383. A NOTE ON NEOBURMESIA, A PECULIAR JURASSIC PELECYPOD, WITH DESCRIPTION OF MITILIDS AND MYACIDS FROM THE UPPER JURASSIC SOMA GROUP IN JAPAN*

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Neoburmesia from the Nakanosawa formation of the Soma Group is an interesting genus having unusualy wide outline. Yabe and Sato (1942) compared it with Burmesia Healey (1908) from the Upper Triassic Napeng Beds of Burma, chiefly from external ornaments. Fortunately, the writer succeeded to collect many well-preserved topotypes which admitted him additional observations with which on the taxonomic position of the genus can be discussed.

Beside Neoburmesia are described here Mytilids and Myacids from the Nakanosawa formation in which are four distinct fossil zones. Geological notes and the fossil localities were listed elsewhere (Tamura, 1959-b). These fossils and their occurrences are shown in Table 1. Most of them are characteristic in

Table 1. List of the fossils and their range chart.

<table>
<thead>
<tr>
<th>Specific name</th>
<th>Nakanosawa formation</th>
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<tbody>
<tr>
<td></td>
<td>6th zone</td>
</tr>
<tr>
<td>Modiolus cf. bipartitus J. Sowerby</td>
<td></td>
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<tr>
<td>Modiolus (Inopera) plicatuus J. Sowerby</td>
<td></td>
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<tr>
<td>Modiolus (Inopera) sp.</td>
<td></td>
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<tr>
<td>Brachidontes (Archestellus) lactuaires (de Lorio)</td>
<td></td>
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<tr>
<td>Mucronula sp.</td>
<td></td>
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<tr>
<td>Pinna cf. mitis Phillips</td>
<td></td>
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<tr>
<td>Plicatula? punctata Tanaka</td>
<td></td>
</tr>
<tr>
<td>Myophila? cf. acuticostata (J. C. Sowerby)</td>
<td></td>
</tr>
<tr>
<td>Plicatula somnus Tanaka, new species</td>
<td></td>
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<tr>
<td>Neoburmesia inakayae Yabe and Sato</td>
<td></td>
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<tr>
<td>Homonyma gibosa (J. Sowerby)</td>
<td></td>
</tr>
<tr>
<td>Goniomya nonscripta Tanaka, new species</td>
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</table>

sandstone facies and widely distributed, not only in South Asia but also in Europe. Such Tethyan similarity, however, cannot be recognized in other pelecypods of Soma. They are mostly long-ranged and invaluable as time indices.

The writer expresses his sincere thanks to Prof. T. Kobayashi of the Univ. of Tokyo for his kind guidance through which this study was accomplished.

Description of Fossils

Family Mytilidae

Genus Modiolus Lamarck, 1799

Modiolus cf. bipartitus J. Sowerby
Plate 32, Figures 19, 20

cf. 1818. Modiola bipartita, Sowerby, p. 17, pl. 210, fig. 4.
cf. 1837. Mytilus bipartitus, Goldfuss, p. 176, pl. 131, fig. 3.
cf. 1906. Almodola tulipa, Borejsjak, p. 24, pl. 1, figs. 3-6.
cf. 1929. Almodola bipartita, Arkell, p. 55, pl. 2, figs. 1-4 and text-fig. 8.
cf. 1940. Modiola cf. bipartitus, Cox, p. 67, pl. 5, figs. 11, 12.

Two internal moulds at hand are almost identical with well-known Modiolus bipartitus. In the larger left mould (plate 32, fig. 20) a deep sulcus extends from umbo to venter on which it gives cnocavity. These features are, however, more or less exaggerated by deformation. The surface is ornamented by very fine regular concentric growth-lines. The median part of shell is most inflated. The specimens are closer to Cox's Upper Bathonian form of Cutch than Sowerby's.

Occurrence: 5th zone at Locs. 2, 7.

Subgenus Inoperna Conrad, 1875

Modiolus (Inoperna) plicatus J. Sowerby
Plate 32, Figures 5-8

1819. Modiola plicata, Sowerby, p. 87, pl. 248, fig. 1.
1837. Mytilus plicatus, Goldfuss, p. 175, pl. 130, fig. 12a.
1853. Mytilus Sowerbyana, Morris and Lyceett, pl. 2, p. 36, pl. 4, fig. 1.
1856. Modiola plicata, Quenstedt, p. 357, pl. 49, fig. 4.
1867. Modiola Sowerbyana, Lander, p. 28.
1874. Mytilus plicatus, de Lorio and Piett, p. 155, pl. 18, figs. 19, 20.
1905. Modiola plicata, Bencke, pl. 4, p. 168, pl. 4, fig. 6.
1906. Modiola plicata, Borissjak, p. 30, pl. 2, figs. 6a, b.
1910. Modiola plicata, Jacque, p. 30, pl. 5, fig. 10.
1931. Modiola plicata, Diaz-Romero, p. 29, figs. 11-12.
1935. Modiola (Pharomylthis) plicata, Cox, p. 13, pl. 1, fig. 21.
1940. Modiola (Inoperna) plicatus, Cox, p. 71, pl. 5, figs. 13, 14.

Although the peculiar ornamentation on the dorsal side is variable among illustrated specimens, they belong to this Upper Bathonian-Kimmeridgian species. Whether it is conspircic with M. (Inoperna) plicatus (Etallon) is a question as noted by Cox (1940). The distinction is in the ribs on dorsal surface which are bifurcate in half-way between dorsal margin and the carina in plicatus. In the Soma form, however, some (fig. 5 etc.) are bifurcated as in plicatus but others as in plicatus. These specimens are found together and indistinguishable in most characters. Therefore the writer deemed that per-
plicatus is synonymous with plicatus.

**Occurrence:** 5th zone at Loc. 7; 7th zone at Loc. 3; 8th zone at Loc. 14.

*Modiolus (Inoperna) sp.*

**Plate 32, Figure 9**

**Description:** Shell medium, about 40 mm long; moderately inflated, ensiform in shape; dorsal margin a little rounded; ventral slightly concave; both margins nearly parallel in posterior; umbonal carina indistinct; surface ornamented only by growth-lines.

**Observation:** A left valve at hand may be referred to *Inoperna* by its ensiform shell. The surface is, however, ornamented only by growth-lines and the peculiar ribs of *Inoperna* are absent on the dorsal side.

**Occurrence:** 8th zone at Loc. 11.

Genus *Brachidontes* Swainson, 1840

Subgenus *Arcomytilus* Agassiz, 1842

*Brachidontes (Arcomytilus) laitmairensis* de Lioroi,

**Plate 32, Figures 3-1**

1853. *Mytilus asper*, Morris, Lumby, p. 39, pl. 2, fig. 3.
1867. *Mytilus (Septifer) asper*, Laurie, p. 30, pl. 2, fig. 8.
1891. *Mytilus laitmairensis*, Diaz-Romero, p. 29, pl. 2, figs. 11 a, b and 12.
1940. *Brachidontes (Arcomytilus) laitmairensis*, Cox, p. 81, pl. 5, figs. 15-17.

**Description:** Shell medium for genus, well inflated, cuneiform and widening gradually towards its postero-ventral extremity; umbo terminal; umbonal region produced but not inflated, most convex at a little anterior to midheight; hinge-margin about a half or a little more of the shell length, slightly rounded and passing into convex posteri- or and concave ventral margin; umbonal carina or ridge fairly distinct; posterocarinal part depressed; radial ribs numerous, increase their number by divarication.

**Measurement:**

- Left valve (MM 3268) 27.0 mm 19.0 mm
- (MM 3369) 28.0 17.0

**Observation:** Three left valves and a right one are at hand. Among foreign specimens, Diaz-Romero's from Central Dancalia (pl. 2, figs. 11, 12) are closely allied to the Soma form. This species is long-ranged from Bathonian to Argovio-Kimmeridgian. Its discrimination from *B. (Arcomytilus) asper* (J. Sowerby) is a matter of discussion. The Soma form is especially akin to the typical laitmairensis.

**Occurrence:** 7th zone at Loc. 15 and 8th zone at Loc. 14.

**Family Modiolopsidae**

Genus *Myoconcha* Sowerby, 1824

*Myoconcha?* sp.

**Plate 32, Figures 1, 2**

**Description:** Shell medium for genus, fairly convex, much inequilateral, oblong and mytiliform; umbo small and indistinct, subterminal; dorsal margin slightly rounded and passing into rounded posterior; ventral straight; anterior short and rounded; shell body dilated backward; umbonal angulation obscure; surface smooth; anterior adductor scar
close to umbo large, trigonal and bounded by a prominent cravicle: hinge unknown.

Measurement:

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Right valve (MM 3271)</td>
<td>55 mm</td>
<td>25 mm</td>
</tr>
<tr>
<td>R. (MM 3272)</td>
<td>26 cm</td>
<td>11 cm</td>
</tr>
</tbody>
</table>

Observation and Comparison:—Three internal moulds of right valves and an incomplete external mould of a right valve are referred to Myoconcha by a large anterior adductor scar bounded by a prominent cravicle and by a terminal umbo. In outline they somewhat resemble Mytilus but the anterior adductor scar is too large for Mytilus. The Soma from is a little different from Myoconcha in general shape, though the form has a wide umbonal region and is more or less similar to M. crassa Sow., which is the type-species of the genus.

Occurrence:—5th zone at Loc. 7.

Family Pinnidae

Genus *Pinna* LINNE, 1758

*Pinna cf. mitis* PHILLIPS

Plate 32, Figures 12-14

cf. 1940. *Pinna cf. mitis*, Cox, p. 132, pl. 19, fig. 11.

Description:—Shell medium for genus (90 mm long and 30 mm high), inflated, wedge-shaped and tetragonal in section; dorsal and ventral margins straight, posterior gaping unknown: median carina distinct and dividing surface into two parts of which ventral one is slightly wider; dorsal half ornamented with about 9 radial riblets and inserted by a few riblets in posterior; ventral half provided with radial riblets (about 4) which are distinct near median carina but obscure and become broad undulations near ventral margin.

Observation and Comparison:—Most bivalved specimens lack their umbonal part and posterior. They closely resemble *Pinna cf. mitis* PHILLIPS by Cox (1940). Although the original description is inaccessible to the writer, these specimens may be referable to this species.

Occurrence:—5th zone at Loc. 15 and 8th zone at Loc. 14.

Family Pleuromyidae

Genus *Pleuromyia* AGASSIZ, 1845

*Pleuromyia? punctostriata* TAMURA

Plate 32, Figures 27, 28


One external mould of a left valve (fig. 27) and one internal mould of a right valve at hand are both deformed and incomplete. Their regular undulation on surface, however, are characteristic in *punctostriata*. Rows of punctae are invisible in them probably due to their poor preservation.

Occurrence:—5th zone at Loc. 7 and 8th zone at Loc. 14.

Family Pholadidae

Genus *Myopholas* DOUVILLE, 1907

*Myopholas cf. acuticosta* (J. de C. SOWERBY)

Plate 33, Figures 25, 26

cf. 1827. *Pholadomya acuticosta*, J. de C. SOWERBY, p. 88, pl. 146, figs. 1, 2.


cf. 1923. *Myopholas Douvillei*, LISSAJOURS, p. 198, pl. 32, figs. 8, 8a.

Description:—Shell large for genus,
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well inflated, inequilateral, oblong or subtrigonal and much longer than high: umbo indistinct, incurved and located anteriorly; anterior margin a little concave; posterior margin nearly straight; ventral evenly rounded; anterior part without radials, more or less depressed; no distinct sulcus seen between anterior and middle part; middle and slightly depressed anterior parts radially ribbed; radials coarser in anterior than middle part; coarse but obscure in posterior; growth-lines fairly distinct but weak in region radially ribbed.

Observation and Comparison:—Three specimens at hand are probably allied to this species. The radial ribs are about .10 in the left valve and a little less in the right. They are irregularly disposed.

Occurrence:—5th zone at Tochikubo; 7th zone at Loc. 13 and 15.

Family Pholadomyidae

Genus Pholadomya Sowerby, 1825

Pholadomya somensis TAMURA.

new species

Plate 32. Figures 10, 11

1939. Pholadomya Protei STEFANINI. p. 263, pl. 27, 28, figs. 6-8.

Description:—Shell small to medium, gibbose, a little higher than long, somewhat trigonal and expanding posteroventrally: umbo subtrigonal, inflated and slightly incurved; anterior margin very short; lunule small deep and distinct; posterior margin slightly concave and lanceolate; escutcheon well defined; ventral well rounded and demarcated from anterior margin; posterior somewhat truncated and gaping; radial ribs about 7 on middle part; concentric folds or growth-lines fairly distinct.

Measurement:

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>H</th>
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<tbody>
<tr>
<td>Bivalved shell (MM 3278)</td>
<td>35 mm</td>
<td>41 mm</td>
</tr>
<tr>
<td>(MM 3279)</td>
<td>32</td>
<td>36</td>
</tr>
<tr>
<td>(MM 3280)</td>
<td>21</td>
<td>28</td>
</tr>
<tr>
<td>(MM 3281)</td>
<td>15</td>
<td>18</td>
</tr>
</tbody>
</table>

Observation and Comparison:—The radial ribs on surface are fairly distinct in some specimens but obscure in others. Pholadomya protei (BRONGNIART) by STEFANINI from Somaliland Jurassic has five radial ribs but the shape of a shell (pl. 28, fig. 7a) closely resembles the Soma form (MM 3279). The original figure of protei by BRONGNIART (1821) is different in shape from that of the Somaliland form.

Occurrence:—5th zone at Loc. 8; 7th zone at Loc. 15; 8th zone at Loc. 14.

Genus Neoburnesia YABE and SATO, 1942

Type species: Neoburnesia iwakiensis YABE and SATO.

Diagnosis:—Shell large, very inequilateral, equivalent, inflated, somewhat Paralleloconus-like or elongate Pholadomya-shaped; umbo much anterior; surface divided into three parts by strong posterior carina and weak anterior carina; anterior and posterior parts depressed, covered with weak concentric ribs; median part with distinct radial and concentric ribs, tuberculate at their junction; escutcheon long, narrow and well defined; posterior gaping distinct: hinge edentulous.

Remarks:—YABE and SATO (1942) founded the genus on Neoburnesia iwakiensis YABE and SATO from the Koike limestone near Koike, which is monotypic. The presence of chondrophore was a question. From the similarity of external ornaments they compared the genus to Burnesia HEALEY (1908) from the Triassic Napeng beds of Burma. It has a chondrophore. Together with Prolaria Hea-
LEY she placed it in the Burmesiidae and considered Anatina and Pholadomya as its close relatives.

Although it resembles Burmesia in ornaments, it is evidently different from Burmesia in the inflated and elongated shell, very anterior umbo, distinct posterior gaping. It agrees with Pholadomya better than Burmesia. The absence of the chondrophore is, however, ascertained by cutting the umbo longitudinally as well as transversely. This point is, further, confirmed by the elevated and strongly incurved umbo.

In the elongate forms, such as Pholadomya gigantea (Sow., Woods, 1909), P. arcata Ac., P. nymphacea Ac., P. partica Ac., P. Bacardiun Ac. (Agassiz, 1840) and P. elegante Musner (d’Orbigny, 1843-47), are they very similar to the type-species. This resemblance of shell form is a proof for the close relation between the two genera. But the distinct posterior carina, strongly inflated and incurved umbo and well-developed posterior part are the distinction of this genus from these elongated Pholadomyas. Its very low shape is also characteristic.

In the writer’s opinion Pholadomya is probably more numerous in Cretaceous than Jurassic. Likewise, Neoburmesia is presumed to have derived from Pholadomya by elongation of shell. YABE and SATO did not cite its taxonomic position but the writer places it in the Pholadomyidae.

**Distribution:** Upper Jurassic in Japan.

**Neoburmesia iwakiensis** YABE and SATO
Plate 32, Figures 21-24; text-figure 1

**Description:** Shell large, equivalve, strongly inequilateral, well infected, much elongated and somewhat Parallelopon-like; umbo at about 1/5 or less of the length from anterior, inflated, strongly incurved and orthogonous; anterodorsal margin short and inseparable from rounded anterior; posterior dorsal nearly straight or a little concave and long; posterior rounded and produced; ventral nearly parallel to dorsal margin but slightly sinuate below umbo; posterior umbonal carina strong, anterior umbonal carina obscure; anterior part depressed, ornamented by only concentric growth-lines: anterior part widely depressed and concave, ornamented by about 20 or more radial ribs; posterior part elongated, concaved and ornamented only by concentric growth-lines, but faint radial ribs visible near umbo, one long ridge close and nearly parallel to hinge bounding lanceolate shallow escutcheon; upper half of posterior margin widely gaping; hinge edentulous.

**Measurement:**

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>H</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bivalved shell (MM 3282)</td>
<td>79</td>
<td>24</td>
<td>22</td>
</tr>
<tr>
<td>(MM 3283)</td>
<td>98</td>
<td>47</td>
<td>21</td>
</tr>
<tr>
<td>(MM 3284)</td>
<td>78</td>
<td>23</td>
<td>25</td>
</tr>
</tbody>
</table>

**Occurrence:** 7th zone at Locs. 13, 115 and 8th zone at Locs. 6 and 14.

**Genus Homomya** Agassiz, 1842

**Homomya gibbosa** (J. Sowerby)

Text-figure 2

1853. Myacites gibbosa (Sow.), Morris and Lydekk, p. 138, pl. 12, fig. 14.
A large internal mould of a bivalved shell (L: 115 mm; H: 75 mm; W: 28 mm) from Lima sandstone is in the collection. Although its umbo and anteroventral parts are unpreserved, it is identified with this well-known species. In the well-inflated shell, strongly convex ventral margin, a fairly concave postero-dorsal margin, an obliquely truncated posterior margin and a posterior gaping it is similar to the type-specimen (J. Sowerby, 1823 and Arkell, 1935). It is long-ranged in England from Inferior Oolite to Corallian.

**Occurrence:**—5th zone at Kozawa (?).

**Genus Goniomya Agassiz, 1842**

**Goniomya nonscripta** Tamura, new species

Plate 32. Figures 15-18

1959-a. Goniomya sp. Tamura, p. 120 pl. 12, fig. 28.

**Description:**—Shell medium-sized for genus, moderately convex, inequilateral, elongate trapeziform; umbo submedian or slightly anterior, indistinct and incurved; dorsal and ventral subparallel, and long; postero-dorsal concave near umbo; ventral slightly rounded; anterior margin rounded, upper half most produced; posterior margin straight and diagonal; posterior gaping distinct; ribs about 30, not v-shaped and divided into three sets: anterior and posterior sets fading away near dorsal margin and do not meet directly at points but always joined by fairly long bars of horizontal set; about 6 ribs near venter inseparable into three sets and not angulate at their junctions; growth-lines concentric and very fine.

**Measurement:**—

<table>
<thead>
<tr>
<th>Valve</th>
<th>Length</th>
<th>Height</th>
</tr>
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<tbody>
<tr>
<td>Right</td>
<td>39 mm</td>
<td>22 mm</td>
</tr>
<tr>
<td>Left</td>
<td>44 mm</td>
<td>24 mm</td>
</tr>
</tbody>
</table>

**Observation and Comparison:**—Several valves and moulds at hand bear characteristic ornaments of *Goniomya*. Their ribs are not strictly v-shaped and always intervened by horizontal fairly long bars. Three sets of ribs are inseparable on ventral side. No anterior and posterior sets intersect the ventral margin. The mode of ornamentation is characteristic of this species. The ribs of three sets are different in number and most of them discontinuous. The posterior gaping is wide.

**Goniomya literata** from the Great Oolite in England resembles this species but its horizontal bars are very short. In typical *G. literata* (J. Sowerby, 1864; Arkell, 1934), horizontal bars are restricted in the umbonal part. *G. inflata*
AGASSIZ (1840) from the Oxfordian of France is close to it in form and ornaments, although the ventral side is probably lacking. The obliquity of ornaments which is here shown by the angle between ventral margin and the line running from the umbo to centers of horizontal bars is larger in inflata (80°) than in this species (65°).

Whether the fragments of Gonionyma from the Sakamoto formation (TAMURA, 1959-a) belong to this species or not is a difficult problem, though they show a part of ornament. Here the writer, however, referred them to G. nonscripta.

Occurrence: 5th zone at Loc. 8; 8th zone at Loc. 14; 7th zone at Loc. 15.

Explanation of Plate 32

Myoconcha? sp.
Figs. 1, 2. Internal moulds of left valves: x1; Loc. 7. (MM 3272, 3271).

Brachidontes (Aegomytilus) laitmairensis (DE LORIO)
Fig. 3. Left valve: x1; Loc. 14. (MM 3263).
Fig. 4. Internal mould of left valve: x1; Loc. 15. (MM 3269).

Modiolus (Inopectena) plicatus J. SOWERBY
Fig. 5. Internal mould of a bivalved shell; x1; Loc. 3. (MM 3263).
Fig. 6. Internal mould of a right valve; Loc. 8. (MM 3294).
Fig. 7. A broken left valve; x1; Loc. 14. (MM 3265).
Fig. 8. Internal mould of a broken left valve; x1; Loc. 3. (MM 3266).

Modiolus (Inopectena) sp.
Fig. 9. Left valve: x1; Loc. 14. (MM 3267).

Phaladomya somensis TAMURA. new species
Figs. 10, 11. Internal mould of a right valve of a bivalved shell; x1; Loc. 8. (MM 3278: holotype).

Pinna cf. nitid PHILLIPS
Fig. 12. Dorsal side of a bivalved shell; x1; Loc. 15. (MM 3273).
Figs. 13, 14. Ventral side and right valve of a bivalved shell: x1; Loc. 15. (MM 3274).

Goniomya nonscripta TAMURA. new species
Figs. 15, 17. Internal moulds of left valves: x1; Loc. 8. (MM 3284, 3293).
Fig. 16. Holotype left valve: x1; Loc. 15. (MM 3292).
Fig. 18. Right valve: x1; Loc. 15. (MM 3291).

Modiolus cf. biparfitus J. SOWERBY
Fig. 19. Internal mould of a right valve; x1; Loc. 8. (MM 3261).
Fig. 20. Internal mould of a right valve; x1; Loc. 2. (MM 3262).

Neobarmesia incaiensis YAH and SATO
Figs. 21-24. Upper, side, under and anterior views of a bivalved shell; x1; Loc. 15. (MM 3282).

Myopholas cf. acaticostata (J. de C. SOWERBY)
Fig. 25. Internal mould of a left valve of a bivalved shell; x1; Loc. Tochikubo. (MM 3265).

Figs. 26. Internal mould of right valve; x1; Loc. 3. (MM 3296).

Pleuromya? punctostriata TAMURA
Fig. 27. Clay cast of an external mould of a left valve; x1. Loc. 7. (MM 3276).
Fig. 28. Internal mould of a right valve; x1; Loc. 14. (MM 3277).

All specimens here illustrated are kept in Geological Institute, University of Tokyo.
References cited


QUENSTEDT, F. A. (1865-8). Der Jura.


