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Late Silurian to Devonian pelagic facies in the Khangai–Khentei belt, Central Mongolia (Central Asian Orogenic Belt) and its radiolarian age

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In the past 15 years, radiolarian researches for pelagic chert facies within Middle Paleozoic accretionary complexes or upon ophiolites have been increasing steadily worldwide and contributed to the understanding of their evolutionary histories. Recent studies undertaken in the Khangai–Khentei belt of the Central Asian Orogenic Belt, Central Mongolia have revealed the widespread occurrences of radiolarian chert and related oceanic and terrigenous rocks within Paleozoic accretionary complexes. Here we present the results of the detailed lithostratigraphic and radiolarian biostratigraphic investigations of the Gorkhi and Erdenetsogt formations in the Khangai–Khentei belt.
The Gorkhi and Erdenetsogt formations consist of sandstone, shale, alternating sandstone and shale of turbidite affinity and chert with small amounts of siliceous shale, basalt, limestone, and clast-bearing mudstone. Radiolarian chert that is completely devoid of terrigenous clastic material is commonly associated with underlying basalt (sedimentary contact) and conformably overlying siliceous shale and turbidite deposits. The tectonic stacking of basalt–chert and chert–turbidite successions is the most remarkable structural feature of the formations.

A standard hydrofluoric acid etching technique was used to recover moderately well-preserved radiolarians and conodonts from red chert, leading to the recognition of four radiolarian assemblages (Assemblages 1 to 4) that have a combined age range from the latest Silurian (Pridolian) to the Late Devonian (Frasnian) (KURIHARA *et al*. 2009). Assemblage 1, constrained to the latest Silurian on the basis of conodonts (e.g., *Ozarkodina remscheidensis eosteinhornensis*), is characterized by the occurrence of spumellarians (ca. 120-140 μm in shell diameter), but preservation is very poor. Several specimens have a moderately large cortical shell with a short external spine grooved at the base. These characteristics support the assignment of these specimens to the family Inaniguttidae, which ranges from Middle Ordovician to Lower Devonian and is most common in the Upper Silurian. Assemblage 2 includes diversified palaeoscenidiids (*Deflantrica solidum*, *Pactarentinia holdsworthi*, *Tlecerina horrida*) which have previously been reported from only a handful of Lower Devonian localities in Japan. Assemblage 3 is characterized by diverse Middle Devonian entactiniid species, such as *Trilonche parapalimbola*, *T. elegans*, and *T. davidi*. Assemblage 4 is composed of poorly preserved but robust taxon *T. minax*, ranging from late Givetian to Frasnian. It also contains poorly preserved conodont elements of *Palmatolepis* sp. Assemblages 1, 2, and 4 were recovered from red chert of the Gorkhi Formation around Ulaanbaatar. Radiolarians of Assemblage 3 were recognized in several chert localities in the Gorkhi Formation and a small chert block of the Erdenetsogt Formation in the Harhorin area. Although no biostratigraphic control exists for the siliceous shale, shale, and sandstone, they are considered to be latest Devonian or slightly younger on the basis of the stratigraphic relationships with underlying chert. According to KELTY *et al*. (2008), the peak U–Pb age of zircon grains collected from sandstone of the Gorkhi Formation outcropping near our radiolarian localities is earliest Carboniferous, indicating that felsic volcanism along the subduction zone above which the Gorkhi Formation formed.

The Gorkhi and Erdenetsogt formations have previously been interpreted as a thick sedimentary basin deposit overlying a hidden Archean–Neoproterozoic basement (BADARCH *et al*. 2002); however, the stratigraphy within individual tectonic slices clearly corresponds to that of an ocean plate stratigraphy generated by the trenchward movement of an oceanic plate. From the lowermost to uppermost units, the stratigraphy comprises ocean floor basalt, pelagic deep-water radiolarian chert, hemipelagic siliceous shale, and terrigenous turbidite deposits. The biostratigraphic data obtained in the present study provide corroborating evidence for the existence of a (probably gigantic) deep-water ocean that

enabled the continuous sedimentation of pelagic chert over a period of nearly 50 million years. These data, together with structural data that are characterized by tectonic repetition of the stratigraphy, indicate that these rocks formed as an accretionary wedge along an active continental margin, possibly that of the Angara Craton. The ocean chert deposited probably corresponds to the northern hemisphere portion of the Paleo-Pacific Ocean that faced the Angara Craton and the North China–Tarim blocks. Thus, we propose that pelagic facies within the accretionary complex of Mongolia will play important roles in understanding detailed tectonic history of the Central Asian Orogenic Belt and biodiversity of pelagic realm in Middle Paleozoic time.

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