

Volatile (F and Cl) concentrations in Iwate olivine-hosted melt inclusions indicating low temperature subduction

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Volatiles in magma are largely degassed during subaerial eruptions, instead, melt inclusions trapped in early crystallizing olivine retain dissolved volatiles of magmas at depth (e.g. [1]). This allows the estimation of pre-eruptive volatile concentrations.

Iwate volcano is located on the volcanic front of the Northeast Japan arc on the Honshu Island. The Iwate samples are one of the most undifferentiated rocks on the volcanic front of Japanese island arcs. The olivine hosted melt inclusions of the 1686 eruption of Iwate volcano are basaltic to basaltic-andesitic in composition.

Evidence for degassing found in systematic variations in H₂O, CO₂, and S, maximum pre-eruptive values are considered to be minimum estimates for concentrations prior to vapor saturation. F and Cl concentrations do not correlate with any of the volatiles affected by degassing. Therefore we used them to draw inferences on mantle processes. The results are that (1) the F and Cl concentrations found in Iwate melt inclusions are at the low end of a global compilation of arc melt inclusion data, and (2) F concentrations overlap with MORB values, whereas Cl is enriched by a factor of 10 relative to MORB. We assumed that peridotite drawn into the mantle wedge has F and Cl concentrations comparable to the MORB source, therefore the relative concentrations found in these melt inclusions is that the metasomatic agent released from the subducted lithosphere was enriched in Cl but not F. Following recent results on F and Cl partitioning between silicate and fluid [2], we suggest the F/Cl ratios of these magmas was fractionated because slab top temperatures were low. New Ce measurements in the same inclusions test this conclusion.

[1] Sobolev (1996), *Petrol.*, 209-220. [2] Wu & Koga (2013), *GCA*, **119**, 77-92.