

## **Sulfur isotope signature ( $\delta^{33}\text{S}$ , $\delta^{34}\text{S}$ and $\delta^{36}\text{S}$ ) of sea-water altered Archean oceanic crust in Siberian eclogite**

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Eclogite xenoliths brought to the surface by kimberlites are high pressure mafic rocks whose origin (magmatic vs crustal) remains debated. In addition to disagreement on how to interpret eclogite compositions, mantle metasomatism overprints the mineralogy and geochemistry of some of these rocks, making the question of their protolith undoubtedly more complex.

In this contribution we aim to test the robustness of multiple S-isotope signatures in highly metasomatized eclogitic sulfides. We selected 12 interstitial sulfides from Mir (n=4) and Udachnaya (n=8) eclogites, intergrown with garnet and omphacite. We analysed their lead (including  $\text{Pb}^{204}$ ) and S-isotope ( $^{32}\text{S}$ ,  $^{33}\text{S}$ ,  $^{34}\text{S}$  and  $^{36}\text{S}$ ) compositions, in-situ, using a Cameca ims 1280. The samples consist of complex assemblages of pyrrhotite pentlandite intergrowth with K- and Cl-rich sulfides (djerfisherite) invaded by veinlets of alteration minerals (mainly chlorite).

All our samples display internal zoning in Pb concentration (118 ppm to 4.2 wt%) but are homogeneous in isotopic compositions (e.g.  $^{208}\text{Pb}/^{204}\text{Pb} = 38.09 \pm 0.35\%$ ). Pb-Pb ages of eclogitic sulfides are modern and undoubtedly reflect the metasomatic overprint by a Cl- and K-rich kimberlitic melt (consistent with the presence of djerfisherite).

Sulfur isotope signatures of these sulfide ( $\delta^{34}\text{S} = -1.3\% \pm 2\%$ ) fall within the canonical mantle range and cannot be distinguished from the composition of sulfides in the kimberlite ( $-1.4 \pm 2.2\%$ , Kitayama et al., 2016). Furthermore, Mir and Udachnaya eclogitic sulfides carry the largest mass independent fractionation (MIF) ever reported in mantle rocks. The overall trend reveals negative  $\Delta^{33}\text{S}$  (down to  $-1.1\%$ ) associated to positive  $\Delta^{36}\text{S}$  (up to  $3\%$ ). This observed correlation between  $\Delta^{33}\text{S}$  and  $\Delta^{36}\text{S}$  is consistent with the composition of sulfate aerosols formed in the Archean by photolysis reactions and likely dissolved in the ocean [4].

Our results indicate that multiple sulfur isotopes survive intense metasomatism (because isotope fractionation does not create S-MIF), and provide further evidence that the protoliths of Siberian eclogites were mafic rocks altered by seawater in the Archean.