MELT INCLUSION STUDIES IN BASALTIC MAGMAS IN ICELAND

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Investigations of melt inclusions and their host macrocryst in erupted basalts from Iceland have provided important insights into subsurface magmatic processes. This presentation is an overview of studies on melt inclusion in mafic magmas in Iceland.
High-Mg# (>65) melt inclusions are among the most primitive liquids known from Iceland, yet record modification of mantle-derived melts by differentiation and mixing. Furthermore, major and trace element compositions of inclusions spanning the basaltic spectrum demonstrate a trace element disequilibrium between primitive and evolved mafic melts, indicating that a range of mantle melt compositions must have contributed to the formation of the relatively evolved and compositionally constrained mafic magmas typifying the erupted products within the volcanic zones of Iceland. The erupted magmas appear to have evolved with time via polybaric storage at 1.5-8 kbars (= depths of ~5 to 30 km), with further modification up on ascent to eruption as evident from a common 0-1.5 kbar signal overprinted onto macrocrysts. Oxygen isotope measurements on host macrocrysts as well as melt inclusions reveal highly variable $\delta^{18}O$ (3.3–5.4 per mil), which have been interpreted as indicating variations in oxygen isotopic composition within the mantle source.
Volatile measurements in melt inclusions indicate a typical pre-eruption concentration in the range of 0.2-1.0 wt% H_2O, 250->3000 ppm CO_2 and 1000-2500 ppm sulphur. The sulphur data were used to propose a two-stage degassing model for basaltic fissure eruptions in Iceland, that is currently being tested by study on the sulphur degassing during the 2014-15 eruption at Dyngjusandur, North Iceland. Implications of these studies for sulphur-linked mineralization will be discussed.