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Neoarchean subduction recorded in the northern margin of the Yangtze Craton, South China

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Archean rocks in the Yangtze Craton of South China are relatively scarce [1]. The best outcropped and intensive studied rocks are 2.95-3.45 Ga TTG and granitic gneisses in the Kongling Complex in the northern Yangtze Craton. A series of studies have shown that they are mainly reworked pre-existing continental crust [2-7]. However, the accretionary history of the Yangtze Craton in the Archean still remains unknown because the previously studied rocks only crop out in the interior of the craton. Here we report zircon U-Pb ages and Hf-O isotopes as well as whole-rock geochemical compositions for some gneissic tonalite and trondhjemite in the Yudongzi Complex in the northern margin of the Yangtze Craton.

The rocks in the Yudongzi Complex are gneissic granite, gneissic tonalite, amphibolite gneiss and magnetite quartzite. Most rocks are enriched in sodic with Na_2O/K_2O ratios higher than 2.0. The gneissic granites show positive Eu anomalies, high (La/Yb)cn and Sr/Y ratios, low Ybcn (<3) and Y (<10ppm), resembling typical TTG or high-pressure to middle-pressure sodic gneiss defined by Moyen [8]. The trondhjemites have Nb/Ta ratios of 6-23 and Zr/Sm ratios of 63-181, suggesting no rutile in the residue. 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, which is identical with the ages of the Douling TTG and diorite to the east of the Yudongzi Complex. 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 contribution of sedimentary material to the source of these rocks. 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 with a garnet-amphibolite residue.

Considering the 2.6-2.7 Ga A-type granitic rocks in the interior of the craton, plate subduction took place in the northern edge of the Yangtze Craton. The Yudongzi trondhjemite and tonalite were formed in a active continental margin and the A-type granites formed as a response to the back-arc extension. The identification of 2.65-2.7 Ga subduction provides a possible link of the Yangtze Craton with the other cratons worldwide, such as the Superior and Tanzania cratons. This is also a new clue to reconstruct the Neoarchean supercontinent Kenorland.

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