Multiple fissure-fed construction of a glaciovolcanic complex at the Askja volcano, Iceland

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Austurfjoll is the largest glaciovolcanic complex at Askja, and the bulk was constructed by eruptions during the last (Weichselian) glacial period. Recent detailed mapping, logging, and chemostratigraphy has demonstrated that the bulk of the c.800 m thick Austurfjoll complex was constructed by at least 15 vents situated along formerly ice-confined fissures which follow three structural trends: rift-parallel (NE-SW), rift-perpendicular (E-W) and concentric to the margin of Askjas largest caldera. The cross-cutting nature of the closely-spaced eruptive fissure generated a large volume, broadly equidimensional massif, rather than a typical elongate Icelandic "tindar", though the processes and products are similar.

The complex rests in the south-east on a diamict, of probable glacial origin, that overlies a small area (0.7 km2) of glacially scoured subaerial aa lavas, that may be of "interglacial" (Eemian?) age. The oldest glaciovolcanic products are dominated by sheet-like units (to 400m in width, 60 m thick) of micro-porphyritic pillow lava, and associated pillow-fragment breccias, which were emplaced beneath thick ice. The sheet lavas are draped by explosively generated vitriclastic lapilli tuffs, that were emplaced by subaqueous density currents and mass flows. The maximum thickness of these tuffs is about 350m, with individual massive or slump-bedded units to about 100m. The uppermost (in altitude) pillow lavas and clastic deposits tend to be more coarsely porphyritic (plagioclase) than lower altitude lavas and tuffs. However, this is not a systematic trend across the whole complex, but may rather be restricted to individual fissure eruptions. The youngest deposits at Austurfjoll, exposed near the rim of Oskjuvatn caldera, include a variety of coarse, indistinctly parallel-bedded volcaniclastic breccias with subaerial lavas clasts and heterolithic lapilli tuffs that include rhyolitic pumice and reddened scoria clasts. These lithofacies imply that at least some of the fissure eruptions became emergent in the west of the massif. The entire massif is also intruded by a wide variety of dike-like and irregular intrusions, that were emplaced into consolidated (including ice-cemented) and wet, unconsolidated clastic deposits.

See the companion presentation by McGarvie for new K-Ar dating, and by Graettinger for environmental conditions of the eruptions.