The influence of crustal assimilation on magma genesis and eruptive behaviour: An oxygen isotope study of the central Aeolian arc, Italy

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Oxygen isotopes can be used to constrain crustal assimilation in magmatic systems. In the Aeolian arc, evidence for crustal assimilation is widespread based upon isotopic data and the occurrence of crustal xenoliths [1]. However, the degree and role of crustal assimilation in the generation of intermediate to felsic magmas and its influence on eruptive behaviour remains poorly constrained.

Here, we investigate the most recent intermediate to felsic eruptions of the central Aeolian arc, focussing on key eruptions from the southern dome field and northern rhyolitic centres on Lipari, La Fossa on Vulcano, and the Pollara crater on Salina. Volcanic glass, feldspar and clinopyroxene were separated for laser fluorination oxygen isotope analysis. These data are combined with thermobarometry and textural observations to investigate the effects of crustal assimilation at different crustal depths, stages of magma differentiation, and the potential influence of assimilation of different crustal lithologies on eruptive behaviour.

Preliminary data from Vulcano show a limited range of $\delta^{18}O_{cpx}$ (6.2-6.7 ‰) in felsic pyroclastic rocks, which overlap with $\delta^{18}O_{cpx}$ from mafic enclaves. $\delta^{18}O_{fsp}$ (7.0-8.1 ‰) generally increases with bulk rock SiO_2 content pointing to increasing crustal assimilation with magma differentiation. $\Delta^{18}O_{fsp\text{-}px}$ also increases with increasing SiO_2, indicating that the analysed clinopyroxenes are not in equilibrium with the more evolved rocks. $\delta^{18}O_{fsp}$ and $\Delta^{18}O_{fsp\text{-}px}$ are highest in sub-plinian pumices, suggesting explosive eruptions are more 'contaminated' than effusive eruptions. Calculated $\delta^{18}O$ melt values, even in the mafic lithologies, are higher than that of mantle-derived magmas, demonstrating that crustal contamination is ubiquitouson on Vulcano. Alongside further data from Vulcano, we will present and discuss new oxygen isotopic results from Lipari and Salina.

[1] Ellam & Harmon 1990, J. Volc. Geoth. Res. 44:105-122. [2] Lucchi et al. 2013, Geol. Soc. Lond. Mem. 37.