Late Carboniferous to early Permian crustal anatexis in the Central Asian Orogenic Belt: Evidence from garnet-bearing granites in the Chinese South Tianshan

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Peraluminous granitic rocks provide important insights on the crustal anatexis processes. Here we study two garnet-bearing granitic plutons in the Kolar region located in the northern margin of Tarim Craton in Xinjiang, NW China. Zircon LA-ICP-MS U-Pb analyses yield ages of 311±2 Ma for the garnet-bearing biotite granite (GBG) and 283±4 Ma for the garnet-bearing two mica granite (GMG). The GBG samples have SiO_2 contents of 69.10-71.78 wt.% and are weakly to strongly peraluminous with ASI from 1.04 to 1.11, and exhibit prominent troughs of Nb, Ta, Sr, P and Ti and relatively sloping rare earth element patterns. They have negative $\varepsilon_{Hf}(t)$ values in the range from −8.4 to −0.8. The GMG samples have high SiO_2 (72.46 -76.79 wt.%) and strongly peraluminous with ASI of 1.14–1.22, and show a general positive correlation between ASI and SiO_2. Besides, they display low Zr (29.6-47.7 ppm), Zr/Hf (16.61-31.80), Na/Ta (3.05-5.71), Eu/Eu*(0.05-0.24ppm) and ∑REE (19.5-49.2 ppm). The relatively high $\varepsilon_{Hf}(t)$ values (-4.12 to +7.12) are obviously different from the GBG. Geochemical and isotopic characteristics suggest the GBG was most likely derived from muscovite dehydration melting of metagreywacke, and the GMG was probably formed by partial melting of the Precambrian metasedimentary rocks at shallow crustal levels, with participation of depleted mantle and highly fractionation. We correlate this with the tectonic processes following the collision to extension between the Central Tianshan–Yili Block and the Tarim Craton. In combination with the occurrence of felsic lavas from Wensu, Laohutai, Boziguo'er and Heiyingshan region, we recognize a peraluminous igneous belt in the central part of Chinese South Tianshan, which provides new insights into the crustal anatexis process of the Central Asian Orogenic Belt.

Key words: Crustal anataxis, Peraluminous granite, Garnet

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