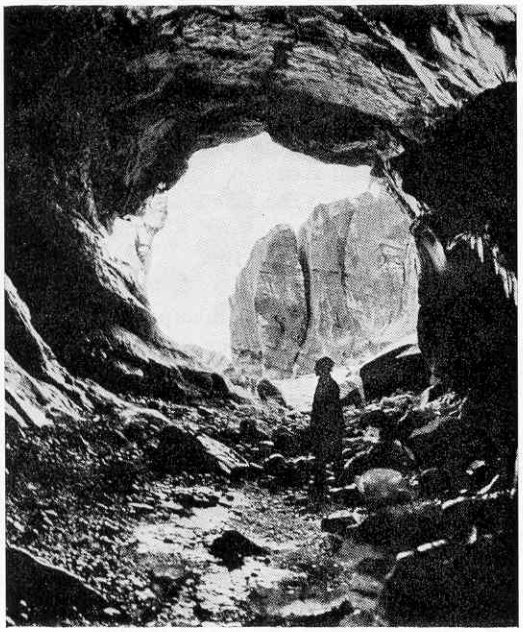

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Explanation of Jökulhlaups from Grímsvötn, Vatnajökull, Iceland

HELGI BJÖRNSSON,
H. H. WILLS PHYSICS LABORATORY, UNIVERSITY OF BRISTOL, ENGLAND*

ABSTRACT

The cause and process of jökulhlaups from the subglacial lake Grímsvötn are explained in this paper. Possible future changes in the phenomenon are discussed.

A topographical model of Skeidarárjökull and the Grímsvötn water basin, based on seismic, gravity and geodetic surveys is presented. Although the present knowledge of the subglacial topography is not detailed, the model is accurate enough to explain the jökulhlaup phenomenon. The glacier surface map, which is well known, proves to be of dominating importance.

In a period of five or six years the water level in the lake rises about 100 m. The glacier is lifted off a subglacial ridge east of the lake and water is forced subglacially through a 50 km long route beneath Skeidarárjökull, causing vast floods. When the water level has fallen about 100 m the waterway is sealed by rapid plastic deformation of the ice at the eastern edge of the Grímsvötn depression. The water level is not lowered to the subglacial rim.

The mass and energy balances of the basin are discussed. A water basin of 300 km² collects water into a subglacial lake of about 30—40 km². About ¾ of this water has been melted by a subglacial geothermal area. The geothermal area is probably the most powerful one in Iceland and its extent is about the same as that of the Torfajökull area (energy flux $1.5 \cdot 10^{17}$ J/yr, energy flux density 50 W/m², area 100 km²). The flow of water estimated from the model agrees well with the estimated discharge of glacial rivers on Skeidarársandur.

The primary cause of jökulhlaups from Grímsvötn is the melting of ice in the geothermal area. The slope of the glacier surface

*) Present address: Science Institute, University of Iceland, Dunhagi 3, Reykjavík, Iceland.