Early Permian (Asselian) orthoconic cephalopods from the Taishaku Limestone, Akiyoshi Belt, Southwest Japan

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Early Permian (Asselian) orthoconic cephalopods from the Taishaku Limestone, Akiyoshi Belt, Southwest Japan

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Abstract: Orthoconic cephalopods including two species of the orthocerid nautiloids, *Michelinoceras hasei* sp. nov. and *Bogoslovskya miharanoroensis* Niko and Ozawa, 1997, and a bactritoid, *Aktastioceras nishikawai* Niko, Nishida and Hamada, 1993, are described from the Lower Permian (Asselian) limestone in the Miharanoro area of Hiroshima Prefecture, Southwest Japan. Stratigraphically, the limestone belongs to the Uyamano Formation of the Taishaku Limestone. *Michelinoceras hasei* differs from comparable taxa in the possession of the surface grooves.

Introduction

Following previous two papers (Niko et al., 1993; Ehiro et al., 2014) the present contribution deals subsequent results of detailed investigations of the cephalopod material that collected from the Taishaku Limestone over the ten years in 1950's to 1960's and preliminary examined by Hayasaka and Nishikawa (1962; faunal composition was introduced by Koizumi, 1967a, b, 1975, as the personal communications from the authors). Here, we additionally describe orthoconic cephalopods. They are *Michelinoceras hasei* sp. nov., *Bogoslovskya miharanoroensis* Niko and Ozawa, 1997, and *Aktastioceras nishikawai* Niko, Nishida and Hamada, 1993.

Systematic Paleontology

Class Cephalopoda Cuvier, 1797
Subclass Nautiloidea Agassiz, 1847
Order Orthocerida Kuhn, 1940
Superfamily Orthoceratoidea M'Coy, 1844
Family Orthoceratidae M'Coy, 1844
Subfamily Michelinoceratinae Flower, 1945
Genus ***Michelinoceras*** Foerste, 1932
Type species.—*Orthoceras michelini* Barrande, 1866.

Michelinoceras hasei sp. nov.
Figures 1.1–1.5, 1.14

Diagnosis.—Species of *Michelinoceras* with 4° in angle of conch expansion and transverse grooves as surface ornamentation; camerae relatively short indicating 1.3–2.0 in form ratios (maximum width/length); siphuncle central and narrow.

Description.—An incomplete phragmocone is available for study, that indicates longiconic orthocone with gradual conch expansion having approximately 4° in angle; its approximate diameter and length are 9 mm near apical end and 51 mm, respectively; cross sections of conch are circular; shell surface ornamented by transverse fine grooves. Septa deeply concaved; sutures are not observable in the specimen, but apparent sinus and obliqueness of sutures are not recognized in longitudinal sections; cameral length relatively short for the genus; form ratios (maximum width/length) of camera are 1.3–2.0; siphuncle is central in position and consists of orthochoanitic septal necks and cylindrical connecting rings; length of septal necks is long, 0.9–1.2 mm; diameter of siphuncle is narrow, 0.9–1.0 mm; ratios of siphuncular diameter per shell diameter are approximately 0.1; endosiphuncular and cameral deposits are not developed.

Material examined.—Holotype, IGPS coll. cat. no. 111503.

Occurrence and age.—*Michelinoceras hasei* sp. nov. was discovered in massive limestone at locality 1 in Ehiro et al., (2014, fig. 1) in the Miharanoro area of Tojo-cho, on the eastern end of Shobara City, Hiroshima Prefecture, Southwest Japan. Stratigraphically, the fossil-bearing limestone belongs to the Uyamano Formation of the central facies in the Taishaku Limestone (Hase et al., 1974). The age of the associated ammonoid fauna with *M. hasei* is highly likely to be Asselian (early Early Permian; Ehiro et al., 2014).

Etymology.—The specific name honors the late Dr. Akira Hase in recognition of his contributions for geology of the Taishaku Limestone.

Discussion.—*Michelinoceras hasei* sp. nov. somewhat resembles *M. magnum* Shimansky (1968, p. 53, 54, pl. 1, figs. 1a, b, v, 2) from the upper Lower Carboniferous of southern Urals in its gross conch shape, relatively short camera for the genus, and narrow siphuncle. However, the Russian species lacks surface ornamentation. *Michelinoceras*? sp. (Niko and Ozawa, 1997, p. 48, figs. 2.14–2.16) from the *Triticites contractus* Zone (late Gzhelian to early Asselian; late Late Carboniferous to early Early Permian) of the Taishaku Limestone also differs from the new species in having the smooth shell surface.

Genus ***Bogoslovskya*** Zhuravleva, 1978

Type species.—*Bogoslovskya perspicua* Zhuravleva, 1978.

Bogoslovskya miharanoroensis Niko and Ozawa, 1997

Figures 1.6, 1.7

Bogoslovskya miharanoroensis Niko and Ozawa, 1997, p. 48, 50, figs 2.1–2.9.

Description.—Longiconic orthocones with gradual conch expansion and circular (to slightly compressed?) cross sections; apical end of a relatively well-preserved specimen (IGPS coll. cat. no. 111499) has 11 mm in approximate diameter; shell surface ornamented by distant ridges forming very narrow ribs, whose direction is oblique and towards apex on siphuncular side. Sutures straight and transverse; siphuncle submarginal in position.

Material examined.—IGPS coll. cat. nos. 111498–111500. In addition, two poorly preserved specimens, IGPS coll. cat. nos. 111501 and 111502, are questionably assigned to this species.

Occurrence and age.—Same as *Michelinoceras hasei* sp. nov.

Discussion.—Morphologies of the present specimens are consistent with those of *Bogoslovskya miharanoroensis* described by Niko and Ozawa (1997) from the *Triticites contractus* Zone of the Taishaku Limestone. This species resembles *B. akiyoshiensis* Niko, Nishida and Kyuma (1995, p. 193, 195, figs. 1.1–1.14) from the Moscovian (Upper Carboniferous) strata of the Akiyoshi Limestone, but in shell surface of the latter species is ornamented by fine transverse lirae. Another Middle Carboniferous species of *Bogoslovskya* from Japan, *B. omiensis* Niko (2001, p. 115–118, figs.1.1–1.3, 1.5–1.9), clearly differs from *B. miharanoroensis* by its strongly eccentric siphuncular position.

Subclass Bactritoidea Shimansky, 1951

Order Bactritida Shimansky, 1951

Family Parabactritidae Shimansky, 1951

Genus ***Aktastioceras*** Shimansky, 1948

Type species.—*Aktastioceras kruglovi* Shimansky, 1948.

Aktastioceras nishikawai Niko, Nishida and Hamada, 1993

Figures 1.8–1.13, 1.15

Orthoceras cfr. *adrivnense*[sic]; Koizumi, 1967a, p. 135; 1967b, p. 208.

Psevdorthoceras[sic] cfr. *adrianense* (Gemmellaro, 1890); Koizumi, 1975, p. 22.

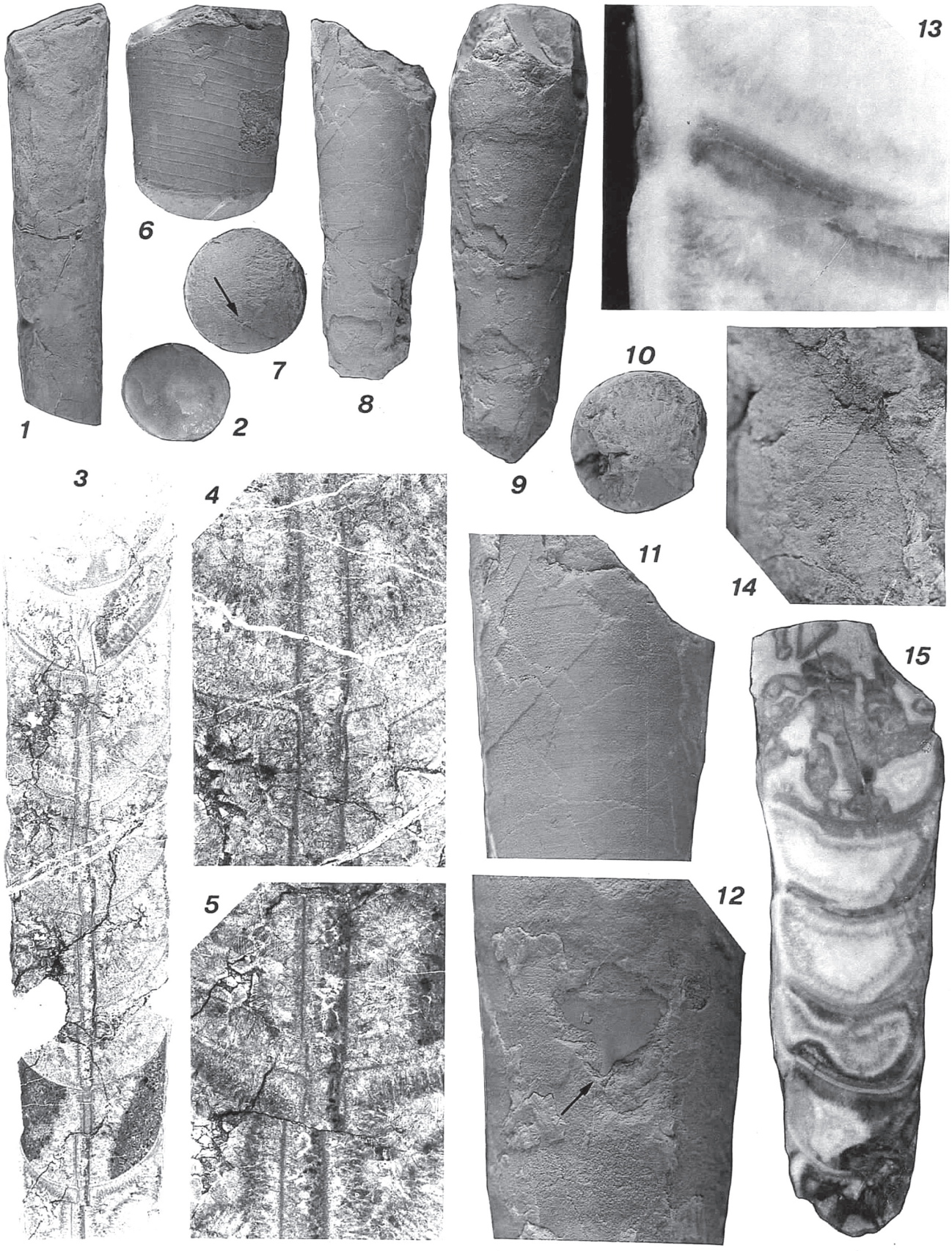
Aktastioceras nishikawai Niko, Nishida and Hamada, 1993, p. 314, 315, figs. 2.1–2.8.

Description.—Longiconic orthocones with approximately 9° in angle of conch expansion; cross sections of conchs are circular at apical shell and laterally compressed in adoral one; shell surface is marked by very fine lirae that run directly transverse to conch axis. Septa indicate deep concavities; except for dorsal sinus, sutures are straight and transverse; cameral length moderate for the genus; form ratios (maximum width/length) of camera are 1.8–2.3; siphuncle situates dorsal margin with orthochoanitic septal necks; length of septal necks is short, approximately 1.0 mm; diameter of septal foramen is approximately 0.8 mm; no connecting ring preserved;

Material examined.—IGPS coll. cat. nos. 111504 and 111505.

Occurrence and age.—Same as *Michelinoceras hasei* sp. nov.

Figure 1. Orthoconic cephalopods from the Taishaku Limestone in the Miharanoro area of Tojo-cho, on the eastern end of Shobara City, Hiroshima Prefecture. **1–5, 14.** *Michelinoceras hasei* sp. nov., holotype, IGPS coll. cat. no. 111503: 1, side view, ×1.5; 2, cross sectional view of polished apical end, ×1.5; 3, thin longitudinal section, ×3; 4, 5, partial enlargements of Figure 1.3 to show details of siphuncular structures, ×10; 14, surface ornamentation of transverse grooves, ×5. **6, 7.** *Bogoslovskya miharanoroensis* Niko and Ozawa, 1997: 6, IGPS coll. cat. no. 111500, lateral view, siphuncular side on right, ×2; 7, IGPS coll. cat. no. 111499, septal view, arrow indicates siphuncle, ×2. **8–13, 15.** *Aktastioceras nishikawai* Niko, Nishida and Hamada, 1993: 8, 11, IGPS coll. cat. no. 111505; 8, side view, ×1.5; 11, partial enlargements of Figure 1.8 to show surface ornamentation of very fine transverse lirae, ×3; 9, 10, 12, 13, 15, IGPS coll. cat. no. 111504; 9, lateral view, venter on right, ×1.5; 10, cross sectional view of adoral end, venter down, ×1.5; 12, dorsal view, arrow indicates siphuncle, ×3; 13, partial enlargement of Figure 1.15 to show details of siphuncular structure, ×8; 15, dorsoventral polished section, venter on right,×2.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Discussion.—Records of bactritoid cephalopods from Japan are rare and restricted in allochthonous limestone bodies in the Akiyoshi Belt, including Akiyoshi (Niko et al., 1991), Omi (Niko, 2001), and Taishaku (Niko et al., 1993; Niko and Ozawa, 1997; this report).

Based on an associated label, it seems that a specimen (IGPS coll. cat. no. 111505) of *Aktastioceras nishikawai* was assigned tentatively to an orthocerid genus, *Pseudorthoceras* Girty, 1911, by Dr. Ichiro Hayasaka and Mr. Isao Nishikawa. This unpublished result was introduced by Koizumi (1967a, b, 1975). These erroneous assignments are corrected herein.

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