Provenance analysis based on clastic composition and CHIME age of detrital zircons on the Lower Jurassic Yamaoku Formation, Chugoku Mountains, Southwest Japan

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Introduction: Provenance analysis presents important information to clarify the role of tectonic event. The provenances of pre-Cretaceous clastic rocks of Japan were significantly changed in Late Triassic to Early Jurassic time (Takeuchi, 2000). However, there is little agreement on the tectonic setting for the changes. In Southwest Japan, shallow marine Lower Jurassic sediments are sparsely distributed.

This study addresses clastic compositions as indicator of source rock and the time-spatial variation, and aims for understanding tectonic event on the Southwest Japan during Early Jurassic time. The Lower Jurassic Yamaoku Formation is mainly composed of alternating beds of sandstone and mudstone with several acidic volcanic layers, and subdivided into lower, middle and upper members based on lithofacies. Studies of modal compositions of sandstones, chemical compositions of detrital garnets and Cr-spinels, and CHIME ages of detrital zircons were carried out in the Yamaoku Formation.

Result: Sandstone and conglomerate of the Yamaoku Formation include acidic volcanic, acidic plutonic, intermediate to basic volcanic, sandstone, chert, mudstone and crystalline schist fragments. Mudstone fragments rarely yield radiolarian fossils. Modal compositions show decrease of rock fragments and increase of K-feldspar stratigraphically upward. Pyrope-rich almandine (the highest 8.9 wt.% MgO) decreases from lower to upper member (lower; 44.1 %, middle; 24.2 %, upper; 6.9 %). The same change is recognized in grossular-rich almandine (the highest 7.3 wt.% CaO) (lower; 4.8 %, middle; 0.5 %, upper; 0 %). On the other hand, spessartine-almandine series poor in pyrope and grossular increases from lower to upper member as follows; 55.1 %, 75.3 %, 93.1 % in number frequency. Low-Ti (TiO_2 < 0.25 wt%) group of Cr-spinel decreases from lower to upper member as follows; 11.8 %, 42.3 %, 50.0 % in number frequency. In addition, CHIME ages of detrital zircon indicate mostly ca. 2000, 250 and 180 Ma and rarely ca. 1500, 500, 350 Ma.

Provenance of the Yamaoku Formation and its change with age: Detrital 180 Ma zircons are likely to have been derived from coeval acidic volcanic rocks with accumulation of the Yamaoku Formation, because many acidic tuffs are intercalated with the Yamaoku Formation. Source rocks of 250 Ma and 2000Ma zircons could not be identified from geological evidences in this study. However, 180 Ma, 250 Ma, 1500 Ma and 2000 Ma ages were reported from granitic rock clasts and gneiss clasts in Permian to Jurassic clastic rocks of Japan (e.g. Shibata and Adachi, 1974; Tanaka et al., 2002). Possible Precambrian high-grade gneisses including pyrope-rich almandine garnets are distributed in the Sino-Korea, Yangzi, Huanan, Khanka and Breya massifs.

Low-Ti group of Cr-spinel and grossular-rich almandine might have been derived from the Oeyama ophiolite and ca. 300 Ma Renge metamorphic rocks, respectively, as basement rocks of the Yamaoku Formation. Chert and radiolarian-bearing mudstone were derived from the Permian accretionary complex of the Akiyoshi Belt.

On the basis of clastic compositions, the provenance of the Yamaoku Formation changed from the neighboring Akiyoshi Belt, Oeyama ophiolite and Renge metamorphic rocks associated with Precambrian continental basement with acidic volcanic rocks to granitic rocks extensively.

Reference: Adachi and Shibata (1974) *EPSL*, **21**, 277-287. Takeuchi (2000) *Mem. Geol. Soc. Japan*, no 57, 183-194. Tanaka et al., (2002) *Jour. Earth Pranet. Sci. Nagoya Univ.*, **49**, 1-13.