A Comparison of isotopes of Granitoids between the Central Asian Orogenic Belt and Qinling-Dabie Orogen and Implications for Understanding of Accretionary to Collisional orogeny

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The Central Asian Orogenic Belt (CAOB) is the world's largest Phanerozoic accretionary orogenic belt. Comparably, the Qinling-Dabie Orogen is a typical collisional or composite orogen. This study attempts to compare their deep crustal compositions by Nd-Hf isotopic mapping of granitoids to depict accretionary to collisional orogeny.

Most granitoids in the CAOB have juvenile sources and can be classified into four types: (1) juvenile crust source, with juvenile Nd-model age (0.8–0.2 Ga) and positive $\varepsilon_{Nd}(t)$ value (0 to +8); (2) slightly-mixed source, slightly old Nd-model age (1.0–0.6Ga) and $\varepsilon_{Nd}(t)$ value around 0; (3) mixed source, characterized by large variation Nd-model age (1.6–1.0 Ga) and $\varepsilon_{Nd}(t)$ value (-10 to 0); (4) ancient source, characterized by very old Nd-model age (2.8-1.6 Ga) and very low $\varepsilon_{Nd}(t)$ value (-23 to -6).

The granitoids in the Qinling-Dabie Orogen are different from those in the CAOB. They almost have negative $\varepsilon_{Nd}(t)$ values from −21.9 to −3 and old model ages of 2.3–1.2 Ga. Their values of $\varepsilon_{Hf}(t)$ are also mostly negative, and a few of lightly positive. All these signatures indicate that the granitoids in the CAOB have significant differences in Nd-Hf isotopic compositions from collisional orogens such as Qinling-Dabie Orogen, suggesting different deep crustal compositions for them. Compared with the general orogens, the CAOB has much juvenile compositions and more crustal growth (juvenile materials) during Phanerozoic time, distinct from a typical collisional orogen. This study reveals that isotopic compositions of magmatic rocks can trace deep compositions of orogens and provide significant information for understanding compositions and evolution stages (from juvenile accretionary, subductional to collisional) of orogens.