二〇〇九年九月 地 球 学 报 Sep. 2009
第三十卷 增刊 1: 12-12 Acta Geoscientica Sinica Vol.30 Supp.1: 12-12
www.cagsbulletin.com www.地球学报.com

Opening and closing process of the Paleo-Tethys in Northern Thailand

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Abstract: The Paleo-Tethys formed a large ocean basin that existed between Laurasia and Gondwana during Late Paleozoic to Early Mesozoic times. It opened in the Early Devonian by the rifting of Gondwanaland and closed at around latest Triassic time by the collision of the Cimmerian continent to Laurasia (Metcalfe, 1999). We reconstructed opening and closing process of the Paleo-Tethys in Northern Thailand.

Key words: Paleo-Tethys; total organic carbon; radiolarians; subduction; accretionary complex

Devonian siliceous rocks are distributed in the Chiang Dao area, Northern Thailand (e.g., Wonganan and Caridroit, 2005). Organic black shale is exposed at the lowest part of this siliceous sequence, bearing Early Devonian graptolite, brachiopod and conodont fossils (Kobayashi and Igo, 1966). The sequence of organic black shale and siliceous rocks record the change of depositional environments related to the Paleo-tethys opening, however, its environment has not yet been clarified. We report the preliminary results of new lithological observation with radiolarian fossil data and total organic carbon (TOC) analysis, for trying to establish the opening history of the Paleo-tethys systematically. Based on lithological change with radiolarian age, the decreasing of the TOC values indicates the opening history of the Paleo-Tethys during the Devonian. The initial Paleo-Tethys was under the anoxic condition during Early to Middle Devonian with deposition of organic black shale. Subsequence to the Paleo-Tethys opening, siliceous rocks were deposited during Late Devonian with the change from anoxic to oxic conditions. For the Paleo-Tethys at Late Devonian, mud, organic matter and tuff with pumice were still derived from continental margin. After Carboniferous, pelagic chert was distributed in the deep ocean with the development of the Paleo-Tethys.

We reconstructed the accretionary process related to the Paleo-Tethys subduction in northern Thailand, based on description of the structures of mélange and thrust, and metamorphic temperatures derived from illite crystallinity analysis (Hara et al., 2009). Process of mélange formation is characterized by hydrofracturing and cataclastic deformations with mud injection under the semilithified conditions, and shear deformation with pressure solution subsequently. Illite crystallinity data suggest metamorphic temperature below 250°C during mélange formation. Combining of structural character and metamorphic temperature during mélange formation, the accretionary complex related to the Paleo-Tethys subduction was developed at shallow level of accretionary prism. Using asymmetric shear fabrics in mélange, most of shear direction are estimated to be top-to-south. After correlation of rotation by collision between the Indian and Eurasian continents, trend of the Paleo-Tethys subduction zone is estimated to be N80˚E. We conclude that the Paleo-Tethys was subducted toward to north beneath the Laurasia (Indochina Block) during Permian to Triassic.

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