Geophysical Research Abstracts
Vol. 17, EGU2015-12309, 2015
EGU General Assembly 2015

Petrography and petrology of the Nornahraun eruption of the Bárðarbunga volcanic system, Iceland

Guðmundur H. Guðfinnsson, Sæmundur Ari Halldórsson, Enikő Bali, Sigurður Jakobsson, Guðrún Sverrisdóttir, Ármann Höskuldssson, Morten S. Riishuus, and Þorvaldur Þórðarson and the 2014 Nornahraun eruption team
Nordic Volcanological Center, Institute of Earth Sciences, University of Iceland, 101 Reykjavík, Iceland (gudmhg@hi.is)

The on-going fissure eruption north of Dyngjujökull is becoming the largest of its kind in Iceland since the 1783-84 Laki eruption. The erupted lava is olivine tholeiite, containing up to 5% normative olivine. It is relatively macrocryst-poor, initially containing less than 1% phenocrysts by volume, increasing to over 1% as the eruption has progressed. Plagioclase is the dominant macrocryst phase but olivine and augite are also present. In most of the samples, crystallization of the groundmass is substantial, with plagioclase and augite as the key groundmass minerals and minor olivine. It features subophitic texture, typical for olivine tholeiites, where the interstitial glass contains dendritic Fe-Ti oxide.

During the first two months of the eruption, magma composition has been constant, displaying uniform major and trace element composition and nearly uniform isotopic compositions (Halldórsson et al. (a), this session). The major and trace element contents, in addition to the isotope ratios of lead, are indistinguishable from basalts in the Bárðarbunga volcanic system (Halldórsson et al. (b), this session). The compositional trends are consistent with crystallization along the ol-plag-cpx cotectic. Crystallization depth estimates, based on the pressure dependence of the cotectic (Yang et al., 1996), indicate that the magma equilibrated at a minimum depth between 6-9 km, consistent with depth estimates derived from CO_2-bearing fluid inclusions trapped in plagioclase phenocrysts (Bali et al., this session). The bulk of the earthquakes associated with this volcano-tectonic episode are also in this range (e.g., Sigmundsson et al., 2015). Calculations with several different magma geothermometers suggest that the temperature of the magma as it rises to the surface is about 1170-1180°C, in good agreement with on-site measurements by thermal imaging cameras.

The eruption has been characterized by steady, high emission of SO_2. The sulfur-rich nature of the lava is also shown by the presence of sulfide globules in groundmass glass and sometimes as inclusions in groundmass minerals. The globules are always Fe-rich with considerable Cu and Ni contents and minor Co content. Sulfide globules are, however, missing in phenocryst phases crystallized at higher pressures, suggesting that sulfide saturation is a late process occurring during the crystallization of the groundmass minerals due to an increase in the sulfide content of the remaining melt.

The presentation will contain more detailed petrographic observations and mineral chemistry of the eruption products that will be acquired with the newly installed EPMA (JEOL JXA-8230) at the Institute of Earth Sciences, University of Iceland.

References:
Bali et al., this session: Volatile budget of the Nornahraun eruption of the Bárðarbunga volcanic system, Iceland.
Halldórsson et al. (a), this session: Geochemistry of the Nornahraun eruption of the Bárðarbunga volcanic system, Iceland.
Halldórsson et al. (b), this session: Magma types and mantle sources of the Bárðarbunga volcanic system, Iceland
Sigmundsson et al. (2015): Segmented lateral dyke growth in a rifting event at Bárðarbunga volcanic system, Iceland. Nature, in press.
Yang et al. (1996): Experiments and models of anhydrous, basaltic olivine-plagioclase-augite saturated melts from 0.001 to 10 kbar. Contrib Mineral Petrol. 124 1-18.