Zircon U-Pb chronology and geochemistry of Permian volcanic rocks in eastern Heilongjiang Province, NE China and its tectonic implications

E. MENG, W.L. XU *, F.P. PEI AND F. WANG

College of Earth Sciences, Jilin University, Changchun 130061, China (mengen08@mails.jlu.edu.cn, *correspondence: xuwl@jlu.edu.cn)

The voluminous Late Paleozoic volcanic rocks occur in eastern Harbin, Heilongjiang Province of the NE China, located in the eastern segment of the Central Asian Orogenic Belt (CAOB) between the Siberian and North China Cratons [1]. The volcanic rocks are composed mainly of the basalt, basaltic-andesite, rhyolite and minor dacite. LA-ICP-MS zircon U-Pb dating results for two basaltic rocks, three rhyolites and one dacite indicate that they formed in the Early Permian (ca. 292 Ma). The mafic rocks have SiO_2 = 50.13-53.80 wt.%, K_2O=0.98-2.28 wt.%, Mg#= 0.51-0.71, Cr=144-541 ppm, Ni =74-261 ppm, $(^{87}Sr/^{86}Sr)i$=0.7044, and ε_{Nd} (t) = +4.28, whereas felsic rocks have SiO_2 =69.12-77.98 wt.%, K_2O=3.09-5.33 wt.%, Mg#= 0.17-0.36, $(^{87}Sr/^{86}Sr)i$=0.7032, and ε_{Nd} (t) = +4.32, suggesting a typical bimodal volcanism. Trace element geochemical data indicate that these mafic volcanic rocks are characterized by strong enrichment in LILEs (such as Pb, Rb, Ba, Sr), depletion in HFSEs (such as Nb, Ta, Ti) and HREEs, and weak negative Eu anomalies (0.88-0.94) whereas felsic rocks exhibit trongly depletion in Nb, Ta, Sr, P, Ti, enrichment in Th, U, K, and relatively large negative Eu anomalies (0.28-0.95). Taken together, it is suggested that the mafic magma could be derived from partial melting of the lithospheric mantle modified by the subducted slab-derived melt/fluid, whereas the felsic magma should originate from partial melting of the newly accretionary crust. The Early Permian bimodal volcanic rocks, together with the coeval A-type granites, imply an extensional envirnment simialr to back-arc basin [2], which could be related to the subduction of the Paleo-Asian oceanic plate beneath the Jiamusi and Songnen-Zhangguangcai Range massifs.

This research was financially supported by research grants from the Natural Science Foundation of China and the Chinese Ministry of Land Resources (Grants 40672038 and 1212010611806).

[1] Sengör *et al*. (1993) *Nature* **364**, 299–307. [2] Meng *et al.* (2008) *Chin. Sci. Bull.* **53**, 1231–1245.

Assessing the relationship between excess argon content and recrystallization of ultrahigh-pressure metamorphic rocks

C.A. MENOLD[1]*, M. GROVE[2] AND C.E. MANNING[3]

[1]Albion College, Albion, MI 49224 (*correspondence: cmenold@albion.edu)
[2]Stanford University, Palo Alto, CA 94305
[3]University of California, Los Angeles, CA 90095

The extent to which strain history and lithology are able to control preservation of UHP mineralogy is a crucial question. In this study we combined petrologic and structural observations with a series of $^{40}Ar/^{39}Ar$ and $\Delta^{18}O$ measurements involving UHP phengite to use ^{40}Ar excess ($^{40}Ar_E$) as a geochemical tracer to determine the spatial scale over which UHP mineralogy is perserved across an important lithologic and rheologic boundary between mafic eclogite and its felsic gneiss host in the North Qaidam UHP belt of China. Our results indicate that accumulation of $^{40}Ar_E$ is a sensitive monitor of the extent of recrystallization. Anomalously old ages were observed in eclogite and in proximal gneiss samples (<5 m away eclogite blocks). Previous geochronologic and petrologic studies have revealed that both lithologies were recrystallized under UHP conditions at 490 Ma where water activity may be too low and fluid mobility too limited for an effective sink for $^{40}Ar^*$ to exist. Argon production modeling indicates that locally derived $^{40}Ar_E$ created during the UHP event cannot explain the wide range of apparent ages observed. Moreover, the solubility of $^{40}Ar^*$ in UHP may be very high. Phengite is a key UHP phase in many common bulk compositions. Partition coefficients between phengite and coexisting minerals such as garnet and quartz appear to be very high and indicate that most $^{40}Ar_E$ in UHP rocks accumulates in phengite during dry conditions. This supports the conclusion that $^{40}Ar_E$ is inherited from the protolith and incorporated in phengite during UHP metamorphism. Nominal model white mica-quartz $\Delta^{18}O$ equilibration temperatures calculated for the variably recrystallized gneiss samples proximal to the eclogite block scatter significantly while the fully recrystallized amphibolite-facies distal gneiss samples that lack $^{40}Ar_E$ cluster between 550-600°C. The UHP mineralogy survived in a strain shadow that extends more than five meters from the eclogite-gneiss contact. The results demonstrate the inability of $^{40}Ar_E$ to escape during dry UHP conditions and its preservation during subsequent metamorphism enables it to serve as a sensitive monitor of extent of UHP preservation.