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journal or publication title	Bulletin of the Tohoku University Museum
volume	15
page range	1-4
year	2016-03
URL	http://hdl.handle.net/10097/00128608

Trematoceras hikichii sp. nov., an Early Triassic orthocerid cephalopod from the Osawa Formation, Miyagi Prefecture, Northeast Japan

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Abstract: A new Olenekian (late Early Triassic) species of orthocerid cephalopod, *Trematoceras hikichii*, is described from the Osawa Formation in the Utatsu area, Miyagi Prefecture, Northeast Japan. The new species more or less resembles *T. mangishlakense* Schastlivtceva, 1981, from Kazakhstan and *T. insperatum* Schastlivtceva, 1988, from Caucasus. Diagnostic characters of the species from these similar species are following; 4° in angle of conch expansion and very fine transverse lirae on the shell surface. This discovery represents the first record of the genus *Trematoceras* in Japan.

Introduction

So far only limited orthocerid cephalopods from the Mesozoic have been reported, namely Triassic *Paratrematoceras* Schastlivtceva, 1981, *Pseudotemperoceras* Schastlivtceva, 1986 and *Trematoceras* Eichwald, 1851, and Cretaceous *Zhuravlevia* Doguzhaeva, 1994. Among them *Trematoceras* is the most common and best-known genus whose records are recognized in the Olenekian (late Early Triassic) to Rhaetian (late Late Triassic) marine faunas of the Tethys, Boreal and Panthalassa regions. The present paper describes a new Olenekian species of *Trematoceras* from the Osawa Formation in Northeast Japan.

Abbreviations used for repositories are IGPS (Institute of Geology and Paleontology, Faculty of Science, Tohoku University, Sendai; kept in the Tohoku University Museum) and UIM (Utatsu Ichthyosaur Museum, Minamisanriku Town).

Systematic Paleontology

Order Orthocerida Kuhn, 1940

Superfamily Orthoceratoidea M'Coy, 1844

Family Orthoceratidae M'Coy, 1844

Subfamily Michelinoceratinae Flower, 1945

Genus *Trematoceras* Eichwald, 1851

Type species.—*Orthocera* [sic] *elegans* Münster, 1841; Carnian (lower Upper Triassic) in Carnic Alps.

Trematoceras hikichii sp. nov.

Figure 1

Diagnosis.—Species of *Trematoceras* with approximately 4° in angle of conch expansion and relatively short camerae with 1.6–2.3 in from ratios (maximum width per length); transverse lirae on shell surface are very fine.

Description.—Longiconic orthocones with circular cross sections; conch expansion is gradual for the family and moderate for the genus, indicating approximately 4° in angle; holotype is incomplete phragmocone with 68 mm in length; the largest specimen (paratype, IGPS coll. cat. no. 111571) attains 99 mm in length and 7 mm in approximate diameter (reconstructed), adoral 51 mm of which specimen represents body chamber; no apical part of conch and peristome preserved; shell surface ornamented by very fine transverse lirae; there are 12–16 ridges in 1 mm of conch length. Sutures are essentially straight and transverse; septa indicate moderate curvature; camerae are relatively short for the genus indicating from ratios (maximum width per length) of 1.6–2.3; siphuncle is nearly central (faintly ventral from center); position ratios of siphuncle (distance of central axis of septal foremen from ventral shell surface per corresponding conch diameter) are 0.45–0.47; siphuncular wall consists of orthochoanitic (to suborthochoanitic) septal necks and cylindrical connecting rings; length of necks is short, 0.19–0.23 mm. Endosiphuncular deposits absent; cameral deposits are well-developed, episeptal-mural, and thicker in venter than dorsum; in later stages, cameral deposits exhibit mammillary growth and extend to hyposeptal area.

Material examined.—Holotype, IGPS coll. cat. no. 111572. Paratypes, IGPS coll. cat. nos. 111569–111571 and UIM

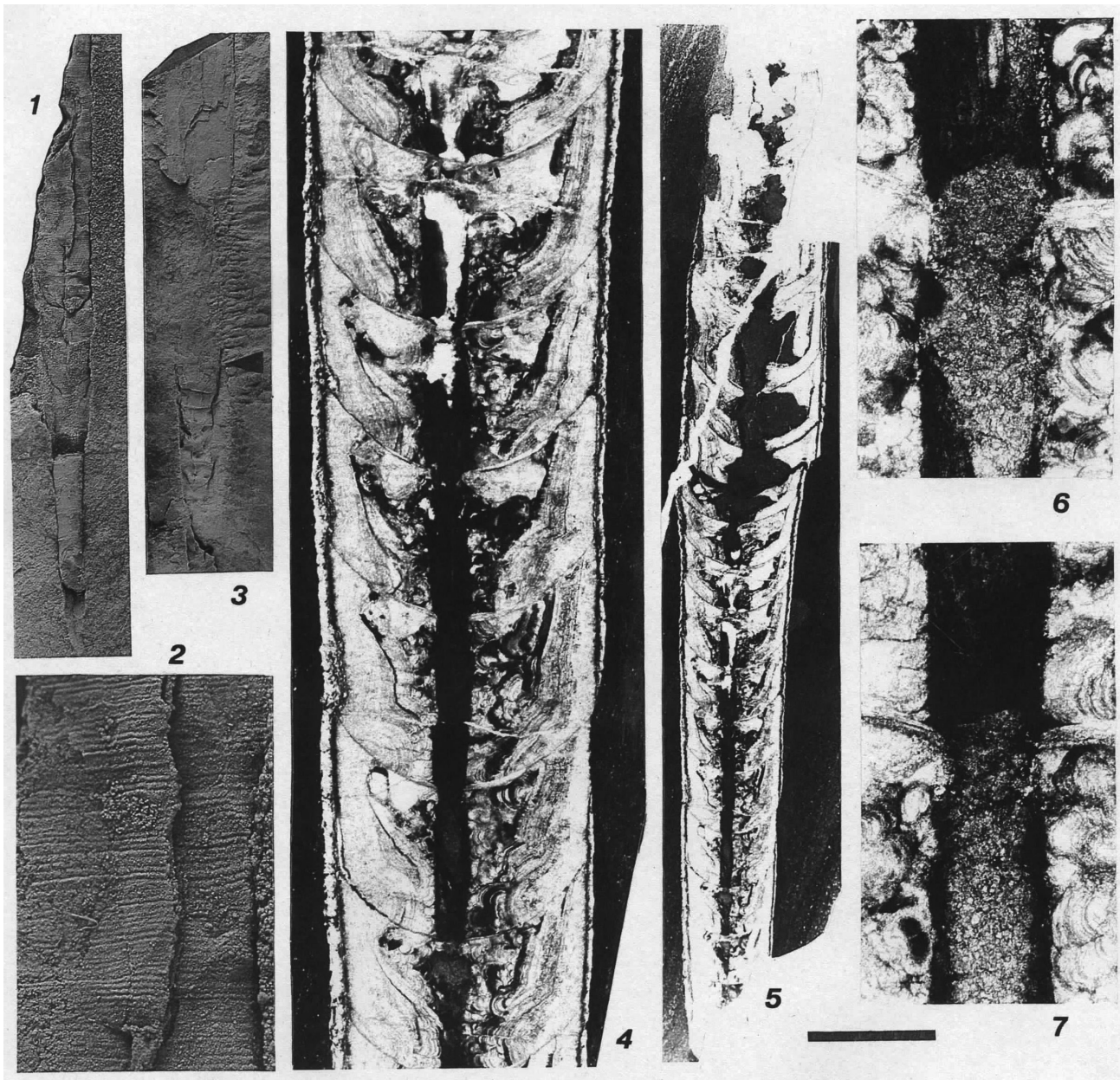


Figure 1. *Trematoceras hikichii* sp. nov. from the Early Triassic Osawa Formation in the Utatsu area, Minamisanriku Town, Miyagi Prefecture. **1, 2.** Paratype, IGPS coll. cat. no. 111569: **1**, side view of mold; **2**, partial enlargement of Figure 1.1 to show details of surface ornamentation, external mold. **3.** Paratype, IGPS coll. cat. no. 111571, side view of mold, arrow indicates the last septum. **4–7.** Holotype, IGPS coll. cat. no. 111572: **4**, partial enlargement of Figure 1.5, to show details of cameral deposits; **5**, dorsoventral thin section, venter on left; **6, 7**, partial enlargements of Figure 1.5 to show details of septal necks. Scale bar is 10 mm in Figure 1.1; 2 mm in Figure 1.2; 20 mm in Figure 1.3; 1.4 mm in Figure 1.4; 4 mm in Figure 1.5; 0.4 mm in Figures 1.6, 1.7.

30622. In addition, two poorly preserved specimens, IGPS coll. cat. no. 111573 and UIM 30623, were also examined.

Etymology.—The specific name honors Mr. Yasuhiro Hikichi, who discovered the holotype of the new species.

Occurrence.—All specimens of *Trematoceras hikichii* sp. nov. were collected from laminated mudstones of the Osawa Formation at the Tatezaki locality (38°42'50"N, 141°32'07"E) in the Utatsu area, Minamisanriku Town, Miyagi Prefecture,

Northeast Japan (see figures 1, 2 in Ehiro et al., 2015 for its geographic point). The specific components of the Osawa ammonoid fauna were revealed by Bando and Shimoyama (1974), Bando and Ehiro (1982), Ehiro (1993), Ehiro (2016), and Ehiro et al. (2016 in press). These results suggest that the formation is correlative with the upper Olenekian (= Spathian; upper Lower Triassic).

Discussion.—In examined specimens, only the apical shell of the holotype is undistorted. Thus, some important characters, such as profile of the conch, siphuncular structure and biotic deposits, in the above description are based on this specimen.

In its ratios of the cameral form and siphuncular position, *Trematoceras hikichii* sp. nov. resembles *T. mangishlakense* Schastlivtceva (1981, p. 79, 80, pl. 1, figs. 3a, b, 4a, b) from the Olenekian of Kazakhstan. The most important features to separate these two species are external morphologies. *Trematoceras mangishlakense* possesses slightly larger angle of conch expansion (6°–7°) and lacks evident surface ornamentation. Transverse surface lirae are developed also in *T. insperatum* Schastlivtceva (1988, p. 67, 68, pl. 2, figs. 12a, b, v) from the Anisian (lower Middle Triassic) of Caucasus, but its interspaces of the liare are much wider, 2–3 ridges in 1 mm, than those of the new species. The type species of the genus, *T. elegans* (Münster, 1841, p. 125, pl. 14, figs 2a–c; Bizzarini and Gnoli, 1991, p. 112, pl. 1, figs. 1–4, pl. 2, figs. 1, 2) clearly differs from the new species in having strongly oblique surface liare and longer camerae.

This discovery from the upper Olenekian Osawa Formation is noteworthy because it represents the first record of *Trematoceras* in Japan. In addition, previous Early Triassic occurrences of the genus were restricted in Albania, Kazakhstan, northeastern Siberia, Primorye, and Vietnam (Kiparisova, 1961; Schastlivtceva, 1988; Shigeta and Nguyen, 2014).

Acknowledgements

We are greatly indebted to Mr. Yasuhiro Hikichi. The present research is not possible without his discovery and donation of an exceptionally well-preserved specimen (holotype). We also thank Dr. Harumasa Kano for collecting some specimens. Thanks extend to the Educational Committee of Minamisanriku Town and Abei-Gumi Co. Ltd. for permissions to excavate fossiliferous beds at the Tatezaki locality. Reviewer Dr. Yasufumi Iryu kindly provided helpful comments on a previous version of this paper.

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