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# FOSSIL ACILA FROM HOKKAIDÔ AND KARAHUTO (SAGHALIN)

By

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*With 3 Plates*

(Contribution from the Department of Geology and Mineralogy,  
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Of the Japanese recent and fossil nuculid shells belonging to *Acila*, 16 forms<sup>(1)</sup> including 4 varieties and one indeterminable but compared with a foreign species, have been hitherto described. From Hokkaidô and Karahuto (Saghalin) the following species are known as fossil:

Cretaceous:

*Acila (Truncacila) hokkaidôensis* (NAGAO)

Tertiary:

*Acila (Truncacila) pictulata* (YOKOYAMA)

*A. (T.) insignis* (GOULD)

*A. (T.) gottschei* (BÖHM) (= *A. kurodai* KANEHARA)

*A. (Acila) cf. gettysburgensis* REAGAN

*A. (A.) divaricata* (HINDS) [= *A. mirabilis* (AD. and RVE.)]

Of these *A. (A.) divaricata* (HINDS) and *A. insignis* (GOULD) are living at present in the seas surrounding our country. Moreover,

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(1) See S. NOMURA and N. ZIMBO: Two new species of *Acila* from the Neogene of Northeast Honsyu, Japan. *The Venus*, Vol. VI, no. 2, 1936, pp. 104-107. The authors enumerated in this paper 11 forms known, besides two described there. Of these *N. writai* KURODA is synonymous with *A. divaricata* var. *vigilia* SCHENCK. *N. cobboldiae* of YOKOYAMA is no other than *A. gottschei* (BÖHM). To these must be added the following forms: *A. (T.) nakazimai*. ÔTUKA, *A. (A.) divaricata* var. (SCHENCK), and *A. (A.) cfr. gettysburgensis* REAGAN.

Of these, 11 were treated with by Dr. H. G. SCHENCK in his elaborate paper entitled "Nuculid Bivalves of the Genus *Acila*." *Geol. Soc. Amer. Special Papers*, no. 4, 1936.

*A. (A.) vigilia* SCHENCK, ranked by SCHENCK as a variety of *A. divaricata*, is known to live off Hokkaidô and Northern Honsyû.

Fossil shells of this genus are very frequently found in Hokkaidô and Karahuto, and abundant specimens from these two islands are contained in the Collection of our Department in Sapporo; among them the following 16 forms including 6 new and 4 indeterminable ones can be distinguished:

#### Subgenus *Truncacila*

*Acila hokkaidoensis* (NAGAO)

*A. sp. a.*

*A. insignis* (GOULD)

*A. gottschei* (BÖHM) (= *A. kurodai* KANEHARA)

*A. hidakensis* NAGAO and HUZIOKA nov.

*A. sp. b.*

*A. gottschei* var. *osugii* NAGAO and HUZIOKA nov.

*A. nakazimai* OTUKA

*A. pictulata* (YOKOYAMA)

#### Subgenus *Acila* (s. str.).

(Fossil specimens of *A. divaricata* (HINDS) are not contained in the Collection.)

*A. sp. a.*

*A. praedivaricata* NAGAO and HUZIOKA nov.

*A. kusiroensis* NAGAO and HUZIOKA nov.

*A. vigilia* SCHENCK var. *brevis* NAGAO and HUZIOKA nov.

*A. vigilia* SCHENCK var. *elongata* NAGAO and HUZIOKA nov.

*A. sp. b.*

Most forms of *Acila* (s. str.) from Hokkaidô and Karahuto are related to the living *A. (A.) vigilia* SCHENCK in many features rather than to *A. (A.) divaricata* (HINDS).

### GEOLOGICAL DISTRIBUTION

Of the above 16 forms, only two occur in the Cretaceous rocks and the remaining 14 are found in the Tertiary formations, of which two are known to live at present.

## Cretaceous:

*Acila* (*Truncacila*) *hokkaidoensis* (NAGAO) Upper Ammonite bed and the Hakobuti Sandstone.

*A.* (*T.*) sp. a. *Trigonia* Sandstone.

## Tertiary: Palaeogene (Isikari series).

*A.* (*Acila*) sp. a.

Neogene, including the Poronai series.

*A.* (*Truncacila*) *insignis* (GOULD)

*A.* (*T.*) *gottschei* (BÖHM)

*A.* (*T.*) *gottschei* (BÖHM) var. *osugii* NAGAO and HUZIOKA nov.

*A.* (*T.*) *hidakensis* NAGAO and HUZIOKA nov.

*A.* (*T.*) *nakazimai* OTUKA

*A.* (*T.*) *pictulata* (YOKOYAMA)

*A.* (*T.*) sp. b

*A.* (*Acila*) *praedivaricata* NAGAO and HUZIOKA nov.

*A.* (*A.*) *kusiroensis* NAGAO and HUZIOKA nov.

*A.* (*A.*) *vigilia* SCHENCK var. *brevis* NAGAO and HUZIOKA nov.

*A.* (*A.*) *vigilia* SCHENCK var. *elongata* NAGAO and HUZIOKA nov.

*A.* (*A.*) sp. b

*A.* (*A.*) *divaricata* (HINDS), listed by previous authors.

## Pleistocene:

*A.* (*T.*) *insignis* (GOULD)

*A.* (*A.*) *divaricata* (HINDS)

The geological occurrences of these fossils are shown in the annexed table (Table I.)

## Cretaceous:

Fossil pelecypods are numerous in the Cretaceous rocks of Hokkaidô and Karahuto, but nuculid shells are rather rare. *A.* (*T.*) *hokkaidoensis* (NAGAO) is unique species already known and commonly met with in the Upper Ammonite bed<sup>(1)</sup> (mainly Senonian)

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

TABLE I.

Geological Occurrence		Cretaceous			Palaeogene	Oligo-Miocene	Miocene	Pliocene	Pleistocene	Recent
		Trigonia Sandstone	Upper Ammonite bed	Hakobuti Sandstone	Iskarian	Poronai	Kawabataian	Oiwakeian	Setanaian & Takikawaian	Sisinaian
<i>Truncacila</i>	<i>A. (T.)</i> sp. a .....	⊕								
	<i>A. (T.) hokkaidoensis</i> (NAGAO).....		⊕	+						
	<i>A. (T.) pictulata</i> (YOKOYAMA).....					⊕				
	<i>A. (T.)</i> sp. b .....					+				
	<i>A. (T.) gottschei</i> (BÖHM).....						⊕	⊕	+	
	<i>A. (T.) gottschei</i> var. <i>osugii</i> nov.....						+			
	<i>A. (T.) hidakensis</i> nov.....						+			
	<i>A. (T.) nakazimai</i> ÔTUKA .....							⊕		
<i>A. (T.) insignis</i> (GOULD).....								+	+	
<i>Acila</i> (s. str.)	<i>A. (A.)</i> sp. a .....				+					
	<i>A. (A.) praedivaricata</i> nov.....					⊕				
	<i>A. (A.) kusiroensis</i> nov.....					+	⊕			
	<i>A. (A.) vigilia</i> var. <i>brevis</i> nov.....						⊕			
	<i>A. (A.) vigilia</i> var. <i>elongata</i> nov.....					+				
	<i>A. (A.)</i> sp. b .....						+	⊕	+	
	<i>A. (A.) divaricata</i> (HINDS).....						?	?	?	+

⊕ common occurrence

in Hokkaidô and Karahuto. Moreover, in Hokkaidô it extends to the overlying Hakobuti Sandstone.<sup>(1)</sup> Another indeterminable form was obtained in the older Trigonia Sandstone<sup>(2)</sup> in Hokkaidô. No species belonging to the subgenus *Acila* of SCHENCK is yet known.

(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. See also H. YABE: Op. cit., 1926.

(2) H. YABE: Op. cit., 1926.

## Tertiary :

The Palaeogene Isikari series<sup>(1)</sup> seems to be almost barren of nuculids, only one indeterminable specimen of *Acila* (s. str.) being contained in our very large collection. On the other hand, the Neogene formations, ranging from the Poronai<sup>(2)</sup> to Takikawa<sup>(3)</sup> or Setana, contain abundant pelecypods, and specimens of *Acila* are by no means rare. They are distributed in almost all Neogene formations in Hokkaidô and Karahuto, although individuals are usually small in number except for a few species.

*A. (T.) pictulata* (YOKOYAMA) is very common in the Poronai series of Isikari, while very large forms of the subgenus *Acila*, *A. vigilia* var. *brevis* and var. *elongata*, are numerous in the Lower Kawabata series<sup>(4)</sup> of Ihuri and Isikari. The Oiwake series<sup>(5)</sup> contains a large, more compressed form, which is, though specifically indeterminable at present, closely related to these varieties, especially to Recent *A. vigilia* SCHENCK, and is widely distributed in Hidaka and Isikari. Of the subgenus *Truncacila*, that species with a long geological range, a wide geographical distribution, and rich in individuals is *A. gottschei* (BÖHM). This species is common in the Kawabata and Oiwake. A closely related form, *A. nakazimai* ÔTUKA is very abundantly found in the Setana series<sup>(6)</sup>, the youngest

(1) H. IMAI: Stratigraphical Studies of the Coal-bearing Tertiary of the Ishikari Coal-Field, the Ishikari Series (in Japanese). Jour. Geogr. Soc., Tôkyô, Vol. XXXVI, 1924.

(2) H. IMAI: On the Relation of the Poronai Bed to the Coal-bearing Formations in the Ishikari Coal-Fields (in Japanese). Contr. from Inst. Geol. and Palaeont. Tôhoku Imp. Univ., in Japanese Language, No. 1, 1921. T. NAGAO: Tertiary Orogeny in Hokkaidô. Jour. Fac. Sci., Hokkaidô Imp. Univ., Ser. VI, Vol. IV, 1938, p. 24.

(3) H. IMAI: Stratigraphical Studies of the Coal-bearing Tertiary of the Ishikari Coal-Field. Op. cit., 1924, Pl. II. T. NAGAO: The Cenozoic History around the Sapporo-Tomakomai Depression (in Japanese). Jour. Geol. Soc. Japan, Vol. 43, 1936, p. 627.

(4) H. IMAI: Stratigraphical Studies of the Coal-bearing Tertiary of the Ishikari Coal-Field. Op. cit., 1924, Pl. II. S. MURATA: Geology of the Kuriyama District (in Japanese). Jour. Geol. Soc., Tôkyô, Vol. 30, 1923. T. NAGAO: Tertiary Orogeny in Hokkaidô. Op. cit., 1938.

(5) S. MURATA: Op. cit., 1923.

(6) T. NAGAO and Y. SASA: On the Deposits and Geological History of the Cenozoic Age in Western Hokkaidô (in Japanese). Jour. Geol. Soc., Japan. Vols. XLI and XLII. 1934-35. T. NAGAO: The Cenozoic History of Western Hokkaidô, with Special Reference to the Periods of Volcanism. Proc. Fifth Pacif. Sci. Congr., Victoria and Vancouver, Canada, 1933.

Tertiary in Hokkaidô. Another form *A. (A.) kusiroensis* nov. is met with in the Neogene Tertiary of Kusiro<sup>(1)</sup>.

The Takikawa, the Upper Pliocene representative in central Hokkaidô, does not have many fossils, but a few specimens referable to *A. gottschei* have been obtained from its basal part, besides *A. (A.) divaricata* (HINDS) listed by Dr. NOMURA. The Setana series is sometimes rich in specimens of *Acila*; *A. (T.) nakazimai* OTUKA is very common among the fossils of this formation, being found at many places in Osima and Siribesi, while *A. (A.) insignis* seems to appear in this formation in Hokkaidô, and most of the specimens from the older formations and allied to this may belong to *A. gottschei*.

#### Pleistocene :

From the Pleistocene Sisinaiian<sup>(2)</sup>, including the Sisinai bed in the province of Isikari and the Kusiro series<sup>(3)</sup> in the province of Kusiro, *A. insignis* (GOULD) is reported. *A. (A.) divaricata* (HINDS) has been sometimes listed from the Tertiary of Hokkaidô and Karahuto, but no specimen safely referable to this species is in our material. A similar species, *A. praedivaricata* nov., is known to occur in the Poronaian of Karahuto.

### DESCRIPTION OF SPECIES

#### *Truncacila* SCHENCK, 1931

#### *Aicla (Truncacila) hokkaidoensis* (NAGAO)

1932. *Nucla (Acila) hokkaidoensis* NAGAO: Some Cretaceous Mollusca from Japanese Saghalin and Hokkaidô. Journ. Fac. Sci., Hokkaidô Imp. Univ., Ser. IV, Vol. II, p. 28. pl. V, figs. 17, 18.

(1) T. NAGAO and Y. SASA: On the Stratigraphy and Geological Horizons of the Coal-bearing Tertiary in the Northern Part of the Sensyô Coal-Field (in Japanese). Jour. Geol. Soc., Tokyô, Vol. XLVI, 1939, p. 392.

(2) T. NAGAO: The Cenozoic History around the Sapporo-Tomakomai Depression. Op. cit., 1936.

(3) Y. SASA: On the Kusiro Series, the Lower Pleistocene of Hokkaidô (in Japanese). Jubilee Publ. Comm. Prof. H. YABE's 60th Birthday, 1939, p. 569.

1936. *Acila (Truncacila) hokkaidoensis* SCHENCK: Nuculid Bivalves of the Genus *Acila*. Geol. Soc. Am., Special Papers, No. 4, p. 52.
1938. *Nucula (Acila) hokkaidoensis* NAGAO and ÔTATUME: Molluscan fossils of the Hakobuti Sandstone of Hokkaidô. Journ. Fac. Sci., Hokkaidô Imp. Univ., Ser. IV, Vol. IV, Nos. 1-2, p. 37, pl. I, fig. 1.

Type localities: Several places in the vicinity of Sibunnai along the Abesinai-gawa, province of Tesio, Hokkaidô. Upper Ammonite bed.

Localities and geological horizons:

I. *Upper Ammonite bed* (mainly Senonian).

Type localities in the province of Tesio. Iwatezawa, a tributary of the Obirasibe-gawa, province of Tesio. Urakawa, province of Hidaka. Rusin, Urahoromura, Tokati-gun, province of Tokati. All in Hokkaidô. Kawakami, Toyohara-gun, Karahuto. Various places in the Keton-Aton district, Sisuka-gun, Karahuto.

II. *Hakobuti Sandstone* (Senonian).

Hetonai, Yûhutu-gun, province of Iburi, Osatinai, Sarugun, province of Hidaka. Both in Hokkaidô.

*Acila (Truncacila) sp. indet. a*

Pl. XXIX (I), Figs. 16, 17.

Shell, small, ovato-trigonal in outline, compressed, slightly longer than high. Antero-dorsal margin apparently straight, abruptly sloped downward, forming an umbonal angle of about 90° with the posterior margin, anterior end more or less narrowly rounded and the posterior one sharply truncated, ventral margin strongly convex. Surface ornamented with crowded, relatively fine radial ribs; neither secondary bifurcation nor distinct area of obsolete radial ribbing present.

One individual measuring ca. 8 mm. in height and ca. 9 mm. in length.

A number of internal and external moulds are at hand; in some of them the sculpture, though very indistinctly, is observable. They are distinguished from the preceding form in being higher and more trigonal in outline, and in having the primary bifurcation situated more posteriorly.

Locality and geological horizon: *Trigonia* Sandstone, Itinosawa near the Miruto Coal-mine, Sorati-gun, province of Isikari. (HUZIOKA coll.)

*Acila (Truncacila) insignis* (GOULD)

Pl. XXIX (I), Figs. 22, 22a.

1936. *Acila insignis* ÔSUGI (in part): Setana Series in Western Hokkaidô and its Fauna (MS.), p. 59.
1936. *Acila (Truncacila) insignis* SCHENCK: Nuculid Bivalves of the Genus *Acila*. Op. cit., p. 99, pl. XI, figs. 1-8, 12; text-fig. 7(8).
1937. *Nucula (Acila) insignis* ÔINOMIKADO: Molluscan Fossils from the Pleistocene Deposit of Sisinai in Tôbetu-mura, Isikari-gun, Hokkaidô. Journ. Geol. Soc., Japan, Vol. 44, p. 65.

For further references, see Schenck's paper.

This living species is known as fossil from the Setana beds (Upper Pliocene) and the Sisinai and Kusiro series (Pleistocene) in Hokkaidô. There is no example in our Department from older rocks in Hokkaidô and Karahuto which is safely referable to this species. Sometimes it has been reported to occur in geologically older deposits in these two islands<sup>(1)</sup>, but most of the specimens seem to belong to other species, especially the next species, *A. (A.) gottschei* (BÖHM)<sup>(1)</sup>.

Localities and geological horizons:

*Sisinai beds* (Pleistocene); Sisinai, Tôbetu-mura, Isikari-gun, province of Isikari: rather common. (KUMANO coll.)

*Kusiro series* (Pleistocene); a railway-cutting near the Harutori Coal-mine, Kusiro, province of Kusiro. (SASA coll.)

*Setana series* (Upper Pliocene); Kaigarazawa west of Kuromatunai, Suttu-gun, prov. Siribesi. (NAGAO and SASA coll.) South of Kuromatunai. (ÔSUGI coll.) Nakanokawa, Yubetu-mura, Suttu-gun, do (NAGAO and SASA coll.)

(1) For example, M. YOKOYAMA: Tertiary Mollusca from South Karafuto. Jour. Fac. Sci., Imp. Univ. Tôkyô, Section II, Vol. II, 1930, p. 417, pl. LXXX, fig. 5.

*Acila (Truncacila) gottschei* (BÖHM)

Pl. XXIX (I), Figs. 10-15.

1916. *Nucula (Acila) gottschei* BÖHM: Ueber Kreideversteinerungen von Sachalin. Jahrb. kön. preuss. geol. Landesanst., Berlin, 36, pt. 1, p. 554, pl. XXIX, figs. 5, 6, 7, 13.
1926. *Nucula cobboldiae* YOKOYAMA: Tertiary Mollusca from the Oil-fields of Embets and Etaibets. Jour. Fac. Sci., Imp. Univ. Tôkyô, Ser. II, Vol. I, pt. 7, 246, pl. XXXI, figs. 3, 4.
1929. *Acila "cobboldiae"* KURODA: The Venus, Vol. I, no. 3. Appendix, p. 8.
1930. *Nucula insignis* YOKOYAMA: Tertiary Mollusca from South Karafuto. Ibid., Vol. II, pt. 10, p. 417, pl. LXXX, fig. 5.
1936. *Acila (Truncacila) gottschei* SCHENCK (in part): Nuculid Bivalves of the Genus *Acila*. Op. cit., p. 88.
1937. *Acila (Truncacila) kurodai* KANEHARA: Pliocene Shells from the Teshio Oil-field, Hokkaidô. Journ. Geol. Soc. Japan, Vol. 44, p. 704, pl. XXII(X), figs. 4-10.
1937. *Acila insignis* var. NOMURA: On Some Neogene Fossils along the Upper Course of the Nikkôgawa, Akumi-gun, Yamagata-ken, Northeast Honsyû, Japan. Saitô Hô-on Kai Mus., Research Bull. no. 13, p. 174, pl. XXIV, figs. 1-4.

Abundant specimens of a *Truncacila* have been obtained from the Neogene at various places in Hokkaidô and Karahuto, ranging from the basal part of the Kawabata series (Miocene) to the lowest part of the Takikawa beds (Upper Pliocene). These specimens are variable in many features, but the more typical ones seem to be well identified with *A. (T.) kurodai* KANEHARA from the Tesio oil field. With regard to this species, a few specimens from Tesio were considered by Dr. YOKOYAMA as conspecific with *A. cobboldiae* SOWERBY but later renamed by Kanehara, together with specimens from Kitami, as *kurodai*.

On the other hand, a form of *Truncacila*, *A. (T.) gottschei* (BÖHM), has been known early from the Tertiary of Russian Saghalin. This species was founded on a few imperfect specimens and taken by BÖHM for a Cretaceous fossil. Although BÖHM's specimens are imperfect, the writers are warranted, as already demonstrated by ÔTUKA, to consider them as identical with *A. kurodai* KANEHARA, and hence prefer to use BÖHM's specific name. There is not much need to add to KANEHARA's precise and adequate diagnosis on this species. A few words regarding the material at hand follow.

About 100 specimens have been examined. The general features are essentially constant among the specimens. The typical ones are moderately high and inflated, but in a few specimens the shell is very obliquely elongated (Pl. I, fig. 15) approaching *A. nakazimai*, to be referred to later. The inflation also varies. Most of the specimens in the material are rather small in size and provided with finer and slightly more crowded radial ribs than the typical examples. A flattened or sometimes excavated lanceolate area is usually observable along the anterior margin around the lunule. The escutcheonal area is generally well defined, but sometimes indistinct. The area of obsolete radial ribbing is usually well developed, but it appears in an early growth-stage in some specimens and in a later one in others.

In some specimens from the Oiwake series in Uryû-gun, the shell is compressed with the growth ridges rather indistinct, the area of obsolete radial ribbing obscure, the posterior depressed area around the lunule not well defined, and the radial ribs broad and very low. These features may distinguish the specimens from the typical ones. However, the latter are, as stated above, variable in these characters, and, moreover, there seem to be intermediate individuals to link these two, they are better considered as conspecific with the typical ones.

Dimensions : (mm.)			
	L	H	T
Motiku .....	23	19	
	24	19	14
Syamani .....	21	19	11
	21	16	9 (elongate form)
	19	18	10
Uryû .....	18	15	10
	19	15	10
	19	16	10
	15	14	8.5
	20	16	11
	22	17	9 (elongate form)
	26	20	12 (elongate form)

Localities and geological horizons:

*Kawabata series* (Miocene).

Syamani, Syamani-gun, province of Hidaka. (TAKENOUTI coll.)

Yûkesi-zawa, Usappu-mura, Sarugun, do. (HATTORI coll.)

Hurenai, Horokesi-mura, Saru-gun, do. (TAKEDA coll.)  
Ororoppu, Niwan-mura, Yûhutu-gun, prov. Iburi.  
(MATUKUMA coll.)

Ponbetu, 2 km. west of Syadai water-fall, the Siraoi-gawa, Siraoi-gun, do. (Kunnui series) (HUKAYA coll.)

Upper course of the Etaibetu-gawa, Hokuryû-mura, Uryû-gun, prov. Isikari. (Numata series) (HUKAYA coll.)

Taihei, Esutoru-mati, Nayosi-gun, Karahuto. (Arakai beds). (IMAMURA and MASUBUTI coll.)

Hatuyuki-zawa, a tributary of the Keton-gawa, Sisuka-gun, Karahuto. (Upper Miocene) (NAGAO and ÔISHI coll.)

*Oiwake series* (Pliocene).

Hatizyûmantubo, Uryû-mura, Uryû-gun, prov. Isikari. (Rumoe series). (YAMADA coll.)

Upper course of the Kamoizawa, a tributary of the Etaibetu-gawa, Hokuryû-mura, Uryû-gun, do. (Lower Rumoe). (HUKAYA coll.)

Motiku, Esutoru-mati, Nayosi-gun, Karahuto. (Motiku beds). (NAGAO and MABUTI coll.)

*Basal part of the Takikawa series* (Up. Pliocene).

Kamiakabira, Sorati-gun, prov. Isikari. (NAGAO coll.)

*Nucula cobboldiae* of YOKOYAMA came from the Yûti Sandstone (Pliocene) and the Wakkanai Shale (Pliocene) of Embetu, Tesio-gun, province of Tesio, and the Wakkanai Shale of Etaibetu, Uryû-gun, province of Isikari. The localities of *A. kurodai* KANEHARA are the Ainuzawa and Yosidazawa, tributaries of the Paromautnai, and Hassennosawa, Nisi-Onupnai, Onupnai, all in the Tesio oil field. (Yûti Sandstone).

YOKOYAMA's specimens from South Karahuto came from Saki-kawa, Tomarigesimura, Sisuka-gun and Isos, Higasi-Sakutan, Moto-domari-gun. (Naikawa Beds, Pliocene).

*Acila (Truncacila) hidakensis* nov.

Pl. XXIX (I), Figs. 20, 20a.

There are at hand two specimens from Anetya, province of Hidaka, which are closely similar to *A. (T.) gottschei* (BÖHM) in general. They differ from the typical specimens of the latter in having a more distinctly excavated escutcheonal area, narrower radial ribs and broader and deeper interspaces, reminding one of the sculpture of *A. divaricata* (HINDS) var. *submirabilis* MAKIYAMA<sup>(1)</sup>. Moreover, the area of obsolete radial ribbing is not developed and secondary bifurcation is observable only in the ventral portion. The primary line of bifurcation is situated posterior to central, though this is probably owing to deformation. More material may prove that this form is a varietal one of *A. (T.) gottschei*.

Length	Height
18 mm.	16 mm.

Locality and geological horizon: Anetya, Ogiusu-mura, province of Hidaka; *Kawabata series* (Miocene). (SAMBONSUGI coll.)

*Acila (Truncacila) sp. indet. b*

Pl. XXIX (I), Figs. 21, 21a.

Seven internal moulds are in the Collection which have been derived from the Hure beds (Poronai stage, Upper Oligocene or Lower Miocene) in Karahuto and represent a form apparently distinct from all known species.

Mould small, oblique, truncato-ovate in outline, inequilateral, evenly convex; anterior extremity narrowly rounded, the posterior one sharply truncated; antero-dorsal margin rather convex, the ventral broadly arched. Inner margin presumably smooth. Escutcheonal area apparently well defined.

This form seems to belong to the subgenus *Truncacila*, for there is not present any trace of the rostral sinus. It is not unlike *A. (T.) gottschei* (BÖHM), from which, however, by comparison with the moulds of the latter, it seems to be distinct in being more

(1) J. MAKIYAMA: Tertiary Fossils from North Kankyô-dô, Korea, Mem. Coll. Sci., Kyôto Imp. Univ., Series B, Vol. II, 1926, p. 151, pl. XII, fig. 9.

oblique and more inflated. In one of the specimens it is shown that the escutcheonal area sculptured is quite similarly to *A. gottschei*.

Dimensions : (mm.)

	L	H	T
(mould)	18	15	11
( " )	19	15	11
( " )	15	12	19

Locality and geological horizon: Hure beds (Poronai stage), Kami-Esutoru, Esutoru-mati, Nayosi-gun, Karahuto.

*Acila (Truncacila) gottschei* (BÖHM) var. *ôsugii* nov.

Pl. XXIX (I), Figs. 18, 19.

Shell small, obliquely ovato-trigonal, moderately inequilateral, rather convex; postero-dorsal margin short, nearly straight, sloping more gently than the postero-dorsal one, and obliquely subtruncated by the anterior margin, antero-ventral extremity evenly rounded, ventral margin convex and rather rapidly raised posteriorly. Umbo prominent, beak small, appressed, opisthogyrous. Umbonal angle acute. Divaricating ribs broad, low, flatly rounded on top, and crowded, being separated by shallow linear grooves which are more distinct and broader towards both anterior and posterior margins, somewhat dichotomous near the margins of the shell. Primary line of bifurcation subcentral, no distinct secondary bifurcation observable. Concentric ridges numerous, prominent at intervals, very dense near the ventral margin, obliterating there the radial ribs. Inner margin apparently finely corrugated. Muscular and pallial impressions distinct. Hinge character unknown. Lunule short, narrow-lanceolate. Escutcheonal area very indistinctly limited, convex, slightly pouting, and crossed by radial ribs all over except the true escutcheon which is small, deep, cordate, and smooth.

Dimensions : (mm.)

	Length	Height	Thickness
Holotype	14.0	11.8	4.0 (left valve)
Paratype	13.5	11.5	ca. 7.5

Five specimens at hand. The present form is similar to *A. (T.) gottschei* (BÖHM) in many features. Compared with the typical specimens of the latter, it is shorter, higher, more trigonal,

and more inflated with a less distinct escutcheonal area. The divaricating ribs in the present species seem to be broader, flatter, and separated by narrower and shallower interspaces than in the latter. However, *A. gottschei* shows some variation among individuals, as stated before, both in outline of the shell and sculpture, and some specimens, especially those derived from the Kawabata series of Hokkaidô, appear to be akin to the present form, so that the latter is better regarded as conspecific with *A. gottschei*.

Another comparable species from Japan may be *A. (T.) osawensis* NOMURA and ZIMBO<sup>(1)</sup> from the Ôsawa shell bed (Miocene) of the Muri series in Yamagata prefecture. The present form differs therefrom in having a less compressed, higher, and more trigonal shell with a narrower umbonal angle.

Locality and geological horizon: The Rettan-gawa, Konotoromura, Maoka-gun, Karahuto (probably the Arakai beds, Miocene). (ÔSUGI coll.)

### *Acila (Truncacila) nakazimai* ÔTUKA

Pl. XXIX (I), Figs. 5-9.

1936. *Acila insignis* ÔSUGI (in part): Setana Series in Western Hokkaidô and its Fauna. Op. cit., p. 59.

1939. *Acila (Truncacila) nakazimai* ÔTUKA: Mollusca from the Cainozoic System of Eastern Aomori Prefecture, Japan. Jour. Geol. Soc. Japan, Vol. XLVI, p. 24, pl. II, figs. 11, 12.

Type locality: Tanabu formation (Pliocene), Tadekohanamizu near Tanabu, Simokita Peninsula, Aomori Prefecture.

More than sixty specimens of a large nuculid shell have been obtained from the Setana beds (Upper Pliocene) and the Otobe bed, both in the southwestern part of Hokkaidô. The Otobe bed exposed at Otobe near Esasi, province of Osima, is probably contemporaneous with or slightly older than the Setana; it is regarded as Pliocene in age. These specimens, which are rather large for the subgenus *Truncacila*, thick-tested, moderately compressed or inflated, obliquely elongated, with a more or less broad area of obsolete radial ribbing, are well identified with *A. (T.) nakazimai* ÔTUKA described by ÔTUKA.

(1) S. NOMURA and N. ZIMBO: Two New Species of *Acila* from the Neogene of Northeast Honsyû, Japan. The Venus, vol. VI, no. 2, 1936, p. 140, text-figs. 3a, 3b.

The specimens at hand are somewhat variable in inflation, being compressed in young stage but rather abruptly convex near the ventral margin in many specimens. The escutcheonal area is usually more or less well defined. The secondary bifurcation is sometimes well developed especially near the ventral margin. The breadth of the area of obsolete radial ribbing is variable, appearing earlier in some individuals and later in others. The radial ribs are generally broad but rarely fine and crowded (fig. ).

This species is identical in many features with *A. (T.) gottschei* (BÖHM), referred to before. It is distinguished from the typical specimens of the latter species, as ÔTUKA remarked, by its longer and lower shell with a less produced posterior extremity. Moreover, the test is thicker, the antero-dorsal margin usually longer and more straight, the posterior extremity more sharply truncated, and the ventral margin more broadly convex than in *A. gottschei*. The latter is, however, widely variable, as described before, in outline of the shell as well as in sculpture, and a few individuals are closely similar to the present form, being obliquely elongated and rather compressed.

The present species seems to be restricted in Hokkaidô to the Setana and Otobe beds, not being yet definitely known to occur in rocks older than these formations.

Localities and geological horizons:

*Otobe beds* (Pliocene); Kaigara-zawa, Otobe near Esasi, province of Osima.

*Setana series* (Upper Pliocene); Byakutan-gawa, Neppumura, Utasutu-gun. (NAGAO and SASA coll.) Maruyama about 3 km. southeast of Higasi-Setana, Higasi-Setana-mura, Setana-gun. (ÔSUGI coll.) Six places along the Tosibetu-gawa between Turibasi and Pirika, Tosibetu-mura, Setana-gun. (NAGAO, SASA, and ÔSUGI coll.) All in the province of Siribesi.

*Acila (Truncacila) pictulata* (YOKOYAMA)

Pl. XXIX (I), Figs. 1-4.

1890. *Nucula pictulata* YOKOYAMA: Versteinerungen aus der japanischen Kreide. Palaeontographica, 36, p. 19, pl. XXV, figs. 1, 2a, b.  
 1936. *Acila (Truncacila) pictulata* SCHENCK: Nuculid Bivalves of the Genus *Acila*. Geol. Soc. Am., Special Papers, No. 4, p. 87, pl. IV, figs. 10, 12; text-fig. 8 (9).

Type locality: Poronai, Sorati-gun, Hokkaidô. Poronai series.

This species, one of the characteristic and most common fossils of the Poronai series in Hokkaidô, was founded upon a few imperfect specimens from Poronai. The following description is based upon a number of specimens, some of them well preserved, in the Collection of our Department collected from various localities in Hokkaidô.

Shell medium in size for the subgenus, ovato-trigonal to truncato-ovate, rather equilateral; anterior extremity rounded, the posterior one sharply truncated, angulated, and produced in its ventral portion. Antero-dorsal margin nearly straight, the posterior one long, sloped backward, and also straight, with usual exception of a pouting in the escutcheonal region, and the ventral margin very broadly arched with its posterior portion straight and subangulated with the rest showing a faint trace of rostral sinus in some individuals. Primary bifurcation subcentral in position, secondary bifurcations rarely present in the umbonal region, usually near the posterior border, and always very numerous near the ventral margin. Radial ribs fine and crowded, separated by narrower, distinct concave interspaces. Obsolete area of radial ribbing usually absent, but in a few individuals faintly observable. Concentric ridges sometimes prominent and numerous. Inner margin finely corrugated. Escutcheonal area rather well defined, ovate in outline, nearly flat except for a low and round radial elevation, external to this elevation the surface is excavated. Area traversed by radial ribs except the dorsal cordate region which is bounded by the elevation above cited and excavated and finely striated. A narrow smooth band present beneath the beak and along the external ridge, and short, soon becoming obsolete. Lunule narrow-lanceolate, circumscribed by a distinct ridge. Adductor muscle-scars not depressed. Anterior teeth ca. 16 in number and the posterior ones ca. 10.

Dimensions : (mm.)

	Length	Height	H/L× 100	Thickness	T/L× 100	Umbonal angle
Holotype	28.0	21.0		15.0		(YOKOYAMA, 1890)
No. 1	22.5	20.0	89	14.8	66	100°
2	24.0	20.0	83	14.0	58	115°
3	26.2	23.2	89	15.0	58	105°
4	24.8	21.0	85	15.2	61	110°
5	23.5	21.0	89	14.8	63	110°
6	22.0	19.0	87	12.0	55	115°
7	26.0	22.2	85			115°

	Length	Height	H/L× 100	Thickness	T/L× 100	Umbonal angle
8	25.0	20.5	82			115°
9	18.8	17.0	90	12.5	67	115°
10	21.1	19.0	90	12.0	57	115°
11	20.0	17.0	85	10.5	53	115°
12	25.0	21.5	86	13.6	54	120°
13	21.0	19.0	90	13.1	62	115°
14	25.0	21.0	84	14.0	56	115°
15	24.3	21.0	86	15.0	62	110°
16	17.6	14.6	83	10.0	52	120°
17	18.8	15.8	89	10.0	53	117°
Range.	17.6-26.2	14.6-23.2	82-90	10.0-15.2	53-67	100-120
Mean.	22.7	19.6	86	13.1	58	

Localities and geological horizon. *Poronai series* (Oligo-Miocene) in Hokkaidô, not yet known to occur in rocks younger than the Poronai.

Ikusyunbetu district, Sorati-gun, province of Isikari; Poronai, Yayoi and Ikusyunbetu. Miruto district, Sorati-gun, province of Isikari; Miruto and Manzi. Yûbari-gun, province of Isikari; Yûbari, Sinyûbari, Sikanotani, Wakkanabe, Ôyûbari, Simizusawa, Numanosawa, Mayati, Kaede, Noborikawa, and Momiziyama.

The Sôsyubetu-gawa and Ryukenai-zawa, tributaries of the Obirasibe-gawa, province of Tesio.

### *Acila* (*s. s.*) H. & A. ADAMS, 1858

#### *Acila (Acila) divaricata* (HINDS)

1935. *Nucula (Acila) divaricata* NOMURA: A Note on some Fossil Mollusca from the Takikawa Beds of the Northwestern Part of Hokkaidô, Japan. Sci. Rept. Tôhoku Imp. Univ., Second Ser., Vol. XVIII, no. 1, p. 32.
1936. *Acila (Acila) divaricata* SCHENCK: Nuculid Bivalves of the Genus *Acila*. Op. cit., p. 90, pl. XV, figs. 1-10; text fig. 8 (1 and 2).
1937. *Acila (Acila) divaricata* KANEHARA: Neogene Shells from the Etaibetu Oil-Field, Hokkaidô. Journ Geol. Soc., Japan, Vol. XLIV 7. 791.

For further references, see SCHENCK's above paper.

In the Collection of our Department, there is no specimen which is referable to this living form of Japan. Mr. KANEHARA listed this species from the Etaibetu dark gray shale (Miocene) in Uryû-gun, prov. Isikari, and Dr. NOMURA also reported its occurrence in the

Takikawa bed (Upper Pliocene) of the same province. NOMURA's material contains "a few, rather small specimens of internal as well as external moulds". Dr. YOKOYAMA also listed this form from the Neogene of Haboro in the province of Tesio<sup>(1)</sup>, Hokkaidô, and from Ôdomari and some other districts in Karahuto<sup>(2)</sup>. All these specimens can not be treated at present, for their features are not described. However, the well preserved large specimen figured by YOKOYAMA<sup>(3)</sup> from the Ôdomari region, Karahuto, and assigned to the present species, is evidently distinct and belongs to the *vigilia*-stock. More material will prove that it is either *A. (A.) vigilia* var. *brevis* nov. or *A. (A.)* sp. b to be treated later.

Localities and geological horizons:

*Etaibetu dark gray shale* (Miocene), Etaibetu-gawa, Uryû-gun, province of Isikari (after KANEHARA).

*Takikawa beds* (Upper Pliocene) in the vicinity of Ebisima Railway Station, Hokuryû-mura, Uryû-gun, province of Isikari (after NOMURA).

*Acila (Acila) vigilia* SCHENCK var.

*brevis* nov. and var. *elongata* nov.

Pl. XXX (II), Figs. 1-4; Pl. XXXI (III), Figs. 1-4.

A large nuculid shell has been long known to occur in the Lower Neogene rocks exposed along the Yûbari-gawa near Momiziyama, province of Isikari. This is frequently listed under the name of *Nucula divaricata* HINDS (= *N. mirabilis* AD. and RVE.), but it is distinct from the latter in many features. Recently SCHENCK described and figured a similar form on a few specimens collected off the south coast of Hokkaidô and named *A. divaricata* var. *vigilia* SCHENCK<sup>(4)</sup>. This living form had been, prior to this, illustrated by

(1) M. YOKOYAMA: Tertiary Shells from the Coal-Field of Haboro, Tesio. Jour. Coll. Sci., Tokyo, Sect. II, Vol. II, pt. 4, 1927, p. 194.

(2) M. YOKOYAMA: Tertiary Mollusca from South Karahuto. Ibid.; Vol. II, pt. 10, 1930, p. 412.

(3) M. YOKOYAMA: Molluscan Fossils from Karafuto. Ibid., Vol. II, pt. 9, 1927, p. 380, pl. LXXVI, fig. 2.

(4) H. G. SCHENCK: Op. cit. 1936, p. 101, pl. XVII, figs. 1-6.

KINOSITA and ISAHAYA<sup>(1)</sup> with the name *A. uritai* KURODA, from Hokkaidô, but without a description. The fossil from the Neogene of Hokkaidô above cited is distinguished from *A. (A.) divaricata* by its sharply truncated posterior extremity, its postero-ventral one not much produced, the rostral sinus less distinct, the radial ribs more crowded, broader, and the escutcheonal area ribbed nearly all over except the true escutcheon. In all these points, it is closely similar to living *A. (A.) vigilia*.

Mr. R. TIBA kindly donated to the present writers for comparison with the fossils 11 well preserved specimens of the latter obtained from the following three localities: [pl. XXX (II), figs. 5-9]

1. Off Erimo, Hokkaidô, 200-250 fathoms deep. [pl. XXX (II), figs. 5-7]
2. Off Muroran, Hokkaidô, 200 fathoms deep. [pl. XXX (II), figs. 8, 8a]
3. Off Kuzi, Iwate Prefecture, 200 fathoms deep. [pl. XXX (II), figs. 9-9b]

The present writers wish to express their thanks to Mr. TIBA for his generosity.

Shell large, subquadrangular to oblong-ovate in outline, usually much inflated, sometimes almost cylindrical. Anterior extremity rounded or obliquely subtruncated, the posterior one sharply and vertically truncated by escutcheonal area, the postero-ventral angulated. Antero-dorsal margin slightly arcuate, the posterior straight except for a weak pouting, and the ventral broadly convex and slightly raised posteriorly, with a more or less distinct rostral sinus. Umbonal angle a little obtuse. Umbones convex, beaks approximate, sharply opisthogyrous.

Primary bifurcation central or sometimes a little anterior to the median vertical and frequently doubled; secondary bifurcation usually well developed and numerous inverted V-shaped markings observable especially in the ventral region, but rarely in the postero-ventral region of the shell. Radial ribs narrow, crowded, rather flat-topped and separated by narrower interspaces; they are more rounded, narrower, more apart in the umbonal region, becoming broader and

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(1) T. KINOSITA and T. ISAHAYA: Catalogue Moll. Hokkaidô, No. 1, p 12, pl. VIII, fig. 61.

flatter in the midheight portion of the shell, and toward the ventral margin from the line about 12–16 mm. from the umbo they are usually dichotomous and individual rib narrower than in the midheight portion, much crowded, and alternated with linear interspaces. Area of obsolete radial ribbing broad. Concentric ridges prominent, numerous and dense, especially near the ventral margin.

Lunule well defined, narrow-lanceolate, and rather short. Escutcheonal area cordate, flat or excavated except for a median faint elevation, circumscribed by a prominent ridge and traversed by radial ribs all over except the true escutcheon. True escutcheon somewhat variable in extension, usually being cordate, but sometimes broad-lanceolate and long, generally excavated. Radial ribs in the area interrupted by a very narrow and short smooth band which is present close to the external ridge of the area and restricted to the subumbonal region, soon fading away below. Sometimes the lower portion of the area is also covered with only densely set striae, but this smooth region is essentially different from that narrow band above cited, having resulted from the obliteration of radial ornamentation by striae. Hinge not well observed, but anterior teeth ca. 16 and the posterior ones ca. 10.

Among the material at hand, two forms are distinguished, though they are found together at places and some individuals are apparently intermediate in several features.

a) *Var. brevis* (Pl. XXX (II), Figs. 1–4)

Usually very inflated but sometimes more compressed, short, sometimes as high as long, quadrangular in outline, with the anterior extremity somewhat broadly rounded or obliquely subtruncated. Umbonal angle only slightly obtuse, the rostral sinus indistinct with the postero-ventral end of the shell not produced.

Localities and geological horizons:

*Upper Poronai* (Lower Miocene); Yayoi coal-mine, Mikasayama-mura, Sorati-gun, province of Isikari. (HUZIOKA coll.) Yûbari-mati, Yûbari-gun, do. (YABE coll.)

*Lower Kawabata* (Middle Miocene); Ororoppu, Yûhutu-gun, province of Ihuri. (ÔTATUME and MATUKUMA coll.) Esamanbetu and Pon-Esamanbetu, Syamani-mura, Syamani-gun, province of Hidaka. (TAKENOUTI

coll.) Upper course of the Gabari-gawa, Monbetu-mura, Saru-gun, do.

Upper Kawabata (Middle or Upper Miocene); Ninosawa, Iwamizawa-mati, province of Isikari. A referable specimen. (HATTORI coll.)

The large specimen figured by Dr. YOKOYAMA from Ôdomari, Karafuto, and referred by him to *A. divaricata*, most probably belongs to this variety or possibly to *A. sp. b* to be described later.

The convexity of shell is somewhat variable; umbonal angle is nearly 90° in many cases, but sometimes slightly obtuse, the anterior extremity often subangulated below; typically only slightly longer than high, or in a few specimens even nearly as high as long, but in others somewhat elongated transversely approaching var. *elongata* to be described below.

## Dimensions: (mm.)

	L	H	T	H/L×100	T/L×100
(Gabari)	24	20	15	83	63
(Pon-Esamanbetu)	34	28	24	82	70
( " )	32	26	22	81	70
( " )	29	25	22+	86	76
(Esamanbetu)	41	34	26	83	63
( " )	31	27	ca. 24	87	76+
( " )	29	25	ca. 19	86	66-
( " )	31	24	18	77	58
( " )	25	20	15	80	60
(Ororoppu)	43	34	26	79	60
( " )	34	26	23	76	68
( " )	ca. 30	25	17	ca. 83	ca. 57
(Poronai)	36	29	20+	80	56*
( " )	28	23	16	82	57
Transitional specimens					
(Ororoppu)	32	25	18+	78	56+
( " )	23	17	12	74	52-**

Note: \* somewhat deformed. \*\* approaching to var. *elongata*.

Var. *elongata* (Pl. XXXI (III), Figs. 1-4). Oblong-ovate in outline, elongate with the anterior margin narrowly rounded and often subpointed, usually much inflated with convex umbones. Radial ribs narrow, crowded. Rostration rather well defined, with a distinct sinus. Postero-ventral extremity more distinctly produced

and umbonal angle often slightly larger than in var. *brevis*. As stated above, there are not wanting certain individuals linking this and the preceding variety.

Localities and geological horizon:

*Lower Kawabata* (Takinoue bed); the Asahi Coal-mine, Sorati-gun, province of Isikari. (HATTORI and HUZIOKA coll.).

A few specimens referable to this variety and somewhat transitional have been obtained from the Lower Kawabata series at Ororoppu, Yûhutu-gun, province of Iburi, together with var. *brevis*.

This form is also variable in the convexity of the shell, being sometimes compressed. The radial ribs are usually narrower than in the preceding variety but often as wide as in that form.

Dimensions: (mm.)

L	H	T	H/L×100	T/L×100
41	29	22	70	54
40	27	21	68	53
37	24	ca. 20	70	(54)
33	24	16 (deformed)	73	(48+)
32	22	18	63	56
26	19	13	73	50

The above two forms are identical in many features with *A. vigilia* SCHENCK as stated before, and the writers are now inclined to consider them not as a distinct species but as varieties, of that living one. A detailed study Mr. R. TIBA<sup>(1)</sup> on numerous specimens, shows that *A. vigilia* is variable in some features, as follows:

L.	ranges 31 to 46 mm.;	36-38 mm. predominating
H.	" 24 to 37 mm.;	27-31 mm. "
T.	" 14 to 24 mm.;	18-23 mm. "
H/L×100	" 71 to 82;	75-78 "
T/L×100	" 44 to 61;	48-52 "

From the above table, it is clear that the varieties are often thicker,<sup>(2)</sup> and the first variety shorter and higher, while the second longer, than *vigilia*, as shown below.

(1) R. TIBA: Statistical Test of Species Concept in *Acila vigilia* SCHENCK. The Venus, Vol. IX, 1939, p. 150.

(2) A specimen of *vigilia* at hand from off Kuzi [pl. XXX (II), figs. 9-9b] is much thicker than the other recent specimens from Hokkaidô, and seems especially to be akin to the fossil varieties in this respect.

Var. *brevis* H/L $\times$ 100 ranges 74 to 84; most specimens have a ratio of 80, and T/L $\times$ 100 ranges 55 to 79, usually 60-70.

Var. *elongata* H/L $\times$ 100 ranges 66 to 73; usually 70+ and T/L $\times$ 100 ranges 48+ to 56, mostly over 53.

Moreover, it is remarkable that var. *brevis* is more sharply truncated posteriorly with a less distinct rostral sinus, while var. *elongata* has a larger umbonal angle and more produced postero-ventral extremity, than *vigilia*. They bear a more distinctly excavated escutcheonal area and narrower and more crowded radial ribs than the living form. Furthermore, the ornamentation of the escutcheonal area is somewhat different from that of *vigilia*. The escutcheonal area of the fossil varieties has the radial ribs only slightly interrupted by a very narrow and short smooth band beneath the beak and close to the external margin. The smooth band is in *vigilia* broader, longer, and usually more pronounced.

Var. *brevis* is similar to *A. gettysburgensis* (REAGAN)<sup>(1)</sup> from America in general outline, but has narrower and more crowded radial ribs and is more sharply truncated posteriorly.

#### *Acila (Acila) kusiroensis* nov.

Pl. XXXI (III), Figs. 10-11b.

Shell subquadrangular in outline, anterior extremity rounded, the posterior one sharply truncated with its ventral portion somewhat produced. Antero-dorsal margin slightly arcuate, sloping gently downward. Posterior margin nearly straight except for a weak pouting in the escutcheonal region; it forms a slightly obtuse angle with the ventral margin. Ventral margin broadly convex with its posterior portion abruptly raised backwards and meeting the rest of the margin at an indistinct angle.

Radial ribs rather narrow and separated by interspaces as wide as or slightly wider than the ribs themselves. Primary bifurcation subcentral in position, no secondary bifurcation observable. Area of obsolete radial ribbing absent or indistinct. Inner margin finely

(1) B. L. CLARK: San Lorenzo Series, Mid. California. Univ. Calif. Publ., Geology, Vol. VII, 913, p. 290, pl. XIV, figs. 2a, 2b. H. G. SCHENCK: Nuculid Bivalves of the Genus *Acila*. Op. cit., p. 78, pl. XII, figs. 1-15; pl. XIII, figs. 4, 7, 9; text-fig. 8 (11, 14).

corrugated. Escutcheonal area elongate-ovate, indistinctly limited, circumscribed by a very obtuse ridge, and crossed by radial ribs all over except the long, lanceolate region along the posterior margin of the shell. Lunule well defined, long-lanceolate, and smooth. Adductor muscle-scars distinct but not deep. Hinge not well observable, but anterior teeth ca. 20 in number and the posterior ones apparently more than 10.

## Dimensions : (mm.)

Length	Height	H/L×100	Thickness	T/L×100	Umbonal angle
29.0	24.0	83	15.5	53	110°
36.0	27.8	77	19.0	53	108°
30.0	22.5	75	16.0	53	105°
32.0	24.0	75	16.0	51	105°
30.0	23.0	77	16.0	53	100°
31.0	23.5	76			
29.0	22.0	76	15.0	51	106°
31.0	22.5	72	16.0	51	
29.0	23.0	79	15.0	51	
29.0	22.5	77	15.5	53	100°
31.0	* 25.0	80	16.5	53	100°
Range.					
29.0-36.0	22.0-27.8	72-83	15.0-19.0	51-53	100°-110°

About 20 specimens have been examined, all but 6 of which are represented by internal moulds. They are characterised by the presence of a very indistinct rostral sinus. In this point and a nearly straight posterior portion of the ventral margin, they stand rather near *A. pictulata* (YOKOYAMA) referred to before, and one may consider them as belonging to the subgenus *Truncacila* of SCHENCK. This form is oblong-ovate and distinguishable from *A. pictulata*.

This species is most closely akin to young specimens of recent *A. vigilia*, but relatively shorter, slightly more inflated, and has more crowded and narrower radial ribs, as far as the imperfect fossil specimens at hand are concerned. It differs from *A. divaricata* (HINDS) in being more quadrate in outline and in having an indistinct rostration and a more sharply truncated posterior end. No smooth band is present in the escutcheonal area. In the last feature, it is also distinct from *A. vigilia* SCHENCK and more similar to *A. (A.) vigilia* var. *brevis* nov. described before.

Most of the specimens at hand are less inflated than var. *brevis* and the radial ribs are relatively narrower and more apart. Moreover, the obsolete area of radial ribbing is indistinct in this species. The escutcheonal area is separated from the flank by less distinct ridges.

Localities and geological horizons: Various places along the upper course of the Tyaro-gawa, province of Kusiro. *Ombetu series* to the *Atunai series*<sup>(1)</sup> (Miocene in the main). (SASA, HIRANO WATANABE, SAITÔ and SAI coll.)

*Acila (Acila) praedivaticata* nov.

Pl. XXXI (III), Figs. 5-8.

Shell rather small for the subgenus, sub-ovate in outline, usually compressed but sometimes moderately inflated. Antero-dorsal margin long, slightly arcuate. Anterior end rounded or obliquely subtruncated, the posterior one truncated. Postero-dorsal margin oblique downward and backward, straight except for a distinct pouting, ventral margin evenly arched and raised posteriorly. Rostral sinus distinct, and protero-ventral end of the shell somewhat produced. Umbonal angle obtuse.

Radial ribs very fine, crowded, separated by linear grooves, and they diverge from the line of bifurcation at an obtuse angle; primary bifurcation situated nearly central, no secondary bifurcation near the posterior border, but inverted V-shaped markings sometimes present, especially near the ventral margin. Concentric ridges numerous and crowded; area of obsolete radial ribbing usually well developed. Inner margin smooth.

Lunule narrow-lanceolate. Escutcheonal area narrow-cordate, ribbed radially except the smooth, lanceolate central portion which is rather broad and long. A short and very narrow smooth band present beneath the umbo and along either of the external margins of the area. On the lower portion of the escutcheonal area, ribs obliterated by the predominance of concentric striae. Hinge not well observable.

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(1) Y. SASA: Stratigraphy of the Tertiary Deposits in the Kusiro Coal-Field and a Critical Review of the Opinions Expressed (in Japanese). Bull. Coal Mining Soc. Hokkaidô, 1940, Nos. 307-308.

## Dimensions : (mm.)

Length	Height	H/L×100	Thickness	T/L×100	Umbonal angle
26.0	21.0	81	14.5	56	110°
25.0	19.5	78	14.5	58	110°
24.0	19.0	79	12.0	50	105°
22.8	18.0	79	11.8	52	105°
29.0	22.0	76	16.0	55	108°
19.2	16.0	83	10.5	54	103°

More than 20 specimens, including several moulds, of this form are at hand, most of which are very imperfect but sufficient for comparison with allied species. This species is closely similar to *A. (A.) divaricata* (HINDS), but is distinguished therefrom by its shorter shell covered with finer and more crowded radial ribs. The rostral sinus is less distinct and the postero-ventral end less produced than in the living species. The umbonal angle is usually smaller. As far as the specimens at hand are concerned, no secondary line of bifurcation is developed on the posterior area behind the rostral sinus.

At first sight it may be considered as similar in the ornamentation of the escutcheonal area to *A. divaricata*, but essentially it belongs to the type of *A. vigilia* var. *brevis*. In one of the specimens, this area is provided with a very narrow smooth band beneath the umbo and very close to the external margin of the area, but the band soon fades away.

In outline it is near to *A. vigilia*,<sup>(1)</sup> but, as compared with large specimens of the latter, the radial ribs are often finer and more crowded, and devoid of the secondary line of bifurcation. Most distinctive features are its more developed rostral sinus and more produced postero-ventral end. Moreover, all the specimens are much smaller than *A. vigilia*, although it is not certain that they are adult individuals. On the other hand, when compared with the young specimens of the latter form which match in size with the present species itself, it is relatively shorter, more inflated with a less produced postero-ventral extremity, and decorated with finer and more crowded radial ribs. Moreover, the area of obsolete radial ribbing is better developed in the present fossil.

This species is also related to *A. vigilia* var. *brevis* described

(1) H. G. SCHENCK: *Nuculid Bivalves of the Genus Acila*. Op. cit., 1936, p. 101, pl. XVII, figs. 1-6.

before, but is usually less inflated and less distinctly truncated posteriorly, with a shorter posterior margin and a more produced postero-ventral end. The radial ribs are diverge at a larger angle than in the latter.

Localities and geological horizon: Arakai-zawa and Karumai-zawa near Maoka-mati, Karahuto. *Upper Nisisakutan beds* (Upper Poronaian, Lower Miocene or Upper Oligocene).

***Acila (Acila) sp. indet. a***

Pl. XXXI (III), Fig. 9.

There is in the material a single internal mould of *Acila* (s. str.) from the Palaeogene Wakkanabe beds in Hokkaidô. The mould is rather small, trigonally ovate in outline, moderately inflated with a relatively straight antero-dorsal margin, a narrowly rounded anterior extremity, and a broadly and evenly convex ventral margin. Divaricating ribs are only partly impressed on it. It is characterised by having a large umbonal angle, a produced posterior extremity, and a probably distinct rostral sinus. Thus it is distinct from all species from Hokkaidô and Karahuto treated in this paper. It seems to be a near relative of *A. (A.) divaricata* var. *ashiyaensis* NAGAO as well as var. *submirabilis* MAKIYAMA.<sup>(1)</sup>

L  
21 mm.

H  
17 mm.

T  
12 mm.

Locality and geological horizon: *Wakkanabe beds* of the Isikari series (Lower Oligocene or Upper Eocene); Nakanosawa, Utasinai, Sorati-gun, province of Isikari. (ÔTATUME coll.)

***Acila (Acila) sp. indet. b***

Pl. XXXI (III), Figs. 12-12b.

There are in the collection several moulds from the Upper Kawabata and Oiwake series of various places in Hokkaidô. They are separable from *A. divaricata* (HINDS) in being shorter, more

(1) These two varieties of *A. divaricata* are sometimes considered as synonymous with each other but distinct in having a different escutcheonal area, as already stated by one of the present writers (T. NAGAO: Palaeogene Fossils of the Island of Kyûshû, Japan. Sci. Rept. Tôhoku Imp. Univ., Second Series, Vol. XII, 1928, p. 21).

sharply truncated posteriorly, and provided with an indistinct rostral sinus and a rather narrowly rounded posterior extremity. They are decidedly less inflated than the varieties of *A. vigilia* described in this paper. They seem to be different from *A. praedivariata* nov. from Karahuto in outline of shell and in its larger size and from *A. kusiroensis* nov. in having slightly broader radial ribs and a better defined escutcheonal area. It seems to be most closely related to Recent *vigilia*. However, these forms are mutually somewhat related, and the position of the specimens under consideration can not be settled until more material comes under examination.

Localities and horizons: *Upper Numata beds (Upper Kawabata)*, Etaibetu, Hokuryû-mura, Uryûgun, province of Isikari; *Lower Oiwake series (Kamogawa beds, Lower Pliocene or Upper Miocene)*, Môrai, Atuta-gun, do; *Oiwake series (Kuromatunai series)*, Nigori-kawa, Kayabe-gun, province of Osima; *Oiwake series*, Sisungawa, Kabato-gun, do.

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## EXPLANATION OF THE PLATES XXIX (I)—XXXI (III)

(All figures are of natural size)

### Plate XXIX (I)

- Figs. 1-4. *Acila (Truncacila) pictulata* (YOKOYAMA). Tômatu, Sorati-gun, province of Isikari. Poronai series. 1a, 2a, dorsal views; 1b, 2b, posterior views.
- Figs. 5-7. *Acila (Truncacila) nakazimai* ÔTUKA. South of Hanaisi Railway Station, Tosibetu-mura, Setana-gun, province of Siribesi. Setana series. 5a, 6a, posterior views; 5b, 6b, dorsal views.
- Figs. 8, 9. Do. West of Hanaisi Railway Station, do. Setana series.
- Figs. 10, 15. *Acila (Truncacila) gottschei* (BÖHM). Kamoizawa, a tributary of the Etaibetu-gawa, province of Isikari. Oiwake series. 15a, a dorsal view; 15b, a posterior view.
- Fig. 11. Do. Upper course of the Etaibetu-gawa, do. Kawabata series.
- Figs. 12-14. Do. Hatizyûmantubo, Uryû-mura province of Isikari. Oiwake series. 14a, a dorsal view; 14b, a posterior view.
- Figs. 16, 17. *Acila (Truncacila)* sp. a. Itinosawa near Miruto, province of Isikari. Trigonía Sandstone. Two artificial moulds.

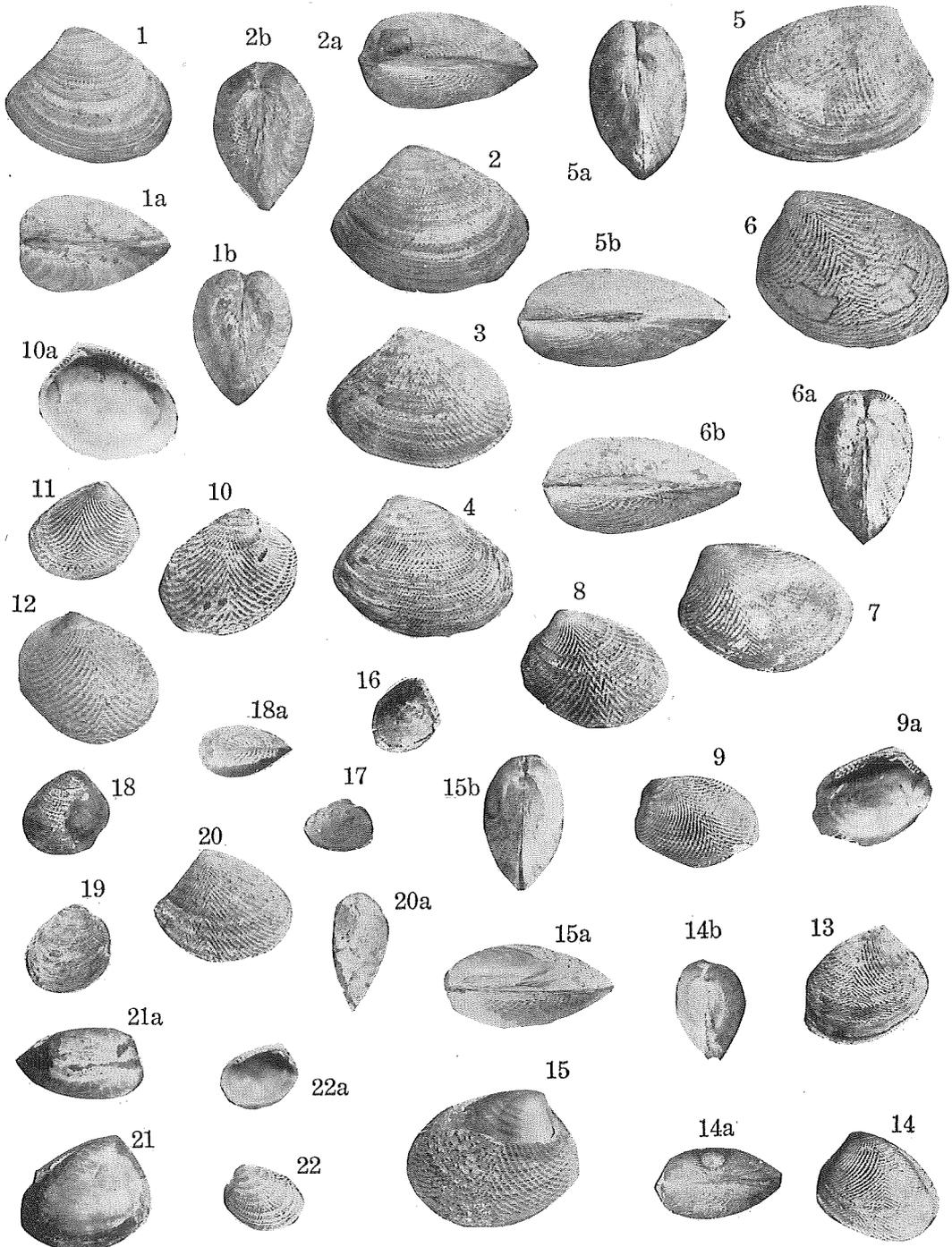
- Figs. 18, 19. *Acila (Truncacila) gottschei* (BÖHM) var. *osugii* nov. Rettan-gawa, Konotoro-mura, Karahuto. Arakai beds? 18a, a dorsal view.
- Fig. 20. *Acila (Truncacila) hidakensis* nov. Anetya, Ogiusu-mura, province of Hidaka. Kawabata series. 20a, a posterior view.
- Fig. 21. *Acila (Truncacila)* sp. b. Kami-Esutoru, Esutoru-mati, Karahuto. Hure beds (Poronai series). 21a, a dorsal view.
- Fig. 22. *Acila (Truncacila) insignis* (GOULD). South of Kuromatunai Railway Station, province of Siribesi. Setana series.

## Plate XXX (II)

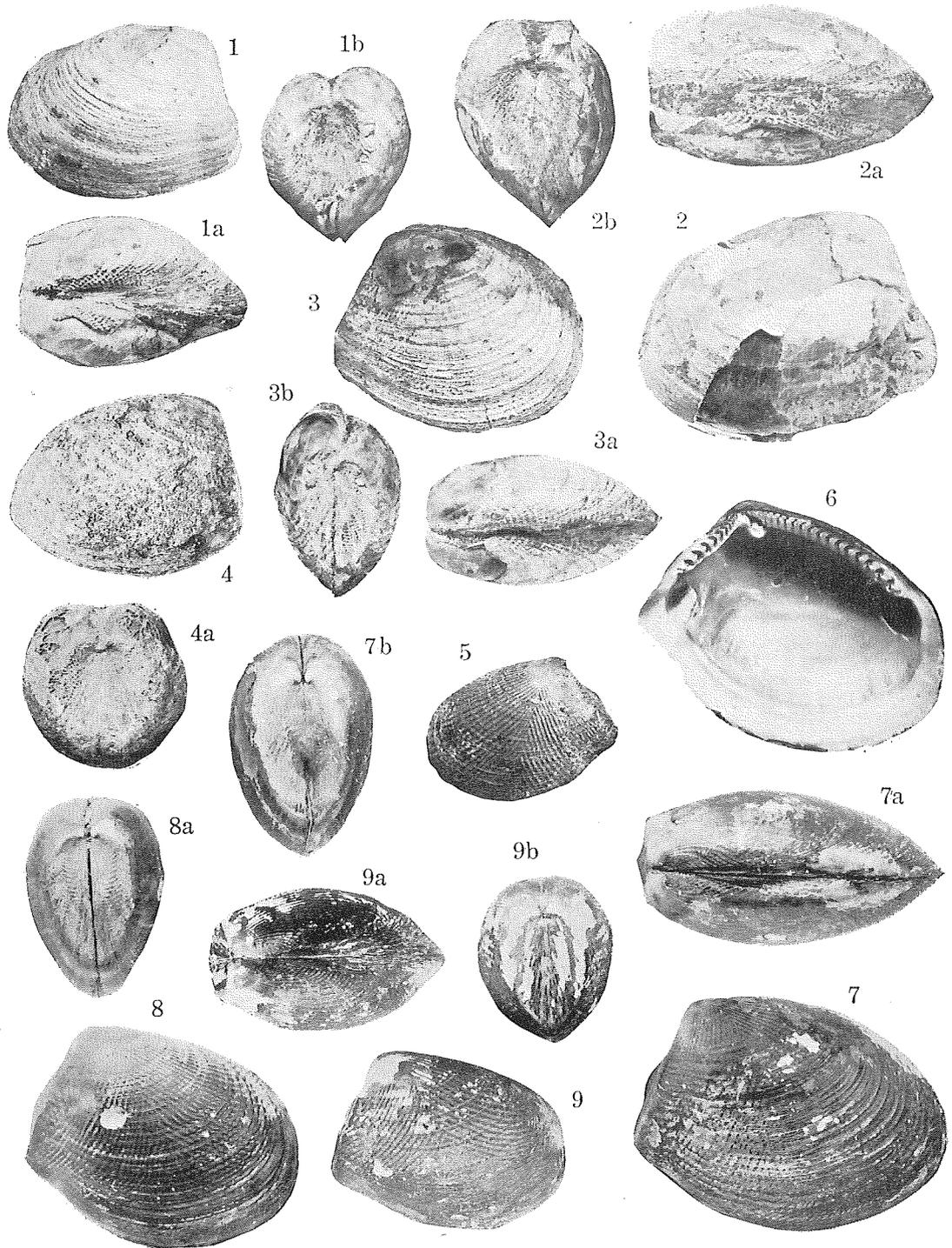
- Figs. 1, 2. *Acila (Acila) vigilia* SCHENCK var. *brevis* nov. Ororoppu, Yûhutu-gun, province of Iburi. Kawabata series. 1a, 2a, dorsal views; 1b, 2b, posterior views.
- Fig. 3. Do. Yayoi Coal-mine, province of Isikari. Poronai series. 3a, a dorsal view; 3b, a posterior view.
- Fig. 4. Do. Esamanbetu, Syamani-mura, province of Hidaka. Kawabata series. 4a, a dorsal view.
- Figs. 5-7. *Acila (Acila) vigilia* SCHENCK. Off Erimo, Hokkaidô. Recent. 7a, a dorsal view; 7b, a posterior view.
- Fig. 8. Do. Off Muroran, Hokkaidô. Recent. 8a, posterior view.
- Fig. 9. Do. Off Kuzi, Iwate Prefecture. Recent. 9a, a dorsal view; 9b, a posterior view.

## Plate XXXI (III)

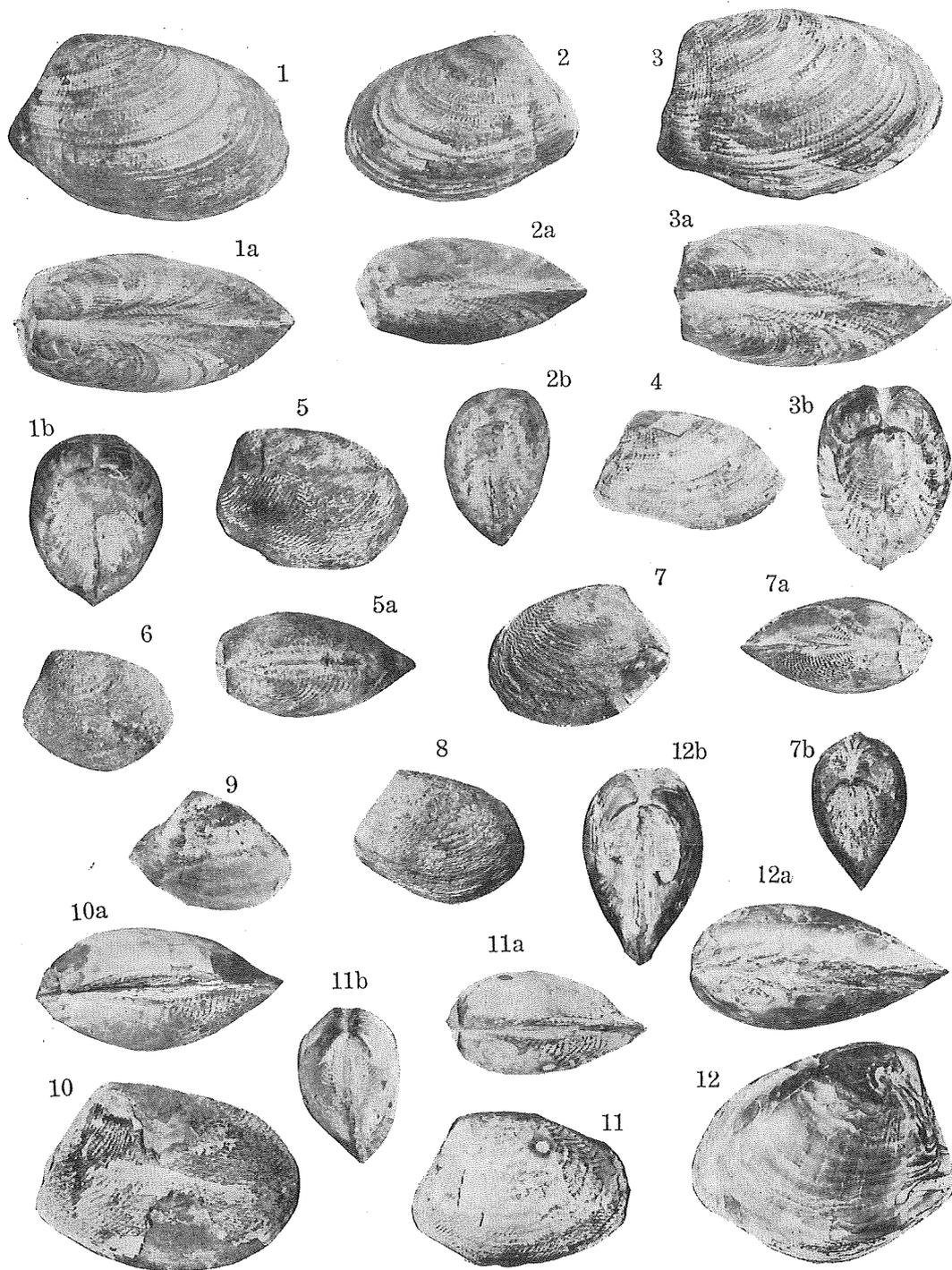
- Figs. 1-4. *Acila (Acila) vigilia* SCHENCK var. *elongata* nov. Asahi, Sorati-gun, province of Isikari. Kawabata series. 1a, 2a, 3a, dorsal views; 1b, 2b, 3b, posterior views.
- Figs. 5-8. *Acila (Acila) praedivariata* nov. Arakai-zawa near Maoka-mati, Karahuto. Nisisakutan beds (Poronai series). 5a, 7a, dorsal views; 7b, a posterior view.
- Fig. 9. *Acila (Acila)* sp. a. Nakanosawa, Utasinai, province of Isikari. Isikari series.
- Figs. 10, 11. *Acila (Acila) kusiroensis* nov. Upper course of the Tyaro-gawa, province of Kusiro. Tyaro beds (Poronai series). 10a, 11a, dorsal views; 11b, a posterior view.
- Fig. 12. *Acila (Acila)* sp. b. Etaibetu, Hokuryû-mura, province of Isikari. Upper Kawabata series. 12a, a dorsal view; 12b, a posterior view.



*Kumano photo.*



*Kumano photo.*



Kumano photo.