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Zirconium in rutile thermometry from garnet granulites of the Jijal complex of Kohistan arc, NW Himalaya

Chihiro NAKAZAWA*, Hafiz Ur REHMAN*, Hiroshi YAMAMOTO* and Tehseen ZAFAR**

*Department of Earth and Environmental Sciences, Faculty of Science, Kagoshima University, Kagoshima 890-0065, Japan
**State Key Laboratory of Ore Deposit Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang 550081, China

Zirconium in rutile thermometry data from the garnet granulites of the Jijal Complex of Kohistan arc, NW Himalaya are presented in this study. The garnet granulites are composed of garnet, clinopyroxene, plagioclase, quartz, symplectic augite/amphibole, rutile, ilmenite, zircon, and magnetite. Rutile grains range in size from 50 to 350 μm, occur as inclusion in garnet, clinopyroxene, and in plagioclase as well as along the grain boundaries. In total 19 rutile grains were analyzed for Zr contents using an X-ray Analytical Microscope (XGT-5000) by HORIBA. The Zr contents among the analyzed grains ranged between 450 and 920 ppm, where the analyzed spots with lower Zr contents (containing SiO_2 or Fe_2O_3), indicating some influence of host silicate or ilmenite, were removed from results. At the individual grain scale, most of the rutile grains exhibited homogeneous chemical compositions, regardless of their textural affinity. Temperature values, based on zirconium in rutile thermometry, ranged between 792 and 849 °C for rutile enclosed in garnet, 771 and 851 °C for rutile in clinopyroxene, and 784 and 862 °C for rutile in plagioclase whereas matrix rutile grains showed *T* values between 820 and 847 °C. Using the pressure-dependent zirconium in rutile thermometry, the *T* values were slightly lower (±50 to 100 °C). The maximum temperature values were consistent with the temperature data obtained from the conventional thermobarometry results (*P*; 1.2 ± 0.2 GPa and *T*; 818 ± 80 °C) whereas the lower values, likely, reflect chemical resetting of the analyzed grains during later stages of retrogression.

Keywords: Zirconium in rutile thermometry, Garnet granulites, Metamorphism, Jijal complex, Kohistan arc

INTRODUCTION

Kohistan arc, situated at the NW Himalayan range (Fig. 1a), represents an oceanic arc exposing mantle to upper crustal complete section, is welded to the Asian Plate along the Northern Suture and the Indian Plate along the Southern Suture, where the rocks from the mantle to upper crustal levels are exposed (Fig. 1b). The arc formed during the Jurassic-Cretaceous periods with some younger late-stage granitic intrusives. The arc collided with Asian Plate during 102-75 Ma and then welded to the Indian Plate during 55-50 Ma (Tahirkheli 1979; Searle et al., 1999 and references therein). The mafic-ultramafic rock unit at the base of the arc, known as the Jijal complex, is exposed above the Southern Suture. The complex is comprised of peridotites, dunites, and pyroxenites in the lower part and mafic rocks (garnet granulite with minor pyroxene granulite/gabbro) in the upper part (Fig. 1c). In this study, we analyzed rutile grains in garnet granulites of the Jijal complex for zirconium contents using an X-ray Analytical Microscope (XGT-5000) by HORIBA. The aims were (1) to check the applicability of XGT to zirconium in rutile thermometry, (2) to understand the metamorphic temperatures of the garnet granulites, and (3) to check if the results obtained from the XGT analysis on texturally different types of rutile (inclusion phase and those in the matrix) bear same or different results for the metamorphism and are comparable to the previously obtained *P-T* data from the conventional thermobarometry.

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H.U. Rehman, hafiz@sci.kagoshima-u.ac.jp Corresponding author