

Additional Tabulate Coral Material from the Carboniferous Hina Limestone, Okayama Prefecture

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Abstract In addition to previously documented tabulate corals of the Carboniferous Hina Limestone, Okayama Prefecture, this paper describes two favositids, *Xianzapor*? sp. indet. (middle Bashkirian in age) of the family Pseudofavositidae and *Michelinia japonica* sp. nov. (late Viséan to Serpukhovian or early Bashkirian in age) of the family Micheliniiidae. *Michelinia japonica* is diagnosed by its small diameters of coralla and corallites, numerous septal spines, relatively rare mural pores, and thickened distal tabulae. This new species represents the first occurrence of the genus in Japan.

Key words: Carboniferous, tabulate corals, Pseudofavositidae, *Xianzapor*, Micheliniiidae, *Michelinia*, Hina Limestone, Okayama

Introduction

Recent researches on corals of the Hina Limestone, Okayama Prefecture, Southwest Japan led Niko (1999) and Yamagiwa *et al.*, (2000) to reveal the diversified Early to Middle Carboniferous faunas including *Lithostrotion* (*Siphonodendron*) *hinensis* and *Hiroshimaphyllum* aff. *simplex* of the Rugosa, and *Pseudofavosites hinaensis*, *Donetzites kibiensis*, *D. vermiculatus*, *Cladochonus* sp. indet., and *Mandulapora yamagiwai* of the Tabulata. During subsequent study, additional coral specimens were recovered from the three float blocks (Sample HL 6, 20, 21) of the formation at riverbed of Sigi-gawa River in the Yoshiki area (see fig. 1 in Niko, 1999, for geographic information). This new material includes two previously undocumented species of tabulate corals, i.e., *Xianzapor*? sp. indet. and *Michelinia japonica* sp. nov. The specimens described herein are kept in the National Science Museum, Tokyo.

Systematic Paleontology

Order Favositida Wedekind, 1937

Suborder Favositina Wedekind, 1937

Superfamily Favositicae Dana, 1846

Family Pseudofavositidae Sokolov, 1950

Genus *Xianzapor* Lin, 1984

Type species: Xianzapor yongzhuensis Lin, 1984.

Xianzapor? sp. indet.

Figs. 1–1–3

Material examined: A single corallum, NSM PA14942.

Description: Corallum massive, oval in growth form with maximum observed size 17 mm in diameter and 12 mm in height, cerioid. Corallites prismatic, radial in arrangement; cross sections of corallites are polygonal with 4–8 sides, and attain 1.7 mm in diameter; distal tabularia subcircular in cross section. Intercorallite walls usually 0.23–0.36 mm in thickness, undifferentiated with

radially fibrous microstructure; mural pores frequent on corallite faces and edges; tabulae rare, complete; squamulae may present; robust spine-like projections occur in distal portion of corallite.

Discussion: With a single and poorly preserved specimen from the Hina Limestone available, the morphology can not be clearly resolved. Although the genus designation is difficult, this species is referred to *Xianzapor*a with a query by its fibrous microstructure of the intercorallite walls, subcircular cross section of the distal tabularia, and complete tabulae.

Occurrence and age: *Xianzapor*a? sp. indet. was recovered from Sample HL 6 of bioclastic grainstone that also contains *Mandulapor*a *yamagiwai* and middle Bashkirian (Middle Carboniferous=early Late Carboniferous in a two-fold division) foraminifers (Niko, 1999).

Family Micheliniidae Waagen and Wentzel, 1886

Subfamily Micheliniinae Waagen and
Wentzel, 1886

Genus *Michelinia* de Koninck, 1841

Type species: *Calamopora tenuiseptata* Phillips, 1836.

***Michelinia japonica* sp. nov.**

Figs. 1-4, 5; 2-1-3; 3-1-6

Holotype: NSM PA14680, from which five thin sections were made.

Other specimens: Thirty-seven thin sections were studied from the 13 paratypes, NSM PA14678, 14679, 14682, 14686, 14689, 14692, 14694, 14703, 14710, 14719, 14727, 14732, and 14733. In addition, 44 specimens, NSM PA14681, 14683-14685, 14687, 14688, 14690, 14691, 14693, 14695-14702, 14704-14709, 14711-14718, 14720-14726, 14728-14731, 14734, 14735, were also examined.

Diagnosis: Small species of *Michelinia* with variable corallum growth form, small corallites having usually 2.7 mm in diameter, numerous septal spines and relatively rare mural pores;

thickness of intercorallite walls attains 1.09 mm; distal tabulae thickened.

Description: Coralla small for genus, variable in growth form, mostly massive with subspherical to domical, but columnar, lobate and encrusting forms also recognized in rare cases, cerioid; typical coralla indicate 22 mm in diameter and 23 mm in height (holotype), ditto 15 mm and 13 mm (paratype, NSM PA14678), 15 mm and 16 mm (paratype, NSM PA14692), 13 mm and 9 mm (paratype, NSM PA14694); maximum observed size represented by lobate corallum (paratype, NSM PA14689) is 61 mm in diameter and 43 mm in height; holotheca poorly developed, may occur on corallum base. Corallites prismatic with 4 to indistinct 8 sides in cross section, divergent in arrangement; corallite diameters small for genus, range from 0.8 to 3.1 mm with 2.7 mm mean; tabularia indistinct polygonal to subcircular in cross section; calices very shallow; their opening perpendicular to corallum surface or obliquely upward with approximately 60° in angle to surface of columnar corallum; increase of new corallites lateral, relatively rare. Intercorallite walls relatively thin for genus, usually 0.25-0.94 mm, form weak peripheral thickening and attain 1.09 mm in thickness, differentiated into partly undulated median dark line and stereoplasm; microstructure of stereoplasm is lamellar with strong undulation that caused by effect of numerous septal spines; each microlamella roughly parallel to median dark line; in addition outermost layer consisting rect-radiate fibers partly developed in stereoplasm; mural pores relatively rare, restricted to peripheral zone of corallum, developed on corallite faces and edges; diameters of mural pore small, 0.08-0.17 mm, with subcircular cross section; septal spines 0.23-0.46 mm in length, but enclosed in stereoplasm excepting apical part, which less than 0.10 mm in length. Tabulae well-developed, incomplete and complete; there are 3-21, including 2-5 complete, tabulae in 5 mm of corallite length; distal tabulae thickened by layer consisting of rect-radiate fibers.

Discussion: Based on the intercorallite wall

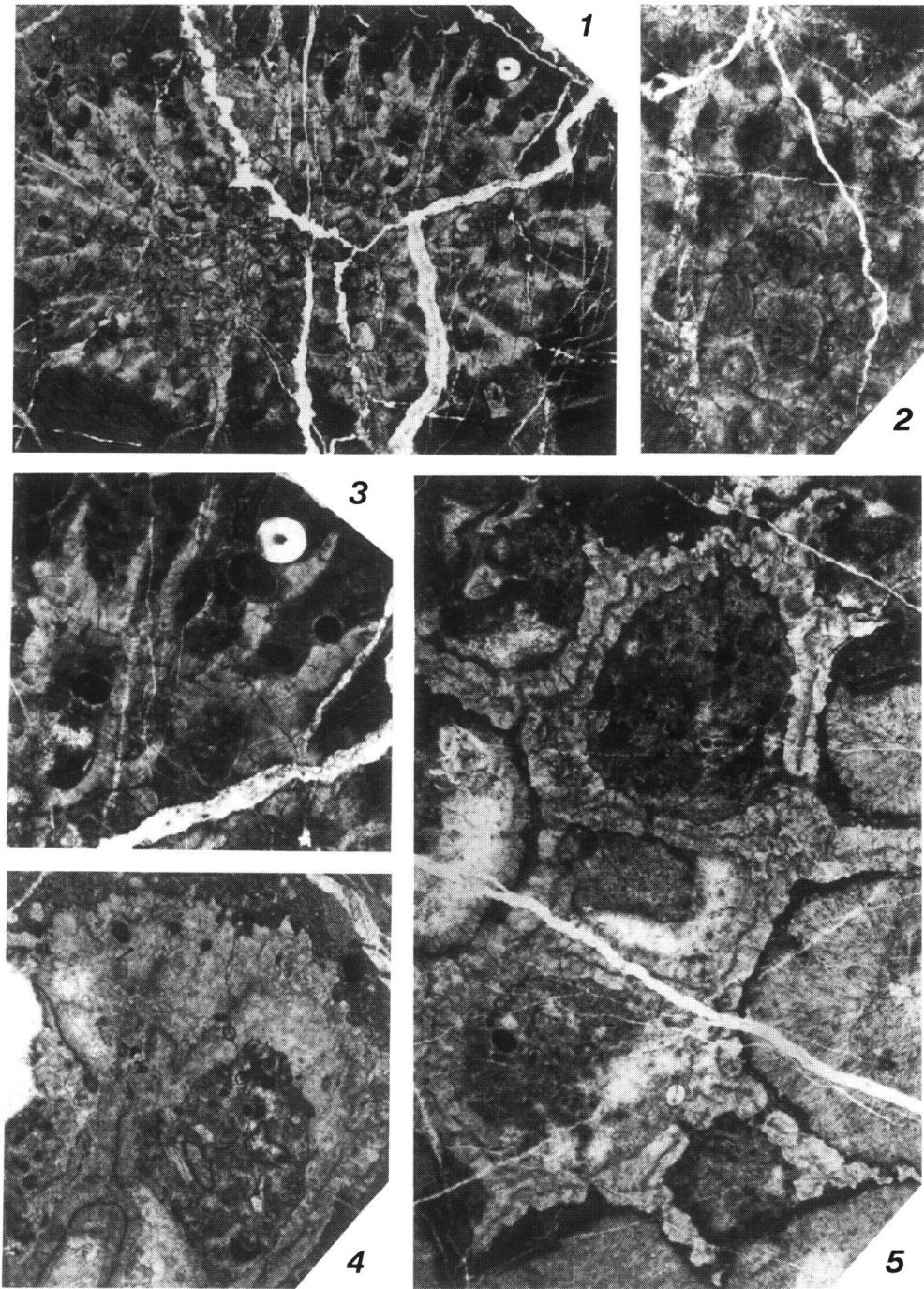


Fig. 1. 1–3, *Xianzaporina?* sp. indet., thin sections, NSM PA14942. 1, longitudinal section of corallum $\times 5$. 2, transverse sections of corallites, $\times 10$. 3, longitudinal sections of corallites, $\times 10$. 4, 5, *Michelinia japonica* sp. nov., thin sections. 4, paratype, NSM PA14733, oblique sections of calices, $\times 14$. 5, paratype, NSM PA14732, transverse sections of corallites, note mural pores, $\times 14$.

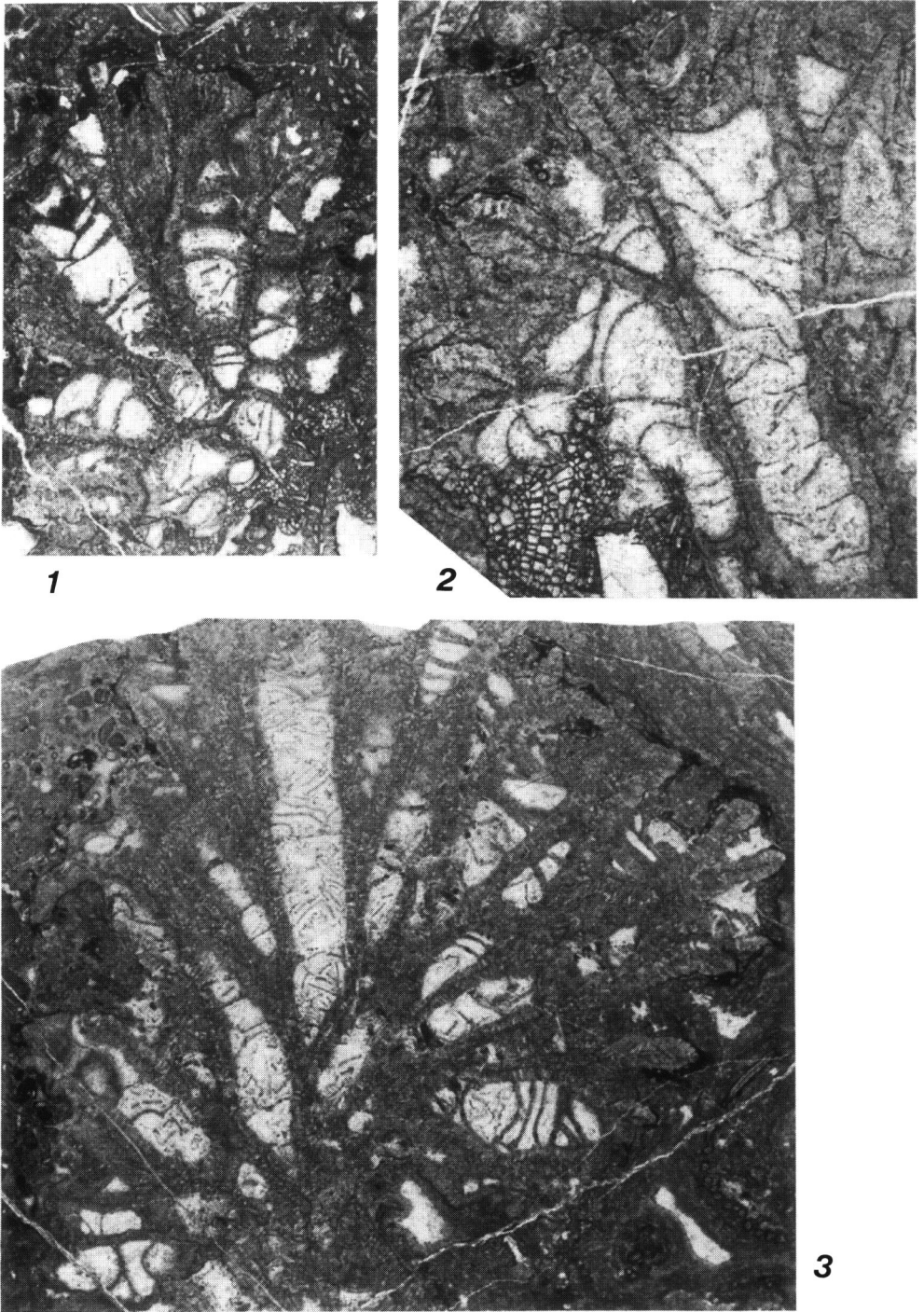


Fig. 2. *Michelinia japonica* sp. nov., thin sections. 1, paratype, NSM PA14678, longitudinal section of corallum, $\times 5$. 2, paratype, NSM PA14710, longitudinal to oblique sections of corallites, showing complete and incomplete tabulae, $\times 10$. 3, holotype, NSM PA14680, longitudinal section of corallum, $\times 5$.

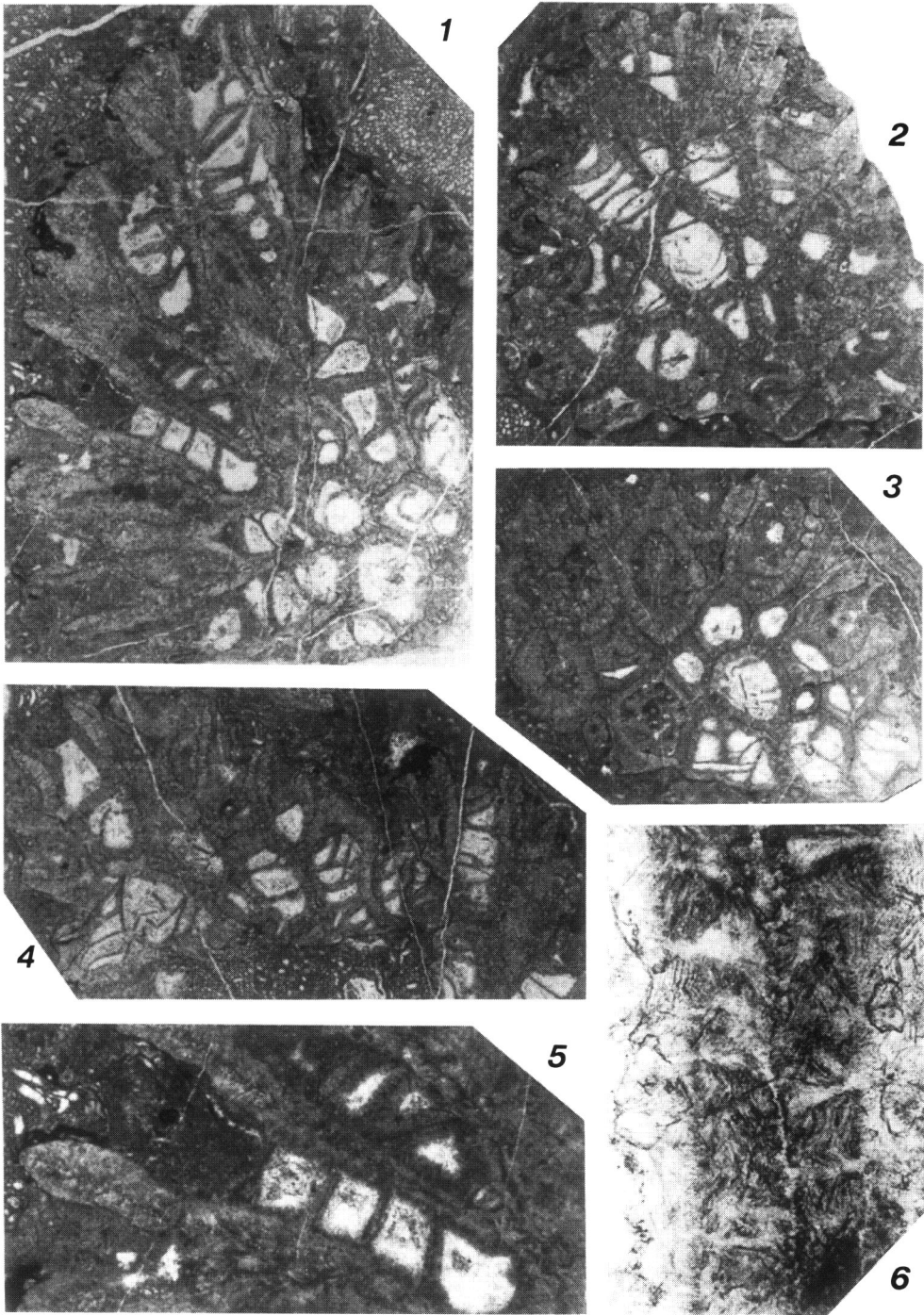


Fig. 3. *Michelinia japonica* sp. nov., thin sections. 1, 5, paratype, NSM PA14719. 1, longitudinal section of corallum, $\times 5$. 5, partial enlargement to show weak peripheral thickening of intercorallite walls and thickened distal tabulae, $\times 10$. 2, paratype, NSM PA14686, oblique section of corallum, $\times 5$. 3, paratype, NSM PA14694, transverse section of corallum, $\times 5$. 4, paratype, NSM PA14703, longitudinal section of corallum, note encrusting growth form, $\times 5$. 6, holotype, NSM PA14680, partial enlargement to show intercorallite wall structure, $\times 50$.

structure, the *Michelinia*-type favositids are divided into eight (or nine?) genera (see Lafuste and Plusquellec, 1985; Plusquellec *et al.*, 1993; Webb and Sutherland, 1993). The lamellae that arrange roughly parallel to the median dark line confirm the generic determination to *Michelinia* (sensu strictiori) of present specimens that represent the first occurrence of the genus in Japan.

In the microstructure of the stereoplasm, the most similar species with the new species is probably *Michelinia crassa* Sayutina (1966, pl. 37, figs. 5a, b, pl. 38, figs. 1a, b) from the Tournaisian (Early Carboniferous) of the Kuznetsk Basin, Baltica. However, the two species differ significantly in that the Russian species has the much larger corallite diameters (usually 2.7 mm versus 7–11 mm in *Michelinia crassa*), the thicker intercorallite walls (maximum 1.09 mm versus 1.5–2 mm in *M. crassa*) and the discoid corallum, and lacks thickening of the tabulae. The small diameters of the coralla and corallites of *Michelinia japonica* share with *M. tenuicula* Moore and Jeffords (1945, figs. 167–169, 181; Webb, 1987, figs. 8.13, 8.14) from the Chesterian to Morrowan (Early to Middle Carboniferous) of Laurentia, although the latter has numerous mural pores.

Etymology: The specific name is derived from Japan.

Occurrence and age: *Michelinia japonica* sp. nov. was collected from the two float blocks, namely sample HL 20 (biolithite composed of this tabulate coral and bryozoans; NSM PA14678–14731) and HL 21 (bioclastic grainstone; NSM PA14732–14735). Associated foraminifers of these limestones are as follows: Sample HL 20; *Eolasiiodiscus* sp., *Palaeospiroplectammina* sp., *Pseudogromospira* sp., *Tetrataxis* sp., *Mediocris breviscula*, and HL 21; *Asteroarchaediscus* sp., *Eolasiiodiscus* sp., *Planoendothyra* sp., *Tetrataxis* sp., *Millerella* sp., *Mediocris breviscula*, *Pseudoendothyra* sp. This microfossil evidence suggests that sample HL 20 is late Viséan (Early Carboniferous) and sample HL 21 is Serpukhovian or early Bashkirian (Early to Middle Carboniferous) in age.

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