Petrogenesis of TTG-type granitoids by partial melting of thickened lower crust and implication for early crustal growth: A case study from the Huichizi pluton, Qinling orogen, central China

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Modern adakitic rocks are often considered to be compositional analogues of Archean TTGs and thus a better understanding of their formation has implications for Archean crustal grow processes. Granites from the Huichizi pluton in the North Qinling unit have high Sr/Y (55-158) and $(La/Yb)_N$ ratios (18-60). Their relatively high SiO_2 (67.75-71.84 wt.%) and Na_2O (4.38-5.23 wt.%) and very low MgO (0.43-0.93 wt.%), Cr (3.5-9.0 ppm) and Ni (2.0-6.3 ppm) contents are in the range of high-SiO_2 adakites and Archean TTGs. New U-Pb zircon SIMS combined with previous conventional zircon age data constrain the emplacement age of the Huichizi pluton at 421.6 ± 4.7 Ma. Coeval migmatization, granulite-facies metamorphism and arc-type magmatism favors the model that the melts were produced by heat anomalies during subduction of the Shangdan ocean at *c*. 420 Ma. The Huichizi granites have $\varepsilon_{Nd}(t)$ and $\varepsilon_{Hf}(t)$ values similar to the Neoproterozoic metabasalts in the region. Considering their normal mantle-like $\delta^{18}O_{zir}$ values (6.09 ± 0.14‰) they are best explained by partial melting of the mafic crustal root. This crust was thickened at to ~50 km by previously underplating of mantle-derived basaltic magmas during the Neoproterozoic (c. 800 Ma), suggesting that this was an important period for vertical continental growth by underplating of mantle-derived magmas in the NQ terrane. Therefore, rifting and separation of the NQ terrane from the South China Block may have started at ca. 800 Ma. Moreover, our results suggest that underplating of mafic magma and its subsequent fusion triggered by slab subduction could be an important mechanism for the formation of early continental crust.