight in number, viz.—

1. *Aptenodytes pennanti*. Called the "King Penguin."
2. *Spheniscus magellanicus*. "Jackass Penguin."
3. *Eudypptes chrysolophus*. "Macaroni Penguin."
4. ——— *diadematus* (accidental visitor).
5. ——— *chrysocome* (accidental visitor).
6. ——— *nigrivestis*. "Rock-hopper Penguin."
7. ——— *antarcticus* (accidental visitor).
8. *Pygosceles wagleri*. "Gentoo Penguin."

Of the preceding eleven species, on which I have remarked as above, ten are not included in my former list. This addition would raise the number of the species belonging to the Avifauna of these islands to sixty-seven. On the other hand, I may remark, Capt. Abbott doubts much the occurrence of *Cinclodes vulgaris* and *Scytalopus magellanicus* in the Falkland Islands, and is also unacquainted with *Phrygilus xanthogrammus*, which is perhaps not really distinct from *P. melanoderus*.

2. ON THE ASIATIC SNAKE CALLED TAPHROMETOPON LINEOLATUM BY PROFESSOR BRANDT. BY DR. W. PETERS, OF BERLIN, FOR. MEM. Z.S.

The late Professor Eversmann of Kasan discovered in the year 1822, on his journey from Orenburg to Buchara, a species of Snake, which was described by Lichtenstein* as "*Coluber trabalis*, Pallas." The specimens are, as I find from the manuscript notes which Eversmann sent with his collection, from Buchara and the desert of "Bur-zuk" (Barusek), on the eastern shores of lake Aral, and bear in our museum the label "Nordasien, Eversmann." There were originally five examples of this snake in our collection; and three are still there. One of them was sent in December 1823 to Temminck. Now, as the description of *Chorisodon sibiricum* (in the 'Erpétologie Générale,' viii. p. 901) may perfectly well be applied to the *Coluber trabalis*,

* Ed. Eversmann, 'Reise von Orenburg nach Buchara,' Berlin, 1823, p. 146.

Lichtenstein (not Pallas), in the Berlin Museum, and as Bibron expressly remarks that his "*Monodiastema*" is founded on a specimen in the Leyden Museum labelled "*Coluber trabalis**, " the latter is doubtless the same which Temminck received from Lichtenstein in 1823. I think this explanation necessary to prove that the habitat of the Leyden specimen is not Siberia properly so called, but the more southern part of Central Asia.

This snake is (what I should not have found out from Bibron's description), in the form and concavity of the head, and in the lanceolate longitudinally-grooved scales, very much like *Cœlopeltis lacertina*. There is scarcely any difference in the plates of the head, excepting in the loreal, which is single and very long. But the general form of the body and tail is very different, much longer and more slender than in *Cœlopeltis*. In a specimen of 1·065 m. in length the head is in all dimensions only half as large as in a *Cœlopeltis lacertina* of 0·930 m. in length. All this agrees exactly with the description Brandt (Bulletin Scientifique de l'Académie des Sciences de St. Pétersbourg, iii. p. 243) has given, in 1837, of a new species of snake, brought home by M. Karéline from the eastern shores of the Caspian Sea. His description, although rather short, is very accurate; but he has omitted to pay attention to the form of the teeth.

"*TAPHROMETOPON*, n. g. *Scutum verticale valde elongatum, postice angustissimum. Corpus necnon cauda valde elongata et tenuia. Frons et vertex depressa. Frontis et verticis ratione ad genus Cœlopeltis accedit, sed præter corporis staturam, capite, præsertim rostro longiore, tetragono et scuto loreo elongato, simplice, necnon superciliis minus acute prominentibus differt.*"

"*COLUBER (TAPHROMETOPON) LINEOLATUS. Caput sat angustum, oblongo-tetragonum. Collum penna anserina paulo crassius. Squamæ medium dorsum obtegentes omnes satis anguste lanceolatae. Abdomen subplanum, album. Collum et abdominis anterior pars punctis lateralibus minoribus et centralibus paulo majoribus olivaceo-nigricantibus adspersa. Frons et verticis, necnon occipitis medium e griseo olivascentia. Dorsum cinereum, exceptis lineis quatuor e nigricante olivaceis, quarum duæ in superciliis incipientes parallele, sed parum distincte in medio dorso pallidiores ad caudam usque decurrunt, et duæ aliæ pone nares initium capientes ab oculis interruptæ in lateribus corporis subevanidæ et magis griseæ conspiciuntur. Corporis longitudo 1' 11", caudæ 5½, abdominis latitudo summa 4'''."*

Brandt does not mention the grooved appearance of the scales;

* Duméril (*l. c.* p. 902) cites *Coluber trabalis*, "Schlegel." But this seems to be a mistake; for Schlegel's *Coluber trabalis* is, as Dr. Günther (Catalogue of Snakes, p. 93) justly remarks, synonymous with *Coluber (Elaphis) dione*, Pallas, and the true *Coluber trabalis* of Pallas only a variety of *Zamenis atrovirens*, Shaw, sp.

but his specimen seems to have been very young, according to the dimensions he has given.

A few years later, in 1841, apparently the same snake was described and figured by Eichwald (*Fauna Caspio-caucasica*, p. 123, t. 29) under the name of *Cælopeltis vermiculata*, from the western shores of the Caspian Sea. At least, the number of the longitudinal rows of scales, seventeen, agrees with *Chorisodon*, and not with *Cælopeltis lacertina*, which has nineteen rows of scales. Yet I have some doubts of their identity, the general form of Eichwald's species being more like that of the latter.

The examination of the teeth of the three Berlin specimens shows no free space between the maxillary teeth, as described by Bibron; but they form a continued row, excepting the hinder furrowed ones, which are separated, as usual, by a small interval from the rest. There are (fig. 5) first seven very small teeth, only loosely attached to the maxillary bone, then three very long and strong ones, followed again by four smaller ones. Bibron found a free space in front of the longer teeth, because the two small ones before them were detached.

The nine palatine and fourteen pterygoid teeth are still smaller, decreasing in size from the front palatal tooth. It is therefore very fortunate that Brandt's name has the priority, as neither Bibron's "*Monodiastema*" nor Duméril's "*Chorisodon*" would be very suitable appellations for this form. The lower jaw has on each side eighteen teeth; they increase very rapidly from the first to the fourth, which is followed by fourteen smaller ones. Bibron counts twenty-five; I might have found the same number, or more, if I had reckoned the changing teeth on the inner side. The form of the transversal and pterygoid bone is the same as in *Cælopeltis*, and not as in *Psammodphis (moniliger)*.

I can hardly add anything to the external description given by Lichtenstein and Bibron. The front part of the frontal (vertical) plate is either straight, or it forms a very obtuse angle; the loreal is curved a little (see fig. 2); and all the specimens have nine upper and ten lower labials. One specimen has 192 abdominal scuta and 103 pairs of subcaudal scales; the second 189 abdominal scuta and 90 pairs of subcaudal scales; the third 189 and 99. All have the anal plate divided, and seventeen longitudinal rows of scales. All have four large dark olive-coloured bands and a smaller middle one on the head. In one, all four bands continue to the end of the tail; the second shows, as described by Bibron, no lateral bands, but three rows of small dark spots on the dorsal part; and the third has neither lateral nor dorsal strokes, the head-bands being lost on the neck. One of them has the lips and the under part of the head yellow, and without any spots; in the two others the labials and the chin are dotted with black. All have the middle of the abdominal scuta dotted with black, and a black longitudinal stroke on their external parts, which forms on each side an uninterrupted line to the end of the tail. The rest of the under side is yellowish, but appears to have been during life of a red colour.

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	A.	B.	C.
Total length	1 ^m ·065	1 ^m ·115	1 ^m ·065
Length of tail	0·28	0·25	0·27
— of head	0·022	0·024	0·025
Distance of eyes	0·006	0·007	0·007
Breadth of head behind . .	0·010	0·010	0·010
Greatest breadth of body .	0·012	0·015	0·014

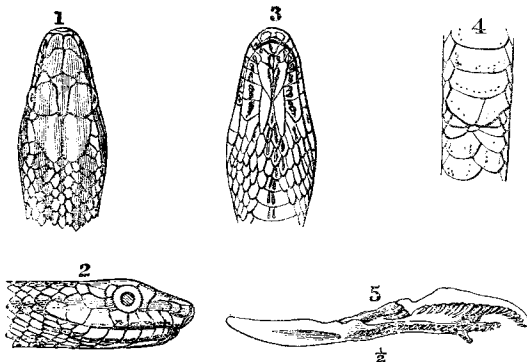
The largest specimen contained in its stomach three species of lizards, viz. *Phrynocephalus helioscopus*, Pallas, *Eremias velox*, Pall., juv. (*vittata*, Eversmann), and *Eremias variabilis*, Pall.

Conclusions.—1. *Chorisodon sibiricum*, Dum. & Bibr., does not come from Siberia properly so called, but from the sandy deserts of Central Asia, around Lake Aral and the Caspian Sea.

2. The row of unfurrowed maxillary teeth is not interrupted by a diastema.

3. *Chorisodon* is closely allied to *Cælopeltis*; it would therefore be most unnatural to separate them into two different families.

4. The name *Chorisodon sibiricum* (date 1854) must be rejected, as it applies to the same species which had been named in 1837, by Brandt, *Taphrometopon lineolatum*.



EXPLANATION OF FIGURES.

Figs. 1-3. Head, viewed from different sides. Nat. size.—Fig. 4. Anal region. Nat. size.—Fig. 5. Maxillary, palatal, and pterygoid bones, with the teeth, from the right side. Twice magnified.

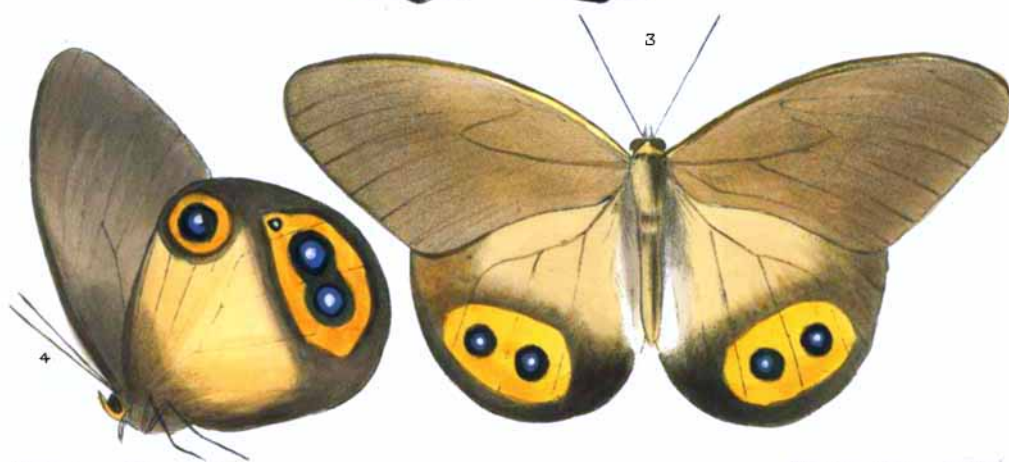
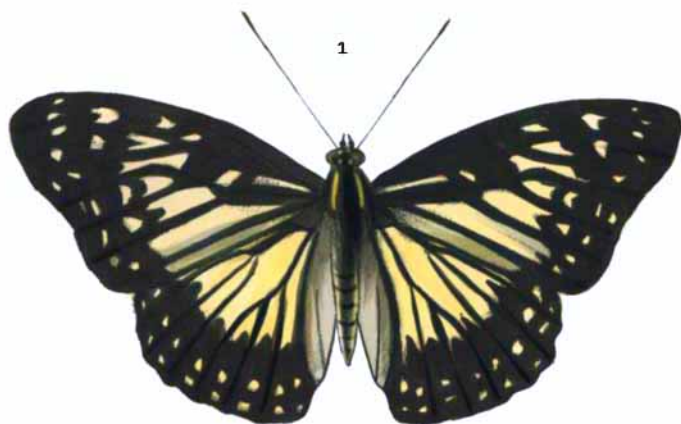
3. DESCRIPTIONS OF SOME BUTTERFLIES FROM THE COLLECTION OF MR. WALLACE. BY W. C. HEWITSON.

(Plates VIII., IX.)

DIADEMA DIVONA. (Pl. VIII. fig. 1.)

Alis omnibus nigris, duplice serie submarginali macularum flavidarum, anticis ante medium fascia lata macularum oblongarum serieque macularum flavidarum, posticis basi ad medium flavidis, venis nigris.

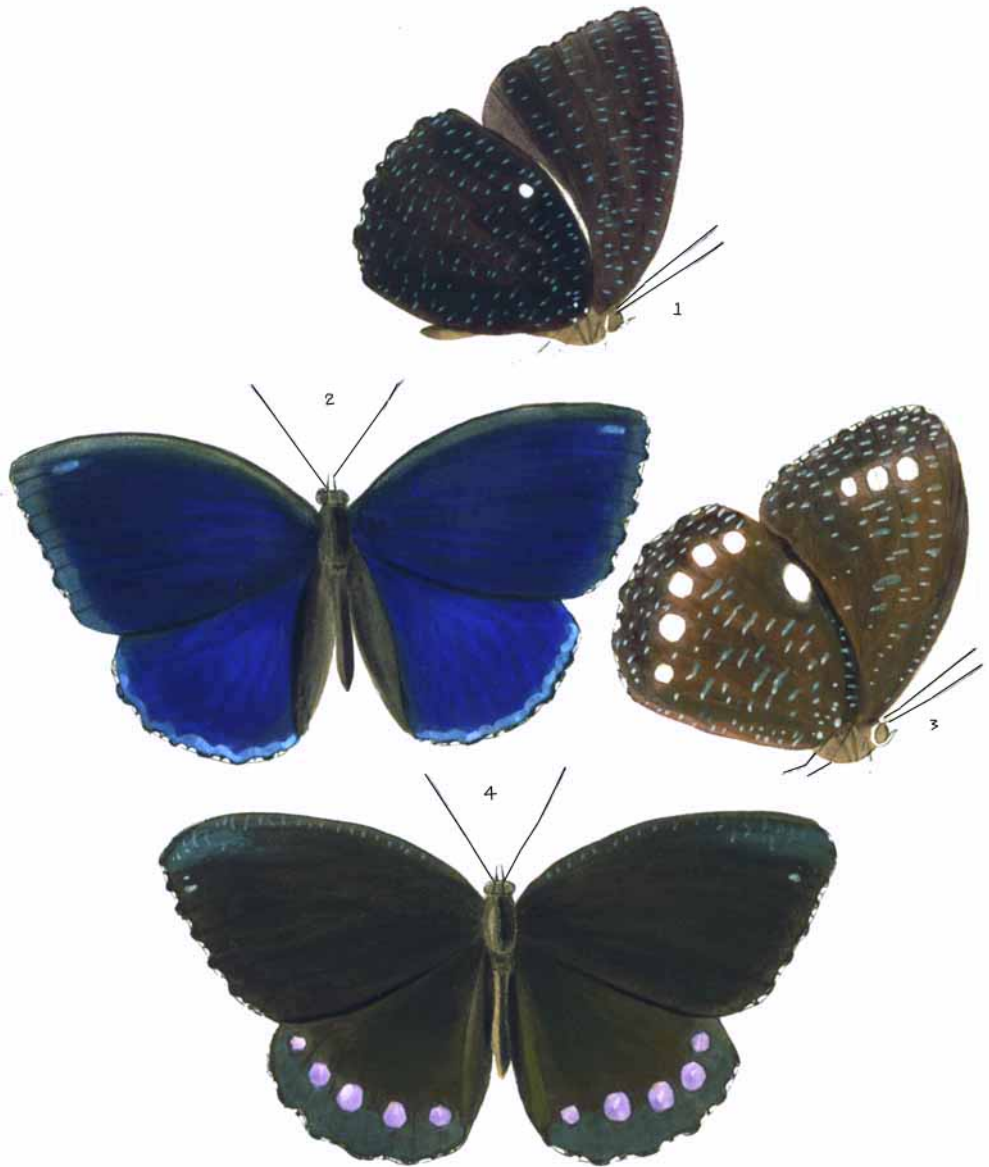
Upperside, male: dark brown, rufous towards the anal angle of the posterior wing. Anterior wing with numerous bands and spots



W.C. Hewitson, del. et lith. 1861.

Printed by Ballmandel & Walton

1. DIADEMA DIVONA 2. DIADEMA DIOMEA.
3. 4. DRUSILLA DOMITILLA.



W.C. Hewitson, del. et lith. 1861.

Printed by Hullmandel & Walton.

1. 2. MELANITIS MIMALON.

3. 4. MELANITIS LEUCOCYMA.

of pale yellow. A line and two small spots within the cell; crossed before the middle by a broad macular band of irregular unconnected spots, the first two spots near the costal margin hastate (the second of them preceded by a small spot), the rest oblong (the last extending to the base of the wing), followed by a band of five spots; all yellow. Posterior wing with the basal half yellow, divided by broad black nervures. Both wings crossed by two submarginal bands of yellow spots—the first distinct and round, the second (near the margin) minute and linear; the margin also spotted with white.

Underside as above, except that the anterior wing has two white spots at the base of the costal margin, that the spots in the cell are larger (the linear spot occupying the whole base of the cell), and that the transverse band is broader and continuous; that the posterior wing has four white spots at the base, and the costal margin rufous.

Exp. $3\frac{1}{2}$ inches.

Hab. Moluccas.

In the collections of A. R. Wallace and W. W. Saunders.

DIADEMA DIOMEA. (Pl. VIII. fig. 2.)

Alis omnibus nigris fasciis latis transversalibus liliaceo-albis, anticis macula alba anali, posticis serie submarginati macularum albarum.

Upperside, male: black. Both wings crossed transversely by a broad band of lilac-white, divided into six parts by the nervures, which are broad and black. Anterior wing with a distinct white spot near the anal angle, followed by three small indistinct spots. Posterior wing with four small white spots between the nervures, just beyond the central band, two of them near the apex, two near the anal angle; a submarginal band of white spots, in pairs. The outer margin of both wings spotted with white.

Underside as above, except that the anterior wing has the central band much broader, the costal margin near the base irrorated with white, and three small white spots within the cell; that the posterior wing has a white oval spot at the middle of the costal margin, the transverse band broader near the anal angle; and that both wings have two bands of white spots near the outer margin: the first band, of triangular spots, in pairs; the second, nearer the margin, of lunular spots, scarcely seen at the apex of the anterior wing.

The female differs only in its greater size, and in having the transverse bands white.

Exp. $4\frac{2}{3}$ inches.

Hab. Moluccas.

In the collections of A. R. Wallace and W. W. Saunders.

DRUSILLA DOMITILLA. (Pl. VIII. figs. 3, 4.)

Alis omnibus supra rufo-fuscis, posticis basi pallidiore, macula magna submarginati fulva, ocellis duobus nigris cæruleo-pi-pillatis ornata; subtus obscurioribus, posticis brunneis in medio albis oculo minuto (in exemplis nonnullis) cæteris proximo alteroque magno apicali.

Upperside, male: pale rufous-brown. Posterior wing lighter near the base, the abdominal fold nearly white, the anal angle and outer

margin darker brown, with, near the middle of the outer margin, a large oval orange spot marked with two black ocelli, each with a centre of blue.

Underside as above, except that the bases of both wings, the abdominal fold, and the outer half of the posterior wing are dark brown; that the large orange spot is (in some examples only) extended towards the apex, so as to contain a minute ocellus; that the two ocelli are so enlarged as to meet in the middle; and that there is a large ocellus at the apex bordered with orange.

The female does not differ, except that it is much larger, with greater proportionate breadth of wing.

Exp. ♂ $3\frac{7}{10}$, ♀ $4\frac{9}{10}$ inches.

Hab. Batchian.

In the collections of A. R. Wallace and W. C. Hewitson.

This can scarcely be another variety of a most variable species. I fully believe that there is as yet but one other species of the genus *Drusilla*, and that all the butterflies hitherto described and figured, to which I have given references below, are only varieties of *Drusilla urania*.

I believe that *D. horsfieldii* of Swainson is simply a male variety of *D. urania*; that *D. catops* and *D. selene* of Boisduval's MS., described by Westwood in the 'Genera of Diurnal Lepidoptera,' page 335 = *D. phorcas* and *D. mylæcha* of Westwood in the Transactions of the Entomological Society, n. s. vol. iv. p. 182, pl. 21 = *D. myops* and *D. macrops* of Dr. Felder in the 'Wiener Entom. Monatschrift,' vol. iv. pp. 109, 248, and pl. 1 = *D. artemis*, *D. anableps*, and *D. dioptica* of Vollenhoven in the 'Nederlandsche Entom. Vereeniging,' are all referable to one species. They differ from each other (just as the butterflies do which I have figured, in a former Plate of these Proceedings, under the name of *Melanitis melane*) in the position and quantity of the white on the surface, in the size and perfection of the ocelli, and their distance from the outer margin. Each genus seems to mimic the other in its general appearance, and each runs into the same extravagant varieties. If the butterflies which are enumerated above are to be considered as good species, there are several more in the collection of Mr. Wallace waiting for the same distinction. One lately arrived from Ceram has the whole underside of a uniform dark brown.

MELANITIS MIMALON. (Pl. IX. figs. 1, 2.)

Alis omnibus purpureis, marginibus griseis; subtus brunneis ubique griseo undulatis, posticis macula alba prope medium marginis costalis.

Upperside, male: purple, with a submarginal band of grey; the margins dentate and spotted with white.

Underside dark brown, undulated throughout with grey. Posterior wing with two minute spots near the base, a round spot near the middle of the costal margin, and some minute spots parallel to the outer margin, all white.

Exp. $3\frac{3}{10}$ inches.

Hab. Manado, Celebes.

In the collection of A. R. Wallace.

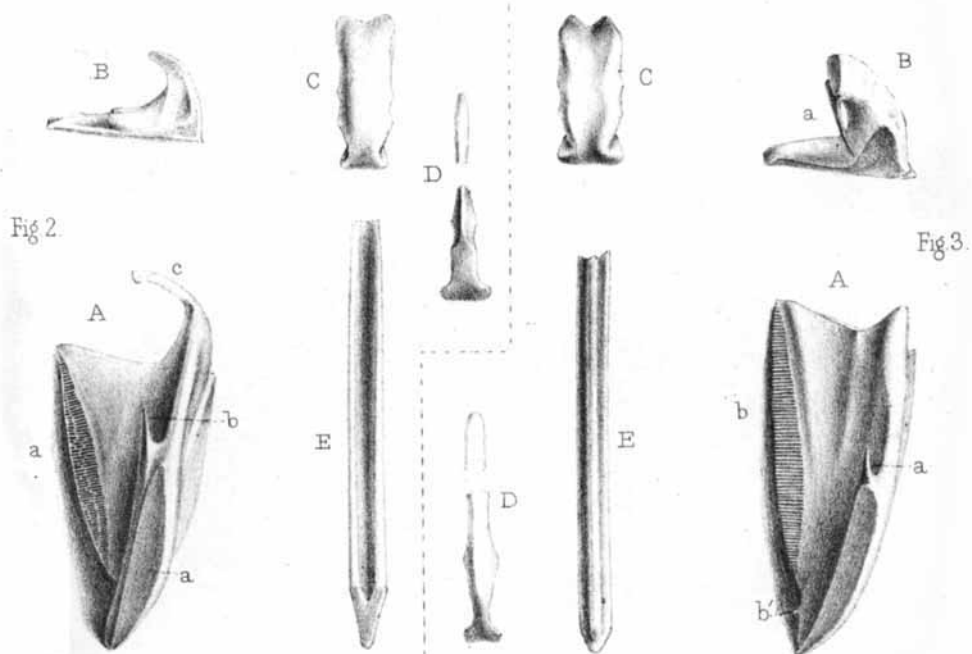
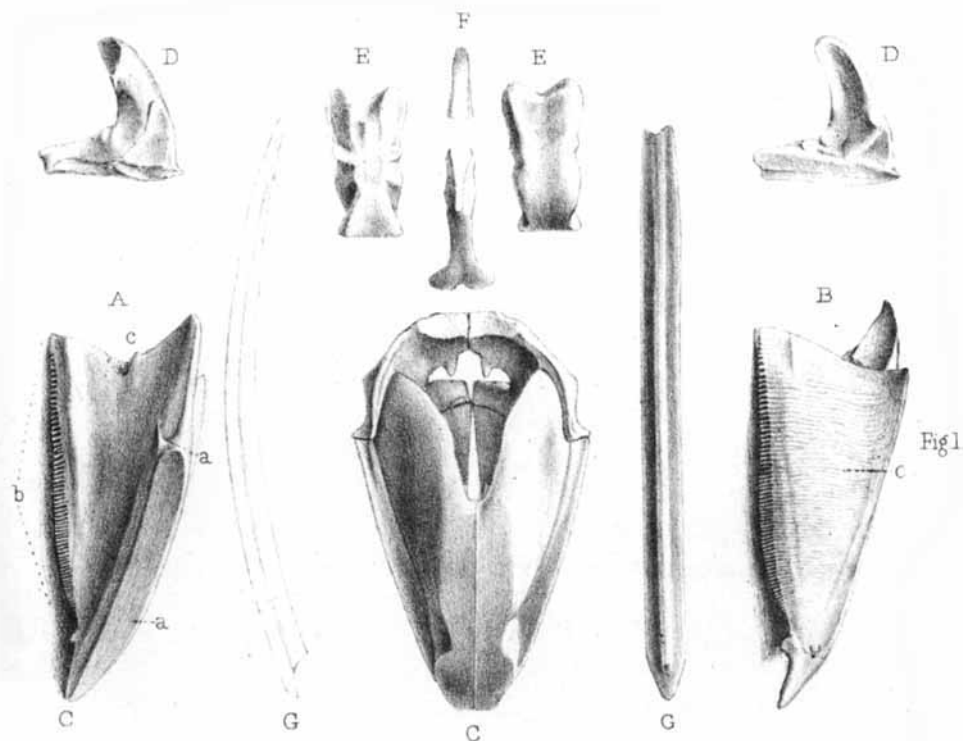


Fig1.

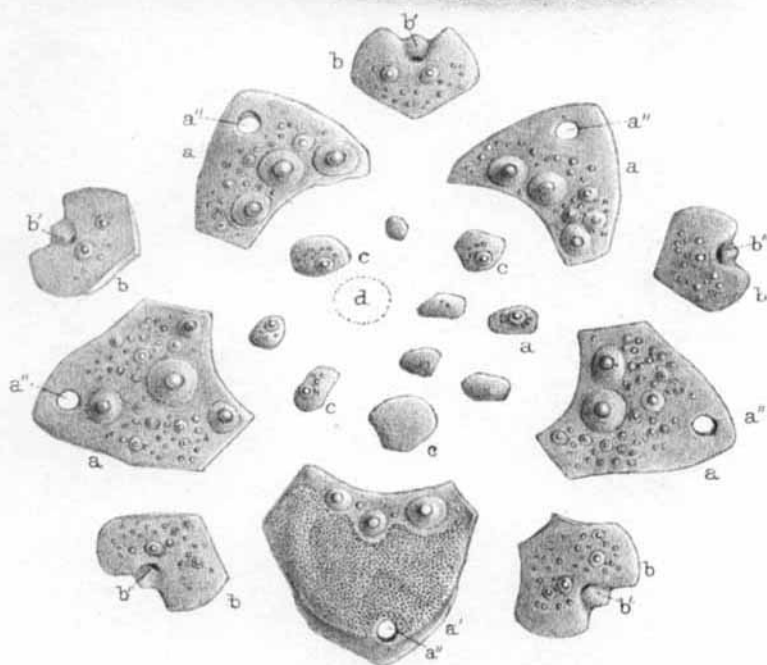
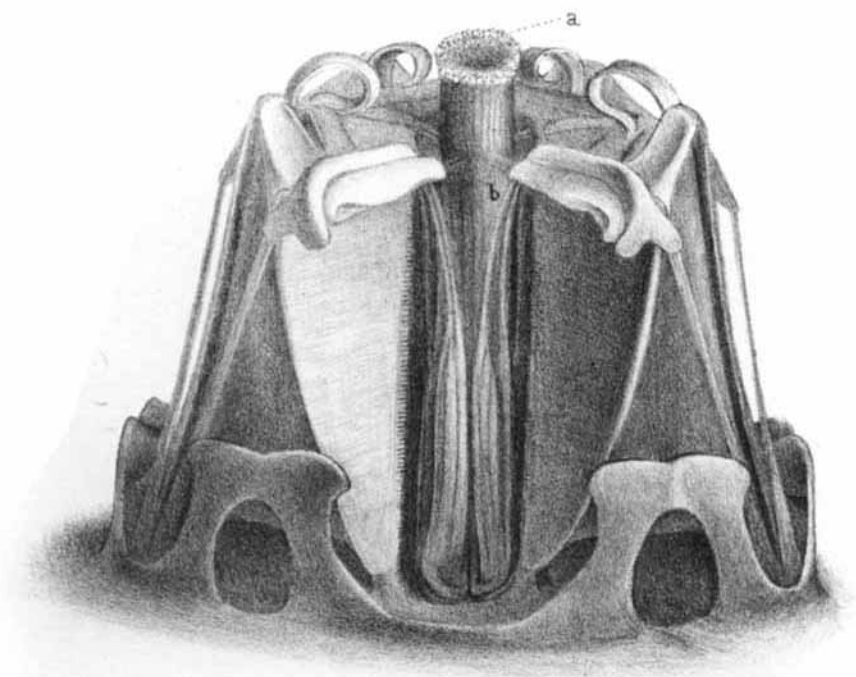
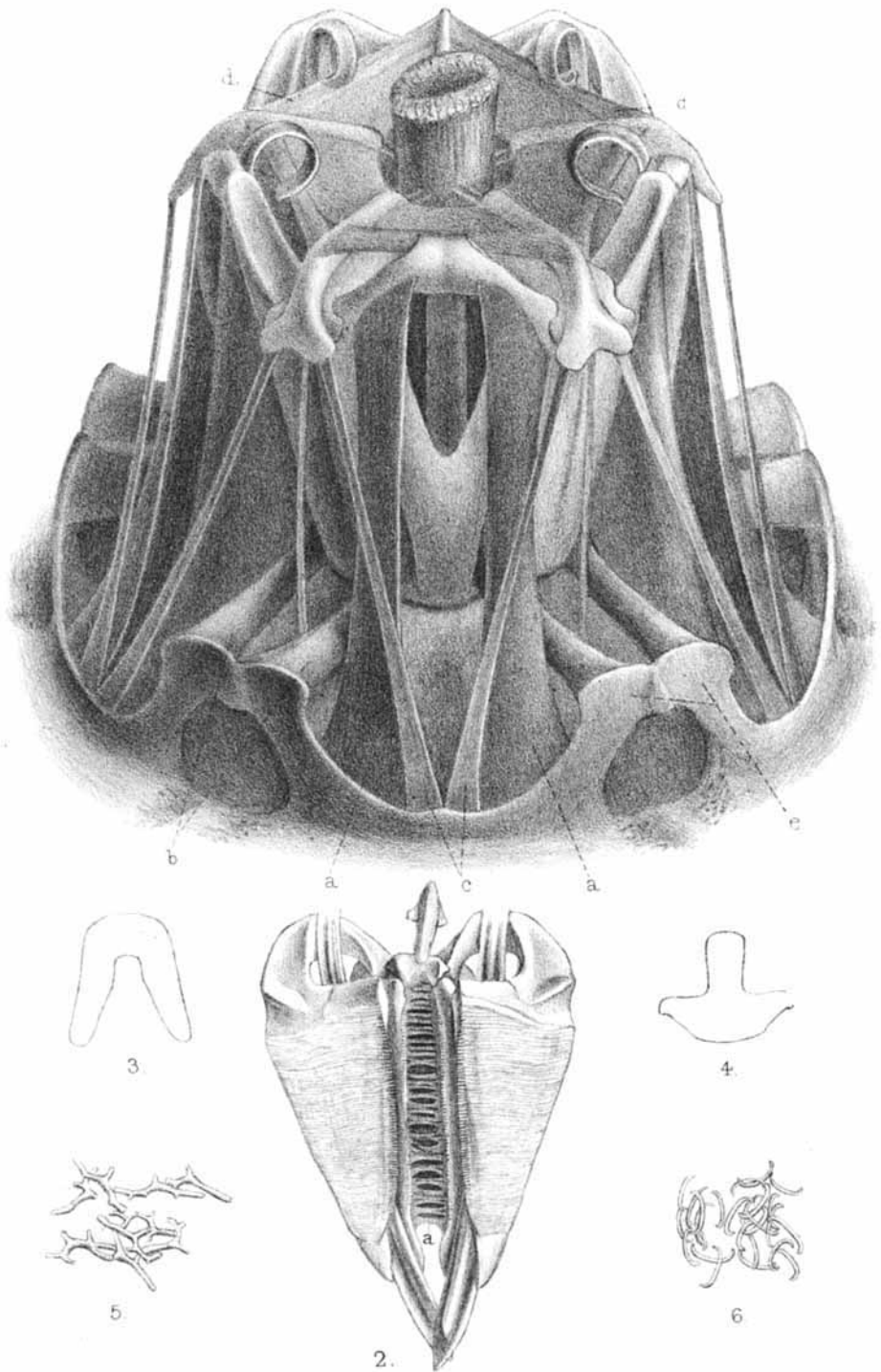


Fig 2.



MELANITIS LEUCOCYMA. (Pl. IX. figs. 3, 4.)*Biblis leucocyma*, Godart, Encl. p. 326.*Alis omnibus brunneis, marginibus griseis, anticis maculis duabus minutis prope apicem, posticis serie submarginali macularum lilaceo-albarum; subtus brunneis, ubique griseo-undulatis, posticis macula alba prope medium marginis costalis.*

Upperside, male: dark brown, with a submarginal band of grey, the outer margins dentate and spotted with white. Anterior wing with two or three small white spots near the apex. Posterior wing with a submarginal band of five, round, lilac-white spots.

Underside rufous-brown, undulated throughout with grey, with a band of large white spots parallel to the outer margin; anterior wing with three or four; posterior wing with five. Posterior wing with an oval white spot near the middle of the costal margin.

Exp. $3\frac{1}{2}$ inches.*Hab.* Celebes.

In the collections of A.R. Wallace and W. C. Hewitson.

Dyctis agondas of Boisduval and *Morpho bioculatus* (*Dyctis bioculatus* of Westwood in the 'Genera of Diurnal Lepidoptera,' pl. 54*, which is its female) belong to this genus, and do not differ in the least, in their generic character, from the other species of *Melanitis*. Deceived by its great variability and the wretched figure of *D. agondas* in the 'Voyage of the Astrolabe,' I have figured, in a former Part of the Proceedings of the Zoological Society (Annulosa, Pl. LV.) a beautiful series of Butterflies from the collection of Mr. Wallace, under the name of *Melanitis melane*, which I now believe to be varieties of the said *Dyctis agondas* and *D. bioculatus*.

4. OBSERVATIONS ON THE ANATOMY OF THE ECHINODERMS. BY THOMAS HOWARD STEWART, M.R.C.S., F.Z.S., ASSISTANT CONSERVATOR, HUNTERIAN MUSEUM.

(Plates X., X. A, XI.)

There are certain points connected with the anatomy of the Echinoderms which I am anxious to lay before the Society; and the more especially do I desire to do so, as I am not able to find any true and accurate description existing of the very wonderful apparatus for the prehension and division of food, which some of the higher groups of this class possess. I mean higher groups with regard to the class itself. The animals forming this class, from their organization, are placed low in the scale of creation, being just above the Polypifera and below the Annelida; yet we shall find, in the order *Echinoidea* of this class, animals possessing what may be called a *splanchnic* or oral skeleton, of so complicated and yet so efficient an arrangement, as cannot fail to make us wonder at the object of its sudden appearance in the anatomy of animals; nor can we help admiring the beauty, and wondering at the perfection of the work. Those who have not searched into the anatomy of these lower forms of life might be surprised to be told that a creature just above the common Sea-anemone, with an almost invisible nervous system, and other-

wise very low organization, possesses jaws (or, as I prefer to call the apparatus, a splanchnic skeleton) of a more complicated arrangement than any other animal in existence, from a simple sponge or *Amæba* up to man himself. This splanchnic skeleton, in *Cidaris*, *Echinus*, and allied genera, is formed of forty separate calcareous portions, arranged in a conical form, and, as we shall see by description and inspection of the specimens on the table, beautifully and perfectly articulated together, and having forty separate muscles to move the teeth in various ways.

If we take up an *Echinus*, or Sea Urchin as it is commonly called, and look at the flattened under-side, we see in the centre a circular part which is membranous, and continued from the corona to the points of the five protruded teeth. This *peristomal* membrane is covered in most of the *Echini* (not in our beautiful *E. flemingii*, however) with minute, oval, and somewhat irregularly scattered calcareous plates, not (as in the rest of the corona) articulated together, but with intervals between each other, leaving the membrane partly bare. On these calcareous particles are placed organs called *pedicellaria*, and also, on some, minute spines, the tubercles for which may be seen with a lens; these particles are of various sizes. Around the teeth, on the peristomal membrane, are situated, ambulacrally, five pairs of large oval plates, each with a pit excavated in the centre, and having a minute perforation, over which is placed externally a modified form of cirrus. Internally an exceedingly small vessel comes from each perforation and joins the large longitudinal ambulacral vessel: these plates are also covered with numerous tubercles for minute pedicellaria. To this series of plates succeeds a soft circular lip, containing excessively fine particles of lime in a radiating linear arrangement, not bearing either pedicellaria or spines, and immediately surrounding the protruded points of the sharp, hard, white, Rodent-like teeth.

Seeing these points of teeth in so humble an animal—and the first appearance of such, makes one, like a child with a new toy, long to see the interior. We set to work to open the shell, as erroneously called, of our *Echinus*. We there find, besides the intestines and other viscera, a complicated conical apparatus surrounding the first part of the alimentary canal, and enclosing the rest of the teeth (previously unseen), and having attached to it all the numerous muscles which act on it. Now it is to this that I principally wish to draw your attention.

In the first place, I will enumerate the parts which make up these curious jaws. There are ten triangular pieces, called *alveoli* (Pl. X. fig. 1), which when articulated together form five prismatic-shaped sockets for the five teeth, and all together constitute a conical mass, with the apex external, formed by the points of the teeth. The apices of the alveoli are firmly fixed to the peristomal membrane; but the lip is loose over the teeth. The bases of the alveolar pairs are united by wedge-like pieces called *falces* (Pl. X. fig. 3), five in number, on each of which is placed an arched portion, divided into two; there are ten pieces arching over the external surface of the alveoli at the base, which may be called the *epiphyses* of the alveoli,—making in

all forty separate parts. The alveoli, when separated, are seen to be triangular in shape: they have a broad external rounded surface, presenting a deep hollow excavation; at the bottom of this is a groove in which is inserted a muscle. The surfaces opposed to the next pair of alveoli are finely striated; and these striæ may be seen to be continued as free points, forming a finely toothed margin on the œsophageal border; to each of these surfaces a muscle is attached, passing from one to that adjoining in the next pair. The remaining surface presents the half of the groove for the tooth, which is completed by the other alveolar piece, and also the symphysis that unites the two portions. The epiphyses arch over the upper or basal part of the alveoli on their outer borders, and serve as attachments for muscles. The *radii* are long, slender, arcuated portions, situated on the upper part of the oral skeleton between the pairs of epiphyses of the alveoli and above the falces: the œsophageal end of each is articulated with the centre of the inner end of the falces; this portion is rounded; but just above the point at which they are divided transversely they are laterally compressed, and here a muscle is inserted; they are then rounded again, and end by a flattened and bifurcated free extremity, forming points for the attachment of the tendons of slender muscles. The falces are somewhat square portions, which fit accurately between the pairs of alveoli, at their base; the œsophageal end has a deep notch, to the centre of which the radius is articulated, and on either side of this the œsophageal ligaments are attached. The teeth, five in number, are in shape somewhat like the incisor tooth of a Rodent; they have a hard, triangular, pointed prehensile end, and towards the root they become gradually soft and friable, and, when dry, split up easily into fine silky fibres; they are covered at their roots by a loose bag or pouch of the membrane of the perisome, which also connects the intervals between the muscles and the various parts of the splanchnic skeleton. The alveoli and teeth are, when in natural position, inter-ambulacral, the radii and falces being ambulacral.

With regard to the numerous muscles supplied to the apparatus, amounting to *forty* in number, there are first to be mentioned *five pairs* of what may be called *protractores* (Pl. X. A. fig. 1 *a*), arising from the interambulacral region of the oral edge of the corona, and inserted into the upper and lateral borders of the epiphyses of the alveoli, and into a groove on the external surface of the alveoli themselves: their office is thus plainly seen, when acting together, to be to protrude the points of the teeth—or as protractors; and when acting singly, to draw the teeth to one side or another. There are *five pairs* of muscles arising from the inner surface of the auricular arches, and inserted into the oral ends or apices of the alveoli, on the inner side of these (Pl. X. A. fig. 1 *b*); they are obviously retractors (*retractores*), and antagonistic in their action to the preceding set. Another set of five pairs of slender muscles arises immediately in front of the protractor group, by a thin, narrow common origin, and terminates by two slender tendons which pass obliquely to be inserted into the bifurcated free ends of the radii. These are the radial muscles or *radiales* (Pl. X. A. fig. 1 *c*): their action is to bring the points of

the teeth together, and in opposition to the next group of five (not pairs), which pass from one radius to another internally and parallel with the epiphyses of the alveoli, and assume, when connected with the five radii, a pentagonal form on the upper part of the conical oral skeleton : these are the *interradiales* (Pl. X. A. fig. 1 *d*), and act so as to separate the points of the five teeth. But there are yet five more muscles, of great importance to the object of this paper : these pass from one alveolar pair to another, being attached to their serrated surfaces as short, coarse individual fibres : they are the *interalveolar* muscles (Pl. X. A. fig. 2 *a*), and their action is to move the points of the teeth on each other in cutting the food. When a muscle is fixed into a bone or hard substance, there is generally, I believe always, a mark left of that attachment ; and this is the cause of these alveoli being serrated as described. They are said by anatomists to be grinding-surfaces ; but this cannot be, when the food cannot get near them, and they are covered by muscles. When we examine this oral apparatus in a fresh state, we find that the œsophagus is most firmly fixed around the apices of the alveoli internally, where they are themselves attached to the peristomal membrane ; and when the teeth protrude, the œsophagus then takes its course through the centre of the conical oral apparatus, being borne up by the five pairs of ligaments, each of which passes as a broad band from the commencement of the œsophagus, and is attached to the bifurcated inner ends of the falces. Now, if the alveoli on their serrated surface or border were used to grind the food, how is the food to get to them ? It must pass through the œsophagus, and thence to the rest of the alimentary canal ; and for it to get near the alveoli, the alveoli must grind the œsophagus itself. We may as well call the muscular impression on the shell of an oyster or any other bivalve, or that caused by the impression of muscles on our own bones, grinding-surfaces, as say that the alveoli of the *Echinus* are grinding-organs.

In the different genera that I have had the opportunity of examining, I find that there are certain peculiarities which might almost form generic characters.

Cidaris differs from *Echinus* in the form of the tooth : in transverse section the tooth of *Cidaris* is semicircular or boat-shaped ; whilst the tooth of *Echinus* is somewhat T-shaped, having a ridge running down the inner surface ; the alveoli in *Cidaris* are more obscurely serrated on their opposed surfaces and œsophageal border than in any other genus ; and the epiphyses of the alveoli do not arch over and meet in *Cidaris*, as they do in *Echinus* ; and in *Cidaris* the falces and radii are also shorter than in *Echinus*.

In *Diadema* the shape of the tooth is like that of *Cidaris* ; the alveoli are serrated on the opposed surfaces as well as on the œsophageal border, and the serrations of the border are very long and fine ; at the basal end of the symphysis on each individual alveolus is a long hamular process, enlarged slightly into a flat free end, and the basal border of the alveolus is long, which also necessitates the epiphyses being lengthened. These epiphyses do not arch over, but are like those of *Cidaris* ; the falces and radii are more like those of *Echinus*. In the genus *Acrocladia* and *Echinometra*, at the end of

the symphyses of the alveoli, there is a sharp, and in some a very long and delicate styliform process, and one also corresponding from the epiphyses; these support the teeth in position: they do not exist at all in *Cidaris*, and are very rudimentary in *Echinus*. The auriculæ of *Cidaris* do not form an arch, as they do in *Echinus*, *Diadema*, and other genera.

The oral skeleton of *Clypeaster* is a modification of that of *Echinus*, but more simple. The *Ophiuridæ* have also a decided oral apparatus, differentiated from the other calcareous portions of their skeleton; it is a decidedly modified form of the splanchnic skeleton of *Echinus*. They have alveoli somewhat like those of *Clypeaster*; a perforated oblong plate is situated perpendicularly at the symphyses of these alveoli; and here are situated a number of small, square, chisel-shaped teeth, translucent and sharp at their free end, and thick and opaque at the attached end or root: there are five of these on each of the plates, and their points can meet so as to close the oral orifice. The *Goniasters* and the *Asterinæ* also, by means of their oral spines, can completely prevent the egress of food once taken into the stomachal cavity. The *Solasters* have beautiful fasciculated spines around the mouth, but they only partially or very slightly close the orifice, which in this Starfish is very capacious. The *Urasters* have five bundles, not quite closing the mouth.

There are some other points to be mentioned with regard to the antambulacral or anal ring of plates in the *Echinidæ*. This ring of plates is all in the *Echinus* that answers to the upper or antambulacral integument in the Star-fish.

The number of plates forming this part of the corona is ten,—five situated interambulacrally, *i. e.* one at the anal end of each interambulacrum; and five ambulacrally, or one at the end of each ambulacrum. The first are known as the genital plates; they are somewhat triangular in shape, with a semicircular border towards the peripygial membrane; these plates have a perforation for the exit of the generative products. Intermediately between these genital plates in the anal ring and at the anal end of the ambulacral series are much smaller triangular plates: these are called "ocular plates;" but as the *Echinus* has no eye, it is erroneous so to call them, and therefore I propose the name of "*inter-genital*" for them. At the point furthest from the anus they have a minute perforation; now, to this perforation can be very readily traced the longitudinal ambulacral vessels that are placed on a raised edge in the centre of each ambulacrum, and terminate at this orifice in the *inter-genital* plates, which, no doubt, is the orifice of exit of the fluid used in the ambulatory system after it has circulated in the body and done its service and is no longer of any use. The anus in *Echinus* is excentric; in *Cidaris* it is centric.

In connexion with the position of the *Echinoidea* in the animal series, it is interesting to know that, as in the class of polyps below them, there are spicula scattered loosely through their tissues, as well as agglomerated ones forming their *corona*. I have found spicula in the fleshy tubes of the cirri, in the membranous madreporic canal, in the generative organs, in the fleshy part of the stem of the *pédi-*

cellaria, and, very curiously, along the border of a spine that I have mounted in longitudinal section for microscopic observation. These spicula are much like those in some Sponges, except that in *Echinus* they are formed of carbonate of lime, whilst those of the Sponges are of silica.

In *Diadema* they take a somewhat triradiate form (Pl. X. A. fig. 5).

In *Comatula* also there are detached spicula in the internal membrane of the perisome, which, when mounted in Canada balsam, form beautiful polarizing objects.

The higher forms of Echinoderms, such as the *Holothuriadæ*, have their skeleton formed entirely of scattered spicula, except the oral ring; in each species the spicula are of a peculiar form: and all microscopists know the wonderful anchor-shaped spicula and plates in *Synapta* and the curious wheels of *Myriotrochus* and *Chirodota*.

EXPLANATION OF THE PLATES.

PLATE X.

Fig. 1. A separated segment of the splanchnic skeleton of *Echinus sphæra*.

A. A single segment of an *alveolus*, showing the surface opposed to its fellow half.

. The symphysis. *b*. The œsophageal, dentated border. *c*. The superior border for the attachment of the epiphyses. *d*. The styloid process for the support of the tooth. *e*. The apex.

B. The corresponding segment; the serrated surface opposed to the adjoining pair of alveoli displayed.

C. The external surface of an alveolar segment.

D. The epiphyses of the alveoli.

E. The falx; upper and lower surfaces.

F. The radius.

G, G'. The tooth, front and side view.

Fig. 2. A separated segment of the splanchnic skeleton of *Diadema*.

A. An alveolar segment, the surface opposed to its fellow half.

a. The symphysis, below the well-marked groove for the tooth. *b*. The styloid process. *c*. The long slender hamular process. *d*. The œsophageal border, with long, slender, dentated processes.

B. The epiphysis of the alveolus.

D. The radius.

C. The falx.

E. The tooth.

Fig. 3. A separate segment of the splanchnic skeleton of *Acrocladia trigonaria*.

A. An alveolar segment, the surface opposed to its alveolar half.

a. The styloid process. *b*. The œsophageal border. *b'*. Dentation at the apex of this border.

B. The epiphysis of the alveolus. *a*. Styloid process.

C. The falx.

D. The radius.

E. The tooth.

PLATE X. A.

Fig. 1. A dissection of the splanchnic skeleton and muscles attached of *Echinus sphæra*.

a. The *protractores*. *b*. The *retractores*. *c*. The *radiales*. *d*. The *interradiales*. *e*. The *auricular arch*.

Fig. 2. A segment of the splanchnic skeleton of *Echinus sphæra*, showing the *interalveolar* muscle (*a*).

Fig. 3. A transverse section of the tooth of *Cidaris*, in outline.

Fig. 4. A similar section of the tooth of *Echinus*.

Fig. 5. Spicula from the cirri of *Diadema*.

Fig. 6. Spicula from the cirri of *Echinus*.

PLATE XI.

Fig. 1. A dissection, showing the course of the œsophagus through the splanchnic skeleton of *Echinus sphaera*.

a. The œsophagus (cut end). *b.* The ligaments of the œsophagus.

Fig. 2. The antambulacral, or anal ring of plates of *E. sphaera*.

a. The genital plates. *a'*. The madreporic genital plate. *a''*. The genital orifice. *b.* The inter-genital plates. *b'*. The ambulatory orifice. *c.* The plates of the peripygial membrane. *d.* The position of the anus.

The following list of additions made to the Menagerie, by gift, purchase, and exchange, during the month of December, 1860, was read :—

1 Macaque Monkey	<i>Macacus cynomolgus</i>	Kennet Harris, Esq.	} Presented by
2 Wedge-tailed Eagles	<i>Aquila fucosa</i>	Dr. Mueller.	
2 Beavers	<i>Castor canadensis</i>	} Hon. Charles Ellis.	
1 Alligator	<i>Alligator lucius</i>		
2 Horned Lizards	<i>Phrynosoma cornutum</i>	} Richmond, Esq.	
1 Bonnet Monkey	<i>Macacus radiatus</i>		
1 Capuchin Monkey	<i>Cebus capucinus</i> ?	H. Alexander, Esq.	} Received in exchange.
1 Bahama Duck	<i>Pecilonetta bahamensis</i>		
2 American Boas	<i>Eunectes murinus</i>	} Purchased.	
1 Ariel Toucan	<i>Ramphastos ariel</i>		
1 Tapir	<i>Tapirus americanus</i>		
1 Axis Deer, fem.	<i>Cervus axis</i>		
2 Ruddy Shieldrakes	<i>Casarca rutila</i>	} Purchased.	
1 Purple Kaleege	<i>Gallophasis horsfieldii</i>		
1 Suricate	<i>Suricata zenic</i>	} Purchased.	
2 Rheas	<i>Rhea americana</i>		
1 African Horned Owl	<i>Bubo lacteus</i>	} Purchased.	
2 Touracos	<i>Corythaix buffoni</i>		
5 Plantain-eaters	<i>Musophaga violacea</i>	} Purchased.	
1 Grison	<i>Grisonia vittata</i>		
3 White-fronted Geese	<i>Anser albifrons</i>	} Purchased.	
4 Linnets	<i>Linota cannabina</i>		
2 Twits	<i>Linota montium</i>	} Purchased.	

Of these, *Bubo lacteus* was stated to be exhibited for the first time.

February 26th, 1861.

John Gould, Esq., V.P., in the Chair.

Dr. P. L. Sclater exhibited a living specimen of a Water Tortoise (*Chelodina longicollis*) from South Australia. In answer to inquiries as to the exact locality of this animal, Mr. Paul Joske, by whom it was presented to the Society's Menagerie, had replied as follows :—

“ The Tortoise you refer to was found at a village called Hawthorne, on the River Yarra. The same animal is also to be met with in the Ovens district, in the immediate neighbourhood of the creeks. It feeds on the young and tender leaves of grasses and other succulent vegetation, and is popularly known as the Snake-Tortoise.”