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Halogens behaviour during the 79 AD plinian eruption at Vesuvius. Implication for phonolitic and rhyolitic melts degassing.

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Halogens (F, Cl, Br, I) partitioning between melt and H_2O vapour provide efficient tools for understanding degassing processes during silicic magma eruptions. Our study focused on the 79 AD eruption of Vesuvius, which is the reference for the plinian activity. Density and vesicularity of a series of $\sim$100 pumice clasts from the main eruptive units have been measured. Halogens contents on pumice clasts representative of each unit are measured using pyrohydrolysis, ion chromatography (F, Cl) and ICP-MS (Br and I). H_2O content in whole rock is measured by H2-manometry. Comparison of volatile contents of bulk rocks, residual melts and melt inclusions (initial melts) show two distinct behaviours for H_2O and halogens. H_2O is strongly degassed in plinian clasts whereas halogens are not sensitive to this degassing process. In addition, halogens contents in all studied materials display clear correlation indicating that they are not fractionated during melt evolutions. Variation of Cl content with melt polymerization degree (described by indexes as NBO/T, the ratio of the non-bridging oxygens over network forming cations) show that halogens behaviour is mainly controlled by melt differentiation processes and their incompatible behaviour. These results are compared to similar studies of other plinian eruptions involving phonolitic and acid andesitic magmas: the Fogo A eruption of Fogo (Açores), the 1902 Plinian eruption of Santa Maria (Guatemala) and the P1 Plinian eruption of Montagne Pelée (Martinique). In phonolitic melts halogens have very high saturation levels even when H_2O degassing occurs and in rhyolitic melts halogens, except F, are efficiently degassed with H_2O. This is interpreted as the result of melt structure and specifically

alkalies contents on halogens behaviour in H_2O–saturated silicic melts.

Keywords: silicic magmas; degassing; halogens; water; plinian eruption; silicate melt structure