Volatiles in melt inclusions – implications for the wet spot hypothesis

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Melt inclusions hosted in olivine crystals within basaltic glassy rims of subglacially erupted pillow lavas from Iceland have been analysed by Fourier-Transform InfraRed spectroscopy (FTIR) and electron microprobe. Inclusion thicknesses have been calculated via a novel technique, using the differences between spectral bands of the host olivine with and without an inclusion in the beam path, combined with accurate measurements of the overall thickness at the exact analysis spot using reflection spectra. This has greatly eased inclusion preparation for FTIR measurements, removing the necessity for them to be doubly exposed and polished. The volatile contents, together with major element concentrations, have been compared to those of the bulk glass of these samples that previously led to the suggestion that Iceland was a wet spot [1]. Inclusions that remain locked within the crystal will record the state of the melt at the time of crystal growth, which may be prior to, or at an early stage of, the secondary processes that can alter the original volatile content in the bulk glass.

Initial measurements show that inclusions contain up to 4 times more water than the bulk glass. In addition, carbon dioxide (up to 800 ppm) has been measured where none was detected in the bulk glass. These data suggest that some inclusions are sampling the melt before a degassing event(s) and that in these cases the volatile content of the inclusions will prove valuable for further evaluating the role of volatiles in the sources of the Icelandic magma. Inclusions that contain less volatiles than the bulk glass have been affected by the addition of volatiles after inclusion formation, perhaps via interaction with hydrous crust, or alternatively incompatible water has become enriched after partial crystallisation of the inclusion. Combining the volatile data with major element and future trace element data will evaluate these hypotheses.

References

[1] Nichols A.R.L., Carroll M.R., and Höskuldsson Á. (2002) *EPSL* **202,** 77-87.