



Title	Two New Decapod-Species from the Upper Cretaceous Deposits of Hokkaido, Japan
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Citation	Journal of the Faculty of Science, Hokkaido Imperial University. Ser. 4, Geology and mineralogy, 1(2), 207-214
Issue Date	1931-09
Doc URL	http://hdl.handle.net/2115/35741
Type	bulletin (article)
File Information	1(2)_207-214.pdf



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TWO NEW DECAPOD- SPECIES FROM THE UPPER
CRETACEOUS DEPOSITS OF
HOKKAIDO, JAPAN

By

Takumi NAGAO

With 1 Plate

A species of Brachiura Crustacea from the Upper Ammonites Beds (Senonian) of Hokkaidô was described by Prof. K. JIMBO who named it *Eucorystes japonicus*⁽¹⁾. Another Palinurid crab is now known⁽²⁾ to occur in the same deposits and, though not yet described in detail, its close affinity with a Canadian form, *Linuparus vancouverensis* (WHITEAVES)⁽³⁾ was noted. Lately the author obtained two species of Decapoda from the Ishikari coal field collected by Mr. R. SAITO, a student of our Department of Geology and Mineralogy in Sapporo. One of them is identical with the *Linuparus*-species above cited and, on a close examination, is known to be distinct from that Canadian form, while the other which was derived from the *Trigonia* Sandstone (Cenomanian) is also new to science and remarkably akin to *Eucorystes japonicus* JIMBO.

Genus *Notopocorystes* M'COY, 1849

(*Palaeocorystes* BELL, 1862)

subgenus *Eucorystes* BELL, 1862

Notopocorystes was established by F. M'COY⁽⁴⁾ on *N. mantelli* M'COY⁽⁵⁾ from the Gault and Upper Greensand of England; this species was

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- (1) K. JIMBO: Beiträge zur Kenntnis der Kreideformation von Hokkaidô. Palaeont. Abh., New Ser., Vol. II, 1894, p. 191, Pl. IX, fig. 7.
 - (2) H. YABE: Cretaceous Stratigraphy of the Japanese Islands. Sci. Rep. Tôhoku Imp. Univ., Second Ser., Vol. IX, 1927, p. 46.
 - (3) J. F. WHITEAVES: Mesozoic Fossils, Vol. I, pt. 5, 1903, p. 323, Pl. XL, figs. 1-3.
 - (4) F. M'COY: On the Classification of some British Fossil Crustacea, with Notes of new Forms in the University Collection at Cambridge. Ann. Mag. Natur. Hist., Second Ser., Vol. IV, 1849, p. 169.
 - (5) F. M'COY: Ibid., p. 170, text-figs.

figured by G. MANTELL⁽⁶⁾ in 1822 under the name of *Corystes* sp. and later (1844) named by the same author *C. stokesii*⁽⁷⁾ to which M'COY's species is synonymous. The second species ascribed by M'COY to this genus is *N. carteri* M'COY⁽⁸⁾ from the Upper Greensand of Cambridge, England. On the basis of the misunderstood structure of the hind legs and abdomen, M'COY put this genus in *Anomura* instead of placing it adequately in *Brachiura*, and consequently this generic name was abandoned by T. BELL⁽⁹⁾ who proposed *Palaeocorystes* for *N. stokesii*. BELL's name was used by H. WOODWARD,⁽¹⁰⁾ M. J. RATHBUN,⁽¹¹⁾ S. KINGSLEY and J. M. CLARKE,⁽¹²⁾ and K. A. ZITTEL.⁽¹³⁾ It seems to me, however, there is no reason why *Palaeocorystes* must replace *Notopocorystes*, notwithstanding the incorrect systematic position, the latter having been published thirteen years earlier than the former.

As to the second form of M'COY, BELL⁽¹⁴⁾ paid his attention to its distinctiveness from the type species and established a new genus *Eucozystes* in 1862. This genus was accepted by WOODWARD,⁽¹⁵⁾ KINGSLEY and CLARKE,⁽¹⁶⁾ and ZITTEL,⁽¹⁷⁾ but was redeposited by K. BEURLEN⁽¹⁸⁾ in *Notopocorystes*. The most distinctive features of *Eucozystes* from *Palaeocorystes* enumerated by BELL seem to be 1) the more square and less convex carapace, 2) the different sculpture of the cephalic arch, which is composed in *Eucozystes* of numerous and complicate sulci separating the distinct regions, while it consists in *Palaeocorystes* of numerous large tubercles and raised and round-topped regions, and 3) the extremely large size of the orbital cavities. These differences are

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- (6) G. MANTELL: Geol. of Sussex, 1822, pl. XXXIX, figs. 15, 16.
 (7) T. BELL: A Monograph of the Fossil Malacost. Crust. of Great Britain. Palaeontogr. Soc. London, 1862, II, Crustacea of the Gault and Greensand, p. 15.
 (8) F. M'COY: On some new Cretaceous Crustacea. Ann. Mag. Natur. Hist., Second Ser., Vol. XIV, 1854, p. 118, Pl. IV, fig. 3.
 (9) T. BELL: Op. cit., 1862, p. 11.
 (10) H. WOODWARD: On some Podiphalmous Crustacea from the Cretaceous Formation of Vancouver and Queen Charlotte Islands. Quart. Jour. Geol. Soc. London, Vol. LII, 1896, p. 225.
 (11) M. J. RATHBUN: The Fossil Stalk-eyed Crustacea of the Pacific Slope of N. America. Smith. Inst., U.S. Nat. Hist., Bull. 133, 1926, p. 101.
 (12) ZITTEL-EASTMAN: Text-Book of Palaeontology, Vol. I, 1913, p. 765.
 (13) K. A. ZITTEL: Handbuch der Palaeontologie, Abt. I. Bd. II, 1881-1885, p. 706.
 (14) T. BELL: Op. cit., 1862, p. 17.
 (15) H. WOODWARD: Op. cit., 1896, p. 225.
 (16) ZITTEL-EASTMAN: Op. cit., 1913, p. 765.
 (17) K. A. ZITTEL: Op. cit., 1881-1885, p. 705.
 (18) K. BEURLEN: Vergleichende Stammesgeschichte, Grundlagen, Methoden, Probleme unter besonderer Berücksichtigung der höheren Krebse. Fortschr. der Geol. u. Palaeont., Bd. VIII, Heft 26, 1930, p. 365.

well marked as far as *P. stokesii* and *E. carteri* are concerned. *Palaeocorystes broderippi* (MANTELL)⁽¹⁹⁾ from the Gault of England which belongs to *Notopocorystes* of M'COY, however, is intermediate between the above two species in several features, though more closely related to *N. stokesii*. Under this condition, the present author believes that *Eucorystes* had better be regarded as a subgenus rather than a genus distinct from *Notopocorystes*.

Notopocorystes (Eucorystes) intermedius nov.

Pl. XIV, Figs. 4, 4a.

Dimensions of the carapace: 27 mm. from the posterior margin to the anterior end excepting the rostrum which is missing; greatest breadth across the hepatic region approximately 22 mm.

Carapace moderately convex, rather smooth and finely granulated all over the surface, the granulation being most prominent on the lateral edges of the branchial regions; suboval in outline, anterior portion broader and the posterior gradually narrowed with the slightly convex lateral borders. Antero-lateral borders ornamented each with two tubercles, beside a smaller one at the junction of this border with the postero-lateral. Frontal border imperfectly preserved, devoid of any developed tubercles except that at the outer angle, which is large and prominent. Orbital cavities moderately large with two fissures above. Posterior end truncated with a short and slightly curved margin.

Regions of the carapace distinct, almost flat and separated by numerous distinct and well developed sulci of about equal width and symmetrically arranged. Metagastric region dagger-shaped, with two small tubercles; the anterior process of the dagger represents the blade, extending forwards to the front. There is a round, slightly raised tubercle on either side near the antero-lateral angle.

The present species is represented by an imperfect carapace without the lower surface. It is in many points intermediate between *Notopocorystes broderippi* (MANTELL)⁽²⁰⁾ from the Gault, and *N. (Eucorystes) carteri* M'COY⁽²¹⁾ from the Upper Greensand, both of England,

(19) G. MANTELL: Op. cit., 1822, Pl. XXIX, figs. 9, 10. T. Bell: Op. cit., 1862, p. 14, Pl. II, figs. 8-13.

(20) G. MANTELL: Geology of Sussex, 1822, Pl. XXIX, figs. 9, 10. T. Bell: Op. cit., 1862, p. 14, Pl. II, figs. 8-13.

(21) F. M'COY: Op. cit., 1854, p. 118, Pl. IV, fig. 3. T. Bell: Op. cit., 1862, p. 17, Pl. II, figs. 14-17.

though it stands more closely to the latter. It is more convex than the second of these English species but more depressed than the first, and more oval than *E. carteri* in outline and somewhat similar to *N. broderippi*. The size of the orbital cavities in our specimen is smaller than M'COY's form, being as large as that of MANTELL's, while its surface sculpture is quite identical with that of M'COY's species.

The new species under consideration closely resembles *N. (E.) japonicus* (JIMBO)⁽²²⁾ from the Senonian Upper Ammonites Beds, but differs in having a more oval and posteriorly more narrowed carapace. The former is provided with two tubercles on each of the antero-lateral borders and another one at the antero-lateral angle.

From the Lower Cretaceous of the Vancouver Islands we have a species of this type, *N. harveyi* (WOODWARD)⁽²³⁾. This Canadian form is similar to *N. broderippi* and is consequently easily distinguished from ours.

Locality and geological horizon: The *Trigonia* Sandstone exposed at a point about 3 km. southeast of the Ikushumbets colliery and along the Ikushubets, Province of Ishikari, Hokkaidô. R. Saito coll.

Genus *Linuparus* A. WHITE, 1847

The genus *Linuparus* was founded by A. WHITE⁽²⁴⁾ on *Palinurus trigonus* DE HAAN,⁽²⁵⁾ recent in Japan. In 1897 A. E. ORTMANN,⁽²⁶⁾ when he described a new Palinurid crab from the Upper Cretaceous of South Dakota, was surprised in finding a close resemblance of his fossil to the Japanese recent species and named the former *Linuparus atavus*. Besides, we know two other Cretaceous species of the sort from Canada, *Linuparus canadensis* (WHITEAVES)⁽²⁷⁾ and *L. vancouverensis* (WHITEAVES).⁽²⁸⁾ These three Northern American forms

(22) K. JIMBO: Op. cit., p. 191, Pl. IX, fig. 7.

(23) H. WOODWARD: Op. cit., 1896, p. 225, text-fig. 4.

J. F. WHITEAVES: Op. cit., 1903, p. 317.

M. J. RATHBUN: Op. cit., p. 101, Pl. XX, fig. 4.

(24) A. WHITE: List Crustacea, British Mus., 1847, p. 70.

(25) W. DE HAAN in SIEBOLD: Fauna Jap., Crustacea, 1841, p. 15, Pls. XXXIX, XL.

(26) A. E. ORTMANN: Amer. Journ. Sci., 4 Ser., Vol. IV, 1897, p. 290.

(27) H. WOODWARD: Further Note on Podophthalmous Crustaceans from the Upper Cretaceous Formation of British Columbia, etc. Geol. Mag., New Ser., Dec. 4, Vol. 7, 1900, p. 396, Pl. XVI, fig. 1.

J. F. WHITEAVES: Mesozoic Fossils, Vol. I, pt. 5, 1903, p. 325.

M. J. RATHBUN: Op. cit., 1926, p. 134, Pl. XXXV; Pl. XXXVI.

(28) H. WOODWARD: Op. cit., 1900, p. 395, Pl. XV, figs. 1-3.

J. F. WHITEAVES: Op. cit., 1903, p. 323, Pl. XL, figs. 1-3.

M. J. RATHBUN: Op. cit., 1926, p. 135, Pl. XXXVII.

were placed in *Linuparus* by H. WOODWARD⁽²⁹⁾ and J. F. WHITEAVES⁽³⁰⁾ but transferred into *Podocrates* (BECKS MS.) GEINITZ by M. J. RATHBUN.⁽³¹⁾ This latter genus with its genotype *P. dülmensis* (BECKS MS.) from the Lower Senonian of Dülmen in Westphalia, Germany, was well described by C. SCHLÜTER.⁽³²⁾ Very lately, however, K. BEURLEN⁽³³⁾ expressed his opinion on these American forms, stating as follow: "Neben weitgehenden Ähnlichkeiten bestehe aber doch gewisse Unterscheide; so sind die Abdominalpleuren der amerikanischen Formen einfach dreieckig, bei *Podocratus* aber gerundet und mehrspitzig. Ferner ist der Stiel der ausseren Antennen dünner als bei *Podocratus*. Genetische Trennung der amerikanischen Formen von *Podocratus* dürfte sonach wohl geboten sein." On the other hand, T. BELL⁽³⁴⁾ in 1857 proposed a new genus *Thenops* founded on *T. scyllariformis* BELL derived from the London Clay. This genus was considered as synonymous to *Podocrates* by SCHLÜTER and WOODWARD but as distinct by BEURLEN.

We have thus six well defined and allied species, beside an indeterminate form *Podocrates* sp. of SCHLÜTER⁽³⁵⁾ (*P. dülmensis* GEINITZ non BECKS) from the Senonian of Germany; they are

1. *Podocrates dülmensis* (BECKS MS.), type, Senonian of Germany,
2. *Thenops scyllariformis* BELL, type, London Clay of England,
3. *Linuparus vancouverensis* (WHITEAVES), Upper Cretaceous of Canada,
4. *L. canadensis* (WHITEAVES), *ibid.*,
5. *L. atavus* ORTMANN, Senonian of South Dakota, and
6. *L. trigonus* (DE HAAN), type, recent in Japan.

These species are doubtlessly closely similar to one another, if they might not all be congeneric. The *Podocrates*-species of Europe may be distinguishable from the American forms referred to *Linuparus*, as noted by BEURLEN, in several points but remarkably agree in other features. Moreover, we can not deny the presence of a close similarity

(29) H. WOODWARD: Op. cit., 1900, pp. 394, 396.

(30) J. F. WHITEAVES: Op. cit., 1903, pp. 323, 325.

(31) M. J. RATHBUN: Op. cit., 1926, pp. 134, 135.

(32) C. SCHLÜTER: Die Decapoden der Senon- und Cenoman-Bildungen Wesphalens. Zeits. der deut. geol. Gesell., Vol. XIV, 1862, pp. 710-716, Pl. XII, figs. 1-3.

(33) K. BEURLEN: Op. cit., 1930, p. 342.

(34) T. BELL: Op. cit., I. Crustacea of the London Clay, 1857, p. 33, Pl. VII, figs. 1-6.

(35) C. SCHLÜTER: Op. cit., 1862, p. 712.

between *L. atavus* and the Japanese recent form, the only important difference being, according to ORTMANN,⁽³⁶⁾ in the frontal horns which are laterally compressed in the North American species and depressed in the recent one.

In most of our specimens there are not preserved the antennae, antennulae or rostrum which are all very useful for the generic discrimination. There is only one of them in which these organs are partly visible but deformed very much and we can not see any conclusive features. Consequently it is impossible to add any new material concerning the generic position of the present species, though it is certainly related to *L. atavus* as well as to *L. trigonus*. Under these circumstances, the writer is forced to place our species, for a while, in *Linuparus*, urgently wishing that some further materials would settle this question.

Linuparus japonicus nov.

Pl. XIV, Figs. 1, 1a, 2, 2a, 3.

1926. *Linuparus* cf. *vancouverensis* YABE: Geology of the Ikushumbets Coal-Mining District. Guide-Book A-2, the Third Pan-Pacific Scientific Congress held in 1926, p. 14.
1927. *Linuparus* cf. *vancouverensis* YABE: Cretaceous Stratigraphy of the Japanese Islands. Sci. Rep. Tôhoku Imp. Univ., Second Ser., Vol. IX, p. 146.
1930. *Linuparus* sp. (pars.) SAEKI and SASA: On the Kuji Formation of the Province of Rikuchû. Jour. Geol. Soc., Tôkyô, Vol. XXXVII, p. 313.

Carapace flattened, nearly rectangular, much longer than broad, divided by an obtusely subangular and broad cervical groove, and covered all over with numerous small granules and pits. Frontal margin truncated, with two front horns which are broken but apparently compressed laterally and divergent forwards and outwards. Scapular arch provided with three rather prominent, subequal and tuberculate longitudinal keels, terminating each anteriorly in a large pointed tubercle. Cephalic arch with well developed lateral keels which are curved and disappear towards the anterior margin and are ornamented by large tubercles; of these tubercles one near the

(36) A. F. ORTMANN: Op. cit., 1897.

posterior end and that at about the midlength of the arch are slightly larger than the others. At the median portion of the cephalic arch, just in front of the cervical groove, are two narrow ridges slightly curved, convergent anteriorly, and surrounding a depressed somewhat lanceolate area; these ridges, extend from the margin of the cervical groove to the midlength of the arch, each ornamented with a single row of small tubercles, among which two situated at the anterior margin and at about the midlength of the ridge are larger than the others. There is another tubercle in front of this area in the median line of the arch, with another smaller one still in front. At the anterior part of the arch are four other tubercles still larger, forming a trapezoid which is much greater than the above described lanceolate area behind; of these tubercles two anterior are situated on the anterior margin and form the frontal horns. Near the posterior margin of the carapace is a deep, narrow and curved groove. Antero-lateral angle ornamented with a prominent and sharp tubercle, while the lateral margins are devoid of any prominent ones.

Lower surface partly visible; sternum forming a rather broad and somewhat triangular area; each sternite smooth without tubercles. Mandibles strong. Walking feet slender. Abdominal segments broad, without well developed lateral keels. The sixth segment semicircular in outline and devoid of a keel. Abdomen minutely granulated all over except the central keel which is ornamented with a series of small tubercles. Abdominal pleurae subtriangular, with the posterior margin minutely serrated but the anterior margin smooth.

The present species has been long known under the name of *Linuparus* cf. *vancouverensis* (WHITEAVES). Two specimens derived from Hokkaidô are before the author; one of them consists of the greater part of the carapace showing the under surface of the cephalothorax in part, some basal segments of the walking feet, and two anterior abdominal segments. The other preserves the posterior five segments of the abdomen but imperfectly exhibits the carapace.

A few years ago, Messrs. S. SAEKI and Y. SASA collected, together with other fossils, some specimens of crab from the Senonian of the Kuji district in the Province of Rikuchû, and among them they distinguished two different species, *Linuparus* a sp. and *L.* b sp. Two specimens of the former which is specifically identical with the present form, were kindly submitted to the author by Mr. SASA. One of them, figured in Pl. XIV, fig. 3, represents only a small part of the carapace. The other is more perfect but the greater part of the body is invisible, being concealed in the matrix and deformed very much.

The present species differs from *L. trigonus* (DE HAAN)⁽³⁷⁾ in having laterally compressed frontal horns, a slightly longer cephalic arch, and smaller tubercles on the antero-lateral margins. The abdominal pleurae are trigonal and ornamented with small serrations only on the posterior margin in ours, while they are somewhat quadrate and have three or four large and prominent processes in the recent form. Our species is distinguished from most of the allied forms by its relatively longer cephalic arch measured along the median line, thus approaching to *L. atavus* (ORTMANN)⁽³⁸⁾ from the Senonian of South Dakota. This Dakota form, however, has abdominal segments with three keels which are moreover, tuberculated. On the sternite there are two tubercles in the American form and none in ours. Furthermore, the new species has a sculpture of the cephalic arch different from that of *L. vancouverensis* (WHITEAVES)⁽³⁹⁾ from the Upper Cretaceous of Canada, to which it was formally referred.

Localities and geological horizons: The *Scaphites* Bed of the Upper Ammonites Beds (Senonian) exposed along the Pombets, a tributary of the Ikushumbets, Province of Ishikari, Hokkaidô. R. SAITO coll. The Kunitan Beds (Senonian) of the Kuji Cretaceous developed along the railway cutting at Kunitan near Kuji, Province of Rikuchû. Y. SASA coll.

Here the present author expresses his cordial thanks to Prof. H. YABE of the Institute of Geology and Palaeontology in Sendai for his valuable advice and the kind permission for the free use of his private library.

(37) W. DE HAAN in SIEBOLD: Op. cit., 1847, p. 157, Pls. XXXIX, XL.

(38) A. E. ORTMANN: Op. cit., 1897, p. 290, figs. 1-3.

(39) H. WOODWARD: Op. cit., 1900, p. 395, Pl. XV, figs. 1-3.

J. F. WHITEAVES: Op. cit., 1903, p. 323, Pl. XL, figs. 1-3.

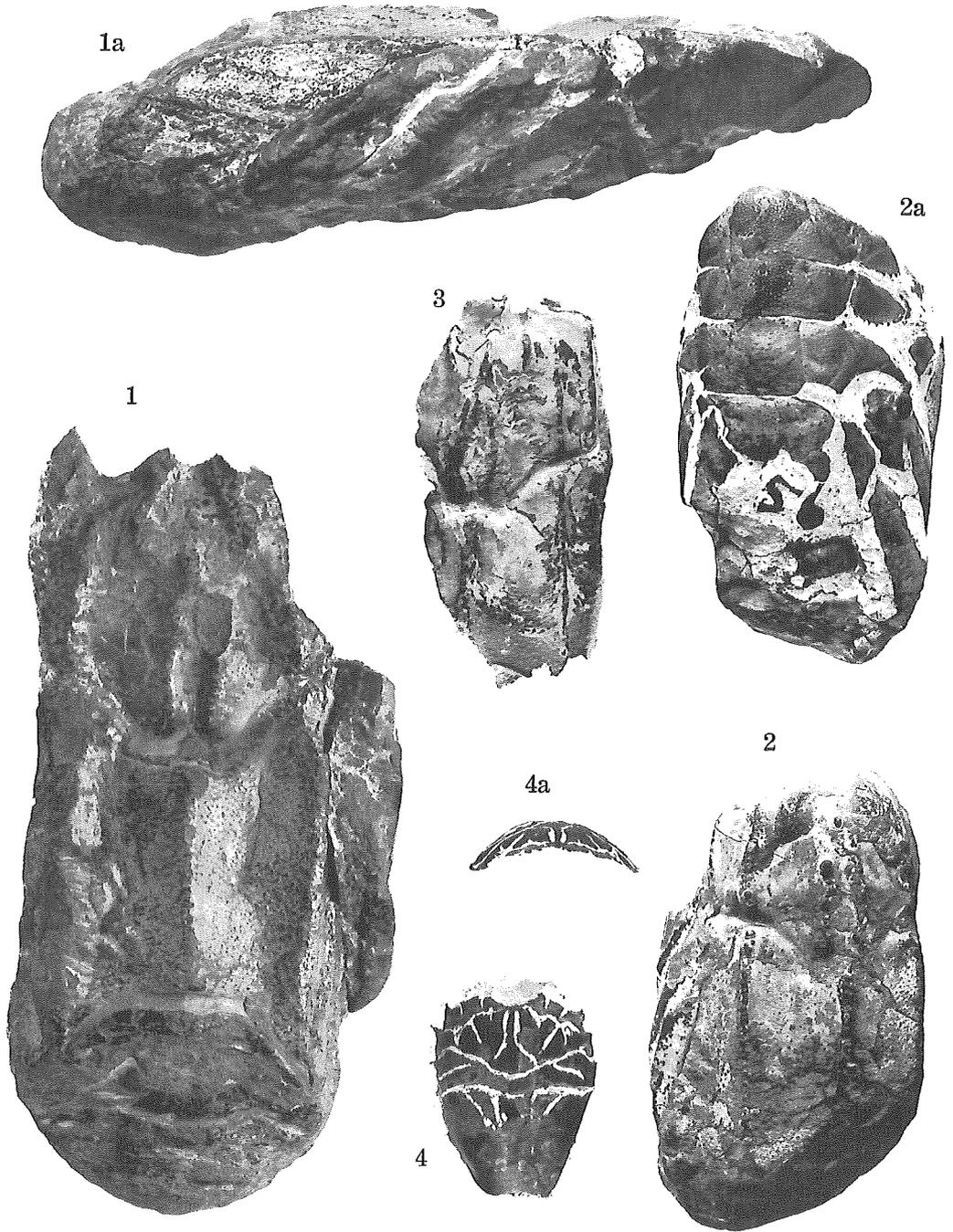
M. J. RATHBUN: Op. cit., 1926, p. 135, Pl. XXXVII.

Plate XIV

PLATE XIV.

(All figures are of natural size.)

- Figs. 1, 1a. *Linuparus japonicus* NAGAO. The Upper Ammonites Beds exposed along the Pombets, a tributary of the Ikushumbets, Province of Ishikari, Hokkaidô. 1, a dorsal view of a carapace; 1a, a lateral view of the same.
- Figs. 2, 2a. *Linuparus japonicus* NAGAO. Ibid. 2, a dorsal view of a carapace; 2a, dorsal view of an abdomen of the same individual.
- Fig. 3. *Linuparus japonicus* NAGAO. The Kunitan Beds; Kunitan near Kuji, Province of Rikuchû. A dorsal view of a carapace.
- Figs. 4, 4a. *Notopocorystes (Eucorystes) intermedius* NAGAO. The *Trigonia* Sandstone exposed along the Ikushumbets, Province of Ishikari, Hokkaidô. 4, a dorsal view of a carapace; 4a, a frontal view of the same.



Mashiko photo.