Geochemical Compositions of the Ultrapotassic Magmatism in Qinling Orogen, China: Petrogenesis and Implications for Crust-mantle Interaction

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Mantle-derived ultrapotassic magmatism (K_2O/Na_2O > 2, K_2O > 3%, and MgO > 3%) above subduction zones is crucial to reveal the growth of the continental crust and the deep processes. Such rocks, previously unknown in the North Qinling unit, have been discovered in the Late Triassic Baoji Pulton, China. The Baoji ultrapotassic rocks yield an age of ~ 212 Ma, generally comparable to those of Baoji granitoids ranging from 217 to 196 Ma. These ultrapotassic rocks display holocrystalline texture and consist mainly of amphibole, biotite, K-feldspar, apatite and titanite. They have high K_2O (6.42-8.00%), MgO (2.92-10.30%) contents and K_2O/Na_2O (3.0-9.5) ratios, and are mainly monzodiorite and monzonite in geochemical compositions. The ultrapotassic rocks are highly enriched in light rare earth element (e.g., La, Ce) and large ion lithosphere elements (e.g., Rb, Sr, Ba, K). While, all the samples are depleted in high field strength elements (e.g., Nb, Ta, Ti), which strongly resemble the trace element signatures of post-collisional ultrapotassic rocks from Lhasa terrane. The high Mg# and Sc, Cr, Ni concentrations, together with high Ba/Nb, Ba/La, La/Nb ratios and low Th/Nb ratios observed in Baoji ultrapotassic rocks indicate derivation from a metasomatized lithospheric mantle regions enriched by inputs of subducted slab derived fluids. In addition, these rocks are characterized by high Ba/Rb and low Rb/Sr ratios, which is consistent with derivation from an amphibole- bearing mantle source. Collectively, this new evidence, together with previous dating and geochemical researches in the Qinling orogenic belt, suggest that the final break-off of continental crust results in the asthenosphere upwelling, which subsequently induced the partial melting of the enriched mantle.