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Mandulapora jimboi, a New Species of Early Permian Coral (Tabulata: Auloporida) from the Nakadaira Formation, Miyagi Prefecture

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Abstract A new species of the periphaceloporid (Auloporida) tabulate coral, *Mandulapora jimboi*, is described from the Early Permian (most probably Artinskian) limestone of the Nakadaira Formation, Southern Kitakami Terrane in the Kamiyasse area, Miyagi Prefecture. This species differs from the two previously known forms, Middle Permian *Mandulapora permica* and Early to Middle Carboniferous *M. yamagiwai*, by the combination of its small corallite diameters, well-developed phaceloid portion, usually long septal spines, and rare and weakly sagging tabulae. The present discovery notes the first Permian occurrence outside Inner Mongolia and supplements stratigraphic gap of the fossil records of *Mandulapora*.

Key words: Early Permian, tabulate coral, Auloporida, Periphaceloporidae, *Mandulapora jimboi*, Nakadaira Formation, Miyagi

Introduction

The tabulate coral *Mandulapora* Ding (*in* Ding *et al.*, 1984) is an exceedingly rare genus of periphaceloporid auloporid. Until now only two isolated species have been undoubtedly referred to the genus, i.e., the type species *Mandulapora permica* Ding (*in* Ding *et al.*, 1984, pl. 23, figs. 1, 2, 3a, b, pl. 24, figs. 1, 2a–c, c′, d, d′, 3a, b) from the Capitanian (Middle Permian in a three-fold division) of Inner Mongolia (Nei Mongol Zizhiqu) and *M. yamagiwai* Niko (1999, figs. 7-1–3, 8-1–4, 9-1; Niko and Hasegawa, 2000, figs. 4-1–3) from the late Visean (Early Carboniferous) to the late Bashkirian (Middle Carboniferous in a three-fold division) of the Akiyoshi, Hina and Omi Limestones in the Akiyoshi Terrane, Japan.

In August 2001, the author discovered an undocumented species of *Mandulapora* from the Early Permian (most probably Artinskian) limestone of the Nakadaira Formation (see Tazawa, 1973; Ehiro, 1977, 1995, for geologic setting) in the Southern Kitakami Terrane. The present material including three specimens permits the creation of a new species, *Mandulapora jimboi*, whose locality is KA-3 (Fig. 1) on the northern flank of the Minami-zawa Valley in the Kamiyasse area, Miyagi Prefecture, Northeast Japan. This paper aims to describe and illustrate the new *Mandulapora* material for further paleobiogeographic purposes. Specimen number used herein is that of the National Science Museum, Tokyo, where the types are deposited.

Systematic Paleontology

Order Auloporida Sokolov, 1947

Superfamily Syringoporicae Fromentel, 1861

Family Periphaceloporidae Hill, 1981

Genus ***Mandulapora*** Ding *in* Ding *et al.*, 1984

Type species: *Mandulapora permica* Ding *in* Ding *et al.*, 1984.

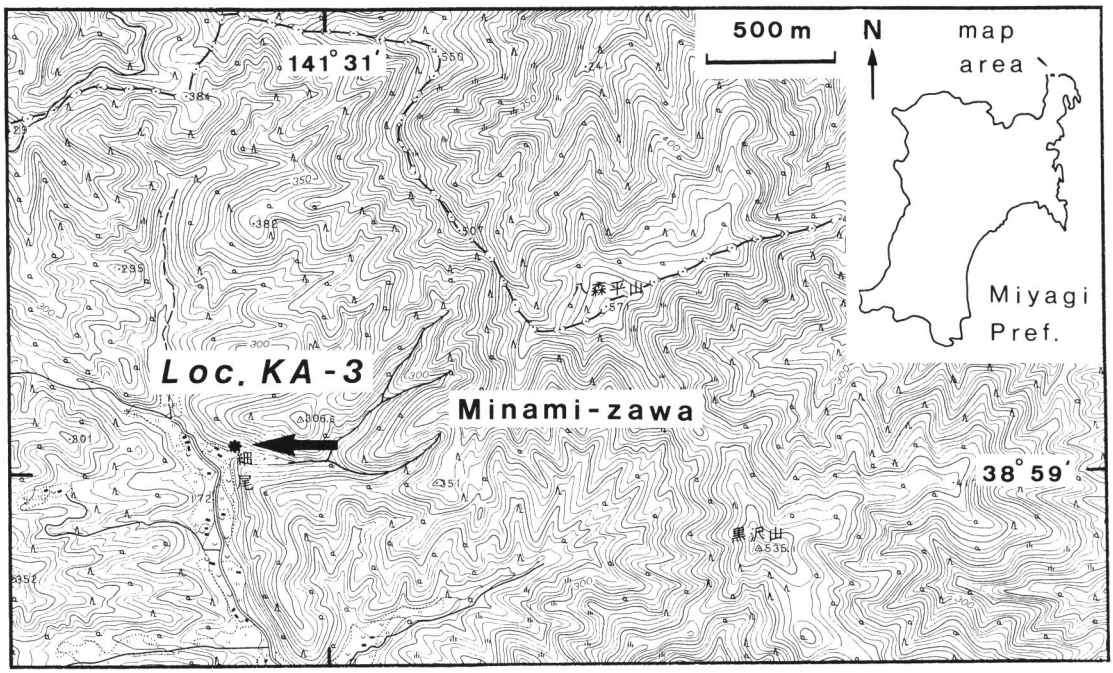

Fig. 1. Index map of the present coral locality in the Kamiyasse area, Kesennuma City, Miyagi Prefecture using 1: 25,000 map of "Shishiori" published by the Geographical Survey Institution.

Mandulapora jimboi sp. nov.

Figs. 2-1–5; 3-1–5

Holotype: NSM PA14959, from which 24 thin sections were made.

Other specimens: Fourteen thin sections were studied from the two paratypes, NSM PA14960 and 14961.

Diagnosis: Species of *Mandulapora* with well-developed phaceloid portion and small corallite diameters having approximately 1.1 mm; connecting tubuli rare; septal spines usually long, attain 0.42 mm in protruded part; tabulae rare, weakly sagging; usual corallites free from tabula.

Description: Coralla indicate astogenetic growth form changes, encrusting and laminar in early growth stages, then create irregular shaped branches to form domical colony; maximum observed size of largest corallum (holotype) approximately 42 mm in diameter and 17 mm in height. Laminar coralla composed of alveolitoid-like corallites with indistinct fan-shaped to semicircular cross sections; each branch consists of lax mass with sub-prismatic to cylindrical corallites, phacelo-cerioid; phaceloid portion well-developed for genus; cross sections usually indistinct polygonal with 4–6 sides in cerioid and circular in phaceloid corallites; corallite diameters relatively small for genus, 0.5–1.7 mm in width and 0.4–1.2 mm in height in alveolitoid-like and 0.4–1.5 mm with 1.1 mm mean in phacelo-cerioid portions; connecting tubuli rarely developed in phacelo-cerioid portion, approximately 0.21 mm in diameter; calice very deep lacking calical modification; increase lateral and intracalicular. Intercorallite (and corallite) walls mostly thick, may form obscure peripheral stereozone, structurally consist of median dark line (=fused epitheca) and stereoplasm; thickness of intercorallite walls increases to 1.1 mm in cerioid corallites; but usual dimensions are 0.19–0.33 mm in alveolitoid-like, 0.25–0.94 mm in cerioid and 0.17–0.44 mm in phaceloid corallites; stereoplasm differentiated into underlying layer of rectradiate fibers and overlying microlamellar layer; phaceloid corallites rarely connected by epithecal

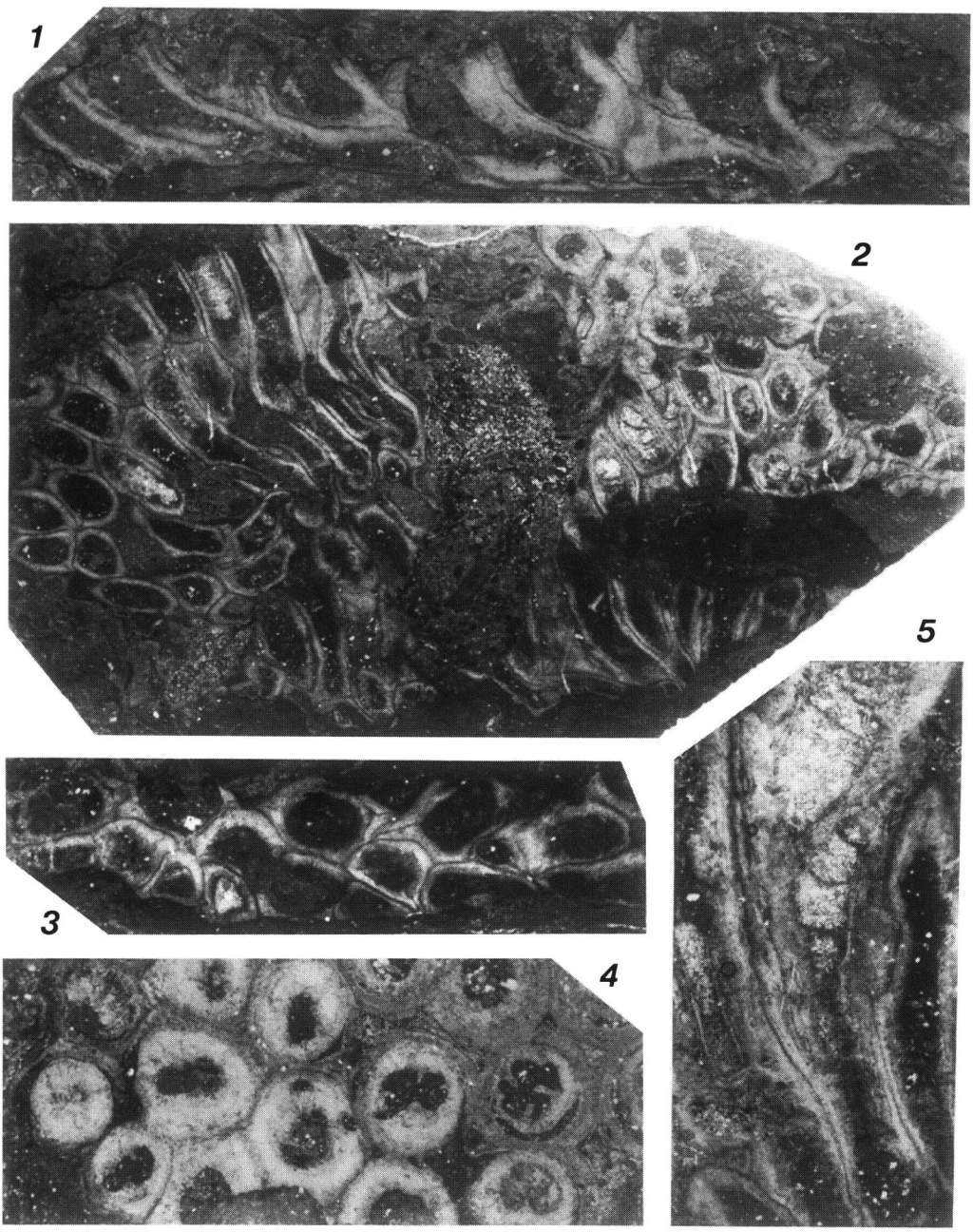

Fig. 2. *Mandulapora jimboi* sp. nov., holotype, NSM PA14959, thin sections. **1**, longitudinal sections of corallites in alveolitoid-like portion, ×10. **2**, longitudinal section of corallum, ×5. **3**, transverse sections of corallites in alveolitoid-like portion, ×10. **4**, transverse sections of corallites in phacelo-cerioid portion, note tunnel-like pores, ×14. **5**, longitudinal sections of corallites in phacelo-cerioid portion, note weakly sagging tabulae, ×14.

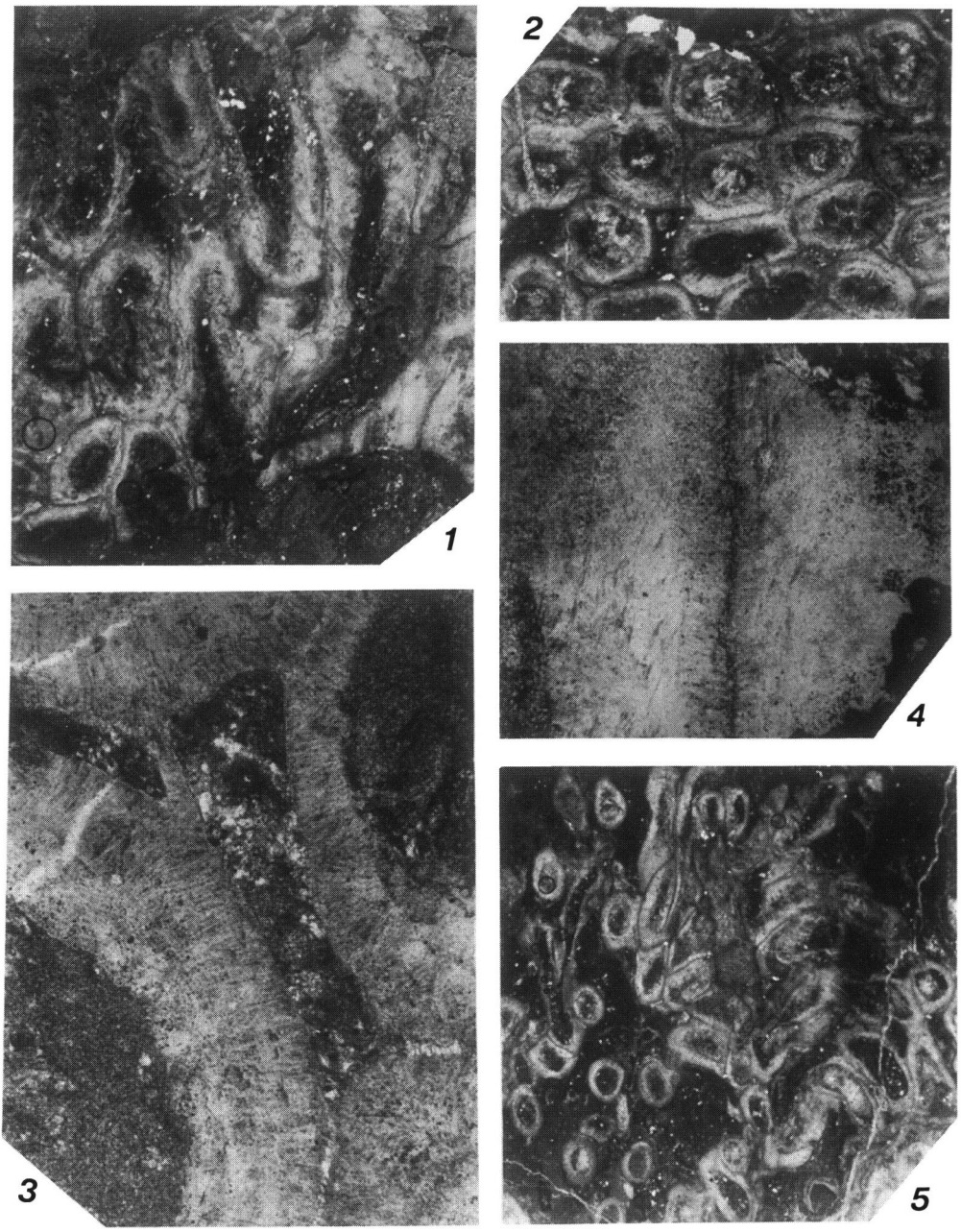

Fig. 3. *Mandulapora jimboi* sp. nov., thin sections. **1**–**4**, holotype, NSM PA14959. **1**, longitudinal to oblique sections of corallites in phacelo-cerioid portion, showing connecting tubule, ×10. **2**, transverse sections of corallites in phacelo-cerioid portion, showing connecting tubule, ×10. **3**, partial enlargement to show corallite wall structure and epithecal scale, transverse sections, ×75. **4**, partial enlargement to show intercorallite wall structure, longitudinal section, ×75. **5**, paratype, NSM PA 14960, oblique section of corallum, ×5.

scales; tabularia more or less narrowed by intercorallite (and corallite) wall thickening, especially this character is remarkable in cerioid portion, where cross sections of tabularia became somewhat irregular and ratios of tabularium diameter per corallite diameter decrease to approximately 0.2; tunnel-like pores rarely occur in thickened intercorallite walls; septal spines common, slightly upturned, usually long for genus; protruded parts into tabularium attain 0.42 mm; tabulae complete, transverse to strongly oblique to each corallite and weakly sagging (concave proximally) in profile, rare but partially crowded; thus usual corallites free from tabula; there are 0–4 tabulae in 2.5 mm of corallite length.

Discussion: *Mandulapora jimboi* sp. nov. differs from the previously known species listed in the commencement of this report in the smaller corallite diameters (approximately 1.1 mm versus 2.0–3.0 mm in *M. permica* and approximately 1.7 mm in *M. yamagiwai*). Range of the corallite diameters in *Mandulapora jimboi* and *M. yamagiwai* is partly overlapped, and the rare development of the connecting tubuli is an also common diagnosis in the both species. However, this new species can easily be distinguished from the latter species by the well-developed phaceloid portion, longer septal spines, and fewer and weakly sagging tabulae.

Pervious occurrences of *Mandulapora* were restricted in the only two regions with considerable geographical and chronological isolation as aforesaid, therefore *M. jimboi* from the Early Permian of the Southern Kitakami Terrane represents the first Permian record outside Inner Mongolia and supplements previous stratigraphic gap from the Moscovian (Late Carboniferous) to Wordian (Middle Permian). The present discovery may suggest coral disposal between the Taishaku-Akiyoshi-South China Province in the equatorial position (Niko, 2000) and Inner Mongolia via the Southern Kitakami Terrane, during Early Permian.

Etymology: The specific name honors the late Dr. Kotora Jimbo in recognition of his pioneering work on the Permian fossils of the Kamiyasse area.

Occurrence: All specimens were found associated with the micheliniid tabulate coral *Protomichelinia multitabulata* (Yabe and Hayasaka, 1915) from float blocks of dark gray limestone (bioclastic wackestone to packstone). Geographical evidence indicates that these coral-bearing blocks are probably derived from the upper part of the Nakadaira Formation.

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