Subduction styles in the Neoarchean: evidence from rocks in the north margtin of the Yangtze Craton, South China

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The Neoarchean is an important era during which plate tectonics began to operate widely on the earth and the continental crust compositions changed dramatically. Plate subduction styles in the Neoarchean should be different from modern earth considering hotter mantle and thicker oceanic crust. Here we report geochemical studies on metagrantic and metabasic rocks in the Yudongzi Complex in the northern margin of the Yangtze Craton, which records a plate subduction at about 2.7 Ga. The results show that the magmatic activity in the Neoarchean subduction in different from modern subduction system.

The rocks in the Yudongzi Complex are gneissic granite, gneissic tonalite, amphibolite gneiss and magnetite quartzite. Most rocks are enriched in sodic. The gneissic granites show positive Eu anomalies, high (La/Yb)cn and Sr/Y ratios, low Ybcn and Y, resembling typical TTG. The amphibolite and tonalite gneiss show less fractionated REE patterns. SHRIMP zircon U-Pb dating on one gneissic trondhjemite, one amphibolite and one tonalite gave crystallization ages of 2667±21 Ma, 2701±10 Ma and 2697±9 Ma, respectively. They all recorded a metamorphic event at about 2.48 Ga. The SHRIMP zircon oxygen isotope analysis for a trondhjemite and an amphibolite gave $\delta^{18}O$ values of 6.2±0.3‰ and 6.3±0.4‰, respectively. The oxygen isotope ratios higher than normal mantle values suggest a source experienced low temperature alteration. The laser fluoration analysis of bulk minerals gave $\delta^{18}O$ values of 6.4-8.8‰ for zircon and 12.5-15.2‰ for quartz. The zircon Lu-Hf isotope analysis on the trondhjemite and amphibolite gave similar $\varepsilon_{Hf}(t)$ values of 0.08±0.48 and 0.07±0.63, respectively. Whole-rock $\varepsilon_{Nd}(t)$ values range from -1.5 to +1.0. These trondhjemite and tonalite can be interpreted as derivation from partial melting of subducted oceanic slab. The basaltic protolith of the amphibolite resemble calcalkaline arc basalt. Considering the coeval A-type granitic rocks to the south, plate subduction took place in the northern edge of the Yangtze Craton. The coeval occurrence of TTG and calcalkaline arc basalt in the Yudongzi suggest that both mantle wedge and slab melted in the Neoarchean hot subduction zones.