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A geochemical study of lithospheric mantle beneath Northern Victoria Land (Antarctica): main evidences from volatile content in ultramafic xenoliths

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A geochemical study of ultramafic xenoliths from Northern Victoria Land (Green Point, GP and Handler Ridge, HR), is carried out in order to investigate the features of the lithosphere mantle beneath the Western Antarctic Ridge System (WARS).

The majority of samples is spinel anhydrous lherzolite with rare presence of secondary phases (secondary cpx and glass). Geothermobarometric calculations, based on the Fe/Mg distribution among the peridotite minerals reveal that Sub Continental Lithospheric Mantle (SCLM) beneath Handler Ridge records temperatures and redox conditions higher then Greene Point (P fixed at 15 Kbar). Moreover, geochemical models evidence that, GP mantle domain represents a residuum after $\sim$7 to 21 % of partial melting in the spinel stability field, which was variably affected by interaction with infiltrating melts, acting in different times, from at least Jurassic to Cenozoic (Pelorosso et al., 2016).

Fluid inclusions (FI) entrapped in olivine and pyroxene crystals were investigated for elemental and isotopic contents of both, noble gases (He, Ne, Ar) and CO_2. He, Ar and Ne concentrations range from 1.52×10^{-14} to 1.07×10^{-12}, from 4.09×10^{-13} to $3.47\times10^{-11}$and from 2.84×10^{-16} to 7.57×10^{-14} mol/g, respectively, while the CO_2amounts are between 7.08×10^{-10} and 8.12×10^{-7} mol/g.

The $^3He/^4He$ varies between 5.95 and 20.18 Ra (where Ra is the $^3He/^4He$ ratio of air), being the lowest and the highest values measured in the He-poorer samples. Post-eruptive input of cosmogenic ^3He and radiogenic ^4He seems to influence mainly the samples associated to a lower He concentrations, increasing and decreasing respectively their primordial $^3He/^4He$ values, that for all the other samples range between 6.76 and 7.45 Ra. This range reasonably reflects the isotope signature of mantle beneath the investigated areas.

The $^4He/^{40}Ar^*$ ratio corrected for atmospheric-derived contamination ranges between 0.004 and 0.39. The lowest $^4He/^{40}Ar^*$ values ($^4He/^{40}Ar^*<0.1$) are systematically in correspondence of the He-poorer samples and probably derive by a selective loss of He with respect to Ar. The $^4He/^{40}Ar^*$ values, ranging between 0.12 and 0.39 are lower than the typical mantle production ratio ($^4He/^{40}Ar$=1-5; Marty, 2012) and suggest that the pristine signature could have been modified by partial melting processes in agreement with major and trace element geochemistry of opx, cpx and sp. The carbon isotope composition of CO_2 is reported as $\delta^{13}C$ (where $\delta^{13}C=[^{13}C/^{12}C_{sample} - {}^{13}C/^{12}C_{std}]/^{13}C/^{12}C_{std}\times10^3$) and varies between -2.5‰ and -4.5‰ with a more homogeneous value (at about -3.5%¸) measured in the CO_2-richest samples. This range of $\delta^{13}C$ is compatible with typical mantle values ($\delta^{13}C$ in average -5‰ Deines, 2002) and reasonably reflects the local mantle signature.

References:

Deines P., 2002. The carbon isotope geochemistry of mantle xenoliths. Earth-Science Reviews, 58, 247–278.

Marty B. 2012. The origins and concentrations of water, carbon, nitrogen and noble gases on earth. Earth and Planetary Science Letters 313–314, 56–66.

Pelorosso B., Bonadiman C., Coltorti M., Faccini B., Melchiorre M., Ntaflos T. & Gregoire M. 2016. Pervasive, tholeiitic refertilisation and heterogeneous metasomatism in Northern Victoria Land lithospheric mantle (Antarctica). Lithos, 248–251, 493–505.