Partial melting and genelation of intermediate to acidic magma in the Yakuno ophiolite of immature oceanic island-arc origin

Yoshimitsu Suda[1]

[1] Earth and Planetary Systems Sci.,Hiroshima Univ.

Gabbro-migmatite - granites association was discovered in the upper Paleozoic Yakuno ophiolitic complex (Asago igneous complex), Asago-cho area, Hyogo Prefecture, Southwest Japan. Those rocks thought to have been constituents of lower crust of immature oceanic island-arc. Its importance is emphasized in the context of the generation of intermediate to acidic magma in the lower crust of immature oceanic island-arc by its partial melting.

The Asago igneous complex shows a horizontal pile of three distinct thrust sheets: the Lower sheet, the Middle sheet and the Upper sheet. The gabbor-migmatite was found in the lowest horizon of the Middle sheet. The Middle sheet shows an relatively complicated geohistory, in which the metamorphic basic complex of oceanic crust origin have been intruded by dykes or sheets of intermediate to acidic rocks of island-arc affinity. Such the situation strongly suggests that the igneous complex of Middle sheet is of the intra-oceanic island-arc origin.

The gabbro-migmatite is classified into agmatite, anaexite, stromatite, diadysite, diktyonite, nebulite and agmatite .The melanocratic gneissose gabbro can be regarded as melanosome in which preferred lattice orientation of constituent minerals is found under the microscope showing the typical texture of metamorphic origin. Typical gabbro-migmatite shows a block-in-matrix structure with randomly oriented melanocratic blocks of gneissose gabbro and leucocratic matrix of tonalite and/or quartz-diorite, suggesting a partial melting of gabbroic rocks had been occurred. Small lenses of hornblendite could be restite formed by hydration change from anhydrous residue. Gneissose gabbro is mainly composed of pargasitic hornblende, augite, orthopyroxene and plagioclase. Their inhomogeneous parallel alignment forms the banded structure. Based on their mineral assemblage and the composition of hornblende, the metamorphic grade of the gneissose gabbro is considered to be attained granulite facies. In contrast to the melanosome, tonalitic or quartz-dioritic leucosome shows the distinct igneous texture, in which the crystallization order can be easily determined.

Numerical simulations for the assumed petrogenetic process have been carried out in two ways. One is calculation for the mass balance using least squares solution on the simple mixing model as:

Host rock = Melt + Restite.

Where the Melt is assumed to tonalitic or quartz-dioritic leucosome and Restite to pyroxene granulite or hornblendite. Although applying possible combination in this model, the RSS, residual sum of squares, gives values greater than 1 that cannot prove this model. Therefore, this simple model could not explain the process of partial melting. The other calculation is to determine the ideal trace element composition of assumed melt using partition coefficient between melt and residual minerals. This calculation also cannot prove this model.

These results strongly suggest that compositional accordance with calculated melt and the object rock using partition coefficient have not always prove the reliability of assumed petrogenetic process. These numerical simulations reveal that amount of residual phase of rocks are insufficient as compared with the field occurrence in the Yakuno complex. They might have been missing elsewhere.