

Rapid growth of a basaltic volcano beneath an ice sheet: Askja, Iceland

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New high-precision K-Ar unspiked ages of basalts of the Austurfjöll glaciovolcanic massif at Askja provide insights into the rapid growth of a basaltic central volcano during the last (Weichselian/Wisconsin) glacial period.

The ice-free Askja central volcano comprises a number of separate glaciovolcanic massifs (constructed of pillows, pillow breccias, and tuffs) which have been dismembered by multiple calderas, and which are surrounded by copious outpourings of Holocene basaltic lavas. Austurfjöll is the largest of Askja's glaciovolcanic massifs and prior to caldera collapses had an estimated area of c.60 km² and volume of c.25 km³. (Current values are c.50 km² and c.20 km³). The massif rises from surrounding plains at c.640 m elevation to a high point at 1510 m on a caldera rim.

Two Austurfjöll basalts yielded K-Ar unspiked ages of 29±8 ka and 71±7 ka, which are within the Weichselian (Wisconsin) glacial period. The 71 ka date comes from a subglacial pillow basalt close to the base of Austurfjöll, and this suggests that the vast bulk of the massif was constructed during one glacial period. This is a surprising finding given that the lifespans of Icelandic central volcanoes are considered to be 0.5-1.0 Ma, and suggests that Askja is a very young central volcano.

Using values of 20 km³DRE and a period of 60 ka yields a Weichselian production rate of 0.33 km³per ka for Austurfjöll alone. This is similar to estimated Holocene production rate of 0.32 km³per ka for Askja from 2.9 ka till the present.

It can be concluded that despite the presence of the Weichselian ice sheet, Askja's Weichselian basaltic magma productivity was equivalent to that of the present-day. Which begs the question: what really triggered production rates at Askja of up to 9.4 km³per ka during the early Holocene?