

Geochemical modeling of the Chilas Complex in the Kohistan Terrane, northern Pakistan

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The Kohistan Terrane in the western Himalaya of northern Pakistan, is regarded as a tilted island arc type crust sandwiched between the Asian and Indian continental crusts (Coward et al. 1982). The Kohistan Island Arc is bounded on the south by Main Mantle Thrust (MMT), and on the north by Northern Suture (or Main Karakoram Thrust, MKT), and can be divided into some geological units. The Chilas Complex is a huge basic intrusion about 50 km wide and elongates 300 km almost parallel to the MMT and MKT. It has been interpreted as the magma chamber root zone of the Kohistan Island Arc (Khan et al. 1989). The Chilas Complex is composed mainly of gabbro and several masses of ultramafic-mafic association (UMA) (Jan et al. 1984). The UMA is composed mainly of olivine (with or without clinopyroxene) cumulate (dunite, wehrlite) and plagioclase-clinopyroxene-orthopyroxene cumulates (two pyroxene gabbro), with minor amount of clinopyroxene-orthopyroxene cumulate (pyroxenite) and clinopyroxene cumulate (clinopyroxinite).

Bulk chemical compositions of major elements for the gabbro of the Chilas Complex plotted on the ternary AFM diagram are suitable to island arc non-cumulate, and those for the UMA are suitable to island arc cumulate (Beard 1986). Major element geochemistries of the gabbro and the UMA, plotted on the variation diagrams of $100\text{MgO}/(\text{MgO}+\text{FeO})$ versus oxides, are explained by cumulate and non-cumulate model.

Chondrite normalized rare earth elements (REE) for the gabbro of the Chilas Complex show light rare earth

element (LREE) enriched patterns, which are typical for island arc type basalt. In the case of UMA, contents of REE are relatively low. This is concordant to their cumulate characters, because REE are basically incompatible especially in the case of basic magma (Hanson 1980). On the spidergram, the LIL elements are enriched and Nb and Sr show negative and positive anomalies, respectively for the gabbros of the Chilas Complex. These are geochemical characters of island arc type basalt. In the case of UMA, contents of these trace elements are relatively low, and high field strength (HFS) elements such as P, Zr and Ti are relatively depleted. These features are suitable to their cumulate characters.

References

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