

State Electricity Authority (S.E.A.)

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BÚRFELL
THE STRATIGRAPHY OF SAMSTADAMULI

BY

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Reykjavík, June 1962

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Preface

This report is based on field work carried out by both authors during a week in early May this year. The scope of the report is to be used as a guide for the sub-surface exploration already started at the proposed Búrfell power plant. But during this exploration programme more detailed geological work will be done, i.e. the contacts of the various series and beds will be surveyed and our questions will be answered through drilling.

In the report entitled "Búrfell, General Geology" the Sámstaðsmúli is handled briefly, mainly through extrapolation of the stratigraphy of Búrfell to the Sámstaðsmúli. Naturally this extrapolation is not the whole truth as this report shows clearly.

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BÚRFELL
THE STRATIGRAPHY OF
SÁMSSTAÐAMÚLI

2. - 1. Introduction

In the report on the general geology of the Búrfell area, the part of the Hreppar-formation visible in Búrfell is divided into the following series:

- 1) The Búrfell basalt series; B3 (oldest)
- 2) The Búrfell sedimentary series, S3
 - a) The lower sediments, S3a
 - b) The intercalated lava layers, S3b
 - c) The upper sediments, S3c
- 3) The Búrfell middle - doleritic series, MD
- 4) The Búrfell pillow-lava series, P3 (youngest)

The Sámstaðamúli is there classified as belonging to the MD series on the top and the S3c and S3b in the lower part.

The latest investigations show that the MD is given too much space and the S3b is more complex in Sámstaðamúli than in Búrfell. Another division will therefore be used for the different series in Sámstaðamúli than in Búrfell, except for the S3c and MD, which seems to be reasonably accurate correlation. But before the division of Sámstaðamúli into different series is discussed the connection of it and Búrfell will be described.

2. - 2. The Stratigraphy around the main fault

The Búrfell proper meets the Sámstaðamúli in a very distinct unconformity just east of the main fault at Sámstaðaklif (see fig. 2.-2.). The surface of this unconformity is probably formed by erosion and dislocation along a major

fault at the same place and with the same direction as that now existing. The line of unconformity is in Búrfell fairly horizontal but just south-east of the main fault it grades down steeply. How far down is not known.

Older than the unconformity are the older Búrfell series, OB, south-east of the main fault, but younger are the Sámstaðaklif, breccia and basalt series, SBB, which consists of thick beds of boulderconglomerate, palagonite breccia and basalt beds.

One basalt layer in the SBB ^{LIES} overlays the OB but overlaying it are the younger Búrfell series of which the upper sediments SSc and the middle - doleritic MD have comparable leads in the Sámstaðamúli.

In order of probable age the Sámstaðamúli can be divided into the following series:

- Older Búrfell series, OB, or
- Skeljastaðir series, SK, (oldest)
- The Sámstaðaklif breccia and basalt series, SBB,
- The Sámstaðir basalt series, SM
- Younger Búrfell series, YB, (youngest)

2. - 3. The older Búrfell series, OB.

The older Búrfell series (section 1) crops out south-east of the main fault. A schematic section through the visible part of these series is on fig. 2-2. It consists mainly of lava beds with thin horizons of conglomerate and an intrusive olivine-basalt. The olivine basalt has big phenocrysts of olivine. The lavabeds are from top to bottom:

Andesite, An, is roughly columnar jointed and has closely spaced cracks perpendicular to the jointing. The colour is light gray on weathered surfaces.

Basalt, OB, is underlying the andesite with a scoriaceous horizon in between. It resembles the andesite macroscopically, although the colour is darker and the columnar jointing smaller.

Basalt, OB₂, ^{is} dark and dense with small columnar jointing.

The olivine-basalt O1 is between OB, and OB₂ facing the fault.

Basalt OB₃ is similar to OB₂.

Between OB₂ and OB₃ is a bed of conglomerate.

Some of these layers can be traced further into Búrfell, but the slopes are ^{THERE} mainly covered with talus.

2. - 4. The Skeljastaðir series, SK.

The Skeljastaðir series ^{ARE} outcropping mainly in the westside of the Sámstaðamúli in the lower part of the mountain.

Section 2 consists of following beds:

Sandstone and conglomerate, SK₅ lowest. Only visible around this section. It is usually rather homogenous medium sand with a thin boulder horizon laying discordant in it.

Basalt layer SK₄ is a dark dense basalt with small phenocrysts of feldspar. It is mainly cube jointed with a more regular jointing at bottom. Small apophyses seem to penetrate from it into the breccia above.

This indicates that SK₄ is an intrusive.

Palagonite breccia SK₃ as above SK₄ is not exposed in this section but at section 3. There it is rather coarse and even pillowy palagonite breccia. Its origin is doubtful. It might be the top of the basalt intrusive or a separate breccia bed.

A pebble horizon 10-20 cm thick is on top of the breccia.

The basalt lava flow SK₂ is bluish gray with phenocrysts of pheldspar. In its lower part it is columnar jointed but higher up cube jointed.

✓ Conglomerate SK₁ is not visible in this section but is found farther north and at section 3.

UNCONFORMITY

At section 3 is an unconformity just at the gully. In the westside of the gully are the same layers as described in section 2, except the sandstone is not visible. But in the south side the beds SK₂ and SK₃ do not exist, but the conglomerate SK₁ takes their space. In the lower part the conglomerate is very coarse boulderconglomerate, but in the middle and upper part finer and better rounded with traces of compound foreset bedding.

✓ The beds SK₁ to SK₃ can be followed along the western side of the mountain for approximately 5-6 km from section 3, but there is a fault with the direction N 60° E with the
TO THE EAST.
✓ downthrown block east. North of this fault sandstone is dominating below SK₄.

2. - 5. The Sámstaðaklif breccia and basalt series SBB

Around the main fault at Sámstaðaklif and to the north-west of it is the Sámstaðaklif breccia and basalt series, which are the most extensive series in Sámstaðamúli.

Underlying the ~~the~~ basalt and the breccia is a very thick layer of boulderconglomerate, which is here included in ^{SERIES.} this series.

Section 4 consists of following beds:

Lowest is a basalt, rather dark and without phenocrysts. It is not included in ^{THIS} this series.

Then comes boulderconglomerate SBB₃ of several tens of meters thickness and especially in the upper part with big angular blocks of basalt as well as palagonite breccia. Rhyolitic ^{PEBBLES} pebbles and blocks are not uncommon but the matrix is somewhere rhyolitic but usually basaltic sand and silt.

Volcanic rock is overlaying the boulderconglomerate and it consists of two different types of rock. The lower part, which is thickest just at the main fault, is mostly palagonite breccia with numerous veins of basalt SBB₂. The lowest part of it at the main fault is roughly bedded.

Highest are several lava flows with bottom breccia. The lava is usually cube jointed and at places almost pillow. The rock is dark and dense hyalobasalt without phenocrysts very closely jointed.

Drillhole BH-14, drilled in autumn 1961 was drilled through two basaltic layers of the SBB₁, a 12 m thick palagonite breccia SBB₂ and a 40 m thick bed of boulderconglomerate SBB₃. Also the drillhole FT-1 recently finished showed the same stratigraphy except SBB₂ was not found there. In a small hillock just north of the main fault at the edge of the map (fig. 2-1) a coarse boulderconglomerate crops out.

Probably all these now mentioned boulderconglomerates represent the same bed ^{L A I D} down along the steep surface of unconformity at Sásstaðaklif. The most probable origin of SBB₃ is talus or alluvial fan ^{O R I G I N A T E D} from east and north. So more precise name should be talus-breccia or fanglomerate. Probably it is both and even more complicated by volcanic action ^L simultaneously with its formation.

The SBB₂ has eventually been partly formed ^{L e} simultaneously with the boulderconglomerate but mainly it is overlaying it and is younger. The SBB₂ are lava-flows which ^{h a v e} have flown into depressions at Sásstaðaklif filled with water. Higher up the topography has become more even but probably still there has been water present, because the lower contacts of the basalt beds SBB₁ are usually palagonite breccia. At last the contacts have been rapidly chilled.

2. - 6. The Sásstaðir basalt series, SM

The Sásstaðir basalt series outcrop mainly in the southwestern part of Sásstaðamúli. It consists mainly of basalt lava beds and one breccia horizon%.

Section 5 consists of:

Palagonite breccia SM₄

Basalt SM₃, with phenocrysts of both olivine and pheldspar. It has mostly columnar jointing.

Basalt SM₂, similar to SM₃

✓ Basalt SM₁, a number of basalt lava flows, each flow rather thin without interbedded sediments. The basalt is perphyritic with rather big phenocrysts of ~~pheldspar~~ pheldspar. The jointing is rather irregular.

✓ A little north of this section some almost vertical ^{dikes} ~~dikes~~ penetrate into the breccia SM₄. These dikes consist of dark dense basalt with small ~~phenocryst~~ ^{phenocrysts} of pheldspar.

✓ Just south of section 3 is a basalt lava flow overlaying SK₁ but goes under SM₄. This basalt flow, given the initials SM₅, is dense, dark ^{HYALD} ~~hyalobasalt~~ with small but regular columns.

✓ The Sámstaðir basalt series (SM) is clearly younger than the Skelfastaðir series (SK) and at least partly younger than the volcanic facies of the Sámstaðaklif breccia and basalt series. But possibly are the oldest (SHE₁ and 2) part of the SM of the same age as the SHE₁ and 2. ^{AND 2}

2. - 7. The younger Búrfell series, YB

The younger Búrfell series outcrop at two places:

✓ One is south  east of the main fault at Sámstaðaklif, the other is the top of the southwestern part of Sámstaðamúli.

At the main fault, the younger Búrfell series (YB) consist of conglomerate SSc very rich in rhyolitic pebbles; a rhyolitic lava flow Rh visible in ca 500 m long outcrop; two beds of middle doleritic basalt MD, a pheldspar porphyritic light gray to bluish gray basalt-lava flows. On top of MD are the pillow lava series, which form the top of Búrfell. Smaller outcrops of MD are also north ~~xxxx~~ of Sámstaðaklif.

In south-western Sámstaðamúli is the SSc overlaying the Sámstaðir basalt SM and also overlaying the Sámstaðaklif breccia and basalt SEB. It is thickest at the contact to SEB but decreasing in thickness to the west. It consists mostly of basaltic pebbles, but rhyolitic pebbles are not unfrequent. Both the middle doleritic lavas (MD) are on top of SSc here, and also probably one more lava bed.

The younger Búrfell series are in both the main outcrops overlaying the SEB and also is it on top of the SM. It is therefore clearly the youngest rock in Sámstaðamúli.

2. - 8. The age relationship.

The age relationship of the various series in the Sámstaðamúli seems to be the following in increasing age:

Younger Búrfell series

The Sámstaðir basalt series

The Sámstaðaklif breccia and basalt series and either one or both of the Skeljastaðir series and the older Búrfell series.

It is not clear yet whether all the SM series are younger than SEB, ~~and 2~~ ^{AND 2} or only the upper part. It is possible that the lowest part of SM can be correlated with part of the SEB.

V The boulder conglomerates in the Skeljastaðir series SK₄ and that of the Sámstaðamúli breccia and basalt series SB₂ are probably the same bed. Magroskopikally resembles the basalt beds in drillholes BH-14 and FT-1 which are underlying the boulderconglomerate, the basalt of SK₄ which are underlying the boulderconglomerate south of the unconformity at section 3. But no ^{DEFINITE PROOFS} definite proofs are yet for this statement and it must be the task of the drilling to obtain the ^{PROOFS} proofs.

V From field work only it is impossible to determine the surface of unconformity below Sámstaðaklif. But it is the key to the age relationship between the older Búrfell series and probably the Skeljastaðir series. (The basalt below boulderconglomerate in drillhole BH-14 and FT-1 ^{ARE} as here counted to the Skeljastaðir series). If the surface of unconformity is below this basalt beds the Skeljastaðir series are younger than the older Búrfell series, but, if the surface of unconformity is on top of this basalt beds, the Skeljastaðir series are of similar age although rather older than the older Búrfell series.

2. - 9. Tectonic







The faults in the Búrfell area are treated in the "Búrfell General Geology 1.2.6 and the matter will only be handled here with special reference to the Sámstaðamúli.

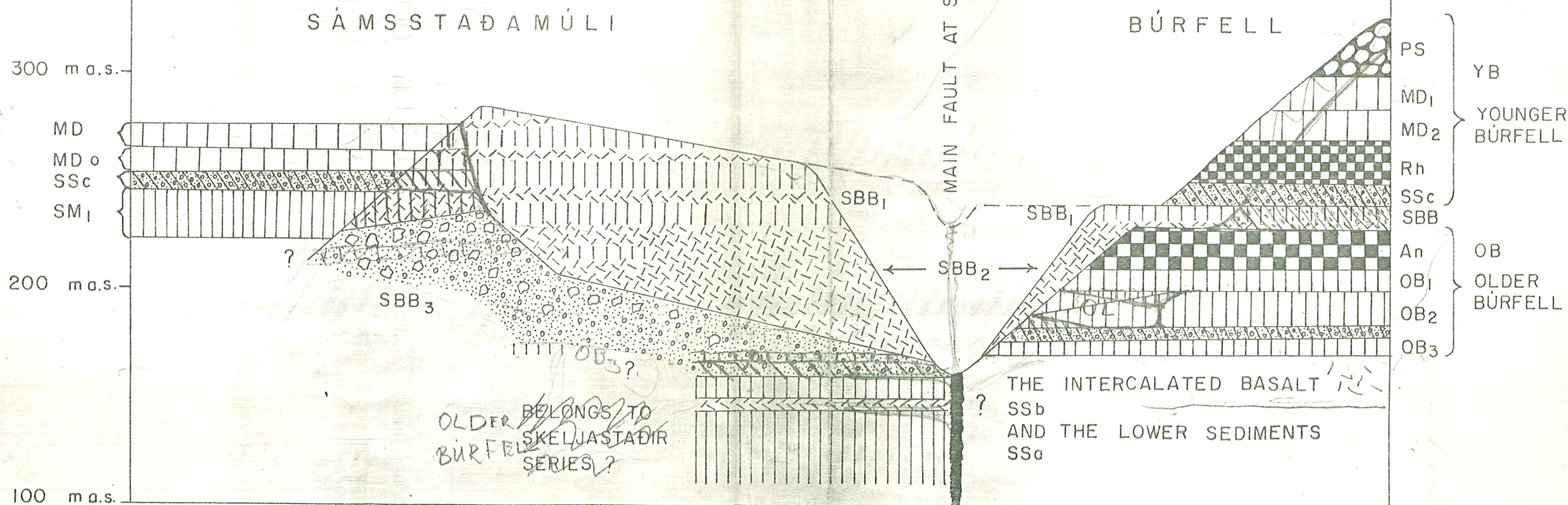
The main fault at Sámstaðaklif is a wrenchfault (tear fault or strike-slip-fault), and no vertical displacement is observed. If such displacement has occurred at this fault, it has been previous to the unconformity there. Other faults are mostly only fissures except for the two western most ones

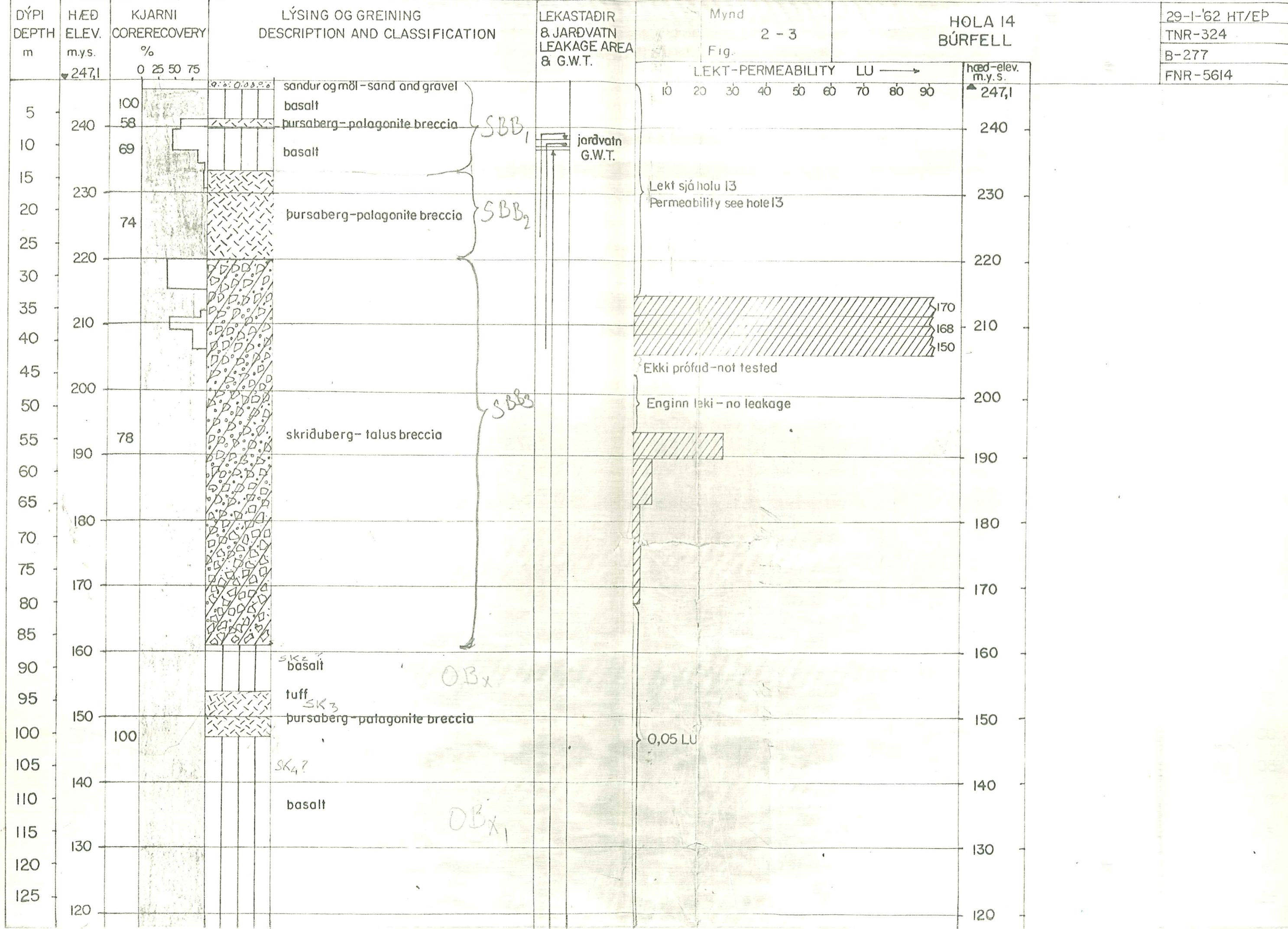
shown on the map. There are vertical displacement with the downthrown block to the west. The displacement is only a few meters in each case. At the western slope of Sámstaba-
múli just outside the map is the fault mentioned in 2.-4.
There is the ^{BLOCK} ~~block~~ to the east downthrown. This seems to indicate that the main part of Sámstaba-
múli is a down-
faulted block.

SCHEMATIC INTERPRETATION OF THE STRATIGRAPHY AROUND SÁMSSTAÐAKLIF

LEGEND:

-  BASALT
-  PALAGONITE BRECCIA
-  RHYOLIT OR ANDESITE
-  BOULDER CONGLOMERATE
-  CONGLOMERATE
-  HYDROTHERMAL ALTERATION





29-I-'62 HT/EP
TNR-324
B-277
FNR-5614

LEKT-PERMEABILITY LU →

10 20 30 40 50 60 70 80 90

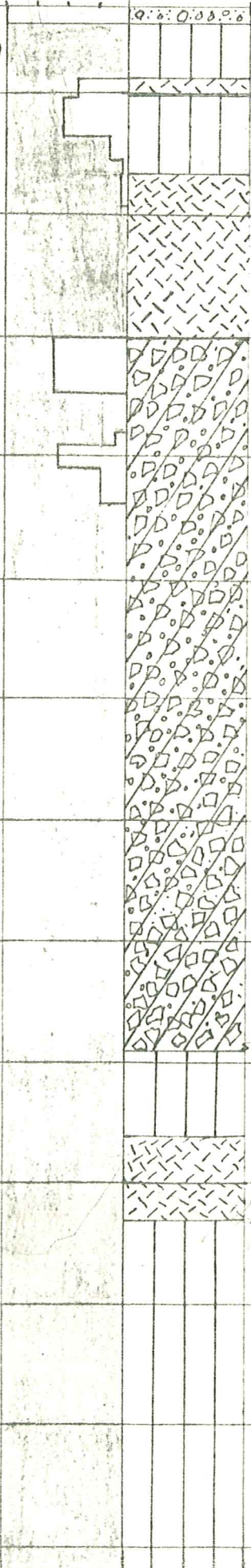
Lekt sjá holu 13
Permeability see hole 13

Ekki prófað-not tested
Enginn leki - no leakage

0,05 LU

OB_x

OB_{x1}



0 25 50 75

100

58

69

74

78

100

22.5'62 HT/PJ
 TNR. 342
 B- 277
 FNR - 5763

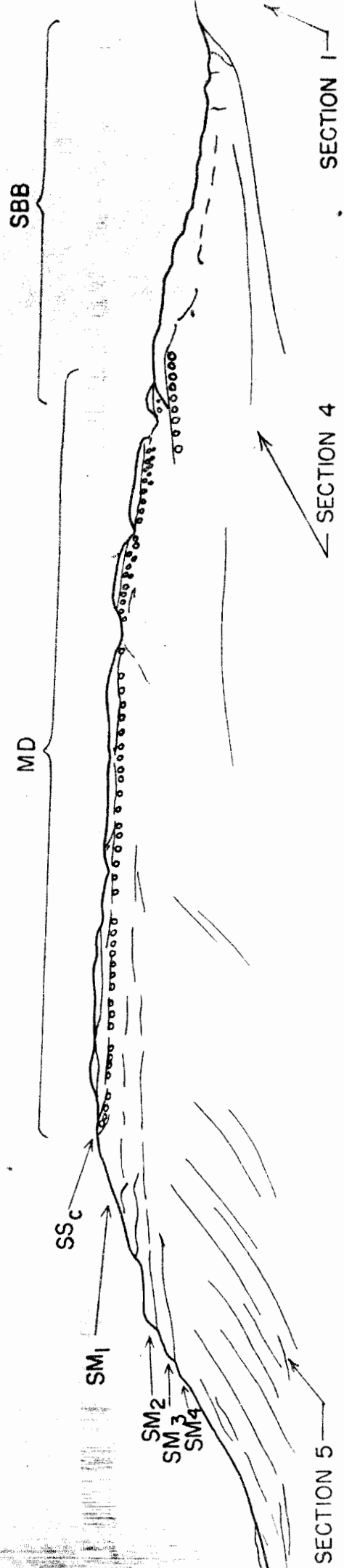
RAFORKUMÁLASTJÓRI

SOUTH SIDE OF SÁMSSTAÐAMÚLI

Fig. 2-4

WEST

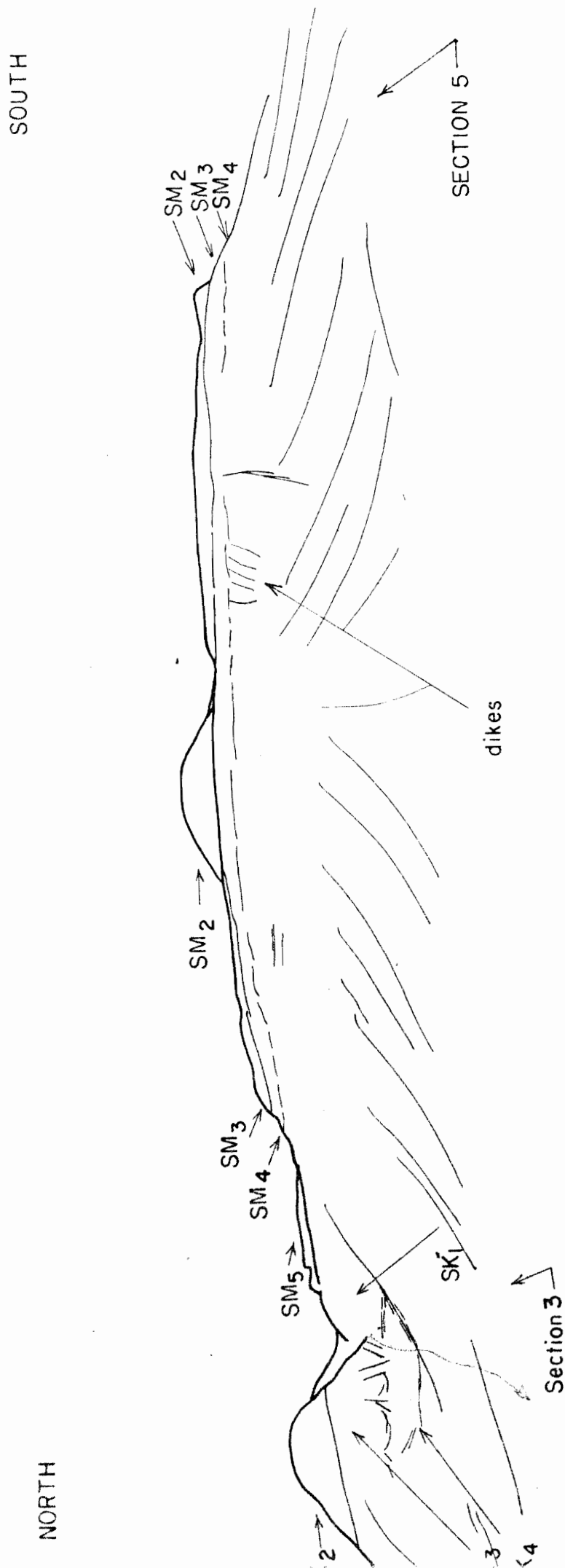
EAST



SOUTH SIDE OF SÁMSSTAÐAMÚLI

Drawing after a photograph by C.K.WILLEY

Fig. 2 - 5	RAFORKUMÁLASTJÓRI	22.562 HT/PJ
	WEST SIDE OF SÁMSSTAÐAMÚLI	TNR. 341
		B - 277
		FNR 5762



WEST SIDE OF SÁMSSTAÐAMÚLI
Drawing after a photograph by C.K. WILLEY.