Sulphur isotope systematics in volcanic sulphides and glasses from El Hierro, Canary Islands

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Sulphur isotopes in volcanic environments have the potential to reveal a vast amount of information about magmatic source, possible contamination, or degassing processes. Olivine-hosted sulphides from Mangaia, which represents the "HIMU" mantle end-member, contain mass-independently fractionated (MIF) sulphur isotopes, interpreted as the signature of recycled Archean crust [1]. Here we report on SIMS measurements of triple S isotopes in crystal-hosted sulphide inclusions from the 2011-2012 eruption at El Hierro, Canary Islands, which involved volatile-rich oxidized magma. $\delta^{34}S$ in sulphides ranges from -9.57 ± 0.13 to 0.99 ± 0.15 ‰, while $\Delta^{33}S$ clusters around 0 ‰ (± 0.1 ‰), consistent with only mass-dependent fractionation. In addition, $\delta^{34}S$ measurements in silicate melt inclusions and matrix glasses show a strong correlation with sulphur content, with S-rich inclusions (up to 5080 ppm) having slightly positive $\delta^{34}S$ (up to 3.57 ± 0.55 ‰) and degassed matrix glasses (~450 ppm S) having values down to -7.83 ± 1.15 ‰. These results imply that (1) ocean island basalts with HIMU-type signatures do not necessarily carry MIF sulphur and (2) degassing strongly fractionated S isotopes during the El Hierro eruption, with the residual magma depleted in ^{34}S, placing robust constraints on sulphur speciation in the melt and gas. Separation of a sulphide liquid likely did not cause significant fractionation, since the $\delta^{34}S$ range of sulphide inclusions mirrors that of the melts.

[1] Cabral *et al.* (2013) *Nature* **496**, 490-494