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Tertiary Fossils from Western Hizen

By

Matajiro YOKOYAMA, *Rigakuhakushi*

With 1 Plate

Off the west shore of North Sonogi Peninsula¹⁾ in the province of Hizen, there are several small islands which produce coal. Mr. E. Sagawa of the Mitsui Mining Company who had on several occasions explored these coal seams sent to me for examination some of the fossils found in the layers containing them. The islands on which they were collected are four,²⁾ namely: Ōshima, Sakitojima, Matsushima and Hakojima.

According to Mr. Sagawa,³⁾ the coal-bearing series found on these islands is in greater part made up of thick layers of sandstone superposed on one another, although sometimes the sandstone alternates with shale. The thickness of the series attained is apparently greatest on Ōshima, the most northern and the largest of the islands, where it is nearly 2000 feet, the coal seams being intercalated somewhere at about 100 feet above the bottom of the series.

On Ichigojima, a little island lying close to Ōshima on the east, Mr. Sagawa observed that the series begins below with a basal conglomerate underneath which there is another coal-bearing series with a line of marked unconformability between, that is to say, while the upper dips

1) What I call here *North Sonogi Peninsula* projects northward from Nagasaki and occupies the greater part of the county of West Sonogi. *South Sonogi Peninsula* will then be the one which juts out from Nagasaki to the southwest and may also be called *Nomo Peninsula*.

2) 西彼杵郡大島、崎戸島、松島、母子島。

3) On an Important Line of Unconformability in the Tertiary Strata of Western Kyushu and the Relation of the Takashima Coal-Field with those of Matsushima and Sakitojima (Japanese). Jour. Geol. Soc. Tokyo, Sept. No. (No. 396), 1926.

to the west with an angle of about 12° , the lower steeply inclines to the northwest, the dip being nearly 40° . The latter is made up of a hard sandstone, a carbonaceous shale and a genuine shale with the rocks of the lowest part—conglomerate, sandstone and shale—presenting a peculiar reddish-purple tint. The coal intercalated between these layers is different from that of the upper series, being of a much superior quality. Fossils have not yet been found; but Mr. Sagawa, judging from the lithological characters, takes the series for an equivalent of that of the island of Takashima which lies outside of the harbour of Nagasaki and is generally considered to be Eocene in age.

The fossils from the upper coal-bearing series are tolerably many, but most of them are so imperfectly preserved as to make their determination extremely difficult. I have been able to distinguish only seventeen species¹⁾ which are given in the following table:

	Oshima	Sakitojima	Matsushima	Hakojima	Geological Occurrence
1. <i>Turritella kiiensis</i> Yok.	+				Pliocene
2. <i>Scala maculosa</i> (Ad. et Rve.)		+			Recent-Up. Musashino
3. <i>Venus</i> (<i>Mercenaria</i>) <i>stimpsoni</i> Gld.	+				Recent-Pliocene
4. <i>Chione casinaeformis</i> Yok.	+				Recent-Miocene
5. <i>Cardium sagawai</i> n. sp.			+		
6. <i>Lucina</i> (<i>Phacoides</i>) <i>borealis</i> L.				+	Recent-Miocene
7. <i>Venericardia ferruginea</i> (Ad.)	+				Recent-Miocene
8. <i>Mytilus hirsutus</i> Lam.				+	Recent-Up. Musashino
9. <i>Lima goliath</i> Sm.	+				Recent-Pliocene
10. <i>Pecten</i> sp.		+			
11. <i>Ostrea</i> sp.	+		+		
12. <i>Arca</i> sp.	+				
13. <i>Pectunculus</i> sp.	+		+		
14. <i>Nucula mirabilis</i> Ad. et Rve.	+				Recent-Pliocene
15. <i>Linthia nipponica</i> Yok.	+				Pliocene
16. <i>Scutella</i> sp.	+				
17. <i>Heterocyathus</i> sp.	+				

According to Mr. Sagawa, the fossils above enumerated do not occur in any single horizon or bed, but in several, among which he dis-

1) There are also a fish-tooth and fragments of bones of a Mammal.

tinguishes three principal ones, which he calls the *Janomegai*¹⁾ (or *Lima*) *Bed*, the *Ostrea Bed* and the *Turritella Bed*. The first is found in the upper portion of the series, while the second and the third occupy respectively the middle and lower portions of the same. But from this we can not infer that the respective fossils which give the names to the beds never occur outside of these limits, for I think that the islands, viewed from the point of fossil occurrence, have not yet been thoroughly investigated.

Concerning the geological age of the series, we can form a fairly correct idea, in spite of the fact that well determinable forms are few. Out of the eleven specifically determined species, two have hitherto been only Pliocene, two range between Recent and Upper Musashino, three between Recent and Pliocene, three between Recent and Miocene, and one is quite new. From this we can see that the greatest weight falls on the *Pliocene*, to which all the strata of the upper coal-bearing series are undoubtedly to be ascribed.

Description of the Species

1. *Turritella kiiensis*, YOKOYAMA

Turritella kiiensis. Yokoyama, Tert. Foss. Kii, p. 52, pl. VI, figs. 9, 10. Tert. Moll. South. Tôtômi, p. 343, pl. XXXI, figs. 3, 4.

Numerous specimens, sometimes filling the entire rock; but all seaworn and badly preserved.

Fossil locality.—Ôshima: (1) in a light reddish micaceous sandstone (exact locality not given); (2) in a hard grey sandstone of the coast of Mazé.²⁾

Geological occurrence.—Pliocene.

2. *Scala maculosa* (A. ADAMS et REEVE)

Pl. L. Fig. 2

Scala maculosa. Yokoyama, Foss. Up. Musashino, p. 86, pl. IV, fig. 14. A. Adams and Reeve, Voy. Samarang, p. 51, pl. XI, fig. 14.

A splendid specimen. It consists of about twelve convex whorls ornamented with erect wall-like oblique ribs which number eight on each of the last three whorls. It is 60 millim. in height and 20 millim. in

1) *Janomegai* is a name given by the islanders of Ôshima to a bivalve, possibly *Chione*. 2) 間瀬.

diameter, so that it is three times as large as those hitherto found either living or fossil. The occurrence of unusually large fossil forms compared with the living has also been observed in several other species of Mollusca.

Fossil locality.—Sakitojima: In a soft, fine-grained sandstone.

Geological occurrence.—Upper Musashino.

Living.—Western Japan. China Sea.

3. *Venus (Mercenaria) stimpsoni*, GOULD

Venus (Mercenaria) stimpsoni. Yokoyama, Foss. Upper Musashino, p. 148, pl. XI, figs. 11, 12. Foss. Shells Sado, p. 292. Tert. Moll. South. Tôtômi, p. 351.

Imperfect examples only.

Fossil locality.—Ôshima: (1) In a light yellowish, fine-grained sandstone with white spots of kaolinized feldspar from the west coast; (2) in a grey, fine-grained sandstone from a place not definitely stated.

Geological occurrence.—Upper Musashino as well as Pliocene in other parts of Japan.

Living.—Northern, Central and Western Japan.

4. *Chione casinaeformis*, YOKOYAMA

Pl. L. Fig. 5

Chione casinaeformis. Yokoyama, Tert. Moll. South. Tôtômi, p. 352, pl. XXXIX, figs. 7-9. Foss. Shells Tosa, p. 368, pl. XLII, fig. 3.

A single specimen only. A fossil bivalve called *Janomegai* by the islanders of Ôshima seems to be this shell.

Fossil locality.—Ôshima: In a hard grey sandstone of Uhamu.

Geological occurrence.—Pliocene and Miocene.

Living.—Central Japan.

5. *Cardium sagawai*, nov. spec.

Pl. L. Fig. 7

Shell small, cordate, subcircular in outline, only slightly longer than high, subequilateral. Surface with concentric corrugations crossed by very fine straight radiating striae. Beaks approaching, small but prominent.

Two specimens, both with the valves complete, but one is rather deformed. The undeformed one measures 21 millim. in length, 19 millim. in height and 16.5 millim. in thickness.

Fossil locality.—Matsushima: in a fine, micaceous sandstone of the Dakeshita Cliff.¹⁾

6. *Lucina (Phacoides) borealis*, Linné

Lucina (Phacoides) borealis. Yokoyama, Moll. Upper. Part Jō-Ban Coal., p. 34, pl. V, figs. 5-8. Moll. Mid. Part Jō-Ban Coal., p. 18, pl. III, figs. 1, 2. Tert. Moll. Shinano a. Echigo, p. 14. Tert. Foss. Kii, p. 57, pl. VI, fig. 11. Moll. Tert. Basin Chichibu, p. 121. Tert. Moll. South. Tôtômi, p. 355.

A single, ill-preserved specimen.

Fossil locality.—Hakojima: In a soft, yellowish, decomposed tuff-like sandstone.

Geological occurrence.—Upper and Lower Musashino, Pliocene and Miocene.

Living.—Central Japan. Atlantic Ocean.

7. *Venericardia ferruginea*, (A. ADAMS)

Venericardia ferruginea. Yokoyama, Foss. Miura Penin., p. 129, pl. XI, figs. 3, 4. Moll. Rem. Low. Part Jō-Ban Coal., 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. Foss. Shells Sado, p. 297.

Specimens are numerous, but mostly badly preserved. They are large compared with the living, just as those of the Jō-Ban Coal-Field.

Fossil locality.—Ōshima: In a hard, grey or yellowish grey sandstone of the west coast, Sajibetto,²⁾ Uhama,³⁾ and of the coast bordering the Strait of Nakado.⁴⁾

Geological occurrence.—Upper and Lower Musashino, Pliocene and Miocene.

Living.—Northern Japan.

8. *Mytilus hirsutus*, LAMARCK

Pl. L. Figs. 3, 4

Mytilus hirsutus. Yokoyama, Foss. Miura Penin., p. 144, pl. XI, fig. 16. Moll. Coral Bed Awa, p. 53.

Comparatively large specimens, though not perfect.

Fossil locality.—Hakojima:—In a coarse, yellowish weathered sandstone.

Geological occurrence.—Coral Bed. Upper Musashino.

Living. Central and Western Japan. China Sea.

1) 岳下絶壁. 2) 佐司別當. 3) ウ濱. 4) 中戸.

9. *Lima goliath*, SMITH

Pl. L. Fig. 1

Lima goliath. Yokoyama, Foss. Miura Penin., p. 147, pl. XVI, figs. 7, 8. Moll. Rem. Upper. Part Jō-Ban Coalf., p. 26, pl. III, fig. 14. Moll. Rem. Mid. Part, p. 19. Moll. Tert. Basin Chichibu, p. 123, pl. XIV, fig. 11.

Many, partly well preserved examples.

Fossil locality.—Ōshima: (1) in a hard dark grey sandstone of the west coast; (2) in a coarse sandstone with many spots of white kaolinized feldspars and (3) also in a fine-grained, light grey one, both from some part of the island not specially named.

Geological occurrence.—Lower Musashino and Pliocene.

Living.—Central Japan. Patagonia.

10. *Pecten* sp.

A badly preserved specimen resembling that of *Pecten laetus* Gld. (Yokoyama, Foss. Up. Musashino, pl. XIV, fig. 26).

Fossil locality.—Sakitōjima: In a hard, coarse, dark grey sandstone.

11. *Ostrea* sp.

Two imperfect specimens, one of which is large and ovate in outline, resembling shorter forms of *Ostrea gigas* Thunb. (Yokoyama, Foss. Miura Penin., pl. XV, fig. 2).

Fossil locality.—Ōshima: In a light grey, quartzose sandstone (only a fragment of the shell); Matsushima: In a fine grained micaceous sandstone (cast of an ovate shell).

12. *Arca* sp.

A few, bad, deformed examples somewhat like *Arca subcrenata* Lischke (Yokoyama, Foss. Up. Musash., pl. XV, fig. 12).

Fossil locality.—Ōshima: In a hard, coarse grey sandstone from a part of the island not specially named.

13. *Pectunculus* sp.

Several specimens showing some resemblance to *Pectunculus yessoensis* Sow. (Yokoyama, Foss. Up. Musashino, pl. XVI, figs. 6, 7).

Fossil locality.—Ōshima: In a coarse sandstone of Uchinoura; Matsushima: In a hard, greenish grey sandstone.

14. *Nucula mirabilis*, A. ADAMS et REEVE

Nucula mirabilis. Yokoyama, Foss. Miura Penin., p. 180, pl. XIX, fig. 9. Moll. Rem. Mid. Part Jô-Ban Coal., p. 24, pl. III, fig. 6. Tert. Moll. South Totomi, p. 362. Moll. Foss. Mino, p. 226.

Two examples only.

Fossil locality.—Ōshima: (1) in a dark grey sandy shale of Hamaguri Shinden; (2) in a fine-grained, argillaceous, grey sandstone.

Geological occurrence.—Upper and Lower Musashino, Pliocene.

Living.—Central and Western Japan.

15. *Linthia nipponica*, TOKUNAGA

Linthia nipponica. Tokunaga, Fossil Echinoids Japan, p. 18, pl. I, figs. 5-7, pl. III, fig. 1.

Two imperfect specimens.

Fossil locality.—Ōshima: In a light grey fine grained soft sandstone (exact locality not stated).

Geological occurrence.—Pliocene.

16. *Scutella* sp.

A central portion of a flat echinoid with a petaloidal ambulacra.

Fossil locality.—Ōshima: In a hard grey coarse sandstone of Sajibetto coast.

17. *Heterocyathus* sp.

Pl. L. Fig. 6.

The only specimen we possess represents the polyparium of a coral in a cross-section. It is thick-walled and circular in form with a diameter of about 11 millim. The number of septa is forty-eight which are straight, more or less granulated and of a nearly equal thickness. Those of the first three cycles reach the columella of the centre, but those of the fourth meet with those of the third at a very acute angle at a place generally nearer the centre than to the periphery.

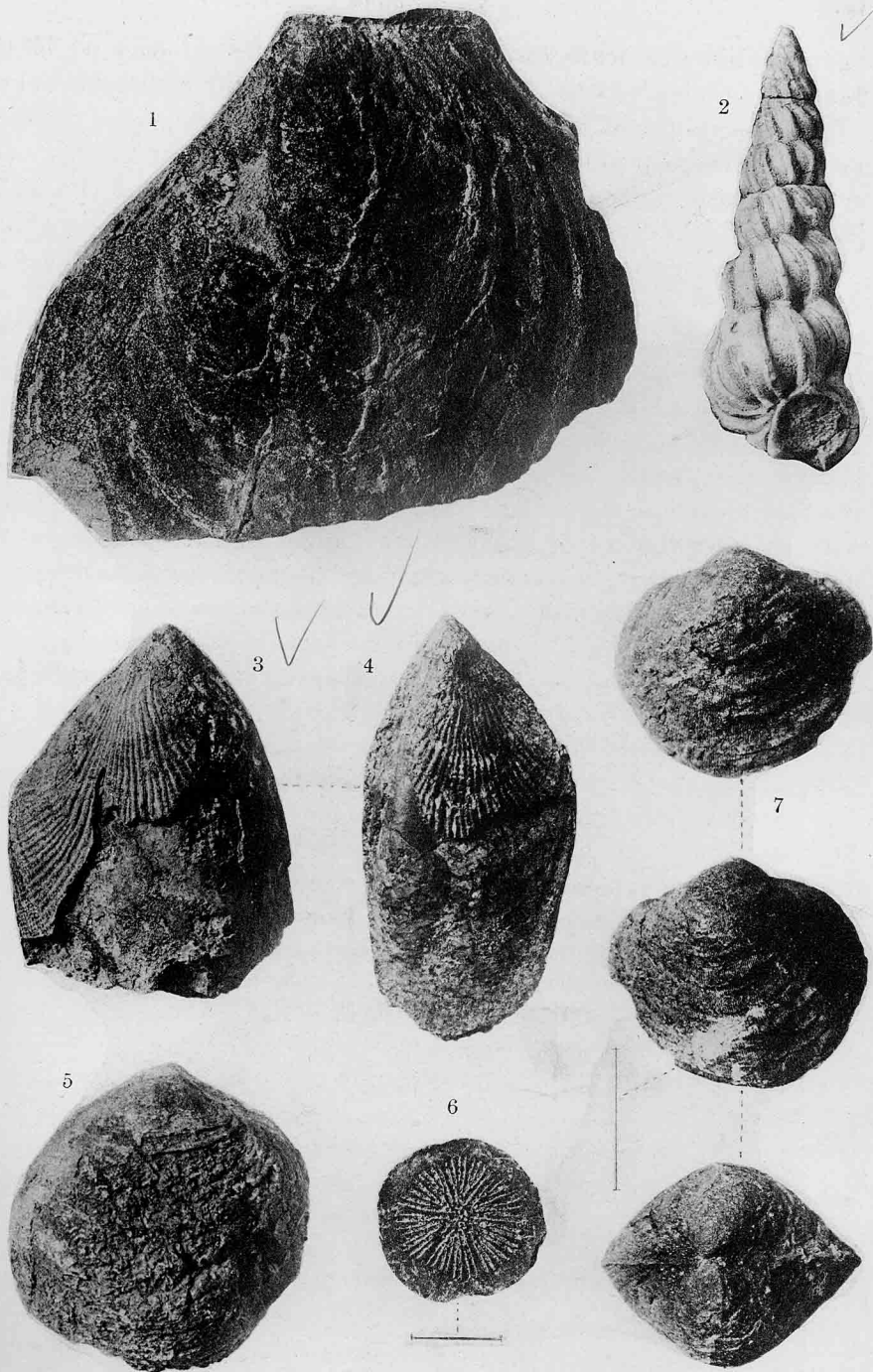
So far as the formation of the septa is concerned, our fossil shows a striking resemblance to that of Sasagé, Kazusa, which Mr. Makiyama

figures as identical with *Heterocyathus elberti* Felix, on page 11 of the January number of the Journal of the Geological Society of Tokyo, 1926, a species found in the Pliocene of Java and Obimajora (Felix, Fossile Anthozoon aus der Gegend von Trinil. p. 363, pl. 27, figs. 1a-c, and Jungtertiäre und Quartäre Anthozoon von Timor und Obi, p. 38, pl. 2, fig. 5). And this resemblance is so great that there is a possibility of the two belonging to one and the same species, although the final decision must wait until the whole polyparium is discovered. As to the question whether the Sasagé fossil is really *Heterocyathus elberti* Fel., as Makiyama thinks, I can not give any definite answer, for I have never seen it. But judging from the figures of their respective fossils given both by Makiyama and Felix, there are some marked differences between them in the formation of the septa, namely: while the septa of the fourth cycle in the Sasagé fossil are straight throughout and meet with those of the third at a very acute angle, in the Javan they curve towards the latter in meeting, making the angle thus formed more obtuse, and this takes place generally nearer to the periphery than to the centre.

Fossil locality.—Oshima: In a micaceous sandstone from a place not specially stated.

Explanation of Plate L

- Fig. 1. *Lima goliath* Im. West coast of Oshima. P. 188
- Fig. 2. *Scala maculosa* Ad. et Rve. Sakitojima. P. 185
- Figs. 3, 4. *Mytilus hirsutus* Lam. Hakojima. P. 187
- Fig. 5. *Chione casinaeformis* Yok. Uhama, Oshima. P. 186
- Fig. 6. *Heterocyathus* sp. Oshima. P. 189
- Fig. 7. *Cardium sagawai* n. sp. Matsushima. P. 186



1. *Lima goliath* SMITH.
3, 4. *Mytilus hirsutus* LAM.
6. *Heterocyathus* sp.

2. *Scala maculosa* AD. et RVE.
5. *Chione casinaeformis* YOK.
7. *Cardium sagawai* YOK.

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