The origin of early Neoproterozoic volcanic rocks and plagiogranites in the northern margin of the South China Block: constraints on the position of South China in supercontinent Rodinia

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In order to understand the accretion history of the South China Block and constrain its position in supercontinent Rodinia in the early Neoproterozoic, a combined study of whole-rock geochemistry, zircon U-Pb ages and Hf-O isotopes was carried out for volcanic rocks and plagiogranites from the northern margin of the South China Block. The volcanic rocks are mainly andesites with SiO_2 contents of 54.2 to 60.2 wt%. Plagiogranites are characterized by high Na_2O (6.6-7.0 wt%), but low TiO_2 (0.2-0.4 wt%). SIMS zircon U-Pb analyses yield concordanteruption age of 936 ± 6 Ma for the andesites and 905 ± 8 Ma for the plagiogranites. Both andesites and plagiogranites are enriched in LILE and LREE but depleted in HFSE. They have highly positive zircon $\varepsilon_{Hf}(t)$ values (+9.6~+15.5 and +8.9~+14.9) and mantle-like zircon $\delta^{18}O$ values (4.1-5.9‰ and 4.6-6.8‰). In addition, both andesites and plagiogranites have depleted whole-rock Sr-Nd-Hf isotope compositions, with low initial $^{87}Sr/^{86}Sr$ ratios of 0.6982-0.7039, positive $\varepsilon_{Nd}(t)$ values of 4.1--6.9 and positive $\varepsilon_{Hf}(t)$ values of 11.1-16.0. These geochemical characteristics suggest that the andesites were produced by partial melting of a depleted mantle source modified by hydrous felsic melts from the subducting oceanic crust. The highly depleted isotope compositons and the lack of relict zircons suggest that they were likely to be form in an intra-oceanic arc, rather than an Andes-type arc setting. The plagiogranites were derived from partial melting of hydrothermally altered basaltic rocks, marking continueous subduction of the oceanic crust to ~900 Ma. Thus, an intra-oceanic subduction system was developed along the northern margin of the South China Block in the early Neoproterozoic. Similar tectonic systems of this period are also recognized in the Kangdian and Jiangnan orogens, respectively, west and southeast to the Yangtze Craton. In this regard, the Yangtze Craton was surrounded by oceanic arcs in the early Neoproterozoic and thus did not amalgamate into Rodinia until ~900 Ma.