The Grímsvötn Caldera, Vatnajökull:
Subglacial Topography and Structure of Caldera Infill

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ABSTRACT

A shallow seismic reflection survey was carried out on the ice shelf covering the subglacial lake in the Grímsvötn Caldera, Vatnajökull, in 1987. The survey showed that at the relatively low water level 9 months after the jökulhlaup in 1986, the area of the subglacial lake was 10 km^2 and the volume of the lake was 0.5 km^3. The ice shelf was 240-260 m thick in most parts and the water layer 40-90 m thick. Comparison and reinterpretation of a seismic survey conducted in 1955 suggests about 100 m increase in the thickness of the ice shelf over the 32 year period. The size of the main caldera is about 20 km^2 and the elevation of the caldera floor is 1060-1200 m a.s.l. The caldera floor dips slightly from south to north and the southern and southwestern parts are believed to be covered with lava flows. In the northern and eastern parts, the lakefloor is believed to be covered with sediments. Interfaces could be seen below the lakefloor in the northern and central parts. These reflections are believed to arise from lava flows or sills within a sediment pile. It is suggested that the caldera infill is composed of a pile of lava flows and volcaniclastic sediments. Lava flows compose the greater part of the pile in the southern part but sediments are predominant in the northern part. This suggests that eruptions have been more frequent in the southern part of the caldera. The existence of the lava flows suggests that eruptions onto the lakefloor have been more voluminous than previously believed. It is suggested that the observed drop in geothermal power of the area in recent years, is caused by the reduced volcanic activity after 1940.

INTRODUCTION

In June 1987 a shallow seismic reflection survey was carried out in the ice covered Grímsvötn Caldera, Vatnajökull (Fig. 1). The purpose of the survey was to map the bottom of the subglacial lake within the caldera and in that way obtain information on the size and volume of the lake, as well as the structure of the caldera. The caldera has been highly active in the past, and numerous eruptions are known to have occurred in Grímsvötn over the last 400 years (Þórarinsson, 1974).

The area has been the focus of interest for Earth scientists since 1934 when an eruption and jökulhlaup (glacier burst) prompted the first scientific work (Áskelsson, 1936). The phenomena of volcanic and geothermal activity in the glacial environment are of great interest, as many of the present landforms observed in Iceland were formed in the subglacial eruptions during the last glaciation. The effects of the geothermal area on the glacier and the jökulhlaups are of great glaciological interest as well as being important in estimating the flood danger. As a consequence, a great deal of research