

Pressure effects complicate our understanding of Earth's sulfur cycle

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Magmas formed by upwelling mantle plumes typically have higher chalcophile and siderophile element (CSE) contents than mid-ocean ridge basalts (MORB). These differences are often attributed to sulfide-under-saturation of plume-related melts [1, 2], which inhibits the fractionation of CSE-rich sulfide minerals from the melt. However, as S-solubility is sensitive to a number of parameters including pressure, temperature, melt composition and fO_2 , and since S can also degas, understanding the behaviour of S in magmatic systems is challenging [3, 4].

To address these challenges, we have examined the CSE content of oceanic plateau basalts (OPB) to assess, in relative isolation from other variables, the pressure effects on S-solubility. We demonstrate that, in contrast to the findings of previous studies [1, 2], most OPB reach sulfide-saturation. Differences in the MgO content at which OPB saturate in sulfide relative to MORB can be attributed to differences between the depth of partial melting and the average depth of crustal differentiation.

We further show that, unlike continental flood basalts, many OPB are erupted under a deep enough water column such that they do not degas S on eruption. When degassing does take place, OPB magmas have higher CSE contents (e.g., Cu and Ag) than undegassed magmas at similar stages of differentiation. Consequently, resorption of sulfide formed at earlier stages of differentiation might be an important mechanism of enriching melts in sulfide-compatible CSE and therefore contribute to the anomalous enrichments of CSE in the crust such as magmatic and hydrothermal ore deposits.

[1] Ely and Neal (2003) *Chem. Geol.* **196**, 235-257. [2] Michael and Cornell (1996) *Eos. Trans.* **77**, F714. [3] Jugo (2009) *Geology* **37**, 415-418. [4] Mavrogenes and O'Neill (1999) *Geochim. Cosmochim. Acta* **63**, 1173-1180.