

# New Traces of Extinct Thermal Activity in Iceland.

(Paper of the IV. Danish-Icelandic expedition)

By

ARNE NOE-NYGAARD.

Almost halfway between the nunatak Geirvörtur and the icedammed lake Grænalón on the south side of Vatnajökull a small unnamed nunatak projects through the ice mass about two kilometers from the border. Seen from the land surface in front of the ice it is rather impressive because of an almost 100 m high wall on the south side; seen from above, f. inst. from the Geirvörtur, it only projects very little above the surface of the glacier. (Cfr. map in NOE-NYGAARD, 1950).

The nunatak consists of the yellow brown rocks of the palagonite system and shows in the lower part of the steep southern wall a pronounced bedding with a dip of  $12^\circ$  almost due west. The rocks are partly fluviatile sediments, partly solifluction breccias and indurated morainic deposits (NIELSEN and NOE-NYGAARD, 1936). In the coarser members of the series the block size may reach 25 by 25 centimeters.

The brown palagonite rocks are in part discordantly overlain by an almost black, likewise indurated, badly assorted, fluviatile sediment loaded with liparitic material; both of these rocks are covered by a rather porous, subaeric lava stream, which disappears below the ice at both ends. Judged by its appearance this lava has been poured out in a period during which the ice had a smaller extension than now, since it has not been smoothed or polished through ice action.

Perhaps the most interesting phenomenon, however, revealed in the nunatak, is found in the areas chiefly occupied by the black fluviatile series on top. Here two round columns similar to small crater pipes are found; one is well preserved (fig. 1), the other has

been somewhat disturbed by the ice. The undamaged pipe has a circumference of about 9 meters and a height of 4.5 meters. It is built concentrically and consists of an outer ring, 35–40 cm thick, of which the outermost 5 cm are of an almost brick-red colour and very coherent and hard; inside the outer ring follows another, about 30 cm thick, also with a red and harder outer shell. The whole



Fig. 1.

column consists of nine such hard rings with more loose material in between; the central part is quite loose. The material making up the column is quite the same as in the black strata underneath it but for the indurated nature of the concentric rings and their conspicuous red colour; furthermore it seems to have lost some of its finer components so that the general appearance conveys the impression of being agglomeratic (cf. fig. 1).

The other column has quite a similar structure.

The rock surface between and around the columns is cut by several almost rectilinear, low walls likewise of an in-

tensely red colour and consisting of a material considerably harder than the host rock (fig. 2). The walls of to-day seem once to have been cracks or fissures now cemented together and indurated by a red-coloured cement. Two of the red walls disappear underneath the above-mentioned lava flow, which gives a relative dating of their formation.

The described phenomena may perhaps be interpreted in more than one way; I shall here set forth my opinion. After the examination of conditions in the field and after a study at home of the samples, I have come to the conclusion that we have to do with a field of extinct thermal activity. The two columns are in all probability the root zones of a couple of hot surface springs — or maybe fuma-

roles — and the still visible, but now cemented fissures are the remnants of a crack or fissure system once procuring the hot water for the springs. After the extinction of the activity of the springs, the ice of the Vatnajökull has removed the upper loose strata whereby the root zone is laid bare. The concentric building may be interpreted thus: The indurated zones were made successively and the diminishing of circumference is the result of a decreasing activity, causing a diminishing of the hole of extrusion.

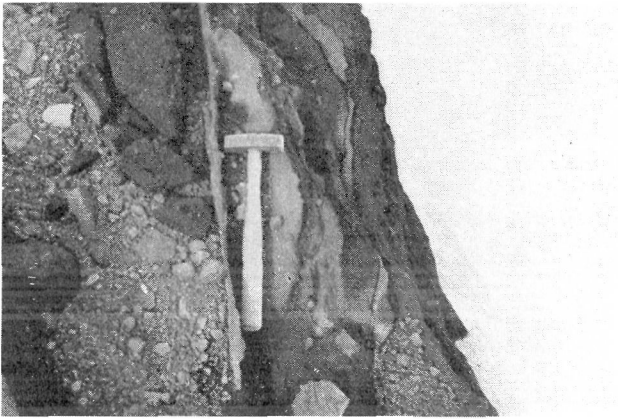


Fig. 2.

The observations are of significance for a judgement of the age of the hot spring action in Iceland, a question attacked by TOM. BARTH from another side (BARTH, 1935); he found in old morainic material altered basalts the nature of which could not be interpreted in any other way than by supposing their alteration to be due to thermal decomposition, a thing made probable through chemical tests and comparison with action of recent hot springs on their wall rocks.

Since the field in Vatnajökull is covered by a subaeric lava which demands less ice than there is to-day for its formation there seems to be no objection to the assumption that the thermal activity here may be late inter-Glacial or perhaps belongs to a post-Glacial period in which there was a recession of the ice exceeding conditions of to-day. Anyway we have to do with an area in which thermal activity, once alive, has been extinct for hundreds, maybe thousands of years.

### Dansk resumé.

På en lille nunatak i Vatnajökulls sydrand er der fundet rester af to kraterlignende dannelser, der i forbindelse med retlinjede, nu cementerede spalter, der gennemsetter fjeldet i deres nærhed, tydes som rodzonen af et tidligere thermal- eller fumarolefelt. Forskellige iagttagelser tyder på, at dette forlængst »afdøde« thermalfelt har en betydelig alder (evt. er interglacialt).

### LITERATURE

- BARTH, TOM. F. W.: Vestige of Pleistocene Activity in Iceland. Trans. Amer. Geophys. Union. XVI Meeting 1935 (p. 284-88).
- NIELSEN, NIELS & NOE-NYGAARD, ARNE: Om den islandske Palagonitformations Oprindelse. Geogr. Tidsskr. Bd. 39. II. København 1936. (p. 1-36).
- NOE-NYGAARD, ARNE: Hågöngur, A Partially Sub-Glacial Volcano in SW-Vatnajökull. Medd. fra D. G. F. Vol. 11, H. 5. 1950.