Sulfur and lead isotopic systematics of sulfides in South African xenoliths

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Sulfide mineral in mantle is considered as a significant carrier phase for sulfur, lead, osmium, as well as platium group elements. We have investigated the isotopic composition of individual sulfide minerals found in xenoliths from the Robert Victor Mine, Premier Mine (South Africa), and Lashaine (Tanzania). Sulfides are exposed by careful polishing, and SEM images were taken for every grain before *in situ* analyses by SIMS (S-isotopes, Cameca IMS 1280 CRPG Nancy) and LA-ICPMS (Pb-isotopes, 193 nm excimer laser coupled with Neptune, LMV Clermont-Ferrand).

Sulfides found in peridotite xenoliths are predominantly pentlandite with few pyrrhotite. $\delta^{34}S$ values range from -0.7 to +5.9 ‰. $^{207}Pb/^{206}Pb$ ranges from 0.79 to 0.90; $^{208}Pb/^{206}Pb$ ranges from 2.07 to 2.14, and the radiogenic-end corresponds to Lashaine garnet peridotite. Sulfides are more frequently found in eclogitic xenoliths and are mostly chalcopyrite and pyrite, with occasional presence of pentlandite and pyrrhotite. $\delta^{34}S$ values range from -5.4 to +2.2 ‰ and $^{207}Pb/^{206}Pb$ ranges from 0.85 to 0.94; $^{208}Pb/^{206}Pb$ ranges from 2.05 to 2.24. Internal precision of $\delta^{34}S$ is from 0.07 to 0.20, external reproducibility of standard values are 0.6 ‰ (2σ). The external reproducibility of $^{207}Pb/^{206}Pb$ of NIST 610 is 0.5% relative deviation (2σ). $\delta^{33}S$ values are also determined for all grains, however no sulfur isotope mass-independent fractionation signature is found, except for one grain.

S-isotope composition in eclogitic xenolith appears to vary significantly even within a grain of sulfide, which is usually a composit of at least two sulfide mineral species and sometime cross-cut by oxide and/or hydroxide veins. Such small scale variation suggests that many eclogitic lithologies in cratonic environment have experienced metasomatic event that can vary the sulfur isotope composition. Pb-isotope ratios vary significantly less than that of sulfur, perhaps reflecting the larger analytical volume (by more than 100 times) used for the analyses. In general, the peridotitic xenoliths show higher $\delta^{34}S$ than eclogite, but Pb-isotope ratios are comparable among South African xenoliths. We did not find any obvious correlation between S and Pb isotope ratios. However, further examinations accouting for lithology, mineral textures, and phase composition will help identify the relationship between metasomatic events and modification of isotopic compositions.