

Brachiopod Fossils from the Upper Permian Gujō Formation of the Maizuru Group, Kyoto Prefecture, Japan

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Abstract

The brachiopod fauna of the Upper Permian Gujō Formation of the Maizuru Group, Kyoto Prefecture, is described. Its stratigraphical position and relation to other faunas in the Maizuru Group are mentioned. One new species is described.

In the former reports, the writer described and analysed two faunas of the Permian Maizuru Group, Southwest Japan. They were named the Kawahigashi and the Takauchi Faunas and estimated to be late and middle Permian in age respectively. The former one is found at many localities in the sand- and granule-stones of the upper formation of the Maizuru Group, in intimate geographical relation, but not associated, with the *Lepidolina toriyamai* Fauna. The latter one is found in a limestone lense of the middle formation of the same Group and has no identical elements with the other fauna.

The Gujō Fauna, now concerned, is most characteristic in the Maizuru Group. That is, this fauna is noticed for abundant pelecypods and by their mesozoic appearances, and Dr. NAKAZAWA had estimated it to be of the Triassic Period. Afterwards, he and others corrected the age to Permian Period by precise field work and the association of the Permian type fossils.

The Gujō Formation is distributed in a narrow area near Gujō, Ōe-cho, Kasa-gun, Kyoto Prefecture. This formation is composed of conglomerates, sandstones and shales with rapid lateral change in lithofacies and sometimes simultaneous erosion is found. This formation is separated by faults from other formations of the Maizuru Group and the Triassic Yakuno Group. Many fossils are collected from behind the Kawahigashi Primary School at Gujō, but in other localities they are only rarely found. Fossils are accumulated in thin beds or fossil banks in the alternations.

This fauna is composed of many pelecypods and rather few brachiopods; namely, (NAKAWAZA, 1960. Specific names of brachiopods are emended)

Costatoria kobayasii, *Neoschizodus permicus*, *Bakevellia gujoensis*, *Actinodontophora* aff. *katsurensis*, "*Pleurophorus*" *tenuistriatus*, *Aviculopecten* sp., *Septimyalina* sp., *Allorisma* sp., *Spinomarginifera nipponica* n. sp., *Schellwienella ruber*, *Schellwienella regularis*, *Orthotetina* sp., *Bellerophon* sp., and *Bucanopsis* sp..

Among them, some pelecypods are apparently of mesozoic type, but the genera are not restricted in the mesozoic and originate in the Permian Period. Some of them have striking resemblance to the species of the Permian Katsura Formation of Shikoku. (ICHIKAWA, 1951, & NAKAZAWA, 1960). On the other hand, all brachiopods of this fauna are restricted in the paleozoic era and have not survived into the mesozoic era.

Brachiopod species of this fauna has no identical elements with the other two faunas of the Maizuru Group already described. *Schellwienella ruber* is reported from the Karita Formation of Hiroshima Prefecture, which has very intimate relation to the Maizuru Group as already mentioned. *Schellwienella ruber* and *Schellw. regularis* are the species found in the Loping Fauna of the Upper Permian of Southwest China. *Spinomarginifera nipponica* had been tentatively referred to as *Spinomarginifera* aff. *kueichowensis* in the former paper. The two species resemble each other in appearance, but after a detailed study they have been specifically distinguished by their several features. This species is also distinguished from *Spinomarginifera huangi* described by NAKAMURA from the lower Kanukura Series of the Kitakami Mountainland.

Although it cannot be decided by these fossils whether the Gujō Formation is late or middle Permian in age, lithologic features are comparable to the upper part of the Maizuru Group. It is presumed that the Gujō Formation represents a part of the uppermost part of the Maizuru Group. Such estimation is supported by another fact, that the sedimentary environment of the Maizuru Group passes from open sea type to inland sea type. If we suppose that this tendency had continued to the end of the Permian Period, the uppermost beds of the Maizuru Group must be littoral or deltaic formation. Accordingly, the deltaic facies of the Gujō formation presents a proof of the uppermost Permian System in the Maizuru Zone.

Before going into description, the writer intends to express his sincere thanks to Professor S. MATSUSHITA of his Institute for his kind guidance and encouragement. He is also indebted to Ass. Prof. K. NAKAZAWA and Messrs. T. SHIKI and Y. NOGAMI, for their advices and for offering him many good materials for study. Thanks are also due to Prof. M. MINATO of Hokkaido University, for his kind advices on paleontological investigation.

Description of Species

Spinomarginifera nipponica n. sp.

Pl. 8, figs. 1~20, Pl. 9, figs. 14~16.

Shell is medium to small in size and somewhat globose. Hinge line is straight and possesses the greatest width of the shell. Beak is slightly turned over the hinge line. The ventral valve is regularly convex but not geniculated. Longitudinally the valve is regularly curved at visceral part and rather abruptly down to frontal margin. Transversely the curvature is very strongly arched, impressed at the middle and sloping rather steeply toward the lateral margins. The ears are very small and ill-preserved. The sinus is broad and shallow. It commences at a short distance from the beak and becomes somewhat distinct at the middle and almost obscure to the frontal margin of the shell. The external surface is ornamented by elongated spine bases, but they are ill-preserved. Internal surface also has no minute characters. The brachial valve is slightly concave or almost flat at almost part and abruptly geniculated at a distance of 13 mm from the beak, where it forms a distinct trail which follows the trail of the ventral valve paralleling it. The ears are small and flattened. In many cases, they are very ambiguously separated from the main part of the shell. The median fold is very low, and broad but somewhat distinct near geniculation. The surface is characterized by irregularly scattered spine bases and concentric rims, of which the latter are rather less distinct. Internal structures of the brachial valve is clearly observed in some well-preserved specimens. A distinct median septum originates just below the beak and extends anteriorly to about four fifth length of the visceral part. Maginal ridge is also obviously preserved. It consists of three segments, two lateral ridges and a complete median diaphragm. The lateral ridges are narrow and low but distinctly erected from the base of the shell. They originate near the apex with an acute angle to the hinge line, extending laterally and bend along smooth curve. The lateral marginal ridges meet in front forming a complete diaphragm, and consequently they form a closed transverse elliptical circle of ridge. The diaphragm is somewhat ill-preserved, broad but low. Cardinal process unites anteriorly with a median septum and projecting distinctly above hinge line. On both sides of the low median septum, a pair of adductor muscle scars are situated, forming elongated and somewhat round triangular depressions.

Measurements of the species are as follows: (in mm.)

	external mould		int. m.	ext. moulds	
	ventral valve	dorsal valve	ventral valve	dorsal valve	
Maximum height	24.5	13.5	17.0	15.0	10.5
Length along curvature	38.0	16.0	28.0	17.5	14.0 ?
Length of hinge line	29.0	26.0	18.0 ?	26.0	21.0

Remarks: The present species resembles *Spinomarginifera kueichowensis* HUANG in its outline, but our specimens have rather round or globular shape and less remarkable geniculation than those of the Chinese original species. Main differences from *Spinomarginifera kueichowensis* are its more transverse and shallow dorsal valve and less distinct marginal ridges. From *Spinomarginifera huangi* NAKAMURA, this species is separated by the short ears of the ventral valve, rather thin visceral cavity, almost obsolete folds and more transverse shape of the dorsal valve. On these respects, the present species is obviously new to science. This new species is somewhat more intimate to *Spinom. kueichowensis* than to *Spinom. huangi*.

Locality and Occurrence: This species is collected behind the Kawahigashi Primary School at Gujō, Ōe-cho, Kasa-gun, Kyoto Prefecture. It associates many pelecypods (*Costatoria kabayashii*, *Neoschizodus permicus*, *Bakevella gujoensis*, *Actinodontophora* aff. *katsurensis* "Pleurophorus" *tenuistriatus* etc.) and brachiopods—*Schellwienella ruber*, *Schellw. reguralis*, etc. These fossils are accumulated in thin bed or fossil banks in the alternations of the Gujō Formation of the Permian Maizuru Group.

Reg. Nos. : JP 30301-30306.

Schellwienella ruber (FRECH)

Pl. 9, figs. 1~5.

1911. *Orthotes ruber* FRECH. Richthofen's China, Vol. V, p. 124, pl. 26, fig. 4.

1922. *Orthotetina ruber*, HAYASAKA. Palaeozoic Brachiopoda from Japan, Korea and China, Pt. I, Sci. Rep. Tohoku Univ., 2nd. Ser., Vol. VI, No. 1, p. 72, Pl. III, figs. 24, 25.

1933. *Schellwienella ruber*, HUANG. Late Permian Brachiopoda of Southwest China, Pt. II, Pal. Sinica, Ser. B, Vol. 9, pp. 23-24, Pl. XXIV, figs. 6, 9.

Several moulds of ventral valves are obtained. The shell is subquadrate in outline. Hinge line is shorter than the greatest width of the shell. The shell is somewhat concave, it appears almost no curvature in longitudinal direction, but rather convex in the transverse direction, and somewhat abruptly curved at marginal parts. Beak is not so prominent but projecting. The cardinal area of this valve is very high and meet at a very sharp angle with the exterior surface of the valve. In the middle of the area, a narrow delthyrium bisects the area. It is closed by a deltidium. Two dental plates slightly diverge anteriorly from apex in a short distance. On the surface of the cardinal area very fine transverse striations are visible.

Surface of the valves are covered by fine radial striae. They increase in number by insertion at several distances from beak, especially these insertion is very much near margin. They are not equal in thickness. The striations are counted 11 at a distance of 5 mm. on frontal margin.

Measurements of the specimens are as follows: (in mm.)

Entire length	20.0	19.5	15.0	14.5
Width	30.0	24.0	18.5	14.0
Length of hinge line	15.5	17.0	11.0	10.0
Height of area	4.5	7.5?	4.0	3.5
Breadth of deltidium	3.0	4.5?	2.5?	3.0?

Remarks: The present species resembles *Schellwienella ruber* (FRECH) in general outline, curvature, surface ornamentations, internal characters, etc.. The original specimen described by FRECH has subquadrate outline, as long as it is wide. Some specimen in hand is rather transverse in shape, but it is probably caused by later deformation. Comparing with Huang's specimens from southwest China, the present ones have rather oval and not quadrate outlines.

Locality and Occurrence: Same as those of *Spinomarginifera nipponica*. n. sp..

Reg. No.: JP 30008 A, B. 30010 A, B. 30310 A, B. 30015.

Schellwienella regularis HUANG

Pl. 9, figs. 6~9.

1933. *Schellwienella regularis* HUANG. Late Permian Brachiopoda of Southwest China, Pt. II, Pal. Sinica, Ser. B, Vol. 9, fasc. 2, pp. 25-27, Pl. III, figs. 10, 11.

This species is represented by incomplete moulds of one ventral valve. The valve is transversely oval in outline with less prominent beak. It seems almost without curvature in longitudinal direction, but transversely it distinctly curved. This curve is rather irregular by deformation. The convexity is most remarkable at umbonal part and becomes rather flat on both lateral sides and frontal ends. The umbo is pointed and strongly projecting, but its internal mould is not preserved. The hinge line is much shorter than the greatest width of the shell. The area is high and inclined. The deltidium is not so wide and convex. The internal characters of the valve is not preserved. The surface is characterized by fine radiating striations, and they increase in number by insertion at whole surface. The area which is represented by external mould, is covered by very fine transverse striations. The dorsal valve is not obtained.

Measurements of the valve are as follows (in mm.):

Length of the shell	20.0
Width of the shell	24.0
Length of the hinge line	15.5
Height of area	4.0

Remarks: The species unfortunately lacks its one lateral side and beak of

internal mould, but the whole shape, surface sculpture and hinge area are clearly observable. This species is more transverse in shape than that of *Schellwienella ruber* (FRECH) and quite resembles transversely oval outline of *Schellwienella regularis* HUANG from Southwest China.

Locality and Occurrence: Same as those of *Spinomarginifera nipponica* n. sp.
Reg. Nos. JP 30311-30312.

Orthotetina sp.

Pl. 9, figs. 10~13.

This specimen is incomplete moulds of one ventral valve. Whole shape is not preserved, but its very transverse oval outline is estimated. The valve is flat and conical. The curvature is not regular, and is very slight in longitudinal direction. From just below the beak, the shell has almost straight curvature toward front, then it abruptly curves to dorsal side. On the other hand, the shell is strongly curved transversely on main part and gradually tend rather flat at lateral parts. The apex is not so pointed, prominent and slightly bent over. The area is comparatively not very large, flat and rather strongly reclined. It is interrupted in the middle by a narrow and strongly convex pseudodeltidium. The hinge line is straight and much shorter than the greatest breadth of the shell. The surface of the shell is covered by fine radial striations and very ambiguous concentric lines. The striations are equal in size and increase in number by insertion. Internally two very distinct and parallel dental plates are preserved, which distant 3mm. from each other. The dorsal valve is not collected.

Measurements of this shell are as follows (in mm.):

Length of the shell	13.5
Width of the shell	19.5?
Length of the hinge line	15.5
Height of area	6.5
Breadth of the pseudodeltidium	4.5

Remarks: This species is obviously characterized as *Orthotetina* by distinct parallel dental plates in ventral umbo. This is somewhat similar to *Streptorhynchus pelargonatus* SCHLOTHEIM in its shape and also resembles to *Streptorhynchus lenticularis* WAAGEN, but our specimen has more transverse outline. The present specimen is easily distinguished from *Streptorhynchus pelargonatus* by two parallel dental plates. Concerning WAAGEN's species, no internal structures are described. In these respects, the present species has been found to be another species.

Locality and Occurrence: Same as those of *Spinomarginifera nipponica*.
Reg. No. JP 30006 A, B.

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Literatures listed in the writer's former description are omitted.

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Plate 8

Explanation of Plate 8

Figs. 1-8. *Spinomarginifera nipponica* n. sp.

1. ventral and 2. lateral views of rubber cast of ventral valve, 3. external mould of dorsal valve, 4. same, enlarged. $\times 2$
5. dorsal and 6. ventral views of "Steinkern", 7, 8. same enlarged. $\times 2$

Figs. 9-12. *Spinomerginifera nipponica* n. sp.

9. ventral, 11. lateral and 12. frontal views of internal mould of ventral valve.
10. same, enlarged as fig. 9. $\times 2$

Figs. 13-14. *Spinomerginifera nipponica* n. sp.

13. external mould of dorsal valve, 14. rubber cast from same specimen.

Figs. 15-17. *Spinomarginifera nipponica* n. sp.

"Steinkern" with ext. mould of dorsal valve.

15. ventral, 16. dorsal, and 17. lateral views.

Figs. 18-20. *Spinomarginifera nipponica* n. sp.

interior of brachial valve showing distinct median septum and marginal ridges.

18. internal mould $\times 2$, and 19. rubber cast, 20. same enlarged. $\times 2$

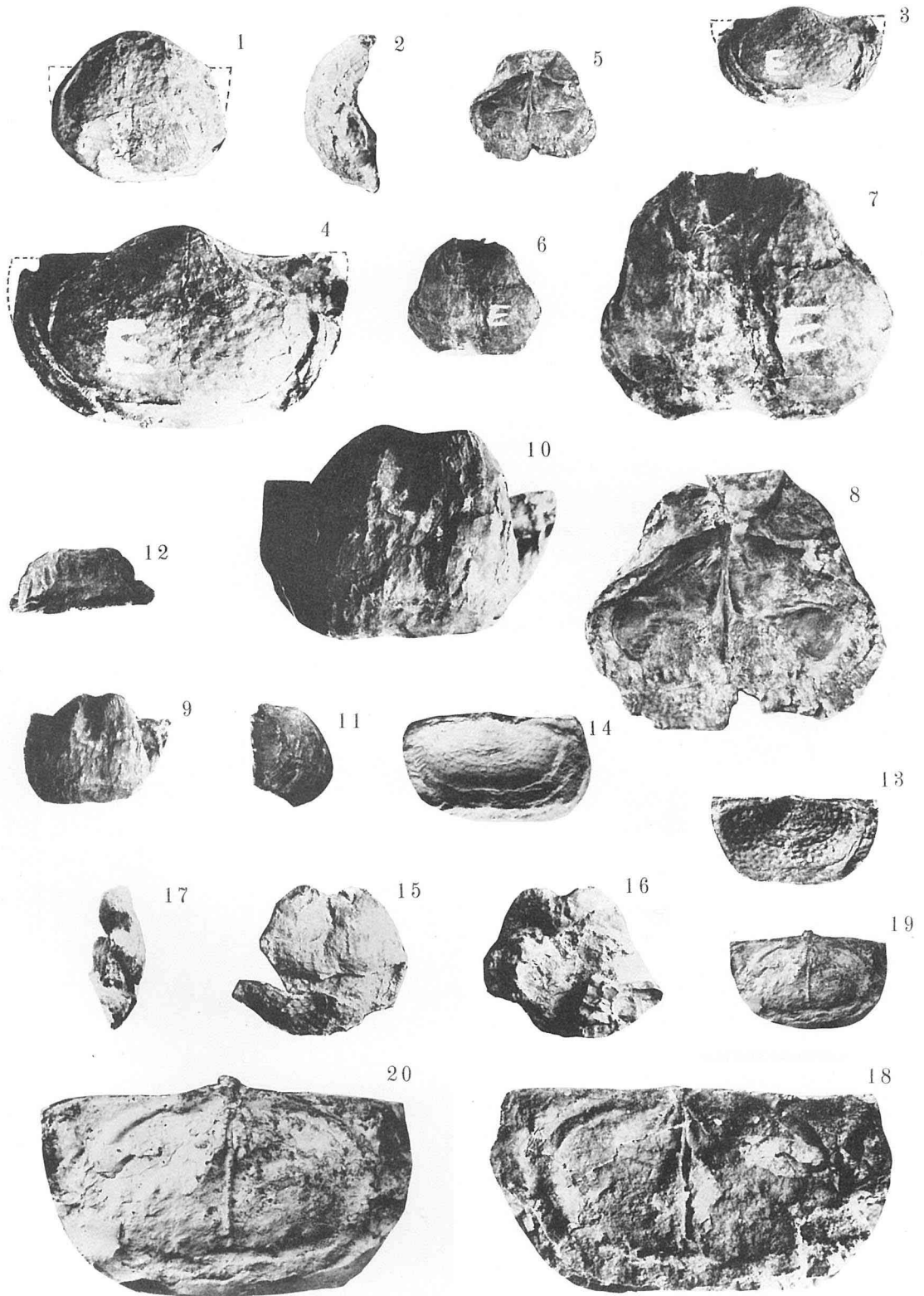


Plate 9

Explanation of Plate 9

Figs. 1-5. *Schellwienella ruber* (Frech)

1. internal and 2. external moulds of a ventral valve.
3. ventral and 4. apical views of internal mould of another ventral valve, enlarged $\times 2$.
5. internal mould of a small ventral valve.

Figs. 6-9. *Schellwienella regularis* Huang.

6. internal mould of ventral valve with external mould of cardinal area.
7. same enlarged $\times 2$.
8. external mould of same specimen, enlarged $\times 2$.
9. external mould of another dorsal valve.

Figs. 10-13. *Orthotetina* sp.

10. external and 13. internal moulds of ventral valve.
11. ventral and 12. apical views of rubber cast of the same specimen.

Figs. 14-16. *Sinomarginifera nipponica* n. sp.

14. external mould of ventral valve.
15. dorsal and 16. ventral views of "Steinkern"

