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Petrogenesis of Early Cretaceous basalts from the western Qinling orogenic belt (China) and its tectonic implications for the evolution of intracontinental orgoeny

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The Qinling-Dabie orogenic belt was formed by the collision of the North and South China Cratons during the Early Mesozoic and subsequently developed into an intracontinental tectonic process during late Mesozoic. Field investigations identified the presence of late Mesozoic basalts in the Duofutun and Hongqiang areas in the western Qinling orogenic belt. A set of integrated geochemical and geochronological data for these basalts is carried out to constrain the characteristics of magma source and Late Mesozoic geodynamics of the region. The petrogenesis of these basalts provides an important constraint on the late Mesozoic geodynamics of the orogen.

The representative basaltic samples yield the $^{40}Ar/^{39}Ar$ plateau age of about 112 Ma. All the samples are typical alkaline series volcanic rocks with low SiO_2 (44.98-48.20%), CaO (8.92-12.14%) and high MgO (7.25-12.19%) contents, and Cr and Ni concentrations. They show enrichment in light rare earth element (LREE), strong high field strength element (HFSE, e.g., Nb, Ta) and large ion lithophile element (LILE) enrichment. These geochemical features exhibit OIB-like trace element distribution patterns with insignificant Eu anomalies (1.00-1.10) and low $(^{87}Sr/^{86}Sr)_i$ ratios (0.702769-0.703919) and high $\varepsilon_{Nd}(t)$ values (6.01-10.10). All the samples can be further divided into two groups based on their geochemical results. Group 1 is characterized by low Al_2O_3 and high TiO_2 and P_2O_5 contents, as well as high La/Yb ratios (> 20), being the product of the high-pressure garnet fractionation from the OIB-derived magma. Group 2 shows higher Al_2O_3 (14.05-16.48 wt.%), lower P_2O_5 (0.41-0.67 wt.%) contents, La/Yb (La/Yb <20) and LREE/HREE ratios relative to Group 1. Given the moderately depleted Sr-Nd isotopes, we infer that the Group 2 originated from deep asthenospheric mantle with delaminated lithospheric signatures.

In combination with available data, it is proposed for the petrogenetic model of the Early Cretaceous thickened lithospheric delamination in response to the asthenospheric upwelling along the western Qinling orogenic belt.