647. TWO NEW NON-MARINE SPECIES OF BIVALVIA FROM THE LOWER CRETAEOUS OF SOUTHWEST JAPAN

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Introduction

This paper contains a result of the palaeontological studies on the Lower Cretaceous Ryoseki fauna in Japan.

I describe, in this paper, two new species under the genera Isodomella and Myopholas on the basis of my new collections.

Before entering into the description, I wish to express my sincere thanks to Professor Tatsuro MATSUMOTO for his invaluable advice and critical reading of this manuscript. Also I am indebted to Dr. Itaru HAYAMI for his invaluable suggestions.

Description

Subfamily Eomiodontinae

HAYAMI, 1965

Genus Isodomella KOBAYASHI and SUZUKI, 1939

Type-species: Cyrena shiroiensis YABE and NAGAO, 1926, from the Lower Cretaceous of Japan.

Diagnosis: Shell small to medium-sized for the Eomiodontinae, equivolve, inequilateral, subtrapezoidal, provided with a prominent posterior carina; umbo prominent, rising high above hinge margin, recurved, more or less prosogyrous, anterior to mid-length; lunule weakly impressed; escutcheon indistinct; surface marked with concentric ribs which are often restricted to the umbonal region as in Astarte (s.s.) in the juvenile stage but nearly smooth except for somewhat rugose growth-lines in the adult stage; hinge essentially similar to that of Eomidon, as formulated below:

\[ \begin{array}{cccc}
\text{AIII} & \text{AI (3a)} & 3b & 5b & \text{PIII} \\
\text{AII} & 2 & 4b & \text{PII} \\
\end{array} \]

cardinal teeth divergent from the beak,

* Received Oct. 28, 1974; read Oct. 19, 1974 at Nagoya.
flattened at the top, stout but 3a rather obscure or weak, 5b clearly separated from nymph; lateral slopes of cardinals transversely crenulated; anterior lateral teeth shorter than posterior ones, PI commonly absent, cross-striation undeveloped on lateral teeth; pallial line simple; umbonal cavity comparatively shallow.

Discussion: YABE and NAGAO noted the presence of three cardinal teeth in each valve, regarding the dentition of this species as cyrenoid. However, as described above, the left valve has only two cardinals 2 and 4b, the cardinal 1 is absent, and the hinge structure is certainly of lucinoid type. While they did not note on the transverse crenulation on the sides of cardinals which is distinct even in the syntype (no. 22451).

KOBAYASHI and SUZUKI (1939, p. 219-220) established Isodomella as a section of the genus Polymesoda on the basis of Cyrena shiroiensis YABE and NAGAO (1926) in describing the characters as “the species reveals the typical mode of dentition in Polymesoda, and furthermore the outline of the shell and the entire pallial line reveal its close approach to the Isodoma section of the genus. However, compared to Polymesoda cyrenoides (DESHAYES) from the Eocene formation of the Paris basin, which is the type of the Isodoma section, the hinge teeth are much more prominent and the posterior lateral teeth tolerably longer in this species”. The Recent species Polymesoda caroliniana (BOSC), the type-species of the genus, which lives in the warm streams of North America, has three strong cardinals in each valve and a pallial line with deep, narrow sinus. The present species is not referred to the genus Polymesoda, because the left valve has only two cardinals and the cardinals in each valve have strong crenulation on their sides and the pallial sinus is entire.

SUZUKI and OYAMA (1943) suggested that Isodomella KOBAYASHI and SUZUKI (1939) may be a section of subgenus Geloina GRAY, 1842, without mentioning the reason. As Isodomella has the dentition of a lucinoid type, it is not related to the subgenus Geloina of the Corbiculidae.

The presence of the dentition of a lucinoid type, an Astarte-like sculpture in the juvenile stage, and a habitat of brackish to marine environments indicate that the present species is certainly assigned to the subfamily Eomiodontinae HAYAMI, 1965, including the genera Eomiodon COX, 1935, Myrene CASEY, 1955, Protocyprina VOKES, 1946, Costocyrena HAYAMI, 1965, and Pseudasaphis MATSUMOTO, 1938.

Isodomella is distinguished from Eomiodon COX, 1935 (type-species: E. indicus COX, 1935) by the following significant points. The cardinal 5b of the former is strong and clearly separated from nymph, but that of the latter is weak and connected with nymph. The former has a weak but distinct lateral PIII and the strong crenulation on the sides of cardinals, but these are absent in the latter. Furthermore, the former has no distinct escutcheon.

In many characters, this genus is very similar to Myrene CASEY, 1955 (the type-species: M. fittoni CASEY, 1955), but the construction and feature of laterals are different between them. Namely, the lateral teeth A0, P0 and lateral cross-striation are absent in the former.

In the presence of the cardinal cross-crenulation and lateral PIII, this genus is also easily distinguishable from Protocyprina VOKES, 1946 (the type-species: Astarte libanotica FRASS, 1878).

Costocyrena HAYAMI, 1965 (type-species: C. matsumotoi HAYAMI, 1965) and Pseudasaphis MATSUMOTO, 1938
(type-species: *P. japonicus* Matsumoto, 1938) which have radial ribs on their whole surfaces, are characteristic genera in the Eomiodontinae. The present genus has many common characters with them, but it is readily be distinguishable from them by the differences in the surface sculpture and cardinal crenulation.

For the above-mentioned reasons, I propose to include the emended genus *Isodomella* in the Eomiodontinae.

*Isodomella matsumotoi* sp. nov.

Plate 9, figs. 1-13; Text-figs. 1, 3.

**Material:** The holotype is a right valve (GF. Y147) collected from the Yoshimo formation at loc. Y51, Yoshimo, Shimonoseki City, Yamaguchi Prefecture. Paratypes (GF. Y106-108, Y110-113, Y127-135, Y142-146, Y148) were collected from the same locality and other paratypes (GF. K2552-2556) from the Kawaguchi formation at loc. K123, Fukami, Saka-moto Village, Yatsushiro County, Kumamoto Prefecture. All are collected by myself and are now kept in Fukuoka University of Education and indicated in this paper with the prefix GF.

The fossil localities (S401, Y51 and K123) and their stratigraphical positions are shown in the map and columns of my previous paper (Ohita, 1973, figs. 1-2).

**Description:** Shell medium-sized, equivelvalve, inequilateral, trigonally ovate to subtrapezoidal in outline, moderately inflated; test fairly thick; umbo prominent, prosogyrous, placed at about one-third of the length of the shell from the anterior end; antero-dorsal margin comparatively short, faintly concave in front of umbo, passing gradually into antero-ventral margin; postero-dorsal margin long, gently convex or nearly straight; siphonal margin short, obscurely delimited from the posterodorsal margin by an obtuse angle, turning angularly to the ventral margin; ventral margin broadly arcuate, passing gradually into the anterior margin; a blunt carina extends from the umbonal region to the postero-ventral corner; lunule moderate in width, rather shallow, weakly defined; escutcheon indistinct; ligament external, not much elongated; surface ornamented with concentric furrows and distinct lamellae with fine growth-lines; hinge plate fairly broad especially in the adult shells; dentition characterized by much modified lucinoid cardinal teeth having strong trigonian cross crenulation and corbiculoid elongated lateral teeth; cardinal 2 fairly stout, opisthoclone, separated from AII, only posterior side crenulated; 4b moderately thick, obliquely elongated, prosocline, both sides fairly strongly crenulated; 3a comparatively small, tubercular, opisthoclone, represented by a terminal thickening of AIII; 3b especially large, very stout and broad, aclinse or slightly prosocline, both sides strongly crenulated; 5b prosocline, separated from nymph, only anterior side crenulated; anterior lateral teeth linearly elongated.

Text-fig. 1. *Isodomella matsumotoi* sp. nov.
1. Right valve, showing the outline of shell and the surface ornamentation of the adult stage. 2. Showing the internal feature of left (2a) and right (2b) valves.
along the antero-dorsal margin, but Al and AIII ill-defined from the margin of hinge plate; posterior lateral teeth PII and PIII remote from cardinal teeth, longer than anterior laterals; PI not defined; no prominent transverse crenulation on lateral teeth; nymph comparatively wide; adductor scars fairly strongly impressed, comparatively large, sub-ovate, subequal in size, placed near the ends of the lateral teeth; pallial line not sinuated but somewhat abruptly bent upwards below the posterior adductor scar; pedal scar not clearly impressed; umbonal cavity comparatively shallow; ventral margin smooth internally.

**Measurements in mm:**

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<tr>
<th>Specimen</th>
<th>Length</th>
<th>Height</th>
<th>H/L</th>
</tr>
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<td>28.0</td>
<td>21.0</td>
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<td>19.0</td>
<td>0.70</td>
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<tr>
<td>&quot; Y 113 ( )</td>
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<td>0.81</td>
</tr>
<tr>
<td>&quot; Y 127 ( ; left valve)</td>
<td>20.0</td>
<td>15.0</td>
<td>0.75</td>
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<tr>
<td>&quot; Y 128 ( )</td>
<td>19.5</td>
<td>15.0</td>
<td>0.76</td>
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<tr>
<td>&quot; Y 129 ( )</td>
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<td>20.0</td>
<td>0.80</td>
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<td>&quot; Y 130 ( )</td>
<td>19.0</td>
<td>15.0</td>
<td>0.78</td>
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<td>&quot; Y 131 ( )</td>
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<td>0.69</td>
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<td>&quot; Y 132 ( )</td>
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<td>27.0</td>
<td>20.5</td>
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<tr>
<td>&quot; K2556 ( )</td>
<td>14.0</td>
<td>10.0</td>
<td>0.71</td>
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Variation: In addition to the above indicated 28 specimens, many specimens from Yoshimo and other areas at hand are referable to the present species. Most of these specimens are little deformed secondarily except some specimens from Kawaguchi. The average of the ratio of H/L is about 0.74, but the ratio varies apparently to a tolerable extent as shown in the measurements and Text-fig. 2. However, there is a trend that the ratio decreases from the juvenile stage to the adult one. In other words, outline of the juvenile stage is rounded trigonal while that of the adult stage subtrapezoidal as shown in Text-fig. 3. The position of umbo which is indicated by the ratio of L'/L varies also to a fairly wide extent, ranging from one-
Text-fig. 4. Diagram showing the relation between the length of shell (L) and the one from the umbo to the anterior end (L').

○: *Isodomella matsumotoi* sp. nov.; ×: *Isodomella shiroiensis* (YABE and NAGAO);
+: "*Cyrena* shiroiensis* var. alata* (YABE and NAGAO) (=*Isodomella shiroiensis* (YABE and NAGAO)).

*shiroiensis* (YABE and NAGAO) (=*Cyrena shiroiensis* YABE and NAGAO) is about 1.00 as shown in Text-fig. 2. In the juvenile stage there is a strong resemblance between the present species and *Isodomella shiroiensis* in the outline of shell and the ratio of H/L as shown in Text-figs. 2, 3 and 5. However, in the adult stage the former is easily distinguished from the latter in that the former is larger, subtrapezoidal instead of subtrigonal in outline, and has a smaller ratio of H/L than the latter.

YABE and NAGAO (1926, pl. 2, fig. 26; pl. 3, figs. 15, 28) discriminated *Cyrena shiroiensis* var. *alata* from *Cyrena shiroiensis* by the reasons that its umbo is median and its outline is subtrigonal. However, I agree with KOBAYASHI and SUZUKI (1939, p. 220) in considering that *Cyrena shiroiensis* var. *alata* is synonymous with *Cyrena shiroiensis* (=*Isodomella shiroiensis*), because the former is included within the variation of *Isodomella shiroiensis* as shown in Text-figs. 4 and 5.

MAEDA (1959) described *Polymesoda* (*Isodomella*) *kobayashii* from the Tochio alternation of sandstone and shale in the Akaiwa formation at Kamitakara Village, Yoshiki County, Gifu Prefecture. MAEDA (1959, p. 158) noted the presence of three cardinal teeth in each valve, interpreting that the dentition is of corbiculid type.

Text-fig. 5. The morphogenetic change of the outline of shell of *Isodomella shiroiensis* (YABE and NAGAO).
However, the left valve has only two cardinals 2 and 4b, without cardinal 1 and, thus, the hinge structure is a kind of lucinoid type. Therefore, *P. (I.) kobayashii* should not be assigned to *Polymesoda* of the Corbiculidae. Furthermore, as it has neither cardinal 5b nor cardinal crenulation, it is not referred to *Isodomeilla*, but it may be related to the genus *Crenotrapeziun* Hayami, 1958.

Matsumoto and Kanmera (1952) and Matsumoto (1954) listed *Polymesoda (Isodomeilla) shiroiensis* (Yabe and Nagao) from the Yoshimo and Kagawuchi formations without any description, but their specimens may be referred to the present species.

The specific name is dedicated to Prof. Tatsuro Matsumoto who kindly suggested me to study the Mesozoic non-marine Bivalvia.

*Occurrence*: Black shale of the Yoshimo formation at loc. Y51, Yoshimo, Shimonoseki City, Yamaguchi Prefecture, and black shale of the Kagawuchi formation at a road-cut (K123) between Kagawuchi and Shimo-fukami, Sakamoto Village, Yatsushingo County, Kumamoto Prefecture.

**Family** Myopholadidae Cox, 1964

**Genus** Myopholas Douville, 1907

**Type-species**: Pholadomya multicostata Agassiz, 1842 (original designation).

*Myopholas carinatus* sp. nov.

Plate 9, figs. 17-21

**Measurements in mm**:

<table>
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<th>Length</th>
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<td>21.0</td>
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<td>32.0</td>
<td>16.0</td>
<td>7.0</td>
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**Material**: The holotype is a left internal mould (GF. Y450) collected from the Yoshimo formation at loc. Y51, Yoshimo, Shimonoseki City, Yamaguchi Prefecture. Paratypes (GF. Y451-458) from the same locality. The holotype and one of the paratypes (GF. Y452) are well preserved.

**Description**: Shell of small size, inequilateral, elongate-ovate with slight tendency to be rostrate posteriorly; umbo broadly rounded and scarcely protruding, situated about one-third of the shell length from the anterior end, and incurved to slightly prosogyrous beak; inflation of shell strong below umbo and maximum convexity lying near the mid-height below the umbo; thickness decreases gradually toward the posterior end; fairly strong carina from umbo to posteroventral angle, delimiting fairly broad, elongate and partly concave posterior area, while weaker radial ridge delimits small anterior area on the other side of umbo; sharp edge of thickening of dorsal margin that projects into cavity of valve gives rise to groove extending parallel with posterior carina on internal mould; valve margin closed or with a narrow posterior gape; escutcheon long, narrow, bordered by a distinct ridge; ornament of anteromedian part of surface marked with radial and concentric ribs with tubercles at their intersection, while radial ribs on anterior part of surface stronger and more widely separated than median ones, and of posterior part of surface weakly ribbed or almost smooth with fairly strong concentric ribs only; hinge feature, adductor scars and pallial line not clear.
Variation: The variation on the present species is not exactly known, but a young specimen (Y452, Fig. 18) is less inflated and has a weaker posterior carina than the adult one (Y450, Fig. 17).

Comparison: In many characters the present species is closely allied to *Myopholas multicostata* (Agassiz, 1842), the type-species of the genus, from the Kimmeridgian of Switzerland. A sharp edge of thickening of dorsal margin and a mode of sculpture are also known in the latter species. But the latter has some submedian ribs of secondary strength in the interspaces of ribs and is larger and more inflated than the former. *M. ledouxi* Douville, 1907, from the Albian of France is similar to the present species in the outline and surface ornamentation, but is again larger and more inflated. *M. minor* Hayami, 1972, from the Lower Jurassic of Southeast Asia, may also be related to the present species. The latter has, however, a strong carina and not so many radial ribs as compared with the former.

The present species seems to be comparable with *Myopholas* cfr. *semicostata* (Agassiz) of Yabe and Nagao, 1926, from the Shiroi formation with regard to many characters, but the posterior carina appears to be stronger than in the latter species, and in the former surface of anteromedian part is covered with rows of minute granules at the intersection of radial and concentric ribs in contrast to smooth radial ribs in the latter species.

The present species is fairly similar to *Burmesia irata* Healey, 1908, from the Rhaetian of Southeast Asia in the elongate-ovate outline, the surface ornamentation and the edentulous hinge, but is clearly distinguishable from the latter by the absence of spoon-like condrophore extending into shell cavity from below the beak. It has only concentric ribs on the posterior area, but the latter has concentric folds and subordinate radial threads.

The present species is fairly similar to the cosmopolitan species, *Pholadomya* (s.s.) *candida* Sowerby, 1819, the type-species of the genus, ranging from Upper Triassic to Recent, in the elongate-ovate outline and the pustulation of surface ornamentation. However, the latter is strongly inequilateral and widely gaping at the posterior end and its dorsal umbonal ridge is not prominent as compared with the former.

The present species is more or less similar to *Neoburmesia iwakensis* Yabe and Sato, 1942, from the Upper Jurassic Soma group in Japan in the surface ornamentation and strong carina, but the terminal beak, the elongate-obleng outline of shell and the wide posterior gap are diagnostic to the latter.

Occurrence: Rather rare in the impure limestone beds consisting of gregarious *Ostrea* sp. of the Lower Cretaceous Yoshismo formation at loc. Y51, Yoshimo, Shimonoseki City, Yamaguchi Prefecture.

Summary of the Results

From the above described observations of new collections from the Shiroi, Yoshimo and Kawaguchi formations, the following articles are led as a conclusion.

1. "Cyrena" *shiroiensis* Yabe and Nagao is a member of the subfamily Eomiodontinae and not that of the family Corbiculidae as Yabe and Nagao (1926) and Kobayashi and Suzuki (1939) have considered respectively.

2. *Isodomella*, which was established for this species as a section of *Polymesoda* by Kobayashi and Suzuki (1939), is emended in this paper as a genus of Eomiodontinae.
3. Kobayashi and Suzuki (1939) identified the specimens from Yoshimo with *Isodomella shiroiensis* (Yabe and Nagao). However, they are clearly distinguished from *I. shiroiensis* from Shiroi in the outline and the size of shell and the ratio of H/L. Therefore, a new species, *Isodomella matsumotoi*, is established for the specimens from Yoshimo and Kawaguchi.

4. Another set of specimens from the Yoshimo formation represents a new species which resembles *Myopholas* cfr. *semicostata* from the Shiroi formation in the outline, size and inflation of the shell, but is distinguished in the strong carina and dissimilar surface ornamentation.

**References**


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### Explanation of Plate 9

Figs. 1-13. *Isodomella matsumotoi* n. sp.
1. Right valve, holotype (GF. Y147) ×1.8
2. Right internal mould, paratype (GF. Y142) ×2.0
3. Right valve, paratype (GF. Y146) ×1.6
4. Right internal mould (GF. Y110), younger specimen ×1.3
5. Right internal mould (GF. Y111), younger specimen ×0.9
6. Right internal mould, paratype (GF. Y103) ×1.6
7. Right internal mould, paratype (GF. Y112) ×1.6
8. Left valve, paratype (GF. Y128) ×1.0
9. Left valve, paratype (GF. Y130) ×1.2
10. Left valve, paratype (GF. Y135) ×1.2
11. Left internal mould, paratype (GF. Y407) ×1.7
12. Left internal mould, paratype (GF. K2554) ×2.0
13. Bivalved internal mould, paratype (GF. Y113) ×1.5

Figs. 14-16. *Isodomella shiroiensis* (YABE and NAGAO)
14. Left internal mould (GF. S4010) ×0.9
15. Left internal mould (GF. S4012) ×2.0
16. Left internal mould (GF. S4011) ×2.0

Figs. 17-21. *Myopholas carinatus* n. sp.
17. Left internal mould, holotype (GF. Y450) ×1.7
18. Right valve, paratype (GF. Y452) ×1.0
19. Left internal mould (GF. Y451) ×1.0
20. Left valve (GF. Y453) ×1.7
21. Left external mould (GF. Y 457) ×1.7
OHTA: Two new non-marine Bivalvia, Lower Cretaceous

Plate 9

1. Shell
2. Shell
3. Shell
4. Shell
5. Shell
6. Shell
7. Shell
8. Shell
9. Shell
10. Shell
11. Shell
12. Shell
13. Shell
14. Shell
15. Shell
16. Shell
17. Shell
18. Shell
19. Shell
20. Shell
21. Shell