XU Haijin, YE Kai and ZHANG Junfeng, 2013. Effects of melt fractional crystallization on whole-rock Sr-Nd and zircon Lu-Hf isotope systems: a case study on Weihai migmatitic gneiss, Sulu UHP metamorphic terrane, eastern China. *Acta Geologica Sinica* (English Edition), 87(supp.): 511-512.

Effects of Melt Fractional Crystallization on Whole-Rock Sr-Nd and Zircon Lu-Hf Isotope Systems: a Case Study on Weihai Migmatitic Gneiss, Sulu UHP Metamorphic Terrane, Eastern China

XU Haijin[1, *], YE Kai[2] and ZHANG Junfeng[1]

1 State Key Laboratory of Geological Processes and Mineral Resources, Faculty of Earth Sciences, China University of Geosciences, Wuhan 430074, China;
2 State Key Laboratory of Lithospheric Evolution, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, P.O.Box 9825, China

The Weihai migmatitic gneiss in the Sulu ultra-high pressure (UHP) metamorphic terrane, eastern China, was suffered from partial melting during its exhumation. The primary partial melt experienced a decompressional fractional crystallization (DFC) process to produce plagioclase (Pl)-rich leucosome crystallized at the high pressure eclogite-facies to granulite-facies condition and K-feldspar (Kfs)-rich pegmatitic vein crystallized at the amphibolite-facies retrogression. It is generally accepted that the fractional crystallization process without assimilation could not change the Sr-Nd-Hf isotopic compositions. In this study, we demonstrate that, (1) the DFC process might cause the decoupling between the whole-rock Sr and Nd isotopes. The Pl-rich leucosome almost has same $\varepsilon_{Nd}(t)$ value (-10.4 to -15.0) and initial ($^{87}Sr/^{86}Sr$) ratio (0.708173-0.712476) with the melanosome. The Kfs-rich pegmatitic vein has relatively homogeneous $\varepsilon_{Nd}(t)$ value(-14.8 to -15.2) but significantly high initial ($^{87}Sr/^{86}Sr$) ratio (0.713882-0.716284). (2) The DFC process could change the zircon $^{176}Yb/^{177}Hf$ and $^{176}Lu/^{177}Hf$ isotopic ratios, but could not affect the zircon $^{176}Hf/^{177}Hf$ ratio and the $\varepsilon_{Hf}(t)$ values. Zircon $^{176}Yb/^{177}Hf$ and $^{176}Lu/^{177}Hf$ ratios are dramatically increased from the Pl-rich leucosome to the Kfs-rich pegmatitic vein. Zircon $^{176}Hf/^{177}Hf$ ratio (0.282330±0.000017 for the Pl-rich leucosome, 0.282321±0.000026 for the Kfs-rich pegmatitic vein) and $\varepsilon_{Hf}(t)$ value (-10.9±0.6 for the Pl-rich leucosome, -11.6±0.8 for the Kfs-rich pegmatitic vein) are nearly unchanged between them. In consideration of the Late-Triassic alkaline complexes in the eastern Sulu UHP metamorphic terrane, we suggest that the extracted Kfs-rich felsic melt metasomatized the overlying mantle wedge resulting in syn-exhumation magmatism.

Key words: Migmatitic gneiss; Decompressional fractional crystallization; Decoupled isotopic compositions; Syn-exhumation magmatism; Sulu UHP metamorphic terrane

References

Auzanneau, E., Schmidt, M.W., 2006. Experimental evidence of decompression melting during exhumation of subducted continental crust. Contributions to Mineralogy and Petrology 152: 125-148.

Chen, Y.X., Zheng, Y.F., Hu, Z.C., 2013. Synexhumation anatexis of ultrahigh-pressure metamorphic rocks: Petrological evidence from granitic gneiss in the Sulu orogen. Lithos 156-159: 69-96.

Hermann, J., 2002. Experimental constraints on phase relations in subducted continental crust. Contributions to Mineralogy and Petrology 143: 219-235.

Hermann, J., Green, D.H., 2001. Experimental constraints on high pressure melting in subducted crust . Earth and Planetary Science Letters 188(1-2): 149-168.

Hermann, J., Spandler, C., Hack, A., Korsakov, A.V., 2006. Aqueous fluids and hydrous melts in high-pressure and ultra-high pressure rocks: implications for elementtransfer in subduction zones. Lithos 92: 399-417.

Liu, F.L., Robinson, P.T., Gerdes, A., Xue, H.M., Liu, P.H., Liou, J.G., 2010. Zircon U-Pb ages, REE concentrations and Hf isotope compositions of granitic leucosome and pegmatite from the north Sulu UHP terrane in China: Constraints on the timing and nature of partial melting. Lithos 117: 247-268.

Liu, F.L., Robinson, P.T., Liu, P.H., 2012. Multiple partial melting events in the Sulu UHP terrane: zircon U-Pb dating of granitic leucosomes within amphibolite and gneiss. Journal of Metamorphic Geology 30: 887-906.

Rubatto, D., 2002. Zircon trace element geochemistry: partitioning with garnet and the link between U-Pb ages and metamorphism. Chemical Geology 184: 123-138.

* Corresponding author. E-mail: xuhaijin@cug.edu.cn

Rubatto, D., Hermann, J., 2007. Experimental zircon/melt and zircon/garnet trace element partitioning and implications for the geochronology of crustal rocks. Chemical Geology 241: 38-61.

Schmidt, M.W., Poli, S., 1998. Experimentally based water budgets for dehydration slabs and consequences for arc magma generation. Earth and Planetary Science Letters 163: 361-379

Schmidt, M.W., Poli, S., 2003. Generation of mobile components during subduction of oceanic crust. Treatise on Geochemistry 3: 567-591.

Xu, H.J., Ye, K., Song, Y.R., Chen, Y., Zhang, J.F., Liu, Q., Guo, S., 2013. Prograde metamorphism, decompressional partial melting and subsequent melt fractional crystallization in the Weihai migmatitic gneisses, Sulu UHP terrane, eastern China. Chemical Geology 341: 16-37.

Xu, H.J., Ye, K., Zhang, J.F., 2012. Temperature of prograde metamorphism, decompressional partial melting and subsequent melt fractional crystallization in the Weihai migmatitic gneisses, Sulu UHP terrane: constraints from Ti-in-zircon thermometer. Journal of Earth Science 23(6): 813-827.