Nebular thermal event recorded in amoeboid olivine aggregates from the reduced CV3 chondrite Leoville

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We collected *in situ* oxygen isotopic analyses of minerals in amoeboid olivine aggregates (AOAs) from the reduced CV chondrites Efremovka, Leoville and Vigarano to evaluate their original isotopic compositions and temperature-time (T-t) histories of alteration. We compard our results with model diffusion in forsterite, diopside, anorthite and spinel [1-5] to interpret T-t histories.

AOAs in the reduced CV chondrites consist of three lithologic components: (1) an olivine-rich component of granular forsterite and minor Fe,Ni-metal; (2) a refractory component of Al-diopside±anorthite±spinel; (3) a volatile component of Na-bearing silicates and FeO-bearing olivine [6]. The forsterite consists of equant, anhedral grains on the order of 5 to 15 µm in diameter. The refractory component is finer grained. The volatile component is interstitial, but is also reflected in olivine zoning from forsteritic cores to more fayalitic rims.

We used the Titech Cameca 1270 ion microprobe [7] to collect *in situ* O-isotopic compositions in two AOAs from Efremovka, two from Leoville, and two from Vigarano. All of the AOAs yielded ^{16}O-rich ($\delta^{17,18}$O ~ -40‰) analyses associated with the olivine-rich and refractory lithologic components, suggesting that AOAs originated from the same O-reservoir as Ca,Al-rich inclusions (CAIs) [8,9].

Depletions in ^{16}O varied among the AOAs in our study. The two AOAs from Leoville exhibit a mineral-dependent trend, with ^{16}O-rich forsterite, ^{16}O-poor anorthite, and Al-diopside having a range of intermediate compositions. Diffusion-modelling for spherical grains of radius = 6 µm for forsterite and radius = 2 µm for anorthite, diopside and spinel rules out low-temperature thermal events, but can be explained by diffusion at temperatures of 1100 to 1300°C on a timescale of several weeks to a year. These constraints are best explained by short-term heating of the AOAs in a ^{16}O-poor nebular setting.

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Absence of lithospheric mantle helium signature in megacrysts of SE China

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In order to elucidate the nature and kind of noble gas reservoir beneath SE China, we have carried out noble gas analysis on megacrysts (1 garnet, 4 CPX and 3 ilmenite) from Cenozoic basalts of Nushan and Yingfengling, SE China. These samples yielded MORB-like ^{3}He/^{4}He ratios of 7.4 to 8.7Ra which are higher than those reported from megacrysts from the subcontinental lithospheric mantle (SCLM) (Fig. 1). Although the occurence of the MORB-type helium is a common feature of the SCLM, this signature tends to be obscured in many cases by the ingrowth of radiogenic ^{4}He in the metasomatized SCLM. This effect is also expected to be significant if helium in the present sample is associated with the SCLM formed with the overlying craton. The absence of radiogneic ^{4}He signature in turn suggests that there is no thick and old lithospheric keel beneath the SE Chinese craton which is in accordance with the geophysically suggested thin continental lithosphere beneath SE China (Griffin et al., 1998). In the Cenozoic, source region of the alkalic basalts hosting the megacrysts should have already been replaced with newly accreted lithosphere with MORB-type helium. In addition, air-like neon and argon signatures observed in the present samples might reflect the presence of atmospheric heavy noble gases recycled during the supra-subduction processes and collision tectonics which may have a role to place in the delamination of the Archaen keel (Menzies and Xu, 1998).

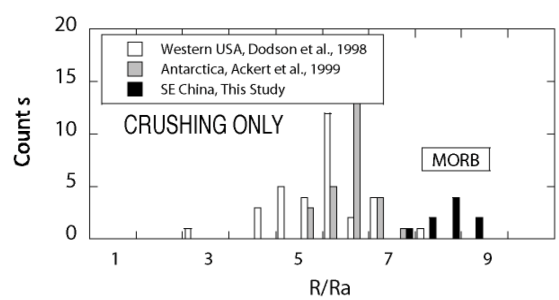

Fig.1. Helium in phenocrysts from the SCLM.

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