

The explosive, basaltic Katla eruption in 1918, south Iceland II. Isopach map, ice cap deposition of tephra and layer volume

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Abstract — *Due to poor preservation and lack of proximal tephra thickness data, no comprehensive isopach map has existed for the tephra layer from the major eruption of the Katla volcano in 1918. We present such a map obtained by combining existing data on the thickness of the 1918 tephra in soil profiles with newly acquired data from the 590 km² Mýrdalsjökull ice cap which covers the Katla caldera and its outer slopes. A tephra thickness of 20–30 m on the ice surface proximal to the vents is inferred from photos taken in 1919. The greatest thicknesses presently observed, 30–35 cm, occur where the layer outcrops in the lowermost parts of the ablation areas of the Kötlujökull and Sólheimajökull outlet glaciers. A fallout location within the Katla caldera is inferred for the presently exposed tephra in both outlet glaciers, as estimates of balance velocities imply lateral transport since 1918 of ~15 km for Kötlujökull, ~11 km for Sólheimajökull and about 2 km for Sléttjökull. Calculations of thinning of the tephra layer during this lateral transport indicate that the presently exposed tephra layers in Kötlujökull and Sólheimajökull were respectively over 2 m and about 1.2 m thick where they fell while insignificant thinning is inferred for the broad northern lobe of Sléttjökull. The K1918 layer has an estimated volume of 0.95 ± 0.25 km³ (corresponding to $1.15 \pm 0.30 \times 10^{12}$ kg) whereof about 50% fell on Mýrdalsjökull. About 90% of the tephra fell on land and 10% in the sea to the south and southeast of the volcano. The volume estimate obtained contains only a part of the total volume erupted as it excludes water-transported pyroclasts and any material that may have been left on the glacier bed at the vents. While three main dispersal axes can be defined (N, NE and SE), the distribution map is complex in shape reflecting tephra dispersal over a period of variable wind directions and eruption intensity. In terms of airborne tephra, Katla 1918 is the largest explosive eruption in Iceland since the silicic eruption of Askja in 1875.*

INTRODUCTION

The eruption of Katla in 1918 (October 12–November 4) with its extensive tephra fallout and a massive jökulhlaup, caused by intense ice melting of the overlying glacier during the first phase of the eruption, belongs to one of the most prominent natural events that occurred in Iceland in the 20th century. Due to Katla's proximity to inhabited areas, with its 100 km²

ice-filled caldera beneath the Mýrdalsjökull ice cap, past eruptions with the associated jökulhlaups have had major impact on the neighboring farming districts (e.g. Thorarinnsson, 1975; Larsen, 2000; 2018). For the same reasons, Katla remains one of the most dangerous volcanoes in Iceland (Gudmundsson *et al.*, 2008) calling for large monitoring networks and detailed response plans (e.g. Þorkelsson *et al.*, 2005).