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Facies Relationships and Emplacement History of the 2014–2015 Eruption at Holuhraun, Iceland

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The 2014–15 eruption at Holuhraun is the largest flood lava flow emplaced in Iceland since the Laki eruption in 1783–1784. The 2014–15 event extruded approximately 1.46 cubic kilometers of lava (= 1.1–1.2 cubic kilometers calculated as dense rock equivalent) [1, 2] from August 2014 to February 2015 and covered an area of 83.5 square kilometers. This exceeds the volume magma erupted from Kilauea Volcano during the past decade. Studying the products of such a large and recent eruption provides unique insights into the emplacement of flood lavas, which are infrequent in the modern geologic record. The 2014–15 lava flow at Holuhraun therefore offers an ideal study area for examining lava flow textures (i.e. facies) that are unaffected by modification processes induced by running water, aeolian sedimentation, and vegetation. To achieve our aim in investigating the different facies and the emplacement history we used three approaches: 1) Analysis of remote sensing data obtained using Unmanned Aerial Vehicle (UAVs) at resolutions of 1–4 cm per pixel and used to generate 4–20 cm per pixel Digital Terrain Models (DTMs). 2) In-situ field observations establish detailed descriptions of the different facies and their relationships to one and another along the flow margin and accessible contact zones within the interior of the lava field. 3) Compilation of this information into a geospatial database in ArcGIS to compare the known eruption chronology to the different facies. The final orthomosaics and DTMs enable us to identify and map out lava types that make up the flow field and are known to span the spectrum from aā to pāhoehoe morphologies, including subtypes such as spiny, slabby and rubbly pāhoehoe [3]. Furthermore, we also investigate structures specific to individual lava types, such as linear compressional ridges and extensional rifts, platy-ridged pattern, wavelike form, spirals/roses and inflation features including lava rise pits and wedges. The results provide a better understanding of facies arrangements and their relation to effusions rate and versus fluxes within the flow field.

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