Proceedings of the Second Russia–China International Meeting on the Central Asian Orogenic Belt (September 6–12, 2017, Irkutsk, Russia)

AN EARLY PERMIAN GARNET-BEATING PERALUMINOUS GRANITIC PLUTON IN THE SOUTH TIANSHAN OROGENIC BELT, NW CHINA: PETROLOGICAL, MINERALOGICAL AND GEOCHEMICAL CONSTRAINTS

Qie Qin1, He Huang1, Tao Wang1, Zhaochong Zhang2

1 Institute of Geology, Chinese Academy of Geological Sciences, Beijing 100037, China
2 State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences, Beijing 100083, China


The Ku’erchu granitic pluton (283±4 Ma) was exposed in the eastern part of the South Tianshan Orogenic Belt. The granites from the intrusion are mainly composed of orthoclase (~45 vol. %), plagioclase (~15 vol. %), quartz (~20 vol. %), muscovite (~10 vol. %), and biotite (~5 vol. %), with accessory minerals including garnet, zircon and Fe-Ti oxide. Garnet is the dominant accessory mineral, shows growth zoning, and is rich in FeO (24.30 % ~ 29.90 %) and MnO (12.15 % ~ 16.89 %) contents. The rocks show high SiO2 (72.46 wt. % ~ 76.79 wt. %), Al2O3 (13.80 wt. % ~ 15.28 wt. %), Na2O (3.84 wt. % ~ 4.62 wt. %), K2O (3.67 wt. % ~ 4.73 wt. %), and have A/CNK values ranging from 1.14 to 1.12, suggesting a strongly peraluminous affinity. Besides, the samples display low Zr (29.6 ppm ~ 47.7 ppm), Zr/Hf (16.61~31.80), Na/Ta (3.05~5.71), Eu/Eu* (0.05 ppm ~ 0.24 ppm) and ∑REE (19.5 ppm ~ 49.2 ppm). These features indicate that the Ku’erchu granite is a highly evolved S-type granite. Mineral chemistry analysis reveals that the crystallization temperature for biotite is 576~608 °C and the solidification pressure is 0.9~1.3 kbar, corresponding to solidification depth 3.25~4.83 km. Petrographic features show that Al-rich minerals (biotite+muscovite+garnet) are the late-stage crystallization phases. Feldspars were crystallized earlier than biotite and garnet, and the latter two phases was related with much lower crystallization pressure.
Garnet crystallized from the MnO-rich evolved melt after fractionation of felsic minerals. The relatively high positive $\varepsilon_{\text{Hf}}(t)$ values ($-4.78~+2.59$) and ancient Hf model ages ($1.13~1.61$ Ga) suggest that the rocks were probably formed by partial melting of the Paleoproterozoic basement rocks at shallow crustal levels, with participation of depleted mantle in an extensional setting.