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Neogene Shells from the Oil-Field of Higashiyama, Echigo

By

Matajiro YOKOYAMA, *Rigakuhakushi*

With 2 Plates

In May 1926, Mr. Tsuruhiko Makiyama, then a student of geology in the Imperial University of Tokyo, made a collection of fossil shells in the oil-field of Higashiyama, Echigo Province, which I had an opportunity to examine during last summer. The following lines embody the results of this examination.

Mr. Makiyama divides the rock-layers of which the oil-field above mentioned is made up into the following six beds which I, for simplicity's sake, call I, II, III, IV, V, and VI, counting from above:

- I. Sandy shale with fossils at Uragara.¹⁾
- II. Sandy shale with fossils at Kaigasawa.²⁾
- III. Grey shale with fossils at Hanzôgané.³⁾
- IV. Alternating layers of sandstone and shale with fossils at Asahi.⁴⁾
- V. Alternating layers of sandstone and shale with fossils at Kajikané.⁵⁾
- VI. Black shale with fossils at Yomogidaira.⁶⁾

The fossils obtained from these six beds are given in the following table:

1) 古志郡六日市浦柄 2) 同栃尾町貝ヶ澤 3) 同半藏金村 4) 同東山村朝日
5) 同竹澤村梶金 6) 同太田村蓬平

	I	II	III	IV	V	VI	Geological Occurrence
	Uragara	Kaigasawa	Hanzogane	Asahi	Kajikane	Yomogidaira	
I. Gastropoda							
1. Lencotina diana (Ad.)	+						{ Rec. (C. W. Japan). Up. Musashino.
2. Terebra teuboiana Yok.	+						{ Rec. (C. Japan). Up. Musashino.
3. Pleurotoma vertebrata Sm.	+						{ Rec. (C. W. Japan). Up. Mus.,
4. Pleurotoma contraria Yok.	+						{ Pliocene.
5. Pleurotoma glabra Yok.	+						Up. a. Low. Musashino.
6. Genotia pseudopannus Yok.	+						Low. Musashino.
7. Drillia pseudoprincipalis Yok.	+						Up. Musashino.
8. Drillia asukana Yok.	+						Up. Musashino.
9. Raphitoma ozawai Yok.	+				+		Pliocene.
10. Bela candida Yok.	+						Up. Musashino.
11. Bela rugulata Tr. var. schneideri } Harm.	+						Up. Musashino, English Crag.
12. Mangilia oynana Yok.	+						Up. Musashino.
13. Mangilia sawanensis Yok.	+						Up. Musashino.
14. Cancellaria lischkei Yok.	+	+	+				Up. Musashino, Pliocene.
15. Olivella fortunei Ad.					+		{ Rec. (C. Japan). Up. Mus.,
16. Voluta megaspira Sow.							{ Pliocene.
17. Fasciolaria uyemurai Yok.	+						{ Rec. (N. C. W. Japan). Up. Mus.,
18. Fusus coreanicus Sm.	+	+					{ Pliocene, Miocene ? Miocene,
19. Fusus simplex Sm.	+	+					Up. Musashino, Pliocene.
20. Chrysodomus despectus (L.)					+		Rec. (W. Japan). Up. Musashino.
21. Volutopsis hirasei Pils.					+		{ Rec. (N. Japan, Polar Seas). Low.
22. Beringius (?) hanzoganensis n. sp.					+		{ Musashino, Pliocene.
23. Siphonalia declivis Yok.					+		Rec. (N. Japan).
24. Nassa (Hima) japonica Ad.						+	Pliocene.
25. Columbella (Mitrella) dunkeri Try.						+	{ Rec. (C. W. Japan). Up. Mus.,
26. Columbella (Atilia) smithi Yok.						+	{ Pliocene.
27. Columbella (Atilia) pumila Dkr.	+						{ Rec. (N. C. W. Japan). Up. Mus.,
28. Trophon acharya Yok.						+	{ Pliocene.
29. Trophon solitarius Yok.						+	{ Rec. (C. Japan). Up. Mus.,
30. Trophon makiyamai n. sp.	+	+					{ Pliocene.
31. Searlesia decessor n. sp.						+	{ Rec. (C. W. Japan). Up. Musashino.
32. Ocinebra falcata (Sow.)	+	+					Up. Musashino.
33. Ocinebra lunaria Yok.						+	{ Rec. (N. C. W. Japan). Up. Mus.,
34. Priene oregonensis Redf.						+	{ Pliocene.
35. Cassis strigata (Gm.)	+						{ Rec. (C. W. Japan). Up. Musashino.

	I Uragara	II Kaigasawa	III Hanzogane	IV Asahi	V Kojikane	VI Yonogidaira	Geological Occurrence
36. <i>Bittium ozawai</i> Yok.	+						Up. Musashino.
37. <i>Turritella saishuensis</i> Yok.	+	+					Up. Musashino, Pliocene.
38. <i>Turritella kiiensis</i> Yok.			+				Up. Musashino, Pliocene.
39. <i>Rissoa sadoensis</i> Yok.		+					Up. Musashino.
40. <i>Rissoa asura</i> Yok.		+					Up. Musashino.
41. <i>Stenica planorboides</i> Yok.		+					Rec. (C. Japan). Up. Musashino.
42. <i>Natica janthostoma</i> Desh.	+	+	+				{ Rec. (N. C. Japan). Up. Mus- Miocene.
43. <i>Polinices ampla</i> (Phil.)		+	+				{ Rec. (N.-S. Japan). Up. Mus- Miocene.
44. <i>Polinices pallidus</i> (Br. et Sow.)		+					{ Rec. (N. Japan). Up. a. Low. Musashino.
45. <i>Sigaretus papilla</i> Gm.		+	+				{ Rec. (C. W. Japan, Philippines), Up. Musashino-Pliocene.
46. <i>Niso interrupta</i> Sow.		+					Rec. (W. Japan). Pliocene.
47. <i>Pyramidella (Iphiana) mira</i> Yok.		+					Up. Musashino.
48. <i>Solariella angulata</i> Tok.		+					Up. Musashino.
49. <i>Margarita lantiuscula</i> n. sp.		+					
50. <i>Margarita kaigasawensis</i> n. sp.		+					
51. <i>Umbonium costatum</i> (Val.)		+	+				{ Rec. (N.C.W. Japan). Up. a. Low. Musashino.
II. Scaphopoda.							
52. <i>Dentalium weinkauffii</i> Dkr.			+				{ Rec. (C. Japan). Up. Mus- Pliocene.
53. <i>Siphonodentalium</i> (Pulsellum) } ozawai Yok.		+					Rec. (C. Japan). Up. Musashino.
III. Lamellibranchiata.							
54. <i>Corbula succincta</i> Yok.			+				Pliocene.
55. <i>Mya arenaria</i> L.	+	+					{ Rec. (N. C. W. Japan). Up. Mus- Pliocene.
56. <i>Mactra sulcataria</i> Desh.				+			{ Rec. (N. C. W. Japan). Up. Musashino.
57. <i>Mactra sachalinensis</i> Schr. var. im- perialis Yok.		+					Up. Musashino.
58. <i>Mactra makiyamai</i> n. sp.			+				
59. <i>Tellina besshoensis</i> Yok.					+		Miocene (Asagai Beds).
60. <i>Macoma praetexta</i> (Mart.)	+						{ Rec. (C. W. Japan). Up. Mus- Miocene.
61. <i>Macoma inquinata</i> (Desh.)	+						{ Rec. (N. C. W. Japan) Up. Mus- Miocene.
62. <i>Meretrix (Macrocallista) ezoensis</i> } (Yok.)					+		{ Rec. (N. Japan). Up. Mus- Miocene.
63. <i>Venus (Mercenaria) stimpsoni</i> Gld.	+						{ Rec. (N. C. W. Japan). Up. Mus- Pliocene.
64. <i>Venus laetifica</i> n. sp.		+					
65. <i>Chione foliacea</i> , (Phil.)	+						{ Rec. (C. W. Japan, Philippines). Up. Musashino-Pliocene.
66. <i>Chione chitaniana</i> Yok.	+						Pliocene.

	I Uragara	II Kaigasawa	III Hanzogane	IV Asahi	V Kajikane	VI Yomogidaira	Geological Occurrence
67. <i>Chione hizenensis</i> Pils.		+					Rec. (W. Japan).
68. <i>Cardium muticum</i> Rve.	+						{ Rec. (C. Japan, Philippines). Up. Musashino-Pliocene.
69. <i>Cardium braunsi</i> Yok.	+						Up. Musashino.
70. <i>Cardium angustum</i> Yok.		+	+				Pliocene.
71. <i>Thyasira bisecta</i> (Corr.)	+			+			{ Rec. (N. Pacific). Up. Mus- Miocene.
72. <i>Thyasira gouldii</i> Phil.	+						Rec. (N. Japan). Up. Musashino.
73. <i>Diplodonta usta</i> Gld.	+						{ Rec. (N. C. Japan). Up. Mus- Pliocene.
74. <i>Lucina borealis</i> L.		+	+				{ Rec. (C. Japan). Up. Mus- Miocene.
75. <i>Venericardia cipangoana</i> , Yok.		+					{ Rec. (C. W. Japan). Up. Mus- Pliocene.
76. <i>Venericardia ferruginea</i> (Ad.)			+		+		{ Rec. (N. Japan). Up. Mus- Miocene.
77. <i>Astarte borealis</i> L.	+	+	+				Rec. (N. Japan). Up. Musashino.
78. <i>Thracia pubescens</i> Pult.	+						{ Rec. (Atlantic). Up. Mus- Pliocene.
79. <i>Mytilus grayanus</i> Dkr.	+						{ Rec. (N. Japan, Philippines). Pliocene.
80. <i>Crenella spectabilis</i> Ad.	+						Rec. (W. Japan). Up. Musashino.
81. <i>Pecten swiftii</i> Bern.		+					{ Rec. (N. Japan). Up. Mus- Pliocene.
82. <i>Pecten kurosawensis</i> Yok.	+		+				Up. a. Low. Musashino.
83. <i>Ostrea gigas</i> Th.	+	+					{ Rec. (N. C. W. Japan). Up. Mus- Pliocene.
84. <i>Arca subcrenata</i> Lke.		+	?				{ Rec. (N. C. W. Japan). Up. Mus- Pliocene.
85. <i>Arca kobeltiana</i> Pils.	+	+					{ Rec. (N. C. Japan). Up. Mus- Pliocene.
86. <i>Arca amacula</i> Yok.	+						Up. Musashino-Pliocene.
87. <i>Pectunculus albolineatus</i> Lke.		+					{ Rec. (C. Japan). Up. Mus- Pliocene.
88. <i>Pectunculus yessoensis</i> Jay.	+	+	+				{ Rec. (N. Japan). Up. Mus- Pliocene.
89. <i>Pectunculus derelictus</i> n. sp.		+					
90. <i>Limopsis tokaiensis</i> Yok.		+	+				{ Rec. (C. Japan). Up. a. Low. Musashino.
91. <i>Leda ramsayi</i> Sm.	+	+					{ Rec. (N. Japan). Up. a. Low. Musashino.
92. <i>Leda naganumana</i> Yok.		+					Up. Musashino.
93. <i>Nucula insignis</i> Ad.	+	+	+				{ Rec. (N. Japan). Up. Mus- Miocene.
94. <i>Solemya labeosa</i> n. sp.		+					
IV. Brachiopoda.							
95. <i>Laqueus rubellus</i> (Sow.)			+			?	{ Rec. (C. W. Japan). Up. a. Low. Musashino.
96. <i>Terebratulina japonica</i> (Sow.)			+				{ Rec. (C. W. Japan). Low. Mus- Pliocene.
97. <i>Hemithyris psittacea</i> (Chem.) var. <i>woodwardi</i> Ad. ¹⁾			+		+		{ Rec. (N. W. Japan). Up. Mus- Pliocene.

1) Besides these Mollusca, there are also an echinoid, *Linthia nipponica* Tok., at Uragara and a tooth of a shark called *Carcharodon megalodon* Ag. at Kaigasawa.

Beds I

The 28 species yielded by Beds I consist of the following elements:

1. Species hitherto found Recent as well as in Upper Musashino	5
2. Species hitherto ranging between Recent and Pliocene	10
3. Species hitherto ranging between Recent and Miocene	5
4. Species hitherto found only in Upper Musashino	2
5. Species hitherto found in Upper Musashino as well as in Pliocene	4
6. Species hitherto found only in Pliocene	1
7. Species hitherto found neither Recent nor fossil (new)	1
	<hr/> 28

From this we see that the Recent species occupy more than 70% of the whole. Of the species which are at the same time fossil, or exclusively fossil, those which occur in the Upper Musashino and Pliocene are the greatest in number. Therefore, it is very likely that we have here a faunula which approximately corresponds to that of the *Lower Musashino* of the Kwantô region, that is to say, of the *Upper Pliocene*.

Beds II

Beds II afforded the greatest number of species amounting to 62 which consist of the following elements:

1. Species hitherto only Recent	3
2. Species hitherto found Recent as well as in Upper Musashino	7
3. Species hitherto ranging between Recent and Pliocene	19
4. Species hitherto ranging between Recent and Miocene	4
5. Species hitherto found only in Upper Musashino	14
6. Species hitherto found in Upper Musashino as well as in Pliocene	3
7. Species hitherto found only in Pliocene	5
8. Species entirely new	7
	<hr/> 62

The number of Recent species compared with the whole is here somewhat less than in Beds I, amounting to about 53%. Of the fossil species, those which point to the Pliocene are much greater in number than those which point to the Miocene (31 to 4). Probably the fauna represents that of the *Middle Pliocene* approximately corresponding to that of the Satsuka Beds of Totomi.

Beds III

The number of species yielded by Beds III is rather small, amounting to only 18 which, however, when divided as before, are as follows:

1. Species hitherto found Recent as well as in Upper Musashino	2
2. Species hitherto ranging between Recent and Pliocene	8
3. Species hitherto ranging between Recent and Miocene	2
4. Species hitherto found only in Upper Musashino	1
5. Species hitherto found in Upper Musashino as well as in Pliocene	2
6. Species hitherto found only in Pliocene	1
7. Species entirely new	2
	<hr/> 18

The number of Recent species amounts to two-thirds of the whole, and of the fossil species, those which point to the Upper Musashino and Pliocene are by far the most numerous. Therefore, the beds are to be ascribed to the *Pliocene*, and probably to its lower part.

Beds IV

If we leave out one species which is not accurately determined (*Arca subcrenata*?), the number of species is 18 as in the preceding beds and are made up of the following elements:

1. Species hitherto found only Recent	1
2. Species hitherto found Recent as well as in Upper Musashino	2
3. Species hitherto ranging between Recent and Pliocene	5
4. Species hitherto ranging between Recent and Miocene	4
5. Species hitherto found only in Upper Musashino	2
6. Species hitherto found in Upper Musashino as well as in Pliocene	3
7. Species hitherto found only in Pliocene	1
	<hr/> 18

Here again the Recent species occupy two-thirds of the whole, and of the fossil species, those which occur in Upper Musashino and Pliocene form the majority. Accordingly, the beds are probably also *Pliocene*.

Beds V and VI

From Beds V we have only two species, *Thyasira bisecta* and *Tellina besshoensis*. The former is still living, but also found in the Pliocene and Miocene layers, while the latter is hitherto known only from the

Asagai Beds (Miocene) of the Jōban Coalfield. Therefore it is probable that the Beds are *Miocene*.

Beds VI have yielded four living species, *Macrocallista ezoensis*, *Venericardia ferruginea*, *Hemithyris psittacca* and *Laqueus rubellus* (?) of which, however, the first two occur also in the Pliocene and Miocene and the last two in the Pliocene. Although from these four nothing conclusive can be drawn as to their age, still as the Beds are below Beds V, we cannot but take them for the *Miocene*.

Description of New, Rare or Important Species.

19. *Fusus simplex*, SMITH

Pl. LXVIII. Figs. 1, 2.

Fusus simplex. Smith, Proc. Zool. Soc. London, 1879, p. 204, pl. 20, fig. 35.

This living shell is represented by many fossil specimens which show more or less variation in the proportion of height to diameter as well as in the length of the canal. The sculpture consists of strong longitudinal plicae about eight in number and unequal spiral lirae. The spire which is made up of about seven whorls is also somewhat variable, being shorter and more obtuse in some than in others. One of the examples shown in our figure is 21 millim. in height and 7.5 millim. in diameter.

Fossil occurrence.—Beds II: Kaigasawa. Beds IV: Asahi.

Living.—Western Japan.

21. *Volutopsis hirasei*, PILSBRY

Pl. LXVIII. Figs. 3-5

Volutopsis hirasei. Pilsbry, New or Little Known Whelks from Northern Japan and the Kurile Islands, Proc. Nat. Sci. Philad., 1907, p. 243, pl. XIX, fig. 2.

Specimens frequent, though all are more or less broken. Some are worn and apparently smooth, while others are distinctly spirally striate. The smooth ones are hardly distinguishable from *Volutopsis norvegica* (Chem.) which is circumpolar in distribution and also occurs in the Sea of Okhotsk as well as fossil in the English Crag. The close affinity existing between the two is not deniable.

Fossil occurrence.—Beds II: Kaigasawa.

Living.—Northern Japan (Kesennuma).

22. *Beringius* (?) *hanzoganensis*, nov. spec.

Pl. LXVIII. Fig. 6

A single example lacking the lower portion of the aperture.

The shell is rather thin, and provided with a turrete spire. The whorls number about seven of which the younger ones are convex, while the older (penultimate and ultimate) are angulate a little above the middle, the surface above the angle on the penultimate being somewhat inclined and slightly angulate in the middle, while in the ultimate it is flat and horizontal. The surface below the angle is in both whorls vertical and gently convex. The sculpture consists of very fine spiral striations, occasionally with a coarser one between and crossed by distinct lines of growth. Aperture oval. Canal rather short (?) Height (without canal) 41 millim. Diameter 20 millim.

Fossil occurrence.—*Beds III*: Hanzogané.

30. *Trophon makiyamai*, nov. spec.

Pl. LXVIII. Fig. 8

Shell small, fusiform. Spire shorter than body-whorl. Whorls about six, convex, longitudinally plicate. Plicae twelve or thirteen on body-whorl, strong, elevated, either more or less roof-like or rounded, somewhat oblique, with interspaces broader or equal. Spiral sculpture usually absent, but in some specimens, a few faint cords are present on the lower half of the whorls. Base rapidly narrowed downward, with longitudinal plicae vanishing near the caudal end. Aperture ovate, pointed behind. Canal moderate in length, bent sideward as well as a little backward. Height slightly greater than twice the diameter. The largest example measures 10 millim. in height and 4.4 millim. in diameter.

This shell resembles *Trophon nipponicus* Yok. (Foss. Miura Penin., pl. III, figs. 13, 14) of the Lower Musashino and also some forms of *Trophon clathratus* (L.) (Harmer, Plioc. Moll. Grt. Brit., pl. XII, fig. 25), although more slender in form.

Rather frequent.

Fossil occurrence.—*Beds I*: Uragara. *Beds II*: Kaigasawa.

31. *Searlesia decessor*, nov. spec.

Pl. LXVIII. Fig. 9

Shell small, fusiform. Spire shorter than one-half body-whorl. Whorls six, of which about one and a half are nuclear, smooth and rounded; postnuclear whorls convex, sometimes showing a trace of

angulation a little below the upper suture, longitudinally costate and spirally striate. Costae about fifteen on body-whorl, elevated, rounded, separated by about equal interspaces, somewhat oblique or sinuous. Spiral striae many, equal or unequal or alternately large and small. Base rapidly narrowed downward with costae vanishing before attaining the lower end of the shell, spirally striate all over. Aperture ovate, pointed behind, passing in front into a short, nearly straight canal.

Two specimens, one of which measures 7 millim. in height and 3.2 millim. in diameter.

This shell is closely akin to *Searlesia japonica* Yok. (Fossil Shells from Sado, p. 269, pl. XXXII, fig. 22) from the Upper Musashino of Sado, although the ribs are somewhat less in number and oblique. It may possibly be only a young form of the latter.

Fossil occurrence.—*Beds II*: Kaigasawa.

49. *Margarita lautiuscula*, nov. spec. ✓

Pl. LXVIII. Fig. 7

Shell small, low-turbinate. Whorls about four and a half, angulate a little below the middle, with the surface above the angle flat and sloping, below flat and vertical, somewhat shouldered close to the upper suture, making the sutures deep and distinct, longitudinally ribbed and spirally striate. Ribs about twenty, taking the same course as growth-lines, only distinct on the upper shelf, separated by much wider interspaces. Spiral striae very fine, only present on the vertical surface. Periphery angulate. Base flat with about twenty blunt radiating ribs which enter into the deep and round umbilicus for some distance, the interstices between the ribs being finely striated across. Aperture subcircular, nacreous within.

A single example, measuring 3 millim. in height, and 3.5 millim. in diameter.

Fossil occurrence.—*Beds II*: Kaigasawa.

50. *Margarita kaigasawensis*, nov. spec. ✓

Pl. LXIX. Fig. 2

Shell small, turbinate, perforate. Whorls about four, convex, provided with four spiral cords, one close to the upper suture, one close to the lower, two between, crossed by longitudinal threads more than twenty in number which take the same course as the incremental

lines. Periphery angulate. Base flatly convex with faint radiating threads. Umbilicus large, deep. Aperture subcircular. Height 2.4. Diameter 2.2. Rare.

The radiating threads of the base are indistinct on the last part of the body whorl, which may possibly be due to friction.

Fossil occurrence.—*Beds II*: Kaigasawa.

✓
58. *Mactra* (?) *makiyamai*, nov. spec.

Pl. LXIX. Fig. 3

One right valve lacking the greater part of the shell, so that it is partly a cast. However, it is so characteristic in shape that I can not but describe it as a new species.

The shell is large, convex, ovato-trigonal, very inequilateral, rounded in front and obliquely truncate behind, with ventre almost straight. The shell, where preserved, shows numerous blunt radiating ribs, distinct in the anterior part, but indistinct in the middle and posterior. This sculpture may possibly be that of a layer underneath the superficial. The beak is rather swollen, pointed and curved forward. Dentition unknown, so that the generic name remains to be confirmed. Height 10.5 millim. Length. 77 millim. Depth about 43 millim.

Fossil occurrence.—*Beds II*: Hanzôgané.

64. *Venus laetifica*, nov. spec.

Pl. LXVIII. Fig. 10

✓
One left valve only. It is very small, thick, convex, transversely suboval, rounded in front, truncate behind, antero-dorsal border slightly convex, sloping and passing into anterior border without making any angle, postero-dorsal nearly straight, also sloping and making a rounded angle with anterior border. Surface radiately ribbed with ribs about twenty-six in number, straight, rounded and broader than interspaces. Pallial sinus short, triangular. Inner ventral border crenate. Inner antero-dorsal and inner posterior borders crenulate. Cardinal teeth three, diverging, with anterior and middle short, thick and somewhat bifid, and posterior long and thin. Height 2.2 millim. Length 2.5 millim. Depth 0.8 millim.

Fossil occurrence.—*Beds II*: Kaigasawa.

67. *Chione hizenensis*, PILSBRY

Pl. LXVIII. Fig. 12

Chione hizenensis. Pilsbry, New Jap. Mar. Moll., Pelecypoda, Proc. Acad. Sci. Philad., 1904, p. 553, pl. XLI, figs. 1, 2.

This neat little shell, compressed and short-ovate in shape, and ornamented with radiating riblets like the preceding is represented by a single left valve 4.1 millim. high, 4.5 millim. long and 1.3 millim. deep.

Fossil occurrence.—*Beds II*: Kaigasawa.

Living.—Western Japan.

89. *Pectunculus derelictus*, nov. spec.

Pl. LXIX. Fig. 1

A single right valve much worn. It is thick, convex, higher than long, ovately pentagonal, almost equilateral, with antero- and postero-dorsal borders nearly straight and sloping, and making nearly a right angle with each other when produced. Surface with distant, engraved, radiating lines. Area triangular, with several parallel bent ridges. Teeth numerous, about sixteen in front and about thirteen behind. Inner margin crenate. Anterior adductor impression ovate, bounded by a ridge on the inner side, posterior rather ovate-triangular. Height 32.5 millim. Length 28.5 millim. Depth 10.5 millim.

This species is closely akin to a living Japanese shell apparently still unnamed, the only difference being in the angle formed by dorsal borders which is greater than a right angle (more than 100°).

Fossil occurrence.—*Beds II*: Kaigasawa.

94. *Solemya labeosa*, nov. spec.

Pl. LXVIII. Fig. 11

Only one worn specimen. The shell is small, thin, compressed, transversely elongated, with dorsal and ventral borders subparallel, rounded both in front and behind, and very inequilateral, the posterior side being nearly double the anterior. The surface is radiately striated, with striae straight and distant from one another. Height 8.6 millim. Length 24 millim. Thickness 5 millim.

Resembles *Solemya yamakawai* Yok. (Moll. Up. Musash. Tokyo a. its Sub., p. 435, pl. L, fig. 10) of the Upper Musashino of Oji and *Solemya japonica* Dkr. (Index Moll. Mar. Japan., p. 220, pl. XIV, fig. 3) of the Japanese waters, although not so inequilateral as these two.

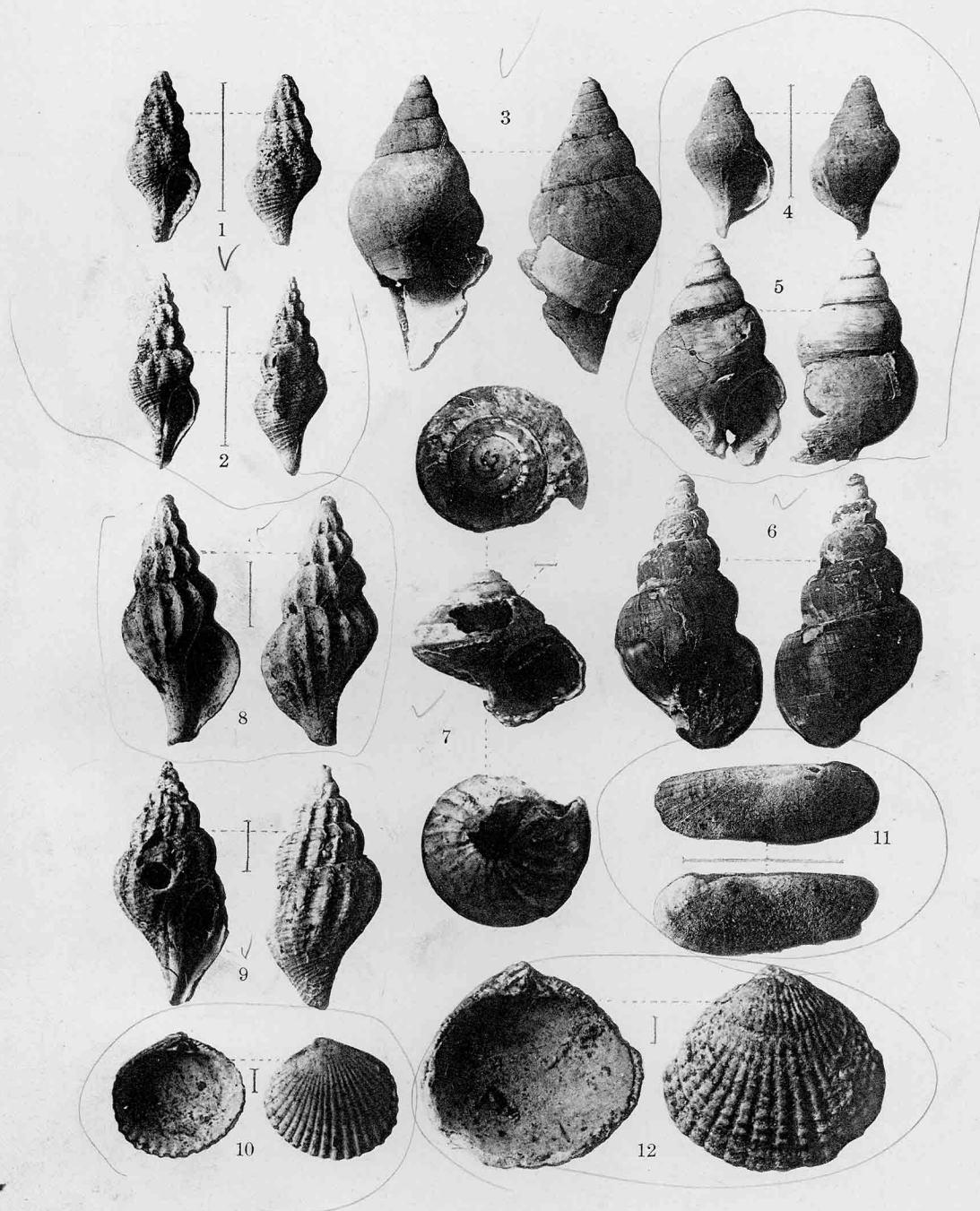
Fossil occurrence.—*Beds II*: Kaigasawa.

Explanation of Plate LXVIII

- Figs. 1, 2. *Fusus simplex* Sm. 1. Shorter form. 2. Longer form. Kaigasawa. P. 357
Figs. 3-5. *Volutopsis hirasei* Pils. 2. Young individual. Kaigasawa P. 357
Fig. 6. *Beringius* (?) *hanzoganensis* n. sp. Hanzogané. P. 357
Fig. 7. *Margarita lautiuscula* n. sp. Kaigasawa. P. 359
Fig. 8. *Trophon makiyamai* u. sp. Kaigasawa. P. 358
Fig. 9. *Searlesia decessor* n. sp. Kaigasawa. P. 358
Fig. 10. *Venus laetifica* n. sp. Kaigasawa. P. 360
Fig. 11. *Solemya labeosa* n. sp. Kaigasawa. P. 361
Fig. 12. *Chione hizenensis* Pils. Kaigasawa. P. 361

Explanation of Plate LXIX

- Fig. 1. *Pectunculus derelictus* n. sp. Kaigasawa. P. 361
Fig. 2. *Margarita kaigasawensis* n. sp. Kaigasawa. P. 359
Fig. 3. *Mactra* (?) *makiyamai* n. sp. Hanzogané. P. 360



Figs. 1, 2. *Fusus simplex* Sm. Figs. 3-5. *Volutopsis hirasei* Pils. Fig. 6. *Beringius hanzoganensis* n. sp. Fig. 7. *Margarita lautiuscula* n. sp. Fig. 8. *Trophon makiyamai* n. sp. Fig. 9. *Searlesia decessor* n. sp. Fig. 10. *Venus laetifica* n. sp. Fig. 11. *Solemya labeosa* n. sp. Fig. 12. *Chione hizenensis* Pils.

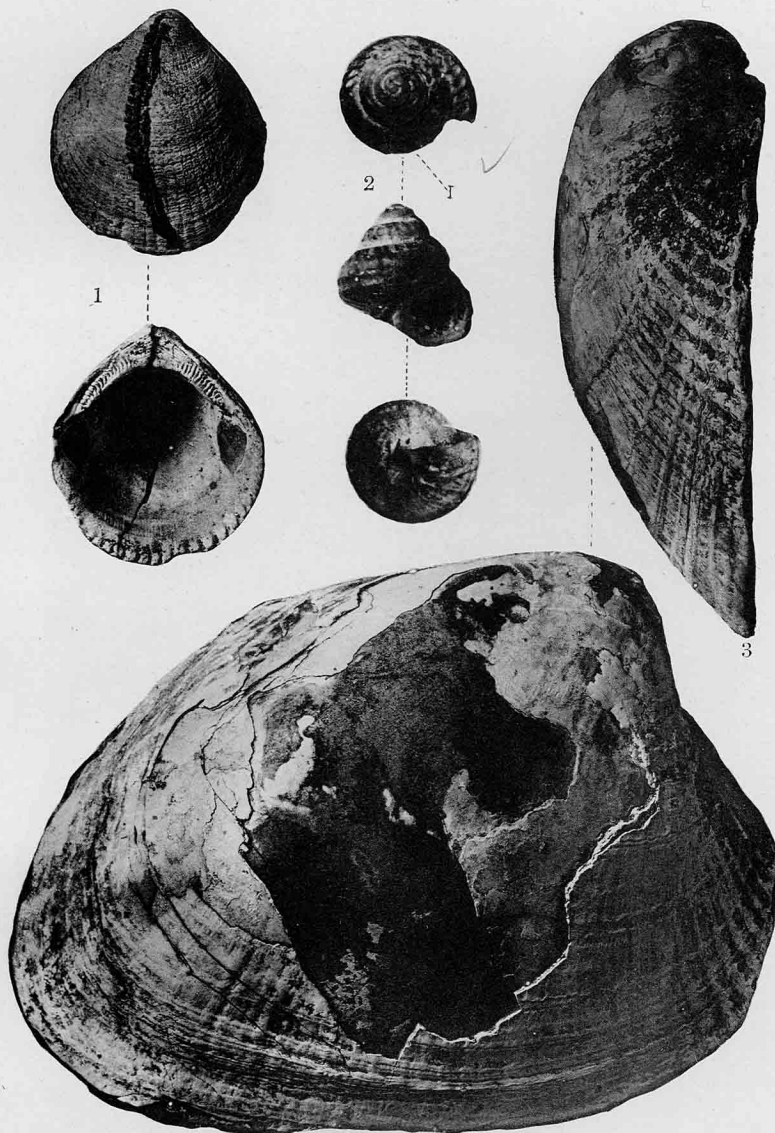


Fig. 1. *Pectunculus direlictus* n. sp.
Fig. 2. *Margarita kaigasawensis* n. sp.
Fig. 3. *Mactra* (?) *makiyamai* n. sp.

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