

Scabrotrigonians in Japan

By

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with 1 Plate

ABSTRACT In this paper the writer discussed the acme of *Scabrotrigonia* and described some forms of Scabrotrigonians in Japan.

When Professor KOBAYASHI and the writer (1957) discussed *Scabrotrigonia* as a genus of Pterotrioniinae, its existences were unknown in the Cretaceous rocks in Japan. Subsequently, the writer discovered Scabrotrigonians in the Middle Cretaceous at some localities in Kyushu and Hokkaido. They are as follows:

Scabrotrigonia imanishii NAKANO, n. sp.

Scabrotrigonia obsoleta NAKANO, n. sp.

Scabrotrigonia kobayashii NAKANO, n. sp.

Scabrotrigonia sp. ?

Scabrotrigonia can be divided into two groups in two provinces by the characters of the ornamentation on the area. Namely the genus prospered in Western Europe at a time and in the Gulf region at another.

The writer is much indebted to Professor Teiichi KOBAYASHI of the University of Tokyo for his kind guidance and reading the manuscript, to Assistant Professor Shigeru IMANISHI of the Kumamoto University and Mr. Hideo SAWA of the Yatsushiro High School at Yatsushiro for supply of Trigonian specimens. He is grateful to Messrs Tsuruo YOKOYAMA and Kimiyoshi SADA of the Hiroshima University for their assistances in this study, and of course to Professor Sotoji IMAMURA of the same university for his unceasing encouragement.

Genus *Scabrotrigonia* DIETRICH, 1933 em.

KOBAYASHI and NAKANO, 1957

Type species:- *Trigonia scabra* LAMARCK, 1819. Albian to Turonian; France, England, etc.

Diagnosis:- Shell medium in size, crescentic to subtrigonal, sometimes produced posteriorly; beak opisthogyrous; umbo prominent, situated anteriorly; flank with diagonal, tuberculate or rarely plain costae; area narrow, fairly convex, ornamented with chevron-shaped tuberculate or plain costae which are sometimes broken into pustules or even die out in later stages of growth; median furrow fairly shallow and distinct; escutcheon depressed, broad, provided with transverse tuberculate or plain costellae; carinae absent except umbonal region.

List of Species:- (*.....*thoracia* group)

Trigonia castrovillensis STEPHENSON, 1941. Up. Maestrichtian; Texas.

Trigonia crenulifera LYCETT, 1877 (pl. 40, fig. 7 only). Cenomanian; Devonshire, England.

Trigonia emoryi CONRAD, 1857. Low. Cenomanian; Texas and Mexico.

Trigonia cfr. *emoryi* CONRAD by TREVISAN, 1937. Cenomanian; Sicily, Italy.

Trigonia eufaulensis GABB, 1850. Campanian; Alabama, Texas, North and South Carolina, Georgia, Delaware, Mississippi, etc.

Trigonia eufaulensis var. *gabbi* STEPHENSON, 1941. Low. Maestrichtian; Texas.

Trigonia eufaulensis var. *moorei* STEPHENSON, 1941. Up. Maestrichtian; Texas.

Trigonia ferdinandi FRECH, 1916. Low. Senonian; Syria and Texas.

Trigonia guadalupae BÖSE, 1910. Mid. Cret.; Mexico.

Trigonia haynensis STEPHENSON, 1923. Up. Campanian; North Carolina.

**Scabrotrigonia imanishii* NAKANO, n. sp., Aptio-Albian?; North Hokkaido, Japan.

Scabrotrigonia kobayashii NAKANO, n. sp., Turonio;-Cenomanian Central Hokkaido, Japan.

Trigonia limbata d'ORBIGNY, 1843. Cenomanian-Santonian; France, Switzerland, Germany, Spain, etc.

**Trigonia mooreana* GABB, 1861. Mid. Cret.; California, Texas and Mexico.

**Scabrotrigonia obsoleta* NAKANO, n. sp., Cenomanian; Amakusa, Kyushu, Japan.

Trigonia scabra LAMARCK, 1819. Albian-Turonian; France, England, Germany, Austria, etc.

Trigonia spinuloso-costata PETHÖ, 1906. Up. Senonian; Hungary.

Trigonia stantoni STEPHENSON, 1941. Low. Maestrichtian; Texas.

**Trigonia thoracia* MORTON, 1834. Turonian; New Jersey, Alabama, Texas, Tennessee, Georgia, Missouri, Delaware, Mississippi, Arkansas, etc.

Trigonia transatlantica BEHRENDSEN, 1892. Up. Cret.; Argentina.

Trigonia vaalsiensis BÜEM, 1885. Low. Senonian; Germany, Belgium, Holland, etc.

Trigonia sp. by STEPHENSON, 1941. Low. Maestrichtian; Texas.

Scabrotrigonia sp.? by NAKANO, 1958. Albian?; Yatsushiro, Kyushu, Japan.

Remarks:- This genus is easily distinguished from others of Pterotrighoniinae by the chevron-shaped costation on the area.

With reference to the sculptures on the area the following two groups can be distinguished. It is interesting to see that the groups are different in distribution.

1) The *thoracia* group characterized by the arrangement of pustules on the area includes 4 species (*T. thoracia* MORTON, *T. mooreana* GABB, *Scabrotrigonia imanishii* NAKANO, n. sp., and *S. obsoleta* NAKANO, n. sp.) in the Middle Cretaceous of Japan and North America. On the pustules, they are aligned commonly in reverse-V on the area, while *Scabrotrigonia obsoleta* NAKANO, n. sp. loses the characteristic sculpture which is limited in juvenalium.

2) The *limbata* group has the characteristic sculptures of the genus on the area and

Scabrotrigonians in Japan

chiefly inhabited in West Europe and the Gulf region from Middle to Upper Cretaceous. It flourished in West Europe at the Cenomanian, while in the Gulf region it culminated most in the Campanio-Maestrichtian. In West Europe, *Trigonia scabra* LAMARCK is the forerunner of the group which appeared in the Albian, and in the Cenomanian it is represented by 4 species [*Trigonia crenulifera* LYCETT (pl. 40, fig. 7 only), *T. cfr. emoryi* CONRAD, *T. limbata* d'ORBIGNY and *T. scabra* LAMARCK]. It declined in the Upper Cretaceous. The lower Senonian forms are *T. limbata* d'ORBIGNY and *T. vaalsiensis* BÖEM where in the latter the costation of the area are obsolete in maturity. *T. spinuloso-costata* PETHÖ is solitary in the late Senonian. (See Table 1)

TABLE 1. THE *limbata* GROUP OF WESTERN EUROPE.

Geological age Specific name	Middle Cretaceous				Upper Cretaceous	
	Apt.	Alb.	Cenom.	Tur.	Low. Senon.	Up. Senon.
<i>T. crenulifera</i> (pars)			×			
<i>T. cfr. emoryi</i>			×			
<i>T. limbata</i>			×	×	×	
<i>T. scabra</i>		×	×	×		
<i>T. spinuloso-costata</i>						×
<i>T. vaalsiensis</i>					×	

In the Gulf region, however, there are 2 species (*Trigonia emoryi* CONRAD and *T. guadalupae* BÖSE) in the Middle Cretaceous. In the lower Senonian *Trigonia ferdinandi* FRECH is a single form of the group, but the group is explosively flourished in the Campanio-Maestrichtian (upper Senonian) in Texas where 7 forms (*Trigonia castrovillensis* STEPHENSON, *T. eufaulensis* GABB, *T. e. var. gabbi* STEPHENSON, *T. e. var. moorei* STEPHENSON, *T. haynensis* STEPHENSON, *T. stantoni* STEPHENSON, and *T. sp. by STEPHENSON*) are recognized. *Haynensis* having plain costae on its flank is an aberrant form of the genus. (See Table 2)

TABLE 2. THE *limbata* GROUP OF THE GULF REGION.

Geological age Specific name	Middle Cretaceous				Upper Cretaceous		
	Apt.	Alb.	Cenom.	Tur.	Low. Senon.	Up. Senon.	
						Low.	Up.
<i>T. castrovillensis</i>							×
<i>T. emoryi</i>			×				
<i>T. eufaulensis</i>						×	
<i>T. e. var. gabbi</i>							×
<i>T. e. var. moorei</i>							×
<i>T. ferdinandi</i>					×		
* <i>T. guadalupae</i>							
<i>T. haynensis</i>						×	
<i>T. stantoni</i>							×
<i>T. sp. by STEPHENSON</i>							×

*.....Middle Cretaceous, horizon dubious

Finally, *Trigonia transatlantica* BEHRENDSEN and *T. ferdinandi* FRECH are respectively collected from the Upper Cretaceous formation of Argentina and Syria. *Transatlantica* is a specialized form having *Haidaia*-like, spiny costae on its flank. In Japan, *Scabrotrigonia kobayashii* NAKANO, n. sp. is collected from the Gyliakian *Trigonia* sandstone (Cenomanio-Turonian) at Katsurazawa, Mikasa-city, Central Hokkaido and *Scabrotrigonia* sp.? is known from the Miyakoan formation (Aptio-Albian) of the Yatsushiro district in Kyushu.

Thoracia group

Scabrotrigonia imanishii NAKANO, new species

Pl. 29, Figs. 1-4.

1956. *Trigonia pocilliformis* IMANISHI, *Kumamoto Jour. Sci., Ser. B, Sect. 1, Vol. 2, No. 1*, p. 53, figs. 1a-c, 3b.

Description:- Shell crescentic, medium-sized, broader than high, very inequilateral, inflated anteriorly, rostrate posteriorly; anterior margin rounded, gradually transmitting into gently curved ventral margin; dorsal margin long and slightly concave; siphonal margin well rounded. Umbo moderate in size; beak opisthogyrous, pointed at about a fourth from the anterior end. Flank with fairly narrow, prominent, finely tuberculate costae; umbonal region sculptured with about 2 concentric costae; next 8 or so on the most inflated part diagonal and slightly curved; remaining 7 costae or so nearly straight, oblique forward and gradually becoming oblique backwards. Area narrow, somewhat convex, ornamented with 10 or so chevron-shaped fine-tuberculate costae which are pustulated in later stages; median furrow shallow and distinct. Escutcheon depressed, wide, provided with about 10 fine tuberculate transverse costellae.

Comparison:- The holotype specimen (NM. Sc-i. 01), if complete, may be about 35 mm. long and 30 mm. high. This form is identified by IMANISHI with *Trigonia pocilliformis* YOKOYAMA, but the sculpture on the area reveals to be a member of *Scabrotrigonia*. It is closely allied to *Scabrotrigonia thoracia* (MORTON) in WADE (1926), but easily distinguished by the smaller shell, narrower intercostal spaces and absence of coarse growth lines on the surface. *Scabrotrigonia mooreana* (GABB) in BÖSE (1910) is also intimately related to this form, but differs in its more trigonal outline and thicker costae on the flank.

Occurrence:- Collected by IMANISHI from the Horombetsu formation at Horombetsu, Utanobori-mura, Esashi-gun, North Hokkaido, together with *Cucullaea* aff. *acuticarinata* NAGAO, *Pecten* (*Neithea*) cfr. *morrissi* (PICTET and RENEVIER) and *Natica* sp., etc. Judging from associated species, the Horombetsu formation is considered probably the Miyakoan (Aptio-Albian) of the Middle Cretaceous.

Scabrotrigonia obsoleta NAKANO, new species

Pl. 29, Figs. 5a-b.

Description:- Shell medium in size, longer than high, crescentic, inequilateral, in-

flated anteriorly, attenuate posteriorly; anterior margin rounded, passing gradually into broadly arched ventral; dorsal long and concave; siphonal margin rounded. Umbo small, prominent; beak opisthogyrous, located at a third to a fourth from front. Carinae obscure except near umbo. Area narrow, provided with several chevron-shaped tuberculate costae in early stage, but soon broadened and smoothened, leaving rather coarse growth lines; median furrow fairly deep and distinct. Escutcheon broad, depressed, with about 15 tuberculate transverse costellae. Flank ornamented with broadly spaced costae which are narrow, sharp, elevated and finely tuberculate; about 3 umbonal costae concentric or subconcentric and not reached to antero-ventral margin; some 8 succeeding oblique and fairly sinuous; last 10 or so somewhat flexuous, oblique forward but gradually becoming oblique backward.

Comparison:- The holotype specimen (NM. Sc-o. 01) may be about 45mm. long and 35mm. high, if complete. This is closely allied to *Scabrotrigonia thoracia* (MORTON), *S. mooreana* (GABB) and *S. imanishii* NAKANO, n. sp., but distinguished by the obsolete costation on its area. *Pterotrigonia datemasamunei* (YEHARA) var. and *Acanthotrigonia pustulosa* (NAGAO) resemble this form, but differ in the absence of chevron-shaped costation on the area.

Occurrence:- An imperfect bivalved specimen was obtained from the Middle Goshonoura group at Kurosaki, Goshonoura-jima, Amakusa-gun, Higo Prov., Kumamoto Pref., Kyushu.

Limbata group

Scabrotrigonia kobayashii NAKANO, new species

Pl. 29, Figs. 6-7.

Description:- Shell medium to fairly large in size, subtrigonal, very inequilateral, inflated anteriorly, attenuated posteriorly, slightly broader than high; anterior margin rounded; ventral margin broadly curved and long; dorsal margin concave and long; siphonal margin well rounded and fairly short; umbo prominent, moderate-sized; beak opisthogyrous, pointed at about a fourth from the anterior end. Area fairly broad, ornamented with about 15 chevron-shaped fine-tuberculate costae; median furrow shallow and distinct. Flank with tuberculate, broadly spaced costae; umbonal region sculptured with about 3 concentric to subconcentric costae; some 7 succeeding oblique and somewhat sinuous; last 8 or so oblique forward but gradually becoming oblique backward. Carinae obscure except for vicinity of umbo. Escutcheon broad, depressed, with 15 or so fine-tuberculate costellae.

Observation:- Costae on the flank are somewhat variable in strength and number which are arranged to 13-22, but about 18 in many common forms. Holotype specimen (MN. Sc.-k. 01) is, if complete, 65mm. long and 55mm. high.

Comparison:- This is similar to *Pterotrigonia hokkaidoana* (YEHARA), but easily distinguished by the chevron-shaped costae on the area. *Scabrotrigonia scabra* (LAMARCK) and

S. limbata (d'ORBIGNY) resemble this species, but differ by the slender and numerous costae on its flank. *Scabrotrigonia imanishii* NAKANO, n. sp. is distinguished from this species by the obsoletion of the sculptures on the area.

Occurrence:- Abundant in the *Trigonia* sandstone (Cenomanio-Turonian) from Katsurazawa, Ikushumbetsu, Mikasa-city, Central Hokkaido.

Incerta sedis

Scabrotrigonia sp.?

Pl. 29, Fig. 8.

This form represented by a single fragmentary cast (NM. Sc-?.01), resembles *Scabrotrigonia* in surface sculptures.

Occurrence:- Shimo-matsukuma-mura, Yatsushiro-gun, Higo Prov., Kumamoto Pref., Kyushu (Coll. H. SAWA); probably the Yatushiro formation (Albian).

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Scabrotrigonians in Japan

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EXPLANATION OF PLATE

PLATE 29

Scabrotrigonia imanishii NAKANO, n. sp. p. 230

FIG. 1. Lateral view of a gypsum cast of the holotype (NM. Sc-i. 01). $\times 1$.

FIG. 2. Postero-lateral view of a modeling cast of a right valve (paratype) (NM. Sc-i. 02). $\times 1.5$

FIG. 3. Lateral view of a modeling cast of a paratype (right valve) (NM. Sc-i. 03). $\times 2$.

FIG. 4. Imperfect external cast of a left valve (paratype) showing the ornamentation on the area and escutcheon (NM. Sc-i. 04). $\times 1$.

Horombetsu formation at Horombetsu, Utanobori-mura, Esashi-gun, Northern Hokkaido (IMANISHI Coll.).

Scabrotrigonia obsoleta NAKANO, n. sp. p. 230

FIG. 5a-b. Lateral and posterior views of a gypsum cast of the bivalved holotype (NM. Sc-o. 01) $\times 1$.

Goshonoura group at Kurosaki, Goshonoura-jima, Amakusa-gun, Higo Prov., Kumamoto Pref.

Scabrotrigonia kobayashii NAKANO, n. sp. p. 231

FIG. 6. Lateral view of a modeling cast of the holotype (left valve) (NM. Sc-k. 01). $\times 1$.

FIG. 7. Postero-lateral view of a modeling cast of an imperfect left valve (paratype. NM. Sc-k. 02) showing chevron-shaped costation on the area. $\times 1$.

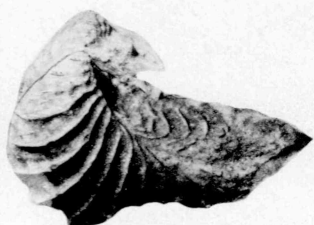
Trigonia sandstone (Cenomanian-Turonian) from the vicinity of the Katsurazawa-dam, Katsurazawa, Ikushumbetsu, Mikasa-City, Central Hokkaido.

Scabrotrigonia sp. ? p. 232

FIG. 8. Imperfect external cast of a left valve showing the ornaments on the area and escutcheon (NM. Sc-?-01). $\times 1$

From Shimo-matsukuma-mura, Yatsushiro-gun, Higo Prov., Kumamoto Pref. (Sawa Coll.)

Depository : All specimens are kept in Geological Institute, Hiroshima University.
(Photo. by C. UEKI)



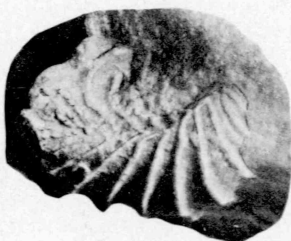
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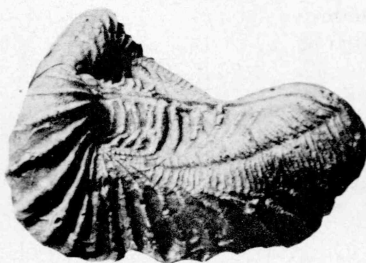
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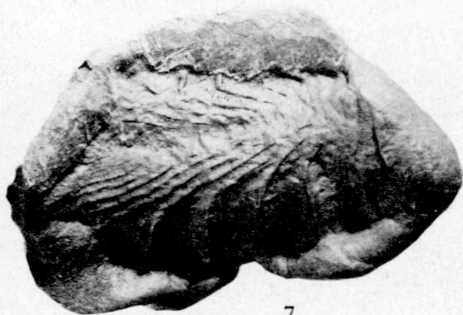
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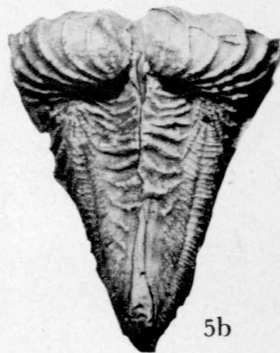
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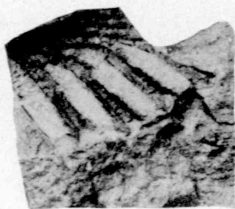
5a



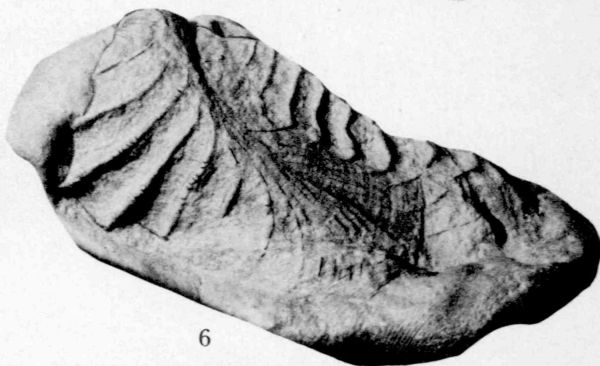
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5b



8



6