

Early Jurassic Radiolarians from the Hashidate Group, Kanto Mountains, Central Japan

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Abstract Early Jurassic radiolarians were newly found from pale greenish grey mudstone of the Hashidate Group, distributed around Mt. Buko in the central part of the Kanto mountains, Japan. They are *Canoptum* sp., *Canoptum* (?) sp., *Hsuum* (?) sp., *Podobursa* (?) sp., *Tricolocapsa* sp., *Parvicingula* sp., *Parvicingula* (?) sp., and some indeterminate nassellarians. The presence of two *Canoptum* species indicates involvement of Early Jurassic sediments in the Hashidate Group. The Hashidate Group is biostratigraphically correlated with such geotectonic units in the northern part of the Chichibu belt, as the Kazahaya-toge, Kashiwagi, Manba and Kamiyoshida units, which have been ascribed to an Early to Late Jurassic subduction-accretion complex. Among them, the Kashiwagi unit is lithologically similar to the Hashidate Group. Our discovery of the Early Jurassic radiolarian assemblage in the Hashidate Group strongly suggests that the formation of the subduction-accretion complex of the Chichibu belt commenced in the Early Jurassic.

Introduction

The geotectonic units of the Chichibu belt in the Kanto mountains form imbricated thrust sheets with almost horizontal structures and suffered low-grade metamorphism, and are regarded as a Jurassic subduction-accretion complex. The Hashidate Formation, one of the units, is widely distributed around Mt. Buko to the south of the Tertiary Chichibu basin in the central part of the Kanto mountains (HISADA, 1983, 1984). This group consists chiefly of alternation of siliceous mudstone and tuff, pale green slate, phyllitic slate and chert with subordinate greenstone and limestone, excluding coarse-grained materials of terrigenous origin. The group had long been considered to be late Paleozoic to Triassic in age on the basis of conodonts and fossil bivalves (IGO, 1972; KOIKE *et al.*, 1979; TAMURA *et al.*, 1978; HISADA, 1984). These fossils were found mostly from the chert and limestone blocks embedded in argillaceous matrices. Although the matrices are quite barren of macrofossils useful for age determination, HISADA *et al.* (1986) discovered *Mirifusus* spp. and other radiolarians from the

siliceous mudstones and cherts of the Group at Bushidaira in the upper stream of the Urayamagawa River, and demonstrate that it includes some late Jurassic strata in part.

The Hashidate Group is lithologically similar to the Kashiwagi unit distributed in the northern part of the Chichibu belt. The Hashidate Group is therefore considered to be a southeastern extension of the northern part of the Chichibu belt, although the distribution of the group is defined to the south of the Tertiary Chichibu basin (THE CONVENERS OF THE PALEO-MESOZOIC SYMPOSIUM OF THE ANNUAL MEETING AT SAITAMA, 1995). Geotectonic position of the geologic unit including the Hashidate and Urayama groups remained uncertain within the Chichibu belt of the Kanto mountains.

In this paper, we report seven species of Jurassic radiolarians obtained from the tuffaceous mudstone of the Hashidate Group in the same route previously examined by HISADA *et al.* (1986). Among the radiolarian species identified, *Canoptum* spp. clearly indicate an Early Jurassic age. Species useful for age determination are also known from the northern part of the Chichibu belt (HISADA *et al.*, 1992; IJIMA *et al.*, 1994; SEKINE *et al.*, 1995). These paleontological evidences suggest that the Hashidate Group is correlated with those of the northern part of the Chichibu belt. Such paleontological evidences are important in elucidating the Paleo-Mesozoic geohistory of the outer zone of the Japanese islands.

Geologic Setting

The Hashidate Group is composed mostly of alternation of light greenish-grey slate, phyllitic black slate, dark-grey siliceous slate and greyish-green tuff with chert, greenstone and limestone blocks of various size. No coarse-grained clastic rocks are included in the group. It is widely developed, together with the Urayama Group, around Mt. Buko, to the south of the Tertiary Chichibu basin (e.g. HISADA *et al.*, 1986). The constituents of the Hashidate Group have a schistose appearance as a whole and is considered to gradate originally to the Mikabu green rocks (HISADA, 1984). However, geotectonic relationships among the other constituting geologic units of the Chichibu belt had remained unclear (Fig. 1).

The Hashidate Group is correlated with the Kashiwagi unit of the northern part of the Chichibu belt based on the lithological similarity: both consist mostly of acid-to-intermediate tuff and mudstone. Preliminary study by SEKINE *et al.* (1994) has shown that the Kashiwagi unit includes some Early Jurassic radiolarians and is correlated in part with the following geotectonic units as the Kazahaya-toge, Manba, and an older part of the Kamiyoshida. The Kazahaya-toge unit, consisting of turbidite facies, contains *Laxtorum* (?) *jurassicum* and

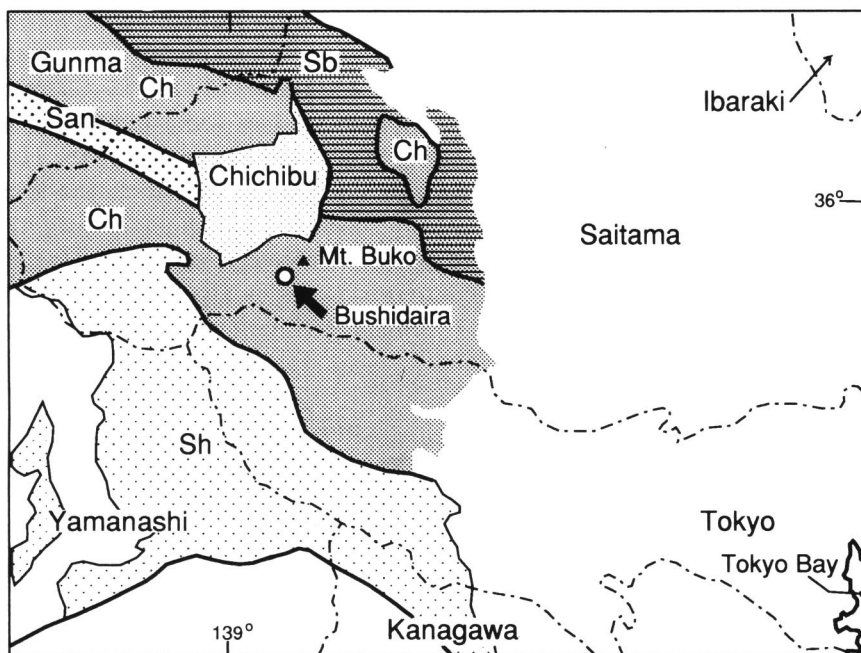


Fig. 1. Index map showing simplified geology and studied site. Sb: Sanbagawa metamorphic belt, Ch: Chichibu belt, Sh: Shimanto belt, San: Cretaceous Sanchu zone, Chichibu: Tertiary Chichibu basin.

other nassellarinas of late early Jurassic age (IIJIMA *et al.*, 1993). The Manba unit consists mostly of mudstone that contains various-sized blocks of greenstone, limestone and chert. MAKIMOTO and TAKEUCHI (1992) regarded the Manba and Kamiyoshida units as mixed rocks of middle Jurassic age, but additional evidence of radiolarians has proved the presence of Early Jurassic strata in the Manba unit (SEKINE *et al.*, 1995). The Kamiyoshida unit, in contrast, consists of terrigenous clastic rocks that include intensely brecciated chert blocks, suggestive of collapse deposits. Early Jurassic radiolarians including the genus *Canoptum* are also known from an older part of the Kamiyoshida unit (IIJIMA *et al.*, 1994). Age determination of the Hashidate Group is therefore important for consideration on geotectonic setting of the Chichibu belt in the Kanto mountains.

Jurassic Radiolarians from the Hashidate Group

Well-preserved radiolarians have been hardly obtained from the Chichibu belt in the Kanto mountains due to recrystallization in relation to regional metamorphism. No Jurassic fossils had been found from the Hashidate Group. But HISADA *et al.* (1986) first discovered late Jurassic radiolarians at Bushidaira

in the upper reaches of the Urayamagawa River, south of Chichibu City. These are *Mirifusus* spp., *Ristola* sp., *Parvicingula?* sp., *Cinguloturris* cf. *carpatica*, *Pseudodictyomitra?* sp. We also tried to collect argillaceous samples for extraction of fossils in the same route at Bushidaira, and in some localities found better-preserved radiolarians from the pale greenish-grey mudstone of the Hashidate Group. Sample localities are shown in Fig. 2 and the radiolarian species identified are listed in Table 1. Among them, species of the genus *Canoptum* and other Early Jurassic nassellarinans were already reported from the western parts of the northern Chichibu belt in the Kanto mountains by HISADA and KISHIDA (1987, 1988) and HISADA *et al.* (1988). Similar radiolarian assemblage was also

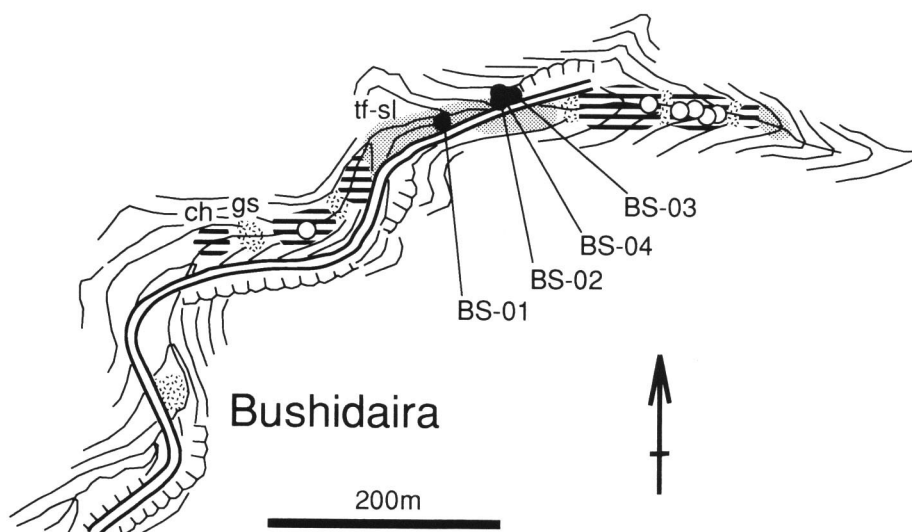


Fig. 2. Simplified route map at Bushidaira, southwest of Mt. Buko, Kanto mountains. Solid circle: sample localities of this study, open circle: sample localities of late Jurassic radiolarians by HISADA *et al.* (1986). ch: chert, gs: greenstone, tf-sl: tuffaceous shale.

Table 1. List of radiolarians from the Hashidate Group at Bushidaira, southwest of Mt. Buko, Kanto mountains.

Species	Locality			
	BS-01	BS-02	BS-03	BS-04
<i>Canoptum</i> sp.			○	
<i>Canoptum</i> (?) sp.			○	○
<i>Hsuum</i> (?) sp.			○	
<i>Podobursa</i> (?) sp.		○		
<i>Tricolocapsa</i> sp.		○		
<i>Parvicingula</i> sp.			○	
<i>Parvicingula</i> (?) sp.	○		○	

found from the Raidenyama Formation of the middle Chichibu belt by SASHIDA and YATSUGI (1991) and from dark-gray siliceous shale of Unit B at Yasudo area (HISADA *et al.*, 1992) which is a nappe of the Chichibu belt on the Sanbagawa metamorphic rocks. Species of the genus *Canoptum* are important index fossils as they occur exclusively from the Late Triassic to Early Jurassic (e.g. PESSAGNO *et al.*, 1979; PESSAGNO & POISSON, 1981; PESSAGNO & WHALEN, 1982; BLOOM, 1984; YEH, 1987; SUZUKI, 1995). Co-occurrence of the *Canoptum* species and other Jurassic radiolarians indicates that Early Jurassic sediments are included in the Hashidate Group. This suggests that the group can be correlated with the turbidite facies of the Kazahaya-toge unit (IIJIMA *et al.*, 1993), an older part of the Kamiyoshida unit (IIJIMA *et al.*, 1994) and the Manba unit (SEKINE *et al.*, 1995).

BS-01: This is located at Bushidaira, upper reaches of the Urayamagawa River, southwest of Mt. Buko, Chichibu, Saitama Prefecture (Figs. 1 and 2), where dark grey and pale greenish-grey mudstone including large blocks of bedded chert and greenstone are developed. This tuffaceous mudstone of the Hashidate group shows a schistose appearance with crenulation cleavage in some cases and appears to be an eastern extension of the Kashiwagi unit. But the group differs in lithology from the latter in having many clasts of greenstone. The mudstone of this locality contains *Parvicingula* (?) sp. (Fig. 3: 9) and many indeterminate nassellarians.

BS-02: This sampling site is situated east of locality BS-01 and materials are structurally and lithologically similar to the Kashiwagi unit (Fig. 2). Siliceous pale green mudstone samples from this locality contains *Podobursa* (?) sp. (Fig. 3: 5 and 6), *Tricolocapsa* sp. (Fig. 3: 7) and other unidentified nassellarians.

BS-03: This locality is close to locality BS-02 and is on similar geologic situation (Fig. 2). Mudstone matrix of this locality contains such radiolarians as *Canoptum* sp. (Fig. 3: 1), *Canoptum* (?) sp. (Fig. 3: 2 and 4), *Hsuum* (?) sp. (Fig. 3: 11), *Parvicingula* sp. (Fig. 3: 8) and *Parvicingula* (?) sp. (Fig. 3: 10). Species of the characteristic genus *Canoptum* have been reported from the Inner and Outer zones of Southwest Japan (TAKADA & ISOZAKI, 1986; IMAZATO & OTOH, 1993; MIYAMOTO & KUWAZURU, 1993; SUZUKI, 1993, 1995; SUZUKI & ITAYA, 1994). This suggests that Early Jurassic unit is widely developed within so-called Jurassic accretionary complex constituting the main framework of the Japanese islands.

BS-04: This is near localities BS-02 and -03 (Fig. 2). From mudstone associated with greenstone are found abundant ill-preserved radiolarian remains. Among them, *Canoptum* (?) sp. is discriminated (Fig. 3: 3). These evidences mentioned above suggest that the Hashidate Group can contain Early Jurassic sediments.



Fig. 3.

Conclusions

Analysis of radiolarians obtained from the Hashidate Group distributed around Mt. Buko, Chichibu, Kanto mountains, central Japan, yields the following results:

1. From the tuffaceous mudstone of the Hashidate Group, which had been considered Late Jurassic strata including late Paleozoic to Triassic exotic blocks, Jurassic radiolarians such as *Canoptum* sp., *Canoptum* (?) sp., *Hsuum* sp., *Podobursa* (?) sp., *Tricolocapsa* sp., *Parvicingula* sp., *P.* (?) sp. and other unidentified nassellarians are found.

2. Such Jurassic radiolarian assemblages including species of the genus *Canoptum* indicates that the Hashidate Group includes Early Jurassic sediments in part, because the occurrence *Canoptum* spp. is known exclusively from the Late Triassic to Early Jurassic.

3. Such fossil evidence supports that the Hashidate Group is correlative with the following geotectonic units of the northern Chichibu belt as the Kazahaya-toge, Kashiwagi, Manba, and partly Kamiyoshida units.

4. Geologic age determination based on radiolarians proved that most of the geotectonic units of the Chichibu belt in the Kanto mountains were formed during the Early to Late Jurassic associated with subduction-accretion process.

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Fig. 3. Scanning electron micrographs of Jurassic radiolarians from the Hashidate Group. 1. *Canoptum* sp. from BS-03, 2. *C.* (?) sp. from BS-03, 3. *C.* (?) sp. from BS-04, 4. *C.* (?) sp. from BS-03, 5 & 6. *Podobursa* (?) sp. from BS-02, 7. *Tricolocapsa* sp. from BS-02, 8. *Parvicingula* sp. from BS-03, 9. *P.* (?) sp. from BS-01, 10. *P.* (?) sp. from BS-03, 11. *Hsuum* (?) sp. from BS-03. Scale bar is 100 μ m for all figures.

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