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**Late Triassic *Mytilus*, *Volsella*, *Pleurophorus* and  
*Myoconcha* from the Sakawa Basin in  
Shikoku, Japan.**

By

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(With Plate I)

This paper contains a description of six species and five varieties referred to the four genera cited in the title as follows:—

- Mytilus tenuiformis* KOBAYASHI and ICHIKAWA, new species.  
*Mytilus tenuiformis* var. *punctatus* KOBAYASHI and ICHIKAWA, new variety.  
*Mytilus (Falcimytilus) nasai* KOBAYASHI and ICHIKAWA, new species.  
*Mytilus (Falcimytilus) nasai* var. *nagaides* KOBAYASHI and ICHIKAWA, new variety.  
*Mytilus (Falcimytilus) nasai* var. *hirataides* KOBAYASHI and ICHIKAWA, new variety.  
*Volsella paronaiiformis* KOBAYASHI and ICHIKAWA, new species.  
*Pleurophorus oblongatus* KOBAYASHI and ICHIKAWA, new species.  
*Pleurophorus oblongatus* var. *compressus* KOBAYASHI and ICHIKAWA, new variety.  
*Myoconcha trapezoidalis* KOBAYASHI and ICHIKAWA, new species.  
*Myoconcha trapezoidalis* var. *posteroexpansa* KOBAYASHI and ICHIKAWA, new variety.

**Family Mytilidae FLEMING**

**Genus *Mytilus* LINN., 1758**

***Mytilus tenuiformis* KOBAYASHI and ICHIKAWA, new species**

Pl. I, Fig. 7

✓ MM 5139

**Description:**—Shell gently convex, long, subtrigonal, longest at about one-third below the umbo; umbo terminal and pointed; hinge-line almost straight, about three-fifths as long as the shell; posterior margin more strongly curved on the ventral side; surface smooth except for fine growth-lines.

**Observation and comparison:**—The type specimen is 23 mm. wide, 16 mm. high, and 4 mm. thick. This is a non-carinate form resembling *Mytilus urusensis* SMITH from the *Juvavites* subzone of the *Tropites subbullatus* zone in California (1927, p. 111, pl. 94, fig. 9), but the outline of the present species is more slender, and its postero-

dorsal margin ascends more abruptly and forms a smaller angle with the hinge margin. *M. eduliformis* SCHLOTH. from the German Muschelkalk (BENECKE, 1905, pp. 705-714) is another form resembling the Japanese species, but is evidently different in its forwardly bent umbo and distinct lunule-like depression in front of it.

*Occurrence* :—*Oxytoma-Mytilus* sandstone at Kashiwai (47TK-50), and Oowada Horiake (47TK-49).

✓  
*Mytilus tenuiformis* var. *punctatus* KOBAYASHI  
and ICHIKAWA, new variety

Pl. I, Fig. 8

MM5140  
✓ Compared with the preceding species this has a shorter and more rounded outline with a larger umbonal angle. At a glance it looks like *M. inflexus* ROEMER from the German Muschelkalk (1851, p. 312, pl. 36, figs. 12-13), but the beak is directed forward distinctly in the latter.

*Occurrence* :—*Oxytoma-Mytilus* sandstone at Okunominetani (47TK-4) and Kashiwai (47TK-50).

Subgenus *Falcimylus* COX, 1937

Although the umbonal outline is generally taken as the distinction between *Mytilus* and "*Modiola*," COX is of opinion that the two genera must be distinguished on the basis of dysodont teeth and edentulous hinge. *Mytilus suprajurensis* COX is edentulous like "*Modiola*", but its outline which is more allied to *Mytilus* is strongly curved and edged by a pronounced carina on the anterior side. With these differences in mind, he established the subgenus *Falcimylus* on the basis of *suprajurensis*.

✓  
✓  
*Mytilus (Falcimylus) nasai* KOBAYASHI and ICHIKAWA,  
new species

Pl. I, Figs. 2-3

MM5134-1-2,3  
✓  
*Description* :—Shell subtriangular to crescentic, anterior margin nearly straight but a little concave, forming an angle of about 30 degrees at the umbo with the hinge-margin which is straight, a little longer than a half of the shell-width; posterior margin describes an

arc more strongly curving on the ventral than on the umbonal side; peripheral carina along the antero-ventral margin arcuate, and acutely angulate, and the area is overhanging except near the umbo where the area is somewhat twisted and the carina obtuse; maximum convexity lies at about the mid-length of the carina; surface marked by weak concentric lines of growth.

*Observation and comparison* :—The holotype is an internal mould of a right valve 22 mm. high, 28 mm. wide, and 4 mm. thick, but the outline and the prominence of the carina are fairly variable in the species. *M. acutaecarinatus* BITTNER from Bakonyerwald (1901, p. 20, pl 7, figs. 15-19) has an acute carina, but in this new species the posterior margin is more elongated whereas the hinge-line is shorter. Furthermore, the overhanging carinate area cannot be seen in that species. Nevertheless, both *nasai* and *acutaecarinatus* are thought to be related to Jurassic mytilids. Though the hinge structure of *nasai* is not well known, two faint grooves which can be seen near the umbo along the dorsal margin may be the casts of thin internal ligament ridges as noted by COX. At least there is no trace of dysodont teeth. The hinge area of *acutaecarinatus* is also similar to that of *suprajurensis*.

*Occurrence* :—Common in the *Oxytoma-Mytilus* sandstone at Kashiwai (47TK-50) and Oowada Horiake (47TK-49).

*Mytilus (Falcimytilus) nasai* var. *nagaides*

KOBAYASHI and ICHIKAWA, new variety

Pl. I, Fig. 4

MM 5135-1-4

Compared to the typical form, the outline of this variety is longer and not as much expanded behind, and the anterior area is subvertical. The type left valve which may possibly be a little compressed laterally, measures 28 mm. in height, 36 mm. in width and about 5 mm. in thickness.

*Occurrence* :—*Oxytoma-Mytilus* sandstone at Kashiwai (47TK-50).

*Mytilus (Falcimytilus) nasai* var. *hirataides*

KOBAYASHI and ICHIKAWA, new variety

Pl. I, Fig. 5

MM 5136-1-5

In this variety the apical angle is as large as 65 degrees. The

postero-dorsal margin is well rounded while the antero-ventral is nearly straight. The anterior area is subvertical and is not so twisted. The typical specimen measures 25 mm. in width, 25 mm. in height, and 5 mm. in thickness.

*Occurrence*.—*Oxytoma-Mytilus* sandstone at Oowada Horiake (47TK-49).

✓ *Mytilus (Falcimylus)* sp. nov. indet.

MM574 1-6-6

Pl. I, Fig. 6

This carinated left valve differs from the precedings in the more regular curviture of the posterior and postero-dorsal margins, somewhat wavy hinge margin, and the straight peripheral carina. But as it is strongly deformed, its denomination is postponed until the original form can be figured out.

*Occurrence*.—*Myoconcha* sandstone at Umenokidani (47TK-26).

Genus *Volsella* SCOPOLI, 1777 (*Modiola* LAMARK, 1801)

*Volsella paronai*formis KOBAYASHI and ICHIKAWA, new species

✓

Pl. I, Fig. 1

MM5133-1-1

*Description*.—Shell thin, modioliform, roundly subquadrate, about one and a half times longer than high, and fairly convex; anterior lobe undefined and well rounded; antero-ventral margin nearly straight or even concave, and abruptly turning up at the postero-ventral end, the posterior margin broadly rounded; dorsal margin a little arcuate forming a wide angle with the posterior; umbo at about the anterior one-sixth, indistinct, well rounded, and scarcely rising above the hinge-line; blunt carina extending from the umbo to the postero-ventral extremity, at the center of which the shell is most inflated; surface marked by fine distinct lines of growth.

*Observation and comparison*.—The holotype is a left valve 23 mm. high, 29 mm. wide and 7 mm. broad. The test is thin as usual in this genus. The postero-ventral expansion is seen in the growth-lines on the mesial carina. Because of the fairly long and rounded anterior margin and the subterminal umbo, this species is thought not to be the member of *Septiolo*, although the hinge character is unknown. *Modiola paronai* (BITTNER, 1885, p. 48, pl. 5, figs. 19-20) is an allied

species which however is more elongated and has a much narrower anterior outline and a weaker carina.

*Occurrence* :—*Myoconcha* sandstone at Umenokidani (47TK-26).

### Family *Pleurophoridae* Dall

#### Genus *Pleurophorus* King, 1848

*Myoconcha* and *Pleurophorus* were respectively established by SOWERBY in 1825 and by KING in 1848 on the basis of *Myoconcha crassa* SOWERBY from the Oolites and of *Arca costata* BROWN from the German Zechstein, the two being coexistent in the Triassic whence the latter ranges down to the Devonian whereas the former is distributed up to the Cretaceous. The two genera look alike, bearing the following features in common :

1. The outline is very elongate and frequently modioliform.
2. The umbo is located far anteriorly, but never prominent.
3. The posterior lateral tooth is generally present and very long.
4. The anterior muscular scar is well rounded, strongly impressed and frequently defined behind by a prominent clavicle.
5. The pallial line is always entire.
6. The surface is generally smooth, but occasionally ornamented by several radial costae.

In so far as can be judged from the studies by WAAGEN (1907), BÖHM (1914) and others, the distinction between these two similar genera may be tabulated as below :

Genus		<i>Pleurophorus</i>	<i>Myoconcha</i>
Outline		elongate trapezoidal	obliquely elongate-oval.
Ventral sinus		absent	present
Lunule		present	absent
Umbo		very anteriorly located, but never prominent	terminal or subterminal
Cardinal area	Right valve	1 tooth seen on a distinct, well developed hinge plate, which is, however, sometimes obsolete.	on the hinge margin is seen a tooth which is sometimes obsolete; hinge plate undeveloped.
	Left valve	ditto.	a cardinal tooth (?) and a cardinal groove present; hinge plate undeveloped.

*Pleurophorus oblongatus* KOBAYASHI and ICHIKAWA,  
new species

MM5144-1-10

Pl. I, Fig. 10

*Description*.—Shell more than three times as long as high with a subterminal umbo; posterior part more than seven times longer, slightly taller, and more gradually rounded than the anterior; dorsal and ventral margins nearly straight and subparallel. Anterior adductor scar roundly ovate and distinctly impressed; a short but strong umbonal ridge extends a little obliquely behind the scar; a long posterior lateral tooth, and a groove above it running along the hinge margin of the right valve; hinge-plate of the right valve without cardinals, well developed, subtriangular, and detached from the lateral by a long but shallow groove; a peculiar narrow relief seen on the other side of the plate behind the anterior adductor scar. Surface ornamented by concentric lines of growth; radial marking, if present, feeble.

*Observation and comparison*.—The holotype is a right valve 22 mm. high and 5 mm thick, its width being 70 mm or more. The cardinal plate is defined by a groove, and there is no cardinal as seen in "*Pl.*" *anderssoni* BÖHM (1903. p. 45, pl. 4, figs. 4-7, 9, 10). A fragmentary left valve shows a long posterior lateral tooth and a groove below it.

Certainly this is allied to "*Pl.*" *perlongus* BÖHM (1903, p. 46, pl. 4, figs. 1-3, 8), but the umbo is less terminal and the cardinal vestigial in this species. Its umbo is not distinctly bent forward as commonly seen in the group of *Pl. curiosi* HAUER.

*Occurrence*.—*Oxytoma-Mytilus* sandstone at Oowada-Horiake. (47 TK-49).

*Pleurophorus oblongatus* var. *compressus*  
KOBAYASHI and ICHIKAWA, new variety

MM5145-1-9

Pl. I, Fig. 9

This differs from the preceding in its compressed outline, smaller hinge area, higher and more posterior position of the anterior adductor scar. The type is 20 mm. high, more than 65 mm. wide, and 3 mm. thick.

*Occurrence*.—*Oxytoma-Mytilus* sandstone at Kashiwai (47TK-50).

Genus *Myoconcha* SOWERBY, 1825*Myoconcha trapezoidalis* KOBAYASHI and ICHIKAWA, new species

Pl. I, Figs. 12-13

MM 5749-1-12

MM 5748-1-13

*Description*.—Shell equivalve, elongate-oblong, more than twice as long as high and moderately inflated; anterior margin short, oblique, somewhat sinuated in front of the umbo, and abruptly rounded at the end; ventral nearly straight except for the broad undulation at the mesial sinus; posterior margin broadly rounded; dorsal margin subparallel to the ventral and a little arched; the greatest width lying a little below the mid-height, while the shell is thickest a little above and in front of its center; lunule absent; umbo located at about one-sixth the width from anterior, medium sized, prosogyre and rising very little above the hinge-line; a long ligament groove extending far back behind it; teeth reduced, small but distinct anterior adductor scar outlined behind by an extraordinarily prominent vertical clavicle; pallial line and posterior scar obscure. Surface marked only by growth lines and folds.

*Comparison*.—*M. hamadensis* YABE and SHIMIZU from the *Daonella* bed at Rifu (1927, p. 134, pl. 13, figs 13-16) which has a modioliform outline, a cardinal and a posterior lateral on each valve, and radial markings, is a normal *Myoconcha* and is quite different from this species. The edentulous hinge and the outline of the shell show that this species belongs to *subanodonte Myoconchen* which WAAGEN (1907 p. 160), took for the connecting link between the Palaeozoic *Pleurophorus* and the Mesozoic *Myoconcha*. Among the linking forms enumerated by him, *M. recta* BROILI (WAAGEN, 1907, p. 81, pl. 32, fig. 3) has an outline more modioliform than this. In *M. wöhrmanni* WAAGEN (ibid. p. 80, pl. 32, figs. 2, 4, 17), on the other hand, the umbo is almost terminal and the shell expanded in the rear part. Even in *M. acquatensis* PARONA (ibid. p. 82, pl. 32, figs. 18, 19) which may be the most similar form, the umbo is located more anteriorly, the mesial sinus is more distinct, and the shell is somewhat expanded backward. The present species is, so far, the one most similar to *Pleurophorus*, but nevertheless, the absence of the lunule, the presence of the mesial sinus, and the undeveloped hinge-plate warrant its reference to *Myoconcha*.

*Occurrence* :—Common in the *Myoconcha* sandstone at Umenokidani (47TK-26) and Kanaidani-1 (47TK-20).

*Myoconcha trapezoidalis* var. *posteroexpansa* KOBAYASHI and  
 ICHIKAWA, new variety

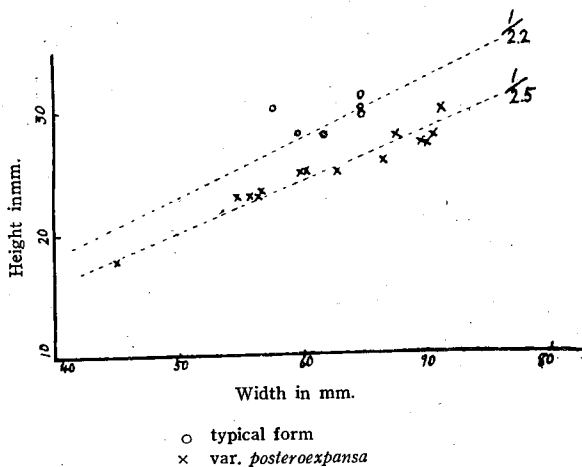
MM 5151-1-11

Pl. I, Fig. 11

Not only the closer position of the mesial sinus to the umbo, but also the more elongate outline expanded behind distinguish this variety from the typical form. As shown in the diagram, the measurement of 25 specimens of the two forms shows that length by height is about 2.2 and 2.5 in the typical and varietal form respectively.

*Occurrence* :—More common than the preceding in the *Myoconcha* sandstone at Umenokidani (47TK-26).

Text-figure I. Proportion of the width to the height of *Myoconcha trapezoidalis* and *M. t. var. posteroexpansa*





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(Manuscript completed in August, 1947)

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## Postscript

Concerning *Palaeopharus* KITTL, 1907, including *scheii* KITTL, *anderssoni* BÖHM, *perlongus* BÖHM and *maizurensis* KOBAYASHI and ICHIKAWA, MS., which is found to be generically distinct from *Pleurophorus*, the reader is referred to the paper by the present writers on "*Palaeopharus*, a Late Triassic Pelecypod Genus" which is awaiting for publication.

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(All figures are in natural size.)

(All specimens here figured are kept in the Geological Institute,  
University of Tokyo.)

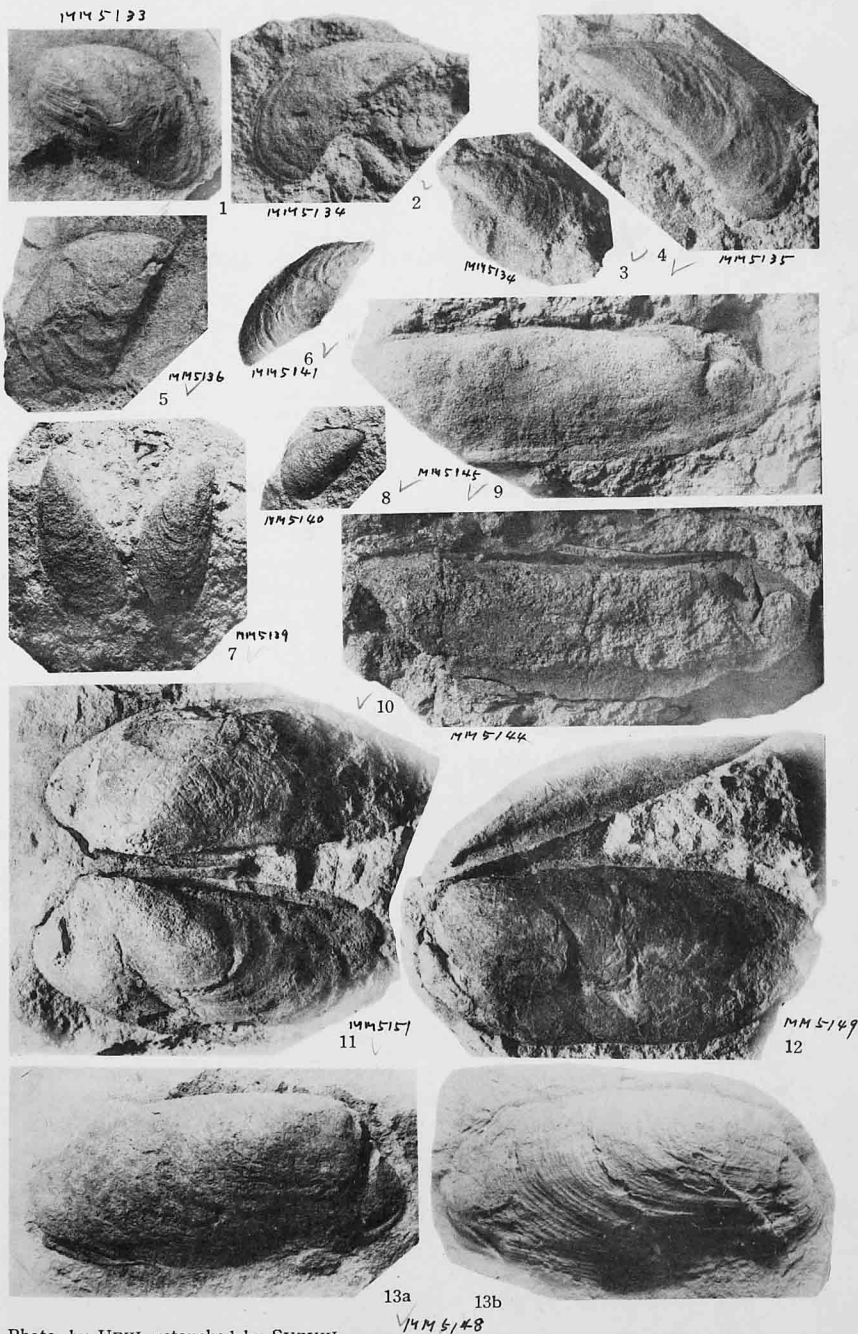


Photo. by UEKI, retouched by SUZUKI.