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Geochemistry of sandstone related to Paleo-Tethys subduction zone in the Inthanon Zone, northern Thailand

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The Paleo-Tethys was opened in response to lifting of the North China, South China, Tarim and Indochina blocks from Gondwana during Devonian, and closed by collision between the Indochina Block and the Sibumasu Block, in the Late Triassic time (Metcalfe, 1999). The Inthanon Zone, northern Thailand has been regarded as the convergence margin of the Paleo-Tethys, and it is important zone to represent diversifying of Gondwana and history of collision within Southeast Asia region.

According to Ueno and Hisada (1999), the Inthanon Zone is composed of the Devonian to Triassic radiolarian ribbon-chert and the Carboniferous to Permian carbonate rocks from the seamount, which correspond to Paleo-Tethysian rocks. The Ordovician limestone, metamorphic rocks and sedimentary rocks also crop out the Inthanon Zone. These rocks correspond to the Sibumasu Block. Therefore, the Inthanon Zone is interpreted to represent nappes of Paleo-Tethysian rocks which thrust over a marginal part of the Sibumasu block. Moreover, melange-type rocks were proposed from the Inthanon Zone by Hara et al (2009), and they concluded that the accretionary complex bearing melange was formed by the Paleo-Tethys subduction. Therefore, in this study, the Carboniferous sandstones which from the Sibumasu Block and sandstones in melanges were analyzed petrographically and geochemically for understanding their provenances.

The mode composition was determined about the Carboniferous sandstones from the Sibumasu block and sandstones in melanges on the basis of Gazzi-Dickinson method. From the Dickinson diagram (Dickinson et al., 1983), sandstones from the Sibumasu Block are quartzose sandstones which composed of well-rounded quartz grains characterized by continental sandstones. They are plotted intracraton or quartzose-recycling area on the diagram. On the other hand, sandstones in melanges are mostly lithic including many volcanic fragments, and plotted quartzose to lithic-recycling on the diagram.

Both sandstones from the Inthanon Zone were carried out geochemical analyses for major elements, trace elements and REEs. Major elements were determined by XRF analysis using a PANalytical Axios PW4400/40 housed at the Geological Survey of Japan. Trace elements and REEs were determined by XRF (Rigaku RIX3000) and ICP-MS (Agilent 7500a) housed at Niigata University. Result of major elements analyses, sandstones from the Sibumasu Block were propensity plotted around the Passive Margins area using Fe_2O_3 + MgO %-TiO_2 %, Fe_2O_3 + MgO %-Al_2O_3 / SiO_2, Fe_2O_3 + MgO %-K_2O / Na_2O, Fe_2O_3 + MgO %-Al_2O_3 / (CaO + Na_2O) diagrams that proposed by Bhatia (1983). Result of trace elements and REEs analyses, sandstones from the Sibumasu Block were plotted in the Passive Margins area, and sandstones in melanges were plotted in the Continental Island Arc area using La-Th-Sc, Th-Sc-Zr, La / Sc-Ti / Zr, Sc / Cr-La / Y diagrams that proposed by Bhatia and Crook (1986).

These results suggest that quartz sandstones from the Sibumasu Block are characterized as continental origins without the arc fragments; whereas, lithic sandstones in melanges are strongly affected to clastics which derived from the arc. Based on geochemical analyses, quartzose sandstones and lithic sandstones from the Inthanon Zone indicate different characteristics of their own provenances. In the late Permian to Triassic time, the arc (the Sukhothai Zone) developed in western to southern margin of the Indochina block. We concluded that the accretionary complex by the Paleo-Tethys subduction, which was matured by supply of clastics from the Sukhothai arc.

Keywords: Paleo-Tethys, Inthanon Zone, sandstone, provinance, geochemistry