Trace elements and Nd isotope of apatites in the early Mesozoic granitoids in the North China Craton: a window to constrain petrogenesis

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Apatite, as a accessory mineral in igneous rocks, has recently been used in constraining petrogenesis and thermal-tectonic process within the Earth sciences. This paper reports the trace elements and Nd isotopic data of apatites from the early Mesozoic granitoids in the northeast North China Craton (NCC) to constrain their petrogenesis. The comparisons between the whole-rock and apatite chemical compositions indicate that linear relationship can be observed between their Sr/Y ratios and Nd isotopic compositions etc., i.e., geochemical data of these apatites in the granitoids can be used to constrain petrogenesis. The apatites from the Late Triassic granitoids are characterized by enrichment in light rare earth elements (LREEs) and depletion in heavy rare earth elements (HREEs), and have $(La/Yb)_N$ ratios of 8.3–35.7 and Sr/Y values of 0.33–2.83, indicating that the Late Triassic granitoids have an affinity to adakitic rocks. Combined with $\varepsilon Nd(t)$ values (−14.4 to −9.2) and T_{DM2} ages (2168 to 1739 Ma) of these apatites, we conclude that the Late Triassic granitoids in the northeastern NCC were derived from magma generated by partial melting of a thickened ancient lower continental crust. Compared with the apatites from the Late Triassic granitoids, those from the Early Jurassic granitoids have relatively high HREE abundances and low LREE/HREE ratios (1.2 to 4.2), low Sr/Y ratios (0.02-0.05), as well as relatively high $\varepsilon Nd(t)$ values (−9.3 to −6.7) and low T_{DM2} ages (1699 to 1502 Ma), indicating that the Early Jurassic granitoids were derived from partial melting of the Paleoproterozoic–Mesoproterozoic lower continental crust with normal thickness.

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