

Coexistence of Early Paleozoic low-Ca and high-Ca boninites from the Central Qilian block, Northwest China: Constraints on petrogenesis and implication for oceanic subduction and back-arc basin development

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Early Paleozoic volcanic rocks (boninites) occur in the Central Qilian orogenic belt, Northwest China. Their petrogenesis can provide insights into the tectonic evolution of Qilian block and its adjacent areas. In this paper, we carry out a study of geochronological, geochemical and Sr-Nd isotopic compositions for the Early Paleozoic boninites in the Lajishan area of Central Qilian block, NW China. The Lajishan boninites have high Al_2O_3/TiO_2 (36.7–64.7) and CaO/TiO_2 (31.1–49.6) ratios, and high MgO (7.86–10.47 wt.%), Cr (439–599 ppm) and Ni (104–130 ppm) contents, indicating that the boninites result from a refractory mantle source. They are depleted in high field-strength elements (HFSEs) and enriched in large ion lithophile elements (LILEs), coupled with slightly high initial $^{87}Sr/^{86}Sr$ values of 0.7059 ~ 0.7074 and the low $\epsilon_{Nd}(t)$ values of -1.05 ~ +2.66, indicating that the mantle source was metasomatized by subducted slab-derived components. Low-Ca and high-Ca boninites coexist in the Lajishan belt. Their coexistence reveals a complicated geodynamic process. The Early Paleozoic volcanism recorded in the Lajishan of the Central Qilian, results from the northward subduction of this ocean basin beneath the South-Central Qilian block. Zircon U-Pb dating of the boninite yields the magma crystallization ages of ~483 Ma. The Lajishan boninites may represent the products of back-arc basin development in response to the northward subduction of the South Qilian oceanic lithosphere. In the light of reported boninites worldwide, we give a diagram Zr/Y vs. CaO/Al_2O_3 that can be used to identify boninites in fore-arc and back-arc regions.