

Multiple Episode Mafic Dykes and Tectonic Evolution in the South Qinling Orogen: Zircon Ages and Sr-Nd Isotopes

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Origin of mantle-derived mafic rocks in orogenic belts can provide insight into tectonic evolution and crust-mantle interaction during the orogenic processes. Qinling Orogen is forming from the amalgamation of the North and South China blocks in Early Mesozoic. Mafic dykes densely exposed in the South Qinling orogen. Here we report zircon U-Pb ages and Sr-Nd isotopic composition of these dykes.

Dating results show that the dykes formed in two different magmatic episodes of ~460 Ma and ~220 Ma, much younger than previous estimation. Two episodes of dykes share similar geochemical feature in major elements, but distinctive characteristics in trace elements and Sr-Nd isotopes. Mafic dykes of Early Paleozoic are characterized by enrichments in LREEs, LILEs and HFSEs and EMII-type isotopic feature, implying an OIB-like enriched mantle for the magma source. Early Mesozoic dykes can be subdivided into two groups. Group I shows depletions in LREEs, LILEs and HFSEs with DM-type isotopic feature, indicating an origin from partial melting of asthenospheric mantle. Group II has higher Rb-, Ba-, and K-contents and EMI-type isotopic feature, probably suggesting significant contribution of lower crust to magma source owing to the subduction. These mafic dykes record the prolonged evolution of South Qinling. It is suggested that the dykes of Early Paleozoic were related to the opening of an oceanic basin separating South Qinling and the Yangtze block, while the dykes of Early Mesozoic were derived from partial melting of upwelling asthenosphere during the extension in the final amalgamation of these two blocks in Early Mesozoic.