Noble gas signatures preserved in podiform chromitites from Luobusa and Kangjinla, Tibet

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We studied noble gases (He, Ne and Ar) by crushing the chromite and olivine separates from the Luobusa and Kangjinla chromitites in order to understand their volatile compositions and further to trace the origin and evolution history of the chromitites. The studied samples can be divided into two groups based on petrography and distinct noble gas signatures.

Group I samples (without carbonates, as opposed to Group II samples with intrusive carbonate veins) have $^{3}He/^{4}He$ from 0.81 to 2.36 Ra (where Ra is the $^{3}He/^{4}He$ ratio of air=1.4×10^{-6}) and air-like Ne and Ar isotopic compositions irrespective of chromitite structure types (nodular, massive, and transitional between the two). Given the absence of atmospheric He, as indicated by the $^{4}He/^{20}Ne$ and $^{3}He/^{36}Ar$ several orders of magnitude higher than air, the observed He can be regarded as a two-component mixture of mantle- and crustal-derived He. In addition, the broadly positive correlation between ^{3}He and ^{36}Ar in nodular samples and the wide distribution range of $^{20}Ne/^{36}Ar$ indicate a source mixing between mantle and recycled noble gases[1-3]. The primary noble gas signatures in Group I samples, combined with major element data, support the idea that the podiform chromitites were formed at supra-subduction zone (probably forearc) by melt-rock interaction[4].

In contrast, Group II samples have much more radiogenic $^{3}He/^{4}He$ from 0.03 to 0.3 Ra but much less radiogenic $^{40}Ar/^{36}Ar$ from 344 to 420. In combination with the occurrence of carbonate veins, it is suggested that the noble gas compositions of these samples have been overprinted by hydrothermal alteration that probably occurred during or after emplacement of the chromitites and peridotites.

[1] Matsumoto *et al*. (2001) *EPLS* **185**, 35-47. [2] Broadley *et al*. (2016) *GCA* **176**, 139-156. [3] Hopp & Ionov (2011) *EPLS* **302**, 121-131. [4] Zhou *et al*. (1996) *J. Petrol.* **37**, 3-21.