Multiple mantle metasomatism as inferred from O, Li and Mg isotopes of the Pleistocene ultrapotassic volcanic rocks in NE China: An EMI /LOMU debate

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There has been a hot debate on the origin of enriched mantle endmember EMI, especially for those exposed in continental settings. Several authors have emphasized the LOMU nature for continental EMI endmember since 1988 (Zhou and Zhu, 1989, Zhou et al., 1992, Zhou and Zhang 1994) and it has received positive response from geochemical community (Zindler, 1993). The previous comprehensive study have revealed that the mantle source of Pleistocene ultrapotassic rocks in NE China show a typical EMI signature in terms of its overall geochemical parameters, particularly, one of the least radiogenic Pb isotope in the world for those with EMI signature, Leucite Hill and Smoky Butte(Zhang, Zhou and Zhang, 1998 , Sun et al., 2014). On the basis of systematic radiogenic isotopes analysis (Sr-Nd-Pb-Hf-Os), in-situ mineral O isotope analysis by SIMS (Cameca 1280HR) have been performed on olivine phenocrysts from Xiaoguulihe lucitites. The results show relatively higher $\delta^{18}O$ values than the normal mantle value, vary between 5.3 and 6.2‰, which imply addition of an 18O-rich crustal component into their mantle source after ruling out the crustal contamination. The high-$\delta^{18}O$ feature of olivine phenocrysts is inherited from the subducted crustal component and it can only be preserved in the cold and stable subcontinental lithospheric mantle. Combined with the variable range of Li isotope on phenocrysts of clinopyroxene (Sun et al., 2015) and the lowest negative Mg isotope signature in Chinese Cenozoic volcanic rocks (Su et al., 2015), it has been postulated that ultrapotassic volcanic rocks were mainly generated from the lower subcontinental lithospheric mantle, which had been experienced multiple metasomatism in different geological time by potassium-rich silicate melts derived from anciently subducted continental-derived sediments, and carbonatic melts derived from an increasingly dehydrated slab. The enriched mantle endmembers are related not only to variable proportions of slab melts but also to the residence time of subducted slabs in the mantle.

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