Geophysical Research Abstracts
Vol. 17, EGU2015-11958, 2015
EGU General Assembly 2015

Nornahraun lava morphology and mode of emplacement

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The ongoing Nornahraun eruption is the largest effusive eruption in Iceland since the Laki eruption in 1783–84, with an estimated lava volume of ∼1.15 km3 covering an area of ∼83.4 km2 (as of 5 JAN 2015). The eruption provides an unprecedented opportunity to study i) lava morphologies and their emplacement styles, ii) the transition from from open to closed lava pathways and iii) lava pond formation.

Tracking of the lava advancement and morphology has been performed by GPS and GoPro cameras installed in 4×4 vehicles as well as video footage. Complimentary observations have been provided from aircraft platforms and by satellite data. Of particular importance for lava morphology observations are 1–12 m/pixel airborne SAR images (x-band).

The Nornahraun flow field comprises a continuum of morphologies from pāhoehoe to ‘a‘ā, which have varied tem-porally and spatially. At the onset of the eruption 31 AUG, lava flows advanced rapidly (400–800 m/hr) from the 1.5 km long fissure as large slabby pāhoehoe [1–3] sheet lobes, 100–500 m wide and 0.3–1 m thick at the flow fronts. By 1 SEPT, the flows began channeling towards the NE constrained by the older Holuhraun I lava field and the to-pography of flood plain itself. A central open channel developed, feeding a 1–2 km wide active ‘a‘ā frontal lobe that advanced 1–2 km/day. In addition to its own caterpillar motion, the frontal lobe advanced in a series of 30–50 m long breakouts, predominantly slabby and rubbly pāhoehoe [4,5]. These breakouts had initial velocities of 10–30 m/hr and reached their full length within tens of minutes and subsequently inflated over hours. With the continuous advancement of the ‘a‘ā flow front, the breakouts were incorporated into the ‘a‘ā flow fronts and seldom preserved. At the margins of the frontal lava lobe, the breakouts were more sporadic, but predominantly rubbly pāhoehoe and slabby pāhoehoe, as at the flow front. The lava flow advanced ENE into Jökulsá á Fjöllum on 7 SEPT and the flow front came to halt on 12 SEPT 18 km from the source vent. Subsequently, a new lobe broke out S of the first lobe and migrated eastward until it came to a halt at a slightly shorter distance from the fissure. This mode of gradual clockwise propagation of new frontal lobes continued from mid-SEPT to end-NOV. Around 15 OCT, a ∼0.8 km2 lava pond developed and persists into 2015. As the activity on the southern front dwindled toward end-NOV, verti-cal stacking of insulated flows had commenced and reached the edge of northern front on 26 NOV. Prior to that the entire northern flow front had hardly advanced for two weeks. The main lava channel partly crusted over and by end-NOV a series of insulated flows were overriding the previous emplaced flows, changing transport system to include closed/insultaed pathways in addition to open channels. Resultantly, the area now covered by the flow field has undergone several topographic inversions due to stacking of lava lobes.

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