Petrology and tectonic setting of the Hantaishir ophiolite complex, which includes boninites, Western Mongolia

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Precambrian-Cambrian Hantaishir ophiolite complex, one of the largest ophiolite complexes in Mongolia, locates in the Altai region of the Western Mongolia, approximately 1000 km south west of Ulaanbaatar. This complex is 50 km long and 10-12 km wide, and its entire configuration is northwest to southeast trending.

The complex consists of harzburgite, dunite with cumulated websterite and gabbro. Pillow lavas are also dominant rocks and sheeted dikes appear to some extent. Thin and small amount of chert covers the pillow lavas. Sheeted dike complex consists of boninites, tholeiitic andesites and tholeiitic basaltic andesites. The pillow lavas have tholeiitic andesite in composition. Ultrabasic rocks of this complex are lightly serpentinised.

The Hantaishir ophiolite complex contains two large ultrabasic massifs: the Taishir in the northwest and the Naran in the southeast. Both massifs are sandwiched in between the large serpentinite mélange. Sheeted dike complexes are composed of boninites and tholeiitic andesites. Pillow lavas have andesitic composition.

The REE contents and normalization patterns of the cumulate and volcanic rocks of the Naran massif differ from those of the Taishir massif. The spider diagrams from both massifs show clearly different patterns. The REE patterns of boninite from Hantaishir ophiolite does not have U-shaped form; such patterns are usually common to Paleozoic and Mesozoic boninites. Spider diagrams of the volcanic rocks from the Taishir massif have negative abnormally at Ce.

The chemical characteristics (low Ti, Zr, Y, REE and Ti/Zr, high MgO, Cr and Ni) of this ophiolite are common with modern boninites from the West Pacific island arcs, excluding REE pattens are not have U-shaped. Although REE patterns of tholeiitic low-Ti andesites from South-Sandwich islands are have analogous patterns.

The mineral chemistry of orthopyroxene and olivine of harzburgite and dunite is consistent with residual upper mantle origin whereas mineral chemistry of clinopyroxene and olivine from cumulate posses high Mg# and chromian spinels, have high Cr#.

On the basis of the discriminant plots using immobile elements, gabbros and lavas from the Hantaishir complex are assigned an origin as island arc tholeiites.

A range of petrological and geochemical parameters suggests that ultrabasic rock was generated in a supra subduction zone environment.

The ultramafic rocks are dominated by variably tectonized and harzburgite with geochemical characteristic comparable to supra-subduction zone (SSZ) ophiolites. Chromian spinel in harzburgite has similar compositions to other intra-oceanic SSZ ophiolites.

A generally accepted tectonic model for the Hantaishir ophiolite involves Paleo-Asian Ocean episode in the late Precambrian followed by ocean closing due to northeast ward subduction during late Precambrian to early Paleozoic.