Early Permian ammonoids from the Takakurayama area, Abukuma Mountains, northeast Japan

Masayuki FUJIKAWA* and Chisato SUZUKI**

Abstract

Four ammonoid species, Thalassoceras? sp., Artinskia sp., Agathiceras sp., and Paragastrioceras? sp., are described from the lower part of the Takakurayama Formation in the Takakurayama area, Abukuma Mountains, northeast Japan. This fauna indicates an Early Permian (Sakmarian-Artinskian) age. Three of these species except for Agathiceras sp. are described from the Takakurayama Formation for the first time.

Key words: Abukuma Mountains, ammonoid, Early Permian, Takakurayama.

Introduction

The Permian Takakurayama Formation (Onuki, 1966) is widely distributed in the Takakurayama area, Abukuma Mountains, South Kitakami Belt, northeast Japan (Fig. 1). The formation is exposed on the northeastern slope of Mt. Takakurayama, where it generally strikes NNE-SSW and dips at 30-45º to the west. It consists mainly of black shale with subordinate sandstone and conglomerate, and is more than 805 m in total thickness (Fig. 2). The formation is subdivided into three members: the Iriishikura, Motomura, and Kashiwadaira members, in ascending order (Onuki, 1966). These members are equivalent to the Iriishikura, Motomura, and Kashiwadaira formations proposed by Yanagisawa and Nemoto (1961). Here, we adopt Onuki’s scheme, and refer to the lower part of the Takakurayama beds as the Iriishikura Member. This paper describes ammonoid specimens

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collected from locality T1 of the Iriishikura Member, which consists mainly of shale and minor sandstone beds.

Yanagisawa and Nemoto (1961) were the first to describe the ammonoid fauna from the Takakurayama Group (Formation), reporting *Medlicottia* sp., *Paraceltites* sp., *Waagenoceras* sp., and *Agathiceras* sp. Hayasaka (1965) described eight species of Permian ammonoids collected from the Kashiwadaira Formation (Member): *Propinacoceras* spp. indet., *Medlicottidae*? gen. et sp. indet., *Paraceltites aff. elegans* Girty, *Pseudogastrioceras* sp. indet., *Agathiceras cf. suessi* Gemmellaro, *Stacheoceras aff. grunwaldti* Gemmellaro, *Popanoceras* sp. indet., and *Waagenoceras cf. dieneri richardsoni* Miller and Furnish. Subsequently, Yanagisawa (1967) described the following Middle Permian ammonoids from localities T7 and T8 (Fig. 2) of the Kashiwadaira Member: *Agathiceras cf. suessi*, *Waagenoceras cf. dieneri Böse*, *Propinacoceras aff. knighti* Miller and Furnish, *Medlicottia cf. costellifera* Miller and Furnish, *Paraceltites aff. elegans*, and *P. elegans*. Tazawa et al. (2005) reported four Middle Permian (Wordian) ammonoid species from locality T7 of the Kashiwadaira Member: *Propinacoceras sp.*, *Agathiceras sp.*, *Mexicoceras? sp.*, and
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Roadoceras sp. Finally, Ehiro (2008) described five species of Middle Permian (Wordian) ammonoids from locality T₃ of the Kashiwadaira Member: Jilingites? sp., Waagenoceras sp., Popanoceras sp., Tauroceras sp., and Agathiceras sp.

In this paper, we describe four species of Early Permian ammonoids from locality T₁ of the Irishikura Member. All of the ammonoid specimens described in this paper are housed in the Fukushima Museum, Japan, under the prefix ‘FM-N’.

**Age of the lower Takakurayama Formation**

Many types of faunas have been collected from locality T₁, including anthozoans, echinoderms, brachiopods, gastropods, and cephalopods (Yanagisawa, 1967; Tazawa, 2008). Yanagisawa (1967) assigned a Middle Permian age to locality T₁ based on the occurrence of Paraceltites aff. elegans. Tazawa (2008) reported five brachiopod species: Chonetinella transversa Tazawa, Dyoros (Dyoros) sp., Haydenella sp., Lamnimargus peregrinus (Fredericks), and Yakovlevia mammatiformis (Fredericks) from locality T₁. These brachiopod fossils were interpreted as reworked fossils, and the age of locality T₁ was assigned a Late Permian (Lopingian) age.
The four ammonoid species collected from locality T_1 and described in this paper provide valuable age constraints based on their stratigraphic distributions (Fig. 3), which follow the results reported by Zhou et al. (1999) and Furnish et al. (2009). The ages indicated by *Thalassoceras*, *Agathiceras*, *Paragastrioceras*, and *Artinskia* are Sakmarian-Wordian, Kasimovian-Wordian, Asselian-Kungurian, and Gzhelian-Artinskian, respectively. Therefore, the ammonoid fauna from T_1 indicates an Early Permian (Sakmarian-Artinskian) age. This finding differs from the Middle Permian age proposed by Yanagisawa (1967). This discrepancy may have arisen from the mis-identification of *Paraceltites* aff. *elegans* by Yanagisawa. No photograph of *P*. aff. *elegans* has been published, and there is no systematic description of the specimen at locality T_1. It is therefore necessary to confirm the identification of the specimen of *P*. aff. *elegans* from this locality. If the specimen has been mis-identified, locality T_1 would be assigned to a strict age of Early Permian (Sakmarian-Artinskian). Meanwhile, we cannot say for certain whether these fossils are reworked or not. If the ammonoid fauna from T_1 were reworked, the age of locality T_1 might be changed to younger age than Early Permian.
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Systematic paleontology

Order Goniatitida Hyatt, 1884
Suborder Goniatitina Hyatt, 1884
Superfamily Thalassocerataceae Hyatt, 1900
Family Thalassoceratidae Hyatt, 1900
Genus *Thalassoceras* Gemmellaro, 1887

*Type species.*—*Thalassoceas mediterraneum phillipsi* Gemmellaro, 1887.

*Thalassoceras? sp.*

Figs. 4.1a-4.2b

*Material.*—Two laterally compressed and deformed specimens, FM-N201000040, FM-N201000041.

*Description.*—Shell medium to large for genus (Table 1). The lenticular conch is deformed laterally due to tectonic deformation. Moderately involute conch has very small umbilicus (The ratio of U/D is from 0.06 to 0.09). Whorl cross section is not precisely known by compression, but seems elliptical, higher than wide (W/H is from 0.42 to 0.77). Shell surface is smooth, and there is no ornamentation as ribs, tubercles or growth lamellae on lateral and ventral shell. Laterally flattened shell is broadly rounded, narrow venter rounded acutely but not angular. Ventral and umbilical shoulders are gently rounded, not ornamented or flared. The suture line is not preserved.

<table>
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<th>Figure</th>
<th>Reg. No.</th>
<th>D</th>
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<td>25.5</td>
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Comparison.—The Family Thalassoceratidae consists of *Gleboceras*, *Mapesites*, *Thalassoceras*, *Aristoceras*, *Aristoceratoides*, *Eothalassoceras*, *Epithalassoceras*, and *Prothalassoceras*. *Gleboceras* has wide whorl and venter gently rounded. *Mapesites* has subglobose conch and strong ribs and tubercules on surface of the shell. *Aristoceras* has deep grooves on ventrolateral shoulder. *Aristoceratoides* has wide whorl and ventrolateral grooves. *Eothalassoceras* has wide conch compare with *Thalassoceras*. *Epithalassoceras* and *Prothalassoceras* are distinguished from *Thalassoceras* by the wide umbilicus. So these specimens can be referred to *Thalassoceras*. However, it is insufficient to determine the genus name for the lack of the suture line. Therefore, we gave the genetic name questionably. The small umbilicus, broadly rounded lateral shell and lenticular conch of these specimens closely resembles to those of *Thalassoceras mediterraneum* (Leonova and Dmitriev, 1989, pl. 5, fig. 8) from the southeastern Pamirs and *T. gemmellaroi* (Ruzhencev, 1956, pl. 6, figs. 1-5) from the southern Urals. The lenticular conch of *T. wadei* (Miller, 1936, pl. 92, figs. 8-12) from the lower Ferruginous Series, western Australia, and *T. welleri* (Miller and Parizek, 1948, pl. 57, figs. 3-6) from the Hueco Formation, New Mexico, are also similar to these specimens.

Measurements.—See Table 1.

Suprafamily Agathicerataceae Arthaber, 1911
Family Agathiceratidae Arthaber, 1911
Genus *Agathiceras* Gemmellaro, 1887

Type species.—*Agathiceras suessi* Gemmellaro, 1887.

*Agathiceras* sp.
Figs. 4.8a-4.11b, 5

Material.—Four specimens. One fragmental body chamber, two partly compressed specimens, and one lateral mould, FM-N201000047, FM-N201000048, FM-N201000049, FM-N201000050.

Description.—Shell medium for genus, diameter of conch is from 16.1 mm to 17.0 mm (Table 1). The discoidal conch has fine longitudinal lirae, and three or four sinuous transverse constrictions on lateral shell. Conch strongly involute. The specimen FM-N201000049 has very small umbilicus (U=1.3 mm, U/D=0.09). Umbilicus of two of specimens (FM-N201000048, FM-N201000050) closed. Whorl cross section is gently rounded, almost ellipse shaped. There is no rib or tubercles on ventrolateral shoulder. The suture line (Fig. 5) shows the typical *Agathiceras*’s one, three broad saddles and lobes are presented. Lateral lobes and saddles broad, gently rounded, with pouched. Width of lobes and saddles seem almost same.

Comparison.—Family Agathiceratidae consists of *Agathiceras*, *Gaetanoceras* and *Pericleites*. *Gaetanoceras* and *Pericleites* distinguished from *Agathiceras* by lack of fine
longitudinal lirae. These specimens are identified as *Agathiceras*. However, these specimens are laterally compressed or lateral mould, so the thickness of conch is uncertain. It is insufficient to determine the species name. Therefore, we treat these specimens under the open nomenclature.

The genus *Agathiceras* is one of the most famous goniatitid ammonoids and was established by Gemmellaro (1887) based on specimens from the Sosio beds of Sicily. It is an almost cosmopolitan genus, and is known to occur from the Lower Pennsylvanian to the Middle Permian. The present species of the genus *Agathiceras* might be similar particularly to the specimens from Takakurayama, Japan (Tazawa et al., 2005, fig.5, B-D), in having fine longitudinal lirae, thickly discoidal involute conch and very small umbilicus.

**Measurements.**—See Table 1.

Superfamily Gastriocerataceae Hyatt, 1884  
Family Paragastrioceratidae Ruzhencev, 1951  
Genus *Paragastrioceras* Tchernow, 1907

_Type species._*Goniatisites jossae* de Verneuil, 1845.

*Paragastrioceras*? sp.  
Figs. 4.12a-4.12b

**Material.**—One fragmental specimen, FM-N201000051.

**Description.**—Shell medium for genus (Table 1). The globular conch is evolute, and has wide umbilicus. U/D can be estimated 30-40%. Umbilical wall steep, umbilical shoulder rounded acutely. Whorl cross section seems almost circle, slightly wider than height (W/H=1.1). Shell surface is smooth. Strong ribs are pronounced on umbilical shoulder, and transversely elongated. They gradually fainted and fade out to ventrolateral shoulder. Venter and ventrrolateral shoulder gently rounded. Growth line, reticulate sculpture and suture line is not preserved.

**Comparison.**—Five Paragastrioceratid genera, *Epijuresanites, Svetlanoceras,*
Synuraloceras, Tumaroceras, and Uraloceras, are taxonomically close to Paragastrioceras. Epijuresanites and Tumaroceras have smooth shell and do not have the ornamentation. Svetlanoceras has numerous fine ribs on lateral shell. Synuraloceras has angular venter and fine growth lines. Uraloceras has fine longitudinal lirae and angular umbilical shoulder. Strong ribs and rounded wide whorl of this specimen might be determined as the genus Paragastrioceras. However, this specimen is fragment and the whole conch is uncertain. In addition, the suture line is not preserved. Therefore, we identified the genetic name with questionably. Many species of Paragastrioceras (Bogoslovskaya, 1976; Glenister and Furnish, 1961; Plummer and Scott, 1937; Nassichuk, 1971; Nassichuk et al., 1965; Ruzhencev, 1956; Teichert, 1942) are closely similar to this specimen on the strong ribs and evolute conch, nevertheless, it is difficult to compare some specimens (Hayasaka, 1947; Zhao and Zheng, 1977; Zhu and Sheng, 1988) with the present specimen for their poor photographs.

**Measurements.**—See Table 1.

Order Prolecanitida Miller and Furnish, 1954
Superfamily Medlicottiaceae Karpinsky, 1889
Family Medlicottidae Karpinsky, 1889
Genus Artinskia Karpinsky, 1926

*Type species.*—Goniatites falx Eichwald, 1857.

Artinskia sp.
Figs. 4.3a-4.7b, 6

*Material.*—Five specimens. All of them are fragmental, FM-N201000042, FM-N201000043, FM-N201000044, FM-N201000045, FM-N201000046.

*Description.*—Shell medium for genus (Table 1). The conch is involute and thinly discoidal.
Whorl cross section is rectangular, W/H is 0.45 (FM-N201000042). Umbilicus is closed. Shell surface is laterally smooth and so flat that almost parallel. The venter bears two rows of prominent nodes or short ribs toward the ventrolateral shoulder. The median groove on the venter separates those nodes. The suture line (Fig. 6) is poorly preserved in one specimen (FM-N201000044). Lateral saddles are narrow and high compare with width. The top of saddle is rounded. Ventral, ventrolateral, umbilical parts and lateral lobes are not preserved.

**Comparison.**—Genera of the Family Medlicottidae are cosmopolitan and are morphologically so close to each other. *Medlicottia, Eumedlicottia, Neogeoceras,* and *Syrdenites* are taxonomically close to *Artinskia.* *Medlicottia, Eumedlicottia,* and *Syrdenites* have concave venter without ventrolateral nodes. *Neogeoceras* has wide umbilicus. Therefore, these specimens are identified as *Artinskia.* However, to determine the species name, the suture line is so important in this case, therefore we should treat these specimens under the open nomenclature. *Artinskia artiensis, A. adkinsi, A. electraensis* (Plummer and Scott, 1937, pl. 4, figs. 1-4, 6-21), *A. falx, A. huecoensis, A. electraensis* (Miller and Furnish, 1940, pl. 2, figs. 7, 8, pl. 3, figs. 1-3, pl. 4, figs. 3, 4), *A. adkinsi, A. liliaceae* (Miller and Youngquist, 1947, pl. 3, fig. 6-9), and other species are very similar on the thinly discoidal conch and two rows of prominent nodes on ventrolateral shoulder.

**Measurements.**—See Table 1.

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