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The Askja volcano in North Iceland and its calderas

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The Askja volcano is perhaps best known for the 28th-29th March 1875 caldera forming Plinian eruption, is an edifice that rises to 1510m above sea level and has a volume of ∼140 km3. It is comprised of basaltic hyaloclastites, pillow lavas and interglacial lava sequences. The flanks are draped by numerous (>100) Holocene basaltic lava flows produced by flank eruptions as well as fissure eruptions related to the associated and encroaching Askja fissure swarm. In addition, Askja has produced at least four silicic eruptions in postglacial times. Three, the ∼10 ka Skolli, ∼2 Ka Askja and the March 1875 events, formed widespread tephra layers that extend well-beyond the shores of Iceland. The fourth eruption took place at ∼3.5 ka producing silicic lava flows exposed in the walls of the recent Öskjuvatn caldera. Askja features three nested, semi-circular calderas. The main summit caldera has an average diameter of ∼8 km (area, ∼ 50 km2) and is at least 600 m deep (volume, ∼ 30 km3), although now largely filled with 3-400 m thick succession of Holocene lavas (e.g. Brown et al., 1991). Some of the basaltic lava flows produced by eruptions within the caldera in the last 3 ka, including the lavas from the 1961 event, have flowed out of the caldera through the enigmatic structure Öskjuop (i.e. the caldera 'entrance'). Straight northeast of the main Askja caldera is the Kollur caldera which is ∼4 km in diameter (area, ∼13 km2). It is filled to the brim by Holocene lava flows and its southern end is dissected by the bounding faults of the main Askja caldera. Therefore, it thus must be older. The youngest one, the lake-filled Öskjuvatn caldera, is situated in the southeast corner of the main caldera. It is ∼5 km in diameter (area, ∼18 km2). The maximum depth of the caldera lake is 205 m and its rims rise >60 m above the lake surface, indicating a total depth of >260 m for the structure. Analysis of historical accounts shows that the Öskjuvatn caldera was not fully developed until 1932 (Hartley and Thordarson, 2012), while internal unconformities in the 28-29 March 1875 tephra deposit indicate that the initiation of the collapse coincides with onset of the eruption. This suggests that the formation of the Öskjuvatn caldera it took more than 50 years. These observations along with a new bathymetric map of the Öskjuvatn caldera will be presented and discussed. The age of the main Askja and Kollur calderas is unknown. It has been suggested that the main caldera formed in association with the ∼10 ka Skolli eruption. However, its bounding ring-faults dissect mid- and late Holocene lavas, indicating that major movements on these faults during the Holocene. Also, the Holocene lava fill of the Kollur caldera implies postglacial age for that structure. Hence, the evidence indicate younger age and more complex growth history for these two calderas than predicted by previous studies.

Hartley and Thordarson, 2012. JVGR 227-228: 85–101; Brown et al., 1991. Geology 19, 352–355.