New constraints on sulfides as the main mantle Pb reservoir

MEGAN D'ERRICO, JESSICA WARREN AND MATTHEW COBLE[1]

[1]mderrico@stanford.edu warrenj@stanford.edu coblem@stanford.edu Stanford University, 450 Serra Mall, Stanford, CA 93405

As one of the most powerful long-lived radiogenic systems, the Pb isotopic composition of the mantle is central to many geochemical problems. Studies have been used to suggest that mantle Pb resides predominately in the sulfide phase, which is possibly a source of missing unradiogenic Pb. Existing data of sulfide Pb concentrations is sparse, and combined with sulfide modal abundances yield a significant Pb deficit. To address this gap in knowledge of the Pb mass balance of the upper mantle, we present the first *in-situ* Pb concentration data for abyssal peridotite sulfides collected using the SHRIMP-RG ion microprobe.

More than 80 sulfide grains were analyzed, half of which occurred in clusters of sulfide grains and half as individual grains. The majority of sulfides display homogenous Pb concentrations within individual sulfides and among grain clusters. Grain-averaged Pb concentrations range from 1 to 40 ppm. The lack of low concentration matrix-matched sulfide standards constrained the detection limit to ~1 ppm. The average concentration of all spots analyzed is 3.3 ppm Pb (n = 190), with a 1σ S.D. of 6.4 ppm, reflecting the large concentration variation in the population as a whole. Our results indicate that sulfides contain less average Pb than the 75 ppm originally estimated by Hart and Gaetani [1]. Our average is within uncertainty of published TIMS measurements that range from ~4-5 ppm.

Based on an average concentration of 3.3 ppm Pb and modal abundance of 0.02%, sulfides contribute 0.6 ppb to bulk peridotite. If Pb concentrations are representative of pre-melting Pb abundances, this suggests sulfides host <3% of Pb in the depleted MORB mantle (23.2 ppb Pb; [2]). This study, combined with literature data from other ridges, suggests that sulfides do not exert a strong control on the fractionation of Pb during mantle melting.

[1] Hart, S.R. and Gaetani, G.A. (2006) Mantle Pb paradoxes: the sulfide solution. *Contrib. to Mineral. Petrol.* **152**, 295–308.
[2] Salters, V.J.M. and Stracke, A. (2004) Composition of the depleted mantle. *Geochemistry, Geophys. Geosystems* **5**, 1–27.