Mid–Neoproterozoic intra–continental rifting in Northeast Yangtze Block: Evidence of the high–T water/fluid–rock interaction

QIAN-RU CAI, MAN-LAN NIU*, QI WU, XIAO-YU YUAN

School of Resources and Environmental Engineering, Hefei University of Technology, Hefei 230009, China

(cqrcqr92@163.com, *correspondence: hfnml@163.com)

Abstract:

Mid–Neoproterozoic (850–720 Ma) bimodal magmatism in periphery of the Yangtze Block recorded intensive extension related to the assembly and break–up of Rodinia supercontinent. However, it is still controversial that the geodynamic model for the extension activity, with two competing models, i.e., continental rifting in response to breakup of the Rodinia supercontinent [1, 2], and back–arc extension triggered by the continuous oceanic subduction [3]. To address this issue, the combined study of whole–rock major– and trace–elements, Sr–Nd isotopes, and zircon U–Pb–Hf–O isotopes were performed on mid–Neoproterozoic igneous rocks in Feidong Complex and Zhangbaling Group, Northeast Yangtze Block. They consist of monzogranite, alkali–feldspar granite, amphibolite in Feidong Complex, and felsic volcanic rocks in Xileng Formation of Zhangbaling Group, with bimodal affinity. SIMS zircon U–Pb dating revealed that the granitoids in Feidong Complex (808–786 Ma) systematically predate the felsic volcanic rocks in Xileng Formation (762–730 Ma). They generally show high HREEs, Zr, Hf contents, FeO^T/MgO ratio and zircon saturated temperatures, diagnostic features for the A–type granite. Interestingly, these rocks have highly variable K_2O (6.35–1.31 wt%), K_2O/Na_2O (3.34–0.30), Sr–Nd–Hf–O (Isr = 0.7015–0.7068, $\varepsilon_{Nd}(t)$ = -19.3–-1.0, $\varepsilon_{Hf}(t)$ = -25.7–4.1, $\delta^{18}O$ = 0.06–7.17‰) isotopes. Enrichment of Sr–Nd –Hf with high $\delta^{18}O$ content in Feidong Complex and depletion of Sr–Nd–Hf with low $\delta^{18}O$ content in Xileng formation. Their zircon $\delta^{18}O$ values broadly varied from slightly $\delta^{18}O$–enriched to strongly $\delta^{18}O$ depleted, hinting that their crustal sources had been subjected to variable degree of high–T water/fluid–rock interaction. Furthermore, the zircon $\delta^{18}O$ values were gradually decreased with decreasing ages. It is therefore inferred that the mid–Neoproterozoic igneous rocks probably derived from previously altered crustal materials with decreasing of melting depths, consistent with gradually decreasing in the degree of high–T water/fluid–rock interaction [4]. Therefore, these indicate that the source material of Feidong granitoids was derived from melting of ancient basement. And the juvenile Nd–Hf isotopes signal in the Xileng formation volcanic rock also should be reconstructed after melting of the ancient crust, rather than juvenile arc magmatic rocks. This is enough to show that the early igneous rocks were not produced by subduction. The data presented in this study are therefore consistent with an intracontinental rift model instead of back–arc extension model [5].

[1] Zheng et al. (2004) Geochimica Et Cosmochimica Acta **68**, 4145-4165. [2] Zheng et al. (2007) Lithos **96**, 127-150. [3] Zhou et al. (2002) Journal of Geology **110**, 611-618. [4] A. Gerdes & A. Zeh (2009) Chemical Geology **261**, 230-243. [5]Zhang & Zheng (2013) Gondwana Research **23**, 1241-1260.