Titill
Sudden advance of Vatnajökull outlet glaciers 1930-1964.

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SIGURDUR THORARINSSON:

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INTRODUCTION

While waiting for the preparation of maps, based on aerial photos, to illustrate the catastrophic advance of Brúarjökull 1963/64, the present writer decided to compile the available information of sudden advances of other outlet glaciers of Vatnajökull during the last three and a half decades in the hope that it may throw some light on this interesting phenomenon. As to such advances before 1930 the best known are the catastrophic advances of Brúarjökull and Eyjabakkajökull 1890 (cf. Jökull 1962, pp. 47–48), when Brúarjökull advanced about 10 km. A similar advance of Brúarjökull is known to have occurred in 1810, and possibly also 1625 (Ólafsson 1772, p. 792). Breidamerkurjökull is said to have advanced 1 km in 1820 and up to 8 m per day during that summer (Thienemann 1824, pp. 311–313).

Systematic observations of the fronts of Vatnajökull outlet glaciers began in 1930 when H. H. Eiríksson mapped the fronts of Hoffellsjökull, Fláajökull and Heinabergsjökull, and built cairns for continued observations (Eiríksson, 1931). Since 1932 Eythórsson and his collaborators in Skaftafellssýslur have measured annually the variations of most of the southern outlet glaciers of Vatnajökull as well as the Öræfajökull outlet glaciers (Eythórsson, 1963, pp. 31–33). The big, lobe-shaped outlets of SW, W and N Vatnajökull have been observed occasionally, but only one of these glaciers, Tungnaárjökull, is systematically observed, and these observations began only 10 years ago. Yet it is possible, thanks to fortunate circumstances, to date with tolerable exactness the sudden advances of these outlets that have occurred since 1930. These advances will now be shortly dealt with.

SÍDUJÖKULL 1934

In connection with the Grímsvötn-eruption in April 1934 two expeditions went from Fljótshverfi to the volcano via Sídujökull short W of Hágöngur, returning the same way. The second of these expeditions, led by N. Nielsen, left the ice margin about May 15th on its way back to Fljótshverfi. The surface of the glacier was then very even except just W of Hágöngur, where there are usually some crevasses, and the glacier was a typical recession margin, thin and gently sloping (Nielsen, 1937a, pp. 19–20, 1937b, pp. 95–98).

In June that year the river Djúpá, which drains the E part of Sídujökull, began to carry unusually much water and kept on doing so until early August.

Towards the end of July this summer a German-Austrian expedition, led by E. Herrmann, intended to reach Grímsvötn by the same route as Nielsen. This expedition arrived at the margin of Sídujökull near the outlet of Djúpá July 28, but to the great astonishment of the participants, who had learned about the conditions from Nielsen, they now found a glacier front, which was high and steep and frightfully crevassed. They tried to force the glacier, but after five days they had to give up, not having covered more than about two kilometers because of the crevassing. Returning to their first camping place at he glacier margin they found that during these five days it had advanced nearly 30 m, or 6 m per day (Jonas 1948, pp. 48–53).

The following summer one of the members of this expedition, R. Jonas, participated in an Austrian expedition, led by Fr. Stefan. This expedition traversed Vatnajökull from N to S along the route Dyngjufjöll–Grímsvötn–Pálsfjall–Sídujökull. Sídujökull was still badly crevassed, but the glacier E of Hágöngur had a smooth surface and its front was a thin recession front (cf. Jonas, op. cit., fig. 69). The expedition reached the margin of Sídujökull June 24, and Jonas estimated its advance W of the outflow of Djúpá about 500 m since he was there the previous year. Further east the glacier had receded somewhat. The steep front of 1934 had thinned out greatly, and obviously its advance had come to an end

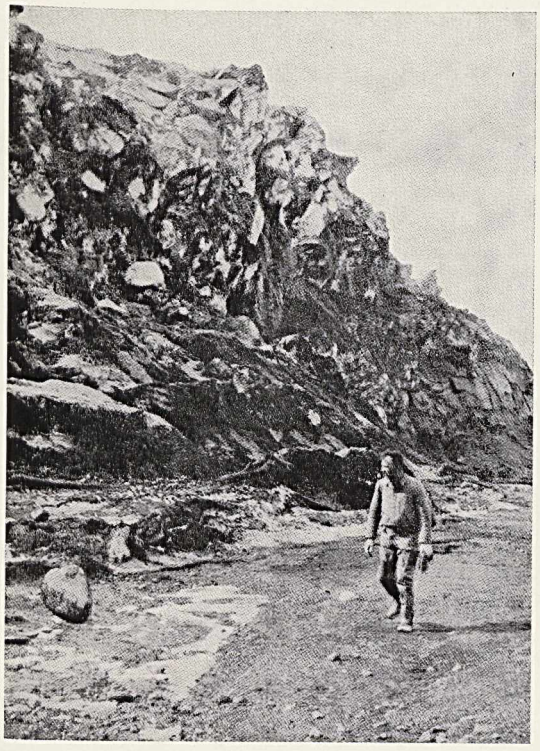

Fig. 1. The front of Dyngjujökull May 25, 1935, 15 km E of Kistufell. (Fig. 29 in Jonas 1948).

(Jonas, op. cit., pp. 166–167). If Jonas' estimate, 500 m, is not far from correct, it means that by advancing at a rate of 6 m/day, like it did towards the end of July 1934, the advance would have lasted until the end of October that year. But judging from the condition of the glacier-margin towards the end of June 1935 it seems likely that its thinning out had begun before the end of the ablation period 1934. This means – provided that the figure 500 m is approximately correct – that the maximum speed of advance exceeded considerably 6 m/day.

DYNGJUJÖKULL 1934

When Spethmann visited Dyngjujökull in 1910 a broad belt of its front was a moraine-covered, dead ice. An enormous ice-cored moraine, stretching across this belt a couple of hundred meters inside the margin indicated an advance overlapping the dead ice some time between 1884 and 1910. The glacier was distinctly receding in 1884 according to Thoroddsen (1905/06, p. 202), and in 1910 the glacier was apparently receding and thinning (Spethmann 1912, pp. 419–423).

May 24, 1935, the above mentioned Austrian expedition reached the margin of Dyngjujökull about 15 km E of Kistufell. Its front was then clearly indicative of a sudden advance of the glacier (fig. 1). The glacier was very crevassed. Yet it was crossed, though with great difficulties, by the expedition. They found it to be crevassed also within the ablation area, nearly to the summit of Kverkfjallahryggur (Jonas, op. cit., pp. 94–126; Nusser 1936, 1940). As to the time of this advance of Dyngjujökull it seems to have come to an end before the Austrian expedition arrived June 24, 1935, as some of the photos taken then show that a slight recession from the most advanced stage had already begun (cf. Jonas, op. cit., fig. 32, and Woldstedt 1938, fig. 1). On the other hand it may be regarded as fairly certain that the advance was not older than from the summer of 1934. Consequently it is most likely that this advance of Dyngjujökull, which according to the descriptions and photos of Jonas and Nusser, seems to have affected the entire glacier, coincided approximately with the advance of Sídujökull in the summer and autumn of 1934.

SKAFTÁRJÖKULL AND TUNGNÁRJÖKLAR 1945

Sept. 22, 1945, P. Hannesson, Headmaster of the Grammar School in Reykjavík, and S. Sigurdsson, Director of the National Research Council, went from Reykjavík on a reconnoitring flight to Grímsvötn, having the day before received news that a glacier burst had started in the river Skeidará. From what Hannesson has written in his diary it is clear that the aeroplane passed the W margin of Vatnajökull between Kerlingar and Hamar. He writes: "The glacier margin was fantastically broken up and split into high pinnacles. ..... crevasses high up on the slopes" (Hannesson 1958, p. 294).

Oct. 4, 1945, Hannesson and Sigurdsson flew again to Grímsvötn. This time they passed the glacier margin just south of Kerlingar, and from there they flew towards NE. Photos taken

Fig. 2. The accumulation area of Northern Tungnárjökull E of Hamar. Aerial view towards W, Oct. 4, 1945. — Photo: S. Sigurdsson.

by Sigurdsson during this flight show network structure of crevasses all around Kerlingar, and a very regular fissuring consisting of wide and very long, somewhat curved and very fresh looking fissures on the south slope stretching from Hamar towards ESE (fig. 2). While studying he sudden advances of Brúarjökull and Sídujökull 1963/64 we learned that this type of crevassing is typical for the upper part of the accumulation areas when a sudden advance is going on or has recently occurred.

Feb. 24, 1946, the present writer joined S. Sigurdsson on a flight to Grímsvötn (Thorarinsson & Sigurdsson 1947, p. 63). From Reykjavík we flew via Thórsmörk and Mt. Laki to Grænalón, and then towards N short W of Grænafjall, then E of Thórdarhyrna and Háabunga to Grímsvötn and the 1938-caldera N of the Grímsvötn depression. From there we flew SSW along the middle of Sídujökull to the glacier margin. The weather was clear. Our aim with this flight was to study changes that might have found place in the Grímsvötn area since the autumn, but our most interesting discovery during the flight was that both Skaftárjökull, and the glacier which stretches into the Langisjór depression, showed every sign of a recent sudden advance. I quote from my diary: "It was astonishing to see how crevassed the SW part of Vatnajökull was. E of Fögrufjöll and NE of Langisjór it has recently advanced. Its front there is very steep ..... a typical "Vorstossfront". No frontal moraines were visible at the front of these glaciers whereas two series of such moraines were clearly visible in front of Sídujökull. Sigurdsson estimates the advance to at least 0.5 km".

An aerial photo of the crevassed glaciers taken by Sigurdsson was published on p. 17 in Geografiska Annaler, Stockholm 1949, volume dedicated to H. Ahlmann. The original is lost, but a similar photo, although not of the same quality, is published here as fig. 3. This advance did not affect Sídujökull at all and there was a sharp limit between its smooth surface and the crevassed surface of Skaftárjökull.

We do not know with certainty when this ad-

vance occurred, but almost certainly it was during the late summer and autumn of 1945, and contemporaneous with the advance of Tungnárjökull. On the map fig. 12 the extent of the crevassed area is shown approximately. When the present writer first visited the margin of the Southern Tungnárjökull, E of Jökulheimar, in July 1953, it was a gently sloping recession front, and it is unlikely that it was affected by the 1944 advance to the same degree as the margin north of Kerlingar.

DYNGJUJÖKULL 1951

After the sudden advance in 1934 the front of Dyngjujökull gradually grew thin again. When visited by Fr. Nusser July 18, 1939, the angle of slope of the glacier margin at the place, where the photo fig. 1 was taken in 1935, was about 25° (Jonas, op. cit., fig. 80), but the margin was still very near to the 1934/35 moraines.

In 1946 the present writer participated in an expedition to Grímsvötn via Ódádahraun—Dyngjufjöll. August 4 we reached the glacier margin short W of Holuhraun. The glacier front was then very gently sloping, and two jeeps and a trailer were driven 18 km across the slightly crevassed ablation area to the temporary firn limit, 1230 m above s.l. (Thorarinsson and Sigurdsson 1947, p. 64). Within the accumluation area we met no crevasses. The glacier surface was still smooth when the crew of the passenger plane Geysir, which crashed on the N slope of Bárdarbunga, was rescued in late Sept., 1950. Together with other members of the French-Icelandic expedition J. Eythórsson visited the accumulation area of Dyngjujökull April 8 and 9, 1951 (Eythórsson 1951, p. 13). He feels rather certain that crevassing had not begun by then (pers. comm.). But in early August that year, when G. Jónasson for the first time drove a car along the margin of the glacier, its entire front west of Holuhraun was very steep and high (pers. comm.) and when the present writer drove with Jónasson the same route July 15, 1957, and again visited Dyngjujökull July 24, the front was still very steep in places, and the recession from the 1951-moraine had just begun. Reconnoitring flights over western Vatnajökull 1954 and later showed that the main part of Dyngjujökull, but especially its western part, was badly crevassed in similar way as described by Jonas and Nusser in 1935.

From the above said we can conclude that during the spring and early summer of 1951 Dyngjujökull advanced in a similar way as in 1954.

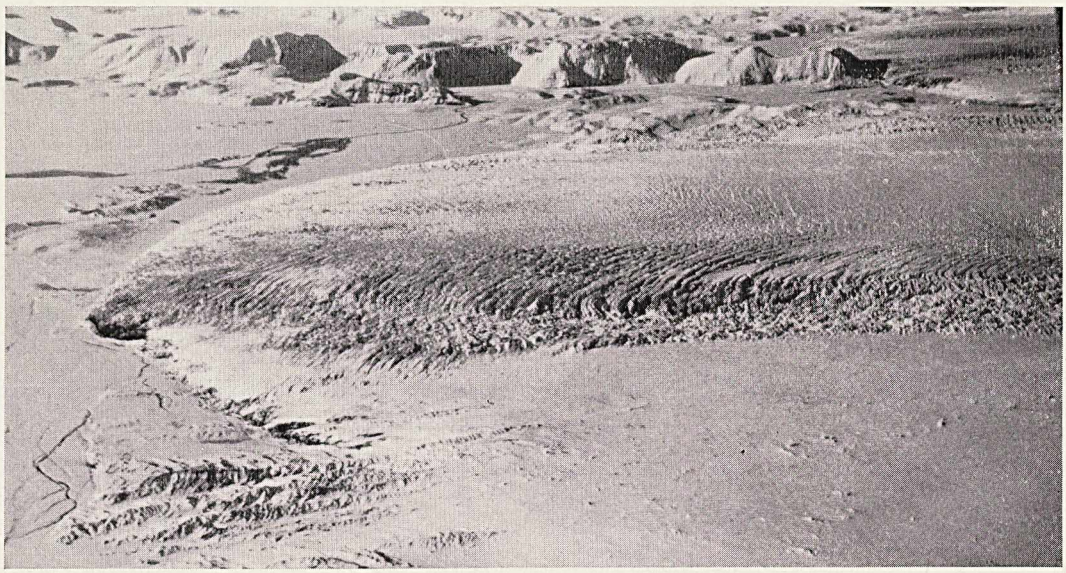

Fig. 3. Skaftárjökull Feb. 24, 1946. Aerial view towards W. — Photo: S. Thorarinsson.

Fig. 4. The front of Dyngjujökull.
Photo: P. Pálsson, Aug. 1956.

SÍDUJÖKULL 1962/64

The first signs of crevassing near Pálsfjall were observed from an aeroplane during the summer of 1962 by M. Jóhannsson (pers. comm.). It was then only a question of rather narrow crevasses. Aug. 6 that summer the present writer viewed the entire margin of Sídujökull from the air and found it a typical smooth recession margin, showing no signs of advance. About the middle of September some members of the Iceland Glaciological Society, led by G. Gudmundsson, visited Pálsfjall and found that the crevassing W and N of that nunatak had increased a lot since observed by M. Jóhannsson. September 27, 1963, when the present writer flew over the glacier, the area all around Páls-

Fig. 5. Pálsfjall and its surroundings. Aerial view towards NNE, Sept. 9, 1964. SW of the nunatak the ice surface has sunk about 25 m.
Photo: S. Thorarinsson.

Fig. 6. The front of Sídujökull W of Djúpá, April 23, 1964. Height of the steep front in the middle of the fig. is about 30 m. — Photo: Halldór Gíslason.

Fig. 7. Part of the front on Fig. 6. Obs. the person standing to the left. Photo: H. Gíslason.

fjall was very heavily crevassed, and long fissures, narrowing towards NW, stretched nearly to the iron mast erected by S. Rist Oct. 6, 1960, 7.5 km NW of Pálsfjall (Rist 1961, p. 10). As far as could be seen from a rather long distance the lower part of Sídujökull was not yet abnormally crevassed.

Next time we viewed Pálsfjall was during a

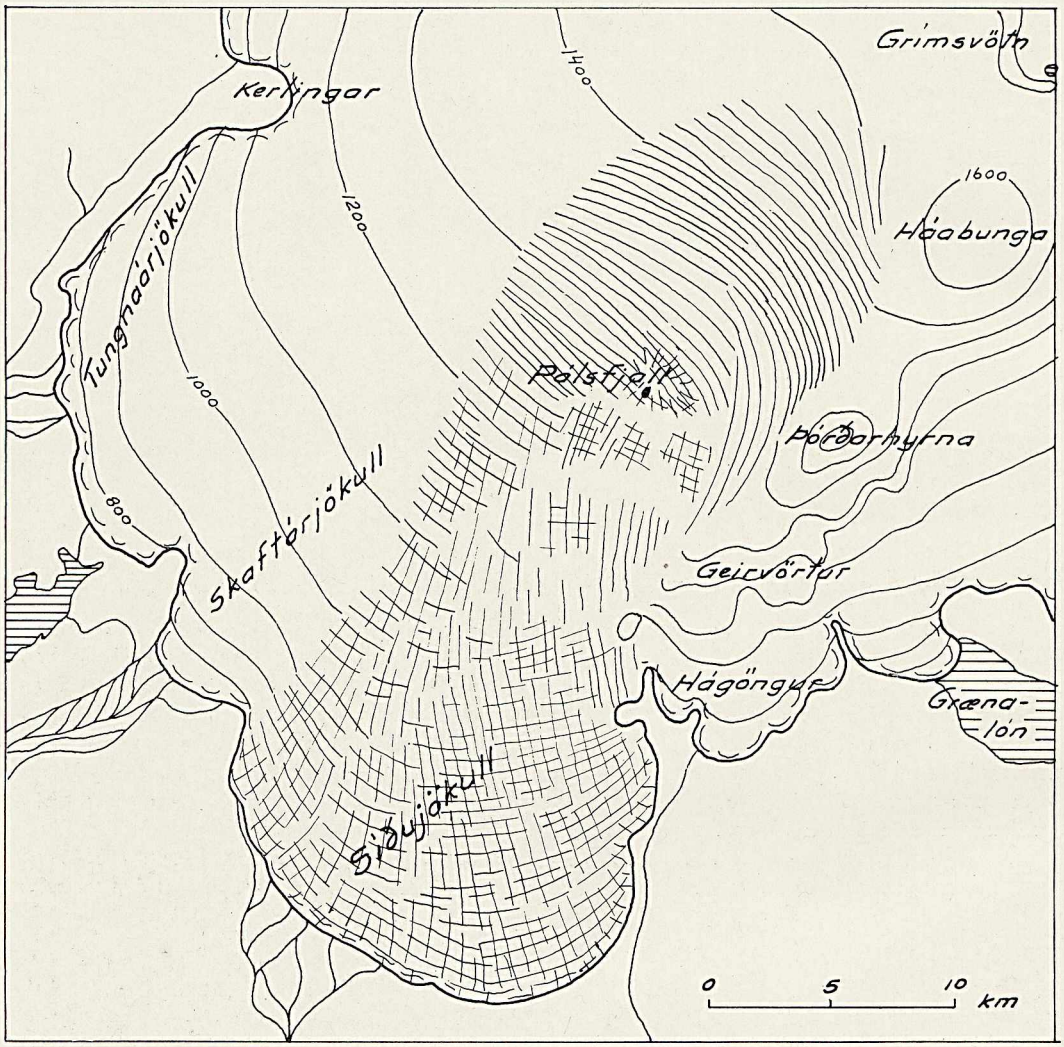

Fig. 8. Sketch map showing the area affected by the advance of Sídujökull 1963/64. Based on aerial photos.

reconnoitring flight Jan. 12, 1964. Then a network of wide crevasses had spread at least 4 km towards SW from Pálsfjall. The lower part of the glacier was covered by fog, but judging from the crevassing SW of Pálsfjall as compared with the condition there Sept. 27 the previous autumn, the writer regards it as certain that the crevassing had now spread to the glacier margin.

April 23, 1964, H. Gíslason, G. Gudmundsson and Th. Sigurdsson, together with some other members of the Glaciological Society, drove in jeeps to the margin of Sídujökull just W of the river Djúpá where it turns SSE. They found a very steep and high front, nearly vertical in places (figs. 6 and 7), but its advance seemed to have come nearly to a halt. In front of the glacier they built four cairns — the distance between the eastern- and westernmost ones being about 5 km — and measured the distance from them to the glacier margin. These measurements they repeated Sept. 24, 1964. Then the ice-margin at the westermost cairn had advanced 30 m, whereas at the other cairns

it had receded 10, 10 and 8 m respectively. This confirms the conclusion that the advance had nearly finished before April 23.

The sketch map on fig. 8 is drawn with the aid of aerial photos taken by the writer and M. Jóhannsson. The area affected by the advance is about 480 km². There are reasons to believe that it is nearly exactly the same area as was affected by the 1934 advance, whereas the SW outlets, that advanced 1944, were not affected this time.

On Sídujökull we observed two main types of crevassing. One, seen within the accumulation area and mainly N and W of Pálsfjall, shows very long crevasses, which can be followed for some kilometers, running nearly parallel to each other at right angles to the glacier movement. This type is the same as shown on fig. 2 from Tungnárjökull 1945. These crevasses become narrower towards the peripheral parts of the accumulation area.

The other main type is best illustrated by the photo fig. 9. The ice is split up by a network of crevasses, leaving between them pillars of ice reminiscent of jointed basalt, although not so regularly jointed. On relatively flat surfaces, like the one shown on the photo, there is only a small vertical displacement between the individual pillars. Near the margin, and in places where the glacier presumably rests on subglacial hillocks, some of the pillars tower up above the others.

On Sídujökull this network type of crevassing is mainly found within the lower part of the ablation area. Great areas of the glacier surface showed all sorts of intermediate stages

Fig. 9. The ablation area of Sídujökull WSW of Hágöngur. Aerial view towards N, Sept. 9, 1964. — Photo: S. Thorarinsson.

Fig. 10. Sídujökull May 25, 1964. Aerial view towards W. The inner dash line marks the extension of the glacier after the 1945-advance. The outer dash line marks the max. advance in Historical Time.
Photo: S. Thorarinsson.

between the two extreme types. In the area SW of Pálsfjall, where the ice surface seemed to have been lowered some tens of meters (fig. 5), there were many irregular domes heavily crevassed in a criss-cross fashion, presumably reflecting the subglacial topography.

As we do not know how much Sídujökull had receded since it was aerially photographed in 1944 we cannot tell exactly how much it advanced, but roughly estimated the maximum advance was of the same order as 1934, about 500 m.

This advance of Sídujökull is the only one which we — thanks to aerial reconnoitring — have been able to follow from its very beginning. This reconnoitring revealed the interesting fact that crevassing in the intake area started nearly a year and a half before the front began to advance.

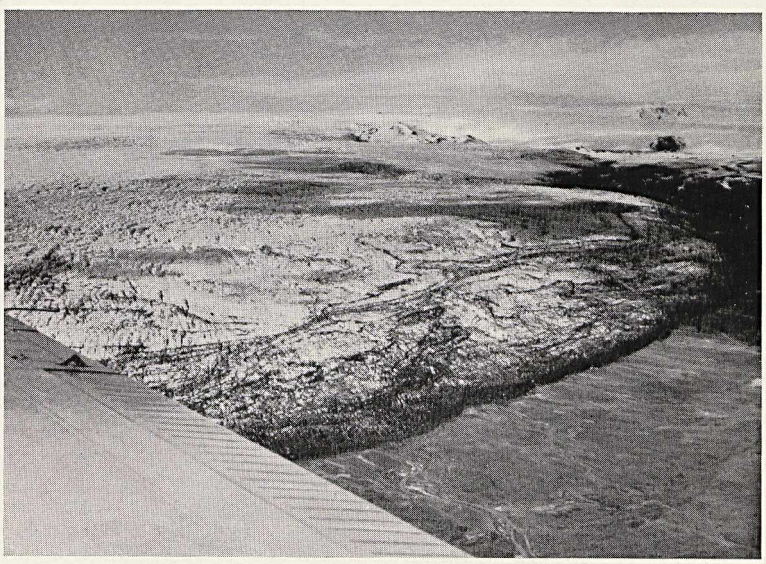

Fig. 11. Sídujökull. Aerial view towards E May 25, 1964. Grænafjall is in the background to the right.
Photo: S. Thorarinsson.

BRÚARJÖKULL 1963/64

By far the greatest advance of any Vatnajökull glacier during the last decade is the advance of Brúarjökull 1963/64, which affected about 1400 km², and brought the margin up to 8 km forward. The maximum rate of the advance probably exceeded 4 m per hour. This advance will be dealt with in a special paper and it suffice to state that roughly speaking its culmination seems to have coincided with that of Sídujökull.

have advanced in this way are of a similar shape. Their ablation areas are flat and lobe-shaped, and the intake areas are mostly flat as well. As far as the subglacial topography is known it shows basins of similar type, shallow spoon-shaped basins widening towards the glacier margins. The fact that Sídujökull and Skaftárjökull move so independent of each other suggests that their basins are separated by a NE–SW running subglacial ridge. It is interesting to note (cf. the photographs in this

TABLE 1

Vatnajökull glaciers affected by sudden advances

Year	*Glacier*	*Facing*	*Area affected km²*	*Max. advance km*
1963/64	Sídujökull	SW	480	about 0.5
	Brúarjökull	N	1400	„ 8.0
1951	Dyngjujökull	N	(about 700)	?
1945	Skaftárjökull	SW	„ 450	„ 0.5
	Tungnárjöklar	W		?
1934	Sídujökull	SW	„ 480	„ 0.6
	Dyngjujökull	N	(„ 700)	?
1890	Brúarjökull	N	„ 1400	„ 10.0
	Eyjabakkajökull	NE	„ 110	„ 0.6

SOME GENERAL REMARKS

Summing up we find that during the last 75 years most of the outlets of SW, W, N and NE Vatnajökull have once or more advanced suddenly, although this period as a whole has been a period of glacier recession. These advances are summarized in Table 1, and the areas affected shown schematically on the map fig. 12. The area of Dyngjujökull is more uncertain than the others, as we do not know to what degree the E part of that glacier has been affected. We find that at least twice, in 1934 and 1963/64, sudden advance of a glacier on the north side has coincided with an advance of a southern glacier. Whether or not any of the W and SW outlets also advanced suddenly 1890 we do not know. Altogether about 3200 km², or nearly 40% of Vatnajökull's area, have been affected by sudden advances during the last 75 years. All the Vatnajökull glaciers that

article) that the thrust moraines formed in front of the advancing glaciers are on the whole very small and on long stretches practically nonexisting.

N. Nielsen, who went to Vatnajökull again via Sídujökull in 1936, when the glacier was still very broken up, was of the opinion that the sudden advance of this glacier in 1934 was "a slow glacierburst, caused by a subglacial eruption pouring out a subglacial lava flow" (Nielsen 1937a, p. 19, 1937b).

Nusser explains the 1934-advance of Dyngjujökull in a similar way (Jonas, op. cit., p. 189). In a paper, 1938, the present writer accepted Nielsen's view, but soon became sceptical against volcanological or seismological explanations of the sudden advances of the outlets of Vatnajökull (cf. Thorarinsson 1943, pp. 36–37). In the material collected in the present article regarding the sudden advances there is nothing

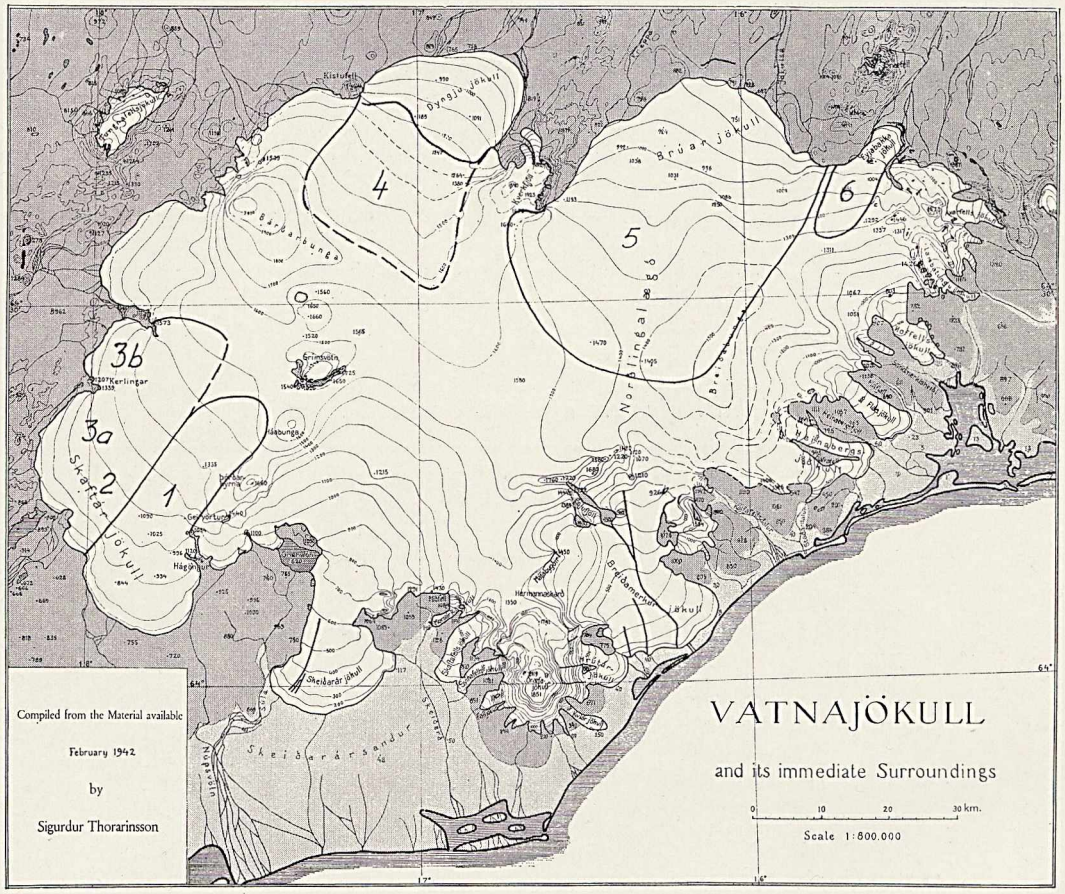

Fig. 12. The areas of Vatnajökull that are known to have been affected by sudden advances during the last 75 years: 1: Sídujökull, 2: Skaftárjökull, 3a: Southern Tungnárjökull, 3b: Northern Tungnárjökull, 4: Dyngjujökull, 5: Brúarjökull, 6: Eyjabakkajökull.

pointing to volcanological causes. Consequently the explanation has to be sought in the shape of the glaciers, in their regime, and in the mechanism of glacier movement.

Fig. 13 shows the sudden advances in relation to the variation of the Vatnajökull outlet glaciers, expressed by the average variation for all the outlets measured by Eythórsson, usually 21 to 24 glaciers (Eythórsson 1963). Tungnárjökull is excluded, as it has only been measured the last 10 years. Thus none of the glaciers affected by sudden advances since 1930 is included in the average figures. We find that the advances in 1934 and 1951 were preceded by a year or years during which the general retreat of the glaciers was slowed up considerably. As a matter of fact some of the outlets advanced during these years. Of 17 outlets measured 1932/33, 5 were advancing and 1 stationary. 1933/34 only one was advancing. 1949/50 4 of the 23 measured showed advance and 2 were stationary, and during the three preceding years the retreat was on the whole slow and 3 to 4 glaciers slightly advancing.

The 1945-advance was preceded by three years of relatively slow retreat, whereas the two last years preceding 1963/64 advance of Brúarjökull and Sídujökull did not show any slowing up of the retreat. Yet it should be kept in mind that (a) the first signs of the advance of Sídujökull were observed already in 1962, (b) that in 1960/61 there was a slowing up of

the average retreat and (c) in 1961/62 3 of 21 measured Vatnajökull outlets were slightly advancing and 1 was stationary, which is a higher figure than for any year in the latter half of the 1950s.

Fig. 13 also shows the annual precipitation and temperature at Fagurhólsmýri, south of Vatnajökull (Öræfajökull) 1930—1963. There is a clear positive correlation between the temperature and the precipitation diagram, the precipitation increasing with temperature, but the correlation between these diagrams and the glacier-variation diagram is more obscure, which is only what could be expected, as increased temperature and precipitation have opposite effect on the glacier regime.

The Swedish-Icelandic Vatnajökull-investigations 1936/38 led to the general conclusion that the temperature, both in summer and winter, had a greater effect on the regime of the southern outlet glaciers of Vatnajökull than the precipitation (Ahlmann 1939, p. 187). This, however, need not be true as regards the accumulation areas as such, and presumably conditions within them play a greater role for the sudden glacier advances, than conditions within the ablation areas.

We know still too little about the condi-

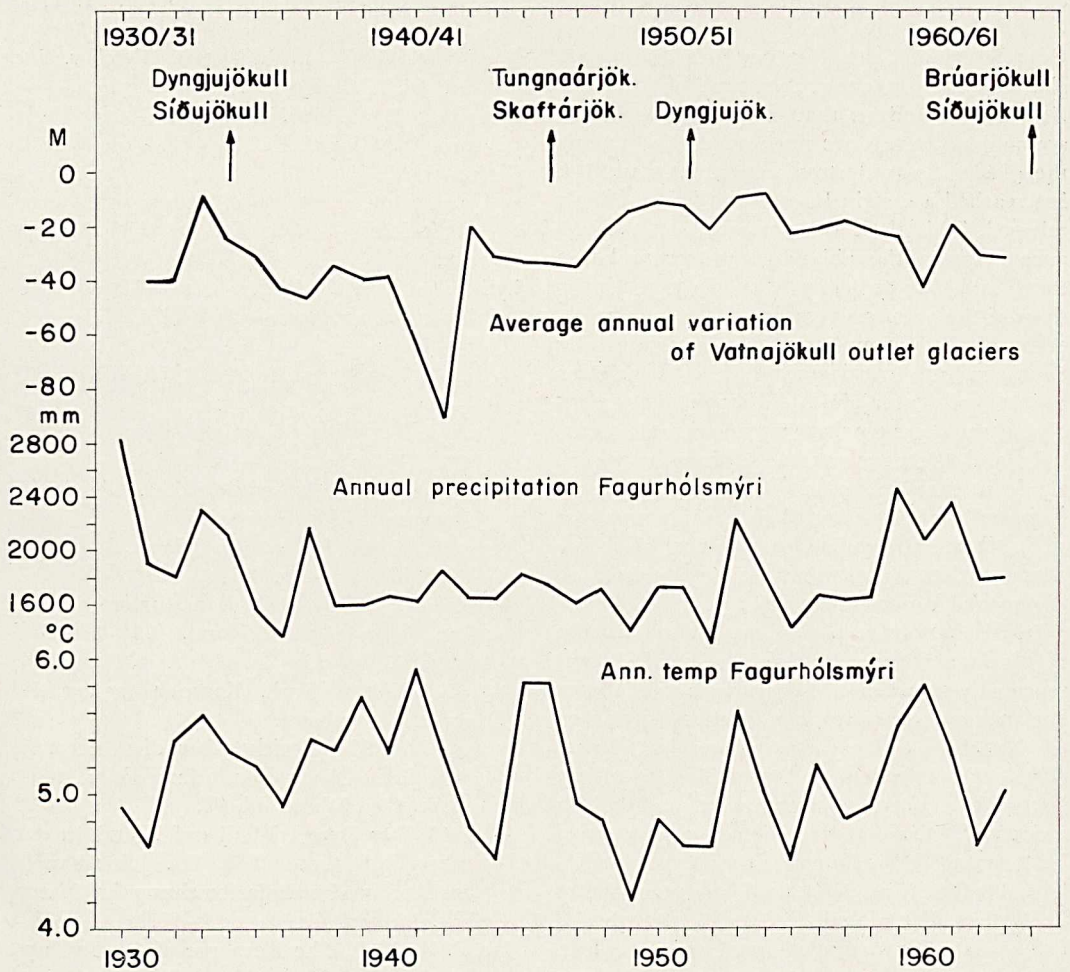

Fig. 13. Diagram showing he average of Vatnajökull outlet glaciers and the annual precipitation and temperature at Fagurhólsmýri 1930—1963.

tions on central Vatnajökull, but annual accumulation-measurements carried out in the Grímsvötn area since 1953 are in good agreement with the precipitation-measurements at Fagurhólsmýri, high precipitation there coinciding with great accumulation within the Grímsvötn area. It can therefore be regarded as likely that the 1934-advance of Sídujökull was influenced by a heavy accumulation on the intake area of that glacier 1932/33, and the last advance of Sídujökull and Brúarjökull may have been initiated by the high accumulation 1960/61.

As pointed out above all the Vatnajökull outlets, that have advanced suddenly, are of a similar flat shape, and this is a shape, which makes them more sensitive to variations in temperature and precipitation than more steep glaciers. And, somehow, the shape of these glaciers has the effect, that changes within their accumulation areas are not spread slowly along the glacier, instead stress accumulates until it has reached a certain limit, when it is suddenly released. This limit is determined by the balance between the ablation and accumulation areas, and may probably be reached by a thinning of the ablation area as well as by a thickening of the accumulation area. It should also be taken into consideration that the highest cupolas of Vatnajökull, although at present of the temperate type, are very near to the arctic type, and slight temperature-changes may play a role in their movement mechanism. Changes in water-lubrication are likely to play a role as well; yet the known sudden advances of Vatnajökull outlets do not seem to be restricted to any special season of the year.

In his important papers on the mechanism of glacier-movement and oscillations Nye has repeatedly stated that his kinematic wave theory does not cover catastrophic advances of glaciers (cf. Nye 1965 and previous papers, and Chumskiy 1965). A student of the oscillations of the Vatnajökull outlet glaciers must find this a serious defect, as catastrophic advances seem to be "normal" behaviour of so many of its outlets. But few, if any, glaciated areas seem more likely than Vatnajökull to furnish us with sufficient data for the solution of this problem. In order to get these data we need, however, a more detailed mapping of the subglacial topography of the areas where these advances occur, as well as a systematic study of one or more of these glaciers during many consecutive years. This includes the measuring of movement and regime, and repeated levellings of profiles both within the ablation and accumulation areas, and frequent aerial reconnoitring in order to time the beginning of crevassing. A meteorological station situated in the highland interior N or W of Vatnajökull and run the whole year round, is also highly desireable.

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ÁGRIP

HLAUP Í SKRIÐJÖKLUM VATNAJÖKULS SÍÐAN 1930

Svo sem kunnugt er hljóp Brúarjökull veturinn 1963/64 og gekk lengst fram um 8 km (sbr. Jökull 1963). Á svipaðan hátt hljóp Brúarjökull 1890 (Jökull 1962) og þá hljóp einnig Eyjabakkajökull.

Í undirbúningi eru kort og snið, er sýna síðasta hlaup Brúarjökuls, en meður því að þau urðu ekki tilbúin fyrir þetta hefti Jökuls, var það ráð tekið, að taka saman í heftið upplýsingar um þau skyndilegu framskrið eða hlaup, sem orðið hafa í skriðjöklum Vatnajökuls síðan skipulagðar mælingar á breytingum skriðjökla hans hófust 1930. Þessar skipulögðu mælingar ná þó aðeins til suðurjöklanna og nú á síðustu árum einnig til Tungnárjökuls, en þeir jöklar, sem hlaupið hafa, eru allir meðal þeirra breiðu tungna, er skríða suðvestur, vestur og norður úr jöklinum.

Þessir jöklar eru:

Síðujökull, *er hljóp 1934 og aftur með svipuðum hætti 1963/64. Forboða síðara hlaupsins varð vart þegar sumarið 1962, er bera tók á nýjum sprungum kringum Pálsfjall og norðvestur frá því.*

Skaftárjökull *hljóp 1945 og sama ár hljóp* Tungnárjökull, *einkum norðan Kerlinga, en óvíst, að jaðarinn inn af Jökulheimum hafi gengið fram.*

Dyngjujökull *hljóp 1934, samtímis Síðujökli. Hann hljóp aftur síðla vetrar eða vorið 1951.*

Brúarjökull *hljóp samtímis Síðujökli veturinn 1963/64, aðallega snemma vetrar.*

Í töflu 1 er dregin saman vitneskja sú, sem fyrir hendi er um tímasetningu og stærð þessara hlaupa, og kortið á 12. mynd sýnir þau jökulsvæði, sem gengið hafa fram eða sprungið síðan 1930, og þau, er hlupu 1890. Samanlagt flatarmál þeirra er um 3200 km² eða 40% af flatarmáli Vatnajökuls. Mjög eru þessi svæði missprungin eftir hlaup og sýna 2. og 9. mynd aðaltegundirnar af sprungukerfum, en milli þeirra eru öll millistig.

Ekki hefur verið sett fram nein sú kenning um skrið jökla, er skýri til fullnustu þessi hlaup. Eitt sinn var talið, að þau stöfuðu af eldsumbrotum undir jökli, en það má nú telja næsta öruggt, að flest ef ekki öll þau hlaup, sem nefnd eru í þessari grein, hafi orðið án þess að um eldsumbrot hafi verið að ræða. Verður því að leita skýringa í búskap jöklanna, þ. e. a. s. í breytingum á áfenni og leysingu, er raska hlutföllum milli ákomu- og leysingasvæða þeirra, en flatir jöklar eru næmari fyrir slíkum breytingum en brattir jöklar.

Fá jökulsvæði á jörðinni munu vænlegri til rannsókna á þessu fyrirbæri en Vatnajökull.