Geophysical Research Abstracts
Vol. 17, EGU2015-11544, 2015
EGU General Assembly 2015

Experimental constraints on the rheology and mechanical properties of lava erupted in the Holuhraun area during the 2014 rifting event at Bárðarbunga, Iceland

Yan Lavallee (1), Jackie Kendrick (1), Richard Wall (1), Felix von Aulock (1), Ben Kennedy (2), and Freysteinn Sigmundsson (3)

(1) University of Liverpool, Geology and Geophysics, Liverpool, United Kingdom (ylava@liverpool.ac.uk), (2) University of Canterbury, Christchurch, New Zealand, , (3) Nordic Volcanological Center, Institute of Earth Sciences, University of Iceland

A fissure eruption began at Holuhraun on 16 August 2014, following magma drainage from the Bárðarbunga volcanic system (Iceland). Extrusion initiated as fire fountaining along a segment of the fracture and rapidly localised to a series of small, aligned cones containing a lava lake that over spilled at both ends, feeding a large lava field.

The lava composition and flow behaviour put some constraints on its rheology and mechanical properties. The lava erupted is a nearly aphyric basalt containing approximately 2-3% plagioclase with traces of olivine and pyroxene in a quenched groundmass composed of glass and 20-25% microlites. The transition from fire fountaining to lava flow leads to lava with variable vesicularities; pyroclasts expelled during fire fountaining reach up to 80% vesicles whilst the lava contain up to 45% vesicles. Textures in the lava vary from a'a to slabby pahoehoe, and flow thicknesses from several meters to few centimetres. Tension gashes, crease structures and shear zones in the upper lava carapace reveal the importance of both compressive and tensional stresses. In addition, occasional frictional marks at the base of the lava flow as well as bulldozing of sediments along the flow hint at the importance of frictional properties of the rocks during lava flow.

Flow properties, textures and failure modes are strongly dependent on the material properties as well as the local conditions of stress and temperature. Here we expand our field observation with preliminary high-temperature experimental data on the rheological and mechanical properties of the erupted lava. Dilatometric measurements are used to constrain the thermal expansion coefficient of the lava important to constrain the dynamics of cooling of the flow. Micropenetration is further employed to determine the viscosity of the melt at super-liquidus temperature, which is compared to the temperature-dependence of viscosity as constrained by geochemistry. Lastly, uniaxial compression and tension tests are presented to constrain the mechanical properties (strength and Young's modulus) of the rocks, forming the cooler carapace of the flow. This high-temperature experimental dataset will be integrated to field observations to constrain lava flow emplacement.