Geochemical study of olivine-hosted melt inclusions and sulfide minerals from Izu-Oshima volcano

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Knowledge of the pre-eruptive volatile content of magma is of fundamental importance for understanding of various magmatic processes, eruption dynamics and ore formation. Since volatiles in magma are largely degassed during subaerial eruption, it makes difficult to estimate their pre-eruptive concentrations from volcanic rock analyses. Melt inclusions trapped in phenocrysts may retain dissolved volatiles in magmas, providing us information on pre-eruptive volatile concentrations, because the host mineral surrounding the inclusion acts like a tiny pressure vessel.

Olivine-hosted melt inclusions in the O95 pyroclastic layer of Izu-Oshima volcano, Japan, have SiO_2 contents of 49 to 54 wt% and their chemical features are interpreted in terms of the magma mixing of highly and least evolved magmas. The latter is characterized by high S (1500 ppm) and H_2O (3.4 wt%). The S^{6+}/S_{total} ratios in melt inclusions range from 0.64 to 0.73, suggesting relatively high oxidation state (NNO+0.87 at 1423 K). Pyrrhotites are present only in titanomagnetite microlites, suggesting that sulfide saturation occur with microlite growth under the sulfur fugacity (log fS_2) of around +0.5 for T = 1333 K. The matrix glasses, whose chemical composition is more evolved than any melt inclusions, contain high amount of Cl (0.13 wt%) but significantly less H_2O (0.2 wt%) and SO_3 (less than 0.02 wt%), suggesting that the Cl remains in magma, in contrast to S and H_2O which are degassed totally during magma effusion.