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Tertiary Mollusca from Dainichi in Tōtōmi.

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With 2 Plates.

In 1889 the late Dr. Kenzō Nakashima in his "Explanatory Text of the Sheet Shizuoka"[1] of the Imperial Geological Survey divided the Tertiary Formation found on both sides of the lower course of the Ōigawa, a river flowing between the provinces of Suruga and Tōtōmi, into two parts, the *Lower* and the *Upper*. The *Lower Part* mainly consisting of sandstones and shales with occasional intercalations of limestones and tuffites, he supposed to be of the Miocene age, and quite correctly, since the subsequent discovery of some fossils in a reef-like limestone[2] near Sagara has pointed to the same age. The *Upper Part* which is made up of sandstones, shales and conglomerates, all more or less tufacious and oil-bearing at some places, but without any limestone-intercalation, was ascribed by him to the *Pliocene* on evidence of some fossils found at Kunō, Hirugaya, Shimomata, etc. In this he was also right, as not only Kuno yields a very characteristic *Lower* Musashino (Upper Pliocene) bivalve, *Limopsis tokaiensis Yok.*, but the Mollusca of Dainichi, which form the subject of the present paper and are found in a layer representing a much lower horizon than that of Kuno, are also very probably *Pliocene*.

1) Shizuoka Zufuku Setsumeisho, Zone 8, Column XI, Meiji 19. (1889).

2) Nishiwada. On Some Organic Remains from the Tertiary Limestone near Sagara, Tōtōmi. Jour. Coll. Sci., Vol. VII, 1895.

The fossil-bearing rock of Dainichi, a village about 4 kilometres south of the town of Mori in Totomi, is a hard sandstone, fine-grained in texture and greyish in colour. On weathering, however, it becomes yellowish and soft, so that the fossils can be collected without much difficulty in such a portion. This fossil locality was first made known to me in 1883 by the late Michihisa Ōkawa who had accidentally discovered it, while engaged in the topographical survey of the district.

In spite of the great multitudes of individuals, the number of species is comparatively small. What I could distinguish are the following:

1. Cylichna musashiensis Tok.
2. Terebra lischkeana Dkr.
3. Terebra tsuboiana Yok.
4. Drillia pseudo-principalis Yok.
5. Drillia quantoana Yok.
6. Drillia sobrina n. sp.
7. Drillia dainichiensis n. sp.
8. Cancellaria crispata Sow.
9. Olivella spretoides Yok.
10. Ancilla ōkawai n. sp.
11. Mitra pristina n. sp.
12. Hemifusus ternatanus (Gmel.).
13. Siphonalia cassidariaeformis (Rve.).
14. Eburna elata n. sp.
15. Nassa (Hima) japonica Lke.
16. Nassa (Hima) demissa n. sp.
17. Murex spinicosta Bronn.
18. Rapana bezoar L. var. thomasiana Crosse.
19. Galeodea (Sconsia) japonica Yok.
20. Turritella perterebra n. sp.
21. Natica janthostoma Desh.
22. Polinices (Neverita) ampla (Phil.).
23. Sigaretus (Eunaticina) papilla Gmel.
24. Calliostoma unicum (Dkr.).
25. Umbonium suchiense n. sp.

26. Umbonium mysticum n. sp.
27. Dentalium sp.
28. Panope generosa Gld.
29. Mactra crossei (Dkr.).
30. Raeta yokohamensis Pils.
31. Macoma praetexta (Mart.).
32. Dosinia troscheli Lke.
33. Meretrix (Callista) chinensis (Chem.).
34. Clementia speciosa n. sp.
35. Chione isabellina (Phil.).
36. Tapes euglyptus (Phil.).
37. Cardium sp.
38. Diplodonta sp.
39. Pinna japonica Hanl.
40. Arca castellata n. sp.
41. Arca sp.
42. Leda confusa Hanl.

If we leave out from the above list four species which are not exactly determined, we have thirty-eight, of which twenty-three or about three-fifths are living ones, while the remaining fifteen or two-fifths, so far as our present knowledge goes, are known only in a fossil condition. The living species are all Japanese save one, *Cancellaria crispata Sow.*, which is found in the Philippines as well as in other tropical regions. The fossil ones are the following:

1. Drillia pseudo-principalis Yok.
2. Drillia quantoana Yok.
3. Drillia sobrina n. sp.
4. Drillia dainichiensis n. sp.
5. Olivella spretoides Yok.
6. Ancilla ōkawai n. sp.
7. Mitra pristina n. sp.
8. Eburna elata n. sp.
9. Nassa demissa n. sp.
10. Murex spinicosta Rrown.
11. Galeodea (Sconsia) japonica Yok.

12. Turritella perterebra n. sp.
13. Umbonium suchiense n. sp.
14. Umbonium mysticum n. sp.
15. Arca castellata n. sp.

Of these *Murex spinicosta Bronn* is an European *Miocene* form hitherto not recorded from Japan, while *Galeodea japonica Yok.* has lately been described by me from the *Pliocene* of Izumo. There are also three *Musashino* forms of which two, *Drillia pseudo-principalis Yok.* and *D. quantoana Yok.*, are from the *Lower Musashino* (*Upper Pliocene*) and one, *Olivella spretoides*, is from the *Upper* (*Upper Pliocene*). The remaining ten are all new. From these considerations, I deem the Dainichi layer to belong to the lower half of the *Pliocene*.

Description of the Species.

1. *Cylichna musashiensis*, TOKUNAGA.

Cylichna musashiensis. Yokoyama, Foss. Miura Penin., p. 27, pl. I, fig. 4.

Several specimens large and small.
Fossil occurrence.—Lower Musashino Formation.
Living—Central Japan.

2. *Terebra lischkeana*, DUNKER.

Terebra lischkeana. Yokoyama, Foss. Miura Penin., p. 31, pl. I, fig. 10. Foss. Up. Musashino, p. 80.

A single specimen broken at both ends.
Fossil occurrence.—Upper Musashino Formation.
Living.—Central and Western Japan.

3. *Terebra tsuboiana*, YOKOYAMA.

Terebra tsuboiana. Yokoyama, Foss. Up. Musashino, p. 35, pl. XIII, figs. 12, 13.

A full grown specimen and several young ones.
Fossil occurrence.—Upper Musashino Formation.
Living.—Central Japan.

4. *Drillia pseudo-principalis*, YOKOYAMA.

Drillia pseudo-principalis. Yokoyama, Foss. Miura Penin., p. 37, pl. I, fig. 21.

Two imperfect specimens.

Fossil occurrence.—Lower and Upper Musashino Formation.

5. *Drillia quantoana*, YOKOYAMA.

Drillia quantoana. Yokoyama, Foss. Miura Penin,, p. 38, pl. I, fig. 22.

Several young specimens in which the number of spiral riblets are less than in the adult one from Naganuma. But the angle-riblet and the one below the upper suture are always more or less distinct.

Fossil occurrence.—Lower Musashino Formation.

6. *Drillia sobrina*, n. sp.

Pl. I. Fig. 1.

Three specimens all lacking the apex, but characteristic enough to be created into a new species.

The shell is longly fusiform and many-whorled, with the body-whorl somewhat longer than the spire. The whorls whose number is not quite certain (eight to ten?) are very convex and ornamented with longitudinal plicae as well as with spiral threads. The plicae are strong, rounded, somewhat oblique, disappearing near the sutures, and a little broader than the shallow valleys separating them. Their number is twelve on the ultimate and penultimate whorls, and ten on the next upper one. The spiral threads are many, the coarser ones, however, being about eight to ten, while the finer ones between are one to several. On the body-whorl, spiral sculpture is present down to its caudal end, while the plicae are only in its upper part. Aperture long, about one-half the shell-height. Outer lip sharp, but a little behind varicose by the last plica. Lip-sinus close to the suture, deep, gradually widening outward. The dimensions may be something like the following: Height about 36 millim. Diameter about 13 millim. Length of aperture 19 millim.

This shell, so far as its external sculptures are concerned, is

hardly distinguishable from *Fusus coreanicus Smith* (Yokoyama, Foss. Up. Musashino, pl. II, fig. 10) living as well as fossil in Japan, with which it is apt to be confounded in case the apertural portion is not preserved.

7. *Drillia dainichiensis*, n. sp.

Pl. I. Fig. 2.

A few examples broken both at apex and base, but quite characteristic.

The shell is small, ovately elongate with the body-whorl longer than the spire. The whorls whose number seems to be more than eight are distinctly shouldered with the surface above a little excavated and below vertical. The sculpture consists of longitudinal plicae and spiral threads or cords. The plicae appear most strongly on the shoulder, obtuse and oblique, numbering about fifteen on the lower whorls. Just below the suture there are also tubercle-like plicae weaker than those on the shoulder, but generally equal in number and a little more in front in position and usually connected with the latter with an indistinct oblique elevation or thread. Below the shoulder-plicae there are longitudinal threads about double in number and somewhat oblique. The spiral threads on the whorls above the body-whorl are unequal, below the shoulder only two or three and coarse with a bead on the point of intersection with the longitudinal ones, few and weaker about the shoulders and not distinct on the plicae. On the body-whorl the spiral threads are about ten in number and coarse, and also beaded at their points of intersection with the longitudinals. Aperture oval, obtuse behind. The canal is broken, but it seems not to have been long. One of the specimens measures about 6.8 millim. in diameter with the height not exceeding 20 millim. probably.

This species is closely akin to *Drillia icenorum* (*Wood*) of the English Crag and especially to the variety *elongata* of Harmer (The Pliocene Mollusca of Great Britain, p. 221, pl. XXVII, fig. 18). But the Crag-species seems to be devoid of the beaded longitudinal threads.

8. *Cancellaria crispata*, Sowerby.

Pl. I. Fig. 3.

Cancellaria crispata. Sowerby, Thes. Conch., p. 452, pl. 96, fig. 89. Reeve, Conch. Icon., sp. 43. Kobelt in Mart. Chem. Syst. Conch. Cab., IV, Pt. 3, Cancellaria, p. 78, pl. 20, figs. 6, 7. Tryon, Man. Conch., VII, p. 80, pl. 6, fig. 96.

This is a small form of *Cancellaria* having a pointed oval shell shouldered near the upper suture and sculptured with strong longitudinal ribs about eleven on the body-whorl and aculeate at shoulders. There are also spiral threads, rather distant in our specimens, which are all strongly worn. The three small folds of the columella are distinct. The umbilicus is small and is closed at a little distance from its month.

There are about seven specimens more or less broken. As stated by several authors, this species is probably only another form of *Cancellaria crenifera Sow.* which has the umbilicus deeply perforate.

9. *Olivella spretoides*, Yokoyama.

Olivella spretoides. Yokoyama, Foss. Up. Musashino, p. 47, pl. II, fig. 4.

Several specimens.

Fossil occurrence.—Upper Musashino Formation.

10. *Ancilla ōkawai*, n. sp.

Pl. I. Fig. 4—7.

The shell is subfusiform inclining to cylindrical, The spire is very short, blunt at apex and wholly covered with a callus which is provided with several fine spiral grooves. The callus also covers the upper portion of the body-whorl, and in front it comes down to cover the upper part of the inner lip. The body-whorl is finely spirally striate and where it meets the spire is a shallow excavation. Near the base there are two spiral bands one above the other, the upper being narrower and bounded by a groove on both sides, while the lower is one and a half times to twice as broad and has a ridge in its middle. The base below the lower band is smooth and separated by a deep and broad valley from the lower portion of the inner lip which at this place shows three longitudinal grooves decreasing in size toward inside. Aperture long, occupying more than

seven-tenths of the shell-height. Outer lip thin. Canal broad and short. Height 40 millim. Diameter 18 millim. Apertural length 28 millim. The younger forms are more slender, one of such measuring 22 millim. in height, 9 millim. in diameter and 15.5 millim. in apertural length.

Quite frequent.

This species is much like *Ancilla albocallosa* (*Lischke*) (Jap. Meeres conch., III, p. 44, pl. II, figs. 24, 25) living in our seas which, however, is acute at apex and more fusiform in shape.

11. *Mitra pristina*, n. sp.

Pl. I. Figs. 8—12.

The shell is fusiform and thin with the spire elevated, pointed and much shorter than the body-whorl. The whorls number about nine of which the first three are nuclear, smooth and rounded; the postnuclear ones are somewhat convex, separated by subchannelled sutures which give them a step-like appearance, and longitudinally as well as spirally sculptured. The longitudinal sculpture consists of many, but weak, distant, straight threads, while the spiral consists of more prominent ones or cords, thickly set and often with a fine interstitial stria between. Aperture long, nearly one-half the shell-height. Columella-plaits three, oblique, with the hindermost the strongest. Outer lip thin.

It is much to be regretted that in spite of the frequency of the shell the mouth-portion is more or less broken in all the specimens, and especially the canal is perfect in none, which is very probably due to the thin state of the shell.

One of the examples measures 13 millim. in diameter with the height about 35 millim.(?) and the apertural length about 15 millim. Another but a smaller one is about 19 millim. high, 7.5 millim. (?) in diameter and about 10 millim. in apertural length.

12. *Hemifusus ternatanus*, (Gmelin).

Hemifusus ternatanus. Tryon, Man. Conch., III, p. 112, pl. 44, fig. 233. Iwakawa, Catal. Jap. Moll. Tokyo Imp. Museum, p. 137. Tokunaga, Foss. Env. Tokyo, p. 7, pl. I, fig. 8.

Pyrula ternatana: Kobelt in Mart. Chem. Syst. Conch. Cab., III, pt. 2, p. 42, pl. 5, fig. 4, 5, pl. 33, fig. 1, 2.

A single fragment of the basal portion.

Fossil occurrence.—Upper Musashino Formation (Shinagawa).

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

13. *Siphonalia cassidariaeformis*, (Reeve.)

Pl. I. Figs. 13, 14, 15,

Siphonalia cassidariaeformis. Lischke, Jap. Meeresconch., I, p. 38, pl. IV, figs. 1–10. Tokunaga, Foss. Env. Tokyo, p. 7, pl. I, fig. 9.

This snail is quite frequent at Dainichi, all having the shoulder-nodules distinct. In the form of the shell there is a great variability, some having the last part of the shelf above the nodules more steeply sloping than in the others. The length of the canal and its curvature are also not constant. And it is not at all improbable that the allied species such as *Siphonalia stearnsii Pils.*, *Siphonalia signum Rve.*, etc. may yet turn out to be only variations of one and the same form. Into this question I hope I shall be able to go in the near future, when I can obtain materials enough for study.

Fossil occurrence.—Upper Musashino Formation.

Living.—Northern, Central and Western Japan.

14. *Eburna elata*, n. sp.

Pl. I. Figs. 16, 17.

This is a species closely related to *Eburna japonica Rve.* on one hand and to *Eburna chrysostoma Sow.* on the other.

The shell is tolerably large, oval in shape and inflated, consisting of about seven whorls which are more or less convex, but least so on the body-whorl, and separated by shallowly but distinctly channelled sutures bounded on the outside by a blunt edge. The channel, however, is indistinct in the younger whorls, being a flattened surface even on the penultimate. Umbilicus perforate, bounded by an elevated spiral band outside separated by a groove from the rest of the body-whorl. Glaze very thick. Outer lip

sharp and thin. Height about 66 millim. Body-whorl about 55 millim. in height. Diameter about 40 millim. Apertural length about 42 millim.

It is distinguished from *Eburna japonica Rve.*, a species now living in our seas, by the channelled sutures, a somewhat flatter body-whorl and a shorter spire, while it differs from *Eburna chrysostoma Sow.* (Kobelt in Mart. Chem. Syst. Conch. Cab., III, pt. 1, Buccinum, p, 4, pl. 71, figs. 4, 5) of Ceylon by the body-whorl being a little more convex and the channel-edge being blunt and not sharp as in the latter. It is not improbable that this fossil is a precursor of our living species, as some specimens of the latter has the body-whorl slightly shouldered and the surface above flattened.

Rather frequent.

15. *Nassa* (*Hima*) *japonica*, Lischke.

Nassa (*Hima*) *japonica*. Yokoyama, Foss. Miura Penin., p. 56, pl. III, fig. 5. Foss. Up. Musashino, p. 58.

A few examples.

Fossil occurrence.—Lower and Upper Musashino Formation.

Living.—Central and Western Japan.

16. *Nassa* (*Hima*) *demissa*, n. sp.

Pl. II. Figs. 8, 9.

The shell is small, ovate in shape and provided with about six whorls of which the first two are embryonal and smooth ; the succeeding ones are convex, separated by deep sutures and longitudinally as well as spirally sculptured. The longitudinal sculpture consists of fine threads, more or less sinuous, rather distant and present in great numbers. The spiral sculpture consists of flat cords, six or seven on the penultimate whorl and more than fifteen on the ultimate, usually close together except near the upper suture where they may be rather distant, the valleys between being usually narrower. Aperture ovate. Canal short and bent. Height 14.5 millim. Diameter 7.5 millim. The younger individuals are generally shorter in form.

This species is very much like the preceding, but the longitudinal sculpture is much finer.

Frequent.

17. *Murex spinicosta*, Bronn.

Murex spinicosta. Bronn, Italiens Tertiaergebilde, p. 34, No. 142. Hörnes, Foss. Moll. Tertiär-Becken v. Wien. p. 260, pl. 26, figs. 6-8.

A very characteristic shell with carinated step-like whorls bearing spines at the carina and a long canal.

Our examples are only two in number, one of which is very badly preserved. The other is not quite perfect, but enough to show the characteristics of the species. The spiral sculpture consists of alternately large and small threads.

Fossil occurrence—Miocene of Austria, Italy, Poland, etc.

18. *Rapana bezoar*, Linné, var. *thomasiana*, Crosse.

Rapana bezoar var. thomasiana. Yokoyama, Foss. Up. Musashino, p, 66, pl. III, fig. 6.

A single small example.

Fossil occurrence.—Upper Musashino Formation.

Living.—Northern, Central and Western Japan.

19. *Galeodea* (*Sconsia*) *japonica*, Yokoyama.

Galeodea (*Sconsia*) *japonica.* Yokoyama, On Some Fossil Mollusca from the Neogene of Izumo, p. 3, pl. II, fig. 4.

An ill preserved specimen.

Fossil occurrence.—Neogene (Lower Pliocene) of Izumo.

20. *Turritella perterebra*, n. sp.

Pl. II. Fig. 2—5.

The shell is high turrete consisting of many whorls which are rounded and spirally sculptured. The greatest convexity of the whorls is always in their lower half, the upper half being generally more or less flattish, or only little convex. The spiral sculpture

consists of unequal threads, the coarser ones being six to eight, alternating with the finer ones. Aperture rounded.

Although the specimens are frequent, all lack the apex, so that the number of whorls and the proportion of height and diameter can not be accurately given. The latter, however, may be about 5 to 1.

The species which is most closely related to this fossil is *Turritella terebra Lam.* (Tryon, Man. Conch., III, p. 195, pl. 59, figs. 32, 33) living in the Philippines and further south, and also fossil in Java. But the Japanese shell has the spiral threads not so coarse and on the lower whorls appearing more like striae.

21. *Natica janthostoma*, DESHAYES.

Natica janthostoma. Yokoyama, Foss. Miura Penin., p. 77, pl. V, Figs. 3, 4. Foss. Up. Musashino, p. 83.

Rather frequent.

Fossil occurrence.—Lower and Upper Musashino Formation. Lower Pliocene of Izumo.

Living.—Northern and Central Japan. Kamtchatka.

22. *Polinices* (*Neverita*) *ampla*, (PHILIPPI).

Polinices (*Neverita*) *ampla.* Yokoyama, Foss. Miura Penin., p. 78, pl. V, figs. 5, 6. Foss. Up. Musashino, p. 84.

Quite commmon.

Fossil occurrence.—Lower and Upper Musashino Formation.

Living.—Northern and Central Japan. China, Australia, Indian Ocean.

23. *Sigaretus* (*Eunaticina*) *papilla*, GMELIN.

Sigaretus (*Eunaticina*) *papilla.* Yokoyama, Foss. Up. Musashino, p. 84, pl. V, fig. 8.

Two worn examples.

Fossil occurrence.—Upper Musashino Formation.

Living.—Central and Western Japan, Philippines, Moluccas.

24. *Calliostoma unicum*, (DUNKER).

Trochus unicus. Dunker, Moll. Japon., p. 23, pl. III, fig. 3.

A single but well preserved specimen quite like the recent ones with angles not so sharp as in the form found in the Musashino Formation (var. *shinagawensis Tok.*).

Living.—Northern to Southern Japan.

25. *Umbonium suchiense*, n. sp.

Pl. II. Fig. 1.

Shell depressed-conical. Whorls about seven of which the first two or three are embryonal and smooth, the succeeding almost flat except the last one which is somewhat convex near the periphery. Spirally sculptured, the sculpture consisting of a broad, elevated, tuberculated band just below the suture and of eight to ten sharp narrow ridges between which an interstitial stria may be found especially on the body-whorl. Periphery roundly angulate. Base slightly convex with fine spiral grooves all over. Aperture subrhombic. Height 22.5 millim. Diameter 35 millim.

This species has a striking resemblance to *Umbomium costatum Val.* (Yokoyama, Foss. Miura Penin., p. 95, pl. VI, fig. 6) living and also fossil in Japan. But on careful examination the sculpture is quite different. In *Umbonium costatum*, the spiral sculpture consists of grooves, leaving the parts between as broad flat bands or cords, while *Umbonium suchiense* has narrow ridges separated by wide interspaces. Moreover, the former has the base smooth, while in well preserved examples of the latter fine spiral grooves are visible. The umbilical callus in our specimens are often detached from the shell leaving a wide and shallow funnel-like space. This is probably due to the loose connection between the two.

Pretty frequent.

26. *Umbonium mysticum*, n. sp.

Pl. II. Figs. 6, 7.

This species, when compared with the preceding, differs in the

following points: The shell is higher, the whorls more convex, especially the body-whorl, the subsutural band not so conspicuous, crenate instead of being tuberculated, the spiral ridges fewer in number, only about six on the body-whorl, four on the others, coarse, generally decreasing in size from above downward, periphery more rounded, the base with five to six coarse spiral grooves. Aperture is subrhombic as in the preceding form. Height 20 millim. Diameter 27 millim, Umbilical callus often fallen out.

Quite common.

27. *Dentalium*, sp.

Many fragments closely resembling *Dentalium weinkauffi Dkr.*, so common in the Musashino Formation and also in our seas.

28. *Panope generosa*, Gould.

Panope generosa. Yokoyama, Foss, Up. Musashino, p. 121, pl. VI, figs. 14, 15.

Several fragments which can be assigned to the living and fossil species above named.

Fossil occurrence.—Upper Musashino Formation. Lower Pliocene of Izumo.

Living.—Northern Japan. West coast of North America.

29. *Mactra crossei*, (Dunker).

Trigonella crossei. Dunker, Index Molluscorum Maris Japonicae, p. 183. pl. VII, figs. 1–4.

This is a small form of *Mactra* ovately triangular in outline, rather compressed and in general thin-shelled. The surface is finely concentrically striated and toward the margin often grooved. Our largest specimen is a right valve 21.5 millim. long, 15 millim. high and 3 millim. deep. It is a form comparatively long. Another but a smaller right valve measures 17 millim. long and 13 millim. high.

Living.—Central Japan.

30. *Raeta yokohamensis*, PILSBRY.

Raeta yokohamensis. Yokoyama, Foss. Up. Musashino, p. 131, pl. VIII, fig. 5, 6.

Only a single right valve.
Fossil occurrence.—Upper Musashino Formation.
Living.—Central Japan.

31. *Macoma praetexta*, (MARTENS).

Macoma praetexta. Yokoyama, Foss. Up. Musashino, p. 142, pl. X, figs. 2, 3.

A few isolated valves.
Fossil occurrence.—Upper Musashino Formation.
Living.—Central and Western Japan.

32. *Dosinia troscheli*, LISCHKE.

Dosinia troscheli. Yokoyama, Foss. Miura Penin., p. 119, pl. VIII, figs. 5, 6. Foss. Up. Musashino, p. 144.

Not very rare.
Fossil occurrence.—Lower and Upper Musashino Formation.
Living.—Central and Western Japan.

33. *Meretrix* (*Callista*) *chinensis*, (CHEMNITZ).

Meretrix (*Callista*) *chinensis.* Yokoyama, Foss. Miura Penin., p. 120, pl. VIII, figs. 9, 10. Foss. Up. Musashino, p. 146.

Common,
Fossil occurrence.—Lower and Upper Musashino Formation.
Living.—Northern to Western Japan. China, Australia.

34. *Clementia speciosa*, n. sp.

Pl. II. Fig. 14, 15.

Shell pretty large, thin, oval, longer than high, inflated, inequilateral, the anterior portion being much shorter than the posterior. Anterior and posterior dorsal margins nearly straight, ventral strongly convex, with anterior and posterior ends more or

less rounded, the latter a little more sharply than the former. Surface finely concentrically striate with several concentric furrows towards the beak. Beaks large, swollen, incurved and pointed. Lunula short-lanceolate.

This shell is somewhat like *Clementia papyracea* (*Gray*) (Sowerby, Thes. Conch. II, p. 700, pl. 160, fig. 155), reported from the Japanese seas, but it is larger and not so oblique.

Clementia aff. papyracea from Shinagawa figured by Tokunaga in his "Fossils from the Environs of Tokyo," pl. III, fig. 6 is probably the present species.

Only a few isolated broken valves, one of which is over 60 millim. in height. The example figured is a left valve broken at the posterior end. It is about 53 millim. high with a depth of 14 millim. The length is perhaps about 60 millim. The species is still living.

Fossil occurrence.—Lower(?) and Upper Musashino Formation.

Living.—Central Japan.

35. *Chione isabellina*, (Philippi).

Chione isabellina. Yokoyama, Foss. Miura Penin., p. 121, pl. VIII, fig. 13. Foss. Up. Musashino, p. 149.

Rather frequent.

Fossil occurrence.—Lower and Upper Musashino Formation.

Living.—Japan. China.

36. *Tapes euglyptus*, (Philippi).

Tapes euglyptus. Yokoyama, Foss. Up. Musashino, p. 152, pl. XII, fig. 8.

Very common.

Fossil occurrence.—Upper Musashino Formation,

Living.—Central and Western Japan.

37. *Cardium*, sp.

Two badly preserved valves, one of which is better. It is a

right valve nearly circular in outline, about 20 millim. both in height and length, convex, ornamented with about thirty-five flat radiating ribs separated by very narrow and shallow valleys. It seems to be a new species, but its state of preservation does not allow an accurate determination.

38. *Diplodonta*, sp.

A single left valve imperfectly preserved. It is much like *Diplodonta semiaspera* Phil. of the Musashino Formation and of the recent seas.

39. *Pinna japonica*, HANLEY.

Pinna japonica. Yokoyama, Foss. Up. Musashino., p. 185, pl. XV, fig. 8.

A fragment belonging to the beak-portion like that of the Musashino Formation.

Fossil occurrence.—Upper Musashino Formation.

Living.—Central and Western Japan.

40. *Arca castellata*, n. sp.

Pl. II. Figs. 10—13.

Shell moderate in size, thick, convex, transversely oval, oblique, very inequilateral, the anterior side being only about one-half as long as the posterior. Anterior border rounded, posterior more or less obliquely truncate, ventral broadly arched and going over insensibly into the anterior border, while behind it forms a blunt angle with the posterior, the angle being generally somewhat less than a right angle. Surface with a blunt edge running from the beak to the postero-ventral corner. Radiately ribbed; ribs thirty-six or thereabout, broad, usually flattened, separated by narrower interspaces. Beaks swollen, curved in, without any marked mesial depression. Area very narrow. The proportion of length and height is about 10 to 7, with the depth of each valve about 3. The largest specimen measures nearly 50 millim. in length.

The species is much like *Scapharca satowi Dunker* (Index Moll.

Mar. Japon., p. 233, pl. IX, figs. 1,2,3) one of our living forms. But it is longer and not so inflated.

Rather common.

41. *Arca*, sp.

An anterior half of the left valve of an apparently new species of *Arca*. It is tolerably large and swollen with numerous fine close radiating ribs. The naming will be postponed until a better specimen is obtained.

42. *Leda confusa*, HANLEY.

Leda confusa. Yokoyama, Foss. Up. Musashino, p. 195, pl. XVII, fig. 4.

Several examples.

Fossil occurrence.—Upper Musashino Formation.

Living.—Central Japan. China Sea.

Published March 31st, 1923.

M. YOKOYAMA:

TERTIARY MOLLUSCA FROM DAINICHI.

PLATE I.

Plate I.

Fig. 1. Drillia sobrina n. sp. P. 5.

Fig. 2. Drillia dainichiensis n. sp. P. 6.

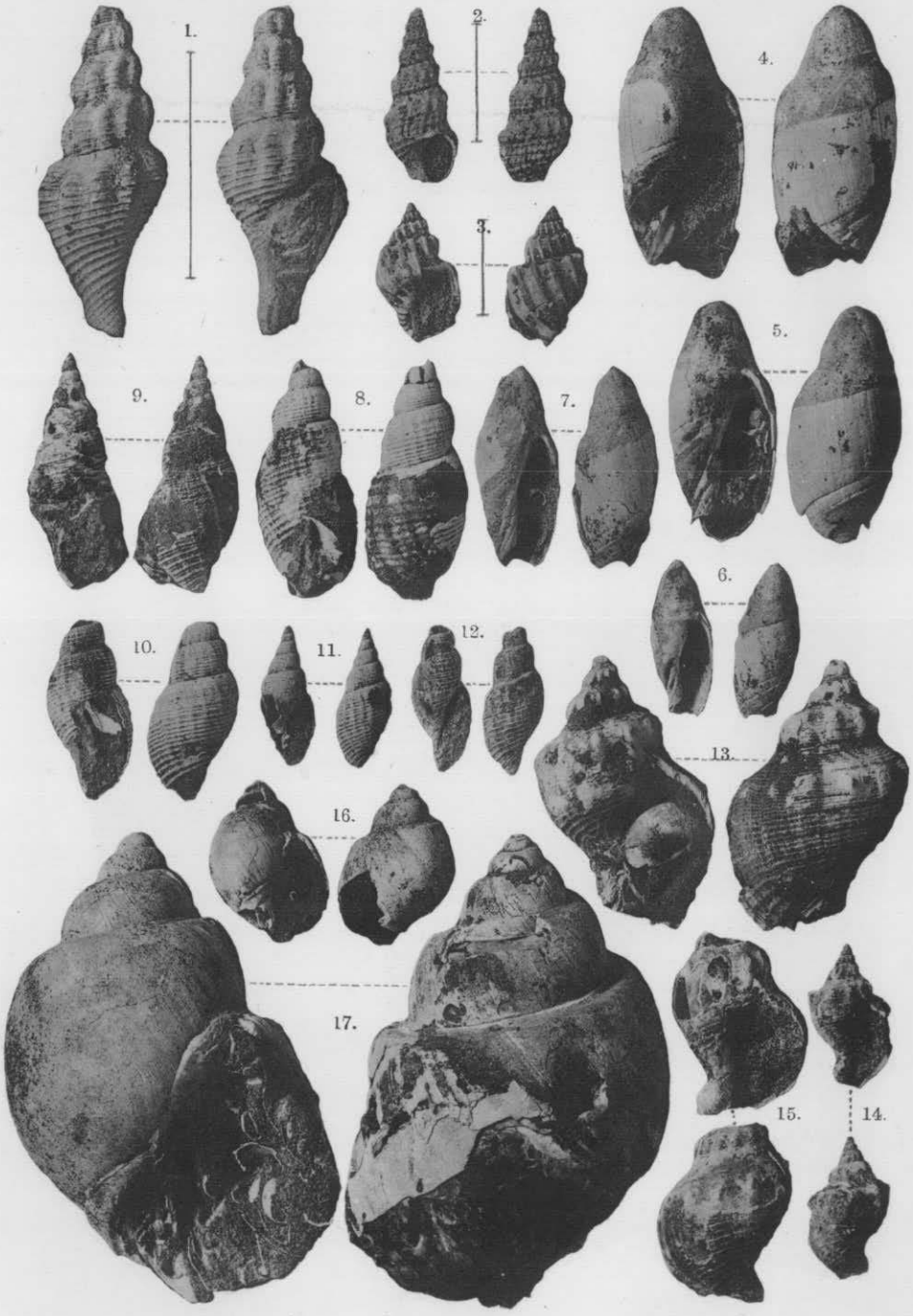
Fig. 3. Cancellaria crispata Sow. P. 7.

Figs. 4–7. Ancilla okawai n. sp. P. 7.

Figs. 8–12. Mitra pristina n. sp. P. 8.

Figs. 13–15. Siphonalia cassidariaeformis Rve. P. 9.

Figs. 16, 17. Eburna elata n. sp. P. 9.



M. Yokoyama: Tertiary Mollusca from Dainichi.

PLATE II.

Plate II.

Fig. 1. Umbonium suchiense n. sp. P. 13.

Figs. 2–5. Turritella perterebra n. sp. P. 11.

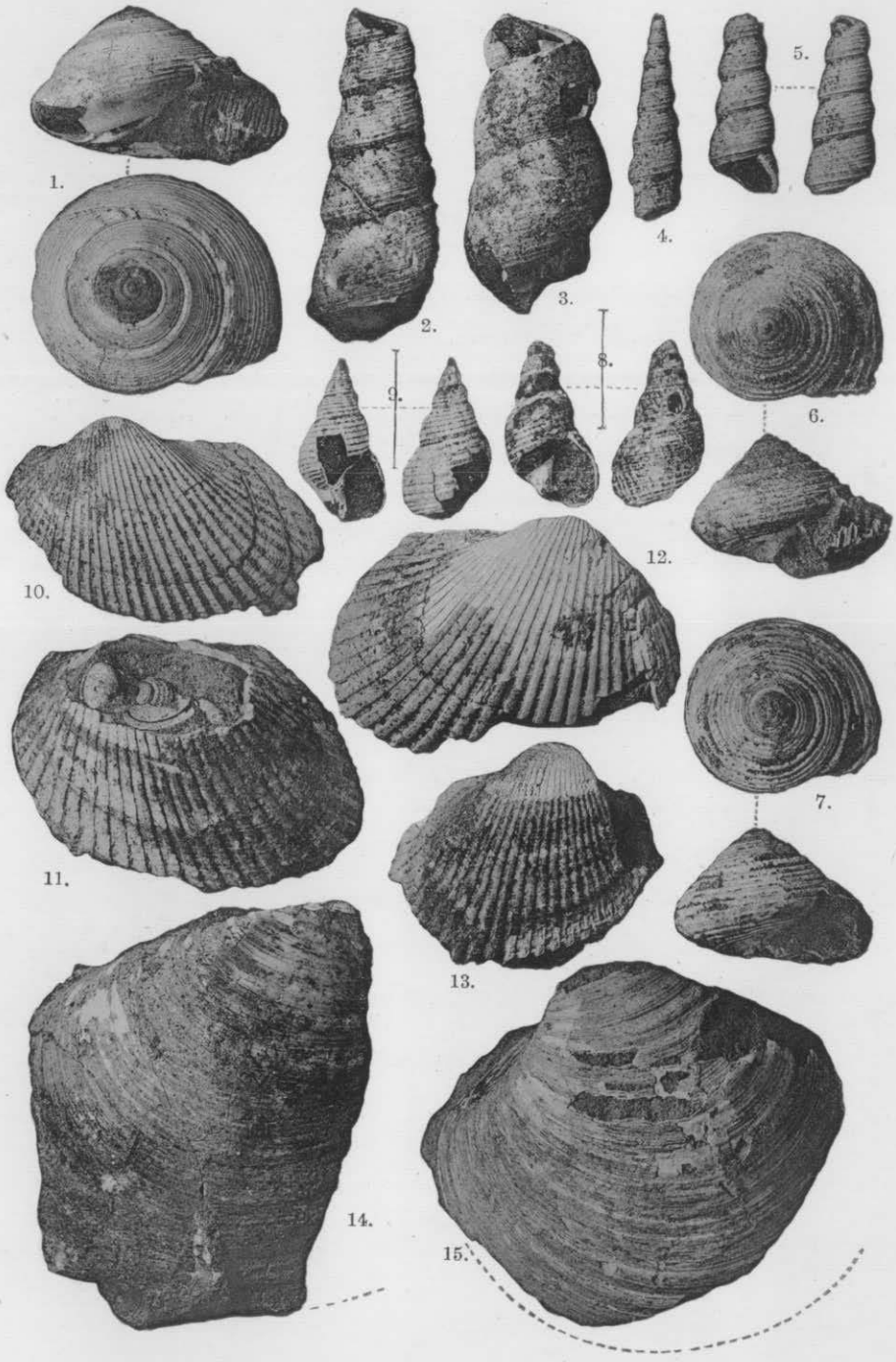
Figs. 6, 7. Umbonium mysticum n. sp. P. 13.

Figs. 8, 9. Nassa demissa n. sp. P. 10.

Figs. 10–13. Arca castellata n. sp. P. 17.

Fig. 14. Clementia speciosa n. sp. P. 15.

Fig. 15. Do. A better preserved specimen from the Musashino Formation of Minami-Tama to the west of Tokio for comparison.



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