New radiolarian species from Late Jurassic chert-terrigenous deposits of the Taukha Terrane, Southern Sikhote-Alin

Authors: Igor' V. Kemkin, and Yojiro Taketani

Source: Paleontological Research, 8(4) : 325-336

Published By: The Palaeontological Society of Japan

URL: https://doi.org/10.2517/prpsj.8.325
New radiolarian species from Late Jurassic chert-terrigenous deposits of the Taukha Terrane, Southern Sikhote-Alin

IGOR’ V. KEMKIN1 AND YOJIRO TAKETANI2

1Far East Geological Institute, Far Eastern Branch, Russian Academy of Sciences, Prospekt 100-letya 159, Vladivostok-22, 690022, Russia (e-mail: kemkin@fegi.ru)
2Fukushima Museum, Joto-Machi 1-25, Aizuwakamatsu 965-0807, Japan (e-mail: taketani.youzirou@we07.fks.ed.jp)

Received August 20, 2003; Revised manuscript accepted October 26, 2004

Abstract. Late Jurassic and Early Cretaceous well preserved radiolarians are obtained from the Taukha Terrane in the southern Sikhote-Alin, Russia. The Taukha Terrane consists of three tectono-stratigraphic units, the Erdagou, Gorbousha and Skalistorechenka units. Three new species (Stichocapsa (?) pseudo-convexa, Sethocapsa taukhaensis and Cinguloturris primorika) are described from Late Jurassic chert-terrigenous sequences of the Gorbousha Unit cropping out in the Roudnaya River and Koreyskaya River areas, and their stratigraphic ranges are made precise.

Key words: Late Jurassic, new species, Radiolaria, Russia, Sikhote-Alin, Taukha Terrane

Introduction

The Taukha Terrane, located in the southeastern part of the Sikhote-Alin folded belt, represents a fragment of an Early Cretaceous accretionary prism that was accreted to the eastern margin of the Khanka-Bureya paleocontinent at the end of the Early Cretaceous (Barremian-Albian) (Figure 1A). The structure and genesis of the terrane was decoded by careful studies including lithological, structural and especially biostratigraphic research of individual sections of the terrane and their correlation with each other.

During this research, huge amounts of data about Jurassic to Early Cretaceous radiolarian fossils were accumulated (Kemkin et al., 1992; Kemkin and Rudenko, 1993, 1994; Kemkin and Khanchuk, 1994; Kemkin, 1996a, 1996b; Kemkin et al., 1997; Kemkin and Kemkina, 1998, 1999; Kemkin et al., 1999 and others). Especially detailed studies of radiolarian assemblages were carried out in the Roudnaya River area of Dalnegorsky Town and the Koreyskaya River area (Kemkin and Kemkina, 1999; Kemkin et al., 1999). The investigated assemblages of Late Jurassic and Early Cretaceous radiolarians are characterized by a large number of well preserved specimens and rich species diversity. Most of them are also well known in other regions (Europe, America, Japan etc.) and allow us to determine the age of the deposits rather confidently. Nevertheless, some species have not been described yet. We have found some new species from the chert-terrigenous deposits of the Gorbousha Unit distributed in the Koreyskaya River and Roudnaya River areas. The descriptions and occurrences of these new radiolarian species are given.

Geological setting

The Taukha Terrane is separated from the neighbouring Samarka and Zhouravlevka terranes by faults (Figure 1A). According to new data (Kemkin and Kemkina, 2000), the terrane consists of three tectono-stratigraphic units which overlie each other and are similar in lithology and structure, but differ in the age of the rocks (Figure 1B). Each unit is composed of paleo-oceanic deposits (mainly cherty and carbonate facies) in the lowest part. Toward their middle part, the units gradually change from these facies to terrigenous rocks derived from the continental margin. The terrigenous rocks are then replaced by olistostrome.

The lower unit (Erdagou Unit) is represented by Late Jurassic to Early Cretaceous (Berriasian) cherts and clayish cherts overlying Middle Jurassic (Callovian) basalts (Erdagou Suite) and followed by
Figure 1. Tectonic map of the Sikhote-Alin region (A), tectonostratigraphic column (B) and generalized cross-section (C) of the Taukha Terrane (after Kemkin et al., 1999).

Kh-Br: Khanka-Bureya Superterrane, Sm: Samarka Terrane, Zh: Zhouravlevka Terrane, Th: Taukha Terrane, Er: Erdagou Unit, Go: Gorbousha Unit, Sk: Skalistorechenka Unit.

1: basalt, 2: chert, 3: limestone, 4: turbidite, 5: olistostrome, 6: Late Cretaceous volcanic rock, 7: character of contact between the lithological units; conformable (a) and estimated (b).
Berriasian-Valanginian turbidite deposits (Silinka Suite). The thickness of the cherts together with basalts is about 150 m, whereas the thickness of terrigenous rocks is estimated at 2500 m (Golozubov and Khanchuk, 1995). However, it is possible that the turbidite part is repeated tectonically several times. The turbidites conformably and gradually replace chert rocks by a set of siliceous mudstone and mudstone. Valanginian-Barremian olistostrome also conformably overlies the turbidites. The thickness of the olistostrome layers fluctuates from 100–200 to 400 m in different areas.

The middle unit (Gorbousha Unit) consists of Middle to Late Triassic limestone (Tetyukha Suite) with high-titanium alkaline basalts at the base (400–500 m thickness). Early Triassic to Late Jurassic cherts and clayish cherts (about 100 m) analogously change to late Tithonian to Berriasian turbidites (Gorbousha Suite), and then to Berriasian-Valanginian olistostrome. The thickness of the turbidites in different slides is 350–700 m (Volokhin et al., 1990; Bragin, 1991 and others). The thickness of the olistostrome deposit is the same as that of the Erdagou Unit.

The upper unit (Skalistorechenka Unit) is composed of Late Devonian to Early Permian limestone (Skalistorechenka Suite) associated with high-titanium alkaline basalts (about 400 m) and Carboniferous to Middle Jurassic chert rocks overlapped by Late Jurassic turbidites (Pantovyi Creek Suite). The thickness of the chert and clastic deposits is not clear because they only have fragmentary outcrops.

The apparent structure of the Taukh Terrane shows inverted stratigraphy because the older marine formations and correspondingly overlapping terrigenous rocks (including olistostromes) comprise the upper structural levels of the terrane, and younger units comprise the base (Figure 1C). However, within each structural unit the stratigraphic succession is normal (from older to younger). Such structure of the terrane results from successive accretion of different-placed units from sea-floor spreading centre sites of a paleo-oceanic plate (Kemkin and Kemkina, 2000).

Radiolarian assemblages

In the Roudnaya River area (Dalnegorsk Town), twelve successive Jurassic to Early Cretaceous radiolarian assemblages were distinguished from the chert-torrigenous sequence of the Gorbousha Unit outcropping along the left bank of the Roudnaya River (Kemkin and Kemkina, 1998, 1999). They are the Parahsuum longiconicum, Hsuum alitile, Parahsuum grande, Parahsuum hiconocosta, Hsuum mirabundum, Hsuum matsuokai, Triactoma tithonianum, Archaeodicyomitra minoensis, Pseudodicyomitra okamurai, Xitus gifuensis, Pseudodicyomitra carpatica and Cecrops sp. assemblages. However, we think that the Pseudodicyomitra okamurai assemblage should be deleted from this list and included in the Archaeodicyomitra minoensis assemblage because the species composition of the two assemblages is rather the same. The age of each assemblage and the stratigraphical position of each sample of the section are shown in Figure 2. Among the eleven assemblages, the species composition and age assignment of Late Jurassic and Early Cretaceous assemblages are as follows:

The Archaeodicyomitra minoensis assemblage was extracted from the boudinaged fragments of cherts (sample P-6) in the contact zone of cherts and cherty mudstones and green cherty mudstones (samples P-5, 86-14). This radiolarian assemblage is characterized by rich specific diversity and contains mainly nassellarian genera. They are Archaeodicyomitra, Xitus, Mirifusus, Hsuum, Sethocapsa, Pseudodicyomitra, Stichocapsa and others. The age of the assemblage is middle Oxfordian to late Kimmeridgian. The assumed lower age boundary is based on the first appearance of the index species (Baumgartner et al., 1995). The upper age limit is restricted by the last appearance of Wrangellium okamurai (= Pseudodicyomitra okamuraiz Mizutani) (Baumgartner et al., 1995). The assemblage is comparable in age with that of the upper part of the Stylocapsa (?) spiralis zone and Hsuum maxwelli zone (Matsuoka, 1995) described in Japan. It should be noted that within the assemblage there are several morphological forms that are more common in the Early Cretaceous time. They are similar to Pseudodicyomitra nuda and Pseudodicyomitra leptoconica.

The Xitus gifuensis assemblage was also found in green cherty mudstones (samples P-4, P-3). Archaeodicyomitra and Xitus predominate among the numerous radiolarians of this assemblage. Some spumellarians such as Trirabas, Emiluvia and Pantelellium are also found. The geological age of the assemblage is presumed to be late Kimmeridgian to middle Tithonian. The lower age boundary corresponds to the first appearance of Xitus gifuensis (Baumgartner et al., 1995). The upper boundary is restricted by the lower boundary of the upper assemblage. The assemblage is correlated with that of the Pseudodicyomitra primitiva zone (Matsuoka, 1995) and also contains some species which are similar to Pseudodicyomitra nuda and Pseudodicyomitra leptoconica.
The *Pseudodictyomitra carpatica* assemblage was found in black mudstones (samples P-1, P-2, 86-16) very close to the contact with green cherty mudstones. The assemblage is represented by numerous and diverse radiolarians correlated to the end of the Jurassic and the beginning of the Cretaceous time. Nassellarians such as *Pseudodictyomitra*, *Archaeodictyomitra*, *Xitus*, *Thanarla* and *Sethocapsa* are predominant. Spumellarians such as *Tritrabs*, *Emiluvia*, *Pantanellium* and others are also contained therein. The age of the assemblage is late Tithonian. The lower age boundary corresponds to the first appearance of *Pseudodictyomitra carpatica* (Matsuoka, 1992, 1995). The upper boundary is determined by the last appearance of *Archaeodictyomitra minoensis*, *Ristola altissima* and *Protunuma japonicus* (Baumgartner et al., 1995). This assemblage also contains some species similar to *Pseudodictyomitra nuda* and *Pseudodictyo-
mitra leptoconica. The assemblage is comparable in age with that of the lower part of the Pseudodictyomitra carpathica zone (Matsuoka, 1995) established in Japan.

The Cecrops sp. assemblage was distinguished in the black mudstones (sample P-0) that are 40 m above the horizon P-1 of the section. The assemblage is characterized by diverse and abundant radiolarian species. Most of them have a wide age interval. However, the presence of Cecrops sp. and Stichocapsa ex gr. altiformina allows us to determine the age as early Valanginian to early Barremian (Baumgartner et al., 1995). This assemblage is comparable in age with that of the Cecrops septemporatus zone and the lower part of the Acanthocircus carinatus zone (Matsuoka, 1995).

In the Koreyskaya River area, three successive Late Jurassic radiolarian assemblages have been distinguished from the chert-elastic sequence of the Gorbousha Unit exposed along the bank of the Koreyskaya River (Kemkin et al., 1999). They are the Xitus gifuensis, Stichomitra doliolum and Pseudodictyomitra carpathica assemblages. The age of each assemblage and the stratigraphical position of each sample of the section are also shown in Figure 2. The species composition and age assignment of the assemblages are as follows:

The Xitus gifuensis assemblage was extracted from the greenish grey clayish cherts (samples 3Ko-3, 3Ko-5, 3Ko-6, 3Ko-7, C-58, C-61, C-63, C-64, C-65, C-66, C-67, C-68, C-69, C-70, C-71, C-74). This assemblage contains numerous well preserved radiolarian faunas which are characterized by rich species diversity. They are Archaeodictyomitra, Cinguloturris, Hsuum, Parvicingula, Pseudodictyomitra, Sethocapsa, Spongocapsula, Stichocapsa, Stichomitra, Thanarla, Xitus, Wrangellium and others. The geological age of the assemblage is presumed to be late Kimmeridgian to early Tithonian. The lower age boundary corresponds to the first appearance of Xitus gifuensis, Archaeodictyomitra excellens, Obesacapsula verbana and Sethocapsa horokanaensis (Mizutani, 1981; Kawabata, 1988; Baumgartner et al., 1995). The upper boundary is restricted by the last appearance of such species as Eucyrtidiellum pyctrum, Parvicingula dhimenaeensis, Sethocapsa funatoensis, Wrangellium okamura, Triactoma blakei and Tritrabs exotica. This boundary corresponds to the early Tithonian (Pessagno, 1977; Mizutani, 1981; Aita, 1987; Baumgartner et al., 1995). The assemblage is correlated with the upper part of the Hsuum maxwelli zone and the lower part of the Pseudodictyomitra primitiva zone (Matsuoka, 1995).

The Stichomitra doliolum assemblage was found in the identical greenish-grey clayish chert (sample C-56). The assemblage is represented by numerous and diverse well preserved radiolarians related to the end of Jurassic and the beginning of Cretaceous time. Nassellarians such as Pseudodictyomitra, Cinguloturris, Parvicingula, Archaeodictyomitra, Xitus, Thanarla, Stichocapsa, Stichomitra and Sethocapsa are predominant. The assemblage also contains spumellarians such as Tritrabs and Emiluvia. The range of the assemblage is middle Tithonian to early late Tithonian. The lower age boundary is based on the absence of characteristic species of the early Tithonian (see Xitus gifuensis assemblage), as well as the presence of Stichomitra doliolum, the first appearance of which is described from the middle Tithonian (Aita and Okada, 1986). The upper age boundary is controlled by the lower boundary of the next assemblage, as well as by the last appearance of Ristola altissima, which corresponds to early late Tithonian (Baumgartner et al., 1995). The assemblage is comparable in age with that of the Pseudodictyomitra primitiva zone (Matsuoka, 1995).

The Pseudodictyomitra carpathica assemblage was revealed in greenish-grey siliceous mudstone and black mudstone (samples T-45, T-46, 3Ko-1, 3Ko-2, C-51, C-53, C-54). Abundant well preserved radiolarians of the latest Jurassic to earliest Cretaceous were extracted from these samples. Representatives of nassellarians such as Archaeodictyomitra, Cinguloturris, Eucyrtidiellum, Hsuum, Parvicingula, Pseudodictyomitra, Sethocapsa, Stichocapsa, Stichomitra, Thanarla, Wrangellium, Xitus and others are predominant among them. The geological age of the assemblage is late late Tithonian. The lower age boundary is accepted according to the first appearance of Pseudodictyomitra carpathica and corresponds to late late Tithonian (Matsuoka, 1992). The upper boundary is determined by the last appearance of Archaeodictyomitra minoenensis, Spongocapsula perampla, Protunuma japonicus, Eucyrtidiellum pyramis and Sethocapsa yahazuensis (Mizutani, 1981; Matsuoka and Yao, 1985; Aita, 1987; Baumgartner et al., 1995). The assemblage is correlated with the lower part of the Pseudodictyomitra carpathica zone (Matsuoka, 1995).

**Systematic paleontology**

Three new species are described and compared with co-occurring species of the same genera.

**Subclass Radiolaria**

**Order Nassellaria**

**Family Theoperidae**

*Genus Stichocapsa* Haeckel, 1881

*Stichocapsa* Haeckel, 1881, p. 439
Type species.—Stichocapsa jaspidea Rüst, 1885

Stichocapsa (?) pseudoconvexa sp. nov.

Definition.—Shell is probably of four segments, lacking strictures. It is composed of two parts. Upper part of shell regularly and gradually increases in width, with segmental partitions only slightly visible outside. Cephalis spherical, small and poreless, without apical horn. Thorax trapezoidal also with sparsely displaced small circular pores. Abdomen trapezoidal also with sparsely displaced small circular pores. Post-abdominal segment globe-shaped, covered by sparse circular pores. The terminal portion of the test is closed, with 2–3 circular rows of large circular pores. The diameter of these pores is 3–5 times bigger than of the other pores.

Remarks.—Shell consists of upper conical and lower globose parts as well as whole genus, but it lacks apparent distal aperture. Therefore it is questionable that this form belongs to Stichocapsa. However, since its outline and surface are similar to Stichocapsa convexa Yao, this form is tentatively described as Stichocapsa convexa (?) pseudoconvexa n. sp. is very similar to Stichocapsa convexa Yao by having almost the same shape and a smooth surface, but it differs from the latter by possessing a smaller cephalis and thorax chambers, and by having 2–3 circular rows of large circular pores in the terminal portion of the test.

Etymology.—Stichocapsa (?) pseudoconvexa means false (or mistaken) Stichocapsa convexa Yao.

Measurements (in μm).—(based on 5 specimens)
Height: 120–146
Max. width: 86–108

Type locality.—Right bank of Koreyskaya River, Gorbousha Unit of the Taikha Terrane, Sikhote-Alin, Russia.

Occurrence.—Archaeodictyomitra minoensis, Xitus gifuensis, Stichomitra doliolum and Pseudodictyomitra carpatica assemblages (middle Oxfordian to late Tithonian).

Family Sethocapsidae
Genus Sethocapsa Haeckel, 1881

Sethocapsa Haeckel, 1881, p. 433

Type species.—Sethocapsa cometa (Pantanelli); Rüst, 1885; Subsequent designation by Foreman, 1973.

Sethocapsa hexagona Hori, 1999

Definition.—Shell pear-shaped, probably of four segments as for all other species of the genus. Upper part of shell conical, regularly and gradually increases in width, with segmental partitions only slightly visible outside. Cephalis is subspherical, small, poreless, without apical horn. Thorax and abdomen are trapezoidal, with sparsely displaced small circular pores. Fourth chamber closed, globose and much larger than first three segments. Pores of the fourth segment circular and have hexagonal or pentagonal pore frames. Terminal portion of the test has 1–2 circular rows of large circular pores, diameters of which are 2–3 times larger than of the other pores.

Remarks.—Sethocapsa hexagona n. sp. is similar to Sethocapsa hexagona Hori, but differs from it by having a much smaller test, by lacking a stricture between the first three segments and the fourth segment, and also by having smaller-sized pores on the whole.
Late Jurassic new radiolarian species

**Etymology.**—The species name is derived from the Taukha Terrane of the Sikhote-Alin region, Far East of Russia.

**Measurements** (in µm).—(based on 5 specimens)

Height: 103–127
Max. width: 83–103

**Type locality.**—Right bank of Koreyskaya River, Gorbousha Unit of the Taukha Terrane, Sikhote-Alin, Russia.

**Occurrence.**—Archaeodictyomitra minoensis, Xitus gifuensis, Stichomitra doliolum, Pseudodictyomitra carpatica and Cecrops sp. assemblages (middle Oxfordian to early Barremian).

**Family Parvicingulidae**

**Genus Cinguloturris** Dumitrica in Dumitrica and Mello, 1982

*Cinguloturris* Dumitrica; Dumitrica and Mello, 1982, p. 22.

**Type species.**—Cinguloturris carpatica Dumitrica; Dumitrica and Mello, 1982.

*Cinguloturris carpatica* Dumitrica in Dumitrica and Mello, 1982

![Figure 3.10](image)

Theoeridae gen. et sp. indet. I; Aita, 1982, pl. 2, fig. 18.
Theoperidea gen. et sp. indet.; Aoki and Tashiro, 1982, pl. 2, fig. 9.

*Cinguloturris carpatica* Dumitrica; Dumitrica and Mello, 1982, p. 23, pl. 4, figs. 7–11; Yeo, 1984, pl. 2, fig. 28; Aita, 1985, fig. 7.12; Ishida, 1985, pl. 4, figs. 13, 14; Matsuoka and Yeo, 1985, pl. 2, fig. 13; Tanaka et al., 1985, pl. 1, fig. 12; Matsuoka, 1986, pl. 2, fig. 16, pl. 3, fig. 11; Matsuoka and Yeo, 1986, pl. 2, fig. 14; Aita, 1987, pl. 64, pl. 10, fig. 12; Wakita, 1988, pl. 5, fig. 8; Kato and Iwata, 1988, pl. 5, fig. 5, fig. 10; Matsuoka and Oji, 1990, pl. 1, fig. 7; Yao, 1990, pl. 4, fig. 11; Ishida and Hashimoto, 1991, p. 46, pl. 4, fig. 16; Matsuoka, 1992, pl. 4, fig. 1; Kashiwagi and Yao, 1993, pl. 2, fig. 4; Sashida et al., 1993, fig. 6.7; Gorican, 1994, p. 64, pl. 23, figs. 1, 6–11; Kemkin and Rudenko, 1994, p. 118, pl. 1, figs. 2, 5–8; Baumgartner et al., 1995, p. 142, pl. 3193, figs. 1, 2, 4–6 (not 3); Ohba and Adachi, 1995, pl. 3, fig. 10; Kemkin, 1996a, pl. 1, figs. 1, 2, 5; Sashida and Uematsu, 1996, p. 65, fig. 4.11; Shen et al., 1996, pl. 2, fig. 11; Nishizono et al., 1997, pl. 2, fig. 13; Ishida and Hashimoto, 1997, pl. 2, fig. 5; Takashima et al., 1997, fig. 5.10; Yang and Matsuoka, 1997, pl. 3, fig. 9; Zybrev and Matsuoka, 1999, pl. 1, fig. 11; Hori, 1999, p. 91, fig. 9.1.

*Dictyomitra* sp. B; Ishida, 1983, pl. 5, figs. 3, 4.

Unnamed multicystoid nassellarian; Yamamoto, 1983, pl. 1, fig. 10.

*Cinguloturris* sp. aff. *C. carpatica* Dumitrica; Yao, 1984, pl. 3, fig. 19.
*Cinguloturris* sp. cf. *C. carpatica* Dumitrica; Tanaka et al., 1985, pl. 1, fig. 7; Kurimoto, 1989, pl. 1, fig. 17.

**Occurrence.**—Pseudodictyomitra carpatica assemblage (late Tithonian).

*Cinguloturris cylindra* Kemkin and Rudenko, 1993

![Figure 4.5–4.7](image)

Unnamed multicystoid nassellarian; Adachi, 1982, pl. 2, fig. 9.
*Cinguloturris* sp.; Wakita, 1987, pl. 1, fig. 8; Kato and Iwata, 1989, pl. 2, fig. 7.
*Cinguloturris* sp. aff. *C. carpatica* Dumitrica; Wakita, 1988, pl. 6, fig. 14; Sashida et al., 1993, fig. 6.8, 6.9.
*Cinguloturris carpatica* Dumitrica; Yasuda, 1989, pl. 1, fig. 14.
*Cinguloturris* sp. cf. *C. carpatica* Dumitrica; Kemkin et al., 1992, p. 33, pl. 2, fig. 3.
*Cinguloturris cylindra* Kemkin and Rudenko, 1993, p. 116, pl. 2, figs. 3, 9–15; Kemkin and Rudenko, 1994, p. 1116, pl. 1, figs. 3, 9–15; Baumgartner et al., 1995, p. 144, pl. 6101, figs. 1–4; Kemkin, 1996a, pl. 3, fig. 11; Dumitrica et al., 1997, p. 69, pl. 14, fig. 16; Kemkin et al., 1997, pl. 3, fig. 9, 4, fig. 11, pl. 6, fig. 3; Hori, 1998, pl. 2, fig. 12; Hori, 1999, p. 91–93; fig. 9.2; Kemkin et al., 1999, figs. 4.8, 4.9, fig. 5.9; Matsuoka et al., 2002, fig. 6.7.
*Cinguloturris* sp. A; Gorican, 1994, p. 64, pl. 23, figs. 3–5.
*Cinguloturris arabica* Jud, 1994, p. 69, pl. 5, figs. 15, 16.

**Occurrence.**—Archaeodictyomitra minoensis, *Xitus gifuensis, Stichomitra doliolum* and *Pseudodictyomitra carpatica* assemblages (middle Oxfordian to late Tithonian).

*Cinguloturris fusiforma* Hori, 1999

![Figure 3.11, 3.12](image)

Unnamed multicystoid nassellarian; Adachi, 1982, pl. 2, figs. 8, 10.
*Cinguloturris carpatica* Dumitrica; Kishida and Hisada, 1986, fig. 2.12; Kawabata, 1988, pl. 2, fig. 10; Tamba Belt Research Group, 1990, pl. 2, fig. 16; Sashida et al., 1993, fig. 6.6.
*Cinguloturris* sp. A; Kemkin and Rudenko, 1994, p. 1118, pl. 1, fig. 6.
*Cinguloturris* sp.; Hori, 1998, pl. 2, fig. 13.
*Cinguloturris fusiforma* Hori, 1999, p. 93, fig. 9.3–9.6, fig. 11.6.
*Cinguloturris* sp. nov.; Kemkin et al., 1999, fig. 5.10.

**Occurrence.**—*Xitus gifuensis* and *Stichomitra doliolum* assemblages (late Kimmeridgian to middle Tithonian).

*Cinguloturris primorika* sp. nov.

![Figure 4.1–4.3](image)

*Cinguloturris carpatica* Dumitrica; Baumgartner et al., 1995, p. 142–
Holotype.—0409-02 – C-69

Definition.—Multisegmented conical test as with all other species of the genus. The number of segments is seven or more. The diameter of the segments increases rapidly from the proximal to the distal portion of the test. Cephalis subspherical, smooth, poreless and without apical horn. Thorax also smooth, poreless and trapezoidal. Thorax and abdomen are separated from one another by a single row of small circular pores. Each post-thoracic segment begins with a narrow, inflated, poreless and slightly costate circumferential ridge. The remaining segment wall is covered with a thick spongy meshwork with irregularly arranged pores. The ratio of height between ridge and spongy meshwork is 1:3–1:5. Meshed portion of segment wall and ridge are separated from one another by a single row of larger pores.

Remarks.—Cinguloturris primorika n. sp. differs from Cinguloturris cylindra Kemkin and Rudenko and Cinguloturris fusiforma Hori by possessing a distinct conical shell shape. From Cinguloturris carpathica Dumitrica it differs by having very narrow, slightly costate circumferential ridges.

Etymology.—The species name is derived from Primorye area, southern part of the Far East of Russia.

Measurements (in μm).—(based on 6 specimens)

Height: 166–186
Max. width: 103–120

Type locality.—Right bank of Koreyskaya River, Gorbousha Unit of the Taukha Terrane, Sikhote-Alin, Russia.

Occurrence.—Xitus gifuensis and Stichomitra doliolum assemblages (late Kimmeridgian to middle Tithonian).

Cinguloturris sp. aff. C. primorika sp. nov.

Figure 4.4

Remarks.—Cinguloturris sp. aff. C. primorika n. sp. differs from Cinguloturris primorika n. sp. by having less prominent circumferential ridges.

Occurrence.—Stichomitra doliolum assemblage (middle Tithonian).

Acknowledgments

The authors thank Alexander I. Khanchuk (Far East Geological Institute, Far Eastern Branch, Russian Academy of Sciences) for his valuable advice and remarks. We also thank Paulian Dumitrica (Institut de Géologie et Paléontologie, Université de Lausanne) and Spela Gorican (Paleontoloski Institut Ivana Rakovca ZRC SAZU) for their critical reviews of the manuscript.

This work was done with partial financial support from the Russian Fund of Fundamental Researches (Grant No. 98-05-65346 and Grant No. 02-05-64038).

References


Aita, Y., 1985: Jurassic radiolarian biostratigraphy of the Irazuyama Formation (Takano Section), Shikoku, Japan. Scientific and Technical Reports of the Mining College, Akita University, no. 6, p. 33–41. (in Japanese with English abstract)

Aita, Y., 1987: Middle Jurassic to Lower Cretaceous radiolarian biostratigraphy of Shikoku with reference to selected section in Lombardy Basin and Sicily. Science Reports of the Tokohoku University, Second Series (Geology), vol. 58, no 1, p. 1–91.


Bragin, N. U., 1991: Radiolarians and Lower Mesozoic deposits of the East of the USSR. Nauka, Moscow, 125 p. (in Russian)

Dumitrica, P., Immennhauser, A. and Dumitrica-Jud, R., 1997: Mesozoic radiolarian biostratigraphy from Masirah Ophiolite, Sultanate of Oman – Part I: Middle Triassic, uppermost Jurassic and lower Cretaceous spumellarians and multisegmented nassellarians –. Bulletin of the
Late Jurassic new radiolarian species


Hori, N., 1999: Latest Jurassic radiolarians from the northeastern part of the Torinoko Block, Yamizo Mountains, central Japan. Science Reports of the Institute of Geoscience, University of Tsukuba, Section B (Geological Sciences), vol. 20, p. 47–114.

Ishida, K., 1983: Stratigraphy and radiolarian assemblages of the Triassic and Jurassic siliceous sedimentary rocks in Konose Valley, Tokushima Prefecture, Southwest Japan. – Studies of the South Zone of the Chichibu Belt in Shikoku, Part IV –. Journal of Science, University of Tokushima, vol. 16, p. 111–141. (in Japanese with English abstract)

Ishida, K., 1985: Radiolarian and conodont ages of the sedimentary bodies and their spatial arrangement in the South Zone of the Chichibu Belt in Tokushima Prefecture. – Studies of the South Zone of the Chichibu Belt in Shikoku, Part V –. Journal of Science, University of Tokushima, vol. 18, p. 27–81. (in Japanese with English abstract)


Kemkin, I. V., 1996a: New data on the geology and age of the Koreyskaya River area (South Sikhote-Alin). The Island Arc, vol. 5, p. 130–139.


Kurimoto, C., 1989: Microfossils from the Gozaishoyama dis-
Matsuoka, A., 1992: Jurassic and Early Cretaceous radiolarians
Matsuoka, A. and Oji, T., 1990: Middle Jurassic radiolarian
Matsuoka, A. 1995: Jurassic and Lower Cretaceous radiolarian
Nishizono, Y., Sato, T. and Murata, M., 1997: A revised radio-
Ru¨ st, D., 1885: Beitra¨ge zur Kenntniss der fossilen Radiolarien
Pessagno, E. A., Jr., 1977: Upper Jurassic Radiolaria and
Mizutani, S., 1981: A Jurassic formation in the Hida-Kanayama
Shen, G., Ujiie, H. and Sashida, K., 1996: Off-scraped Permian-

Jurassic bedded chert thrust on Jurassic-early Cretaceous
accretionary prism: Radiolarian evidence from Ie Island,
central Ryukyu Island Arc. The Island Arc, vol. 5, p. 156–
165.

Takashima, R., Suzuki, N., Koike, T. and Saito, T., 1997:
Reexamination of the unconformity proposed at the
boundary between the Lower and Middle Yezo Groups in
the Soshubetsu area, Hokkaido, and its geological signifi-
cance – reevaluation of the intra-Yezo disturbance –.
Journal of the Geological Society of Japan, vol. 103, no. 5,
p. 489–492. (in Japanese)

Tamba Belt Research Group, 1990: Paleozoic and Mesozoic
systems in the Tamba Belt (Part 7) – The Type I Suite
in the southern part of Natasho Village, Onyu-gun, Fukui
Prefecture –. Earth Science (Chikyu Kagaku), vol. 44, no. 2,
p. 77–90. (in Japanese with English abstract)

Tanaka, H., Fujita, H., Miyamoto, T. and Hase, A., 1985: Late
Jurassic radiolarian fossils from the Shinkai Formation
developed to the south of Mt. Haidate, Oita Prefecture,
91, no. 8, p. 569–571. (in Japanese)

Volokhin, Y. G., Burii, G. I., Rudenko, V. S. and Filippov,
A.N., 1990: Triassic cherty formation of the South
Sikhote-Alin. Izvestiya Akademii Nauk SSSR, Geo-
logichestuya Seriya, no. 4, p. 45–57. (in Russian)

Wakita, K., 1987: The occurrence of Latest Jurassic-Earliest
Cretaceous radiolarians at the Hida-Kanayama area in
the Mino Terrane, central Japan, Journal of the Geological
Society of Japan, vol. 93, no. 6, p. 441–443. (in Japanese)

Wakita, K., 1988: Early Cretaceous melange in the Hida-

Yamamoto, H., 1983: Occurrence of late Jurassic radiolarians
of the Mirifusus baileyi Assemblage from Neo Village,
Gifu Prefecture, central Japan. Journal of the Geological

Yang, Q. and Matsuoka, A., 1997: A composition study on
Upper Jurassic radiolarian biostratigraphy of the Taman
Formation, east-central Mexico and the ODP Site 801B
Section, west Pacific. Science Reports of Niigata University,
Series E (Geology and Mineralogy), no. 12, p. 29–49.

Yao, A., 1984: Subdivision of the Mesozoic complex in Kii-
Yura area, southwest Japan and its bearing on the Meso-
zoic basin development in the southern Chichibu terrane.
Journal of Geosciences, Osaka City University, vol. 27,
art. 2, p. 41–103.

Yao, A., 1990: Triassic and Jurassic radiolarians. In Ichikawa,
K., Mizutani, S., Hara, I., Hada, S. and Yao, A., eds., Pre-
Cretaceous Terranes of Japan, p. 329–345. IGCP Project
no. 224.

Yasuda, M., 1989: Equivalents to the Torinosou Group of the
Chichibu Belt in the southeastern part of the Kanto
Mountains, central Japan – lithology and radiolarian
biostratigraphy –. Journal of the Geological Society of
Japan, vol. 95, no. 6, p. 463–478. (in Japanese with English
abstract)

Zyabrev, S. and Matsuoka, A., 1999: Late Jurassic (Tithonian)
radiolarians from a clastic unit of the Khabarovsk complex
(Russian Far East): Significance for subduction accretion
timing and terrane correlation. The Island Arc, vol. 8,