THE STATE ELECTRICITY AUTHORITY

HESTVATN HYDRO-ELECTRIC PROJECT

GEOLOGICAL REPORT

by

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C O N T E N T S

LIST OF DRAWINGS:

THE DEVELOPMENT OF HVÍTÁ AT HESTVATN

1 GEOLOGY

1.1 Areal Geology

1.1.1 Introduction

The bedrock in Southern Iceland is now, according to a prevailing custom introduced by G. Kjartansson, divided into three formations, Old Grey Basalt formation from Late Tertiary and/or Early Pleistocene; Palagonite Formation Pleistocene and Young Grey Basalt Interglacial.

Old Grey Basalt or Hreppar formation as it is named in this district is the bedrock of eastern Árnessýsla and western Rangárvallasýsla. In the Hestfjall area the bedrock of the lowlands and Vörðufell is Hreppar formation, which is equally built up of basalt and palagonite rock, is rather impervious. The majority of the precipitation runs off the Hreppar formation as surface water; e.g. Vörðufell contains a lake and numerous brooks.

The Palagonite Formation in this sense is more restricted than customary as it formerly covered all Pleistocene formations in Iceland. The Geological Map of Iceland, recently published by the Museum of Natural History, Reykjavik, uses the term Palagonite Formation in the more restricted sense and it will be followed here.

The Palagonite formation is highly heterogeneous although it is mainly various kinds of palagonite rock. It is usually highly pervious and the precipitation infiltrates it and appears again at lower elevation as springs. The Palagonite formation and the Postglacial lavas are the sources of the spring fed rivers. In the vicinity of Hestfjall Palagonite formation is in Ingólfsfjall and the mountains north of Laugardalur.

The Young Grey Basalt, which is mostly shield volcanoes, is formed by lava eruptions in the Pleistocene Interglacial periods. It is rather pervious although not to the same extent as the more pervious part of the Palagonite formation. Lyngdalsheiði is a Grey Basalt shield volcano in the vicinity of Hestfjall.

Hestfjall should be classified as Young Grey Basalt. There is no surface run-off which among others indicates its low age.

The bedrock proper was fully developed at the end of the Pleistocene Ice Age. At that time or later thick subsoil was formed in the vicinity of Hestfjall, i.e. marine terraces, outwash plains and deigulmór at a higher sea level. Furthermore the Thjórsá lava, which 8000 years ago ran in a 40 m thick basalt flow beyond the eastern and southern slopes of Hestfjall, changed extensively the landscape in Southern Iceland. The most pronounced of these changes was that the common course of Thjórsá and Hvítá, east of Hestfjall, was uplifted by ca. 40 m, which caused the rivers to seperate and flow on each side of the lava in shallow and sensitive courses. Lakes were dammed up to the west of the lava edge between Hestfjall and Vörðufell and to the north of the latter, but they have been silted up by sediment deposits of Hvítá long time ago. Lake Hestvatn was uplifted probably by ca. 10 m.

Fig. 1.01 is a geological areal map of Hestfjall and vicinity, partly made from established sources and partly from own observations.

1.1.2 The Kiðjaberg Formation

The oldest formation at Hestfjall reaches the surface in the vicinity of Kiðjaberg but is otherwise covered by later formations of Hestfjall. In this report I will call it the Kiðjaberg formation, although it is an integral part of the Hreppar formation.

This formation is mostly palagonite rock of many varieties with a few grey basalt sills. Tuff and breccia seem to be in similar proportions with some diffuse bedding. Both tuff and breccia are of volcanic origin. The fresh colour of the palagonite rock is bluish green but the angular pieces of the breccia is of grey basalt. The sills consists of rather coarse grained grey basalt. The Kiðjaberg formation is an impervious rock with few vesicles generally all calcide filled.

Fig. 1.02 shows the relation of the Hreppar formation to other formations in Hestfjall. Sand and siltstone is inbedded between Hreppar- and Tuff formations. This sand and siltstone cannot be later than the last interglacial stage thus the Kiðjaberg formation is probably mid pleistocene or earlier.

1.1.3 The Tuff Formation

The Tuff formation is mostly covered by the grey basalt of Hestfjall as illustrated on fig. 1.01 but it is uncovered at Snoppa and seems to be lacking altogether under the most western part of the grey basalt. The tuff formation has probably originated in volcanic activities in the vicinity of the present peak of Hestfjall. The formation is bedded tuff in Snoppa and elsewhere in the vicinity of the peak. Further down breccia dominates and at the spillway site at Árhraun the breccia is covered by 30-40 m thick pillow lava. The tuff in Snoppa is folded intensely as if it had been compressed from north east.

The tuff formation is soft and very incompetent rock from engineering point of view, it is never highly consolidated and sometimes hardly so. It will be discussed further in connection with the spillway. The tuff formation is highly erodable by rivers, glaciers and the sea. This property of the tuff is probably the main cause of the steep eastern slope of Hestfjall although fissures and faults are secondary causes.

The key to the age and formation of the tuff lies probably in the underlying siltstone, which appears in the right bank of Hvítá some distance east of the farm Hestur. West of the fault, which divides Vatnsheiði and Hestfjall proper, the siltstone is covered by sandstone and even thin layer of conglomerate and grey basalt. East of the fault the siltstone is no longer covered by sandstone but by breccia which belongs to the tuff formation.

Siltstone appeared also in drillhole 25 at Árhraun at a depth of 81.5 m which I consider belongs to the same siltstone layer. The siltstone is grey in colour when weathered but otherwise it is bluish. In drillhole 25 it is of bluish colour with a faint green shade. As yet it has not been examined whether the siltstone is formed in sea or fresh water.

On map 1.01 it can be observed that the course of the Thjórsá lava becomes narrower as ridges of Hreppar formation south and south west of Hestfjall lie perpendicular to the direction of the lava flow. It is possible that these ridges have dammed up a lake, where Hestfjall and Skeið are now situated, when the volcanic activities started which formed the Tuff.

Both sea and lake are therefore possible as phases of the siltstone.

The breccia of the tuff formation has been formed when the siltstone was a water sogged sediment. Lava has flowed over the sediment and caused the water to boil and the steam pressure has split the lava and thus formed breccia. (The geologist J. Jónsson has described in a note in the "Náttúrufræðingurinn", 1953, "how the craters of Landbrotshólar, which were formed when lava flowed over water sogged sand, are being turned into palagonite.")
The lava flowed over breccia in water and therefore turned into pillow lava ; finally bedded tuff was formed in the crater when it rose out of the water. At the time of the tuff formation the eruptions were mixed with composite cones of pyroclast and lava.

If the eruptions started in a lake the lava flows to the south could possibly have dammed its outlet and therefore caused an uplift of the lake. It could be a possible explanation why breccia and pillow lava reach considerable higher level in the eastern part of Hestfjall than in the western.

The folds in Snoppa could be caused by a glacial flow before the grey basalt covered the tuff,which would therefore belong to a glacial stage or at least part of such a stage older than the grey basalt. However, I hardly consider that the age difference can be so great. In my opinion it is more likely that the eruptions which built Hestfjall were rather continuous and that it was all formed during the last interglacial stage. The folds in Snoppa would then be formed during the last glacial stage after faulting and subsidence had occured at both sides and the grey basalt cover had vanished through erosion. A glacier flow from north-east has compressed the low consolidated tuff in Snoppa.

Fig. 1.03 illustrates a profile of Hestfjall. Now one half of the original mountain is lacking, it has subsided, faulted and eroded. But in the southern part the silouette of the original mixed volcano can be seen under the grey basalt cover.

1.1.4 The Grey Basalt Formation

As previously mentioned I am not of the opinion that there are any considerable differences in age between the grey basalt and the tuff formation, but continuous eruptions have only changed character by time; turning from mixed into effusive eruptions. The grey basalt east of the farm Hestur covers the sand- and siltstone previously mentioned. The grey basalt bears clear evidence that it has flowed into water, it is jointed into irregular columns and the contacts to sandstone are coated with brown glass.

In the western part of the sandstone rounded cobbles can be seen in its upmost part. I think that these bottom grey basalt layers must be the same as those further east turned into breccia and pillow lava. The water was shallower with sand and even gravel in the bottom which indicates a shore in the vicinity. I have not found any inbedded layers or discordance in the grey basalt. The grey basalt is in thin layers, rather fine grained but with remarkable spots on polished surface where the rock seems to have weathered more rapidly than elsewhere.

The vent from which the grey basalt emerged has been in the vicinity of the peak of Hestfjall. In the western slopes of Hestfjall below Hestseyru are numerous dykes and slaggy screes but on the eastern side dykes are less prominent. I therefore believe that the main crater has been slightly to the west of Hestseyru which according to their shape could be remains of a parasitic crater.

The grey basalt eruptions have completely altered the composite volcano and formed a shield volcano. The distribution of grey basalt from Hestfjall is illustrated on fig. 1.01. It extends to the west of Hestvatn and beyond the faults north of the mountain. The grey basalt at Grjótá between Eyvík and Ormsstaðir seems to have originated in Hestfjall but further northwest at Brjánsstaðir it is rather coarse grained as in the Kiðjaberg formation.

The destruction of the shield volcano has started by formation of caldera around the main crater. But later a more extensive subsidence has occurred. I consider that the grey basalt formation as well as the tuff formation belongs to the last interglacial stage.

1.1.5 Tectonic

When eruptions in Hestfjall ceased the northern part of the shield volcano subsided between straight faults. On map 1.04 the fissures and faults are illustrated which are easily seen on maps or through ground survey. The most common tectonic line has the direction N 40° E. This line limits Snoppa at both sides, the western edge of Hestfjall and Vatnsheiði and the eastern side of Kiðjaberg. The fault, which limits the depression at Hverakot to the west and a fissure which forms the course of Grjótá about one kilometer further west, has the direction N 33° E. Fault at the northern shore of Hestvatn has the direction N 27° E. All these tectonic lines can be considerated as random to the chief tectonic line in Southern Iceland, which is W 30° - 35° E. The fault which forms the western shore of Hestvatn has the direction N 5° E.

The fault which limits the depression at Hverakot to the east has approximately the same direction. The eastern slope of Hestfjall is partly formed by fault with the direction N 23° W. The southern course of Grjótá runs through a fissure with this direction. The southern shore of Hestvatn is formed by a curved fault. The depression which is now occupied by Hestvatn is limited by some of these above mentioned faults. To the south and east of the lake there is only one fault but to the west and north are many fissures and block faults.

In the north-eastern slope of Hestfjall there are probably some parallel faults, but as previously mentioned the glacial and marine erosion in the easily eroded tuff formation is probably the chief cause of the steep eastern slope of the mountain.

Probably at this time Vatnsheiði has also been effected by tectonic movements. The average dip of the grey basalt in Hestfjall proper is 2° - 3° but in Vatnsheiði they are approximately horizontal. The northern part of Vatnsheiði has therefore subsided a little. The fault can easily be observed at the northernmost point to the boundaries between Vatnsheiði and Hestfjall proper, its direction is N 12° - 15° E.

It is most likely that tectonic movements have already started at the end of eruptions in Hestfjall but they have increased much in the last glacial stage.

1.1.6 The Kambar Formation

In connection with tectonic movements eruptions have again taken place in the Hestfjall area. It has happened at two places i. e. Kiðjaberg and in the subsided area (caldera) at Vatnsnes. Then the Kambar formation was built up which distinctly lies above the grey basalt and thus indicates their age relationship.

It is quite common that eruptions take place in outskirts of shield volcanoes and very common that they occur in calderas. The explanation why eruptions took place at Kiðjaberg but not elsewhere in the vicinity of Hestfjall is that the main tectonic line through the imagined central crater lies in the vicinity of Kiðjaberg. In the opposite direction from the central crater is a line of ridges and hills which are nearly hidden by lake deposits.

These eruptions have taken place in the last glacial stage as these hillocks belong to a type which G. Kjartansson has called ridges. These ridges have a direction more northernly than the main tectonic line, but they are short and parallel, only few hundred meters each in length. These eruptions have began early in the last glacial stage in the caldera, in Vörðuás and Laugarás in the Kiðjaberg area. In later eruptions Kambar were formed.

In the Kiðjaberg formation the rock has altered considerably at places by these eruptions. Hydro thermal gases and hot water as post volcanism has dissolved and weakened the rock specially in the continuation of the eruption fissures and other fissures and bedding contacts.

The rock in the Kambar formation is much more competent than the tuff formation from engineering point of view. The rock is similar to the Kiðjaberg formation except that fillings in holes and joints are clearly less developed.

1.1.7 The Ice Age

Subsoils from the ice age glaciers are not prominent at Hestfjall. It is chiefly striations on the grey basalt on top of the mountain which indicate the ice age. I have also seen striations on the palagonite at Hlaupandi brook. Their direction is chiefly north-easternly but there exists also much more easternly direction and another approximately direct north. Moraine is hardly seen in this area.

At Hestfjall the rock is usually bare where it is not covered by loessy soil. Doubtless some of the subsoil in the slopes and at the foot of the mountain is originally moraine but it is now highly altered and shows few signs of its origin.

1.1.7.1 <u>Shorelines.</u> Marks of higher sea level and subsoils made at it are prominent around Hestfjall. Investigations on these ancient shorelines are of some practical use as the gravel terraces often contain useable concrete aggregate. The gravel terraces at Vatnsheiði, Gíslastaðir and in the western slopes of Hestfjall, in the vicinity of Vatnsnes, were therefore investigated in detail, surveyed and profiles made by bulldozers.

The highest marks which distinctly are made at a higher sea level are 94 m at Vatnsbotn and 93 m at Stekkjarhamar. At this elevation are clearly worn stones and boulders without any distinct division line between the worn and not worn stones. I therefore do not suppose that the sea level has been stationery here but been at this elevation or higher at the deglaciation of Hestfjall when the uplift of land was very rapid.

It is quite another case with the gravel terraces further down where the sea level has been stationery for a long time, probably centuries. These gravel terraces form two continuous shorelines which I call the higher and the lower shorelines.

At the higher shoreline gravel terraces are formed with distinct notch and edge. Material down to at least 2 m depth is only coarse gravel and cobbles which indicate that the shoreline has been without fluctuations while these terraces were formed.

The sea level moved in a short time from the higher shoreline to the lower where the terraces have distinct notches only where one can expect considerable wave forces at their formation as at Stekkjarhamar and Gíslastaðir, but at Vatnsnes and Vatnsbotn which lay partly in shelter the terraces have not distinct notches. Furthermore, the material in these terraces is mostly sand and gravel which indicates more fluctuations in sea level than at the higher shoreline. A more sheltered position as sea level became lower can also explain better gradation of the material at the lower shoreline. Yet there was formed a 50 m wide wave cut platform in palagonite rock at Stekkjarhamar.

A bar was formed between Vatnsheiði and Kambar, which is mostly sand, its thickness varies according to the underlying bedrock but is usually about or more than 10 m.

From the notch of the lower terrace the sea level has slowly moved down at the beginning; it is indicated by storm beaches one below the other at exposed positions but at sheltered positions by sloping tops of the terraces.

The storm beaches are most prominent in a wind eroded strip between Stekkjarhamar and Hestur, where there are distinctly 6 beaches.

The elevation of the beaches is as follows. The numbers indicate the notch and edge of every beach.

Higher shoreline	77.5 - 75.4 m above sea level
1. lower "	63.2 - 62.0 " " " "
2. " "	60.7 - 59.5 " " " "
3. " "	57.5 - 56.8 " " " "
4. " "	53.9 - 52.8 " " " "
5. " "	51.2 - 48.3 " " " "

Below the lowest storm beaches no terraces are visible.

The notch of each terrace cannot be higher than high tide level when it was formed. The mean sea level above present should therefore be ca. 2 m lower than the elevation of the notch as tidal range is 3-4 m at the southern coast of Iceland. Accordingly, the sea level has been as follows in meters above present at various places at Hestfjall:

Vatnsbotn	
higher shoreline	75 - 76 m
lower "	61 - 64 m
Stekkjarhamar	
lower shoreline	61 m
Between Stekkjarhamar and Hestur	
higher shoreline	76 m
lower "	61 m
Efri Heiðar	
higher shoreline	75 - 77 m
lower " , vague	61 m
Gíslastaðir	
higher shoreline	86 - 88 m
lower "	66 - 68 m
Vatnsnes	
higher shoreline	87 - 90 m
lower "	66 - 68 m

It is clear that since these shorelines were formed uplift of land has been more in the north-eastern part of Hestfjall than in the south-western part. The warping of the higher shoreline amounts to 8´(minutes) (0.14°) in the direction N 70° E, but the lower 4´(0.07°).

Marks of the sea level above the higher shoreline are not visible at Vatnsnes and Gíslastaðir as the topography is such that they must be covered by talus.

I think that two explanations are possible for a stationery sea level; i.e. an equilibrium has existed between the eustatic rise of sea level and the isostatic rise of land, or a considerable glacier load has been constant or increasing for centuries and land almost reached isostatic equilibrium. I consider it most likely that the former has caused the lower shoreline and the latter the higher one, i.e. that land has almost reached isostatic equilibrium at Búði-stage, the last major advance of the ice age glacier in Iceland, but during the Alleröd-stage an equilibrium has existed between the eustatic rise of sea level and isostatic rise of land.

It has taken the sea level mostly 2000 years to move from the lower shoreline to the present one or probably further down. It was at that time that the Thjórsá lava ran to the sea at Eyrarbakki and Stokkseyri; then the sea level was not higher than at present.

1.1.7.2 <u>Sea Deposits.</u> At the end of the ice age the glacial rivers carried forth enormous quantities of sand and silt which were deposited in the lowlands while they were submerged by the sea. This deposit is named deigulmór and resembles varved clay, although apparently more coarse grained. Between Vatnsheiði and Kambar deposition of clay and silt has not taken place because of currents in that strait except in depressions in the bedrock. West of Kambar all depressions are filled with deigulmór which forms considerable beds there. But the deigulmór is thickest in the deep course east and south of Hestfjall, its thickness being 36 m in drillhole 25 at Árhraun.

The deigulmór is usually grey, bedded and thin clay layers alternate with silt. It is consolidated to some degree and does not need casing in drillholes.

The deigulmór at Árhraun is covered by sand which is formed in Hvítá and Thjórsá when they had a common course at Skeið when it emerged from the sea. Then the rivers have been heavily sediment laden, as the high plateau had recently deglaciated and the vegetation cover sparse and weak. They have probably formed a braided river at Skeið and continuous aggregation of sand has taken place. The thickness of sand in drillhole 25 is 5 metres.

1.1.8 The Post-glacial Period. The Thjórsá Lava.

8,000 years ago the last great event took place towards the present shape of the south-western lowlands, Then the Thjórsá lava ran, the biggest lava flow ever localized in Iceland. The sources of the lava flow are in an eruption fissure in the vicinity of Vatnaöldur. Tungnaá crosses it at Hófsvað. Thence the lava stream has flown through the thalweg of Tungnaá and Thjórsá down Skeið, western

Flói and to the sea at Stokkseyri and Eyrarbakki. As a consequence the main river valleys of the lowlands were filled by lava and the rivers were for a time without any channels. The channels of Hvítá and Thjórsá are still in most places in the lowlands very shallow.

The consequences of the lava flow were very revolutionary at Skeið, where the lava is 40 m thick and the courses of the rivers were uplifted accordingly. Thjórsá and Hvítá were seperated. Thjórsá made its course by the eastern edge of the lava towards a depression in the Hreppar formation where its channel is now at Urriðafoss. Hvítá on the other hand flowed into a lake which was dammed up north of Vörðufell and thence partly across the lava at Skeið but partly across the ridges at Iða and into another lake west of the lava edge between Vörðufell and Hestfjall. Brúará flowed into that lake, which was much bigger and deeper than the lake north of Vörðufell, Hestvatn was connected to it by narrow straits on each side of Vatnsnes and its level was probably uplifted by ca. 10 m due to the lava flow.

The lake north of Vörðufell was soon silted up by the sediment transport of Hvítá. By similar sediment transport as at present it would only have needed a few decades or mostly one or two centuries to silt it up. But during that period the interior was gradually being covered by vegetation but hardly to such an extent as to cause a different sediment transport from the present.

For a considerable time after the silting up of the northern lake Hvítá flowed on both sides of Vörðufell and carried sand to the lava east and south of the mountain. But gradually the channel at Iða got the upper hand and from now on Hvítá deposited all its sediment load in the southern lake. It was also silted up except Hestvatn. It took much longer time to silt up the southern lake than the northern one due to following reasons. It was bigger and deeper and the sediment transport gradually decreased as the vegetation cover of the interior increased. Probably the southern lake has been completely silted up one or two thousand years after the lava flow. Then the lake deposits were covered by bogs except where the river flowed through rather narrow course. The sediment transport is small as climatic optimum is now reached.

The peat which was formed on top of the lake deposit compressed it gradually as it thickened which indicates that it consists of silts or organic material, It is more likely that it is silt. At the right bank of Hvítá the compression of the lake deposits amounts to the same as the thickness of the peat which is 5.2 m where thickest.

The compression has not been to the same extent on the left bank at Útverk and the river bank is probably higher than the original level of the lake deposit.

Since the Thjórsá lava flowed Hvítá has run close to Hestfjall, where it has gradually cut a channel in the tuff formation and lowered the water level north of Hestfjall. This lowering probably amounts to 3 m at Árhraun, 51-48 m above sea level.

2,500 years ago a climatic change took place which caused the climate to cool considerably. Glaciers expanded and sediment transportation increased. But the sediment transportation did not become serious until after the settlement of the country which few centuries later caused soil erosion and deflation on an enormous scale due to heavy pasturing.

Then the sediment transportation of Hvítá increased greatly. It caused aggregation at Skeið, from Árhraun to Iða, and widening of the river channel by eroding or burying the peat in sand. The aggregation is now at least balanced by degradation and there are even indications that it has been decreasing in the last few decades.

1.2 Site Geology

1.2.1. The Kiðjaberg area

1.2.1.1 The bedrock of the Kiðjaberg area is mapped on fig. 1.05. It is divided into three formations, (in chronological order): a) Kiðjaberg formation, b) Grey basalt formation and c) Kambar formation.

The Kiðjaberg formation is mostly palagonite rock yet containing some layers or sills of grey basalt. The grey basalt is rather coarse grained. The palagonite is both breccia and tuff, its colour is usually bluish green, it is very tight with few vesicles all filled with calcide. Most of the drillholes of the Kiðjaberg area are drilled in this rock. Close corelogging shows that the rock has diffuse bedding. The bedding is between varieties of breccia, between breccia and tuff and even between varieties of tuff.

Figs. 1.08 - 1.12 are profiles through drillholes in this area. The contacts between tuff and breccia and varieties of breccia are often diffuse and it seems that the same bed can distinctly be tuff in one place and breccia with dominating matrix in another place; or bed is in one place breccia with rather small angular pieces but in another place with rather large angular pieces, etc.

The oldest rock seems to be in Heiðar, tuff is dominating but there is also some breccia. The layers seem to strike NE with a dip 2-3° NW. Overlying this is a discordant younger rock in the southern slope. It is equally breccia and tuff and 2 sills of grey basalt have been found here. These layers dip similar to the present surface slope.

Much later after the formation of this rock extensive alterations took place due to hydro thermal action, it is most intensive when bordering fissures and bedding contacts. In some places the rock has been completely turned into clay. Figs. 1.08 - 1.09 illustrate distinctly this connection between fissures and hydro thermal alterations, it can furthermore be seen that a fault has occurred at this fissure. The dislocation seems to be approximately 15-20 m. Miðkambur seems to be formed by an eruption in the continuity of this fissure. At profiles 1.08 - 1.09 the eastern wall of this fault is eroded down to the same level as the western wall, but at the mouth of Hlaupandi the eastern wall is still 10-15 m higher.

A fissure is also in the vicinity of drillholes 9, 10, 11 and 12 to the west. The fissure, or weakened zone in the rock of its continuity, extends perhaps down to the mouth of Hlaupandi. Some dislocation has occurred at the central part of the fissure, but its limits are uncertain or if the related dislocation is everywhere on the same side. Alterations bordering this fissure are not as great as in the continuity of Miðkambar but are more extensive. A probable explanation is that to the south of Kambar chemically active hydro thermal solutions have caused the alterations as results of the eruptions which formed Kambar. The alteration has been rapid but intensive. But at the fissure through Heiðar the alteration has been caused by hot water, the hydro thermal action has been of long duration but not intensive. In one place the hot water has reached the surface of the bedrock, deposited geyserite (siliceous sinter) and consolidated the overlying sand. This has happened in the vicinity of drillhole 11.

This hydro thermal action has now mostly ceased, one thermal spring is said to be east of Laugarás but last summer when I visited it, it was dry. But 10-14,000 years ago the hydro thermal action has been in its prime at Heiðar, as the consolidated sand and the geyserite in drillhole 11 proves, which must be formed after the deglaciation of Hestfjall.

The Kiðjaberg formation is a competent rock, impervious and rather hard, where it has not been effected by hydro thermal action, but where so the rock is considerably weakened in fissures and bedding contacts. There the fillings in the joints and fissures are partly clay formed by hydro thermal action. At a water pressure which the fillings withstand, the rock is rather impervious but when they wash out it becomes highly pervious. It varies highly how much water pressure the fillings can withstand but it can be assumed that in the vicinity of the main fissures it is 1-2 kg/cm^2 but farther away it is 2-3 kg/cm^2 or even more, re. fig. 1.23.

Unconfined pressure tests made of rock samples from the Kiðjaberg area gave the following results:

Hole No.	Formation	Depth m	Diameter of sample cm^2	Length of sample cm	Compression strength kg/cm^2	Remarks
28	Kambar	7.0	26.4	11.2	900	-
"	"	31.5	23.8	8.2	620	-
29	Kiðjaberg	14.0	22.8	10.2	307	Doubtful failure.
"	"	20.4	-	-	-	Hydrothermal altered sample which did not succeed in forming suitable cylinder for testing

Grey basalt from Hestfjall is on both sides of Heiðar as shown on fig. 1.05, it has previously been continuous but fissures and minor faults weakened the basalt cover to such an extent that during the last ice age it broke up by glacial erosion. The underlying Kiðjaberg formation was also effected by this erosion. The grey basalt is rather fine grained, bluish grey, in thin beds, numerous vesicles with small fillings and highly jointed.

Kambar formation is in Kambar, Laugarás and Vörðuás. On the surface Kambar are rather irregular, ridges consisting of palagonite rock of various varieties although mainly breccia. Laugarás is on the other hand more regular, the original loose surface rock is eroded and the surface consists now of bedded breccia and tuff which dip ca. 30° WNW.

The two drillholes which have been drilled in the Laugarás rock show that breccia alternates with tuff and basalt. The rock in Laugarás is hard and competent but fillings in vesicles and joints are small. The rock is easily distinguished from the Kiðjaberg formation by the colour which is blue or bluish grey while the Kiðjaberg formation is bluish green.

The rock in Kambar is probably incompetent in the upper part but it can be supposed that it is more competent further down. The rock in Laugarás is competent but rather pervious in the upper part.

Two drillholes are at the contacts of the Laugarás and Kiðjaberg formations, hole 23 at the Laugarás side of the contacts and hole 20 in the Kiðjaberg formation. There is some red clay and sand and the rock is fractured. The clay and the sand seem to have a limited extension, are consolidated and tight and have a fair core recovery in drilling. The permeability is not higher than in the upper part of Laugarás.

1.2.1.2 Soil and subsoil. Subsoil is mapped on fig. 1.05, where it is 2 m thick or more. The majority of the subsoil is formed at the end of ice age and consists mainly of shore deposits and deigulmór. Furthermore, Hlaupandi has formed a delta in a lake which was dammed up by Thjórsálava east of Kiðjaberg and which is now long ago silted up, but the river has now cut down a channel at the southern end of Kiðjaberg which has caused the surface of the old delta to lie 3 m above normal level of the river.

Shore deposits are of two kinds, gravel terraces in the slopes of Hestfjall and a bar between Vatnsheiði and Kambar. The gravel terraces are in two elevations as previously mentioned. The upper ones are thin and seem to consist only of open'work gravel. The lower ones are much thicker and the grain size of the material decreases as it gets further down. The lower terrace at Vatnsbotn is the most promising source of concrete aggregate at Hestfjall.

The subsoil is thickest in the bar. Fig. 1.06 shows the bedrock elevation in the Kiðjaberg area. It indicates that the subsoil in the bar is 10-15 m thick, which is mostly sand but in the southern part it is covered by a mantle of gravel, 1-2 m thick.

Near the bedrock the sand is often silty and there are even deigulmór in depressions. In drillhole 23 I have observed moraine beneath the gravel mantle. This moraine has probably been transported by icebergs which have stranded there.

Drillhole 20 west of Laugarás cut through some gravelly layer, which I think is originally ground moraine which has been deposited in a depression in the bedrock on the contacts of the Laugarás and Kiðjaberg formation. In the southern slope there is a thin layer of sand which is generally 1-2 m thick.

Hlaupandi runs through a depression in the bedrock which has been filled by deigulmór. Its thickness is usually unknown as the brook has not cut its channel down to the bottom of it except opposite the southern end of Litli Kambar. The depth of the Hlaupandi channel in the deigulmór is often 5-8 m. The deigulmór is usually covered by sand of 1-2 m thickness.

The soil in the Kiðjaberg area is of two kinds, loessy soil and peat. The loess is usually ca. 2 m thick and dominates in all higher elevations, e.g. in Heiðar. The peat is usually thicker than the loess, it is thickest in drillholes 19 and 20 where it is over 5 metres, but usually the thickness is 2-3 m. There is a bog in the southern slope between Laugarás and Kambar.

Samples were taken of the soil and subsoil and sent for investigation at the Geoteknisk Institut in Copenhagen. The samples were poor as they were all disturbed and those from more than 6-7 m depth are settled from wash water, which brought the sand to the surface. This method had to be used this time as no sampling apparatus is available here yet.

The results of the investigations of the Geoteknisk Institut is shown on fig. 1.151 - 1.156. Following is a table over these samples, drillholes and classification:

Sample no.	Drillhole	Depth m	Classification
1	12 b	0.5 - 0.7	loess
2	"	1.7 - 1.9	"
3	"	2.8 - 2.9	sand mixed with ferro humus
4	"	3.5 - 3.9	" " " " "
5	"	4.5 - 5.2	sand mixed with faint ferro humeous colour
6	12 c	0.5 - 0.6	loess
7	"	2.0 - 2.5	"
8	"	3.3 - 3.5	sand and gravel mixed with ferro humus
9	"	3.8 - 4.0	sand mixed with ferro humus
10	"	5.0 - 5.2	sand mixed with faint ferro humeous colour
11	"	6.0 - 6.4	sand and gravel
12	"	8.0 - 9.0	"
13	"	9.0 - 9.7	"
14	"	10.0 - 11.7	"

Sample no.	Drillhole	Depth m	Classification
15	Vatnsbotn	3.2 - 5.2	organic lake deposit
16	Bæjarvík	0.5 - 2.1	" " "
17	"	3.0 - 4.0	" " "
18	"	5.0 - 5.5	" " "
19	Súez	1.5 - 2.0	peat
20	"	3.5 - 4.1	"
21	"	5.2 - 6.0	sand
32	10	2.2	diatomeous earth
33	"	3.0	sand
70	29	1.9	gravel mixed with loess
71	"	2.1	sand and gravel coloured by ferro humus
72	"	2.2	gravel and sand
73	"	3.2	moraine
74	"	3.4	"
75	"	3.7	moraine, silty
76	"	4.2	"
77	"	5.2	moraine, sandy
78	"	7.0 - 7.5	sand
79	"	7.5 - 8.0	"
80	"	8.0 - 8.5	"
81	"	8.5 - 9.0	"
82	"	9.0	sand, coarse

1.2.1.3 Structures. Two main alternatives have been discussed for the water conductors of this power plant. Firstly, head race canal across Heiðar and power house either at the northern or southern end of Efri Laugarás; secondly, power house near Vatnshamar and tail race canal through Kambar. No special investigations have been carried out along that route.

Fig. 1.131 shows a long profile of head race canal and power house according to alternative 1 A. The structures cut through the following layers :

1) Soil, at higher elevations loess, but in the southern slopes peat. The loess is usually less than 2 m thick but the peat 2-5 m. The peat is thickest at the site of the proposed power house. Fig. 1.153, sample 7, shows a gradation curve for loess.

2) Layer of gravel and sand is in the vicinity of the southern edge of Heiðar. It is 1-2 m thick. At the top the gravel is coloured by ferro humus and often mixed with loess which has been washed down to it. Fig. 1.155, samples 70, 71 and 72, shows gradation curves for this layer.

3) In drillhole 29 a 2 m thick moraine is beneath the gravel. It has a limited extension. Fig. 1.155 and 1.156, samples 73, 75 and 77, show gradation curves of the moraine. The layers now mentioned should not cause any difficulties in the construction.

4) Sand is far the thickest subsoil at the canal route, 5 - 10 m thick in Heiðar and still thicker down at Vatnsbotn. The deeper parts of the sand is mixed with some silt. Where the sand contacts the soil it is usually partly cemented by ferro humus. The thickness of the cemented layer varies, it is thin where the sand is fine but thicker where the sand is coarse. It seems to be over one metre where it is thickest. Beneath the cemented layer the sand is completely unconsolidated and nearly always beneath ground water table, re. fig. 1.07. This sand has a tendency to flow out in excavations cut through it. Near Vatnsbotn the canal is completely excavated in this sand and in the lake it has to be dug near the shore but further out it is covered by mud, which consists of organic, loessy and clay material. This mud is cohesive to some extent and therefore should not cause any difficulties. Gradation curves for the sand are illustrated in figs. 1.153, 1.154 and 1.156. Sample 8, mixed with loess, samples 10 and 11 with correct proportions and samples 12, 14, 78 and 80 from wash water and are probably lacking in silt, but the colour of the wash water indicates that silt existed in the lower parts of the sand.

Some permeability tests were carried out in the sand and gravel, which indicate that the sand has usually permeability coefficient of degree $k = 10^{-4}$ - $k = 10^{-3}$.

5) The bedrock in the canal route consists mainly of tuff and breccia of the Kiðjaberg formation. The canal also cuts through consolidated sand and the southern part of the Kambar formation in Laugarás. A fissure crosses the canal bottom in the vicinity of Vatnsbotn. This fissure must be highly pervious as it causes a local depression in ground water table near Vatnsbotn, re. fig. 1.07. Hot water which has issued from this fissure has consolidated some of the sand locally. It has furthermore altered the rock at bedding contacts far away from the fissure. This altered rock is in part of the canal bottom and even in its side-walls, as shown on fig. 1.131. The alteration can be so intensive that the rock will erode if it is unlined. This possibility diminishes as it gets further away from the fissure. Otherwise the palagonite rock of the Kiðjaberg formation is competent rock which can stand unlined in a steep slope. Leak is small except near the fissure and in some places near bedding contacts.

In the southern part the canal cuts the Laugarás rock. The contacts are probably rather dirty but as the canal cuts them perpendicularly they are only in a small part of it. Problems which could crop up there are similar to those at fissures and alternated bedding contacts. The rock in Laugarás is hard but where it is cut by the canal it is probably rather pervious. No altered rock is in Laugarás. Power house according to alternatives 1 A and 1 B will be situated in Laugarás rock, which is doubtless a competent foundation rock. It should be noted, however, that the surface beds in Laugarás dip ca. 30° towards proposed structures.

Therefore there can be some danger of slipping, especially as regards alternative 1 A. I hardly consider this a real problem as frequently no signs of joints parallel to bedding contacts are visible. Furthermore, it is not proved that the beds dip as much further down. This should be considerated in further investigations.

Tail-race canal cuts oblique the contacts of the Laugarás rock and Kiðjaberg formation according to alternative 1 A, where there is some gravel on top of the rock at the contacts. According to alternative 1 B the tail-race canal cuts the contacts at a very small angle. Therefore, one wall is Kiðjaberg formation, and the other is Laugarás rock, during the greater part of the route. The southern parts of the contacts are fairly competent rock according to our present knowledge. In the northern part, however, the contacts have not been investigated and more drillings are necessary if the power house is to be situated here. Fig. 1.132 shows a long profile of tail race canal and power house according to alternative 1 B.

Long profile through water conductors according to alternative II, is shown on fig. 1.14, accordingly the power house is situated at or near fissures and the direction of the tail race tunnel is at a small angle to fissures and Kambar. One can therefore expect incompetent rock during considerable parts of this route.

Hvítá has a $3^1/2$ m head between the proposed tail water and downstream Kiðjaberg. For the greater part of this route the river course is sand but a rock barrier at the southern end of Kiðjaberg controls the river elevation above, where the Thjórsá lava has dammed up a lake which is now silted up by sand and gravel.

It may be feasible to cut down the rock barrier after which the sand will erode automatically. In this connection it is necessary to investigate the extents of the sand which is most easily done with seismic survey.

1.2.2 The Árhraun area

1.2.2.1 Layers. Fig. 1.16 shows the surface layers at spillway site at Árhraun which are: a) bed-rock of pillow lava and palagonite rock; b) moraine and c) Thjórsá lava.

The right bank and one half of the river bed consists of pillow lava and palagonite tuff, which erodes more easily than lava. The river has therefore cut the deepest channel there. Both are very incompetent rocks with little or no core recovery in drilling and very pervious. The contacts between the pillow lava and the tuff seems to be most competent where the pillow lava seems to have consolidated the surface of the tuff. The consolidation in drillholes 26 and 27 is very thin but thicker in an islet in the river. The pillow lava has probably extended further east or perhaps to the edge of the slope of Hestfjall which was buried in lava when the Thjórsá lava flowed.

Moraine is above the palagonite rock in the northern part of the river bed at Árhraun. The moraine is hard as rock but probably reaches only the river bed as there is a deep channel close to the bank.

The Thjórsá lava, which is 8,000 years old, is 40 m thick at Århraun. It is porfyric basalt highly jointed and visicular in the upper part but the lower part is considerably more tight. In both drillholes, which were drilled through it, the lava is highly vesicular down to ca. 20 m depth, but at 15 m depth the core becomes less jointed. The permeability decreased also considerably at this depth. The lava seems to be tighter farther from the river.

Unconfined pressure tests made with rock samples from the Århraun area, gave the following results :

Hole No.	Rock	Depth m	Diameter of sample cm 2	Length of sample cm	Compression strength kg/cm2	Remarks
25	Thjórsá lava	37.4	23.7	10.4	1430	Circumference not complete
27	Pillow lava	6.0	23.1	9.8	1030	Homogeneous basalt from pillow lava

Fig. 1.17 is a profile of damsite showing the layers beneath the lava, which are very schematized at the lava border. Between the lava and the tuff there is probably talus; drillhole 24 was drilled through talus which extended from 40 m depth down to 58 m. At 54-58 m depth the silt content was so high, that the drillhole did not cave in. Probably the contacts between deigulmór, talus and sand are diffused and mixed. Otherwise sand is beneath the lava, originally river sand. Its thickness in drillhole 25 is 5 m. The sand and the talus were permeability tested by the same method as rock which gave the result that the permeability decreased downwards. But figures on the permeability of these layers, according to these tests, must be taken with great care, as the drillholes in the sand always caved in and the area or the length of the tested section was never known.

Beneath the sand is deigulmór but underlying the latter is siltstone, bluish grey in colour, which I consider is the same as appears beneath the tuff formation at the foot of Hestfjall in its southern part. But here it is ca. 70 m lower. This difference in elevation is at least partly caused by the faults which limit Hestfjall to the east as shown on fig. 1.04. Probably there are some parallel faults, one of them is visible in a steep slope 20-30 m high with fault direction few hundred m from the eastern edge of the mountain. Other possible locations are at the present edge of the mountain and beneath the contacts between the Thjórsá lava and Hestfjall in the river.

1.2.2.2 <u>The Århraun dam.</u> Fig. 1.17 shows a profile of the damsite. As yet the contacts between the lava and the slope have not been investigated and this profile shows therefore only one of many possibilities, which however I consider most likely. Another possibility is that no talus is at the uppermost part of the contacts, then they are steeper than shown on the fig. The palagonite rock has been steeper than angle of repose. Then one can expect small caves in the contacts only partly filled with lava. It is also possible that a fault is beneath the contacts which however does not exclude other possibilities but it might be that the fault is still active and a movement could take place with dangerous results for the dam. But there are no indications that a fault has been active here since the Thjórsá lava flowed and therefore hardly reason to fear a movement although a fault could be localized.

The contacts are however the main problem at the damsite. They are highly pervious and if the talus reaches the river bed or close to it there will be a danger of piping.

At the selected damsite the groove in the river bed is unusually small and therefore the talus should be thin or absent. The palagonite rock is also relatively strong as at this location there is a ridge across the river which has withstood erosion better than the palagonite rock, upstream and downstream. But it is also possible that the groove in the river at Árhraun is not eroded in palagonite rock but in talus. In both cases the conclusion is that the selected damsite is the best available at Árhraun.

1.2.3 The District Skeið

Thjórsá lava is beneath the greater part of Skeið, where Thjórsá and Hvítá have deposited sand and silt and thus levelled the surface and turned it into a fertile agricultural district. It is everywhere low and level and ground-water stands usually quite high as the surface is only few meters above the water level of Thjórsá and Hvítá; it is mainly the latter which drains the ground water.

G. Kjartansson states in a report from 1949 that the lava edge is at Bauluós and continues to the southern end of Vörðufell as shown on fig. 1.01. Certainly there is an edge in the lava at Bauluós and no signs of lava north of it. There are only banks consisting of thick layers of soil in the upper part, but peat in the lower part.

Single hillocks rise from the level plain, where all habitations are localized. I have only observed sand in the hillocks. But they are well covered by thick soil and vegetation which mostly hides the subsoil. Their origins are doubtful and there are two possible explanations :

a) Dunes formed of aeolian sand on the extensive silt and sand plain which was there when the lake north of Hestfjall was silted up.

b) The lava extended further west than is visible on the surface. Then the hillocks could be formed around lava vents or pseudocraters as aeolian sand covered the craters.

The ground water in Skeið drains off to Hvítá through Bauluós and the lava at Árhraun and further south. A spillway elevation of 49.5 m above sea level would cause some increase in the water level at Bauluós and the drainage path through the lava to Hvítá would become considerably longer and as consequence the ground water would rise. Fig. 1.17 shows the ground-water table as it was in the autumn 1960 at the spillway site and fig. 2-12 in the hydrological section illustrates ground water survey from Skeið.

These figs. show that the ground-water table slopes towards Hvítá at Árhraun by nearly 0.0025, but further away from the river the slope is much less and extends both towards the river and the south and approximately equal in both directions.

The elevation of the ground-water table is usually above 50 m north of the spillway site. A dam would cause a part of the water which now drains off to the river north of the spillway site to drain off to the south. But it is a 4-5 km wide area which can drain the ground-water towards south, therefore a rise in ground-water elevation would not be considerable with a spillway elevation of 49.5 m above sea level or even little higher.

A rockfill wall is proposed at Útverkatungur to direct the stream flow from the left bank towards the mouth of the diversion canal. At its site the left bank is 2 m high and consists of peat and loessy soil.

The first 20-30 m of the river bed is peat, then it deepens abruptly with the deepest channel immediately at this spot. Everywhere else the river bed is sand.

Some silt must be beneath the peat as it reaches considerably below the ancient lake surface, which has hardly been lower than 49-50 m above sea level when it was silted up by Hvítá. Beneath the peat there must be subsoil which has been compressed. There is hardly a danger that the rockfill wall will subsidize as the silt has already consolidated to some extent and its height is only a little above the highest sandbanks. On the other hand if it is constructed previous to damming the stream flow might possibly be able to bury the wall in sand but hardly after damming when the stream velocity decreases.

1.2.4 The Vatnsnes Area and the Diversion Canal

Fig. 1.18 is a geological map of the Vatnsnes area showing that the bedrock forms a ridge perpendicular to the canal route east of Bæjarvík. This ridge belongs to the Kambar formation and consists of bluish breccia and tuff. The bedrock is covered by deigulmór which in its turn is covered by gravel. The thickness of the deigulmór increases towards the lake which is caused by the ridge which sheltered the deigulmór from marine erosion when the shoreline was at this elevation, the gravel is shore formation from the same period.

The ridge has a steep slope towards east as only 300 m from the edge the bedrock is at 40-60 m depth according to a seismic survey by G. Pálmason. The bedrock is here covered by lake deposits and probably some deigulmór. The peat which has covered these deposits has compressed them in the same manner as described for the left bank. But here the compression has been more intense which indicates that the silt is thicker here. In the river bed peat is buried beneath the sandbanks. The river has probably eroded and buried this peat in later centuries.

In drillhole Suez the lake deposit under the peat was sand (re. fig. 1.154, sample 21). This sand rose in the drillhole when the drilling passed through the peat, which is 5.2 m thick. It can therefore be assumed from these two facts, i.e. the compression and the quicksand condition, that the lake deposits are very loose and highly inclined to liquefaction.

It is intended to cut the canal through the peat and partly into the lake deposits. It is likely that the sand will flow into the canal until the peat banks have subsided enough to stop the flow. Doubtless it will cause considerable stress in the peat layer but if the spoil is placed on the banks it can cause failure in the peat. If the canal is not cut through the peat layer a danger of failure is not likely.

Another reason why the canal should not be cut so deep, but made wider, is the bedload transportation of Hvítá. But its effect on the canal will be discussed in another section (3).

1.2.5 Hamrar and Slauka

No structures are intended at Hamrar and Slauka but G. Pálmason has made a seismic survey of bedrock depth, illustrated on fig.1.20, which is passing to include in this report.

In this area the bedrock consists of palagonite rock of the Kambar formation. It is a broken line of hillocks with thick subsoil on both sides.

The outlet of Hestvatn prior to Thjórsá lava has probably been where Slauka is now situated. There the surface topography of the bedrock is broken as indicated on fig. 1.20. It is caused by a buried chasm cut in the palagonite hillocks by the outlet of Hestvatn. Old Slauka has had a considerable slope and therefore a great erosive power.

It seems that the Thjórsá lava has caused a rise in the elevation of Hestvatn by ca. 10 m, which is indicated by the following:

a) Profiles at random perpendicular to the contour lines where deep water is close to the shore show that at a depth of 5-10 m the slope is less than at the shore or deeper, which indicate that the ancient shore terrace is near the 10 m contour.

b) East of Galtarhólmi is a curved ridge which could be an ancient recurved spit similar to present Kríutangi. Its top is in a 10 m depth.

c) Finally, the seismic survey of G. Pálmason indicates that the depth of the old Slauka chasm is at least 7-10 m.

From the above mentioned it seems that the rise in the elevation of Hestvatn caused by the Thjórsá lava has been somehow less than 10 m but yet nearly so.

1.3 Construction Materials

1.3.1 Investigation

At the following places samples were taken in search for construction materials.

Locations:				Samples, no.:
Gravel	terrace	at	Vatnsbotn	1, 2, 8, 9 and 10
"	"	"	Stekkjarhamar	3, 4 and 5
"	"		Efri Heiði	11 and 16
"	"	at	Vatnsnes	6
"	mine	"	Brjánsstaðir north of Hestvatn	7
"	terraces	"	Gíslastaðir	12, 13, 14 and 15

All the gravel terraces are ancient shorelines but the gravel mine at Brjánsstaðir is probably a part of an ancient outwash plain (sandur). The gravel terraces at Vatnsbotn and the Efri Heiði are at a slope consisting of grey basalt from Hestfjall. The gravel terrace at Stekkjarhamar is just below the contacts of palagonite rock and grey basalt. The gravel terrace at Vatnsnes is at a slope, which lower parts consist of palagonite rock with many basalt sills and dykes, but the upper parts consist of grey basalt. The gravel terraces at Gíslastaðir are situated in a steep slope, which upper part is grey basalt but the lower one is pillow lava.

1.3.2. The Result of the Investigations

The result of the investigations for concrete aggregate is that the most suitable deposit is at Vatnsbotn containing well graded material in considerable quantities and in a good situation near the main structures. Fig. 1.21 shows this deposit and a profiles which were made in the terrace by bulldozers. As indicated by figs. 1.221 - 1.223 the gravel content increases upwards. The deposit is more extensive than shown on fig. 1.21 but that which is outside this limit is probably of little value, - north of it as the deposit has become thin, but west and south of it because of too much sand content, and east of it as the material consists of poorly graded gravel and cobbles which has been infiltrated by loessy soil and humus acids.

The deposit is ca. 50,000 m^2 in size, whereof 18,000 m^2 are without soil cover.

On fig. 1.21 the deposit is divided into 3 belts according to particles size. The area with equal or higher sand content than sample 8 is 15,000 m^2 and it is probably possible to work a 5 m thick layer or 75,000 m^3. Area represented by sample 9 is 17,000 m^2 and I estimate it is at least 4 m thick or 70,000 m^3. Area with equal or higher gravel content than sample 10 is 18,000 m^2 and workable ca. 1-2 m thick layer or 25,000 m^3. Total workable deposit is therefore 170,000 m^3.

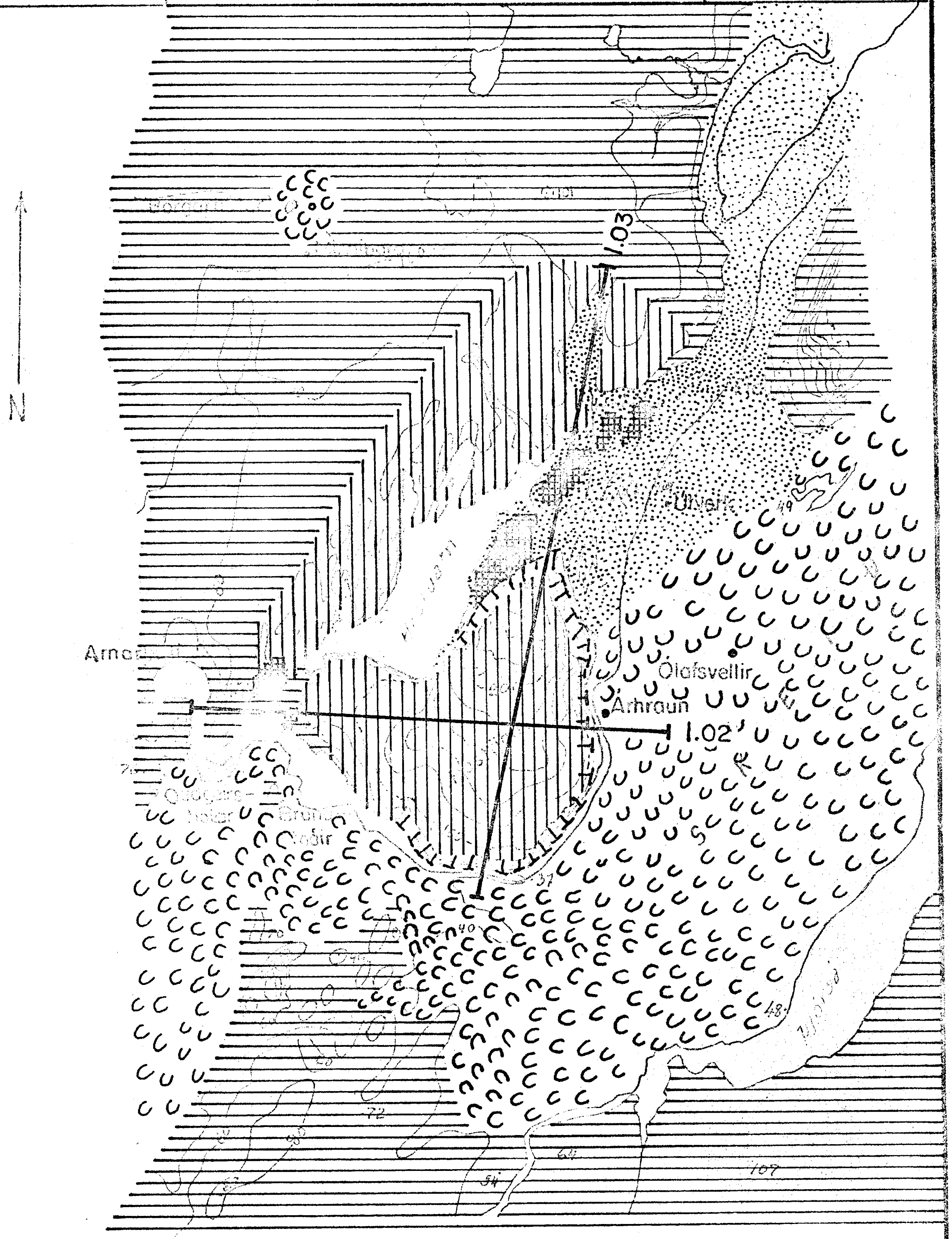
It is only gravel which could be lacking, but it could be obtained at Stekkjarhamar. Figs. 1.224 and 1.225 are gradation curves for the deposit at Stekkjarhamar. The sand consists partly of palagonite but the gravel could be used with sand and gravel from Vatnsbotn. The deposit is 13,000 m^2 and without soil cover. The average thickness is ca. 1 m, totalling 13,000 m^3, whereof ca. 7,000 m^3 is gravel.

Enormous quantities of gravel and cobbles are in Efri Heiði. But in the higher parts it is poorly graded and dirty because of loess and humus infiltration, in the lower parts it is well graded but the rock material is weak. Yet K. Eysteinsson of the University Research Institute considers that it could be used as a concrete aggregate but the deposit is scattered along the lower parts of Efri Heiði, and is in a thin layer often beneath soil cover, so it is not easily workable. Fig. 1.226 shows gradation curve for this material. The material in the higher parts is on the other hand usable as gravel lining in canals; fig. 1.227 is a gradation curve of this gravel.

At Gíslastaðir the result of the investigations was negative, chiefly because of weak rock material, and boulders and stones in the gravel terraces, the deposits are rather thin with a thick cover of dirty material.

The best concrete aggregate for the spillway would be at Vatnsbotn, but other possible places in the vicinity are at Vatnsnes (fig. 1.228) with a considerable quantity and at Murneyri by Thjórsá (fig. 1.229), with great quantities.

RAFORKUMÁLASTJÓRI Orkudeil Jarðfræðikort af Hestfjalli og nágrenni Geological map of Hestfjall and vicinity	1.2'61 HT/EÞ Tnr. 250 B-274 Fnr. 5313

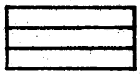


MYND 1,01

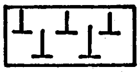
FIG. 1,01

Skýringar við mynd 1.01
Explanations to Fig. 1.01

Skýringar
Legend

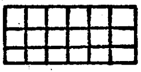


Hreppamyndun; móberg og grágrýti.
Hrepparformation; palagonite rock and gray basalt.

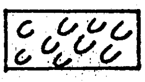


Tuffmyndun Hestfjalls; tuff, þursaberg og bólstraberg.
Tuffformation in Hestfjall; pillow lava, palagonite-tuff and breccia.

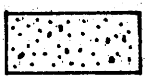
Grágrýtismyndun Hestfjalls.
Gray basalt formation in Hestfjall.



Kambamyndun; móberg og blágrýtisinnskot.
Kambarformation; palagonite rock and basalt sills.



Hraun, Þjórsárhraun suður og austur af Hestfjalli.
Lava, Þjórsálava, south and east of Hestfjall.



Vatnaset.
Lake deposits

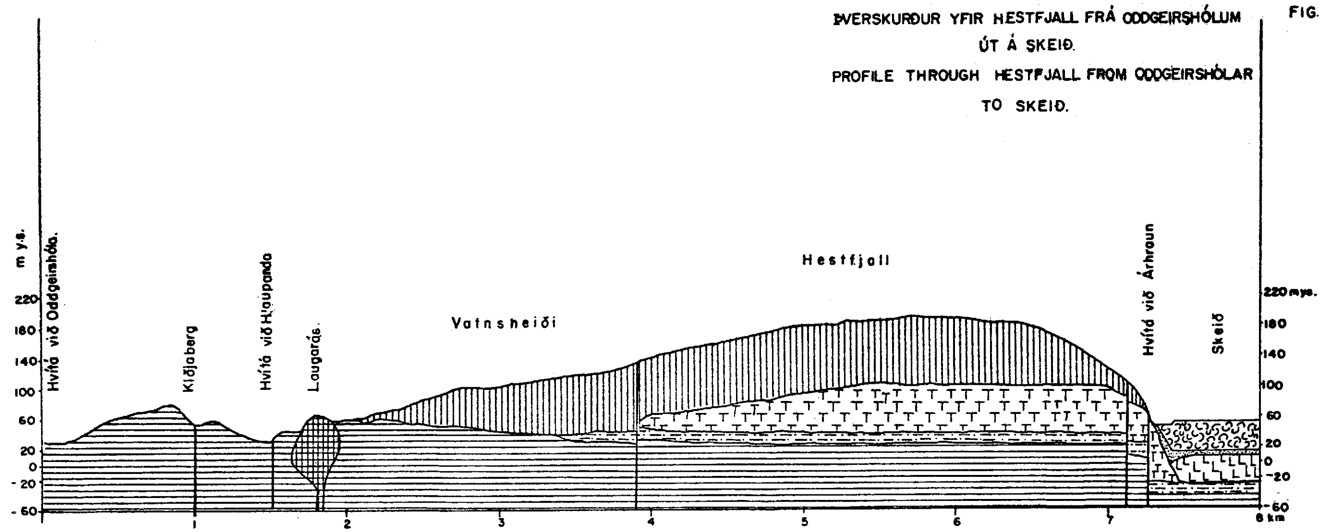
	RAFORKUMÁLASTJÓRI Orkudeild	T.2.'61 H.T./PJ
	Þverskurður yfir Hestfjall frá Oddgeirshólum út á Skeið.	TNR. 256
		B- 274
	Profile through Hestfjall from Oddgeirshólar to Skeið.	FNR. 5327

MYND 1.02

FIG. 1.02

ÞVERSKURÐUR YFIR HESTFJALL FRÁ ODDGEIRSHÓLUM ÚT Á SKEIÐ.

PROFILE THROUGH HESTFJALL FROM ODDGEIRSHÓLAR TO SKEIÐ.



Hreppamyndun; móberg og grágrýti
Hreppaformation; palagonite rock and gray basalt.

Setlög; sand- og leirsteinn
Sediment layer; sand- and siltstone.

Tuffmyndun Hestfjalls; lagskift tuff, bursaberg og bólstraberg
Tuff-formation in Hestfjall, palagonite breccia, pillow lava and bedded palagonite breccia.

Grágrýtismyndun Hestfjalls
Gray basalt formation in Hestfjall.

Þjórsárhraun
Þjórsálava.

Kambamyndun, móberg og blágrýti.
Kambar formation, palagonite rock and basalt.

Sandur og finna set, yngra en ísaldarlok
Sand and silt, postglacial.

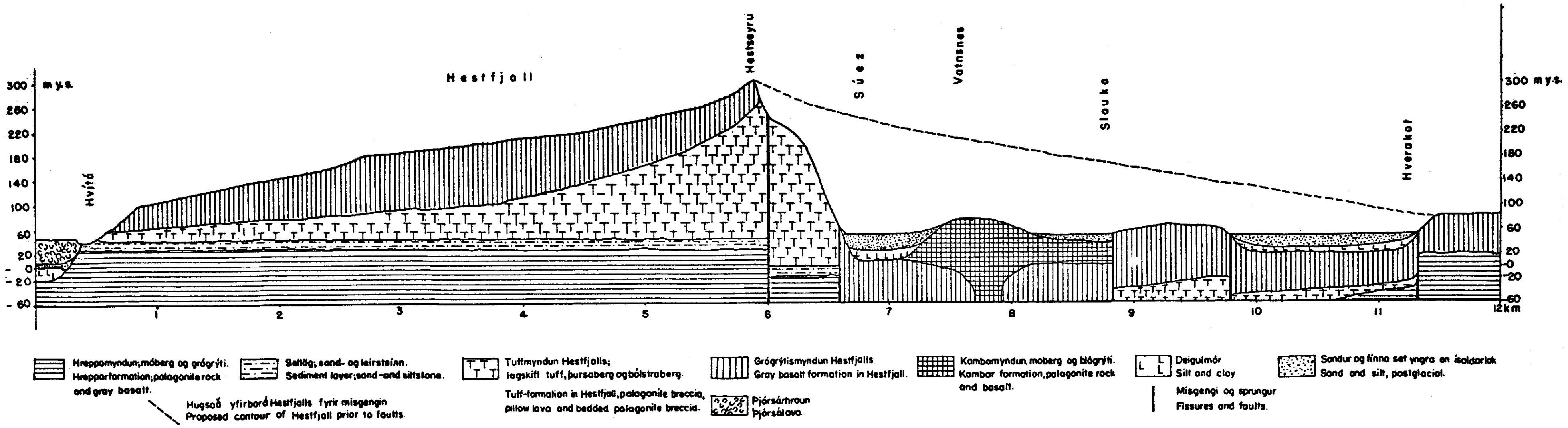
Deigulmór.
Silt and clay

Misgengi og sprungur
Fissures and faults.

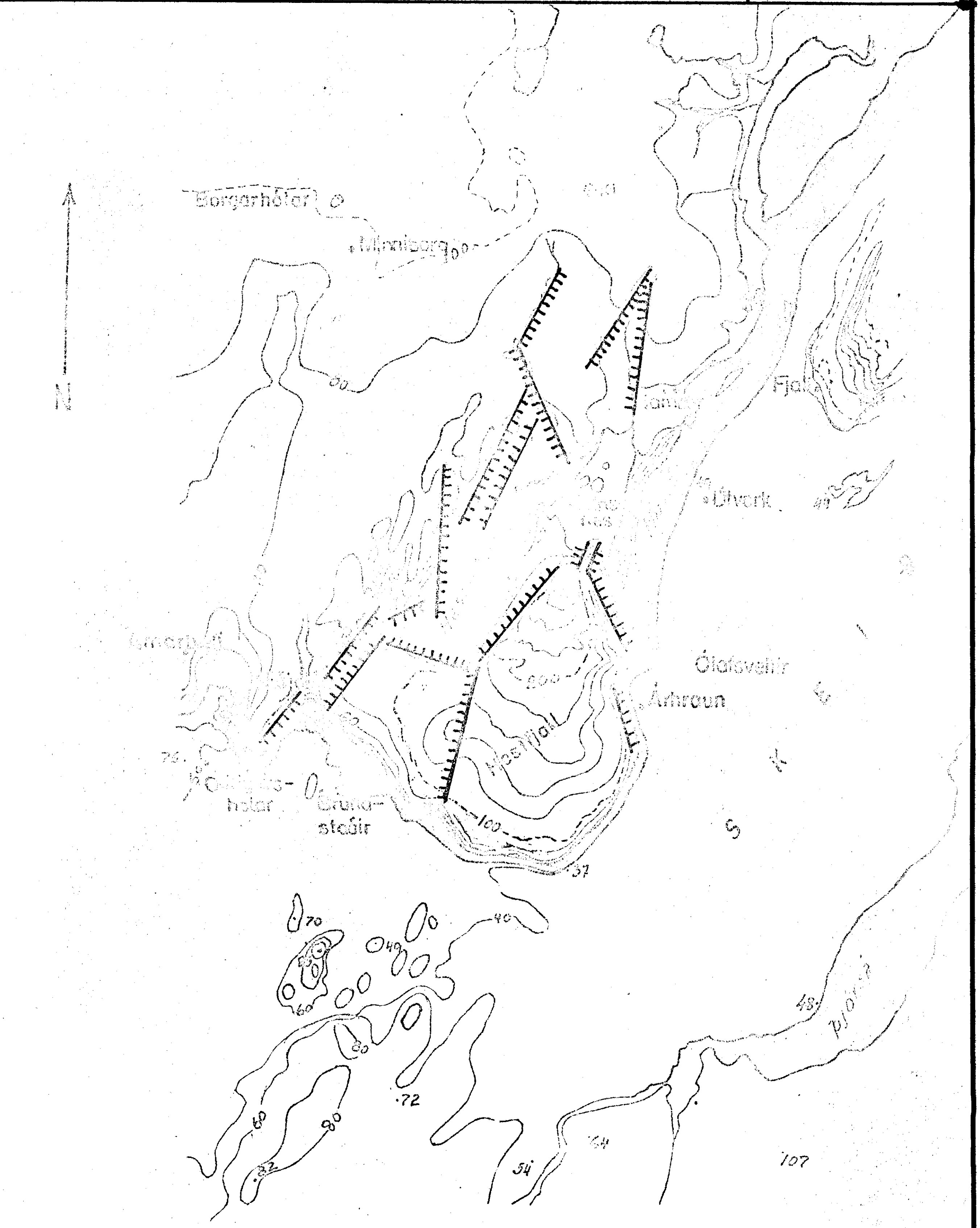
	RAFORKUMÁLASTJÓRI Orkudeild Þverskurður yfir Hestfjall frá Þjórsárhrauni í Flóa og Hverakoti Profile through Hestfjall from Þjórsálava in Flói to Hverakot	8.2.'61 H.T./PJ
		TNR. 257
		B– 274
		FNR. 5 3 2 8

MYND 1.03

FIG. 1.03

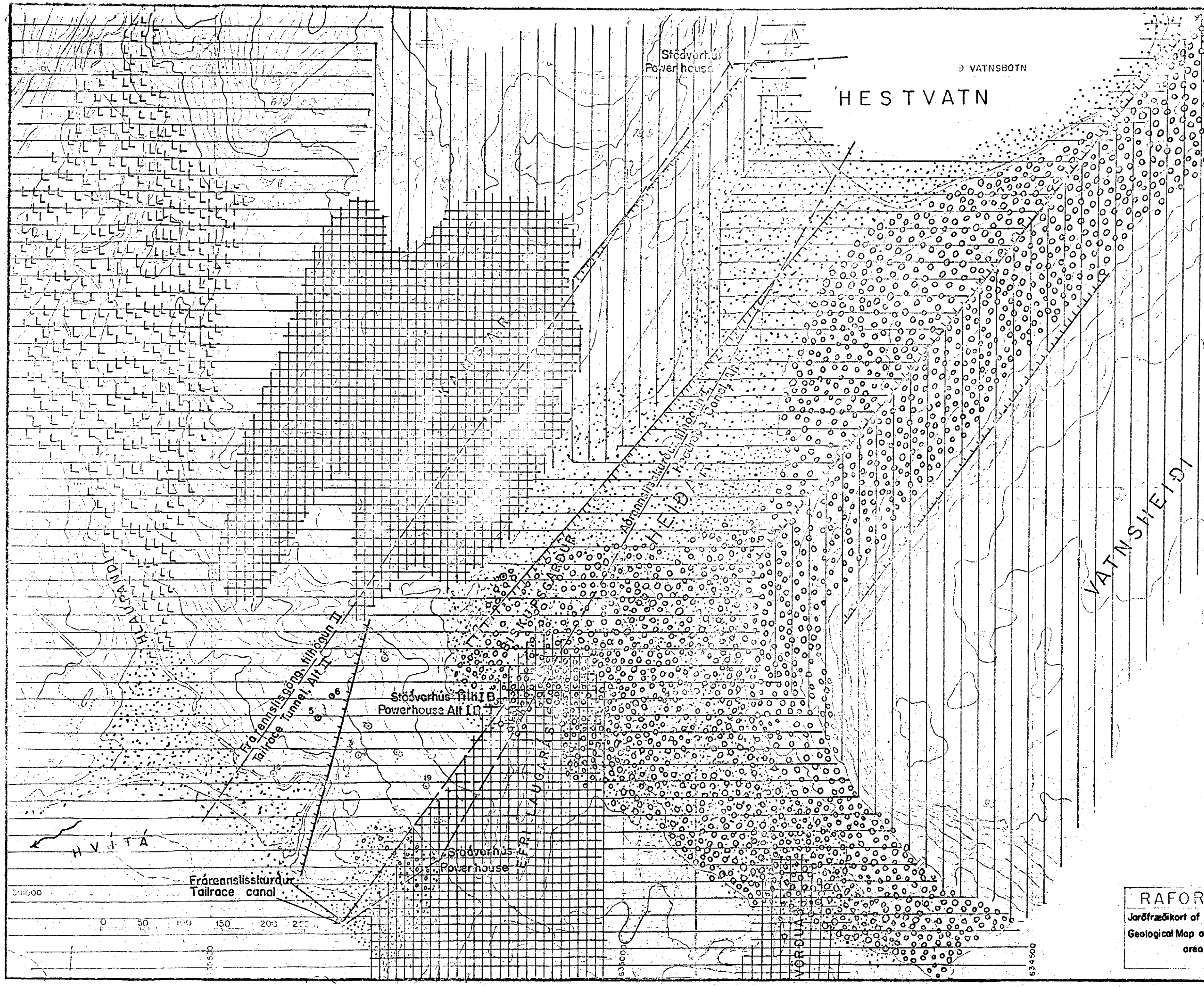


RAFORKUMÁLASTJÓRI	1.2'61 HT/EP
Sprungur og misgengi í Hestfjalli og nágrenni	Tnr. 251
Fissures and Faults in Hestfjall and vicinity	B-274
	Fnr. 5314



MYND 1,04

FIG 1,04



MYND I.05
FIG. I.05

RAFORKUMÁLASTJÓRI

Jarðfræðikort af Kiðjabergssv.
Geological Map of the Kiðjaberg area.

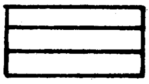
102'61 HT/PJ
261

FNR. 5334

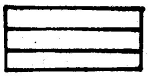
Skýringar við mynd 1.05
Explanations to Fig. 1.05

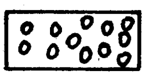
Skýringar
Legend

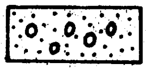
Kortið sýnir berggrunn og jarðgrunn þykkari en 2 m.
The map showes bedrock and subsoil where it is more than 2 m thick.

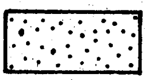

Kiðjabergsmyndun, aðallega móberg.
Kiðjabergformation, mostly palagonite rock.


Hestfjallsgrágrýti.
Gray basalt from Hestfjall.

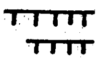

Kambamyndun; móberg og basaltinnskot.
Kambarformation; palagonite rock and basalt sills.

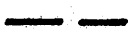

Malarhjallar, fornar strandlínur.
Gravel deposits, ancient shorelines.

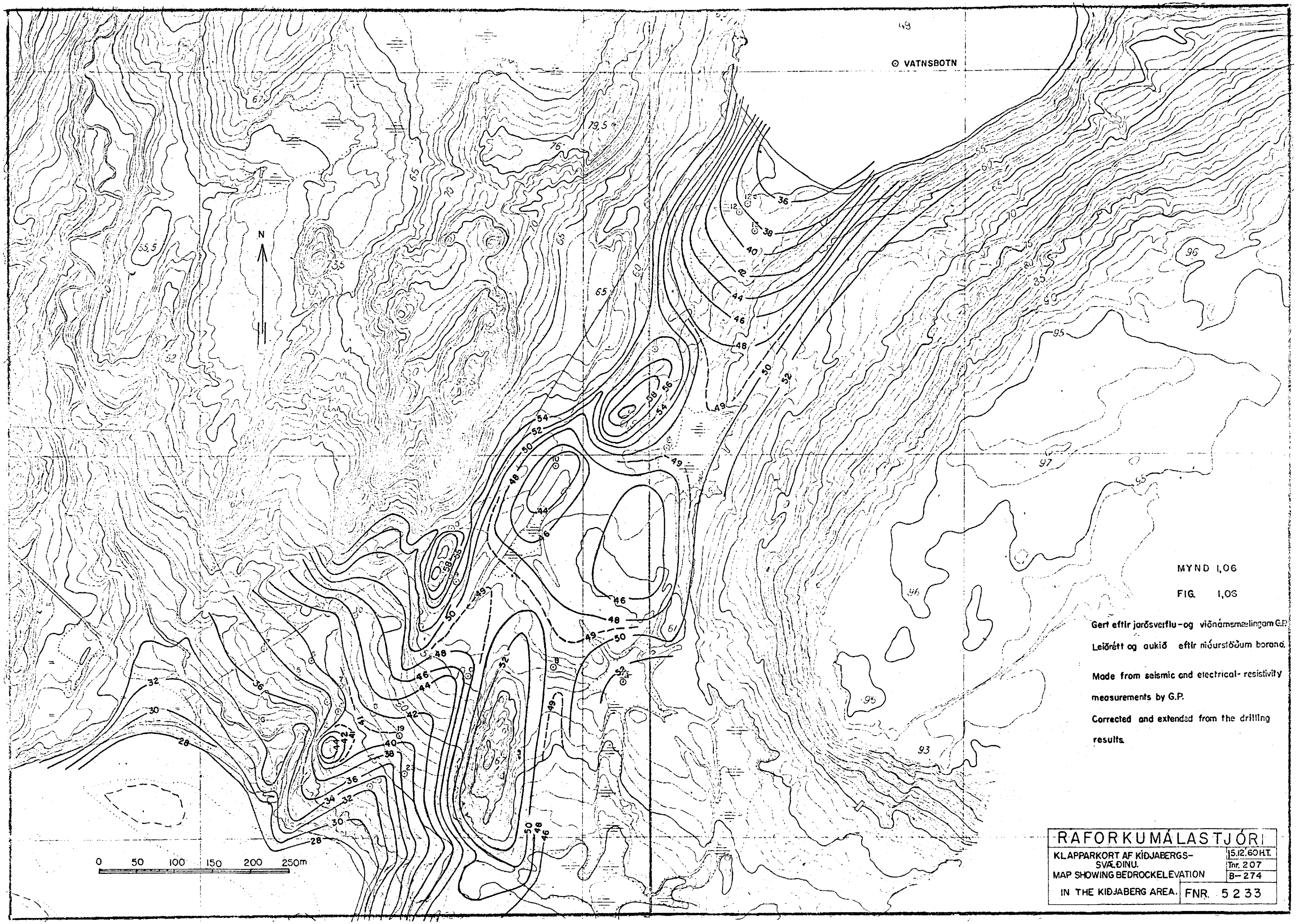

Möl og sandur, strandmyndun.
Gravel and sand; shore deposits.


Sandur; aðallega strandmyndanir og fornar óseyrar Hlaupandilæks.
Sand; mainly shore deposits and delta from Hlaupandi brook.


Deigulmór.
Silt and clay.


Sprungur og misgengi.
Fissures and faults.


Miðlína byggingarmannvirkja samkvæmt tveimur tilhögunum.
Central-line in hydrolic structures for two alternatives.



MYND 1,06

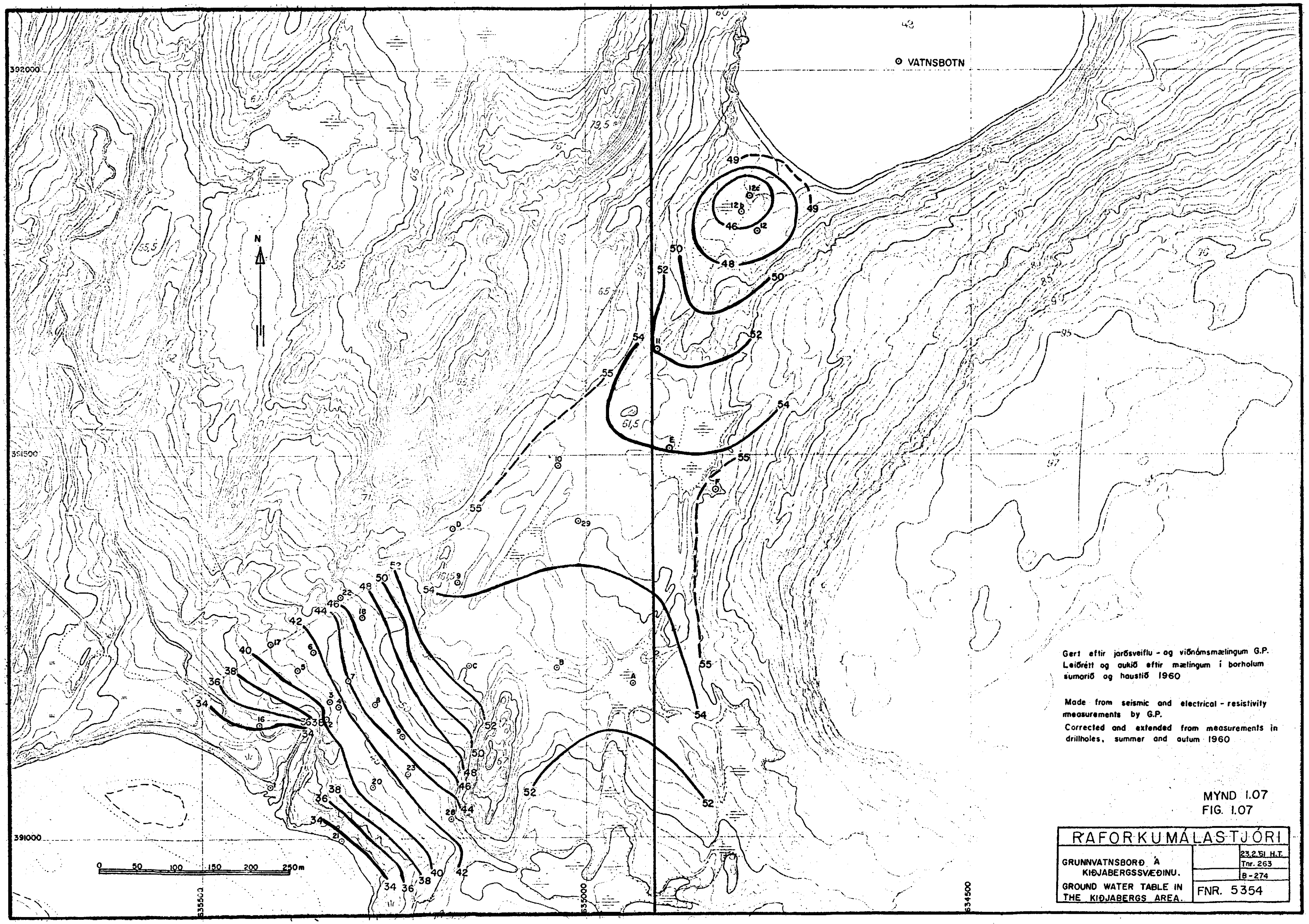
FIG. 1,06

Gert eftir jarðsveiflu- og viðnámsmælingum G.P.

Leiðrétt og aukið eftir niðurstöðum borana.

Made from seismic and electrical-resistivity measurements by G.P.

Corrected and extended from the drilling results.



MYND 1.07
FIG. 1.07

RAFORKUMÁLASTJÓRI	
GRUNNVATNSBORÐ Á KIÐJABERGSSVÆÐINU.	23.2.'61 H.T.
	Tnr. 263
	B-274
GROUND WATER TABLE IN THE KIÐJABERGS AREA.	FNR. 5354

	Skýringar við myndir 1.08-1.09-1.10-1.11-1.12-1.13 og 1.14 Explanations to Fig. 1.08-1.09-1.10-1.11-1.12-1.13 and 1.14	12.3.'61 HT/PJ TNR. 276 B- 274 FNR 5367

Skýring
Legend

Grágrýti
Gray basalt

Móberg, þursaberg
Palagonite, breccia

Móberg, tuff
Palagonite, tuff

Bólstraberg
Pillow lava

Berg umbreytt af jarðhita
Rock hydrothermal weathered

Kambamyndun í Laugarás, tuff, þursaberg og basalt
Kambarformation in Laugaras, Palagonite, tuff and breccia alternating with basalt

Sandsteinn
Sandstone

Sandur
Black Sand

Deigulmór
Silt and clay

Möl
Gravel

Morena
Moraine

Fok eða mór
Loess or Peat

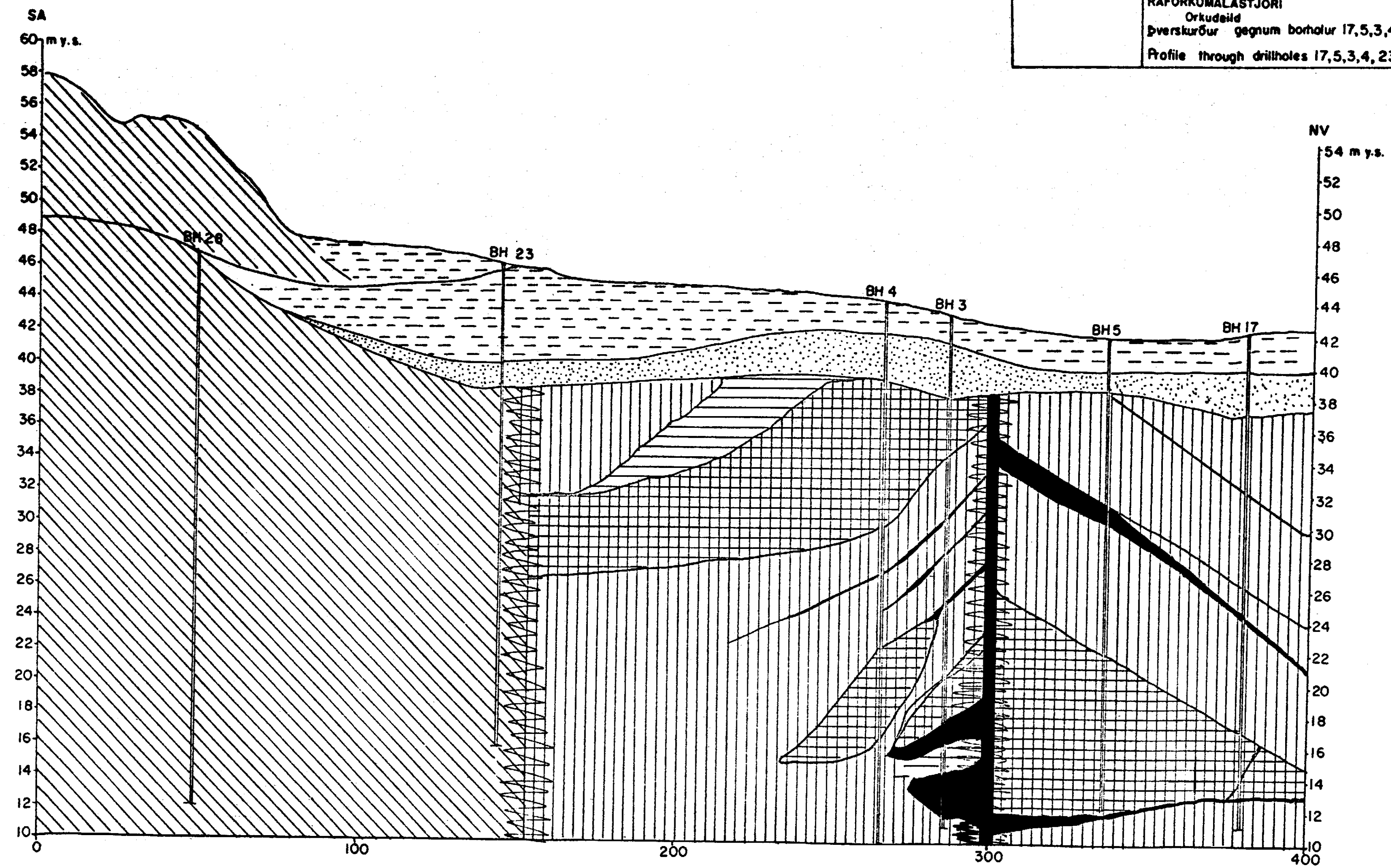
Misgengi
Fault

Óljós mörk
Diffuse contacts

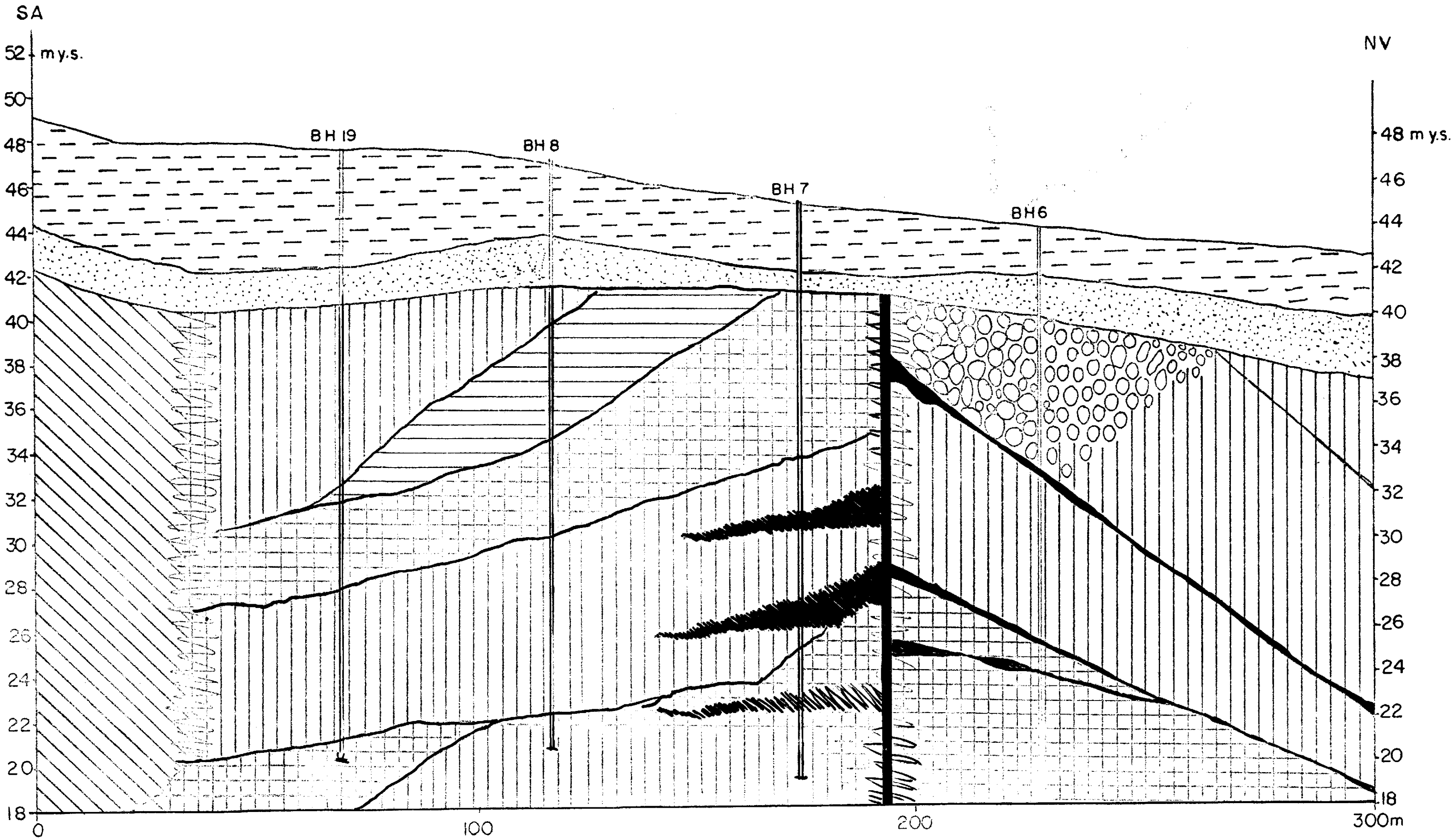
	RAFORKUMÁLASTJÓRI Orkudeild Þverskurður gegnum borholur 17,5,3,4,23 og 28	2.3.61 H.T./P.J.
		Tnr. 264
		B-274
	Profile through drillholes 17,5,3,4,23 and 28	Fnr. 5355

MYND 1.08

FIG. 1.08



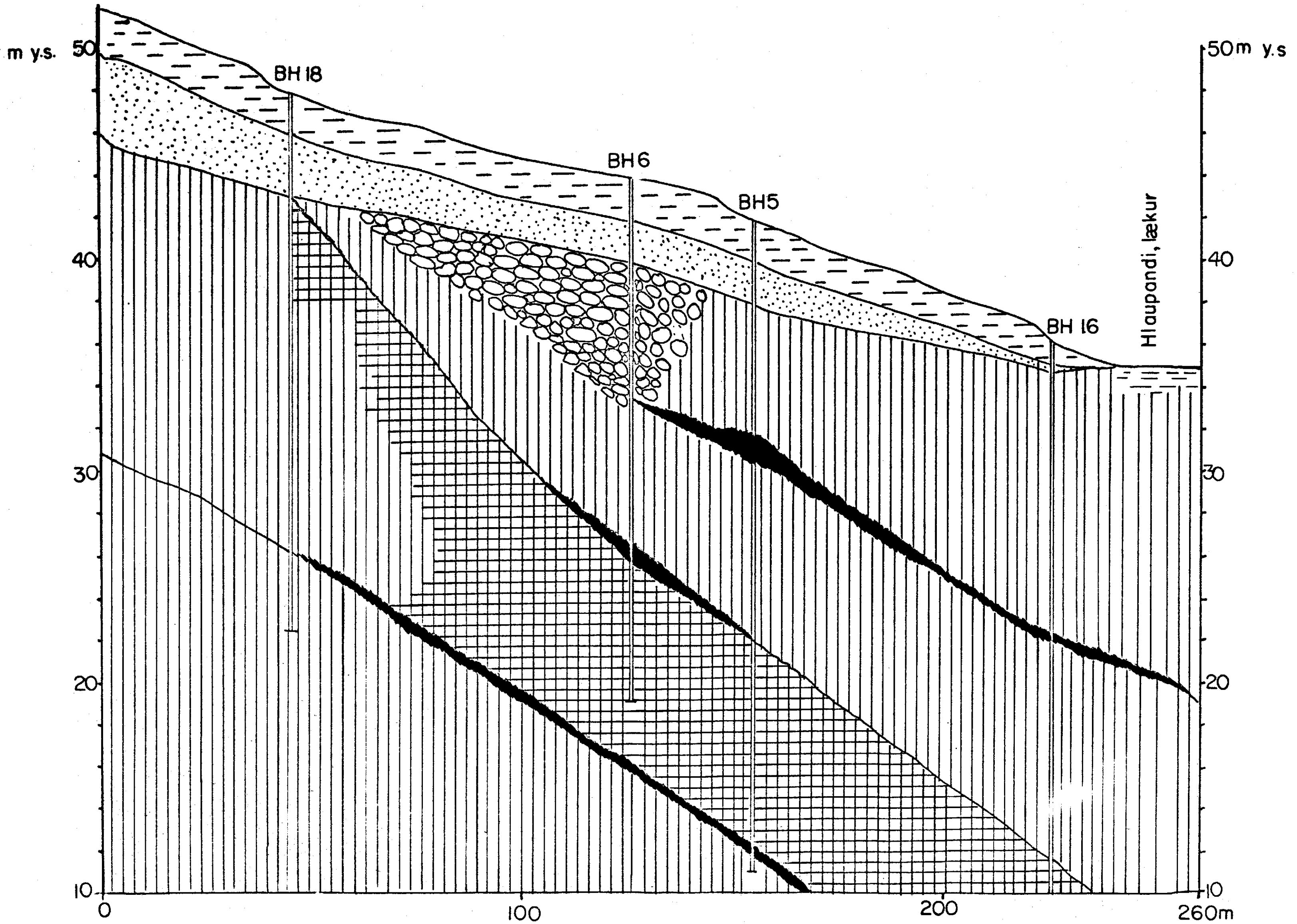
	RAFORKUMÁLASTJÓRI Orkudeild. Langskurður gegnum borholur 6, 7, 8 og 19. Long Profile through drillholes 6, 7, 8 and 19.	1.3.'61 HT / PJ TNR. 265 B — 274 FNR. 5356



MYND 1.09
FIG. 1.09

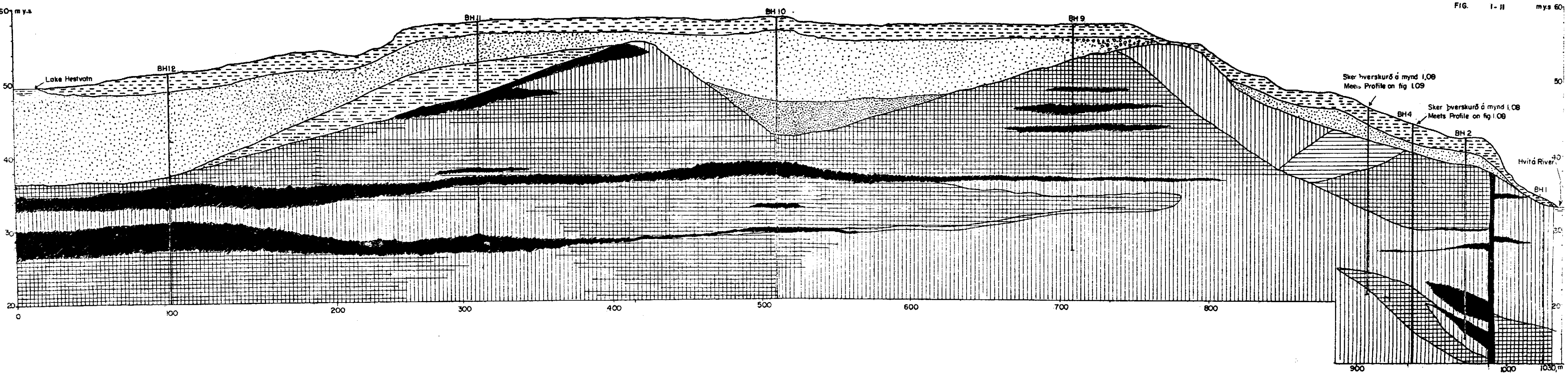
	RAFORKUMÁLASTJÓRI Orkudeild Langskurður gegnum borholur 16,5,6 og 18 Long Profile through drillholes 16,5,6 and 18.	1.3.'61 HT / PJ
		TNR. 266
		B– 274
		FNR. 5357

MYND 1.10
FIG. 1.10



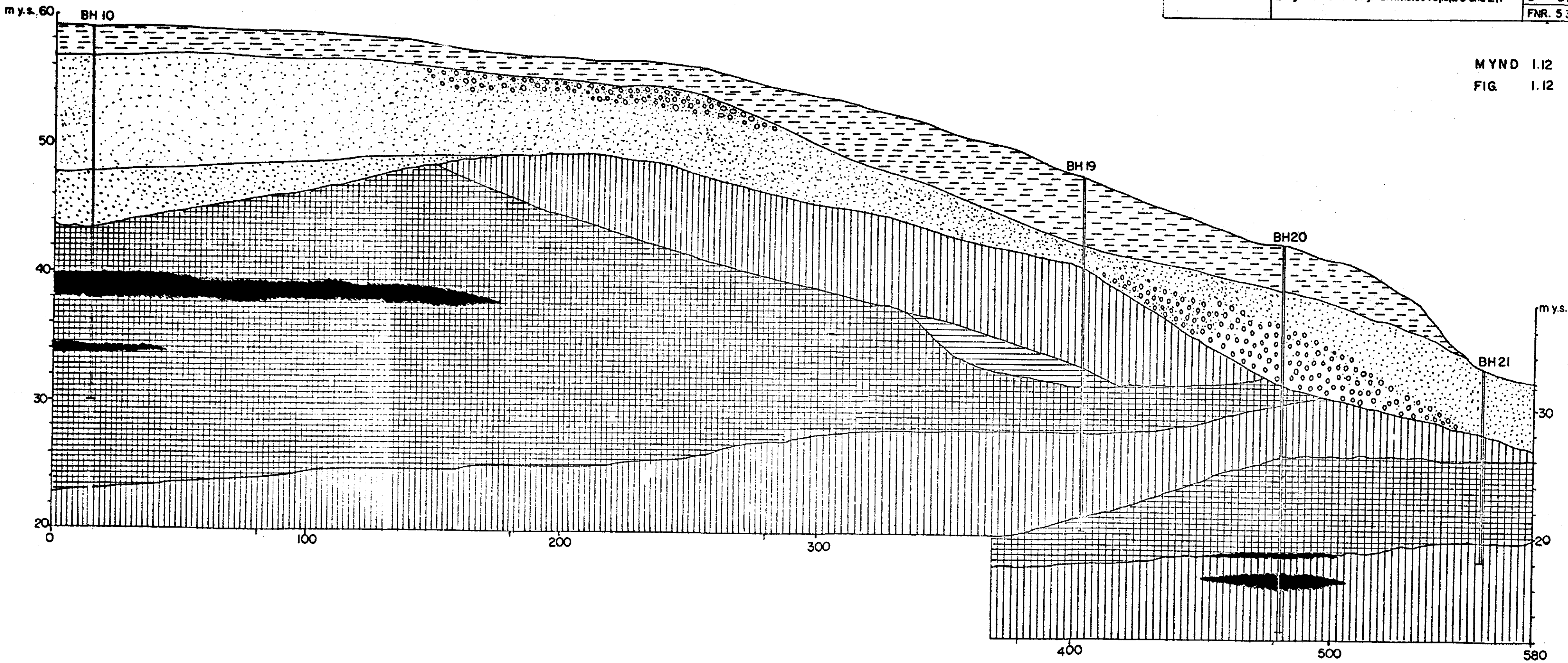
	RAFORKUMÁLASTJÓRI	1.3.'61 H.T. / P.J.
	Langskurður gegnum borholur 1,2,4,9,10,11 og 12	Tnr. 267
	Long Profile thr. drillholes 1,2,4,9,10,11 and 12	B-274
		Fnr. 5358

MYND 1,-11
FIG. 1-11



	RAFORKUMÁLASTJÓRI Orkudeild Langskurður í gegnum borholur 10, 19, 20 og 21. Long Profile through drillholes 10,19,20 and 21.	28.2.'61 HT/PJ TNR. 268 B— 274 FNR. 5359

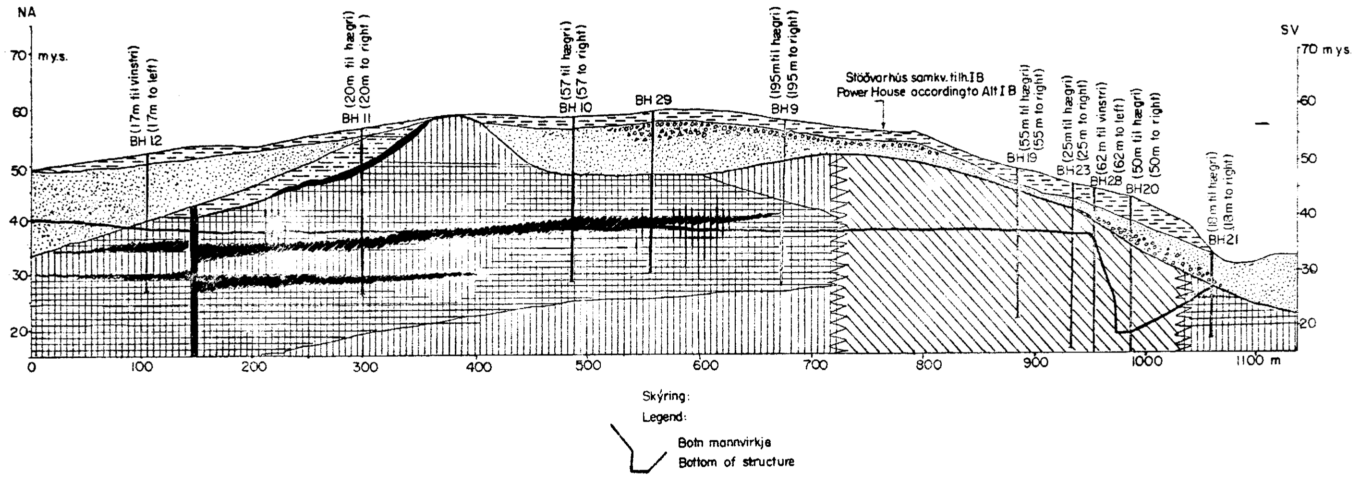
MYND 1.12
FIG. 1.12



	RAFORKUMÁLASTJÓRI Orkudeild Langskurður af skurðleið Tilhögun I A Long Profile through Canel route, alt I A	22 2'61 HT/PJ TNR. 269 B— 274 FNR-5360

MYND 1.131

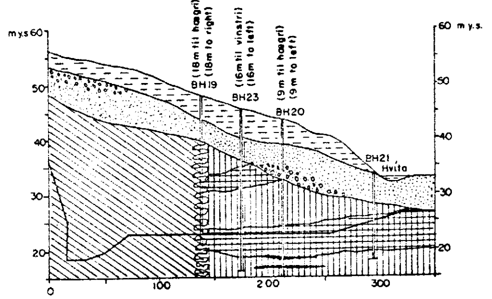
FIG. 1,131



	RAFORKUMÁLASTJÓRI Orkudeild Langskurður, stöðvarhús-frárennslisskurður. Tilh. I B Long Profile. Power house-Tailrace canal route Alt I B	23.2'61 HT/PJ TNR. 270 B— 274 FNR. 5361

MYND 1.132

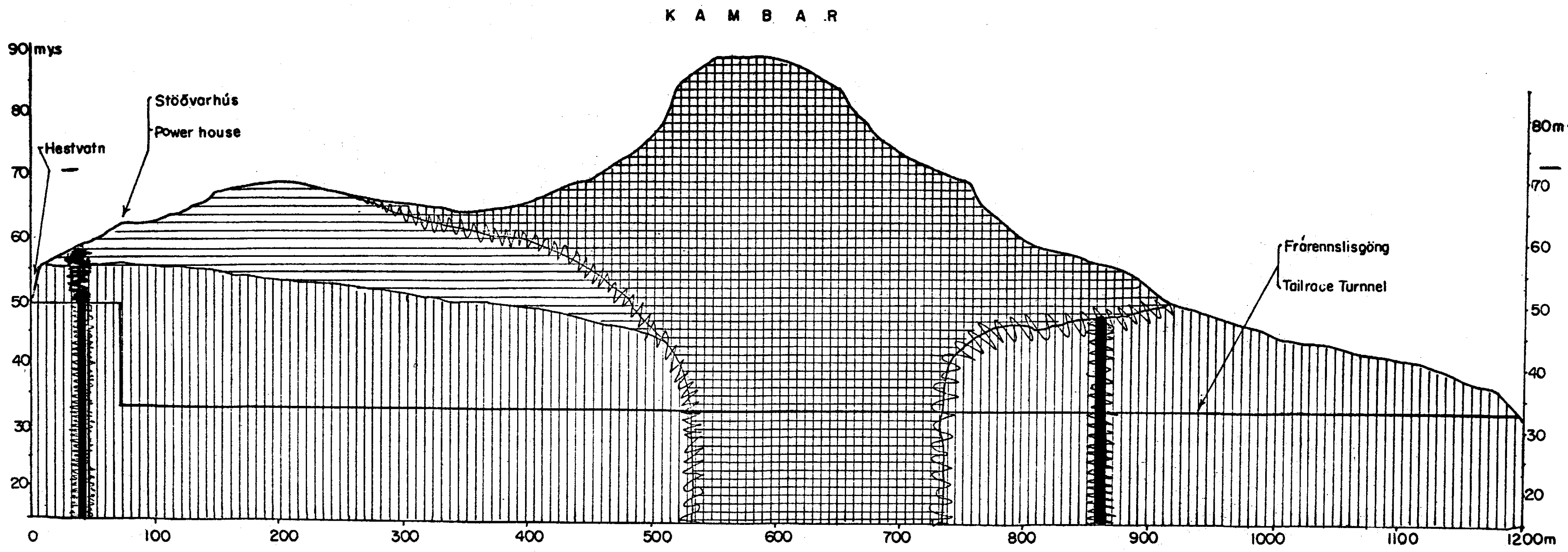
FIG. 1.132



	RAFORKUMÁLASTJÓRI	22.2.'61 H.T./P.J.
	Langskurður af jarðgangnaleið. Tilh. II.	TNR 271
	Long Profile through turnnelroute. Alt. II.	8 — 274
		FNR.5362

MYND 1.14

FIG. 1.14

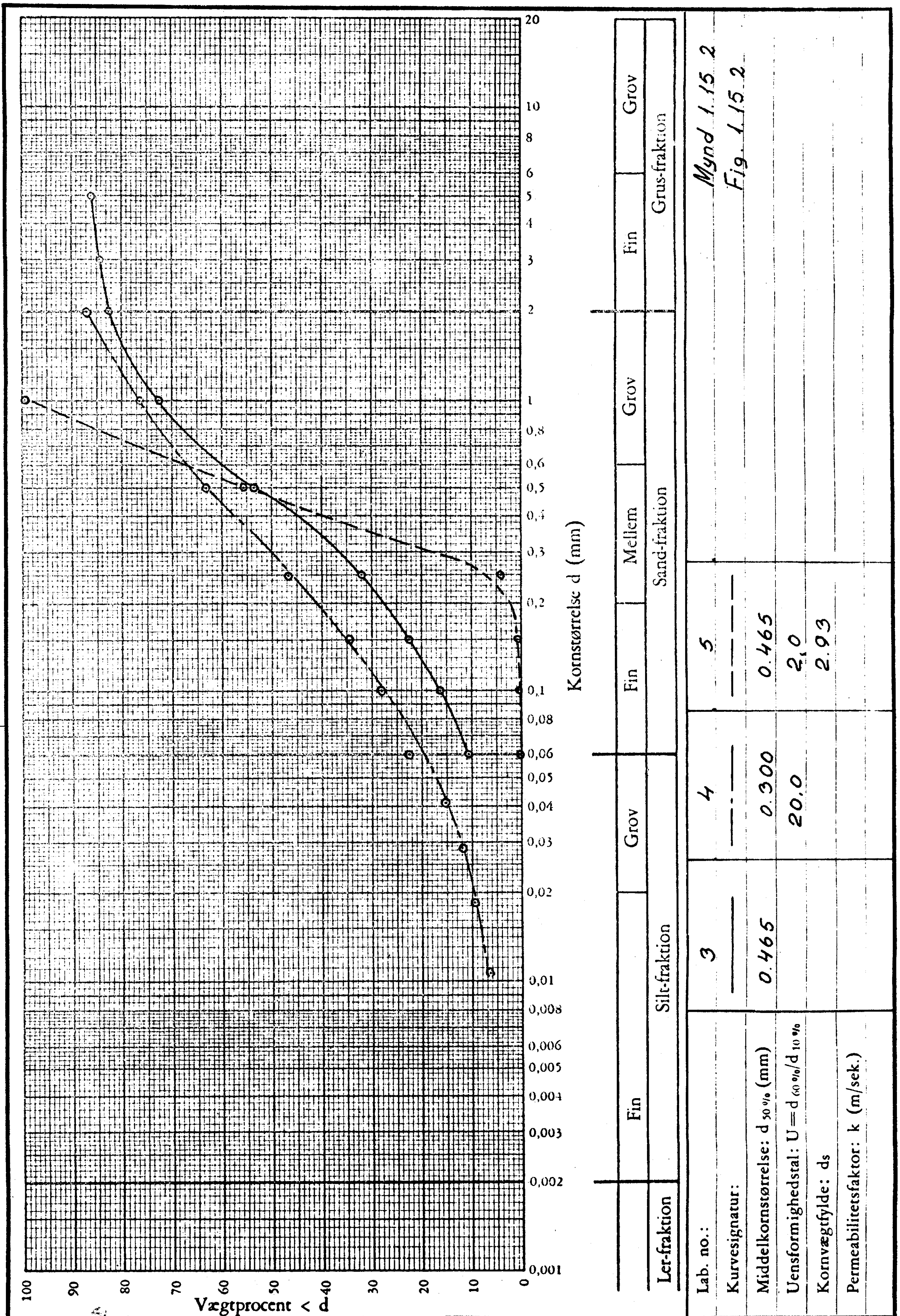


Prøve no. (S = skylleprøve)	Vandindhold w%	Glødetab gl	Kalkindhold ka	Kornvægtfylde d_s	Kornkurve: Middelkornstørrelse $d_{50\%}$ (mm)	Kornkurve: Uensformighedstal $U = \frac{d_{60\%}}{d_{10\%}}$	Kornkurve: Bilag no.	Kornform: Skarpkantet	Kornform: Middel	Kornform: Afrundet	Kornform: Rund
1	99	29,5	o,85								
2	197	46,1	o,31								
3					o,465		2			x	
4					o,300	2o,o	2			x	
5				2,93	o,465	2,o	2			x	
6	22,5										
7	1o5	13,7	o,36	2,68	o,115	14,7	3			x	
8					o,575	48,4	3			x	
9										x	
1o				3,o6	o,225		4			x	
11					1,49	9,o	4			x	
S 12							4			x	
S 13									x		
S 14				3,oo	o,183	3,9	4			x	
15	494	13,1	o,72								
16	189										
17	417	25,6	1,53								
18	188	23,6	1,5o								
19	658	51,6	o,9o								
2o	287	46,7	o,7o								
21				2,48	o,52o	5,7	4			x	
32	177	23,o	o,46								
33	52	11,9	o,oo								
7o	38				o,o4o	3,9	5		x		
71	16,1				o,228	3,6	5			x	
72				2,89	o,6oo	18,6	5			x	
73	17,8				o,3o5	7,1	5			x	
74										x	
75	6,3				o,225		6				
76										x	
77	9,3			2,97	o,274	3,1	6			x	
S 78					o,191	1,4	6		x		
S 79										x	
S 8o					o,296	2,4	6			x	
S 81									x		
S 82										x	

Mynd 1.15 1
Fig. 1.15 1

GEOTEKNISK INSTITUT			Laboratorieforsøg. Oversigt
Boring no.:	Dybde: m	Kote:	Sag: 6o227 Island
Forsøg: d.	Tegn.:	d.	
Kontr.: *AHN* d. *17-1 61*	Godk.:	d.	Lab. no.: Forsøg no.: Bilag no.: 1

A 4 GI 205 AGF 1826



GEOTEKNISK INSTITUT

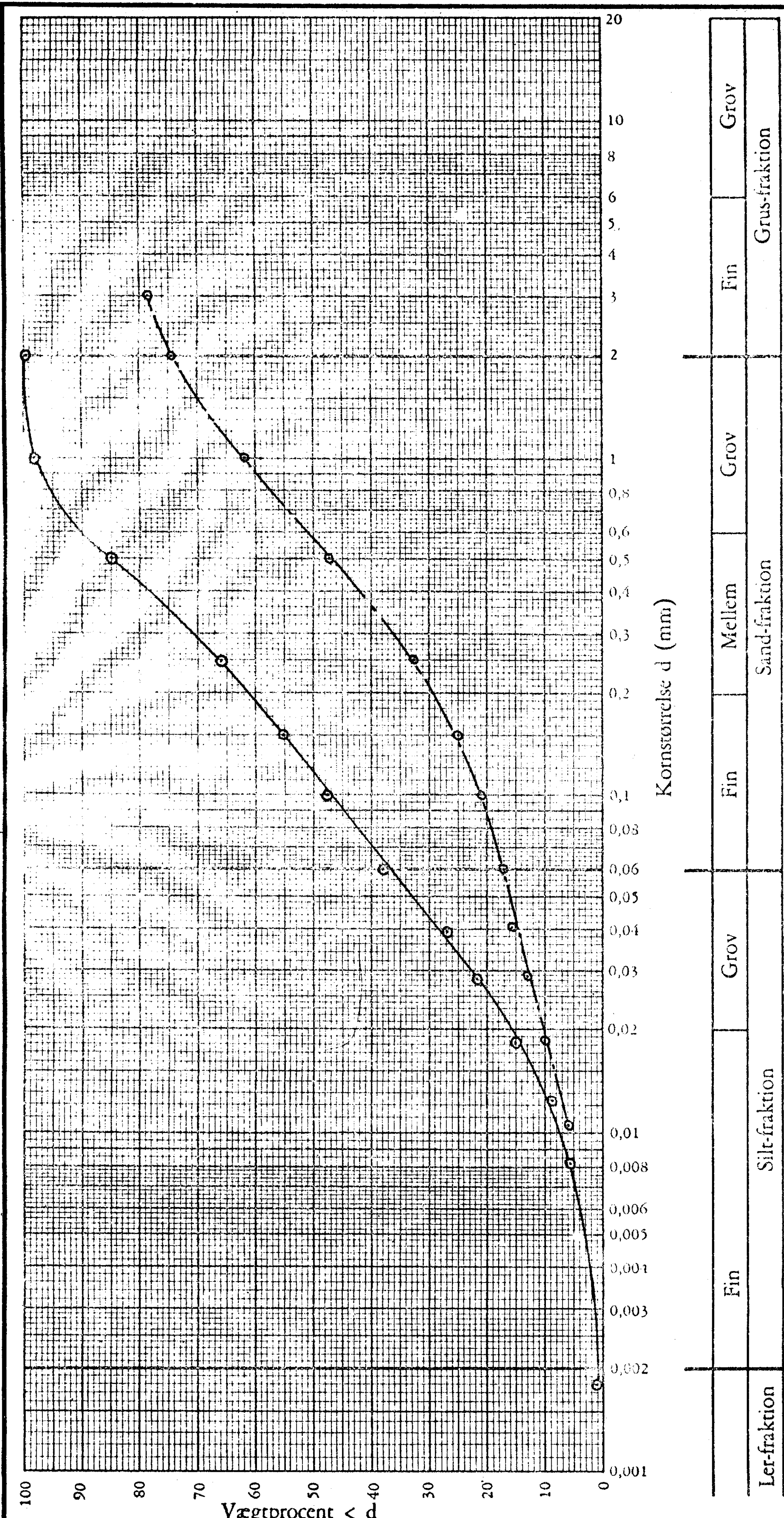
KORNKURVE

Boring no.:	Dybde: m	Kote:
Forsøg: d.	Tegn.: *HI*	d. *15-2-61*
Kontr.: d.	Godk.:	d.

Sag: *60227 ISLAND*

Lab. no.: *3-4-5* | Bilag no.:

A 4 GI 208 AGF 1880

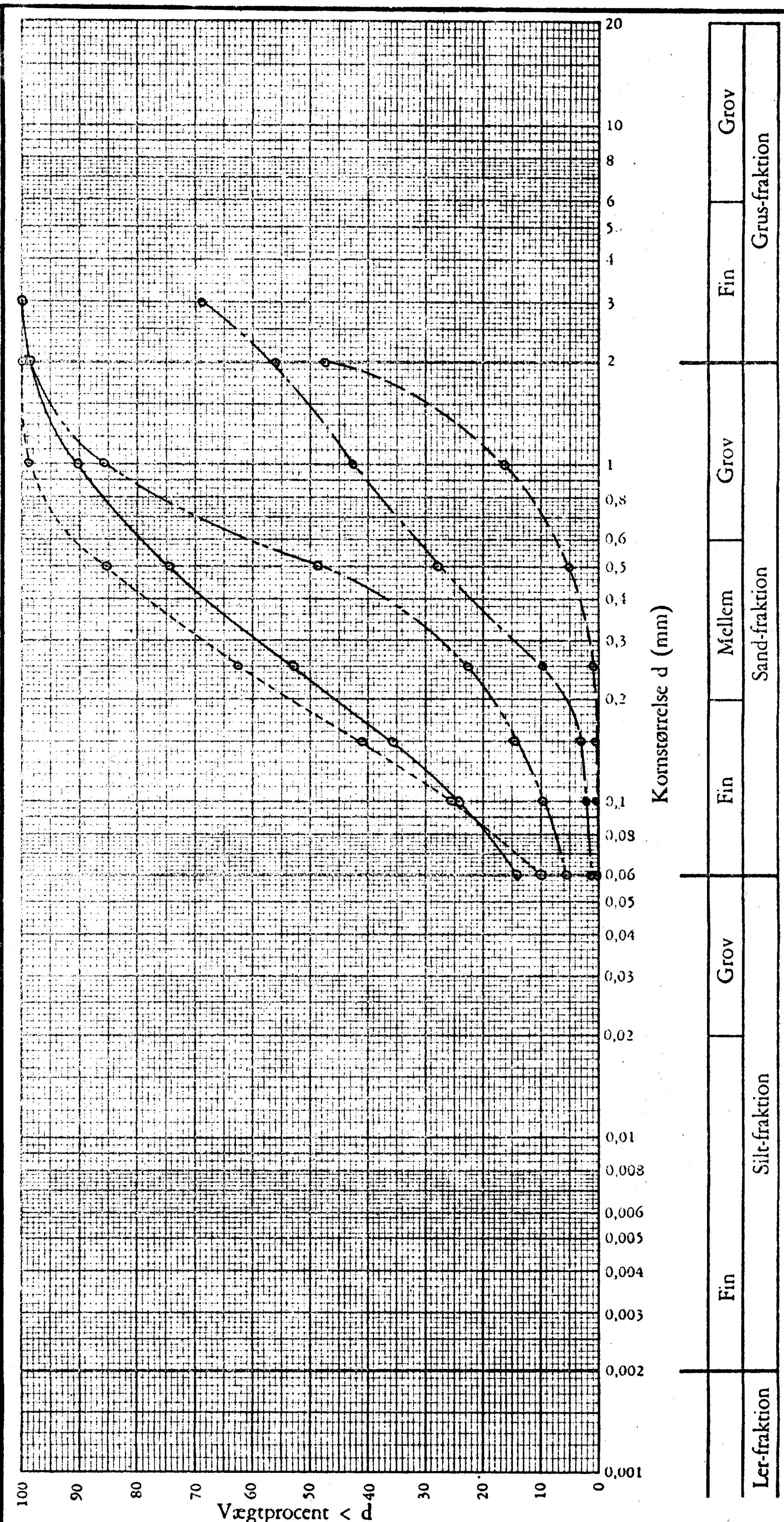


Mynd 1.15.3
Fig. 1.15.3

Lab. no.:	7	8
Kurvesignatur:	———	—·—
Middelkornstørrelse: $d_{50\%}$ (mm)	0.115	0.575
Uensformighedstal: $U = d_{60\%}/d_{10\%}$	14.7	48.4
Kornvægtfylde: d_s	2.68	
Permeabilitetsfaktor: k (m/sek.)		

GEOTEKNISK INSTITUT				KORNKURVE
Boring no.:	Dybde: m	Kote:		
Forsøg:	d.	Tegn.: IH	d. 15-2-61	Sag: 60227 ISLAND
Kontr.:	d.	Godk.:	d.	Lab. no.: 7-8 Bilag no.: 3

A 4 GI 208 AGF 1880



Mynd 1.15 4
Fig. 1.15 4

Lab. no.:	10	11	12	14	21
Kurvesignatur:	———	—·—·—	— — —	- - - - -	———
Middelkornstørrelse: $d_{50\%}$ (mm)	0.225	1.490		0.183	0.520
Uensformighedstal: $U = d_{60\%}/d_{10\%}$		9,0		3,9	5,7
Kornvægtfylde: d_s	3.06			3.00	2.47
Permeabilitetsfaktor: k (m/sek.)			Skylleprøve	Skylleprøve	

GEOTEKNISK INSTITUT

KORNKURVE

Boring no.:	Dybde: m	Kote:	
Forsøg:	d.	Tegn.: HI	d. 15-2-61
Kontr.:	d.	Godk.:	d.

Sag: 60227 ISLAND

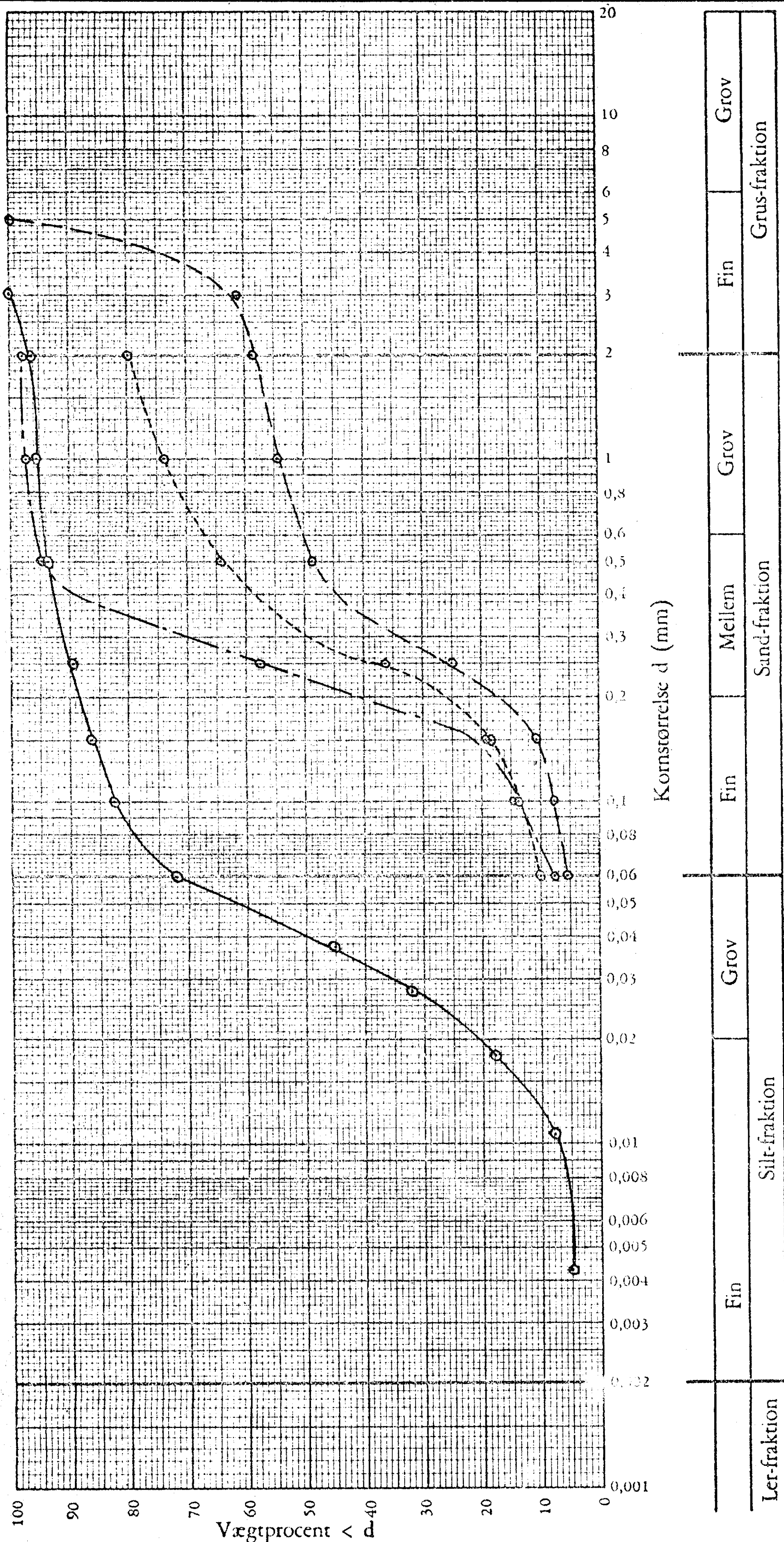
Lab. no.: 10-11-12-14-21 Bilag no.:

A 4 GI 208

AGF 1880

Mynd 1.15.5

Fig. 1.15.5



Lab. no.:	70	71	72	73
Kurvesignatur:	——	—·—	— —	- - - -
Middelkornstørrelse: $d_{50\%}$ (mm)	0,040	0,228	0.600	0.305
Uensformighedstal: $U = d_{60\%}/d_{10\%}$	3.9	3.6	18.6	7,1
Kornvægtfylde: d_s			2.89	
Permeabilitetsfaktor: k (m/sek.)				

GEOTEKNISK INSTITUT

Boring no.: Dybde: m Kote:

Forsøg: d. Tegn.: JH d. 15-2-61

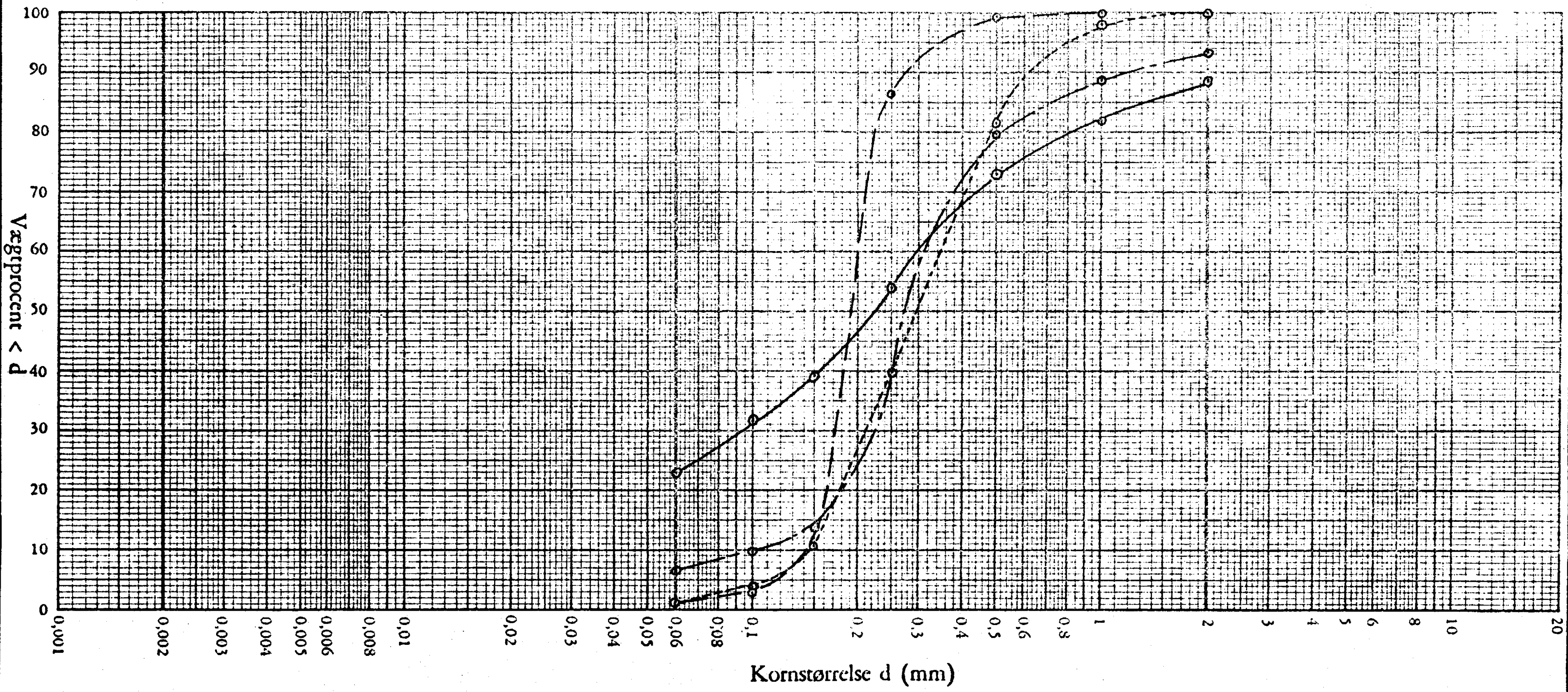
Kontr.: d. Godk.: d.

KORNKURVE

Sag: 60227 ISLAND

Lab. no.: 70-71-72-73 Bilag no.:

A 4 GI 208



	Fin	Grov	Fin	Mellem	Grov	Fin	Grov
Ler-fraktion	Silt-fraktion		Sand-fraktion			Grus-fraktion	

Lab. no.:	75	77	78	80	Mynd 1.15 6
Kurvesignatur:	———	—·—	— — —	- - - - -	Fig. 1.15 6
Middelkornstørrelse: $d_{50\%}$ (mm)	0.225	0,274	0.191	0.296	
Uensformighedstal: $U = d_{60\%}/d_{10\%}$		3,1	1,4	2,4	
Kornvægtfylde: d_s		2.97			
Permeabilitetsfaktor: k (m/sek.)					
			Skylleprøve	Skylleprøve	

GEOTEKNISK INSTITUT

Boring no.:		Dybde: m		Kote:	
Forsøg:	d.	Tegn.: FH		d. 15-2-61	
Kontr.:	d.	Godk.:		d.	

KORNKURVE

Sag: 60227 ISLAND

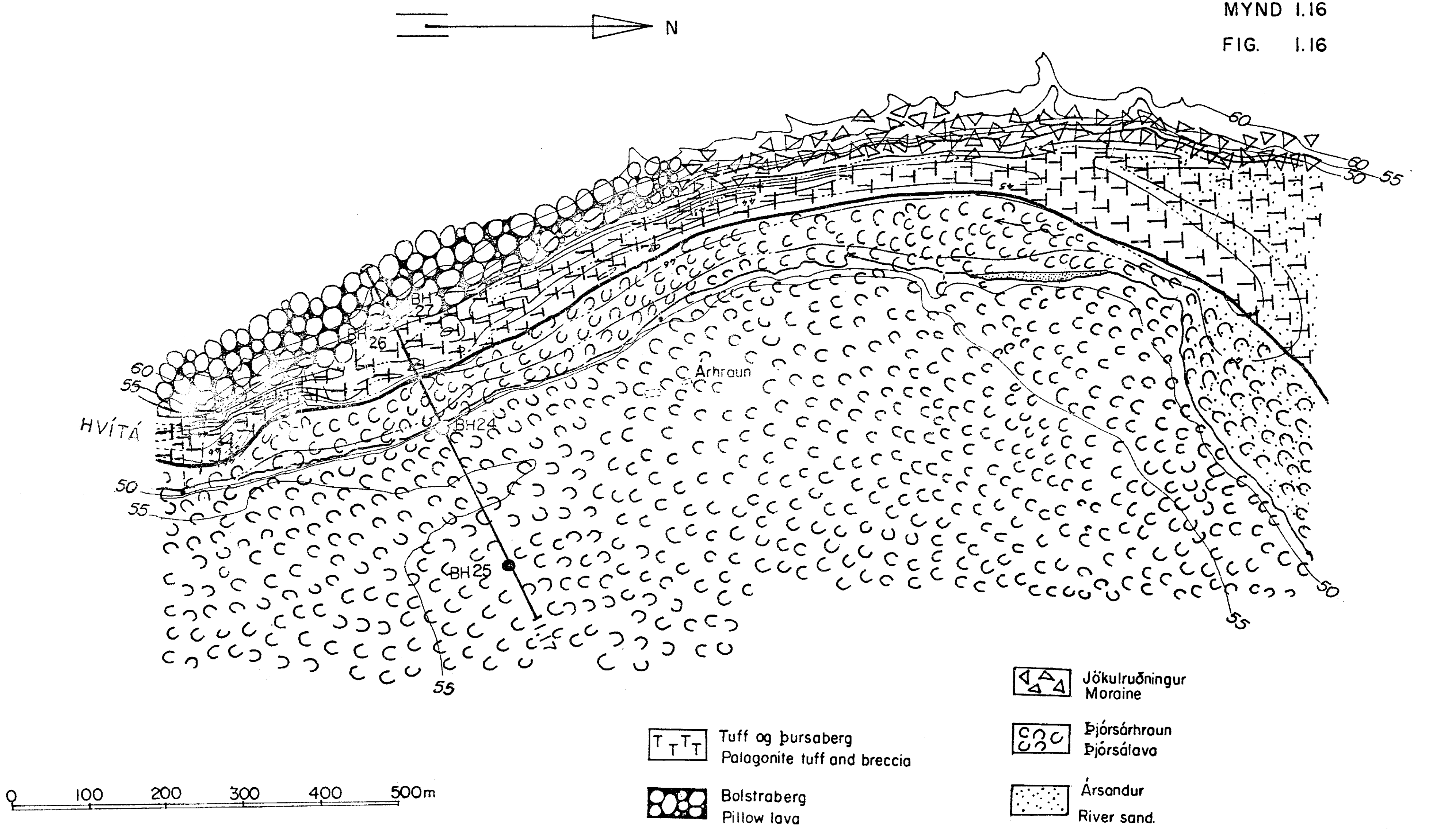
Lab. no.: 75-77-78-80 Bilag no.:

A 4 GI 208

	RAFORKUMÁLASTJÓRI	9.3.'61 HT/PJ
	Jarðfræðikort af stíflustæði.	TNR. 278
	Geological map of the dam site.	B— 274
		FNR. 5376

MYND I.16

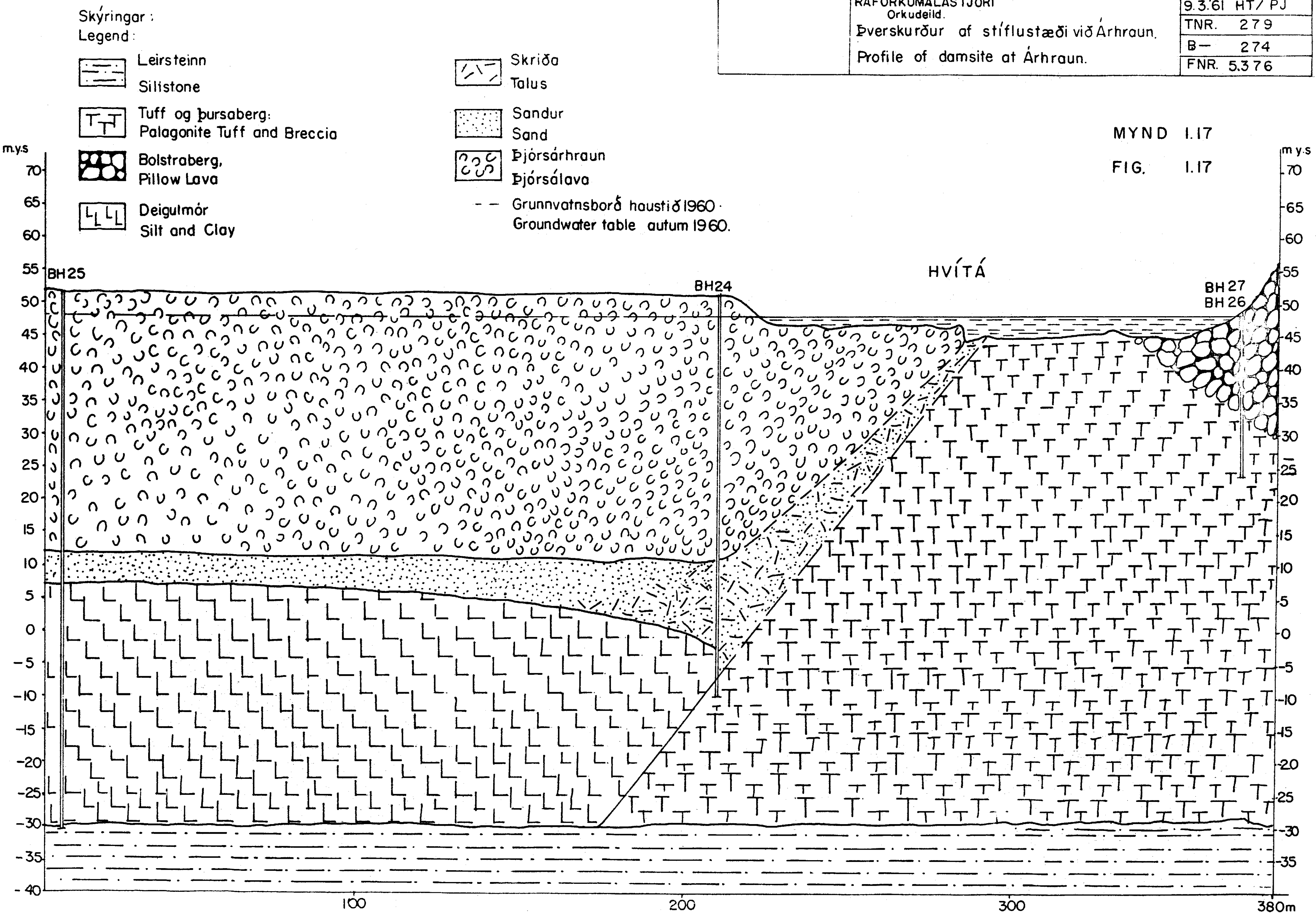
FIG. I.16



RAFORKUMÁLASTJÓRI Orkudeild.	9.3.'61 HT/ PJ
Þverskurður af stíflustæði við Árhraun.	TNR. 279
	B— 274
Profile of damsite at Árhraun.	FNR. 5.376

MYND 1.17

FIG. 1.17



	RAFORKUMÁLASTJÓRI Orkudeild. Jarðfræðikort af Vatnsnessvæði, sýnir berggrunn og jarðgrunn. Geological Map of the Vatnsnesarea with bedrock and subsoil.	26.2.'61 H.T./PJ TNR. 274 B— 274 FNR 5365

Skýringar: Legend:

MYND 1.18
FIG. 1.18

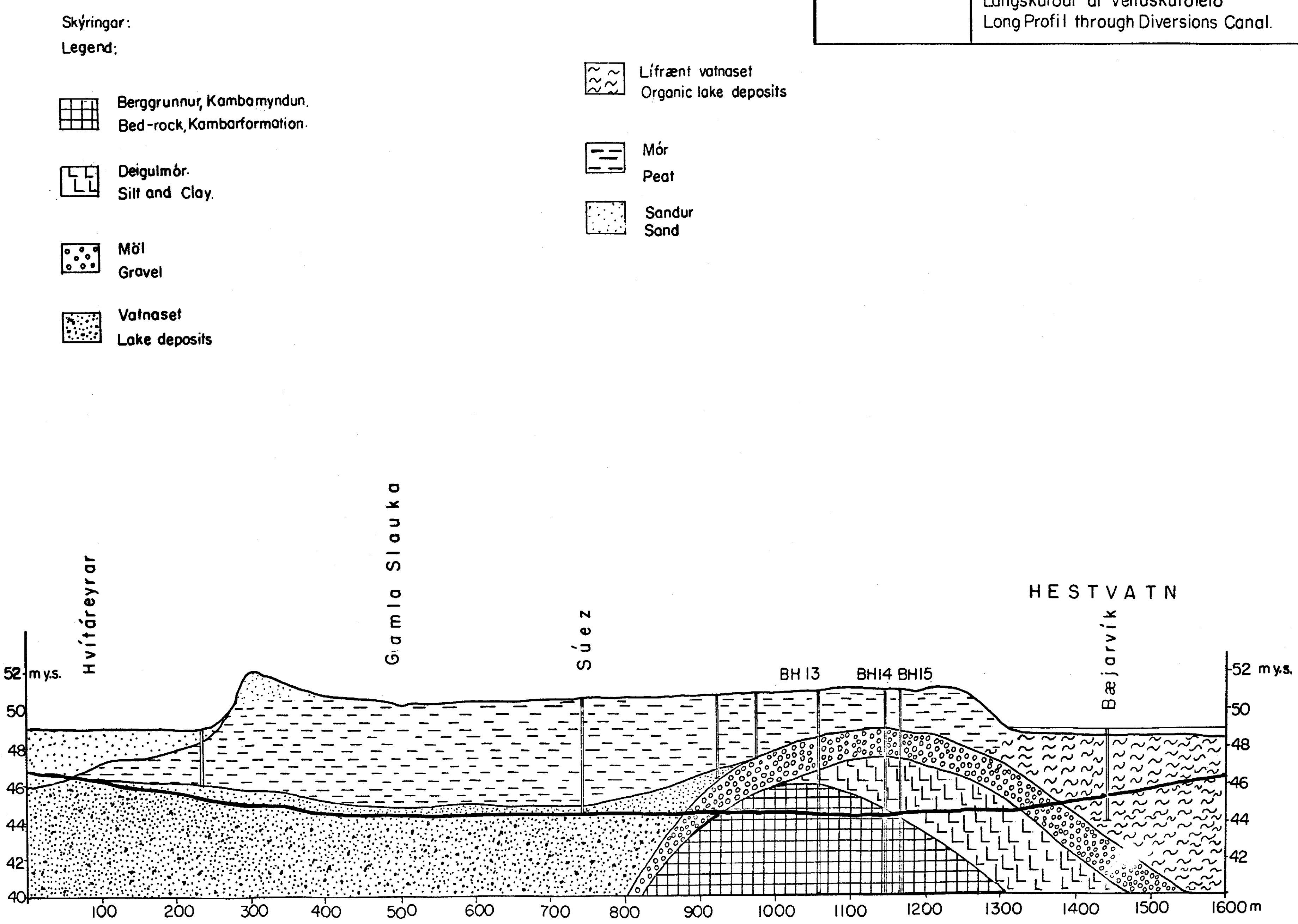
- Möl með deigulmó undir; Gravel, silt and clay beneath.
- Vatnaset, og finkornótt og lífrænt; Silty Lake Deposits.
- Borholur; Drillholes.
- Berggrunnu, Kambamyndun. Bedrock, Kambarformation.

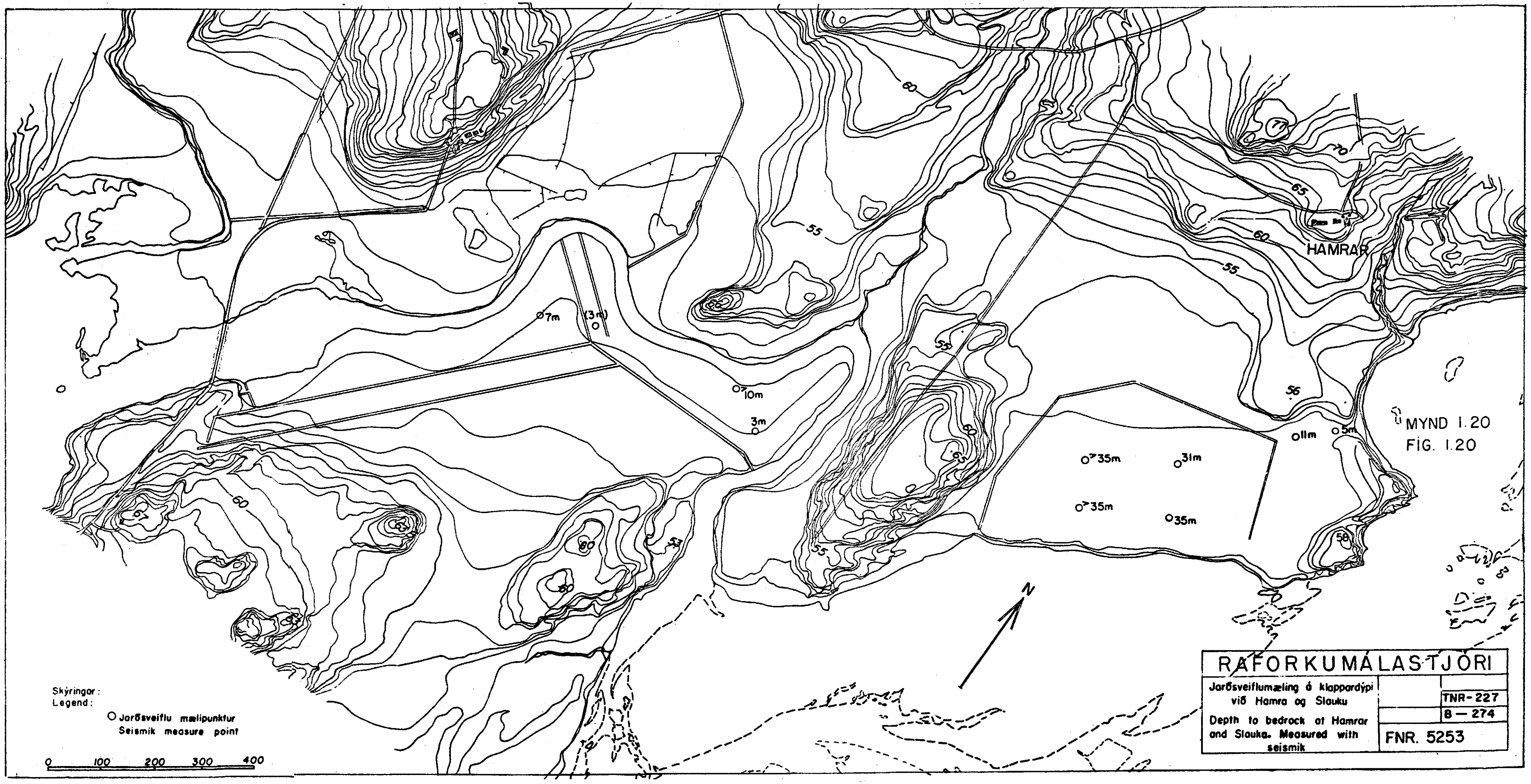
N

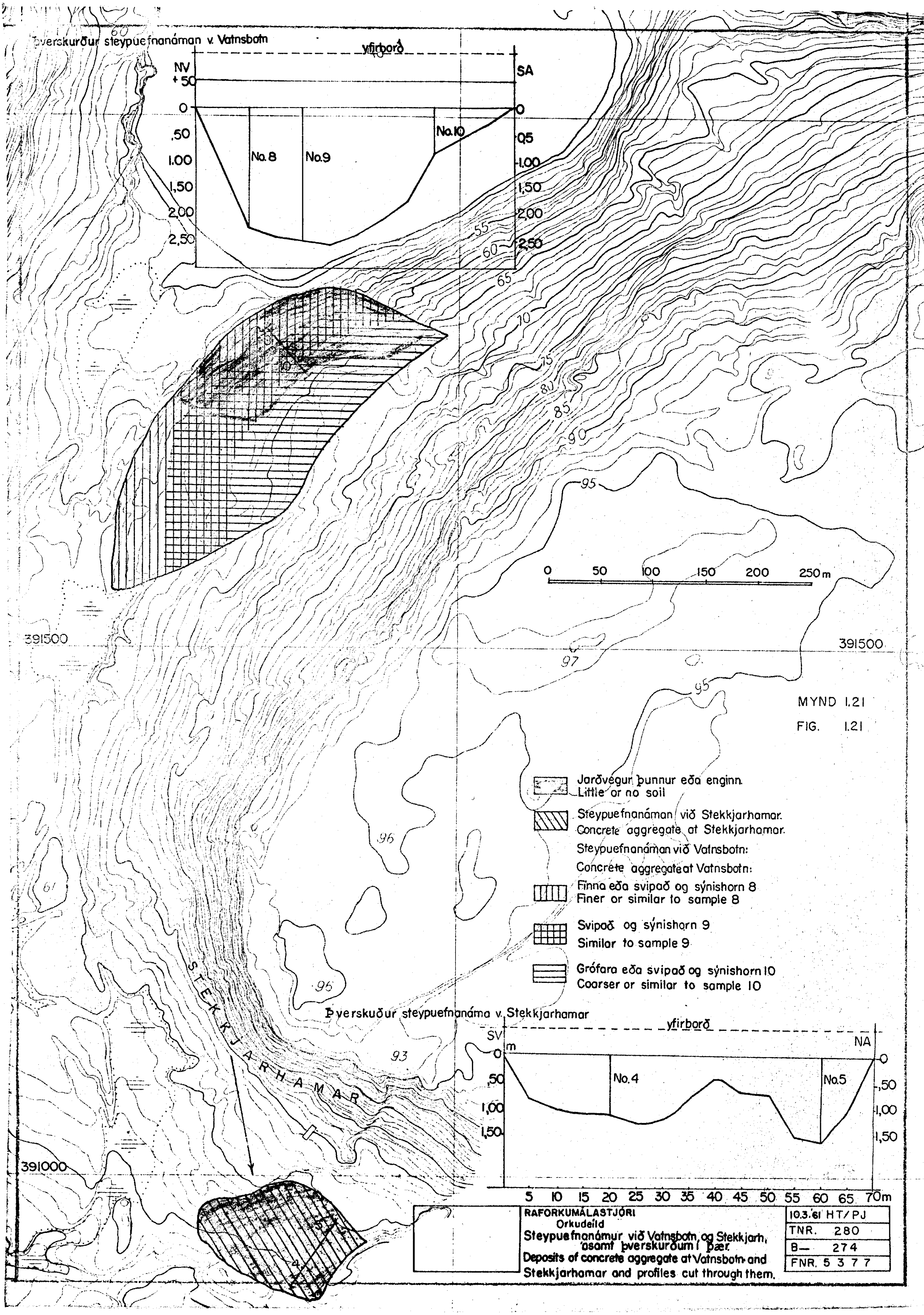
	RAFORKUMÁLASTJÓRI Orkudeild Langskurður af veituskurðleið Long Profil through Diversions Canal.	53.61 H.T/ PJ TNR. 275 B — 274 FNR. 5366

MYND 1.19

FIG. 1.19




MYND 1.20
FIG. 1.20
HAMRAR
N
70
65
60
55
56
77
68
58
53
80
67
63
○7m
○(3m)
○>10m
○3m
○11m
○5m
○>35m
○31m
○>35m
○35m
Skýringar:
Legend:
○ Jarðsveiflu mælipunktur
Seismik measure point
0 100 200 300 400
RAFORKUMÁLASTJÓRI
Jarðsveiflumæling á klappardýpi við Hamra og Slauku
Depth to bedrock at Hamrar and Slauka. Measured with seismik
TNR-227
B-274
FNR. 5253



MYND 1.21

FIG. 1.21

ATVINNUDEILD HÁSKÓLANS

RANNSÓKN NR.

Mynd: 1.221 Kornakúrva steypuefnis frá Vatnsbotni

Fig.: 1.221 Gradation curve for concrete aggregate at Vatnsbotn

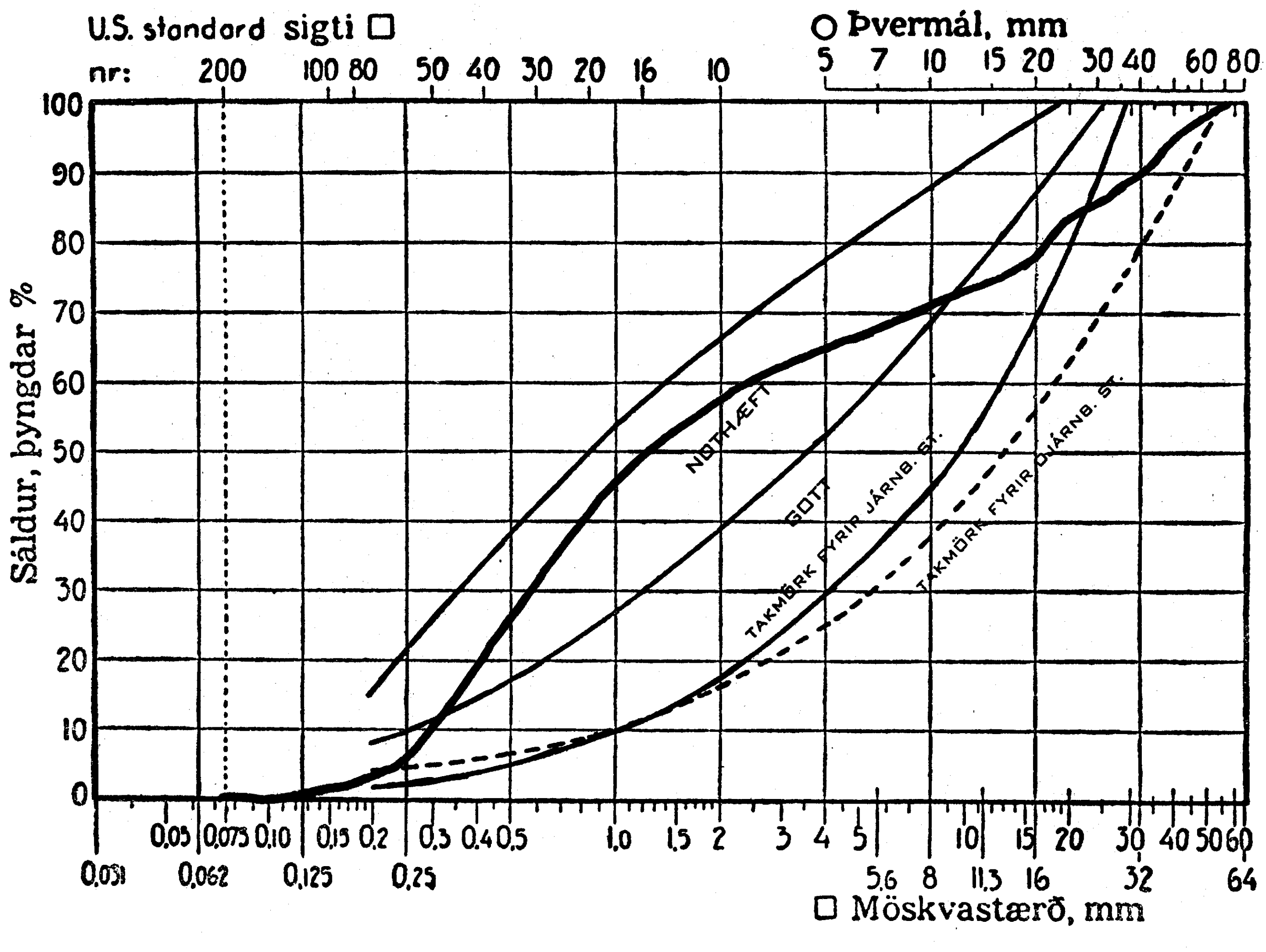
Húmusgráða 0

Slam 1 %

Vatnsbotn no. 8

Rannsókn á kornastærðum.

Steypuefni (sandur og möl).



Bergefni: No. 8-10: Öll efnin eru úr fersku og sterklegu blágrýti en í no. 8 og 9 er þó vottur af móbergi og myndbreyttu basalti, þó ekki svo mikið að skaðlegt geti talist.

Rock material:

No. 8-10: All samples are fresh and solid basalt, but in no. 8 and 9 contain some palagonite and altered basalt, although not that much as to do any harm.

Kornalína steypuefnisins þarf að mestu leyti að liggja innan svæðanna „gott" og „nothæft". Ef mulningur er notaður í stað malar, á kornalínan — sérstaklega á sandsvæðinu — að liggja tiltölulega hærra.

Ef kornalína steypuefnisins liggur að mestu fyrir utan þau takmörk, sem hér eru sett, má þó stundum fá sæmilega steypu úr efninu, en gera verður þá sérstakar steyputilraunir.

ATVINNUDEILD HÁSKÓLANS

RANNSÓKN NR.

Mynd 1.222 Kornakúrva steypuefnis frá Vatnsbotni

Fig.:1.222 Gradation curve for concrete aggregate at Vatnsbotn

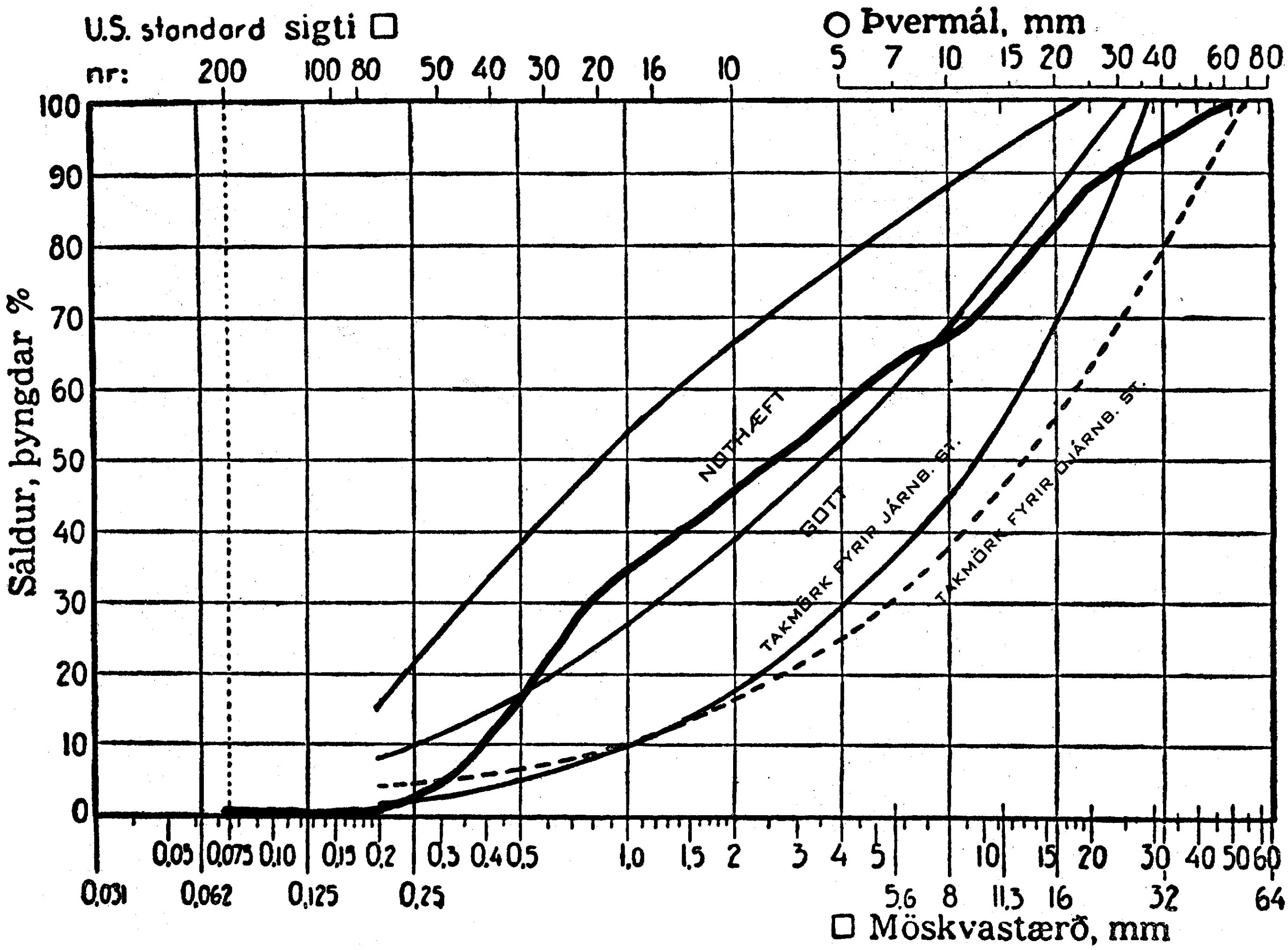
Húmusgráða 0

Slam 1 %

Vatnsbotn no. 9

Rannsókn á kornastærðum.

Steypuefni (sandur og möl).



Bergefni: Sjá mynd 1.221

Rock material: See Fig. 1.221

Kornalína steypuefnisins þarf að mestu leyti að liggja innan svæðanna „gott" og „nothæft". Ef mulningur er notaður í stað malar, á kornalínan — sérstaklega á sandsvæðinu — að liggja tiltölulega hærra.

Ef kornalína steypuefnisins liggur að mestu fyrir utan þau takmörk, sem hér eru sett, má þó stundum fá sæmilega steypu úr efninu, en gera verður þá sérstakar steyputilraunir.

ATVINNUDEILD HÁSKÓLANS

RANNSÓKN NR.

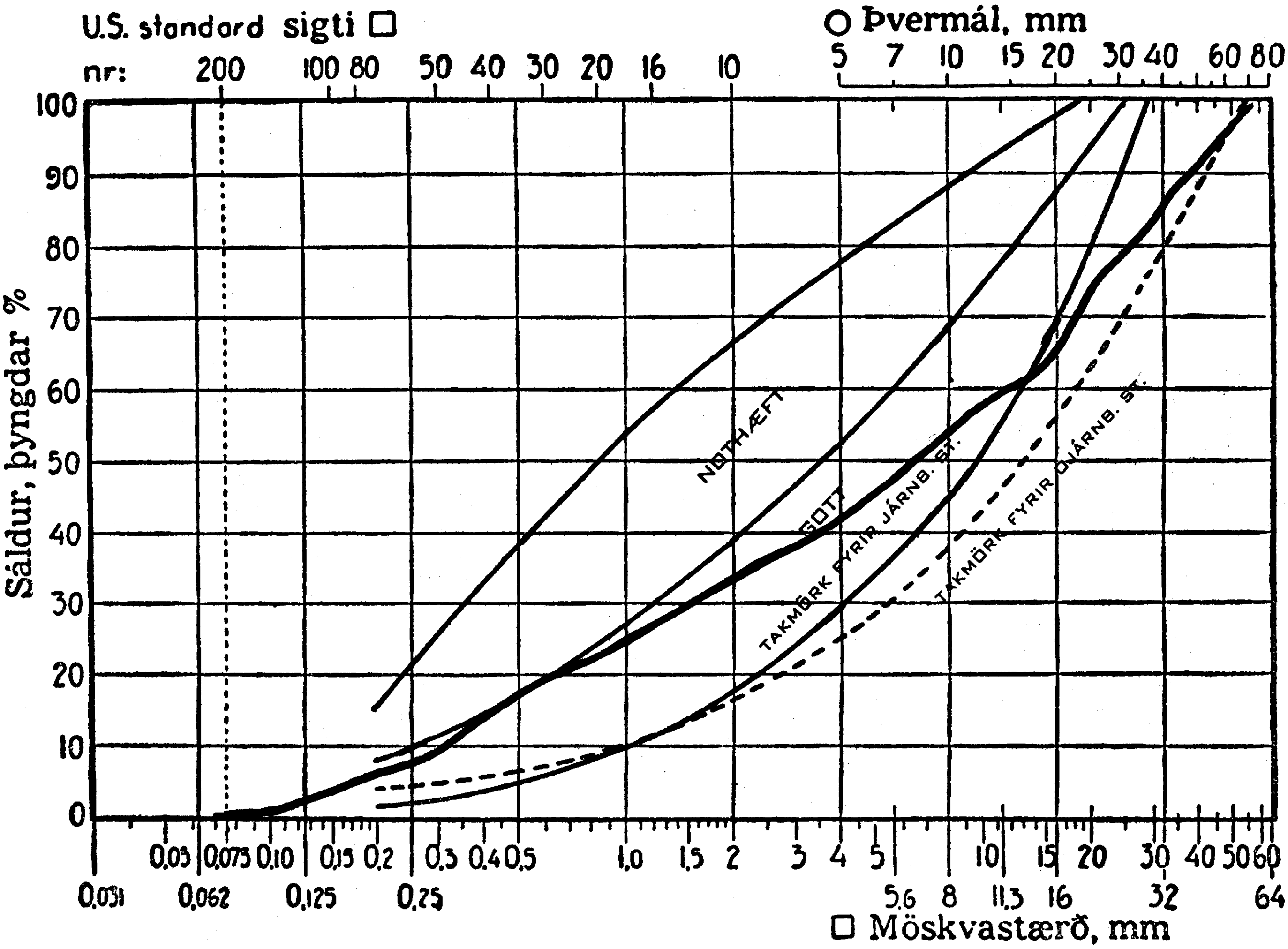
Mynd 1.223 Kornakúrva steypuefnis frá Vatnsbotni

Fig. 1.223 Gradation curve for concrete aggregate at Vatnsbotn

Húmusgráða 0
Slam 1 %

Vatnsbotn no. 10

Rannsókn á kornastærðum.
Steypuefni (sandur og möl).



Bergefni: Sjá mynd 1.221

Rock material: See Fig. 1.221

Kornalína steypuefnisins þarf að mestu leyti að liggja innan svæðanna „gott" og „nothæft". Ef mulningur er notaður í stað malar, á kornalínan — sérstaklega á sandsvæðinu — að liggja tiltölulega hærra.

Ef kornalína steypuefnisins liggur að mestu fyrir utan þau takmörk, sem hér eru sett, má þó stundum fá sæmilega steypu úr efninu, en gera verður þá sérstakar steyputilraunir.

ATVINNUDEILD HÁSKÓLANS

RANNSÓKN NR.

Mynd 1.224 Kornakúrva steypuefnis frá Stekkjarhamri

Fig. 1.224 Gradation curve for concrete aggregate at Stekkjarhamar

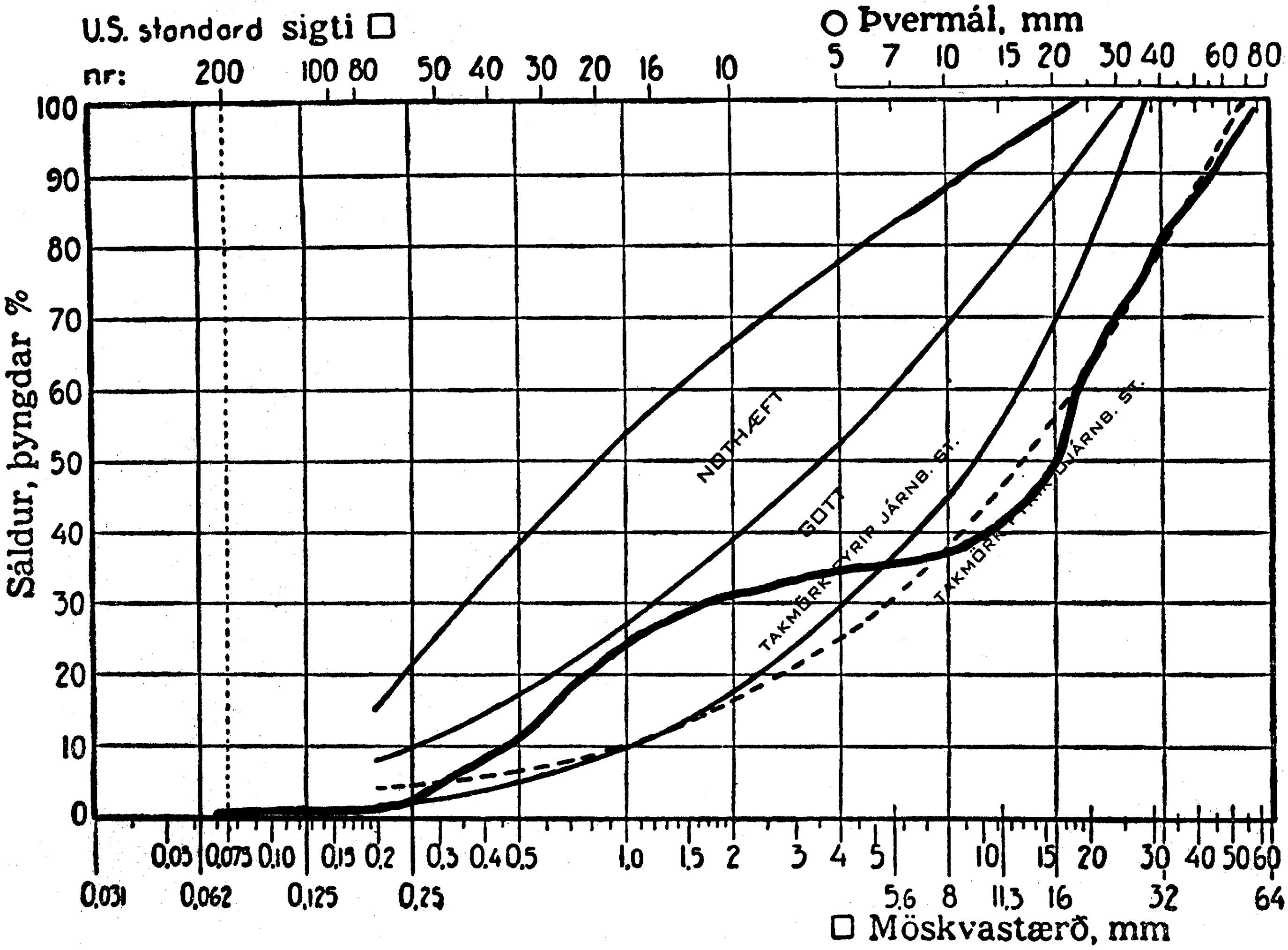
Húmusgráða 0

Slam 1 %

Stekkjarhamar no. 4

Rannsókn á kornastærðum.

Steypuefni (sandur og möl).



Bergefni: No. 4-5: Sandurinn er allmikið blandaður móbergi og því varhugavert að nota hann í steypu sökum veðrunarhættu, en mölin virðist sæmilega sterk þótt hún sé ekki úr jafnfersku bergi og no. 8-10.

Rock material:

No. 4-5: The sand contains cinsiderable palagonite and it is therefore questionable to use it in concrete aggregate because of risks for weathering, but the gravel seems solid, although not as fresh rock material as samples 8-10.

Kornalína steypuefnisins þarf að mestu leyti að liggja innan svæðanna „gott" og „nothæft". Ef mulningur er notaður í stað malar, á kornalínan — sérstaklega á sandsvæðinu — að liggja tiltölulega hærra.

Ef kornalína steypuefnisins liggur að mestu fyrir utan þau takmörk, sem hér eru sett, má þó stundum fá sæmilega steypu úr efninu, en gera verður þá sérstakar steyputilraunir.

ATVINNUDEILD HÁSKÓLANS

RANNSÓKN NR.

Mynd 1.225 Kornakúrva steypuefnis frá Stekkjarhamri

Fig. 1.225 Gradation curve for concrete aggregate at Stekkjarhamar

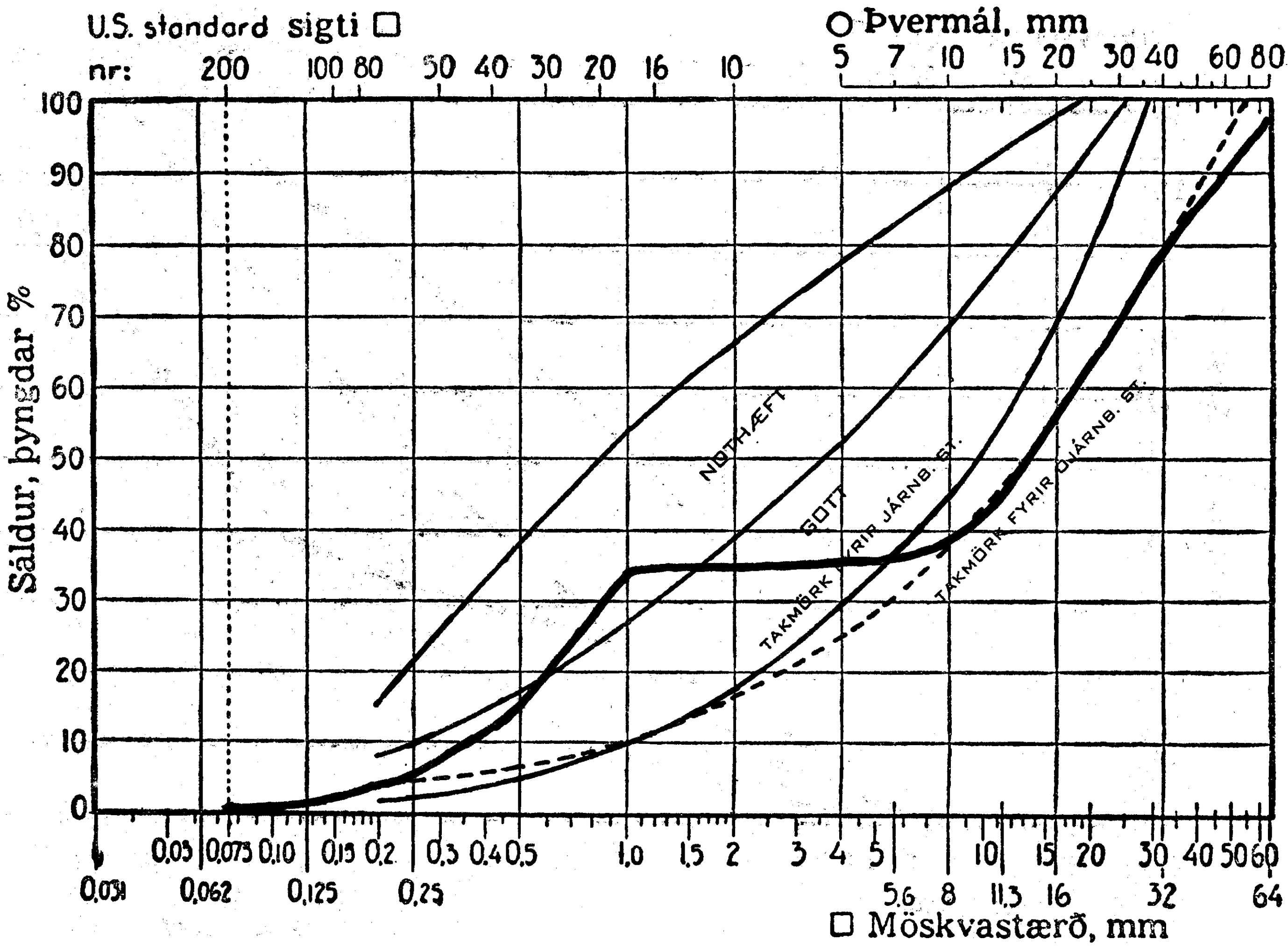
Húmusgráða 0-1

Slam 1/2 %

Stekkjarhamar no. 5

Rannsókn á kornastærðum.

Steypuefni (sandur og möl).



Bergefni: Sjá mynd 1.224

Rock material: See fig. 1.224

Kornalína steypuefnisins þarf að mestu leyti að liggja innan svæðanna „gott" og „nothæft". Ef mulningur er notaður í stað malar, á kornalínan — sérstaklega á sandsvæðinu — að liggja tiltölulega hærra.

Ef kornalína steypuefnisins liggur að mestu fyrir utan þau takmörk, sem hér eru sett, má þó stundum fá sæmilega steypu úr efninu, en gera verður þá sérstakar steyputilraunir.

ATVINNUDEILD HÁSKÓLANS

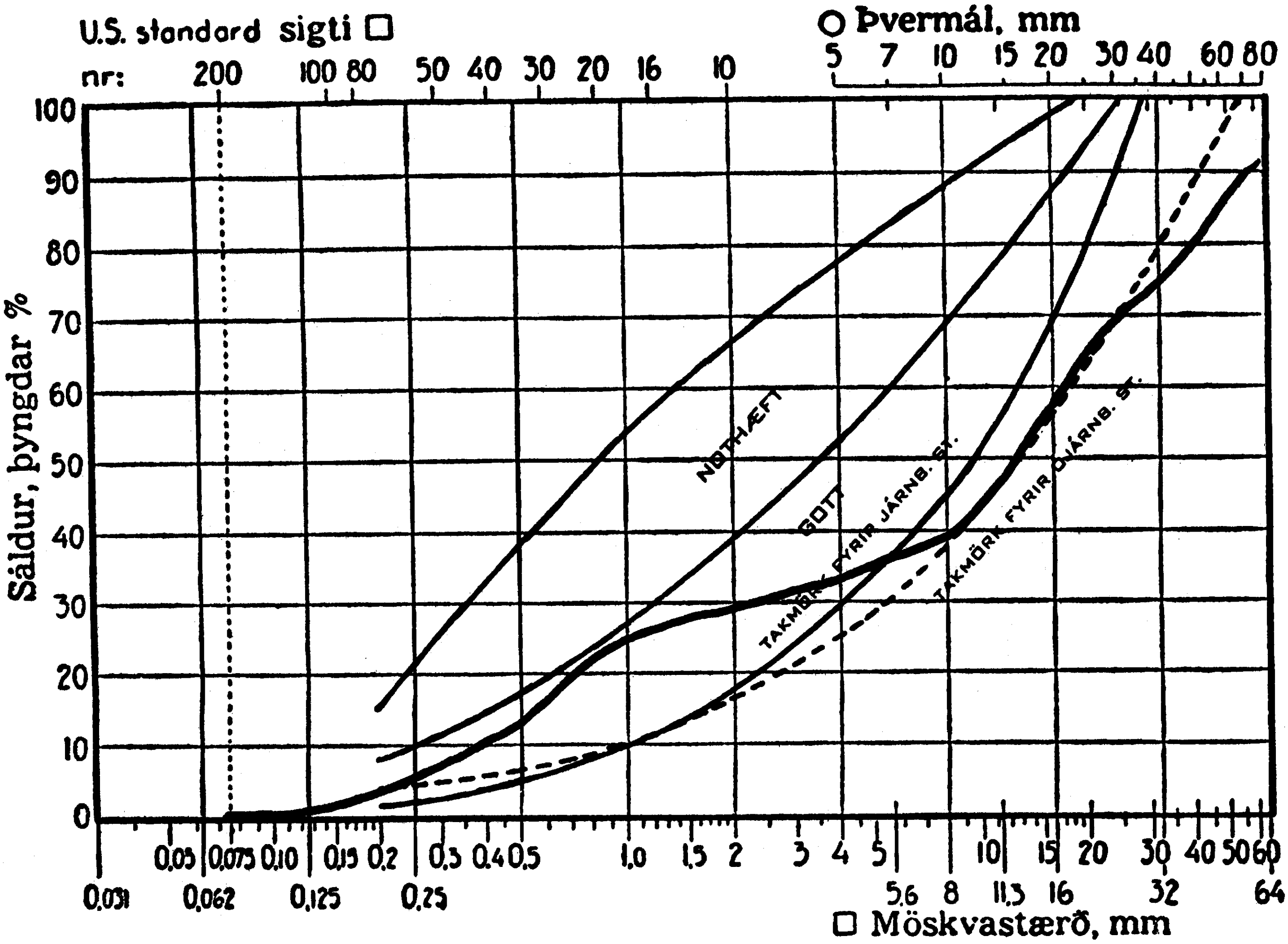
RANNSÓKN NR.

Mynd: 1.226 Kornakúrva steypuefnis frá Efri Heiði
Fig. 1.226 Gradation curve for concrete aggregate in Efri Heiði

Húmusgráða 0
Slam 1 %

Efri-Heiði no. 11

Rannsókn á kornastærðum.
Steypuefni (sandur og möl).



Bergefni: Núið, grófkornótt, smáblöðrótt, lítið eitt holufyllt og veikbyggt grágrýti, þó getur verið að steypa úr því standist sæmilega veðrun.

Rock material:

Well rounded, coarse-grained with small partly filled vesicular, rather weak gray basalt, yet it is possible that concrete made of it, could resist weathering fairly well.

Kornalína steypuefnisins þarf að mestu leyti að liggja innan svæðanna „gott" og „nothæft". Ef mulningur er notaður í stað malar, á kornalínan — sérstaklega á sandsvæðinu — að liggja tiltölulega hærra.
Ef kornalína steypuefnisins liggur að mestu fyrir utan þau takmörk, sem hér eru sett, má þó stundum fá sæmilega steypu úr efninu, en gera verður þá sérstakar steyputilraunir.

ATVINNUDEILD HÁSKÓLANS

RANNSÓKN NR.

Mynd 1.227 Kornakúrva malar frá
Efri Heiði
Fig. 1.227 Gradation curve for gravel in
Efri Heiði

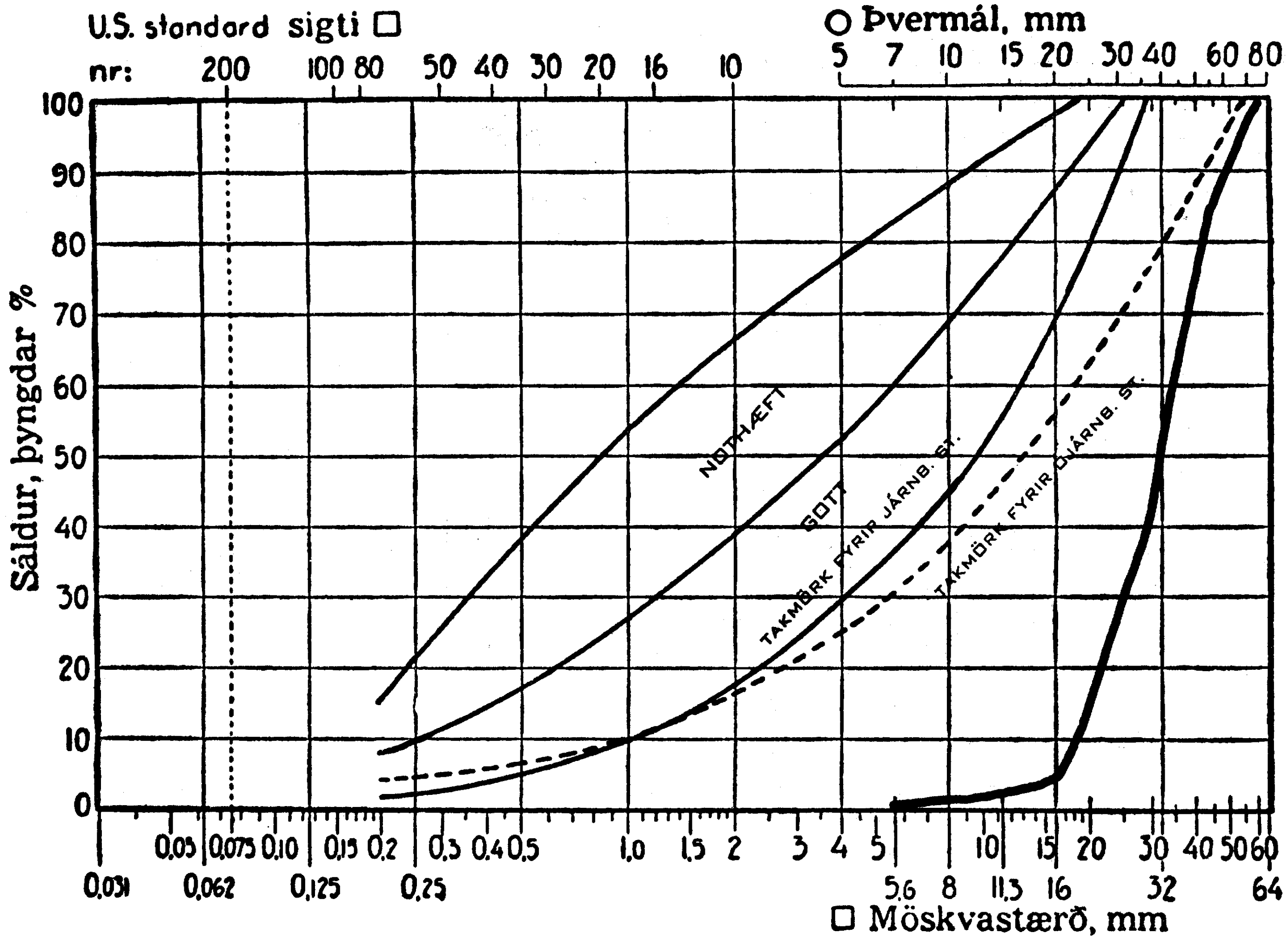
Húmusgráða

Slam %

Efri-Heiði no. 16

Rannsókn á kornastærðum.

Steypuefni (sandur og möl).



Bergefni: Meldin möl, ekki nothæf í steypu sökum skaðlegra jarðvegssýrna.

Rock material:

Gravel mixed with silt, not useable in concrete aggregate because of organic acids.

Kornalína steypuefnisins þarf að mestu leyti að liggja innan svæðanna „gott" og „nothæft". Ef mulningur er notaður í stað malar, á kornalínan — sérstaklega á sandsvæðinu — að liggja tiltölulega hærra.

Ef kornalína steypuefnisins liggur að mestu fyrir utan þau takmörk, sem hér eru sett, má þó stundum fá sæmilega steypu úr efninu, en gera verður þá sérstakar steyputilraunir.

ATVINNUDEILD HÁSKÓLANS

Mynd: 1.228 Kornakúrva steypuefnis við Vatnsnes

Fig. 1.228 Gradation curve for concrete aggregate at Vatnsnes

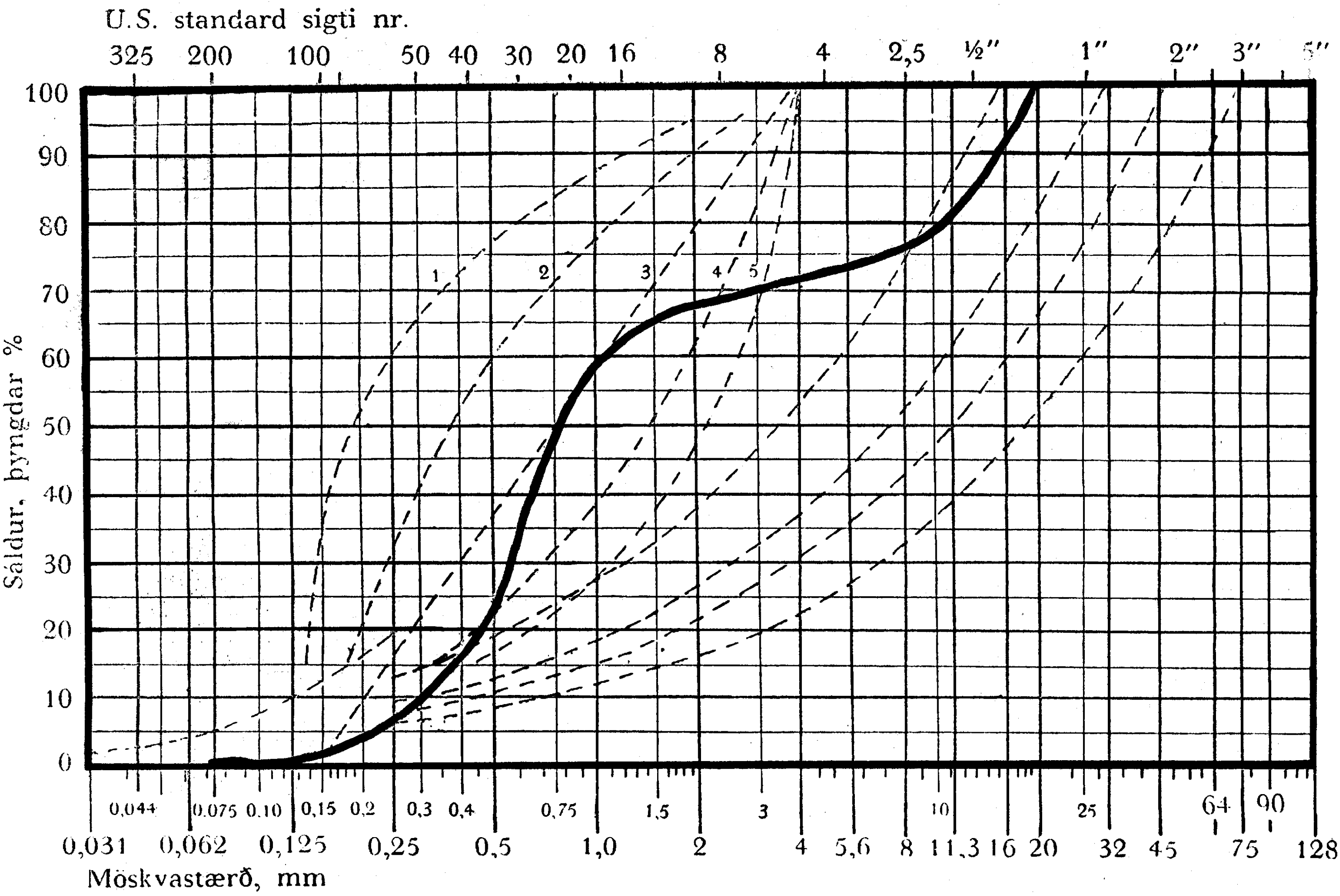
Rannsókn nr. H6c/231

Húmusgráða 0

Slam ½ %

Rannsókn á kornastærðum.

Steypuefni: No 6, við Hestfjall Vatnsnessmegin



Allsterklegt blóðótt basalt, en dálítið blandað móbergi.

Rock material:

Rather strong vesicular basalt, but a little mixed with palagonite.

ATVINNUDEILD HÁSKÓLANS

RANNSÓKN NR.

Mynd 1.229 Kornakúrva steypuefnis frá Murneyri

Fig. 1.229 Gradation curve for concrete aggregate at Murneyri

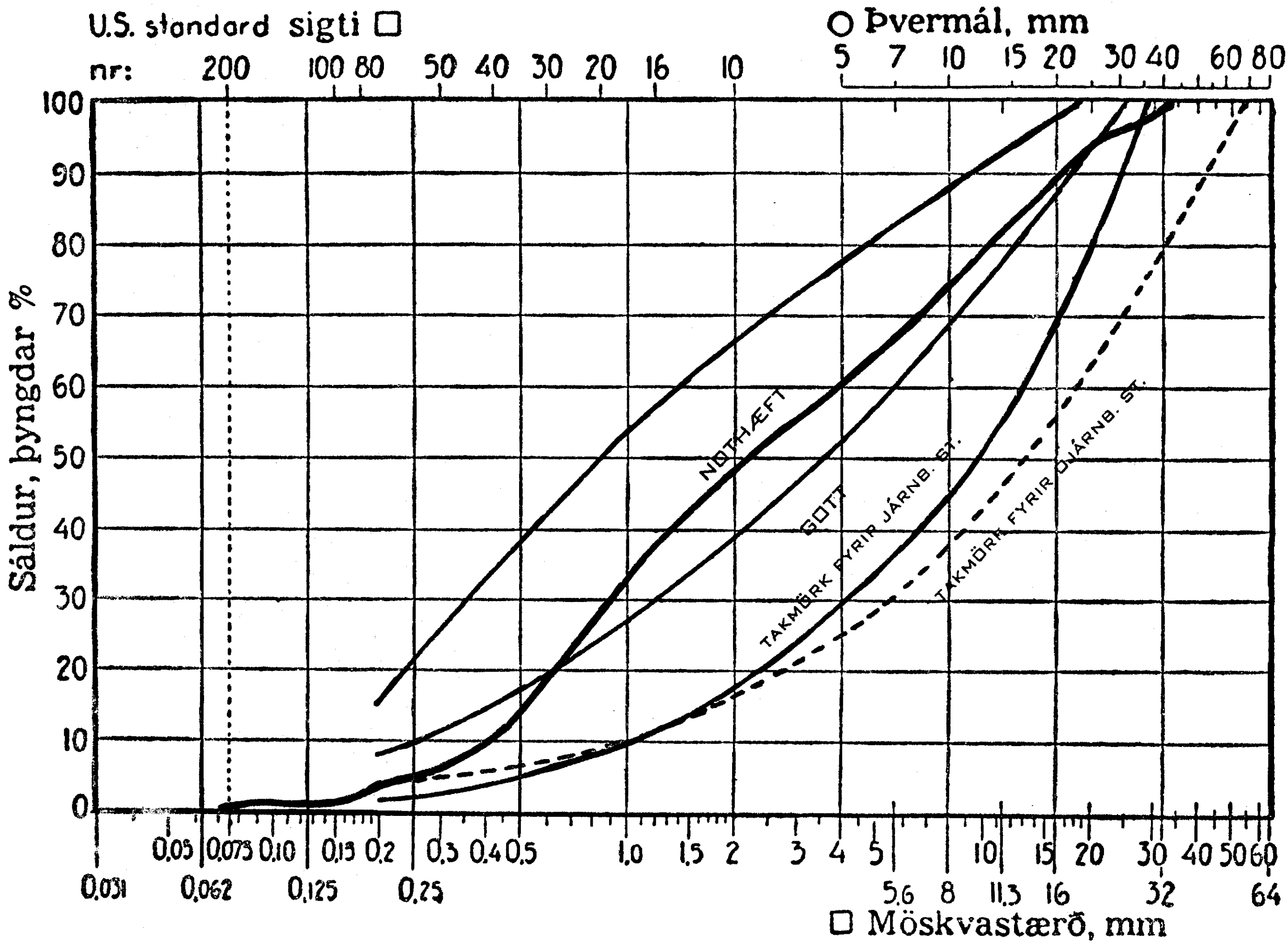
Húmusgráða

Slam 0 %

Rúmþ.: 1.76

Rannsókn á kornastærðum.

Steypuefni (sandur og möl).



Bergefni: Nokkuð sterkleg basaltmöl, blönduð ljósgrýti.

Rock material:

Rather strong basaltgravel, mixed with rhyolite

Kornalína steypuefnisins þarf að mestu leyti að liggja innan svæðanna „gott" og „nothæft". Ef mulningur er notaður í stað malar, á kornalínan — sérstaklega á sandsvæðinu — að liggja tiltölulega hærra.

Ef kornalína steypuefnisins liggur að mestu fyrir utan þau takmörk, sem hér eru sett, má þó stundum fá sæmilega steypu úr efninu, en gera verður þá sérstakar steyputilraunir.

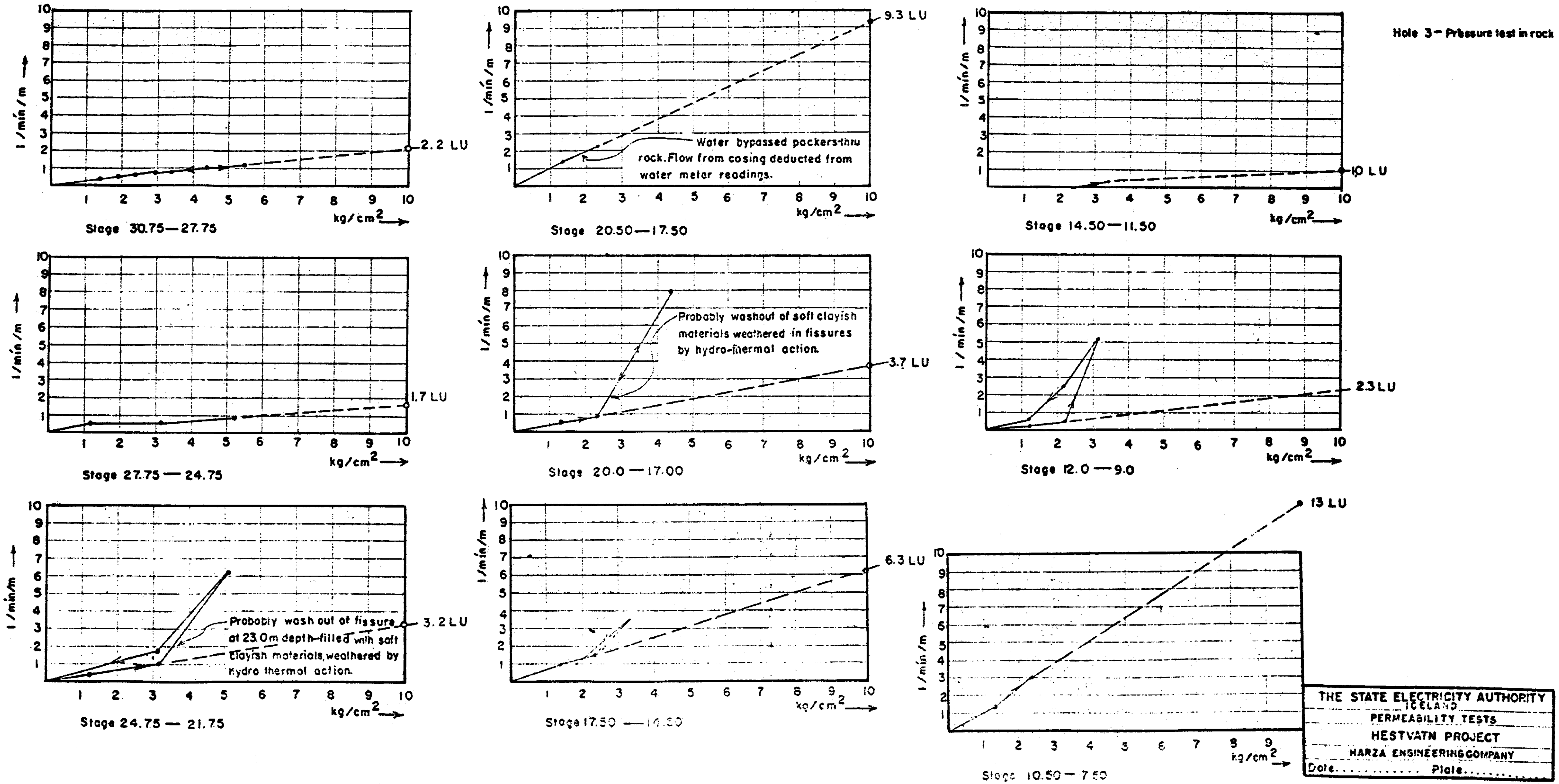


Fig. 1.23 Examples of pressure tests in the Kiðjaberg formation, showing the phenomen of washing out the clayish material in fissures and joints.