

**Devonian tabulate corals from pebbles in Mesozoic conglomerate,  
Kotaki, Niigata Prefecture, central Japan  
Part 2: Alveolitina**

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**Abstract**

As the second fascicle, this paper describes five species of Devonian alveolitine tabulate corals from limestone pebbles in Mesozoic conglomerate of the Kotaki area, Niigata Prefecture, central Japan. They are *Alveolites* sp. indet., *Crassialveolites niigataensis* Niko, Ibaraki and Tazawa sp. nov., *Squamealveolites* sp. indet., *Coenites?* sp. indet., *Planocoenites* sp. indet., and *Roseoporella?* sp. indet. A Middle Devonian species, *Crassialveolites tumefactus* Tchi, 1980, from North China is most similar to this new species, but they can separate in growth forms of the coralla and presence or absence of the septal spines. Until now, occurrences of *Crassialveolites* and *Squamealveolites* have not been known in Japan.

*Key words:* Devonian, alveolitine tabulae corals, Kotaki area, Mesozoic conglomerate, *Crassialveolites niigataensis* sp. nov.

**Introduction**

A diverse fauna of Devonian tabulate corals was collected from the Kotaki area of Itoigawa, Niigata Prefecture, central Japan. These coral fossils are preserved in limestone and black shale pebbles in a float block of conglomerate that is derived probably from the Lower Jurassic Kuruma Group. Following Niko et al. (2013), the present second fascicle focuses on the suborder Alveolitina of this material. Five species are described herewith on

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the basis of 39 specimens housed in the Fossa Magna Museum (abbreviation: FMM).

### Systematic Paleontology

Subclass Tabulata Milne-Edwards and Haime, 1850

Order Favositida Wedekind, 1937

Suborder Alveolitina Sokolov, 1950

Family Alveolitidae Duncan, 1872

Subfamily Alveolitinae Duncan, 1872

Genus *Alveolites* Lamarck, 1801

*Type species.*—*Alveolites suborbicularis* Lamarck, 1801.

*Alveolites* sp. indet.

Figs. 1-1, 2

*Material.*—FMM5285, 5286.

*Description.*—Coralla probably massive, alveolitoid. Corallites have fan-shaped to semicircular transverse sections, whose sizes are 0.63–0.86 mm in width and 0.42–0.63 mm in height; form rations (width/height) of corallites range from 1.2 to 1.8. Intercorallite walls uniformly thickened attaining 0.25 mm; mural pores well-developed, situate near corallite angles; septal spines common, high conical; tabulae well-developed, mostly complete. Cylindrical and empty tube (approximately 0.2 mm in diameter) is recognized at corallite angle in a specimen (FMM5285).

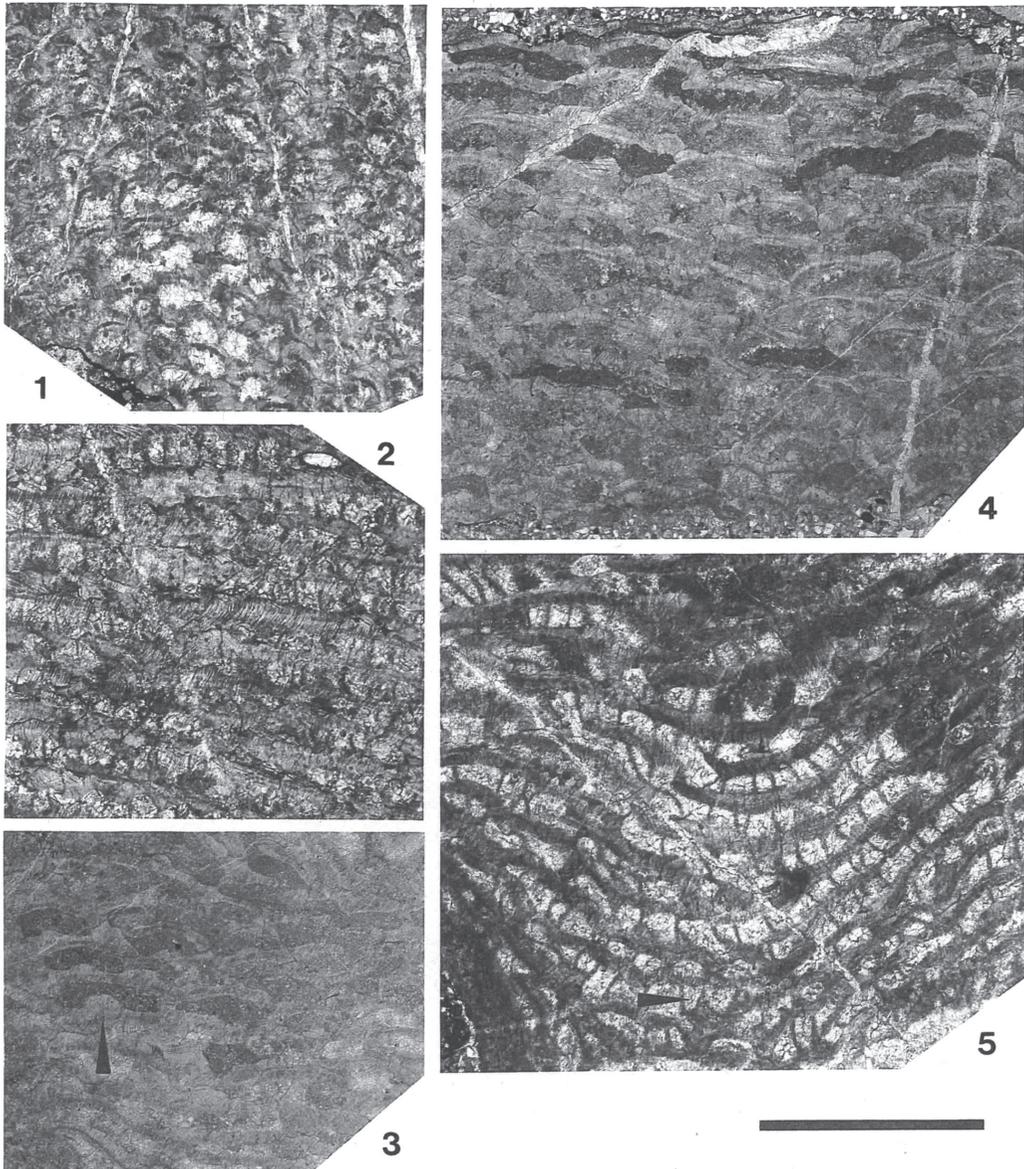
*Occurrence.*—Light gray limestone pebbles.

*Discussion.*—Only two fragmentary specimens are present. They appear similar to a Givetian (late Middle Devonian) species, *Alveolites mailleuxi* Lecompte (1933, p. 36–38, pl. 3, figs. 2, 3, 3a), described from Ardenne, Belgium. In addition, there is a possibility that they are conspecific with *A.* sp. cf. *A. mailleuxi* of Niko and Senzai (2010, p. 52, 54, figs. 11-1–8) from a float block of tuffaceous shale in the Kuzuryu Lake-Ise River area, Fukui Prefecture. These similarities may suggest age and derivation of pebbles containing *A.* sp. indet.

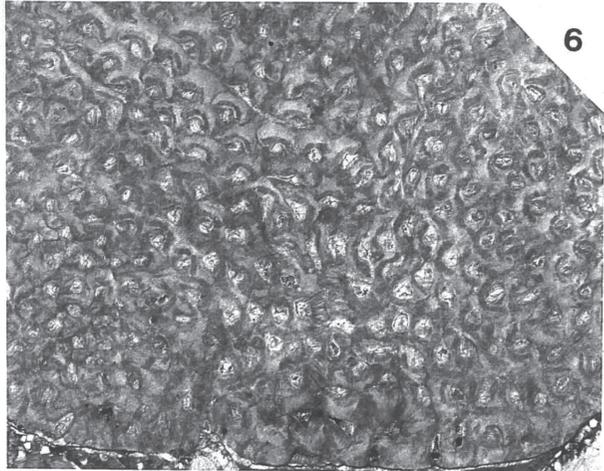
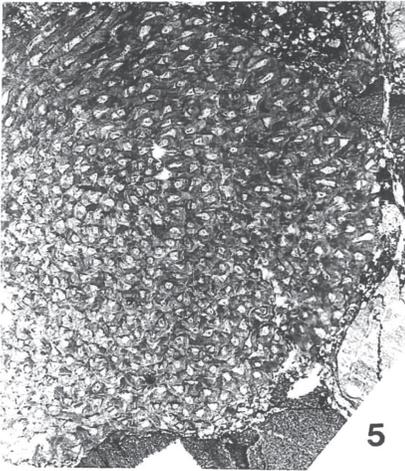
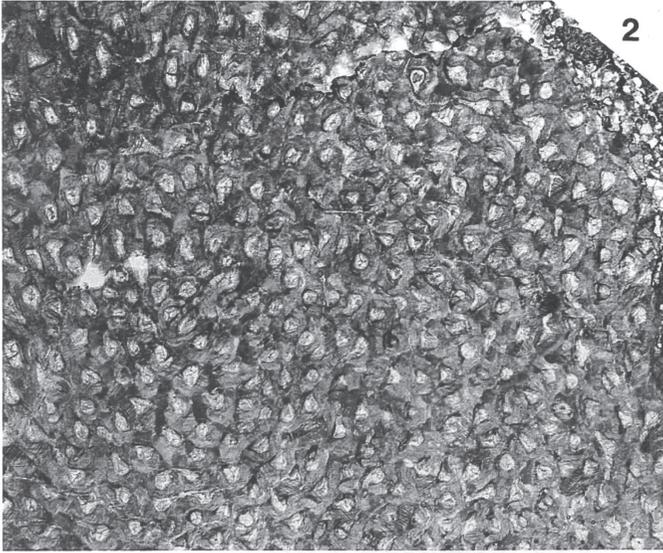
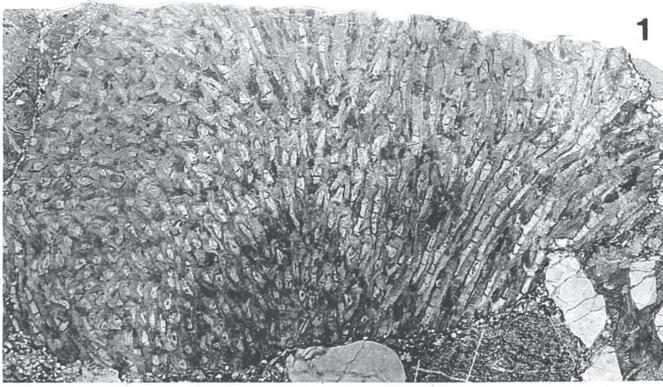
A tube developed in *Alveolites* sp. indet. was observed in only a single longitudinal thin section. Its morphology is similar to that of a possible parasitic worm, *Chaetosalpinx* Sokolov, 1948.

Genus *Crassialveolites* Sokolov, 1955

*Type species.*—*Alveolites crassiformis* Sokolov, 1952.



**Fig. 1.** 1, 2: *Alveolites* sp. indet., FMM5285, thin sections. 1, transverse section of corallites; 2, longitudinal section of corallites, note a tube of possible parasitic worm. 3-5: *Squameoalveolites* sp. indet., thin sections. 3, 5, FMM5281; 3, transverse sections of corallites, arrow indicates squamula; 5, longitudinal sections of corallites, arrow indicates squamula; 4, FMM5282, transverse sections of corallites. Scale bar = 3 mm.



*Crassialveolites niigataensis* sp. nov.

Figs. 2-1-6

*Etymology.*—The specific name is derived from prefectural name, Niigata, of the type locality.

*Material.*—Holotype, FMM5293, from which four thin sections were prepared. Three thin sections were studied from a single paratype, FMM5294. In addition, two specimens, FMM5295, 5296, were also examined.

*Diagnosis.*—Species of *Crassialveolites* with small corallite diameters, approximately 0.40 mm in width and 0.28 mm in height; fan-shaped to semicircular shapes predominate in corallite transverse sections; intercorallite walls attain 0.36 mm in thickness; mural pores well-developed; septal spine absent; tabulae well-developed, complete.

*Description.*—Coralla massive, alveolitoid; the holotype has nodular growth form and 20 mm in approximate diameter. Corallites subprismatic, more or less inclined; diameters of corallites are very small for the family and small for the genus, 0.38–0.44 mm (0.40 mm mean) in width and 0.25–0.31 mm (0.28 mm mean) in height; transverse sections of corallites are fan-shaped to semicircular, or subpolygonal in rare cases; form ratios (width/height) of corallites range from 1.4 to 1.5; increase of corallites is probably lateral; calices deep, open at nearly right angles to corallum surface. Intercorallite walls mostly thick to very thick in comparing with corallite diameters, range from 0.10 to 0.36 mm; constituents of walls are relatively thick median dark layer and stereoplasm; microstructure of stereoplasm is not preserved; tabularia (lumina) narrow with subcircular in usual transverse sections; mural pores well-developed, but not so numerous in comparing the generic type, forming mural tunnels in thickened portions of walls; positions of pores (tunnels) are at corallite angles or on narrow sides of corallite faces; profiles of pores are circular with 0.05–0.10 mm in diameter; septal spine absent; tabulae well-developed, thin and complete; profiles of tabulae are slightly concave to nearly flat; there are 3–7 tabulae in 3 mm of corallite length.

*Occurrence.*—Gray to milky white limestone pebbles.

*Discussion.*—Very small diameters of the corallites for the Alveolitidae and the strongly thickened intercorallite walls with the narrowed tabularia of the Kotaki specimens warrant their assignment to *Crassialveolites*. The present discovery represents the first record of the genus in Japan.

In the morphology of the corallites, *Crassialveolites niigataensis* sp. nov. most resembles to *C. tumefactus* Tchi (1980, p. 175, pl. 80, figs. 8, 9a, 9b) from the Middle Devonian of Jilin,

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← **Fig. 2.** *Crassialveolites niigataensis* Niko, Ibaraki and Tazawa sp. nov., thin sections. **1–5**, holotype, FMM5293; **1**, longitudinal section of corallum; **2, 4**, transverse sections of corallites; **3**, longitudinal sections of corallites; **5**, transverse section of corallum; **6**, paratype, FMM5294, transverse sections of corallites. Scale bar = 1.5 mm for Figs. 2-1, 5, = 3 mm for Figs. 2-2-4, 6.

North China. However, the Chinese species differs from *C. niigataensis* in having the tabular corallum and the large septal spines. A Middle Devonian (? to Frasnian, Late Devonian) species, *C. crassus* (Lecompte, 1939, p. 46–48, pl. 8, figs. 1, 1a, 1a, 2) from Europe and the Kuznetsk Basin in southwestern Siberia (Zapalski, 2012) is somewhat similar to the new species, but it differs in having larger diameters of the corallites (0.4–0.6 mm) with subpolygonal profiles in usual transvers sections.

Subfamily Caliaporinae Mironova, 1974

Genus *Squameoalveolites* Mironova, 1969

*Type species.*—*Alveolites fornicatus* Schlüter, 1889.

*Squameoalveolites* sp. indet.

Figs. 1-3-5

*Material.*—FMM5281–5284.

*Description.*—Coralla alveolitoid with thick tabular in probable growth form. Corallites reclined, and have laterally elongated subelliptical transverse sections, whose sizes are relatively large, 0.48–1.75 mm in width and 0.25–0.73 mm in height; form ratios (width/height) of corallites range from 1.6 to 3.0. Intercorallite walls uniformly thickened attaining 0.29 mm; mural pores well-developed, situate near corallite angles; squamulae common, developed on median flowers of corallites; profiles of squamulae in transverse section of corallites are semielliptical to semicircular; tabulae well-developed, mostly complete.

*Occurrence.*—Light gray to milky white limestone pebbles.

*Discussion.*—Four specimens examined herein bear the distinctive characteristics of *Squameoalveolites*, such as their relative large corallites with laterally elongated sections and possession of the squamulae. The present discovery from the Kotaki area represents the first record of the genus in Japan.

Family Coenitidae Sardeson, 1896

Genus *Coenites* Eichwald, 1829

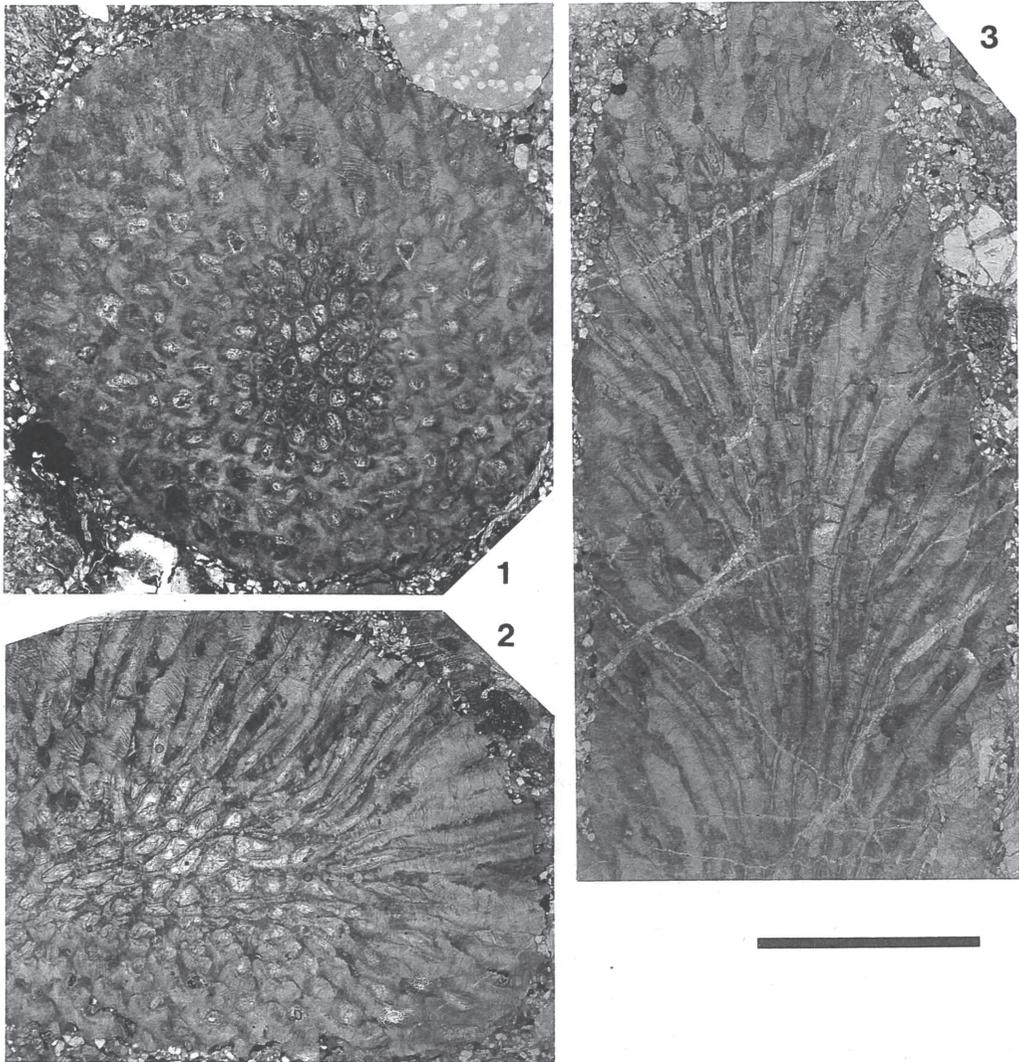
*Type species.*—*Coenites juniperinus* Eichwald, 1829.

*Coenites?* sp. indet.

Figs. 3-1-3

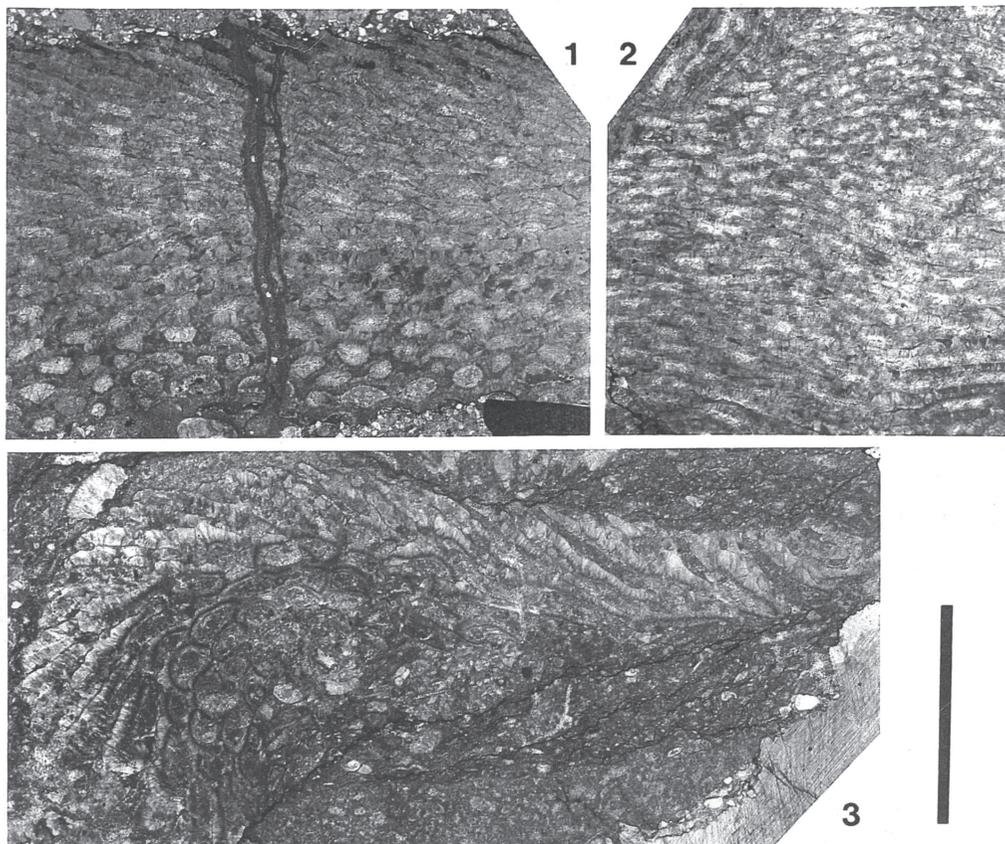
*Material.*—FMM5297–53199.

*Description.*—Coralla elongate with diameters of 2.6–8.4 mm, cerioid in axial and alveolitoid in peripheral zones. Corallites slender, prismatic to subprismatic; axial corallites



**Fig. 3.** *Coenites?* sp. indet., thin sections. **1, 2**, FMM5304; **1**, transverse section of corallum; **2**, oblique section of corallum; **3**, FMM5303, longitudinal section of corallum. Scale bar = 3 mm.

longitudinally directed, having polygonal transverse sections with 4-6 sides and 0.19-0.44 mm in diameter, then they turn outwardly to form peripheral zone where transverse sections of corallites indicate semi-circular to fan-shaped; approximate diameters of peripheral corallites are 0.5-0.7 mm in width and 0.3-0.5 mm in height; form ratios (width/height) of corallites range from 1.3 to 2.0; calices very deep, semicircular in transverse sections of usual calical pits. Intercorallite walls relatively thin (0.03-0.08 mm) in axial zone, to thick (up to approximately 0.4 mm) in peripheral one; mural pores well-developed, situate near corallite corners; no septal spine is observed; tabulae sporadic, complete.



**Fig. 4.** **1, 2:** *Roseoporella?* sp. indet., FMM5291, thin sections. **1,** longitudinal section of corallum; **2,** transverse to longitudinal sections of distal corallites. **3:** *Planocoenites* sp. indet., FMM5287, longitudinal thin section of corallum. Scale bar= 3 mm.

*Occurrence.*—Light gray to milky white limestone pebbles.

*Discussion.*—All examined specimens from the Kotaki area are small fragments. They are tentatively treated as *Coenites?* sp. inset. The calices of the species differs from typical forms of the genus that is diagnosed by the transversely elongated calical pits.

Genus *Planocoenites* Sokolov, 1952

*Type species.*—*Coenites orientalis* Eichwald, 1861.

*Planocoenites* sp. indet.

Fig. 4-3

*Material.*—FMM5287-5290.

*Description.*—Coralla encrusting, laminar in growth form, alveolitoid. Corallites reclined, having semicircular to fan-shaped transverse sections; approximate width and height of corallites are 0.4–0.7 mm and 0.2–0.5 mm, respectively; calices oblique, deep. Intercorallite walls of proximal corallites are thin, 0.04–0.06 mm, then they abruptly thickened attaining approximately 0.4 mm in distal corallites; mural pores rare, occur at corallite angles; no septal spine observed; tabulae very rare, complete.

*Occurrence.*—Dark gray argillaceous limestone to gray limestone pebbles.

*Discussion.*—Previously three species of *Planocoenites* have been recorded in Japan, namely *P. gifuensis* Niko, 2004, *P. oishinouchiensis* Niko and Adachi, 2002, and *P. ozakii* Niko, 2003. Due to insufficient material from the Kotaki area, detailed comparisons between the present *Planocoenites* sp. indet. and these species are difficult.

#### Genus *Roseoporella* Spriesterbach, 1934

*Type species.*—*Roseoporella rhenana* Spriesterbach, 1934.

*Remarks.*—We follow Zapalski (2012) in considering validity and familial assignment of *Roseoporella*.

*Roseoporella?* sp. indet.

Figs. 4-1, 2

*Material.*—FMM5291, 5292.

*Description.*—Coralla tabular in growth form, alveolitoid. Corallites reclined, subcylindrical; transverse sections of proximal corallites in basal portion of corallum are fan-shaped to elliptical with 0.27–0.88 mm in width and 0.25–0.46 mm in height, then they become strongly elongated elliptical with 0.50–0.71 mm in width and 0.17–0.21 mm in height in more distal ones; form ratios (width/height) are 1.1–1.9 in proximal and 3.0–3.4 in distal corallites; calices oblique, deep. Intercorallite walls thin for the family, 0.06–0.17 mm; mural pores rare; no septal spine is observed; tabulae common, complete.

*Occurrence.*—Milky white limestone pebbles.

*Discussion.*—Two fragmentary specimens from the Kotaki area indicate strongly elongated transverse sections of the distal corallites and the thin intercorallite walls, whose characters suggest a possible relationship of this species to *Roseoporella* rather than *Planocoenites*.

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### References

- Duncan, P. M., 1872, Third report on the British fossil corals. *Rep. 41st Meeting Br. Assoc. Adv. Sci., Edinburgh*, **157**, 116–137.
- Eichwald, C. E. d', 1829, *Zoologia specialis quam expositis animalibus tum vivis, tum fossilibus potissimum Rossiae in universum, et Poloniae in specie, in usum lectionum*. Volume 1, 314p., 5 pls., J. Zawalski, Vilna.
- Eichwald, C. E. d', 1861, *Paleontology of Russia, an ancient period*. Volume 2, 520p., P. Golike, Sanktpetersburg (in Russian).
- Lamarck, J. B. P. A. de M. de, 1801, *Système des animaux sans vertèbres, ou tableau général des classes, des orders et des genres de ces animaux; présentant leurs caractères essentiels et leur distribution, d'après la considération de leurs rapports naturels et de leur organisation, et suivant l'arrangement établi dans les grleries du Muséum d'Hist. Naturelle, parmi leurs dépouilles conservées; précédé du discours d'ouverture du Cons de Zoologie, donné dans le Muséum National d'Histoire Naturelle l'an 8 de la République*. 432p., privately published, Paris (Reissued by Culture et Civilisation, Bruxelles, 1969).
- Lecompte, M., 1933, Le genre *Alveolites* Lamarck dans le Dévonien moyen et supérieur de l'Ardenne. *Mém. Mus. Royal d'Hist. Nat. Belgique*, no. 55, 1–49, pls. 1–4.
- Lecompte, M., 1939, Les tabulés du Dévonien moyen et supérieur du Bord sud du Bassin de Dinant. *Mém. Mus. Royal d'Hist. Nat. Belgique*, no. 90, 1–229, pls. 1–23.
- Milne-Edwards, H. and Haime, J., 1850, *A Monograph of the British Fossil Corals. First Part. Introduction; Corals from the Tertiary and Cretaceous Formations*. 71p., 11 pls., Monographs of the Palaeontographical Society, London.
- Mironova, N. V., 1969, New genera of Tabulata. *Tr. Sibirskogo Nauchno-Issled. Inst. Geol. Geofiz. Mineral. Syrja*, no. 84, 85–87 (in Russian).
- Mironova, N. V., 1974, Early Devonian Tabulata from Gornyy Altay Mountains and Salair. *Tr. Sibirskogo Nauchno-Issled. Inst. Geol. Geofiz. Mineral. Syrja*, no. 163, 1–166, pls. 1–81 (in Russian).
- Niko, S., 2003, Devonian coenitid tabulate corals from the Fukuji Formation, Gifu Prefecture. *Bull. Natn. Sci. Mus., Tokyo, Ser. C*, **29**, 19–24.
- Niko, S., 2004, Late Silurian Favositida (Coelenterata: Tabulata) from the Hitoegane Formation, Gifu Prefecture. *Bull. Natn. Sci. Mus., Tokyo, Ser. C*, **30**, 21–46.
- Niko, S. and Adachi, T., 2002, Silurian Alveolitina (Coelenterata: Tabulata) from the Gionyama Formation, Miyazaki Prefecture. *Bull. Natn. Sci. Mus., Tokyo, Ser. C*, **28**, 9–24.
- Niko, S., Ibaraki, Y. and Tazawa, J., 2013, Devonian tabulate corals from pebbles in Mesozoic conglomerate, Kotaki, Niigata Prefecture, central Japan. Part I: Favositina. *Sci. Rep., Niigata Univ. (Geol.)*, no. 24, 53–66.
- Niko S. and Senzai, Y., 2010, Stratigraphy of the Devonian Kamianama Formation in the Kuzuryu Lake–Ise River area, Fukui Prefecture and its favositid coral fauna. *Bull. Natl. Mus. Sci., Ser. C*, **36**, 31–59.

- Sardeson, F. W., 1896, Ueber die Beziehungen der fossilen Tabulaten zu den Alcyonarien. *Neues Jahrb. Mineral. Geol. Paläontol., Beil-Bd.*, **10**, 249–362.
- Schlüter, C., 1889, Anthozoen des rheinischen Mittel-Devon. *Abh. Geol. Specialkarte Preuss. Thüring. Staaten*, **8**, 261–465.
- Sokolov, B. S., 1948, Commensalism among the favositids. *Izv. Akad. Nauk SSSR, Ser. Biol.*, no. 1, 101–110 (in Russian).
- Sokolov, B. S., 1950, Systematics and history of the development of the Paleozoic corals Anthozoa Tabulata. *Vopr. Paleont.*, **1**, 134–210 (in Russian).
- Sokolov, B. S., 1952, Paleozoic Tabulata of the European parts of the USSR. Part 4. Devonian of the Russian Platform and the western Urals. *Tr. Vses. Nauchno-Issled. Geol.-Razved. Inst., N. S.*, **62**, 1–292, pls. 1–40 (in Russian).
- Sokolov, B. S., 1955, Paleozoic Tabulata of the European parts of the USSR, Introduction to the general study of the systematics and development of the tabulates. *Tr. Vses. Nauchno-Issled. Geol.-Razved. Inst., N. S.*, **85**, 1–527 (in Russian).
- Spriesterbach, J., 1934, Beitrag zur Kenntnis der Fauna des rheinischen Devon. *Jahrb. Preuss. Geol. Landesanst.*, **55**, 475–525, pls. 41–50.
- Tchi, Y., 1980, Tabulata. In Shenyang Institute of Geology and Mineral Resources (ed.), Paleontological Atlas of Northeast China. (1), Paleozoic volume, p. 153–188, 646–649, pls. 67–87, Geological Publishing House, Beijing (in Chinese).
- Wedekind, R., 1937, *Einführung in die Grundlagen der Historischen Geologie, II. Band. Mikrobiostratigraphie, die Korallen- und Foraminiferenzeit.* 136p., 16 pls., Ferdinand Enke, Stuttgart.
- Zapalski, M. K., 2012, Tabulate corals from the Givetian and Frasnian of the southern region of the Holy Cross Mountains (Poland). *Palaeontology, Sp. Pap.*, **87**, 1–100.