

á hina nýju Íslandsjarðfræði mína, og hann tók upp, af miklum drengskap, óbreytta, í hið merka jarðfræðitímarit, sem hann er ritstjóri fyrir.

Gáfaðir lesendur munu taka eftir því, að hér er ekki um neitt hégómamál að ræða. Og þar sem svo er ástatt, að ég er að halda fram sannindum, sem ég tel alveg sérstaklega áriðandi að þiggja, hefði verið mjög leitt, og líklegt til að torvela framgang heimsfræði minnar, ef hægt væri að sýna framá, að brautryðjandi náttúrufræðiuppögötvánir, sem ég hygg mig hafa gert, séu ekki annað en hégómi og misskilningur. En svo að dálítið gamansamlega sé að orði komist, þó að um alvörumál sé að ræða: Próf. dr. Trausti Einarsson mun fyrr velta Kirkjufelli, þessu jarðfræðilega svo stórmerkilega fjalli norðan á Snæfellsnesinu, en honum takist að hrinda undirstöðuárangri mínum í jarðfræðirannsókn Íslands. Ég efast ekki um, að próf. Trausti er efnilegur vísindamaður, og óska rannsóknnum hans í jarðfræði Íslands alls framgangs. En ég tel engan vafa á því, að hann er nú í verulegum atriðum á rangri leið. Árangur af rannsóknnum hans mun verða meiri, ef hann byggir á því sem þegar hefir verið áreiðanlega fundið, heldur en ef hann er að leggja vinnu í að reyna til að gera tortryggilegt það sem ekki verður með réttu véfengt.

On the Pleistocene Rocks of Iceland and the Age of the Submarine Shelf ¹⁾

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I

As shown by his paper on „The Age of the Rocks and Topography of Middle Northern Iceland“ (Geol. Mag., LXXV, 1938, 289—296), Dr. Hawkes realizes the great change of view concerning fundamental features of Icelandic geology necessitated by my discoveries of Pleistocene metamorphic glacial deposits in Iceland. In fact, the changes involved seem to him so great that he finds the whole thing

1) Reprint from the Geological Magazine, Vol. LXXVI, June, 1939.

incredible, and he rejects what he terms my hypothesis. In this incredulity, I think, is to be found the reason for his being unable to repeat for himself some observations I made on the eastern side of Fnjóskadal. That I should have been mistaken, is, I think, out of the question; a typical „striated pavement“ is something a geologist of some experience cannot be mistaken about. In Skridugil I exposed a surface which quite definitely exhibited traces of glacial action. That „similar deposits“ to those overlying the pavement „are found at various horizons in the older Tertiary Series of Iceland“ (Hawkes, op. cit., p. 293) is unknown to me. The name „Skridugil“ was given to me by a man who may not have understood to which locality I was referring.

II

When I began geological work in Iceland in 1899, only one glaciation was recognized — probably the Würm, or fourth glaciation of Penck — and it was believed that the present topographical features were largely pre-glacial. When I found that much of the so-called volcanic breccia was in reality of glacial origin, I realized that the views on fundamental features of Icelandic geology must be changed, and I therefore took the greatest care to be sure of my ground. J. Geikie, J. Horne, and B. N. Peach took a sympathetic interest in my work and encouraged me to publish my researches („The Glacial Palagonite Formation of Iceland“ Scottish Geogr. Mag., 1900).

III

As the work progressed it appeared to me that certain intercalations in the, as then believed, Tertiary basalt formation were moraines, a conclusion so startling to me that I can well understand Dr. Hawkes's incredulity. Further field work confirmed my discovery, and my doubts were removed. I have been criticized for not then concluding at once that the basalts overlying the moraines were of Pleistocene age, but

this I feel to be somewhat unjust. No one had ever doubted the Tertiary age of the basalts in question and to argue a Pleistocene age on the evidence of glacial character alone was not safe enough. When, however, I discovered an intercalation with Pleistocene mollusca more than a thousand feet below the uppermost basalts in Kirkjufell, Snæfellsnes, the conclusion was clear that a not inconsiderable part of the basalt formation was Pleistocene in age.

IV

The interbasaltic shell beds contain the typical glacial *Portlandia arctica* and the inter-glacial *Purpura lapillus*. Interbasaltic inter-glacial plant-remains have recently been discovered by J. Áskelsson¹⁾ in Snæfellsnes, and by J. Lindal in Northern Iceland; and in places the unconformity between the older basalt series and the Pleistocene basalts is well marked. Thus in Kirkjufell the basalt dykes confined to the older series have a different strike from the later dykes which persist through the moraines, shellbearing beds, and overlying basalts to the top of the hill. This Pleistocene basalt formation is in Kirkjufell about 1,100 feet thick, and in some neighbouring mountains is considerably thicker. In other places the older basalt have been tilted and dislocated prior to the laying down of the younger basalts and moraine intercalations.

I would draw attention to the great difference shown in the amount of physical and chemical changes which the two series have suffered. For example, in Mt. Esja (3,300 feet) near Reykjavik, is a beautiful moraine horizon with striated boulders. The Pleistocene basalts have been tilted, faulted, and greatly eroded, yet how fresh they look when compared with the older series with its colossal crushings, slickensiding, brecciation, and extensive chemical decomposition! Also the Pleistocene liparite intrusions have had considerable

1) Cf. his interesting paper on interglacial plant-beds in Snæfellsnes, Medd. fra Dansk Geol. Foren., 1938.

metamorphic consequences, and greatly influence the modelling of the landscape.

V

Dr. Hawkes's remark that „difference of opinion as to whether particular beds in Iceland are glacial or not is common“ (op. cit., p. 291) requires comment. When I began working in Iceland there was no such difference of opinion. Vast amounts of rock of glacial origin were by common consent believed to be volcanic breccias, and at least 90 per cent of the deposits of Pleistocene age had not been recognized as such. A curious consequence of this misconception was the failure to recognize the remnants of much dissected volcanic cones. Widespread dislocation breccias with striated stones presented a difficulty, and these rocks puzzled me for a long time, until I realized the enormous crushing and thrusting they had suffered.

VI

The discovery of the older glacial series could not fail to throw new light on the problem of the age of the submarine shelf and of the general topography of Iceland, and I must dissent from Dr. Hawkes's view that „There is nothing of importance to be added to the full discussion of the question given by Nansen“. Nansen writes: „**According to my view, it is probable that the principal features of the surface relief of Iceland and its continental shelf had been sculptured by subaerial erosion in pre-glacial times**“¹⁾ („The Bathymetrical Features of the North Polar Seas, etc.“, The Norwegian North Polar Expedition, 1893—6. Scientific Results, iv, 1904, p. 171), and again: „I consider it therefore probable that the continental shelf of Iceland was chiefly formed in pre-glacial times during the Pliocene and Pleistocene periods“ (p. 172).

There is no doubt that Nansen's opinions just quoted are far from correct. It is certain that even „the principal

1) Leturbreyting mín. H. P.

features of the surface relief of Iceland“ are younger than the first glaciation of the country. The 100 fathom line probably roughly shows the coastline of Iceland in the first interglacial period, and without the ice of the first glacial period we would hardly be able to account for the submarine fjords of the shelf.

It must be remembered that Nansen when he wrote his discussion was unaware of the discovery of the older (metamorphic) glacial series of Iceland, with its evidence of a more prolonged Pleistocene period than was previously recognized.

VII

In recent years very interesting additions to our knowledge of the older Pleistocene rocks of Iceland have been made by the Icelandic geologists J. Áskelsson, P. Hannesson, St. Emilsson, and J. Lindal, and by the Danish geologists N. Nielsen and A. Noe-Nygaard. Further detailed studies of the deposits may be expected to yield results of the greatest general importance.