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Geochemical, Ar-Ar geochronological and Sr-Nd isotopic constraints on the origin of Late Mesozoic volcanic rocks from the West Qinling area in China

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A set of integrated geochemical and geochronological data for andesites-dacites and basalts from West Qinling orogenic belt, Central China, are presented to constrain their petrogenesis and the late Mesozoic geodynamics of the region. The andesites and dacites exhibit SiO_2 of 56.86-66.86 %, K_2O of 0.99-2.46 %, and MgO of 1.03-4.47 %, with mg-numbers of 42-56. They are characterized by an arc-like geochemical signature with significant enrichment in large ion lithophile element (LILE) and light rare earth element (LREE), and depletion in high field strength element (HFSE). Three of them yield $^{40}Ar/^{39}Ar$ plateau ages of 128.6-129.7 Ma. All the samples have relatively enriched Sr-Nd isotopic compositions, with initial $^{87}Sr/^{86}Sr$ ratios ranging from 0.71125 to 0.71487 and negative $\varepsilon_{Nd}(t)$ values from -10.04 to -6.19. These geochemical signatures reflect derivation from of an enriched lithospheric mantle source followed by a combination of assimilation and fractional crystallization. The enriched lithospheric mantle formed from mantle previously modified by sediment-derived fluid in response to the early Paleozoic and/or late Triassic subduction events that affected the Qinling orogenic belt. Two basaltic samples from Duofutun have yielded $^{40}Ar/^{39}Ar$ ages of 112.0 ± 2.3 Ma and 112.0 ± 0.6 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 LREE, strong HFSE (e.g., Nb, Ta) and LILE enrichment, but depletion in high rare earth elements (HREE). 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). According to the elemental and isotopic variations from the basaltic samples, we suggest that the mafic volcanic rocks are derived from low degrees of partial melting of asthenosphere beneath the West Qinling orogenic belt. The early Cretaceous magmatism in Central West Qinling shows a compositional evolution from intermediate-acidic around ca. 130 Ma to more mafic and Si-undersaturated compositions at ca. 110 Ma. Thus we suggest that the petrogenesis of these volcanic rocks reflects delamination of thickened lithosphere resulting in asthenospheric upwelling.