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Title	Carnian Fossils from Kyowa, Okayama Prefecture, Japan.
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Citation	Journal of science of the Hiroshima University. Ser. C, Geology , 2 (1) : 63 - 67
Issue Date	1957
DOI	
Self DOI	10.15027/52969
URL	https://ir.lib.hiroshima-u.ac.jp/00052969
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Carnian Fossils from Kyowa, Okayama Prefecture, Japan.

By

Mitsuo NAKANO

with 1 Plate

It has long been known that the Upper Triassic in Nariwa district, Okayama Prefecture, contains Norian *Entomonotis* in the upper part and a rich flora in the middle and lower parts. Carnian fossils which the writer discovered in the Kyowa formation at Janoana, Onji, Kyowa, Shitsuki-machi, Shitsuki-gun, Okayama Prefecture are described hereunder. The stratigraphical succession of the Triassic formations (NAKANO, 1952) is tabulated below:

Upper Triassic System (“Nariwa group”)	Nariwa formation (Norian)	Upper part.....sandstone...(<i>Entomonotis ochotica</i> var. <i>eurachis</i> , (45 m. +) <i>E. o.</i> var. <i>densistriata</i> .)
		Middle part.....sandstone and shale...(plant fossils and coal (40 m. +) seams.)
		----- fault -----
	Lower part.....conglomerate, sandstone and shale...(Plant (98 m. +) fossils and coal seams.)	
----- fault -----		
Kyowa formation (Carnian)	Upper part.....conglomerate, sandstone and shale...(<i>Oxytoma (35 m. +) subzitteli</i> , “ <i>Aguileria</i> ” <i>hekiensis</i> , <i>Lima</i> sp. cfr. <i>L. yataensis</i> , <i>Minetrigonia katayamai</i> , <i>Palaeopharus maizurensis</i> , <i>P. m.</i> var. <i>imamurai</i> , n. var. and <i>P. m.</i> var. <i>flexicostatus</i> . n. var.)	
	Lower part.....conglomerate, sandstone and shale...(plant fossils (29 m. +) and coal seams.)	

The Kyowa collection comprises *Oxytoma subzitteli* KOBAYASHI and ICHIKAWA, “*Aguileria*” *hekiensis* (KOBAYASHI and ICHIKAWA), *Lima* sp. cfr. *L. yataensis* NAKAZAWA *Minetrigonia katayamai* KOBAYASHI and ICHIKAWA, *Palaeopharus maizurensis* KOBAYASHI and ICHIKAWA, *P. m.* var. *imamurai* NAKANO, n. var., and *P. m.* var. *flexicostatus* NAKANO, n. var. Its age is early Carnian or ICHIKAWA’s Early Sakawan subage. The Hirabara formation in Minè area, Yamaguchi Prefecture contains *Minetrigonia katayamai* and *Oxytoma subzitteli*, which are both rare in Nabae group in Kyoto Prefecture. While *Palaeopharus maizurensis* and *Lima* sp. cfr. *L. yataensis* are common in Nabae district, they are unknown in Minè region. Therefore, the Kyowa fauna is intermediate between

Minè and Nabae faunas.

Here the writer expresses his sincere thanks to Professor T. KOBAYASHI of the University of Tokyo for kind guidance and reading the manuscript; to Prof. S. IMAMURA and Ass. Prof. A. HASE of the Hiroshima University for encouragement; and also to Messrs T. SATO, I. HAYAMI and A. TOKUYAMA of the University of Tokyo for their assistance.

DESCRIPTION OF FOSSILS.

Family Pteriidae MEEK.

Genus *Oxytoma* MEEK, 1864.

Oxytoma subzitteli KOBAYASHI and ICHIKAWA.

Plate 9, Figure 1.

1950. *Oxytoma subzitteli* KOBAYASHI and ICHIKAWA, *Jour. Fac. Sci., Univ. Tokyo, Sect. 2, Vol. 7, Pt. 3-5*, pp. 221-222, pl. 2, figs. 7a-b.

An incomplete small left valve resembles *Oxytoma subzitteli*, but primary radial ribs less numerous than in the typical form.

Family Bakevelliidae KING.

Genus *Aguileria* WHITE, 1887.

"*Aguileria*" *hekiensis* (KOBAYASHI and ICHIKAWA).

Plate 9, Figures 2-3.

1952. "*Gervillia*" *hekiensis* KOBAYASHI and ICHIKAWA, *Japan. Jour. Geol. Geogr., Vol. 22*, pp. 76-77, pl. 2, figs. 4-6.

1954. *Bakevellia hekiensis* NAKAZAWA, *Mem. Coll. Sci., Univ. Kyoto, Ser. B, Vol. 21, No. 2*, pp. 218-219, pl. 5, figs. 3-8; pl. 6, figs. 1-3.

The present form represented by several fairly large ill-preserved specimens, agrees with the typical specimen from the Heki formation in outline and dentition. This species having pseudotaxodont denticles on equivalve shell is closer to *Aguileria* than to *Bakevellia* KING (1848).

Family Limidae d'ORBIGNY.

Genus *Lima* BRUGUIÈRE, 1792.

Lima sp. cfr. *L. yataensis* NAKAZAWA

Plate 9, Figure 4.

This form represented by fragmentary internal casts and depressed shells, resembles *Lima yataensis* NAKAZAWA in outline and ornamentation, although it is much broader than the latter.

Family Trigoniidae LAMARCK.

Subfamily Minetrigoniinae KOBAYASHI.

Genus *Minetrigonia* KOBAYASHI and KATAYAMA, 1938.

Minetrigonia katayamai KOBAYASHI and ICHIKAWA.

Plate 9, Figures 5-7.

1938. *Trigonia (Minetrigonia) hegiensis* KOBAYASHI and KATAYAMA, *Proc. Imp. Acad. Tokyo*, Vol. 14, No. 5, pp. 188-89, text-figs. 1-2 (non *Trigonia hegiensis*).
1949. *Trigonia (Minetrigonia) katayamai* KOBAYASHI and ICHIKAWA, *Japan. Jour. Geol. Geogr.*, Vol. 21, Nos. 1-4, p. 84.
1954. *Minetrigonia katayamai* ICHIKAWA, *Jour. Inst. Polytec., Osaka City Univ., Ser. C*, Vol. 2, pp. 63-64, pl. 4, figs. 9, 10a-b.
1956. *Minetrigonia katayamai* NAKAZAWA, *Mem. Coll. Sci., Univ. Kyoto, Ser. B*, Vol. 23, No. 2, p. 246, pl. 4, fig. 4.

Description:— Shell medium in size, triangularly-ovate to trigonal, inequilateral, a little longer than high, moderately inflated; anterior margin rounded, passing gradually into arcuate ventral; postero-dorsal long and nearly straight or slightly convex; siphonal rounded. Umbo nearly orthogyrous, fairly prominent, pointed at about a third from front. Flank with two series of plain costae; about 40 concentric costae narrow, distinct and regularly disposed; about 12 radial ones sometimes bifurcating, gradually weakened forward till they die out near the extremity. Area fairly broad, with a fine network of concentric and oblique striae, which the latter is, however, later effaced. Median furrow narrow and shallow. Escutcheon depressed, broad, with lattice of concentric and radial striae. Marginal and escutcheon carinae obtuse but well marked. Illustrated specimen (Ky. T. 1) is 28 mm. long and 25 mm. high.

Comparison:— NAKAZAWA (1955) noted that some specimens of *Minetrigonia hegiensis* (SAEKI) resembles *M. katayamai*, but is separable from *hegiensis* as a distinct species, because in *hegiensis* the area is distinctly sculptured with obliquely latticed fine and dense striae, while the network is obscured through growth in *katayamai*. This form is identified with *M. katayamai*, though more trigonal than the typical form.

? Family Pleurophoridae DALL.

Genus *Palaeopharus* KITTL, 1907. emend.

KOBAYASHI and ICHIKAWA, 1951.

Palaeopharus maizurensis KOBAYASHI and ICHIKAWA.

Plate 9, Figures 8-13.

1951. *Palaeopharus maizurensis* KOBAYASHI and ICHIKAWA, *Trans. Proc. Palaeont. Soc. Japan, N. S.*, No. 1, pp. 7-12, pl. 1, figs. 1-6.
1952. *Palaeopharus maizurensis* KOBAYASHI and ICHIKAWA, *Japan. Jour. Geol. Geogr.*,

Vol. 22, p. 79, pl. 3, figs. 1-3.

1955. *Palaeopharus maizurensis* NAKAZAWA, *Mem. Coll. Sci., Univ. Kyoto, Ser. B, Vol. 22, No. 2*, pp. 256-257, pl. 16, figs. 4-6, 8.

In well preserved specimens, the cardinal tooth of the right valve is crenulated on its upper surface. The sculpture of the umbonal region is obscure, but the remaining part is ornamented with fairly strong reverse V- or sometimes M-shaped costae which, however, disappear later; about 12 radial costae in anterior at first slightly concave upwards; about 16 radial costae present in posterior except postero-dorsal part; concentric striae fairly distinct in anterior half and postero-dorsal part, and thickened at intersection with radial costae. The chevron shaped costae measures about 130° near the umbo and about 90° in the middle stage.

This form is identical with *Palaeopharus maizurensis*, although it is larger in size and its chevron shaped costae are less numerous than those of the typical ones. The illustrated specimen (Ky. P. 1.) is 77 mm. long and 26 mm. high.

Palaeopharus maizurensis var. *imamurai* NAKANO, new variety

Plate 9, Figure 14,

This variety is distinguished from *Palaeopharus maizurensis* simply by the smaller number of radial anterior costae. It resembles *Palaeopharus paucicostatus* NAKAZAWA and *P. burji* KIPARISOVA, but differs in the existence of about 6 anterior radial costae in the early stage.

Palaeopharus maizurensis var. *flexicostatus* NAKANO, new variety

Plate 9, Figure 15.

This is similar to the precedings in outline and ornamentation, but differs in having the V-shaped costae in the anterior part.

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EXPLANATION OF PLATE

PLATE 9

All figures in natural size except FIG. 6b. (x2)

Oxytoma subzitteli KOBAYASHI and ICHIKAWA.

FIG. 1. Modelling cast of an imperfect left valve. (Ky. Ox. 1.)

"*Aguileria*" *hekiensis* (KOBAYASHI and ICHIKAWA)

FIG. 2. Right internal mould showing pseudotaxodont denticles. (Ky. Ag. 1.)

FIG. 3. Left internal mould. (Ky. Ag. 2.)

Lima sp. cfr. *L. yataensis* NAKAZAWA.

FIG. 4. Right internal mould. (Ky. Li. 1.)

Minetrigonia katayamai KOBAYASHI and ICHIKAWA.

FIG. 5. Lateral view of a clay cast of a right valve. (Ky. T. 2.)

FIG. 6a-b. Lateral and posterior views of a clay cast of a left valve. (Ky. T. 1.)

FIG. 7. Imperfect internal cast of a left valve. (Ky. T. 3.)

Palaeopharus maizurensis KOBAYASHI and ICHIKAWA.

FIG. 8. Cast of bivalved shell. (Ky. P. 1.)

FIG. 9. Internal cast of bivalved shell. (Ky. P. 2.)

FIG. 10. Internal cast of an imperfect right valve. (Ky. P. 3.)

FIG. 11. Internal cast of an imperfect left valve. (Ky. P. 4.)

FIG. 12. Plaster cast of a right valve. (Ky. P. 5.)

FIG. 13. Plaster cast of an internal right valve (Ky. P. 3.), showing cardinal and pseudocardinal teeth.

Palaeopharus maizurensis var. *imamurai* NAKANO, new variety

FIG. 14. External cast of a left valve. (Ky. Pi. 1.)

Palaeopharus maizurensis var. *flexicostatus* NAKANO, new variety

FIG. 15. External cast of a left valve. (Ky. Pf. 1.)

All specimens are kept in Geological Institute, Hiroshima University.

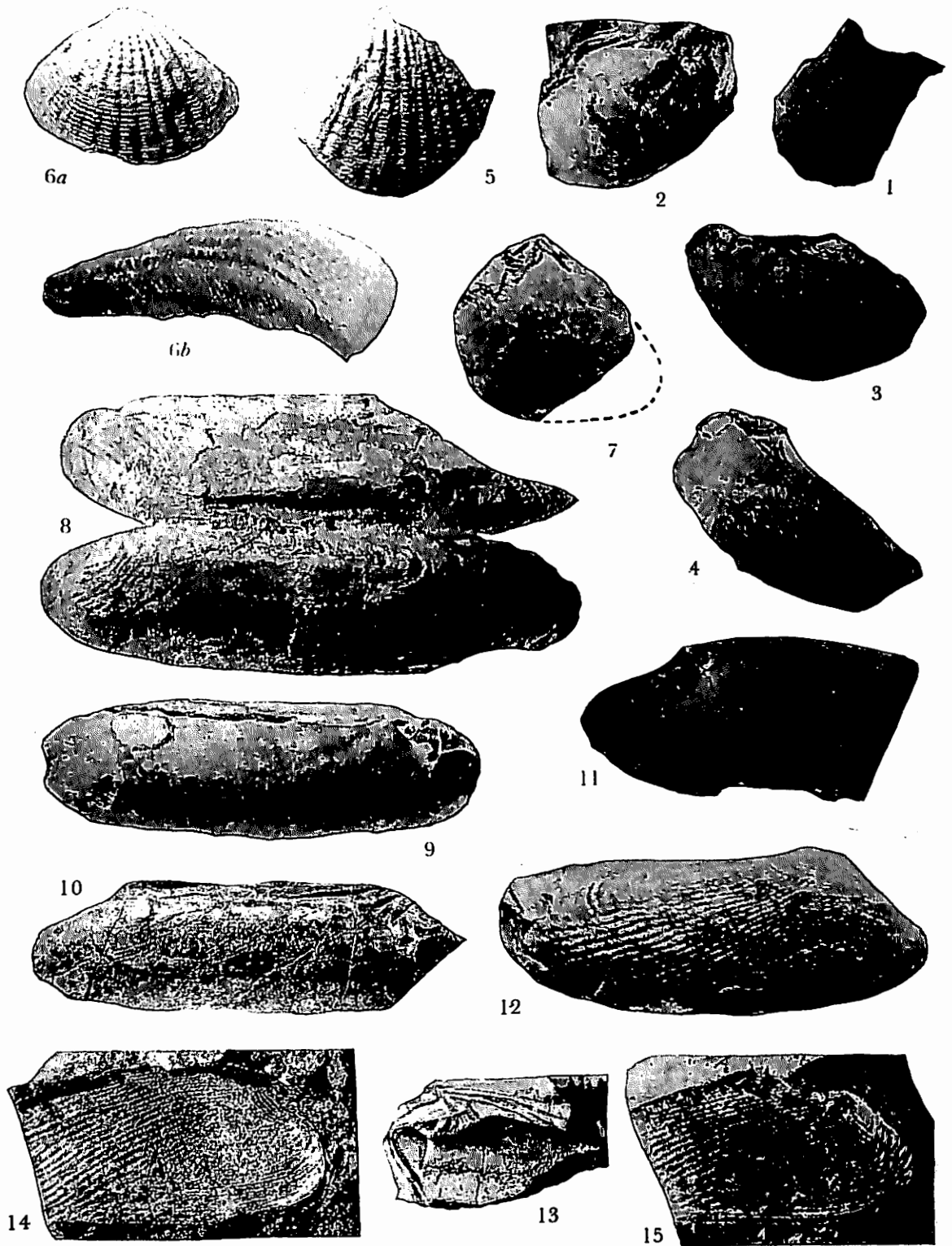


Photo by C. Ueki.