Origin of TTG rocks from anatexis of ancient crust: Geochemical evidence from granitoid batholith at Huangling in the Yangtze Gorge

S.-B. ZHANG AND Y.-F. ZHENG

School of Earth and Space Sciences, University of Science and Technology of China, Hefei 230026, China (sbzhang@mail.ustc.edu.cn)

Petrogenesis of TTG rocks has been controversial between melting of subducted slab and thickened lower crust. Previous studies have mainly focused on the issues of major and trace elements without sufficient attention to the difference in the age of involved crust. While reworking of juvenile crust is responsible for the slab melting, reworking of ancient crust corresponds to the melting of thickened lower crust. This latter possibility is illustrated by this study of a composite batholith that is mainly composed of TTG rocks at Huangling in the Yangtze Gorge, South China.

The Huangling batholith is composed of three granitoid suites (Huanglingmiao, Sadouping and Dalaoling). All the granitoids share the TTG characteristics of high Na_2O/K_2O, Sr/Y, $(La/Yb)_N$ ratios, depletion in Nb, Ta, and lack of Eu anomaly. Zircon U-Pb dating indicates they were crystallized in a period of 820 to 800 Ma. Inherited cores yield two groups of U-Pb ages at Paleoproterozoic (1.8-2.0 Ga) and Archean (~2.9 Ga), respectively. Zircon $\varepsilon_{Hf}(t)$ values for inherited cores and syn-magmatic domains are significantly different from each other. $\varepsilon_{Hf}(t)$ values for the syn-magmatic domains range from to -29.7 to -3.6, concordant with whole-rock $\varepsilon_{Nd}(t)$ values of -21.3 to -2.1. Correspondingly, zircon Hf model ages are 2.09 to 3.16 Ga, suggesting their derivation from ancient Paleoproterozoic-Archean crust. $\varepsilon_{Hf}(t)$ values for the inherited cores are consistent with those for Archean TTG gneiss and migmatite in the Kongling complex, suggesting involvement of Archean crust. There are systematic differences in source nature between the different suites: the Huanlingmiao suite has relatively lower $\varepsilon_{Nd}(t)$ and $\varepsilon_{Hf}(t)$ values, higher Sr/Y and $(La/Yb)_N$ ratios, stronger depletion in Nb, Ta, and thus is mainly derived from the Archean crust. In contrast, the Sandouping and Dalaoling suites are mainly derived from the Paleoproterozoic crust. $\delta^{18}O$ values for zircons are 4.85-6.84‰ for the all rocks, suggesting a limited contribution from supracrustal materials to their sources.

The petrogenesis of the Huangling batholith is interpreted by tectonic collapse of Paleoproterozoic arc-continent collision zone and consequent anatexis of the Paleoproterozoic and Archean mafic rocks at different depths. This demonstrates a decoupling between the TTG formation and the slab subduction.

Permian bimodal volcanic rocks from Central Inner Mongolia, North China: Geochemistry, Petrogenesis and tectonic Implication

XIAOHUI ZHANG[1,2]*, H. ZHANG[1], Y. TANG[1] AND S. WILDE[2]

[1]State Key Laboratory of Lithospheric Evolution, Institute of Geology and Geophysics, Chinese Academy of Sciences, China (*correspondence: zhangxh@mail.iggcas.ac.cn)

[2]Department of Applied Geology, Curtin University of Technology, Perth, WA 6845, Australia

Zircon U-Pb ages, geochemical and Sr-Nd-Pb isotopic data are presented for the Late Paleozoic volcanic rocks from central Inner Mongolia, North China. These volcanic rocks show a bimodal distribution in composition, with dominant rhyolite and dacite, subordinate basalt and local andesite. New zircon U-Pb isotopic data constrain their magmatic emplacement at ca. 280 Ma. The mafic samples are characterized by high abundances in Th, U and Pb, slightly enriched LREE patterns and low HFS/LREE ratios. These features, together with their OIB-like isotopic signature, indicate that they were likely derived from high percentage partial melting of a subduction metasomatized asthenospheric mantle in the spinel facies field at depths shallower than 60-70 km. The felsic rocks show an A-type affinity. Combined with their moderately positive $\varepsilon_{Nd}(t)$ values, they are inferred to be generated by the mixing between partial melts of a newly-underplated lower crustal source and an ancient felsic crustal source. The typical magma progression starting with asthenospheric melts then proceeding to lithospheric melts indicates that Early Permian magmatism in Central Inner Mongolia occurred in an extensional setting, most probably related to the post-collisional delamination. Therefore, the occurrence of this unique bimodal magmatism not only demonstrates that the Solonker zone experienced final amalgamation of arc-related terranes by the late-Carboniferous, but also indicates that significant vertical continental growth of crustal continuum through repeated magmatic underplating occurred in the continental interior during post-collisional extension.

This study was financially supported by the Major State Basic Research Program of the People's Republic of China (Grant No. 2006CB403504), the Knowledge Innovation Program of the Chinese Academy of Sciences (Grant No. KZCX2-YW-103).