Origin of salt nodules in the Udachnaya-East kimberlites? Insights from Sr-Nd and S- isotopes

Y. KITAYAMA[1*], E. THOMASSOT[1], A. KORSAKOV[2], A. GALY[1]

[1] CRPG-CNRS, BP20, 54501 Nancy, France (*correspondence: yumi@crpg.cnrs-nancy.fr)

[2] V.S. Sobolev Institute of Geology and Mineralogy, Siberian Branch, 630090 Novosibirsk, Russia

Salty fluids are stable in the lithospheric mantle [1] and thus we may expect to find them in extrusive volcanic rocks as well. In Siberia, the Udachnaya-East kimberlite hosts extremely well preserved 'nodules' of molten salts that do not present any relicts sedimentary textures [2]. It is still debated, however, whether these nodules are genetically linked to the kimberlitic magma.

Here we used a combination of radiogenic (Rb-Sr, Sm-Nd) and stable (S) isotopes analyses to investigate the origin of these nodules Salt-rich nodules, including chloride (95% chloride; n=2) and chloride-carbonate nodules (70% chloride + 30% alkali-carbonate; n=2) were studied, as well as host kimberlites (n=4), country-rock sediment and regional brine for comparison.

On an evolution diagram, water and acetic acid leachates of chloride nodules define a linear array that, if interpreted as an isochron, yields an apparent age of 355 Ma, within error of the emplacement age of the kimberlite and an initial $^{87}Sr/^{86}Sr_{t=355Ma}$ of 0.710 ± 0.003. Bulk and carbonate fractions of chloride-carbonate nodules define an initial $^{87}Sr/^{86}Sr_{t=355Ma}$ (0.706 ±0.002) and $^{143}Nd/^{144}Nd_{t=355Ma}$ (0.5123 ±0.0002) that overlap with those of the kimberlite (initial $^{87}Sr/^{86}Sr_{t=355Ma}$ =0.705 ±0.001 and $^{143}Nd/^{144}Nd_{t=355Ma}$ =0.5124 ±0.0001). $^{87}Sr/^{86}Sr_{t=355Ma}$ of the brine and host sediment (0.7088) cannot explain the Sr isotopic composition of the chloride nodules. A dual origin for the nodules is thus possible, depending on their carbonate contents.

In terms of sulfur isotopes, sulfates of the chloride-carbonate nodules and the salty kimberlite are undistinguishable ($\delta^{34}S$=11‰). Sulfates of a chloride nodule have distinctly heavier isotopic compositions ($\delta^{34}S$=18‰) but their Sr isotopes imply they cannot be explained by the assimilation of known sedimentary components or post magmatic fluid circulation ($\delta^{34}S$=34‰ for host sediment and brine). In this contribution, we will discuss the robustness of both approches and propose some explanation(s) for the occurence of these salt nodules.

[1] Weiss *et al*. (2015) *Nature*. [2] Kamenetsky et al. (2007) *Chem. Geol*.