Conformable lithological relationship between Upper Permian radiolarian chert and basaltic sandstone layers in the Inthanon Zone, Northern Thailand

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Introduction

The Inthanon Zone of Northern Thailand is characterized by the distribution of pelagic Carboniferous–Permian seamount-type carbonates with a basaltic basement (the Doi Chiang Dao Limestone) and Middle Devonian–Middle Triassic radiolarian chert (the Fang Chert). Ueno (2002) interpreted this zone as a geotectonic domain that consists of the pre-Devonian basements of the Sibumasu Block, such as Cambrian sandstone and Ordovician limestone, and is structurally overlain by the Paleo-Tethyan oceanic rocks. He also stated that the Paleo-Tethyan oceanic rocks in the Inthanon Zone have been displaced from the east and emplaced on a marginal part of the Sibumasu Block as tectonic nappes (Caridroit et al. 1992).

The Fang Chert has been studied mainly from a viewpoint of radiolarian biostratigraphy and outline of the depositional age, ranging from the Middle Devonian to Middle Triassic, has been clarified. However, detailed lithological changes of the chert and environmental transition that influenced chert lithology have not been well documented.

In this presentation, we report the occurrence of a succession consisting of basaltic sandstone layers and conformably overlying radiolarian bedded chert, and discuss the origin of the basaltic sandstone layers and sedimentary environment of the sandstone and the overlying radiolarian chert.

Occurrence

The studied section is located about 40 km northwest of Chiang Mai Province, North Thailand. In this outcrop, chert (about 10 m in thickness) crops out along a road-cut, and stratigraphically overlies basaltic sandstone layers (about 3 m in thickness). The chert is gray to bluish gray in color and well bedded, ranging from a few to 10 cm in thickness. The sandstone layers underlying the chert are green in color and commonly show graded bedding. Thin chert layers ranging in thickness from a few mm to 1 cm are sporadically intercalated within the sandstone layers, suggesting their originally conformable stratigraphic relationship. Under the microscope, the greenish sandstone is composed mainly of fragments of glasses and volcanic rocks, which diameter ranges from the clay- to sand-sized. Volcanic rock fragments show the interstitial texture that is commonly observed in basaltic rocks. Coarse terrigenous grains such as quartz larger than silt are not observed in both of these sandstone and chert.

Geochemistry

We preliminarily performed whole-rock composition analysis on the basaltic sandstone. A plot of the basaltic sandstone falls in the fields of OIB (oceanic island tholeiite) of the TiO₂-MnO-P₂O₅ discrimination diagram. Chondrite-normalized multi-element spider diagram and REE pattern of this sandstone shows an enrichment in LREEs that is similar to that of an oceanic island basalt (OIB) rather than that of MORB and Island Arc Basalt (IAB).

Radiolarian age

Late Permian radiolarians that constitute the Follicucullus charveti-Albaillella yamakitai and Neoalbaillella ornithoformis assemblage zones of Kuwahara et al. (1998) were obtained from the lower and upper part of the chert, respectively. Based on radiolarian biostratigraphy, the geological age of the overlying radiolarian chert can be assigned to the Late Permian (Wuchiapingian ~ early Changhsingian).

Discussion

Field occurrence and the result of radiolarian biostratigraphy indicate that the radiolarian chert has a Late Permian (Wuchiapingian ~ early Changhsingian) age and it conformably overlies the basaltic sandstone layers. Basaltic rocks providing sand-sized fragments within the sandstone layers have originated from an oceanic island volcanism based on the whole-rock chemical composition analysis. Enrichment of glasses and accumulation of the basaltic fragments as layers, together with the conformable stratigraphic relationship between the sandstone layers and chert, indicate that the volcanic activity itself would occur within a chert-accumulating sedimentary basin. An absence of coarse-grained terrigenous grains in both of the sandstone layers and the Upper Permian chert indicates that the depositional site of both rocks should be in a pelagic environment, which was, at least during Permian time, entirely free from terrigenous influx. This result accords with the supposed tectonic setting and origin of the basaltic rocks that supplied the basaltic fragments of the sandstone layers.

References