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journal or publication title	Science reports of the Tohoku Imperial University. 2nd series, Geology
volume	15
number	3
page range	169-A4
year	1932
URL	http://hdl.handle.net/10097/30249

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BY

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With 2 Plates

A study of the Cenozoic stratigraphy of the Izu Peninsula and the Hakone district has been undertaken by Mr. R. TAYAMA and one of the present writers (NIINO) immediately after the great earthquake of Kita-Izu (northern Izu) of November 21, 1930, and their report was published in one of the scientific journals of the Saitô Gratitude Foundation, under the title "Outline of the Geology of the Izu Peninsula."

In this report TAYAMA and NIINO divided the Cenozoic deposits of the Izu Peninsula into the following groups:

I. Quaternary System.

1. Lowland alluvium.
2. Post-loam (PL) terrance deposits. Gravels and sands.
————— Unconformity —————
3. Loam bed. Loam and loamy sands, covering unconformably the underlying deposits.
4. Tama (T) terrace and Musashino (M) terrace deposits. Mostly gravels.
————— Unconformity —————
5. Atami Group. Volcanic ejecta prevailing, with occasional intercalation of tuffaceous shale in thin layers; which rarely contains diatom remains.
————— Unconformity —————
6. Jô Group. Tuffs, tuffaceous shales, sands, and gravels, in thin alternation and containing fragmental plant remains at places; a gravel bed at the base contains molluscan remains.

II. Tertiary System.

7. Matsuzaki Group. Composed of andesite flows, andesitic tuffs and brecciated agglomerates, often with layers of sandstones.
8. Shirahama Group. Andesitic agglomerates and tuffs in the northern part of the peninsula; cross-bedded calcareous sandstones intercalated by liparitic tuffs in the southern part. Containing numerous fossils not only of marine Mollusca but also of Foraminifera, Corals, Echinodermata, Bryozoa, Crustacea, Brachiopoda and shark's teeth (Shirahama shell-beds).
9. Tateishi Group. Alternate layers of sandstones and shales, with a massive tuff at its basal part; and intercalating dacite and liparitic flows at places. Rarely with shark's teeth.
10. Aoishi Group. Composed of andesitic flows and agglomerates, with beds of gravels of hyperthine andesite.
————— Unconformity? —————
11. Yugashima Group. Green tuffs and propylite flows in alternation; also sheets of quartz propylite and pyroxene porphyry. Marine shell remains are found in a sandy part of the green tuff (Yugashima shell-beds).

At north of the Hakone volcano, there are marine Tertiary deposits known for a long time as "Ashigara Group." The Ashigara Group is a very thick complex of heavy bedded conglomerates and sandstone with frequent intercalation of shale in thin layers; shell remains are frequent at some places (Ashigara shell-beds). The fossil beds of the Sugumogawa valley, Hakone, are also provisionally included by TAYAMA and NIINO in this group. According to Mr. F. UEDA, the Ashigara Group is unconformably covered by Ninomiya Beds between Ôiso and Kôzu on the Tôkaidô Railway line; it lies beneath the older, Misaka Series overthrust from north at a little north of Yamakita on the same line, as once pointed out by the late TETSUNOSUKE KATÔ.

The Misaka Series is a thick series essentially of pyroclastic materials: andesite agglomerates and tuffs; it also has layers of marine sedimentaries interbedded, most noteworthy of them being small limestone lenses or masses with *Nephrolepidina* and *Miogypsina* found at a very limited number of localities. Water-worn blocks, often of huge sizes, of the Misaka pyroclastics are common in the lowest part of the Ashigara Group; hence, the two complexes are thought to be unconformable.

While much attention has hitherto been paid to the volcanic rocks of Izu and Hakone, but little palaeontological works have been accomplished on the Tertiary deposits of the districts; this is in part due to the scantity of fossil remains in these deposits.

Some twenty years ago, the late Mr. T. KATÔ¹ enumerated 30 species of Mollusca from the Ashigara shell-beds of Jizôdô of the Ashigara district and concluded that the deposits were laid down very late in Tertiary epoch.

In 1926, Dr. M. YOKOYAMA² described 11 species of Mollusca from Jizôdô; and judging from the fossil remains as well as from the situation of the shell beds, their age was considered by him to be Pliocene.

Recently Mr. Y. ÔTSUKA³ distinguished 27 species of Mollusca, 1 species of Brachiopoda and 3 species of plant remains from the same deposits, and on special reference to *Umbonium suchiense* YOKOYAMA, which the fauna contains, he regarded the Ashigara shell-beds to be the Lower Pliocene in age.

In an earlier day, the late Mr. H. ISHIWARA⁴ mentioned several occurrences of Tertiary fossils, mostly Mollusca, Echinoids and shark's teeth, in his report on the volcanoes of the Izu Peninsula; of these fossils, shark's teeth from Shimoda-machi and Iruma-mura only were figured.

Mr. S. HANZAWA⁵ described several species of Foraminifera found in a tuff of Shimoshiro-iroiwa and a limestone of Nashimoto; the materials were collected by TAYAMA and NIINO. The former was found to be rich in several species of *Amphilepidina* and the latter very rarely to contain *Miogypsina*. The palaeontological evidence speaks for the Miocene age of these rocks. The same opinion is now held by the present writers after the studies of the fossil molluscs mentioned in sequence and stored in the Institute of Geology and Palaeontology, Tôhoku Imperial University.

¹ KATÔ, T.: Report on the Geology near Yamakita in the Province of Sagami. Bull. Imp. Geol. Surv. No. 18, 1910. Fossils specifically determined by Prof. H. YABE.

² YOKOYAMA, M.: Neogene Shells from Kôzuke and other Provinces. Journ. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2. Vol. I, Pt. VII, p. 230, 1926.

³ ÔTSUKA, Y.: Early Pliocene Crustal Movement etc. Bull. Earthq. Res. Inst. Imp. Univ. Tôkyô, Vol. IX, Pt. III, p. 340, 1931.

⁴ ISHIWARA, H.: Volcanoes of the Izu Peninsula. Rep. Imp. Earthq. Inv. Comm. No. 17, 1898 (in Japanese).

⁵ HANZAWA, S.: On Some Miocene Rocks with *Lepidocyclus* from Izu and Bôsô Peninsulas. Sci. Rep. Tôhoku Imp. Univ., Ser. II (Geol.), Vol. XII, No. 2 A, 1931.

The materials now at our disposal were collected by TAYAMA and NIINO from the following localities :

- 1) Localities of the Ashigara shell-beds in the province of Sagami.
 1. Jizôdô, Ashigara-Kami-gun.
 2. Sugumo-gawa, Ashigara-Shimo-gun.
 3. Kawanishi, Ashigara-Kami-gun.
- 2) Localities of the Shirahama shell-beds in the province of Izu.
 4. Nagata, Shirahama-mura, Kamo-gun.
 5. Shirahama-shrine, Shirahama-mura, Kamo-gun.
 6. Mera, Shirahama-mura, Kamo-gun.
 7. Sawada, Shimo-Kawazu-mura, Kamo-gun.
 8. Yukawa, Inazusa-mura, Kamo-gun.
 9. Kakisaki, Hamasaki-mura, Kamo-gun.
 10. Shimo-Shiroiwa, Shimo-Ômi-mura, Tagata-gun.
 11. Ichiyama, Yugashima-mura, Tagata-gun.
- 3) Localities of the Yugashima shell-beds in the province of Izu.
 12. Itado (Nawachi gold mine), Shirahama-mura, Kamo-gun.
 13. Yugashima, Tagata-gun.

There are a great number of specimens, but relatively small number of species, and the writers have been able to distinguish only 42 species among them which are enumerated in the annexed list.

The species derived from the Ashigara shell-beds number sixteen, of which the two, *Umbonium* sp. and *Venus (Chione)* sp., are indeterminable. The remaining fourteen species are all still living in the seas adjacent to the fossil localities; consequently the fauna has a very young aspect. But the stratigraphic position and tectonic relation seem to request an older age than the shell-beds of the Koshiba zone of the Lower Musashino of Dr. M. YOKOYAMA; in all probability the former may approximately be contemporaneous with the "*Thyasira* beds" of Bôsô and Miura Peninsulas (the Lower Pliocene).

From the Shirahama shell-beds we have twenty species, of which the two, *Lima* sp. and *Thylacodes* sp. are indeterminable. The remaining are six new and extinct species and twelve living ones. The evidence taken alone is too slight for precise age-determination of the shell-beds, but is at least in no way contrary to the conclusion, from the study of foraminifera they contain which indicate a Miocene age of the deposits.

Of the eight species distinguished in the material from the Yugashima shell-beds, *Pecten praesignis* YOKOYAMA and *Haliotis kamtschatkana glabrosa* n. subsp. are extinct forms. Excepting the two extinct and one indeterminable specimen of *Trochus*, the other are species now inhabiting the adjacent seas. Thus the number of distinguished species from the Yugashima shell-beds is too limited for age-determination, but their stratigraphic position as well as the general feature of the molluscan association seem to indicate a nearly similar age of them to that of the Shirahama shell-beds.

Our sincere thanks are due to Prof. H. YABE for his kind advice given during the preparation of this article.

Specific List

Specific names	Horizons		
	Ashigara	Shirahama	Yugashima
1. <i>Glycymeris rotunda</i> DKR.	—	×	—
2. <i>Ostrea sinensis</i> GMEL.	—	×	×
3. <i>Ostrea folium</i> LIN.	—	×	—
4. <i>Ostrea gigas</i> THUNB.	×	—	—
5. <i>Pecten naganumanus</i> YOK.	—	×	—
6. <i>Pecten vesiculosus</i> DKR.	×	×	—
7. <i>Pecten irregularis</i> SOW.	—	×	—
8. <i>Pecten farreri nipponensis</i> KURODA	—	×	—
9. <i>Pecten tayamai</i> n. sp.	—	×	—
10. <i>Pecten izuensis</i> n. sp.	—	×	—
11. <i>Pecten kakisakiensis</i> n. sp.	—	×	—
12. <i>Pecten planicostulatus</i> n. sp.	—	×	—
13. <i>Pecten shirahamaensis</i> n. sp.	—	×	—
14. <i>Pecten praesignis</i> YOK.	—	—	×
15. <i>Spondylus anacanthus</i> MAWE.	—	×	—
16. <i>Spondylus cruentus</i> LKE.	—	×	—
17. <i>Lima zushiensis</i> YOK.	—	×	—
18. <i>Lima</i> sp.	—	×	—
19. <i>Volsella modiolus</i> LIN.	×	—	—
20. <i>Anodontia pila</i> RVE.	—	—	×
21. <i>Dosinia pubescens</i> PHIL.	×	—	—
22. <i>Meretrix meretrix</i> LIN.	×	—	—
23. <i>Macrocallista pacifica</i> DILLW.	×	—	—
24. <i>Venus toreuma</i> GLD.	—	×	—
25. <i>Venus</i> sp.	×	—	—
26. <i>Paphia undulata</i> BORN.	—	—	×
27. <i>Paphia variegata</i> HANL.	×	—	—
28. <i>Tellina rutila</i> DKR.	×	—	—
29. <i>Solen gouldii</i> CONR.	×	—	—
30. <i>Mactra veneriformis</i> DESH.	×	—	—
31. <i>Spisula bernardi</i> PILS.	×	—	—
32. <i>Mya arenaria</i> LIN.	×	—	—
33. <i>Panope generosa</i> GLD.	×	—	—
34. <i>Pleurotomaria yabei</i> n. sp.	—	×	—
35. <i>Haliotis kamtschatkana glabra</i> n. subsp.	—	—	×
36. <i>Umbonium</i> sp.	×	—	—
37. <i>Trochus</i> sp.	—	—	×
38. <i>Turbo coronatus</i> GMEL.	—	×	—
39. <i>Batillaria multiformis</i> LKE.	×	—	—
40. <i>Thylacodes</i> sp.	—	×	—
41. <i>Strombus lukuanus</i> LIN.	—	—	×
42. <i>Tonna luteostoma</i> KÜST.	—	—	×

DESCRIPTION OF THE SPECIES

Class Pelecypoda

Family Arcidae

Genus *Glycymeris* DA COSTA, 1778*Glycymeris rotunda* (DUNKER)

1882. *Pectunculus rotundus* DUNKER: Index Moll. Mar. Jap., p. 236. Pl. XVI, fig. 10.
 1895. *Pectunculus rotundus* PILSBRY: Catal. Mar. Moll. Jap., p. 150.
 1922. *Pectunculus yamakawai* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLIV, Art. 1, p. 190, Pl. XVI, figs. 4, 5.
 1927. *Glycymeris rotunda* MAKIYAMA: Mem. Coll. Sci. Kyôto Imp. Univ., Ser. B, Vol. III, No. 1, Art. 1, p. 31, Pl. I, fig. 7.
 1930. *Glycymeris rotunda* KURODA: The Venus, Vol. I, No. 6, appendix, p. 21.
 1931. *Glycymeris rotundus* YOKOYAMA: Catal. Mar. Fresh-W. Land Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 1.

Few small imperfect specimens.

Circular in outline, moderately convex and thick-shelled; about 80 mm. in length and height, and 10 mm. in depth. A precise account is found in the work of Dr. J. MAKIYAMA above cited.

Occurrence:—Shirahama-shrine (Shirahama Group).

Distribution:—Kakegawa Series of Tôtômi and Tosa. Upper Musashino of Kazusa. Lower Musashino of Sagami and Awa.

Living:—Tôkyô Bay to Ryûkyû. Japan Sea.

Family Ostreidae

Genus *Ostrea* LINNAEUS, 1758*Ostrea sinensis* GMELIN

- Ostrea sinensis* KÜSTER in MARTINI u. CHEMNITZ: Syst. Conchyl. Cab. Vol. VII, p. 82, Pl. XII, fig. 1.
 1870. *Ostrea sinensis* SOWERBY: Conch. Icon., *Ostrea*, fig. 5.
 1928. *Ostrea sinensis* KURODA: Catal. Shell-Bearing Moll. Amami-Ôshima, p. 4, No. 34.
 1930. *Ostrea sinensis* HIRASE: Jap. Jour. Zool., Vol. III, No. 1, p. 31, fig. 43.
 1930. *Ostrea sinensis* KURODA: The Venus, Vol. II, No. 3, appendix, p. 50, fig. 57.
 1931. *Ostrea sinensis* YOKOYAMA: Catal. Mar. Fresh-W. Land Shell Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 3.

Several specimens, large and small.

Shell attaining over 100 mm. in height; outline ovate, fairly convex and thick-shelled with few radial wavy folds on the disk surface. Interior finely crenulate along both sides of the hinge. Muscular impresion situated marginally, distinct, small, slightly sunken, and concentrically striated. The largest right-valve measures 110 mm. in height, 94 mm. in length, and 37 mm. in depth. According to Mr. T. KURODA, *O. turbinata* LAM., is identical with this species.

Occurrence:—Shirahama-shrine (Shirahama Group); Nawachi gold mine (Yugashima Group).

Distribution:—Raised beach deposits of Awa.

Living:—Amami-Ôshima, Kyûshû and Ryûkyû.

Ostrea folium LINNAEUS

Pl. XII (II), Fig. 2.

- Ostrea folium* KÜSTER in MARTINI u. CHEMNITZ: Syst. Conchyl. Cab. Vol. VII, (Pt. I), p. 76. Pl. VIII, figs. 4-7, 10.
1871. *Ostrea folium* SOWERBY: Conch. Icon., *Ostrea*, fig. 40 a, b, c.
1882. *Ostrea folium* DUNKER: Index Moll. Mar. Jap., p. 249.
1930. *Ostrea folium* HIRASE: Jap. Jour. Zool., Vol. III, No. 1, p. 21, figs. 35-37.
1930. *Ostrea folium* KURODA: The Venus, Vol. II, (No. 3), appendix, p. 50.
1931. *Ostrea folium* YOKOYAMA: Catal. Mar. Fresh-W. Land Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 3.

A single small well preserved specimen.

The median rib which is one of the characteristics of this species is prominently developed in the specimen. Height, 20 mm., length, 10 mm., depth, 6.5 mm.

Dr. J. MAKIYAMA considers that *O. cuculata* YOKOYAMA (not BORN)¹ from Numa is identical with the present species, but that species seems to have a closer affinity to an immature specimen of *O. sinensis* than to *O. folium*.

Occurrence:—Shirahama-shrine (Shirahama Group).

Distribution:—Kakegawa Series of Tôtômi.

Living:—Kii to Ôsumi, Kyushu. Indian Ocean.

Ostrea gigas THUNBERG

1869. *Ostrea laperousii* SCHRENCK: Reis. Forsch. Amurl., p. 475, Pl. XIX, figs. 1-6.
1869. *Ostrea gigas* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 174.
- 1871? *Ostrea gigas* var. LISCHKE: Ibid., Vol. II, p. 160, Pl. XIV, figs. 1, 2.
1871. *Ostrea talienvahnensis* SOWERBY: Conch., Icon., *Ostrea*, fig. 21.
1881. *Ostrea gigas* DUNKER: Index Moll. Mar. Jap., p. 145.
1895. *Ostrea gigas* PILSBRY: Catal. Mar. Moll. Jap., p. 145.
1906. *Ostrea gigas* TOKUNAGA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXI, Art. 1, p. 68, Pl. IV, figs. 5 a, b.
1920. *Ostrea gigas* YOKOYAMA: Ibid., Vol. XXXIX, Art. 6, p. 162, Pl. XV, figs. 3, 4. ? 1, 2.
1922. *Ostrea gigas* YOKOYAMA: Ibid., Vol. XLIV, Art. 1, p. 184.
1923. *Ostrea gigas* MAKIYAMA: Jap. Jour. Geol. Geogr., Vol. II, No. 2, p. 24.
1924. *Ostrea gigas* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLV, Art. 1, p. 57.
- 1924? *Ostrea gigas* YOKOYAMA: Ibid., Vol. XLV, Art. 3, p. 20, p. 20, Pl. V, figs. 1, 2.
1925. *Ostrea gigas* YOKOYAMA: Ibid., Vol. XLV, Art. 5, p. 28.
1925. *Ostrea gigas* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. I, p. 19.
1925. *Ostrea gigas* YOKOYAMA: Ibid., Vol. I, Pt. III, p. 124.
1926. *Ostrea gigas* YOKOYAMA: Ibid., Vol. I, Pt. IX, p. 358, 379.
- 1926? *Ostrea gravitesta* YOKOYAMA: Ibid., Vol. I, Pt. IX, p. 388, Pl. XLV, figs. 1, 2.
1927. *Ostrea gigas* YOKOYAMA: Ibid., Vol. I, Pt. X, p. 402, 446.
1927. *Ostrea gigas* YOKOYAMA: Ibid., Vol. II, Pt. IV, p. 169.
1929. *Ostrea gigas* YOKOYAMA: Ibid., Vol. II, Pt. IX, p. 393, Pl. LXXVI, fig. 1.
1929. *Ostrea laperousii* WAKIYA: Jap. Jour. Zool., Vol. II, No. 3, p. 259, Pl. VIII, figs. 1-3; Pl. X, figs. 1, 2.
1930. *Ostrea gigas* HIRASE: Jap. Jour. Zool., Vol. III, No. 1, p. 45, figs. 61-64.
1930. *Ostrea laperousii* HIRASE: Ibid., p. 49, figs. 70-80.
1930. *Ostrea gigas* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Vol. II, Pt. X, p. 400.
1931. *Ostrea gigas* YOKOYAMA: Ibid., Vol. III, Pt. IV, p. 199.

¹YOKOYAMA, M.: Moll. Coral-Bed of Awa. Jour. Coll. Sci Tôkyô, Vol. XLV, Art. 1, p. 54, Pl. IV, figs. 12, 13.

1931. *Ostrea gigas* KURODA: The Venus, Vol. II, No. 5, appendix, p. 55.

1931. *Ostrea gigas* YOKOYAMA: Catal. Mar. Fresh-W. Land Shells Jap., Min. Mus, Imp. Geol. Surv. Jap., p. 3.

1931. *Ostrea gigas* var. *talienwahnensis* YOKOYAMA: Ibid., p. 3.

An elongated lower valve measuring 90 mm. in height and 36 mm. in length. This species is very variable in form, and sometimes its test grows tolerably heavy.

Occurrence:—Jizôdô (Ashigara Group).

Distribution:—Raised beach deposits of Awa, Kazusa, Shimosa, Musashi, Sagami and Noto. Upper Musashino of Kazusa, Shimôsa, Hitachi and Musashi. Lower Musashino of Kazusa. Pleistocene of Saghalien. Pliocene of Ugo, Kaga, Echigo, Shinano, Yamashiro, Iwaki and Harima. Iwaki Beds of Iwaki (?).

Living: Hokkaidô to Kyûshû. Okhotsk Sea. Japan Sea. Korea. China. Strait of Tartary.

Family Pectinidae

Genus *Pecten* OSBECK, 1765¹

Subgenus *Pecten* s. s.

Pecten shirahamaensis n. sp.

Pl. XII (II), Figs. 5, 5 a.

A single individual, both valves jointed.

Shell attains about 40 mm. in height, suborbicular, slightly convex, higher than long, subequivalve, equilateral except for ears; test medium in thickness; sides slightly concave in the middle; base regularly rounded. Right valve with numerous, unequal, rounded, narrow and more or less imbricated ribs which multiply, both by division and intercalation, up to about 45 in number near the ventral border of the disk; interspaces narrow, subchanneled; hinge-line much longer than one-half of disk-length. Ears very unequal; anterior ear being larger than the posterior, produced, sculptured by prominent concentric, imbricating lines as well as few (5?) radiating riblets; byssal notch quite prominent, rather deep and triangular; posterior ear nearly half the length of the anterior, sharply truncated obliquely, sculptured as in the anterior, though with the radial riblets less prominent. Left valve similar to the right except of possibly being a little more convex.

Dimensions:—Height, 42 mm.; length, 38 mm.; hinge line, 26.5 mm.; depth, ca. 12 mm. (both valves).

This species somewhat resembles *P. islandicus* MÜLLER of the Arctic seas, but is distinguished mainly by the ears. *P. halimensis* MAKIYAMA from the Pliocene of Harima² also resembles the present species although specifically may be distinct.

Occurrence: Nagata in Shirahama-mura (Shirahama Group).

¹ GRANT and GALE: Pliocene and Pleistocene Mollusca of California etc., Mem. San Diego Soc. Nat. Hist., Vol. I, 1931, p. 154.

² MAKIYAMA J.: Some Pliocene Mollusca from Maiko, near Kôbe. Jap. Jour. Geol. Geogr., Vol. II, No. 2, 1923, p. 23, pl IV, fig. 1.

Pecten irregularis SOWERBY

1847. *Pecten irregularis* SOWERBY: Thes. Conch., Vol. I, p. 69, Pl. XIII, figs. 51-52.
 1852. *Pecten irregularis* REEVE: Conch. Icon., *Pecten*, Pl. IV, figs. 19 a, b.
 1869. *Pecten irregularis* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 170.
 1871. *Pecten irregularis* LISCHKE: Ibid., Vol. II, p. 158.
 1882. *Pecten irregularis* DUNKER: Index Moll. Mar. Jap., p. 240, Pl. XI, figs. 2, 15.
 1888. *Pecten irregularis* KÜSTER in MARTINI u. CHEMNITZ: Syst. Conchyl. Cab., Vol. VII, Pt. II, p. 139, Pl. XXXVIII, figs. 5, 6.
 1911. *Pecten irregularis* YOKOYAMA: Jour. Geol. Soc. Tôkyô, Vol. XVIII, No. 208, p. 2, Pl. I, figs. 5-7.
 1920. *Pecten irregularis* YOKOYAMA: Jour. Coll. Sci. Tôkyô, Vol. XXXIX, Art. 6, p. 153, Pl. XIII, figs. 1-3.
 1924. *Pecten irregularis* YOKOYAMA: Ibid., Vol. XLV, Art. 1, p. 55.
 1931. *Chlamys irregularis* YOKOYAMA: Catal. Mar. Fresh-W. Land Shells Jap., Min. Mus, Imp. Geol. Surv. Jap., p. 3.

Few ill preserved specimens. Height, 24 mm., length, 18 mm. (a right valve).

According to LISCHKE *P. limatula* RVE. is only a colour variety of this species.

Occurrence:—Nagata and Shirahama-shrine in Shirahama-mura (Shirahama Group).

Distribution:—Raised beach deposits of Awa. Miyata Beds and Yokosuka Beds of Sagami.

Upper and Lower Musashino of Musashi.

Living:—Tateyama Bay, Bôshû to Kyûshû. Japan Sea. E. Indies.

Pecten farreri nipponensis KURODA

1862. *Pecten laetus* GOULD: Otia Conch., p. 177.
 1869. *Pecten laetus* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 169, Pl. XII, figs. 6, 7.
 1869. *Pecten laetus* SCHRENCK: Reis. Forsch. Amur-Lande, p. 603.
 1871. *Pecten laetus* LISCHKE: Ibid., Vol. II, p. 157.
 1882. *Pecten laetus* DUNKER: Index Moll. Mar. Mar. Jap., p. 241.
 1888. *Pecten laetus* KÜSTER in MARTINI u. CHEMNITZ: Syst. Conchyl. Cab., Vol. VII, Pt. II, p. 134, Pl. XXXVII, figs. 4, 5.
 1895. *Pecten laetus* PILSBRY: Catal. Mar. Moll. Jap., p. 144.
 1906. *Pecten laetus* TOKUNAGA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXVI, Art. 6, p. 65, Pl. V, fig. 2.
 1920. *Pecten laetus* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXXIX, Art. 6, p. 152, Pl. XIV, figs. 1, 2.
 1922. *Pecten laetus* YOKOYAMA: Ibid., Vol. XLIV, Art. 1, p. 180, Pl. XIV, fig. 26.
 1923. *Pecten laetus* YOKOYAMA: Ibid., Vol. XLIV, Art. 7, p. 7.
 1924. *Pecten laetus* YOKOYAMA: Ibid., Vol. XLV, Art. 1, p. 56.
 1925. *Pecten laetus* YOKOYAMA: Ibid., Vol. XLV, Art. 5, p. 26.
 1925. *Pecten laetus* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Vol. I, Sec. 2, Pt. I, p. 16.
 1926. *Pecten laetus* YOKOYAMA: Ibid., Vol. I, Pt. VIII, p. 303.
 1926. *Pecten laetus* YOKOYAMA: Ibid., Vol. I, Pt. IX, p. 371, 379.
 1927. *Pecten laetus* YOKOYAMA: Ibid., Vol. II, Pt. IV, p. 169.
 1931. *Pecten laetus* YOKOYAMA: Catal. Mar. Fresh-W. Land Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 3.
 1932. *Chlamys farreri nipponensis* KURODA: The Venus Vol. III, No. 2 appendix p. 91, fig. 169.

Few immature specimens. Length, 31 mm.; height, 36 mm., depth, ca. 4 mm. (a right valve).

Occurrence:—Nagata in Shirahama-mura; Kakisaki in Hamasaki-mura and Shirahama (Shirahama Group).

Distribution:—Raised beach deposits of Awa. Miyata Beds and Yokosuka Beds of Sagami. Upper Musashino of Musashi, Kazusa and Shimôsa. Lower Musashino of Musashi, Shirado Beds of Hitachi. Pliocene of Sado, Ugo, Kaga Saishû Is., Izumo, Shinano and Mikawa.

Living:—Hokkaidô to Kyûshû. Korea. Japan Sea.

Pecten kakisakiensis n. sp.

Pl. XII (II), Figs. 3, 4.

Shell medium in size, compressed, somewhat higher than long, equivalve, equilateral except for ears; sides sloping, very slightly concave above or almost straight; umbonal angle 85°; test rather thin. Right valve with 26 equal, rounded, more or less scaly ribs which are subsequently divided into three unequal parts as the shell grows; median one is largest, the other two smaller and equal; interspaces narrower than ribs and rarely with an interstitial riblet near the ventral margin in a well grown specimen. Ears unequal; anterior ear being longer and larger than the posterior; byssal notch prominent, rather deep and its end rounded; posterior ear nearly rectangularly truncated; both ears sculptured by 6 radial scaly riblets. Hinge line more than one-half of disk-length. Left valve nearly similar to the right, except for ears. The anterior ear being smaller than the posterior, obliquely truncated.

Dimensions:—Height, 55 mm.; length, 53 mm.; depth, ca. 6 mm. Length of ear, 29 mm. (a right valve).

This species somewhat resembles *P. nobilis* RVE., a species found as fossil and living in Japan, but it is distinguished from that species by the ribs. In *P. nobilis* the ribs are simple and usually 23 or 24 in number while in the present species there are 26 ribs and each of them accompanies riblets on both sides.

Pecten kakisakiensis n. sp. is more closely allied to *P. satoi* YOKOYAMA¹ from the Island of Taiwan; the difference between the two is in the less number of ribs in the present species. *P. satoi* is said to have 30 ribs according to Dr. YOKOYAMA.

Occurrence:—Kakisaki (Shirahama Group).

Subgenus **Patinopecten** DALL, 1898

Pecten planicostulatus n. sp.

Pl. XI (I), Figs. 2-5.

Shell large, about 110 mm. in height, compressed, length nearly equal to height, subequi-valve, subequilateral; sides straight, with margins smooth; umbonal angle about 110°. Test rather thin. Right valve ornamented by 18 low, rounded, subequal ribs which are sometimes dichotomous or branching; in some specimens the ribs are almost obsolete near the ventral margin; interspaces subequal, very shallow, much narrower than the ribs, rarely provided with interstitial riblets; whole surface covered by numerous fine growth lines and a few stronger periodic ones; hinge line less than one-half of disk-length. Ears subequal in length; anterior ear rounded in front and ornamented by almost obsolete radials as well as concentric lines of growth; byssal notch rather shallow and broad; posterior ear is obliquely truncated, ornamented by only concentric lines. Left valve quite similar to the right except for almost equal ears.

¹YOKOYAMA, M.: Imp. Geol. Surv. Jap., Rep. No. 101, 1928, p. 94, Pl. XJII, figs. 13, 14; Pl. XIV, fig. 2.

Dimensions :—

Height, 112 m. ; length, 112 mm. ; depth, — ; length of hinge, — (a right valve)
 ,, 83 m. ; ,, 83 mm. ; ,, 7 mm. ; ,, 39 mm. (,,)
 ,, 65 m. ; ,, — ; ,, 7 mm. ; ,, 38 mm. (,,)

Occurrence: Ichiyama near Yugashima (Shirahama Group).

Subgenus *Aequipecten* FISCHER, 1836*Pecten vesiculosus* DUNKER

1882. *Pecten vesiculosus* DUNKER: Index Moll. Mar. Jap., p. 241, Pl. XI, fig. 1.
 1888. *Pecten vesiculosus* KÜSTER in MARTINI u. CHEMNITZ: Syst. Conchyl. Cab. Vol. VII, Pt. II, p. 138, Pl. XXXVIII, fig. 4.
 1895. *Pecten vesiculosus* PILSBRY: Catal. Mar. Moll. Jap., p. 144.
 1911. *Pecten vesiculosus* YOKOYAMA: Jour. Geol. Soc. Tôkyô, Vol. XVIII, No. 208, p. 1, Pl. I, figs. 8-10.
 1920. *Pecten vesiculosus* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXXIX, Art. 6, p. 154, Pl. XIII, figs. 11-13.
 1922. *Pecten vesiculosus* YOKOYAMA: Ibid., Vol. XLIV, Art. 1, p. 181.
 1923. *Pecten vesiculosus* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Vol. II, Pt. VII, Sec. 2, p. 335.
 1931. *Chlamys (Aequipecten) vesiculosus* YOKOYAMA: Catal. Mar. Fresh-W. Land Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 3.

Numerous well preserved right and left valves. The largest and most perfect specimen which is a right valve measures 36 mm. in height, 38 mm. in length 9 mm. in depth; it is larger than that of the type given by DUNKER.

Occurrence:—Nagata in Shirahama-mura; Sawada in Shimo-Kawazu-mura; Kami-shiroiwa in Shimo-Ômi-mura (Shirahama Group). Sugumo-gawa (Ashigara Group).

Distribution:—Upper Musashino of Kazusa. Lower Musashino of Musashi and Sagami. Pliocene of Hyûga and Hitachi.

Living: Rikuzen to Kyûshû, Japan Sea.

Subgenus *Decadopecten* SOWERBY, 1839¹*Pecten tayamai* n. sp.

Pl. XI (I), Figs. 6-8.

Shell attains about 60 mm. in height, much higher than long, compressed, almost equi-valve, subequilateral; sides sloping, long and straight; base regularly rounded, umbonal angle about 60°; test rather solid. Right valve with 14 prominent, rounded and subequal ribs, accompanying a single riblet on each side of disk; interspaces rounded at base and nearly equal to ribs; whole surface covered with numerous radial riblets (about 7 or 8 on each rib), crossed by fine, more or less imbricating lines of growth. Ears small; much shorter than half the disk length; posterior ear a little larger than the anterior, almost rectangularly truncated, the anterior with a wide and shallow notch below; both ears similarly sculptured by about 5 radial riblets as well as fine concentric lines. Left valve similar in every respect to the right except for subequal ears.

Dimensions:—Height, 55 mm.; length, 41 mm.; depth, ca. 7 mm.; length of hinge, 18 mm. (a right valve).

¹ *Palium* SCHUMACHER, 1817, preoccupied by SHROETER, 1802 (The Venus Vol. 3, No. 1, 1931, appendix, 83).

There is a specimen larger than that measured, and unfortunately fractured at its umbonal part. No allied forms have hitherto been reported in Japan either recent or fossil.

Occurrence:—Nagata in Shirahama-mura, ? Ichiyama near Yugashima (Shirahama Group).

Pecten izuensis n. sp.

Pl. XI (I), Figs. 9-13.

Shell attains about 40 mm. in height, compressed, slightly shorter than high, subequivalve, equilateral; test thick. Left valve with 6 prominent, rounded, subequal ribs accompanying a single riblet on each side of disk; sides straight and smooth; basal margin rounded, umbonal angle 85°; interspaces nearly equal to the ribs, rounded at base; whole surface ornamented by radiating riblets, 7 or 8 in number on a rib, minutely imbricated by the intersection of numerous fine incremental lines; right valve similar to the left except of possibly being a little more convex. Ears mostly fractured in all specimens.

Few ill-preserved specimens.

Dimensions:—Height, 34 mm., length, 33 mm. (a left valve)

„ „, 40 mm., „ „, 33 mm. („ „)

This species is similar to *P. plicatus* SOWERBY, a living species in Japan, but the main ribs in our species are invariably six in number instead five in SOWERBY'S species. Furthermore the ears are quite different in the two.

P. radula LINNAEUS from Southern Japan is also related to the present new species, but specifically distinct in having more number of ribs.

Occurrence:—Nagata in Shirahama-mura (Shirahama Group).

Subgenus *Vola* H. and A. ADAMS, 1857¹

Pecten naganumanus YOKOYAMA

1920. *Pecten naganumana* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXXIX Art. 6, p. 160, Pl. XIII, figs. 4-6.

1928. *Pecten (Vola) sinensis* YOKOYAMA: Imp. Geol. Surv. Jap. Report, No. 101. Moll. Oil-Field Taiwan, p. 97, Pl. XIV, fig. 1.

A left valve measuring 50 mm. in length and 43 mm. in height.

Pecten naganumanus was first established by Dr. M. YOKOYAMA on the fossil specimens from Naganuma in the Province of Musashi related to *P. fumatus* REEVE and *P. laqueatus* SOWERBY. Subsequently he stated that the species is specifically identical with *P. sinensis* SOWERBY, a living species in Japan and China. The two are, the writers believe, closely related to each other, but the beak of the right valve is more swollen larger ears, and the concavity of the left valve is apparently greater in *P. sinensis* and they rather prefer to accept his previous opinion and to apply the name *P. naganumanus* for the present form.

Occurrence:—Yukawa (Shirahama Group).

Distribution:—Naganuma Beds of Musashi. Upper and Lower Musashino of Kazusa. Upper and Lower Byôritsu Beds of Taiwan. Philippines.

Living: ? Western Japan (Kyûshû).

¹*Janira* SCHUMACHER, 1817, preoccupied by OKEN, 1815 (Ctenophora), and also by RISSO, 1816 (Crustacea).

Subgenus *Amusiopecten* SACCO, 1897*Pecten praesignis* YOKOYAMA

1922. *Pecten praesignis* YOKOYAMA: Jour. Geol. Soc. Tôkyô, Vol. XXIX, No. 350, p. 1, Pl. V, figs. 1-3.
 1926. *Pecten praesignis* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. IX, p. 357, Pl. XL, figs. 1, 2; Pl. LI, fig. 1.
 1927. *Pecten (Amusiopecten) praesignis* MAKIYAMA: Mem. Coll. Sci. Kyôto Imp. Univ., Ser. B, Vol. III, No. 1, Art. 1, p. 34.

An internal mould of right valve measuring 60 mm. in length and 57 mm. in height. It is rather compressed, thin-shelled and internally grooved. The number of main ribs are 13, hence fewer than in the type specimen described by Dr. YOKOYAMA. This species subsequently reported also by Dr. YOKOYAMA from the Tertiary deposits of Taiwan (Formosa)¹ but the figure given by him seems to be quite distinct from the named species in having more number of internal ribs. This difference was first pointed out by Mr. T. KURODA.²

Occurrence:—Nawachi gold mine (Yugashima Group).

Distribution:—Kakegawa Series of Tôtômi and Tosa.

Family Spondylidae

Genus *Spondylus* LINNAEUS, 1758*Spondylus anacanthus* MAWE

Pl. XI (1), Figs. 1, 1 a.

1847. *Spondylus nudus* SOWERBY: Thes. Conch., Vol. I, p. 430, Pl. XLVIII, figs. 39, 40.
 1856. *Spondylus nudus* REEVE: Conch. Icon., *Spondylus*, fig. 2.
 1932. *Spondylus anacanthus* KURODA: The Venus, Vol. III, No. 3, appendix, p. 108, fig. 117.

Several specimens.

Shell of medium size, oblong-ovate, swollen; test rather thin. Upper valve with numerous fine radial riblets with subsequent finer ones between; whole surface minutely imbricated by intersections of growth lines. Lower valve more convex than the upper, ornamented with numerous fine radial riblets and about 10 rows of tubercles; tubercles not erect, and distantly spaced.

Dimensions:—Height, 45 mm.; length, 42 mm.; (upper valve);
 ,, 50 mm.; ,, ,, (lower valve);
 depth, 33 mm. (both valves).

Occurrence:—Nagata in Shirahama-mura (Shirahama Group).

Living:—Sagami, Tosa and Kii. Mauritius and Philippines.

Spondylus cruentus LISCHKE

1869. *Spondylus cruentus* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 172, Pl. XII, figs. 1-2.
 1832. *Spondylus cruentus* DUNKER: Index Moll. Mar. Jap., p. 246.
 1895. *Spondylus cruentus* PILSBRY: Catal. Mar. Moll. Jap., p. 143.
 1922. *Spondylus cruentus* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLIV, Art. 1, p. 179, Pl. XIV, fig. 24.

¹ YOKOYAMA, M.: Imp. Geol. Surv. Jap., Report No. 101, p. 96, Pl. XV, fig. 1.

² KURODA, T.: The Venus Vol. III, No. 1, appendix p. 77.

1924. *Spondylus cruentus* YOKOYAMA: Ibid., Vol. XLV, Art. 1, p. 55, Pl. V, fig. 12.
 1926. *Spondylus cruentus* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. VIII, p. 302.
 1931. *Spondylus cruentus* YOKOYAMA: Catal. Mar. Fresh-W. Land Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 4.

A single small upper valve measuring 30 mm. in length and 28 mm. in height.

It is an ovate and strongly compressed shell with numerous radiating, more or less spiny and discontinuous riblets on the disk-surface.

Occurrence:—Nagata in Shirahama-mura (Shirahama Group).

Distribution:—Raised beach deposits of Awa and Kazusa. Upper Musashino of Shimôsa. Pliocene of Sado.

Living:—Matsushima Bay to Ryûkyû.

Family LIMIDAE

Genus *Lima* BRUGUIÈRE, 1797

Lima zushiensis YOKOYAMA

1920. *Lima zushiensis* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXXIX, Art. 6, p. 148, Pl. XII, fig. 8.
 1929. *Lima zushiensis* FUJITA: The Venus, Vol. I, No. 2, p. 50.

Few ill-preserved specimens.

A cast of right valve measuring 50 mm. in height, 42 mm. in length and 9 mm. in depth.

Similar to *L. lima* LIN. in general respects, but differs in its greater number of ribs.

Occurrence:—Shirahama-shrine (Shirahama Group).

Distribution:—Lower Musashino of Sagami.

Living:—Tateyama Bay, Awa.

Lima sp.

An imperfect specimen of right valve measuring about 30 mm. in height. It resembles somewhat *L. orientalis* AD. ET RVE. (= *L. angulata* SOWERBY) a species found as fossil and living in Japan.

Occurrence:—Nagata in Shirahama-mura (Shirahama Group).

Family Mytilidae

Genus *Volsella* SCOPOLI, 1777¹

Volsella modiolus (LINNAEUS)

1858. *Modiola modiolus* REEVE: Conch. Icon., *Modiola*, fig. 2.
 1863. *Mytilus modiolus* JEFFREYS: Brit. Conch., Vol. II, p. 111.
 1867. *Modiola modiolus* SCHRENCK: Reis. Forsch. Amurl., p. 498.
 1869. *Modiola modiolus* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 156.
 1872. *Modiola modiolus* CARPENTER: Western Moll., p. 643.
 1874. *Modiola modiolus* LISCHKE: l.c., Vol. III, p. 109.

¹ GRANT and GALE: l.c., 1931, p. 248.

1882. *Modiola modiolus* DUNKER: Index Moll. Mar. Jap., p. 222.
 1889. *Modiola modiolus* KÜSTER in MARTINI u. CHEMNITZ: Syst. Conchyl. Cab., Vol. VIII, Pt. III, p. 92, Pl. V, fig. 3; Pl. XXVIII, figs. 1, 2.
 1895. *Modiola modiolus* PILSBRY: Catal. Mar. Moll. Jap., p. 139.
 1906. *Modiola modiolus* TOKUNAGA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXI, Art. 6, p. 68.
 1920. *Modiola modiolus* YOKOYAMA: Ibid., Vol. XXXIX, Art. 6, p. 145, Pl. XI, fig. 21.
 1921. *Modiola modiolus* DALL: Northwest Coast Shell-bearing Moll., U. S. Nat. Mus., Bull., 112, p. 21.
 1922. *Modiola modiolus* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLIV, Art. 1, p. 175.
 1923. *Modiola modiolus* YOKOYAMA: Jap. Jour. Geol. Geogr., Vol. II, No. 2, p. 7.
 1924. *Modiola modiolus* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLV, Art. 3, p. 20, Pl. IV, figs. 7, 8.
 1925. *Modiola modiolus* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. I, p. 15, Pl. III, fig. 2.
 1926. *Modiola modiolus* YOKOYAMA: Ibid., Vol. I, Pt. VIII, p. 300.
 1930. *Modiola modiolus* YOKOYAMA: Ibid., Vol. II, Pt. X, p. 409.
 1931. *Modiola modiolus* YOKOYAMA: Ibid., Vol. III, Pt. IV, p. 190.

One internal mould measuring 47 mm. in height, 20 mm. in length and 16 mm. in depth.

Occurrence:—Jizôdô (Ashigara Group).

Distribution:—Upper Musashino of Musashi and Kazusa. Miyata Beds and Lower Musashino of Sagami. Pliocene of Izumo and Shinano. Iwaki Beds of Iwaki. Naikawa Beds of Saghalien. Pliocene of Hidaka and Sado.

Living: Kuril Islands to Inland Sea. Arctic to San Pedro, California. Circumboreal. N. Atlantic.

Family Codakiidae¹

Genus *Anodontia* LINK, 1807²

Anodontia pila (REEVE)

Pl. XII (II), Fig. 1.

1851. *Lucina pila* REEVE: Conch. Icon., *Lucina*, fig. 24.
 1928. *Lucina pila* KURODA: Catal. Shell-Bearing Moll. Amami-Ôshima, p. 10, No. 105.
 1931. *Lucina pila* YOKOYAMA: Catal. Mar. Fresh-W. Land. Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 8.

One well preserved internal mould of jointed valves, measuring 23 mm. in height, 24 mm. in length and 15 mm. in depth.

The shell is small, orbicular, swollen, apparently thin-shelled with elongated muscular impression and closely similar to the named species.

Occurrence: Nawachi gold mine (Yugashima Group).

Living:—Kyûshû and Ryûkyû.

Family Veneridae

Genus *Dosinia* SCOPOLI, 1777

Dosinia pubescens (PHILIPPI)

1845. *Cytherea pubescens* PHILIPPI: Abbild. u. Beschr. Conchyl., Vol. III, p. 24, Pl. VIII, fig. 3.
 1855. *Artemis pubescens* SOWERBY: Thes. Conch., Vol. II, p. 672, Pl. CXLIV, fig. 72.
 1862. *Dosinia pubescens* ROEMER: Monogr. Moll. *Dosinia*, p. 79, No. 96, Pl. XV, fig. 1.
 1931. *Dosinia (Dosinisca) pubescens* YOKOYAMA: Catal. Mar. Fresh-W. Land. Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 9.

¹ GRANT and GALE: l.c., 1931, p. 283,

² Ibid., p. 292.

Two specimens, the larger (left valve) measuring 50 mm. in length and height, and 20 mm. in depth.

The shell is more convex and bears finer concentric lines than in *D. japonica* RVE. ROEMER considers *D. coelata* as a synonym, but that species seems to be different from the present species.

Occurrence:—Kawanishi (Ashigara Group).

Distribution:—Raised beach deposits of Awa and Shimôsa.

Living:—Inland Sea. Philippines.

Genus *Meretrix* LAMARCK, 1799

Meretrix meretrix (LINNAEUS)

1855. *Cytherea meretrix* SOWERBY: Thes. Conch., Vol. II, p. 619, Pl. CXXIX, figs. 48-50.
 1857. *Cytherea meretrix* JAY: Rep. Shells Coll. Jap. Exped., p. 292, Pl. II, figs. 1, 2.
 1867. *Venus (Meretrix) meretrix* SCHRENCK: Reis. Forsch. Amurl., p. 545.
 1869. *Meretrix meretrix* ROEMER: Monogr. Moll. Venus p. 27, Pl. VIII, figs. 1 a, b.
 1869. *Cytherea meretrix* PFEIFFER in MARTINI u. CHEMNITZ: Syst. Conchyl. Cab., Vol. XI, Pt. I, p. 15, Pl. III, figs. 4-6, 8, 9.
 1869. *Cytherea meretrix* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 122.
 1871. *Cytherea meretrix* LISCHKE: Ibid., Vol. II, p. 108.
 1882. *Cytherea meretrix* DUNKER: Index Moll. Mar. Jap., p. 199.
 1895. *Meretrix meretrix* PILSBRY: Catal. Mar. Moll. Jap., p. 126.
 1906. *Cytherea meretrix* TOKUNAGA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXI, Art. 2, p. 47, Pl. III, fig. 5 a, b.
 1922. *Meretrix meretrix* YOKOYAMA: Ibid., Vol. XLIV, Art. 1, p. 146, Pl. II, fig. 4.
 1926. *Meretrix meretrix* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. VII, p. 230.
 1926. *Meretrix meretrix* YOKOYAMA: Ibid., Vol. I, Pt. VIII, p. 291.
 1927. *Meretrix meretrix* YOKOYAMA: Ibid., Vol. I, Pt. 10, p. 400, 445.
 1928. *Meretrix meretrix* YOKOYAMA: Imp. Geol. Surv. Jap., Rep. No. 101, p. 75, Pl. VII, fig. 9.
 1931. *Meretrix meretrix* YOKOYAMA: Catal. Mar. Fresh-W. Land. Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 9, No. 298.

Several specimens examined; mostly deformed. A perfect specimen measures 25 mm. in length and 22 mm. in height and 6 mm. in depth.

Many living species of *Meretrix* has been reported from Japan and other districts of the eastern seas, but I believe that they except for a few, are probably only varietal forms of this species.

Occurrence:—Jizôdô (Ashigara Group).

Distribution:—Raised beach deposits of Awa, Kazusa, Shimôsa, Musashi, and Sagami. Upper Musashino of Kazusa, Shimôsa and Musashi. Pliocene of Sado and Sagami. Upper and Lower Byoritz Beds and Upper Arisan Beds of Taiwan.

Living:—Kuril Island and Hokkaidô to Formosa. China. Philippines. Indian Ocean.

Genus *Macrocallista* MEEK, 1876

Macrocallista pacifica (DILLWYN)

1855. *Cytherea sinensis* SOWERBY: Thes. Conch., Vol. II, p. 624, Pl. CXXXI, figs. 80, 81.
 1863. *Dione chinensis* REEVE: Conch. Icon., *Cytherea*, figs. 4 a, b.
 1867. *Venus (Callista) pacifica* SCHRENCK: Reis. Forsch. Amurl., p. 541.
 1869. *Cytherea (Callista) chinensis* ROEMER: Monogr. Moll. Venus, p. 66, Pl. XIX, fig. 3.

1869. *Cytherea chinensis* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 122.
 1869. *Cytherea chinensis* PFEIFFER in MARTINI u. CHEMNITZ: Syst. Conchyl. Cab., Vol. XI, Pt. I, p. 31, Pl. X, fig. 2.
 1882. *Callista chinensis* DUNKER: Index Moll. Mar. Jap., p. 200.
 1895. *Meretrix (Callista) chinensis* PILSBRY: Catal. Mar. Moll. Jap., p. 127.
 1906. *Cytherea chinensis* TOKUNAGA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXI, Art. 2, p. 46, Pl. III, figs. 4 a, b.
 1920. *Meretrix (Callista) chinensis* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXXIX, Art. 6, p. 120, Pl. VIII, figs. 9, 10.
 1924? *Meretrix (Callista) chinensis* YOKOYAMA: Ibid., Vol. XLV, Art. 3, p. 14, Pl. II, figs. 7, 8.
 1927. *Macrocallista pacifica* MAKIYAMA: Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B, Vol. III, No. 1, Art. I, p. 48.
 1928. *Meretrix (Macrocallista) ezoensis* YOKOYAMA: Imp. Geol. Surv. Jap., Rep. No. 101, p. 77, Pl. VIII, fig. 1 (not 1889).
 1928. *Meretrix (Macrocallista) ezoensis* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. II, Pt. VII, p. 348 (not 1889).

Two rather well preserved small specimens of nearly equal size and measuring 50 mm. in length, 30 mm. in height and ca. 13 mm. in depth.

Occurrence:—Jizôdô (Ashigara Group).

Distribution:—Raised beach deposits of Awa. Upper Musashino of Hitachi, Shimôsa, Kazusa and Musashi. Naganuma Beds and Miyata Beds of Sagami. Kakegawa Series of Tôtômi and Tosa. Pliocene of Ôsumi and Hyûga. Pliocene (?) of Okinawa. Iwaki Beds of Iwaki. Upper and Lower Byôrits Beds of Taiwan.

Living:—Hokkaidô to Kyûshû. China. New Holland. South Sea. Australia.

Genus *Venus* LINNAEUS, 1758

Subgenus *Venus* s. s.

Venus toreuma (GOULD)

1855. *Venus crebrisulca* SOWERBY: Thes. Conch., Vol. II, p. 728, Pl. CLXI, figs. 187-189 (not Lamareck).
 1862. *Venus toreuma* GOULD: Otia Conch., pp. 84, 246.
 1864. *Venus toreuma* REEVE: Conch. Icon., *Venus*, Pl. XVI, fig. 64.
 1869. *Venus junkesi* PFEIFFER in MARTINI u. CHEMNITZ: Syst. Conchyl. Cab., Vol. XI, p. 217, Pl. XXXV, figs. 7-9.
 1869. *Venus toreuma* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 121.
 1882. *Venus toreuma* DUNKER: Index Moll. Mar. Jap., p. 196.
 1895. *Venus toreuma* PILSBRY: Catal. Mar. Moll. Jap., p. 127.
 1924. *Venus toreuma* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLV, Art. 1, p. 44, Pl. II, fig. 22.
 1928. *Clausina toreuma* KURODA: Catal. Shell-Bearing Moll. Amami-Oshima, p. 14, No. 14.

Three moulds; the largest measures 39 mm. in length, 25 mm. in height, and 7 mm. in depth.

Occurrence:—Nagata and Shirahama-shrine in Shirahama-mura (Shirahama Group).

Distribution:—Raised beach deposits of Awa. Upper Musashino of Kazusa.

Living:—Sagami Bay to Ryûkyû. Philippines. Australia.

Subgenus *Chione* MEGERLE, 1811

Venus sp.

A small and transversely elongated species of *Chione* resembling *Venus ozawai* YOKOYAMA¹ from the Sagara Beds of Tôtômi. It is too much worn to enable specific determination. Length, 24 mm.; height ca. 20 mm.

Occurrence:—Sugumo-gawa (Ashigara Group).

¹ YOKOYAMA, M.: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. IX, p. 351, fig. 5.

Genus *Paphia* BOLTEN, 1798*Paphia undulata* (BORN)

1845. *Venus rimosa* PHILIPPI: Abbild. u. Besch. Conchly., Vol. III, p. 27, Pl. VII, fig. 7.
 1855. *Tapes rimosa* SOWERBY: Thes. Conch., Vol. II, p. 682, Pl. CXLVI, fig. 29.
 1864. *Tapes undulata* REEVE: Conch. Icon., *Tapes*, fig. 8.
 1869. *Tapes undulata* ROEMER: Monogr. Moll., *Venus*, Vol. II, p. 20, Pl. V, figs. 2, 2a, b, c.
 1871. *Tapes undulatus* LISCHKE: Jap. Meeres-Conch., Vol. II, p. 171.
 1882. *Tapes undulatus* DUNKER: Index Moll. Mar. Jap., p. 206.
 1895. *Tapes undulatus* PILSBRY: Catal. Mar. Moll. Jap., p. 129.
 1919. *Tapes undulatus* IWAKAWA: Catal. Jap. Moll., p. 299.
 1925. *Tapes undulatus* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLV, Art. 5, p. 22, Pl. V, fig. 1.
 1927. *Tapes undulatus* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. X, p. 445.
 1928. *Tapes undulatus* YOKOYAMA: Imp. Geol. Surv. Jap., Rep. No. 101, p. 82, Pl. VIII, fig. 2.

Two internal moulds, the larger measuring 40 mm. in length, 23 mm. in height, and 6 mm. in depth.

Occurrence:—Nawachi gold mine (Yugashima Group).

Distribution:—Raised beach deposits of Kazusa and Awa. Upper Musashino of Musashi. Shirado Beds of Hitachi. Moniwa Beds of Rikuzen. Upper Byôritz Beds of Taiwan.

Living:—Tôkyô Bay to Inland Sea.

Subgenus *Ruditapes* CHIAMENTI, 1900*Paphia variegata* (HANLEY)

1855. *Tapes variegata* SOWERBY: Thes. Conch., Vol. II, p. 696, Pl. CLI, figs. 133-138.
 1864. *Tapes variegatus* REEVE: Conch. Icon., *Tapes*, figs. 64a, b.
 1869. *Venus variegata* PFEIFFER in MARTINI u. CHEMNITZ: Syst. Conchyl. Cab., Vol. II, Pt. I, p. 223, Pl. XXXVIII, figs. 2-5.
 1869. *Tapes variegatus* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 118.
 1871. *Tapes variegatus* LISCHKE: Ibid., Vol. II, p. 108.
 1874. *Tapes variegatus* LISCHKE: Ibid., Vol. III, p. 79.
 1882. *Tapes variegatus* DUNKER: Index Moll. Mar. Jap., p. 207.
 1895. *Tapes variegatus* PILSBRY: Catal. Mar. Moll. Jap., p. 130.
 1920. *Tapes variegatus* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, vol. XXXIX, Art. 6, p. 125, Pl. IX, figs. 4, 5.
 1922. *Tapes variegatus* YOKOYAMA: Ibid., vol. XLIV, Art. 1, p. 125, Pl. IX, figs. 4, 5.
 1923. *Paphia variegata* MAKIYAMA: Imp. Jour. Geol. Geogr., vol. II, no. 2, p. 25.
 1925? *Tapes variegatus* YOKOYAMA: Ibid., vol. XLV, Art. 7, p. 18, Pl. III, fig. 13.
 1927. *Tapes variegatus* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. X, p. 445.
 1928. *Ruditapes variegata* KURODA: Catal. Shell-Bearing Moll. Amami-Ôshima, p. 15, No. 103.
 1928. *Paphia variegata* YOKOYAMA: Imp. Geol. Surv. Rep. No. 101, p. 116.

Several specimens. The largest attains 38 mm. in length, 19 mm. in height and 6 mm. in depth.

The shell is generally smaller, less higher and provided with finer radials than in *P. philippinarum* ADAMS and REEVE.

Occurrence: Jizôdô (Ashigara Group).

Distribution:—Raised beach deposits of Kazusa and Noto. Upper Musashino of Hitachi, Shimôsa, Kazusa and Musashi. Miyata Beds of Sagami. Shirado Beds of Hitachi. Pliocene of Harima.

Living:—Rikuzen to Ryûkyû. South Sea. Philippines.

Family **Tellinidae**Genus **Tellina** LINNAEUS, 1758Subgenus **Angulus** MEGERLE, 1811**Tellina rutila** DUNKER

1861. *Tellina rutila* DUNKER: Moll. Jap., p. 27, Pl. III, fig. 6.
 1871. *Tellina rutila* LISCHKE: Jap. Meeres-Conch., Vol. II, p. 115.
 1874. *Tellina jedoensis* LISCHKE: Ibid., Vol. III, p. 92, Pl. IX, figs. 1-3.
 1882. *Tellina rutila* DUNKER: Index Moll. Mar. Jap., p. 191.
 1895. *Tellina rutila* PILSBRY: Catal. Mar. Moll. Jap., p. 124.
 1895. *Tellina jedoensis* PILSBRY: Ibid., p. 124.
 1906. *Tellina jedoensis* TOKUNAGA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXI, Art. 2, p. 43, Pl. II, figs. 31a, b.
 1906. *Tellina aff. rutila* TOKUNAGA: Ibid., p. 44, Pl. II, figs. 35a, a'.
 1922? *Tellina jedoensis* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLIV, Art. 1, p. 138, Pl. IX, figs. 15, 16.
 1927. *Tellina jedoensis* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. X, p. 399.
 1931. *Tellina rutila* YOKOYAMA: Catal. Mar. Fresh-W. Land. Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 11, No. 369.

Two specimens. The perfect but smaller one measures 18 mm. in length, 13 mm. in height and 6.5 mm. in depth. It is certainly identical with *Tellina jedoensis* LISCHKE.

Occurrence:—Jizôdô (Ashigara Group).

Distribution:—Raised beach deposits of Musashi and Kasusa. Upper Musashino of Kazusa, Shimôsa and Musashi.

Living:—Tôkyô Bay to Kyûshû.

Family **Solenidae**Genus **Solen** LINNAEUS, 1758**Solen gouldii** CONRAD

1862. *Solen gracilis* GOULD: Otia Conch., p. 165.
 1871. *Solen gouldii* LISCHKE: Jap. Meeres-Conch., Vol. II, p. 128.
 1882. *Solen gouldii* DUNKER: Index Moll. Mar. Jap., p. 173, Pl. XVI, fig. 11.
 1888. *Solen gouldii* CLESSIN in MARTINI u. CHEMNITZ: Syst. Conchyl. Cab., Vol. XI, Pt. III, p. 12, Pl. IV, fig. 1.
 1906. *Solen gouldii* TOKUNAGA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXI, Art. 2, p. 35.
 1923. *Solen gouldii* MAKIYAMA: Jap. Jour. Geol. Geogr., Vol. II, No. 2, p. 25.
 1925. *Solen gouldii* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLV, Art. 5, p. 18, Pl. II, fig. 5.
 1927. *Solen gouldii* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. X, pp. 399, 455, Pl. LI, fig. 17.

Two imperfect specimens.

A narrow, slender and straight shell being identical with the named species.

Occurrence:—Jizôdô (Ashigara Group).

Distribution:—Raised beach deposits of Awa, Kazusa, Shimôsa and Musashi. Upper Musashino of Musashi. Shirado Beds of Hitachi. Pliocene of Harima.

Living: Hokkaidô to Kyûshû. China,

Family Mactridae

Genus *Mactra* LINNAEUS, 1767*Mactra veneriformis* DESHAYES

1855. *Mactra veneriformis* REEVE: Conch., Icon., *Mactra*, Pl. I, fig. 2.
 1855. *Mactra quadrangularis* REEVE: Ibid., fig. 3.
 1869. *Mactra veneriformis* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 133.
 1871. *Mactra veneriformis* LISCHKE: Ibid., Vol. II, p. 121, Pl. IX, figs. 6, 7, 8.
 1882. *Trigonella veneriformis* DUNKER: Index Moll. Mar. Jap., p. 182.
 1884. *Mactra veneriformis* WEINKAUFF in MARTINI. u. CHEMNITZ: Syst. Conchyl. Cab. Vol. XI, Pt. II, p. 63, Pl. XXII, figs. 3, 3a.
 1895. *Mactra veneriformis* PILSBRY: Catal. Mar. Moll. Jap., p. 119.
 1906. *Mactra veneriformis* TOKUNAGA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXI, Art. 2, p. 40.
 1920. *Mactra veneriformis* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXXIX, Art. 6, p. 109, Pl. VII, fig. 10.
 1922. *Mactra veneriformis* YOKOYAMA: Ibid., Vol. XLIV, Art. 1, p. 127.
 1925. *Mactra veneriformis* YOKOYAMA: Ibid., Vol. XLV, Art. 5, p. 17.
 1927. *Mactra veneriformis* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. X, p. 443.
 1931. *Mactra veneriformis* YOKOYAMA: Catal. Mar. Fresh-W. Land Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 13. No. 419, 420.

Of the two specimens, the larger one (left valve) gives the following measurements. Length, 32 mm.; height, ca. 30 mm.; depth, 7 mm.

Occurrence:—Jizôdô (Ashigara Group).

Distribution:—Raised beach deposits of Kazusa, Shimôsa and Musashi. Upper Musashino of Kazusa, Shimôsa, Musashi and Hitachi. Yokosuka Beds of Sagami. Shirado Beds of Hitachi.

Living: Kesenumma, Rikuzen to Kyûshû. China.

Genus *Spisula* GRAY, 1837*Spisula bernardi* PILSBRY

1904. *Spisula (Oxyperas) bernardi* PILSBRY: Proc. Acad. Nat. Sci. Phila., New Jap. Mar. Moll. Pelecypoda, p. 550, Pl. XXXIX, figs. 4-6.
 1922. *Spisula (Oxyperas) bernardi* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLIV, Art. 1, p. 130, Pl. VIII, figs. 3, 4.

A small mould.

The shell is triangularly elongated, apparently thin-shelled, with rude concentric undulations on the surface. Length, 35 mm.; height, 24 mm.; depth, 11 mm.

Occurrence:—Jizôdô (Ashigara Group).

Distribution:—Upper Musashino of Kazusa and Shimôsa. Miyata Beds of Sagami.

Living:—Tôkyô Bay and Inland Sea.

Family Myacidae

Genus *Mya* LINNAEUS, 1758*Mya arenaria* LINNAEUS

1857. *Mya japonica* JAY: Rep. Shells Coll. Jap. Exped., p. 292, Pl. I, figs. 7, 10.
 1869. *Mya arenaria* SCHENCK: Reis. Forsch. Amurl., p. 588.
 1869. *Mya arenaria* JEFFREYS: Brit. Conch., Vol. V, p. 192, Pl. I, fig. 1.

1869. *Mya arenaria* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 138.
 1875. *Mya arenaria* REEVE: Conch. Icon., *Mya*, figs. 1 a-c.
 1875. *Mya acuta* REEVE: Ibid., fig. 12.
 1882. *Mya arenaria* DUNKER: Index Moll. Mar. Jap., p. 176.
 1895. *Mya arenaria japonica* PILSBRY: Catal. Mar. Moll. Jap., p. 118.
 1919. *Mya arenaria japonica* IWAKAWA: Catal. Jap. Moll., p. 307.
 1921. *Mya arenaria* DALL: Northwest Coast Shell-Bearing Moll., U.S. Nat. Mus. Bull., 112, p. 53.
 1924. *Mya arenaria* OLDROYD: Mar. Shells W. Coast N. America, Stan. Univ. Pub., Vol. I, No. 1, p. 198, Pl. XXXII, figs. la, b.
 1925. *Mya arenaria japonica* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLV, Art. 5, p. 16, Pl. VI, fig. 4.
 1925. *Mya arenaria japonica* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. I, p. 10, Pl. III, fig. 3.
 1926. *Mya arenaria japonica* YOKOYAMA: Ibid., Vol. I, Pt. I, p. 10.
 1926. *Mya arenaria* YOKOYAMA: Ibid., Vol. I, Pt. VII, p. 210.
 1926. *Mya arenaria* YOKOYAMA: Ibid., Vol. I, Pt. IX, p. 370.
 1927. *Mya arenaria* YOKOYAMA: Ibid., Vol. I, Pt. X, pp. 399, 443.
 1927. *Mya arenaria* YOKOYAMA: Ibid., Vol. II, Pt. IV, p. 198, Pl. LI, fig. 2.
 1928. *Mya arenaria* YOKOYAMA: Ibid., Vol. II, Pt. VII, p. 353.
 1929. *Mya arenaria* YOKOYAMA: Ibid., Vol. II, Pt. IX, p. 335, Pl. LXXIV, fig. 3.
 1930. *Mya arenaria* YOKOYAMA: Ibid., Vol. II, Pt. X, p. 409.
 1930? *Mya arenaria* YOKOYAMA: Ibid., Vol. III, Pt. IV, pp. 190, 191.

One fragmental specimen of a full grown individual.

Occurrence:—Jizôdô (Ashigara Group).

Distribution:—Raised beach deposits of Kazusa, Shimôsa and Musasai. Upper Musashino of Musashi, Shimôsa and Hitachi. Shirado Beds of Hitachi. Pliocene of Shinano, Echigo and Mikawa. Shiobara Beds of Shimotsuke. Dainenji Beds and Tatsunokuchi Beds of Rikuzen. Miocene, Pliocene and Pleistocene of Saghalien. Neogene of Hokkaidô.

Living:—Kuril Islands and Okhotsk Sea to Kyûshû. ?Cochin China. America and Europe.

Family Saxicavidae

Genus *Panope* MERNARD, 1807

Panope generosa GOULD

1862. *Panope generosa* GOULD: Otia Conch., p. 163.
 1895. *Glycymeris generosa* PILSBRY: Catal. Mar. Moll. Jap., p. 117.
 1898. *Panope generosa* DALL: Tert. Fauna Florida, Pt. IV, p. 830.
 1903. *Panope generosa* ARNOLD: Mem. Cal. Acad. Soc., Vol. III, Mar. Plioc. Pleistoc. San Pedro, p. 182.
 1906. *Panopea generosa* TOKUNAGA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXI, Art. 2, p. 40.
 1913. *Panope generosa* PARKARD: Moll. Fauna San Francisco Bay, p. 287.
 1921. *Panope generosa* DALL: Northwest Coast Shell-Bearing Moll., U. S. Nat. Mus. Bull., 112, p. 54.
 1922. *Panope generosa* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLIV, Art. 1, p. 121, Pl. VI, figs. 14, 15.
 1923. *Panope generosa* YOKOYAMA: Jap. Jour. Geol. Geog., Vol. II, No. 2, p. 4.
 1923. *Panope generosa* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLV, Art. 2, p. 14.
 1924. *Panope generosa* OLDROYD: Mar. Shells W. Coast N. America, Stan. Univ. Pub., p. 205, Pl. II, figs. 1, 2.
 1925. *Panope generosa* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLV, Art. 5, p. 16.
 1925. *Panope generosa* YOKOYAMA: Ibid., Vol. XLV, Art. 7, p. 16.
 1925. *Panope generosa* YOKOHAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. I, p. 9.
 1925. *Panope generosa* YOKOYAMA: Ibid., Vol. I, Pt. III, p. 118.
 1926. *Panope generosa* YOKOYAMA: Ibid., Vol. I, Pt. IV, p. 132.
 1926. *Panope generosa* YOKOYAMA: Ibid., Vol. I, Pt. VIII, p. 289.
 1926. *Panope generosa* YOKOYAMA: Ibid., Vol. I, Pt. IX, p. 347.

1927. *Panope generosa* MAKIYAMA: Mem. Coll. Sci. Kyôto, Imp. Univ., Vol. III, No. 1, Art. 1, p. 56.
 1927. *Panope generosa* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. X, pp. 339, 443.
 1927. *Panope generosa* YOKOYAMA: Ibid., Vol. II, Pt. IV, p. 193.
 1929. *Panope generosa* YOKOYAMA: Ibid., Vol. II, Pt. VIII, p. 364.

Three specimens. The smaller but well preserved specimen measuring 42 mm. in length, 26 mm. in height and about 15 mm. in depth.

According to Dr. J. MAKIYAMA, "*Glycymeris*" *japonica* A. ADAMS may be identical with this species.

Occurrence:—Jizôdô (Ashigara Group).

Distribution:—Raised beach deposits of Kazusa and Shimôsa. Upper Musashino of Kazusa, Shimôsa, Musashi and Hitachi. Miyata Seds of Sagami. Pliocene of Izumo, Iwami and Shinano. Moniwa Beds and Tatsunokuchi Beds of Rikuzen. Kakegawa Series of Tôtômi, Shirado Beds of Hitachi. Chichibu Beds of Musashi. Pliocene of Hokkaidô. Miocene, Pliocene and Pleistocene of North America.

Living: Hokkaidô to Tôkyô Bay. Kamtchatka. Puget Sound to San Diego, California.

Glass Gastropoda

Family Pleurotomariidae

Genus *Pleurotomaria* SOWERBY, 1821

Pleurotomaria yabei n. sp.

Pl. XII (II), Figs. 6-9.

Four deformed specimens.

Shell about 70 mm. in diameter, low conical, perforate; test thin; whorls 5 (nuclear ones unpreserved), separated by well defined sutures. Surface with prominent, regularly beaded revolving ridges crossed by incised grooves which are oblique above and nearly vertical below. Spire elevated, acute at its top. Periphery bluntly angulated; base nearly flat with numerous elevated ridges as well as radial threads: aperture deformed, apparently more or less quadratic in outline and rather small. Sinus obliterated, but evidently deep and narrow as indicated by the growth lines.

The present species resemble *P. hirasei* PILSBRY,¹ living in the Prov. of Tosa, being distinguished, however, from it by the smaller shell, the more pronounced surface sculpture and by the sharper peripheral angle.

This occurrence of fossil *Pleurotomaria* is quite interesting being the first instance found in the Tertiary deposits of Japan.

Approximate dimensions:—Height, 63 mm.; diameter, 70 mm.

„ 55 mm.; „ 60 mm.

Occurrence: Mera (Shirahama Group).

Family Haliotidae

Genus *Haliotis* LINNAEUS, 1758

Haliotis kamtschatkana glabrosa n. subsp.

Pl. XII (II), Fig. 12.

Compare with:—

1845. *Haliotis kamtschatkana* REEVE: Conch. Icon., *Haliotis* Pl. III, fig. 8.

1867. *Haliotisa gigntea* SCHRENCK: Reis. Forsch. Amurl., p. 334, Pl. XVII, fig. 4.

¹PILSBRY H: Proc. Acad. Nat. Sci. Philad., p. 496, Pl. XXII, 1903.

1869. *Haliotis gigantea* var. *kamtschatkana* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 101.
 1883. *Haliotis gigantea* var. *kamtschatkana* WEINKAUFF in MARTINI u. CHEMNITZ: Syst. Conchyl. Cab. Vol. VI, Pt. II, p. 81, Pl. XXX, figs. 2, 3.
 1887. *Haliotis kamtschatkana* SOWERBY: Thes. Conch., Vol. V, p. 19, Pl. V, figs. 33, 34.
 1890. *Haliotis gigantea* var. *kamtschatkana* TRYON: Man. Conch., Vol. XII, p. 85, Pl. IX, figs. 47, 49.
 1921. *Haliotis kamtschatkana* DALL: Northwest Coast Shell-Bearing Moll., U. S. Nat. Mus., Bull., No. 112, p. 184, Pl. 19, figs. 1, 2.
 1925. *Haliotis gigantea* var. *kamtschatkana* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. 1, p. 8.
 1927. *Haliotis kamtschatkana* OLDROYD: Mar. Shells W. Coast N. America, Stan. Univ. Pub., Vol. II, Pt. III, p. 234, Pl. LXXXVIII, figs. 1, 2.
 1931. *Haliotis kamtschatkana* YOKOYAMA: Catal. Mar. Fresh-W. Land Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 17, No. 505.

A single specimen of a mould measuring 67 mm. by 95 mm. in diameter.

The surface undulations are less developed in the fossil specimen than in the typical ones, hence the writers here propose provisionally the subspecific name *glabrosa*.

H. gigantea var. *mekai* KISHINOUE is the true *H. gigantea* while *H. gigantea* of many Japanese authors should be placed under the name of *H. kamtschatkana*.

Occurrence:—Nawachi gold mine (Yugashima Group.)

Distribution:—The typical "*kamtschatkana*" once reported by Dr. YOKOYAMA from the Pliocene of Shinano.

Living: Northern to Western Japan. Kamchatka. Sitka, Alaska to Redondo, California.

Family Trochidae

Genus **Umbonium** LINK, 1807

Umbonium sp.

Two deformed specimens, the larger one approximately measuring 10 mm. in height and 23 mm. in diameter. The revolving lines of the specimens are finer and more numerous than those of and the base is apparently smooth as in *U. costatum* VAL. from our recent seas.

Occurrence:—Kawanishi (Ashigara Group).

Genus **Trochus** LINNAEUS, 1758

Trochus sp.

A badly preserved cast with 5 whorls. It represents a large species of *Trochus* resembling *T. niloticus* LIN. from the tropical seas. But strict determination is impossible; the external sculpture being totally unknown.

Occurrence:—Nawachi gold mine (Yugashima Group). A similar fragmental large mould was also found from Yugashima in the Yugashima Group.

Family Turbinidae

Genus **Turbo** LINNAEUS, 1758

Turbo coronutus GMELIN

1846. *Turbo coronutus* PHILIPPI in MARTINI u. CHEMNITZ: Syst. Conchyl. Cab., Vol. II, Pt. II, p. 10, figs. 5, 6.
 1848. *Turbo coronutus* REEVE: Conch. Icon., *Turbo*, Pl. II, fig. 4.
 1867. *Turbo coronutus* SCHRENCK: Reis. Forsch. Amurl., p. 362.

1869. *Turbo coronatus* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 87.
 1871. *Turbo coronatus* LISCHKE: Ibid., Vol. II, p. 81.
 1874. *Turbo coronatus* LISCHKE: Ibid., Vol. III, p. 62, Pl. IV, figs. 7, 8.
 1887. *Turbo coronatus* SOWERBY: Thes. Conch., Vol. V, p. 190, Pl. I, fig. 1; Pl. XIII, fig. 78.
 1882. *Turbo coronatus* DUNKER: Index Moll. Mar. Jap., p. 127.
 1888. *Turbo (Batillus) coronatus* TRYON: Man. Conch., Vol. X, p. 210, Pl. XLIII, figs. 50, 52.
 1895. *Turbo (Batillus) coronatus* PILSBRY: Catal. Mar. Moll. Jap., p. 88.
 1919. *Turbo coronatus* IWAKAWA: Catal. Jap. Moll., p. 32.
 1924. *Turba (Batillus) coronatus* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLV, Art. 1, p. 37, Pl. I, fig. 22.
 1931. *Turbo (Batillus) coronatus* YOKOYAMA: Catal. Mar. Fresh-W. Land Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 21, No. 626, 626 a.

Two imperfect specimens. The larger attains about 120 mm. in height. Spinous tubercles of the surfaces are preserved in the fossil specimen; they are rather short.

Occurrence:—Mera in Mihama-mura (Shirahama Group).

Distribution:—Raised beach deposits of Awa, Kazusa and Sagami. Yokosuka Beds of Sagami.

Living:—Hokkaidô to Kyûshû. Korea. China. Philippines.

Family Cerithidae

Genus *Batillaria* BENSON, 1842

Batillaria multiformis (LISCHKE)

1869. *Lampania multiformis* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 74, Pl. IV, figs. 1-10.
 1882. *Lampania multiformis* DUNKER: Index Moll. Mar. Jap., p. 109.
 1887. *Lampania multiformis* TRYON: Man. Conch., Vol. IX, p. 167, Pl. XXXV, fig. 13; Pl. XXXIV, figs. 6, 8.
 1895. *Potamides (Batillaria) multiformis* PILSBRY: Catal. Mar. Moll. Jap., p. 57.
 1920. *Potamides (Batillaria) multiformis* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXXIX, Art. 6, p. 69, Pl. IV, fig. 9.
 1922. *Potamides (Batillaria) multiformis* YOKOYAMA: Ibid., p. 72.
 1923. *Batillaria multiformis* MAKIYAMA: Mem. Coll. Sci. Kyôto, Imp. Univ., Ser. B. Vol. I, No. 2, Art. 3, p. 258.
 1927. *Potamides (Batillaria) multiformis* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol. I, Pt. X, pp. 394, 441.
 1931. *Batillaria multiformis* YOKOYAMA: Catal. Mar. Fresh-W. Land Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 29, No. 938.

Our specimen measures about 34 mm. in height and 14 mm. in diameter.

Occurrence:—Jizôdô (Ashigara Group).

Distribution:—Yokosuka Beds and Miyata Beds of Sagami. Upper Musashino of Musashi, Shimôsa, Hitachi and Kazusa. Pleistocene of Tôtômi. Raised beach deposits of Awa, Kazusa, Shimôsa, Sagami and Musashi.

Living:—Rikuzen to Inland Sea.

Family Vermetidae

Genus *Thylacodes* GUETTARD, 1774

Thylacodes sp.

A few fragmental specimens of a *Thylacodes* resembling *T. imbricatus* DUNKER of our recent seas.

Occurrence:—Shirahama-shrine (Shirahama Group).

Family **Strombidae**Genus **Strombus** LINNAUS, 1758**Strombus luhuanus** LINNAEUS

Pl. XI (I), Fig. 14.

1841. *Strombus luhuanus* SOWERBY: Thes. Conch., Vol. I, p. 29, Pl. VII, fig. 54.
 1851. *Strombus luhuanus* REEVE: Conch. Icon., *Strombus* Pl. IX, fig. 19.
 1835 }
 1857 } *Strombus luhuanus* KIENER: Spec. Gen. Coq. Viv., Vol. 4, p. 39, Pl. XXVII, fig. 1.
 1869. *Strombus luhuanus* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 31.
 1871. *Strombus luhuanus* LISCHKE: Ibid., Vol. II, p. 24.
 1882. *Strombus luhuanus* DUNKER: Index Moll. Mar. Jap., p. 96.
 1885. *Strombus luhuanus* TRYON: Man. Conch., Vol. VII, p. 122, Pl. VIII, figs. 91, 92.
 1907. *Strombus luhuanus* HIRASE: Conch. Mag., Vol. I, Pl. VII, figs. 24, 26.
 1919. *Strombus luhuanus* IWAKAWA: Catal. Jap. Moll., p. 87.
 1931. *Strombus (Cocomurex) luhuanus* YOKOYAMA: Catal. Mar. Fresh-W. Land Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 31, No. 986.

One slightly deformed internal mould measuring 51 mm. in height. It agrees in all respects with the recent *S. luhuanus* from the neighbouring seas of the fossil locality.

Occurrence:—Nawachi gold mine (Yugashima Group).

Distribution:—Raised beach deposits of Awa.

Living:—Tôkyô Bay to Ryûkyû. Philippines. Australia.

Family **Tonnidae**Genus **Tonna** BRUNNICH, 1772**Tonna luteostoma** (KÜSTER)

1857. *Dolium luteostoma* KÜSTER in MARTINI u. CHEMNITZ: Syst. Conchyl. Cab., Vol. III, Pt. I, p. 66, Pl. LVIII, fig. 2.
 1867. *Dolium variegatum* SCHRENCK: Reis. Forsch. Amurl., p. 403.
 1869. *Dolium luteostoma* LISCHKE: Jap. Meeres-Conch., Vol. I, p. 65.
 1871. *Dolium luteostoma* LISCHKE: Ibid., Vol. II, p. 57.
 1882. *Dolium luteostoma* DUNKER: Index Moll. Mar. Jap., p. 58.
 1885. *Dolium luteostoma* TRYON: Man. Conch., Vol. VII, p. 261, Pl. I, fig. 6.
 1895. *Dolium luteostoma* PILSBRY: Catal. Mar. Moll. Jap., p. 49.
 1906. *Dolium luteostoma* TOKUNAGA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXI, Art. 2, p. 17, Pl. I, fig. 30.
 1919. *Dolium luteostoma* IWAKAWA: Catal. Jap. Moll., p. 99.
 1920. *Dolium luteostoma* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XXXIX, Art. 6, p. 66, Pl. IV, fig. 2.
 1922. *Dolium luteostoma* YOKOYAMA: Ibid., Vol. XLIV, Art. 1, p. 69, Pl. III, fig. 10.
 1925. *Dolium luteostoma* YOKOYAMA: Jour. Coll. Sci. Imp. Univ. Tôkyô, Vol. XLV, Art. 5, p. 11.
 1927. *Tonna luteostoma* MAKIYAMA: Mem. Coll. Sci. Kyôto Imp. Univ., Ser. B, Vol. III, Art. 1, p. 72.
 1927. *Dolium luteostoma* YOKOYAMA: Jour. Fac. Sci. Imp. Univ. Tôkyô, Sec. 2, Vol I, Pt. X, pp. 395, 441.
 1931. *Tonna luteostoma* YOKOYAMA: Catal. Mar. Fresh-W. Land Shells Jap., Min. Mus. Imp. Geol. Surv. Jap., p. 36, No. 1194.

A large internal mould measuring about 100 mm. in height.

Occurrence:—Nawachi gold mine (Yugashima Group).

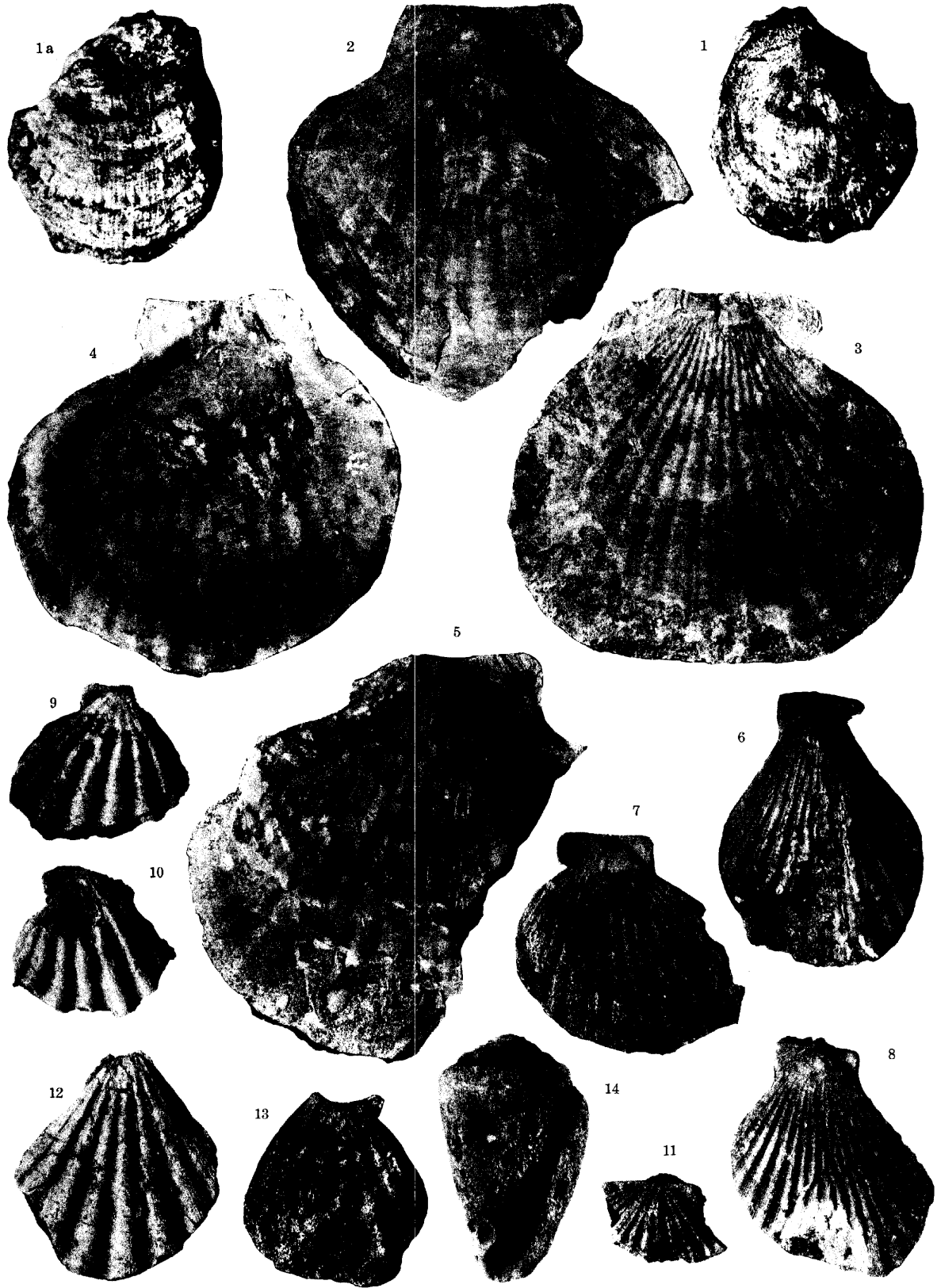
Distribution:—Raised beach deposits of Awa, Kazusa and Shimôsa. Upper Musashino of Musashi, Hitachi, Shimôsa and Kazusa. Naganuma Beds of Musashi. Miyata Beds and Yokosuka Beds of Sagami. Lower Musashino of Musashi. Pliocene of Hitachi. Kakegawa Series of Tôtômi and Tosa.

Living:—Hokkaidô to Kyûshû. Indian Ocean.

PLATE XI (I)

(All figures are in natural size.)

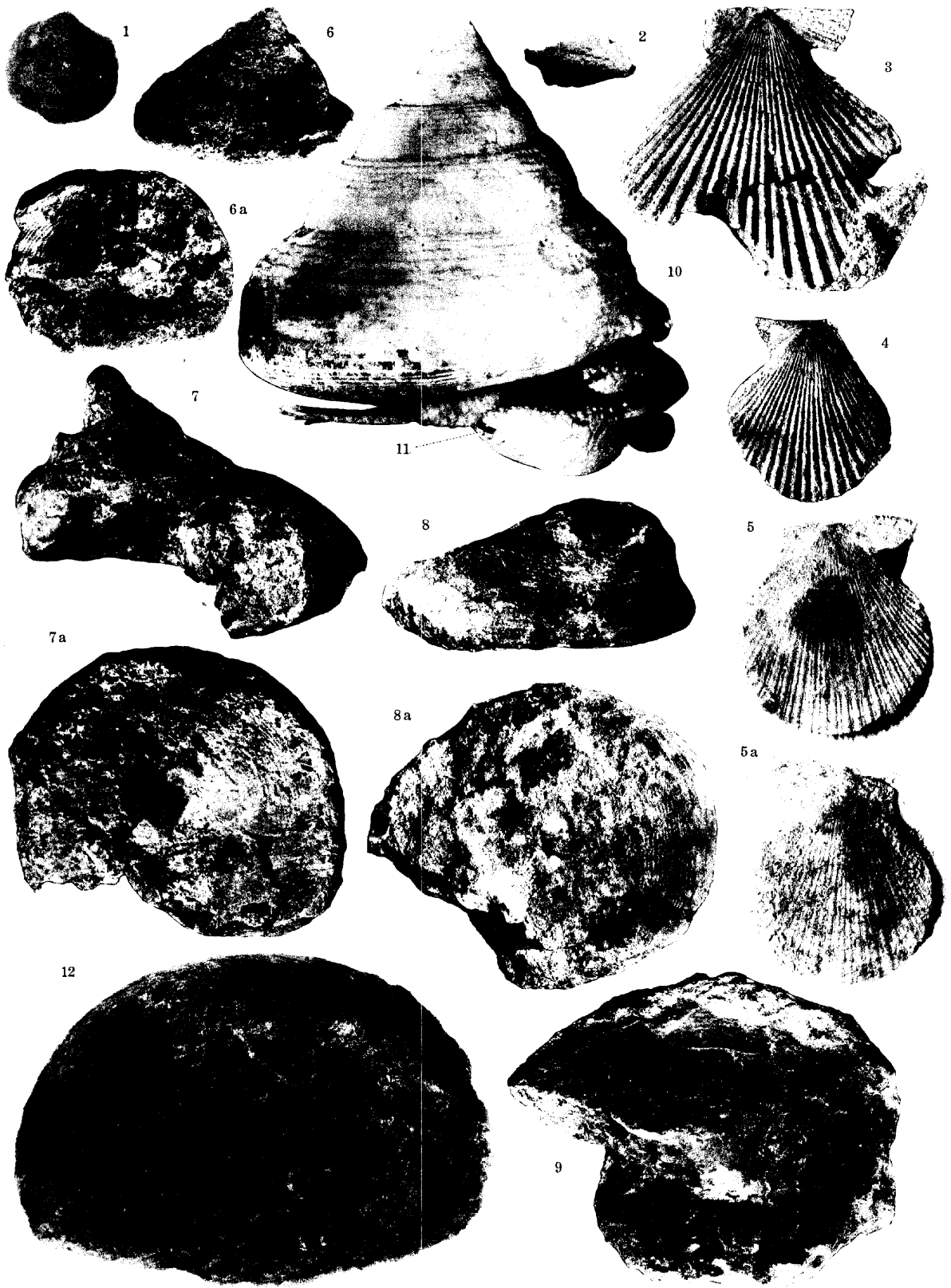
- Figs. 1. *Spondylus anacanthus* MAWE from Nagata, Shirahama Beds. Fig. 1, exterior of upper valve; fig. 1 a, exterior of lower valve. P. 180 (12)
- Figs. 2-5. *Pecten planicostulatus* n. sp. from Ichiyama, Shirahama Beds. Figs. 2 and 3, exterior of right valves; fig. 4, interior of right valve; fig. 5, exterior of left valve. Type (Cotype), G.I.S. Coll., Regist. No. 44584. P. 177 (9)
- Figs. 6-8. *Pecten tayamai* n. sp. from Nagata, Shirahama Beds. Fig. 6, exterior of right valve; figs. 7 and 8, exterior of deformed left valves. Type (Cotype), G.I.S. Coll., Regist. No. 44581. P. 178 (19)
- Figs. 9-13. *Pecten izuensis* n. sp. from Nagata, Shirahama Beds. Fig. 9, exterior of right valve; figs. 10 and 11, exterior of left valves; figs. 12 and 13, exterior of ? left valve. Type (Cotype), G.I.S. Coll., Regist. No. 44583. P. 179 (11)
- Fig. 14. *Strombus luhuanus* LINNAEUS from the Nawachi gold mine, Yugashima Beds. Mould. P. 192 (24)



K. Kimura photo.

PLATE XII (II)

- Fig. 1. *Anodontia pila* (REEVE) from the Nawachi gold mine, Yugashima Beds. Mould. P. 182 (14)
- Fig. 2. *Ostrea folium* LINNAEUS from Shirahama-shrine, Shirahama Beds. Exterior of lower valve. P. 174 (6)
- Figs. 3, 4. *Pecten kakisakiensis* n. sp. from Kakisaki, Shirahama Beds. Fig. 3, exterior of right valve; fig. 4, exterior of left valve. Type (Cotype), G.I.S. Coll., Regist. No. 44582. P. 177 (9)
- Fig. 5. *Pecten shirahamaensis* n. sp. from Nagata, Shirahama Beds. Fig. 5, exterior of right valve; fig. 5a, exterior of left valve. Type (Holotype), G.I.S. Coll., Regist. No. 44587. P. 175 (7)
- Figs. 6-9. *Pleurotomaria yabei* n. sp. from Mera, Shirahama Beds. Figs. 6, 7 and 8, side view; 6a, 7a, 8a and 9 basal view. Type (Cotype), G.I.S. Coll., Regist. No. 16010. P. 189 (21)
- Fig. 10. *Pleurotomaria hirasei* PILSBRY from Tosa. Recent specimen here figured for comparison.
- Fig. 11. *Aniculus* sp.
- Fig. 12. *Haliotis kamtschatkana glabrosa* n. subsp. from the Nawachi gold mine, Yugashima Beds. Mould. Type (Holotype), G.I.S. Coll., Regist. No. 44586. P. 189 (21)



K. Kimura photo.