Title
Jurassic and Cretaceous Radiolarians from the pre-Tertiary System in the Hidaka Belt, Maruseppu Region, Northeast Hokkaido

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- **Abstract**
  - Provide a brief summary of the content of the article.

- **Keywords**
  - List the main topics or subjects covered in the article.

- **Introduction**
  - Briefly introduce the research topic and its relevance.

- **Methods**
  - Describe the methods used in the research.

- **Results**
  - Present the findings of the research.

- **Discussion**
  - Analyze the results and their implications.

- **Conclusion**
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- **Figure 1**
  - Include any figures or diagrams that support the research.

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JURASSIC AND CRETACEOUS RADIOLARIANS FROM THE PRE-TERTIARY SYSTEM IN THE HIDAKA BELT, MARUSEPPU REGION, NORTHEAST HOKKAIDO

by

Keiji Iwata and Jun Tajika*

(with 3 text-figures and 5 plates)

Abstract

We have made a study of the pre-Tertiary Hidaka Supergroup (the Kanayama Formation), which is distributed at the most easterly portion of the Hidaka Belt, in order to ascertain the age of accumulation of this supergroup. The Kanayama Formation consists mainly of broken formations in which clastic rocks of terrigenous origin predominate and many exotic blocks are included in the scaly shale matrix. The tuffaceous shale of this formation yielded *Amphicyndax tylotus* — *Clathroceras diceros* radiolarian assemblage which indicates late Campanian to early Maastrichtian age. And a late Jurassic *Stylocapsa (?) spiralis* and early Cretaceous *Sethocapsa trachystraca* — *Staurosphaera septemporatus* assemblages were obtained from chert block within the melange facies of the Kanayama Formation. This formation may represent a part of accretionary complex formed by subduction process during the late Cretaceous.

Introduction

The pre-Tertiary Hidaka Supergroup is widely distributed in the Hidaka Belt, a major tectonic belt in Hokkaido. The Hidaka Supergroup has formerly been considered to be a geosynclinal sediment of the late Paleozoic to middle Mesozoic Eras (Hahsimoto et al., 1975; Minato et al., 1965). Recently, however, Cretaceous radiolarians have been reported from various localities of this supergroup in the Hidaka Belt and from the Yubetsu Group in the Tokoro Belt (Iwata et al., 1983; Tajika and Iwata, 1983; Kiminami et al., 1983, 1985; Iwata and Kato, 1986; Kato et al., 1986; Iwata and Tajika, 1986; Watanabe and Iwata, 1987); consequently, the age of the Hidaka Supergroup has been reassigned to the Cretaceous System. Instead of regarding this supergroup as part of the geosynclinal sediment, scholars have recently represented it as an accretionary complex in a convergent zone along the eastern margin of the Eurasian Plate (Kiminami et al., 1985; Kimura, 1985). At the same time, the Yubetsu Group in the western wing of the Tokoro Belt has also been regarded as an accretionary complex around the Okhotsk Micro-continent (Kiminami et al., 1986; Kimura and Hohanagi, 1983; Sakakibara et al., 1986). Until recently, the pre-Tertiary System of this region has been treated as an age-unknown Mesozoic System. In this paper we should like to report the results of a radiolarian biostratigraphic study on the pre-Tertiary System in

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*Geological Survey of Hokkaido, N18 W12, 060 Sapporo Japan.*
the Maruseppu region, which lies to the most easterly margin of the northern Hidaka Belt, to examine the age of accumulation of the Hidaka Supergroup in the study region.

**Outline of geology**

The region studied occupies an area of $10 \times 6 \text{Km}^2$ in the northern part of Maruseppu, northeast Hokkaido (Text-Fig. 1). This region is situated at the most easterly margin of the Hidaka Belt. The Yubetsu Group of the Tokoro Belt is distributed only several kilometers away from the region studied. In the southern and the northern parts of the studied region, Tertiary and Quaternary pyroclastic flows cover the pre-Tertiary System (Text-Fig. 2). The pre-Tertiary System of this region was named Kanayama Formation by Takahashi et al. (1936). It was firstly included to the “Hidaka System” by Takeuchi (1942), but later Tajika (1982) included it to the Hidaka Supergroup. We describe briefly a summary of geological nature of the Kanayama Formation. The Kanayama Formation occupies the most easterly part of the Hidaka Supergroup in the northern Hidaka Belt (Text-Fig. 1). This formation is mainly composed of sandstone, sandstone predominating alternating beds of sandstone and shale, and pebbly shale. It often includes thin beds of tuffaceous shale. This formation has a general strike of NE-SW direction, but shows different dips in the western half and the eastern half of the studied region. In the western half of this region, the Kanayama Formation dips to the north at low angles, but in the eastern half it dips steeply to the east. In the western half of this region, the Kanayama Formation is characterized by “broken formation” (Hsu, 1968), with many closed folds whose axial planes are nearly horizontal, and

![Text-fig. 1 Distribution of the pre-Tertiary System in the Axial Zone of Hokkaido. An arrow indicates the region studied.](image-url)
Text-fig. 2 Simplified geological map of the study region and localities of radiolarian fossils. Black circles are matrices of the Kanayama Formation, and star markings show chert blocks. Short broken lines around Me-9, KY-509, Yu-61, and Yu-62b suggest a possibility of presence of tectonic sheet.

Text-fig. 3 A sketch of occurrence of Yu-25 chert.

...thrusts are developed in the alternating beds of sandstone and shale. This formation includes many exotic blocks and exhibits a typical melange facies. Chert, recrystallized limestones, and hyaloclastites of various sizes (several centimeters to several tens of meters) are intercalated within the scaly shale and pebbly shale matrices. Locations of exotic blocks are shown in Text-Fig. 2. An example of the occurrence of a chert block (Yu-25) in a scaly shale matrix is illustrated in Text-Fig. 3. In the eastern half of this region, the Kanayama Formation also consists mainly of sandstone, black shale and their alternations, and often intercalates pale green tuffaceous shales and conglomer...
ates. This formation shows a slumping sedimentary facies (Tajika, 1982), and also includes exotic blocks of cherts, limestones, and greenstones. The matrix usually consists of black shale without foliation, and scaly shale and pebbly shale are rarely developed. The deformation of this formation, especially in the eastern part of the study region, seems to have occurred in unconsolidated condition. Exceptionally, greenstones, cherts, and acidic tuffs of tens of meters to one hundred meters in thickness are unusually intercalated as exotic blocks in the vicinity of Me-9 (See Text-Fig. 2). There is a possibility that this chert-greenstone complex may be a tectonic slice or sheet.

Radiolarians of the Kanayama Formation

Late Cretaceous radiolarian assemblage from the matrix of the Kanayama Formation


Among the above-cited radiolarians, Amphipyndax enesseffi has been known to be

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**Explanations of Plate 1**

Late Cretaceous radiolarians of the Kanayama Formation (Loc. A-2). Scales 100μm.

- **Fig. 1** Amphipyndax enesseffi Foreman
- **Fig. 2** Amphipyndax enesseffi Foreman
- **Fig. 3** Amphipyndax cf. plouhis Foreman
- **Fig. 4** Amphipyndax tylothus Foreman
- **Fig. 5** Amphipyndax tylothus Foreman
- **Fig. 6** Amphipyndax sp.
- **Fig. 7** Amphipyndax sp.
- **Fig. 8** Amphipyndax stocki (Clark & Campbell)
- **Fig. 9** Stichomitria cf. asymbatos Foreman
- **Fig. 10** Stichomitria cf. asymbatos Foreman
- **Fig. 11** Xitus (?) sp.
- **Fig. 12** Alievium cf. gallowayi (White)
present from the early to middle Campanian of the Atlantic Basin and its borderland (Riedel et al., 1974; Foreman, 1977) and the Campanian portion of the Shimanto Group in southwest Japan (Nakaseko and Nishimura, 1981). *Amphipyndax tyloitus* has been reported from the late Campanian to early Maastrichtian of the same regions (Foreman, 1977; Nakaseko and Nishimura, 1981). This species has recently been reported from late Campanian to early Maastrichtian of the Kamtchatka and Koryak highland (Vishnevskaya, 1986). Vishnevskaya (1986) has also reported that *Clathrocyclus diceros* ranges from late Campanian to early Maastrichtian, and she established newly *Clathrocyclus diceros* zone. Pessagno (1976) has reported that *Phaseliforma laxa* is confined to the late Campanian portion of the Great Valley sequence. Empson-Morin (1981, 1984) has reported *Amphipyndax enesseffi, A. tyloitus, Stichomitrea asymbatos, Archaeodictyomitra lamellicostata, Dictyomitra multicosata, Schadelfusslerus echts*, and *Kuppelellia (?)* sp. from the late Campanian of the Mid-Pacific mountains (Site 313). Consequently, the radiolarian assemblage of the matrix of the Kanayama Formation is represented by *Amphipyndax tyloitus* — *Clathrocyclus diceros* assemblage which are index radiolarian species of late Campanian to early Maastrichtian in age. We therefore consider that the matrix of the Kanayama Formation can be dated late Campanian to early Maastrichtian.

*Jurassic and early Cretaceous radiolarians from chert blocks in the Kanayama Formation*  
Yu-25

Dark green to black chert from Yu-25 (more than 10 meters in diameter) yielded the following radiolarian species: *Eucyrtidium (?) ptyctum, Stylocapsa (?) spiralis, Ristola boesii, Zhamoidellum mikamense, Hsuum sp., Tricolocapsa sp., Dictyomitra sp., Eusyringium (?) sp., Paronaella sp., Archaeospongoprunum sp.* (Plate 4). Among these radiolarians, *Stylocapsa (?) spiralis* has been known from the late Jurassic sequence (approximately Oxfordian) of the Sakawa Basin, southwest Japan (Matsuoka, 1983). *Eucyrtidium (?) ptyctum* has been reported from middle to late Jurassic in California (Riedel et al., 1974; Pessagno, 1977; Pessagno et al., 1984) and Europe (Baumgartner et al., 1980; Aita, 1985). *Zhamoidellum mikamense* has been reported from late Jurassic (approximately Kimmeridgian) of the Irazuyama Formation in southwest Japan (Aita, 1985). We therefore consider that Yu-25 can be dated late Jurassic (Oxfordian to Kimmeridgian). This is the first occurrence of a *Stylocapsa (?) spiralis* assemblage in Hokkaido.

**Explanation of Plate 2**  
Radiolarians from A-2. Scales 100 μm.

- **Fig. 1** *Pseudoaulophacus floresensis* Pessagno  
- **Fig. 2** *Pseudoaulophacus lenticulatus* (White)  
- **Fig. 3** *Phaseliforma cf. laxa* Pessagno  
- **Fig. 4** *Phaseliforma cf. laxa* Pessagno  
- **Fig. 5** *Dictyomitra multicostata* Zittel  
- **Fig. 6** *Dictyomitra cf. rhadina* Foreman  
- **Fig. 7** *Dictyomitra koslovae* Foreman  
- **Fig. 8** *Archaeodictyomitra cf. lamellicostata* Foreman  
- **Fig. 9** *Dictyomitra* sp.  
- **Fig. 10** *Pseudodictyomitra* sp. A  
- **Fig. 11** *Pseudodictyomitra* sp. B  
- **Fig. 12** *Pseudodictyomitra* sp. B
A-23
This chert alternates with pink colored limestone. It yielded the following radiolarians: *Sethocapsa cetta*, *Ristola boesii*, *Emiluvia* sp., *Pseudodictyomitra carpatica*, *Eucyrtis micropora*, *Thanarla pulchra*, *Podobursa triacantha*, *Sphaerostylus lanceola*, *Siphocampium* cf. *ruterni*, *Paronaella* sp., *Napora* sp. (Plate 5). This radiolarian assemblage is similar to *Sethocapsa trachystraca* assemblage described by Foreman (1975). Foreman (1975) established the *Sethocapsa trachystraca* zone and correlated it to the *Staurospheara septemperatus* zone of Riedel et al. (1974) (Valanginian to Barremian). Kito (1987) has also made it clear from a radiolarian biostratigraphic study of the Sorachi Group and the Lower Yezo Group in central Hokkaido that the *Staurospheara septemperatus* zone indicates a Valanginian to Barremian origin. The chert of A-23 did not yield *Staurospheara septemperatus*, but the radiolarian assemblage of A-23 shows that it can be dated approximately Valanginian to Barremian.

A-26b
This chert yielded the following radiolarians: *Staurospheara septemperatus*, *Acaeniotyle umbilicata*, *Thanarla conica*, *Sphaerostylus lanceola*, *Eucyrtis micropora*, *Obesacapsula* cf. *rotunda*, *Sethocapsa* sp., *Napora* sp. *Paronaella* sp., *Archaeospongosprunum* sp. As we have mentioned above, *Staurospheara septemperatus* is known to indicate Valanginian to Barremian (Riedel et al., 1974; Schaal, 1981; Kito, 1987). We therefore consider that the chert of A-26b is the early Cretaceous (Valanginian to Barremian).

A-21
Green siliceous shale of A-21 yielded *Sphaerostylus lanceola*, *Sethocapsa uterculus*, *Acaeniotyle umbilicata*, *Archaeodictyomitra* sp. On account of very small amount of radiolarian species we were unable to determine the precise age of this siliceous shale. But A-21 seems to be early Cretaceous.

Yu-23
This black chert is much recrystallized, and yields a very small amount of such radiolarians as *Sethocapsa* spp., and *Tricolocapsa* spp. The geological age of this chert could not be determined.

Me-9
Tajika and Iwata (1983) have reported early Cretaceous radiolarian assemblage from

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**Explanation of Plate 3**
Radiolarians from A-2. Scales 100 µm.

<table>
<thead>
<tr>
<th>Fig.</th>
<th>Radiolarian</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Plectopyramidis</em> sp.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td><em>Cornuella californica</em> Clark &amp; Campbell</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><em>Litharactus pusillus</em> Taketani</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td><em>Cryptamphorella</em> sp.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td><em>Stichomitra campi</em> Clark &amp; Campbell</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><em>Stichomitra livermorensis</em> Foreman</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td><em>Stichomitra campi</em> Clark &amp; Campbell</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td><em>Spongosaturnalis lateralis</em> Clark &amp; Campbell</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><em>Myllocerion</em> cf. <em>acinetomon</em> Empson-Morin</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td><em>Schadelfussierus</em> cf. <em>echtus</em> Empson-Morin</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td><em>Schadelfussierus</em> (?) sp.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td><em>Kuppelella</em> (?) sp.</td>
<td></td>
</tr>
</tbody>
</table>
the green chert of Me-9. This chert yielded *Staurosphaera septemporatus*, *Sphaerostylylus lanceola*, *Thanarla conica*, *Mirifusus mediodilatatus*, *Acaeniotyle umbilicata*, *Eucyrtis micropora*, *Archaeodictyomitra apiarum*, *Sethocapsa* spp. As we have said, *Staurosphaera septemporatus* is known to range from the Valanginian to Barremian. Cherts of Yu-61, Yu-62b and KY-509 yielded the same radiolarian assemblages as Me-9.

**Discussion**

This study has revealed that the pre-Tertiary System of the studied region (Kanayama Formation) is an accretionary complex of late Cretaceous (late Campanian to (?) early Maastrichtian) origin, showing a melange facies in which many exotic blocks including greenstones, cherts, and limestones are mixed in a chaotic manner. During this study an *Amphipyndax tylos — Clathrocyclas diceros* assemblage was obtained from the matrix of the Kanayama Formation in the northern Hidaka Belt for the first time. Recently Kiminami (1987) has reported this assemblage from the Hidaka Supergroup in the southern Hidaka Belt, while Vishnevskaya (1986) has reported this assemblage from the Upper Cretaceous System of Kamchatka and Koryak Highland. However, this assemblage has not yet been found in the Hakobuchi Group, the Yubetsu Group and the Nemuro Group of Hokkaido. Consequently, it is reasonable to regard that the Kanayama Formation belongs to the Hidaka Supergroup.

Chert blocks from the Kanayama Formation yielded late Jurassic to early Cretaceous radiolarian assemblages. Among them, for instance, a late Jurassic *Styllocapsa (?) spiralis* assemblage was obtained from Yu-25 within the Kanayama Formation. This radiolarian assemblage was first reported from the Togano Group in the outer zone of the southwestern Japan (Matsuoka, 1983). According to Matsuoka (1984, 1985), the chert sequence of the Togano Group accumulated on the oceanic plate and this group was probably an accretionary complex of the late Jurassic age. Consequently, the Yu-25 chert of the Kanayama Formation may also be considered to have been a part of the Jurassic oceanic plate (Kula-Izanagi Plate?). Exotic blocks in the Hidaka Belt and other convergent belts in the Japanese Islands and other Circum-Pacific regions are expected to serve as models for a reconstruction of past oceanic plate stratigraphy. For this purpose, many more studies are bound to be necessary from an applied paleontological and geological point of view.

**Explanation of Plate 4**

<table>
<thead>
<tr>
<th>Fig.</th>
<th>Early Cretaceous radiolarians from chert clock (Yu-23). Scales 100μm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fig. 1</td>
<td><em>Sethocapsa trachyostraca</em> Foreman</td>
</tr>
<tr>
<td>Fig. 2</td>
<td><em>Riscola boesii</em> (Parona)</td>
</tr>
<tr>
<td>Fig. 3</td>
<td><em>Thanarla cf. pulchra</em> (Squinabol)</td>
</tr>
<tr>
<td>Fig. 4</td>
<td><em>Napora</em> sp.</td>
</tr>
<tr>
<td>Fig. 5</td>
<td><em>Podobursa triacantha</em> (Fischli)</td>
</tr>
<tr>
<td>Fig. 6</td>
<td><em>Podobursa</em> sp.</td>
</tr>
<tr>
<td>Fig. 7</td>
<td><em>Sphaerostylylus lanceola</em> (Parona)</td>
</tr>
<tr>
<td>Fig. 8</td>
<td><em>Siphocampium</em> sp.</td>
</tr>
<tr>
<td>Fig. 9</td>
<td><em>Emiluvia</em> cf. <em>chica</em> Foreman</td>
</tr>
<tr>
<td>Fig. 10</td>
<td><em>Paronaella</em> sp.</td>
</tr>
<tr>
<td>Fig. 11</td>
<td><em>Pseudodictyomitra carpatica</em> Lozyniak</td>
</tr>
</tbody>
</table>
Acknowledgements

We should like to acknowledge Profs. S. Uozumi and K. Nakamura of Hokkaido University for the continuing guidance and critical reading of the manuscript. We are also grateful to Drs. K. Matsushita, K. Hasegawa, and K. Takahashi of the Geological Survey of Hokkaido for their kind discussions on the geology. Thanks are also due to Mr. M. Hirama and Miss. A. Tanisawa during the laboratory work. This work was financially supported by Grants-in-Aid from the Japanese Ministry of Education (No. 630209 and No. 62540592).

References


Explanation of Plate 5

Late Jurassic radiolarians from chert block (Yu-25). Scales 100µm.

Fig. 1 Eucyrtidium (?) ptyctum Riedel & Sanfilippo
Fig. 2 Zhamaoidellium mikanense Aita
Fig. 3 Triclolocapsa sp.
Fig. 4 Stylocapsa (?) spiralis Matsuoka
Fig. 5 Stylocapsa (?) spiralis Matsuoka
Fig. 6 Ristola boesi (Parona)

Fig. 7 Archaeospongoprunum sp.
Fig. 8 Hsuum sp.
Fig. 9 Eusyringium (?) sp.
Fig. 10 Stichocapsa (?) sp.
Fig. 11 Dictyomitra sp.
Fig. 12 Paronaella sp.


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