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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 *Amphipyndax tylotus — Clathrocyclas diceros* radiolarian assemblage which indicates late Campanian to early Maastrichtian age. And a late Jurassic *Stylocapsa* (?) *spiralis* and early Cretaceous *Sethocapsa trachyostraca — 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 Hoyanagi, 1983; Sakakibara et al., 1986). Until recently, the pre-Teriary 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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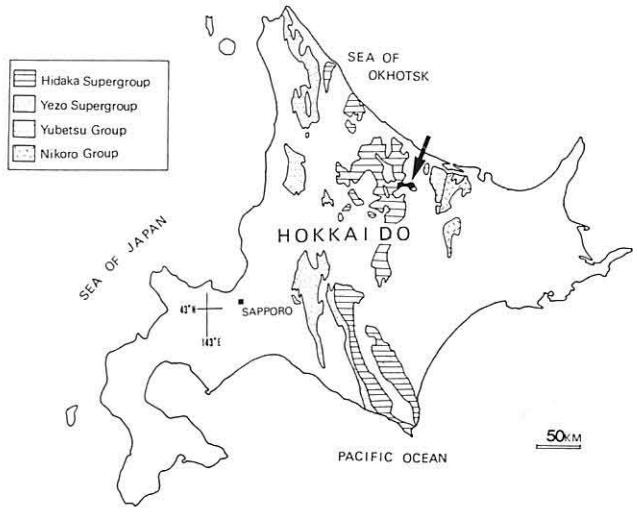
* Geological Survey of Hokkaido, N18 W12, 060 Sapporo Japan.

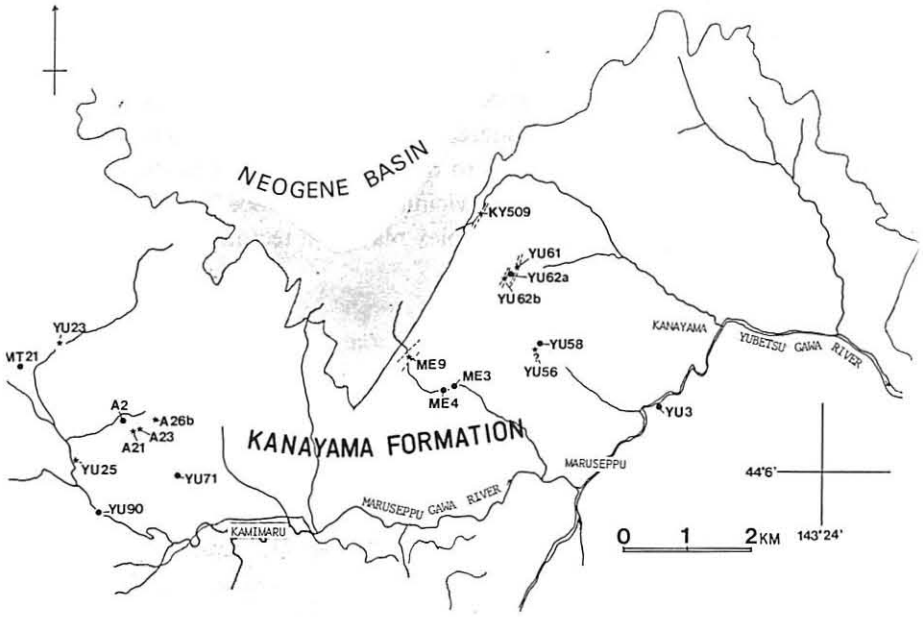
the Maruseppu region, which lies to the most easterly margin of the northern Hidaka Belt, to examine the age of accumulation of the Hidaka Supergroup in the study region.

Outline of geology

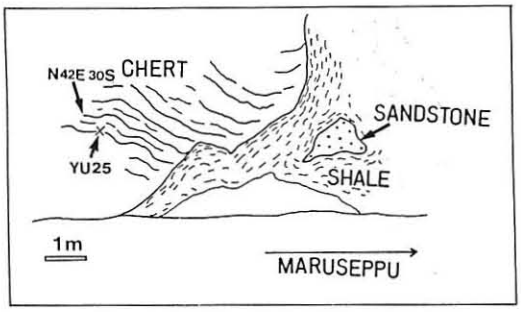
The region studied occupies an area of $10 \times 6 Km^2$ in the northern part of Maruseppu, northeast Hokkaido (Text-Fig. 1). This region is situated at the most easterly margin of the Hidaka Belt. The Yubetsu Group of the Tokoro Belt is distributed only several kilometers away from the region studied. 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 Sueprgroup 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.



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 presense 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 interclated 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

Greenish tuffaceous shale (Locs. A-2, Yu-90, Yu-71) and siliceous shale (Loc. MT-21) in the western part of the study region yielded relatively well-preserved radiolarians. Especially, A-2 yielded the following radiolarian species: *Amphipyndax enesseffi, A. tylotus, A. stocki, Stichomitra* cf. *asymbatos, Alievium* cf. *gallowayi* (Plate 1), *Pseudoaulophacus florescens, P. lenticulatus, Phaseliforma* cf. *laxa, Dictyomitra multicostata, D.* cf. *rhadina, D. koslovae, Archaeodictyomitra* cf. *lamellicostata, Pseudodictyomitra* sp. A and B (Plate 2), *Cornutella californica, Lithatractus pusillus, Stichomitra campi, S. livermorensis, Spongosaturnalis lateralis, Myllocercion* cf. *acineton, Schadelfusslerus* cf. *echtus, Kuppelellia* sp. (Plate 3), etc. Yu-90 yielded *Bathropyramis campbelli, Phaseliforma* cf. *laxa, P.* spp., *Orbiculiforma* cf. *monticelloensis, Stichomitra* cf. *campi, Dictyomitra multicostata,* and *Spongodiscus* spp. Yu-71 also yielded *Phaseliforma* cf. *laxa, Dictyomitra multicostata, Bathropyramis campbelli.* On the other hand, in the eastern part of the study region, black shale of Locs. Me-3 and 4 yielded the following radiolarian species, as already stated in the earlier papers (Tajika and Iwata, 1983; Iwata and Kato, 1986). *Amphipyndax alamedaensis, Bathropyramis campbelli, Clathrocyclas diceros, Cornutella californica, Dictyomitra multicostata, Eucyrtidium* sp. A, *Lithatractus pussillus, Lithomespilus* cf. *mendosa, Phaseliforma* spp., *Lithostrobus* sp. A, *Orbiculiforma* sp., *Praestylosphaera hastatus, Spongosaturnalis spinifer, Theocaryptra* cf. *limbata, Neosciadiocapsa* sp. Yu-3 also yielded similar radiolarian species. Tuffaceous shales from Yu-62a and Yu-58 yielded *Lithostrobus* sp. A, *Bathropyramis campbelli, Phaseliforma* spp., *Stylosphaera* cf. *goruna, Praestylosphaera hastatus, Spongodiscus* spp.

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

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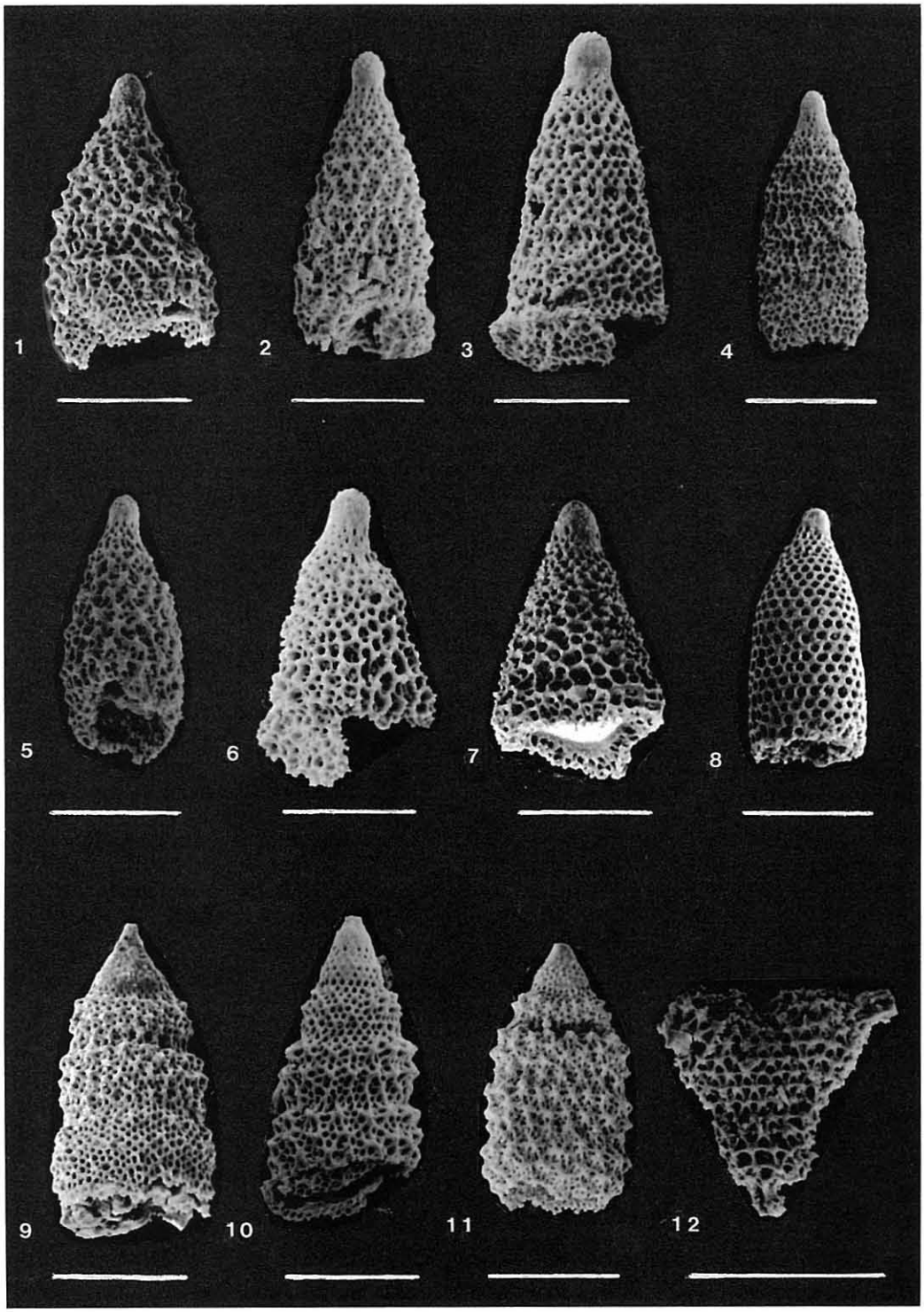
Explanation of Plate 1

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. *plousios* Foreman
Fig. 4 *Amphipyndax tylotus* Foreman
Fig. 5 *Amphipyndax tylotus* Foreman
Fig. 6 *Amphipyndax* sp.
Fig. 7 *Amphipyndax* sp.
Fig. 8 *Amphipyndax stocki* (Clark & Campbell)
Fig. 9 *Stichomitra* cf. *asymbatos* Foreman
Fig. 10 *Stichomitra* cf. *asymbatos* Foreman
Fig. 11 *Xitus* (?) sp.
Fig. 12 *Alievium* cf. *gallowayi* (White)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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 tylotus* 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 *Clathrocyclas diceros* ranges from late Campanian to early Maastrichtian, and she established newly *Clathrocyclas 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. tylotus, Stichomitra asymbatos, Archaeodictyomitra lamellicostata, Dictyomitra multicostata, Schadelfusslerus echtus, 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 tylotus — Clathrocyclas 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

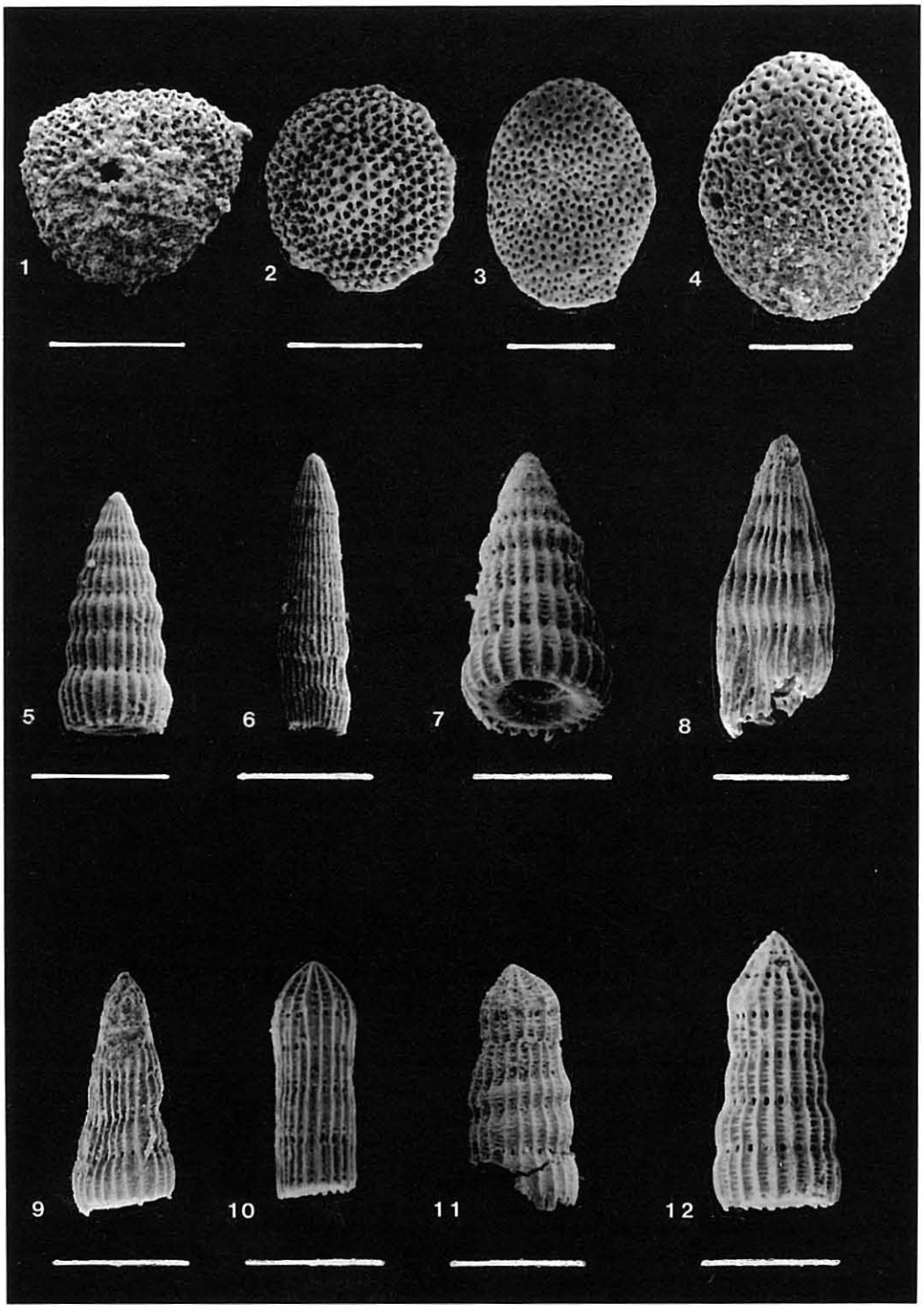
Yu-25

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 100μm.

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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A-23

This chert alternates with pink colored limestone. It yielded the following radiolarians: *Sethocapsa cetia, Ristola boesii, Emiluvia* sp., *Pseudodictyomitra carpatica, Eucyrtis micropora, Thanarla pulchra, Podobursa triacantha, Sphaerostylus lanceola, Siphocampium* cf. *rutterni, Paronaella* sp., *Napora* sp. (Plate 5). This radiolarian assemblage is similar to *Sethocapsa trachyostraca* assemblage described by Foreman (1975). Foreman (1975) established the *Sethocapsa tracyostraca* zone and correlated it to the *Staurosphaera septemporatus* zone of Riedel et al. (1974) (Valanginian to Barremian). Kito (1987) has also made it clear from a radiolarian biostratigraphic study of the Sorachi Gròup and the Lower Yezo Group in central Hokkaido that the *Staurosphaera septemporatus* zone indicates a Valanginian to Barremian origin. The chert of A-23 did not yield *Staurosphaera septemporatus,* 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: *Staurosphaera septemporatus, Acaeniotyle umbilicata, Thanarla conica, Sphaerostylus lanceola, Eucyrtis micropora, Obesacapsula* cf. *rotunda, Sethocapsa* sp., *Napora* sp. *Paronaella* sp., *Archaeospongoprunum* sp. As we have mentioned above, *Staurosphaera septemporatus* is known to indicate Valanginian to Barremian (Riedel et al., 1974; Schaaf, 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 recrystalized, 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.

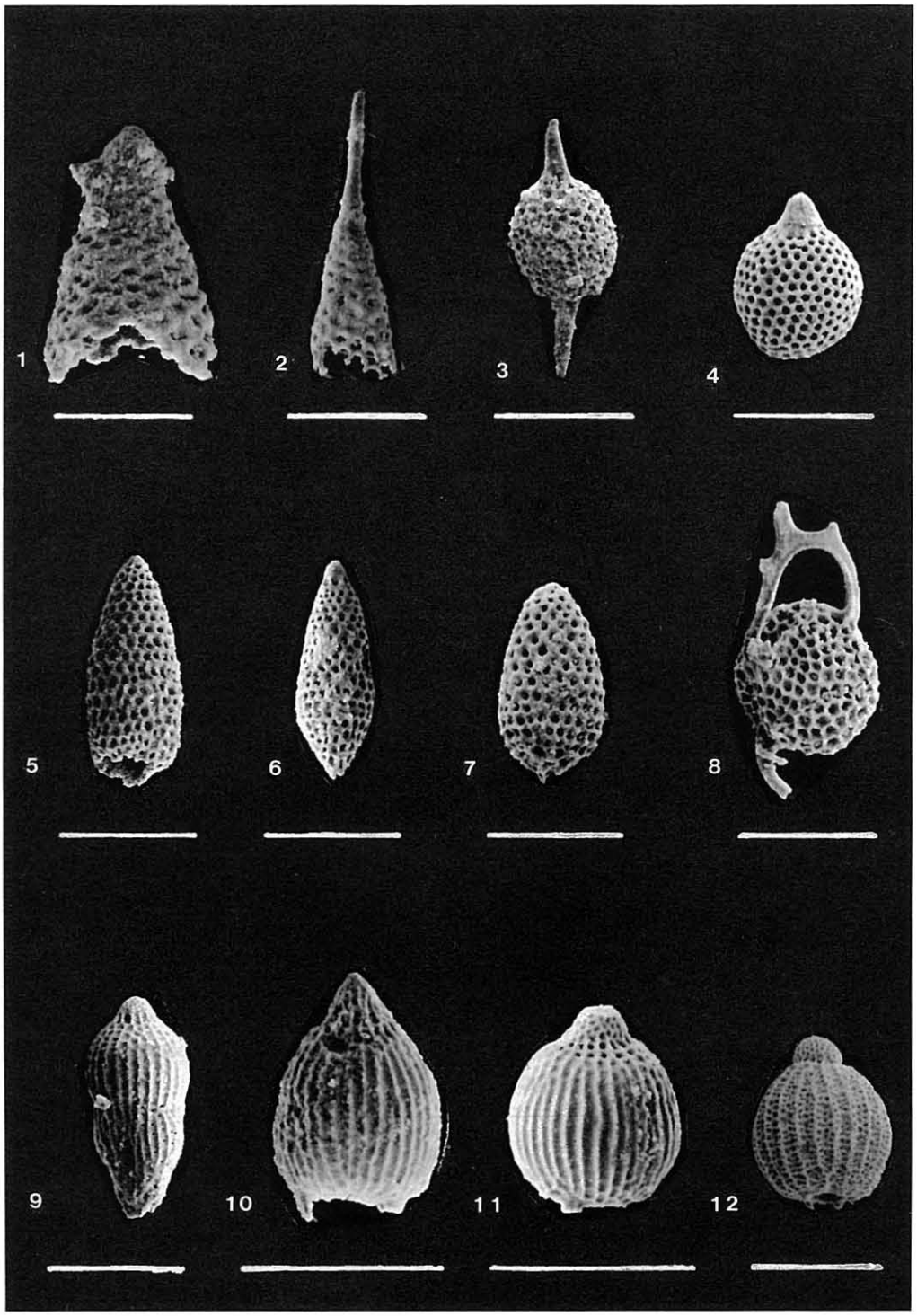
Me-9

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

Explanation of Plate 3

Radiolarians from A-2. Scales 100μm.

Fig. 1 *Plectopyramis* sp.
Fig. 2 *Cornutella californica* Clark & Campbell
Fig. 3 *Lithatractus pusillus* Taketani
Fig. 4 *Cryptamphorella* sp.
Fig. 5 *Stichomitra campi* Clark & Campbell
Fig. 6 *Stichomitra livermorensis* Foreman
Fig. 7 *Stichomitra campi* Clark & Campbell
Fig. 8 *Spongosaturnalis lateralis* Clark & Campbell
Fig. 9 *Myllocercion* cf. *acineton* Empson-Morin
Fig. 10 *Schadelfusslerus* cf. *echtus* Empson-Morin
Fig. 11 *Schadelfusslerus* (?) sp.
Fig. 12 *Kuppelella* (?) sp.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the green chert of Me-9. This chert yielded *Staurosphaera septemporatus, Sphaerostylus 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

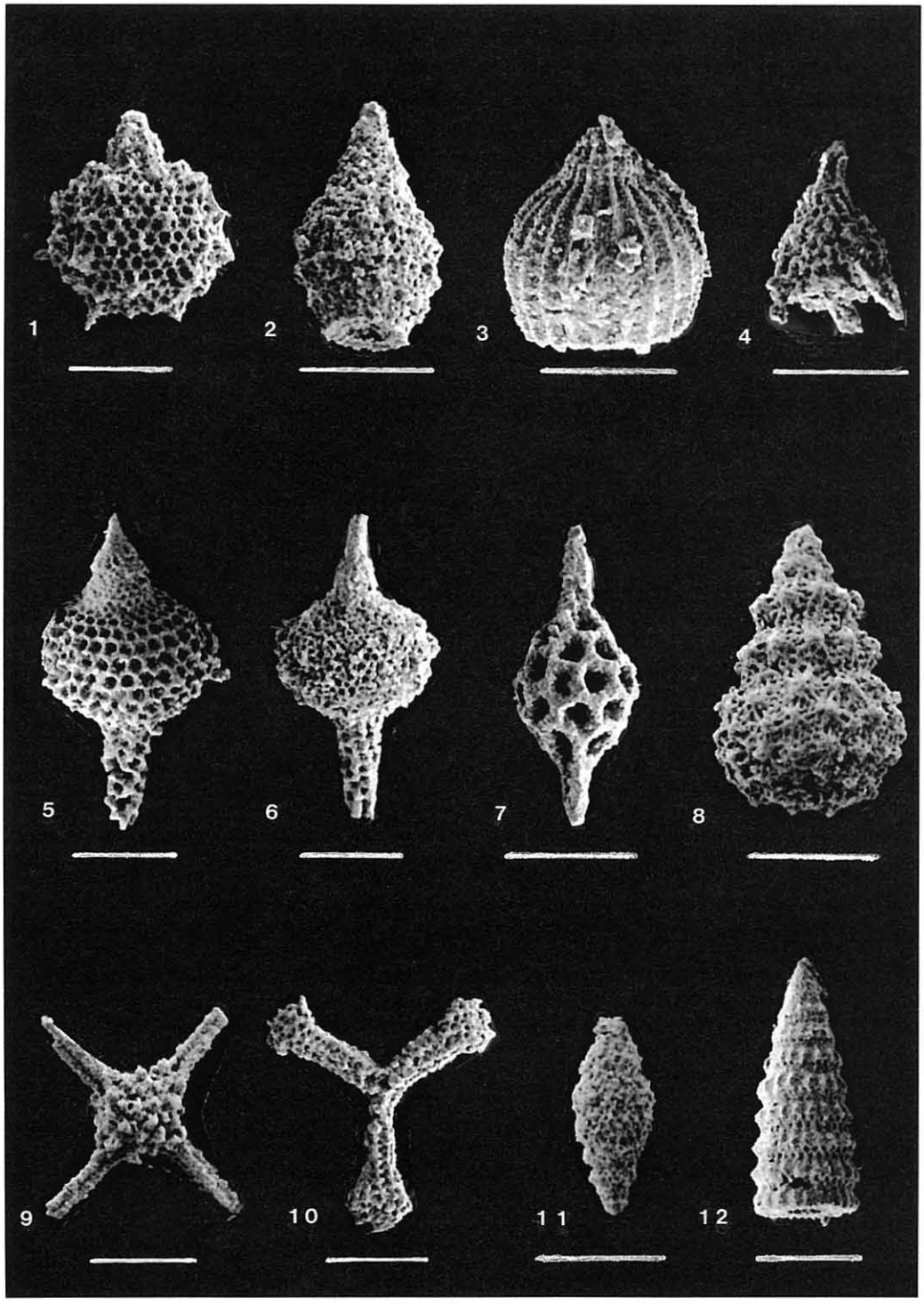
This study has revealed that the pre-Tertiary System of the studied region (Kanayama Formation) is an accretionary complex of late Cretaceous (late Campanian to (?) early Maastrichtian) origin, showing a melange facies in which many exotic blocks including greenstones, cherts, and limestones are mixed in a chaotic manner. During this study an *Amphipyndax tylotus — 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 Kamtchatka 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 *Stylocapsa* (?) *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

Early Cretaceous radiolarians from chert clock (Yu-23). Scales 100μm.

Fig. 1 *Sethocapsa trachyostraca* Foreman
Fig. 2 *Ristola boesii* (Parona)
Fig. 3 *Thanarla* cf. *pulchra* (Squinabol)
Fig. 4 *Napora* sp.
Fig. 5 *Podobursa triacantha* (Fischli)
Fig. 6 *Podobursa* sp.
Fig. 7 *Sphaerostylus lanceola* (Parona)
Fig. 8 *Siphocampium* sp.
Fig. 9 *Emiluvia* cf. *chica* Foreman
Fig. 10 *Paronaella* sp.
Fig. 11 *Pseudodictyomitra carpatica* Lozyniak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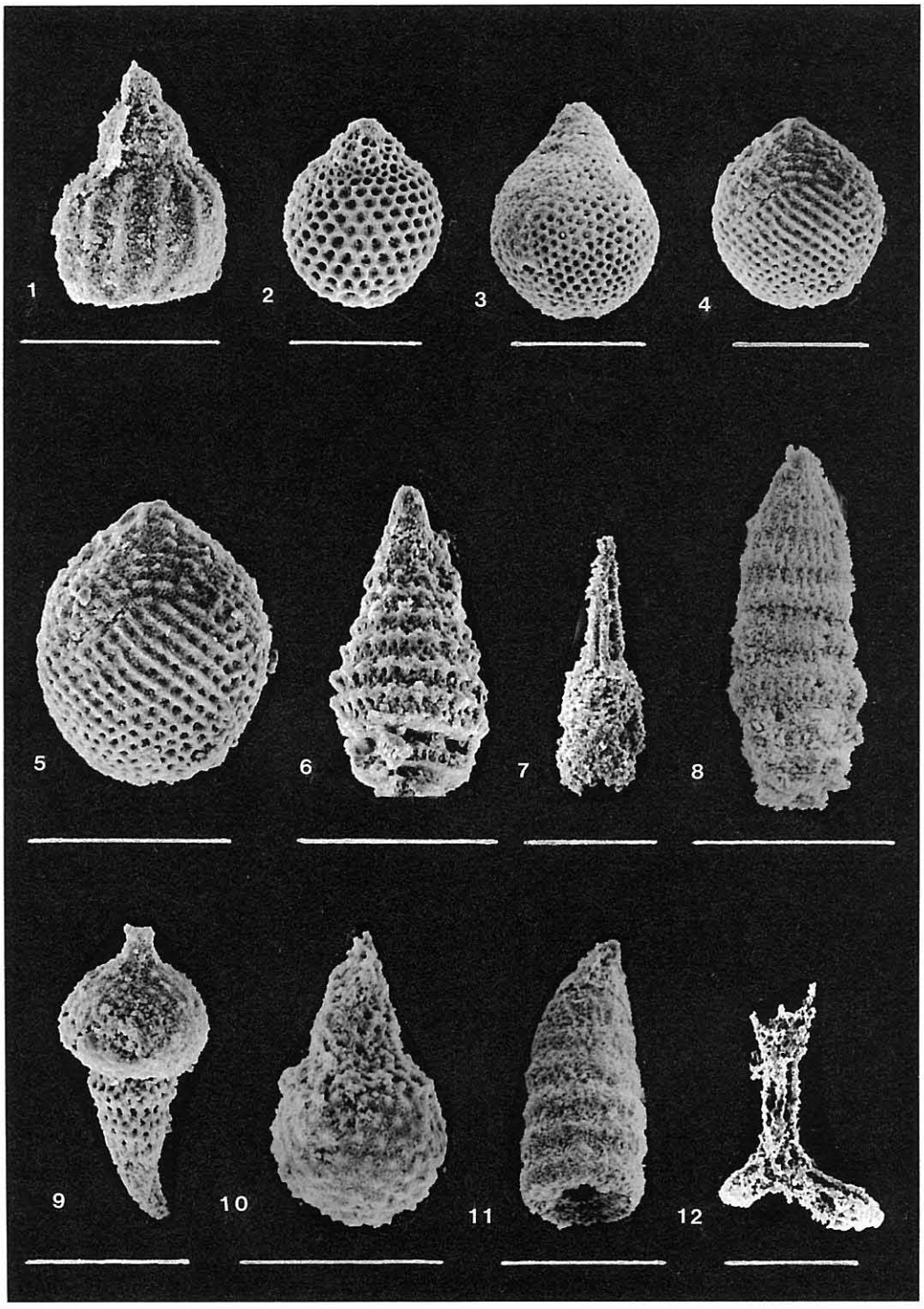
Explanation of Plate 5

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

Fig. 1 *Eucyrtidium* (?) *ptyctum* Riedel & Sanfilippo
Fig. 2 *Zhamoidellum mikamense* Aita
Fig. 3 *Tricolocapsa* sp.
Fig. 4 *Stylocapsa* (?) *spiralis* Matsuoka
Fig. 5 *Stylocapsa* (?) *spiralis* Matsuoka
Fig. 6 *Ristola boesii* (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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