Bull. Natl. Mus. Nat. Sci., Ser. C, 42, pp. 1–4, December 22, 2016

Axuolites higoensis, a new species of tabulate coral from the Silurian Fukami Formation, Kumamoto Prefecture, Japan

Shuji Niko

Department of Environmental Studies, Faculty of Integrated Arts and Sciences, Hiroshima University, 1–7–1 Kagamiyama, Higashihiroshima, Hiroshima 739–8521, Japan

Abstract A coenitid tabulate coral, *Axuolites higoensis* sp. nov., is described from the Ludlow (early Late Silurian) limestone of the Fukami Formation in Kumamoto Prefecture, southern Japan. *Axuolites notabilis* Sharkova, 1963, from the Upper Silurian of Kazakhstan is most closely related to this new species, but it has somewhat smaller diameters of corallites and more closely spaced tabulae. Because *Axuolites* previously documented only from the Urals, Central Asia and south-western Australia, the present discovery extends the geographic range of the genus to East Asia.
Key words: Ludlow (early Late Silurian), Fukami Formation, *Axuolites*, Coenitidae, tabulate coral

Introduction

The Fukami Formation consists of limestone, tuffaceous shale and acidic pyroclastic rocks (Matsumoto and Kanmera, 1964). Among them, limestone yields abundant marine fossils ranging from Wenlock (late Early Silurian) to Ludlow (early Late Silurian) in age (Murata, 1992). Following Niko (2015), this fascicle describes a new species of coenitid tabulate coral from the formation on the basis of material collected in the Fukami area, Kumamoto Prefecture, southern Japan.

Systematic Paleontology

Subclass Tabulata Milne-Edwards and Haime, 1850
Order Favositida Wedekind, 1937
Suborder Alveolitina Sokolov, 1950
Family Coenitidae Sardesson, 1896
Genus ***Axuolites*** Sharkova, 1963

Type species: *Axuolites notabilis* Sharkova (1963, p. 119, figs. 1-a, b, v, g), from the Upper Silurian of Kazakhstan.

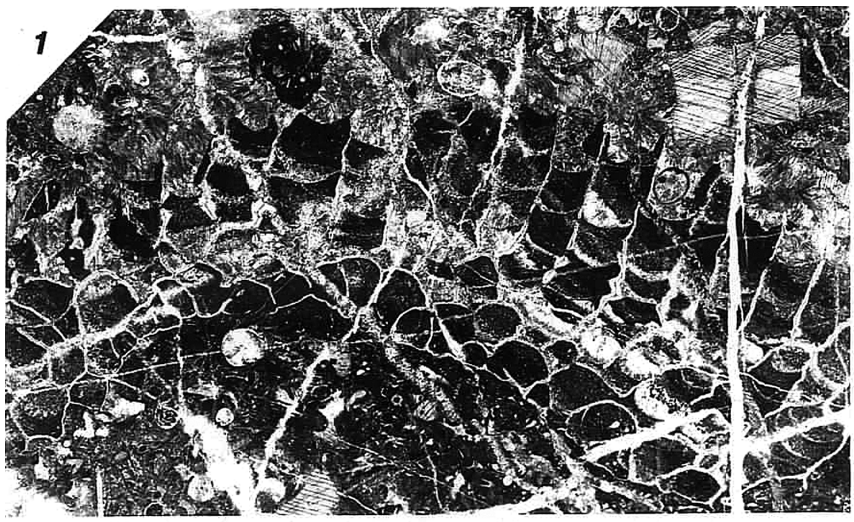
Discussion: *Axuolites* was proposed by Sharkova (1963) as a new coenitid genus. Subsequently, Hill (1981) tentatively placed *Axuolites* within the Alveolitidae in the Treatise and Lin *et al.* (1988) replaced the genus back to the Coenitidae. Because *Axuolites* has several synapomorphies fund in a coenitid *Planocoenites* Sokolov, 1952, the author regards the genus as a coenitid. *Axuolites* differs from *Planocoenites* only in lacking visor-like projections at the calical rims.

Axuolites higoensis sp. nov.

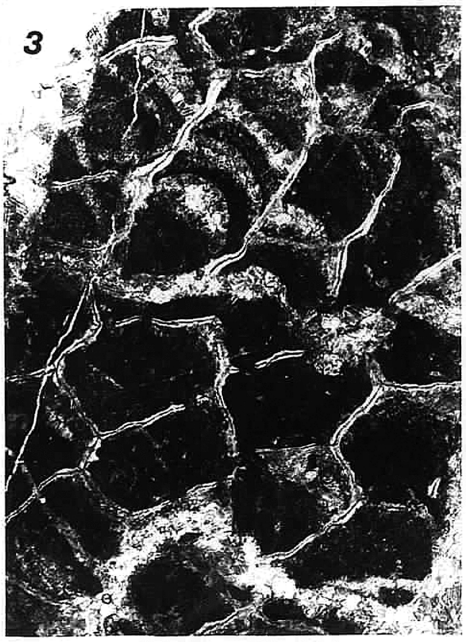
(Figs. 1-1–6)

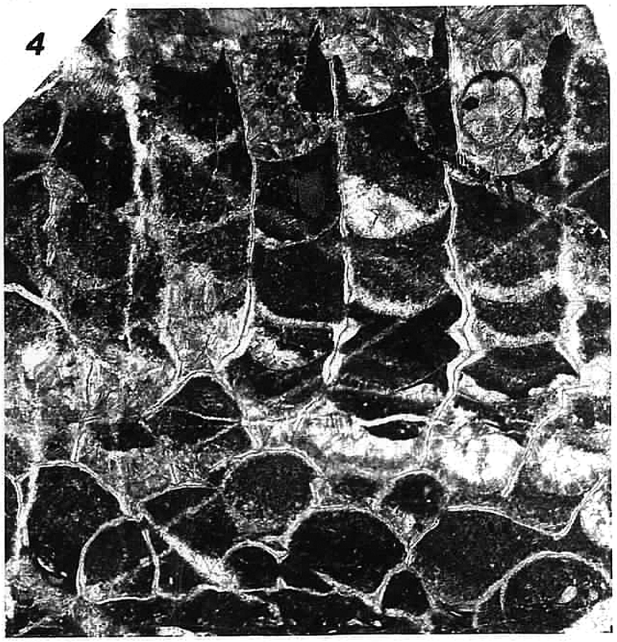
Material examined: Holotype, NMNS PA18350, from which six thin sections were made. Paratypes, NMNS PA18352, 18353. In addition, a single poorly preserved specimen, NMNS PA18351, also assigned to *Axuolites higoensis* sp. nov. They are reposited in National Science Museum of Nature and Science, Tokyo (prefixed NMNS).

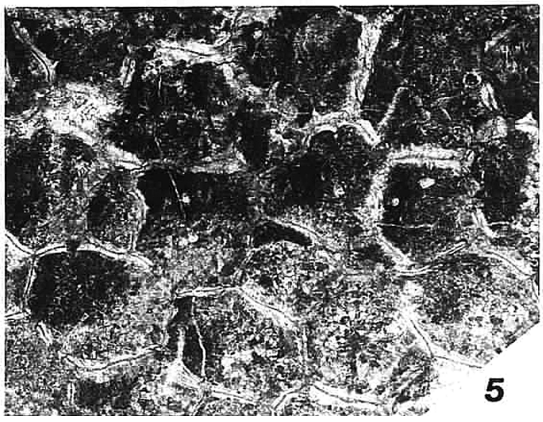
Diagnosis: Species of *Axuolites* with relatively large corallite diameters, commonly 1.4–1.8 mm in cerioid portion; intercorallite walls mostly thin, 0.05–0.07 mm, but attaining 0.25 mm in thickened part; mural pores common; septal spines sporadic, short; spacing of tabulae wide,

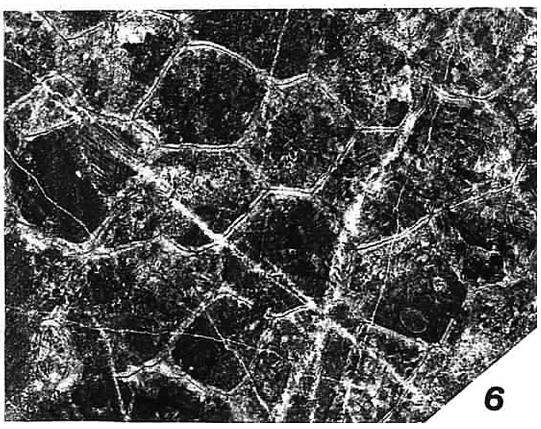

1


2


3


4


5


6

1–3 tabulae in 2 mm.

Description: Coralla encrusting, thick tabular in growth form; the largest fragment of corallum (holotype) attains 58 mm in diameter and 9 mm in height. Basal part of corallum is alveolitoid that composed of prostrate corallites having fan-shaped, semicircular to subtrapezoidal transverse sections; more distal corallites indicate erect and prismatic forms with transverse sections of 4–8 sided polygonal, to form cerioid part; ratios of height of alveolitoid portion per corresponding corallum height are approximately 0.3–0.4; diameters of corallites are relatively large for the genus, 0.8 × 0.4 to 1.7 × 1.2 mm in alveolitoid and 1.0–2.1 (commonly 1.4–1.8) mm in cerioid portions; form ratios (width/height) of prostrate corallites are approximately 1.2–2.0; calices very shallow; increase of new corallites is not observable. Intercorallite walls mostly thin, 0.05–0.07 mm, but partial thickening developed, where wall thickness attains 0.25 mm; structurally, intercorallite walls differentiated into median dark line and stereoplasm; microstructure of stereoplasm is not preserved; mural pores commonly occur in corallite faces and at corallite angles; diameters of pores are approximately 0.13 mm; septal spines sporadic, high conical to needle-like with short length, 0.08–0.19 mm; tabulae complete, weakly concave; spacing of tabulae is wide; there are 1–3 tabulae in 2 mm of corallite length.

Etymology: The specific name is derived from Higo, where is the historic province name of the type locality.

Occurrence: Rare in gray limestones (Ludlow; early Late Silurian) at locality 2 (NMNS PA18350) and 3 (NMNS PA18351–18353). Detailed geographic positions of these localities are given in Niko (2015).

Discussion: Among previously known three Silurian species of *Axuolites*, the generic type, *A. notabilis*, is most closely related to *A. higoensis* sp. nov. However, *A. notabilis* has somewhat smaller diameters of corallites (1–1.5 mm) and more closely spaced tabulae (approximately 3–6 tabulae in 2 mm) than those of *A. higoensis*. *Axuolites karashokensis* (Sharkova *in* Litvinovich *et al.*, 1963, p. 154, 155, pl. 24, figs. 2, 3) clearly differs from the new species in having more numerous mural pores. *Axuolites borissiakae* (Chernyshev *in* Vasilyuk *et al.*, 1960, p. 186, 187, pl. 31, figs. 4a, b) is diagnosed by very long and well-developed septal spines.

Previous records of *Axuolites* were limited in the Urals, Central Asia including Kazakhstan and Outer Mongolia, and southwestern Australia (Sharkova, 1963; Hill, 1981). Thus, the present discovery from the Fukami Formation extends the geographic range of the genus to East Asia.

Acknowledgements

The author thanks the following individuals. The late Dr. Takashi Hamada provided information of Silurian fossil localities in the Fukami area. Mr. Yoshihito Senzai assisted with field collections. Comments by the reviewer Dr. Hisayoshi Igo improved the manuscript.

References

Hill, D. (1981) Part F, Coelenterata. Supplement 1, Rugosa and Tabulata. In: Moore, R. C. *et al.* (Eds.), Treatise on Invertebrate Paleontology. The Geological Society of America, INC. and the University of Kansas, Boulder, Colorado and Lawrence, Kansas, pp. F1–F762.

Lin, B., Tchi, Y., Jin, C., Li, Y. and Yan, Y. (1988) Monograph of Palaeozoic Corals. Tabulatomorphic Corals, Volume 1. 467 pp. Geological Publishing House, Beijing. (In Chinese with English abstract.)

Litvinovich, N. V., Bondarenko, O. B., Sverbilova, T. V.,

Fig. 1. *Axuolites higoensis* sp. nov., thin sections. **1**–**5**, holotype, NMNS PA18350. 1, longitudinal section of corallum, × 5. **2**, partial enlargement of Fig. 1-5 to show details of septal spines, mural pores and intercorallite wall structure, negative print, × 14.5. **3**, transverse to oblique sections of corallites, × 10. **4**, partial enlargement of Fig. 1-1 to show transverse sections of corallites in alveolitoid and longitudinal sections of dittos in cerioid portions, × 10. **5**, transverse sections of corallites, × 10. **6**, paratype, NMNS PA18352, transverse sections of corallites, × 10.

Smelovskaya, M. M., Troitskaya, T. D. and Sharkova, T. T. (1963) Stratigraphy and Fauna of Palaeozoic Beds of the Tarbagatai Ridge (Ordovician, Silurian, Devonian, and Lower Carboniferous). 472 pp. Gosudarstvennoe Nauchno-Tekhnichescoe Izdatel'stovo Literatury po Geologii i Okhrane Nedr, Moscow. (In Russian.)

Matsumoto, T. and Kanmera, K. (1964) Explanatory Text of the Geological Map of Japan. Scale 1 : 50,000. 147 pp. Geological Survey of Japan, Kawasaki. (In Japanese with English abstract.)

Milne-Edwards, H. and Haime, J. (1850) A Monograph of the British Fossil Corals. First Part. Introduction; Corals from the Tertiary and Cretaceous Formations. 71 pp., 11 pls. Monographs of the Palaeontographical Society, London.

Murata, M. (1992) 2.7 Chichibu Terrane. (1) Kurosegawa Tectonic Zone. 1. Paleozoic Formations. In: Karakida, Y. *et al.* (Eds.), Regional Geology of Japan. Part 9. Kyushu. Kyoritsu Shuppan, Tokyo, pp. 48–51. (In Japanese)

Niko, S. (2015) Halysitid tabulate corals from the Silurian Fukami Formation, Kumamoto Prefecture, Japan. *Bulletin of the National Museum of Nature and Science*, *Series C*, **41**: 17–23.

Sardesson, F. W. (1896) Ueber die Beziehungen der fossilen Tabulaten zu den Alcyonarien. *Neues Jahrbuch für Mineralogie*, *Geologie und Paläontologie*, *Beilage-Band*, **10**: 249–362.

Sharkova, T. T. (1963) The new genus *Axuolites* (Favositida) from the Late Silurian of Kazakhstan. *Akademiia Nauk SSSR*, *Paleontologicheskii Zhurnal*, 1963, (3): 117–119. (In Russian.)

Sokolov, B. S. (1950) Systematics and history of the development of the Paleozoic corals Anthozoa Tabulata. *Voprosy Paleontologii*, **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. *Trudy Vsesoyuznogo Nauchno-Issledovatel'skogo Geologo-Razvedochnogo Instituta*, *Novaya Seriya*, **62**: 1–292, pls. 1–40. (In Russian.)

Vasilyuk, N. P., Dubatolova, Yu. A., Kim, A. I., Kovalevskii, O. P., Leleshus, V. L., Chernova, I. A. and Chekhovich, V. D. (1960) Class Anthozoa. Subclass Tabulata. In: Markovskii, B. P. (Ed.), New Species of Ancient Plants and Invertebrates of the SSSR, Part 1. Vsesoyuznyi Nauchno-Issledovatel'skii Geologicheskii Institut, Ministerstva Geologii i Okhrany Nedr SSSR, Moscow, pp. 173–213, pls. 30–41. (In Russian.)

Wedekind, R. (1937) Einführung in die Grundlagen der Historischen Geologie. II. Band. Mikrobiostratigraphie, Die Korallen- und Foraminiferenzeit. 136 pp., 16 pls. Ferdinand Enke, Stuttgart.