Two New Species of *Venericardia* and *Crassatella* from the Eocene Formations in Amakusa Island

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**INTRODUCTION**

This paper deals with the description of two new species belonging to *Venericardia* and *Crassatella*, i.e., *Venericardia (? Pacific) ushibukensis* sp. nov. and *Crassatella (Eucrassatella) hataei* sp. nov., from the Paleogene strata of Amakusa-Shimojima Island, Kyushu.

The formation yielding a new species of *Venericardia* is composed of dark-gray siltstone inserting with several calicarious sandstone lenses which inclusive of *Nummulites ushibukensis* and *Dyscocyclina* sp.. Although the formation was called the Fukuregi Formation (Matsushita, 1949; Matsushita et al., 1959; Miki, 1975; Miki and Uematsu, 1973) or Akashimisaki Formation (Hatae, 1959), this was correlated with the "Akasaki" Formation by Tashiro and Otsuka (1979). The geological age of the formation had been determine to lower part of the Middle Eocene judging from the occurrence of calicarious nannofossils (*Discoaster rodoensis* Zone: Tashiro et al., 1979).

Text-fig. 1. Map showing fossil localites.

A. locality of *Venericardia (? Pacific) ushibukensis* Tashiro, sp. nov.

B. localities of *Crassatella (Eucrassatella) hataei* Tashiro, sp. nov.
Crassatella (Eucrasstella) hataei sp. nov. occurs from the fine grained glauconite sandstone of the upper-most part of the Kyoragi Formation which lays conformably on the "Shiratake" Formation.

Before going into my study, I wish to express my hearty thanks to Dr. Kenshiro Ogasawara of Tohoku Univ, for his kind advice.

The specimens described in this paper are preserved in the Faculty of Science, Kochi University (Kochi, 780).

Systematic description

Order Veneroida

Superfamily Carditacea Fleming

Family Carditidae Fleming

Genus Venericardia Lamarck, 1801

Subgenus Pacificar Verastegui, 1953

Venericardia (? Pacificar) ushibukensis, sp. nov.

Plate 1. Figs. 13-15, Text-fig. 2

Material: - Holotype, KSG 0900, a conjoined valves, from Ushijima islet, Ushibuka City, Kumamoto Prefecture.

Diagnosis: - Shell large, well inflated, subtriangular in outline, a little longer than high; test very thick; umbo large, well prominent, pointed at a little anterior than mid-point of the dorsal margin; beak nearly orthogyrous, very incaved, situated nearly mid-length of the valve; anterior margin weakly concave, with about two thirds of the valve height; ventral margin broadly arched, with full length of the valve;

Text-fig. 2. Venericardia (? Pacificar) ushibukensis sp. nov. (left valve)
Two New Species of *Venericardia* and *Crassatella* (田代)

posterior margin nearly straight, a little longer than the anterior margin; umbonal angle is about 80°; lunular area flat, lanceolated in outline, nearly smooth; escutcheonal area indistinct; surface ornamented with 35 or more radial ribs; the ribs strong, flat-topped and narrower than their interspaces on the umbonal part, gradually changing into broad and strongly granulated on anterior ventral part, and broadened and low or nearly effaced with only finely waved growth lines on median and posterior ventral parts; the interspaces of the ribs deep and broad on umbonal and anterior ventral parts, but gradually became narrow and shallow grooves on the median and posterior ventral parts.

**Remarks:** - This specimen is measured 74.6 mm in length, 65.6 mm in height and 26.5 mm in thickness. The hinge structure is unknown. This species is characterized by very weak or nearly effaced radial ribs on the median and posterior ventral parts on the flank. The feature of the ribs is one of the important characters of the subgenus *Pacificar* Verastegui (1953). Such the features are also known in the species of the subgenera *Venericar* Stewart (1930) and *Leuroactis* Stewart (1930). This species, however, may cannot be refer to *Venericar* and *Leuroactis*, because of its flat lunular area and strongly prominentumbo.

The type species of *Pacificar, Venericardia* (*Pacificar*) mulleri Verastegui (1953), from the Paleogene of western North America, is discriminated from this species in having its rounded outline. This species resembles *Venericardia* (*Pacificar*) hornii (Gabb) (Verastegui, 1953; Stewart, 1930; Givens, 1974) from the Eocene of California, in its strongly inflated valve and largeumbo, but differs in its subtriangular outline and numerous ribs. *Maoricardium spatiosum* (Hutton) (Marwick, 1944; Boreham, 1965) from the Paleogene of New Zealand, is similar to this species in its largeumbo and subtrigonal outline. *Maor. spatiosum* is, however, characterized by the distinct radial ribs on the ventral part of the disk. *Venericardia* (*Venericar*) nipponica Yokoyama (1911; Nagao, 1928; Oyama, Mizuno and Sakamoto, 1960; Otsuka, 1978), from the Eocene Formation of North Kyushu and Amakusa-Shimojima, is clearly discriminated from this species in its less prominentumbo and less distinct lunular area than those of this species.

**Occurrence:** - Dark gray siltstone of the lower part of the "Akasaki" Formation (= Fukuregi Formation by Matsushita, 1949, or upper part of the Akashimisaki Formation by Hatae, 1959), at northern seashore of the Ushijima islet, Ushibuka City (Amakusa-Shimojima), Kumamoto Prefecture; lower part of the Middle Eocene.

Superfamily Crassatellacea Ferssac

Family Crassatellidae Ferssac

Subfamily Crassatellinae Ferssac
Genus *Crassatella* Lamarck, 1799

Subgenus *Eucrassatella* Iredale, 1924

*Crassatella (Eucrassatella) hataei* sp. nov.

Plate 1, Figs. 1-12, Text-fig. 3

**Material:** - Holotype, KSG 0901, left valve, from Medake of Miyanokawachi, Amakusa-Shimojima; paratypes, KSG 0902 - KSG 0907, from the same locality of the holotype; the other paratypes, KSG 0908 - KSG 0909, from the western seasour of the Ubushima islet of Miyanokawachi, Amakusa-Shimojima.

**Diagnosis:** - Shell roundly ovate, longer than high, moderately inflated; umbo small, weakly prominent, nearly orthogyrus or slightly prosogylate, located at about two fifths from front of the valve; anterior dorsal margin short, weakly concave; posterior dorsal margin slightly convex with about a fourth of the valve length; umbonal angle about 100°; anterior margin semicircular, gradually changing into broadly arched ventral margin; posterior margin slightly convex, obliquely subtruncated from the posterior dorsal margin; lunule lanceorated, moderately

Text-fig. 3. *Crassatella (Eucrassatella) hataei* sp. nov.

A: Internal view of left valve; B: External view of left valve;
C: Dorsal view of conjoint valves
depressed, ornamented with numerous concentric ribs which conjoint with the ribs on the flank; escutcheon narrow, deeply depressed; flank ornamented with concentric ribs and riblets; the ribs narrow, round-topped, crowded regularly near the umbo but broadly spaced on the later; the riblets occupying on each interspace between a rib and a next rib, number about 4 in each interspace; posterior carina not angulated only a roundly elevated ridge; ligamental resilifer entirely internal, moderately in size, located under the umbo, not reaching the lower periphery of the hinge plate; hinge plate wide with anterior and posterior lateral teeth and two cardinal teeth on each valve; hinge formula is as follows:

All 2 4b PII / Al 3b 5b PI

cardinal 2 is very narrow; 4b large, nearly vertical; 3b strong, triangular; 5b short and small; lateral teeth narrow; nymph rather broad; inner surface smooth; inner margin smooth; a strong radial inner buttress extending from the umbo to posterior of the anterior adductor scar but not reach the pallial line; both lateral adductor scars strongly impressed; anterior one somewhat larger than posterior one; pallial line simple, weakly impressed.

**Measurements (in mm):**

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Length</th>
<th>Height</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>KSG 0907, left valve</td>
<td>16.5</td>
<td>14.4</td>
<td>2.8</td>
</tr>
<tr>
<td>KSG 0908, conjoint valves</td>
<td>18.3</td>
<td>15.0</td>
<td>4.3</td>
</tr>
<tr>
<td>KSG 0901, left valve</td>
<td>25.8</td>
<td>21.7</td>
<td>5.7</td>
</tr>
<tr>
<td>KSG 0902, left valve</td>
<td>30.7</td>
<td>24.0+</td>
<td>7.5</td>
</tr>
<tr>
<td>KSG 0903, conjoint valves</td>
<td>34.6</td>
<td>24.9+</td>
<td>7.0</td>
</tr>
<tr>
<td>KSG 0904, conjoint internal moulds</td>
<td>29.3</td>
<td>28.0</td>
<td>–</td>
</tr>
<tr>
<td>KSG 0905, conjoint external moulds</td>
<td>22.6</td>
<td>16.8+</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Text-fig. 4. Comparison of the outlines between *Crassatella (Eucrassatella)* hataei, sp. nov. (full line) and *Crassatella (Eucrassatella)* nipponensis Yokoyama (dotted line).
Remarks: - This species is probably identical with "Crassatelites n. sp." which was listed from so-called Tomiyama fossil Bed of the Kyoragi Formation of the Amakusa-Shimojima, by Hatae (1960).

The concentric ribs on the flank number about 20. 10 or so ribs near the umbo are closely spaced. But the other ribs are irregular in the stoutness and gradually broaded in their interspaces towards the venter. The ratio of length to height of the valve is rather uniform with about 0.88.

Comparison: - Although this species differs from Crassatella (Eucrassatella) nipponensis Yokoyama (= C. fusca Yokoyama, 1981; Nagao, 1928; Oyama, Mizuno and Sakamoto, 1960), from the Eocene Formations of North Kyushu and Amakusa Island, in having its rounded outline and more posterior location of the umbo, the hinge structure of this species is nearly identical with that of C (E.) nipponensis in the almost features. Crassatella (Spissatella) australis (Hutton) (Boreham, 1965) from the Middle Eocene of New Zealand is similar to this species in its rounded outline and the arrengement of the ribs and riblets on the surface. The foreign species is, however, characterized by more depressed escutcheon and narrower cardinal 3b and distinct 3a than those of this species. Several species which were described from the Paleogene

Text-fig. 5. Comparison of the outlines among the species of Japanese Paleogene Crassatella.
1: Crassatella (Crassatella) komodai Oyama et Mizuno;
2: Crassatella (Crassatina) pauxillus (Yokoyama)
3: Crassatella (Eucrassatella) nipponensis Yokoyama
4: Crassatella (? Eucrassatella) matsuraensis Nagao.
5: Crassatella (Eucrassatella) asakuraensis Nagao
6: Crassatella (Eucrassatella) inconspicus Nagao
7: Crassatella (Eucrassatella) yessoensis Mizuno et Kumano
8: Crassatella (Eucrassatella) yabei Nagao
9: Crassatella (Eucrassatella) hataei Tashiro, sp. nov.
of Japan as the members of genus Crassatella, are easily distinguishable from this species in their features of each outline of the valve as showing in Text-fig. 5.

**Occurrence:** Fine grained glauconite sandstone of the upper-most part of the Kyoragi Formation at the roadside exposure of Nonaka, Medake peninsula, and the western sease of Ubushima islet, both of Miyanokawachi, Kawaura-Machi, Amakusa-gun (Amakusa-Shimojima), Kumamoto Prefecture; Middle Eocene. This species occurs together with Venericardia (Venericar) nipponica Yokoyama, Acesta kumasoana (Nagao) etc.

**REFERENCES**


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PLATES 1
Explanation of plate 1

**Crassatella (Eucrassatella) hataei** sp. nov.

Fig. 1: Lateral view of left valve, KSG 0902, x 1.5; loc. Nonaka of Medake, Miyanokawachi, Kawaura-Machi, Amakusa-Shimojima.

Fig. 2: Lateral view of left valve (holotype), KSG 0901, x 1.5; loc.: ditto.

Fig. 3: Lateral view of left valve, KSG 0907, x 1.5; loc.: ditto.

Fig. 4: Lateral view of right valve, KSG 0903, x 1.2; loc.: ditto.

Fig. 5: Lateral view of left valve, same specimen with KSG 0903, x 1.2.

Fig. 6: Dorsal view of the same KSG 0903, x 1.2.

Fig. 7: Lateral view of right valve, same with KSG 0903, x 1.5.

Fig. 8: Lateral view of internal mould of left valve, KSG 0904, x 1; loc.: ditto.

Fig. 9: Lateral view of left valve, gum cast of external mould, KSG 0905, x 1; loc. ditto.

Fig. 10: Inner umbonal view of right valve; KSG 0906, x 1; showing hinge structure; loc. ditto.

Fig. 11: Lateral view of left valve, KSG 0908, x 1.5; loc. south-western seashore of Ubushima islet, Miyanokawachi, Kawaura-Machi.

Fig. 12: Lateral view of right valve, same specimen with KSG 0908, x 1.5.

**Venericardia (P. Pacificar) ushibukensis**, sp. nov.

Fig. 13. Lateral view of left valve (holotype), KSG 0900, x 1; loc.: eastern seashore of Ushijima, Ushibuka City, Amakusa-Shimojima.

Fig. 14. Dorsal view of the same specimen, x 1.

Fig. 15. Anterior marginal view of right valve, same with KSG 0900, x 1.