The grorudites of Professor Brögger form the acid extreme of a well-defined rock-series of which, so far as the Christiania district is concerned, tinguaite is the basic extreme. No rocks answering to tinguaites in chemical composition have been found in the north-west of Scotland. The dykes discovered by Mr. Gunn in west Ross-shire, to which the term borolanite was extended, not without hesitation, as melanite is far less abundant than in typical borolanite, are composed mainly of nepheline, orthoclase, and ægirine, and therefore allied to tinguaites in mineralogical composition; but the rock analyzed contains over 5 per cent. of lime—a fact which sharply differentiates it from typical tinguaites. Another point which differentiates these dykes from tinguaites is their structure. Nepheline, ægirine, melanite, and biotite occur as idiomorphic crystals in large irregular patches of orthoclase (micropœcilitic structure) But if these dykes do not fit into the grorudite-tinguaite series they correspond very well with some of the more basic members of the plutonic mass of Cnoc na Sròine, with the nepheline-melanite syenites, just as the grorudite-like rocks correspond with the more acid portions of the same mass. It is probable, therefore, that both are aschistic, in Professor Brögger's sense, and that they represent the dyke forms of the magmas which gave rise to the plutonic mass.

In the foregoing account of this small but extremely interesting petrographical province, special emphasis has been laid on its relations to the Christiania district; but it might equally well be compared with other districts in which nepheline-syenites occur. Each of these districts has its own special features. The occurrence of borolanite is a peculiarity which the district in question shares, so far as we know at present, only with that of Magnet Cove.

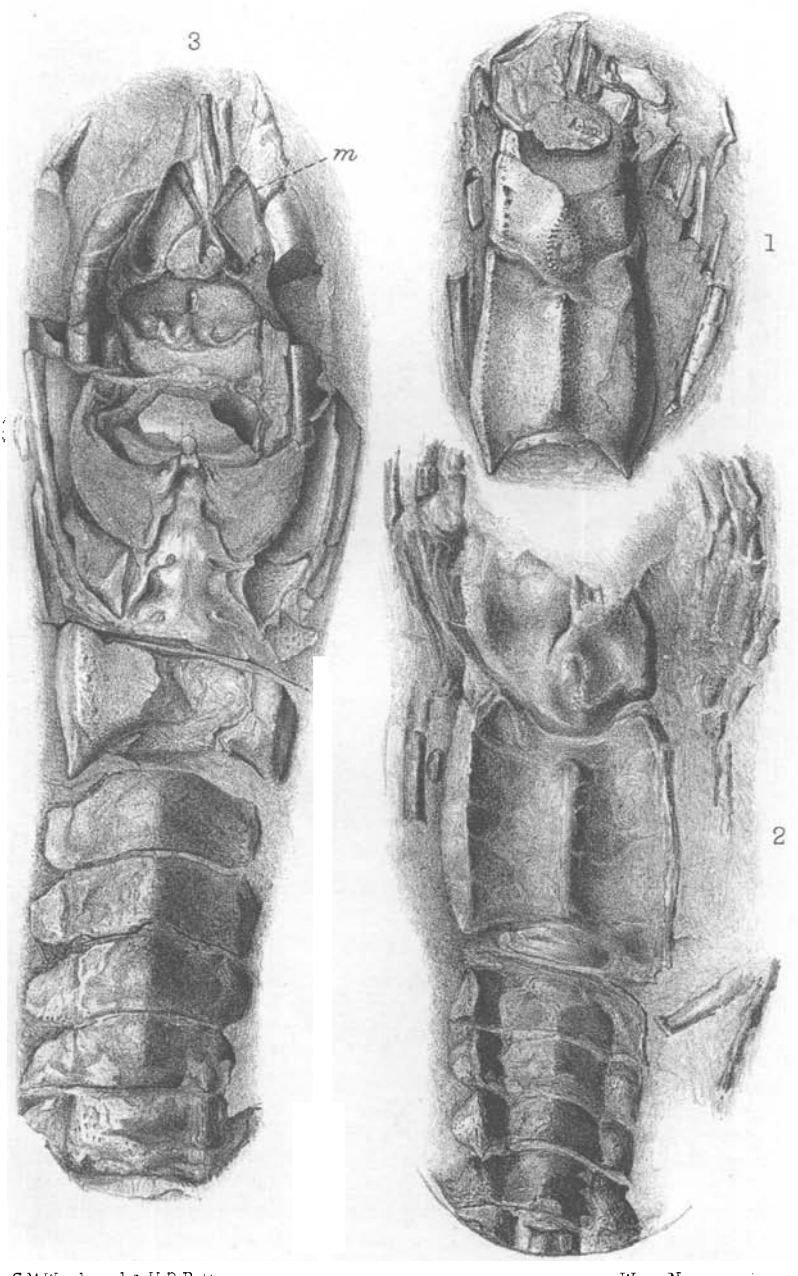
II.—Further Notes on Podophthalmous Crustaceans from the Upper Cretaceous Formation of British Columbia, etc.

By Henry Woodward, LL.D., F.R.S., F.G.S., etc., of the British Museum (Natural History).

(PLATES XV and XVI.)

In 1896 I described some decapod Crustaceans found in the Cretaceous formation of Vancouver and adjacent islands, British Columbia, which, with the approval of Dr. G. M. Dawson, C.M.G., F.R.S., the Director, had been most kindly placed in my hands for examination by Dr. J. F. Whiteaves, F.G.S., Palæontologist to the Geological Survey of Canada. They were referred by me to the genera *Callianassa*, *Homolopsis*, *Palæocorystes*, and *Plagiolophus* (see Quart. Journ. Geol. Soc., 1896, vol. lii, pp. 221–228, with 6 figures).

From the same source I have since received a further and much larger collection of specimens from the Nanaimo and Comox Group (Upper Cretaceous). Like the earlier series, all these Crustaceans are preserved in hard concretionary nodules, which render their examination in detail often extremely difficult and disappointing, as



G.M. Woodward & H.B. Potter. West, Newman imp.

Decapod Crustaceans
U. Cretaceous Vancouver Island, B.C.

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they split unevenly with a jagged fracture, and have also a tendency to divide up into cuboidal fragments.

The material which has now been placed in my hands may be summarized thus:—

No. 1. One specimen of a dark nodule, split into halves ($3'' \times 1\frac{3}{4}''$), exposing the cephalothorax and portions of the limbs of a Crustacean referred to *Linupārus* (*Podocrates*) *Vancouverensis* by Whiteaves (Pl. XV, Fig. 1), described in Trans. Roy. Soc. Canada, ser. II, vol. i (1895–6), sect. 4, pp. 132 and 133. Formation: from the Nanaimo Group (Upper Cretaceous), Museum Geol. Surv. Canada. Locality: from two miles up the Puntledge (called also the Comox) River, Vancouver Island; collected by the Rev. G. W. Taylor, 1889.

No. 3 (labelled also 58 in white paint). A large dark nodule, split in halves ($6\frac{3}{4}'' \times 3\frac{3}{4}''$), exposing the dorsal aspect of a second specimen of *Linupārus* (*P.*) *Vancouverensis*, W., showing the cephalothorax and a portion of the base of the left antenna. The three characteristic longitudinal ridges, the small central pear-shaped area in front of the neck-furrow on the carapace, and five of the abdominal segments can also be seen (Trans. Roy. Soc. Canada, op. cit.). Formation: Upper Cretaceous. Locality: Hornby Island; coll. by W. Harvey, 1893.

No. 4. A long, dark, and rather cylindrical nodule ($6\frac{1}{2}'' \times 2\frac{1}{2}''$), split in halves and also broken across transversely, exposing the interior of the cephalothorax and five segments of the abdomen of *Linupārus* (*P.*) *Vancouverensis*, W. (Pl. XV, Fig. 3). The upper surface of the carapace is not preserved, but the bases of the mandibles (*m.*) are exposed, the monodactylous walking-legs, and the bases of the antennules. The epimeral portions of the abdominal segments are serrated behind, and bear small tubercles on the surface. Formation: Upper Cretaceous. Locality: Comox River, Vancouver Island; coll. by J. B. Bennett, 1895.

No. 6. Half of a nodule only ($7'' \times 4\frac{3}{4}''$), containing an obscurely preserved Crustacean, *Linupārus* (*P.*) *Vancouverensis*, showing characteristic traces of the carapace and limbs and the nearly entire abdomen, including remains of the caudal appendages. The posterior borders of the epimera are spinous. The right antenna is preserved for a length of $2\frac{1}{2}$ inches. Formation: Upper Cretaceous. Locality: Hornby Island; coll. by W. Harvey, 1895. (Specimen also marked No. 1 in ink.)

No. 55 *a* and *b*. Two sides of a dark egg-shaped nodule split open ($4\frac{1}{2}'' \times 3\frac{3}{8}''$), exposing the dorsal aspect of a specimen of *Linupārus* (*P.*) *Vancouverensis*, W. (Pl. XV, Fig. 2), showing the carapace and the five abdominal segments, also the remains of the caudal appendages and the thoracic limbs. The three characteristic ridges are well seen, also the cervical furrow, with its pear-shaped tuberculated area just in front. Formation: Upper Cretaceous. Locality: Hornby Island; coll. by Mr. Robbins in 1896, Provincial Museum, Victoria, British Columbia.

A few additional specimens from the same series are referred to later on.

Notes on the Genus *Linupārus*, A. White, 1847.

Before proceeding further it seems desirable to say a few words upon the nomenclature of this genus, which, like the materials illustrating it, has greatly increased and become somewhat complicated.

In 1884 Dr. Whiteaves first called attention to these interesting Palinurids in the Transactions of the Royal Society of Canada (vol. ii, sect. 4, pp. 237, 238) under the provisional generic name of *Hoploparia* (?), with the specific designation of *Canadensis* for the form then under discussion, obtained from the Cretaceous of Highwood River, a tributary of the Bow River.

This fossil was again described by Dr. Whiteaves (in 1885) under the name of *Hoploparia* (?) *Canadensis* in "Contributions to Canadian Palæontology," 1885, vol. i, pp. 87–89, where it is figured for the first time (pl. xi). It appears that some time afterwards (1890) Dr. C. Schlüter, of Bonn, stated that the so-called *Hoploparia* (?) *Canadensis* was closely allied, if not identical with, his *Podocrates Dulmenensis*, a name proposed by Becks (without description), but described fully by Dr. Schlüter in 1862 (in the Zeitsch. der Deutsch. Geol. Gesellsch., xv, pp. 710–716, taf. xii). This genus *Podocrates* was also adopted by Fritsch & Kafka in their "Crustacea Böhm. Kreidform.," pp. 20, 21, taf. iii, figs. 1 and 2 and text-fig. 44, Prague, 1887.

In 1895 Dr. J. F. Whiteaves added a new species of Cretaceous Palinurid to the series of Crustaceans already recorded by him from the Cretaceous of Vancouver (Proc. and Trans. Roy. Soc. Canada, ser. II, vol. i, sect. 4, pp. 132, 133), under the name of *Podocrates Vancouverensis*, thus accepting and acknowledging the correctness of Dr. Schlüter's earlier determination in 1862.

Two years later, Dr. A. E. Ortmann described a new species of Palinurid, from the Upper Cretaceous of Dakota, under the generic name of *Linuparus*, Gray (1847), a monotypic genus containing only the single living Japanese species *Palinurus trigonus* of De Haan (see De Haan, in Siebold's "Fauna Japonica," Crustacea, 1841, p. 157, pls. xxxix and xl). This genus *Linupārus*,[1] attributed to Dr. John Edward Gray ("List of Crustacea in the British Museum," p. 70), as pointed out by the Rev. T. R. R. Stebbing, F.R.S. ("A History of Crustacea," 1893, p. 197), (spelt by him *Linupāris*), is *not* Dr. Gray's name, but was given by Adam White in 1847; "the characters of the new genus being left to be inferred from the known species (as described by De Haan), a very slovenly method of definition which is much to be deprecated" (Stebbing, op. cit.).

Linupārus Vancouverensis, Whiteaves, sp. (Pl. XV, Figs. 1–3.)

1841. *Palinurus trigonus*, De Haan, Fauna Jap. Crustacea, p. 157, pls. xxxix, xl.
1847. *Linuparus trigonus*, White (gen. emend.), List Crustacea Brit Mus., p. 70.
1857. *Thenops*, Bell, Foss. Malacost. Crust., pp. 33, 34, pl. vii: Pal. Soc. Mon., 1857.

[1] This name is an anagram on Fabricius's genus *Palinurus*, from which *Linupārus* was separated by Adam White, the real author of the "List of Crustacea in the British Museum," 1847.

1862. *Podocrates* (Becks, nom. nud.), Schlüter, Zeitsch. der Deutsch. Geol. Gesellsch., xiv, 1862, pp. 710–716, taf. xii.
1887. *Podocrates*, Fritsch & Kafka, Crust. Böhm. Kreidform., pp. 20, 21, taf. iii, figs. 1 and 2 and text-fig. 44.
1893. *Linupāris* (*sic*), Stebbing, Hist. Crustacea, p. 197.
1895. *Podocrates*, Whiteaves, Trans. and Proc. Roy. Soc. Canada, 1895, ser. II, vol. i, sect. 4, pp. 132, 133.
1897. *Linuparus*, Ortmann, Amer. Journ. Sci., ser. IV, vol. iv, pp. 290–297, figs. 1–4 in text.

At the meeting of the Royal Society of Canada, May, 1895, Dr. J. F. Whiteaves gave descriptions of the fossils from the Nanaimo group of the Vancouver Cretaceous series, and among others described a new species of Crustacean, of which description I subjoin a copy.

LINUPĀRUS (PODOCRATES) VANCOUVERENSIS, Whiteaves, sp.

"Carapace flattened, rectangular, longer than broad, marked by three low angular tuberculous or spinose longitudinal ridges, one in the median line and one near each of the lateral margins, and divided at about one-third the distance from the front by an obtusely subangular cervical groove, which is rather broad but not very deep. On the anterior portion or cephalic arch the lateral longitudinal ridges are well developed, and armed with larger and more spinose tubercles than those on the corresponding ridges of the posterior portion, one a little behind the mid-length on each ridge being larger than any of the others, but the central ridge is obsolete. In its place, just in advance of the cervical groove, there is an ovate lanceolate or narrowly spear-shaped area, which is elevated at the pointed end anteriorly, shallowly depressed posteriorly, and margined with a single row of small tubercles. Immediately in front of this area there is a pointed or spinose tubercle, almost in a line with the largest tubercle on each of the lateral ridges, and still farther forward there are two similar tubercles at a short distance from the anterior margin and about seven millimetres apart. On the posterior portion, or scapular arch, the three longitudinal ridges are minutely tuberculated, and extend from the posterior margin to the cervical groove, where they each terminate in a pointed tubercle larger than any of the rest, but the central ridge is shorter than either of the two lateral ridges. Anterolateral angles of the carapace each armed with a nearly straight but slightly divergent spine. Rostrum, central portion of the anterior margin, and position of the eyes unknown. External antennæ broad and flattened at their bases, inner antennæ cylindrical at theirs. Walking feet slender, as is usual in the genus. In addition to the spines and tubercles on the lateral ridges and elsewhere, as already described, the whole of the upper surface of the carapace is minutely granulose and apparently setose, numbers of minute objects, which seem to be detached setæ, being plainly visible under an ordinary lens."

"Two miles up the Puntledge River, Vancouver Island, Rev. G. W. Taylor, 1889: a good specimen of the carapace, with the rostrum and a small piece of the anterior broken off, but with considerable

portions of the ambulatory feet and the bases of the inner and outer antennæ preserved. This interesting fossil is now in the Museum of the Geological Survey of Canada. [See Pl. XV, Fig. 1.]

[No. 3.] "Hornby Island, W. Harvey, 1893: a less perfectly preserved specimen, showing most of the carapace (but not the rostrum), portions of the ambulatory feet, and the dorsal aspect of five segments of the abdomen (their margins were denticulated).

"In 1884 (Trans. Roy. Soc. Canada) the writer [Dr. J. F. Whiteaves] described a long-tailed decapod crustacean from the Cretaceous rocks at the Highwood River in Alberta, under the provisional name *Hoploparia* (?) *Canadensis*. Dr. C. Schlüter, of Bonn, Germany, in a letter dated February 20, 1890, expresses the opinion, which appears to be well founded, that this species, which is figured on plate ii of the first part of the first volume of 'Contributions to Canadian Palæontology,' is a *Podocrates*, closely allied to, if not identical with, the *P. Dülmensis* of Becks. *P. Vancouverensis* seems to differ from that species in the much smaller proportionate size of the tubercles on the three longitudinal ridges on its carapace, especially posteriorly, and in the different arrangement of the distant spinose tubercles on the anterior moiety of its cephalic arch."

The publication of Dr. Ortmann's paper (American Journal of Science, ser. IV, vol. iv, 1897, pp. 290–297, figs. 1–4) makes us acquainted with another species of Palinurid, which he names *Linuparus atavus*, from the Upper Cretaceous of Cotton Wood Creek, Mead Co., South Dakota.

There is no doubt that this form is closely related generically with *P. Canadensis*, *P. Vancouverensis*, Whiteaves, and also with *P. Dulmenensis*, Schlüter, and that for all these species Adam White's genus *Linupārus* (1847) takes priority over the other genera to which they have heretofore been referred by various authors.

Formation: Upper Cretaceous.

Locality: Puntledge or Comox River (Fig. 1), Hornby Island (Fig. 2), Comox River (Fig. 3), British Columbia.

In the "Contributions to Canadian Palæontology" for 1885, vol. i, pp. 87–89, pl. xi, Dr. J. F. Whiteaves, F.G.S., published the following description of *P. Canadensis*, a decapod Crustacean from the Upper Cretaceous of Highwood River, Alberta, N.W.T., which we here reproduce:—

Linupārus (Podocrates) Canadensis, Whiteaves, sp.

Hoploparia (?) *Canadensis*, Whiteaves, 1884.[1]

"The fossil, which it is the more immediate object of this paper to describe, is a rather remarkable example of a macrourous decapod crustacean, collected by Mr. R. G. McConnell in 1882 from the Cretaceous shales of the Highwood River, a tributary of the Bow, ten miles west of the first fork.

"The specimen originally consisted of an elongate-oval and

[1] Trans. Roy. Soc. Canada, vol. ii (1884), sect. 4, pp. 237, 238.

flattened concretionary nodule of soft argillite, with a small piece broken off from one end, but enough of the matrix has been removed to show most of the carapace and the upper surface of a few of the abdominal segments. The anterior extremity of the carapace, with the rostrum, is unfortunately not preserved, and the tail, with some of the posterior abdominal segments, was broken off when the nodule was found. The ambulatory feet are preserved, but it was found to be scarcely possible to remove the soft shale from around them without running the risk of spoiling the specimen.

"The carapace, like that of most of the macroura, is elongated and comparatively narrow, with nearly parallel sides, and, when perfect, its length must have been about twice as great as its breadth. A little in advance of the mid-length a single, broadly V-shaped, deep, and rather wide cervical furrow crosses the carapace transversely. The posterior half of the carapace is depressed and rather distinctly three-keeled in a longitudinal direction. In the specimen collected by Mr. McConnell a central keel, or narrow but prominent raised ridge, about three times as broad posteriorly as it is anteriorly, and which is bounded on each side by a deep and angular furrow, extends from the posterior end of the carapace to the centre of the V-shaped (cervical) groove which transverses it. This central keel is much more strongly marked than the broad and comparatively obtuse lateral keels near the outer margin of each side. The surface of the posterior half of the carapace (and perhaps that of the anterior also) is covered with rather distant, small, isolated conical tubercles, which occasionally are surrounded by a minute annulus at the base; and the three keels each have a single series of larger conical tubercles, whose pointed apices are directed forward.

"In front of the transverse and V-shaped (cervical) furrow the carapace is very badly preserved, and the anterior margin with the rostrum is broken off. The two lateral and tuberculated keels appear to be prolonged to within a short distance of the front margin of the carapace, though they are somewhat less distinct in front of the (cervical) furrow than they are behind it. On the anterior side of the furrow the central keel is absent, and the median portion of this part of the carapace bears a number of comparatively large and prominent, distinct and conical tubercles, which are somewhat peculiarly arranged. Next to the furrow, and in advance of it, in the median line, there are five tubercles arranged in two convergent rows of two pairs and an odd one, which, if connected by lines, would have much the shape of an isosceles triangle, with its base near to the furrow. Between the space bounded by these five tubercles and each lateral keel there is a shallow, concave, and rather broad depression of the carapace. In front of these five tubercles, again, there are four others and still larger ones (the two anterior ones apparently of considerable size), arranged somewhat in the form of a square, any of whose sides would be greater than the base of the isosceles triangle indicated by the other five.

"The upper surface of each of the abdominal segments bears a tubercle in the centre, on its anterior edge, and another one on the margin of each of the sides. The most prominent characteristic

of the species, in fact, is the possession of three widely distant, longitudinal, and tuberculated keels, which extend over nearly the whole length of the upper surface of the body." . . . .

"Judging by the invertebrate fossils alone, it would seem probable that the friable and fissile shales at Mill Creek, which hold typical examples of *Inoceramus problematicus*, may represent the 'Niobrara Group' of the Upper Missouri section. On similar evidence, also, the rocks of the two localities on the Waterton River, which have yielded respectively *Ostrea congesta* and *Volviceramus exogyroides*; those at the Highwood River, which contain *Inoceramus undabundus* and *Scaphites Warreni*; those on the north-west branch of the north fork of the Old Man River, from which *Inoceramus undabundus*, *Pholadomya papyracea*, *Scaphites Warreni*, and *S. vermiformis* were collected; and those at the entrance to the North Kootanie Pass, which are characterized by *Volviceramus exogyroides*, *Scaphites Warreni*, and *S. vermiformis*, would appear to be as nearly as possible the Canadian equivalents of the 'Fort Benton Group.'

"In conclusion, it may be remarked that the invertebrate fauna of the 'Belly River Series' seems to be essentially the same as that of the 'Laramie' of the United States and Canada, unless more than one formation has been confounded under the latter name, and that it is at present scarcely possible to separate the 'Lower Dark Shales' of Dr. Dawson's Bow and Belly River Report from the 'Fort Pierre and Fox Hills' Groups on purely palæontological grounds."[1]

Additional note on *Linupārus Canadensis* (Pl. XVI, Fig. 1), by H. Woodward.—No. 55 *c*. One half of a dark nodule ($6\frac{1}{4}'' \times 4''$), exposing the under side of a large Crustacean, showing the five sternites and the bases of the thoracic limbs. I have referred this specimen to Dr. Whiteaves' species *L. Canadensis*, with which it agrees in size, being one of the largest specimens of the fossil Palinurids from this locality.

It exhibits the under surface of the cephalothorax, with the sterna and the basal joints and portions of the five pairs of ambulatory appendages, one or more being nearly complete. The sternum forms a rather broad and somewhat triangular area, in front of which the mandibles and the labrum are seen, with the spinous stout basal joints of the long stiff antennæ. There are also traces of the antennules visible.

Each sternite, carrying the thoracic limbs, is ornamented with a pair of rounded, sub-central tubercles, except the first, which has only a single central one.

Upper Cretaceous: Hornby Island; collected by Mr. Robbins, preserved in the Provincial Museum at Victoria, B.C.

Here I would also place a second specimen, preserved in a half nodule, No. 7 (marked 2 in ink), which I refer to *L. Canadensis*. The half nodule measures $6'' \times 4''$, and displays one of the large antennæ and five of the walking-legs very well preserved. The

[1] Added from Dr. Whiteaves' Contrib. Canad. Palæont., vol. i (1885), p. 88.

surface of the appendages is rugose. Three of the body-segments can be seen. Locality: Hornby Island; W. Harvey, 1895.

Although not refigured, it seems desirable, in order to complete this record, to reproduce Dr. Whiteaves' description of this additional Cretaceous form.

"PALÆASTACUS (?) ORNATUS, Whiteaves.

Palæastacus (?) *ornata*, Whiteaves, 1887, Geol. and Nat. Hist. Surv. Can. Ann. Rep., N.S., vol. ii, p. 161 E.

Palæastacus (?) *ornata*, Whiteaves, 1889, Contrib. Canad. Palæont., vol. i, pt. ii, p. 183, pl. xxv, fig. 3.

"The foregoing was suggested as a provisional name for a rather remarkable specimen of a macrouran decapod which evidently belongs to the family *Astacomorpha* of Zittel [1885]. Of Cretaceous representatives of this family it seems to come nearest to such genera as *Palæastacus* and *Hoploparia*, though it differs from each in some important particulars. In many respects it appears to the writer to be still more nearly related to the recent fresh-water genera *Astacus* and *Cambarus*, but there is good reason for supposing that it will eventually prove to be the representative of a new generic type, which at present there is not sufficient material to define satisfactorily.

"Nearly the whole of the under surface of the cephalothorax of the specimen is buried in the matrix, the front margin of the carapace is very imperfect, the caudal plates, as well as the under part of the five abdominal segments, are broken off, and only small portions of the chelæ and of the other ambulatory legs are preserved or exposed.

"The carapace is moderately convex and slightly depressed, and not quite twice as long as broad. It is divided into two nearly equal parts by a single, well-marked, and deeply impressed cervical furrow, which is arched forward in a shallow, concave curve. Behind this furrow the lateral margins of the carapace are slightly expanded, the branchial region is moderately inflated, and the posterior margin is slightly concave in the middle. A short distance in advance of the cervical furrow, on the outer and lower portion of the carapace, on each side, there is a very short and transverse groove or narrow constriction, which may possibly be confluent with the neck-furrow on the strongly curved lateral margins of this part of the carapace. The exact outline of the anterior margin of the carapace cannot be ascertained, and the tip of the rostrum is broken off. The basal portion which remains is about seven or eight millimetres long. At the base it measures 5 mm. in breadth, and at the broken anterior extremity its breadth is 2 mm. Its outer margins are defined by two linear and acute, tuberculated, and raised longitudinal ridges, between which the surface is smooth and concavely excavated.

"The whole of the outer surface of the carapace is ornamented by rather distant, isolated tubercles. In its posterior moiety these tubercles are somewhat irregularly disposed, though there is a low, very narrow, and rather inconspicuous keel on the median line, on

either side of which the cardiac region is comparatively smooth. On the anterior portion of the carapace the tubercles are grouped somewhat obscurely in two or three longitudinal rows on both sides of the narrow median keel, which is continued with greater or less distinctness up to the commencement of the rostrum.

"The anterior chelæ appear to have been short and robust, while their surface is distinctly tuberculated. The portions of the posterior ambulatory legs that happen to be preserved, on the other hand, are very slender, and their surface is minutely granulated. The abdominal segments are badly preserved, but their outer surface seems to have been smooth, though a narrow median keel can be traced throughout the greater part of their dorsal surface.

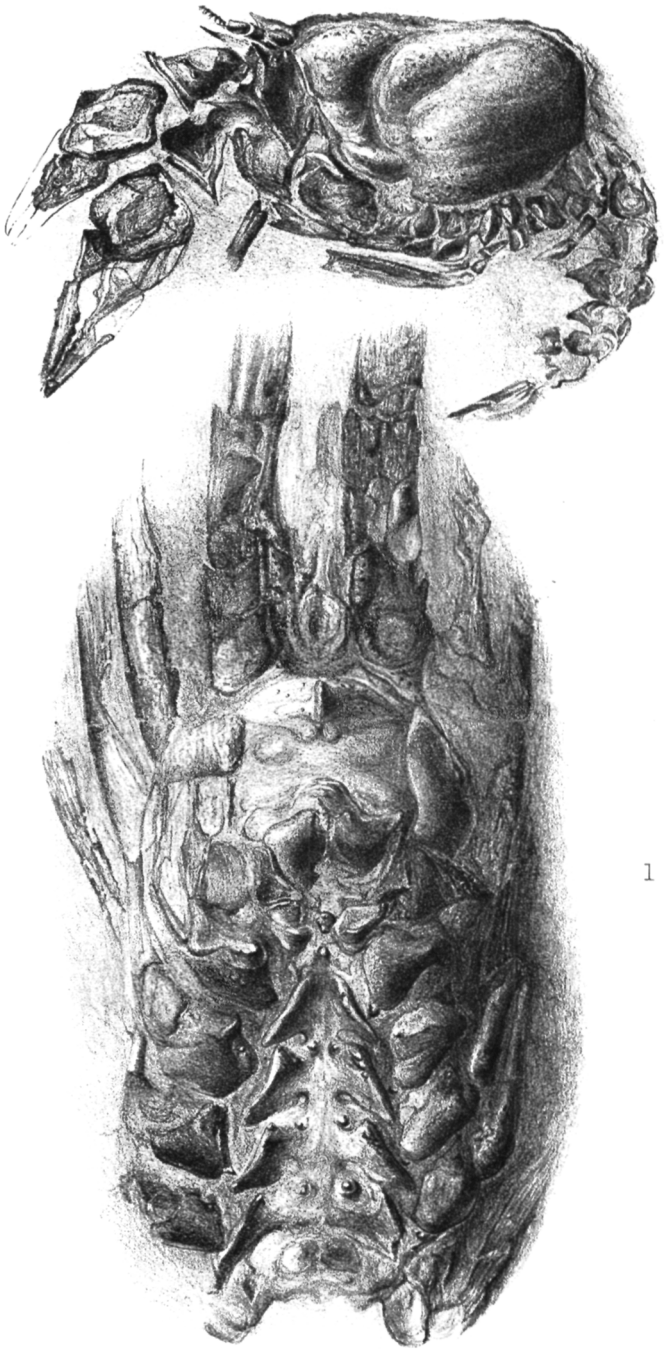
"Locality: Sounding Creek, Township 30, Range 8; west of the 4th Principal Meridian, 1886.

"At the same locality and date, five detached chelæ, apparently of a second species of decapod Crustacean, were collected in as many concretionary nodules. These claws resemble those of *P. ornatus* in the comparative shortness and robustness of their terminal segments, but the outer surface of the latter is finely granulated rather than coarsely tuberculated."

ERYMA DAWSONI, H. Woodw., sp. nov. (Pl. XVI, Fig. 2.)

Among the specimens which form a second collection sent by Dr. J. F. Whiteaves (24th September, 1898) from the Geological Survey of Canada, is the half of a nodule containing an Astacidean from the Upper Cretaceous of the north-east side of Hornby Island, British Columbia, collected by Mr. J. B. Bennett in 1898 (No. 55D).

The Crustacean is seen in profile on the split surface of a nodule, and exhibits the cephalothorax, with its stout pair of chelate limbs (or forceps) attached, and the remains of the four pairs of succeeding ambulatory legs, the six abdominal somites, and the telson, but the lateral lobe of the tail-fin was probably preserved in the other half of the nodule not sent. The branchiostegite (covering the branchiæ) is broad and tumid, and the branchiocardiac groove is strongly marked. Starting from the median dorsal line as a V-shaped furrow, about 12 millimetres from the posterior border, it bends rapidly forward, becoming deeper on each side, and reaches the lateral border 24 mm. in advance; here it unites, close to the hepatic lobe, with the equally deep but more transverse cervical furrow, which crosses the carapace 10 mm. nearer to the front. In advance of the cervical groove the postorbital ridge and spine can be seen, also the base of one of the antennules, with part of one of its flagella, beneath the somewhat short rostrum, and lower down the base of one of the outer and larger antennæ. The surface of the branchiostegite is marked by numerous small tubercles scattered irregularly over the surface. The branchial, cardiac, and hepatic regions are also similarly tuberculated, and very tumid. Length of carapace 48 mm., depth of side 25 mm. The ambulatory limbs are fairly long and slender; the chelate limbs measure about 60 mm. in length; length of penultimate



G.M. Woodward & H.B. Potter. West, Newman imp.

Decapod Crustaceans
U. Cretaceous Comox & Hornby Id. B.C.

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joint 35 mm., breadth 15 mm., length of ultimate joint 20 mm. The fingers are long and slender, the inner edge of the forceps being denticulated; wrist 6 mm. long by 10 mm. broad. The epimeral border of each abdominal segment is falcate in contour.

The general form and details of this Crustacean, so far as preserved, clearly mark its place among the Astacidea, or under the Astacomorpha (as defined by Huxley, 1881), and I would suggest that Oppel's name of *Eryma* is appropriate for it, seeing that it agrees very closely in the divisions of its carapace and its tuberculated surface, in the antennæ, the form of the first pair of forcipated chelæ, and the proportions of its abdomen, with *E. Perroni* and other Jurassic species.

Oppel observes[1] that no examples of the genus *Eryma* have been found in rocks younger than the Jurassic, and that the Astacidæ of the Chalk are placed in McCoy's genera *Hoploparia* and *Enoploclytia*, but in this instance the form in question agrees much more closely with Oppel's genus *Eryma* than with other forms. I therefore propose to relegate it to that genus, and to designate it by the specific name of *Dawsoni*, in honour of Dr. G. M. Dawson, C.B., F.R.S., the eminent Director of the Geological Survey of Canada, who has done such splendid work in the field in mapping the geology of British Columbia.

EXPLANATION OF PLATES XV AND XVI.

(All from the Upper Cretaceous formation, and drawn of the natural size.)

PLATE XV.

FIG. 1. *Linuparus Vancouverensis*, Whiteaves. Dorsal aspect of cephalothorax, showing some of the ambulatory legs. Puntledge or Comox River, Vancouver Island, British Columbia.

,, 2. *Linuparus Vancouverensis*. Hornby Island. Shows cephalothorax and abdomen united and smaller walking limbs.

,, 3. *Linuparus Vancouverensis*. Comox River. Shows inner surface of thorax, with the mandibles (*m.*) and the walking-legs; also bases of the antennules and upper surface of abdominal somites.

PLATE XVI.

FIG. 1. *Linuparus Canadensis*, Whiteaves. Under side of cephalothorax.

,, 2. *Eryma Dawsoni*, H. Woodw. Hornby Island. Specimen imbedded in a nodule seen in profile. Geological Survey Museum, Ottawa.

(*To be continued.*)

III.—FOSSIL MAMMALIA FROM EGYPT. Part II.

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

IN addition to the remains of the large Anthracotheroid (*Brachyodus africanus*) described in the first part of this paper (GEOL. MAG., Dec. IV, Vol. VI, 1899, p. 481), the collection of mammalian bones from the Lower Miocene of Moghara also includes portions of the skeleton of a small rhinoceros. Unfortunately this is very poorly represented, there being only an incomplete scapula and an atlas vertebra, and in the absence of any portion of the skull or teeth it is impossible to determine the species to which it may have belonged. As was pointed out in Part I, the age of the deposit is Burdigalien (Lowest Miocene), and it is therefore contemporary with the Sables de l'Orléanais and the fresh-water deposits of

[1] Palaeontol. Mittheilung., 1862, p. 22.

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No. X.—OCTOBER, 1900.

ORIGINAL ARTICLES.

I.—Further Notes on Podophthalmous Crustaceans from the Upper Cretaceous Formation of British Columbia, etc.

By Henry Woodward, LL.D., F.R.S., F.G.S., of the British Museum (Natural History).

(PLATE XVII.)

(*Concluded from the September Number, p.* 401.)

Hoploparia Westoni, sp. nov. (Pl. XVII, Figs. 1*a*, *b*, *c*.)

Among other specimens received from the Geological Survey of Canada are the fragmentary remains of a Crustacean (enumerated in Dr. Whiteaves' list as No. 10), comprising the abdomen (*a*), a small part of a carapace (*b*), and the penultimate joint of one of the chelate fore-limbs (*c*), occurring in detached fragments (probably parts of a concretionary nodule). They are labelled Red Deer River, Alberta Range 15, Township 23, west of the 4th principal meridian; collected by Mr. T. C. Weston, 1889. Although in so fragmentary a condition these specimens are of much interest, and are characteristic in their details.

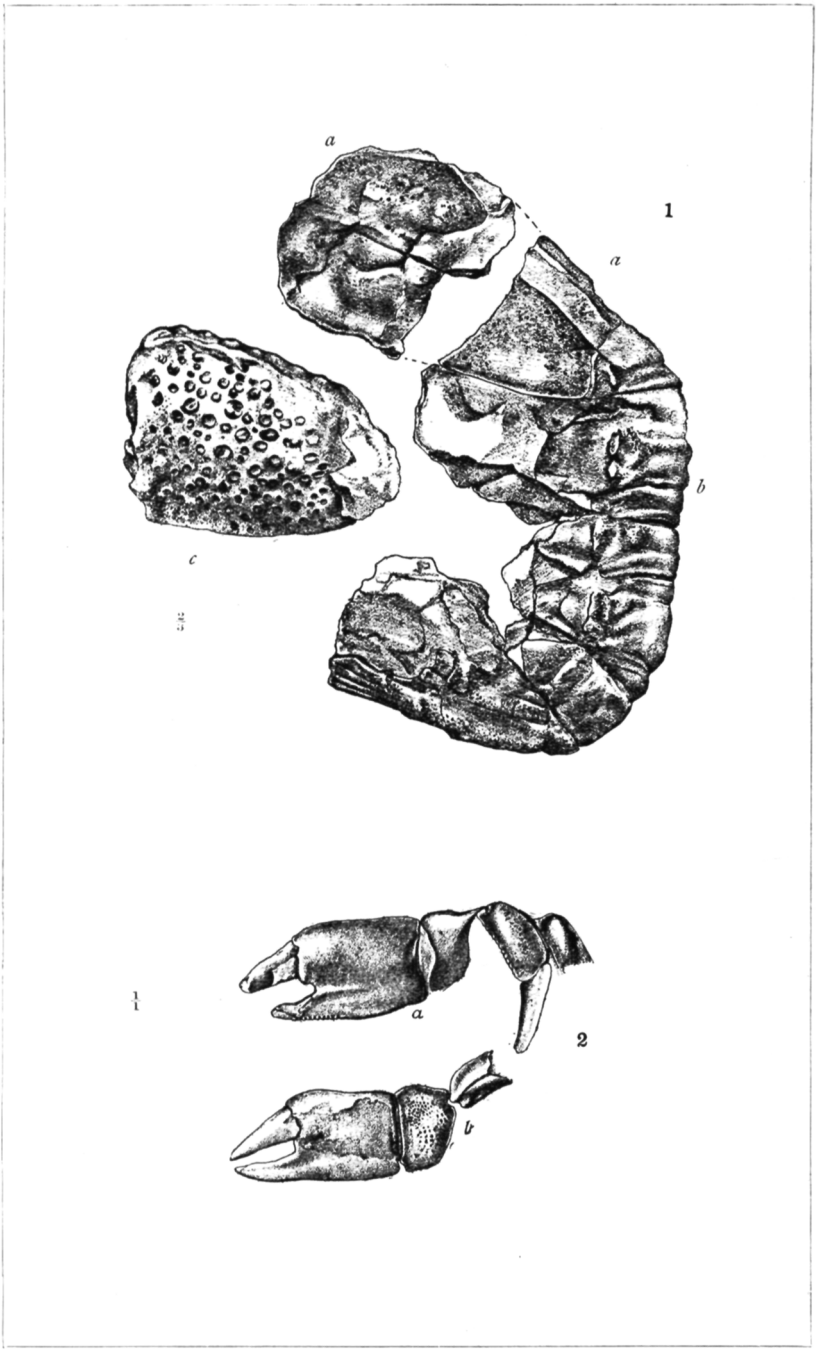
The abdominal segments are united and display the characteristic markings and raised ridges on the segments seen in the living *Nephrops Norvegicus* and in *Hoploparia Saxbyi* and other English Cretaceous forms. The epimeral portions of each segment are roundly falcate, and divided from the tergum by a well-marked ridge. The sixth segment and the telson are more rugose and marked by parallel ridges. The cephalothoracic portion is too obscure for description; the surface is tuberculated. The penultimate joint of the great claw is very coarsely and strongly tuberculated, as much so as in *Enoploclytia* and in *Hoploparia scabra*.

Length of abdomen (measured along dorsal line), $5\frac{1}{2}$ inches; width over third segment, $2\frac{1}{4}$ inches. Length of penultimate segment of great claw, $2\frac{1}{4}$ inches; breadth, 2 inches.

I have designated this form as *Hoploparia Westoni*, after the discoverer. The specimen is from the Upper Cretaceous of the North-West Territories.

Hoploparia Bennetti, sp. nov.

This species is based on a very imperfectly preserved specimen, No. 5 in list, contained in a dark nodule (measuring 5″ × 2″) split



G. M. Woodward del. S. Austin & Sons imp.

Cretaceous Crustacea, N.W. Territory of Canada.

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in halves very irregularly, and exposing the dorsal aspect of five posterior abdominal somites and the telson with two swimmerets on the left side still attached. The abdominal segments are smooth, and the epimera broadly falcate and pointed as in *Homarus*. Length of five abdominal segments, 40 mm.; length of telson, 13 mm.; breadth of abdomen, 25 mm.

The sternites are still attached to the abdomen, but the carapace has been removed, exposing the inner and upper surface of the cephalothorax, with the bases of five pairs of ambulatory appendages still attached. Length of cephalothoracic portion, 30 mm. Some of the small ambulatory legs on the left side are preserved nearly to their extremities, and the bases of the large (chelate) fore-legs can also be seen, one joint of which shows a tuberculated surface. Length of base of area of sternites, 25 mm.; greatest breadth, 15 mm. There is no trace whatever of the presence of large palinurid antennæ. This and the general character of the thoracic appendages and the form of the abdomen, resembling the modern *Homarus* rather than *Palinurus*, lead me to refer this fossil to the genus *Hoploparia*. I have added the specific name of *Bennetti* after its discoverer.

Formation: Upper Cretaceous.

Locality: Comox River; collected by Mr. J. Bennett in 1895.

ENOPLOCLYTIA MINOR, sp. nov.

The evidence for this species consists of a nodule (4″ × 3″, No. 9 in Dr. Whiteaves' list, marked also 59 in white paint) split into two parts, but affording little comfort to the investigator. One can make out an imperfectly preserved carapace (cephalothorax), with a tuberculated surface from which two pairs of imperfectly preserved antennæ take their origin and the flagella of which can be indistinctly traced. These are followed by a pair of long and slender chelate appendages, with finely tuberculated surfaces, the fingers of the forceps being very attenuated as in *Enoploclytia Leachii*. Two pairs of slender ambulatory legs follow; these also have forcipated or chelate extremities. The abdominal segments are narrow and only imperfectly preserved.

The specimen is from the Upper Cretaceous of Hornby Island, and was obtained by Mr. W. Harvey in 1893.

MEYERIA? HARVEYI, sp. nov.

The evidence of this species rests on a single specimen exposed on the half of a fractured nodule ($3\frac{1}{2}$ inches × $2\frac{1}{2}$ inches), marked No. 8 in list. It is also marked 3 in ink. It was obtained by Mr. W. Harvey in 1895 at Hornby Island, and shows the remains of the abdominal somites and the long slender rugose fore-limbs of the cephalothorax ($2\frac{1}{4}$ inches in length by $\frac{1}{8}$ inch in thickness). They do not appear to have possessed forceps at their extremities, but were monodactylous. The form of the epimera of the abdomen agrees with *Meyeria vectensis* in shape.

From the Upper Cretaceous. Named after its discoverer, Mr. W. Harvey.

DECAPODA—BRACHYURA—CALLIANASSIDÆ.

CALLIANASSA, Leach, 1814.

CALLIANASSA WHITEAVESII, H. W., 1896. (Pl. XVII, Figs. 2*a*, *b*.)
Quart. Journ. Geol. Soc., vol. lii, p. 223, figs. 1, 2.

In addition to the Macrouran Decapods already noticed as received from Dr. J. F. Whiteaves, F.G.S., on behalf of the Geological Survey of Canada, I find the following:—

No. 2. Nodule in four pieces collected by the Rev. G. W. Taylor on the Puntledge or Comox River, Vancouver Island, in 1889.

The four parts of this nodule display on the split surfaces the remains of a *Callianassa*, or possibly parts of two individuals, but so broken up and detached as to be difficult to describe. The large fore-limbs are seen (in parts), and the smaller limbs and segments of the abdomen are also present, but in a very fragmentary state. These, no doubt, are referable to one and the same species, viz. *Callianassa Whiteavesii* (see Q.J.G.S., 1896, vol. lii, p. 223, figs. 1, 2).

Formation: Upper Cretaceous.

Locality: Comox River, Vancouver Island.

No. 11. Eight portions of nodules (*a* and *b*, *c* and *d* being counterparts; *e* and *f* are halves of distinct nodules; *g* and *h* are pieces of the rock itself, not nodules). *a* and *b*, *c* and *d*, *e* and *f* display the well-preserved flattened chelate hands of *Callianassa Whiteavesii* (Pl. XVII, Figs. 2*a*, *b*); *g* contains a fragment of a hand; *h* is not a Crustacean fragment, but an undoubted fish-bone.

All these specimens are from the North-West Territory, Township 30, Range 8, west of 4th principal meridian, and were collected by Mr. J. B. Tyrrell, F.G.S. (May 25th, 1886).

NOTE ON NORTH AMERICAN CRETACEOUS SPECIES OF *Callianassa*.

Dr. J. F. Whiteaves calls my attention to a paper by Mr. W. M. Gabb in the Geological Survey of California, vol. i, Palæontology (1864, 4to), Section iv, Description of the Cretaceous Fossils, p. 57, pl. ix, figs. 1*a*, *b*, *c*. Here Mr. Gabb describes and figures three small Crustacean fragments, under the name of *Callianassa Stimpsoni*, from Chico Creek and Clayton Contra Costa County, and also found near Canada de las Uvas from both divisions of the Californian Cretaceous. Pl. ix, fig. 1*a*, is correctly described as three segments of abdomen, and may very likely belong to a *Callianassa*, but figs. 1*b* and *c* are pieces of an ornamented chela and do not agree with any known *Callianassa*. *Callianassa Stimpsoni* may therefore properly remain on the list represented by fig. 1*a*, but the other figures do not belong to the same Crustacean, and should be separated from it in future. The chela may even have belonged to a Brachyuran decapod.

EXPLANATION OF PLATE XVII.

FIG. 1.—*Hoploparia Westoni*, H. Woodw., sp. nov. Upper Cretaceous: Red Deer River, Alberta Range, North-West Territories. (*a*) Parts of carapace or cephalothorax; (*b*) the segments of the abdomen; (*c*) the penultimate joint of one of the chelate fore-limbs. (One-third less than nat. size.)

FIG. 2.—*Callianassa Whiteavesii*, H. Woodw., 1896. Upper Cretaceous: North-West Territory. (*a*) Shows a complete fore-limb with its five-jointed chela; (*b*) another example with three joints united. (Drawn nat. size.)