TECHNICAL COMMITTEE ON POWER DEVELOPMENTS

STATE ELECTRICITY AUTHORITY

BÚRFELL PROJECT

THE MODIFIED SAETERSMOEN SCHEME

Reykjavík, December 1964

TECHNICAL COMMITTEE ON POWER DEVELOPMENTS
STATE ELECTRICITY AUTHORITY

BÚRFELL PROJECT

THE MODIFIED SAETERSMOEN SCHEME

Reykjavík, December 1964

TABLE OF CONTENTS

REPORT

APPENDIX

INTRODUCTION

Late in August 1964 the State Electricity Authority received from Electro-Watt in Zürich a new Alternative Scheme on the Búrfell Project.

The Scheme followed a visit of Mr. Simonetta from Electro-Watt to SEA late in July this year. Mr. Simonetta visited the site at Búrfell on July 26, and studied different schemes of the project together with Dr. G. Sigurðsson.

The oldest Búrfell Scheme was made by a Norwegian engineer Mr. G. Saetersmoen in the year 1917. The new scheme from Electro-Watt represents a modernization of that first scheme.

Our consultants on the Búrfell Project, Harza Engineering Company International, studied a similiar alternative early in their study of the Project. These studies were only carried out to the point where the consultant found it obvious that they did not deserve further investigations. The studies were of course not worked out to the same detail as in the Project Planning Report.

As Electro-Watt in its Cost scheme estimates the costs to only $ 19,610,000.- for the first stage, compared with $ 23,870,000.- by Harza, we have found it necessary to perform further investigations in the Samstadaklif area, and make a cost estimate on a new modified alternative of the Saetersmoen Scheme. The investigations were made to complement the geological knowledge obtained by former investigations of areas close to this site.

The geology of the approach canal area is complex but well known - especially the ground surface-so drilling is not needed there for this purpose. The geology of the penstock area is also fairly well defined as the exploration tunnel was dug close to the penstock alignment. The power house area, however, needed further investigation. It was decided that two diamond drillholes would be enough in this area particularly as it would be combined with several borro soundings in the tailrace area.

The investigations are now finished and a report of our geologists together with drawings follow as an appendix.

In order to investigate the resistance of the sandstone to erosion by water a small experiment was made. Stones about 15x20x30 cm were cut out of the sandlayers in the tailrace area and placed in the rivers Fossá and Thjórsá. The water velocity in Fossá was 0.8 meters per second and 1.4 meters in Thjórsá. After several hours in the rivers the sandstones had the same size as when placed there.

Our engineers went one day up to the Búrfell area for a close study of the site. This trip lead to the choise of positions for the different features as described below.

DESCRIPTION OF THE MODIFIED SAETERSMOEN SCHEME

The Approach Canal:

We have moved the approach canal about 70 meters to north-west, from the position shown on the E. W. drawing, or almost to the same position as in the old Saetersmoen Scheme.

The canal is in the E. W. Scheme cut through the O. B. formation and close to the limits of the SM formation on the south side of the pass Sámsstadaklif. The rock would be tight on the left side of the canal but a leakage could be expected through the right side as it slopes down from the canal there. The left bank is also too low.
The banks of the canal must reach elevation 251 meters, and this means that a dam has to be built on the right side bank of the approach canal from the dike to the right corner of the intake, where it would be a part of the intake dam.

The design criteria used by Harza in the design of the approach canal is to keep the velocities so low that ice cover will always form on the canal. This is considered essential in the Icelandic climate. When comparing two schemes as those of Harza and E. W. the same design criteria must be used for both. Therefore, we have made the canal large enough to keep the velocities below the critical value for ice formation.

We find it natural to move the canal into the depression at right where there is less excavation. It should be noted that the excavation in this area is almost completely rock excavations. No provision is made for costs associated with sealing measures that might be necessary for the contact zone between the O. B. and SM formations.

The Intakes :

We find the depth down to the intakes in the E. W. Scheme too shallow according to Icelandic experience. The intakes in the E. W. Scheme are in a concrete dam, which on the left side is cut into the rock and on the right is up to 23 meters high as it reaches down into the depression at the right hand. Therefore, the intake dam is moved to the right to close the depression left open in the E. W. Scheme. This arrangement makes it possible to place the intakes at a lower elevation.

The Sluiceway :

By moving the intake and the canal into the depression, the sluiceway will be shorter than in the E. W. Scheme. Actually an aquaduct is needed on a part of the sluiceway shown as a canal in that Scheme.

The Penstocks :

We have placed the penstocks in a trench, encased in concrete and backfilled, as by E. W. This solution looks adequate relative to the heat balance and should be preferred instead of a vertical pressure shaft in this area where the rock is thermally altered.

The penstocks are completely in the moraine. The properties of the moraine are fairly well known as the exploration tunnel was dug through it. The moraine is hard, sticky and able to stand vertically for a short time. When weathered the moraine gets a natural slope of 1 to 4.

The Powerhouse :

We have placed the powerhouse about 100 meters farther down than in the E. W. Scheme as we find it economical to lengthen the penstocks and reduce the excavation for the powerhouse. The ground surface is at elevation 167 meters and the top of the powerhouse at elevation 146 m, so the powerhouse is, in spite of being moved downwards, in a deep trench with the roof 21 meters below the original ground surface. This excavation is in the moraine, the O.B. andesite and lapilli. A sample of the moraine was tested for Harza, and the result is shown in Volume II of the Harza Búrfell Report of February 1963. The testing was made on a remolded sample to find the moraines sutability as a core material. Based on these tests the slope of the moraine behind the powerhouse has been computed 1:1.75. This gives a safety factor of 1.3 against sliding. The slopes in the O.B. andesite are on the other hand nearly vertical or 4:1.

The properties of the moraine in situ might be somewhat different from the properties of the remolded sample. For example, there are several glideplanes in the moraine that might make it necessary to reduce the slopes below 1:1.75. (See geologic report in the appendix.) The moraine would certainly have to be covered to keep it from weathering. This could be done with rockfill or with soil and grass cover.

It should be noted that explosives are needed in the moraine. Contractors claim it worse to work in than in rock. However, open cut rock excavation unit prise is used for the moraine.

The Tailrace Canal :

Our tailrace alignment is more straight lined than shown in the E.W. Scheme but otherwise similiar. It follows a depression in the bedrock and lies mostly in a sandstone layer. On the upper part of the canal there is though some peat and organic silt and on that again a layer of lapilli, that is in places very thick. The sandstone is slightly consolidated. It is hard enough to stand vertically for a considerable time and soft enough to be worked out with heavy machinery.
We find it, therefore, necessary to dig the sandstone in the tailrace canal completely out with mechanical machinery. To assume that the flow from the turbines is able to flush effectively the sandstone layers out from a pilot canal is illusive for a canal up to 33 m deep.
The water will slowly widen the pilot canal at the bottom, then the sides will slough down into the water. This takes a far to long time

and a serious clogging of the canal could submerge the powerhouse. The elimination of the cost of this excavation really means to move it from investment cost over to expensive maintainance cost, as operation will be disturbed. The tailrace canal may be flushed out with high pressure water from Thjórsá above but this would require expensive installations and change the time schedule for the construction of the powerhouse and the tailrace canal. Effects from new sand deposits in the Fossá-Thjórsá area below should costwise be taken into account.

The safest way for a realistic cost estimate is to assume mechanical digging with a rather low unit price.

On the other hand the lapilli can be removed easily for example by a jet of water. As the quantities of lapilli that have to be removed are very great they could justify the cost of some special installations. Therefore, the unit price for lapilli excavation has been drastically reduced from the unit price used by Harza for the same material in other locations.

The velocity in the tailrace canal is too high to allow ice cover to form, and considerable scour can be expected in the sandstone. However, the scour and the subsequent sloughing of the banks is expected to be slow enough to allow the canal to keep itself clean.

The canal is designed with side slopes of 1:1.5 in the sandstone and 1:2 in the lapilli. A 6 m berm is planned at the elevation of the contact between the sandstone and the lapilli

Other Features :

We have kept other features the same as in the Harza Scheme. Only the costs are in both schemes moved to the current price level in accordance with Harza's revised cost estimate from October 19, 1964.

COST ESTIMATE

TABLE I

ITEM	INITIAL STAGE 105 MW $	FINAL STAGE 210 MW $
RESERVOIR, DAMS AND WATERWAYS		
Búrfell reservoir	78,000	
Bjarnalækur dike	1,089,000	1,261,000
Right bank dike	-	722,000
Left bank dike	-	
Diversion canal	559,000	957,000
Bjarnalækur canal	475,000	-
Diversion weir and inlet	1,477,000	2,139,000
Approach canal	828,000	-
Dike of approach canal	146,000	-
Intake	1,497,000	-
Sluiceway	250,000	-
Penstocks	1,536,000	3,072,000
Tailrace Canal	1,634,000	2,313,000
Sub total	9,569,000	13,660,000
POWERPLANT STRUCTURES		
Excavation for powerhouse	601,000	670,000
Powerhouse	1,180,000	2,246,000
TURBINES AND GENERATORS	2,070,000	4,140,000
ACCESSORY ELECTRICAL EQUIPM.	532,000	1,043,000
MISCELLANEOUS POWERPLANT EQUIPM.	400,000	610,000
OPERATORS VILLAGE-GENERAL PLANT	285,000	374,000
ROADS, BRIDGES	513,000	678,000
Sub total prod. plant	15,150,000	23,421,000
TRANSMISSION PLANT	3,051,000	3,761,000
Sub total direct cost	18,201,000	27,182,000
CONTINGENCIES		
15% of construction items	2,151,000	2,936,000
5% of equipment items	208,000	382,000
TOTAL DIRECT CONSTRUCTION COST	20,560,000	30,500,000

TABLE I, CONTINUED

ITEM	INITIAL STAGE 105 MW $	FINAL STAGE 210 MW $
TOTAL DIRECT CONSTRUCTION COST	20,560,000	30,500,000
Engineering, supervision, overhead	1,830,000	2,720,000
TOTAL CONSTRUCTION COST	22,390,000	33,220,000
Interest during construction	2,130,000	2,880,000
SUBTOTAL	24,520,000	36,100,000
PRELIMINARY COST	800,000	
THORISVATN INITIAL STORAGE		2,000,000
EXTRA COST FOR INCREMENTAL COST ...		650,000
TOTAL INVESTMENT	25,320,000	38,750,000

TABLE II

COMPARISON

ITEM	S.E.A. s Modified Sætersmoen Scheme INITIAL	S.E.A. s Modified Sætersmoen Scheme FINAL	Harza s New Scheme INITIAL	Harza s New Scheme FINAL
RESERVOIR DAMS AND WATERWAYS	9.569.000	13.660.000	8.856.000	11.924.000
POWER PLANT STRUCTURES	1.781.000	2.916.000	1.481.000	2.603.000
TURBINES AND GENERATORS, ACCESSORY ELECTRICAL EQUIPMENT MISSCELLANEOUS POWERPLANT EQUIPM., OPERATOR VILLAGE GENERAL PLANT, ROAD AND BRIDGES	3.800.000	6.845.000	3.800.000	6.845.000
SUBTOTAL PRODUCTION PLANT	15.150.000	23.421.000	14.137.000	21.372.000
TRANSMISSION PLANT	3.051.000	3.761.000	3.051.000	3.761.000
SUBTOTAL DIRECT COST	18.201.000	27.182.000	17.188.000	25.133.000
CONTINGENCIES	2.359.000	3.318.000	2.162.000	3.017.000
ENGINEERING, SUPERVISION, OVERHEAD	1.830.000	2.720.000	1.720.000	2.520.000
TOTAL COSTRUCTION COST	22.390.000	33.220.000	21.070.000	30.670.000
INTEREST DURING CONSTRUCTION	2.130.000	2.880.000	2.000.000	2.670.000
PRELIMINARY COST	800.000		800.000	
THORISVATN INITIAL STORAGE, EXTRA COST		2.650.000		2.650.000
TOTAL INVESTMENT	25.320.000	38.750.000	23.870.000	35.990.000
÷	23.870.000	÷ 35.990.000		
DIFF.	1.450.000	2.760.000		

CONCLUSION

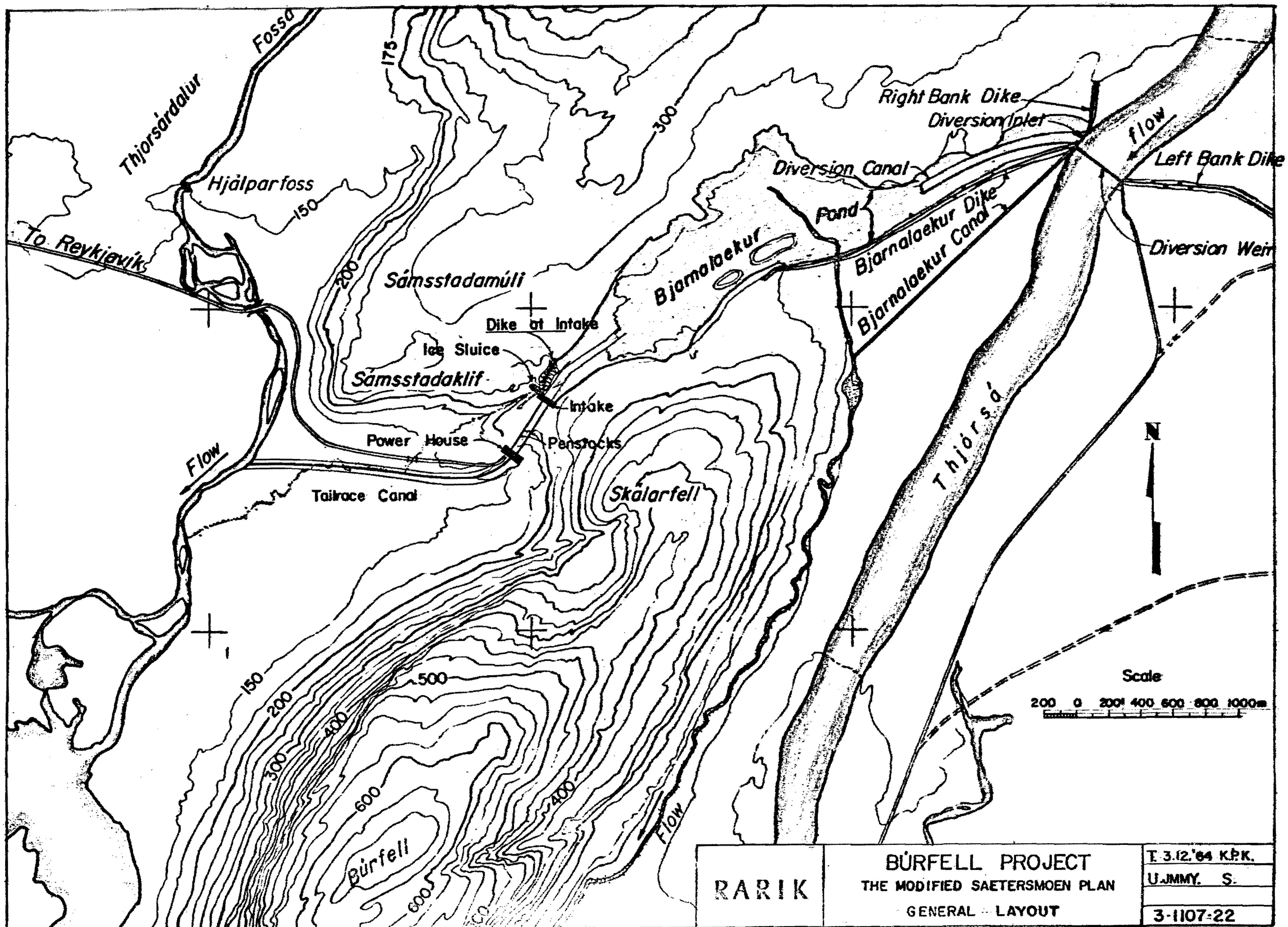
Table II shows a comparison between the costs of Harza´s new Scheme and SEA´s modified Saetersmoen Scheme. The cost estimate of Harza is made in Oct. 1964 and our unit prices correspond to those of Harza.

As for net head, utilized flow, installed capacity and annual energy production, the two schemes are comparable.

The comparison shows that the SEA Scheme is $ 1,40,000.- higher in the first stage and $ 2,760,000.- higher in the final stage.

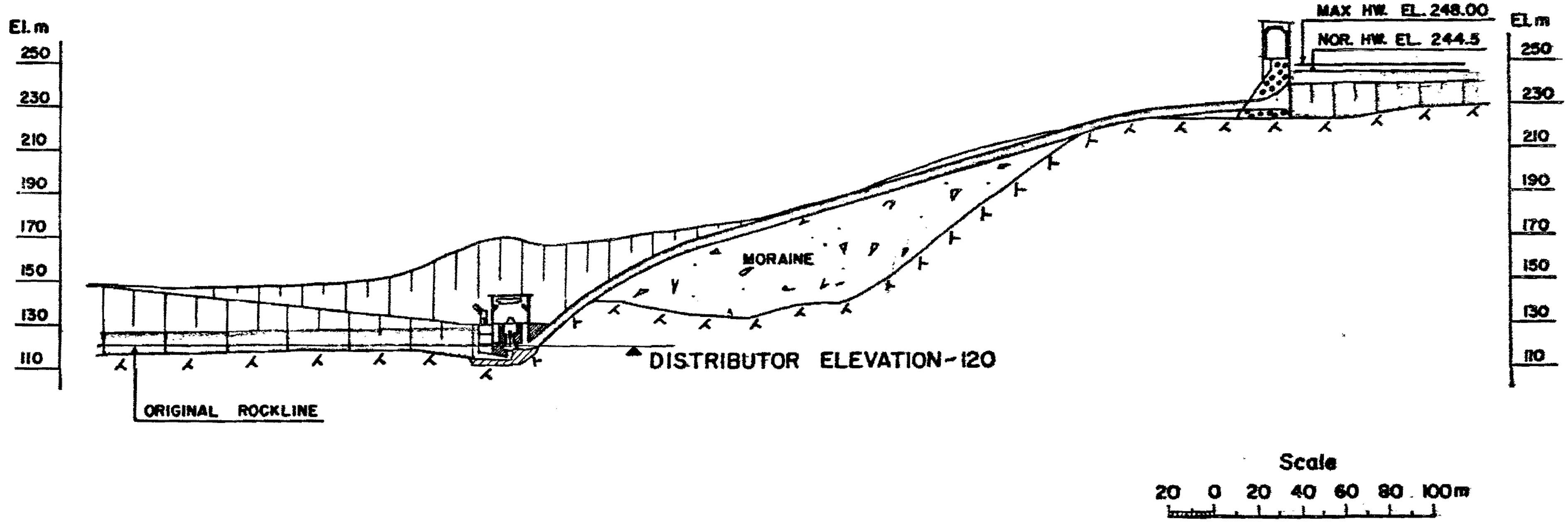
A more detailed study of the SEA Scheme might change the cost estimate somewhat, but it should be evident that this scheme has no economical advantage over the Harza Scheme.

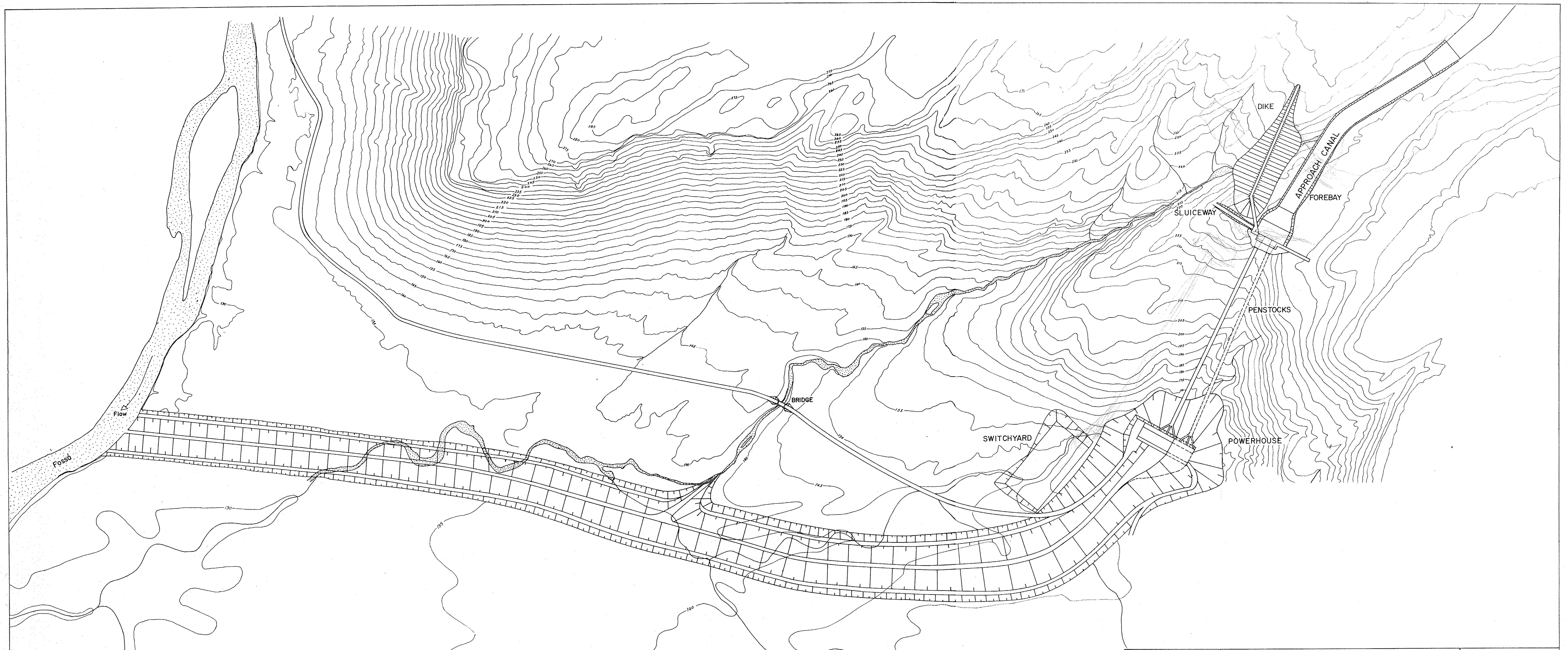
We have not found it necessary for the time being to calculate the price of the energy as they are obviously higher than in the Harza Scheme.



Right Bank Dike
Diversion Inlet
flow
Left Bank Dike
Diversion Canal
Pond
Bjarnalaekur Dike
Bjarnalaekur Canal
Diversion Weir
Bjarnalaekur
Thjórsá
Thjorsárdalur
Fossá
Hjálparfoss
To Reykjavik
Sámsstadamúli
Dike at Intake
Ice Sluice
Sámsstadaklif
Intake
Power House
Penstocks
Flow
Tailrace Canal
Skálarfell
Búrfell
N
Scale
200 0 200 400 600 800 1000m
175
300
150
200
500
400
600
RARIK
BÚRFELL PROJECT
THE MODIFIED SAETERSMOEN PLAN
GENERAL LAYOUT
T. 3.12.'64 K.P.K.
U.JMMY. S.
3-1107-22

RARIK	BÚRFELL PROJECT THE MODIFIED SAETERSMOEN PLAN LONGITUDINAL SECTION	T.3.12.'64 S.L. U.JMM Y. S. 3·1108·22





RARIK

BURFELL PROJECT

THE MODIFIED SAETERSMOEN PLAN

PRODUCTION PLANT LAYOUT

T. 3.12.'64 Þ.K.Þ	
U. Y. S.	
3·1109·22	

THE GEOLOGY OF THE SITE FOR THE MODIFIED SAETERSMOEN ALTERNATIVE BÚRFELL PROJECT

By

Haukur Tómasson fil. cand., geologist S. E. A.

and

Elsa G. Vilmundardóttir fil. cand.

CONTENTS :

FIGURES

1. Special investigation for the Modified Saetersmoen Alternative

For this alternative two core drillholes, SO-1 and SO-2, were drilled during early September to late October. Total length of the drill-holes is 73.5 m. At the same time 12 Borro-soundings, SMO-1-12, were performed with the total length of 139.4 m. All the holes were surveyed and their locations are shown on the geologic maps. Furthermore data from the exploration tunnel (which was excavated in 1962 and is situated in the area), have been of great value for the geologic interpretation of the powerhouse area.

2. Geologic setting

The general geology of the Búrfell area has been thoroughly described in Búrfell Project Vol. 2, Appendix B by the Harza Engineering Co., Int., and is recommended for more detailed information.

The bedrock of the Búrfell area is of late Tertiary or early Quarternary age and is part of the so-called Hreppar series (Old grey basalts). In the Búrfell area it has been divided into several groups by erosional uncomformities, and the sequence of the groups inside the investigation area is as follows, counted from the oldest to the youngest :

OLDER BURFELL (OB), which consists of basalt- andesite- and rhyolite flows with clastic interbeds.

SAMSSTADAMÚLI GROUP (SM), consisting of volcanic breccia and tuff (PL) overlain by tuffaceous sandstone (TS) and on top of it are basaltflows interfingering with talus fanglomerate (TF).

SAMSSTADAKLIF BASALT (SB), which is basalt and volcanic breccia.

The bedrock is mostly covered by much younger sediments, which can be divided into 3 main groups according to age and composition.

GLACIAL TILL (GT). Morainic material from the glacial periods sporadically overlying the bedrock, and building up a thick local moraine in the powerhouse area.

FINIGLACIAL SAND (FG). Thick banks (up to 40 m) of current bedded sand and gravel, slightly consolidated, forming a plain at the southwest side of the Búrfell mountain complex.

OVERBURDEN (OV), mainly consisting of pumice and ash coming from numerous eruptions originating at the volcano Hekla, and drifting sand.

3. The Older Búrfell Group (OB)

The Older Búrfell Group is the oldest one in the Búrfell area, and is made of a great number of lavaflows highly varied in composition, from basaltic to rhyolitic. In the powerhouse area flows of fine-grained andesite are dominating. Each individual flow is about 10 metres in total thickness. Most of it or (6-7 m) is sound rock, columnar jointed, and showing only slight signs of hydrothermal alteration, but the top of each layer is brecciated (the breccia is 3-4 m in thickness). The breccia has originally been formed as the scoriaceous surface of the lavaflow, and it is usually highly hydrothermally altered. The total thickness of the andesite beds is at least 100 metres.

To the west of the moraine of the powerhouse area is a tounge of basalt beds intercalated with the andesites. The andesites are overlain, at the left abutement of the damsite, by hydrothermally altered sandstone about 20 m in thickness, and on top of it is a thin rhyolite bed.

4. The Samsstadaklif basalt (SB)

The Samsstadaklif Basalt is the youngest group of the Hreppar series in the Búrfell area. Between the OB- and SB-group is the Samsstada-múli group (SM), which is situated at the periphery of the area in question and will not be dealt with any further in this report.

The SB-group is filling up a narrow valley dug into the older, underlying groups SM and OB. At the damsite in Samsstadaklif, the SB-group is immediately overlying the OB-group, and the SB-group will be the foundation for the dam and its right abutement. The intake will go through the SB-group and possibly into the OB-group.

The SB-group consists of basalt flows with interbeds of volcanic breccia. Each basalt bed is usually about 10 m in thickness and is most often showing closely spaced columnar and cube jointing. At the contact with the OB-group is usually a layer of volcanic breccia, which is probably formed by a rapid chilling of molten lava which has flowed down the above mentioned ancient valley.

5. Tectonic Structure

The main tectonic direction in the Búrfell area, is the NNE-SSW direction which is dominant in southern Iceland. Still, more dominating on smaller scale inside the Búrfell area is the ENE-WSW direction (N 60^{o}E), and the main fault of the investigation area, the Samsstadaklif fault, runs in this direction. The Samsstadaklif canyon is cut along this fault line. The fractured fault zone is thin and almost impermeable. Slickenside structures, which are exposed in the canyon and in the core from a hole drilled through the fault, indicate horizontal movement. Movement along the fault has most likely ceased long time ago.
A few anchillary faults or fractures are also to be found in the area. For example such minor faults in NNA-SSW direction are situated along the depression of the moraine of the powerhouse area. One minor fault of this kind was found to cross the northern end of the exploration tunnel.

6. Glacial till (GT)

The moraine in the powerhouse area is filling a depression in the bedrock with very steep sides and roughly V shaped. This depression is most likely the work of water along a system of anchillary faults or fractures. The moraine is mainly composed of silt and clay with scattered boulders highly varying in size. The biggest ones are up to 0.5 m in diameter. The boulders are most often well rounded. The colour of the silt- and clay material is usually gray and the boulders mostly basalt and andesite. The andesite boulders increase in number near the base of the moraine and the moraine also becomes more sandy downwards. In the exploration tunnel this was the most difficult layer to penetrate. The increase in andesite boulders and sand near the base is due to the short transport of this material. The andesite boulders come from the slopes above and the bedrock from under the moraine. The moraine is hard and well packed, but it is not cemented. Some jointing is present in the moraine and glideplanes also, probably due to the pressure from the glacier during the formation, and also because of consolidation in the postglacial period. In the exploration tunnel these joints and glideplanes opened gradually by weathering and lenses between the glideplanes and tunnel roof had to be cleared every now and then. The orientation of the jointing was not studied in detail, but there seems to be a set of jointing perpendicular to the surface slope and another set with the same strike as the surface slope, but appreciably steeper (glideplanes). The moraine, although hard, cannot be considered as rock as it will weather down in relatively short time to some rather stable slope, and therefore high walls would be dangerous because of the glideplanes, which could cause severe slides. Especially the bottom layer of the moraine is a weak and dangerous glideplane as there is a considerable water leakage in that layer, and it is much less consolidated.

7. Finiglacial sand (FG)

South and west of Búrfell are extensive sand plains, which reach almost to the present sea. At present great part of the sand is overlain by postglacial lavaflows. The sandplains were formed during finiglacial periods when the sealevel was much higher than at present, and can be considered as deltaplains or outwash plains of the glacial rivers during this period.

The Búrfell sandplain is mostly made of a mixture of coarse sand and fine gravel that are current bedded, and slightly consolidated. This can clearly be seen at the erosion cliffs along the rivers Fossá and Thjórsá, which show almost vertical walls up to 5 m high. These cliffs seem to be fairly stable and, at the bottom of the river Fossá, big sandblocks that have fallen from the cliffs are soaking in the water and disintegrade only slowly. At least some of the blocks have been lying in the water for several years. Further to the south in the district Rangárvellir, caves have been exacavated in the sand and these caves have been preserved in good condition at least for several centuries.

Despite the consolidation of the sand the Borro-sound can penetrate it in its usual state, but at some places a "hardpan" layer of ferrous compounds and humus acids has been formed at the surface which cannot be penetrated by the Borro-sound.

Below the sand in the powerhouse area there seems to be a depression in the bedrock with rather even surface at roughly 120 m elevation. The upper end of this depression is filled by the moraine. West of the faultline at Sámsstadaklif the bedrock goes appreciably further down and below the scope of this project.

8. Overburden (OV)

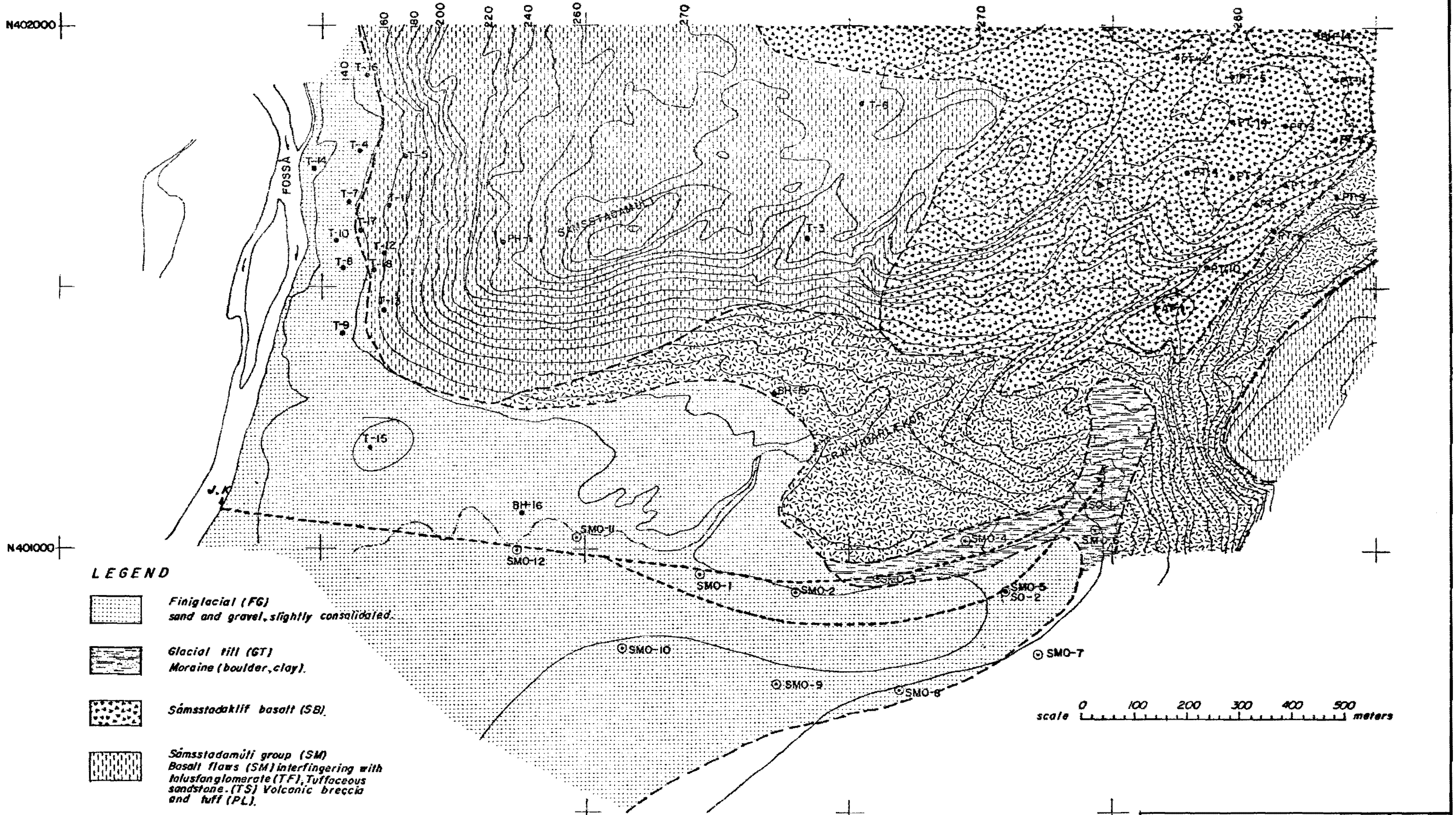
The Búrfell area is situated in the vicinity of Hekla, the most active volcano of Iceland in postglacial time. The distance between Hekla and the Project area is approximately 14 kilometers, and great quantities of volcanic ash and pumice have been carried to the Búrfell area from the numerous eruptions in Hekla.

In the Búrfell area, especially on the Thjórsá lavas and on the lower slopes of the mountains, there are thick layers of primary and rebedded tephra. The talus of Búrfell and the neighbouring mountains consists mainly of rebedded pumice which locally can be 30 metres thick. One of the tephra layers, H_3, reaches the thickness of 7 metres in primary bedding on the lava east of Búrfell. The primary tephra is coarse (up to 30 cm in diameter), and the specific gravity is extremely low, less than 1. But in the screes the rebedded tephra has broken down into smaller pieces of the size of gravel and coarse sand, and at the same time the specific gravity has increased. (The increase in specific gravity is owing to the fact that when the Pumice breaks down, closed vesicules and cavities in the pumice open up).

The specific gravity of massive rhyolite glass is approximately 2.2 and is thus the maximum specific gravity for the rhyolite tephra. The screes in the Búrfell area can be expected to have a specific gravity higher than 1, partly because of the above mentioned reason that the specific gravity increases with the breakdown of the tephra and partly because some amount of basalt pieces is mixed with the tephra.

The tephratic eruptions in Hekla have changed the course of most of the small rivers and brooks in the vicinity, so that even on fairly steep gradients, they are flowing on alluvial beds consisting of pumice and sand, and constantly fed by the unlimited source of pumice on the slopes and really everywhere in the area. The Trjavidarlaekur, brook is flowing on the flats between Sámsstadamúli and Búrfell. It seems that previously to the eruptions, the brook has had its course in a gully cut into the finiglacial sand. During and after the eruptions the gully was buried in the pumice by aggradation of the Trjavidar-laekur, which has stabilized on much steeper slope than previously. This old fossilized gully seems to be a good explanation as to why the before mentioned hardpan layer is not met in all the SMO Borro-soundings. Where they hit the old gully, no hardpan layer is present. These holes hit the sand at slightly lower elevation than the holes that hit the hardpan layer.

FIG. 1



LEGEND

- **Finiglacial (FG)** sand and gravel, slightly consolidated.
- **Glacial till (GT)** Moraine (boulder, clay).
- **Sámsstaðaklif basalt (SB).**
- **Sámsstaðamúli group (SM)** Basalt flows (SM) interfingering with talusfanglomerate (TF), Tuffaceous sandstone. (TS) Volcanic breccia and tuff (PL).
- **Older Búrfell (OB)** Basalt, andesite and rhyolite flows with clastic interbeds.
- Geologic contact between groups.

BÚRFELL PROJECT

MODIFIED SAETERSMOEN ALTERNATIVE

RAFORKUMÁLASTJÓRI

Geologic map

Sheet 1 of 2	B 277	Fnr. 6897
Nov. 64 EGV/hb	Tnr. 520	

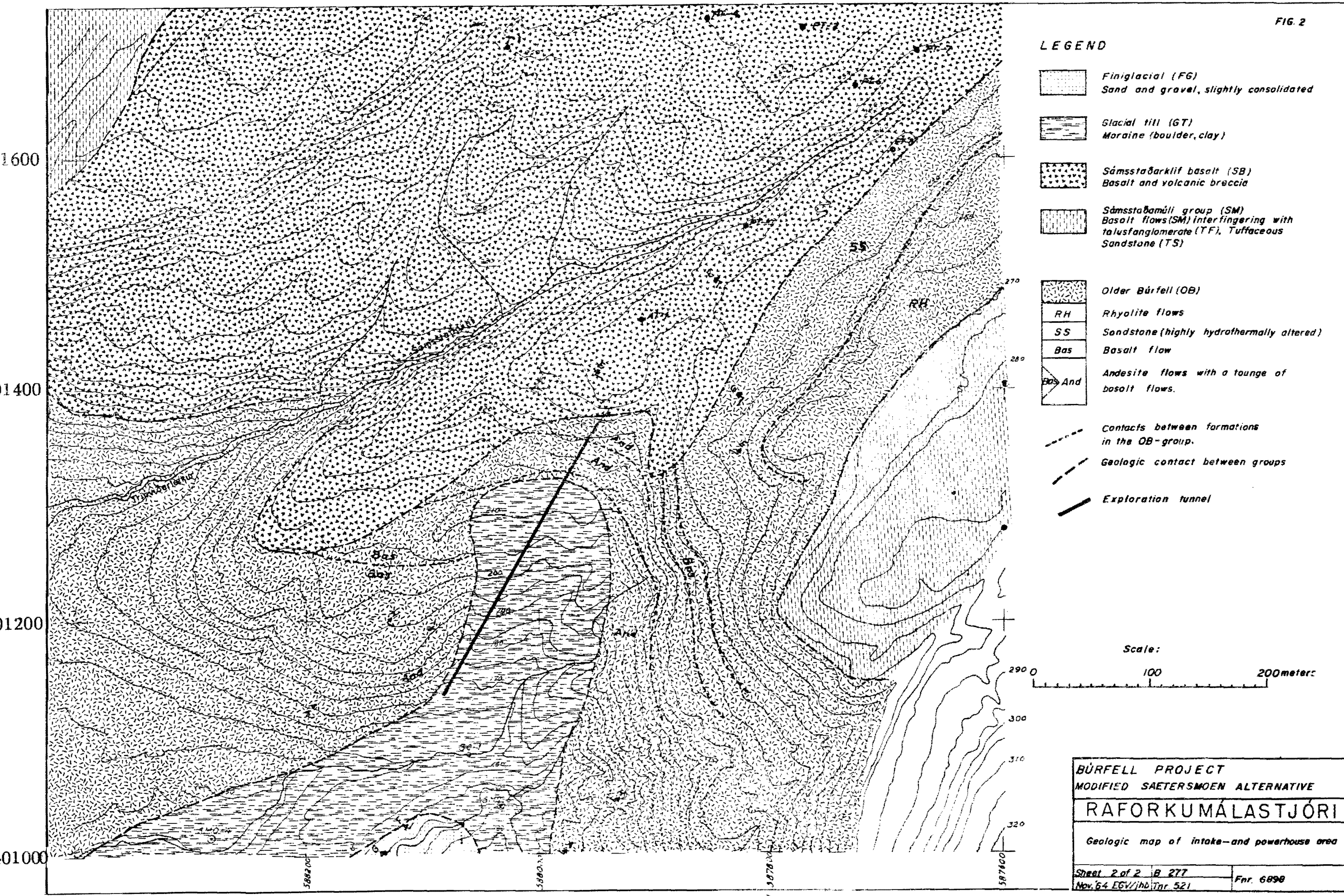
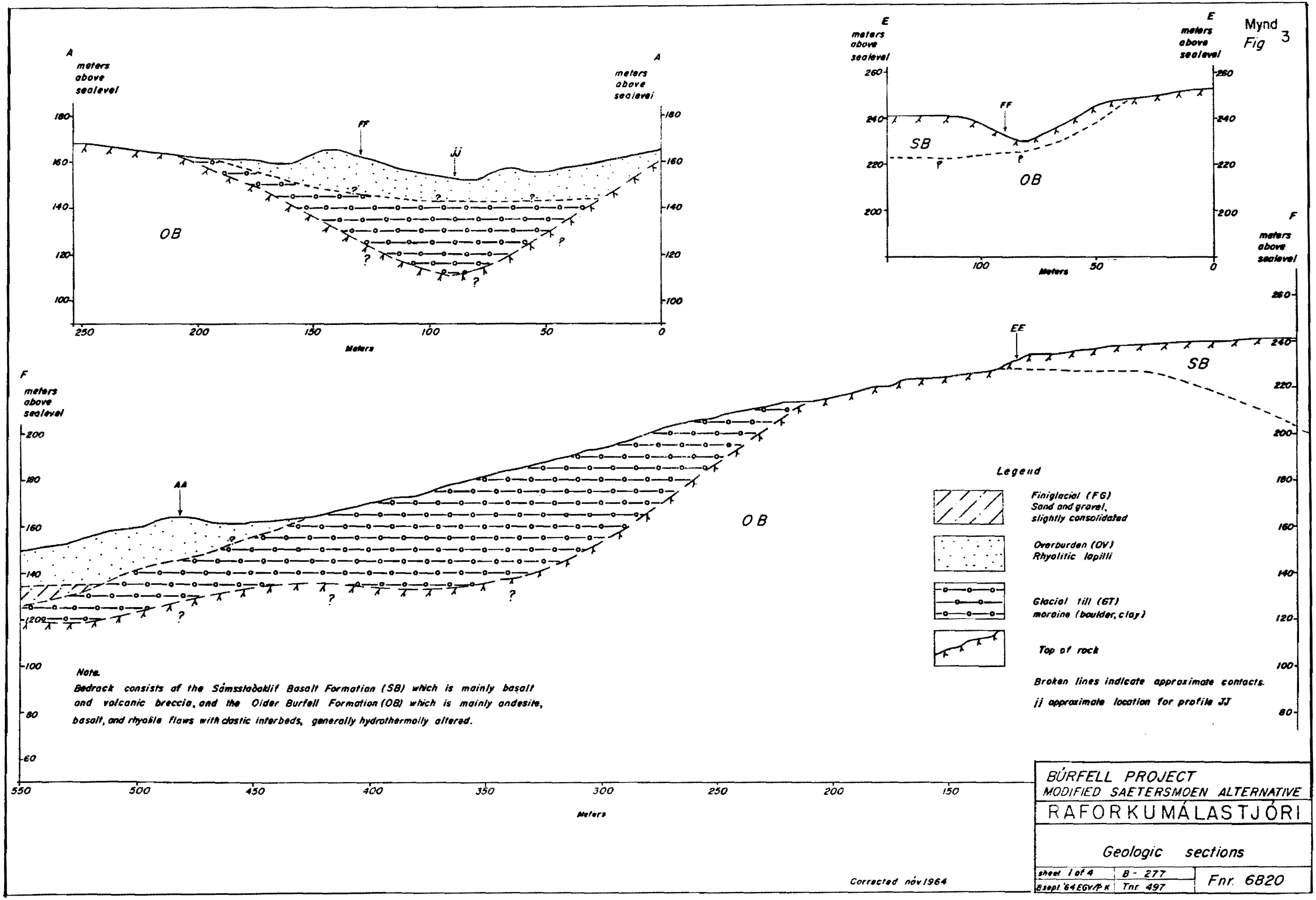
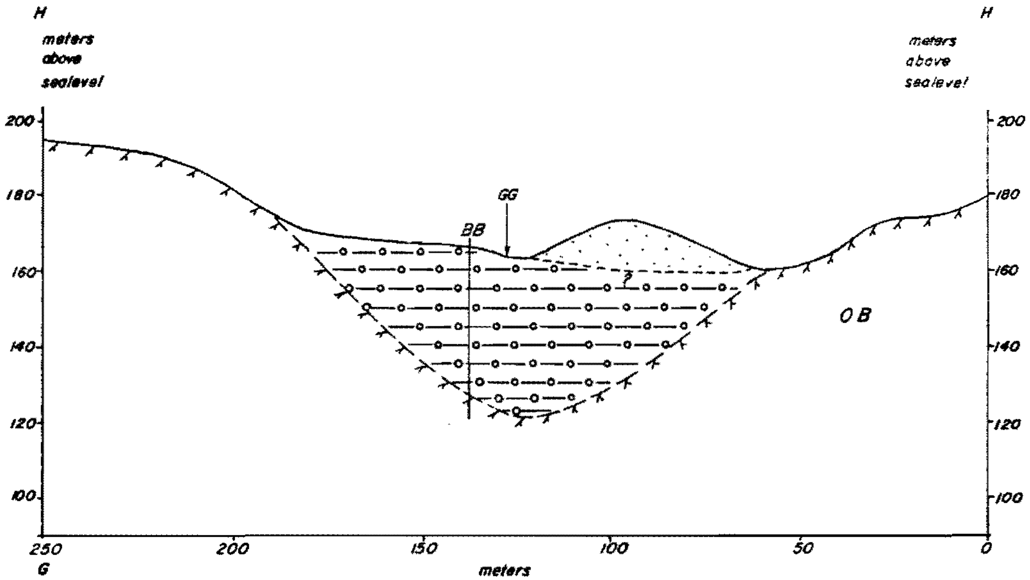


FIG. 2
LEGEND
Finiglacial (FG)
Sand and gravel, slightly consolidated
Glacial till (GT)
Moraine (boulder, clay)
Sámsstaðarklif basalt (SB)
Basalt and volcanic breccia
Sámsstaðamúli group (SM)
Basalt flows (SM) interfingering with talusfanglomerate (TF), Tuffaceous Sandstone (TS)
Older Búrfell (OB)
RH
Rhyolite flows
SS
Sandstone (highly hydrothermally altered)
Bas
Basalt flow
Bas And
Andesite flows with a tounge of basalt flows.
Contacts between formations in the OB-group.
Geologic contact between groups
Exploration tunnel
Scale:
0
100
200 meters
BÚRFELL PROJECT
MODIFIED SAETERSMOEN ALTERNATIVE
RAFORKUMÁLASTJÓRI
Geologic map of intake- and powerhouse area
Sheet 2 of 2
B 277
Nov. '64 EGV/jhb
Tnr. 521
Fnr. 6898
1600
1400
1200
1000
RH
SS
Bas
And
270
280
290
300
310
320


Mynd
Fig 3
A
meters above sealevel
FF
JJ
OB
Meters
E
meters above sealevel
SB
OB
EE
F
meters above sealevel
AA
O B
SB
Legend
Finiglacial (FG)
Sand and gravel,
slightly consolidated
Overburden (OV)
Rhyolitic lapilli
Glacial till (GT)
moraine (boulder, clay)
Top of rock
Broken lines indicate approximate contacts.
jj approximate location for profile JJ
Note.
Bedrock consists of the Sámsstaðaklif Basalt Formation (SB) which is mainly basalt
and volcanic breccia, and the Older Burfell Formation (OB) which is mainly andesite,
basalt, and rhyolite flows with clastic interbeds, generally hydrothermally altered.
Corrected nóv 1964
BÚRFELL PROJECT
MODIFIED SAETERSMOEN ALTERNATIVE
RAFORKUMÁLASTJÓRI
Geologic sections
sheet 1 of 4
8 sept. '64 EGV/P K
B - 277
Tnr. 497
Fnr. 6820

Mynd 4
Fig

Note.
Bedrock is Older Búrfell formation. (OB) Mainly andesite, basalt and rhyolite flows with clastic interbeds, generally hydrotermally altered.



LEGEND

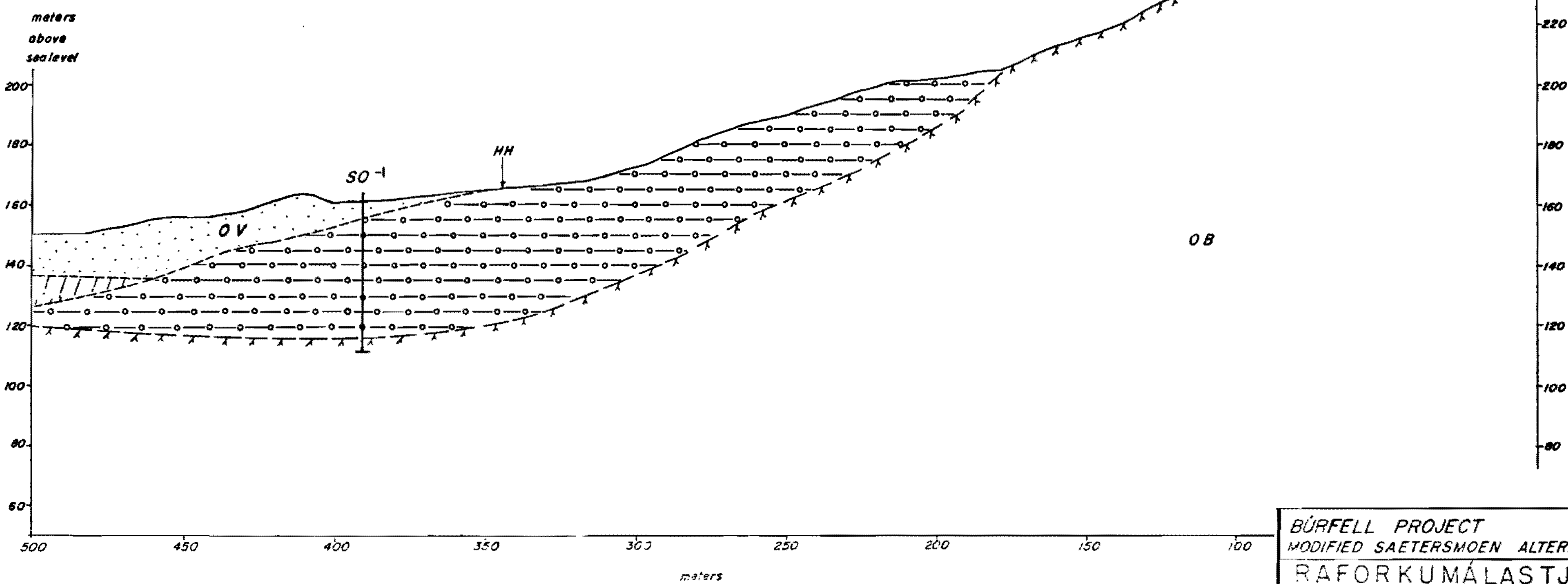
Overburden (OV)
Rhyolitic lapilli

Glacical till, well packed (GT)
moraine (boulder, clay)

Top of rock

Finiglacial (FG)
Sand and gravel,
slightly consolidated

Broken lines indicate
approximate contacts



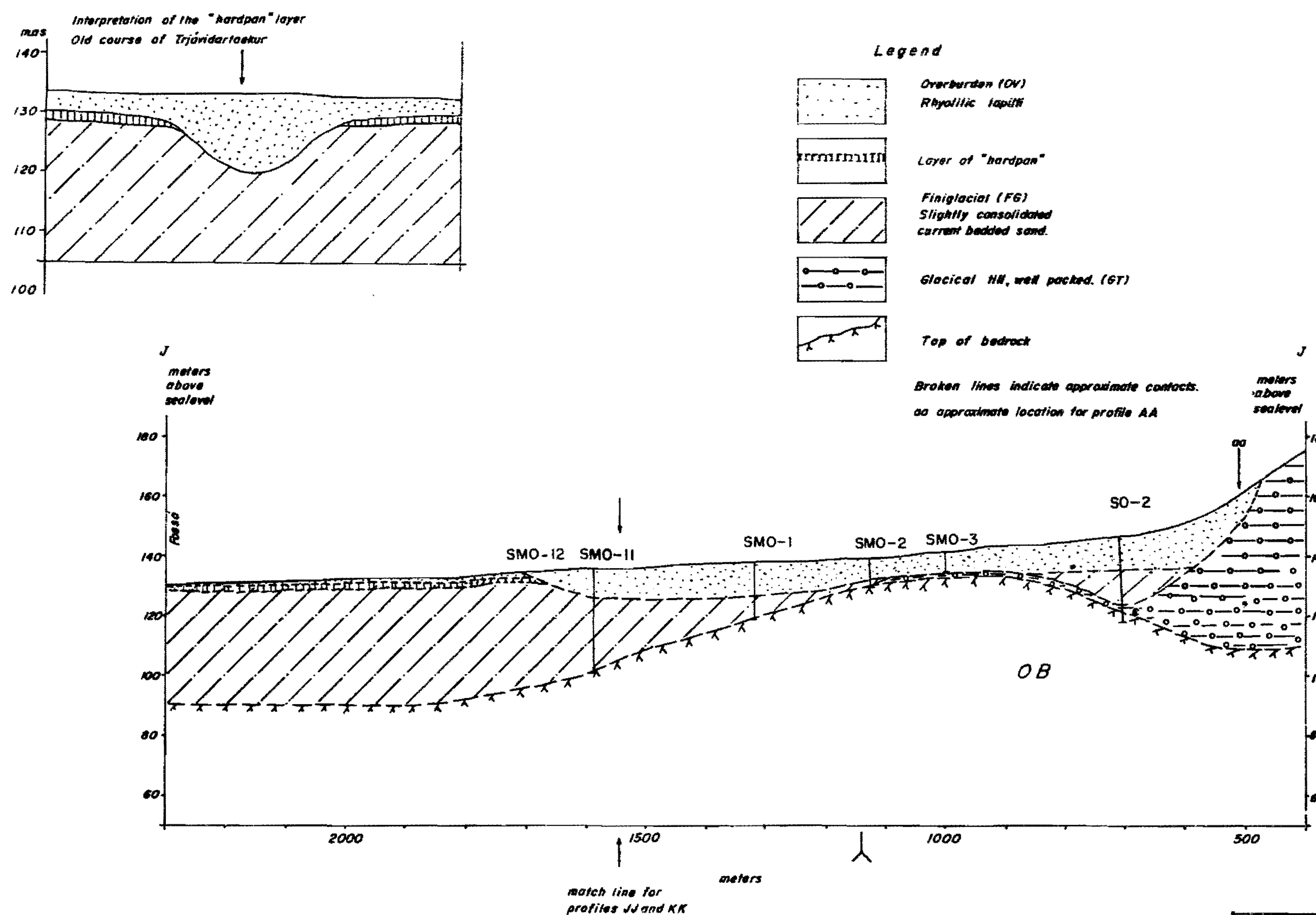
Corrected nov. 1964

BÚRFELL PROJECT
MODIFIED SAETERSMOEN ALTERNATIVE
RAFORKUMÁLASTJÓRI

Geologic sections

sheet 2 of 4	B - 277	Fnr. 6819
8 sept '64 EGV/sk	Tnr 496	

Mynd
Fig 5

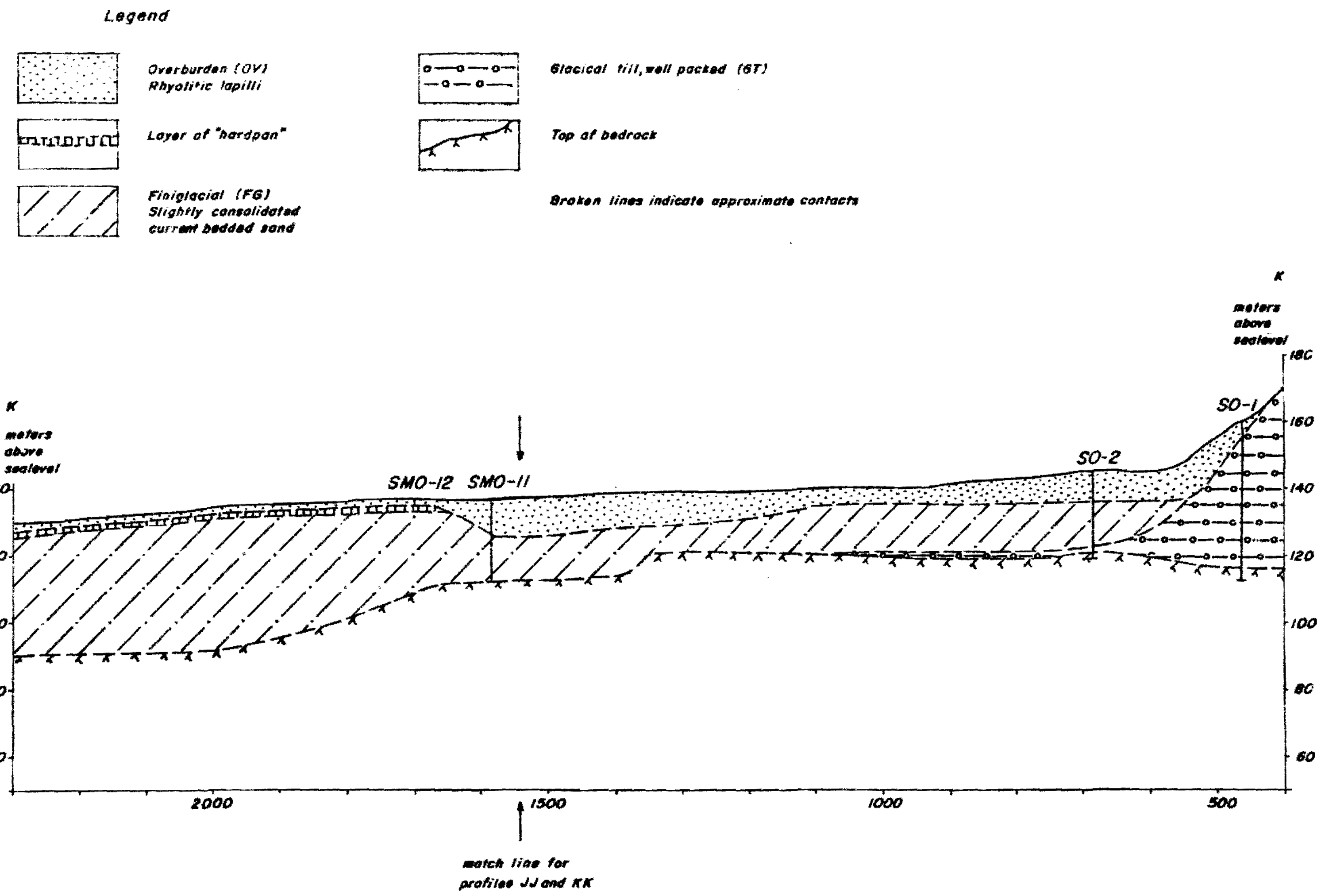


Note.
Bedrock most likely belongs to the Old Búrfell Formation (OB), which is mainly andesite, basalt and rhyolite flows with clastic interbeds, generally hydrothermally altered.

Corrected nov. 1964
ADDED: interpretation of the "hardpan" layer

BÚRFELL PROJECT MODIFIED SAETERSMOEN ALTERNATIVE		
RAFORKUMÁLASTJÓRI		
Geologic sections		
sheet 3 of 4	B - 277	Fnr 6821
8 sept. 64 EGv/Pk	Tnr 498	

Mynd 6
Fig

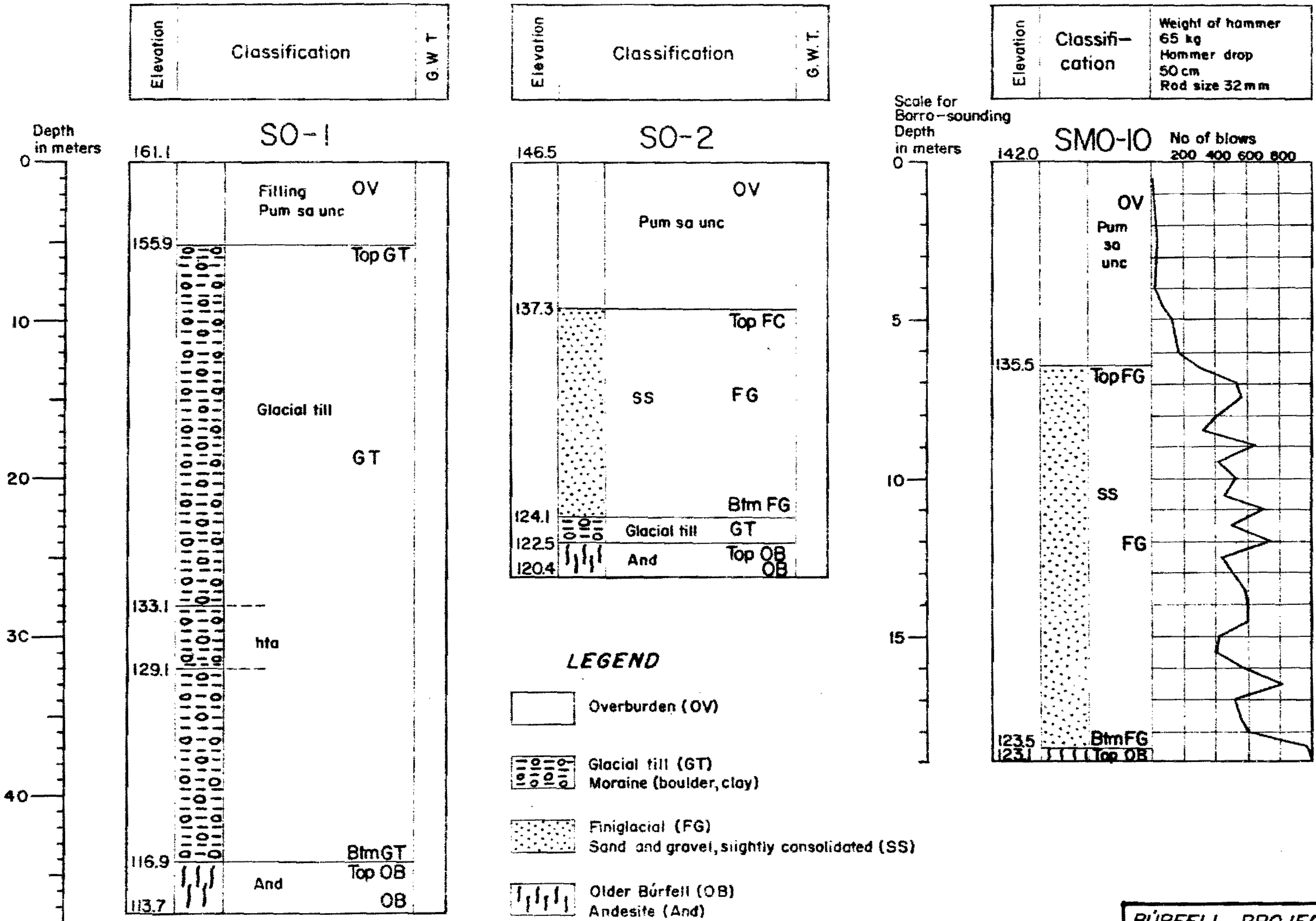


Note

Bedrock most likely belongs to the Old Búrfell Formation (OB), which is mainly andesite, basalt and rhyolite flows with clastic interbeds, generally hydrothermally altered.

BÚRFELL PROJECT MODIFIED SAETERSMOEN ALTERNATIVE	
RAFORKUMÁLASTJÓRI	
Geologic sections	
sheet 4 of 4 B-277 nóv. 64 EGV/Gyða Tnr. 522	Fnr 6899

Mynd 7
Fig



Note: SMO-10 is taken as an example of a Borro-sounding in the area

BÚRFELL PROJECT
MODIFIED SAETERSMOEN ALTERNATIVE
RAFORKUMÁLASTJÓRI

Graphic core logs

Nov.64 EGV/GyBo	Tnr. 515	Fnr. 6883
sheet 1 of:	B-277	