

## Osmium isotope heterogeneity in recently erupted volcanic rocks

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Re-Os isotope studies of orogenic, cratonic, ophiolitic and abyssal peridotites have revealed that bulk inventory of Os in the earth's mantle is present in trace sulfide and platinum metal minerals whose  $^{187}\text{Os}/^{188}\text{Os}$  ratios are variable reflecting prior events of mantle melting and/or metasomatism [1]. Partial melting of mantle, magma transport, and contamination through lithosphere all conspire to obfuscate mantle Os isotope heterogeneity in recently erupted lavas. In this context, the observation [2] that USGS BHVO-2 standard displays intrasample Os isotope variations is intriguing. If sulfide melts in the mantle exist as interconnected network [3], the above observation would indicate the presence of refractory and unradiogenic osmiridium nuggets in BHVO-2 that may be hosted by silicate phases. A robust method is needed to investigate intrasample Os isotope disequilibrium.

We have developed a two-step procedure to obtain a pair of Os isotopes from a single sample aliquot: (1) Step-I: inverse aqua regia attack in quartz reaction vessels in a High-Pressure Asher and (2) Step-II: complete dissolution of Step-I residue using HF-HBr mixture. We analyzed USGS BIR-1a standard and samples of phonolites and parent basanite from Laacher See, Germany (13 ka). For BIR-1a, two  $^{187}\text{Os}/^{188}\text{Os}$  ratios obtained are within error of each other viz., 0.1340 +/- 0.0003 (Step I) and 0.1347 +/- 0.0003 (Step II). In contrast, the Laacher See samples exhibit two significantly different  $^{187}\text{Os}/^{188}\text{Os}$  ratios: radiogenic values from Step I and relatively unradiogenic from Step II. The isotopic disequilibrium can be interpreted in two ways. One, early fractional crystallization of Os-bearing phases (Step II) and subsequent contamination of Os-poor residual melt (Step I). Second, presence of xenocrystic osmiridium driving Step II  $^{187}\text{Os}/^{188}\text{Os}$  ratio to a lower value. The new method is a robust way of unraveling the more pristine (uncontaminated) melt composition, with implications for deciphering petrologic and mantle processes.

[1] Luguet and Pearson (2019), *Amer. Mineral.*; [2] Li et al. (2015) *Chem. Geol.*; [3] Zhang and Hirschmann (2016) *Amer. Mineral.*

