On Some Species of the Family Nodosariidae found in the Tertiary Formations of the Philippine Islands*

By

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Introduction

Of the numerous families of Cenozoic Foraminifera found in Eastern Asia that claim the attention of palaeontologists, the Nodosariidae is one of the most interesting. Certain species belonging to this family are to be met with exclusively in the Pliocene that is developed on the Pacific side, consequently in none on the Japan Sea side. Besides being fairly large, the surface ornamentation of their walls is also very marked. The writer\(^1\), previously proposed the name of Robulus-Planularia fauna for these paticular forms of the Japanese Pliocene.

Seeing that the Philippine materials now dealt with in this article comprise some species of the family Nodosariidae from Japan, such as, Robulus pseudo-rotulatus, Robulus kimituiensis, Robulus nikobarenensis, Robulus tibaensis, Vaginulina bōsē, and Planularia japonica, they seem to be similar to the Robulus-Planularia fauna of the Japanese Pliocene\(^2\), although not so conspicuous as in Japan, particularly, as they are characterized by the presence of the genera Operculina, Rotalia, and Quinqueloculina rather than by Robulus-Planularia. In this respect, the Pliocene Foraminifera from the Philippine Islands is closely related to those from the East Indies\(^3\) and Taiwan (Formosa)\(^4\).

The fossil Foraminifera now in question were collected by Mr. Wataru HASHIMOTO in the Philippine Islands, and kindly submitted to the writer for examination. This collector once gave a list of the Foraminiferal species in a paper that he wrote\(^5\). The present writer here revises the list and describes some the species.

The fossil-localities treated here are as follows:

* Transactions of the Palaeontological Society of Japan, No. 153.
4) S. HANZAWA: 1939, A List of the Neogene Foraminifera of Taiwan, Taiwan Tigaku Kizai, vol. 3.
On Some Species of the Family Nodosariidae found in Tertiary Formations

a) About 4 km east of Sta Cruz, Zambales, Luzon Islands.
   *Nodosaria raphana* (LINNÉ) var., Pl. 11 (7), fig. 1.
   *Lagenonodosaria scalaris* (BATSCH)
   *Robulus calcar* (LINNÉ)
   *Robulus orbicularis* (d’ORBIGNY) var.
   *Robulus pseudoechinatus* n. sp., Pl. 11 (7), fig. 2.

   **Formation**: Visaya series, Oligocene.

b) Campana River, Sumagwi, Bongabon, Mindoro Islands.
   *Nodosaria raphana* (LINNÉ)
   *Nodosaria vertebralis* (BATSCH), Pl. 11 (7), fig. 4.
   *Nodosaria vertebralis* (BATSCH) var., Pl. 11 (7), fig. 5.
   *Marginulina philippinensis* CUSHMAN, Pl. 11 (7), fig. 3.
   *Planularia mindoroensis* n. sp., Pl. 11 (7), fig. 8.
   *Robulus rotulatus umbonatus* (CUSHMAN)
   *Robulus orbicularis* (d’ORBIGNY)
   *Robulus iotus* (CUSHMAN)
   *Robulus calcar* (LINNÉ)
   *Robulus kimituensis* ASANO
   *Robulus tibaensis* ASANO
   *Robulus papillosus* (FICHTEL and MOLL)
   *Robulus nikobarensis* (SCHWAGER)
   *Robulus cf. surugaensis* ASANO
   *Robulus limbosus* (REUSS)
   *Robulus vortex* (FICHTEL and MOLL)
   *Robulus sumaguiensis* n. sp., Pl. 11 (7), fig. 10.

   **Formation**: Tagalog series, Pliocene.

c) About 4 km west of San-ao, National Road, Ilocos Norte, Northern Luzon.
   *Planularia japonica* ASANO, Pl. 11 (7), fig. 12.
   *Planularia luzonica* n. sp., Pl. 11 (7), fig. 15.
   *Planularia* sp., Pl. 11 (7), fig. 14.
   *Saracenaria italica* DEFRANGE
   *Robulus orbicularis* (d’ORBIGNY)
   *Robulus limbosus* (REUSS)
   *Robulus submamillicerus* (CUSHMAN)
   *Robulus echinatus* (d’ORBIGNY)
   *Robulus depressus* ASANO
   *Robulus kimituensis* ASANO
   *Robulus pseudorotulatus* ASANO
   *Robulus expansus* (CUSHMAN), Pl. 11 (7), fig. 9.

   **Formation**: Tagalog series, Pliocene.

d) Near Baag, Ilocos Norte, Northern Luzon.
   *Nodosaria vertebralis* (BATSCH)
   *Lagenonodosaria scalaris* (BATSCH)
   *Robulus calcar* (LINNÉ)
   *Robulus limbosus* (REUSS)
   *Robulus rotulatus umbonatus* (CUSHMAN)
   *Robulus orbicularis* (d’ORBIGNY)
   *Robulus kimituensis* ASANO

---166---
Formation: Tagalog series, Pliocene.
e) Malbog, Baco, Marinduque Islands.
  
  *Nodosaria raphana* (LINNÉ)
  *Nodosaria insecta* SCHWAGER
  *Nodosaria spirostriolata* CUSHMAN
  *Nodosaria tornata* SCHWAGER, Pl. II (7), fig. 11.
  *Nodosaria* sp.
  *Dentalina emaciata* REUSS
  *Dentalina filiformis* D’ORBIGNY
  *Lagonomonosaria scalaris* (BATSCH)
  *Vaginulina spinigera* BRADY
  *Vaginulina legumen elegans* D’ORBIGNY
  *Vaginulina bosso ASANO
  *Saracenaria italica* DEFRANCE
  *Robulus pseudorotulatus* ASANO
  *Robulus submamilligerus* (CUSHMAN)
  *Robulus calcare* (LINNÉ)
  *Robulus nikobarensis* (SCHWAGER)
  *Robulus orbicularis* (D’ORBIGNY)
  *Robulus sumaguiensis* n. sp.
  *Robulus kimitiensis* ASANO
  *Robulus limbosus* (REUSS)
  *Robulus gibbus* (D’ORBIGNY) var., Pl. II (7), fig. 13.
  *Planularia japonica* ASANO
  *Planularia* sp.

Before going further the writer wishes to record his great indebtedness to Prof. S. HANZAWA of the Institute of Geology, Tōhoku Imperial University, Japan, under whose supervision the present work was undertaken, for many kind suggestions and corrections. He is also indebted to Mr. W. HASHIMOTO, who kindly placed his specimens at the writer’s disposal for examination.

Description of Species

Family *Nodosariidae* SCHULTZE, 1854

Genus *Robulus* MONTFORT, 1808

*Robulus sumaguiensis* n. sp.

Pl. II (7), fig. 10.

Test broadly biconvex, close-coiled; chambers about 10 in last whorl; sutures almost straight with raised ribs, ending in a knob near umbilicus, which shows a central boss of clear shell-substance; periphery almost round, not markedly keeled; aperture radiate with a ventral slit. Diameter about 1.5 mm.

Locality (b), (e), Pliocene.

The umbilical region of the test is similar to that of *Robulus expansus* (CUSHMAN), but differs from it in the broadly rounded periphery.

(Institute of Geology and Palaeontology, Tōhoku Imperial University, Sendai, Japan, Catalogue No. 66010)
Robulus pseudoechinatus n. sp.

Pl. 11 (7), fig. 2.

Test biconvex, compressed, closely coiled, about 8 or 9 chambers in last whorl; sutures curved, raised, often with knob-like projections, umbonal region excavated in center, forming a ring of shell-material; periphery with a narrow keel from which projects short spines; apertural face concave, aperture radiate with a slit. Diameter about 1.5 mm.

Locality (a), Oligocene.

The species is easily distinguished from Robulus calcarata (Cushman) by its papillate sutures, and from "Cristallaria echinata (d'Orbigny)" by the features of the umbilicus.

(I. G. P. S. J., Cat. No. 66002)

Robulus expansus (Cushman)

Pl. 11 (7), fig. 9.

1921. Cristallaria expansa Cushman, Bull. 100, Ibid., p. 236, pl. 46, fig. 2.

This species is endemic to seas adjacent to the Philippine Islands, and has not yet been recorded from other seas. The present specimens closely resemble the figure given by J. A. Cushman with a very wide and thin keel. Diameter about 2.5 mm.

Locality (b), (c), Pliocene. (I. G. P. S. J., Cat. No. 66009)

Robulus gibbus (d'Orbigny) var.

Pl. 11 (7), fig. 13.

A variety differing from the type by having a very wide and thin keel, otherwise like the type. Length about 3 mm.

Locality (e), Pliocene. (I. G. P. S. J., Cat. No. 66013)

Robulus papillosus (Fichtel and Moll)

Pl. 11 (7), fig. 7.

1913. Cristallaria papillosa Cushman, Bull. 71, U. S. Nat. Mus., pl. 3, p. 74, pl. 37, fig. 2.

This is a beautifully ornamentated species, with beading bosses of the umbonal region. The species seems to be fairly common in Eastern Asia both fossil and recent. Length up to 2.5 mm.

Locality (b), Pliocene. (I. G. P. S. J., Cat. No. 66007)
Genus *Nodosaria* Lamarck, 1812

*Nodosaria raphana* (Linné) var.

Pl. 11 (7), fig. 1.

Compare with: *Nodosaria raphana* Cushman, U. S. Nat. Mus., Bull. 100, 1921, p. 210, pl. 37, figs. 5-7.

Differs from *N. raphana* (Linné) in weak constriction of chambers and undepressed sutures of the earlier chambers.

Locality (a), Oligocene. (I. G. P. S. J., Cat. No. 66001)

*Nodosaria tornata* Schwager

Pl. 11 (7), fig. 11.


This species, first described from the Tertiary of Car Nikobar, by Schwager, has not yet been found in recent materials. Length about 4 mm.

Locality (e), Pliocene. (I. G. P. S. J., Cat. No. 66011)

*Marginulina philippinensis* Cushman

Pl. 11 (7), fig. 3.


Type specimen in from Albatross Station D 5220, between Marinduque and Luzon, in 50 fathoms. According to Cushman, the present species is very characteristic of the seas adjacent to the Philippine Islands, but it has not yet been noticed in the fossils. Length about 3 mm.

Locality (b), Pliocene. (I. G. P. S. J., Cat. No. 66003)

Genus *Planularia* DeFrange, 1824

*Planularia japonica* (Asano)

Pl. 11 (7), fig. 12.


The species, which is described from the Pliocene of Kamiyasuki, Tarukimura, Ogasa-gun, Sizuoka-ken, Japan, seems to be fairly common in the Pliocene of Japan and the Philippines.

Locality (c) and (e), Pliocene. (I. G. P. S. J., Cat. No. 66012)

*Planularia mindoroensis* n. sp.

Pl. 11 (7), fig. 8.

Test compressed, slightly longer than broad, becoming loosely coiled in later portion; periphery with several narrow keels; chambers about 8; sutures curved, ornamented with beads; -- 169 --
wall spinose with exogenous materials; aperture radiate, somewhat projecting. Length about 2.5 mm.

Locality (b), Pliocene.

The present form is similar to *P. japonica* (Asano), but differs from it in the sutures, which are fairly broad and ornamented with prominent beads. Besides, the periphery is decorated with several keels.

(I.G. P.S.J., Cat. No. 66008)

*Planularia luzonica* n. sp.

Pl. 11 (7), fig. 15.

Test with early portion close-coiled, later tending to uncoiled, periphery acute with distinct keel; chambers elongate, about 10; sutures raised, with thick bands of clear shell-substance; wall smooth, distinctly umbonate; aperture radiate at the peripheral angle of last formed chamber. Length about 4 mm.

Locality (c), Pliocene.

This is a comparatively large species, and its form one of the most distinctive in the present materials; in may easily be distinguished from allied forms.

(I.G. P.S.J., Cat. No. 66015)

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Explanation of Plate 11 (7)

Fig. 1. *Nodosaria raphana* (Linne) var. ×30

Locality (a), Oligocene. (I.G. P.S.J., Cat. No. 66001)

Fig. 2. *Robulus pseudoechinatus* n. sp. ×30

Locality (a), Oligocene. (I.G. P.S.J., Cat. No. 66002)

Fig. 3. *Marginalina philippinensis* Cushman ×25

Locality (b), Pliocene. (I.G. P.S.J., Cat. No. 66003)

Fig. 4. *Nodosaria vertebolaris* (Batsch) ×25

Locality (b), Pliocene. (I.G. P.S.J., Cat. No. 66004)

Fig. 5. *Nodosaria vertebolaris* (Batsch) var. ×30

Locality (b), Pliocene. (I.G. P.S.J., Cat. No. 66005)

Fig. 6. *Nodosaria raphana* (Linne) ×25.

Locality (b), Pliocene. (I.G. P.S.J., Cat. No. 66006)

Fig. 7. *Robulus papillosus* (Fichtel and Moll) ×30

Locality (b), Pliocene. (I.G. P.S.J., Cat. No. 66007)

Figs. 8a, 8b. *Planularia mindoroensis* n. sp. ×30

Locality (b), Pliocene. (I.G. P.S.J., Cat. No. 66008)

Fig. 9. *Robulus expansus* (Cushman) ×25

Locality (b), Pliocene. (I.G. P.S.J., Cat. No. 66009)

Fig. 10. *Robulus sumarjuiensis* n. sp. ×25

Locality (b), Pliocene. (I.G. P.S.J., Cat. No. 66010)

Fig. 11. *Nodosaria tornata* Schwager ×25

Locality (c), Pliocene. (I.G. P.S.J., Cat. No. 66011)

Fig. 12. *Planularia japonica* (Asano) ×30

Locality (c), Pliocene. (I.G. P.S.J., Cat. No. 66012)

---170---
比布利-len[-]第三紀層ノドサリデ科の有孔症類（簡要）

浅野 清

東亜の近世地理に属する有孔症類に、特に興味ある1科としてノドサリデ科がある。此者は筆者が発表させる日本産のものに就いて述べた如く、Robulus-Planulariaフォーヌを含もし、従新期時代に見出された一つの分布を示し、日本の太平洋沿岸の同時代のものは、日本海岸の同時代のものよりも南に在る、トキシマフローナに密接なる関係あることを、既に先年、矢部教授及び筆者の研究により認識させ、著者産のものと比較される関係が、今日新本理学士採集の比布利産のものと比較して、一層根拠をつけられた。仰有孔症フォーヌ全体として、比布利群島の第三紀層の、臺灣及びジャワのものと甚だ近似することを認識したものである。

之等東亜に於けるノドサリデ科有孔症類の繁殖研究は別に発表の用意があるので、本文に於ては比布利産のものに於て発見された本科のリスト及び4つの新種を記載し、之等に次する名称を興へた。

Robulus pseudoechinatus n. sp.
Robulus sumaguiensis n. sp.
Planularia mindoroensis n. sp.
Planularia luzonica

---171---