

the Royal Society, and the British Museum, with other scientific institutions, should proceed to carry out these necessary investigations. These problems are not extraneous to the explorations which may be carried out by an Antarctic expedition, and I think the new discoveries which I now communicate to the *GEOLOGICAL MAGAZINE* may urge on the dispatch of such expeditions as I propose. If these expeditions be made, how many changes may be produced in actual and general ideas on the age of the South American fossiliferous strata, on the disappearance of the lost southern lands, and on the affinities of extinct faunas so distant in time and space as those of South America and Australia.

II.—CONTRIBUTIONS TO FOSSIL CRUSTACEA.

By Professor T. RUPERT JONES, F.R.S., F.G.S., and HENRY WOODWARD, LL.D., F.R.S., F.G.S.

(PLATE XV.)

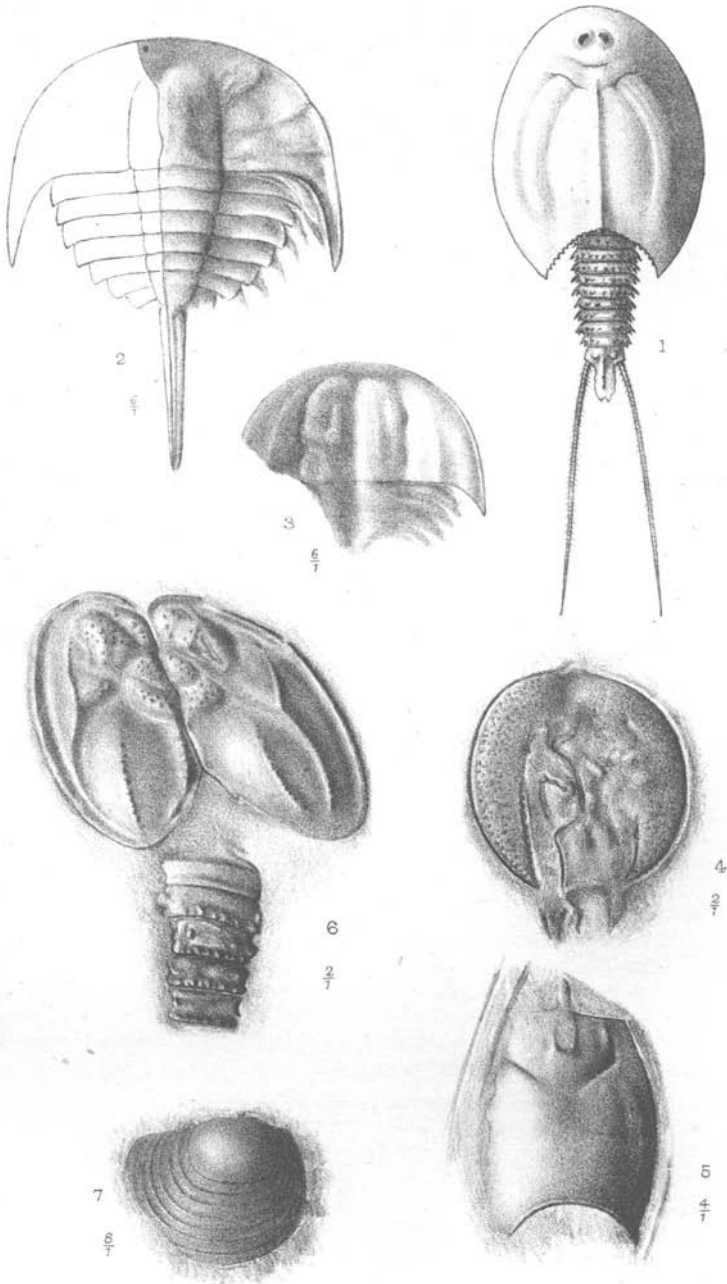
THE following notes are devoted to a small series of Crustacea, not directly related to one another, but which have been awaiting a favourable moment for description.

1. *BELLINURUS GRANDÆVUS*, Jones & Woodw. (Pl. XV, Figs. 2 and 3; × 6 diam.)

Through the kindness of our friend Dr. Henry M. Ami, M.A., F.G.S., Assistant-Palæontologist to the Geological Survey of Canada, and with the permission of the Director, Dr. G. M. Dawson, C.M.G., F.R.S., we received, a year ago, two tiny specimens of Palæozoic Limuloid Crustaceans, referable to the genus *Bellinurus* of König. Dr. Ami writes:—"The precise locality of these protolimuloid Crustaceans is the 6th cutting east of Riversdale Station on the Intercolonial Railway of Canada, in the county of Colchester, Nova Scotia. There are besides this Crustacean (which you are at liberty to describe if you wish) a number of plant- and animal-remains associated in the same beds, viz.: *Asterophyllites acicularis*; *Sphenopteris*, sp.; *Cyclopteris (Aneimites)*, sp.; Ostracoda; *Anthracomya obtenta*, etc., etc. A species of *Leaia*, closely related to *Leaia tricarinata*, also occurs here, and fern-pinnules allied to *Neuropteris*, besides *Calamites*, *Cordaites*, etc. The shales from which these Crustaceans were obtained are overlain conformably by sandstones and red shales of great thickness, and these in turn are unconformably capped by Lower Carboniferous Marine Limestones. Thus, in descending order the strata are:—

1. Lower Carboniferous Marine Limestones.
(Unconformity.)
2. Red rocks of Union and Riversdale Series.
3. Black, grey, and glossy shales of Riversdale and vicinity.
(Unconformity.)"

1. Turning to the specimens themselves, the label states "the first specimen found by Mr. Ami" (which is represented on Pl. XV, Fig. 3, enlarged six diam.) is said to be from the "3rd cutting



G.M. Woodward ad nat. lith.

West, Newman imp.

1. Recent, 2-7. Fossil Crustacea.

east of Colnary River (30, vi, 1897)," and shows a nearly entire head-shield and a portion of five thoracic segments of a small Limuloid Crustacean, probably near to *Bellinurus reginæ*, Baily, from the Irish Coal-measures, and measuring in its present imperfect state 5 mm. in breadth and 4 mm. in length. The cephalic buckler is twice as broad as it is long; the angles of the shield are moderately produced, and the ocular and median ridges of the shield are very distinctly marked, and also the position of the compound eyes; the thoracic segments are distinct, and sharply pointed at their free extremities. The margin of the head-shield is slightly thickened and raised, and the front margin somewhat depressed. The telson or tail-spine is not preserved. Each specimen is *intaglio*.

2. The second specimen obtained ("6, vii, 1897") is labelled from the "*Asterophyllites* or 6th cutting east of Riversdale, Colchester Co., Nova Scotia." Although only one side of the specimen and the telson are preserved, it happens to take in rather more than one-half, so that by tracing and reversing the outline one obtains a very correct idea of the form of the entire animal (Pl. XV, Fig. 2). The specimen is larger than No. 1, measuring 9 mm. in length and 7 mm. in greatest breadth when restored. The artist did not detect the ocular line in this specimen, but it is really present as a minute depressed line outside the glabella, having a deeper spot where the compound eye was situated. Three radiating lines seen on the right side of the head-shield are probably traces indicating the presence of some of the six pairs of maxillipeds or jaw-feet seen in the modern King-crab (*Limulus*). The cheek-spines of the head-shield are well developed, and extend backwards to the 4th thoracic segment. Five well-defined thoracic segments can be distinctly observed, and two (or three?) shorter abdominal ones in front of the telson. The lateral margins or pleuræ of these thoracico-abdominal segments appear to be distinctly truncated, unless, as is just possible, their pointed extremities may have been detached and have adhered to the counterpart impression of the specimen which has not been preserved. The median axis of these segments rapidly diminishes in breadth from the head towards the telson, as is seen to be the case in *Bellinurus reginæ*. The telson or tail-spine is robust, and rather more than one-third of the entire length of the animal.

As stated elsewhere—see Pal. Soc. Mon., "Brit. Foss. Crustacea: The Merostomata," Part V (Xiphosura), 1878, p. 236—we believe that the five segments composing the thorax in *Bellinurus* were free and moveable, as in the larval stages of the young of the living *Limulus polyphemus* and *L. Motuccanus*, and that such was also the case in *Neolimulus falcatus*, H. Woodw., from the Upper Silurian, Lesmahagow, Lanarkshire, the earliest Limuloid Crustacean that we know.

Although *Bellinurus* is a very ancient type of *Limulus*, it has not at present been found in rocks of earlier age than the Coal-measures, nor can we assert that the black, grey, and glossy shales of Riversdale, Colchester Co., Nova Scotia, in which these specimens occur, are older than Carboniferous.

Leaia Leidy, T. R. Jones, which occurs with *Bellinurus* in these Riversdale black shales, occurs in the Lower Carboniferous of Pennsylvania, but in rocks "regarded by some geologists as the uppermost part of the Devonian or Old Red Sandstone."¹ *Leaia* also occurs in the Upper Coal-measures of Lancashire and the Lower Carboniferous of Fifeshire (Jones, op. cit.).

In his "Acadian Geology" (3rd edition, 1878), Sir William Dawson gives an interesting account of the geology of Colchester Co., Nova Scotia, and figures *Leaia Leidy* (misspelt 'Leidii') from the Lower Carboniferous Coal Formation (see p. 256, fig. 78e). At p. 258 he also gives a section at Walton which would seem to justify the inclusion of the Red Rocks of Union and Riversdale in the Lower Carboniferous Series, thus uniting these disturbed beds in one group. But this suggestion is made with the utmost diffidence, in the absence of a knowledge of the district.

As the two specimens of *Bellinurus* (Pl. XV, Figs. 2 and 3) are both imperfect, and better materials may at any time be forthcoming, it seems prudent to refrain from suggesting more than one trivial name. This Crustacean may therefore be known as *Bellinurus grandævus*, Jones & Woodw., Lower Carboniferous Series, Riversdale, Colchester Co., Nova Scotia.

2. *HIBBERTIA ORBICULARIS*, gen. et sp. nov. (Pl. XV, Fig. 4.)

This small Crustacean shield, together with other specimens, was presented to the British Museum, many years ago, by our late friend Dr. John Millar, F.G.S., of Bethnal House, Bethnal Green. The specimen is imbedded in a finely laminated, micaceous, non-calcareous shale (bluish-grey in section), and bears the label "Coal M., Burdiehouse." It was at first believed to be one of Dr. Hibbert's types from Burdiehouse, but nothing like this fossil was found to have been figured or mentioned in Dr. Hibbert's memoir² on the strata and fossils of Burdiehouse; therefore, its occurrence there, as shown by its old label, is of great interest. It was reserved for description with other Phyllo-pods to form part of a monograph in course of publication by the Palæontographical Society; but upon further examination it was found to differ so markedly from the other members of this division that it was held over for some time for further consideration and comparison. It has now become necessary to give it a name, and place it approximately among its congeners.

Specific Characters.—A nearly circular shield, 14 mm. broad by 15 mm. long, having an opening behind, bounded by two acute incurved angular spines which form the backward extremities of the concentric shield or buckler-like test. The periphery of the concentric part of the test is turned up sharply as a thin rim in the fossil, leaving a uniform narrow groove behind it, from which the field of the buckler rises with a gentle swelling over and along the

¹ "Fossil Estheriæ": Pal. Soc. Mon., 1862, p. 117, pl. v, figs. 11, 12.

² See Dr. S. Hibbert's memoir, Trans. Roy. Soc. Edinburgh, vol. xiii (1836), p. 280, plates.

crenate area, except where the edge falls in for a little space just on the centre of the front border; where the buckler becomes slightly depressed and the narrow groove along the margin is interrupted or perhaps injured there is an obscure impression of what may have been a jointed antennary organ in front. The surface of the two lateral areas of the buckler have a finely granulated ornamentation, which is most marked just within the peripheral rim of the carapace, and is limited by two thin parallel granulated ridges, each starting from the incurved posterior angles of the shield, the longest being 7 mm. and the shortest only 4 mm. in length; the intervening space of 5 mm. in breadth, forming the centre of the carapace, is devoid of the granulated ornament seen on the other parts of the shield, and has only a small spine-like impression 3 mm. long, which extends for three-quarters of the entire length of the shield as a curved irregular incised line. There are some other markings, too obscure for interpretation; also a slight posterior projection on the central line, as if possibly representing a part of a lost series of caudal segments (?).

The presence of the two corresponding angles, and the narrow posterior opening between them, suggests affinities with *Dithyrocaris* (cf. *D. Scouleri* as represented by McCoy, with its two raised lateral ridges), but in most of the members of this group the lateral portions of the shield are less circular in outline, and in many the surface ornamentation is composed of linear or reticulate, and only occasionally of granulate markings. Compared with the shield of *Apus* or *Lepidurus*,¹ the general outline is much alike, but the granulated mesolateral ridges continued forward from each of the posterior angles in *Hibbertia* are not present in *Apus*, whereas the median ridge so conspicuous in both *Apus* and *Dithyrocaris* is apparently quite absent in *Hibbertia*, or is not preserved in the fossil. Contrasted with the anterior (cephalic) buckler in *Limulus*, the shield of *Hibbertia* is seen to be nearly circular, whilst that of *Limulus* is semicircular; the posterior angles of the shield of *Hibbertia* are contracted together and directed somewhat inwards at their extremities, whilst in *Limulus* they are wide apart and directed rather outwards. The mesolateral (ocular) ridges are present both in *Hibbertia* and *Limulus*, but in *Limulus* they form a curved line, not a straight ridge as in *Hibbertia*.

The granulation on the lateral areas of the shield and on the ridges is also strange to *Apus*, and more closely resembles that seen in some species of the Carboniferous genus *Cyclus* (cf. *Cyclus Johnsoni*, H. Woodw.,² and *C. testudo*, Peach, the former from the Coal-measures of Coseley, near Dudley, the latter from the Carboniferous shales—so rich in Crustacea, Arachnida, etc.—of Eskdale on the Scottish borders).³

¹ See Plate XV, Fig. 1, copied from Dr. A. S. Packard's figure. (Mon. Phyllopod Crustacea of North America, 1883, pl. xvi, fig. 1.)

² See "Contributions to our Knowledge of the Genus *Cyclus* from the Carboniferous Formation of various British Localities," by H. Woodward: GEOL. MAG., Dec. IV, Vol. I (1894), pp. 530-9, Pl. XV.

³ Trans. Roy. Soc. Edinburgh, vol. xxx (1883), p. 227, pl. xxviii, figs. 9-9d.

None of the earlier fossil forms of Limuloid Crustaceans hitherto figured and described (examples of two of which, Figs. 2 and 3, are given on Pl. XV with *Hibbertia*, and of which a series may be studied on pl. xxxi, figs. 1–8, Pal. Soc. Mon. Merostomata, part v, 1878) aid us in finding a suitable form for comparison with the shield of *Hibbertia*, nor do the larval stages of the recent *Limulus* greatly assist us in this direction (see op. cit., pl. xxxiii). We are therefore reduced to the conclusion that *Hibbertia* may be more conveniently placed along with and near to those forms referred to the genus *Cyclus* than with any other group. Under these circumstances we prefer to regard it as being characteristic of a distinct genus, and we name it after Dr. Hibbert, with whose discoveries in the Carboniferous strata at Burdiehouse it is most closely associated.

From the paper by H. Woodward, already referred to, we make the following extract, to show the conclusions arrived at by the writer as to the affinities of the curious little forms included in the genus *Cyclus*, to which family, under the name of *Hibbertia*, our specimen from Burdiehouse must now be added.

“The presence of antennæ and biramous swimming-legs proves undoubtedly that *Cyclus* was a Crustacean. The large size of the former and the homogeneous nature of the rest of the appendages (all biramous swimming-legs, with possibly masticatory bases), taken in connection with the large, slightly-bivalved carapace, suggest that it is an Entomostracan and probably one of the Phyllopoda, with a broad cephalic carapace like that possessed by *Apus* and by *Daphnia*; with large swimming second antennæ like the latter, and possibly with a pair of stalked eyes. *Cyclus*, however, differs from the Cladocera in being flattened dorso-ventrally, and from the lowest Crustacea in not apparently possessing any true jaw-parts—the head, with the labrum and mouth, being bent further back than in the living Entomostraca. These differences may either indicate very lowly characters or very much specialized ones. Two views suggest themselves:—

“(1) That these animals were small, free-swimming Phyllopods, with expanded cephalic shield, swimming second antennæ, and biramous limbs, the bases of which served as masticatory organs, no true jaws having yet been developed; the backward position of the mouth may have been brought about in order to allow as many appendages as possible to serve as jaws, as is seen in *Limulus*. Or, possibly, the beast could attach itself, like a living *Daphnia*, by a cement gland on the dorsal side of the head, in which case it might be an advantage to have the mouth as near the freer end as possible and close to the swimming-legs, which were, by their movements, producing the foot-currents.

“(2) The other view is that these animals were ecto-parasitic Phyllopods, although they had not lost their power of free-movement, yet had become specialized in the form of their body, which is flattened ventrally and only slightly convex above, the whole animal being expanded horizontally, unlike most other

Phyllopods. This view might account for the two large round structures seen on the ventral surface, situated one on either side of the body, and close to the anterior margin of the shell. These might possibly represent a pair of ventral suckers, such as are seen in the modern fish-lice; these structures, whatever they may be, are evidently enormously developed, and possess great muscles, which produce prominent modifications of the dorsal shield, where they are attached. The great labrum might possibly represent the suctorial tube of *Argulus*, under cover of which are concealed the reduced mandibles, etc.

"Some of the specimens show curious oblique scars on the coxæ of the legs, which may indicate the points of attachment of spines or setæ to enable the parasite to stick to its fishy host." (GEOL. MAG., 1894, pp. 534-5.)

3. ANTHRAPALEMÓN GLABER, Jones & Woodw. (Pl. XV, Fig. 5.)

This small cephalothoracic shield of a Macrouran Decapod Crustacean was obligingly sent to us by our friend and correspondent, Mr. John Smith, of Monkredding, Kilwinning, who obtained it in the Coal-measure series of Kilmaurs, Ayrshire. The other specimens which accompanied this will be dealt with elsewhere. The specimen, which is 7 mm. long and 5 mm. in breadth, displays a gently rounded, almost smooth carapace, preserved on a fragment of fawn-coloured shale enclosing plant-remains. The carapace has no dorsal ridge, but there is a well-marked cervical furrow forming an open V-shaped depression across the carapace in the centre; a small but prominent rostrum is seen in front, and the cervical furrow gives rise to a gastric furrow and spine on either side, only one of which, however, that on the right side, is preserved. The sides of the carapace are slightly expanded and smoothly arched, and there is a faint trace of a serrated border on the hepatic region, terminating in a short anteriorly directed spine. The posterior border is deeply and roundly emarginated, and has a thickened, raised, and smooth rim. The surface of the test is smooth, and quite free from ornamentation. The specimen closely resembles *Anthrapalæmon Etheridgei*, figured and described by Mr. B. N. Peach, F.R.S., from Eskdale (see Trans. Roy. Soc. Edinb., 1883, vol. xxx, figs. 4 and 5), but may be specifically separated from it by its absence of ornamentation; it may bear the trivial name of *A. glaber*.

Locality.—Coal-measures: Kilmaurs, Ayrshire.

4. ECHINOCARIS WHIDBORNEI, Jones & Woodw. (Pl. XV, Fig. 6.)

The following note on *Echinocaris* has been most obligingly sent to us, together with the three specimens, by Mr. A. K. Coomára-Swámy, the discoverer of the beautiful specimen drawn on Pl. XV, Fig. 6:—

"This phyllopod was first described and figured in the GEOL. MAG., Dec. III, Vol. VI (1889), p. 385, Pl. XI, Fig. 1, by Professor Rupert Jones and Dr. H. Woodward, from a specimen found by Mr. Dufton in a quarry at Sloly, near Barnstaple, in beds of the Baggy or Marwood series, associated with *Lingula squamiformis* and other

fossils. There is also a fragmentary specimen in the Porter collection, from Pilton, near Barnstaple. Mr. Dufton's specimen was redescribed and refigured by the Rev. G. F. Whidborne in the 'Monogr. Devonian Fauna of the S. of England' (Pal. Soc., vol. iii, pt. 1, 1896, p. 6, pl. i, fig. 3). In 1896 I was in the Sloy quarry with the Geologists' Association, and found a small slab bearing one good specimen [Pl. XV, Fig. 6] and a cast of another. Later, the same day, the corresponding half was found by Mrs. A. M. Davies. These specimens are referred to in the Proc. Geol. Assoc., vol. xiv, pt. 10, p. 440, and in the Brit. Assoc. Report of the Committee on Paleozoic Phyllopoda, 1897. In my specimen the valves are slightly elongated and narrowed by shearing, but are nevertheless equal in breadth to those of the first specimen. Five body-segments are visible. They bear the tubercles characteristic of *Echinocaris* on their posterior margins. The other specimen, occurring as an impression on the same slab, is smaller; three body-segments are seen in Mrs. Davies' half. Two other specimens have since been found by Miss Partridge, of Barnstaple, in the same locality."

By the kindness of Mr. A. K. Coomára-Swámy we have been allowed to study his own specimen, and also the two obtained by Miss E. M. Partridge, of Barnstaple. One of Miss Partridge's specimens (732) shows evidence of the body-segments behind the carapace; both valves are present, but rather squeezed out of shape. The other specimen (759), although the valves are less perfect behind, shows the anterior border with the granulated surface of the valves very beautifully, and what appear to be two ocular spots (or tubercles) near the anterior border. We are much indebted to Miss Partridge and also to Mr. A. K. Coomára-Swámy for the opportunity to see and examine these rare Devonian Phyllopods.

5. *ESTHERIINA EXTUBERATA*, sp. nov. (Pl. XV, Fig. 7.)

This seems to be the very tumid umbonal portion of a right-hand valve of an *Estheriina*, separate from the rest of the valve. The flat marginal portion of the valve may have been broken away, or perhaps lies hidden in the matrix.

Size.—Length 3 mm., height $2\frac{1}{2}$ mm.

The valve is semicircular on the ventral and nearly straight on the dorsal border; but the swollen umbo bulges out to some extent at the anterior third of that hinge-line. It slopes gently down to a rather blunt angle in front, and with a short hollow slope to a sharp angle behind.

The umbo is large, convex, very smooth, and shiny, $1\frac{1}{2}$ mm. broad, 1 mm. distant from the anterior and scarcely $\frac{1}{2}$ mm. from the posterior angle. It extends downwards for 1 mm. nearly to the middle of the valve, and is succeeded by seven concentric, broad, undulatory ridges, each having a raised line, mostly $\frac{1}{4}$ mm. apart, with smooth interspaces.

The strong local convexity of the valve, succeeded by a limited series of coarse concentric riblets, reminds us of the similar feature

in *Estheriina* (GEOL. MAG., May, 1897, pp. 198, etc., Pl. VIII, Figs. 1–11); but there is wanting the flat outer extension of the valve along its free margins. It may be a separate umbonal boss, such as occurred with the Brazilian specimens, and one of them also was described as being shiny (loc. cit.).

Indeed, the specimen under notice much resembles the very distinct umbonal area of *Estheriina astartoides* (as represented in Pl. VIII, Fig. 7, GEOL. MAG., 1897), with its six or seven coarse riblets and their smooth interstitial spaces; the umbo itself, however, is relatively much larger in the German specimen. The Brazilian fossil, from a cutting on the railway 83 kilometres from Bahia, was in a shale of Cretaceous age. The Stegocephalian limestone from which Baron von Reinach obtained the specimen here described is of Permian age.

This little fossil was communicated to us for description by Professor Fried. Kinkelin, of the Senckenberg Museum, Frankfurt-on-the-Maine. It was found by Baron A. von Reinach¹ in the Stegocephalen-Kalk near that city.

EXPLANATION OF PLATE XV.

- Fig. 1.—*Lepidurus glacialis* (after Dr. A. S. Packard). (Mon. Phyllopod Crustacea, North America, 1883, pl. xvi, fig. 1.) Recent: North America.
- „ 2. } *Bellinurus grandævus*, Jones & Woodw. Lower Carboniferous Series:
 „ 3. } Riversdale, Colchester Co., Nova Scotia. × 6 times nat. size.
- „ 4.—*Hibbertia orbicularis*, Jones & Woodw. Coal-measures: Burdiehouse, near Edinburgh. × twice nat. size.
- „ 5.—*Anthrapalæmon glaber*, Jones & Woodw. Coal-measures: Kilmaurs, Ayrshire. × 4 times nat. size.
- „ 6.—*Echinocaris Whidbornei*, Jones & Woodw. Marwood Beds (Devonian): Sloyly, near Barnstaple, Devon. × twice nat. size.
- „ 7.—*Estheriina extuberata*, sp. nov. Permian: Frankfurt-on-the-Maine. × 8 times nat. size.

III.—NOTE ON A NEARLY COMPLETE SKELETON OF *DINORNIS MAXIMUS*.

By CHAS. W. ANDREWS, B.Sc., F.G.S., British Museum (Nat. Hist.).

(PLATE XVIII.)

AN exceedingly well-preserved and nearly complete skeleton of the largest species of *Dinornis*, *D. maximus*, has recently been mounted and exhibited in the Palæontological Galleries of the British Museum (Natural History). The finding of this fine specimen has been described by its fortunate discoverer, Mr. C. A. Ewen,² and to his paper a brief account of the remains themselves was added by Captain Hutton.³ It appears that the bones were found on shifting

¹ Baron von Reinach has communicated to us other Phyllopods from the Permian of the Wetteran and the valley of the Nahe; see *Rep. Brit. Assoc. for 1893* (1894), pp. 465–6, pl. i, figs. 1–5.

² “On the Discovery of Moa-remains on Riverton Beach”: *Trans. New Zealand Institute*, vol. xxviii (1895), p. 651.

³ *Tom. cit.*, p. 652.