364. ON THE "NIPPONONAIA" FROM THE LOWER CRETACEOUS WAKINO SUBGROUP, NORTH KYUSYU, JAPAN.

(Studies on the Molluscan Fauna of the Cretaceous Inkstone Series. Part 3.)*

YOSHIHISA OTA

Fukuoka Liberal Arts College.

In 1941, SUZUKI erected a subgenus, Nippononaia, with an internal and external moulds. However, whether the specimens came from the Lower Cretaceous of Sandal graben in Kwanto mountains or Katsuragawa basin in eastern Shikoku was a question. They were unfortunately gone by a fire in the Second Great War.

Lately I collected several specimens from the Lower Cretaceous Wakino subgroup. They are similar to Trigonioides kodairai KOBAYASHI and SUZUKI in the ornament and Plicatunio kwanmonensis OTA in the hinge nature. Namely, they have intermediate features between Trigonioides and Plicatunio but probably more related to Nippononaia ryosekiana SUZUKI in both respects. When the hinge is unknown, one can not distinguish them from T. kodairai. Therefore these Wakino specimens have once been taken for T. kodairai but its type locality is the lower Naktong formation at Shinshu, Korea. The specimen (COX, 1955. Text fig. A; KOBAYASHI, 1956. Pl. V. Fig. 3; OTA, Pl. 6, Fig. 11) which was disputed by COX and KOBAYASHI to Plicatunio naktongensis multiplicatus, if not a Nippononaia. It is difficult to decide whether the specimen belongs to "Nippononaia" or Plicatunio, for its surface ornament can not be seen. I have once identified it with T. kodairai, but now it is ascertainment that the Wakino specimens can be distinguished from Trigonioides in the hinge nature.

I want to describe here two new species from the lower Wakino formation, which are provisionally referred to "Nippononaia", although much obscurity is attached to the hinge nature of true Nippononaia and its taxonomic position is ambiguous.

Before going further, I wish to record his warmest appreciations to Prof. T. KOHAYASHI of the University...
of Tokyo, for his continuous encouragement, and express many thanks to Messrs. I. Hayami and A. Tokuyama of the University and Mr. M. Nakano of the Hiroshima University and Assist. Prof. H. Hongo of the Fukuoka Liberal Arts College at Tagawa for their kind help.

I Distinction among “Nippononaia”, Trigonioides and Plicatounio.

A. The difference of “Nippononaia” from Trigonioides on one side, from Plicatounio on the other. One can easily distinguish the last from the two others in outline and ornament. Namely, Plicatounio is distinct from them in its posterior radial plications and transversely elongated outline. Plicatounio is more or less similar to “Nippononaia” in the subquadrate or subtriangular outline.

B. It is not always easy to distinguish “Nippononaia” from Trigonioides as they resemble in the outlines and ornaments. As the result of this study, it was found that the two genera can be distinguished by the hinge nature. More precisely, the median teeth are more developed in Trigonioides than in “Nippononaia”, as formulated below:

\[
\begin{align*}
\text{Trigonioides} & : & 5a & 3a & (3b) & 2b & 4b \\
\text{Plicatounio} & : & (5a) & 3a & (1') & 2b & 4b
\end{align*}
\]

where brackets indicate such great variability that the teeth in brackets are sometimes totally absent. Furthermore, the difference between them exists in the disposition of hinge teeth. Two pseudocardinal teeth are subparallel to the anterior hinge margin in the left valve of “Nippononaia”, while in that of Trigonioides they are four in number, diverging from beak to the anterior hinge margin with angles of 0°, 30°, 60° and 90° (Text-fig. A).

The hinge plate of “Nippononaia” is narrow with slender teeth and that of Trigonioides wide with stout dentition.

Suzuki in his second paper (1943) took true Nippononaia as a subgenus of Plicatounio instead of Unio because of its hinge nature indistinguishable from that of Plicatounio. “Nippononaia” is somewhat similar to P. kwannonensis OTA (1958) in the hinge but fairly different from P. nakdongensis which has many unionid features in the hinge nature.

II Comparison between American species of Nippononaia and “Nippononaia” of the Wakino subgroup.

Reeside (1957) reported the find of Nippononaia in the Lower Cretaceous of Colorado, North America. Comparing “Nippononaia” of Wakino with Reeside’s, the following differences can hardly be overlooked.

1) In the composition and arrangement of the teeth, they are very much alike, but Reeside’s teeth are not distinctly crenulated as those of Wakino form.

2) Reeside’s appears rather smooth according to his Text-figure 2 (Reeside, 1957, p. 652), but the Wakino form has distinct crenulation on the ventral margin. However, I cannot make sure whether the ventral margin of Reeside’s is crenulated or smooth as nothing is stated.

3) In ornamentation Reeside’s is more similar to Trigonioides matsumotai Kobayashi and Suzuki than Nippononaia.
Genus “Nippononaia” SUZUKI, 1941

“Nippononaia” wakinoensis Ota, new species

Plate 11, Figures 1-7, 11.
Description.—Shell medium in size, transversely elongated, subelliptical in outline, subequilateral, regularly rounded in anterior and subquadrate in posterior; dorsal margin broadly arched, subparallel to ventral margin which is slightly curved. Test fairly thick. Beak fairly prominent, prosogyrous, more or less incurved, placed at about two-fifths to submedian and fairly projected above hinge line. Surface ornamented with many V-shaped ribs crossed by concentric growth lines: radial ribs fine and closely set in middle; several middle ribs (6-8) converging to form acute Vs on a line through beak; each side of them regularly ornamented with reversed V-ribs; anterior ribs about 18-20 including middle V-ribs smaller and more numerous than posterior (14-16). Hinge well developed; cardinal teeth relatively short, narrow and finely crenulated; lower one stronger than upper; lateral teeth fairly long, lamellar, finely crenulated, but weak and lower than anterior ones. Internally, ventral margin crenulated especially in posterior half.

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Length</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wi. S</td>
<td>5057</td>
<td>31 mm</td>
</tr>
<tr>
<td></td>
<td>5060</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>5051</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>5086</td>
<td>42</td>
</tr>
</tbody>
</table>

Occurrence.—Lower Sengoku formation in Wakino subgroup at Rikimaru, Miyata-machi, Kurate-gun, Fukuoka Pref.

Observation.—The hinge nature and surface ornament vary considerably: 4a, 3b and median tooth are developed in some but not in others. Namely, 4a and 3b are degenerative. Even when developed, they are smaller than the others and a little convex and crenulated only on one side. It is a tendency for 3a or 2a to branch off near beak. The branching tooth can be seen as arrangements of nodes under the beak.

The ornament of the anterior area is variable. Namely, anterior ribs become weak in adult stages, while radial ones are sometimes replaced by concentric costae. In the anterior area ribs are sometimes zig-zag or irregular.

Comparison.—This is most similar to N. ryosekiana Suzuki in outline, ornamentation and hinge nature. However, "N." wakinoensis differs from N. ryosekiana in lateral teeth and posterior ornament. This new species is also similar to Trigonioides kodairai and T. paucisulcatus Suzuki, but differs in the hinge nature. As already discussed, this differs from N. asinaria Reeside in hinge and ornament.

Occurrence.—Lower Wakino formation at Rikimaru, Miyata-machi, Kurate-gun, Fukuoka Pref.

"Nippononaiia" sengokuensis Ota, new species

Plate 11, Figures 8-10.

Description.—Shell rather small, oblong, moderately convex, subequilateral, rather regularly rounded on both sides, ventral margin rounded. Beak small, submedian, prosogyrous, more or less incurved. Numerous ribs arranged as usual in wakinoensis. Hinge teeth identical with those of the species, but the angle of hinge margin is smaller.

* I showed these specimens of "N." wakinoensis to Dr. K. Suzuki who erected Nippononaiia. He said that the Wakino specimens are so similar to N. ryosekiana in all respects that they are referable to his subgenus notwithstanding the fact that the two species disagree in the number and crenulation of lateral teeth.
Comparison:—This is distinguished from "N." wakinoensis and "N." ryosekiana by small size and oboval outline of the shell. T. kodairai was originally described from lower Naktong and Wakino series by Kobayashi and Suzuki. The Wakino specimen (Kobayashi and Suzuki, 1936. Pl. 29, Fig. 13) which they described is incomplete in ornament, and its hinge nature is also not distinct. Therefore I cannot accurately determine whether it is T. kodairai or "N." sengokuensis. But I presume that it is probably "N." sengokuensis as suggested by its oboval outline and small size.

Occurrence:—Same as the preceding species.

References


Explanation of Plate 10

All natural size

*Trigonioides matsumotoi* Kobayashi and Suzuki ........................................... Page 102

- Fig. 1. Right internal mould, showing the hinge.
- Figs. 2, 3, 4, 5, 6, and 7. Left internal moulds.
- Figs. 8, 9, 10 and 11. Right internal moulds.
- Fig. 12. Right external mould, showing the posterior and median ornament.
- Fig. 13. Right plaster cast.
- Fig. 14. Right external mould, showing an anterior and median ornament.
- Fig. 15. Right artificial cast, showing the anterior ornament.

*Trigonioides paucisulcatus paucisulcatus* Suzuki .............................................. Page 103

- Fig. 16. Incomplete right internal mould, showing the anterior ornament.

Upper Gosyonoura group at Kyodomari, Gosyonoura Island, Kumamoto Pref.

Explanation of Plate 11

All natural size except Fig. 9 (×2)

"*Nippononaia*" wakinoensis Ota, new species .............................................. Page 107

- Fig. 1. Right internal mould, holotype.
- Figs. 2a and 2b. Plaster cast showing the surface ornament.
- Figs. 3 and 4. Internal moulds of an immature right valves, showing the outline of the younger stage.
- Fig. 5. Plaster cast of an incomplete right valve.
- Fig. 6. Plaster cast of an incomplete left valve.
- Fig. 7. External mould of a right valve, showing disappearance of the anterior radial ribs.

"*Nippononaia*" sengokuensis Ota, new species ........................................ Page 108

- Fig. 8. Left internal mould, holotype.
- Fig. 9. Right internal mould.
- Fig. 10. Plaster cast of an incomplete right valve.

"*Nippononaia*" wakinoensis Ota (?)

- Fig. 11. Right internal mould.

All above specimens: Lower Wakino subgroup at Rikimaru, Miyata-machi, Kurate-gun, Fukuoka Pref.

*Trigonioides paucisulcatus suzukii* Ota, new subspecies ................................ Page 102

- Fig. 12. Internal mould of the bivalve, holotype, showing the hinge.
- Fig. 13. External moulds of the paratype bivalve, showing the surface ornament.
- Fig. 14. Right internal mould.
- Figs. 15 and 16. Bivalve internal moulds, showing the hinge.
- Figs. 17 and 18. Right external moulds.
- Fig. 19. Left external mould.
- Fig. 20. Dorsal view of an external mould of a bivalve.

Upper Wakino subgroup at Hata, Katsuki-machi, Yahata-city, Fukuoka Pref.