

Ascent of Öräfajökull

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THE GLACIER BOOK OF SVEINN PÁLSSON

Sveinn Pálsson did glaciological research in Iceland in the years 1792-1794 after academic studies in Copenhagen. In 1795, he sent a manuscript of a treatise on Icelandic glaciers in Danish to the Society of Natural History in Copenhagen. For a variety of reasons it was not printed in full until 1945 and then only in an Icelandic version (Pálsson, 1945). The "Glacier Book" is "the culmination of a glaciology which may be called Icelandic in the sense that it was principally based on knowledge of Icelandic glaciers" (Thorarinnsson, 1960).

One of the most noteworthy chapters in the "Glacier Book" is the description of Pálsson's ascent of Öräfajökull where he became convinced that his previous ideas of the plastic motion of glacier ice, were correct, when he observed the regular pattern of ogives on Hrutárjökull or Fjallsjökull. That idea had not been published before, except in the works of the French naturalist A. C. Bordier in 1775 (Bordier, 1775). That piece of writing also lay obscure for almost a century before being revealed to the glaciological community.

Flosi Björnsson, farmer at Kvísker, studied the route supposedly taken by Pálsson (Fig. 1) and found a cairn and Pálsson's initial "P" engraved on a rock close to the glacier (Björnsson, 1957, 1965).

EXCERPT FROM THE "GLACIER BOOK"

Here follows an excerpt from *A Physical, Geographical, and Historical Description of Iceland's Glaciers on the Basis of a Journey to the Most Promi-*

nent of Them in 1792-1794 (Including Four Plan and [Eight] Perspective Drawings) by Sveinn Pálsson. Translated into English by Björn Netland and edited, with annotations (endnotes), by Richard S. Williams, Jr. and Oddur Sigurðsson.

Ascent of Öräfajökull

On 11 August [1794] we were already well underway long before sunrise with our intention of climbing Öräfajökull; the weather was quite calm, without a cloud in the sky. Eggert Ólafsson¹ considered Öräfajökull to be the highest mountain in Iceland. Equipped with a barometer, thermometer, pocket compass, pickaxe, glacier cane, and a length of rope measuring eight fathoms, my two companions and I set out from the abandoned Kvísker farmstead at 0545 hr after having indicated our destination on a piece of paper that we fastened to our tent, in case we should get lost on the glacier. We made our way up rather steep foothills and finally reached the margin of the glacier at 0845 hr, where we rested on a hill for a few minutes. At the foot of this hill, we observed a few plants of the beautiful alpine species *Ranunculus nivalis* [*corr. Ranunculus glacialis* (mountain buttercup)] growing on the barren gravel; a few of them had even shed their blossoms. The ones that had just bloomed had snowy-white petals, but the large ones had saffron-yellow and later [stage of the blooming cycle] red ones. I had not come across this species of plant before in the mountains of the southern districts. At this location, it grows at a higher altitude than *Statice armeria* [*Armeria maritima* (thrift)], which had still not started blossoming here, and even higher up than the little *Salix herbacea* [least willow], which, however, usually grows in the highest location and is second only to lichens [that grow at the highest eleva-

tions] in the Icelandic mountains. The barometer on the aforementioned hill had fallen from 28' 4.25" [768 mm]² at Kvísker to 25' 11.5" [703 mm], and the temperature read 8.5°R³ [10.6°C]. The margin of the glacier had obviously pushed up against the upper part of this little hill and formed a kind of a gravel wall⁴ half way up the middle of the slope, but the glacier had now receded by a few fathoms.

After all three of us had tied ourselves together with our rope, with a two-fathom distance separating each of us, so that we could give the other a hand in case he should fall into a crevasse, we continued our ascent of the glacier. No sooner had we advanced more than 40 paces, however, than we heard what sounded like a loud thunderclap a short distance to the west of us. The loud noise seemed to travel through the entire glacier from south to north and lasted for over a minute. We could feel very distinctly how the ice kept shaking and rumbling under our feet, after which my two companions would have been only too happy to turn back. Although the shudder caused us to stop our advance for a few seconds, my innate desire to climb this alpine glacier compelled me to continue to my intended destination and not let anything stop me. Later on, we saw what caused the ice to shudder was a so-called "jöklabrestur" [glacier thunder]. Glacier ice along the approximately 0.5 mile-long [Danish miles; about 2.5 statute miles] narrow mountain gorge, which I mentioned earlier in this section [Section 14] and from which the rivers Kvíár⁵ have their source, had split on either side of the gorge and collapsed. We continued on our way farther up the southeastern slope of the glacier, where it was less steep, past some black tuff cliffs jutting up through the ice, and across a great many crevasses, the bottom of which we could not see. As is usual at such altitudes, the air started getting thin and breathing became more labored. One of my companions became so anxious and drowsy that he finally had to be left behind; he stretched out on the uncovered snow and fell asleep immediately. The other of my companions, whose physique was marred by palpitation of the heart and melancholy in addition to being ill-tempered and crude, became happier and more jocular the higher up we climbed without feeling any particular sign of fatigue or unpleasantness on account of the air. Finally,

we reached the southeastern summit of the mountain at 1145 hr, which, together with the three or four peaks farther to the west and north, is nothing more than the rim of an immensely large volcanic bowl⁶; they form between them a broad and level valley. These peaks or nooks atop the glacier are so steep that the glacier mass is crevassed in places or has subsided down away from them. The black and scorched peaks protrude, but they have nevertheless a glacier hat on their summits. The majority of these peaks are inaccessible, because by taking a single wrong step one could fall down into the bottomless crevasses at the foot of them. The barometer here had fallen to 22' 6"⁷ [609 mm] - or altogether a decrease of 5' 10.25" [159 mm] from the reading at Kvísker. The temperature reading was 11.25°R [14.1°C]. The air was clear with a brisk and cold northwesterly wind; the compass appeared to be correct, and the declination was just about two points⁸. The view was marvelous, of course. We could see over towards all of the northeastern and Hornafjörður [outlet] glaciers⁹ in addition to the location of the Máfabyggðir [Esjufjöll nunatak] a short distance to the northwest of Breiðamerkurjall both of which are within the glacier [Breiðamerkurjökull]. Máfabyggðir [Esjufjöll nunatak] looks pretty black and charred. From Máfabyggðir [Esjufjöll nunatak] run two gravel bands¹⁰, which, however, soon merge into one, toward the southeast over toward the location where the river Jökulsá gushes out from Breiðamerkurjökull. To the north of the Hornafjörður [outlet] glaciers we could see the summit of Snæfell; to the west we could see Eyjafjallajökull¹¹ in its entirety, but the elevation caused the level and distant land to appear as if enveloped in twilight; to the north we had no view because of the previously mentioned summits. I became particularly interested in the appearance of the nearest [outlet] glacier, to the east of Kvísker¹², the same outlet glacier mentioned before that had slid down. Its surface, particularly all the way to the main glacier, seemed to consist of nothing but semicircles running right across it [ogives], whose convex arches pointed downward to the level land, exactly as though the previously noted outlet glacier had flowed down in a semi-melted or thick and viscous state. I wonder whether this phenomenon might not prove in part that glacier ice, without actually melting, has some kind of fluidity¹³, like

several resins, which is the idea that I introduced in the previous section.

On the top of the glacier the ice consisted of small thin "sheets", but farther down, where the heat has a greater effect, it is coarse and granular¹⁴. In the [mercury] glass thermometer the bulb of which was stuck down into the snow, the quicksilver fell to 0.5°R [0.6°C], which shows that some thawing takes place, even on these high alpine glaciers. Regardless of the temperature measured, we were nonetheless unable to protect ourselves against the penetrating cold but had to turn back at 12 noon and return the same way we had come. The snow-covered glacier, however, had in this short space of time become quite soft only a little way below the summit, because it was on the leeward

side of the mountain and exposed to the midday sun. Even where the glacier had appeared to be solidly frozen, and where we had only a half-hour earlier left hardly a trace of our footprints on its hard surface, we now sank into the snow up to our knees. This rendered our descent nearly as tiring as our ascent had been. We soon came upon our companion who we had left behind, and who was refreshed after a sweet but brief and interrupted nap, and we all made it down the glacier to the previously mentioned hill, happy and in good condition, at 1400 hr.

To avoid the bothersome thirst on these glacier excursions, where one has no other way to quench it except by means of ice fragments and snow, this time we found ourselves quite comfortable by chewing

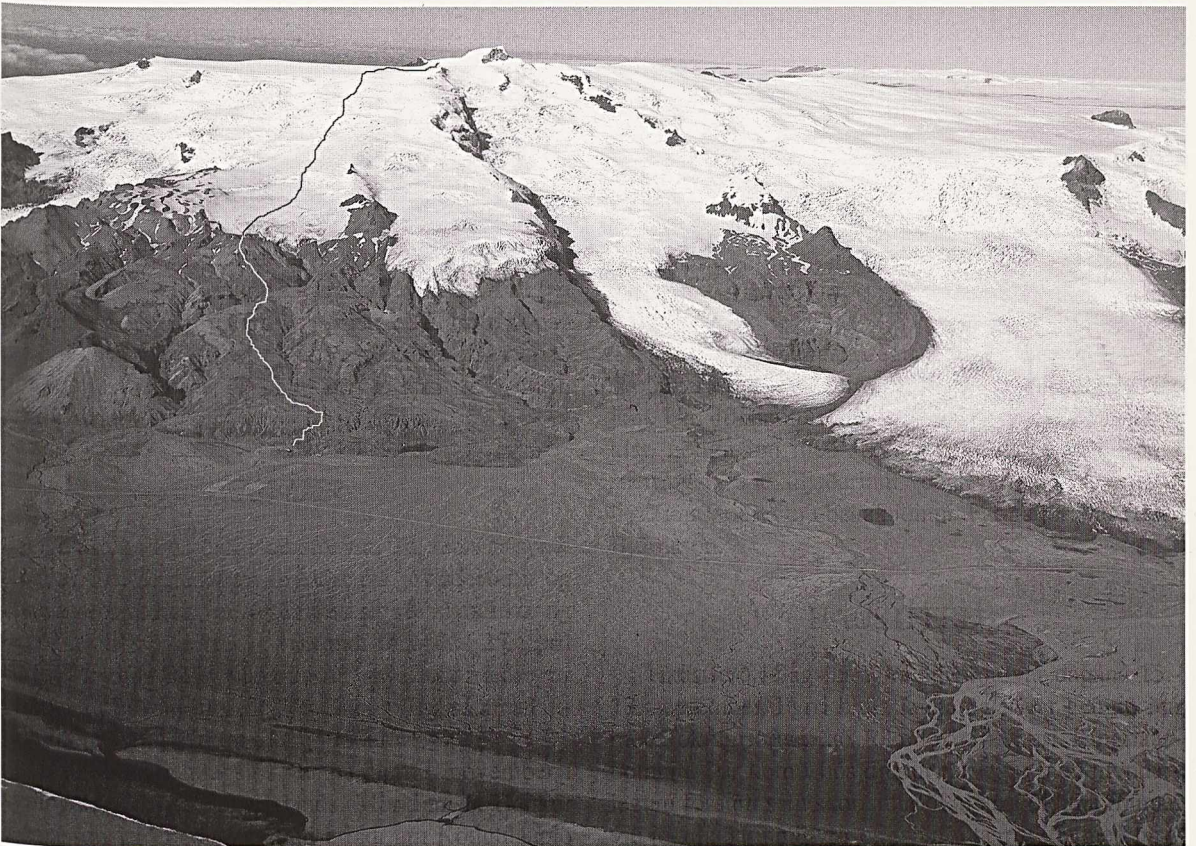


Fig. 1. Öraefajökull viewed from the east. The most likely route of Sveinn Pálsson, who ascended to the west from Kvísker, between Hrutárjökull (smaller outlet glacier on the right that flows around Ærfjall and merges with Fjallsjökull) and Kvíárjökull (only upper part showing in upper left of photograph), is indicated on the photograph. Photo: Oddur Sigurðsson, 10 Sept. 1986. – Öraefajökull séður frá austri. Sennileg leið Sveins Pálssonar er merkt á myndina.

snow or ice together with rock candy. On the basis of this ascent of a glacier, as well as of other such climbs that I have made, I maintain that the intolerable heat, about which all glacier climbers complain, comes not at all from atmospheric heat or heat from the sun. In order to be convinced of this, one only needs to stand still for a quarter of an hour to find out whether or not the heat dissipates. By contrast, it is easily understood that the blood expands in the veins as a result of the thinner air and with the least movement or very limited activity is agitated significantly, from which the fatiguing heat is produced. For this very reason, too, most people during an ascent, can hardly make it more than a dozen or so steps without feeling faint or being out of breath, when the barometer has fallen by about 3.5-4 inches [about 100 mm] less than what is normal at sea level. However, if one then stands still or throws oneself down upon the snow for a few seconds, the relaxed muscles are revived, and one seems to be rid of all fatigue and anxiety, and one is capable of running around the world, even though the sequence will soon repeat itself.

On the hill just noted, we built a stone pyramid (Icelandic *varða*) and placed a Danish copper coin on top of it, so that if anybody should try to follow our steps, they would here find the location from which we started our ascent of the glacier. This location undoubtedly is the most convenient as long as the glacier does not undergo any changes here. The barometer now showed a reading of 25' 9.25" [698 mm] here, and the temperature reading was 18° [22.5°C]. We arrived back at our tent at Kvísker at 1630 hr.

The height of Örfafjökull I calculated to be 6,060 Danish feet [1903 m a.s.l.], in other words, 930 feet [292 m based on the recorded barometric observations] higher than Eyjafjallajökull but 802 feet [252 m] lower than Snæfell glacier¹⁵.

Volcanic eruptions from Örfafjökull and the resulting destruction will be discussed in a later section.

ENDNOTES

1. Eggert Ólafsson (Olafsen) and Bjarni Pálsson (Povel- sen), 1772 (Danish publication), and 1975 (latest publi- cation), *Ferðabók Eggerts Ólafssonar og Bjarna Páls- sonar* (um ferðir þeirra á Íslandi árin (1752-1757): Reykjavík, Bókaútgáfan Örn og Örlygur hf., v.2, p. 105-106 [Section 782] [Reprinted version of 1942 transla- tion by Steindór Steindórsson].
2. Sveinn Pálsson used a mercury barometer. Readings were in French inches ("). Each inch equals 27.07 mm, and each inch is divided into 12 lines ("); e.g., 28' 4.25" is 28 inches, 4.25 lines.
3. The Réaumur scale (named after the French physicist and inventor René Antoine Ferchault de Réaumur) is a temperature scale in which 0° is the freezing point of water and 80° is the boiling point. It is abbreviated as °R. Measurements were usually made unsheltered regardless of weather. Therefore readings may seem quite high in bright sunshine.
4. Here Sveinn Pálsson is describing a terminal moraine.
5. In Sveinn Pálsson's time and until the middle of this century, two rivers, Eystri-Kvíá and Vestari-Kvíá, ema- nated from the terminus of the outlet glacier Kvíár- jökull. The latter part of this century melt water from Kvíárjökull has been confined to one river, Kvíá, in the bed of Vestari-Kvíá.
6. Volcanic bowl refers to the volcanic caldera of Örfafa- jökull.
7. The manuscript reads 26'6" which must have been a lapse of the pen.
8. A point on the compass is 1/32 of a circle (11.25°). Sveinn Pálsson's measurement of a declination of 22.5° is relatively accurate. How he went about defining true north is, however, unclear.
9. On Sveinn Pálsson's 1794 map of Klofajökull (Vatna- jökull) (fig. 1), the Hornafjörður outlet glaciers (e.g., Skálafellsjökull, Heinabergsjökull, Fláajökull, and Hof- fellsjökull are collectively called "Hornafjarðar-Jöklar" [Sveinn Pálsson, 1795, Tab. I].
10. Sveinn Pálsson is describing two medial moraines that merge down glacier into one on Breiðamerkurjökull. No doubt he is here referring to Esjujallarönd, which is the medial moraine from Esjujöll nunatak. Máfabýggðir nunatak is not to be seen from the place he visited as pointed out by Flosi Björnsson (1957).
11. On Sveinn Pálsson's 1795 map of Eyjafjallajökull (Mýrdalsjökull and Eyjafjallajökull) (fig. 2), "Mýrdals- jökull" is shown as the name of a glacier on the eastern part of the ice cap [Sveinn Pálsson, 1994, Tab. II]. In

- Sveinn Pálsson's time, Mýrdalsjökull and Eyjafjallajökull were connected by a perennial snowfield, not solid glacier ice. Eyjafjallajökull was the name applied to the entire ice cap. Nowadays, the two ice caps are separate because of thinning of the once contiguous ice-and-snow mass and separation at the saddle ["Lágjökull" on Sveinn Pálsson's 1795 map] between them.
12. Hrutárjökull is the next outlet glacier to the east of Kvísker. In Pálsson's time Fjallsjökull, still farther to the east, was solidly connected at its terminus to Hrutárjökull. Both of those are clearly visible from Sveinn Pálsson's viewpoint. Nowadays, the ogives on Fjallsjökull, the more prominent of the two outlet glaciers, are much more conspicuous.
 13. Sveinn Pálsson is describing here the concept of plastic flow or deformation of glacier ice.
 14. Sveinn Pálsson apparently observed large ice crystals in the lower parts of the glacier.
 15. Jón Eyþórsson (1945, p. 765) shows 6,000 feet for the height of Örafajökull. The original manuscript indicates 6,060 Danish feet. The Danish foot, at the time, equaled 314 mm. He also thought that Sveinn Pálsson's elevations were too high. The difference between Sveinn Pálsson's results (1,903 m.a.s.l.) and the currently accepted elevation (1,927 m.a.s.l. on the peak that Sveinn supposedly visited) is as close as can be expected (-1%) by a measurement using an uncalibrated barometer, without reference to a base-station barometer. His other measurements of the heights of mountains (Eyjafjallajökull: 1,610 m.a.s.l. vs. 1,666 m.a.s.l.; and Hekla: 1,581 m.a.s.l. vs. 1,447 m.a.s.l., errors of -3 percent and 8 percent, respectively) indicate that his measurements of elevations of mountain summits by barometer were sometimes not so reliable. The over-estimated elevation of Snæfell is based on the estimate that he was 1/3 up the mountain when he was forced back by foul weather.

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Ágrip

Úr Jöklaritinu

Í greininni er birt ensk þýðing á þeim hluta Jökla-rits Sveins Pálssonar þar sem lýst er göngu hans á Örafajökul 1794. Þar kemur fram að Sveinn taldi svingður á Hrutárjökli eða Fjallsjökli, sem bar fyrir augu hans í ferðinni, staðfesta þá kenningu hans að jökulís væri seigfljótandi og hnigi undan halla líkt og viðarkvoða. Þar var Sveinn langt á undan sinni samtíð í skilningi á eðli jökla.