

Constraining P-T-X-t paths of magma storage and migration in the Snæfellsnes Volcanic Belt (SVB), W- Iceland

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The ability to track pre-eruptive magma storage and transfer through the crust is an important goal in volcanology. We apply an integrated method, combining a Systems analysis approach with diffusion chronometry of compositionally zoned olivine macrocryst populations, a micro analytical study of melt inclusion geochemistry and thermobarometry to constrain pressure-temperature-composition-time (P-T-X-t) paths of sub-surface magma processing in the SVB, in W-Iceland. We investigate olivine, clinopyroxene and plagioclase macrocrysts, groundmass glasses and olivine-hosted melt inclusions contained in two postglacial lava flows from the SVB: Búðahraun (Búð) ~5.0-8.0 ka [1] and Berserkjahraun (Bers) ~4.0 ka [1]. Olivine macrocrysts (Fo₆₆ - Fo₉₁) from both eruptions show simple normal and complex reverse zonation. Clinopyroxene and plagioclase compositions range from Mg_{#70} to Mg_{#89} and from An₅₃ to An₈₈. Mineral-liquid equilibria calculations indicate that rims of plagioclase, olivine, and clinopyroxene are in chemical equilibrium with their respective carrier liquids. The majority of the macrocryst cores are too primitive to be in equilibrium with the observed groundmass glass compositions, indicating a possible mush origin of the cores. Clinopyroxene-liquid thermobarometry [2] was applied revealing pressures of 4.7-8.0kbar (Búð) and 2.4-7.9kbar (Bers) and temperatures of 1183-1244°C (Búð) and 1161-1263°C (Bers) for the cores. Rims record lower temperatures of 1126-1173°C (Búð) and 1121-1192°C (Bers) with a slightly larger pressure spectrum of 0.1-4.5kbar (Búð) and 0.5-5.4kbar (Bers). Preliminary mush disintegration timescales, obtained from olivine Fe-Mg diffusion chronometry, range from a few days up to 7 months, with the majority (61%) of timescales being shorter than 60 days.

[1] Harðarson, B.S., 1993. PhD thesis, University of Edinburgh, pp. 435; [2] Neave, D. A. & Putirka, K.D., 2017. AmMin, 102, 777-794