Decoupling between Nd-Hf isotopic systems in the Chinese Altai: Constraints on the nature of the basement and tectonic implications

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Whole rock Hf and Nd isotopic results and geochemical data for the representative early Paleozoic granites and rhyolites in the Chinese Altai are reported to constrain the nature of the basement. The studied samples include I-type granites (Hanasi Batholith, Kurmutu Pluton, Altai Batholith and Kezgar Pluton), S-type granites (Hemu Batholith, Kuwei Batholith), plagiogranites (Habahe Batholith) and rhyolites from Jiadengyu. The I-type granites are metaluminous to weakly peraluminous and have $\varepsilon_{Nd}(t)$ and $\varepsilon_{Hf}(t)$ values ranging from -2.57 to 0.65 and 4.03 to 12.95, respectively. The S-type granites and rhyolites are all strongly peraluminous and have $\varepsilon_{Nd}(t)$ and $\varepsilon_{Hf}(t)$ values ranging from -3.24 to 1.70 and 2.13 to 15.67, respectively. The plagiogranites from the Habahe Batholith are characterized by low K_2O and high Fe_2O_3 and CaO contents, flat REE pattern and low content of LILE (Rb, Ba). The two plagiogranites have positive $\varepsilon_{Nd}(t)$ (4.32–4.45) and $\varepsilon_{Hf}(t)$ values (13.42–15.67), suggesting their derivation from the mantle. All the samples are plotted above the Terrestrial Array, indicating significant Nd-Hf isotopic decoupling in the magma source. The I- and S-type granites nearly cover the whole Chinese Altai and their age range from 445 Ma to 368 Ma, illustrating that the Nd-Hf isotopic decoupling is prevailed in the Chinese Altai through early Paleozoic. All the samples are not depleted in the HREE and have similar Lu/Hf ratios to the average crust, suggesting that the decoupling of the crust of the Chinese Altai is not resulted from an ancient basement with elevated Lu/Hf ratios but inherited from its source. The similar Nd-Hf isotopic decoupling pattern in mantle and crustal sources support that the lower crust of Chinese Altai was mainly derived from the mantle during early Paleozoic and represents significant continental growth. We suggest that the decoupling between Nd-Hf isotopic systems in the mantle was possibly resulted from selective enrichment of Nd over Hf by metasonmatism.