

Report of the Biological Survey of Mutsu Bay.
22. Brachiopods of Mutsu Bay.¹⁾

By

ICHIRO HAYASAKA, *Rg. H.*

Professor of Geology and Palaeontology, Taihoku Imperial University, Taiwan.

(With Plates I-II).

(Received Oct. 16th, 1931).

INTRODUCTORY.

This paper is intended to describe the Brachiopods of Mutsu Bay, collected by Prof. HÔZAWA and other members of the Biological Institute of the Tôhoku Imperial University. The valuable material was sent to me more than half a year ago. Owing, however, to the unsatisfactory library, I could not but wait some time for some publications to arrive. It is of great pleasure to have been able to study such a collection, and I appreciate very much this privilege given me by Prof. HÔZAWA. My thanks are also due to Prof. HIRASAKA, of the Zoological Department, Taihoku Imperial University, for the loan of several important monographs and journals concerning the subject of this study.

The numerous specimens sent to me were preserved in alcohol. Beside these, there have been in my possession a number of dried specimens mostly from the same district as the former. These latter have been useful for this study, because the loops are often very well preserved in them.

The following is the list of species identified :

1. *Lingula nipponica* HAYASAKA.
2. *Hemithyris psittacea* GMELIN var. *woodwardi* ADAMS.
3. *Terebratulina* sp. indet.
4. *Terebratalia coreanica* ADAMS & REEVE.
5. *Coptothyris grayi* (DAVIDSON) subsp. *aomoriensis*, HAYASAKA.
6. *Laqueus rubellus* SOWERBY.

Of these six, *Terebratalia* and *Coptothyris* are quite common, while *Laqueus* and *Hemithyris* are represented by a smaller number of specimens :

¹⁾Contributions from the Marine Biological Station, Asamushi, Aomori-ken. No. 76.

Lingula and *Terebratulina* are not more than three and one, respectively.

Terebratalia coreanica is rather wide-spread in the seas around Japan, and is also found as fossil at several places in Japan. *Coptothyris grayi* subsp. *aomoriensis* has not hitherto been recorded, but it seems to be rather common in the northern part of Japan. *Hemithyris psittacea* subsp. *woodwardi* is confined to the seas of North Japan, while *Laqueus rubellus* is found in both southern and northern Japan. For the specific determination of *Terebratulina*, more material is necessary, though the only specimen at hand greatly resembles *T. caput-serpentis*, a widely distributed species. Those are also known as fossil in the Japanese Cainozoic. The occurrence of *Lingula* from the coast of the northern part of Japan is recorded for the first time.

On the whole, the Brachiopod fauna is composed of species that are not found in the waters outside the limits of those surrounding Japan. These seem to have been in existence in this part of the world since the time of late Tertiary.

The seas around the Japanese Islands have for long been known for its very rich Brachiopod fauna. But it is worthy of note that hardly any species of these seas seem to occur in other seas. Thus, Brachiopods alone may not be of much significance for the purpose of faunal correlations.

DESCRIPTION OF THE SPECIES.

1. *Lingula nipponica* HAYASAKA.

(Pl. I, Fig. 1; Pl. II, Fig. 1.)

? 1888. *Lingula anatina*, DAVIDSON (pars):— Trans. Linn. Soc. London, 2nd ser. (Zoology), vol. IV, pt. 3, p. 206, pl. 30, fig. 6.

1931. *Lingula*, n. sp., HAYASAKA:— The Venus, vol. III, No. 1, p. 2, Fig. 1.

1931. *Lingula nipponica*, HAYASAKA:— Kwagaku (The Science), vol. I, No. 9, p. 364.

The name in use for a long time, *anatina*, was abandoned sometime ago because of the priority of LINNÉ's old name *unguis*¹⁾. This species has been studied repeatedly by various scientists since the time of LINNÉ, in 1858²⁾. The characteristics of this species are, therefore, well defined in most of the papers of those scientists.

The species here under consideration have almost all the characteristics in common with *L. unguis*: the only point of difference is in the outline

¹⁾ DALL:— Proc. U. S. Nat. Mus., vol. 57, p. 262. 1920.

THOMSON:— Brachiopod Morphology and Genera, p. 124. 1927.

²⁾ For literature, see DAVIDSON, DALL, THOMSON, l. c.

of the shell, which has its widest part a little behind the middle, almost equally and very slightly tapering both anteriorly and posteriorly; the front is nearly straight, or very slightly convex, the median projection is hardly recognizable: postero-lateral margins convex and the posterior extremity obtuse. The pedicle valve slightly exceeds the opposite in length. The colour of the shell is light yellowish green to emerald green marginally and yellowish brown on the visceral portion. Two valves are very similar to each other.

Among the figures in DAVIDSON's monograph, there is only one which, to a considerable degree, resembles the one now being described (Fig. 6, Pl. 30). In it, the posterior end of the shell is somewhat more attenuating, while the front is wider, and the median projection is far more conspicuous. The sides are but slightly convex, in both these specimens. It is worthy of note that Fig. 6, Pl. 30 is an example of a specimen from Japanese Seas, while, all the other figures (Figs. 1-8, Pl. 29) are of the specimens from the more southern seas.

In the specimens from the Philippines, as are drawn by DAVIDSON in his Monograph, the shape of the shells gives us the impression of a rectangular front, the sides being almost parallel to each other. The median projection seems to be far more developed than in the Japanese species here described.

The material at hand consists of only three specimens, occurring from different stations: they are all the same in the point of the shape of the shell. The largest one (Fig. 1, Pl. II) measures 31.5 mm, 14 mm and 5 mm in length, width and height, respectively: this specimen has lost its pedicle. Another specimen is drawn on the coloured plate (Fig. 1, Pl. I).

The shape of the shell being so different from *L. unguis*, which, among the many known species, is the closest ally, the specimens from Mutsu Bay are likely to be regarded as new species.

Up to the present, several species of *Lingula* have been known from the waters around Japan, but none have been reported to occur from the sea of Northern Japan¹⁾. The only case of the occurrence of this species in the northern latitude of this side of the Pacific is that of *L. unguis* on the coast of Chili²⁾, North China³⁾.

¹⁾ Y. OKADA observes that *Lingula* has not been known from Japan north of the Tôkyô Bay, it being chiefly distributed in South Japan. (IWANAMI's Biological Manuals, in Japanese; Molluscoidea, p. 18, 1930.)

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²⁾ DALL:— op. cit., p. 263.

Localities:—

Station 75; 22. VIII. 1926. Off Noheji; coll. KOKUBO and KAMADA.

Station 66; 11. VIII. 1926. Off Tozawa; coll. HÔZAWA and KOKUBO.

Spec. No. 492.

Station (?); 14. III. 1927. Off Gomijima; coll. TAKATSUKI. Spec. No. 1517.

2. *Hemithyris psittacea* GMELIN subsp. *woodwardi* ADAMS.

(Pl. I, Figs. 2 a, b, c; Pl. II, Figs. 2 a, b; Figs. 3 a, b, for comparison.)

1863. *Phynchonella woodwardi*, ADAMS:—On the Genera and Species of Recent Brachiopods found in the Seas of Japan. Ann. & Mag. Nat. Hist. 3rd ser. vol. XI, p. 100.

1887. *Rh. psittacea* GM. var. *Woodwardi*, DAVIDSON:—A Monogr. of Rec. Brach. Trans. Linn. Soc. London, 2nd ser. (Zoology), vol. IV, p. 168, pl. XXIV, figs. 12-13.

1930. *Hemithyris woodwardi*, OKADA:—Molluscoidea, p. 22, pl. 2, fig. 2. (IWANAMI'S Biological Manual, in Japanese).

1931. *Hemithyris psittacea woodwardi*, HAYASAKA:—The Venus, vol. III, No. 1, p. 2, Fig. 2.

1931. *Hemithyris psittacea woodwardi*, HAYASAKA:—Kwagaku (The Science), vol. I, No. 9, p. 364.

“R. testa subtrigulari, tumida, nigricante, semiopaca: valvis subaequalibus, impunctatis, concentricis striolatis; umbone rostriformi, parvo, curvato, apice acuto; margine ventrali rotundato, in medio producto”¹⁾.

“This species differs from *R. psittacea* in being concentrically striolate instead of radiately grooved; the beak, moreover, is smaller and less curved; the form is more broadly triangular, and the ventral margin is rounded and produced in the middle. The young possess the same characters seen in more adult specimens”¹⁾.

It is very difficult, if not altogether impossible, to distinguish the variety from the typical species. The species *H. psittacea* has a very wide range of distribution, having been recorded from the seas of the Atlantic and the Pacific Hemispheres²⁾. As far as the material at my disposal is concerned, the specimens collected in Mutsu Bay are much smaller in size than those mentioned in the papers of various authors³⁾. The surface sculpture or ornamentation of the Japanese specimens is just what is meant

¹⁾ ADAMS:—l. c.

²⁾ DALL:—Annotated List of the Recent Brachiopoda in the Collection of the U. S. Nat. Mus. with Descriptions of 33 New Forms. Proc. U. S. Nat. Mus., vol. 57, pp. 284-286. 1920. DALL does not seem to recognize the subspecies *woodwardi*.

³⁾ J. SOWERBY and G. B. SOWERBY:—The Genera of Recent and Fossil Shells, pl. 134, fig. 5. (*Terebratula psittacea*.)

DAVIDSON:—A Monogr. Rec. Brachiopoda, l. c. (*Rhynchonella psittacea*.)

OLDROYD:—The Marine Shells of the West Coast of North America, vol. I. Stanford Univ. Publication. Univ. series. Geol. Sci. vol. I, No. 1, p. 223, pl. 16, figs. 8-12 (reduced reproduction from DAVIDSON). (*Hemithyris psittacea*.)

by the original diagnosis, or is represented by the illustrations given in DAVIDSON's monograph. The outline of the shells from Mutsu Bay is, as a whole, more transverse than the specimens of *H. psittacea*. All these characteristics build the foundation upon which I follow the old course of DAVIDSON in separating the Japanese forms as a variety, instead of making them merged within the range of *H. psittacea*. In this place we have to keep in mind that the late J. ALLAN THOMSON, in his little but comprehensive manual¹⁾, excluded the variety *woodwardi* from the synonymy of *H. psittacea*²⁾. PH. DAUTZENBERG and H. FISCHER likewise excluded the variety from the synonymy of *H. psittacea* in their monograph on the Arctic fauna³⁾.

In the younger Tertiary and Post-Tertiary formations of our country, the Brachiopod under consideration is known to occur at various places⁴⁾. In most cases the fossils are the variety *woodwardi*, though some of them are more like *H. psittacea* s. s.

Thus, in my opinion, the variety *woodwardi* represents a local type characterizing the fauna living in the seas around the northern part of Japan. CH. SCHUCHERT⁵⁾ recognized that the variety *woodwardi*, but not the species *psittacea*, lives in the seas around Japan.

Dimensions:—

Length	10.5 mm	13 mm	13 mm	15 mm
Width	10.5	12	13	14
Height	5	7.5	8	10

Localities:—

Station 116; 22. VII. 1929. Off Fujishima; coll. HÔZAWA. Spec. Nos. 2465 (b) and 2458 (b).

Station 94; 24. VII. 1927. Off Tairadate; coll. TAKATSUKI and SATÔ. Spec. No. 1789.

Fossil Occurrence:—The species has been found fossil in the following provinces⁶⁾: Mutsu, Ugo, Etigo⁷⁾, and Sinano⁸⁾ all being Pliocene in age.

¹⁾ Brachiopod Morphology and Genera (Recent and Tertiary), 1927.

²⁾ ditto, p. 145. Figures 12 and 13, plate 24, of DAVIDSON's Monograph are excluded from the synonymy.

³⁾ DUC D'ORLEANS:—Campagne Arctique de 1907. Mollusques et Brachiopodes, p. 24. (The occurrence of the species in Novaja Zemlja is recorded.)

⁴⁾ HAYASAKA:—On Some Tertiary Brachiopods from Japan. Sci. Rep. Tôhoku Imp. Univ. 2nd ser. (Geology), vol. VI, No. 2. 1922.

⁵⁾ SCHUCHERT:—Paleogeographic and Geologic Significance of Recent Brachiopoda. Bull. Geol. Soc. Amer. vol. XXII. 1911.

⁶⁾ HAYASAKA:—Japanese Jour. Geol. Geogr. vol. IV, No. 2, p. 117.

⁷⁾ YOKOYAMA:—Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. II, vol. II, pt. 7 p. 354, 1928.

⁸⁾ YOKOYAMA:—ditto, vol. I, pt. 1, p. 22, pl. I, fig. 7, 1925.

The occurrence in the Province Noto is ascertained by the collection of MOTITUKI whose material I have examined. According to YOKOYAMA the Geological age seems to be the youngest Pliocene¹⁾.

3. *Terebratulina* sp. indet.

(Pl. I, Figs. 3 a, b.)

1931. *Terebratulina*, indet. sp., HAYASAKA:—The Venus, vol. III, No. 1, p. 3.

1931. *Terebratulina*, indet. sp., HAYASAKA:—Kwagaku (The Science), vol. I, No. 9, p. 364.

Among the specimens sent to me there is a single specimen of a *Terebratulina*, which is a small, young individual, measuring only 11 mm, 9 mm and 5.5 mm in length, width and height, respectively. By treating the specimen with a hot dilute solution of caustic potash, I have been able to examine the loop, which is ringform: unfortunately it was broken off.

Characteristics observed are:—(a) comparatively coarse longitudinal or radial ribs; (b) a few more or less distinct concentric growth wrinkles; (c) a very slight flattening of the anterior margin of the ventral valve.

It is very difficult to specifically decide what this small specimen is. My opinion is that it may either be *T. caput-serpentis*²⁾ or its variety (according to DAVIDSON) *ungicula*³⁾. Its affinity with *T. japonica* is slight, because there is a flattening of the ventral valve at the anterior margin. But, as the material is a single small specimen which can not be considered adult, the specific determination is not at present possible.

The distinction between *T. japonicus* and *caput-serpentis* is not always very easy, but among the adult specimens it is not impossible⁴⁾.

Locality:—

Station 115 22. VII. 1929. Off Masukawa; coll. HÔZAWA. Spec. No. 2405.

¹⁾Jour. Geol. Soc. Tôkyô, vol. XXXIII, p. 9. April, 1926; Rep. No. 104, Imp. Geol. Survey, 1929.

²⁾DAVIDSON:—op. cit., 1887, p. 17, pl. III, fig. 12; pl. IV, figs. 1–11; pl. V, figs. 32–34.

³⁾ditto, p. 25, pl. V., figs. 38–40. *T. unguicula* is regarded by DALL an independent species which is characteristic of the North Pacific coast of America, Proc. U. S. Nat. Mus., vol. 57, p. 300–301. 1920. The present specimen very much resembles fossil specimens of *T. caput-serpentis* described and illustrated by Prof. YOKOYAMA from the Pliocene of Sagami Province (Jour. Coll. Sci. Imp. Univ. Tôkyô, vol. XXXIX, Art. 6, p. 182, pl. XIX, figs. 15–17, 1920).

⁴⁾HAYASAKA:—Sci. Rep. Tôhoku Imp. Univ. II ser. (Geology), vol. VI, No. 2, p. 147, 1922.

4. *Terebratalia*¹⁾ *coreanica* ADAMS & REEVE.

(Pl. I, Figs. 4 a, b, c; Pl. II, Figs. 4 a, b, 5 a, b, 6, 7 a, b.)

1882. *Terebratella coreanica*, DUNKER:—Index Molluscorum Maris Japonici, p. 252.

1887. *Terebratella coreanica*, DAVIDSON:—Trans. Linn. Soc. London, 2nd ser. (Zoology) vol. IV, p. 81, pl. XXXIII, figs. 4–7.

1920. *Terebratalia coreanica*, DALL:—Proc. U. S. Nat. Mus., vol. 57, p. 345.

1931. *Terebratalia coreanica*, HAYASAKA:—The Venus, vol. III, No. 1, p. 5, Fig. 3.

1931. *Terebratalia coreanica*, HAYASAKA:—Kwagaku (The Science), vol. I, No. 9, p. 364.

This large and beautiful species is very common in the waters around North Japan. Beside the specimens from Aomori Bay there are in my private collection several of them from Sendai Bay.

According to DAVIDSON's Monograph, referred to above, the species seems to include quite a variety of shell forms. The specimens now under my disposal are mostly the type of those represented by the figures 4 and 5 in DAVIDSON's plate 33. In other words, specimens with a long hinge line are by far the most abundant in the collection examined. They are, however, not necessarily transverse in outline, as is represented by the figures 4 and 5: some of the specimens are much longer than wide, differing from the fig. 6 of DAVIDSON in having a much longer and almost straight hinge-line.

Generally speaking the specimens now under consideration are a little more inflated than the specimens of DAVIDSON appear to be: the median depression of the brachial valve is much more conspicuous in the former than in the latter. In some specimens the median depression and the corresponding ridge are separated from the rest of the shell, and are produced anteriorly (Fig. 6, Pl. II).

The details of the specific characters are found in DALL's brief but comprehensive description in the work cited above. In this definition *Terebratella coreanica* and *T. miniata*²⁾ of DAVIDSON are included, but his *T. bouchardi*³⁾ does not seem to be a very common form, for, not only I do not find it in the material at hand but also DALL remarks that it "occurs rarely among the specimens"⁴⁾ he has seen.

¹⁾For the generic diagnosis, see J. ALLAN THOMSON:—Brachiopod Morphology and Genera (Recent and Tertiary), p. 245. 1927. The characteristic features are in the inner structure. "Septum generally stout, but very low posteriorly. Loop generally with a narrow ribbon, long, reflected, and united to the septum by a narrow connecting band from the descending branches".

²⁾DAVIDSON:—op. cit. 1887, pl. XXXIII, fig. 5.

³⁾ditto, figs. 8, 9.

⁴⁾DALL:—l. c.

Dimensions:—

Length	50 mm	51 mm	44 mm	51 mm
Width	46	52	39	45
Height	31.5	33.5	24.5	31.5
Hinge-line	26	32	24	26

A few younger specimens at hand are usually more transverse in outline and much less inflated: in them the red and yellow of the shell are in alternate radial streaks. It may be worthy of note that the same colour pattern is also found in the larger but more transverse specimens.

Localities:—

Station 12; 2. VI. 1926. Off Urashima; coll. TAKATSUKI. Spec. No. 487.

Station 21; 19. VII. 1926. Off Hanagurizaki; coll. HÔZAWA and TAKATSUKI. Spec. No. 489.

Station 41; 31. VII. 1926. Off Okunai; coll. Sôyômaru. Spec. No. 488. (A large transverse specimen included).

Station 45; 2. VIII. 1926. Off Tsubakiyama; coll. HÔZAWA and TAKATSUKI. Spec. No. 486.

Station 115; 22. VII. 1929. Off Masukawa; coll. HÔZAWA. Spec. No. 2418 (a). (Younger Specimens).

Station 116; 22. VII. 1929. Off Fujishima; coll. HÔZAWA and TAKATSUKI. Spec. No. 2465 (c) (Young, small, lenticular specimens).

Station 108; 29. VIII. 1927. Off Yunoshima; coll. HÔZAWA and TAKATSUKI. Spec. No. 2253. (Two young specimens).

Distribution:—Korean sea to Northern Japan, Tsingtao (China)¹⁾.

Fossil Occurrence:—Prov. Hitati (upper Miocene)²⁾ and Prov. Sagami (upper Pliocene)³⁾; Prov. Noto⁴⁾ (youngest Pliocene according to YOKOYAMA⁵⁾).

¹⁾ DALL:—op. cit., p. 345, Table.

²⁾ HAYASAKA:—Sci. Rep. Tôhoku Imp. Univ. 2nd ser. vol. II, No. 2, p. 149, pl. VII, fig. 25. 1922.

³⁾ Ditto; and YOKOYAMA:—Jour. Coll. Sci. Imp. Univ. Tôkyô, vol. XLIV, Art. 1, p. 198. 1922.

⁴⁾ There are in my hand a number of this species together with others, from several localities in this Province, collected by Mr. MOTITUKI, on which another paper will be written by me shortly.

⁵⁾ Jour. Geol. Soc. Tôkyô, vol. XXXIII, p. 9. April, 1926; Rep. No. 104, Imp. Geol. Survey of Japan. 1929.

5. *Coptothyris grayi* (DAVIDSON) subsp. *aomoriensis* HAYASAKA.

(Pl. I, Figs. 5 a, b, 6, Fig. 7, for comparison).

1931. *Coptothyris grayi*, subsp. nov., HAYASAKA:—The Venus, vol. III, No. 1, p. 6, Figs. 4, 5.

1931. *Coptothyris grayi aomoriensis*, HAYASAKA:—Kwagaku (The Science), vol. I, No. 9, p. 364.

Coptothyris grayi (DAVIDSON)¹⁾ is a species which is, as far as known at present, exclusively Japanese in distribution. Although DALL seems to have mentioned its occurrence in Catalina and Monterey²⁾, it is not referred to in the list of synonymy of this species in one of his more recent works³⁾. The list of the localities of this brachiopod given in this last paper of DALL is perhaps the most comprehensive one hitherto published. Of the 9 lots of specimens in the U. S. National Museum as are enumerated in DALL's list, 4 are from Hokkaidô (Hakodate Bay, 3: Otaru 1), 1 is from Matusima, near Sendai and 2 are from Kyûsyû: the other two lots are from some unknown locality around Japan.

Now, there are, in the collections of shells of the Zoological Institute of the Taihoku Imperial University, a few specimens of *Coptothyris grayi* from the sea of the province of Hizen, Kyûsyû (Fig. 7, Pl. I.). These specimens are, except for a slight difference in the outline of the shells, not distinguishable from those figured in the works of DAVIDSON⁴⁾. On the other hand, I have not been able to find a single specimen of this type in the material from Mutsu Bay. The only form comparable with *Coptothyris grayi* is the one which is described in this place. There are, at my disposal, not only the specimens sent to me by Prof. HÔZAWA of Sendai, but a number of dried ones which have been in my own collection for some time. All of them belong to the same type. The characteristics

¹⁾ J. ALLAN THOMSON:—Brachiopod Morphology and Genera (Recent and Tertiary), p. 247, 1927. "*Coptothyris* is clearly only a *Terebratalia* in which the loop has entirely freed itself from the septum by the resorption of the connecting bands—i. e., it bears the same relationship to *Terebratalia* as *Magadina* does to *Terebratella*". (op. cit., p. 248.)

See JACKSON:—On *Terebratula grayi* DAVIDSON, Geol. Mag. Decade VI. vol. V, p. 479, 1918. The genus *Coptothyris* was proposed in this note.

²⁾ DAVIDSON:—Trans. Linn. Soc. London, 2nd ser. (Zoology), vol. IV, pt. 3, p. 55, 1886. (*Waldheimia grayi*.)

³⁾ DALL:—Proc. U. S. Nat. Mus., vol. 57, p. 36 (*Pereudesia grayi*). 1920.

⁴⁾ Proc. Zool. Soc. London, XX, p. 76, pl. XIV, figs. 1-2. 1852 (*Terebratula grayi*). Compare these coloured figures with the Fig. 7, pl. I of this paper.

Trans. Linn. Soc. London, 2nd ser. vol. IV, pt. 3, pl. X, figs. 1-3. 1886. The subspecies *transversa* (fig. 4 of Davidson) is likely to be regarded as an example of individual variations.

of this type are represented by figs. 5 and 6, Pl. I of this paper. A mere comparison with these and fig. 7 on the same plate is perhaps more than an explanation of any length.

The characters observed are summarized as follows.

Shell orbicular in outline, strongly inequivalve, the ventral being roughly hemispherical, the dorsal, very slightly convex. Hinge-line about $2/3$ as long as the width of the shell, almost straight: slightly sulcate, i. e., having "a single sulcus in the dorsal valve, opposed by a fold in the ventral valve"¹⁾. Beak obtuse, beak ridges sharply defined, with an almost flat pseudo-area below: foramen permesothyrid²⁾, large, transversely oval, deltidial plates conjunct. Hinge-teeth supported by strong dental plates. Crura thin, long, crural processes long and pointed, nearly parallel. Loop dalliniform, i. e., neither descending nor ascending branch connected with the median septum, which, in this case, is strongly reduced, its distal end being a little expanded like a thin blade, with an inwardly directed spiniform projection.

Test irregularly multiplicate, with a few concentric growth lamellae. Radial ridges multiplying both by adding new ones in the intercostal spaces and by splitting of older ones in the anterior part. The radial ribs are in a specimen of a medium size, about 30 or more in the central part.

The red colour is strong on the radial plications and along the growth swellings, the interspaces being more yellowish than red.

Dimensions:—

Length	35 mm	38 mm	40 mm	31 mm
Width	35	37	40	32.5
Depth (or Height)	18.5	21.5	24	17

Remarks:—The specimens examined by me seem to make themselves a group, or type, which, as a whole, is different from *Coptothyris grayi* in the form of the shell and their surface sculptures, but these differences are not of quality but rather of degree. They may be the northern representative of the type species *C. grayi*, assuming that it does not occur in the northern part of Japan.

Localities:—

Station 30; 10. VIII. 1927. Off Itanozaki; coll. HÔZAWA and KOKUBO. Spec. No. 1937.

Station 41; 31. VII. 1926. Off Okunai; coll. Sôyômaru. Spec. No.

¹⁾J. ALLAN THOMSON:—op. cit., p. 58.

²⁾J. ALLAN THOMSON:—op. cit., p. 71. The foramen is "Permesothyrid when little of the foramen lies in the pseudo-area but the main of it is in the ventral umbo".

488 (a).

Station 45; 2. VIII. 1926. Off Tsubakiyama; coll. HÔZAWA and TAKATSUKI. Spec. No. 485.

Station 111; 21. VII. 1929. Off Enokama; coll. HÔZAWA. Spec. No. 2319.

Station 93; 7. VII. 1927. Off Kanita; coll. TAKATSUKI and SATÔ. Spec. No. 1717.

Fossil Occurrence:—The occurrence of the species *C. grayi* has been reported from several places in Japan, but the variety here described does not seem to have been recognized.

6. *Laqueus rubellus* Sowerby.

Pl. I, Figs. 8 a, b, c, 9 a, b, c; Pl. II, Fig. 8.

1882. *Laqueus rubellus*, DUNKER:—Index Molluscorum Maris Japonici, p. 252.

1887. *Laqueus rubellus*, DAVIDSON:—Trans. Linn. Soc. 2nd ser. (Zoology) vol. IV, p. 113, pl. 19, figs. 1-5.

1920. *Laqueus rubellus*, DALL:—Proc. U. S. Nat. Mus, vol. 57, p. 353.

1930. *Laqueus rubellus*, OKADA:—Molluscoidea, pl. II, fig. 1. (IWANAMI'S Biological manuals, in Japanese.)

1931. *Laqueus rubellus*, HAYASAKA:—The Venus, vol. III, No. 1, p. 7, Fig. 6.

1931. *Laqueus rubellus*, HAYASAKA:—Kwagaku (The Science), vol. I, No. 9, p. 364.

Of the 5 species¹⁾ of the genus *Laqueus* known from the seas around Japan, *L. rubellus* and *L. pictus* used to be very confusing. DALL, in his work cited above says that he has "not seen any specimens of the typical *pictus* with the divaricating irregular coloration", but he thinks it may be identical with *L. rubellus*. J. ALLAN THOMSON, on the other hand, after having examined both the species, came to the conclusion that these two species are greatly different in the structure of the loops²⁾. DAVIDSON and DALL laid stress upon the presence or absence of the slight indentation in the front of the shell: the former recognized a systematic value there, while the latter was inclined to discard it³⁾.

The many specimens from Mutsu Bay are all with that indentation, in a few of them the indentation is quite wide, thus, they belong to the type of *L. rubellus* rather than to that of *L. pictus*, in the form of the anterior

¹⁾*L. rubellus*, *pictus*, *blanfordi*, *morsei* and *suffulus*.

²⁾J. ALLAN THOMSON:—Brachiopod Genera and Morphology (Recent and Tertiary), p. 256-257, 1927.

³⁾It is not improbable that this conclusion was arrived because DALL examined specimens from as south as Kagoshima to as north as Hakodate: there may be some local variations in the form of the shell.

commissure. The radial colour bands or rays, in red and yellow in alternation, also confirm us of this conclusion.

THOMSON, on the contrary, considers the difference in the loop development in the two species. In *L. rubellus* the descending branches of the loop are connected to the median septum by means of connecting bands, while, such connecting bands are wanting, or resorbed in the course of development. On account of this difference THOMSON created a new genus *Picthyris*¹⁾, of which "*Laqueus*" *pictus* is the type.

In the specimens of Mutsu Bay the connecting bands between the descending branches of the loop and the septum are well developed (Fig. 8, Pl. II). Therefore, these specimens belong to *L. rubellus*.

Not having examined any complete specimen of "*Laqueus*" *pictus*, I am not able to criticise the matter of the separation of *Laqueus* and *Picthyris*. Perhaps many more specimens must be examined before we can deny the presence of some transitional forms between them.

The shells measure, in an average, about 22–23 mm, 18 mm and 13 mm in length, width and height, respectively. But there are forms that are much wider, and consequently more rounded in outline.

Localities:—

Station 112; 21. VII. 1929. Off Ôtomari; coll. HÔZAWA. Spec. No. 2351.

Station 115; 22. VII. 1929. Off Masukawa; coll. HÔZAWA. Spec. No. 2418 (b).

Station 116; 22. VII. 1929. Off Fujishima; coll. HÔZAWA. Spec. Nos. 2458 (a) and 2465 (a).

Distribution:— Seas around Japan, from North to South, and Hawaii²⁾.

Fossil Occurrence:— Province Sagami (upper Pliocene)³⁾; Prov. Etigo (upper Pliocene)⁴⁾; Prov. Noto (youngest Pliocene according to YOKOYAMA)⁵⁾.

¹⁾ ALLAN THOMSON:— op. cit., p. 257.

²⁾ DALL:— l. c.

³⁾ HAYASAKA:— Sci. Rep. Tôhoku Imp. Univ., 2nd ser. vol. VI., No. 2, p. 153, pl. VII, fig. 2, 1922.

⁴⁾ YOKOYAMA:— Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. II, vol. II, pt. 7, p. 354, 1928.

⁵⁾ YOKOYAMA:— Jour. Geol. Soc. Tôkyô, vol. 33, No. 391, p. 9. 1926; Report No. 104, Imp. Geol. Survey of Japan, 1929.

EXPLANATION OF PLATES.

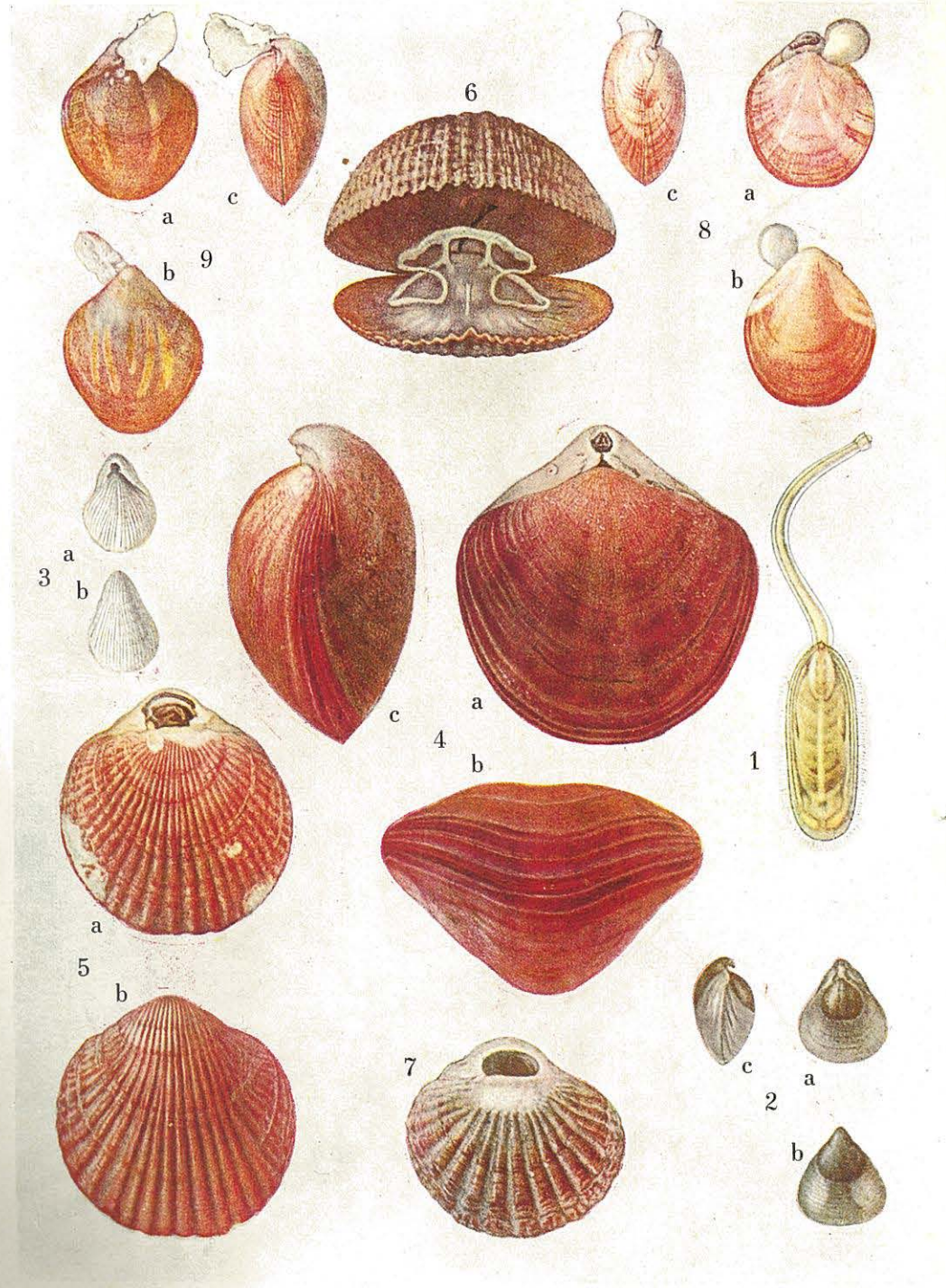
PLATE I.

- Fig. 1. *Lingula nipponica* HAYASAKA (Spec. No. 492). Enlarged, and somewhat modified: to show the colour and general appearance.
- Fig. 2. *Hemithyris psittacea* GMELIN var. *woodwardi* ADAMS. (Spec. No. 2458 b). Slightly enlarged. a, dorsal, b, ventral, c, lateral views.
- Fig. 3. *Terebratulina* sp. indet. (Spec. No. 2405). Slightly enlarged. a, dorsal, b, ventral views.
- Fig. 4. *Terebratalia coreanica* ADAMS and REEVE. (Spec. No. 489). Slightly enlarged. a, dorsal, b, anterior, c, lateral views.
- Fig. 5. *Coptothyris grayi* (DAVIDSON) subsp. *aomoriensis* HAYASAKA. (Spec. No. 485). Natural size. a, dorsal, b, ventral views.
- Fig. 6. The same: a dried specimen to show the loop inside. Slightly enlarged. (HAYASAKA'S collection).
- Fig. 7. *Coptothyris grayi* (DAVIDSON), for comparison with the new variety. Natural size. Locality:— Hizen, Kyûsyû. (Collection of the Zoological Institute, Taihoku Imperial University). A dorsal view.
- Figs. 8 and 9. *Laqueus rubellus* SOWERBY. (Spec. No. 2458 a). Slightly enlarged. a, dorsal, b, ventral, c, lateral views. For loop, see Fig. 8, Pl. II.

PLATE II.

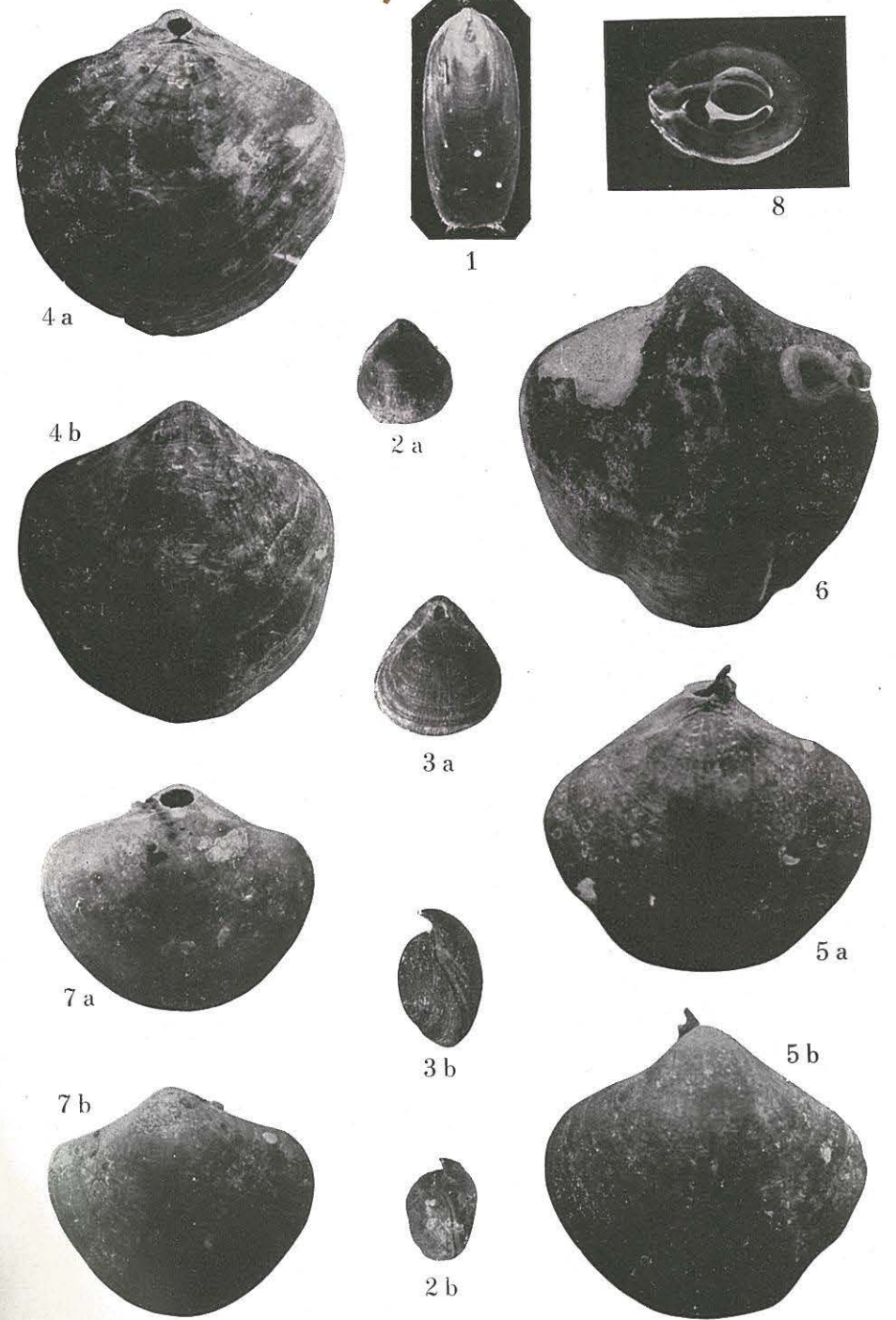
(All the figures in Natural Size.)

- Fig. 1. *Lingula nipponica* HAYASAKA (Spec. No. 1517). Note the characteristic outline of the shell. A dorsal view.
- Fig. 2. *Hemithyris psittacea* GMELIN subsp. *woodwardi* ADAMS. (Spec. No. 2465 b). a, dorsal, b, lateral views.
- Fig. 3. *Hemithyris psittacea* GMELIN. For comparison with the subspecies, Fig. 2. Locality:— North Atlantic: presented by Mr. JACKSON of Manchester.
- Fig. 4. *Terebratalia coreanica* ADAMS and REEVE (Spec. No. 487). An elongate specimen. a, dorsal, b, ventral views.
- Fig. 5. The same (No. 488 b). A more transverse specimen. a, dorsal, b, ventral views.
- Fig. 6. The same (Spec. No. 486). One of the largest specimen, in which the median fold is very conspicuously developed. A dorsal view: the right anterior corner is broken.
- Fig. 7. The same. A very transverse specimen from Western Japan, for comparison. Locality:— Province Tango (Collection of the Zoological Institute, Taihoku Imperial University). a, dorsal, b, ventral views.
- Fig. 8. *Laqueus rubellus* SOWERBY. (Spec. No. 2465 a). A brachial valve to show the characteristic loop. A slightly oblique view.



Sakuma

I. HAYASAKA: Brachiopods of Mutu Bay.



Hayasaka photo.

I. HAYASAKA: Brachiopods of Mutu Bay.