

Nippononaia ryosekiana (Bivalvia, Mollusca) from the Tetori Group in Central Japan

By

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Abstract *Nippononaia ryosekiana* is first recorded from the Inner Zone of Southwest Japan in the Kitadani Formation, the uppermost division of the Tetori Group. This species is a constituent of the TPN Assemblage which is ubiquitous in Early Cretaceous non-marine faunas of East Asia. The occurrence of *N. ryosekiana* from the Kitadani Formation indicates that this formation can be correlated with the Sebayashi Formation in the Outer Zone of Southwest Japan and be assigned to the Late Barremian to the Early Aptian or thereabout in age.

Introduction

The discovery of *Nippononaia ryosekiana* from the Kitadani Formation of the Tetori Group was preliminarily mentioned by ISAJI and HASEGAWA (1990). One of the specimens described in this paper has already been figured by TAMURA (1990, pl. 8, fig. 23). Subsequently, I have obtained a few additional specimens of this species from another locality. In this paper I describe these specimens and briefly discuss the biostratigraphic significance.

Geological Setting

The specimens discussed in this paper were collected from the Kitadani Formation, the uppermost division of the Tetori Group (Fig. 1). The Itoshiro and Akaiwa Subgroups are distributed in the Katsuyama and Shiramine areas. The Akaiwa Subgroup conformably overlies the Itoshiro Subgroup and is subdivided into two formations in these areas. The Akaiwa (lower) Formation consists mostly of coarse sandstone and contains interbedded conglomerates composed of pebbles to cobbles of orthoquartzite. The Kitadani (upper) Formation mainly consists of alternating beds of sandstone and shale with some layers of tuff. This formation yields dinosaur remains sporadically (AZUMA, 1991) and non-marine bivalves abundantly. (MAEDA 1958, 1962b, 1963, TAMURA, 1990).

The specimens of *Nippononaia ryosekiana* were collected at two localities (Fig. 2): one is at a road cut along the Sugiyama valley, near Sugiyama, Katsuyama City,

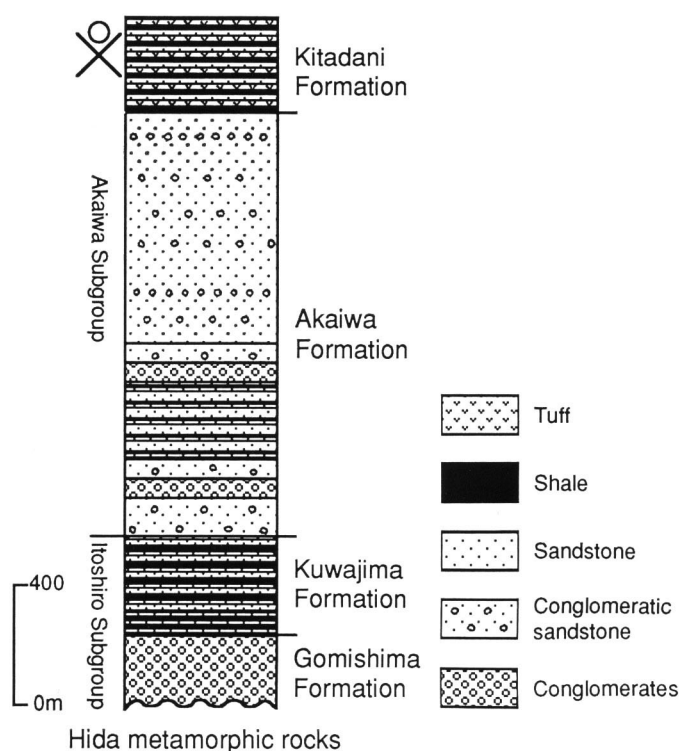


Figure 1. Generalized geological column of the Tetori Group distributed in the Katsuyama and Shiramine areas (modified from MAEDA, 1961), showing the stratigraphic position of the fossil occurrences.

Fukui Prefecture and the other is an exposure in the lower course of the Ota valley, near Donomori, Shiramine Village, Ishikawa Prefecture. Although the two localities are separated more than 6 km apart, both are stratigraphically assigned to the upper part of the Kitadani Formation. At the Sugiyama locality, one specimen was collected directly from the outcrop, where *N. ryosekiana* is associated with *Plicatounio* (s.s.) *kobayashii*, *Pseudohyria matsumotoi*, *Nagdongia soni*, *Nippononaia* aff. *tetoriensis*, *Trigonioides* (*Wakinoa*) *tetoriensis*, *Viviparus* sp., fragmentary bones of vertebrates and plant fossils. At the Ota locality, two specimens and a few fragments were collected from boulders of muddy fine sandstone. *Plicatounio* sp., *Pseudohyria matsumotoi*, *Nagdongia soni*, *Nippononaia* sp., *Viviparus* sp. and fragmentary bones of vertebrates were associated in the same boulders. These boulders were certainly derived from the bed just beneath the river floor which was excavated to build a dam. At present, no fossiliferous bed crops out. At both localities, the fossil beds are in the alternating strata of fine sandstone, shale and thick coarse sandstone, regarded as fluvial in origin.

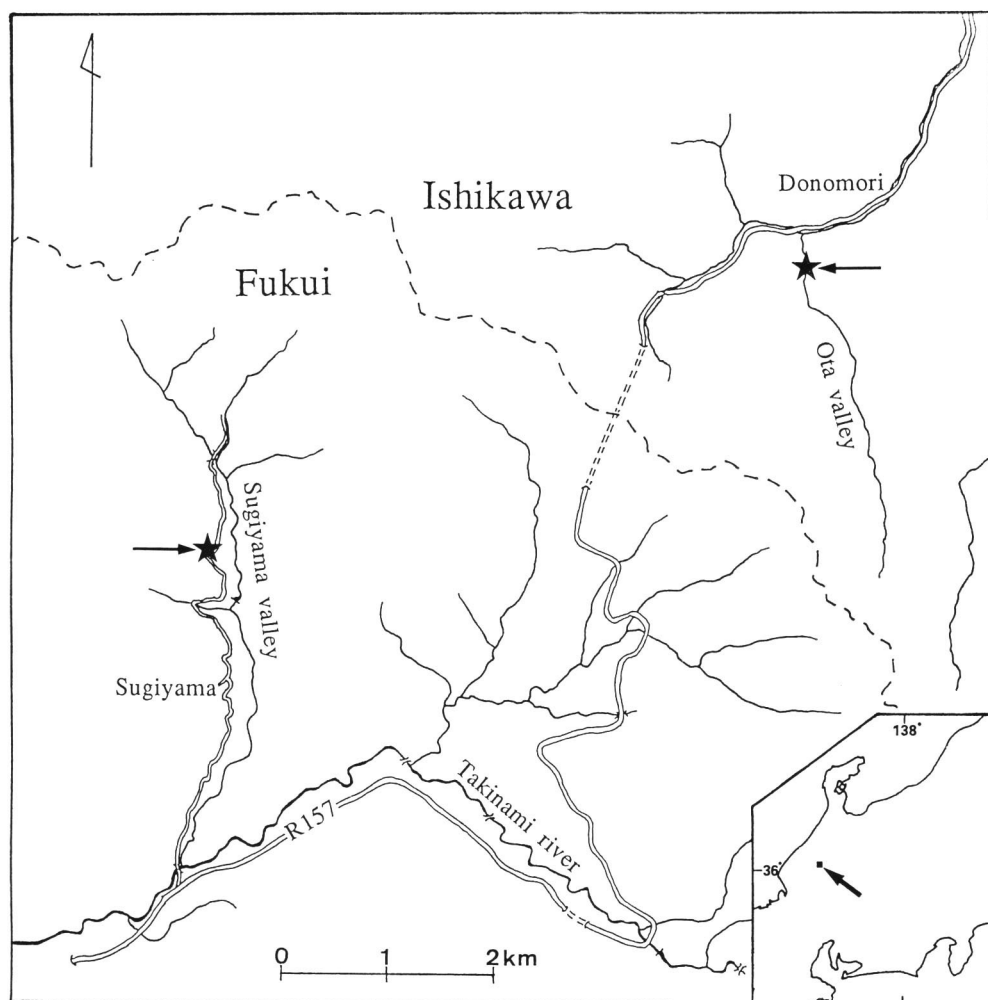


Figure 2. Map showing the collecting localities of *Nippononaia ryosekiana* (SUZUKI).

Systematic Description

Family Trigonoididae COX, 1952

Genus *Nippononaia* SUZUKI, 1941

Nippononaia ryosekiana (SUZUKI)

Figure 3

Unio (*Nippononaia*) *ryosekiana* SUZUKI, 1941, [sic], p. 412, text-figs. 1–3.

Plicatounio (*Nippononaia*) *ryosekiana* (SUZUKI) [sic]; SUZUKI, 1943, p. 196, 211.



Figure 3. *Nippononaia ryosekiana* (SUZUKI). 1: Right valve (NSM PM15516), $\times 1.78$ Loc. Sugiyama valley, near Sugiyama, Kitadani-mati, Katsuyama City, Fukui Prefecture. 2: Articulated specimen (NSM PM15517), $\times 1.78$ Loc. Ota Valley, near Donomori, Shiramine Village, Ishikawa County, Ishikawa Prefecture. 3: Articulated specimen (NSM PM15518), $\times 1.78$. Loc. *ditto*.

Nippononaia ryosekiana (Suzuki); HAYAMI & ICHIKAWA, 1965, p. 147, text-fig. 2, pl. 17, figs. 1–8; MATSUKAWA, 1977, p. 122, pl. 1, figs. 12, 13; YANG, 1978, p. 35, text-figs. 3, 4, pl. 1, figs. 1–7; CHEN & JIANG, 1990, p. 21, text-fig. 14.

Nippononaia linhaiensis GU & MA, 1976, p. 361, pl. 106, figs. 6–10.

Material: Three specimens and a few fragments are at hand. One of them (NSM PM 15516) from the Sugiyama valley is a well-preserved right valve but its posterior part is incomplete. Two specimens from the Ota valley are conjoined. One of the conjoined specimens (NSM PM15517) is deformed and the other (NSM PM15518) is strongly compressed. It is difficult to remove the matrix from the shell. These specimens are preserved in the Department of Geology, National Science Museum, Tokyo.

Description: Shell small in size, equivalve and inequilateral, transversely elongated, about three times as long as high, wedge-shaped in outline, rounded in front, tapering posteriorly, pointed at the extremity; antero-dorsal margin short, passing into the anterior margin; postero-dorsal margin very long, nearly straight; ventral margin gently and broadly arcuate, rather straight in its posterior part; umbo slightly prosogyrous, not prominent, situated at about two sevenths of shell length from the anterior extremity; carina distinct, extended from the umbo to the posterior extremity, delimiting a postero-dorsal area; lunule and escutcheon not demarcated; surface ornamented with numerous oblique ribs; several ribs on the part just below the umbo converge to make acute Vs, the angle of which is 25° – 30° ; the line linking the apices of Vs prosocline, forming about 75° with the ventral margin; anterior ribs fine, nearly straight or a little sinuous, regularly spaced, numbering about 20; posterior ribs subvertical and as fine as anterior ones near the umbo, but becoming gradually broader and more widely spaced toward posterior, numbering more than 22; antero-dorsal area ornamented with diverging short riblets; internal structure unknown.

Remarks: Compared with the holotype specimen described by SUZUKI (1941) and

the specimens described by HAYAMI and ICHIKAWA (1965, pl. 17, figs. 3–8) from the Sebayashi Formation, the Kitadani specimens are distinctly smaller in size. In this respect, they are more similar to the specimens of *N. ryosekiana* from the Yeonhwadong Formation of the Gyeongsang Group of Korea reported by YANG (1978, pl. 1, figs. 1–7). Although there is no evidence for the present specimens to be immature, they seem to be specifically identical with those described from the Yeonhwadong Formation. GU and MA (1976, pl. 106, figs. 6–10) described *Nippononaia linhaiensis* from the Guantou Formation of the Yongkang Group in Eastern Zhejiang Province of China. CHEN and JIANG (1990), however, dealt with it as a synonym of *N. ryosekiana*. The specimens of *N. linhaiensis* are as small as the Kitadani specimens, and they seem to be indistinguishable in surface ornamentation. CHEN and JIANG's (1990) opinion is accepted here.

Trigonioides-Plicatounio-Nippononaia Assemblage (TPN Assemblage) is ubiquitous in the Early Cretaceous non-marine faunas of East Asia (GUO, 1986). *N. ryosekiana* is also a constituent of the TPN Assemblage in the Kitadani, Yeonhwadong (YANG, 1979) and Guantou Formations (HAO *et al.*, 1986). In the Sebayashi Formation, however, *N. ryosekiana* occurs in association with *Hayamina* sp. (= *Protocyprina* sp. in HAYAMI and ICHIKAWA, 1965) instead of *Trigonioides* and *Plicatounio*. *Hayamina* is generally regarded as a brackish-water genus. The size difference of *N. ryosekiana* between the Sebayashi and other formations in East Asia may be due to environmental factors.

The present species is clearly distinguishable from *N. tetoriensis* MAEDA, 1962a from the Kuwajima and Okurodani Formations (Itoshiro Subgroup) (MAEDA, 1962a) by the much more delicate ribs on the shell surface.

Discussion

The Early Cretaceous non-marine formations of East Asia have been correlated with one another based on fossil molluscan assemblage. As suggested by MATSUMOTO *et al.* (1982) and TAMURA (1981, 1990), however, their precise age is unknown because these non-marine formations are not in contact with marine strata containing ammonites and other index fossils.

Among the Early Cretaceous non-marine fossils, *Nippononaia* has been regarded as an important genus. *Nippononaia ryosekiana*, the type-species of this genus, has been obtained from the Sebayashi Formation of the Sanchu area (HAYAMI and ICHIKAWA, 1965, MATSUKAWA, 1977). Although the lower part of the Sebayashi Formation yielding *N. ryosekiana* has not been directly dated, MATSUKAWA (1983) demonstrated that the Sebayashi Formation ranges from the late Late Barremian to the Aptian from his analysis of the ammonite assemblages of the underlying Ishido Formation and overlying Sanyama Formation. Therefore, *N. ryosekiana* has been regarded as a good index fossil which is useful to classify the non-marine formations and correlate them with marine ones (YANG, 1978, 1979, GUO, 1986).

YANG (1978) correlated the Yeonhwadong Formation of the Gyeongsang Group of Korea with the Sebayashi Formation based on the occurrence of *N. ryosekiana*. YANG (1979) also correlated those formations with the Wakino Subgroup in north Kyushu (OHTA, 1960) and the Kitadani Formation, and suggested that these formations are regarded as middle Neocomian to Aptian in age. OGASAWARA (1988) described a freshwater molluscan fauna from the Monomiyama Formation in the Kitakami Mountains, which is correlative with the Kitadani and Wakino faunas. The Monomiyama Formation is assigned to the Hauterivian to the Barremian based on the lithologic similarities with the Ofunato Group, which is dated by some ammonites (MATSUMOTO *et al.*, 1982). MATSUMOTO *et al.* (1982) suggested that the Kitadani Formation is Hauterivian to Early Aptian in age based on the fossils recorded by MAEDA (1958, 1961, 1962b, 1963), supporting YANG's (1979) correlation. TAMURA (1990), however, correlated the Kitadani Formation with the Kuwajima and Okurodani Formations (Itoshiro Subgroup) based on the occurrence of *Nippononaia*. Although the non-marine molluscan fauna from the Kuwajima and Okurodani Formations contains *N. tetoriensis*, other representatives of the TPN Assemblage (e.g. *Trigonoides*, *Plicatounio*) and *N. ryosekiana* have not been obtained from these formations. It is doubtful, therefore, that the Kitadani Formation is coeval with the Kuwajima and Okurodani Formations. It is more likely that the Kitadani fauna is more or less younger than the Kuwajima and Okurodani faunas.

The discovery of *N. ryosekiana* from the Kitadani Formation of the Hida Belt suggests that this formation can be roughly correlated with the Sebayashi Formation of the Chichibu Belt, and may be assigned to the Late Barremian to the Early Aptian or thereabout in age. The evidence indicates the age of upper limit of the Tetori Group and that the correlation attempted by YANG (1979) and MATSUMOTO *et al.* (1982) is adequate.

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