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Post-collisional mafic and high Ba-Sr magmatism in the North Qilian, NW China: Melting of metasomatized mantle and implications for lithospheric delamination

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Magmatic rocks are extensively distributed in orogenic belts. Unravelling the complexities of post-collisional magmatism is essential to understanding the latter stages of orogen evolution. A variety of mafic rocks and high Ba-Sr granitoids in post-collisional settings have recently been recognized in the northern margin of the North Qilian, but their petrogenesis and geodynamic processes remain poorly constrained. In this contribution, we present an integrated geochronological, geochemical and Sr-Nd-Hf isotopic data set for early Paleozoic mafic rocks and high Ba-Sr granitoids from Xijin pluton in the north margin of the North Qilian. U–Pb zircon dating yields crystallization ages of 440 Ma $\pm$2 Ma for the hornblende gabbro, 438$\pm$4 Ma for the high Ba-Sr monzonite and 407$\pm$5 Ma for the high Ba-Sr quartz monzonite. The Xijin hornblende gabbros have Mg# of 53-54, whole-rock initial $^{87}Sr/^{86}Sr$ ratios of 0.706, $\varepsilon_{Nd}\,(t)$ values of - 1.1 and zircon $\varepsilon_{Hf}(t)$ values ranging from 1.7 to 3.6. The low MgO (4.80-4.85), Cr (37-41) and Ni (28-52) contents of Xijin hornblende gabbro are consistent with the removal of olivine and pyroxene. The presence of large amounts of hornblende in the Xijin mafic rock highlights that their parental magma was hydrous. We suggest that they were largely derived from hydrous mantle-derived magma. The monzonite and quartz monzonite are characterized by high Sr (677-1131 ppm) and Ba (1360 to 1823 ppm). These high Ba-Sr granitoids have whole-rock initial $^{87}Sr/^{86}Sr$ ratios ranging from 0.707 to 0.709, $\varepsilon_{Nd}\,(t)$ values of - 6.4 to - 5.0, and zircon $\varepsilon_{Hf}(t)$ values ranging from - 5.5 to -2.1, indicating that their magma was derived from partial melting of enriched mantle sources. Moreover, the Xijin monzonite and quartz monzonite are characterized by low Ba/Th (24-68) and Sr/Th (12-44) ratios, high Th contents (25-72 ppm) and Th/Ce (0.18-0.30) ratios, indicative of a slab-derived sediment contribution perhaps due to previous subduction of the North Qilian ocean slab. Post-collisional lithospheric delamination during the Early Paleozoic may account for the generation of the mafic rocks and the high Ba-Sr granitoids.