



Title	Molluscan Fossils of the Hakobuti Sandstone of Hokkaidô
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Citation	Journal of the Faculty of Science, Hokkaido Imperial University. Ser. 4, Geology and mineralogy, 4(1-2), 31-56
Issue Date	1938
Doc URL	http://hdl.handle.net/2115/35776
Type	bulletin (article)
File Information	4(1-2)_31-56.pdf



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MOLLUSCAN FOSSILS OF THE HAKOBUTI SANDSTONE OF HOKKAIDÔ

By

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With 4 Plates and 1 Figure.

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The name Hakobuti Sandstone⁽¹⁾ was given some fourteen years ago to a thick complex of the uppermost division of the Cretaceous rocks in Hokkaido.⁽²⁾ This complex at the type locality, the Hakobuti gorge⁽³⁾ of the Yûbari-gawa, below the junction of the Siyûbari and Pankemoyûbari, in the province of Isikari, is about 350 meters in thickness comprising medium to fine grained green sandstone intercalated with conglomerate, sandy shale, and shale layers at several horizons. It has a wide distribution in the provinces of Isikari and Iburi. It is underlain always by the thick Upper Ammonites bed and overlaid usually by the Palaeogene coal-bearing Isikari Series, but sometimes by the Neogene Tertiary rocks.

It is very remarkable that the Hakobuti Sandstone is unusually poor in fossil content through its whole thickness, in strong contrast to the underlying Upper Ammonites bed which at many places is very fossiliferous in numerous ammonites, *Trigonia*, *Inoceramus*, and

(1) H. IMAI: The Stratigraphical Relation between the Coal-bearing Tertiary (the Ishikari Series) and the Cretaceous Deposits in the Ishikari Coal-Field (in Japanese). Jour. Geol. Soc. Tôkyô, Vol. XXXI, p. 107, 1924.

(2) The Cretaceous deposits of Hokkaidô are divided into the following groups:

The Hakobuti Sandstone
The Upper Ammonites bed
The Trigonia Sandstone
The Lower Ammonites bed

(See H. YABE: A New Scheme of the Stratigraphical Subdivision of the Cretaceous Deposits of Hokkaidô. Proc. Imp. Acad., Vol. II, p. 214, 1926.)

(3) 石狩國夕張郡夕張町大夕張函淵

other molluscs. Except plant remains⁽¹⁾ found in the *Nilssonia* bed intercalated in this Sandstone, *Trigonia subovalis* JIMBO var. *minor* YABE and NAGAO, *Cucullaea* sp., *Ostrea* sp., and *Rhychonella* sp. are the fossils known to occur rarely in this complex and *Callianassa ezoensis* NAGAO⁽²⁾ is the only species which has been described from it.

As above stated, fossils are almost lacking in the Hakobuti Sandstone, but they are not rare in the equivalent rocks in the Hetonai district⁽³⁾ in the province of Iburi where the formation is called the Hetonai group.⁽⁴⁾ The Hetonai group is well exposed along the Mukawa⁽⁵⁾ and its tributary, the Hobetu-gawa,⁽⁶⁾ in the province of Iburi and spreads southwards into the area of the middle course of the Saru-gawa⁽⁷⁾ in the province of Hidaka (Fig. 1). Along the Mukawa, west of Hetonai, it consists of sandstone and sandy shale, attaining about 1000 meters in thickness. Fossil molluscs are rather abundant at certain horizons in this complex, but with the exception of *Inoceramus* which are well preserved and sometimes common, they are ill-preserved and, though abundant in individuals at places, few in number of species. Consequently the number of species treated in this paper is not great and the specimens are always far from being perfect, but the present short note may contribute to a knowledge of the Japanese Cretaceous faunas.

The Hetonai group is divided into two parts, the Lower and Upper Hetonai, the latter comprising three subdivisions as shown below.

Hetonai group
 Upper Hetonai group
 upper sandy shale
 Hukausi⁽⁸⁾ Sandstone
 lower sandy shale
 Lower Hetonai group

(1) S. ENDÔ: *Nilssonia* Beds of Hokkaidô and its Flora. Sci. Rep. Tôhoku Imp. Univ., 2nd Ser., Vol. VII, p. 57, 1925.

(2) T. NAGAO: Two Tertiary and One Cretaceous Crustacea from Hokkaidô, Japan. This Journal, Ser. IV, Vol. II, p. 20, pl. IV, figs. 1, 2, 4, 8, 15, 1932.

(3) 膽振國勇拂郡穂別村邊富内

(4) K. UWATOKO and K. ÔHTATSUME: The Upper Cretaceous Oil-bearing Sedimentary Rocks of Hokkaidô, Japan. This Journal, Ser. IV, Vol. II, p. 139, 1933.

(5) 鷓川

(6) 穂別川

(7) 沙流川

(8) 深牛

The Lower Hetonai is about 300 meters thick consisting of coarse to medium grained yellowish or light greenish sandstone and passes gradually into the underlying Upper Ammonites bed which is largely composed of thick dark coloured shale. The transition bed from the Upper Ammonites bed is represented by grayish sandy shale and sandstone containing numerous calcareous nodules. Molluscan remains are sometimes abundant in these nodules as well as in the surrounding rocks in which they are often found in aggregation. The most fossiliferous rocks of this basal part are exposed at a point 2 km. east of Osatinai,⁽¹⁾ Saru-gun, province of Hidaka, along the road cut on the northern side of the Saru-gawa.

Above this basal part, the sandstone is massive and usually rich in *Inoceramus orientalis* SOKOLOW and *I. japonicus* NAGAO and MATUMOTO.⁽²⁾

The main part of the Lower Hetonai overlying the sandstone above described is composed of sandstone, sandy shale, and shale in alternation and contains a few thin carbonaceous layers with *Nils-sonia serotina* HEER, *Asplenium dicksonianum* HEER, and other plant fossils. The Lower Hetonai is fossiliferous along the Mukawa, west of Hetonai, especially on the southern side of this river.

The following species have been derived from the Lower Hetonai:

- Nucula (Acila) hokkaidoensis* NAGAO
- Yoldia hakobutsensis* nov. sp.
- Parallelodon (Nanonavis) sachalinensis* (SCHMIDT)
- Pedalion* sp.
- Trigonia subovalis* JIMBO var. *minor* YABE and NAGAO
- Aphrodina* cf. *pseudoplana* (YABE and NAGAO)
- Spisula (Cymbophora) ezoensis* YABE and NAGAO var. *hetonaiensis* nov. var.
- S. (C.?) tellinoides* nov. sp.

Besides these, *Inoceramus orientalis* SOKOLOW, *I. pseudosulcatus* NAGAO and MATSUMOTO, and *I. japonicus* are found in this part.

The Upper Hetonai is a very thick complex, the maximum thickness being about 670 meters along the Mukawa, near Hetonai. It is subdivided into three parts, the lower or lower sandy shale, the middle or Hukausi Sandstone, and the upper or upper sandy shale.

(1) 日高國沙流郡長知内

(2) The species of *Inoceramus* will be treated on another occasion by T. MATUMOTO and the senior author of this note.

The lower sandy shale begins with a renewed transgression over the Lower Hetonai, though these two are conformable, indicated by a thin glauconitic sandstone bed at the base and consists mainly of thick, dark gray or green sandy shale. Numerous calcareous nodules are met with in this sandy shale. At a certain horizon a layer of petroliferous sandstone is intercalated. From this lower sandy shale the following species have been collected:

- Solemya* cf. *angusticaudata* NAGAO
Nucula (Acila) hokkaidoensis NAGAO
Yoldia hakobutsensis nov. sp.
Parallelodon (Nanonavis?) elongatus nov. sp.
Trigonia subovalis JIMBO var. *minor* YABE and NAGAO
Anisomyon altus nov. sp.
Helcion ? problematicus nov. sp.
Pseudoperissitys bicarinata nov. sp.

Moreover, *Inoceramus sikotanensis* INAI (MS.) is not rare.

The middle part or Hukausi Sandstone is a thick sandstone, fine to medium grained, intercalating conglomerate layers at places. This sandstone is fossiliferous especially at Ômagari⁽¹⁾ and Hukausi, both west of Hetonai. The fossils obtained from it are

- Yoldia hakobutsensis* nov. sp.
Trigonia subovalis JIMBÔ var. *minor* YABE and NAGAO
Periplomya elliptica nov. sp.
Aphrodina cf. *pseudoplana* (YABE and NAGAO)
Cyprimeria? sp.
Spisula (Cymbophora?) tellinoides nov. sp.
Pseudoperissitys bicarinata nov. sp.

Also numerous specimens of *Inoceramus sikotanensis* occur in this sandstone.

The upper sandy shale is composed of loose gray sandy shale intercalating layers of conglomerate. Fossils are rare, but ammonites and *Inoceramus sikotanensis* are found in calcareous nodules at some localities.

The fossils to be described in this paper are as follows:

- Solemya* cf. *angusticaudata* NAGAO
Nucula (Acila) hokkaidoensis NAGAO

(1) 大曲

- Yoldia hakobutsensis* nov.
Parallelodon (*Nanovavis*) *sachalinensis* (SCHMIDT)
Parallelodon (*Nanonavis*?) *elongatus* nov.
Pedalion sp.
Ostrea sp.
Trigonia subovalis JIMBO var. *minor* YABE and NAGAO
Periplomya elliptica nov.
Cyprimeria? sp.
Aphrodina cf. *pseudoplana* (YABE and NAGAO)
Spisula (*Cymbophora*) *ezoensis* YABE and NAGAO var. *hetonaiensis* nov.
S. (*C.*?) *tellinoides* nov.
Solarium? sp.
Anisomyon altus nov.
Helcion? *problematicus* nov.
Pseudoperissitys bicarinata nov.

Among these species, *Trigonia subovalis* var. *minor* has a wide geological range; it has been reported from the Trigonia Sandstone in Hokkaidô, the equivalent Werbrud group of Russian Saghalien, and the Gosyonoura and Himenoura groups of the Islands of Amakusa, Kyûsyû. *Spisula* (*Cymbophora*) *ezoensis* var. *hetonaiensis* nov. has its type species in the Trigonia Sandstone and *Aphrodina* cf. *pseudoplana* and *Solemya* cf. *angusticaudata* are regarded as referable to the species in the same complex. *Nucula* (*Acila*) *hokkaidoensis* and *Parallelodon* (*Nanonavis*) *sachalinensis* are two species also common in the Upper Ammonites bed of Hokkaidô and Saghalien.

The Hakobuti Sandstone is considered to occupy a part in Upper Senonian of the European standard because the underlying Upper Ammonites bed with its rich ammonite fauna is considered to range from Turonian to Upper Senonian in age.

It is also remarkable that the Lower Hetonai has a few species of *Inoceramus* which range upward from the Upper Ammonites bed and do not survive into the overlying lower sandy shale of the Upper Hetonai. Moreover, most of the other species of mollusca treated in this paper are common with those of the Upper Ammonites bed. Consequently it will be very natural to suspect its close relationship with the latter complex. Lithologically it passes insensibly into the latter and, being intercalated with the terrestrial *Nilssonina* bed, represents the end regressive phase, of the Upper Ammonites beds. The Upper Hetonai begins with a renewed transgression indicated by

a glaucanitic layer at its base. It is characterized by *Inoceramus sikotanensis* which is found throughout its whole thickness but not in the Lower Hetonai. Besides this, the other species are also restricted in it, except a few which have a wide geological range and are known from the older formations of the Cretaceous in Hokkaidô.

DESCRIPTION OF SPECIES

Solemya, LAM.

Solemya cf. *angusticaudata* NAGAO

Pl. I, Fig. 11.

1932. *Solemya angusticaudata* NAGAO: Some Cretaceous Mollusca from Japanese Saghalien and Hokkaidô (Lamellibranchiata and Gastropoda). This Journal, Vol. II, p. 25, Pl. V, fig. 7.

An imperfect cast with its ornamentation rather well preserved has been collected. *Solemya* is very poorly represented in the Japanese Cretaceous, *S. angusticaudata* NAGAO being the only species known from the Trigonina Sandstone of the Ikusyunbetu district in Hokkaidô. The present specimen from the Hetonai district is much smaller and the radial ribs are almost obsolete on the posterior half of the flank. The latter feature, however, may be due to a different state of preservation, for these ribs are visible, though very faintly, especially near the posterior extremity.

In the present specimen, the shell seems to be very elongated with the upper and lower margins almost parallel to each other, the anterior margin apparently truncated vertically, the posterior one narrowly rounded, the umbo subterminal, and the radial ribs on the anterior portion broad and separated by narrower grooves. It is most probable that this form is conspecific with or very closely related to the species from the Trigonina Sandstone.

The specimen under consideration is also very similar to *S. subplicata* MEEK and HAYDEN⁽¹⁾ from the Fox Hills group of the Upper Missouri, North America. A close comparison is impossible owing to the bad state of preservation of the former, but the Japanese form seems to be a little more slender with more distinct radial striae on the posterior portion than the American species.

(1) F. B. MEEK: A Report on the Invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri Country. U. S. Geol. Surv. Terr., Vol. IX, 1876, p. 129, Pl. XXVIII, fig. 19.

Locality and geological horizon: Hetonai, Yûhutu-gun, province of Iburi; the lower sandy shale of the Upper Hetonai.

Nucula, LAM.

(*Acila*, H. and A. Adams)

***Nucula (Acila) hokkaidoensis* NAGAO**

Pl. I, Fig. 1.

1932. *Nucula hokkaidoensis* NAGAO: Some Cretaceous Mollusca from Japanese Saghalin and Hokkaidô. This Jour., Vol. II, p. 28, Pl. V, figs. 17, 18.

A few specimens of *Acila* were obtained from the Lower Hetonai and the lower sandy shale of the Upper Hetonai. The shell is rather small and ovate in outline, relatively short with a broad and rounded anterior end and truncated posterior one. The radial ornamentation is rather fine and the line from which the ribs diverge is situated anterior to the middle of the shell.

The present specimens are doubtless indetical with *Nucula (Acila) hokkaidoensis* NAGAO, a common form of the Upper Ammonites bed of Hokkaidô and Saghalien, and although they are shorter, more trigonal in form, and more convex than the type specimens of this species from the Abesinai-gawa, province of Tesio, these differences may be attributed to the immaturity of the specimens. This species belongs to *Truncatacila* of SCHENK and is certainly related to *N. (A.) demessa* FINLEY (*N. truncata* GABB)⁽¹⁾ from the Upper Cretaceous of North America.

Localities and geological horizons: Hetonai, province of Iburi; the lower sandy shale of the Upper Hetonai. Osatinai, Saru-gun, province of Hidaka; the basal part of the Lower Hetonai.

Yoldia, MÖLLER

***Yoldia hakobutsensis* nov. sp.**

Pl. I, Figs. 2-6.

Shell small, subovate, slightly inequilateral, the anterior side being a little shorter than the posterior; moderately inflated near

(1) W. M. GABB: Paleontology of California, Vol. I, 1864, pp. 198, 235, pl. XXVI, fig. 184 (*Nucula truncata* GABB). See R. B. STEWART: GABB's California Cretaceous and Tertiary Type Lamellibranchs. Special Publ. No. 3, Acad. Nat. Sci. Pa., 1930, p. 45, pl. III, fig. 6.

the umbo. Dorsal margins inclined both anteriorly and posteriorly; the postero-dorsal one longer, more steeply sloping downward near the umbo and slightly excavated; anterior margin semicircular and the posterior one narrowly rounded, forming a nearly right angle with the postero-dorsal margin or pointed at the postero-dorsal end; ventral margin very broadly arcuate, gradually passing into both anterior and posterior margins. Umbo small, not prominent, situated a little in advance of the middle. Surface ornamented with numerous concentric incremental lines. Test relatively thick.

Hinge with its anterior row composed of about fifteen teeth and its posterior one slightly longer.

Dimensions:

Length	Height	Thickness of a valve
16 mm.	9 mm.	3 mm.
17 mm.	11 mm.	?

Several specimens have been obtained; all of them are very imperfect, not showing the inner side of the shell. As the cartilage pit and the pallial line are not visible, the generic position of this species is doubtful. The present form, however, is closely similar in many features to *Y. scaphulodies* STOL.⁽¹⁾ from the Arrialur group of Southern India, though the Japanese species seems to have a less excavated postero-dorsal margin and also to be slightly more equilateral. The antero-dorsal margin inclines more gently in ours than in the Indian species.

Localities and geological horizons: Osatinai, province of Hidaka: the basal part of the Lower Hetonai. The Penkemobetu-sawa, Simo-Hobetu, province of Iburi; the lower sandy shale of the Upper Hetonai. Hetonai, province of Iburi; the Hukausi Sandstone.

Parallelodon, MEEK and WORTHEN.

(*Nanonavis*, STEWART.)

Parallelodon (Nanonavis) sachalinensis (SCHMIDT)

Pl. II, Fig. 2.

1873. *Cucullaea sachalinensis* SCHMIDT: Über die Petrefakten der Kreideformation von der Insel Sachalin, p. 24, Pl. V, fig. 5; Pl. VIII, figs. 6, 7.

(1) F. STOLICZKA: Cretaceous Fauna of Southern India, Vol. III (Lamelli-branchiata). Palaeontologia Indica, 1871, p. 325, pl. XVII, figs. 11, 12.

1873. *Cucullaea* aff. *striatella* SCHMIDT: Ibid., p. 24, Pl. V, fig. 7.
 1873. *Macrodon* aff. *japeticum* SCHMIDT: Ibid., p. 25, Pl. V, fig. 6; Pl. VIII, fig. 8.
 1890. *Cucullaea* cfr. *sachalinensis* YOKOYAMA: Versteinerungen aus der japanischen Kreide. Palaeontographica, Vol. 36, p. 176, Pl. XVIII, fig. 8.
 1932. *Grammatodon sachalinensis* NAGAO: Some Cretaceous Mollusca from Japanese Saghalien and Hokkaidô. This Jour., Vol. II, p. 31, Pl. VI, figs. 1-5.

A few very imperfect specimens of "*Grammatodon*" were obtained from the Hetonai group which are identical with *Grammatodon sachalinensis* (SCHMIDT), a very common species from the Upper Ammonites bed of Hokkaidô and Saghalien. The surface ornamentation is shown in none of these specimens, but the reference is justifiable because of the oblique, moderately elongated shell with an incurved, and broad, relatively low umbo, a rather distinct posterior umbonal carina, an acutely pointed antero-dorsal corner, and an obliquely truncated posterior end.

H. WOODS is of the opinion that *Parallelodon* MEEK and WORTHEN is synonymous with *Grammatodon* MEEK and HAYDEN. STEWART,⁽¹⁾ however, on account of "the genotype of the latter being still inadequately known", prefers to use *Parallelodon* "for the elongate species with coarse radial ribs". (STEWART, p. 68).

STEWART's *Nanonavis*⁽²⁾ was founded on *Grammatodon carinatus* (SOW.) and the Japanese species may be transferred into this subgenus, since it is very akin to that European form. According to STEWART, *Nanonavis* is characterized by anterior teeth more horizontal than those of *Parallelodon* s. str., which slope in the opposite direction just beneath the umbo. This feature is also well shown in the Japanese species.

Localities and geological horizons: Naka-Hobetu, province of Iburi; the Lower Hetonai. Also from the same horizon exposed at the Momizi-zawa, a small tributary of the Horoka-kuruki, Yûbari-gun, province of Isikari.

Parallelodon (*Nanonavis*?) *elongatsu* nov. sp.

Pl. II, Figs. 1, 1a, 1b.

Shell large, about 80 mm. long and 40 mm. high, elongate-subtrapezoid in outline, very convex along the line from the umbo to the

(1) R. B. STEWART: GABB's California Cretaceous and Tertiary Type Lamellibranchs. Op. cit., 1930, p. 67.

(2) R. B. STEWART: Ibid., p. 68.

middle of the ventral margin, inequilateral, the anterior being much shorter. Hinge margin long, straight, most probably forming an acute angle with the anterior margin; antero-dorsal end broken, but the anterior margin probably slightly oblique downward and backward and very gently convex, passing gradually into the long, broadly arcuated ventral one which is nearly parallel with hinge margin; posterior end injured, probably vertical or slightly oblique backward. Umbo large, inflated, and prominent, projecting high above the plane of the hinge margin; posterior umbonal carina broad and rounded. Ligamental area imperfectly preserved, but elongate-trigonal in outline, very broad, and shown to be ornamented with numerous and crowded inverted V-shaped grooves. Test thick.

Hinge plate very narrow, long, with about four (?) anterior and about four or five straight and horizontal, long teeth and numerous small and nearly vertical central teeth; posterior lateral teeth longer than the anterior ones. Surface ornamentation almost unknown.

An incomplete specimen with both extremities injured and the surface weathered. The elongated shell indicates its belonging to *Parallelodon*. Of the anterior teeth which may be four in number, the two upper are visible and nearly parallel with the upper margin. There are three or four short teeth directed obliquely forward and upward and situated anterior to the umbo and posterior to the anterior laterals. More than ten very small and nearly vertical teeth occupy the hinge plate between the point beneath the umbo and the posterior end of the ligamental area. The posterior lateral teeth number four or five and are long and almost parallel with the dorsal margin, three lower of them being preserved.

Since the surface ornamentation is unknown, the subgeneric position of the present species is somewhat doubtful. The new species seems to be akin to *Parallelodon brewerianus* (GABB)⁽¹⁾ from the Upper Cretaceous of California and *Macrodon vancouverensis* (MEEK)⁽²⁾ from the Cretaceous of Vancouver Island. However, the new species is decidedly more elongated with a narrower and more elevated umbo than in these North American forms. *M. vancouverensis* has the central vertical teeth of a much smaller number.

Locality and geological horizon: Kiusu, Simo-Hobetu, province of Iburi: the lower sandy shale of the Upper Hetonai.

(1) W. M. GABB: Paleontology of California, Vol. I, 1864, p. 193, pl. XXV, fig. 181. R. B. STEWART: GABB's California Cretaceous and Tertiary Type Lamellibranchs. Op. cit., 1930, p. 69, pl. II, fig. 1.

(2) J. F. WHITEAVES: Mesozoic Fossils, Vol. I, 1879, p. 163, pl. XIX, fig. 2.

Pedalion, SOLANDER.***Pedalion* sp. indet.**

Pl. I, Figs. 12-14.

The material comprises three internal moulds of *Pedalion*, of which one is large and two others are smaller. The larger one, a cast of a right valve, is quadrate in outline, very flat with its anterior margin broadly rounded and excavated beneath the beak. The beak is broken but projects beyond the anterior margin of the shell. The ventral margin is semicircular, passing gradually into both anterior and posterior margins. The posterior margin is slightly oblique backward and downward and very weakly arcuate forming a slightly obtuse angle with the hinge margin. The hinge margin seems to be straight. Numerous broad and relatively short ligamental pits are present, of which about nine are visible on the cast.

The smaller ones show the outline of the beak which is very much produced and pointed, with a broad and shallow excavation below. At a glance these smaller specimens may appear to differ much from the larger one but on a closer examination, the writers are inclined to regard them as conspecific with the latter. The postero-dorsal end being missing in the smaller ones, the hinge and posterior margins give a gentle and convex curvature. That the shell has a subquadrate outline is indicated by the lines of growth faintly preserved on the casts.

The surface ornamentation is suggested by the impressions on the casts to consist of distinct growth lamellae at more or less regular intervals.

This form is doubtless related to *P. sanchuensis* (YABE and NAGAO)⁽¹⁾ from the Siroi (Shiroi) group of Wealden age in the Kwanto Mountainland; therefrom it is distinguished in having a higher shell with a more evenly rounded ventral margin. Among the foreign species, *P. willardi* STEPHENSON⁽²⁾ may be similar to the present species. If the smaller specimens are different from the larger one, they seem to represent a form somewhat akin to *P. holmesi* STEPHENSON.⁽³⁾

(1) H. YABE, T. NAGAO and S. SHIMIZU: Cretaceous Mollusca from the Sanchu Graben in the Kwanto Mountainland, Japan. Sci. Rep. Tôhoku Imp. Univ., 2nd Ser., Vol. IX, 1926, p. 57, pl. XII, figs. 1-4.

(2) L. W. STEPHENSON: Invertebrate Fossils of the Upper Cretaceous Formations. North Carolina Geol. and Econ. Surv., Vol. V, 1923, p. 125, pl. XXIII, figs. 1-3; pl. XXIV, figs. 1, 2.

(3) L. W. STEPHENSON: Ibid., p. 126, pl. XXVI, figs. 1-3.

Locality and geological horizon: the Syuttano-sawa, Naka-Hobetu, province of Iburi; the Lower Hetonai.

Ostrea, LAM.

***Ostrea* sp. indet.**

Pl. II, Fig. 7.

A number of a large and thick-tested *Ostrea* have been found on the southern side of the Nukibetu-gawa. The specimens are mostly imperfect with the surface much weathered. The shell is higher than long, convex from the umbo to the postero-ventral end. The anterior margin is broadly concave, the posterior one convex, and the basal one narrowly rounded. The umbonal angle is rounded, the surface in front of this being flattened and nearly perpendicular to the posterior surface which is somewhat convex and steeply inclined towards the posterior margin. There is no indication of a radial ribbing.

The height of the largest specimen attains about 74 mm.

Locality and geological horizon: East of Nioi,⁽¹⁾ Saru-gun, province of Hidaka; the Lower Hetonai?

Trigonia, BRUG.

***Trigonia subovalis* JIMBO var. *minor* YABE and NAGAO**

Pl. I, Figs. 7-9.

1915. *Trigonia* cf. *subovalis* YEHARA: The Cretaceous Trigoniae from Hokkaidô and Miyako. Sci. Rep. Tôhoku Imp. Univ., Second Ser., Vol. I, p. 42, Pl. I, Figs. 14-17.
1921. *T.* cf. *subovalis* HAYASAKA: Publications of the Geological Committee of Russian Far East, no. 12, p. 4, Pl. I, fig. 2.
1923. *T.* cf. *subovalis* YEHARA: Cretaceous Trigoniae from Amakusa Islands, Prov. Kyushu, Japan. Jour. Geol. Soc. Tokyo, Vol. XXX, p. 8, Pl. VI, figs. 1-5.
1925. *T. subovalis* JIMBO var. *minor* YABE and NAGAO: New or Little-known Cretaceous Fossils from North Saghalin. Sci. Rep. Tôhoku Imp. Univ., Second Ser. Vol. VII, p. 166.

There are in the present material two large and a few smaller specimens of *Trigonia*. The smaller ones are identical with *T. sub-*

(1) 荷負

ovalis var. *minor* YABE and NAGAO, a form very common in the Japanese Cretaceous deposits. On the other hand, the larger specimens are also identical in various important features with and can not be distinguished from many specimens of that variety, except for their size. One of them is 58 mm. in length and 35 mm. in height, and stands in size near the type specimens of *T. subovalis* from the *Trigonia* Sandstone of Ikusyumbetu where the variety *minor* is also found. However, they seem to be distinguished from the type species in various points. The specimens from the Hetonai group are less convex, being flattened especially near the ventral margin, shorter, and lower with a less excavated postero-dorsal margin and possess a more broadly arcuated ventral margin than in the type species.

Localities and geological horizons: Ômagari, west of Hetonai; the lower sandy shale and the Hukausi Sandstone of the Upper Hetonai. Osatinai, province of Hidaka; the basal part of the Lower Hetonai.

Periplomya, CONRAD

Periplomya elliptica nov. sp.

Pl. III, Figs. 4, 4a, 5, 5a.

Shell rather large, nearly equilateral, thin-tested, transversely elongate-ovate or elliptical and compressed, but moderately inflated near the umbo. Antero-dorsal margin usually steeper in inclination than the postero-dorsal one and evenly arcuated; postero-dorsal margin nearly straight and slightly excavated beneath the umbo; anterior end rounded along the margin, the posterior one subtruncated vertically; ventral margin broadly and evenly convex. Umbo inflated, a little elevated, subcentral, and curved inwards and backwards, with a distinct carina running from it obliquely backwards and downwards; behind this carina the shell is excavated and flattened toward the postero-dorsal extremity.

Surface ornamented, besides fine growth lines, with growth ridges and grooves at intervals. These ridges and grooves most distinct near the anterior end and on the posterior area behind the posterior umbonal carina.

Internal features very imperfectly known; hinge plate broad, resilifer apparently spoon-shaped, long, narrow, nearly vertical, deeply sunken and placed beneath the umbo. A fissure and a clavicle

present on the postero-dorsal slope of the shell, slightly divergent to each other; the fissure long and situated on the posterior margin of the umbonal angle and the clavicle broader and slightly shorter.

Dimensions:	Length	Height	Thickness
	81 mm.	50 mm.	14 mm. (one valve)
a cast	50 mm.	35 mm.	15 mm. ,,

A large, well preserved left valve and two moulds have been collected, the latter preserving the general features and ornamentation. The larger one has a very elongated shell with a nearly straight ventral margin and rather expanded posterior portion. Its anterior portion is more or less produced and rather narrowly rounded along the margin, but this may be due to the injury of the antero-dorsal margin causing it to show a more steep inclination and more straight contour than it had originally. In the smaller specimens, the antero-dorsal margin is better represented and shows an arcuated contour, the anterior margin being evenly rounded.

These two forms may appear different at first sight; the larger one may be taken as a right valve of a *Mya* shell and the smaller as belonging to a *Thracia* shell. However, it is evident that these are conspecific, for there is no important difference except the antero-dorsal portion which is doubtless due to injury of this part, as mentioned above, in the larger one.

Thracia-like shells have been reported from the West coast of North-America and included in *Periplomya* CONRAD. The present writers do not well acquainted with these shells, but if the Japanese species is not congeneric with these, the former is doubtless very closely related to this American genus. The smaller specimens are externally similar to *Periplomya quadrata* (GABB),⁽¹⁾ but it is slightly longer. On the other hand, the larger specimen is almost identical in the outline of the shell with *P. tryoniana* GABB⁽²⁾ and, if

(1) W. M. GABB: Paleontology of California, Vol. II, 1869, p. 177, pl. XXIX, fig. 64. J. F. WHITEAVES: Mesozoic Fossils, Vol. I, 1879, p. 140.

R. B. STEWART: GABB's Calif. Cret. and Tert. Type Lamell. Op. cit., 1930, p. 299, pl. VI, fig. 13.

(2) W. M. GABB: Paleontology of California, Vol. I, 1864, p. 150, pl. XXIX, fig. 240; Vol. II, 1869, p. 177. J. F. WHITEAVES: Mesozoic Fossils, 1879, p. 140.

R. B. STEWART: GABB's California Cret. and Tert. Type Lamell. Op. cit., 1930, p. 298, pl. III, fig. 13.

not identical, it may be closely akin to this latter. "*Thracia*" *sanctae-crucis* PICTET and CAMP. figured by WOODS⁽¹⁾ from the Gault and "T." sp.⁽²⁾ from Cenomanian and Gault, both of England, are forms related to ours.

Localities and geological horizons: Kiusu, Simo-Hobetu, and the Sanusubezawa, Naka-Hobetu, both in the province of Iburi: the Hukausi Sandstone.

Cyprimeria, CONRAD

Cyprimeria? sp. indet.

Pl. II, Figs. 5, 6.

There are at hand three casts which externally recall some species of *Cyprimeria*.

Shell moderate in size, transversely ovate in outline, slightly convex from the umbo to the ventral margin; very inequilateral, the posterior side being a little shorter than twice the anterior one. Postero-dorsal margin long, sloping very gently backward and slightly arcuate, gradually passing over a narrowly rounded posterior margin, into an evenly and broadly convex ventral one; antero-dorsal margin short, more abruptly inclined than the postero-dorsal one, and also arcuate, continuing with the round anterior margin. Umbo very small, slightly elevated beyond the plane of the dorsal margins.

Surface apparently ornamented with fine concentric lines of growth. Hinge unknown.

Dimensions:	Length	Height
	51 mm.	46 mm.
	45 mm.	31 mm.

The generic reference of this specimen to *Cyprimeria* is of course provisional, since the hinge, pallial line, and other internal features are not attainable in any of the casts.

Locality and geological horizon: the Sanusubezawa, Naka-Hobetu, province of Iburi; the Hukausi Sandstone.

(1) H. Woods: Cretaceous Lamellibranchia of England. Op. cit., 1909, p. 243, pl. XL, figs. 4-6.

(2) H. Woods: Ibid., p. 243, pl. XL, figs. 7-9.

Aphrodina, CONRAD

Aphrodina cf. *pseudoplana* (YABE and NAGAO)

Pl. III, Figs. 1-3, 6, 7-10.

1925. *Callista pseudoplana* YABE and NAGAO: New or Little-Known Cretaceous Fossils from North Saghalin. Sci. Rep. Tôhoku Imp. Univ., Second Ser. (Geology), Vol. VII, p. 120, Pl. XXVII, figs. 9, 10; Pl. XXIX, figs. 1-6.

A number of specimens of "*Callista*" have been collected, all of which are represented by moulds with a small part of the test attached. Some specimens are small and some others moderate in size. Although they are variable in outline and inflation, they belong most probably to one species. The mould is quite identical with "*Callista*" *pseudoplana* YABE and NAGAO reported from the Trigonina Sandstone of the Ikusymbetu district and the Cape Khoi group of Russian Saghalien. Most of the specimens found in the Hetonai district coincide with the typical form of this species, besides an example which is more closely similar to var. *rotundata* in its rounded and slightly higher shell than the other specimens are. The convexity is usually a little less than the types probably due to the state of preservation and there is a mould which is large in inflation, standing near the type examples from Isikari.

In respect to the inequilateral shell with a more or less produced anterior part, a rather steeply inclined and arcuated anterodorsal margin, and a broadly convex ventral margin, the specimens at hand agree well with the type specimens of this species. Moreover, the umbo is elevated, the lunule elongate and bounded by an impressed line, and the escutcheon not well defined; all these points are shown in the type form. The hinge is identical with that of the latter.

The surface is always weathered preventing a closer comparison with the type specimens, but there seem to be present numerous concentric lines, besides stronger growth ridges and grooves at intervals.

Dimensions:	Length	Height
(moulds)	48 mm.	31 mm.
	35 mm.	25 mm.
	23 mm.	18 mm.
	?	52 mm. (a rotundate form)

"*Callista*" *pseudoplana* has hitherto been known only from the Trigonina Sandstone, and if the present specimens from Hetonai are

found to really to belong to this species, then it ranges up to the Hakobuti Sandstone, the youngest formation of the Japanese Cretaceous. The type species is closely akin to "*Callista*" *plana* (Sow.) from the Upper Greensand of England⁽¹⁾ and the Trichinopoly group of South India.⁽²⁾ It is also related to "*Meretrix*" *nitida* GABB⁽³⁾ from the Chico of California and the Nanaimo group of Vancouver Island.⁽⁴⁾ These two foreign species are regarded by STEWART as members of *Aphrodina* CONRAD. Two California species, *Aphrodina varians* (GABB)⁽⁵⁾ and *A. nitida* are suspected by STEWART to be "subgenerically removed from *Aphrodina* because of their smooth lateral". This is also the case in the Japanese form.

Localities and geological horizons: Osatinai, province of Hidaka: the basal part of the Lower Hetonai. Ômagari, west of Hetonai and Panke-Tosanosawa, Hetonai; the Hukausi Sandstone.

Spisula. GRAY

(*Cymbophora*, GABB)

Spisula (*Cymbophora*) *ezoensis* YABE and NAGAO

var. *hetonaiensis* nov. var.

Pl. II, Figs. 3, 3a.

Shell small, trigonally ovate in outline, slightly inequilateral, the posterior side being a little longer, and moderately convex from the umbo to the ventral margin. Antero-dorsal margin slightly concave in front of the umbo and the postero-dorsal one very faintly arcuated, sloping backward a little more gently than the antero-dorsal one. Anterior end round pointed and the posterior obliquely truncated, forming an acute angle with the ventral margin; ventral margin broadly and evenly rounded, passing gradually into the anterior one and angulated with the posterior. Umbo convex, rather large, curved

(1) H. WOODS: Cret. Lamell. England. Op. cit., Vol. II, p. 273, pl. XXX, figs. 1-6.

(2) F. STOLICZKA: Cret. Fauna Southern India. Palaeontologia Indica, 1871, Vol. III, p. 169, pl. VII, figs. 1-4.

(3) W. W. GABB: Pal. Calif., Vol. I, 1864, p. 165, pl. XXIII, figs. 145, 146. R. B. STEWART: Op. cit., 1930, p. 250, pl. V, fig. 10; pl. VI, fig. 9.

(4) J. F. WHITEAVES: Mesozoic Fossils, Vol. I, 1879, p. 149, pl. XVII, figs. 14-14b (*Cutherea plana*): 1903, n. 377.

(5) W. M. GABB: Pal. Calif. Vol. I, 1864, p. 161, pl. XXIII, figs. 140, 140a.

inward and very slightly forward; antero-dorsal area compressed and separated from the median part of the valve by an indistinct and round anterior umbonal ridge; postero-dorsal area flattened, being defined by a distinct, rounded posterior ridge. Surface more or less weathered but ornamented with regular and slightly raised concentric ribs and shallow grooves in alternation. Test thin. Inner features unknown.

Dimensions:	Length	Height
	15 mm.	14 mm.

A few imperfect specimens were obtained, most of which are represented by moulds except one in which the shell, although more or less weathered, is relatively well preserved and the ornamentation is distinctly visible.

The present form is quite identical with *S. (C.) exoensis* YABE and NAGAO⁽¹⁾ described from the Trigonia Sandstone of the Isikari coal-field, except for the slightly longer and lower shell, with a little more narrowly rounded anterior margin. The fine groove in front of the anterior umbonal angle as well as the shallow depression on the posterior area, visible in well preserved specimens of that species, are not shown in any of the specimens at hand, probably owing to the bad state of preservation. Under the circumstances the writers are warranted to consider them as a variety of, rather than a distinct species, from the one found in the Trigonia Sandstone.

The type species, together with the present variety, seems to be very closely akin to *Cymbophora trigonalis* STEPHENSON⁽²⁾ from the Upper Cretaceous of North Carolina, North America, and *C. ashburnerii* (GABB)⁽³⁾ from the Chico of California, though the last is much longer than the Japanese form.

Locality and geological horizon: Osatinai, Saru-gun; the basal part of the Lower Hetonai.

(1) H. YABE and T. NAGAO: Cretaceous Fossils from Hokkaidô, Annelida, Gastropoda, and Lamellibranchiata. Sci. Rep. Tôhoku Imp. Univ., 2nd Ser., Vol. IX, 1928, p. 91, pl. XVI, figs. 5-10.

(2) L. W. STEPHENSON: Invert. Foss. Upper Cret. Form. Op. cit., 1923, p. 336, pl. LXXXV, figs. 1-6.

(3) W. M. GABB: Paleontology of California, Vol. 1, 1864, p. 153, pl. XXII, fig. 127. R. B. STEWART: GABB's California Cretaceous and Tertiary Type Lamellibranchs. Op. cit., 1930, p. 212, pl. V, figs. 6, 6a. (Synonyms).

F. L. PACKARD: Mesozoic and Cenozoic Mactrinae of the Pacific Coast of North America. Univ. Calif. Publ., Bull. Dept. Geology, Vol. IX, 1916, p. 298, pl. XXVI, figs. 4, 5.

Spisula (Cymbophora?) tellinodes nov. sp.

Pl. II, Figs. 8, 8a.

Shell of moderate size, rather compressed, transversely oblong-trigonal in its dorsal half and subelliptical in the lower contour; subequilateral, the anterior side being very slightly shorter. Antero-dorsal margin weakly concave and excavated beneath the umbo, the postero-dorsal one nearly straight or very slightly convex and more gentle in inclination than the antero-dorsal; anterior and posterior margins both rounded, the latter being slightly narrower; ventral margin evenly and broadly convex. Umbo small, subcentral, moderately elevated, and slightly curved forwards.

Surface apparently covered with fine concentric lines and much broader interspaces in alternation.

Left hinge plate provided with a spoon-shaped cartilage cavity which is relatively long and narrow, convex at margin, and directed obliquely backward; cardinal tooth inverted V-shape, small, and close to the anterior margin of the cartilage cavity. Right hinge also with a narrow, deep cartilage cavity.

A few specimens were obtained, most of which are casts and moulds. One of the larger specimens measures 62 mm. in length and 41 mm. in height. Another one attains 56 mm. by 39 mm.

The hinge being incompletely visible, the reference of this species to some group of Mactridae is questionable, but as suggested by the general features of the shell form and hinge, it recalls some species of *Spisula*, especially *Cymbophora*. The hinge seems to a great extent identical with that of "*Lutraria*" *truncata* GABB⁽¹⁾ from the Chico of California figured by GABB and later by PACKARD.⁽²⁾ This species was thought by PACKARD to be a form of *Cymbophora* and was by him renamed as *C. chicoensis*. If the specimens at hand be in reality a *Cymbophora*-shell, then they may be congeneric with PACKARD's, as the left hinge seems very closely similar in these two forms. Because of the imperfection of the hinge in the present material, the generic reference of the Japanese fossil is provisional for the time being.

(1) W. M. GABB: Paleontology of California, Vol. I, 1864, p. 154, pl. XXII, fig. 128.

(2) E. L. PACKARD: Mesozoic and Tertiary Mactrinae of the Pacific Coast of North America. Op. cit., 1916, p. 300, pl. XXVII, figs. 6, 7.

R. B. STEWART: GABB's Calif. Cret. and Tert. Type Lamell. Op. cit., 1930, p. 213, pl. IV, fig. 10.

The present form differs externally from the California one in being transversely more elongated with a slightly arcuated ventral margin. The figure given by PACKARD indicates that the American species is higher, with its umbo more elevated and its anterior margin more narrowly rounded.

Locality and geological horizon: the Sanusube-zawa, Naka-Hobetu, Yûhutu-gun; the Lower Hetonai.

Solarium, CHEMNITZ

Solarium? sp. indet.

Pl. I, Figs. 10, 10a.

An imperfect mould was obtained from the Hukausi Sandstone, but it is not suitable for specific determination.

Shell rather small, low conical, much depressed with a short spire. Volutions about 5, convex. Body whorl large, convex, with a narrow spiral keel at the periphery and a rather narrow umbilicus. Ornamentation faintly shown, consisting of lines of growth and numerous revolving lines. Umbilical surface convex towards the umbilicus and covered with numerous spiral revolving lines all over.

Breadth, 40 mm.

Height, 25 mm.

Locality and geological horizon: Southern side of the Mukawa, west of Hetonai; the Hukausi Sandstone.

Anisomyon, MEEK and HAYDEN

Anisomyon exoensis nov. sp.

Pl. II, Figs. 4, 4a, 9, 9a, 9b.

Shell small, high conical, with a subcircular aperture; apex very excentric, tip itself broken, much curved anteriorly and slightly to the left side, placed very near above the anterior margin, high-elevated and horn-shaped. Margins smoothly continuous without any distinct angulation. Surface ornamented with five radial furrows from the umbo to the posterior margin, besides numerous crowded fine lines of growth and wrinkles; three posterior furrows placed close together and the other two anterior ones more widely apart from each other and also from the posterior ones.

Two specimens were obtained, of which one is small without the apex, and the other larger and very imperfect with the upper half of the shell injured. The larger one may be about 20 mm. in the larger diameter of the aperture and the smaller one measures 10 mm. in length and 9 mm. from the apex to the apertural surface. In the larger one the anterior margin is more broadly rounded than the posterior, but this may probably be owing to the different state of preservation.

Anisomyon MEEK and HAYDEN, with its genotype "*Helcion*" *patelliformis* MEEK and HAYDEN, includes many fossil species of thin smooth patelloid shells. MEEK stated that this genus is especially characterized by the abruptly pointed and reflexed apex. As in the Japanese form the apex is broken, its reference to this genus is uncertain at present. However, its resemblance with *A. saxsulcatus* MEEK and HAYDEN⁽¹⁾ from the Upper Cretaceous of North America seems to be great, but it is distinguished therefrom in having five irregularly placed furrows and a much elevated, curved, and more excentric apex. It also differs from *A. centrale* MEEK⁽²⁾ from the Upper Cretaceous of North America by its higher and much more curved apex than this American form.

On the other hand, it differs from *Capulus cassidarius* YOK.,⁽³⁾ a common species of the Cretaceous of Hokkaido and Saghalien, in having radial furrows.

Locality and geological horizon: Hetonai, province of Iburi; the lower sandy shale of the Upper Hetonai.

Helcion, MONTF.

Helcion? problomaticus nov. sp.

Pl. IV, Figs. 1, 1a, 2.

In the material at hand there are two specimens of a large patelloid shell with a small part of the test preserved.

(1) F. B. MEEK: *Invert. Cret. and Tert. Foss. Upper Miss. Op. cit.*, 1876, p. 293, pl. XVIII, figs. 8 a, b.

(2) J. F. WHITEAVES: *Contributions to Canadian Palaeontology*, Vol. I, pt. 1, 1885, p. 47, pl. VII, figs. 1, 2.

(3) M. YOKOYAMA: *Versteinerungen aus der japanischen Kreide. Palaeontographica*, Vol. XXXVI, 1890, p. 177, pl. XVIII, figs. 10 a, b, 11 a, b.

Shell subelliptical in outline of the aperture, moderately large, with the apex small, low, and situated near the anterior end. Anterior margin somewhat more narrowly rounded than the posterior one which is broken but apparently semicircular as suggested by the lines of growth; lateral margins almost symmetrical, very broadly and evenly convex. All margins smooth. Marginal portion of the shell flattened, the middle convex along the line from the apex to the posterior end; anterior slope of the apex steeply inclined forward. Test rather thick.

Surface shown to be ornamented with broad and rounded concentric ridges; the ridges most distinct, somewhat regularly spaced, and crowded on the apical portion, becoming lower, more irregular, and broader towards the posterior margin; these ridges almost obsolete on the flattened area along the margins.

Although the possibility of this form's belonging to *Anisomyon* is not excluded, it recalls at first sight "*Helcion*" *giganteus* SCHMIDT,⁽¹⁾ a very common species of the Upper Cretaceous of Japan, to which, however, it seems related very remotely. It is possible that the present shell is generically distinct from the latter species.

Helcion giganteus SCHMIDT is a large species, with an usually depressed shell. The specimens referred to this species are ornamented with rounded radial ribs, with some exceptions, for instance, a small specimen (Pl. III, fig. 9) which was regarded by SCHMIDT as a juvenile example of var. *centralis*, is figured as ornamented with a few tubercles near the apex. The present writers possess numerous specimens from the Cretaceous of Hokkaidô, which have a high smooth shell with a central apex, and may be referable to this species. These specimens are characterized by a rather irregularly outlined aperture.

Localities and geological horizon: Sososizawa in Naka-Hobetu and Hetonai; the lower sandy shale of the Upper Hetonai.

Pseudoperissitys nov. gen.

Genotype: *Pseudoperissitys bicarinata* nov. sp.

Shell pyriform, rather thick-tested, with a moderately depressed spire. Suture deep, circumscribed by a distinct collar. Body whorl

(1) M. F. SCHMIDT: Ueber die Petrefacten der Kreideformation, 1873, p. 19, pl. II, figs. 17, 18; pl. III, figs. 1-10; pl. VII, figs. 2-5. K. JIMBO: Beiträge zur Kenntniss der Fauna der Kreideformation von Hokkaidô. Pal. Abh., Vol. VI, 1894, p. 41, pl. XXV, figs. 4, 4a, 5.

large, inflated, relatively short, and rather abruptly contracted below. Outer lip smooth, not thickened, shallowly excavated above. Inner lip smooth, sinuous, thickened, reflected, and widely spread on the whorl. Anterior canal almost null; columella short, slightly twisted, not perforated. Surface with revolving nodulous carinae, besides numerous fine revolving striae.

Although all specimens at hand are far from being perfect, they are believed to bear some important features distinct from those of allied genera, so a new generic name is proposed to receive them.

Pseudoperissitys bicarinata nov. sp.

Pl. IV, Figs. 3-5.

Shell pyriform, robust, with thick test; spire very short with an apical angle of 60° - 70° and composed of about six low whorls. Each spire whorl flattened, slightly excavated, gently sloped outwards and provided with an nodulous carina along the lower margin. Suture sometimes very distinct and bordered by a collar-like upper margin of the next whorl; this collar-like band sometimes overlapping the carina of the preceding whorl.

Body whorl very large, inflated and ventricose, occupying more than two-thirds of the total height and biangulated by carinae; upper surface flattened, the base concave and tapering to the canal; carinae placed rather closely to each other, ornamented with numerous round nodes; one node on the upper carina connected by a vertical ridge with the corresponding node on the lower carina. In a small example the body whorl unicarinated and ornamented with nodes of one series instead of two, slightly elongated vertically, showing a tendency to split into two carinae. Aperture very wide, ovate, posteriorly narrowed and anteriorly ended in a very short, almost obsolete canal. Outer lip smooth, with a broad and shallow sinus above the angle of the aperture; inner lip smooth, slightly sinuous at the middle; columella very short.

Upper surface and the base ornamented with numerous fine revolving lines, these lines becoming obsolete on the anterior portion of the body whorl. Interspace between the two carinae deeply excavated. Lines of growth originating from the suture, and running obliquely backwards and downwards, forming a concave curve on the upper surface, nearly vertical on the base.

Three specimens of this species have been obtained. Except for the very short, almost null anterior canal, the present form is similar to some species of *Pyropsis*, for example, *P. bairdi* MEEK and HAYDEN⁽¹⁾ from the Upper Cretaceous of the Upper Missouri, North America, in respect to its inflated body whorl with a broad aperture and its reflected thick and sinuous lip. This American form has a very long and slender anterior canal and a short spire. MEEK established a new section, *Apiotropis*,⁽²⁾ for this species, while COSSMANN⁽³⁾ included *Pyropsis* of CONRAD under *Tudicula*. There is a similar fossil, *Perissolax brevirostris* GABB,⁽⁴⁾ from the Chico of California which, though frequently cited as the genotype of *Perrissolax* GABB, has been separated by STEWART from other species of this genus and a new generic name *Perissitys*, has been proposed for it. STEWART⁽⁵⁾ states that *Perissolax brevirostris* has a very prominent collar with the lines of growth nearly vertical to the suture, unlike *Pyropsis* in which they are oblique. Moreover, its anterior canal is described to be shorter and its spire higher than in *Pyropsis*. The Japanese form under consideration, like *Perissolax brevirostris*, is provided with a rather elevated spire and its collar is distinctly developed, though much lower than in GABB's species. The lines of growth are oblique to the suture in ours, the posterior portion of the outer lip having a distinct, shallow and broad sinus. Moreover, the anterior end of the aperture is not elongated into a long canal in the Japanese form. Thus the general resemblance of its shell to those of *Pyropsis* and *Perissolax* may be due to convergence.

On the other hand, the present species recalls some forms of *Pyrifusus* and *Neptunella*, but because of its short and much inflated body whorl, lower spire, and thickened, reflected, and excavated inner lip, it is safely separable from these genera.

From the Trichinopoly group of Southern India, STOLICZKA described three species under *Rapa*; *Rapa andorensis* STOL.,⁽⁶⁾ *R.*

(1) F. B. MEEK: Invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri Country. Op. cit., 1876, p. 369, pl. XXXI, figs. 10 a, b.

(2) F. B. MEEK: Ibid., p. 369.

(3) M. COSSMANN: Ess. Paléont. Comp., Vol. IV, 1901, p. 63.

(4) W. M. GABB: Paleontology of California, Vol. I, 1864, p. 91, pl. XVIII, fig. 43. M. COSSMANN: Ess. Paléont. Comp., Vol. IV, p. 73, fig. 21. R. B. STEWART: GABB's California Cretaceous and Tertiary Type Gastropods. Op. cit., 1927, p. 426, pl. XX, fig. 4.

(5) R. B. STEWART: Ibid., p. 427.

(6) F. STOLICZKA: Gastropoda of the Cretaceous Rocks of Southern India. Palaeontologia Indica, 1897, p. 153, pl. XII, figs. 9, 9a.

nodifera STOL.,⁽¹⁾ and *R. cancellata* (Sow.).⁽²⁾ Among these, *R. nodifera* and *R. cancellata* are somewhat similar in ornamentation and other features to the present form. These species were considered by MEEK⁽³⁾ to belong to *Pyropsis* and by COSSMANN⁽⁴⁾ to *Streptosiphon* GILL. They are provided with a body whorl similar to the Japanese form, but they have a shorter spire and longer anterior canal, standing near *Pyropsis*, as stated by MEEK. *Pyropsis africana* WOODS⁽⁵⁾ from the Upper Cretaceous of South Africa is also distinct from the specimens at hand in having a shorter spire and much more expanded inner margin of the inner lip. The anterior canal seems to be distinctly developed in this African species.

Localities and geological horizon: Kiusu, Simo-Hobetu; Hukausi Sandstone. The Sososizawa, Naka-Hobetu, and the Matutake-zawa, Noborikawa, province of Isikari; the lower sandy shale of the Upper Hetonai.

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- (1) F. STOLICZKA: Ibid., p.153, pl. XII, figs. 10, 11.
(2) F. STOLICZKA: Ibid., p. 154, pl. XII, figs. 12-16; pl. XIII, figs. 1-4.
E. BASSES: Faune malacologique du superieur du sud-ouest de Madagascar. Ann. de Paléontl., Vol. XXI, 1932, p. 73, pl. IX, fig. 27.
(3) F. B. MEEK: Op. cit., p. 344.
(4) M. COSSMANN: Ess. Paléont. Comp., Vol. IV, p. 73.
(5) H. WOODS: Cretaceous Fauna of Pondoland. Ann. South Africa, Vol. IV, 1908, p. 322, pl. XXXVIII, fig. 17; pl. XXXIX, fig. 1.

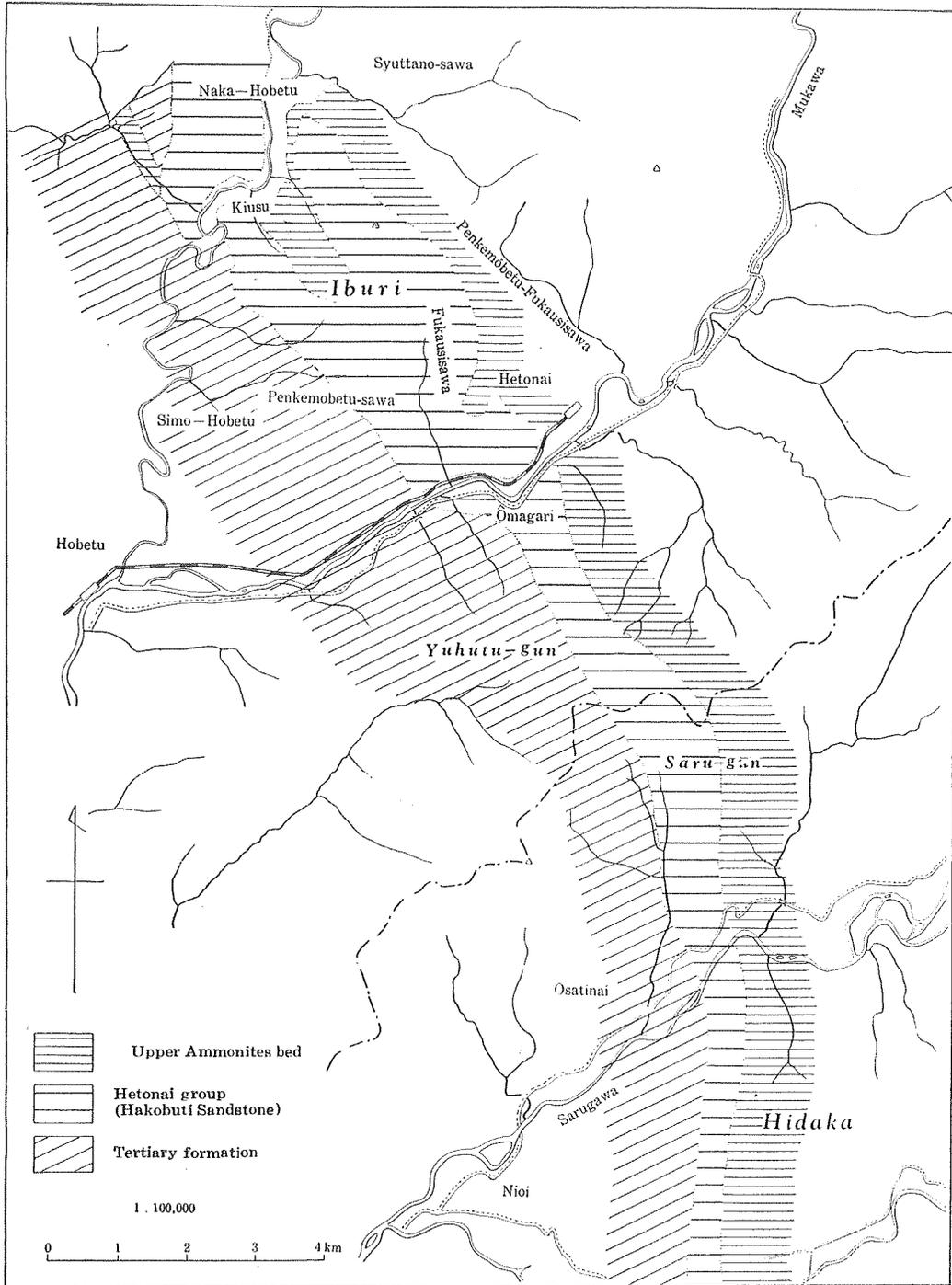


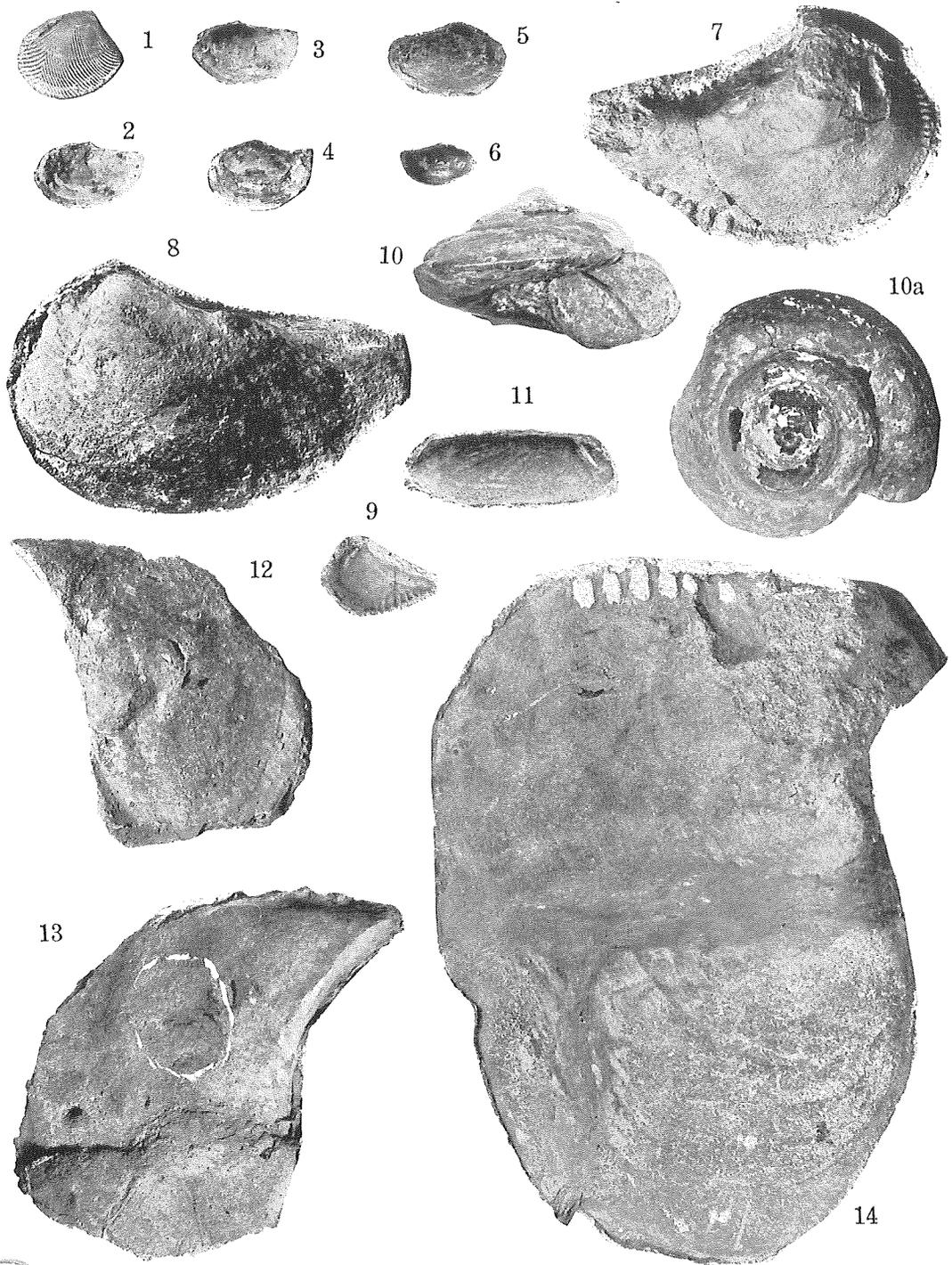
Fig. 1. Geological Map of the Hetonai District.

Plate I

PLATE I

The figures are of natural size.

- Fig. 1. *Nucula (Acila) hokkaidoensis* NAGAO. Hetonai, Yûhutu-gun. Lower Hetonai group.
- Figs. 2-6. *Yoldia hakobutsensis* NAGAO and OTATUME. 2, 3, 4, Osatainai, Sarugun; basal part of the Lower Hetonai. 5, Penkemobetu, Simo-Hobetu, Yûhutu-gun; lower sandy shale of the Upper Hetonai. 6, Ômagari, west of Hetonai; Hukausi Sandstone. 3, the type.
- Figs. 7-9. *Trigonia subovalis* JIMBÔ var. *minor* YABE and NAGAO. 7, 9, Hetonai; lower sandy shale of the Upper Hetonai. 8, Ômagari, west of Hetonai; Hukausi Sandstone. 7, internal view of a left valve.
- Figs. 10, 10a. *Solarium?* sp. Ômagari, west of Hetonai. Hukausi Sandstone.
- Fig. 11. *Solemya cf. angusticaudata* NAGAO. Ômagari, west of Hetonai. Hukausi Sandstone.
- Figs. 12-14. *Pedalion* sp. Three internal moulds. Syuttanosawa, Naka-Hobetu, Yûhutu-gun. Lower Hetonai group.



(Ôtatumé and Takeda photo.)



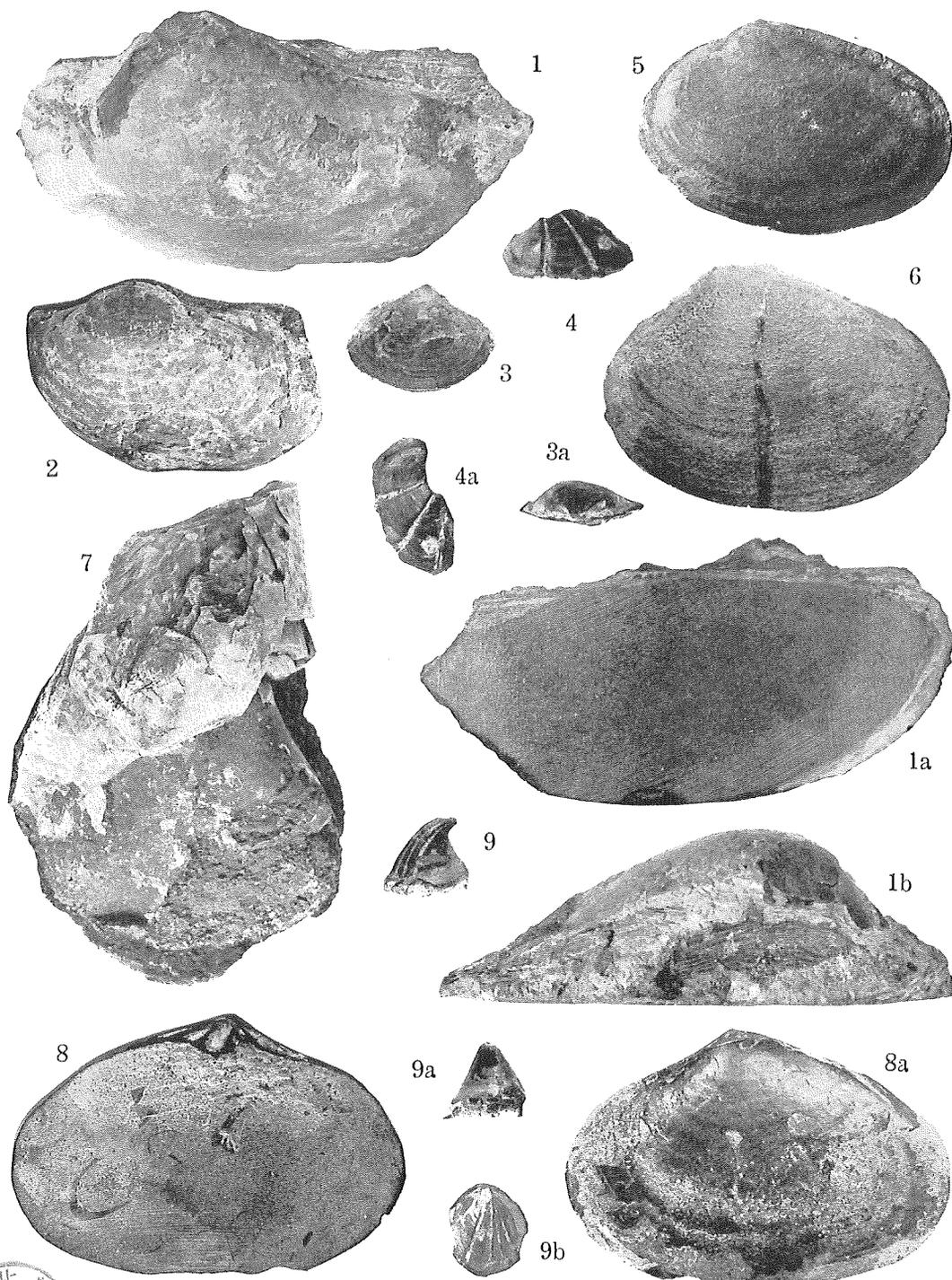
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Plate II

PLATE II

The figures are of natural size.

- Figs. 1, 1a, 1b. *Parallelodon* (*Nanonavis*?) *elongatus* NAGAO and OTATUME. Kiusu, Simo-Hobetu, province of Iburī. Lower sandy shale of the Upper Hetonai. 1b, umbonal view.
- Fig. 2. *Parallelodon* (*Nanonavis*) *sachalinensis* (SCHMIDT). A weathered specimen. Momizisawa, a tributary of the Horoka-kuruki, province of Isikari. Lower Hetonai group.
- Figs. 3, 3a. *Spisula* (*Cymbophora*) *ezoensis* YABE and NAGAO var. *hetonaiensis* NAGAO and OTATUME. Osatinai, Saru-gun. Basal part of the Lower Hetonai group. 3a, umbonal view.
- Figs. 4, 4a, 9, 9a, 9b. *Anisomyon* *ezoensis* NAGAO and ÔTATUME. Hetonai, Yûhutu-gun. Lower sandy shale of the Upper Hetonai group. 9, the type. 4, 9, left-side views. 9a, anterior view.
- Figs. 5, 6. *Cyprimeria*? sp. Two external casts. Sanusubezawa, Naka-Hobetu, Yûhutu-gun. Hukausi Sandstone.
- Fig. 7. *Ostrea* sp. East of Nioi, Saru-gun. Lower Hetonai group?
- Figs. 8, 8a. *Spisula* (*Cymbophora*?) *tellinoides* NAGAO and ÔTATUME. Sanusubezawa, Naka-Hobetu, Yûhutu-gun. Lower Hetonai group.



(Ôtatumé and Takeda photo.)



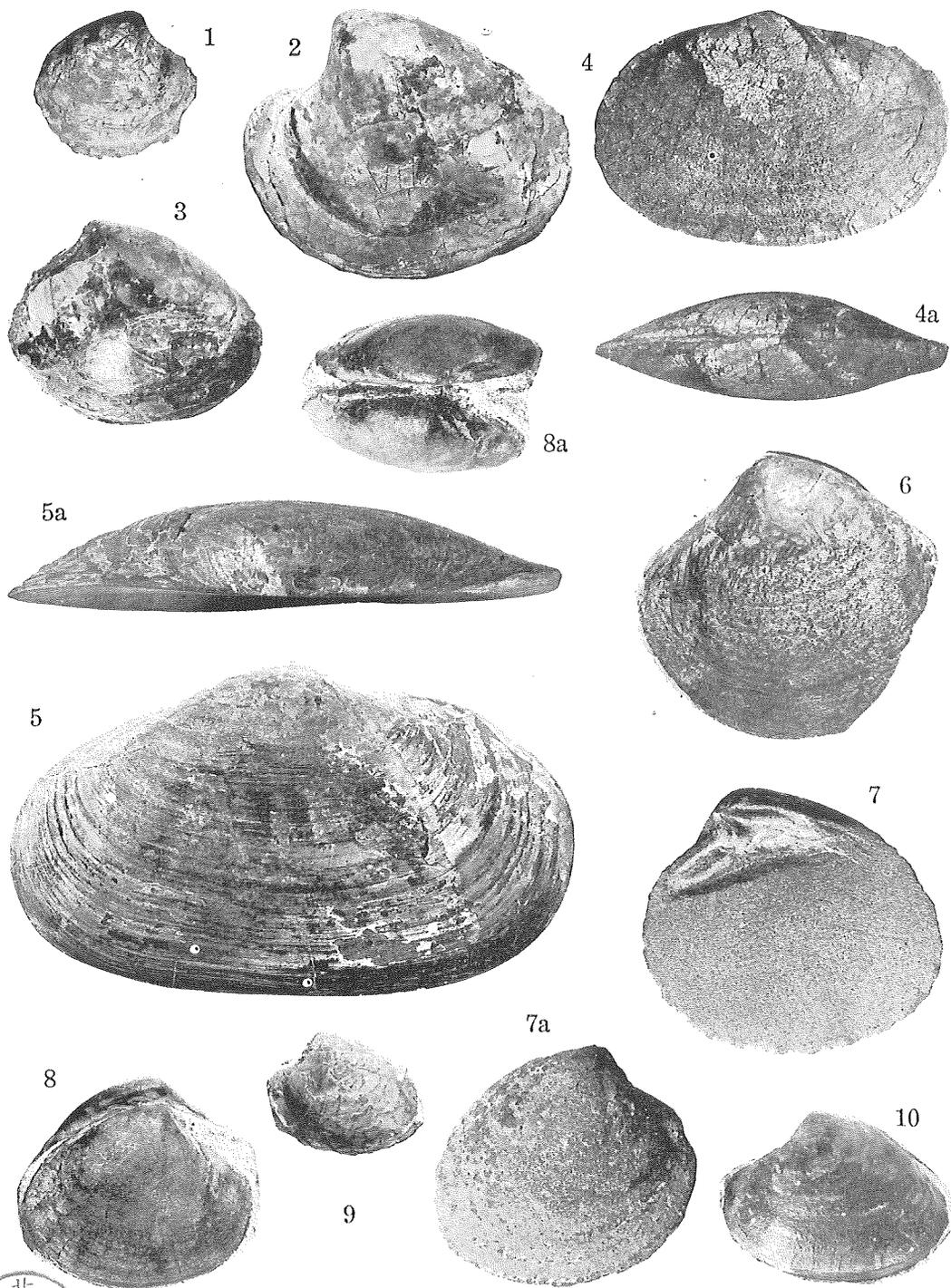
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Plate III

PLATE III

The figures are of natural size, unless otherwise stated.

- Figs. 1, 6. *Aphrodina* cf. *pseudoplana* (YABE and NAGAO) var. *alta* YABE and NAGAO. 1, Osatinai, Saru-gun; basal part of the Lower Hetonai group. 6, Hetonai; Lower Hetonai group.
- Figs. 2, 3, 7-10. *Aphrodina* cf. *pseudoplana* (YABE and NAGAO). 2, 3, 8-10, internal moulds. 2, 9, Osatinai, Saru-gun; basal part of the Lower Hetonai group. 3, 8, Panke-Tosanosa, Hetonai; Hukausi Sandstone. 7, Hetonai; Lower Hetonai group. 7a, a little reduced in size.
- Figs. 4, 4a, 5, 5a. *Periplomya elliptica* NAGAO and ÔTATUME. 4, Kiusu, Simo-Hobetu; 5, the Sanusube-zawa, Naka-Hobetu. Hukausi Sandstone. 4, the type.



(Ôtatume and Takeda photo.)

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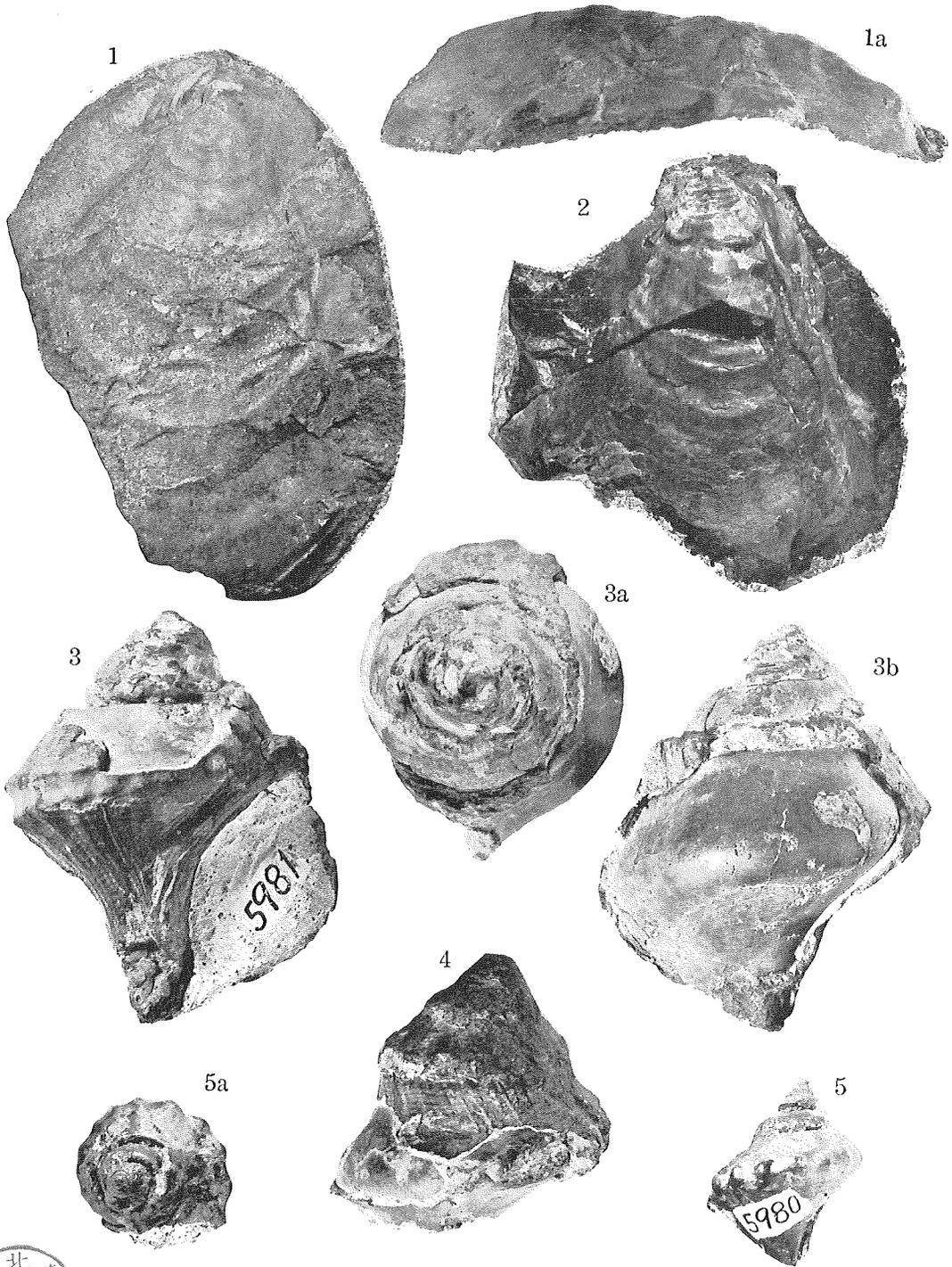
Plate IV

PLATE IV

The figures are of natural size.

Figs. 1, 1a, 2. *Helcion? problematicus* NAGAO and ÔTATUME. 1, Hetonai; 2, Sososizawa, Naka-Hobetu. Lower sandy shale of the Upper Hetonai group. 1, the type.

Figs. 3-5. *Pseudoperissitys bicarinata* NAGAO and ÔTATUME. 3, Kiusu, Simo-Hobetu; Hukausi Sandstone. 4, Matutakezawa, Noborikawa, province of Isikari; lower sandy shale of the Upper Hetonai. 5, Sososizawa, Naka-Hobetu; lower sandy shale of the Upper Hetonai. 3, the type.



(Ôtatumé and Takeda photo.)

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