

Melt fractionation during pāhoehoe flow lobe emplacement, Heiðin há lava, SW Iceland

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Melt segregations are vesicular formations of evolved melts generated by *in situ* closed system fractionation of a host lava. Although they are common in pāhoehoe flows, pillow basalts, lava lakes and shallow intrusions, their development is not fully understood. In addition, as the melt segregations are often confined to the scale of a single outcrop, they can be seen as an easily approachable analogue to the crystal-melt fractionation processes generating evolved magmas in the Earth's crust.

An eight meter high pāhoehoe flow lobe in Heiðin há lava, SW Iceland, was sampled in order to understand the development of the elaborate segregation structures within. The sampled outcrop is a cross-section of a typical Icelandic pāhoehoe lava, belonging to a large post-glacial lava shield on Reykjanes Peninsula. The lava core is striped by melt segregations in the form of vertical vesicle cylinders 1–7 cm in diameter, which feed horizontal vesicle sheets higher up in the upper lava core and lower crust.

Whole-rock major and trace element results for the 20 samples from the Heiðin há lava reveal a homogenous olivine tholeiitic host lava intersected by segregations of varying composition. The vesicle cylinders in the flow core are only mildly differentiated, but the segregated melt evolves upwards to horizontal vesicle sheets, from which some have experienced an additional enrichment possibly by a gas filter-pressing of the residual liquid in the horizontal sheet. The most evolved segregations are extremely Fe-rich with 19.5 % FeO_{tot} in comparison to the average of 12.4 % FeO_{tot} in the host lava. Consequently, MgO drops from the host lava's 9.5 % to 4.4 % in the segregation sheets. In addition, segregations are enriched by a factor of ~ 2 – 2.5 in TiO_2 , K_2O , P_2O_5 and incompatible elements Zr, Nb, Y and V. As a consequence of the closed system behavior, geochemical trends are evident between the host lava, vesicle cylinders, and vesicle sheets of different types.