ACTA NATURALIA ISLANDICA

28

The Sólheimar tephra layer and the Katla eruption of ~ 1357

EINAR H. EINARSSON
GUDRÚN LARSEN
SIGURDUR THORARINSSON

NÁTTÚRUFRAEDISTOFNUN ÍSLANDS
ICELANDIC MUSEUM OF NATURAL HISTORY
REYKJAVÍK 1980

ACTA NATURALIA ISLANDICA

PUBLISHED BY
THE ICELANDIC MUSEUM OF NATURAL HISTORY
(NÁTTÚRUFRAEDISTOFNUN ÍSLANDS)

The Museum has published two volumes of Acta Naturalia Islandica in the period 1946—1971, altogether 20 issues. From 1972 each paper appears under its own serial number, starting with no. 21.

ACTA NATURALIA ISLANDICA is a series of original articles dealing with botany, geology, and zoology of Iceland.

ACTA NATURALIA ISLANDICA is published preferably in English, and appears at irregular intervals.

ACTA NATURALIA ISLANDICA may be obtained:

1) on basis of institutional exchange from the Museum of Natural History, P. O. Box 5320, 125 Reykjavík, Iceland.

2) by purchase (including mailing costs) from
Snaebjörn Jónsson, The English Bookshop,
Hafnarstraeti 4 & 9, 101 Reykjavík, Iceland.

PRENTSMIÐJAN ODDI HF.

The Sólheimar tephra layer and the Katla eruption of ~ 1357

EINAR H. EINARSSON
Skammadalshóll, Mýrdalur, Iceland

GUDRÚN LARSEN
Nordic Volcanological Institute, University of Iceland

SIGURDUR THORARINSSON
Science Institute, University of Iceland

(Received August 24, 1979; revised and accepted October 26, 1979)

Abstract. In the upper part of the soil in the Mýrdalur district, South Iceland, one dark tephra layer is conspicuously thick and coarse-grained. This layer, called the Sólheimar layer, was produced by an eruption within the accumulation area of Sólheimajökull in the Katla caldera in the Mýrdalsjökull central volcano. The eruption was accompanied by a jökulhlaup from Sólheimajökull. In easternmost Mýrdalur this layer is found closely underneath the tephra from Öræfajökull 1362 and it can be no more than a few years older. The eruption which produced the Sólheimar layer is nowhere listed among Katla eruptions, but three old annals mention an eruption in Trölladyngjur in the 1350s and devastation of many farms in Mýdalur. No doubt this is the eruption which deposited the Sólheimar layer. The year 1357 is probably the most correct one and the layer is therefore designated as K ~ 1357. The estimated volume of K ~ 1357 is 0.2—0.3 km^3 and its maximum thickness when freshly fallen in the settled parts of Mýrdalur was about 35 cm. From the isopach map of the layer one can conclude that 60—70% of the farms in Mýrdalur, or some 30 farms, were abandoned for at least some months and about 50% of the farms were deserted for 1—5 years.

TABLE OF CONTENTS

INTRODUCTION

Examination of soil profiles in the central part of the Mýrdalur district reveals a dark coarse-grained tephra layer which is much thicker than both the layers above and immediately below it (Fig. 1).

Most of the inhabitants of Mýrdalur knew of this tephra layer, as it is not possible to dig deep in the earth there without discovering it. It was generally considered to have come from Katla, many thought before the beginning of settlement of Iceland in 874 A.D., as it was so thick that it would have laid farms waste and none had heard of a farm laid waste in Mýrdalur by a tephra fall. Observations of the distribution of the layer began in the summer of 1969 and soon its distribution indicated a source under Mýrdalsjökull, somewhat west of the Kötlugjá fissure(s) active in the last few centuries. It was soon found out that the eruption had been simultaneous with a jökulhlaup from under Sólheimajökull.

The above mentioned tephra layer quickly came to be called the Sólheimar layer (an abbreviation of Sólheimajökull layer). At this stage of the research it was thought unsafe to postulate that the tephra layer was deposited in historical times, as the thickness and distribution are such that it would have made farming very difficult in Mýrdalur for some time after the tephra fall and no documents

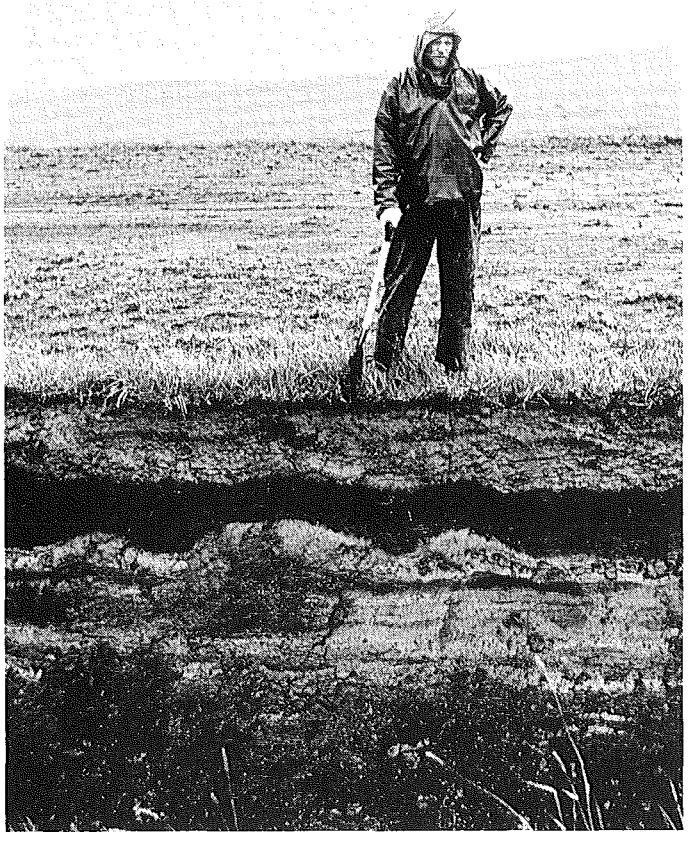

Fig. 1. The Sólheimar layer (the black, thick layer) deposited on a hummocky ground short NW of Geitafjall (near point 8 on Fig. 6). Photo: S. Thorarinsson.

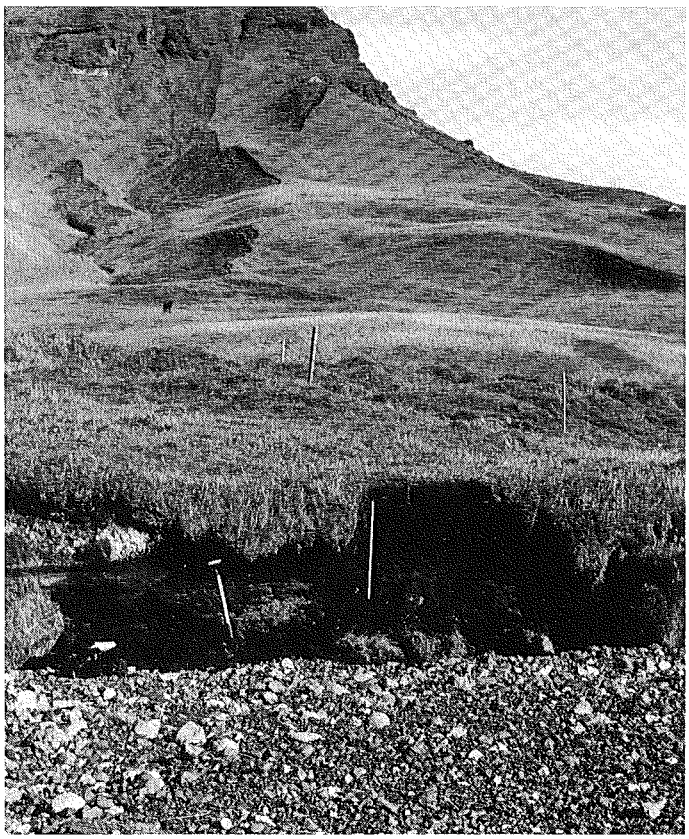

Fig. 2. River-eroded bank in front of the ruins of the farmhouses of Fell. Photo: S. Thorarinsson, Sept. 10th 1970.

mentioning such a calamity were then known to the present writers. No tephra layers from historical times had then been dated in Mýrdalur except the most recent Katla layers. It was not possible to verify that the thick Sólheimar layer was from historical times unless either evidence of human occupancy or tephra layers known to have formed after the country began to be settled were found under it.

In the summer of 1970 search for evidence of human occupancy under the Sólheimar layer was begun and in September that year a midden was found under the layer in a down-cut river bank about 7 m in front of the ruins of the farm Fell in Mýrdalur (Fig. 2), which was abandoned about the year 1900 because of erosion by the river Klifandi. A soil profile was measured at this site (Fig. 3). Close to the sod wall (cf. Fig. 3), an 8 cm long sewing needle was found under the Sólheimar layer, that had been deposited there by flood water (see later in this paper). The needle (Fig. 4) is the only one from the Middle Ages found in Iceland (Thorarinsson, 1971). Later, in the spring of 1972, stones from a wall were found at the same spot under an undisturbed Katla layer which itself lies right under the Sólheimar layer. Thus it is evident that Fell was inhabitated long before the Sólheimar layer covered it over.

Evidence of human occupancy has also been discovered under the layer in Skammadalsheidi were there are ruins of chalets known as 'Brúnasel. There the Sólheimar layer is rather thin, as the group of chalets is exposed to wind from the northeast. It appears certain that quite a while had passed after the huts were abandoned until the Sólheimar layer was deposited. In one of the ruins the layer was found above stones that had fallen from the inside of a wall. In another place two black

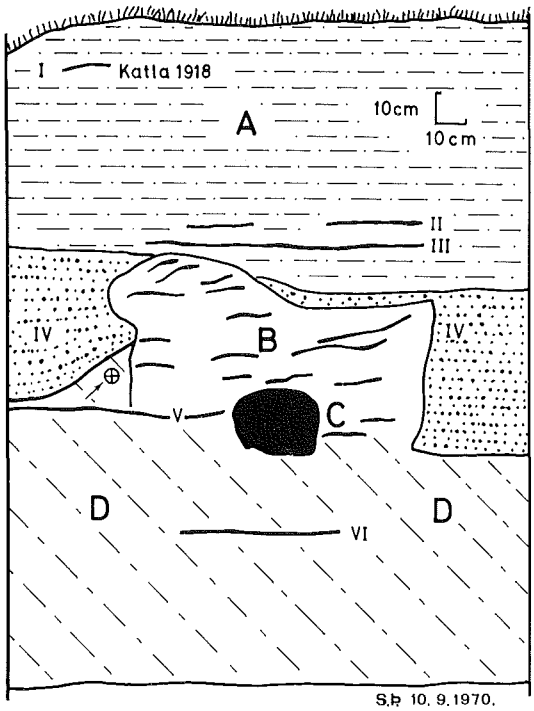

Fig. 3. Schematic section of the river bank, cf. Fig. 2. I—VI: Katla tephra layers (IV is the Sólheimar layer). A: Undisturbed loessial soil. B: Sod wall with lenses of Katla tephra. C: Boulder. D: Cultural deposit. The arrow points to the spot where the needle was found. From Thorarinsson (1971).

layers right beneath the Sólheimar layer were found undisturbed on top of stones from a previously collapsed outer wall.

In the eastern part of Dyrhólaey there are in two places ruins of buildings, which are either ruins of ancient chalets or some kind of seaside shacks dating from the time fishermen stayed at the place locally known as Kirkjufjara (Church shore). The position of the Sólheimar layer in relation to the westernmost ruin suggests that the layer is younger than the ruins, though this is not fully confirmed. At the easternmost ruin part of a bovine jawbone was found in the soil 15 cm under the Sólheimar layer. This human refuse attests that people had lived there long before the layer was deposited.

It fell solely to EHE to survey the thickness and coarseness of the layer in the upland north of the settled area in Mýrdalur and its influence on soil erosion there. Together the authors worked on soil profiles in Mýrdalur. It fell principally to STh to try to ascertain the age of the Sólheimar layer by connecting it with the tephra layers outside of Mýrdalur, whose age is known, and by searching in written records for any information about the age of the layer and its influence on the settlement. GL made the granulometric measurements and worked on the identification of several tephra layers in the soil profiles.

THE AGE OF THE SÓLHEIMAR LAYER

In order to date the Sólheimar layer it was thought most promising to trace to Mýrdalur, where this layer is found, known and dated tephra layers outside of the Mýrdalur district. An attempt was made to trace to Mýrdalur from the west the tephra layer from the Hekla eruption of 1510, and the Katla layer that is found a few cm underneath it and is from approximately 1490 (Thorarinsson, 1959), but it has not proved possible to trace these layers into the area covered by the Sólheimar layer.

When the light tephra layer from the Öræfajökull eruption of 1362 was mapped more than twenty years ago, it was successfully traced to the bridge on the river Hólmsá, though it was

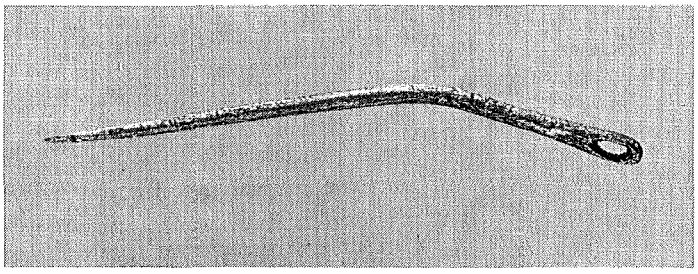

Fig. 4. The bronze needle found at Fell. Natural size. Photo G. Gestsson.

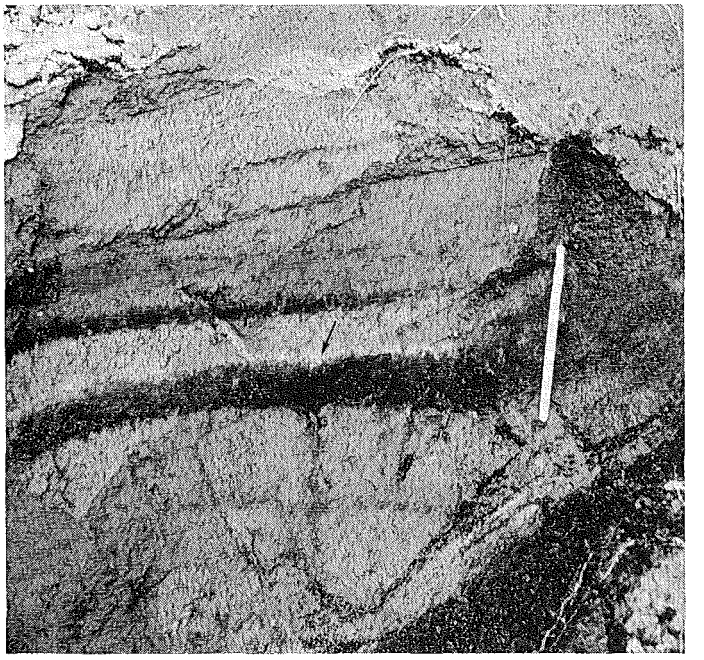

Fig. 5. Soil section at Merkigil on Höfdabrekkuheidi, near point 16 in Fig. 6. The arrow points at the light tephra layer Ö 1362 immediately above the black Sólheimar layer. Length of ruler 20 cm. Photo: S. Thorarinsson, Aug. 1, 1974.

found there only in a single soil profile (Thorarinsson 1958). In succeeding years evidence of this layer was found in soil profiles farther northwest in the highlands northeast of Hekla (Thorarinsson 1967, profiles 45 and 46, p. 16). An effort was later made to find this layer west of Mýrdalssandur. In July 1971 evidence was found in a profile from Hjörleifshöfdi (profile 18, Fig. 8) on the slope east of and above the farm ruins. In August 1974 it was finally found in a profile on Höfdabrekkuheidi on the eastern rim of Merkigil (northwest of Hríshóll) (Fig. 5 and profile 16 in Figs. 6 and 8). Both there and in Hjörleifshöfdi there is a dark tephra layer right under this layer. In Hjörleifshöfdi the dark layer is 2 cm thick and in the profile from Höfdabrekkuheidi 4 cm thick. There is no doubt that this tephra layer is from Katla.

It had thus been established that a considerable tephra eruption had taken place in Katla a very few years before 1362 and that the tephra had settled over the easternmost part of Mýrdalur. But an eruption of Katla around the middle of the 14th century is nowhere mentioned in the literature on Katla. An investigation of the old annals, however, revealed that this eruption was indeed mentioned though it was not credited to Katla. Three annals give what is probably a documentation based on contemporary, or almost contemporary sources. These annals recorded the following:

Skálholtsannáll (about the year 1354): „Fire came up in Trölladyngjur, many farms in Mýdalur were laid waste in the ash fall, the pumice drifted all the way west to Mýrar, and the fire was seen from Snæfellsnes". *Flateyjarannáll* (about the year 1360) records the event in virtually the same words as Skálholtsannáll. *Gottskálksannáll* (about the year 1357): „Fire came up in Trölladyngjur causing great threats and tremendous rumblings. Nearly all the farms in Mýdalur were laid vaste and a wide area near to it was partly damaged. The pumice drifted so far from the east that it reached Stadur on Snæfellsnes and even further" (Isl. Ann.: 314, 407, 757). *Gottskálksannáll*, the most detailed account of the above event, is based on an annal from the end of the 14th century. The account is therefore from the same time, or about the same time, as the event in question.

Oddur Einarsson had the following to say in

his description of Iceland, *Qualiscunque descriptio Islandiæ*, which was probably written principally in the winter of 1588—89: „There was seen in 1356 A.D. a tremendous eruption from the mountain which is named Trölladyngjur, i.e. den er refuge of the mountain wights. There was a strong earthquake at the same time as the eruption and a large number of farms were completely destroyed, especially in that area called Mýdalur (Qualiscunque: 10). Jakob Benediktsson wrote in the preface to the Icelandic translation of this book (Einarsson, 1971: 10) that Oddur's source of information about the eruption, though with a difference of one year in the telling, in all likelihood was a copy or a summary of *Gottskálksannáll*, which was recorded at Hólar, with some additions made to the original. The information about the earthquake could have come from this. There would be no validity in examining more recent documents about the Trölladyngjur eruption.

In his draft on the history of Icelandic volcanoes, Jónas Hallgrímsson wrote, in Danish, about these accounts in the annals. He claims it is evident that the eruption was from Trölladyngja on the Reykjanes peninsula and that it was not unlikely that the writer of the annal in a far off part of the country had misunderstood and thought that the destruction had occurred in Mýrdalur because there had been similar misfortune there before. Jónas continues: "The complete silence of the annals stops us from taking into consideration an eruption from Katla at the same time, all the more so as activity in that volcano always occurs simultaneously with the notorious jökulhlaups, which could hardly have escaped the attention of the Icelandic annalist" (Rit J.H. IV.: 165—166).

Thorvaldur Thoroddsen mentioned the account in the *Flateyjarannáll* and says that it is conceivable that an eruption of Trölladyngja on the Reykjanes peninsula and an eruption of Katla had been confused, though he makes nothing more of this, and does not mention it when he writes the history of eruptions of Katla (Thoroddsen, 1925: 114—141; 189).

Ólafur Jónsson regards it as certain that the eruption was in Trölladyngjur in the Ódádahraun, that is in Dyngjufjöll or within the area between Ketildyngja and Kverkfjöll. He said that it was not impossible for this Trölladyngjur eruption to have caused the damage in Mýrdalur, but finds it more likely that by Mýdalur the analists mean the settlement around Lake Mývatn, as the annals also report considerable loss of life in the Mývatn district the same year (Jónsson 1945, II: 204—206). This hypothesis is refuted by research on tephra layers around Mývatn (Thorarinsson 1951, 1952).

Jón Jónsson writes that it is certain that none of those eruptions that the annals report for Trölladyngja (dyngjur) occurred in that part of Núpshlídarháls, which is now known as Trölladyngja, but considers that close to this area there could have been one or two eruptions in historical times. Furthermore he considers it likely that the name Trölladyngjur was formerly used for the mountainous land that is now called Langahlíd (J.Jónsson, 1976: 43; 170; 223 and 260). A similar observation was made by Jónas Hallgrímsson (Rit J.H. IV: 165).

It is likely that eruptions in the Trölladyngja area in historical times, if indeed they occurred, were those of the 12th century (1151 and 1188) which the annals credit to Trölladyngja, rather than that there was also an eruption there in the 14th century. If indeed the Langahlíd area was named Trölladyngjur, then it is conceivable that the eruption of the 14th century occurred there.

Concerning the "coming up of fire" in Trölladyngjur in 1357 or thereabouts there seem to be three possibilities. The one that fits best with the annals is that an eruption occurred in or near the area on Reykjanesskagi that was called Trölladyngja or Trölladyngjur, and that glowing lava fountains or a lava flow were seen from Snæfellsnes. It seems likely that the three annals quoted above have drawn their information from one and the same written source, and what they say about Snæfellsnes points to an annalist in West Iceland. Hermann Pálsson maintains (1965: 76) that Gottskálks-

annáll was, until the year 1394, based mainly on an annal that probably was written on Snæfellsnes. If this is really the case, it easily explains the details from Snæfellsnes and Mýrar mentioned in connection with the Trölladyngjur eruption, and the Trölladyngjur in question is then probably an eruption site on the Reykjanes peninsula. This in its turn indicates that an eruption on the Reykjanes peninsula coincided, or almost so, with a Katla eruption that wrought havoc upon Mýrdalur.

Another possibility is that the fire seen from Snæfellsnes and the rumblings heard there were lightning and thunder in the eruption column above Katla, which an annalist in West Iceland attributed to an eruption in a volcano named Trölladyngjur in the eastern highland of Iceland. The ideas about the location of this volcano were somewhat diffuse, although it was usually thought to be the volcano now called Dyngjufjöll, in the Ódádahraun desert.

The third possibility is that an annalist in North Iceland got news of the pumice drift at Mýrar and Snæfellsnes together with news of a disastrous tephra fall in Mýrdalur. He might then have concluded that the tephra fall was caused by an eruption in Trölladyngjur in Ódádahraun, even if no eruption in reality took place there at that time. Lightning from the eruption column above Katla may have been visible from places in North Iceland.

We must trust the annals only cautiously concerning distant sites of eruptions. The Reverend Gunnlaugur Thorsteinsson, for example, credited Hekla with the 1660 eruption of Katla (Ann. 1400—1800 I: 355).

After the survey of the records it was understood that there had been an eruption in Mýrdalsjökull a few years before 1362 and that the tephra layer from this eruption was to be found east of Kerlingardalur river. It was also known that a few years before 1362 several, or rather most of the farms in Mýrdalur had been destroyed by tephra fall. Now the dark layer under Ö 1362 is not thick enough east of Kerlingardalur river that we can say for certain that it laid waste farms there. But further west in Mýrdalur there was one layer from historical times, the Sólheimar layer, that was certainly thick enough to have laid farms waste. Up to this point it had been thought that, because this tephra layer had fallen at the same time as a jökulhlaup from Sólheimajökull took place, that here was one of the two eruptions, 1245 or 1262, which the annalists credited to Sólheimajökull. Here on the one hand was the only tephra layer thick enough to have caused damage in Mýrdalur sufficient to have been recorded in the annals, and on the other hand authentic records of the destruction of many farms in Mýrdalur in the sixth decade of the 14th century. The most reasonable solution was then that the Sólheimar layer and the layer directly under Ö 1362 east of Kerlingardalur river are actually one and the same layer. In the winter of 1975 this view was set forth with the reservation that the two layers had not yet been definitely shown to be one (Thorarinsson, 1975: 138—40). In the summer of 1975 profiles were measured between the lake Heidarvatn and the Kerlingardalur river (cf. profile 14, Figs. 6 and 8) that clearly showed that these were indeed one and the same layer, the Sólheimar layer.

As to which of the dates the annals mention is the most correct, the year 1360 is the least likely. Almost certainly more than two years passed between the deposition of the Sólheimar layer and Ö 1362. The profiles indicate the year 1357, without, however, completely eliminating the possibility of 1354. The layer is therefore properly labelled ~ 1357, in which the mark ~ indicates that the date is approximate.

Three eruptions of Katla in historical times have now through tephrochronological studies been added to those known through written sources. The other two are: an eruption which most likely took place around the year 1000 (Thorarinsson, 1967) and an eruption about 1490 (Thorarinsson, 1959; 1967). The eruptions of Katla have now been shown to outnumber those of Hekla. Tephrochronological studies together with a survey of the written records (Thorarinsson, 1967) have reduced by five the number of eruptions of Hekla recorded by

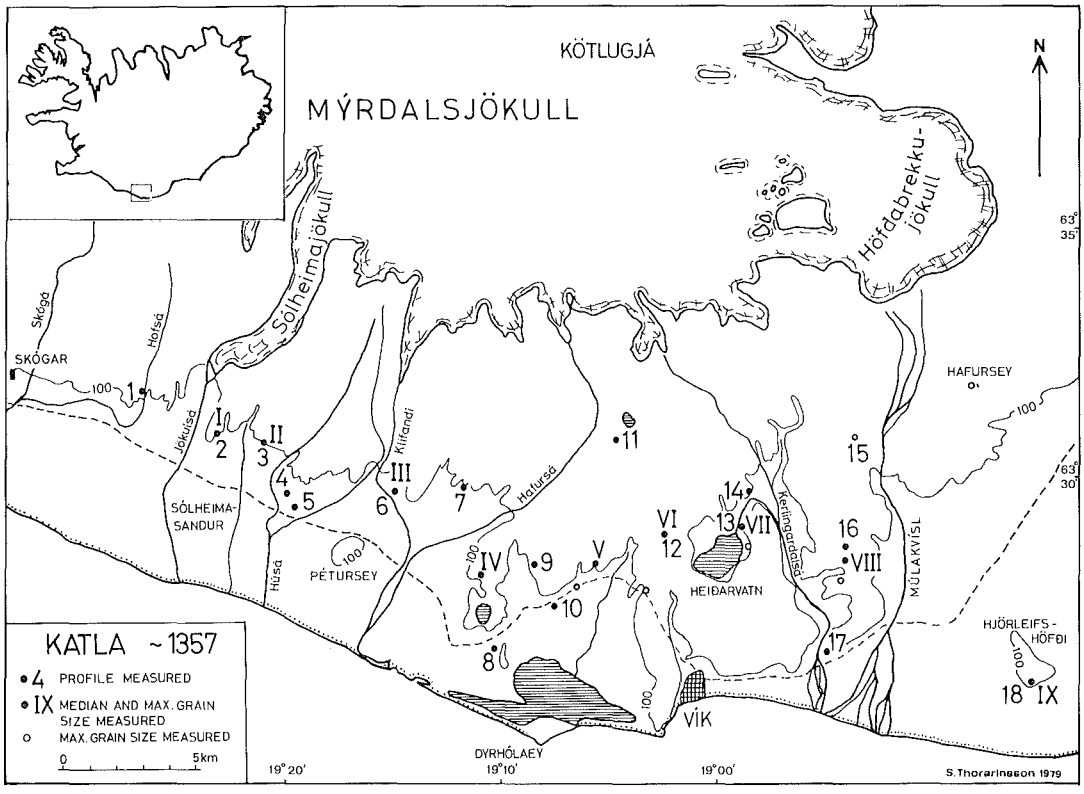

Fig. 6. Map showing the location of the soil profiles on Figs. 7 and 8 and places where the Sólheimar tephra was sampled for granulometric measurements.

Thoroddsen (1925) in his history of the volcanoes. Hekla is now credited with 15 and Katla with at least 17 eruptions. Of all Icelandic volcanoes only Grímsvötn is likely to have erupted more often since the beginning of settlement (Thorarinsson, 1974). At any rate Katla has now been shown to erupt twice in a hundred years, both in the 14th and 15th centuries, just as it has in recent centuries.

DISTRIBUTION AND GRAIN SIZE CHARACTERISTICS

A great number of soil profiles has now been measured in Mýrdalur and adjacent areas. Besides those shown in Figs. 6—8 many more have been measured, cf. the map (Fig. 9) which shows the distribution of the Sólheimar layer. The relatively coarse tephra which fell in Mýrdalur was easily eroded by water and wind. In soil profiles the layer has variable thickness, which made it necessary to measure a great number of profiles in order to draw the isopachs with tolerable accuracy. It was widely blown off the heights but drift accumulations of the tephra are usually clean and not contaminated with humus or other material. This indicates that it was piled into drifts rather quickly, most likely by north-northeasterly winds. The layer appears to have been greatly disturbed by wind within an area bounded by the brook Brandslækur on the east and the river Hafursá on the west — as it ran before men changed its course — and stretching from Búrfell south to Dyrhólaey.

Generally the Sólheimar tephra layer is greyish-black, but the colour is slightly modified by the soils in which it lies. The layer contains some light, dense rhyolite grains, but their distribution within the layer is uneven. It

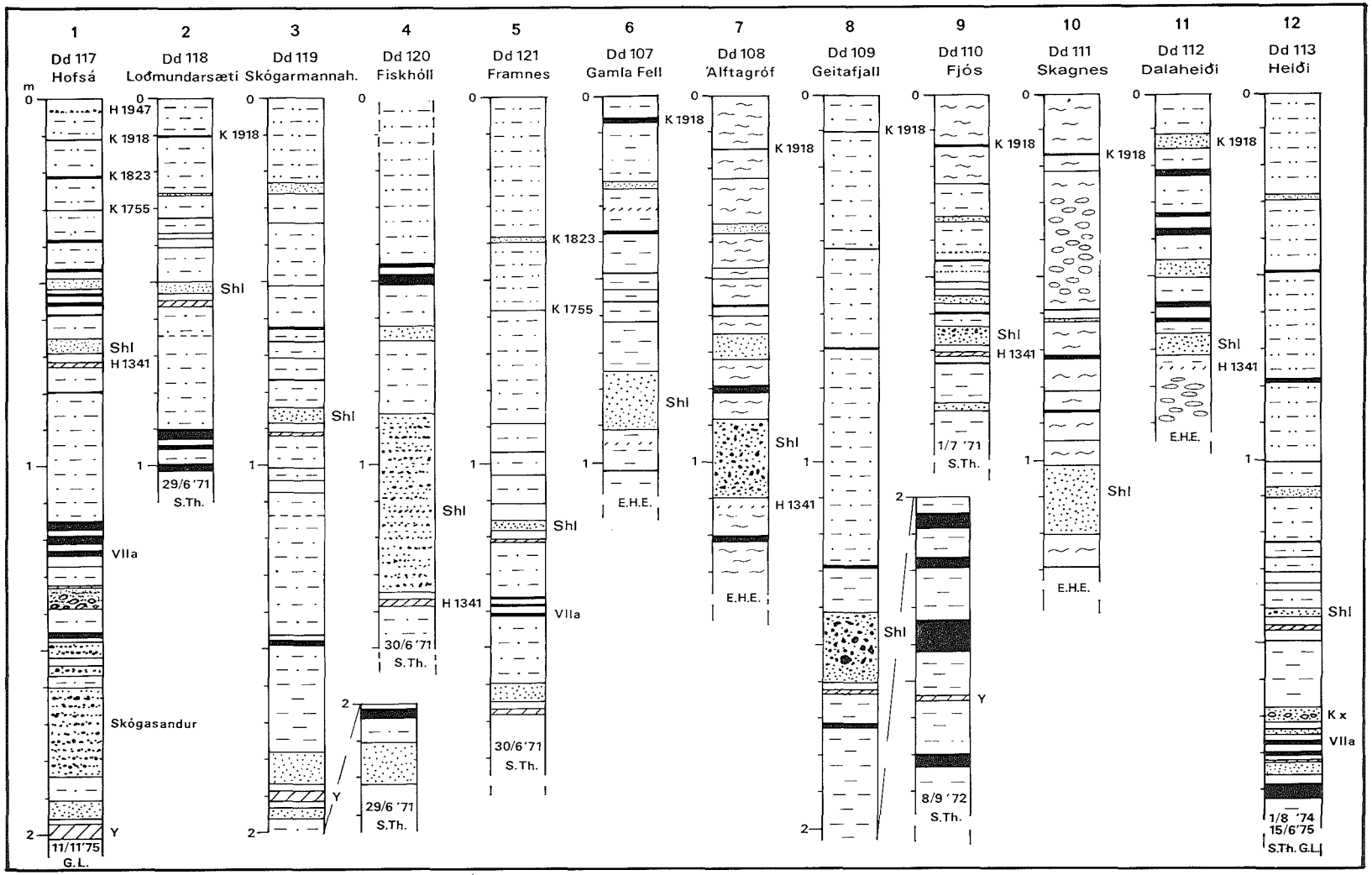

Fig. 7. Soil profiles with the Sólheimar layer. Locations shown on Fig. 6, legend on Fig. 8.

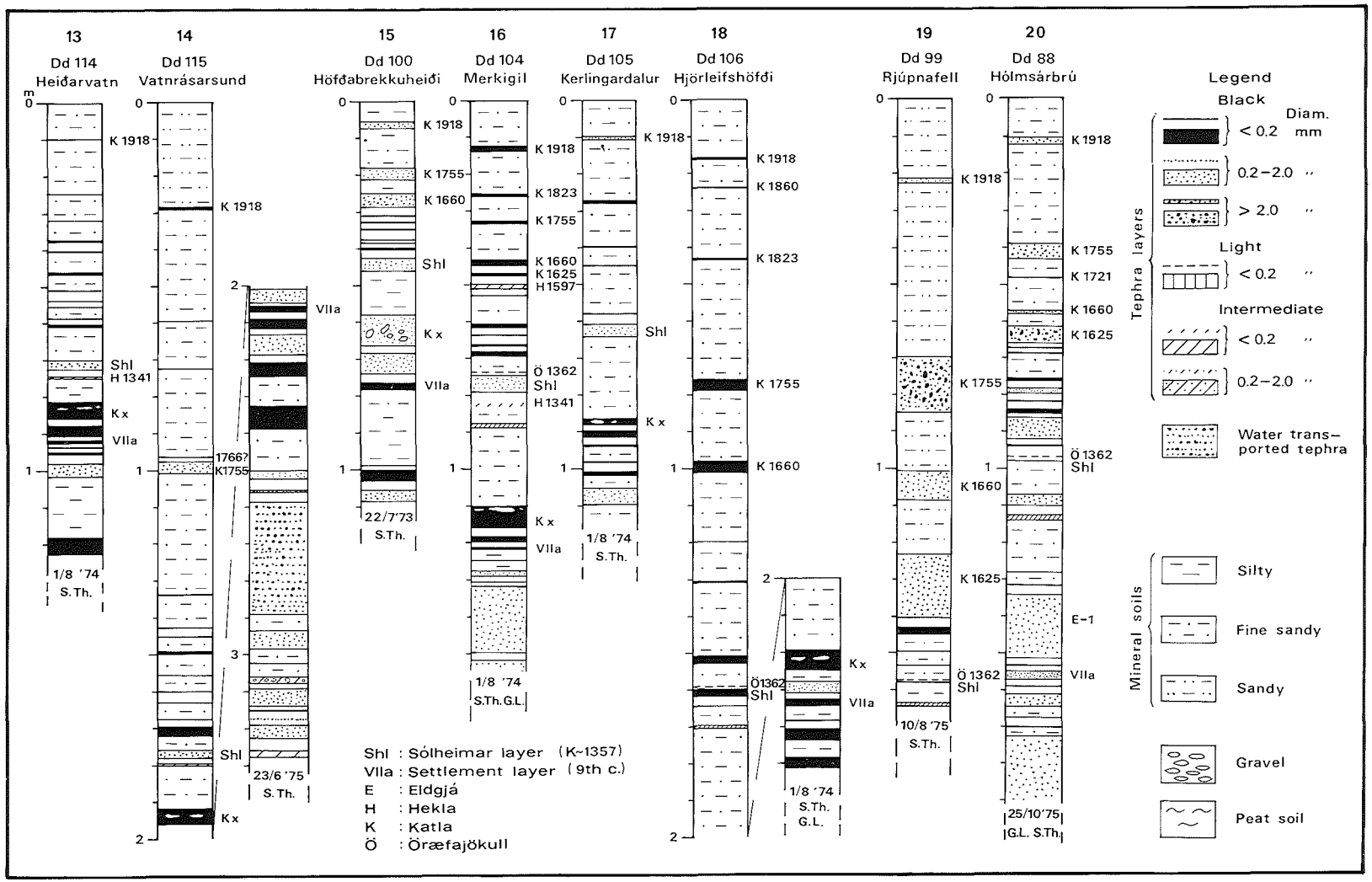

Fig. 8. Soil profiles with the Sólheimar layer. Locations shown on Fig. 6.

appears that rhyolite grains fell mainly in a limited area just west and southwest of the axis of maximum thickness that stretched from Búrfell southeastward across the marshes in central Mýrdalur.

Profiles in Figs. 7 and 8 show most of the tephra layers that have been deposited in the Mýrdalur area after the beginning of settlement in Iceland. Among them is a layer designated VIIa. This layer has a distinguishing greenish-brown colour, which makes it a good marker horizon. It has been argued (Larsen, 1978: 44—46) that the source of the layer is in the crater row Vatnaöldur in Tungnár-öræfi and that this is the same layer as the upper, dark part (VIIa) of a layer designated VIIa+b, which Thorarinsson identified in the Thjórsárdalur valley northwest of Hekla (Thorarinsson, 1943). The layer is a little older than the oldest farm ruins in Thjórsárdalur, but appears to be somewhat younger than the oldest farmstead in Skálholt (Th. Einarsson, 1962). It should therefore have been deposited approximately A.D. 900 and is also called the Settlement layer (*Landnámslag*). All the layers above VIIa in the Mýrdalur area are accordingly from historical time. The layer VIIa+b has been found in peat deposits in Scandinavia (Persson, 1970).

The layer directly under the Sólheimar layer in the profiles is a bluish-grey layer from the Hekla eruption of 1341, and above the Sólheimar layer in some profiles is another Hekla layer, from the eruption of 1597 (Larsen, 1978: 25 and 35). Old records attest that tephra fell in Mýrdalur in both these eruptions (Thorarinsson 1967: 53—54, 82).

On the isopach map (Fig. 9) the area of distribution of the Sólheimar tephra is as follows:

Within the 20 cm isopach 25 km²
Within the 15 cm isopach 70 km²
Within the 10 cm isopach 130 km²
Within the 5 cm isopach 215 km²

It is only possible to determine roughly how much of the tephra was carried out to sea and how much spread over the land beyond the area shown on the map. At Rjúpnafell, on northern Mýrdalssandur, the layer is several millimetres thick, and at the bridge on Hólmsá only a trace amount has been found in the profiles. But in Hjörleifshöfdi the layer is 2 cm thick, as discussed before, and it is likely that some tephra was carried to Álftaver, though no definite identification has been made in profiles there. Some tephra could easily have been carried to the north and west with a change in wind direction. It is most likely, however, that little fell on land outside of the area shown on the map.

A rough estimate of the total volume of the fresh fallen tephra is 0.2—0.3 km³. Here must be added the tephra that the jökulhlaup carried away, perhaps one tenth of the total volume. This eruption is not among the largest eruptions from Katla in historical times, but the wind direction and tephra spreading were as unfavourable as possible for Mýrdalur. Northerly winds also prevailed in the beginning of the Katla eruptions of 1823 and 1860, but the tephra production in these eruptions was very small, or only about one fifth that of the ~ 1357 eruption.

The greater part of the Sólheimar tephra is hardly so light that it could have floated in fresh water. There is little doubt, however, that a part of the tephra that was carried out to sea could have been carried west and north along the coast, as happened during the Surtsey eruption when basaltic tephra, carried clockwise along the coasts by the ocean currents, reached the north coast.

The grain size characteristics of the Sólheimar tephra were measured in 17 samples. All except one were collected at distances of 15 to 20 km from the source. The samples were sieved with a set of sieves with aperture size ranging from 16 to 1/16 mm or —4 to 4ϕ on the phi scale (Krumbein 1936). The grain size analyses were plotted as cumulative curves on probability paper from which the median diameter Md (the value, in mm or ϕ units, at which the curve crosses the 50 wt. % level) and sorting $\sigma\phi$ (half the distance in ϕ units between the points at

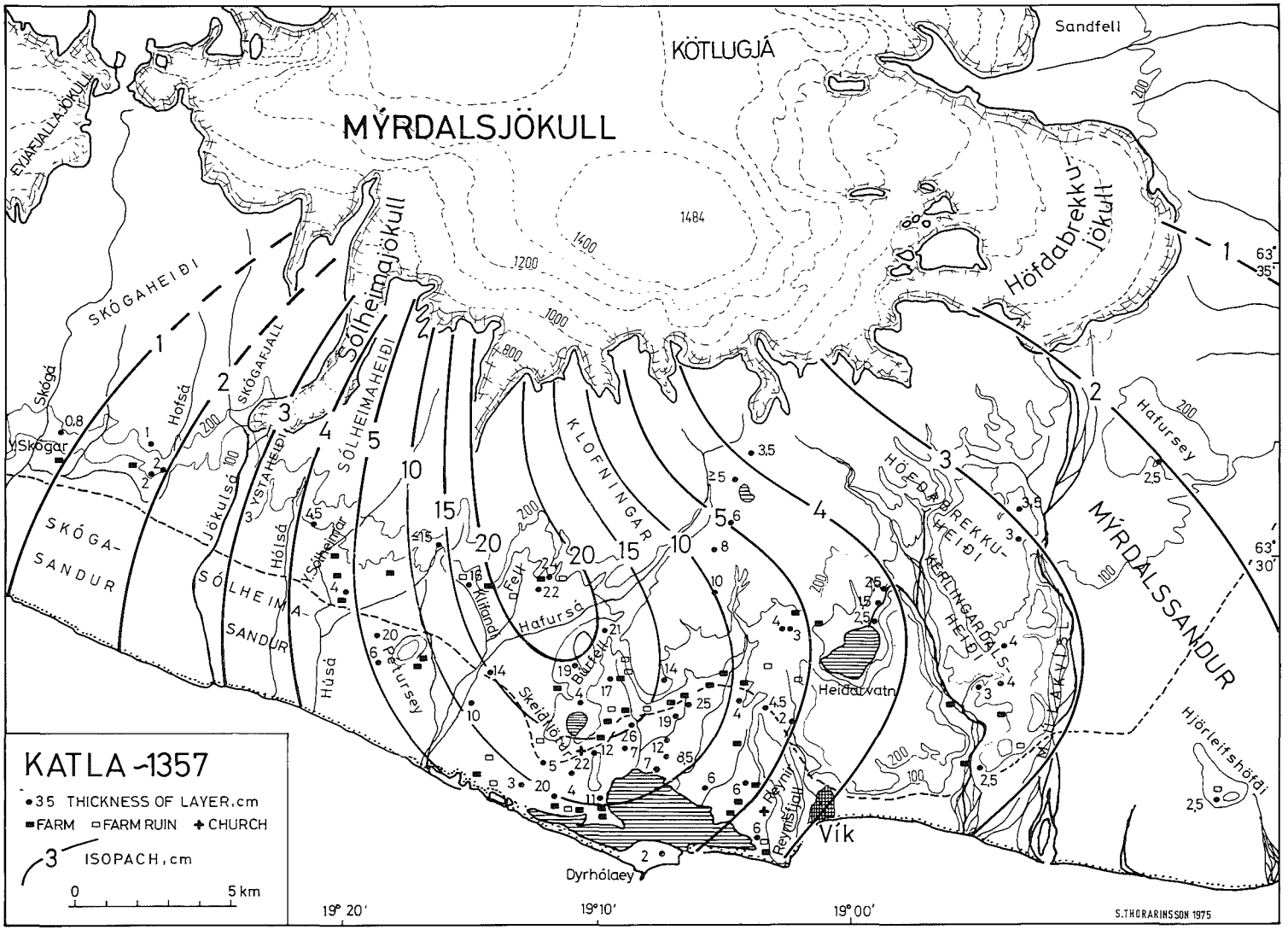

Fig. 9. Isopach map of the Sólheimar layer (K ~1357).

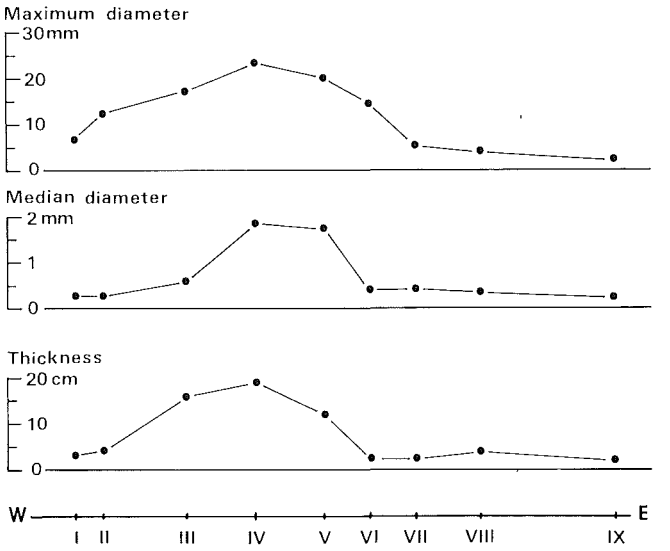

Fig. 10. Plots of maximum diameter and median diameter of the Sólheimar tephra and the thickness of the Sólheimar layer from W to E across the tephra sector. The numbers refer to locations shown on Fig. 6.

which the curve crosses the 84 and 16 wt. % level) were derived.

Nine of the samples were collected along a line running from west to east across the tephra sector between Jökulsá river and Hjörleifshöfdi (I—IX Fig. 6). The average maximum diameter of the five largest tephra grains from each sample, the median diameter (expressed in mm) and the thickness of the Sólheimar layer at each sample locality are plotted together on Fig. 10. The tephra is most coarse-grained in the western part of the sector, around the axis of maximum thickness. There the finest material is found at the bottom of the layer. In the easternmost part of the sector, east of the river Kerlingardalsá, the entire layer is relatively fine-grained and much thinner than in the western part. This indicates that the tephra formed during the initial stages of the eruption was relatively fine-grained and was deposited over most of the fall area before the coarse-grained tephra began to form. The average maximum diameter correlates rather well with the thickness of the layer. The axis of the largest median diameter is shifted somewhat towards east as compared to the axis of maximum thickness.

Fig. 11 shows histograms of the grain size distribution for these samples. In III, V and VI the distribution is bimodal, partly due to the fine-grained tephra found at the bottom of the layer. The samples from the easternmost part, VII—IX, are thought to represent tephra from the initial stages of the eruption. This tephra is well sorted. Sample IX is collected ca. 30 km, the other two ca. 20 km from the source. Although sorting usually is improved with greater distance from the source it seems clear that the range of grain sizes in the first tephra was different and more limited than later on in the eruption.

Fig. 12 is a plot of $\sigma\phi$ against $Md\phi$ for 17 samples of the Sólheimar tephra. The tephra plots mostly in the field of Walker's and Croasdale's (1972) surtseyan ashes and has the characteristics of tephra from an explosive basaltic eruption where water has access to the vent. This is to be expected for subglacial eruptions since water is generated by melting of the ice covering the vents and may have an easy access to them most of the time eruptions last.

CHEMISTRY OF THE TEPHRA

In Table I are listed chemical analyses of the Sólheimar layer and other Katla tephra layers, besides one analysis of lava from northern Eldgjá. The Katla tephras are transitional alkali

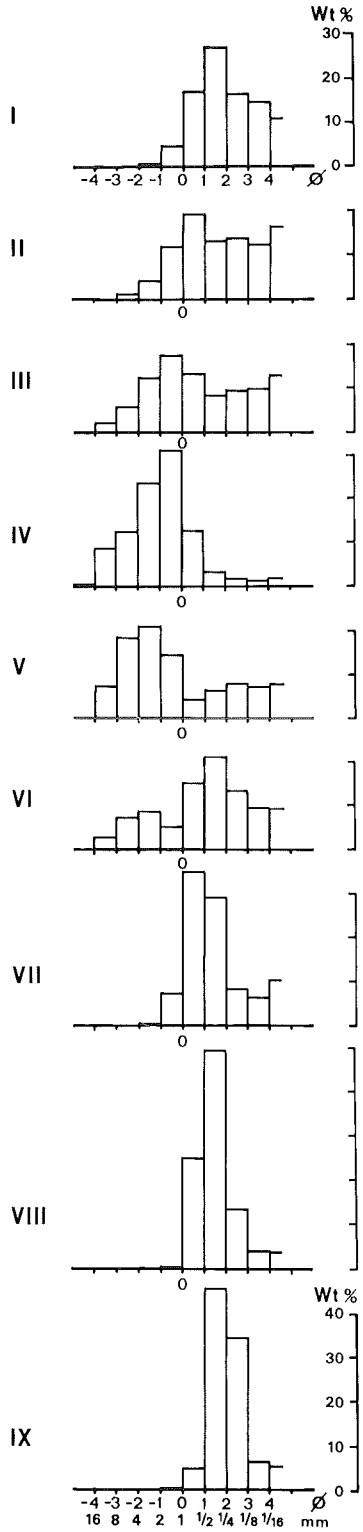

Fig. 11. Histograms showing the grain size distribution (in wt%) of the Sólheimar tephra. Grain sizes smaller than 4.6 ϕ are not plotted. The numbers refer to locations shown on Fig. 6.

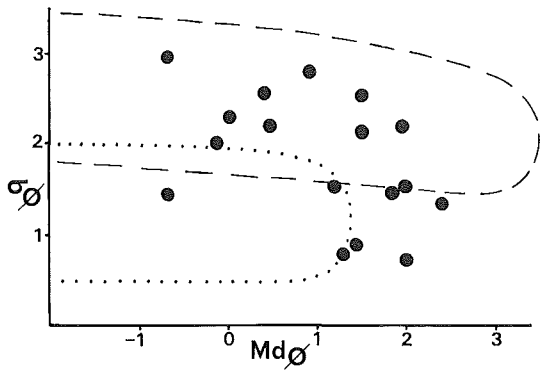

Fig. 12. Plots of sorting ($\sigma\phi$) against median diameter (Mdϕ) for the Sólheimar tephra showing the surtseyan character of the tephra. The dashed line shows the field of surtseyan tephra and the dotted line shows the field of strombolian tephra as outlined by Walker and Croasdale (1972).

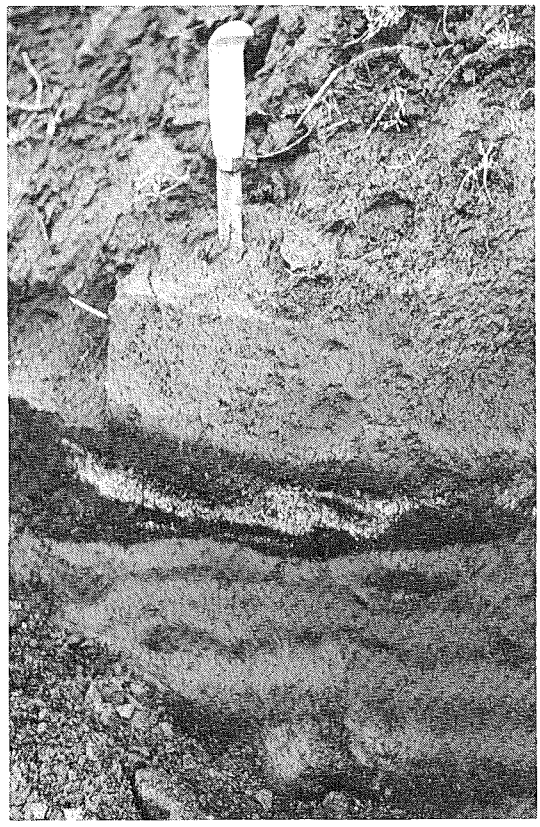

Fig. 13. A lens of light frothy glass within the black Katla layer Kx at Kerlingardalur (Point 17 on the map Fig. 6). Length of knife 15 cm. Photo S. Thorarinsson.

Table 1
Chemical composition of historical Katla tephras and the Eldgjá lava

	1 Xenoliths Kx	2 K~1000	3 K~1357	4 K~1490	5 K 1625	6 K 1660	7 K 1721	8 K 1860	9 K 1918	10 Eldgjá
SiO_2	63.42	45.20	47.65	45.50	46.60	46.00	47.00	47.40	47.30	47.26
TiO_2	1.43	4.23	4.46	5.02	4.54	4.72	4.59	4.63	4.20	4.42
Al_2O_3	14.58	13.16	13.72	13.05	13.05	13.00	13.15	13.05	12.82	13.60
Fe_2O_3	0.91	4.34	2.65	3.56	2.87	2.74	2.37	1.62	2.97	1.71
FeO	6.05	10.99	11.89	12.01	12.01	12.46	12.46	13.14	12.24	13.05
MnO	0.17	0.22	0.28	0.22	0.22	0.27	0.22	0.22	0.22	0.24
MgO	1.38	4.00	3.76	3.68	4.13	4.45	4.24	3.80	4.56	5.30
CaO	4.04	10.04	8.96	9.47	9.47	9.55	9.91	9.18	10.00	9.89
Na_2O	4.78	2.74	2.45	2.96	3.40	3.40	3.34	2.90	2.90	2.86
K_2O	1.93	0.55	0.78	0.60	0.78	0.86	0.76	0.77	0.86	0.76
P_2O_5	0.30	0.65	0.65	0.64	0.73	0.72	0.65	0.62	0.73	0.48
H_2Ot	0.80	2.15	2.06	1.85	0.93	1.77	0.90	2.94	1.07	0.25
Total	99.79	98.27	98.53	98.56	98.73	98.94	99.59	100.27	99.87	99.82

Text to Table 1

1. Frothy glass xenoliths from the tephra layer Kx. Kerlingardalur (profile 17, Figs. 6 and 8).
2. Black, fine sandy tephra, K~1000. Búrfellsháls, 68 km NW of Kötlugjá.
3. Black to greyish black, scoriaceous tephra with minor amount (approx. 1%) of lightcoloured xenoliths. K~1357, the Sólheimar layer. Geitafjall (profile 8, Figs. 6 and 7).
4. Black, sandy tephra, K~1490. The village Hella, 76 km WNW of Kötlugjá.
5. Black to greyish black, scoriaceous tephra. K 1625. Hólmsá bridge, 24 km E of Kötlugjá (profile 20, Fig. 8).
6. Black, sandy tephra, K 1660. Hólmsá bridge.
7. Black, fine sandy tephra, K 1721. Búrfellsháls, 68 km NW of Kötlugjá.
8. Black, sandy tephra, K 1860. Framnes (profile 5, Figs. 6 and 7).
9. Black, fine sandy tephra, K 1918. Kirkjubæjarklaustur, 48 km ENE of Kötlugjá.
10. Eldgjá lava. Landbrot district, near Kirkjubaejarklaustur.

All tephra samples were collected by S. Thorarinsson. The sample of the Eldgjá lava was collected by S. Steinthórsson. Chemical analyses of the tephras were made on bulk samples and the Eldgjá lava was analysed on a whole rock sample. Analyses were made at the Nordic Volcanological Institute and the Science Institute (N.V.I. & S.I.) laboratory, University of Iceland. Analytical procedures are described by Sigvaldason (1974).

basalts. Characteristic for them, as well as the Eldgjá lava, is their high content of TiO_2 and total iron.

Generally speaking the Katla tephras consist of brownish basaltic glass. Plagioclase (labradorite) forms sparse microphenocrysts in the glass. Augite occurs less commonly. Various lithic fragments, basaltic to acidic, are common. Most noteworthy are acidic xenoliths in various stages of fusion, ranging from white-greyish nodules to a white creamy froth. This froth is most conspicuous in the layer designated Kx in Figs. 7 and 8, cf. the photo Fig. 13.

THE JÖKULHLAUP ACCOMPANYING THE ~1357 ERUPTION

The eruption that spread the Sólheimar tephra over Mýrdalur was accompanied by a

jökulhlaup from under Sólheimajökull. It flooded principally the Sólheimasandur, with almost nothing pouring over Skógasandur. We still do not know sufficiently well how much material was carried in this jökulhlaup.

The main force of the water in the jökulhlaup most likely came from between Skógafjall and Sólheimaheidi. The water also flowed down Ystaheidi, carrying with it the soil and vegetative cover from a large area and leaving behind only large blocks and naked rock. The hlaupwater also flowed down the gully of the river Hólsá. It seems likely that the sandur plain along the river Húsá southwest of the farm Sólheimakot is now at the same level as before the hlaup, and that the highest flood lines of the hlaup are marked by beds of the Sólheimar layer in the soil east of and above the river. The flood lines are about 10 m higher than the present riverbed.

When excavation was in process for the foundation of the house at the farm Sólheimahjáleiga, it became evident that this farm actually stood on the Sólheimasandur, though covered with earth and vegetation; the same can be said of the farm Sólheimakot. The river Húsá left behind a part of the sandur to the east of the channel it eroded after the hlaup.

There is little doubt that the eastern part of Sólheimasandur thickened by several metres in this hlaup. As the hlaup advanced it undoubtedly carried millions and conceivably tens of millions of cubic metres of tephra. The rivers Húsá and Klifandi have since continued to erode the east margin of the sandur.

POSITION OF THE ERUPTION SITE

The measurements made in 1955 of the thickness of the ice cover of Mýrdalsjökull showed a large caldera under the centre of the glacier (Rist, 1967; Sigbjarnarson, 1973). Pictures taken by the ERTS-1 satellite (cf. Fig. 14) and recent radar measurements (H. Björnsson, 1977) have increased our knowledge of the area and depth of this caldera, and more exact measurements are planned.

From the caldera and to the southeast creeps Höfdabrekkujökull (Kötlujökull), along the way followed by the jökulhlaups out of the Kötlugjá (the Katla fissure) of the last few centuries. A second pass goes out of the caldera

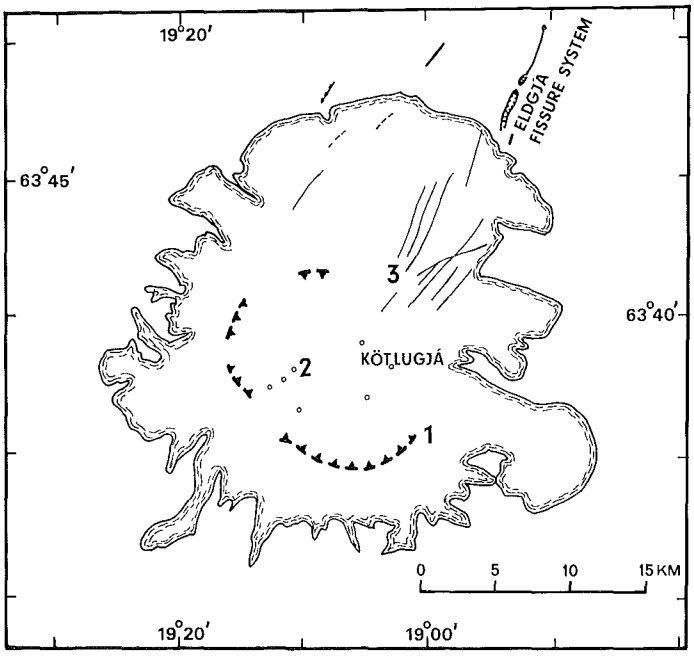

Fig. 14. Sketch map showing some surface features of the Mýrdalsjökull ice cap as interpreted from an ERTS-1 image of Oct. 12th 1973. The outlines of the glacier are drawn from the General Map of Iceland, 1:250.000, sheet 6. 1) Probable reflections of a caldera rim; 2) Shallow cauldrons; 3) Probable reflections of subglacial ridges.

to the southwest beneath the accumulation area of Sólheimajökull; this is the path that the hlaup followed at the time of the ~ 1357 eruption. We must look for the source of the eruption within the caldera somewhat west of Kötlugjá. This is consistent with the isopach map of the tephra layer. ERTS-1 images show shallow depressions in the southwest half of the caldera which indicate geothermal heat under the ice. It is probable that this geothermal heat is responsible for the constant stench that comes from the Jökulsá on Sólheimasandur (Fúlilækur). Further reconnaissance of the subglacial topography within the caldera is expected to show how large an area could have drained or does drain subglacially to Sólheimajökull. This area includes the source of the Sólheimar layer.

It would be appropriate to call the caldera in the Mýrdalsjökull central volcano as a whole Katla and to speak of the eruptions that have occurred within the caldera as Katla eruptions, and to use the old name Kötlugjá for the fissure(s) that produced the jökulhlaups from Höfdabrekkujökull, at least in the last few centuries. The geographical position of Kötlugjá was established with some precision during the eruption of 1918 (Jón Trausti, 1918, cf. also Rist, 1967).

Mýrdalsjökull, like other so called central volcanoes, is composed in part of acid and intermediate rocks. Rhyolite and dacite are found in the caldera walls to the north and northeast of Kötlugjá (Sigurdsson, 1970). Rev. Jón Austmann, the first to reconnoitre Kötlugjá, found obsidian up there on August 12 1823 (S.t.s. Isl. IV: 262) but no acid eruption has taken place in Katla since the time of the settlement. In most of the tephra layers, however, there are some acid and intermediate xenoliths, especially in the Sólheimar layer, though more in a layer labelled Kx in the profiles. This layer was definitely produced in historical times. In a sector of this layer there are quite large lenses of light-coloured frothy glass (Fig. 13 and analysis 1, Table I).

The volcanic activity in the Krafla caldera since 1975 has greatly clarified the connection between calderas and fissure swarms (Björnsson et al. 1977). When Th. Thoroddsen in the summer of 1893 found a large chasm and a crater row collectively called Eldgjá (= Fire fissure) he traced the fissure south to Mýrdalsjökull (Thoroddsen, 1894). G. Robson (1956) maintained that Kötlugjá should be regarded as the southernmost part of Eldgjá, and certainly in favourable light conditions the crater row can be seen extending some distance under the cover of Mýrdalsjökull in a direction towards Kötlugjá. He considered the chemical composition of the tephra from Katla and the eruption products from the Eldgjá to be so similar that there is little doubt that the Katla fissure is the southern end of Eldgjá (Robson, 1956). Whether or not the large lava flows from Eldgjá caused changes in the topography of the Katla caldera, because of lava escape similar to what has occurred along the Krafla fissure swarm (Björnsson et. al. 1977, Sparks et al. 1977, Saemundsson 1978), is not possible to say, but it is certain that hlaups from Sólheimajökull took place both before and after the formation of the northern part of the Eldgjá and, thus also before and after the formation of the whole of the Eldgjá, if it was formed in one eruption (Larsen, 1978, 1979).

WRITTEN RECORDS OF ERUPTIONS CREDITED TO SÓLHEIMAJÖKULL

In light of the foregoing analysis of the Katla eruption of ~ 1357 and the concomitant jökulhlaup from under Sólheimajökull, it is appropriate to discuss the two eruptions of 1245 and 1262 that the annalists credited to Sólheimajökull. It is not possible to say whether or not these eruptions were accompanied by jökulhlaups from under Sólheimajökull, but it need not have been. It could well have been ordinary Katla eruptions with hlaups from under Höfdabrekkujökull, even though recorded as eruptions in Sólheimajökull. There is a much earlier example of meaning Mýrdalsjökull but writing Sólheimajökull. In the Life of Bishop Árni Thorlákssson it is recorded: "This

summer [1270] Árni the bishop rode to the north of Sólheimajökull and made his visitationes in the Eastern Quarter" (Biskupasögur II: 685). This is considered to have been written in Skálholt in the days of bishop Árni Helgason, 1304—1320. Oddur Einarsson described in his aforementioned description of Iceland (Qualiscunque: 43) that there was an eruption in the year 1580 in a mountain called Sólheimajökull ("in monte qui dicitur Sólheimajökull"), though it is clear from other records that he meant an eruption of Katla coincident with a hlaup from under Höfdabrekkujökull. Evidence has been found (Larsen 1978) that jökulhlaups from Sólheimajökull have taken place more than once after the great prehistoric hlaup that formed Skógasandur. One of these hlaups was probably the hlaup recorded in Landnámabók (The Book of Settlements) in connection with the dispute between Thrasi and Lodmundur.

The little that the ancient annalists had to say about the 1245 and 1262 eruptions is as follows:

1245: Resensannáll "Coming up of fire in Sólheimajökull". Höyersannáll reads the same, apparently based on Resensannáll. These two annals mention no other eruption in Sólheimajökull. Konungsannáll for the year 1245 reads, "Fire in Sólheimajökull", and for 1262, "Fire in Sólheimajökull. Great darkness and the sun obscured". The wording of Skálholtsannáll is almost the same as that of Konungsannáll for the year 1245, "Fire in Sólheimajökull", and for the year 1262, "Coming up of fire in Sólheimajökull and a great darkness followed so that the sun was obscured" (Isl.Ann.: 26, 65, 131, 134, 189, 193). Flateyjarannáll and Oddaverjaannáll follow Konungsannáll in reporting the eruption from under Sólheimajökull.

Herewith is recounted all the information that the ancient records hold about volcanic activity under Sólheimajökull in the 13th century. The little else that has been written about this is from later centuries.

Both Jón Steingrímsson (S.t.s. Ísl. IV: 196—7) and Sveinn Pálsson (Ferdabók: 550) have more to say about these two 13th century eruptions than did the old annalists. Rev. Jón said that he had collected accounts of the eruptions of Katla after the eruption of 1755, when he had just moved to the parsonage Fell in Mýrdalur. His chief source is Jón Sigurdsson from Holt in Mýrdalur, who was born about 1700, "A wise man and learned", wrote Rev. Jón, and says that among other things he had got from his grandfather, Einar Thorsteinsson, several tattered books with accounts of events both here in Iceland and elsewhere (S.t.s. Ísl. IV: 192—3). Rev. Jón wrote of what he called the fourth hlaup in 1245: "Fire came up out of the same glacier [viz. Sólheimajökull] with sand and ash fall on the Sólheimar side of it". Sveinn Pálsson wrote in his Treatise on Glaciers concerning the 1245 eruption that there is "no further information at hand except that the sand lay a quarter of an ell thick on the land after the eruption". Rev. Jón wrote about the fifth jökulhlaup, in 1263, "The fire came up in the same place with ashfall so thick that the sun was obscured at midday in a cloudless sky". Sveinn Pálsson wrote: "A fearful sand and pumice fall followed the eruption, so that men thought that Sólheimasandur had risen 20 fathoms above what it had been". As to the last point, he must have misunderstood the Rev. Jón, who continued the above quote of his with: "Such a terrifying amount of pumice, sand and large rocks has poured from the glacier in these jökulhlaups, and spread out on both sides for a good third of a day's journey. The vertical thickness I estimate as 20 fathoms, according to my measurements of the sloping sand ridges or the banks along the river where it flows on a hard gravel bed". Here Rev. Jón means Sólheimasandur in the wide sense of both Sólheimasandur and Skógasandur, and the words "in these jökulhlaups" include the jökulhlaup recorded in the Book of Settlements and, perhaps, also the jökulhlaup that accompanied the eruption that Rev. Jón says occurred in the year 1000. The cleric had taken into account the fact that Sólheimasandur both east and west of the river Jökulsá for the most part consists of

jökulhlaup sediment, and he is presumably the first man to have measured the thickness of such sediments.

Rev. Jón continued: "It is generally known that these jökulhlaups have ravished the land on both sides, although this has not actually been recorded. This can be seen at so called Baejarstadur, furthest out on Sólheimanes, where even now there is still evidence of large man-made structures that the sandur and debris could not cover" (S.t.s. Ísl. IV: 197). The argument of Markús Loftsson that the jökulhlaup of 1263 did destroy Baejarstadur (Loftsson, 1930: 11) could have been his own conclusion.

It could well be that what Jón Steingrímsson and Sveinn Pálsson both wrote about the two eruptions, besides what is recorded in the old annals, and credited to Sólheimajökull actually is based on traditions in Mýrdalur and in fact refers to the ~ 1357 eruption. Jón Sigurdsson, whose writings the Rev. Jón Steingrímsson later read, was interested in the eruptions of Katla and wrote a discerning description of the eruption of 1755. His grandfather, the sheriff Einar Thorsteinsson, living at Fell in Mýrdalur († about 1691), was the son of Thorsteinn Magnússon, the keeper of the former monastery Thykkvabaejarklaustur, who wrote a description of the eruption of Katla in 1625, the oldest detailed description of an Icelandic eruption. Those "tattered books with accounts" that Jón Sigurdsson had from his grandfather were hardly much older than the middle of the 17th century. Conceivably there was something about the 1245 and 1262 eruptions in the lost annals that Jón Steingrímsson said that Rev. Thorleifur Árnason had written. Thorleifur was born in 1630 and died in 1713; he was in the services of the bishop Brynjólfur Sveinsson from 1655 and was in charge of the Kálfafell parsonage in 1659.

The information about the sand- and ash fall on the Sólheimar side is indisputably in accord with the ~ 1357 eruption (cf. the isopach map). Indeed, Jónas Hallgrímsson wrote in his aforementioned compilation of the history of the volcanoes that this information came from the Hungurvaka, but that is a misunderstanding, as Hungurvaka does not mention events after 1176. Jón Steingrímsson probably got his information from Jón Sigurdsson or from the annal by Thorleifur Árnason. The wording of Rev. Jón about the latter eruption ("the sun was obscured at midday in a cloudless sky") could conceivably have been a stylized form of the old annals, although it was not like him to write in stylized form. The wording undeniably accords with the eruption of ~ 1357 as it has been clear weather with a northwesterly wind when the eruption began.

Where Sveinn got the information that the sand had been a quarter of an ell thick on the earth after the eruption of 1245, cannot be said with certainty. Sveinn knew from Jón Steingrímsson that the debris lay 20 fathoms thick on Sólheimasandur and he seems to have seen Jón's account of the Katla eruptions, (cf. Ferdabók: 543). It is not improbable that the information about the quarter of an ell thick sand also came from Rev. Jón, directly or indirectly, and could conceivably have been based on his conclusions from his own observations of the tephra layers, as he elucidates this in another connection when he describes the tephra layers in the soil (S.t.s. Ísl. IV: 3). This thickness accords better with the Sólheimar layer than with other layers from historical times in Mýrdalur. If traditions in Mýrdalur were connected with an eruption in Sólheimajökull, then it is to be expected that Rev. Jón would connect them with those eruptions which the old annals record as eruptions in Sólheimajökull.

DAMAGE CAUSED BY THE ~ 1357 ERUPTION

In order to assess the effect of the thickness and spread of the Sólheimar layer, we can look at the effects of other Icelandic historical tephra layers of known thickness. A 20—40 cm thick layer lays farms waste for a decade or more, a 15—25 cm thick layer stops farming for 1—5

years. Generally a farm is not laid waste by tephra fall unless the layer is at least 8—10 cm thick (Thorarinsson, 1971). The extent of the damage depends greatly on what time of year the tephra falls. It cannot be said for certain in what season the Sólheimar layer was deposited, but it is likely that it fell on snowfree ground.

These figures for the thickness of the tephra are for freshly fallen or nearly freshly fallen tephra. The map of the spread and thickness of the Sólheimar layer, however, is based on its present thickness as compressed in the soil profiles. We can conclude that the original thickness of the tephra was probably at least 70% greater than at present. We may consider that where the thickness at present is 6 cm or more the farms were uninhabitable for several months, and that the farms within the 10 cm isopach were abandoned for a year or more.

The tephra seems to have given rise to soil erosion, or to have greatly increased it, especially in the uplands of Sólheimar, Fell, Holt, Grófar, and Keldudalur, which were at one time covered over with thick soil and vegetation almost to the present glacier margin. East of the river Hafursá the erosion caused by the layer has been less. Widely the tephra choked the streams, as if by a snow storm, when the tephra fall passed over. An example is the old parsonage at Fell where a considerable brook ran near the farm. When it cleared itself after the tephra fall the brook had carried pumice slurry all around the farm and left behind a pumice layer that now is a good half metre thick, compressed under a soil cover of 60—70 cm thickness.

The exact number of farms laid waste by the tephra fall of ~1357 will never be known, but it may be possible to establish a lower limit. Our principal sources of information about settlement in Mýrdalur in the first half of the 14th century are chartularies of the local churches, believed to date from about 1340, and the chartulary of the monastery at Thykkvibaer in Ver drawn up by Bishop Jón Indridason in 1340.

The following are the relevant passages from these chartularies:

"To the church of St. Mary at Sólheimar [Ytri Sólheimar] belongs half the glebe land with scot and lot, 12 cows, 30 milking sheep and 2 ewes. Horses to the value of three hundreds, 5 yearling oxen, 2 of two winters.

— — —

To it belong two churches, mass to be said every holy day in one, to receive 4 marks, every other day in the other, to receive 2 marks.

5 "aurar" for the chapel at Sólheimar. Half a mark for the chapel at Hvoll. Half a mark from Keldudalur. 12 "aurar" for Fell.

Burial from all farms west of Brandslaekur, and 2 priests to be kept. The home priest to receive 4 marks." (DI II, no. 482).

The one church which according to this chartulary belongs to the church at Ytri-Sólheimar is undoubtedly the church at Eyjan há (Pétursey), where there was a church with income to support a resident priest around the year 1200 according to Bishop Páll Jónsson's register of churches (DI XII, no. 1). The "chapel at Sólheimar" was presumably at Eystri-Sólheimar. The chartularies from about 1340 seem to indicate that at that time there was still an annex church at Keldudalur, where there was such a church (dedicated to St. Nicholas) in 1179 (DI I, no. 47) as well as an annex church or a chapel at Fell (DI I, no. 48).

"To the church of St. Michael at Durhólmar belongs land at Raudháls and a good drift-beach and one cow . . . A priest to be there and say mass regularly according to custom and 4 marks to be paid the priest. Mass to be said thence at Ketilstadir every fourth day and the priest to be paid a mark one day a week in Lent.

12 masses to be said at Brekkur.

To the church belong tithes from Brekkur and Raudháls, Steig and Ketilsstadir, Hryggir and Hváll and Vesturhús. The day of dedication is three night before Michaelmass." (DI II, no. 482).

"To the church of St. Mary at Reynir belong 20 hundreds in land, livestock to the value of 7 cows. To it belong tithes and lighting tax from 10 farms, except at Dalur payment is made at home. Mass to be said there every other day. The priest to receive 2 marks. Twenty masses at Hvammur and 11 ells to be paid. 12 masses at Heidi. The priest to receive half a mark. From Vík, half a mark. A priest to be maintained there and to receive 4 marks." (DI II, no. 481).

"To the church of St. Olaf at Höfdabrekka belongs as much of the glebe land as makes up the rent of priest and deacon, 8 cows and 7 milking sheep, livestock to the value of 4 cows and 20 hundreds in drift-beach.

— — —

To it belong 2 annex churches, mass to be said on alternate days at each. The priest to receive 2 marks at each church. One more farm belongs to it." (DI II, no. 480).

The chartulary of 1340 of the monastery at Thykkvibaer lists the following farms among its properties:

"Hvoll in Mýrdalur, pays cc in wadmal and 2 "vættir" butter
Hryggir, pays one mark butter and 2 marks wadmal
Durhólmar, pays ccc in wadmal and 2 "vættir" butter
Ketilsstadir, pays ccc in wadmal and 2 "vættir" butter
Geilar, pays 2 "vættir" butter and 10 "aurar" wadmal
Götur, pays 3 "vættir" butter and 12 "aurar" wadmal
Heidi, pays 3 marks wadmal
Vík, pays cc in wadmal and 2 "vættir" butter and 12 "aurar" in salt.
Fagridalur, pays one and a half hundreds." (DI II, no. 479).

The chartulary also lists rights of forest use at Heidi, Geilar, Hvoll, Götur, Dyrhólmar, Vík, and Hryggir.

According to the scources cited above, there were in the district of Mýrdalur, about twenty years before the eruption of ~ 1357, 4 main churches and mass is said in 11 other houses of worship, of which at least 4 were annex churches. Twenty farms are mentioned by name, and the names of three more are known with near certainty (Ytri-Sólheimar, Pétursey, Hjörleifshöfdi). To these must be added a farm with an annex church (possibly Fagridalur) and another, unnamed, farm belonging to the church at Höfdabrekka, and ten farms are said to belong to the church of St. Mary at Reynir, of which, however, only three are mentioned by name. Even allowing for the possibility that some of the unnamed farms are among those already listed here by name, it seems safe to conclude that about thirty farms are referred to in our sources, and we can be certain that this number does not include all the farms in occupation in Mýrdalur at the time. Of these thirty odd farms, about twenty will have been abandoned for a longer or shorter period. The census of 1703 lists 49 farms in Mýrdalur. Of these, probably 34 would have been abandoned for several months, and another 7, in the southern part of the Reynir-neighbourhood would have been on the verge of being abandoned temporarily, and 22—24 farms most likely remained unoccupied for from one to five years. The annalists of Skálholtsannáll and Flateyjarannáll are therefore not overstating things in saying that "many farms in Mýdalur were laid waste in the ash fall," nor is it much of an exaggeration when we are told in Gottskálksannáll that "nearly all the farms in Mýdalur were laid waste" — that is to say, if we are thinking of the situation in the first months after the tephra fall. A few years later, and before the Mýrdalur district had recovered from the ~1357 tephra fall, the county Skaftafellssýslur was hit by a still more serious disaster. The annalistic fragment known as Skálholtsannáll, which may be considered a virtually contemporary source, has this to say about the year 1362: "Fire in the earth in three places in the South, and continued with such enormity

from early June till autumn that all of Litlahérad was laid waste and a large part of Hornafjördur and Lónshverfi, the devastation extending over more than a hundred miles" (Isl.Ann.: 326). Other annals as well as tephrochronological studies confirm that one of these eruptions, i.e. the one that devastated Litlahérad, the prosperous district along the foot of Öraefajökull, and the districts as far as Lónsheidi, was the eruption of Öraefajökull in 1362, the greatest tephra eruption in Iceland in historical times (Thorarinsson 1958). Recent studies of the tephra layer from that eruption have shown that shortly before, and almost certainly in the same year, a fairly thick layer of black tephra fell on the district Sudursveit, similar to the one that fell on the adjacent district Mýrar in the Grímsvötn eruption of 1873; it seems quite certain that this tephra derives from an eruption in Vatnajökull, most likely in Grímsvötn. Thus another of the three eruptions has been identified.

We can now state, that although the volcanoes of Skaftafellssýsla have often proved vexatious neighbours to the people of the county they have never before the Lakagígar eruption of 1783 shown themselves as relentlessly hostile as early in the second half of the 14th century.

ACKNOWLEDGEMENTS

Thanks are due to Halldór Ólafsson, Níels Óskarsson and Sigurdur Steinthórsson, who assisted with the measurements of soil profiles in Mýrdalur. Translation into English was done by Tony G. Lacy except for the chartularies, which were translated by Jóhann Hannesson.

REFERENCES

Björnsson, A., Saemundsson, K., Einarsson, P., Tryggvason, E. & Grönvold, K., 1977. Current rifting episode in North Iceland. Nature 266, 318—323.

Björnsson, H., 1977. Könnun á jöklum med rafsegulbylgjum. (Summary: Radio-echo sounding of temperate glaciers). Náttúrufraedingurinn 47, 184—194.

Einarsson, O., 1971. Íslandslýsing. Qualiscunque descriptio Islandiae. Bókaútgáfa Menningarsjóds. Reykjavík.

Einarsson, Th., 1962. Vitnisburdur frjógreiningar um gródur, vedurfar og landnám (Pollenanalytical evidence of vegetation, climate and settlement in Iceland). Saga 1962, 442—469.

Jónsson, J., 1978. Jardfraedikort af Reykjanesskaga I—II (Geological map of the Reykjanes Peninsula). Orkustofnun OR JHD 7841. Reykjavík.

Jónsson, Ó., 1945. Ódádahraun I—III. Bókaútgáfan Nordri. Akureyri.

Krumbein, W.C., 1936. Application of logarithmic moments to size frequency distribution of sediments. Jour. Sed. Petrology 6, 35—47.

Larsen, G., 1978. Gjóskulög í nágrenni Kötlu (Tephra layers in the vicinity of Katla). B.Sc. Hon. thesis, 66 pp. University of Iceland.

Larsen, G., 1979. Um aldur Eldgjárhrauna. (Summary: Tephrochronological dating of the Eldgjá lavas in South Iceland). Náttúrufraedingurinn 49, 1—25.

Loftsson, M., 1930. Rit um jardelda á Íslandi (Treatise on volcanic eruptions in Iceland). 2nd ed. Ísafoldarprentsmidja. Reykjavík.

Pálsson, H., 1965. Eftir thjódveldið (After the Commonwealth). Heimskringla. Reykjavík.

Persson, Ch., 1970. Tephrochronological investigation of peat deposits in Scandinavia and on the Faroe Islands. Dept. of Quaternary Research, University of Stockholm (mimeographed).

Rist, S., 1967. The thickness of the ice cover of Mýrdalsjökull, Southern Iceland. Jökull 17, 237—242.

Robson, G.R., 1956. The volcanic geology of Vestur-Skaftafellssýsla. Unpubl. Ph.D. thesis, 296 pp. Durham University, England.

Sigbjarnarson, G., 1973. Katla and Askja. Jökull 23, 45—51.

Sigurdsson, H., 1970. The petrology and chemistry of the Setberg volcanic region and of the intermediate and acid rocks of Iceland. Unpubl. Ph.D. thesis, 308 pp. Durham University, England.

Sigvaldason, G.E., 1974. Basalts from the centre of the assumed Icelandic mantle plume. J. Petrol. 15, 497—524.

Sparks, S.R.J., Sigurdsson, H., & Lionel, W., 1977. Tephra formed in the 1875 Askja eruption. Case history of a plinian eruption triggered by magma mixing. X INQUA Congress, Birmingham, Abstracts, 429.

Saemundsson, K., 1978. Fissure swarms and central volcanoes of the neovolcanic zones of Iceland. In: Crustal evolution in northwestern Britain and adjacent regions. D.R. Bowes & B.E. Leaks (eds.). Geol. Journ. 10, 415—432

Thorarinsson, S., 1943. Thjórsárdalur och dess förödelse (Thjórsárdalur and its devastation). Forntida gårdar i Island. M. Stenberg (ed.). Ejnar Munksgaard. Copenhagen.

— 1951. Laxárgljúfur and Laxárhraun. Geogr. Ann. 33, 1—80.

— 1952. Hverfjall. Náttúrufraedingurinn 22: 113—129 and 145—172.

— 1958. The Öraefajökull eruption of 1362. Acta Nat. Isl. II, 2, 1—100.

— 1959. Um möguleika á því að segja fyrir naesta Kötlugos. (Summary: On the possibilities of predicting the next eruption of Katla). Jökull 9, 6—18.

— 1967. The eruptions of Hekla in historical times. The eruption of Hekla 1947—1948. I. Societas Scientiarum Islandica, 1—170.

— 1971. Forn saumnál finnst ad Felli í Mýrdal. (Summary: Old sewing needle found at Fell in Mýrdalur). Árbók Hins íslenzka fornleifafélags 1971, 95—99.

— 1974. Vötnin stríd (The swift flowing rivers). Bókaútgáfa Menningarsjóds. Reykjavík.

— 1975. Katla og annáll Kötlugosa (Katla and a list of Katla eruptions). Árbók Ferdafélags Íslands 1975, 124—149.

Thoroddsen, Th., 1894. Ferd um Vestur-Skaftafellssýslu sumarid 1893 (Travel through Vestur-Skaftafellssýsla in the summer of 1893). Andvari 19, 44—161.

— 1925. Die Geschichte der isländischen Vulkane. D. Kgl. Danske Vidensk. Selsk. Skr. Naturv. og Mathem. Afd., 8. Raekke, IX. Copenhagen.

Trausti, J., 1918. Austur med söndum (Eastwards along the sandurs). Ritsafn VII 1945. Bókaútgáfa Gudjóns Gudjónssonar. Reykjavík.

Walker, G.P.L. & Croasdale, R., 1972. Characteristics of some basaltic pyroclastics. Bull Volc. 35, 303—317.

— — —

Annálar 1400—1800 I—IV. 1922—1948. Hid íslenzka bókmenntafélag. Reykjavík.

Biskupa sögur I. 1856. Hid íslenzka bókmenntafélag. Copenhagen.

DI: Diplomatarium Islandicum I—XVI. 1850—1916. Copenhagen and Reykjavík.

Ferdabók: Ferdabók Sveins Pálssonar. 1945. Snælandsútgáfan. Reykjavík.

Isl. Ann.: Islandske Annaler indtil 1578. 1888. G. Storm (ed.). Christiania.

Qualiscunque Descriptio Islandiae. 1928. F. Burg (ed.). Selbstverlag des Staats- und Universitäts Bibliothek. Hamburg.

Rit J.H.: Rit Jónasar Hallgrímssonar I—V. 1929—1937. Ísafoldarprentsmidja. Reykjavík.

S.t.s.Ísl. IV: Safn til sögu Íslands IV. 1907—1915. Copenhagen and Reykjavík.

ACTA NATURALIA ISLANDICA

Volume I:

1. T. Einarsson: Origin of the Basic Tuffs of Iceland. 75 pp. 1946.
2. J. Áskelsson: A Contribution to the Geology of the Kerlingarfjöll. A Preliminary Report. 15 pp. 1946.
3. S. Steindórsson: Contributions to the Plant-Geography and Flora of Iceland IV. The Vegetation of Ísafjardardjúp, North-west Iceland. 32 pp. 1946.
4. I. Davídsson: Notes on the Vegetation of Arskógsströnd, North Iceland. 20 pp. 1946.
5. S. H. Pétursson: Die Herkunft der Milchsäurelangstäbchen des isländischen Speisequarks. 8 pp. 1946.
6. Ó. B. Bjarnason: The Componenent Acids of Icelandic Herring Oil. 9 pp. 1946.
7. H. Einarsson The Post-larval Stage of Sand-eels (Ammodytidae) in Faroe, Iceland and W-Greenland Waters. 75 pp. 1951.
8. H. Lister, R. Jarvis, M. McDonald, I. W. Paterson and R. Walker: Sólheimajökull. Report of the Durham University Iceland Expedition 1948. With an Introduction by J. Eythórsson. 41 pp. 1953.
9. R. Dearnley: A Contribution of the Geology of Lodmundarfjördur. 32 pp. 1954.
10. T. Tryggvason: On the Stratigraphy of the Sog Valley in SW Iceland. 35 pp. 1955.

Volume II:

1. H. Einarsson: On the Post-larval Stages of *Ammodytes lancea* Cuvier. 7 pp. 1955.
2. S. Thorarinsson: The Öraefajökull Eruption of 1362. 99 pp. 1958.
3. J. Áskelsson: Fossiliferous Xenoliths in the Móberg Formation of South Iceland. 30 pp. 1960.
4. S. Steinthórsson: The Ankaramites of Hvammsmúli, Eyjafjöll, Southern Iceland. 32 pp. 1964.
5. E. Wenk, H. Schwander und H.-R. Wenk: Labradorit von Surtsey. 29 pp. 1965.
6. S. Jakobsson: The Grímsnes Lavas, SW-Iceland. 30 pp. 1966.
7. K. Saemundsson: Vulkanismus und Tektonik des Hengill-Gebietes in Südwest-Island. 105 pp. 1967.
8. K. Nakamura: En Echelon Features of Icelandic Ground Fissures. 15 pp. 1970.
9. G. Jónsson: Fasciation inflorescentielle et fasciation végétative. 15 pp. 1970.
10. N. Hald, A. Noe-Nygaard & A. K. Pedersen The Króksfjördur Central Volcano in North-west Iceland. 29 pp. 1971.

---

21. I. Munda: General features of the benthic algal zonation around the Icelandic coast. 36 pp. 1972.
22. T. W. Johnson, Jr.: Aquatic fungi of Iceland: Uniflagellate species. 38 pp. 1973.
23. T. W. Johnson, Jr.: Aquatic fungi of Iceland: Biflagellate species. 40 pp. 1974.
24. A. Ingólfsson: The feeding habits of Great Black-backed Gulls, *Larus marinus*, and Glaucous Gulls, *L. hyperboreus*, in Iceland. 19 pp. 1976.
25. A. Ingólfsson: Distribution and habitat preferences of some intertidal amphipods in Iceland. 28 pp. 1977.
26. S. P. Jakobsson: Petrology of Recent basalts of the Eastern Volcanic Zone, Iceland. 103 pp. 1979.
27. C. I. Morgan: A systematic survey of Tardigrada from Iceland. 25 pp. 1980.
28. E. H. Einarsson, G. Larsen & S. Thorarinsson: The Sólheimar tephra layer and the Katla eruption of ~1357. 24 pp. 1980.

AVAILABLE FROM:
SNAEBJÖRN JONSSON & CO. HF. — THE ENGLISH BOOKSHOP
Hafnarstraeti 4 & 9, Reykjavík — Iceland.