Grímsvatnahlaup 1972, Mechanism and Sediment Discharge

HAUKUR TÓMASSON,
NATIONAL ENERGY AUTHORITY, REYKJAVIK, ICELAND

ABSTRACT

The discharge of the Grímsvatnahlaup in 1972 is estimated as 2 km³ in volume. About 29.5 · 10⁶ tons of sediment load were carried from the glacier. This sediment load is 50 per cent coarse silt. Two thirds of the sediment load are deposited on Skeidarársandur but one third reaches the ocean and is deposited near the shore. The mechanism of Grímsvatnahlaup is assumed to be a complex one with mainly Glens theory valid for the beginning of the jökulhlaup and a mechanism first described by Liestöl responsible for the continuation.

CALCULATIONS OF VOLUME

The last Grímsvatnahlaup of March 1972 was observed and studied with greater effort than any previous jökulhlaup from Grímsvötn. The author was in charge of the sediment discharge measurements and this paper presents the results of his findings, which are not limited to the sediment discharge, but are also centered on the mechanism and volume of the water released in the jökulhlaup.

The volume of flood water from Grímsvötn is usually referred to as having been 3.2–3.5 km³. These figures are based on estimates of discharge made on Skeidarársandur during the jökulhlaup. This value also fits well to the estimated water balance of the Grímsvötn basin.

An alternative approach to measuring the jökulhlaup would be to measure the volume changes in Grímsvötn with reference to Grímsvatnahlaup. Actually this has been done already. After the flood of January 1960 the Grímsvötn basin was mapped (in June 1960) and a storage diagram constructed according to which the maximum storage in Grímsvötn is 1.5 km³ (*Rist,* 1961).

Although jökulhlaups from Grímsvötn last for a few weeks this kind of flood has a very sharp peak and approximately half of the flood water is discharged in 3 days (*Rist,* 1973). The quantity of fresh water in the sea was therefore measured by the Marine Research Institute on the second and third days after the peak flow. The result is shown in Fig. 1. A well established fresh water layer is found, the volume of which is calculated as 0.7 km³ of fresh water. The fresh water found in the sea corresponds reasonably well to the volume of Grímsvötn if the measured volume represents the bulk of 3 days peak flow, which, from knowledge of speed of sea currents in this area, is reasonable.

Now we have to consider another aspect of this problem, i. e. the water budget of the Grímsvötn basin. *Thorarinsson* (1953) has estimated the inflow into Grímsvötn in the form of ice and water to be 0.7 km³ per annum which makes 3.5 km³ in the 5 year interval between jökulhlaups. This is equal to *Rist's* estimate of the discharge volume. In his model *Thorarinsson* does assume that there is no leakage from Grímsvötn through ice or underlying bedrock.

The model of a watertight Grímsvötn basin is not necessarily true (cf. also *Thorarinsson,* 1974). Similar lakes outside glaciers often have substantial leakage. Substantial leakage can therefore take place through rock into some of the branches of Skeidará. Leakage through the glacier is also a possibility.

Water can also occasionally escape from Grímsvötn through sub-glacial tunnels. The Grímsvötn water is well characterized by its high content of dissolved solids, which design-