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# New Fossil Molluscs Indicating Tropical Sea Elements from the Miocene Bihoku Group, Southwest Honshu, Japan Part 2. Description of *Cancilla hirosei* n. sp., with Notes on Some Molluscs from the Bihoku Group of Shobara City, Hiroshima Prefecture

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**Abstract**

*Cancilla hirosei* n. sp. (Gastropoda: Mitridae) is described from the Miocene Bihoku Group of Shobara City, Hiroshima Prefecture. Taxa of some fossil molluscs co-occurred with it are examined.

*Key words*: Mollusca, Miocene, Bihoku Group, Japan.

## Introduction

Miocene molluscs of the Bihoku Group had been studied by Yokoyama (1929) from Okayama Prefecture and by Otuka (1938) from Hiroshima Prefecture in the early years. They described a few noteworthy molluscan fossils.

On the other hand, Makiyama (1926, 1936) described similar Miocene molluscan fauna from North Korea. Later, many other studies had been made on the molluscs from the Bihoku Group of the various localities in Chugoku mountainland. But, taxonomical researches are not so many made up to date, because of ill-preservation of their specimens except brackish waters one.

Recently, we have had an opportunity to examine the well preserved topotypes of the localities of Otuka (1938) of Shobara City. Here, we present our interpretations on some molluscan taxa.

*Cancilla hirosei* n. sp. (Mitridae: Imbricarininae) is described.

## Systematics

Family Trochidae Rafinesque, 1815
Subfamily Trochinae Rafinesque, 1815
Genus *Tectus* Montfort, 1810

*Type species*: *Tectus pagodalis* Montfort, 1810 (= *Trochus mauritianus* Gmelin, 1791), by original designation; Recent, India.

*Range*: Late Cretaceous — Recent; Japan — Indo

-Pacific — Africa — Europe.

*Tectus japonicus* Horikoshi
*in* Kobayashi and Horikoshi, 1958
(Pl. 7, Figs. 2a, b, 3a-d)

1950 *Tectus* (*Tectus*) n. sp., Watanabe, Arai and Hayashi, pl. 5, fig. 8.
1958 *Tectus* (*Rochia*) *japonicus* Horikoshi *in* Kobayashi and Horikoshi, p. 49, pl. 4, figs. 4a-c.
1958 *Tectus yamadensis* Kanno, p. 205, pl. 5, figs. 14a, b (n. syn.).
1960 *Tectus yamadensis* Kanno; Kanno, p. 340, pl. 47, figs. 1a, b.
1985 *Tectus* (*Rochia*) *japonicus* Horikoshi; Nakagawa and Takeyama, pl. 23, fig. 4.
1988 *Tectus* (*Rochia*) sp. , Itoigawa, Nishimoto and Nobuhara, pl. 7, fig. 3a, b.

*Type locality*: Ogurui, Takahama-cho, Ohi-gun, Fukui Prefecture; Lower Matsuodera conglomerate Member [Najima volcanic Member, Shimo Formation, Uchiura Group of Nakagawa and Takeyama (1985)].

Type locality of *T. yamadensis,* near the Yamada bridge, Yamada, Chichibu City; Hiranita Formation, Chichibumachi Group (Kanno, 1958).

*Localities*: 1 (Tab. 1, Loc. 1) ··· Nakabara, Monde-cho, Shobara City, Hiroshima Prefecture (locality of fig. 1 of Sugimura *et al.*, 1990); fine-grained sandstone (thickness 80 cm) ··· Lower sandstone Formation, Bihoku Group (locality 18 of Ueda, 1991).

2 (Tab. 1, Loc. 2) ··· Southwest of Kaisekidani bridge, Miyauchi-cho, Shobara City, Hiroshima Prefecture (type locality of *Lamellinucula hirosei* Oyama and Nishimoto, 1988); very coarse-grained sandstone (thickness 3 m) ··· the uppermost part of Lower sandstone Formation, Bihoku Group (Horizon Kd 2 of Okamoto *et al.*, 1990).

*Measurement*: MFM 21005 (Coll.: T. Yamaoka), preserved height *ca.* 25 mm, major diameter 36.2 mm, minor diameter 27.2 mm; MFM 21006 (Coll.: T. Yamaoka), preserved height *ca.* 22 mm, major diameter 31.5 mm, minor diameter 30.6 mm.

*Remarks*: Shobara's specimens differ from the holotype in having less number of spiral striations and rounded small nodules. These features may be indicated by intraspecific variation between these specimens and the type of *T. japonicus,* contrasted with variations of Recent *T. pyramis* (Born) (Yokogawa, 1990 *etc.*).

Horikoshi *in* Kobayashi and Horikoshi (1958) compared *T. japonicus* with *Trochus neglectus* Martin and *Trochus virgatus* Gmelin *sensu* Martin from the Miocene of Java in having a plano-concave base with an angular periphery and the aspect of columella.

*Associated molluscan forms*: Table 1, Loc. 1 and Loc. 2.

*Occurrence*: This species occurs in muddy nodules at Loc. 1 in which shells had broken before the sedimentation. It occurs with *Turbo* (*Marmarostoma*) *ozawai* Otuka, *Cernina nakamurai* (Otuka) and so on (Table 1) under the conglomeratic facies of the algal reef limestone.

The above-described occurrence of this species is similar to those of the type from the Uchiura Group (Horikoshi *in* Kobayashi and Horikoshi, 1958 and Nakagawa and Takeyama, 1985), of *"T. yamadensis"* from the Chichibumachi Group (Kanno, 1958, 1960), and of *"T.* (*Rochia*) sp." from the Mizunami Group (Itoigawa *et al.*, 1988).

Family Turbinidae Rafinesque, 1815
Subfamily Turbininae Rafinesque, 1815
Genus *Turbo* Linnaeus, 1758

*Type species: Turbo petholatus* Linnaeus, 1758, by subsequent designation (Montfort, 1820): Recent, Indo-West Pacific.

*Range*: Late Cretaceous—Recent; Japan, global temperate to tropical seas.

Subgenus *Marmarostoma* Swainson, 1829

*Type species*: *Turbo chrysostomus* Linnaeus, 1758, by subsequent designation (Herrmannsen, 1847); Recent, Indo-Pacific.

*Range*: Miocene—Recent; Japan—Indo-Pacific—Europe.

*Turbo* (*Marmarostoma*) *ozawai* Otuka, 1938

1938 *Turbo* (*Lunella*) *ozawai* Otuka, p. 16-17, pl. 3.

Table 1.
Molluscan fossils from Nakabara, Monde-cho and southwest of Kaisekidani bridge (Horizon Kd 2 of Okamoto *et al.*, 1990), Miyauchi-cho, Shobara City.
VA, very abundant; A, abundant; C, common; F, frequent; R, rare.
Loc. 1, Nakabara, Monde-cho, Shobara City; Loc. 2, southwest of Kaisekidani bridge (Horizon K2), Miyauchi-cho, Shobara City.

| Species | Locality | |
|---|---|---|
| | 1 | 2 |
| **Gastropoda** | | |
| *Tectus japonicus* Horikoshi in Kobayashi and Horikoshi, 1958 | F | R |
| *Turbo (Marmarostoma) ozawai* Otuka, 1938 | F | R |
| *Nerita (Amphinerita)* sp. | R | R |
| *Ochetoclava ancisa* (Yokoyama, 1928) | | R |
| *O.* sp. | R | |
| *Vicaryella baculla* (Yokoyama, 1924) | R | |
| *Terebralia* sp. | C | |
| *Calyptraea* sp. | | R |
| *Xenophora sunakozakaensis* (Ogasawara, 1976) | F | |
| *Cernina nakamurai* (Otuka, 1938) | C | |
| *Euspira meisensis* (Makiyama, 1926) | R | F |
| *Sinum yabei* Otuka, 1934 | R | F |
| " *Mancinella* " sp. | | R |
| *Pigulina (Volegalea) sazanami* (Kanehara, 1937) | R | R |
| *Cancilla hirosei* sp. n. | | R |
| *Architectonica kurodae* Tsuda, 1960 | R | R |
| **Scaphapoda** | | |
| *Fissidentalium* sp. | R | A |
| *Antalis* sp. | | R |
| **Bivalvia** | | |
| *Acila (Acila)* sp. | | F |
| *Saccella* " *miensis attenuata* Itoigawa and Shibata, 1975 " | | F |
| *Anadara ogawai* Makiyana, 1926 | | R |
| *A. abdita* Makiyama, 1926 | | R |
| *Lithophaga (Labis)* sp. | F | |
| *Atrina* sp. | R | |
| *Mizuhopecten kimurai* (Yokoyama, 1925) | | F |
| *Chlamys iwamuraensis* Itoigawa, 1955 | | R |
| *Crassostrea gravitesta* (Yokoyama, 1926) | C | C |
| *Ostrea itoigawai* Taguchi, 1992 | R | R |
| *Lucinoma uetanii* (Otuka, 1938) | R | F |
| *Cycladicama ferruginatum* (Makiyama, 1926) | | F |
| *Diplodonta* sp. | | R |
| " *Hedecardium* " *ogurai* (Otuka, 1938) | C | C |
| *Vasticardium* sp. | | R |
| *Cardilia toyamaensis* Tsuda, 1960 | R | |
| *Pitar (Pitarina) itoi* (Makiyama, 1926) | | F |
| *Phacosoma suketoense* (Otuka, 1934) | F | C |
| *P. nomurai* (Otuka, 1934) | | R |
| *Nipponomarcia nakamurai imobaraensis* Itoigawa and Nishikawa, 1976 | F | R |
| *Paphia (Paphia) ohiroi* Masuda, 1966 | | R |
| *Cyclina (Cyclinorbis) lunulata* (Makiyama, 1926) | VA | F |
| *Solidicorbula nisataiensis* (Otuka, 1934) | | F |
| *Panopea tyugokuensis* (Otuka, 1941) | | R |

figs. 22-24 [operculum].

1958 *Turbo* (*Marmarostoma*) cf. *ticaonica* Reeve, 1842; Horikoshi *in* Kobayashi and Horikoshi, p. 49-50, pl. 4, fig. 1a, b [shell].

1958 *Turbo* (*Marmarostoma*) *ozawai* Otuka; Horikoshi *in* Kobayashi and Horikoshi, p. 50-51, text-fig. b [operculum].

1960 *Turbo* (*Marmarostoma*) *minoensis* Itoigawa, p. 27-28, pl. 4, fig. 2, 3 [shell].

1960 *Turbo* (*Marmarostoma*) *ozawai* Otuka; Itoigawa, p. 28 [opercula].

1966 *Turbo* (*Marmarostoma*) *ozawai* Otuka; Masuda, p. 333, pl. 36, figs. 18a-19b [shell], figs. 20a-22c [opercula].

1976 *Turbo* (*Marmarostoma*) *ozawai* Otuka; Masuda and Noda, p. 271 [for *T.* (*M.*) cf. *ticaonica* Reeve; Horikoshi *in* Kobayashi and Horikoshi, 1958].

1976 *Turbo* (*Marmarostoma*) *minoensis* Itoigawa; Itoigawa and Nishikawa, p. 136, 138. [shell].

1985 *Turbo* (*Marmarostoma*) *ozawai* Otuka; Nakagawa and Takeyama, p. 39-40, pl. 23, figs. 3a, b. [shell].

1986 *Turbo* (*Marmarostoma*) *ozawai* Otuka; Ozawa, Nakagawa and Takeyama, pl. 13, fig. 1 [shell].

1986 *Turbo ozawai* Otuka; Ueda, p. 71.

*Type locality*: "Suketo", Shobara-cho, Hiba-gun, Hiroshima Prefecture [the downstream from Aokiide (dam), Saijo river, Higashihonmachi-4, Shobara City; *pro.* Honmachi; Lower sandstone Formation, Bihoku Group.

Type locality of *T. minoensis,* Shukubora, Hiyoshi-cho, Mizunami City; Shukunohora Facies, Akeyo Formation, Mizunami Group (Itoigawa, 1960).

*Remarks*: *Turbo* (*Lunella*) *ozawai* was first described on the basis of opercula. We examined some well-preserved shells co-occurred with opercula of *T. ozawai* from the type locality, "Suketo". Compared with those shell specimens the holotype of *T.* (*M.*) *minoensis,* we regard that both shells are conspecific following the opinions of Masuda (1966), Masuda and Noda (1976), and Nakagawa and Takeyama (1985). Then, *T.* (*M.*) *minoensis* become a junior synonym of *T.* (*M.*) *ozawai.*

Horikoshi (1983) compared *"T. minoensis"* from the Mizunami Group with *T.* (*M.*) *jobiensis* Tapparone-Canefri from the Recent, Geelvinck Bay, Ilian Jaya (New Guinea) and *T.* (*M.*) *sondeianus* Martin from the Miocene, Java as its allied species.

The "Suketo" is perhaps a shop name of an alone house. It would be caused probably the nickname of the founder of the shop and had usually not been used as a place name in Shobara City by habitants.

Family Mitridae Swainson, 1838
Subfamily Imbricariinae Troschel, 1867
Genus *Cancilla* Swainson, 1840

*Type species*: *Mitra isabella* Swainson, 1840, by subsequent designation (Herrmannsen, 1847); Recent, Japan to Hainan Island and the Philippines.

*Range*: Miocene to Recent; Japan—Indo-Pacific—East Africa, West Africa, South America, Europe (Cernohorsky, 1991).

*Cancilla hirosei* n. sp.
(Pl. 7, Figs. 4a, b)

*Description*: Shell medium in size, slender, elongate-fusiform, whorls slightly convex. Protoconch not preserved, preserved teleoconch 7 1/2. Sculpture thread or weak flat spiral cords, early teleoconch with 3 cords, penultimate whorl with 5 cords and body whorl with 20 cords, and indistinct longitudinal striae. Aperture longer than the spire, narrow, smooth within. Outer lip convex, inner lip with narrow callus. Columella with 4 distinct, oblique folds, the posterior one longer than the others. Siphonal canal straight.

*Holotype*: MFM 20059 (Coll.: S. Hirose).

*Type locality*: Southwest of Kaisekidani bridge, Miyauchi-cho, Shobara City, Hiroshima Prefecture (type locality of *Lamellinucula hirosei* Oyama and Nishimoto, 1988); very coarse-grained sandstone (thickness 3 m) ··· the uppermost part of Lower sandstone Formation, Bihoku Group (Horizon Kd2 of Okamoto *et al.*, 1990).

*Measurement*: Holotype, preserved height 41.4 mm, major diameter 13.3 mm, minor diameter 8.5 mm.

*Remarks*: This species resembles *Cancilla aegra* (Reeve) living in seas off Japan to Java and East Africa, but differs in having a smaller and slender shell, less numerous, weaker spiral cords and weaker

longitudinal striae.

Cernohorsky (1991) stated as follows: Species of *Cancilla* made their appearance during Miocene times in Europe and during Pliocene were already living in Japan and Taiwan 〔Yokoyama, 1928; Nomura, 1935; Shuto, 1969〕, Recent 〔four〕 species live in West Africa, the east coast of South American and the Philippines – Japan regions .

But, the migration to Japan of the genus *Cancilla* had been appeared since the early Middle Miocene, in the Climatic Optimum 1 (Barron and Baldauf, 1990) of *ca.* 16 million years ago.

This new species was dedicated for eighty birthday after Mr. Shigeto Hirose, Shobara City, Hiroshima Prefecture who offered the holotype specimen.

*Associated Molluscan forms*: Table 1, Loc. 2.

Family Ungulinidae H. Adams and A. adams, 1857

Genus *Cycladicama* Valenciennes *in* Rousseau, 1854

*Type species*: *C. luciniformis* Valenciennes *in* Rousseau, 1854, (=*Cyrenoida oblonga* Hanley, 1844 (*nom. nud.*)) by original designation; Recent, Philippine Islands.

*Synonym*: *Joannisiella* Dall, 1895 (*Joannisia* Dall, 1895, *non* Monterosatto, 1844, *nec* Kiefer, 1894).

*Range*: Eocene–Recent; Japan–Indo-Pacific-West Africa–?Europe (Chavan, 1969).

*Cycladicama ferruginatum* (Makiyama, 1926) n. comb.

1926 *Diplodonta ferruginata* Makiyama, p. 157-158, pl. 12, figs. 12, 13.

1934 *Taras ferruginata* (Makiyama); Otuka, p. 616, pl. 45, figs. 29, 40.

1938 *Joannisiella takeyamai* Otuka, p. 29, pl. 4, figs. 32-34, 37.

1952 *Joannisiella* cf. *takeyamai* Otuka; Kenzo Ogasawara and Tanai, p. 207-208, pl. 19, fig, 3.

1964 *Diplodonta ferruginata* Makiyama; Mizuno, pl. 2, fig. 6.

1966 *Diplodonta ferruginata* Makiyama; Uozumi and Fujie, p. 150, pl. 12, figs. 8, 9.

1974 *Diplodonta ferruginata* Makiyama; Itoigawa *in* Itoigawa, Shibata and Nishimoto, p. 76, pl. 19, figs. 5a-c.

1976 *Felaniella ferruginata* (Makiyama); Masuda and Noda, p. 69.

1981-82 *Diplodonta ferruginata* Makiyama; Itoigawa, Shibata, Nishimoto and Okumura, p. 70, pl. 12, figs., 8a, b 〔non 11a, b = *Anodontia* sp.〕

1985 *Diplodonta ferruginata* Makiyama; Nakagawa and Takeyama, pl. 17, fig. 1.

1986 *Diplodonta ferruginata* Makiyama; Ozawa, Nakagawa and Takeyama, pl. 14, fig. 10.

1986 *Joannisiella takeyamai* Otuka; Ueda, p. 442.

1986 *Felaniella ferruginata* (Makiyama); Sasaki and Kenshiro Ogasawara, pl. 5, fig. 10.

1989 *Felaniella ferruginata* (Makiyama); Nakagawa, p. 37, pl. 1, fig. 9.

1990 *Diplodonta ferruginata* Makiyama; Okamoto, Katsuhara, Ueno and Sumiyoshi, pl. 11, fig. 42.

1991 *Felaniella ferruginata* (Makiyama); Ueda, p. 284.

1992 *Cycladicama* cf. *takeyamai* (Otuka); Kenshiro Ogasawara and Nagasawa, p. 1235, figs. 7·1-3,9·8,9.

*Type locality*: Kinshodo 〔Kumsodon, Yonbukmyon, Kirchu-gun, Hamgyon-Pudo, North Korea〕; Mankodo Formation 〔Lower Banko sandstone Formation, Myonchon Group (Makiyama, 1938)〕.

Type locality of *Joannisiella takeyamai,* "Suketo", Shobara City; Lower sandstone Formation, Bihoku Group (Otuka, 1938).

*Remarks*: *"Joannisiella" takeyamai* from the type locality, "Suketo", is synonymous of *"Diolodonta" ferruginata,* because of topotypes of *"J." takeyamai* having following characters: less inflated shell with rounded anterior margin and somewhat truncated posterior margin; sculpture with faint concentric growth lines; not bifid anterior cardinal and shallowly bifid posterior cardinal of the right valve.

*"J." takeyamai* is also identified to be synonymous of *"Diplodonta" ferruginata* Makiyama, 1926, by Okamoto *et al.* (1990).

Family Cardiidae Lamarck, 1809

Subfamily Cardiinae Lamarck, 1809

Genus *Hedecardium* Marwick, 1944

*Type species*: *Cardium waitakiensis* Suter, 1907, by original designation; Oligocene, Wharekuri Green-

sand; Waitaki river, opposite Wharekuri, South Canterbury, New Zealand (Bew and Maxwell, 1990).

*Range*: Eocene–Late Miocene; New Zealand, Australia and Burma (Keen, 1969a); learliest Middle Miocene, Southwest Japan.

*"Hedecardium" ogurai* (Otuka, 1938) n. comb.

1938 *Cardium* (*Bucardium*) *ogurai* Otuka, p. 8-9, pl. 1, figs. 1, 2, 8.
1971 *Vepricardium ogurai* (Otuka); Okamoto, Takahashi and Terauchi, tab. 2.
?1973 *Vasticardium ogurai* (Otuka); Kenshiro Ogasawara, p. 148, pl. 12, figs. 12, 13.
1980 *Vasticardium ogurai* (Otuka); Bito, Hayakawa, Kaseno and Ogasawara, p. 55, pl. 2, fig. 6.
1984 *Vasticardium ogurai* (Otuka); Sakanoue and Takayasu, p. 173.
*non*? 1985 *"Vasticardium" ogurai* (Otuka); Nakagawa and Takeyama, pl. 17, fig. 6.
1986 *"Vasticardium" ogurai* (Otuka); Ueda, p. 442.
1986 *"Vasticardium" ogurai* (Otuka); Okamoto, Kawatani, Nakagawa, Hara and Sakanoue, pl. 19, figs. 12, 13.
1989 *"Vasticardium" ogurai* (Otuka); Okamoto, Hayashi and Katsuhara, pl. 9, fig. 2.
1990 *"Vasticardium" ogurai* (Otuka); Okamoto, Katsuhara, Ueno and Sumiyoshi, pl. 9, figs. 2, 3.
1991 *Vasticardium ogurai* (Otuka); Ueda, p. 284.
1992 *Vasticardium ogurai* (Otuka); Kenshiro Ogasawara and Nagasawa, fig. 9·7.

*Type locality*: Suketo, Shobara City; Lower sandstone Formation, Bihoku Group.

*Remarks*: Well preserved topotypes of *"C." ogurai* have smooth ribs and fine interspaced lines of which is a criteria of *Hedecardium*. Keen (1969a) treated *Hedecardium* as a subgenus of the genus *Vepricardium*, but we follow the opinions of Fleming (1966) and Bew and Maxwell (1990) who treated *Hedecardium* as a distinct genus.

Taguchi (1990) considered that this species differs from *Vepricardium* (*Vepricardium*) *okamotoi* Taguchi, 1990 by having different numbers of ribs.

Family Veneridae Rafinesque, 1815

Subfamily Cyclininae Frizzeel, 1936

Genus *Cyclina* Deshayes, 1850

*Type species*: *Cyclina chinensis* Deshayes, 1850 (= *Venus sinensis* Gmelin, 1791) by subsequent designation (Dall, 1902); Recent, South China Sea.

*Range*: Oligocene–Recent; Japan–Vietnam (Kamada, 1952).

Subgenus *Cyclinorbis* Makiyama, 1926

*Type species*: *Cyclina* (*Cyclinorbis*) *lunulata* Makiyama, 1926 (as a section of *Cyclina*), by original designation; Miocene, Heirokudo Formation, Nanseki, North Korea.

*Range*: earliest Middle Miocene; North Korea, South Korea (Yoon and Noda, 1976), Japan.

*Cyclina* (*Cyclinorbis*) *lunulata* Makiyama, 1926

1926 *Cyclina* (*Cyclinorbis*) *lunulata* Makiyama (n. section *et* n. sp.), p. 158-159, pl. 8, fig. 1.
1936 *Cyclina lunulata* Makiyama, p. 212.
1964 *Cyclina lunulata* Makiyama; Mizuno, pl. 3, fig. 13.
1965 *Cyclina lunulata* Makiyama; Mizuno, p. 331, pl. 1, figs. 5, 6.
1966 *Cyclina* (*Cyclinorbis*) *lunulata* Makiyama; Masuda, p. 326, pl. 35, fig. 33.
1969 *Cyclina* (*Cyclinorbis*) *lunulata* Makiyama; Hayasaka, p. 45, pl. 2, fig. 9.
1971 *Cyclina* (*Cyclinorbis*) *lunulata* Makiyama; Okamoto, Takahashi and Terachi, pl. 14, figs. 4a, b.
1976 *Cyclina hwabongriensis* Yoon and Noda, p. 27-31, 5 figs. (n. syn.).
1976 *Cyclina hwabongriensis* Yoon and Noda; Ogasawara, p. 51, pl. 12, figs. 9, 13. 14, 16, 21.
1980 *Cyclina* cf. *hwabongriensis* Yoon and Noda; Bito, Hayakawa, Kaseno, Ogasawara and Takayama, p. 55(tab. 2).
1981 *Cyclina hwabongriensis* Yoon and Noda; Itoigawa, p. 192, 194.
1981 *Cyclina* (*Cyclinorbis*) *lunulata* Makiyama; Itoigawa, p. 192, 194.
1981 *Cyclina lunulata* Makiyama; Itoigawa and Shibata, p. 21, fig. 2.
1981 *Cyclina hwabongriensis* Yoon and Noda; Itoi-

gawa and Shibata, p. 21, fig. 2.

1983 *Cyclina lunulata* Makiyama; Chinzei, p. 70.

1984 *Cyclina hwabongriensis* Yoon and Noda; Sakanoue and Takayasu, p. 173.

1984 *Cyclina* cf. *lunulata* Makiyama; Sakanoue and Takayasu, p. 173. (tab. 1).

1985 *Cyclina hwabongriensis* Yoon and Noda; Tsuru, p. 28-29.

1986 *Cyclina hwabongriensis* (Yoon and Noda); Takayasu, tab. 1.

1986 *Cyclina lunulata* Makiyama; Takayasu, tab. 1.

1986 *Cyclina hwabongriensis* Yoon and Noda; Ueda, p. 71.

1986 *Cyclina lunulata* Makiyama; Itoigawa and Shibata, pl. 16, fig. 6.

1986 *Cyclina hwabongriensis* Yoon and Noda; Okamoto, Kawatani, Nakagawa, Hara and Sakanoue, tab. 2, pl. 19, fig. 20.

1986 *Cyclina hwabongriensis* Yoon and Noda; Sasaki and Ogasawara, 84(tab. 1), pl. 5, fig. 9.

1989 *Cyclina hwabongriensis* Yoon and Noda; Okamoto, Hayashi and Katsuhara, pl. 6, figs. 10, 11.

1991 *Cyclina hwabongriensis* Yoon and Noda; Ueda, p. 284.

*Type locality*: Nanseki 〔Nansok, San-u-nam-myon, Myonchon-gun, Hamgyon-Pudo, North Korea〕; Heirokudo Formation 〔Pyonrhoku conglomerate Formation, Myonchon Group (Makiyama, 1936)〕.

Type locality of *C. hwabongriensis,* Ulsansi, Gyeongsangnam-do, Korea; Hwabongri Formation (Yoon and Noda, 1976).

*Remarks*: *"Cyclina hwabongriensis"* is reported from the Lower sandstone Formation, Bihoku Group of Nakabara, Monde-cho, and the other limited locality of Shobara City, (Ex. Okamoto *et al.*, 1989). This species with equilateral shells can be identified *C.* (*Cyclinorbis*) *lunulata* Makiyama, under examination of some well preserved specimens.

Makiyama (1926) established *Cyclinorbis* as a section of the genus *Cyclina,* but he considered *Cyclinorbis* as a synonym of true *Cyclina* (Makiyama, 1936). Later, Kamada (1952) separated *Cyclinorbis* as a subgenus of the *Cyclina*. We agreed with the opinion of Kamada (1952) of and Keen (1969b) which *Cyclinorbis* is a subgenus of *Cyclina.*

*Associated molluscan forms at Nakabara*: Table 1, Loc. 1.

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## 備北層群から産出した熱帯系貝類化石 (2). *Cancilla hirosei* n. sp. の記載および庄原市の備北層群産貝類数種の検討

大山　桂・西本博行・成瀬　篤

### 要　　旨

前報 (Oyama and Nishimoto, 1988) に続いて，広島県庄原市の中新世貝類1新種 *Cancilla hirosei* を記載し，ほか5種の貝類の種属位のタクサを検討した．

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**Plate**

Plate 7

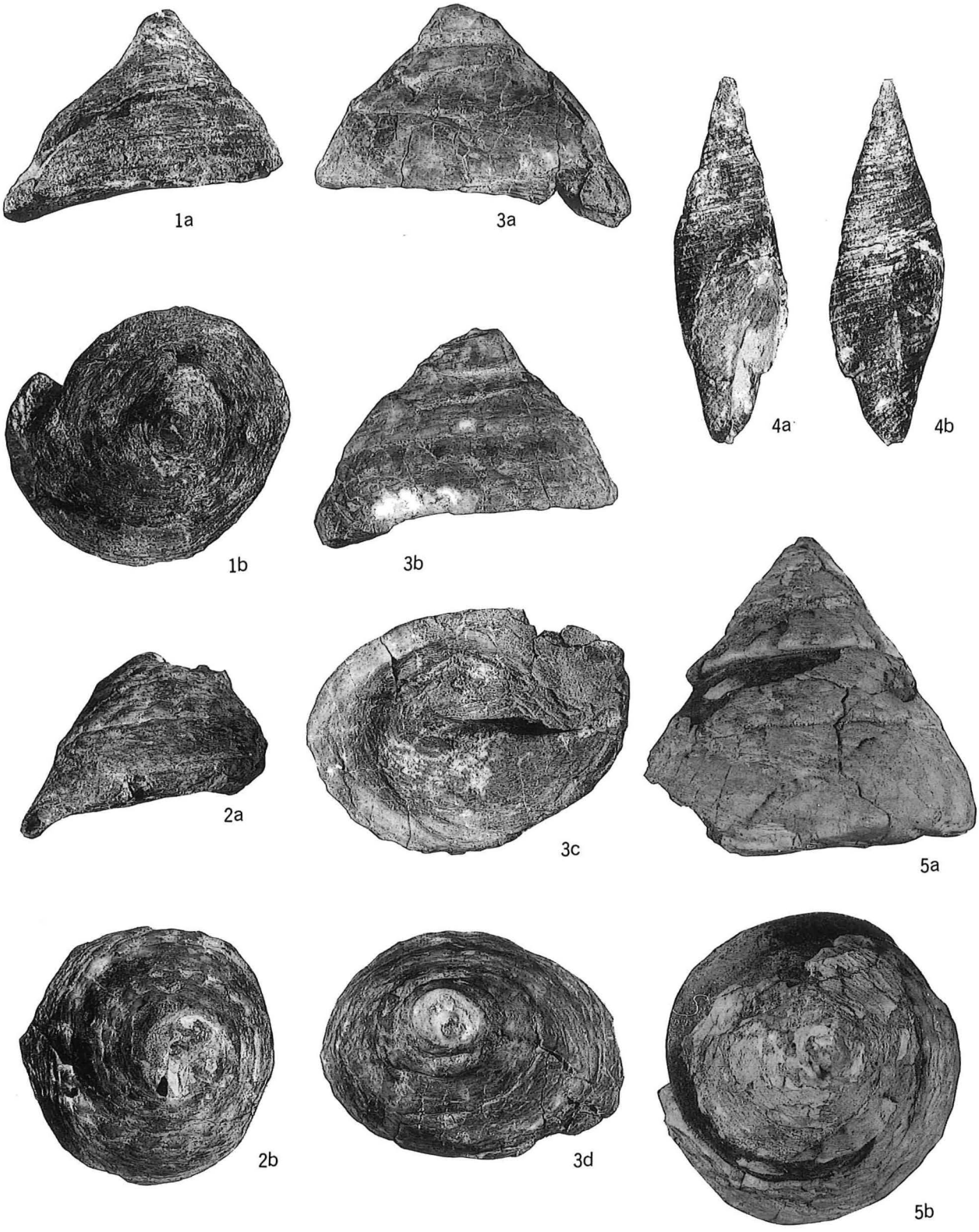
Figs. 1a, b. *Tectus japonicus* Horikoshi *in* Kobayashi and Horikoshi, 1958; MFM 41007 (Coll.: Y. Okumura); early Middle Miocene, Najima volcanic Member, Shimo Formation, Uchiura Group; Ogurui, Takahama-cho, Ohi-gun, Fukui Prefecture. ×1.5.

Figs. 2a, b. *Tectus japonicus* Horikoshi *in* Kobayashi and Horikoshi, 1958; MFM 21006 (Coll.: T. Yamaoka); Early Middle Miocene, Lower sandstone Formation, Bihoku Group; Nakabara, Monde-cho, Shobara City, Hiroshima Prefecture. ×1.5.

Figs. 3a-d. *Tectus japonicus* Horikoshi *in* Kobayashi and Horikoshi, 1958; MFM 21005 (Coll.: T. Yamaoka); Locality and Horizon is the same of figs. 2a, b.

Figs. 4a, b. *Cancilla hirosei* n. sp. holotype, MFM 20059 (Coll.: S. Hirose); early Middle Miocene, Uppermost part of lower sandstone Formation, Bihoku Group; Southwest of Kaisekidani bridge, Miyauchi-cho, Shobara City, Hiroshima Prefecture. ×1.5.

Figs. 5a, b. *Tectus japonicus* Horikoshi *in* Kobayashi and Horikoshi, 1958; MFM 11036 (Coll.: H. Nishimoto); early Middle Miocene, Shukunohora Facies, Akeyo Formation, Mizunami Group.; Shukubora, Hiyoshi-cho, Mizunami City, Gifu Prefecture. ×1.5.


1a
3a
4a
4b
1b
3b
2a
3c
5a
2b
3d
5b