PORISVATN
GEOLOGICAL REPORT

Supplement to Volume II

THE VATNSFELL DIVERSION
NOTES ON GEOLOGY

by

Birgir Jónsson geologist NEA.

Prepared for

LANDSVIRKJUN
THE NATIONAL POWER COMPANY
September 1970
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Notes on Geology

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THE VATNSFELL DIVERSION

Notes on Geology.

Introduction.

These notes are on the geology of the canalsite west of Vatnsfell, the Vatnsfell Diversion, at the southern end of Lake Þórisvatn. They are based on information from the drilling done during the period March to September 1970 and are supplementary to "ÞÓRÍSVATN, GEOLOGICAL REPORT, Vol. I-III, The National Energy Authority, February 1970", which deals with all the previous investigations.

In the storage development at Lake Þórisvatn, four main routes for outlet works have been under consideration in the Vatnsfell area. These routes were numbered 1 to 4 (see chapter 3 in the above mentioned geological report).

Most of the exploration during the summer of 1969 was focused on routes 3 and 4, east of Vatnsfell, but early in 1970, route 1, west of Vatnsfell was chosen. Only the upper sections of 2 holes, 0-1 and 0-2 had then been drilled in this route, mostly with tricone bits and neither of them had, at that time, reached the main groundwater table, as we found out this year. Some borro soundings had also been done.

In the middle of March 1970, further investigations on route 1 were started, first by borro soundings through the ice on Lake Þórisvatn and, during the first half of April, borro soundings on land and core drilling began.

This route is dealt with on pages 3.13 and 3.14, Vol. II in the geol. report and the geological section of it (section A-A, Exh. 3.09) is based on the scarce information then available. Much of what is said there still holds true, but along with further information the present report also contains some corrections.
**Canalsite Geology.**

For classification and description of each member of the Vatnsfell formation and its units, see Vol. II of Þórísvatn, Geological Report, pp. 3.2 to 3.10.

a) At the Lake. See section F-F, in Exh. 4, and for location see Exh. 2.A and Exh. 1.

One of the core drillholes, 0-7 was drilled on the ice of Lake Þórísvatn, about 170 m from the shore. This hole along with hole 0-4, showed, that the bedrock at the lake, which had been found to have a high seismic velocity (about 3000 m/sec) and is interpreted as a dense móberg (V₂), in section A-A, Exh. 3.09 in the geological report, is in fact a pillow lava which belongs to the Grasatangi formation.

The Grasatangi formation is older than the Vatnsfell one (see the geol. report, vol. I, pp. 1.6-1.11) and can easily be distinguished from the latter because of the great number of feldspar phenocrysts the Grasatangi magma did contain. Also the colour of the basalt, which makes up the pillow lava in the Grasatangi formation is light grey, but that of the Vatnsfell formation is much darker.

The pillow lava is a very heterogeneous rock with occasional lenses of badly consolidated material, mostly sand made of basaltic glass. There are also basaltic injections in the pillow lava, consisting of cube jointed basalt, which represent late stages of the eruption, when most of the ordinary pillow lava had already solidified. These injections are usually very irregular in shape, and do not solidify as quickly as the ordinary pillow lava, and therefore contain much less glassy material, if any at all. The section F-F in Exh. 4 shows the stratigraphy of the part of the canal nearest to the lake and in the lake itself. As can be seen, the stratigraphy is very simple; the bedrock consisting of pillow lava and on top is a few meters thick layer of soft sediments, which are beach and lake deposits (L₃). The graphic logs of the borro soundings in this area are shown in Exh. 14 to 19.
b) At the control structures. See sections A-A up to E-E in Exh. 3, and for location see Exh. 2.B and Exh. 1.

In the part of the canal, where the control structures are to be placed, many holes have been drilled. Eight of them are within, or in the immediate vicinity of, the construction site, and they are shown in the sections A-A to E-E.

The control structures will be placed where the canal route is highest. This is where a móberg ridge crosses the route (section A-A). This ridge belongs to the Vatnsfell formation and is made of the various types of móberg and pillow lava found in this formation. The ridge is most likely a crater rim, the crater being the depression between this rim and the mountain Vatnsfell itself. The drillhole 0-13, which is 45 m deep, is in the western part of this crater and does not reach the bedrock proper, but only extends down into the $L_1$ unit, which is defined as tuffaceous sand, formed subglacially, not penetrated by borro soundings.

This depression, and the one to the north of it, were once an inlet, or a small fjord, extending southwards from Lake Pórisvatn. Later a gravel bar was formed, which crossed the inlet and now makes up the present shore of the lake west of Vatnsfell. This changed the inlet into a closed lagoon, which subsequently drained out. We do not know how deep the lagoon was when it became dry, but the dry lake bottom is the boundary between the $L_3$ and $L_2$ units, as the $L_3$ is deposited in water, but the $L_2$ is mostly windblown. From an engineering point of view, this boundary should not be important, as both units have similar properties with regard to excavation.

In Pórisvatn, Geological Report the boundary between these two units was assumed at 570 m elevation (present level of Lake Pórisvatn is about 571 m). This means that the inlet or lagoon was almost filled with sediments before it became dry.
Another possibility is, that this boundary is about 10 m lower than assumed before, or at an elevation of about 558-560 m, where there is a dense horizontal layer in which most of the borro soundings stop (see the graphic logs of borro soundings: 1115V, 1112V, 1110, 1113H, 12125V, 12120V and 12115V in Exh. 21 and 22, and their locations in Exh. 13. This layer was also noticed in drillhole 0-13 (Exh.8) and borro sounding No. 1060 penetrated through it down to an elevation of 532 m, but at 558 m, the number of blows per half a meters run increased greatly, and further down the number decreased again (see Exh.20). This layer may represent the former lake bottom, which may have cemented into a hard crust when it became dry.

In the stratigraphy of the móberg ridge or the crater rim itself, the symbols V₁, V₂, F₂ etc. are used, but as this is the same formation, the stratigraphy is mostly based on how consolidated the material is, whether belonging to the same units as classified in the above mentioned report.

It became necessary to divide the V₂ and the F₂ units to form a new unit on the boundary between V₂ and F₂. The unit V₂, i.e. coarse móberg breccia was divided into well consolidated V₂ with good core recovery, which was classified along with V₁, and badly consolidated V₂ with a low core recovery, which was classified along with some of the F₂. The F₂ unit was also divided into F₂ with a lot of glassy sand between and inside the pillows, often a pillow breccia, which was classified along with V₂, and F₂ with less glassy sand, but more basalt, which was classified along with F₁.

This new unit V₂-F₂ then grades from badly consolidated V₂, i.e. móberg breccia, over to badly consolidated pillow breccia, which should be on the boundary between V₂ and F₂ over to
very sandy F₂, which is pillow lava, sand filled or with sand lenses. Generally the parts of this unit which are marked V₂ are a better rock than the F₂ part, as there some of the matrix is strong enough to withstand the erosion caused by the flush water during drilling.

Ground Water.

The permanent ground water table in the bedrock west of Vatnsfell is much lower than thought before, as the holes drilled last year did not reach deep enough. Therefore the northwestern part of the ground water map in the geol. report (Exh. 3.06, Vol. II) is incorrect. A renewed copy of this map, based on information from the drilling done this year accompanies the present report as Exh. 10.

The permanent ground water table beneath the above mentioned ridge is at an elevation of about 520 m, but during drilling some water was noticed at higher levels in many of the drillholes. For further information, see the graphic logs of the holes.

Hrauneyjafoss 10.09.70

Birgir Jónsson
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**LEGEND**

- **L1** Tuffsand, vel pakket
  - Tuffaceous sand, well packed
- **L2** Sand, mostly winddrifted tektro
- **L3** Strand og vatnset
  - Beach and lake deposits
- **V1 og V2** Möberg, bøtt og vel samlømt
  - Möberg, tight and well consolidated
- **V2 og F2** Tila samlømt möbergbreccia, som greinist vitr.
  - Tila samlømt möbergbreccia, which grades into glassy consolidated pillow breccia or sand filled pillow lava
- **F1 og F2** Bølstroberg, F2 er sandfylt
  - Pillow lava, F2 is sand filled

**SKIRINGAR**

- **Exh. 4**

**Stoatsensning sjø**

Location see **Exh. 2A**

**FOR DEFINITIONS OF EACH MEMBER OF THE VATNSEL Formation, SEE BØRISVATN, GEOLOGICAL REPORT, VOLUME II, PP. 3.2-3.10**

**BØRISVATN, VATNSEL 1970**

**JORODASEN**

**GEOLOGICAL SECTIONS**

**LANDSVIRKJUN**

**The National Power Company**

**VERKFRÆDISTÖFA SIG THORODDSEN S/F**

**Thordardóttir and Partners**

**ORKUSTÓFNUN**

**2870 BJÖM/Tr 208**

**Fnr. 9557**
Elevation

Greining

Classification

Lekt

Permeability

LU

D FPN m

522.6

0-1

O-1

V1 Möberg, bøtt, finkornrett dense, finegrained

V2 Möberg, grønnsteinritk porous, brecciated

V3 Möberg, grønn, sundurlaust porous, body consolidated

F1 Bølstroberg Pillow lava

F2 Bølstroberg, sandfyllt Pillow lava, sand filled

F3 Tuffsandur med basaltitekton Tussockous sand with veins of basalt

L-1 Tuffsandur Tussockous sand

L-2 Tuffsandur og gosaska Tussockous sand and tephra

L-3 Vatnaset, sandur og kisilgur Lake deposits, sand and diatomaceous earth

Jökulberg Tillite

TH Haun Basaltic lava

Öhhrænuð yfirbordslag Overburden

Kjemi: Taller sene kjøntheimtur i % + kjønnstoke ekki repp

Core: Numbers indicate per cent core recovery + core sampling not attempted

Abbreviations: Diat diatomaceous Tus Tussockous w with

Støbsetning, sjá tryggjökl 1 og 2 Location, see Exhibit No. 1 and 2

Exh. 5

Landsvirkjun
The National Power Company

Verfræðistofna skg. Thoroddson og Partners

Orkustofnun

Þóðrarvatn Vatnsfell
SNÍD af Bórhúlum 0-1-0-3

Graphic Core Logs

211 705 05427

B.-332

Fmr 9292
Sjøseining sjå
Location see Exh. 1-2

LANDSVIRKJUN
The National Power Company
VERKÆRISTITUTE SIG THORODSEN S/F
Thorildensen og Partners
ORKUSTOFNUN
PORSVINN VINTSSELL
Sand of boreholes O-12 - O-15
Graphic core logs
Hällafirur grunnvatnssins og þær voru sýnlítaða sumars 1969.
Melumur hæðalina 2m á millihála við að 10m á útjoðum.
Bedrock potential lines as observed in late summer 1969.
Contour interval 2m in the center, but 10m in the outskirts of the area.
The higher elevation figure at each borro sounding indicates the elevation of the ground surface and the lake bottom, but the lower one indicates the elevation of bedrock surface.
Bedrock not reached at 43 m

Location see Eex.11

Legend see Exh. 18

Skýringar sjá bláð 14

Ekki komið á fossi í 43 m

Eækt komið á fossi í 43 m

Bedrock not reached at 43 m
NB: The surface was still frozen when the borro soundings were done, so the number of blows in the uppermost 1-1.5 m is far too high.
Skýrningar, sjá bláð 14

Legend, see Exh. 14

Ath: Klaki var ennþá í þöru þegar barða barönnar voru gerðar, svo að haggtjóðni í efsta 1-1,5 m er stilt af hör.

NB: The surface was still frozen when the barro soundings were done, so the number of blows in the uppermost 1-1,5 m is far too high.
NB. The surface was still frozen when the barro soundings were done, so the number of blows in the uppermost 1-1.5m is far too high.
Legend, see E x h 14

Stöðsetningar sjá E x h 13.

Ath: Mikki var eníða í jörðu þegar barrós hætta voru gerðar, svo að nýggjafjöldi í elstu 1 - 1,5 m er allt af hár.

NB: The surface was still frozen when the barrs soundings were done, so the number of blows in the uppermost 1 - 1,5 m is far too high.
Ath: Klaki var emphæ i jordu pegað borro borarinæ voru gerðar, svo að hópsafjöldi í eftir 1-1.5 m er allt að hár.

NB: The surface was still frozen when the borre soundings were done, so the number of blows in the uppermost 1-1.5 m is far too high.