A chlorine isotope view of mantle metasomatism via slab fluids/melts

J. SELVERSTONE* AND Z.D. SHARP

Dept of Earth & Planetary Sciences, University of New Mexico, Albuquerque, NM 97131 USA
(*correspondence: selver@unm.edu)

We use Cl, H and O stable isotope geochemistry to investigate fluid/melt infiltration of the Finero peridotite (Ivrea Zone) in a shallow mantle wedge setting (1.2-1.6 GPa, ~900°C, Perple_X modelling). Unaltered samples from the Balmuccia peridotite have typical mantle δ^{37}Cl values of -0.4±0.3‰ and provide a reference frame for the metasomatized rocks. Four lithologies from Finero (1: spinel harzburgites with minor amph ± phlog, 2: harzburgites with abundant phlog ± amph, 3: amph segregations, and 4: phlog segregations) have δ^{37}Cl values between –2.0 and +2.1‰ (Fig. 1). We also report preliminary chlorine isotope data from HP/UHP rocks (hydrothermally altered oceanic crust, serpentinites with rodingite dikes, and Mn-rich and calcmica schists) that represent likely subduction inputs (Fig. 1). The isotopic variability recorded at Finero cannot be reconciled with metasomatism by a single fluid. Three principal components describe the sample variability: (A) endmember peridotite, (B) a low δ^{37}Cl, high δD, and high δ^{18}O component (melt derived from subducted sediment), and (C) a high δ^{37}Cl, δD, [Cl], and [K] component (high-salinity fluid likely released from altered oceanic crust). Preserved cm-scale isotopic heterogeneities indicate channelized infiltration of fluid/melt at different times and from different slab source rocks. Small-scale fluid release events – not just large-scale serpentinite dehydration – are thus important in chemical transfer from subducted slabs to the mantle wedge.

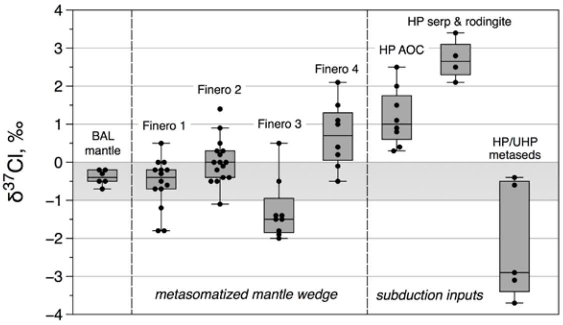

Figure 1: Box-and-whisker plot of δ^{37}Cl values from unaltered mantle peridotite (BAL), metasomatized Finero rocks, and various HP and UHP rocks from the western Alps.

Correlation of δ^{13}C and PGE contents in magmatic ores

D.V. SEMENOVA*, V.A. PONOMARCHUK
AND V.V. RYABOV

Sobolev Institute of Geology and Mineralogy SB RAS, 630090 Novosibirsk, Acad. Koptyug av., 3, Russia
(*correspondence: semenovadina@gmail.com)

Typically, the spatial association of rare metals, including PGE, with the organic matter is regarded as an argument to the important role of organic matter in ore formation. As an example, ore deposit in black shales is given [1]. However, there are also many sedimentary basins with low metal concentrations. Thus, ore mineralization occurences in black shales are not a reliable criterion for genetic connection: mineralization – organic matter. Mineralized geological formations with low contents of reduced carbon are best suited to reveal such relations.

The example of correlation between the isotopic composition of carbon, it's content and PGE concentrations in the ores of one of the deposits of the northwestern Siberian platform is presented in this study. Carbon isotope composition were determined using Thermo Finnigan 253 mass spectrometer with specially-constructed line [2]. Special attention was paid for the signal from neutral C0 species (graphit, solid solution C) in the isotopic analysis. The contents of this carbon in the samples range from 15 to 80 ppm. δ13C values were mainly in the range of -21 to -26, 5 ‰. In rare cases, heavier isotope values were obtained for graphite: -12; -13, 5; -14, 5‰. Data have shown that there is no correlation between carbon contents and PGE concentrations (correlation coeffcient is 0.45). However, the comparison of PGE contents in ores and carbon isotope values (C0) has shown the complete linear dependence (the correlation coefficient is 0.94) between them: the weighting of carbon isotope composition was accompanied by the increasing of PGE contents in the same samples. Such a weighting of carbon isotope composition was noted earlier by Ryabov *et al.* [3]. The most possible explanations of the results is that platinum group elements are transfered by specific organometallic compounds rather than the whole organic matter.

[1] Coveney *et al.* (2003) *Ore Geol. Rev.* **24**, 1–5. [2] Semenova & Ponomarchuk (2009) *Geochim. Cosmochim. Acta* **73**, A1193. [3] Ryabov *et al.* (2010) *Geochim. Cosmochim. Acta* **74**, A895.