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Fossil Shells from Sado

By

Matajiro YOKOYAMA, *Rigakuhakushi*

With 6 Plates

General Remarks

In the summer of 1925, Dr. Y. Ozawa, Assistant Professor of Geology in the Imperial University of Tokyo, visited Sado, an island in the Japan Sea off the coast of Echigo, whence he brought back a large number of fossil shells which he subsequently submitted to me for examination. These shells are from what is called the *Sawané Formation* which in greater part seems to belong to the Pliocene. Below this formation there is another called the *Aikawa Tertiary* which is generally regarded as Miocene.

The Sawané Formation is made up of several layers which, enumerated from above, are as follows:

1. Conglomerate.
2. Sand with a zone filled with fossils, which in the upper horizon are mostly shells and in the lower, which is strongly argillaceous, mostly Foraminifera.
3. Diatom-earth.
4. White tuffite, thinly cleavable and containing plants,[1] fish and Foraminifera.
5. Sandstone with teeth of sharks as well as of the Sirenian, *Desmostylus japonicus* Yosh. et Iwas.
6. Conglomerate.

The shells which are treated in the following pages are from layer

1) Nathorst mentions in his „Beiträge zur fossilen Flora Japans" p. 30 the following four species from this layer: *Abies cf. bicolor.* Max., *Alnus cf. incana* Willd., *Betula* sp., *Tilia cf. mandshurica* Rupr. et Max.

No. 2. The localities where they were collected are Sawané[1] and Tsurushi,[2] the former lying on the sea-coast and the latter about two kilometres inland, the spot where the shells actually occur being a small stream known as the Kaidaté-no-Sawa. The shells from this stream are all coloured brown by hydrous oxide of iron like those of the Red Crag of England. According to Ozawa, the fossil zones of the above two places are in the same geological horizon. What is quite singular about the shells that I received is the fact that while the bivalves are almost all of a large or moderate size, the univalves are without exception small, and even those species which when fully grown become tolerably large are represented only by small immature individuals. Why this is so, it is at present difficult to explain.

The different fossil species which I have been able to distinguish amount in all to 149, the names and distribution of which are given in the following table :

Gastropoda	Sawane Lower	Sawane Upper	Kaidate	Geological Occurrence.
	Horizon			
Fam. Actaeonidae				
1. Tornatina longispirata Yam.		+		Upper Musashino.
2. Tornatina yamakawai n. sp.		+		
3. Retusa minima Yam.		+		Lower and Upper Musashino.
4. Volvula angustata Ad.		+		Upper Musashino. Recent (North. Japan. South Sea).
5. Volvula acutaeformis Yok.		+		Upper Musashino.
Fam. Scaphandridae				
6. Cylichna musashiensis Tok.	+	+		Upper Musashino. Recent(C.Japan.)
Fam. Pleurotomidae				
7. Pleurotoma sadoensis n. sp.		+	+	
8. Genotia pseudopannus Yok.		+		Upper Musashino.
9. Genotia ogurana Yok.		+		Upper Musashino.
10. Bela sattva n. sp.		+		
11. Bela ozawai n. sp.		+		
12. Bela yanamii n. sp.	+			
13. Bela candida n. sp.	+	+		
14. Bela exquisita n. sp.		+		
15. Bela dissoluta n. sp.	+			
16. Mangilia deshayesii Dkr.		+		Musashinos. Recent (C. W. Japan.)
17. Mangilia sawanensis n. sp.		+		Recent (Central Japan).
Fam. Cancellariidae				
18. Cancellaria lischkei n. sp.	+	+		

1) 澤根村澤根 2) 澤根村鶴子貝立ノ澤

	Sawane Lower	Sawane Upper	Kaidate	Geological Occurrence
	Horizon			
19. Cancellaria tabatai n. sp.		+		
20. Cancellaria longispirata n. sp.		+		
Fam. Olividae				
21. Marginella cotamago Yok.		+		Upper Musashino.
Fam. Fasciolariidae				
22. Fusus coreanicus Smith.		+		Upper Musashino, Recent (W. Japan
Fam. Nassidae				
23. Nassa (Hima) japonica Ad.		+		Pliocene, Musashinos, Recent (C. W. Japan)
24. Nassa (Hima) festiva Pow.		+		Musashinos, Recent (N.C.W. Japan)
Fam. Columbellidae				
25. Columbella (Atilia) masakadoi Yok.		+		Upper Musashino, Recent (Centr. Japan)
26. Columbella (Mitrella) dunkeri Try.	+	+		Musashinos, Recent (N.C.W. Japan)
Fam. Muricidae				
27. Trophon subclavatus Yok.		+		Lower and Upper Musashino.
28. Trophon nipponicus Yok.	+	+		Lower Musashino.
29. Trophon suborpheus n. sp.		+		
30. Trophon acharya n. sp.		+		
31. Searlesia japonica n. sp.			+	
32. Ocinebra lumaria n. sp.		+		
Fam. Cerithiidae				
33. Bittium binodulosum Yok.		+		Lower Musashino.
34. Bittium ozwai n. sp.		+		Recent (Central Japan)
Fam. Cerithiopsidae				
35. Cerithiopsis crassicincta n. sp.		+		
Fam. Triforidae				
36. Triforis otsuensis Yok.		+		Upper Musashino, Recent (Centr. Japan)
Fam. Solariidae				
37. Solariella nipponensis n. sp.		+		
Fam. Rissoidae				
38. Rissoa (Apicularia) sadoensis n. sp.		+		
39. Rissoa (Alvania) asura n. sp.		+		
40. Rissoa (Alvania) lusoria n. sp.		+		
41. Rissoa (Alvania) sitta n. sp.		+		
42. Rissoa (Alvania) maya n. sp.		+		
43. Rissoa (Alvania) akibai n. sp.		+		
44. Rissoa (Cingula) dharma n. sp.		+		
45. Rissoa (Cingula) mundana n. sp.		+		
46. Rissoina submerculialis Yok.		+		Upper Musashino, Recent (Centr. Japan)
47. Rissoina fortunata n. sp.		+		
48. Rissoina tabatai n. sp.		+		

	Sawane Lower	Sawane Upper	Kaidate	Geological Occurrence.
	Horzion			
49. Rissoina (Zebina?) occulta n. sp.		+		
50. Rissoina (Morchiella) sawanensis n. sp.		+		
Fam. Naticidae				
51. Natica janthostoma Desh.	+	+		Miocene—Recent (N.C. Japan)
52. Polinices pallidus Br. et Sow.	+	+		Lower Musashino, Recent (N.Japan)
Fam. Scalidae				
53. Scala azumana Yok.		+		Upper Musashino. Recent (Centr. Japan)
Fam. Pyramidellidae				
54. Pyramidella (Iphiana) mira Yok.		+		Upper Musashino.
55. Odostomia (Egilina) marielloides gracilis Yok.		+		Upper Musashino.
56. Odostomia (Odostomia) suboxia Yok.		+		Upper Musashino, Recent (C.Japan)
57. Odostomia (Ondina?) calypso n. sp.		+		
58. Turbonilla (Strioturbonilla) pacifica Yok.		+		Upper Musashino, Recent (C.Japan)
59. Turbonilla (Chemnitzia) fusoensis n. sp.		+		
60. Turbonilla (Pyrgiscus) yanamii. n. sp.	+	+		
61. Turbonilla (Tragula) spinulosa n. sp.		+		
62. Turbonilla (Cingulina) morsei n. sp.		+		
63. Turbonilla (Cingulina) pseudocingulata n. sp.		+		Recent (Central Japan)
Fam. Turbinidae				
64. Leptothyra amussitata Gld.	+	+		Lower Musashino, Recent (North. Japan)
65. Leptothyra purpurescens Dkr.	+		+	Musashinos, Recent (Japan)
66. Leptothyra pygmaea Yok.		+		Upper Musashino, Recent (C.Japan)
Fam. Phasianellidae				
67. Phasianella tristis Pils.		+		Recent (Northern Japan)
Fam. Trochidae				
68. Gibbula orientalis n. sp.		+		
69. Margarita vahlioides n. sp.		+		
70. Margarita laudata n. sp.		+		
71. Margarita hilarula n. sp.		+		
72. Calliostoma kalavinka n. sp.	+			
Fam. Cyclostrematidae				
73. Cyclostrema pulchellum Dkr.		+		Recent (Centr. a. West. Japan)
Fam. Fissurellidae				
74. Puncturella nobilis Ad.		+		Upper Musashino—Recent (N. Japan
75. Emarginula vadososinuata Yok.		+		Pliocene, Upper Musashino.
Fam. Acmaeidae				
76. Acmaea kuragiensis Yok.		+		Lower Musashino
77. Acmaea concinna Lke.		+		Recent (North.—West. Japan)
78. Acmaea schrenckii Lke.		+		Recent (North.—West. Japan)
79. Acmaea asmiiformis n. sp.		+		

	Sawane Lower	Sawane Upper	Kaidate	Geological Occurrence
	Horizon			
80. Acmaea asperulata n. sp.		+		
81. Acmaea oblongata n. sp.		+		
82. Acmaea angustitesta n. sp.		+		
Fam. Patellidae				
83. Helcioniscus pallidus Gld.		+		Pliocene, Up. Mus. Recent (N. C. Japan)
Scaphopoda				
Fam. Dentalinidae				
84. Siphonodentalium (Pulsellum) ozawai n. sp.		+		Recent (Central Japan)
Lamellibranchiata				
Fam. Saxicavidae				
85. Panope generosa Gld.		+		Pliocene—Recent (North. Japan)
Fam. Corbulidae				
86. Corbula venusta Gld.		+		Musashinos, Recent (N. Japan)
Fam. Mactridae				
87. Mactra sulcataria Desh.		+		Pliocene—Recent (N.C.W. Japan)
88. Spisula grayana Schr.		+		Pliocene—Recent (Northern Japan)
Fam. Psammobiidae				
89. Psammobia kazusensis Yok.			+	Upper Musashino.
Fam. Tellinidae				
90. Macoma praetexta Mart.		+		Miocene—Recent (C.W. Japan)
91. Macoma nipponica Tok.		+		Upper Musashino, Recent (North. Japan)
92. Macoma inquinata Desh.		+		Miocene—Recent (N.C.W. Japan)
Fam. Veneridae				
93. Dosinia troscheli Lke.		+		Pliocene—Recent (C.W. Japan)
94. Meretrix meretrix L.		+		Pliocene –Recent (N. Japan—Philippines)
95. Meretrix (Callista) chinensis Chem.		+		Miocene—Recent (N.C.W. Japan)
96. Venus (Mercenaria) stimpsoni Gld.		+		Pliocene—Recent (N.C.W. Japan)
97. Venus jedoensis Lke.		+		Pliocene—Recent (C.W. Japan)
Fam. Cardiidae				
98. Cardium californiense Desh.		+		Pliocene—Recent (N.C.W. Japan)
99. Cardium muticum Rve.	+			Pliocene—Recent (N.C.W.S. Japan)
100. Cardium shinjiense Yok.		+		Miocene and Pliocene.
101. Papyridea (Fulvia) nipponica Yok.		+		Miocene and Pliocene.
Fam. Leptonidae				
102. Thyasira bisecta Conr.		+		Miocene—Recent (North Pacific)
103. Thyasira ozawai n. sp.		+		
Fam. Diplodontidae				
104. Diplodonta semiaspera Phil.			+	Pliocene—Recent (C.W. Japan)

	Sawane Lower	Sawane Upper	Kaidate	Geological Occurrence
	Horizon			
Fam. Lucinidae				
105. Lucina pisidium Dkr.		+		Musashinos, Recent (N.—S. Japan)
106. Lucina (Phacoides) borealis L.		+		Miocene—Recent (C. Japan)
Fam. Chamidae				
107. Chama semipurpurata Lke.			+	Musashinos, Recent (C—S Japan)
Fam. Carditidae				
108. Cardita cumingiana Dkr.		+		Pliocene—Recent (C.W. Japan)
109. Venericardia cipangoana Yok.		+	+	Miocene?—Recent (C.W. Japan)
110. Venericardia ferruginea Ad.		+	+	Miocene—Recent (N. Japan)
111. Venericardia nakamurai Yok.		+		Upper Musashino? of Saishu.
Fam. Astartidae				
112. Astarte borealis Chem.		+	+	Upper Musashino, Recent (N. Japan)
113. Astarte sulcata Dacosta.		+	+	English Crag. Recent (Northern seas)
114. Astarte hakodatensis Yok.	+			Musashinos. Recent (N. Japan)
Fam. Pleurophoridae				
115. Trapezium nipponicum Yok.		+	?	Upper Musashino, Recent (C. W. Japan)
Fam. Myochamidae				
116. Myodora fluctuosa Gld.		+	+	Upper Musashino, Recent (W. Japan)
Fam. Thraciidae				
117. Thracia transmontana Yok.		+		Upper Musashino, Recent (C. Japan)
118. Thracia sematana Yok.		+		Upper Musashino.
Fam. Mytilidae				
119. Mytilus hirsutus Lam.		+		Upper Musashino, Recent (C. W. Japan)
120. Modiola modiolus L.		+		Miocene—Recent (C.W. Japan)
121. Modiola barbata L.		+		Pliocene—Recent (N.—S. Japan)
122. Crenella delicatula n. sp.		+		
123. Crenella parvula n. sp.		+		
Fam. Anomiidae				
124. Placunanomia macrochisma Desh.		+		Recent (N.C.W. Japan, Kamtchatka)
Fam. Limidae				
125. Lima japonica Ad.		+	+	Lower Musashino—Recent (N. C. Japan)
126. Lima vulgatula Yok.		+		Pliocene, Upper Musashino.
Fam. Spondylidae				
127. Spondylus cruentus Lke.			+	Upper Musashino—Recent (C. W. Japan)
Fam. Pectinidae				
128. Pecten laetus Gld.		+	+	Pliocene—Recent (N.C.W. Japan)
129. Pecten yessoensis Iay.		+	+	Pliocene—Recent (N. Japan)
130. Pecten swiftii Bern.	+	+		Pliocene—Recent (N. Japan)
131. Pecten heteroglyptus n. sp.		+	+	

	Sawane Lower	Sawane Upper	Kaidate	Geological Occurrence
	Horizon			
132. Pecten intuscostatus Yok.	+	+		Musashinos.
133. Pecten plebejus n. sp.	+	+	+	
134. Pecten foedus n. sp.			+	
Fam. Arcidae				
135. Arca kobeltiana Pils.	+	+	+	Pliocene—Recent (N.C. Japan)
136. Arca (Barbatia) stearnsii Pils.		+		Lower Musashino.—Recent (C. W. Japan)
137. Arca (Barbatia) symmetrica Rve.		+		Musashinos, Recent (C. Japan—Philippines)
138. Pectunculus yessoensis Sow.		+	+	Pliocene—Recent (North. Japan)
139. Pectunculus nipponicus Yok.		+	+	Lower Musashino—Recent (C. Japan).
Fam. Parallelodontidae				
140. Parallelodon obliquatus Yok.		+	+	Pliocene—Recent (N.C. Japan)
Fam. Limopsidae				
141. Limopsis tokaiensis Yok.	+	+	+	Lower Musashino—Recent (C. Japan)
142. Limopsis crenata Ad.		+		Musashinos, Recent (N.C.W. Japan)
143. Limopsis azumana Yok.		+		Pliocene, Musashinos.
Fam. Ledidae				
144. Leda sadoensis n. sp.		+		
145. Yoldia scapha Yok.	+			Pliocene.
Brachiopoda				
Fam. Terebratulidae				
146. Terebratella coreanica Ad.		+		Pliocene—Recent (N.C.W. Japan)
147. Terebratella frontalis Mid.		+		Recent (N. Japan, Japan Sea, Aleutian)
148. Terebratalia gouldii Dall.		+		Pliocene?—Recent (N.C. Japan)
Fam. Rhynochonellidae				
149. Hemithyris psittacea Chem. var. woodwardi Ad.	+	+		Pliocene—Recent (N.C.W. Japan)

In determining the age of fossils geologically very young, it is usual to employ the method of computing the percentage of the extinct species to the living. Naturally, this method is only fully reliable when the living fauna of the region in question is thoroughly well known. In applying this method to a case like the present, we feel not a little uncertainty, because among the forms now regarded as extinct there may be several which future investigations will show are living, especially among the univalves which, as before mentioned, are represented only by small forms, the least known of all the living shells found in Japan.

These apparently extinct forms amount at present to 50 or about 33% of the entire fauna. This percentage, according to my own opinion, is a little too high. I think it will be reduced in future at least to what the bivalves taken alone show; for as above stated, they are almost all larger and consequently much better known. This percentage is about 25, which again is capable of being more or less reduced. In such circumstances, it goes without saying, some other method of determination would be better. Fortunately two-thirds of the fossils are those which have already been found in other parts of Japan. Consequently their geological distribution is fairly well known, as is shown below:

1.	Number of species hitherto found only living (Recent)	10
2.	Number of species ranging between Recent and Upper Musashino	18
3.	Number of species ranging between Recent and Lower Musashino	16
4.	Number of species ranging between Recent and Pliocene (whole)	24
5.	Number of species ranging between Recent and Miocene	9
6.	Number of species hitherto found only in Upper Musashino	10
7.	Number of species hitherto found only in Lower Musashino	3
8.	Number of species hitherto found in Upper and Lower Musashino	3
9.	Number of species ranging between Upper Musashino and Pliocene	3
10.	Number of species hitherto found only in Pliocene	1
11.	Number of species hitherto found in Pliocene and Miocene	2
		99

As seen above, out of the 99 species whose geological distribution is known, those which have already been found in the Musashino Formation, Upper as well as Lower, together with those which may possibly be found in the same, because they have already been recognized as occurring in layers younger as well as older, amount to 86, far outnumbering the Recent, or Pliocene and Miocene forms. Consequently I do not hesitate to conclude that the Sado shells belong to a formation which corresponds in geological horizon to the Musashino of the neighbourhood of Tokyo. This conclusion is made still more probable by the intermingling in the fauna of several forms now living in the more northern seas, just as in the case of the Musashino fossils. What I call the more northern forms are the following:

1. Polinices pallidus Brod. et Sow.
2. Leptothyra amussitata Gld.
3. Phasianella tristis Pils.
4. Panope generosa Gld.
5. Spisula grayana Schr.
6. Macoma nipponica Tok.

7. Thyasira bisecta Conr.
8. Venericardia ferruginea Ad.
9. Astarte borealis Chem.
10. Astarte sulcata Dac.
11. Astarte hakodatensis Yok.
12. Pecten yessoensis Sow.
13. Pecten swiftii Bern.
14. Pectunculus yessoensis Sow.

The next question which arises is, To what part of the Musashino Formation does the Sado layer correspond, to the Upper or to the Lower? This is somewhat difficult to answer, although the numerical value points to the former. The number of species which were actually found, or which we may confidently expect to find, amounts to 83 in the Upper and to 58 in the Lower. Therefore it is highly probable that we have here to deal with a layer corresponding in age approximately to the *Upper Musashino*. There is, however, one thing which does not exactly coincide with this view, and that is the percentage of the northern forms. This percentage in the Sado fossils amounts to about 18, which is not only higher than that of the Upper Musashino (6), but also higher than that of the Lower (13.5). This circumstance suggests that it may be proper to compare the Sado shells with those of the *Lower Musashino* rather than with those of the Upper. However, we must bear in mind that the percentage of the northern forms amongst the Sado shells is liable to be reduced in proportion as the number of living forms is increased by the discovery that some forms regarded as extinct are living; and even if this reduction does not go so far as to make the percentage approximately as low as that of the Upper Musashino, this, I believe, can be accounted for by the geographical position of Sado Island. For first it is in the Japan Sea, a sea cooler than that in the neighbourhood of Tokyo; and secondly, its latitude is higher, the fossil localities lying only a little south of the 38th parallel, north latitude, a line which I have been taking until now as the boundary between what I call Central and Northern Japan. This more northern position seems also to account for the frequent occurrence of specimens of most of the so-called northern forms already enumerated.

The Upper Musashino is generally considered to be *Lower Pleistocene* in age, although I myself think it may represent the *Uppermost Pliocene*. As to the Lower Musashino, it is unanimously regarded as *Pliocene*.

Description of the Species.

Class GASTROPODA.

Family Actaeonidae.

CM23071

1. **Tornatina longispirata,** YAMAKAWA.

Tornatina longispirata. Yokoyama, Foss. Up. Musashino Kazusa a. Shimosa, p. 24, pl. I, fig. 5.

Several specimens, most of which belong to what Yamakawa called a variety with the spire less pointed than the typical form. That this separation, however, is not necessary, I have already pointed out in my work above cited.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

CM23072 H

2. **Tornatina yamakawai,** n. sp.

Pl. XXXII. Fig. 1.

Shell small, solid, cylindrical, pointed above, rounded below. Whorls about four with the embryonal whorl mammillary and somewhat inclined. Spire very short, broadly conical, terraced, with the outer margin of the terrace slightly shouldered. Surface smooth, only with lines of growth which are coarse and striae-like on the shoulders of the whorls. Sutures slightly channelled. Aperture narrow above, dilated below, the dilatation beginning at about half its height. Outer lip thin, straight. Inner lip somewhat thickened by a callus. Height 4.6 millim. Diameter 2 millim.

A single example.

Fossil occurrence.—Upper horizon, Sawané.

CM23073

3. **Retusa minima,** YAMAKAWA.

Retusa minima. Yokoyama, Foss. Miura Penin., p. 26, pl. I, fig. 1. Foss. Up. Musashino, p. 25.

A single example.

Fossil occurrence.—Upper horizon, Sawané. Musashinos.

CM23074

4. **Volvula angustata,** (A. Adams).

Volvula angustata. Yokoyama, Foss. Up. Musash., p. 26, pl. I, fig. 8.

A single specimen which tapers above a little more than in the

typical form. This, however, must be taken as a variation, as such specimens occur also among those found in the Upper Musashino.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

Living.—Northern Japan. Philippines. New Guinea.

CM 23075

5. **Volvula acutaeformis,** YOKOYAMA.

Volvula acutaeformis. Yokoyama, Foss. Up. Musash., p. 26, pl. I. fig. 9.

A single example.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

Family Scaphandridae.

6. **Cylichna musashiensis,** TOKUNAGA. CM 23076

Cylichna musashiensis. Tokunaga, Foss. Env. Tokyo, p. 32, pl. II, fig. 12. CM 23077
Yokoyama. Foss. Miura Penin., p. 27, pl. I, fig. 4. Foss. Upper Musashino, p. 27, pl. I, fig. 10.

Frequent.

Fossil occurrence.—Upper and lower horizons, Sawané. Musashinos.

Living.—Central Japan.

Family Pleurotomidae.

CM 23078 -32-3

7. **Pleurotoma sadoensis,** n. sp. S

Pl. XXXII. Fig. 3. (52) CM 27099

Shell moderate in size, fusiform. Whorls about ten, convex, ornamented with many, close, impressed spiral lines. Sutures subchannelled. Spire pointed, somewhat shorter than body-whorl. Periphery rounded, suddenly narrowed below. The outer lip is broken, but judging from the lines of growth, the sinus seems to have been distant from the suture, deep, triangular, blunt at end and with the mouth very wide. Canal slightly bent.

14

The only specimen we possess is much worn, lacking the greater part of the outer layer of the shell. Height 24.5 millim. Diameter 8.2 millim.

The general form of the shell shows a great resemblance to *Pleurotoma* (*Spirotropsis*) *smithi* Arnold (Palaeont a Stratigr. Mar. Plioc. a Pleistoc. San Pedro Calif., p. 216, pl. VI, fig. 13) living as well as fossil in California. But the latter has the surface smooth.

Fossil occurrence.—Upper horizon, Sawané. Kaidaté.

CM23079
CM23080-32-2

8. **Genotia pseudopannus,** YOKOYAMA.

Pl. XXXII. Fig. 2.

Genotia pseudopannus. Yokoyama, Foss. Up. Musash., p. 37, pl. I, fig. 27.

Two specimens.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

CM23081
(R)

9. **Genotia ogurana,** YOKOYAMA.

Pl. XXXII. Fig. 7.

Genotia ogurana. Yokoyama, Foss. Up. Musash., p. 38, pl. I, fig. 29.

A single example somewhat larger but more slender than the one already described. The height is almost three times the diameter, while in the latter it is only two and one half times. The present form may provisionally be separated from the type as var. *gracilis.* Height 24.5 millim. Diameter 8.3 millim.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino (the type).

CM23082
H

10. **Bela sattva,** n. sp.

Pl. XXXII. Fig. 5.

Shell small, rather thin, shortly fusiform. Whorls five of which one and a half are nuclear, rounded and smooth, post-nuclear ones angulate in the middle with the surface above the angle sloping and concave, below flat and vertical. Longitudinally plicate; plicae fifteen on the body-whorl, fourteen on the penultimate, roof-like in shape, though blunt at top with interspaces nearly equal in breadth, most distinct at the angle where they are tuberculous, while above they are faint, becoming also fainter and flatter towards the outer lip. Finely and faintly spirally striate. Base rather abruptly contracted, with plicae evanescent. Aperture narrowly rhombic. Outer lip sharp, with notch very shallow and broad. Canal bent somewhat sideward as well as backward.

A single specimen measuring 6.5 millim. in height, 2.7 millim. in diameter, 5 millim. in the height of the body-whorl and 3.3 millim in apertural length.

Fossil occurrence.—Upper horizon, Sawané.

CM23083 8 S
CM23084 5

11. **Bela ozawai,** n. sp.

Pl. XXXII. Fig. 8.

Shell small, fusiform. Whorls about five, convex, longitudinally

and somewhat obliquely plicate; plicae seventeen or eighteen on the penultimate whorl, rounded, with interspaces usually a little narrower, faint on the body-whorl and vanishing towards its end. Spiral striae about five in number, weak though there is a tendency to make the plicae tuberculous on crossing them. Base gradually narrowed with plicae obsolete, though spiral striae are distinct and many. Aperture elongated, broadest in the middle, ending in a short canal. Outer lip thin with a shallow v-shaped notch near the suture. Height 6.3 millim. Diameter 2.3 millim.

A few examples.

Fossil occurrence.—Upper horizon, Sawané.

S CM 23085-11

12. **Bela yanamii**, n. sp.

CM 23086

Pl. XXXII. Fig. 11.

Shell small, fusiform. Whorls about six and a half, of which two and a half are nuclear, smooth and angulate; post-nuclear whorls convex, longitudinally plicate and spirally ornamented with impressed lines. Plicae eighteen on the body-whorl and sixteen on the penultimate, strong, rounded, generally separated by wider intervals, somewhat oblique and slightly curved with concave side towards front. Impressed lines equidistant, distinct on the lower two-thirds of the whorls, indistinct or absent on the upper third. Periphery rounded. Base abruptly narrowed, with longitudinal plicae rapidly weakening and then vanishing, while impressed lines become broader, so that the interspaces take the appearance of flat spiral cords. The number of these cords is eight or nine, being present down to the caudal end. Aperture elongated, ovate. Outer lip thin and sharp so that it is more or less broken in the specimens. Sinus hardly indicated. Inner lip covered with a glaze and smooth. Canal short, bent. Height 21 millim. Diameter 9 millim.

Several specimens.

This species was named in honour of Mr. Yanami, Director of the Sado Middle School who is said to have assisted greatly in the collection of these shells.

Fossil occurrence.—Lower horizon, Sawane.

S CM 23087-1

S CM 23088-2

13. **Bela candida**, n. sp.

(2) CM 23089

(1) CM 23090

Pl. XXXIV. Fig. 1, 2.

Shell small, rather thin, fusiform. Whorls about seven, of which

two are nuclear and five post-nuclear : nuclear whorls smooth, slightly angulate ; post-nuclear also slightly angulate in the upper ones, convex in the lower, longitudinally plicate and spirally closely striate. Plicae twenty-one on the body-whorl, seventeen on the penultimate, strong, roof-like, somewhat oblique, either straight or slightly curved with the concave side backwards, becoming flatter and rounded towards the last part of the body-whorl. Periphery rounded. Base abruptly narrowed with longitudinal plicae quickly vanishing, while there are many unequal spiral striae on it down to the caudal end. Aperture elongated, broadest near the middle, without any glaze on the labium. Outer lip thin and sharp. Sinus hardly indicated. Canal short, bent a little backward.

A single specimen measuring 13.6 millim. in length and 6 millim. in diameter.

This shell has a great resemblance to the preceding, of which it may possibly be only a variety. The difference, however, lies in the number, shape and course of the plicae as well as in the sculpture of the base.

The specimen shown in fig. 2 is what may be called var. *angulata*. It has all the characters of the type except the angulate state of all the whorls.

Fossil occurrence.—Upper and lower horizons, Sawané.

S CM23091-9
S CM23092.

14. **Bela exquisita**, n. sp.

Pl. XXXII. Fig. 9.

Shell small, ovato-fusiform. Whorls about five of which one is embryonal and smooth ; the remaining ones angulate in the middle, with the surface above the angle sloping and slightly concave, below vertical and somewhat convex ; longitudinally plicate and spirally striate; plicae about thirty on the body-whorl, rounded, flattening towards their lower end, separated by valleys of less breadth; spiral striae fine and numerous. On the body whorl, the plicae become very faint towards the base. Aperture elongated, subrhomboidal with outer lip sharp. Canal short, wide, and slightly bent sideward. Height 4.8 millim. Diameter 2.4 millim.

Only a few specimens.

Fossil occurrence.—Upper horizon, Sawané.

S CM 23093-13
S CM 23094

15. Bela dissoluta, n. sp.

Pl. XXXII. Fig. 13.

Shell small, fusiform. Whorls six, of which two are nuclear; post-nuclear whorls convex, longitudinally plicate and spirally striate. Longitudinal plicae many, twenty-eight to thirty on the body-whorl, two or three less on the penultimate, rounded, oblique, slightly curved backward just below the upper suture, generally separated by about equal interspaces. Spiral striae fine, many, most distinct in the valleys. Periphery rounded. Base rather abruptly narrowed below and finely spirally striate down to the caudal end, while longitudinal plicae either vanish near the upper part or extend considerably into it before vanishing. Aperture elongated, broadest in the middle. Outer lip thin, with a broad shallow notch just below the suture. Inner lip smooth. Canal short, slightly bent sideward. Some specimens are broader than others. One of the broader forms measures 9.3 millim. in height and 4.4 millim. in diameter, while one of the narrower ones measures 8 millim. in height and 3.5 in diameter.

This species somewhat resembles *Bela recticostulata* Yok. (Foss. Up. Musash., p. 44, pl. I, fig. 38) from the Upper Musashino of Kazusa, although it is finer in sculpture.

Not rare.

Fossil occurrence.—Lower horizon, Sawané.

CM 23095

16. Mangilia deshayesii, DUNKER.

Mangilia deshayesii. Yokoyama, Foss. Miura Penin., p. 41, pl. I, fig. 24. Foss. Up. Musash., p. 41.

A single example 7.5 millim. in height and 2.5 millim. in diameter. It is therefore somewhat shorter than the form already described.

Fossil occurrence.—Uper horizon, Sawané. Musashinos.

Living.—Central and Western Japan.

S CM 23096-6
S CM 23097

17. Mangilia sawanensis, n. sp.

Pl. XXXII. Fig. 6.

Shell small, thick, fusiform. Whorls about seven of which one and a half are nuclear and smooth; post-nuclear whorls angulate at about one-third of the distance from the upper suture, the surface above the angle being flat and somewhat sloping, below vertical and slightly convex, longitudinally plicate and spirally striate. Plicae strong, rounded,

straight, with interspaces varying in breadth, some equal, some broader, some narrower, fourteen on the body-whorl, thirteen on the penultimate. Spiral striae equal, one at the angle, three below it, but none on the sloping shelf, the points of intersection with the plicae being more or less tubercular. On the body-whorl there is a faint spiral stria also above the angle, while below there are about ten down to the caudal end, although the longitudinal plicae vanish near it. Aperture elongated. Outer lip with a varix outside. Sinus deep, close to the suture. Canal short, broad, somewhat bent back. Height 7.6 millim. Diameter 2.9 millim. Height of body-whorl 4.5 millim. Quite frequent.

Fossil occurrence.—Upper horizon, Sawané.

Living.—Central Japan (Japan Sea).

CM 23098 16 S
CM 23099 17 S
CM 23100
CM 23101

Family Cancellariidae.

18. Cancellaria lischkei, n. sp.

Pl. XXXII. Figs. 16, 17.

Shell small, thin, ovately conical. Whorls about six, of which one and one-half are nuclear, smooth, and rounded; post-nuclear whorls strongly convex, more or less biangulate except the last, the angles being present at some distance from the upper as well as from the lower suture; surface above the upper angle flat and somewhat sloping, below the lower also flat and receding, between the two angles also more or less flat, except on the body-whorl on which it is convex. Longitudinally costate and spirally corded. Longitudinal costae eighteen on the body-whorl and sixteen on the penultimate, strong, straight, rounded, separated by about equal interspaces, weakening and becoming faint near the upper as well as the lower suture. Spiral cords six, two on the upper shelf, weaker than the others and striae-like, one on the upper angle, one on the lower, one between and one close to the lower suture, the last four being more or less equal in size. Intersection-points of costae and cords more or less tubercular. Periphery rounded, with a smooth spiral cord on it, which corresponds to the suprasutural cord of the upper whorls. Base abruptly narrowed below, bearing five or six spiral cords succeeding the peripheral one separated by broader intervals and gradually weakening as they go downward. Longitudinal sculpture not present on the base. Aperture rhomboidal. Outer lip thin, with a rib on the outside. Inner lip with two oblique folds, of which the upper is weaker. Canal very short.

Specimens are not rare ; some are more slender than others. One of the shorter forms measures 9.7 millim. in height and 5.4 millim. in diameter, while one of the longer measures 5.7 millim. in height and 3.9 millim. in diameter.

Fossil occurrence.—Upper and lower horizons, Sawané.

CM 23102.12 H

19. **Cancellaria tabatai,** n. sp.

Pl. XXXII. Fig. 12.

Shell small, ovately conical. Whorls about five, of which one and a half are nuclear and smooth ; postnuclear whorls angulate a little above the middle with the surface above the angle flat and somewhat inclined, below more or less flat and vertical. Spirally corded; main cords three, one on the angle and two below it, subsidiary single, near the upper suture, although on the body-whorl there is still a second, somewhat stronger one between the first and the angle-cord. Growth-lines coarse, crossing the cords and making them more or less crenulate. Periphery rounded. Base abruptly narrowed, with about ten spiral cords which gradually diminish in size toward the caudal end. Aperture rhombic. Outer lip thin. Inner lip with two oblique plaits near the canal and a shallow elongated depression outside of the lower part. A single example. Height 5.7 millim. Diameter 3.2 millim.

Named in honour of Mr. H. Tabata, a teacher in the Girl's High School of Kawarada, Sado.

Fossil occurrence.—Upper horizon, Sawané.

CM 23103 - 1014

(R)

20. **Cancellaria longispirata,** n. sp.

Pl. XXXII. Fig. 10.

Shell small, longish ovate. Whorls seven, convex, ornamented with cancellate sculpture. Longitudinals consisting of coarse low rounded plicae which are sixteen on the penultimate whorl and eighteen on the ultimate, becoming flatter and broader anteriorly. Spirals consisting of five elevated cords of which the uppermost lies at about one-third of the distance from the upper suture while the lowest is close to the lower suture, the intervals between each cord becoming gradually narrower downward. On the penultimate and ultimate whorls, there is still a weaker cord above the uppermost as well as between the latter and the next lower one. Intersection-points of longitudinals and spirals more or less tubercular. Periphery rounded. Base abruptly narrowed down-

ward with five or six spiral cords without longitudinals, which gradually become weaker towards the caudal end, sometimes with a thin intercalary between. Aperture fusiform. Inner lip with three oblique folds, the uppermost being most distinct and occupying the middle part of the inner lip. Outer lip sharp, though somewhat thickened a little behind, dentate within, the number of teeth corresponding to that of the spiral cords without. Canal very short, somewhat bent sideward. A single example measuring 18 millim. in height of shell, 7.2 millim. in diameter, 10 millim. in height of spire and 7 millim. in apertural length.

Fossil occurrence.—Upper horizon, Sawané.

Family Olividae.

CM23104

21. Marginella cotamago, Yokoyama.

Marginella cotamago. Yokoyama, Foss. Up. Musash., p. 49, pl. II, fig. 6.

Many specimens, Some have the outer lip denticulate within like *Marginella minuta* Pfr. (Tryon, Man. Conch., V. pl. XII, figs. 60–63), although otherwise different in shape.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

Living.—Central Japan.

Family Fasciolariidae.

CM23105

22. Fusus coreanicus, Smith.

Fusus coreanicus. Yokoyama, Foss. Up. Musash., p. 52, pl. II, fig. 10.

Fossil occurrence.—Upper horizon, Sawané (frequent). Upper Musashino.

Living.—Western Japan.

Family Nassidae.

CM23106

23. Nassa (Hima) japonica, A. Adams.

Nassa (Hima) japonica. Yokoyama, Foss. Miura Penin., p. 56, pl. II, fig. 5. Foss. Up. Musash., p. 58. Moll. Rem. Mid. Part. Jô-Ban Coalf., p. 12. Moll. Tert. Basin Chichibu, p. 116.

Numerous.

Fossil occurrence.—Upper horizon, Sawané. Musashinos. Minato Beds. Pliocene of Chichibu.

Living.—Central and Western Japan.

CM23107

24. Nassa (Hima) festiva, Powis.

Nassa (Hima) festiva. Yokoyama, Foss. Miura Penin., p, 57, pl. IV, fig. 6. Foss. Up. Musash., p. 58.

Many, but mostly young individuals.

Fossil occurrence.—Upper horizon, Sawané. Musashinos.

Living.—Northern, Central and Western Japan.

Family Columbellidae.

CM23108

25. Columbella (Atilia) masakadoi, Yokoyama.

Columbella (Atilia) masakadoi. Yokoyama, Foss. Up. Musashino, p. 62, pl. III, fig. 23.

Numerous.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

Living.—Central Japan.

CM23109
CM23110

26. Columbella (Mitrella) dunkeri, Tryon.

Columbella (Mitrella) dunkeri. Yokoyama, Foss. Miura Penin., p. 59, pl. III, fig. 15. Foss. Up. Musash., p. 62, pl. II, fig. 26.

Numerous.

Fossil occurrence.—Upper and lower horizons, Sawané. Musashinos.

Living.—Northern, Central and Western Japan.

Family Muricidae.

CM23111

27. Trophon subclavatus, Yokoyama.

Trophon subclavatus. Yokoyama, Foss. Miura Penin., p. 60, pl. III, fig. 2, pl. VI, figs. 13, 14. Foss. Up. Musashino, p. 64, pl. III, fig. 2.

A single small specimen.

Fossil occurrence.—Upper horizon, Sawané. Musashinos.

CM23112
CM23113

28. Trophon nipponicus, Yokoyama.

Trophon nipponicus. Yokoyama, Foss. Miura Penin., p. 61, pl. III, fig. 13, 14.

Few but large examples, one of which attains the diameter of 11 millim.

Fossil occurrence.—Upper and lower horizons, Sawané. Lower Musashino.

CM23114-185
CM23115

29. Trophon suborpheus, n. sp.

Pl. XXXII. Fig. 18.

Shell small, fusiform. Whorls about six, angulate a little above the middle, the surface above the angle being flat and somewhat sloping, below vertical with the lowest part slightly receding, longitudinally ribbed and spirally corded. Longitudinal ribs somewhat varying in number, eleven to fourteen on the body-whorl, straight and rigid, quite elevated like walls, or more or less rounded ridge-shaped, with intervals usually broader, occasionally flattening near the extreme end of the body-whorl. Spiral cords several in number, one or two on the sloping shelf, weak, three on the vertical surface, strong, elevated, one on the angle, two below it, sometimes with one or two weaker ones on the receding surface. Ribs and cords either equal in size or unequal, in the latter case the cords being stronger. Intersection-points on the angle more or less tubercular, rarely even short-spiny. Base abruptly narrowed, with several spiral cords crossed by weakening ribs. Aperture oval. Outer lip thin. Canal short, bent somewhat sideward and backward.

There is great variation in sharpness of sculpture as well as in form. However, the diameter is usually about one-half the height. The largest specimen obtained is about 10 millim. in height. Frequent.

This species is closely akin to *Trophon muricatoides* Yokoyama (Foss. Miura Penin., p. 61, pl. III, fig. 17) as well as to *Trophon orpheus* Gould united by Tryon in his Manual of Conchology, vol. II, p. 139 with *Trophon craticulatus* Fab. living in northern seas, and also fossil in the English Crag. *Trophon muricatoides* described by me on a single specimen from the Lower Musashino has convex whorls with strong rounded longitudinal ribs. *Trophon orpheus* as figured in the Manual above mentioned seems to have only two spiral cords instead of three on the lateral vertical surface, and yet the resemblance of the present species to the other is so great that there is a possibility of the three belonging to one and the same species.

I may here mention that *Trophon craticulatus* Fab. is called *Trophon Fabrici* (Beck) Möller by Harmer in his Pliocene Mollusca of Great Britain (Palaeont. Soc., Vol. LXVII, p. 130) and that Tryon takes Japan as one of its habitats on the authority of A. Adams.

Fossil occurrence.—Upper horizon, Sawané.

SCM 23116-14 A
Str CM27100

30. Trophon acharya, n. sp.

Pl. XXXII. Fig. 14.

Shell small, fusiform. Whorls five; first one and a half nuclear and smooth; postnuclear whorls angulate, the surface above the angle being flat and obliquely sloping, but vertical below. Longitutinally striate and spirally corded. Longitudinal striae elevated with much wider intervals. Spiral cords three, the one just below the suture is weak; the one on the angle, strong; and the third between the angle and the lower suture, equally strong. Points of intersection of cords and striae tubercular. On the body-whorl, there are some seven spiral cords below the lowest one, being present down to the caudal end, all crossed by longitudinal striae, with crossing points tubercular. Aperture oval with the sharper end directed downward. Outer lip thin. Canal rather long, bent sideward as well as backward. Height 6.7 millim. Diameter 2.8 millim. Height of body-whorl 4.5 millim.

Only a single specimen.

Fossil occurrence.—Upper horizon, Sawané.

CM23117-22 H

31. Searlesia japonica, n. sp.

Pl. XXXII. Fig. 22.

Shell thick fusiform. Whorls about seven, convex, longitudinally plicate and spirally corded. Plicae about eighteen on the body-whorl, seventeen on the penultimate, broad, rounded, now and then flattening and vanishing, with interspaces much narrower and broadly v-shaped, reaching from the upper suture to the lower. Spiral cords seven, broader than interspaces, separating on weathering into three of which the upper and lower are much weaker and appear like intercalaries. Points of intersection of spiral cords and longitudinal plicae more or less tubercular. On the body whorl there are about ten more spiral cords which are on the base and like those above them split quite distinctly into three. Longitudinal plicae are obsolete on the base. Aperture about one-half the shell-height, fusiform. Outer lip thin with distant transverse ridges approximately agreeing in number with the cords outside. Inner lip covered with a glaze and smooth. Canal short, slightly bent sideward as well as backward.

A single specimen measuring 21 millim. in height and 9 millim. in diameter.

Fossil occurrence.—Kaidaté.

CM 23118-21 H

32. **Ocinebra lumaria,** n. sp.

Pl. XXXII. Fig. 21.

Shell fusiform. Whorls about seven, angulate at about one-third of the distance from the upper suture, with the surface above the angle flat and slightly sloping, below somewhat convex and vertical. Longitudinally and spirally corded. Longitudinal cords about thirteen on the penultimate and only about ten on the body-whorl, distant and mostly elevated, but near the anterior extremity often weak and indistinct; the two on the body-whorl are lamellar and changed into varices, one being at the extreme end outside the aperture and one on the dorsal side at a distance equal to about one-third of a whorl from the aperture. The crossing points of longitudinal and spiral cords are tubercular, the tubercles on the varices each bear a spine. Base gradually narrowed towards the caudal end and having about ten spiral cords crossed by the longitudinal ones with crossing points also tubercular. Aperture narrowly oval with outer lip coarsely dentate within. Canal moderate in length, almost closed, bent somewhat backward.

A single mature specimen. Height 19 millim. Diameter about 8 millim.

This species is somewhat like *Ocinebra lugubris* Brod. of the west coast of America (Tryon, Man. Conch., II, p. 124, pl. 37, figs. 438–440) though differing in many respects.

Fossil occurrence.—Upper horizon, Sawané.

Family Cerithiidae.

CM 23119-15
CM 23120

33. **Bittium binodulosum,** Yokoyama.

Pl. XXXII. Fig. 15.

Bittium binodulosum. Yokoyama, Foss. Miura Penin., p. 68, pl. IV, fig. 8.

Many examples, some of which are larger than the single one described from the Lower Musashino, the height attaining a little over 10 millim.

Fossil occurrence.—Upper horizon, Sawané. Lower Musashino.

CM 23121-20 S
CM 23122 S

34. **Bittium ozawai,** n. sp.

Pl. XXXII. Fig. 20.

Shell small, turrete. Whorls about twelve, quite convex in the younger ones, less so in the older, so that the last is only slightly convex.

Longitudinally plicate and spirally corded; plicae about ten on the younger whorls and strong, but gradually becoming weaker and indistinct on the older, so that on the body-whorl none at all are developed; spiral cords about seven of which usually two (rarely one) are larger than the others, forming two angles on the whorl, one a little above the middle and the other midway between the upper angle and the lower suture. Crossing-points of plicae and cords tubercular. Periphery angulate, below which the surface is suddenly contracted, forming a flat base with a spiral cord below the periphery to which succeed several fine spiral striae, which may often be faint or even absent. Aperture broadly oval. Canal only slightly indicated. Height 13.2 millim. Diameter 4.8 millim. Very frequent.

This shell is much like the preceding which, however, has the plicae well developed and the shell more slender.

Fossil occurrence.—Upper horizon, Sawané.

Living.—Central Japan (Echigo).

Family Cerithiopsidae.

CM 23/23-11 S

CM 23/24 S

35. Cerithiopsis crassicincta, n. sp.

Pl. XXXVII. Fig. 11.

Shell small, subulate, many-whorled. Whorls about fifteen; first two nuclear smooth and rounded, the rest flat, spirally costate; costae four, of which the upper three are strong, rounded and elevated, the lowest is close to the suture, weak and on younger whorls hardly developed. Between the costae there are fine longitudinal striae. On the body-whorl the lowest costa well developed and forming an angulate periphery, below which there is a single more or less strong costa. Base abruptly narrowed, flat or somewhat excavated. Aperture roundish quadrate. Canal very short, rather broad and somewhat bent sideward.

Four specimens. The largest is 11 millim. is height, 2.5 millim. in diameter, and lacks the apex. A perfect, though smaller, one is somewhat shorter, measuring 7.8 millim in height and 1.9 millim. in diameter.

Fossil occurrence.—Upper horizon, Sawané.

Family Triforidae.

CM 23/25

36. Triforis otsuensis, Yokoyama.

Triforis otsuensis. Yokoyama, Foss. Miura Penin., p. 69, pl. IV, fig. 11. Foss. Up. Musash., p. 74, pl. III, fig. 16. Moll. Coral Bed Awa, p. 22.

Several specimens in which the three spiral rows of tubercles are developed nearly in equal strength, which is also the case in the recent specimens brought from Echigo.

Fossil occurrence.—Upper horizon, Sawané. Musashinos. Pleistocene of Awa.

Living.—Central Japan.

CM 23126-16 N S

CM27101
CM27102
(S) CM27103
CM27104
CM27105
CM27106
CM27107
CM27108
CM27109
CM27110
CM27111
CM27112
CM27113

Family Solariidae.

37. Solariella nipponensis, n. sp.

Pl. XXXIII. Fig. 16.

Shell small, ovately conical. Whorls five, of which one is nuclear, smooth and rounded, the remaining bluntly angulate a little below the upper suture, with the surface above the angle flat and horizontal, below slightly convex and steeply sloping; spirally corded and longitudinally plicate. Spiral cords several in number, a weak one at the angle, a few faint ones below it, and three stronger near the lower suture of which the middle is the strongest. Longitudinal plicae coinciding with growth-lines in their direction, being so to speak elevated growth-lines, obtuse, about thirty on the penultimate whorl, becoming more or less indistinct on the last part of the body-whorl. The crossing points of the plicae and the cord of the angle are more or less tubercular. Periphery rounded. Base convex, with three distinct spiral cords which diminish in size as they go downward, succeeded by a few faint ones and then again by three very strong ones surrounding the umbilicus, of which the outermost is the strongest and the innermost the weakest. All these cords are more or less tubercular at the points of intersection with the prominent growth lines. Umbilicus large and deep. Aperture semicircular, with a continuous peristome.

A single specimen, 7.5 millim in height and diameter.

Fossil occurrence.—Upper horizon, Sawane.

CM23127-12-S
CM23128 S

Family Rissoidae.

38. Rissoa (Apicularia) sadoensis, n. sp.

Pl. XXXIII. Fig. 12.

Shell small, ovately conic. Whorls about six, of which one and a half are nuclear and smooth, the remaining convex, longitudinally plicate and spirally threaded. Longitudinal plicae strong, rounded,

oblique, somewhat curved with the concave side towards the front, about fifteen on the penultimate whorl and a few more on the body-whorl, becoming flattened and indistinct anteriorly so that on the last half of the last whorl they can hardly be distinguished. Spiral threads about ten, close together, distinct near the lower suture, but getting faint and indistinct towards the upper. Periphery rounded. Base abruptly narrowed, with only about ten spiral threads which gradually weaken toward the caudal end where they are indistinct. Aperture oval, pointed behind, sharply rounded in front, with peristome continuous; rarely is there any indication of a channel. Height 3.6 millim. diameter 1.5 millim. Numerous.

Fossil occurrence.—Upper horizon, Sawané.

CM 23129 S
CM 23130 S

39. **Rissoa (Apicularia ?) asura,** n. sp.

Pl. XXXIII. Fig. 15.

Shell small, ovately conic. Whorls about five, of which one and a half are nuclear and smooth, the remaining convex and longitudinally plicate with plicae about eighteen on the penultimate and about twenty on the ultimate whorl, strong, rounded, narrower than interspaces, straight, vertical, disappearing near the upper as well as the lower suture, more or less flattening and becoming indistinct on the last half of the body-whorl. Spiral sculpture also present as extremely fine striae often hardly visible, most distinct on body-whorl. Periphery rounded. Base smooth save for fine microscopic striae. Aperture shortly ovate, pointed behind, with peristome continuous. Outer lip with a broad flat varix on the outer side. Umbilicus indicated by a narrow chink. Height 3.7 millim. Diameter 2.2 millim. Four examples.

Fossil occurrence.—Upper horizon, Sawané.

CM 23131-33 H

40. **Rissoa (Alvania) lusoria** n. sp.

Pl. XXXIII. Fig. 18.

Shell small, longish ovate, with apex blunt. Whorls five and a half, of which one and a half are nuclear and smooth, succeeding longitudinal ly and apirally corded. Longitudinal cords, straight, somewhat oblique, distant, elevated, rounded on top, distinct, about seventeen on the penaltimate and ultimate whorls. Spiral cords somewhat stronger than the longitudinal ones, two in number, elevated, forming angles and separating the surface into three equal parts. Close to the upper suture there is a

weaker cord making the latter quite distinct, while on the body-whorl there is a still another close to the lower suture and not much weaker. Intersection points of these two sets of cords tubercular. On the base, which is rapidly narrowed downward, there are two more spiral cords of strength nearly equal to the supersutural of the body-whorl. Aperture round. Outer lip thin, not thickened outwardly by a varix. Height 3 millim. Diameter 1.6 millim.

A single example. It is somewhat like *Rissoa didyma* Watson (Challenger Gastropoda, pl. XLIV. fig. 1), though not quite agreeing with it.

Fossil occurrence.—Upper horizon, Sawané.

CM 23132-13 S
CM 23133 S

41. **Rissoa (Alvania) sitta,** n. sp.

Pl. XXXIII. Fig. 13.

Shell small, ovately conical. Whorls about five, of which one and a half are nuclear, rounded and smooth, the succeeding angulate in the middle with the surface above the angle flat and steeply sloping, below flat and vertical, spirally and longitudinally corded. Spiral cords generally four, one close to the upper suture, weak and often indistinct, one at the angle, strong, rounded and elevated, one midway between the angle and the lower suture and equally strong, one close to the latter and weaker, though more or less distinct. Longitudinal cords somewhat weaker than the spiral, about seventeen on the penultimate whorl, straight, rounded, separated by somewhat broader interstices, becoming fainter anteriorly on the body-whorl. Crossing points of longitudinal and spiral cords tubercular. Base abruptly narrowed, smooth. Umbilicus with a chink. Aperture subcircular. Outer lip with a broad varix outside. Height 4.3 millim. Diameter 2.5 millim.

Rare.

Fossil occurrence.—Upper horizon, Sawané.

CM 23134-26 S
CM 23135-25 S

42. **Rissoa (Alvania) maya,** n. sp.

Pl. XXXII. Figs. 24, 25.

Shell small, low-turrete. Whorls about five and a half, of which one and a half are nuclear, smooth and rounded, the remaining convex, spirally and longitudinally corded. Spiral cords rounded, five in number, of which the lowest is close to the suture and weaker, subequidistant with broader interstices. Longitudinal cords weaker than the spiral,

many, most distinct between the longitudinals and on the younger whorls, faint or obsolete on the body-whorl. Base rapidly narrowed, ornamented with about five spiral cords. Aperture oval with peristome continuous. Outer lip sharp, but with a broad flat varix outside Height 3 millim. Diameter 1.4 millim. There are only two examples, of which one is more slender than the other (3 millim by 1.3 millim.).

This species has some resemblance to *Rissoa lusciniae* Wats. (Challenger Gastropoda, pl. XZ, IV. fig. 3.) which, however,has the longitudinal cords much stronger and fewer in number.

Fossil occurrence.—Upper horizon, Sawané.

CM 23136·3 S
CM 23137 S

43. Rissoa (Alvania) akibai, n. sp.

Pl. XXXIV. Fig. 3.

Shell small, ovately conical. Whorls about five, of which one and a half are nuclear, the remaining convex, ornamented with longitudinal and spiral threads. Longitudinal threads, straight, vertical, distant, about twenty four on the penultimate whorl and about thirty on the ultimate. Spiral threads equal in size to the longitudinal ones or somewhat larger, four or five on the penultimate whorl and one more on the ultimate; in the former, the uppermost is close to the suture, sometimes weak and indistinct, the next one is situated a little above the middle of the whorl and stronger, with two more equally strong ones below, the lowest being just above the lower suture. On the body whorl, there is another between the upper two, which is stronger than the uppermost, but weaker than the lower ones or equal to them. Intersection-points of these two sets of threads more or less tubercular. On the base there are about eight spiral threads down to the caudal end, while the longitudinal ones become thinner and disappear below the third spiral. Aperture circular with peristome continuous. Inner lip outwardly rimate.

Two examples, one of which measures 3 millim. in height and 2.3 millim. in diameter.

This shell resembles *Rissoa tarsodes* Watson (Challenger Gastropoda, pl. 44, fig. 2) which, however, is more coarsely sculptured.

Fossil occurrence.—Upper horizon, Sawané.

CM 23138-9 H

44. Rissoa (Cingula) dharma, n. sp.

Pl. XXXIII. Fig. 9.

Shell small, ovately conical. Whorls four, the first nuclear and smooth, the succeeding convex, ornamented with fine spiral impressed

lines which make the intervals appear like flat cords, and number about ten on the penultimate whorl. Sutures shallowly channelled. Base convex, sculptured like the whorls. Aperture ovate with the posterior corner bluntly pointed. Peristome almost continuous being interrupted only at the upper part of the inner lip. Height 2.2 millim. Diameter 1.5 millim.

A single example.

Fossil occurrence.—Upper horizon, Sawané.

CM23139 - 11 S
CM23140 · S

45. **Rissoa (Cingula) mundana,** n. sp.

Pl. XXXIII. Fig. 11.

Shell small, longish ovato-conic. Whorls six, somewhat convex, perfectly smooth. Periphery rounded. Base convex. Aperture shortened ovate, pointed behind. Peristome continuous. Outer lip thin. Height 3.3 millim. Diamter 1.5 millim.

Quite numerous.

Fossil occurrence.—Upper horizon, Sawané.

CM23141

46. **Rissoina submercurialis,** Yokoyama.

Rissoina submercurialis. Yokoyama, Foss. Miura Penin., p. 73, Pl. IV, fig. 15.

Quite frequent.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

Living.—Central Japan (Echigo).

CM 23142 = 10 H

47. **Rissoina fortunata,** n. sp.

Pl. XXXIII. Fig. 10.

Shell small, ovately conic. Whorls about seven, flat, longitudinally costate and spirally corded. Longitudinal costae about thirteen on the body-whorl, strong, rounded, somewhat oblique, straight or slightly curved with the concave side directed forward, separated by valleys of greater breadth. Spiral cords, two on the whorls younger than the penultimate, strong, stronger than longitudinal costae, while on the last two they are not only greater in number (about six), but also weaker and in some cases even indistinct. Intersection-points of costae and cords tubercular. Periphery subangulate. Base convex, only with several distinct spiral cords. Aperture subsemilunar, with a faint indication of a channel in front.

A single example measuring 3.7 millim. in height and 1.4 millim. in diameter.

Fossil occurrence.—Upper horizon, Sawané.

CM 23143-145
CM 23144 S

48. Rissoina tabatai, n. sp.

Pl. XXXIII. Fig. 14.

Shell small, turrete. Whorls about nine, flattish, longitudinally costate and spirally corded. Costae rounded, separated by intervals of about equal breadth, straight, vertical or somewhat oblique, about fifteen on the penultimate whorl, somewhat more on the ultimate, often becoming flattish and indistinct, or increasing in number by splitting toward the last extremity of the whorl. Spiral cords about seven on the body-whorl, rounded, close, separated by intervals of narrower breadth. Periphery more or less rounded. Base only with spiral cords which are about six in number and sometimes indistinct. Aperture subsemilunar, with the inner side somewhat convex. Peristome continuous, with a distinct indication of a channel in front. Height 5.7 millim. Diameter 2.2 millim.

Many specimens, somewhat varying in the proportion of height to diameter.

Fossil occurrence.—Upper horizon, Sawané.

CM 23145-12 S
CM 23146 S

49. Rissoina (Zebina ?) occulta, n. sp.

Pl. XXXIV. Fig. 12.

Shell small turrete. Whorls about six, somewhat convex a little below the middle, and then flattening above up to the upper suture, very finely spirally striate when seen under a magnifier. Aperture semilunar, with a thickened continuous peristome. Height 2.7 millim. Diameter 1 millim.

A few examples.

Fossil occurrence.—Upper horizon, Sawané.

CM 23147-7 S
CM 23148 S

50. Rissoina (Morchiella) sawanensis, n. sp.

Pl. XXXIV. Fig. 7.

Shell small, turrete. Whorls about nine, either slightly convex or almost flat. Spirally corded and also longitudinally plicate on the younger whorls. Spiral cords rounded, either distinct or indistinct; in the former case the number is about five or six, equal or unequal, usually

separated by broader intervals. Longitudinal plicae, about twelve, coarse, rounded, somewhat oblique, most distinct on the lower half of the whorls. Periphery rounded. Base abruptly narrowed with about six spiral cords on it down to the caudal end. Aperture ovately semilunar with peristome continuous, pointed behind and faintly channelled in front. Outer lip thin. Height 6.4 millim. Diameter 2.4 millim.

This shell is much like *Rissoina manzakiana* Yok. described from the Upper Musashino of Shimosa (Foss. Up. Musash., p. 79, pl. IV. fig. 4) which, however, has a different kind of longitudinal plicae, no spiral cords except on the base, and the aperture not channelled.

Frequent.

Fossil occurrence.—Upper horizon, Sawané.

CM23149
CM23150

Family Naticidae.

51. Natica janthostoma, Deshayes.

Natica janthostoma. Yokoyama, Foss. Miura Penin., p. 77, pl. V, figs. 3, 4. Foss. Up. Musash., p. 83. Moll. Rem. Lowest Part Jô-Ban Coalf., p. 12, pl. I, fig. 20. Moll. Rem. Mid. Part, p. 14. Moll. Rem. Up. Part, p. 13. Tert. Moll. Dainichi, p. 12. Tert. Foss. Kii, p. 53. Foss. Moll. Izumo, p. 4. Tert. Moll. Shinano a. Echigo, p. 7. Moll. Tert. Basin Chichibu, p. 116.

Many specimens, but all young individuals.

Fossil occurrence.—Upper and lower horizons, Sawané. Musashinos. Pliocene and Miocene of Japan.

Living.—Northern and Central Japan. Kamchatka.

CM23151
CM23152

52. Polinices pallidus, (Broderip et Sowerby).

A few immature examples.

Fossil occurrence.—Upper and lower horizons, Sawané. Lower Musashino.

Living.—Circumpolar seas. Sea of Okhotsk.

CM23153

Family Scalidae.

53. Scala azumana, Yokoyama.

Scalaria azumana. Yokoyama, Foss. Up. Musash., p. 86, pl. IV, fig. 15.

A single example.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

Living.—Central Japan.

Family Pyramidellidae.

CM23154

54. Pyramidella (Iphiana) mira, Yokoyama.

Pyramidella (Iphiana) mira. Yokoyama, Foss. Up. Musash., p. 93, pl. IV, fig. 25.

A small specimen, smaller than those already described with only the last six whorls preserved. The spiral striations are not visible, but the colour-band above the lower suture is indistinctly preserved.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

55. Odostomia (Egilina) marielloides, Yokoyama.

CM 23155-19

pl. XXXII. Fig. 19.

Odostomia marielloides. Yokoyama, Foss. Up. Musash., p. 100, pl. IV, fig. 34.

A single specimen which, in its general sculpture, can not be distinguished from those described under the above name from the Upper Musashino, but is more slender and with one more whorl. It may be provisionally called var. *gracilis.* I here take the opportunity of pointing out that the figure of *Odostomia marielloides* given in the above work shows the costae a little finer than they really are. The figure given of the present variety represents them more correctly.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

56. Odostomia (Odostomia) suboxia, Yokoyama.

(R) CM23156

Odostomia (Odostomia) suboxia. Yokoyama, Foss. Up. Musash., p. 98, pl. IV, fig. 32.

A single example.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

Living.—Central Japan.

57. Odostomia (Ondina ?) calypso, n. sp.

CM23157-4 H

Pl. XXXII. Fig. 4.

Shell small, ovately conic. Whorls about five, of which the first is embryonal; the succeeding convex, subgradate, with fine impressed spiral lines, about seven on the penultimate whorl and a little more on the last. Base convex, with many similar, spiral lines. Aperture ovate, pointed behind. Lip-fold obsolete. Height 4.1 millim. Diameter 2.1 millim. A single example.

Fossil occurrence.—Upper horizon, Sawané.

CM23158

58. Turbonilla (Strioturbonilla) pacifica, Yokoyama.

Turbonilla (*Strioturbonilla*) *pacifica*. Yokoyoma, Foss. Up. Musash., p. 105, pl. V, fig. 13.

A few examples.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

Living.—Central Japan.

CM23159-64

59. Turbonilla (Chemnitzia) fusoensis, n. sp.

Pl. XXXIV. Fig. 6.

Shell small, turrete. Whorls about nine, of which one is nuclear, the remaining rather convex, longitudinally plicate. Plicae about sixteen on the penultimate whorl and about eighteen on the ultimate, strong, elevated, rounded, somewhat oblique with the lower end situated more forward, separated by interspaces of somewhat less breadth. Periphery rounded, but provided with a strong spiral cord. Base abruptly narrowed with one or two faint spiral cords below the periphery. Aperture subquadrate.

A single example with the outer lip partly broken. It is 5 millim. high and 1.5 millim in diameter.

Fossil occurrence.—Upper horizon. Sawané.

CM23160 S

CM23161-4 S

CM23162 S

60. Turbonilla (Pyrgiscus) yanamii, n. sp.

Pl. XXXV. Fig. 4.

Shell small, high-turrete. Whorls about twelve, of which two are nuclear, the post-nuclear strongly convex, longitudinally plicate and spirally grooved. Longitudinal plicae about eighteen on the penultimate whorl, a little more on the ultimate on which, however, they are flattened and indistinct especially in its last part, rounded, separated by intervals of narrower breadth, either straight and vertical or somewhat curved and oblique with the concave side directed forward. Spiral grooves usually two, deep and distinct, the one a little above the middle, and the other midway between it and the lower suture, but sometimes there is a weaker one above the upper one and also just above the lower suture, making the part between appear like a thread; in rare cases the subsidiary grooves may be two instead of one. Periphery rounded. Base rapidly narrowed, flattish, with about five spiral grooves. Aperture ovate, bluntly pointed behind. Height 13.3 millim. Diameter 3.6 millim.

A few examples.

Fossil occurrence.—Upper and lower horizons. Sawané.

61. Turbonilla (Tragula) spinulosa, n. sp. CM 23163-5 H

Pl. XXXV. Fig. 5.

Shell small, turrete. Whorls about eight, convex, spirally and longitudinally corded. Spiral cords rounded, four on the younger whorls, five on the penultimate as well as on the ultimate. Of the five cords of the last two whorls, four are equally distributed, while the fifth is weaker and lies between the lower suture and the fourth, being tolerably close to both. Longitudinal cords about ten on the body-whorl, rounded, equal in size to the spiral ones, straight, vertical and crossing them, the points of crossing being spiny. Periphery angulate, the fifth cord forming the angle. Base flattened, with a smooth spiral cord close to the periphery, the rest of the surface being smooth. Aperture subquadrate, with corners rounded.

A single example, 4.5 millim. high, and 1.5 millim. in diameter.

Fossil occurrence.—Upper horizon, Sawané.

62. Turbonilla (Cingulina) morsei, n. sp. CM 23164-17 H

Pl. XXXIII. Fig. 17.

Shell small, turrete. Whorls about nine, convex, spirally corded. Cords equally distributed, five, of which the uppermost is somewhat weaker than the others, while on the last two whorls there is a still weaker one below the suture. Intervals between cords broader than the cords themselves. On the body-whorl there is a strong intercalary between the second and the third. Periphery rounded. Base rapidly narrowed downward, convex with about seven spiral cords which become gradually weaker towards its end. Aperture oval, with peristome interrupted on the inner side close to the posterior end. A single example measuring 10.7 millim. in height and 3.5 millim. in diameter.

Fossil occurrence.—Upper horizon, Sawané.

63. Turbonilla (Cingulina) pseudocingulata, n. sp. CM 23165-1 H

Pl. XXXV. Fig. 1.

A single example with the last six whorls intact, the apical part being broken. It is a slender turrete shell with flat whorls ornamented with four rounded spiral cords of which the lowest is the weakest and suprasutural in position, while the uppermost is larger and somewhat below the upper suture; the second and third are still somewhat larger, the second being a little above the middle of the whorl, while the

third is midway between the second and the lowest. The interspace between the first and the second is equal to that between the second and the third, and is almost equal to, or somewhat broader than, the cords themselves; it is ornamented with fine longitudinal striae, only seen under a magnifier. Periphery rounded. Base convex with two spiral threads, the upper being stronger and at about the same distance as the third is from the second on the body-whorl, while the second one is fainter and also equally spaced. Aperture rhomboidal with the outer posterior corner acute and the inner obtuse. Height 2.7 millim. Diameter 1 millim.

The shell is white and glossy. It has some resemblance to *Turbonilla* (*Cingulina*) *cingulata* Dkr. (Dall Bartich, Notes on Japanese, Indo-pacific and American Pyramidellidae, Proc. U. S. Nat. Mus., XXX, p. 344, pl. 21, fig. 1) living near Enoshima.

Fossil occurrence.—Upper horizon, Sawané.

Living.—Central Japan.

Family Turbinidae.

CM23166
CM23167

64. Leptothyra amussitata, (Gould).

Leptothyra amussitata. Yokoyama, Foss. Miura Penin., p. 85, pl. V, fig. 21.

Quite numerous.

Fossil occurrence.—Upper and lower horizons, Sawane. Lower Musashino.

Living.—Northern Japan. Sakhalin.

CM23168
CM23169

65. Leptothyra purpurescens, (Dunker).

Leptothyra purpurescens. Yokoyama, Foss. Miura Penin., p. 86, pl. V, fig. 22. Foss. Up. Musash., p. 107.

A few specimens.

Fossil occurrence.—Lower horizon, Sawané. Kaidaté. Lower and Upper Musashino.

Living.—Japan (Dunker).

CM23170

66. Leptothyra pygmaea, Yokoyama.

Leptothyra pygmaea. Yokoyama, Foss. Up. Musash., p. 108, pl. V, fig. 17.

Numerous.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

Living.—Central Japan.

Family Phasianellidae.

CM 23171-7
CM 23172.

67. Phasianella tristis, Pilsbry.

Pl. XXXVII. Fig. 7.

Phasianella tristis. Pilsbry, Nautilus, XVIII 69 (October, 1903). New. Jap. Mar. Moll., Gastr., Proc. Acad. Nat. Sci. Philad., Jan., 1904, p. 32, pl. VI, fig. 64.

Several examples of this small smooth shell with quickly growing whorls still preserving its deep purplish colour were obtained. All are somewhat shorter than the figure given of the species by Pilsbry. The largest is only 3 millim. high with diameter of about 2.2 millim.

Fossil occurrence.—Upper horizon, Sawané.

Living.—Northern Japan (Island of Rishiri off the northern extremity of the main island of the Hokkaido).

Family Trochidae.

CM 23193-9-5
CM 23194 5

68. Gibbula orientalis, n. sp.

Pl. XXXV. Fig. 9.

Shell small, flatly ovato-conical. Whorls four, rapidly growing, younger convex, last angulate in the middle with a spiral cord no the angle ; the surface above the angle flat, very gently sloping and provided with four subequal, equally distributed spiral cords somewhat weaker than the one on the angle, while the surface below the angle is also flattish, steeply sloping with four alternately large and small spiral cords. Periphery subangulate with a cord on it. Base convex with about ten spiral cords. Umbilicus small, deep. Aperture roundly quadrate. Outer lip thin. Height 2 millim. Diameter 2.5 millim.

Two specimens with the original dark purplish colouration still preserved.

Fossil occurrence.—Upper horizon, Sawané.

CM 23195-8 5
CM 23196 5

69. Margarita vahliioides, n. sp.

Pl. XXXVII. Fig. 8.

Shell small, turbinate, conoidal. Whorls about four and a half, somewhat convex, smooth save for microscopic spiral impressed lines. Periphery sharply rounded. Umbilicus small, deep. Aperture subquadrate, pointed behind. Base convex. Height 3 millim. Diameter 3.7 millim.

Only two examples. Very much like *Margarita vahlii* Möller (Tryon. Man. Conch., XI, p. 287, pl. 39, figs. 58, 69) of arctic and subarctic seas, without exactly agreeing with it.

Fossil occurrence.—Upper horizon, Sawané.

CM 23179-8 H

70. **Margarita laudata**, n. sp.

Pl. XXXIV. Fig. 8.

Shell small, rather thin, turbinate. Whorls about four, angulate a little above the middle, with a cord at the angle; the surface above the angle, gently convex and slightly sloping, below also somewhat convex and nearly vertical. A spiral cord is also present between that of the angle and the lower suture, though somewhat weaker. There are also regular longitudinal riblets which run parallel to the growth lines, distant and flattish, numbering about sixteen on the penultimate whorl and about twenty-two on the ultimate. Periphery rounded with a spiral cord on it, which is weaker than the second one. Crossing-points of the longitudinal cords with the spiral more or less tubercular. Base convex with distinct longitudinal riblets. Umbilicus small, deep, with a spiral cord at its mouth and also about two more weaker ones outside as well as inside. Aperture subcircular with peristome continuous. Height 2.8 millim. Diameter 2.5 millim Only a single specimen.

Fossil occurrence.—Upper horizon, Sawané.

CM 23178-9 H

71. **Margarita hilarula** n. sp.

Pl. XXXIV. Fig. 9.

Shell small, turbiform, with spire low. Whorls about four, convex with sutures more or less sunken, ornamented with five equally distributed spiral cords which on the body-whorl are faint and indistinct. Growth-lines coarse and distinct, looking on the penultimate whorl like longitudinal sculpture. Periphery quite rounded. Base convex, with several (about five) faint spiral threads. Umbilicus deep, funnel-shaped, with several (about four) spiral grooves near its mouth. Aperture subcircular, with peristome almost continuous. Height 1.7 millim. Diameter 2.1 millim. A single example, on which the original purplish colour is still preserved.

Fossil occurrence.—Upper horizon, Sawané.

72. Calliostoma kalavinka, n. sp. CM 23179-19H

Pl. XXXIII. Fig. 19.

Shell small, turbinate. Whorls about five and a half of which two and a half are nuclear, rounded and smooth, and the rest angulate a little below the middle; the surface above the angle being flat and steeply sloping except close to the upper suture where it is horizontal, below vertical and flat. Spirally corded, with cords unequal and variable in number, the largest one being situated at the angle. On the penultimate whorl, there are two somewhat weaker ones below the angle, while above there are also two which are much weaker and nearer to the upper suture than to the angle. On the body-whorl, those below the angle are three which are at first unequal, but on the last part of the whorl nearly equal in size; while above the angle there are five or six subequal ones on the last part of the whorl. Incremental lines coarse and conspicuous, looking like fine longitudinal striations. Periphery with a strong cord and angular. Base rapidly narrowed downward and with about ten subequal spiral cords which are approximately equal in strength to the weaker ones on the whorls. Aperture subcircular, channelled in front. Height 4.6 millim. Diameter 3.1 millim.

A single specimen, quite characteristic in its prominent growth-lines, which cover the entire surface of the shell.

Fossil occurrence.—Lower horizon, Sawané.

Family Cyclostrematidae.

73. Cyclostrema pulchellum, Dunker. CM 23180-23 CM 23181

Pl. XXXII. Fig. 23.

Cyclostrema pulchellum. Dunker. Moll. Jap., p. 20, pl. III, fig. 5. Pilsbry, Catalogue p. 102.

Shell very small, thick, subglassy, shining, depressed. Whorls about four, rapidly growing, first two nuclear, smooth and rounded; third (penultimate) shouldered, with the surface between the shoulder and the upper suture somewhat sunken, below very steep or almost vertical and flattish, longitudinally ribbed, with ribs about sixteen in number, elevated though rounded on top, separated by broader interstices which are finely longitudinally striate. Body-whorl double-shouldered with the upper shoulder weaker, angulate at periphery, the angle being elevated with top rounded, so that the surface above the angle is somewhat concave; ribs about twenty in number with interstices striate

as on the preceding whorl. Shoulders and angle tubercular at the points of intersection with the ribs. Base three-angled, the angles becoming weaker as they go downward, the third one surrounding the large and deep umbilicus within which there is still a weaker one. These angles are all crossed by longitudinal ribs, with the crossing points tubercular. Aperture subcircular with a thickened continuous peristome. Height 1 millim. Diameter 2.5 millim. Frequent.

Tryon unites this species with *Cyclostrema micans* A. Adams (Man. Conch., X, p. 88) of the tropical seas, which is apparently different.

Fossil occurrence.—Upper horizon, Sawané.

Living.—Central and Western Japan.

CM23182

Family Fissurellidae.

74. Puncturella nobilis, A. Adams.

Puncturella nobilis. Yokoyama, Foss. Up. Musash., p. 116, pl. VI, fig. 4.

Several examples.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

CM23183

75. Emarginula vadoso-sinuata, Yokoyama.

Emarginula vadoso-sinuata. Yokoyama, Foss. Up. Musashino, p. 117, pl. VI, fig. 5. Tert. Moll. Shinano a. Echigo, p. 9.

Only one specimen which is, however, quite well preserved.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino. Pliocene of Shinano.

CM23184

Family Acmaeidae.

76. Acmaea kuragiensis, Yokoyama.

Acmaea kuragiensis. Yokoyama, Foss. Miura Penin., p. 100, pl. VI, fig. 9.

Several specimens, some of which are larger than the only one described from Koshiba, the longer diameter being almost 10 millim.

Fossil occurrence.—Upper horizon, Sawané. Lower Musashino.

CM23185-5

CM23186

77. Acmaea concinna, Lischke.

Pl. XXXIV. Fig. 5.

Acmaea concinna. Lischke, Jap. Meeresconch., II. p. 98, pl. VI, 1-6. Iwakawa, Cat. Jap. Moll. Nat. Hist. Dep., Tokyo Imp. Museum, p. 3.

This low orbicular-elliptical shell with five unequal radiating riblets is represented by two small examples, the larger of which is 10.5 millim. long, 9 millim. broad and 3.5 millim. high.

Fossil occurrence.—Upper horizon, Sawané.

Living.—Northern, Central and Western Japan.

CM 23189-13
CM 23188

78. Acmaea schrenckii, Lischke.

Pl. XXXIV. Fig. 13.

Acmaea schrenckii. Lischke, Jap. Meeresconch., I. p. 107, pl. VIII, figs. 1-4, II. p. 99. Iwakawa, Cat. Jap. Moll. Nat. Hist. Dep., Tokyo Imp. Museum, p. 2.

This species is a little narrower than the preceding; still the resemblance is so great that Pilsbry in his "Catalogue of the Marine Mollusks of Japan," p. 110 unites the two. However, following Iwakawa, a great authority on our recent shells, I keep them separate for the present. Only two worn specimens.

Fossil occurrence.—Upper horizon, Sawané.

Living.—Northern, Central and Western Japan.

CM 23189-15 5
CM 23190-5

79. Acmaea asmiiformis, n. sp.

Pl. XXXIV. Fig. 15.

Shell small, moderate in thickness, conical, with elliptical base. Apex acute, situated somewhat in front of the middle. The surface in most specimens is smooth, but under a magnifier, fine radiating riblets generally separated by wider interspaces are seen near the margins. Length 1.2 millim. Breadth 9.5 millim. Height 6.2 millim. The colour of the shell seems to have been brown, as that colour is more or less preserved in all the specimens. Not rare.

This shell resembles *Acmaea asmi Midd.* (Mal. Ross. II, p. 39, pl. I, fig. 5. Tryon, Man. Conch., XIII, p. 19, pl. VI, figs. 38, 39) of the west coast of America, though somewhat lower in form.

Fossil occurrence.—Upper horizon, Sawané.

CM 23191-4 14

80. Acmaea asperulata, n. sp.

Pl. XXXIV. Fig. 4.

Shell small, high-conic, oval in outline, somewhat longer than broad, finely radiately costellated. Costellae numerous, subequal, close, made granular by the growth lines which are distinct and cut them. Apex pointed, close to the anterior end.

A single specimen measuring 5 millim. in length, 3.7 millim. in breadth and 2 millim. in height.

Fossil occurrence.—Upper horizon, Sawané.

CM 23192-10 B
CM 23193-5

81. **Acmaea oblongata,** n. sp.

Pl. XXXIV. Fig. 14.

Shell small, rather thin, conical, oblong in outline with lateral sides subparallel. Apex a little anterior to the middle, obtuse, anterior slope straight, posterior slightly convex. Surface with faint distant radiating riblets which are only visible under a magnifier.

Two specimens. The one measures 6 millim. in length, 3.7 millim. in breadth and 2.8 millim. in height, while the other measures 5.9 millim. in length, 3.6 millim. in breadth and 2.7 millim in height.

Fossil occurrence.—Upper horizon, Sawané.

CM 23194-10 H

82. **Acmaea angustitesta,** n. sp.

Pl. XXXIV. Fig. 10.

Shell small, rather thin, low-conic, narrowly oblong in outline with lateral sides straight and parallel. Surface smooth. Apex about midway between the centre and the anterior end of the shell, bluntly pointed, with anterior slope straight and posterior gently convex.

A single example measuring 7.4 millim. in length, 3.3 millim. in breadth and 2.7 millim. in height.

Fossil occurrence.—Upper horizon, Sawané.

Family Patellidae.

CM 23195

83. **Helcioniscus pallidus,** (Gould).

Helcioniscus pallidus. Yokoyama, Foss. Miura Penin., p. 101, pl. VI, figs. 16, 17. Foss. Up. Musash., p. 117. Moll. Rem. Up. Part Jô-Ban Coalf., p. 15, pl. I, fig. 4. Moll. Rem. Mid. Part, p. 18. Tert. Moll. Shinano a. Echigo, p. 9.

Many well preserved young specimens in which the anterior as well as posterior declivities are either straight or slightly excavated.

Fossil occurrence.—Upper horizon, Sawané. Musashinos. Shirado-Beds. Pliocene of Shinano.

Living.—Northern and Central Japan.

Class SCAPHOPODA.

Family Dentaliidae.

CM 23196-11 H

84. Siphonodentalium (Pulsellum) ozawai, n. sp.

Pl. XXXIV. Fig. 11.

Shell small, milk-white, glossy, somewhat pellucid, distinctly curved, nearly circular in section. Aperture obliquely truncate, with diameter not quite twice that of apical orifice. Surface perfectly smooth save for somewhat oblique lines of growth.

A single example measuring about 10 millim. in length, with the diameter of the aperture about 1.3 millim. and of the apical orifice 0.7 millim.

This species resembles *Siphonodentalium lofotense* Sars (Tryon, Man. Conch., XVII, p. 138, pl. XXIV, figs. 40–44) of the Atlantic in which, however, the aperture is comparatively larger.

Fossil occurrence.—Upper horizon, Sawané.

Living.—Central Japan.

Class LAMELLIBRANCHIATA.

Family Saxicavidae.

CM23197

85. Panope generosa, Gould.

Panope generosa. Yokoyama, Foss. Up. Musash., p. 121, pl. V, figs. 14, 15. Foss. Moll. Izumo, p. 4. Tert. Moll. Dainichi, p. 14. Moll. Rem. Up. Part Jô-Ban Coalf., p. 16, pl. VI, fig. 6. Moll. Rem. Mid. Part, p. 16. Tert. Moll. Shinano a. Echigo, p. 10. Moll. Tert. Basin Chichibu, p. 118. Tert. Moll. Shiobara, p. 132.

A single right valve of an immature individual.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino. Shirado and Minato Beds. Pliocenes of Izumo, Totomi, Shinano, Chichibu and Shiobara.

Living.—Northern Japan. West coast of America.

Family Corbulidae.

CM23198

86. Corbula venusta, Gould.

Corbula venusta. Yokoyama, Foss. Miura Penin., p. 107, pl. VII, figs. 4-6. Foss. Up. Musash., p. 122. Tert. Moll. Shinano a. Echigo, p. 10.

A single left valve.

Fossil occurrence.—Upper horizon, Sawané. Musashinos. Pliocene of Shinano.

Living.—Northern Japan.

Family Mactridae.

CM23199

87. Mactra sulcataria, Deshayes.

Mactra sulcataria. Yokoyama, Foss. Up. Musash., p. 126, pl. VII, fig. 6. Moll. Rem. Up. Part., p. 17. Tert. Moll. Shinano a. Echigo, p. 10.

Only a single fragment.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino. Shirado and Minato Beds. Pliocene of Shinano.

Living.—Northern, Central and Western Japan.

R CM23200

88. Spisula grayana, Schrenck.

Spisula grayana. Yokoyama, Foss. Up. Musash., p. 130, pl. VIII, figs. 1, 2. Moll. Rem. Upperm. Part. Jō-Ban Coalf., p. 17, pl. II, fig. 11. Moll. Rem. Mid. Part, p. 16. Tert. Moll. Shinano a. Echigo, p. 11, pl. IV, fig. 3. Tert. Moll. Shiobara, p. 132.

Rather frequent.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino. Shirado and Minato Beds. Pliocenes of Shinano and Shiobara.

Living.—Northern Japan. Sea of Okhotsk.

Family Psammobiidae.

CM23201

89. Psammobia kazusensis, Yokoyama.

Psammobia kazusensis. Yokoyama, Foss. Up. Musash., p. 136, pl. IX, fig. 4.

A few broken valves, some of which are larger than those hitherto described.

Fossil occurrence.—Kaidaté. Upper Musashino.

Family Tellinidae.

CM23202

90. Macoma praetexta, (Martens).

Macoma praetexta. Yokoyama, Foss. Upper Musash., p. 142, pl. X, figs. 2. 3, Tert. Moll. Dainichi, p. 15. Moll. Rem. Low. Part Jô-Ban Coalf., p. 13. Moll. Tert. Basin Chichibu, p. 118. Tert. Moll. Shiobara, p. 133.

A single right valve of a young individual.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino. Pliocenes of Dainichi, Chichibu and Shiobara. Asagai Beds.

Living.—Central and Western Japan.

91. Macoma nipponica, Tokunaga.

CM23203

Macoma nipponica. Yokoyama, Foss. Miura Penin., p. 117, pl. VIII, figs. 3, 4. Foss. Up. Musash., p. 142.

Many specimens.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

Living.—Northern Japan.

92. Macoma inquinata, (Deshayes).

CM23204

Macoma inquinata. Yokoyama, Foss. Miura Penin., p. 117, pl. VIII, figs. 1, 2. Foss. Up. Musash., p. 142. Moll. Rem. Upperm. Part Jô-Ban Coalf., p. 13. Moll. Rem. Mid. Part, p. 17. Tert. Foss. Kii, p. 56. Moll. Coral Bed Awa, p. 42.

Quite frequent.

Fossil occurrence.—Upper horizon, Sawané. Coral Bed of Awa. Musashinos. Pliocene of Kii. Shirado Beds. Minato Beds. Asagai Beds. Pliocene and Pleistocene of California.

Living.—Northern, Central and Western Japan. West coast of America.

Family Veneridae.

93. Dosinia troscheli, Lischke.

CM23205

Dosinia troscheli. Yokoyama, Foss. Miura Penin., p. 119, pl. VIII, figs. 5, 6. Foss. Up. Musash., p. 144. Tert. Moll. Dainichi, p. 15. Moll. Rem. Upperm. Part Jô-Ban Coalf., p. 19. Moll. Rem. Mid. Part, p. 17. Moll. Tert. Basin Chichibu, p. 118. Tert. Moll. Shiobara p. 133, pl. XVI, fig. 1b. Moll. Foss. Mino, p. 222. Neog. Shells Kozuké a. oth. Prov., p. 230.

A few immature specimens.

Fossil occurrence.—Upper horizon, Sawané. Musashinos. Pliocenes of Sagami, Dainichi, Chichibu and Shiobara. Shirado Beds. Minato Beds.

Living.—Central and Western Japan.

94. Meretrix meretrix, (Linné).

CM23206

Meretrix meretrix. Yokoyama, Foss. Up. Musashino, p. 146, pl. XI, fig. 4. Neog. Shells from Kozuké and other Prov., p. 230.

A single right valve of a very young individual.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino. Pliocene of Yagurasawa (Sagami).

Living.—Northern, Central and Western Japan. Philippines. Indian Ocean.

CM23207

95. Meretrix (Callista) chinensis, (Chemnitz).

Meretrix (Callista) chinensis. Yokoyama, Foss. Miura Penin., p. 120, pl. VIII, figs. 9, 10. Foss. Up. Musash., p. 146, pl. XI, fig. 5. Moll. Rem. Low. Part Jô-Ban Coalf., p. 14, pl. II, figs. 7, 8. Moll. Tert. Basin Chichibu, p. 119. Moll. Foss. Mino, p. 222.

Several examples.

Fossil occurrence.—Upper horizon, Sawané. Musashinos. Pliocenes of Chichibu and Mino. Iwaki Beds.

Living.—Northern, Central and Western Japan. China Sea. Australia.

CM23208

96. Venus (Mercenaria) stimpsoni, Gould.

Venus (Mercenaria) stimpsoni. Yokoyama, Foss. Up. Musash., p. 148, pl. XI, figs. 11, 12. Neog. Shells Izumo, p. 6, pl. I, fig. 5. Moll. Rem. Upperm. Part Jô-Ban Coal-Field, p. 21. Moll. Rem. Mid. Part, p. 18. Tert. Moll. Shinano a. Echigo. p. 13. Moll. Tert. Basin Chichibu, p. 119.

A young individual.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino. Shirado Beds. Minato Beds. Pliocenes of Izumo, Shinano and Chichibu.

Living.—Northern, Central and Western Japan.

CM23209

97. Venus jedoensis, Lischke.

Venus jedoensis. Yokoyama, Foss. Miura Penin., p. 120, pl. VIII, figs. 9, 10. Foss. Up. Musash., p. 148. Moll. Coral Bed Awa, p. 43, pl. II, fig. 20. Moll. Rem. Upperm. Part Jô-Ban Coalf., p. 22.

Four isolated valves of immature individuals.

Fossil occurrence.—Upper horizon, Sawané. Musashinos. Pleistocene of Awa. Shirado Beds.

Living.—Central and Western Japan.

Family Cardiidae.

CM 23210

98. Cardium californiense, DESHAYES.

Cardium californiense. Yokoyama, Foss. Miura Penin., p. 127, pl. IX, fig. 10. Foss. Up. Musash., p. 154. Moll. Rem. Upperm. Part Jō-Ban Coalf., p. 22. Moll. Tert. Basin Chichibu, p. 120.

Rather frequent.

Fossil occurrence.—Upper horizon, Sawané. Musashinos. Shirado Beds. Pliocene of Chichibu.

Living.—Northern, Central, and Western Japan. Bering Sea. California.

CM 23211

99. Cardium muticum, REEVE.

Cardium muticum. Yokoyama, Foss. Miura Penin., p. 128, pl. IX, fig. 11. Foss. Up. Musashino, p. 154, pl. XII, fig. 7. Moll. Tert. Basin Chichibu, p. 121. Moll. Rem. Upperm. Part Jô-Ban Coalf., p. 28.

Two small isolated valves.

Fossil occurrence.—Lower horizon, Sawané. Musashinos. Pliocene of Chichibu, etc.

Living.—Northern, Central and Western Japan. Philippines. East Indies.

CM 23212-17
CM 23213-18

100. Cardium shinjiense, YOKOYAMA.

Pl. XXXIV, Figs. 17, 18.

Cardium shinjiense. Yokoyama, Foss. Moll. Neog. Izumo, p. 7, pl. II, fig. 6. Moll. Rem. Lowest Part Jô-Ban Coalf., p. 16, pl. III, figs. 13-15. Moll. Rem. Up. Part, p. 23. Moll. Rem. Mid. Part, p. 18, pl. III, figs. 10, 11. Tert. Moll. Shinano a. Echigo, p. 13. Moll. Foss. Tert. Mino, p. 223.

This shell hitherto described only from external appearance is present in two perfect valves, a right and a left, which also show internal characters.

The shell is thin, convex, suborbicular, inequilateral, anteriorly rounded and posteriorly subtruncate. The radiating ribs number about thirty four, mostly straight except on the anterior side where they are somewhat curved, with their concave side towards the front, more or less roof-like with broad v-shaped valleys crossed by a few periodic constrictions. Beaks small, not very prominent. Main teeth two, small, thick ; laterals one on each side, elongated, thin. Muscular impressions distinct, anterior ovate, posterior broadly fusiform. Inner margin crenate.

The left valve measures 38.7 millim. in height, 39 millim. in length and 12 millim. in depth; while the right which belongs to a younger individual measures 30 millim. in length, 30.2 millim. in length and 10.5 millim. in depth. Both valves have the beak portion decorticated.

Fossil occurrence.—Upper horizon, Sawané. Shirado Beds. Minato Beds. Pliocenes of Izumo, Shinano and Mino. Asagai and Iwaki Beds.

CM23214-16
CM23215

101. Papyridea (Fulvia) nipponica, YOKOYAMA.

Pl. XXXIV. Fig. 16.

Papyridea nipponica. Yokoyama, Moll. Rem. Lowest Part Jô-Ban Coal-Field, p. 17, pl. III, figs. 3, 4. Tert. Moll. Shinano. a. Echigo, p. 14.

A fine perfect left valve and two small fragmentary right valves were obtained, which though thin, are quite firm and show internal characters not seen in the specimens hitherto described.

The left valve above mentioned is 52.6 millim. long, 37.4 millim. high, and 10.5 millim. deep. It is ornamented with about fifty radiating ribs which are closest and finest at the anterior end and most distant and coarsest a little before the posterior beyond which they are again somewhat closer. The shape of these ribs is generally roof-like with the posterior side steeper than the anterior, while near the anterior end they are more or less rounded with narrow valleys between. The folds caused by the ribs outside are also distinct on the inner side. The beak is small with two small main teeth, the posterior being longer and much thinner than the anterior. The lateral, only one on the posterior side, long and thin. In the right valve, the anterior main teeth are thinner than the posterior.

Fossil occurrence.—Upper horizon, Sawané. Pliocene of Shinano. Asagai Beds.

CM23216-2
(R) CM23217-3
CM23218

Family Leptonidae.

102. Thyasira bisecta, (CONRAD).

Pl. XXXV. Figs. 2, 3.

Thyasira bisecta. Yabé and Nomura, Notes on the Recent and Tertiary Species of Thyasira in Japan, (Sci. Rep. Tohoku Imp. Univ., Geol., Vol. VII, No. 4, 1925) p. 2.

Yabé and Nomura after studying a great number of fossil specimens of Thyasira bisecta Conr. from various parts of Japan came to the conclusion that most of the fossil forms hitherto called simply Thyasira

bisecta belong to a special variety for which they proposed the name of *nipponica*. The chief difference lies in the umbonal angle which in this variety is either a right angle or somewhat greater, while in the typical one it is less than a right angle (70° to 80°). The other differences are in the degree of convexity of the shell, the character of the lunular field etc.

According to the above view, most of the specimens from Sado belong to the typical form, although some decidedly show the characters of the variety. Out of more than ten valves in which the umbonal angle is more or less distinct, there are two in which it is decidedly obtuse. These two are also more convex as Yabé and Nomura assert.

Fossil occurrence.—Upper horizon, Sawané. The variety *nipponica* is widely distributed in the Miocene and Pliocene of Japan, while the typical species has hitherto been found only in layers supposed to be older than Pliocene.

Living.—The type lives in North Pacific.

CM 23219-K 14

103. Thyasira ozawai, n. sp.

Pl. XXXVI. Fig. 4.

A single left valve 16.4 millim. high, 15 millim. long, 5 millim deep.

The shell is thin, convex, roundly ovate, broadest a little below the middle, slightly higher than long, and somewhat inequilateral, rounded in front and truncate behind. The antero-dorsal and postero-dorsal borders are both steeply sloping, the former almost straight, while the latter is convex. The ventral border is broadly arched. The surface is smooth and evenly convex, only it is interrupted by a deep posterior fold running from the beak to the posterior side making that side somewhat concave. A second smaller fold seems to be present behind the main one, although it is not quite distinct, owing to this part of the shell being broken. A heart-shaped lunula is present, marked by a shallow depression. Hinge edentulous, only a ligamental groove running parallel to the cardinal margin behind the beak.

This shell is closely akin to *Thyasira sinuosa* (Donovan) of the Atlantic, as depicted by Wood (Crag Mollusca, Bivalves, pl. XII, fig. 20) as well as by Forbes and Hanley (British Mollusca, vol. II, pl. 35, fig. 4) which is, however, smaller, thinner, angulate in front and devoid of lunula.

Fossil occurrence.—Upper horizon, Sawané.

OM23220

Family Diplodontidae.

104. Diplodonta semiaspera, (Philippi).

Diplodonta semiaspera. Yokoyama, Foss. Miura Penin., p. 160, pl. XIV, fig. 2. Foss. Up. Musash., p. 130, pl. X, figs. 2, 3. Foss. Shells Saishu, p. 5. Moll. Rem. Up. Part Jô-Ban Coalf., p. 23.

Several specimens, some attaining the length of 43.5 millim. and in general flatter than those of the Musashino Formation, the depth falling below one-third the length.

Fossil occurrence.—Kaidaté. Musashinos. Shirado Beds.

Living.—Central and Western Japan. West Indies.

OM23221

Family Lucinidae.

105. Lucina pisidium, Dunker.

Lucina pisidium. Yokoyama, Foss. Miura Penin., p. 132, pl. X, fig. 6. Foss. Up. Musashino, p. 160. Moll. Coral Bed. Awa, p. 49.

Rather rare.

Fossil occurrence.—Upper horizon, Sawané. Musashinos. Pleistocene of Awa.

Living.—Northern to Southern Japan. New South Wales.

OM23222

106. Lucina (Phacoides) borealis, (Linné).

Lucina borealis. Yokoyama, Foss. Miura Penin., p. 133, pl. X, fig. 7. Foss. Up. Musash., p. 160. Moll. Rem. Up. Part Jô-Ban Coalf., p. 24, pl. V, figs. 5-8. Moll. Rem. Mid. Part, p. 7, pl. I, fig. 2 (?), p. 18, pl. III, figs. 1, 2. Tert. Moll. Shinano a. Echigo, p. 14. Tert. Foss. Kii, p. 57, pl. VI, fig. 11. Moll, Foss. Tert. Mino, p. Moll. Tert. Basin Chichibu, p. 121. Tert. Moll. Shiobara, p. 134. Neog. Shells Kozuké a. Other Prov., pp. 229, 230.

Very frequent.

Fossil occurrence.—Upper horizon, Sawané. Musashino. Shirado Beds. Minato Beds. Mizunoya Beds. Pliocenes of Kii, Shinano, Sagami, Chichibu, Mino and Kozuké. Miocene (?) of Shimonita (Kozuké).

Living.—Central Japan. Atlantic.

Family Chamidae.

CM23283

107. Chama semipurpurata, (LISCHKE).

Chama semipurpurata. Yokoyama, Foss. Miura Penin., p. 136, pl. X, figs. 13, 14. Foss. Up. Musash., p. 161. Moll. Coral Bed Awa, p. 50.

A single worn valve of an immature individual.

Fossil occurrence.—Kaidaté. Musashinos. Pleistocene of Awa.

Living.—Central, Western and Southern Japan.

Family Carditidae.

CM23224

108. Cardita cumingiana, DUNKER.

Cardita cumingiana. Yokoyama, Foss. Miura Penin., p. 137, pl. X, fig. 16, pl. XI, fig. 1. Moll. Rem. Mid. Part Jô-Ban Coalf., p. 19.

Only two isolated valves.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino. Minato Beds.

Living.—Central and Western Japan.

CM23225

109. Venericardia cipangoana, YOKOYAMA.

CM27114

Venericardia cipangoana. Yokoyama, Foss. Miura Penin., p. 137, pl. X, fig. 2. Foss. Up. Musash., p. 162, pl. XIII, fig. 4. Foss. Shells Saishu, p. 5.

Very rare.

Fossil occurrence.—Upper horizon, Sawané. Kaidaté. Musashinos. Upper Musashino (?) of Saishu. Pliocene (?) of the Hokkaido.

Living.—Central and Western Japan.

CM23226

110. Venericardia ferruginea, (A. ADAMS).

CM23227

CM23228

Venericardia ferruginea. Yokoyama, Foss. Miura Penin., p. 129, pl. XI, figs. 3, 4. Foss. Up. Musash., p. 162. Foss. Shells Saishu, p. 5. Moll. Rem. Low. Part Jô-Ban Coalf., p. 19, pl. III, figs. 8, 9. Moll. Rem. Up. Part, p. 24, pl. V, fig. 4. Moll. Rem. Mid. Part, p. 19. Moll. Tert. Basin Chichibu, p. 122.

Many small examples of an orbicular shape, resembling those from the Island of Saishu which I called var. *orbicularis*. But I am now convinced that it is simply a variation.

Fossil occurrence.—Upper horizon, Sawané. Kaidaté. Musashinos. Upper Musashino (?) of Saishu. Shirado Beds. Minato Beds. Iwaki Beds.

Living.—Northern Japan.

CM23229-3
CM23230

111. Venericardia nakamurai, YOKOYAMA.

Pl. XXXVI. Fig. 3.

Venericardia nakamurai, Yokoyama, Foss. Shells Saishu, p. 5, pl. I, fig. 9.

This species first founded by me on a single right valve from the island of Quelpart is present in many specimens.

The shell is small, thick, rather compressed, subequilateral, ovately triangular, somewhat higher than long, rounded both in front and behind, though somewhat more sharply in the former than in the latter, and ornamented with ten to twelve, broad, flatly rounded radiating ribs separated by very narrow, often linear valleys. Beaks pointed and curved forward. Main teeth two, the anterior short and the posterior elongated; the anterior lateral of the right valve is small and indistinct, while the posterior lateral of the left valve is elongated and distinct. Inner margin crenate. Height 4.6 millim. Length 4.3 millim. Thickness 3 millim.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino (?) of Saishu (Quelpart).

Family Astartidae.

CM23231-2
CM23232-3
CM23233
CM23234

112. Astarte borealis, (CHEMNITZ).

Pl. XXXVII. Fig. 2, 3.

Astarte borealis. Yokoyama, Foss. Up. Musash., p. 163, pl. X, fig. 11.

This northern shell hitherto found only once in the Upper Musashino as a single isolated valve is now present in numerous specimens both adult and young. In shape the Japanese specimens are somewhat higher than those of Europe, resembling what Wood figures as *Astarte obliquata* Sow. in his "Crag Mollusca" (Bivalves, p. 189, pl. XVI, fig. 4) in which, however, the inner margin is crenulate.

Fossil occurrence.—Upper horizon, Sawané and Kaidaté. Upper Musashino.

Living.—Northern Japan. Bering Sea. Arctic seas.

CM23235-9
CM23236-10
CM23237
CM23238

113. Astarte sulcata, (DACOSTA).

Pl. XXXVII. Figs. 9, 10.

Astarte sulcata. Wood, Crag. Moll. Biv., p. 182, pl. XVI, fig. 5.
Astarte scotica. Middendorff, Malacol. Ross., III, p. 44, pl. XVI, figs. 10-12, pl. XVII, figs. 1, 2.
Astarte danmoniensis. Id., p. 44, pl. XVII, fig. 3.

This species, in shape closely resembling the preceding, is concentrically coarsely sulcate on the surface, on which account it is generally regarded as a distinct species. The specimens from Kaidaté are much more coarsely sulcated than those of Sawané. The inner margin in the European specimens is either smooth or crenulate, while in ours it is all smooth, excepting in a single young valve which has it crenulate. Quite common like the preceding species.

Fossil occurrence.—Upper horizon, Sawané. Kaidaté. English Crag.

Living.—Britain. Northern seas.

CM23239

114. Astarte hakodatensis, YOKOYAMA.

Astarte hakodatensis. Yokoyama, Foss. Miura Penin., p. 140, pl. XI, figs. 5, 6. Foss. Up. Musash., p. 164.

A single right valve.

Fossil occurrence.—Lower horizon, Sawané. Musashino.

Living.—Northern Japan.

Family Pleurophoridae.

CM23240
CM23241

115. Trapezium nipponicum, YOKOYAMA.

Trapezium nipponicum. Yokoyama, Foss. Up. Musash., p. 167, pl. XIII, fig. 17.

A few ill-preserved specimens.

Fossil occurrence.—Lower horizon, Sawané. Kaidaté? Upper Musashino.

Living.—Central and Western Japan.

Family Myochamidae.

CM23242
CM23243

116. Myodora fluctuosa, GOULD.

Myodora fluctuosa. Yokoyama, Foss. Up. Musash., p. 170, pl. XIV, figs. 6, 7. Foss. Shells Saishu, p. 6.

Frequent.

Fossil occurrence.—Upper horizon, Sawané. Kaidaté. Upper Musashino.

Living.—Western Japan.

CM23244

Family Thraciidae.

117. Thracia transmontana, Yokoyama.

Thracia transmontana. Yokoyama, Foss. Up. Musashino, p. 172, pl. XIV, figs. 13, 14.

Several specimens.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

Living.—Central Japan.

CM23245

118. Thracia sematana, Yokoyama.

Thracia sematana. Yokoyama, Foss. Up. Musash., p. 173, pl. XIV, figs. 17, 18.

Rare.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino.

Family Mytilidae.

CM23246

119. Mytilus hirsutus, Lamarck.

Mytilus hirsutus. Yokoyama, Foss. Miura Penin., p. 144, pl. XI, fig. 16. Moll. Coral Bed Awa, p. 52.

Very rare.

Fossil occurrence.—Upper horizon, Sawané. Upper Musahino. Pleistocene of Awa.

Living.—Central and Western Japan. China Sea.

CM23247

120. Modiola modiolus, Linné.

Modiola modiolus. Yokoyama, Foss. Miura Penin., p. 145, pl. X, fig. 21. Foss. Up. Musash., p. 175. Foss. Moll. Neog. Izumo, p. 7. Moll. Rem. Low. Part Jô Ban Coalf., p. 20, pl. IV, figs. 7, 8. Tert. Moll. Shinano and Echigo, p. 15, pl. II, fig 2.

A fragment of a right valve.

Fossil occurrence.—Upper horizon, Sawané. Musashinos. Pliocenes of Shinano and Izumo. Iwaki Beds.

Living.—Northern, Central and Western Japan. North Pacific. North Atlantic.

CM23248

121. Modiola barbata, (Linné).

Modiola barbata. Yokoyama, Foss. Up. Musash., p. 174, pl. XIV, fig. 19. Moll. Coral Bed Awa, p. 53. Tert. Moll. Mino, p. 245.

Only three isolated valves.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino. Pleistocene of Awa. Pliocene of Mino.

Living.—Northern, Central and Southern Japan. Atlantic.

122. Crenella delicatula, n. sp.

CM23249-7 H

Pl. XXXVI. Fig. 7.

Shell thin, convex, very inequilateral (the beaks being almost terminal), transversely oval with the sharper end in front. Ventral border straight. Surface with about eight fine radiating riblets, coarser near the anterior end, flatly rounded, separated, by much narrower interspaces. Lines of growth looking like striae between the riblets. Inner margin finely crenulate all round, being finer and indistinct behind the beak.

A single right valve, 14.8 millim. long, 10 millim. high and 3.7 millim. deep.

Fossil occurrence.—Upper horizon, Sawané.

123. Crenella parvula, n. sp.

CM23250-8 S
CM23251-5

Pl. XXXVI. Fig. 8.

Shell small, thin, convex, somewhat longer than high, roundish four sided, with the dorsal and ventral borders subparallel, but with the posterior obliquely descending, making a sharply rounded angle with the ventral. Inner border crenulate all round, with a few coarse crenular teeth below the beak. Surface with numerous, fine, impressed, radiating lines.

Three isolated valves. One of the two right valves measures 4.7 millim. in length, 3.5 millim. in height and 1.5 millim. in depth, while the left measures 4.2 millim. in length, 3.2 millim. in height and 1.4 millim. in depth.

Fossil occurrence.—Upper horizon, Sawané.

Family Anomiidae.

124. Placunanomia macrochisma, Deshayes.

CM23252-7
CM23253-8
CM23254
CM23255

Pl. XXXV. Figs. 7, 8.

Placunanomia macrochisma. Pilsbry. Cat. Mar. Moll. Japan, p. 142. Iwakawa, Cat. Jap. Moll. Nat. Hist. Departm. Tokyo, Imp. Museum, p. 238.

Anomia macrochisma. Deshayes, Revue Zool., 1839, p. 359. Middendorff, Malak. Ross., III, p. 6. Sibirische Reise, Mollusken, p. 242, pl. XIX, figs. 1-5. Philippi, Abbild., III, p. 132, pl. I, fig. 4.

Several examples. In its possession of coarse and irregular radiating ribs, this species is much like what I had already described from the Pliocene of Shinano under the name of *Anomia densicostulata* (Tert. Moll. Shinano a. Echigo, p. 16, pl. II, fig. 3) which may possibly be also a *Placunanomia*, though the latter is longer than high, instead of being higher than long as in the former.

Fossil occurrence.—Upper horizon, Sawané. Kaidaté.

Living.—Northern, Central and Western Japan. Kamchatka. Bering Sea.

Family Limidae.

CM23256
CM23257

125. Lima japonica, (A. Adams).

Lima japonica. Yokoyama, Foss. Miura Penin., p. 149, pl. XII, fig. 9.

A few examples.

Fossil occurrence.—Upper horizon, Sawané. Kaidaté. Lower Musashino.

Living.—Northern and Central Japan. New Zealand.

CM23258

126. Lima vulgatula, Yokoyama.

Lima vulgatula. Yokoyama, Foss. Up. Musash., p. 179, pl. XVII, figs. 18, 19. Moll. Rem. Up. Part Jô-Ban Coalf., p. 26.

A few fragments.

Fossil occurrence.—Upper horizon, Sawané. Upper Musashino. Shirado Beds.

CM23259

Family Spondylidae.

127. Spondylus cruentus, Lischke.

Spondylus cruentus. Yokoyama, Foss. Upper Musash., p. 179, pl. XIV, fig. 24. Moll. Coral Bed Awa, p. 55, pl. V, fig. 13.

A single flatter valve (left).

Fossil occurrence.—Kaidaté. Upper Musashino. Pleistocene of Awa.

Living.—Central and Western Japan.

Family Pectinidae.

CM23260
CM23261

128. Pecten laetus, GOULD.

Pecten laetus. Yokoyama, Foss. Miura Penin., p. 152, pl. XIV, figs. 1, 2. Foss. Up. Musash., p. 180, pl. XIV, fig. 20. Moll. Coral Bed Awa, p. 56. Moll. Rem. Up. Part, p. 26. Moll. Rem. Mid. Part. p. 19, Tert. Moll. Shinano a. Echigo, p. 16. Foss. Shells Saishu, p. 7.

Not rare.

Fossil occurrence.—Upper horizon, Sawané. Kaidaté. Pleistocene of Awa, Musashino. Shirado Beds. Minato Beds. Pliocene of Shinano. Upper Musashino (?) of Saishu.

Living.—Northern, Central and Western Japan.

CM23262
CM23263

129. Pecten yessoensis, TAY.

Pecten yessoensis. Foss. Miura Penin., p. 159, pl. XIII, figs. 14, 15. Moll. Rem. Up. Part Jô-Ban Coalf., p. 27. Tert. Moll. Shinano a. Echigo, p. 17, pl. IV, fig. 4. Tert. Moll. Shiobara, p. 135. Tert. Moll. Mino, p. 225.

Very frequent.

Fossil occurrence.—Upper horizon, Sawané. Kaidaté. Lower Musashino. Shirado Beds. Pliocenes of Shinano. Shiobara and Mino.

Living.—Northern Japan.

CM23264-5
CM23265-6
CM23266
CM23267
CM23268

130. Pecten swiftii, BERNARD.

Pl. XXXVII. Figs. 5, 6.

Pecten swiftii. Yokoyama, Foss. Miura Penin., pl. 154, pl. XIV, fig. 11. Moll. Rem. Up. Part Jô-Ban Coalf., p. 27, pl. II, fig. 7. Moll. Tert. Basin Chichibu, p. 123, pl. XV, fig. 2. Tert. Moll. Shiobara, p. 135.

Pecten tigerrinus. Yokoyama, Foss. Miura Penin., p. 155, pl. XIV, figs. 5, 6.

Quite common. There is a great deal of variation in the form of the ribs which in some specimens are high and prominent, while in others they are low and flattened. Their number, however, is tolerably constant, the main ribs being generally four in the right valve and five in the left. The outline is very characteristic, and the height is invariably greater than the length.

The two young valves which I had taken for those of *Pecten tigerrinus* Müller in my work on the fossils of the Miura Peninsula are, as I am now fully convinced, the left valves of *Pecten swiftii*.

Fossil occurrence.—Upper and lower horizons, Sawané. Kaidaté. Lower Musashino. Shirado Beds. Pliocenes of Chichibu and Shiobara.

Living.—Northern Japan. Sea of Okhotsk. Alaska.

S CM 23269-1
S 23270-2
S 23271-3
S 23272-4
S 23273-5
S 23274-6
S 23275-7
S 23276-8
S 23277 S
23278 S

131. Pecten heteroglyptus, n. sp.

Pl. XXXIII. Figs. 1-8.

Shell medium-sized, of moderate thickness, compressed, right valve more so than left, inequivalve, subcircular, somewhat higher than long, radiately unequally ribbed. Ribs in right valve many, main ribs several, not constant in number, also unequal among themselves, flattish, either single or bipartite, the two parts being either equal or unequal; intercalaries also unequal, either flattish or rounded, with valleys usually very narrow, mostly fine grooves. Ribs in left valve also numerous and unequal, the main ribs, however, being more prominent, either single or bipartite or tripartite near the ventral border. In both valves several concentric constrictions are present, and also now and then a mesh-like structure in valleys as well as on flanks of ribs. The inner side of both valves shows more or less distinctly the traces of external ribs especially near the ventral border. Ears unequal, radiately ribbed, with a few constrictions, the anterior in the right valve and the posterior in the left being larger and longer. Byssal notch deep. The largest right valve is 58.5 millim. high, 54 millim. long and 9.2 millim. deep, while the largest left is 58.5 millim. high, 54.5 millim. long and 11.5 millim. deep. There are some variations in these dimensions, the deepest right valve being 56.5 millim. high, 51.5 millim. long and 10 millim. deep.

A *Pecten* which I described under the name of *Pecten cosibensis* from the Lower Musashino of Koshiba (Foss: Miura Penin., p. 156, pl. XIII, figs. 7, 8) is, as I am now convinced, only one of the many forms of this species with the three main valleys of the right valve much deeper and the ribs between more elevated. The name *cosibensis* I now propose to confer on this variety which also occurs at Sawané and Kaidaté, although very rarely. I may here mention that the right valve of Koshiba (fig. 7) is more convex, when compared with those of Sado. But this, I believe, is only an abnormity, as the fragment which I then took for a left valve (fig. 8) is really a right one and flatter, the degree of convexity being like that seen in the Sado specimens.

Fossil occurrence.—Kaidaté (the type is very frequent) and upper horizon, Sawané (both the type and the variety are rare).

132. Pecten intuscostatus, YOKOYAMA.

CM23279
CM23280

Pecten intuscostatus. Yokoyama, Foss. Miura Penin., p. 156, pl. XIII, figs. 9, 10. Foss. Up. Musash., p. 182.

Three right valves, possessing a greater number of internal ribs than the form hitherto described, numbering twenty six. Therfore I separate this as a variety under the name of var. *multicostata.*

Fossil occurrence.—Upper and lower horizons, Sawané. Musashinos.

CM23281-1 S
CM23282-2 S
23283 S
23284 S
23285 S

133. Pecten plebejus, n. sp.

Pl. XXXVI. Figs. 1, 2.

Shell large, thin, compressed, orbicular, inequivalve. Right valve somewhat convex, ornamented with numerous, very low, broad, flattish often unequal, radiating ribs with interspaces either equal or narrower; left valve flatter than right, with very little convexity, ornamented with small, obtuse, distant, radiating riblets with very wide intervals, the number varying from a little over ten to more than twenty and usually with a finer intercalary between; the surface is often covered with a fine net-like ornament. Ears somewhat unequal, the anterior in both valves being somewhat larger; a shallow byssal notch is present below the anterior ear of the right valve. Very frequent at Kaidaté.

The largest right valve measures about 130 millim. in height and length, and is 15 millim. deep. Another right valve somewhat smaller in size measures about 10 millim. in height and length, and 11 millim. in depth. The largest left valve measures about 113 millim. in height and length, and about 6.5 millim. in depth, while another, a little more convex measures about 108 millim. in height and length, and 9 millim. in depth.

Fossil occurrence.—Kaidaté (frequent). Upper and lower horizons, Sawané.

134. Pecten foedus n. sp.

CM23286-1-4

Pl. XXXVII. Fig. 1.

Only a single left valve which, however, is characteristic enough to be created into a new species.

The shell is moderately large, thick, fairly convex, orbicular, slightly higher than long, nearly equilateral, ornamented with thirteen strong, straight, elevated, rounded, unequally coarse-scaly, radiating ribs separated by deep valleys of greater breadth. Incremental lines fine,

dense, somewhat wavy and most distinct in valleys. Ears large, unequal, the anterior larger, with a few coarse-scaly, strong, radiating riblets. Inner surface with a large oval muscular impression and traces of external ribs. Ventral border coarsely crenate, caused by the ribs. Height 93. Length 87 millim. Depth 20 millim.

Fossil occurrence.—Kaidaté.

CM23287
CM23288
& CM23289

Family Arcidae.

135. Arca kobeltiana, Pilsbry.

Arca kobeltiana. Yokoyama, Foss. Miura Penin., p. 163, pl. XVII, fig. 4. Foss. Up. Musash., p. 185. Moll. Coral Bed Awa, p. 59. Moll. Rem, Up. Part Jô-Ban Coalf., p. 28. Tert. Moll. Mino, p. 225.

Rather rare.

Fossil occurrence.—Upper and lower horizons, Sawané. Kaidaté. Musashinos. Shirado Beds. Pleistocene of Awa. Pliocene of Mino.

Living.—Northern and Central Japan.

Family Arcidae.

CM23290

136. Arca (Barbatia) stearnsii, Pilsbry.

Arca stearnsii. Yokoyama, Foss. Miura Penin, p. 165, pl. XVI, fig. 9. Moll. Coral Bed Awa, p. 59, pl. III, figs. 5, 6.

A single right valve of an immature individual.

Fossil occurrence.—Upper horizon, Sawané. Lower Musashino. Pleistocene of Awa.

Living.—Central and Western Japan.

CM23291

137. Arca (Barbatia) symmetrica, Reeve.

Arca (Barbatia) symmetrica. Yokoyama, Foss. Miura Penin., p. 166, pl. XVII, figs. 7, 8. Foss. Up. Musash., p. 186. Moll. Coral Bed Awa, p. 59.

Only a single specimen.

Fossil occurrence.—Upper horizon, Sawané. Musashinos. Pleistocene of Awa.

Living.—Central and Western Japan. Philippines. Indian Ocean.

CM23292

138. Pectunculus yessoensis, SOWERBY.

CM23293

Pectunculus yessoensis. Yokoyama, Foss. Miura Penin., pl. 168, pl. XVIII, figs, 1, 2, Foss. Up. Musash., p. 189, pl. XVI, figs. 6, 7. Tert. Moll. Shinano a. Echigo, p. 20. Tert. Moll. Shiobara, p. 136. Tert. Moll. Mino, p. 225. Neog. Shells Kozuké a. Other Prov., p. 230.

Quite frequent at both localities below named.

Fossil occurrence.—Upper horizon, Sawané. Kaidaté. Musashinos. Pliocenes of Shinano, Shiobara and Sagami.

Living.—Northern Japan.

CM23294
CM23295

139. Pectunculus nipponicus, YOKOYAMA.

Pectunculus nipponicus. Yokoyama, Foss. Miura Penin., p. 168, pl. XVIII, figs. 3-5.

Numerous at Kaidaté.

Fossil occurrence.—Kaidaté. Upper horizon, Sawané. Lower Musashino.

Living.—Central Japan.

CM23296
CM23297

Family Parallelodontidae.

140. Parallelodon obliquatus, YOKOYAMA.

Parallelodon obliquatus. Yokoyama, Foss. Miura Penin., p. 167, pl. XVII, figs. 10, 11. Foss. Up. Musash., p. 191. Moll. Coral Bed Awa, p. 62. Moll. Rem. Up. Part, Jôban Coalf., p. 29. Moll. Rem. Mid. Part, p. 20. Moll. Rem. Tert. Mino, p. 225.

A few examples.

Fossil occurrence.—Upper horizon, Sawané. Kaidaté. Musashinos. Pleistocene of Awa. Pliocene of Mino. Shirado Beds. Minato Beds.

Living.—Northern and Central Japan.

CM23298
CM23299
CM23300

Family Limopsidae.

141. Limopsis tokaiensis, YOKOYAMA.

Limopsis tokaiensis. Yokoyama, Foss. Miura Penin., p. XVIII, figs. 14-16.

A few immature examples.

Fossil occurrence.—Upper and lower horizons, Sawané. Kaidaté. Lower Musashino.

Living.—Central Japan.

CM23301

142. Limopsis crenata, A. Adams.

Limopsis crenata. Yokoyama. Foss. Miura Penin., p. 173, pl. XIII, figs. 17, 18. Foss. Up. Musash., p. 193.

A single isolated left valve.

Fossil occurrence.—Upper horizon, Sawané. Musashinos.

Living.—Northern, Central and Western Japan.

CM23302

143. Limopsis azumana, Yokoyama.

Limopsis azumana. Yokoyama, Foss. Miura Penin., p. 178, pl. XVIII, figs. 19-21. Foss. Up. Musash., 193. Moll. Rem. Up. Part Jô-Ban Coalf., p. 29.

Several examples much worn, with radiating ribs mostly obliterated.

Fossil occurrence.—Upper horizon, Sawané. Musashinos. Shirado Beds.

CM23303-6-5, 23304-5

Family Ledidae.

144. Leda sadoensis, n. sp.

Pl. XXXVI. Fig. 6.

Shell small, convex, transversely elongated, sharply rounded in front, rostrate; narrowed and truncate behind. Antero-dorsal border somewhat convex, postero-dorsal slightly concave, ventral broadly arched. From the beak two ridges run to the posterior border, the one to its lower corner and the other to its upper, embracing a long field between. Behind these ridges, there is a long lanceolete area, somewhat elevated in a longitudinal direction between the posterior ridge and the shell-border. There is also a shallow depression running from the beak to the antero-ventral corner. Surface concentrically finely furrowed, the furrows continuing also into the field between the posterior ridges. On the inner side, a short longitudinal ridge is found at the posterior end, occupying its middle. Teeth about sixteen behind the beak and somewhat fewer in front of it.

Several isolated valves. The largest right valve is 11.7 millim. long, 6 millim. high, and 2.4 millim. deep, while the largest left is 10.1 millim. long, 5 millim. high and 2.1 millim. deep.

Fossil occurrence.—Upper horizon, Sawané.

145. Yoldia scapha, YOKOYAMA.

CM 23305-6-

Pl. XXXV. Fig. 6.

Yoldia scapha. Yokoyama, Tert. Moll. Oil-Fields Embets a. Etaibets, p. 247, pl. XXXI, figs. 7-11.

A single left valve of a young individual which, however, shows the shell-characters quite well, far better than those of Etaibets on which the species was founded.

The shell is moderately thick, inflated, transversely subquadrate, somewhat inequilatreal, sharply rounded in front, truncate behind, with antero-dorsal border nearly straight, postero-dorsal slightly excavated, ventral very broadly arched and postero-ventral corner rounded. Surface smooth, only with lines of growth. A very flat indistinct edge runs from the beak to the postero-ventral corner. Area lanceolate, distinctly bounded by edges. Teeth about twenty-five in front and about sixteen behind. Ligamental pit transversely oval, with surface finely striated in a vertical direction. Pallial sinus large, deep, rounded, reaching to the median line of the shell. Height 13 millim. Length 21 millim. Depth 5.4 millim.

The shell is a little more inflated and the anterior end sharper than those previously described. But it must be mentioned that the present specimen belongs to a young individual.

Why the area which is here distinct was not indicated even in the best specimen of Etaibets is probably because the latter was much worn.

Fossil occurrence.—Lower horizon, Sawané. Pliocene of Etaibets.

Class BRACHIOPODA.

Family Terebratulidae.

CB 23306

146. Terebratella coreanica, ADAMS ET REEVE.

Terebratella coreanica. Yokoyama, Foss. Miura Penin., p. 184, pl. XIX, figs. 25, 28. Foss. Up. Musash., p. 198. Foss. Shells Saishu, p. 8. Hayasaka, Tert. Brach. Japan, p. 149, pl. VII, fig. 25, VIII, fig. 1.

A few isolated valves.

Fossil occurrence.—Upper horizon, Sawané. Musashinos. Upper Musashino ? of Saishu. Pliocene of Miyata, Hitachi (Hayasaka).

Living.—Northern, Central and Western Japan.

CB 23307-5
CB 23308

147. Terebratella frontalis, (Middendorff).

Pl. XXXVI. Fig. 5.

Terebratella frontalis. Davidson, Rec. Brach., p. 86, pl. XV, figs. 1-8a.
Terebratula frontalis. Middendorff, Sibir. Reise, Mollusken, p. 241, pl. XVIII, figs. 9-14.

This is a species hitherto not found in Japan as a fossil. The specimens, though not rare, are all small, the height being not much above 10 millim. Otherwise they agree in general with the descriptions and figures given by the above authors.

Fossil occurrence.—Upper horizon, Sawané.

Living.—Northern Japan. Japan Sea. Okhotsk Sea. Aleutian Islands.

CB 23309-4

148. Terebratalia gouldii, Dall.

Pl. XXXVII. Fig. 4.

Terebratalia gouldii. Pilsbry, Cat, Mar. Moll. Japan, p. 153, pl. XI, figs, 7, 8. Hayasaka, Tert. Brach. Japan, p. 150, pl. VIII, fig. 5.

A single ventral valve of an immature individual which, however, is readily recognized by the coarse radiating ribs.

Fossil occurrence.—Upper horizon, Sawané. Tertiary (Pliocene ?) of Sabusawa, Rikuzen (Hayasaka).

Living.—Northern and Central Japan.

CM 23310
CM 23311

Family Rhynchonellidae.

149. Hemithyris psittacea, (Chemnitz).
var. woodwardi (Adams).

Rhynchonella psittacea. Yokoyama, Foss. Up. Musash., p. 141, pl. VII, figs. 1, 2.
Hemithyris psittacea. Hayasaka, Tert. Brach. Japan, p. 141, pl. VII, figs. 1, 2.

Hayasaka unites the variety with the typical species, which may be correct, as the variation in Brachiopods is a well known fact. But as the materials at hand are not enough to confirm his view, I leave the name of the Japanese shell just as has been used by older authors.

Fossil occurrence.—Upper and lower horizons, Sawané. Upper Musashino. Pliocene of Miyata, Hitachi.

Living.—Northern and Western Japan.

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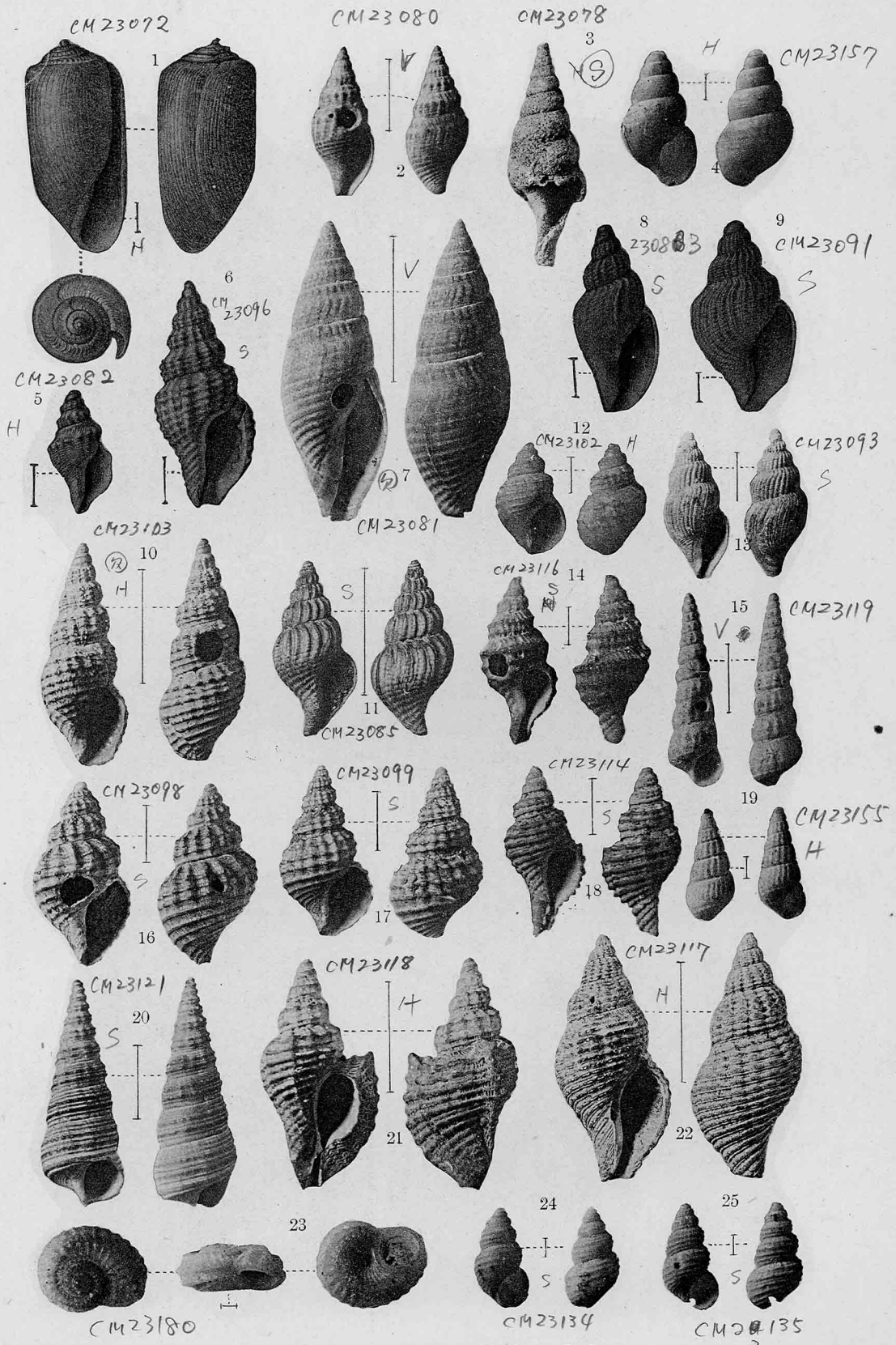

M. YOKOYAMA: Fossil Shells from Sado.

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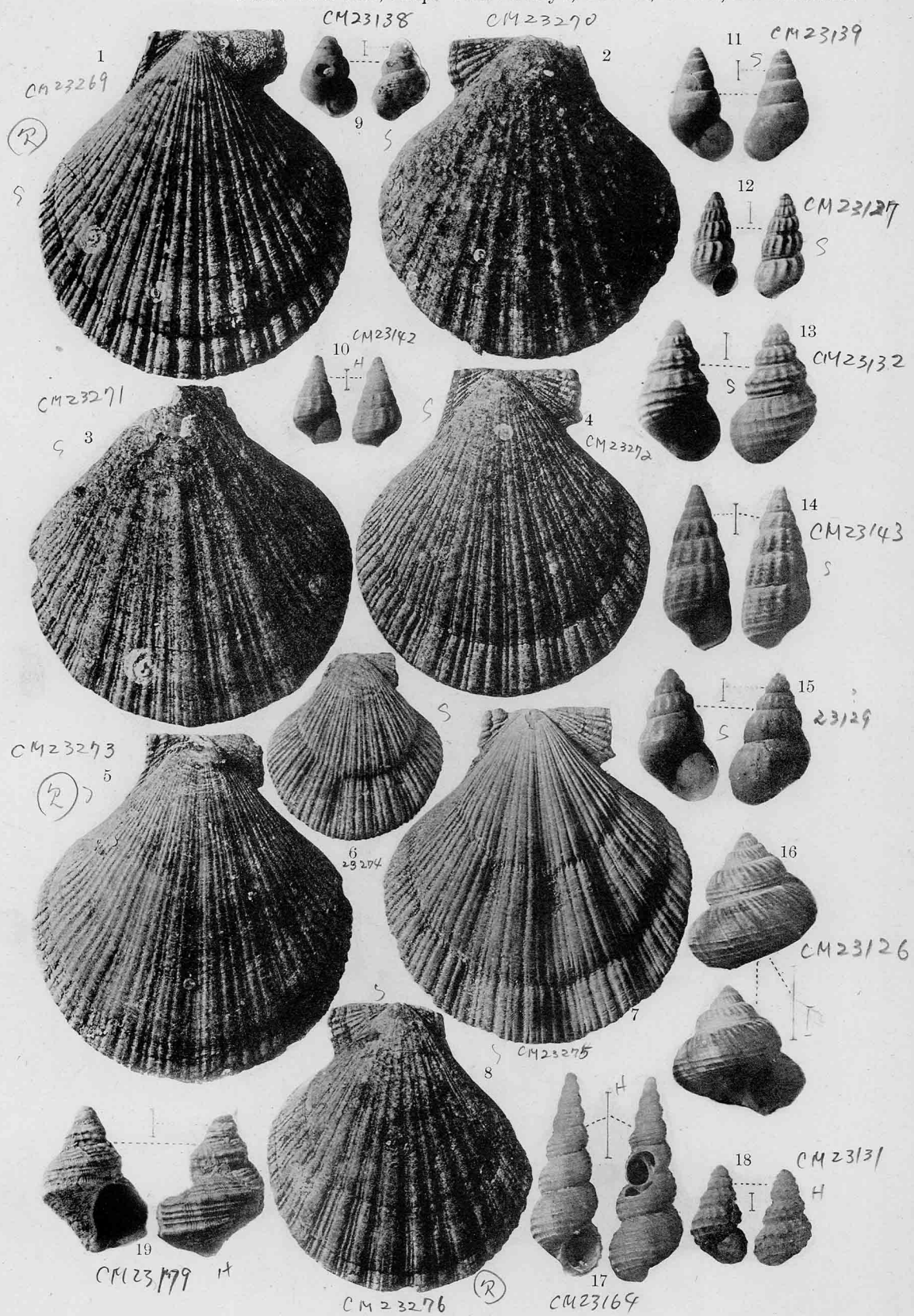

M. YOKOYAMA: Fossil Shells from Sado.

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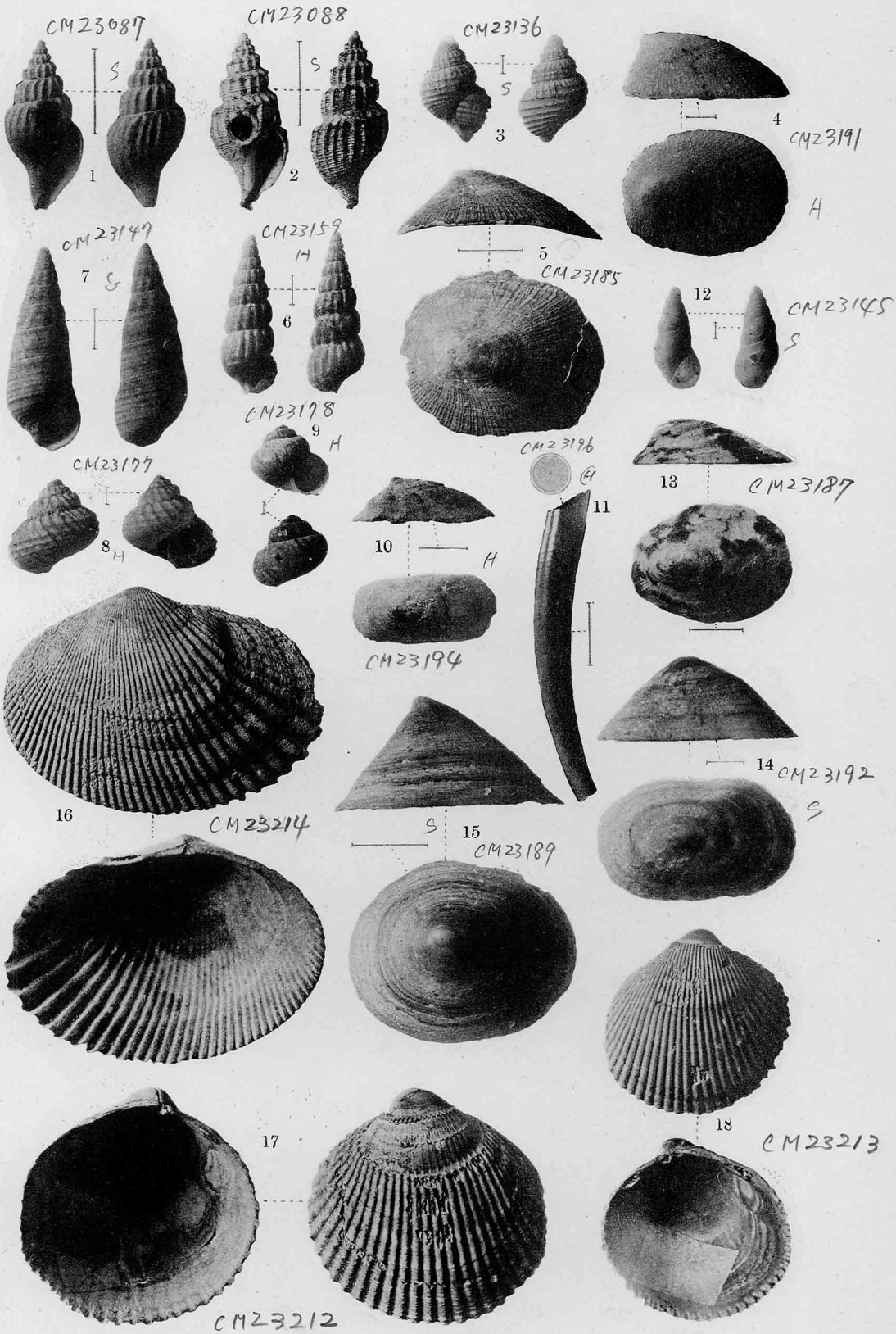

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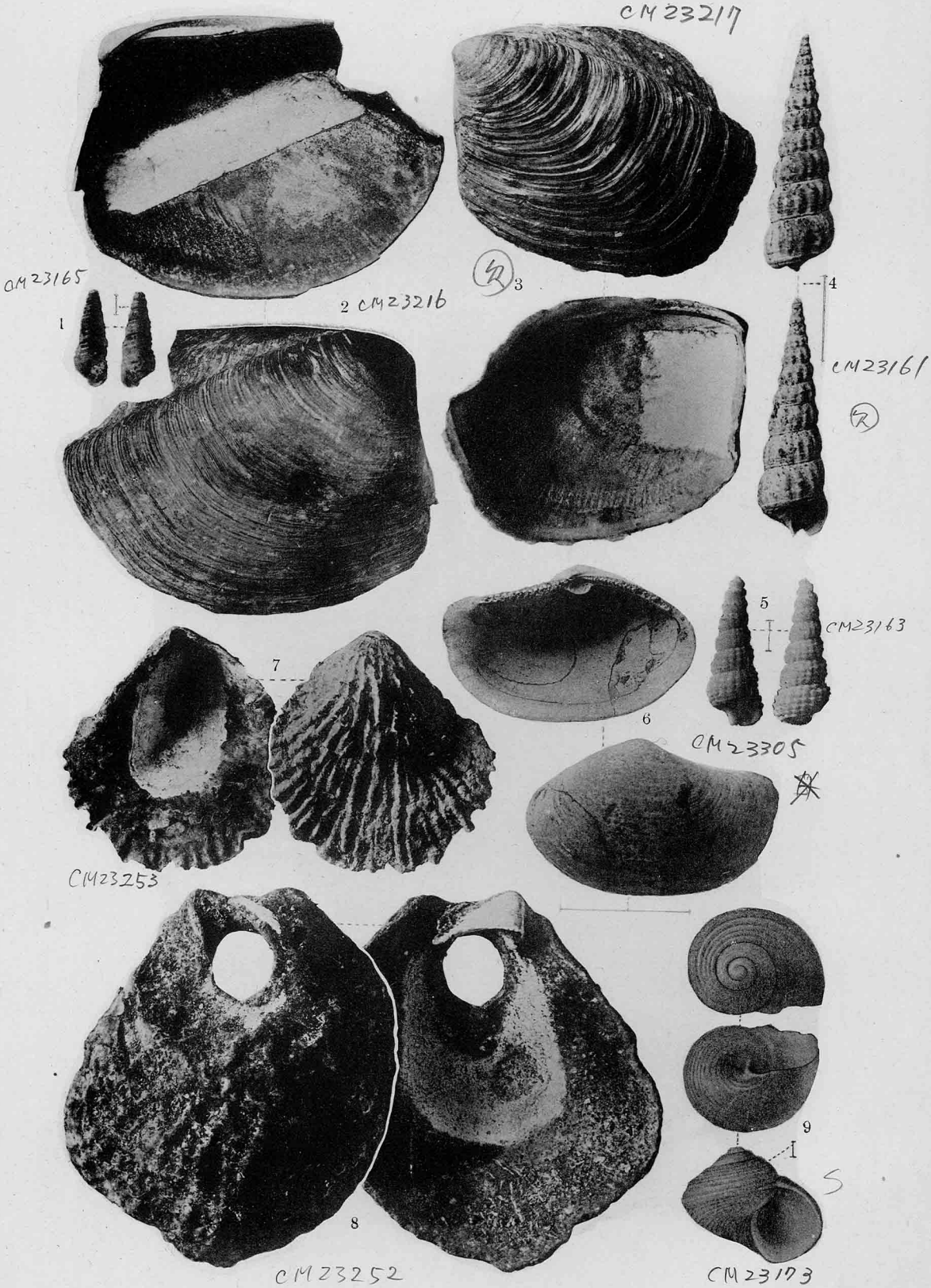

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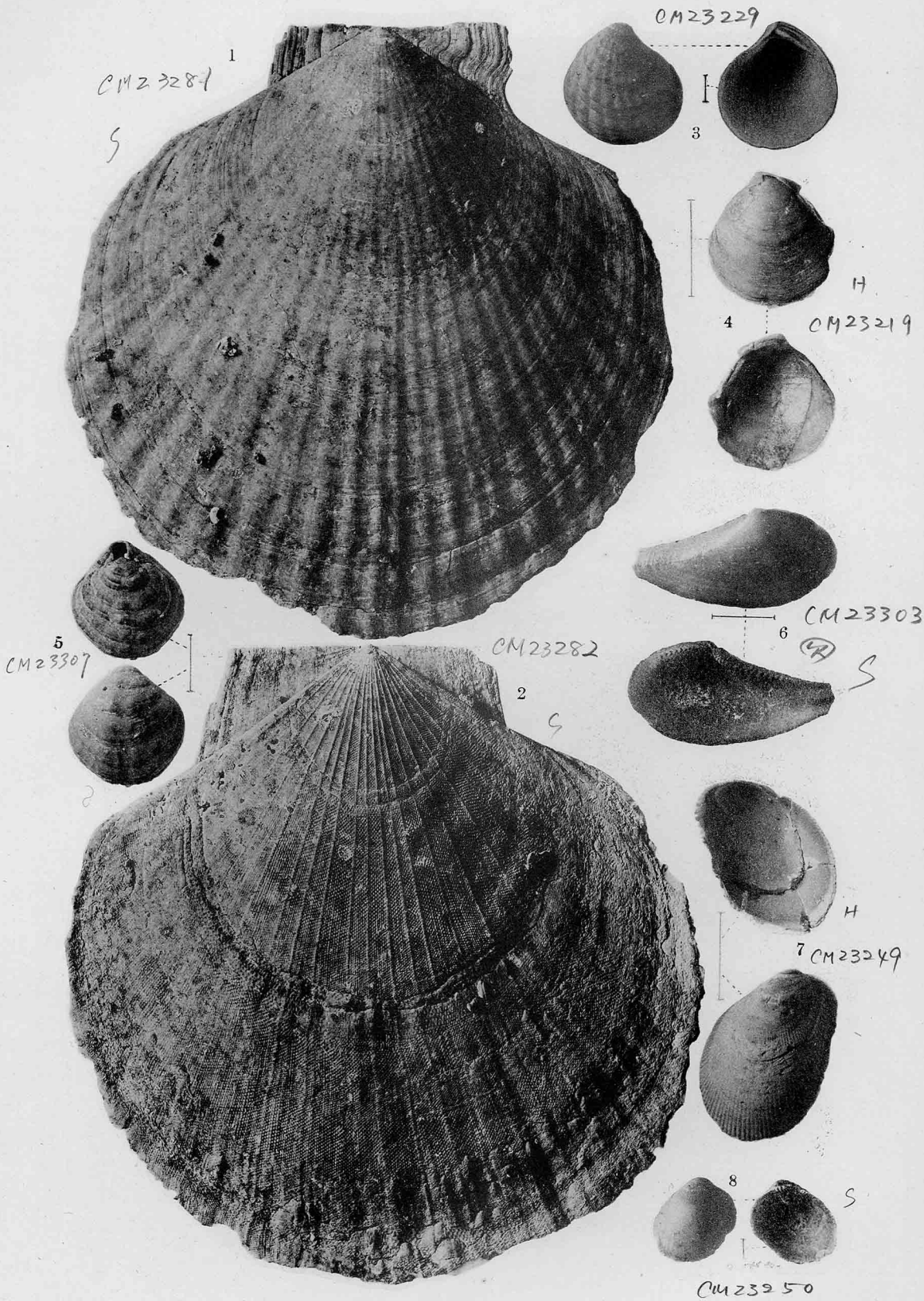

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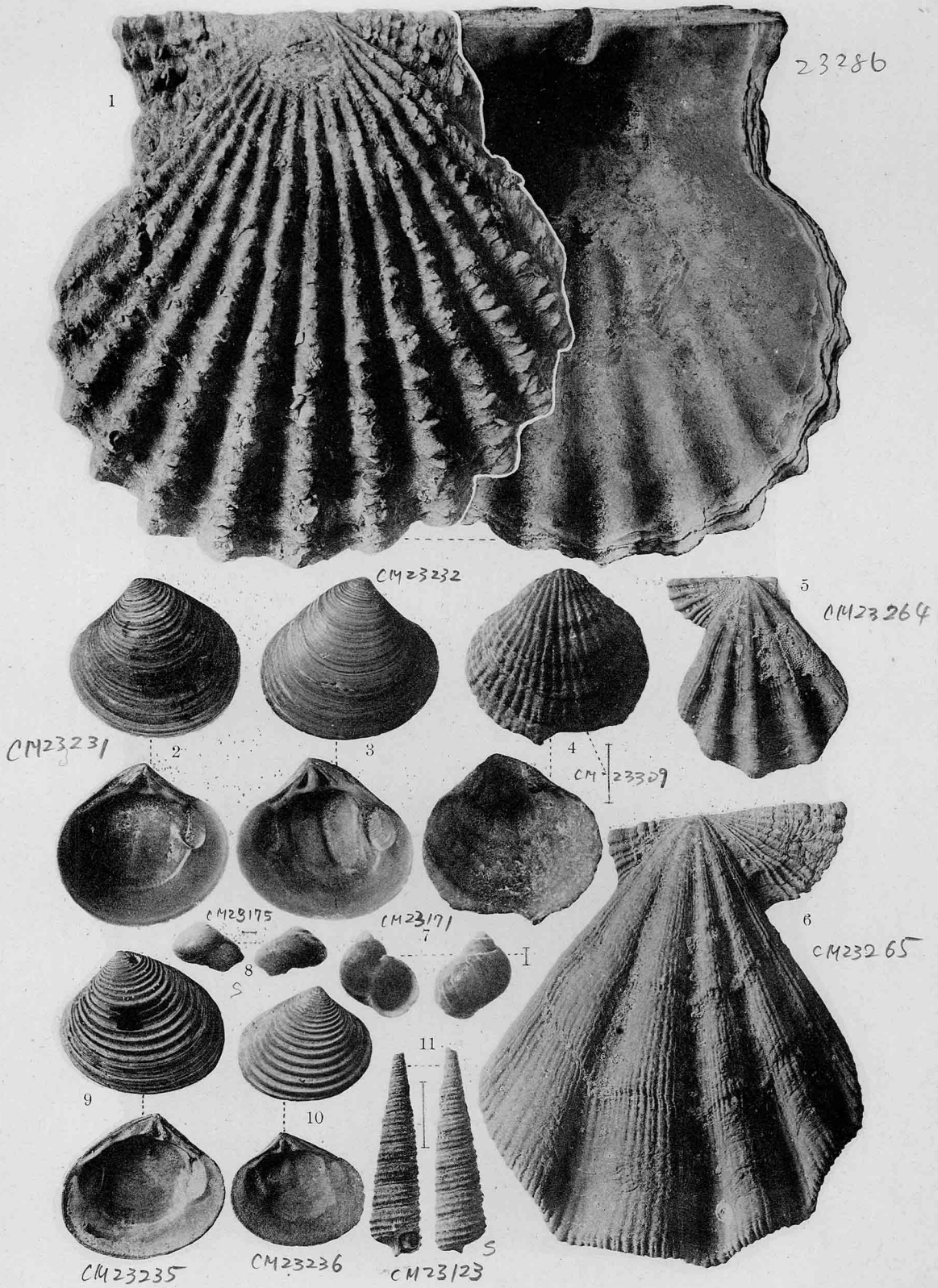

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