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NATIONAL ENERGY AUTHORITY

HELGUVÍK

Quarry study

Björn A. Harðarson

OS85092/VOD22 B November 1985

NATIONAL ENERGY AUTHORITY
HYDROPOWER DIVISION

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1 INTRODUCTION

The work described in this report was conducted in accordance with a contract between Icelandic Prime Contractors and National Energy Authority, dated October 28, 1985.

The work carried out by National Energy Authority included the following;

1. Core logging of 8 boreholes (B-11 to B-18) drilled in the designated quarry area NW of Helguvík (see location on Fig. 1). The coordinates, elevation and depth of boreholes is shown in Table 1. Core logs are presented in Appendix 1. Core photographs are shown in Appendix 2.

2. Quarry yield predictions based on results of the drilling and previous data.

TABLE 1

Coordinates, elevation and depth of boreholes

Name	Lambert coordinates X	Y	Elevation (m)	Depth (m)
B-6	722.657	399.482	25.0	15.2
B-7	722.587	399.307	23.1	60.3
B-8	722.725	399.324	23.9	60.1
Boreholes drilled in october 1985				
B-11*	722.643	399.405	23.6	25.5
B-12*	722.774	399.359	22.0	25.5
B-13	722.780	399.466	26.0	25.5
B-14	722.881	399.314	23.2	22.6
B-15	722.987	399.411	25.1	25.6
B-16	723.042	399.564	24.5	25.5
B-17	722.829	399.588	25.1	25.5
B-18	722.774	399.689	26.9	25.0

* Note: Two previous holes, drilled in december 1983 in the Selvik area, have the same numbers (see figure 1).

2 GENERAL DESCRIPTIONS OF THE ROCKS

All the boreholes penetrate the same lava flow and the core is geologically quite similiar from one hole to the other. Three older boreholes in the designated quarry area (B-6, -7 and -8) also show the same rock unit.

Detailed geological description of lava flows in the Helgavík area has been given in earlier report (OS-82042/VOD25B) and needs no repetition.

The relative quality of the rocks in the boreholes for quarrying purposes is shown on Fig. 2. The top few meters of each borehole is in highly to moderately jointed rock (excluding the thin overburden), as commonly seen in lava flows of this kind. The thickness of this jointed surface-rock is from 2 m in B-15 to 8 m in B-18. Below this the rock is quite sound in all the boreholes. In some holes the sound rock extends down to bottom which in most cases is around sea level. The thickness of the sound rock in the holes is commonly 14-18 m with a maximum of 26 m in B-8 (60 m deep hole) and a minimum of 6 m in B-14. Five of the holes extend through the sound rock into moderately and highly jointed rock.

Details of jointing frequency in the boreholes can be seen in the core logs and core photographs. It should be pointed out that RQD_{50} and RQD_{100} of the rocks are given in the logs as well as the traditional RQD_{10}. It is of interest to note that scoria was not found in any of the holes and slightly scoriacious lava was only found in B-15 (lower part) and at the bottom of B-14.

These results show predominantly good rock for quarrying purposes and strongly indicate that the same thick lava flow-unit extends over the whole designated quarry area. This flow-unit is nicely exposed along the cliff ramp and in the test quarry at the base of the ramp. The existence of a very broken and scoriaceous rock in the NE side of the test quarry shows however, that unusable rock bodies of considerable thickness and extent can be expected anywhere in the designated quarry area.

3 QUARRY YIELD PREDICTIONS

The designoted quarry area is divided into nine sections (Q1-Q9, see Fig. 1). The south rim of the quarry area is believed to be least suitable and is omitted in the yield estimates shown in tables 2 and 3. The estimates are based on linear extrapolation of the stratigraphy from boreholes and cliff exposures. The yield is calculated for two different quarry depths, to +10 m elevation in table 2 and to +15 m elevation in table 3. The estimated competent rock volume is obtained by reducing the sound rock thickness in each borehole and cliff exposure above those elevations by 20-30% (to account for possible bad rock areas in each section). Average armor stone yield is estimated 30% of the volume of competent rock. Bulking factors of 1.40 for armor stone and 1.25 for core material are assumed. Rock waste is estimated 10% of total rock volume.

Based on these assumptions the quantity of armor stone for quarry depth to +10 m would average 18.7% of total volume shot versus 14% for quarry depth to +15 m. The percentage for the sections Q1-Q9 would range from 15% (Q1) to 23% (Q3) for quarry depth to +10 m.

These results indicate that the designated quarry area can produce sufficient material for the proposed jetty and docking facilities.

Finally it should be stressed that the yield estimates for seven of the nine sections are based on only one borehole.

TABLE 2

QUARRY YIELD ESTIMATES
Quarry depth to +10 m elevation

Section No.	Total volume (m^3)	Estimated volume of competend rock (m^3)	Estimated yield * Armor stone Class I+II (m^3)	Core material Class III+IV (m^3)
Q1	104.800	37.400	15.700	103.900
Q2	240.100	96.000	40.300	234.100
Q3	322.400	173.600	72.900	297.600
Q4	290.000	140.000	58.800	273.700
Q5	217.000	108.500	45.600	203.400
Q6	236.200	110.200	46.300	224.400
Q7	383.200	164.200	69.000	369.500
Q8	270.600	112.000	47.000	262.400
Q9	302.600	115.600	48.600	297.100
TOTAL	2.366.900	1.057.500	444.200	2.266.100

*) Assumptions: armor stone yield = 30% of competent rock volume
bulking factor = 1.40 for armor stone
bulking factor = 1.25 for core material
rock waste = 10% of total volume

TABLE 3

QUARRY YIELD ESTIMATES
Quarry depth to +15 m elevation

Section No.	Total volume (m^3)	Estimated volume of competent rock (m^3)	Estimated yield * Armor stone Class I+II (m^3)	Core material Class III+IV (m^3)
Q1	67.400	30.000	12.600	64.600
Q2	144.100	57.600	24.200	140.500
Q3	198.400	99.200	41.600	186.000
Q4	190.000	80.000	33.600	183.700
Q5	139.500	46.500	19.500	139.500
Q6	157.500	55.100	23.200	156.500
Q7	246.400	68.400	28.800	251.500
Q8	177.300	37.400	15.700	185.400
Q9	206.600	38.600	16.200	217.900
TOTAL	1.527.200	512.800	215.400	1.525.600

*) Assumptions: armor stone yield = 30% of competent rock volume
bulking factor = 1.40 for armor stone
bulking factor = 1.25 for core material
rock waste = 10% of total volume

Reference:

Víkingsson, S. and Kristinsson, B., 1982: Holmsberg. Geological report. National Energy Authority OS82042/VOD25B, May 1982.

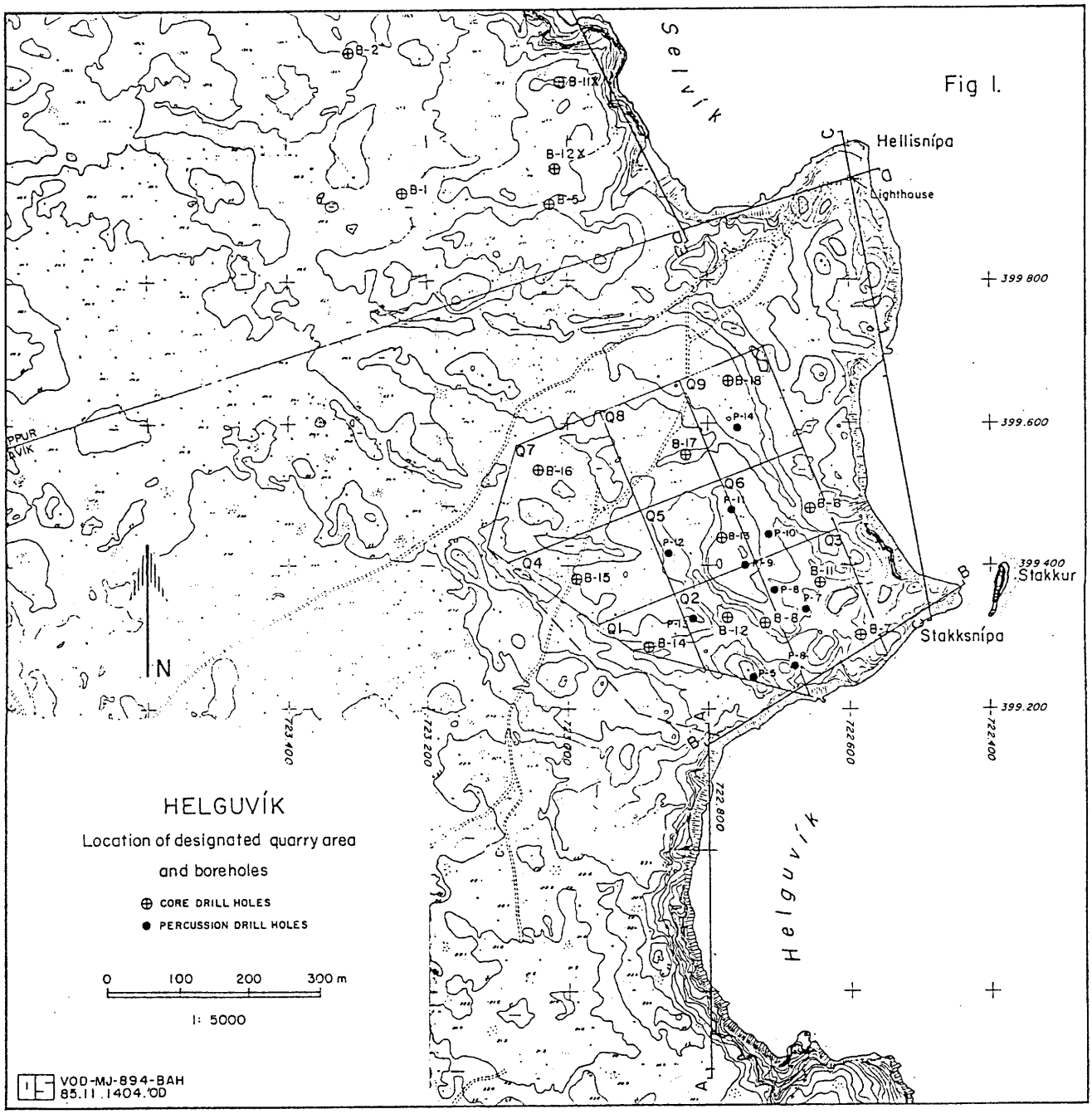


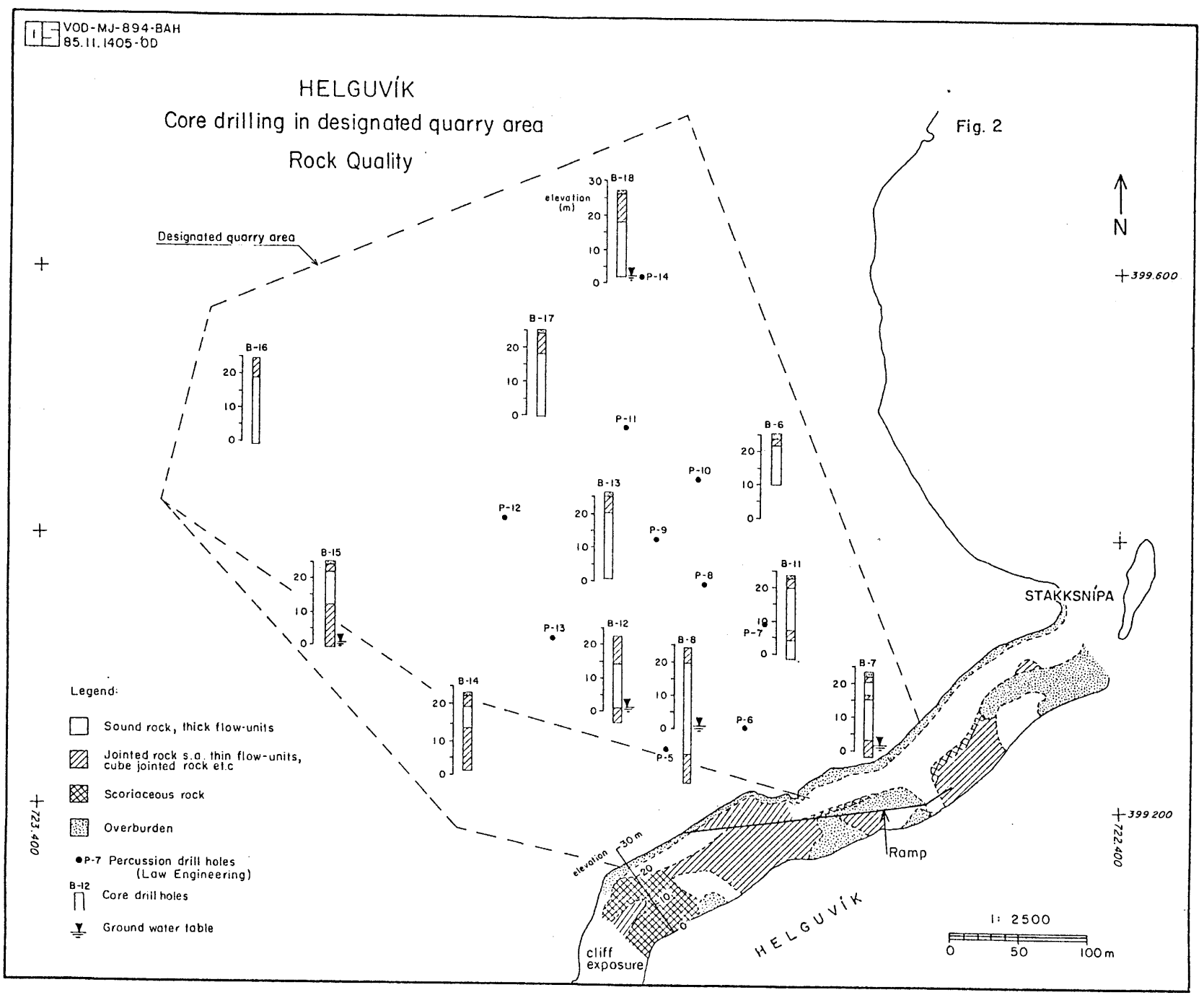
Fig I.
Selvik
Hellisnípa
Lighthouse
Stakkur
Stakksnípa
Helguvík
B-1
B-2
B-5
B-11
B-12
B-13
B-14
B-15
B-16
B-17
B-18
P-1
P-5
P-6
P-7
P-8
P-9
P-10
P-12
P-14
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
399 800
399.600
399 400
399.200
722 400
722 600
722 800
723 200
723 400
N
HELGUVÍK
Location of designated quarry area
and boreholes
CORE DRILL HOLES
PERCUSSION DRILL HOLES
0 100 200 300 m
1: 5000
VOD-MJ-894-BAH
85.11.1404.'0D

VOD-MJ-894-BAH
85.11.1405-00

HELGUVÍK

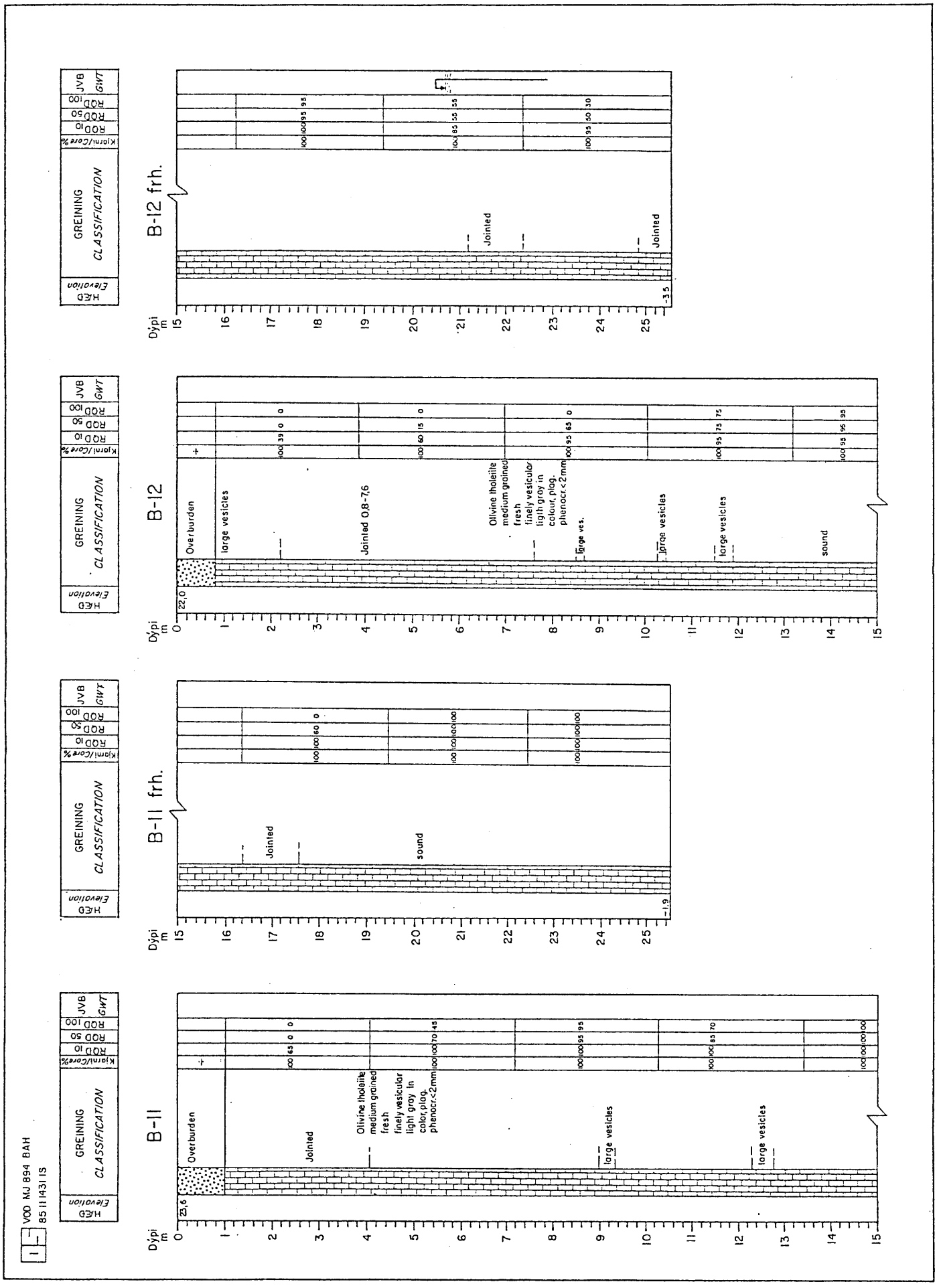
Core drilling in designated quarry area

Rock Quality

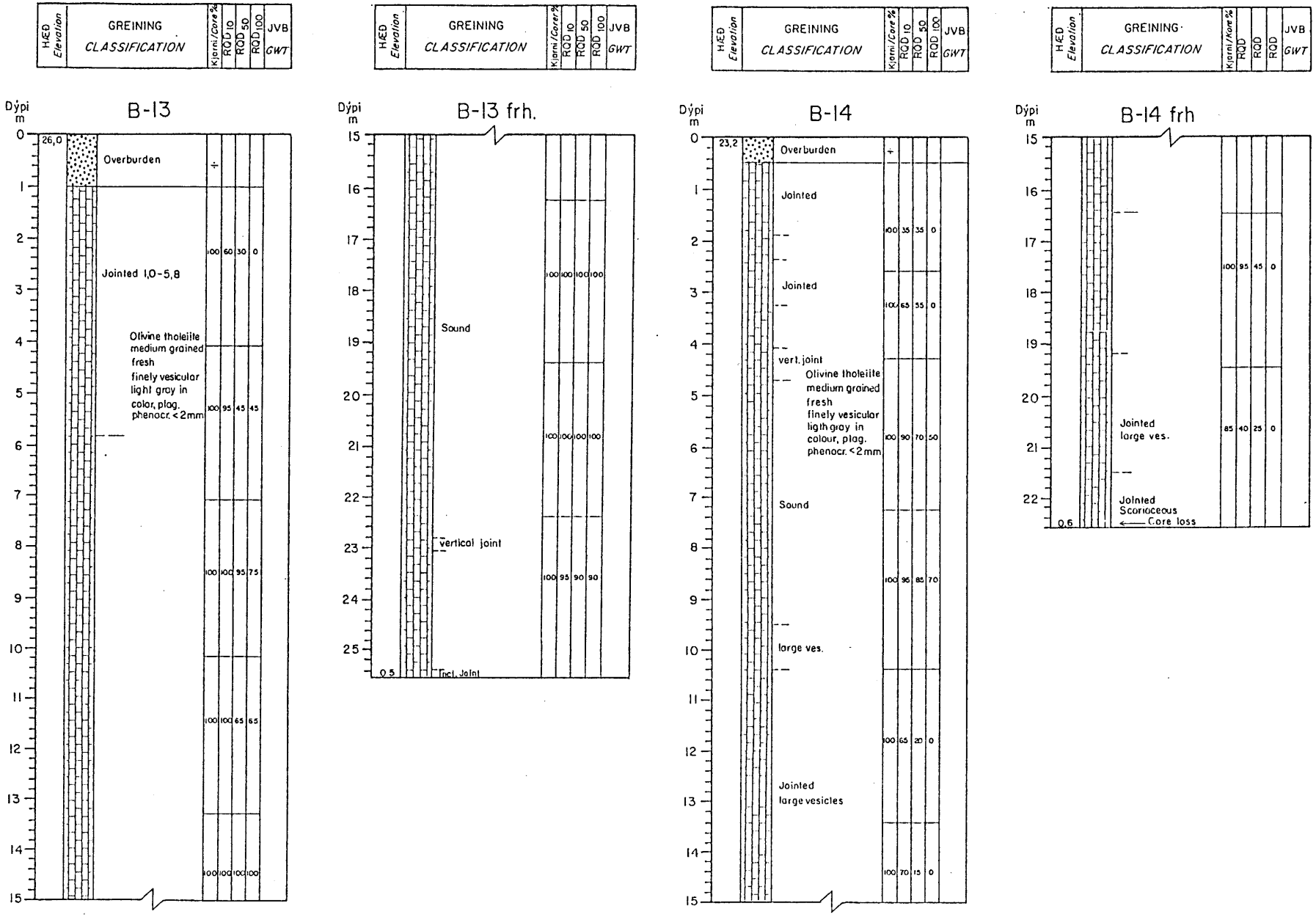


APPENDIX 1

Craphic core logs


VOO MJ 894 BAH
85 11 1431 IS
B-11
B-11 frh.
B-12
B-12 frh.
Dýpi m
H.E.Ð Elevation
GREINING CLASSIFICATION
Kjarni/Core %
ROD 10
ROD 50
ROD 100
JVB GWT
Overburden
Jointed
Olivine tholeiite medium grained fresh finely vesicular light gray in color, plag. phenocr. <2mm
large vesicles
sound
Jointed 0,8-7,6
Olivine tholeiite medium grained fresh finely vesicular ligth gray in colour, plag. phenocr. <2 mm
23,6
22,0
-1,9
-3,5

VOD MJ 894 BAH
85 11 1432 IS



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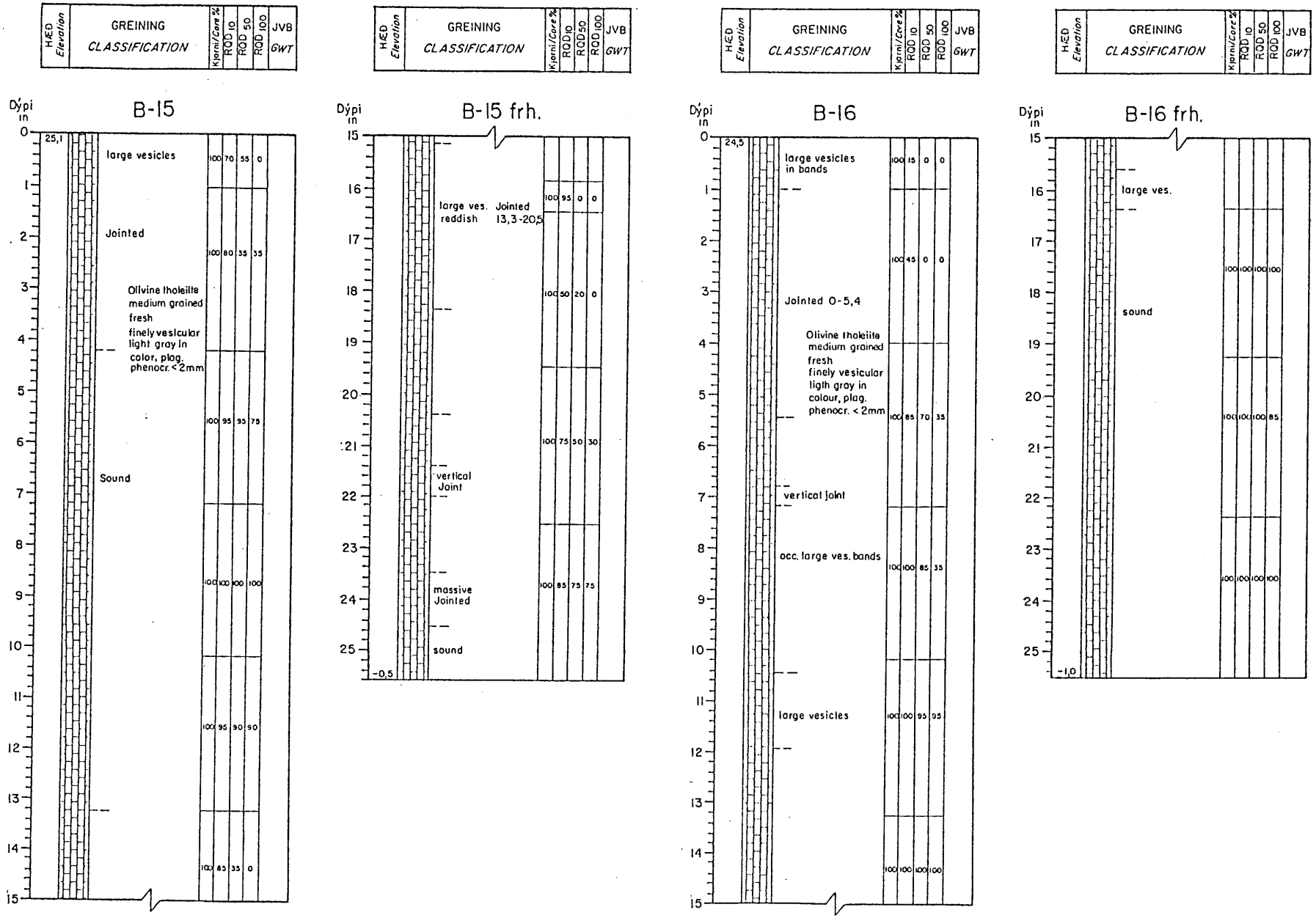

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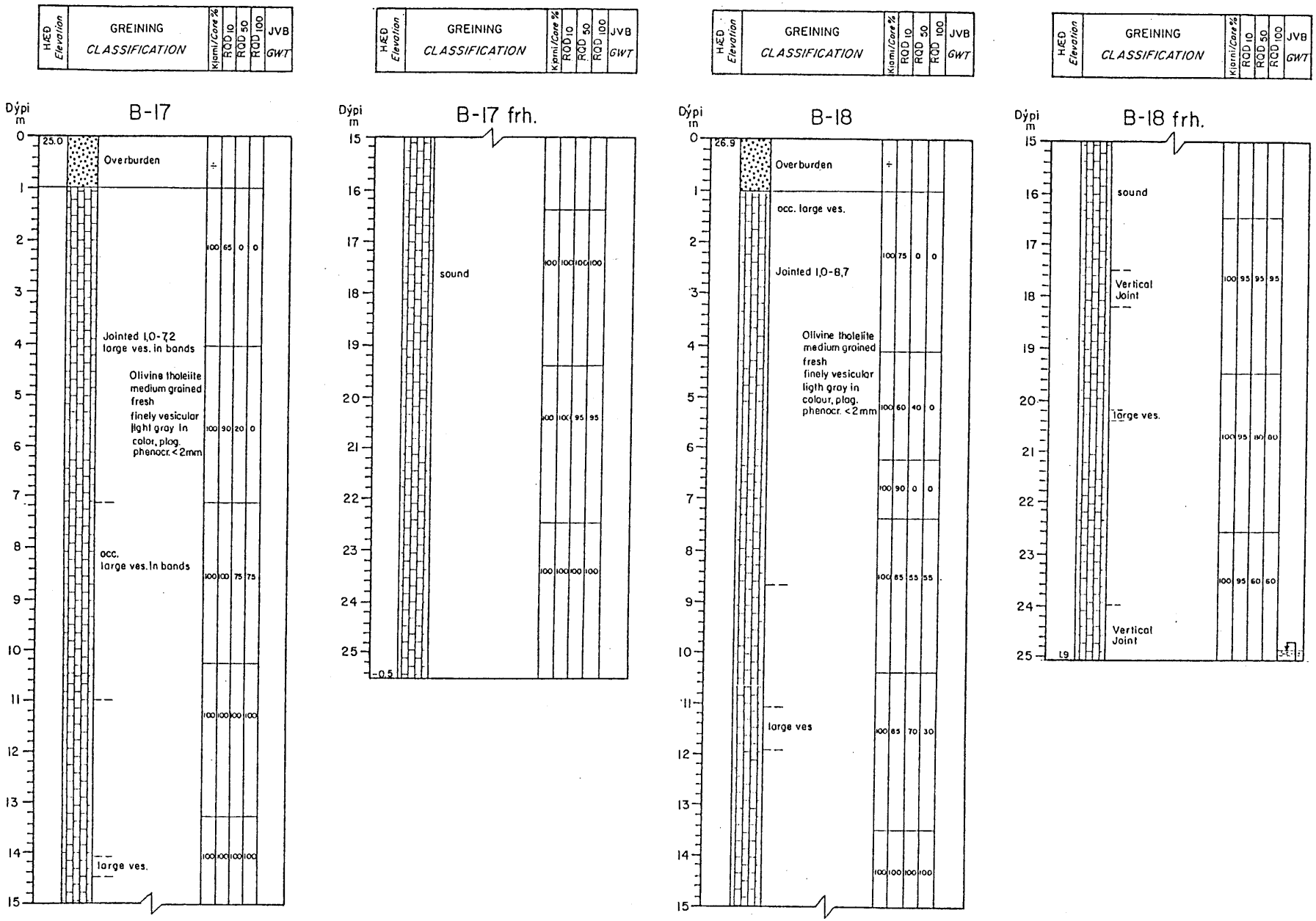
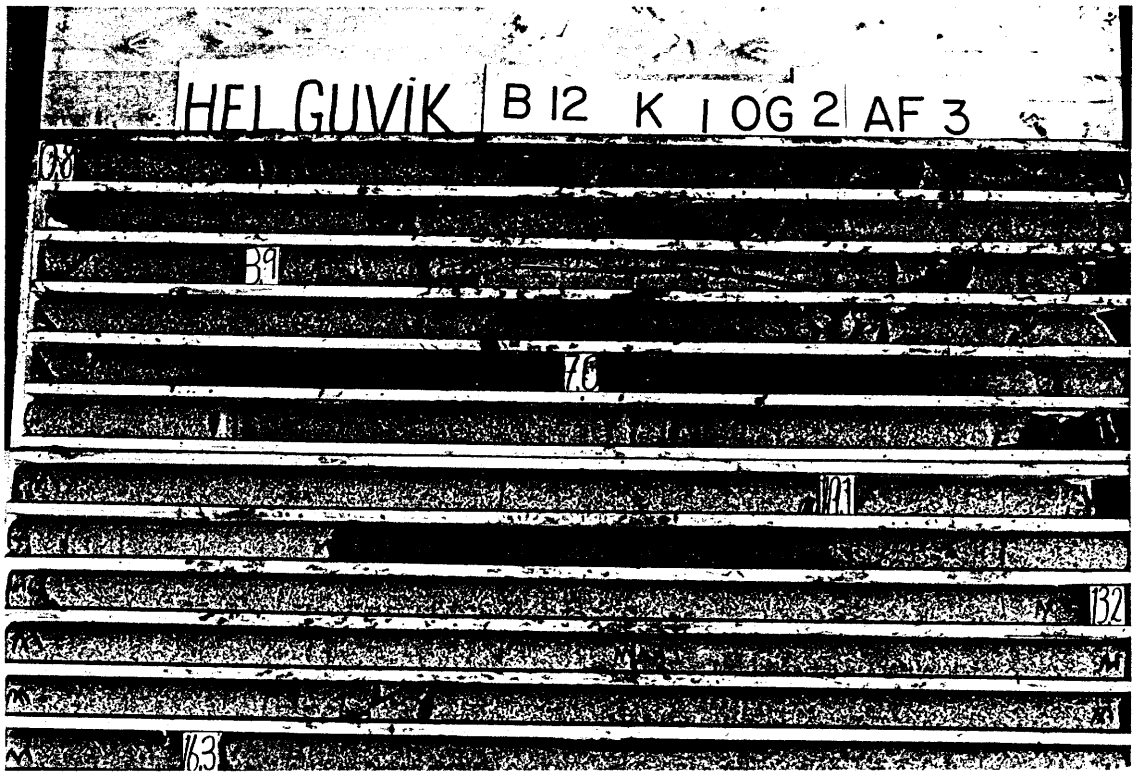


APPENDIX 2

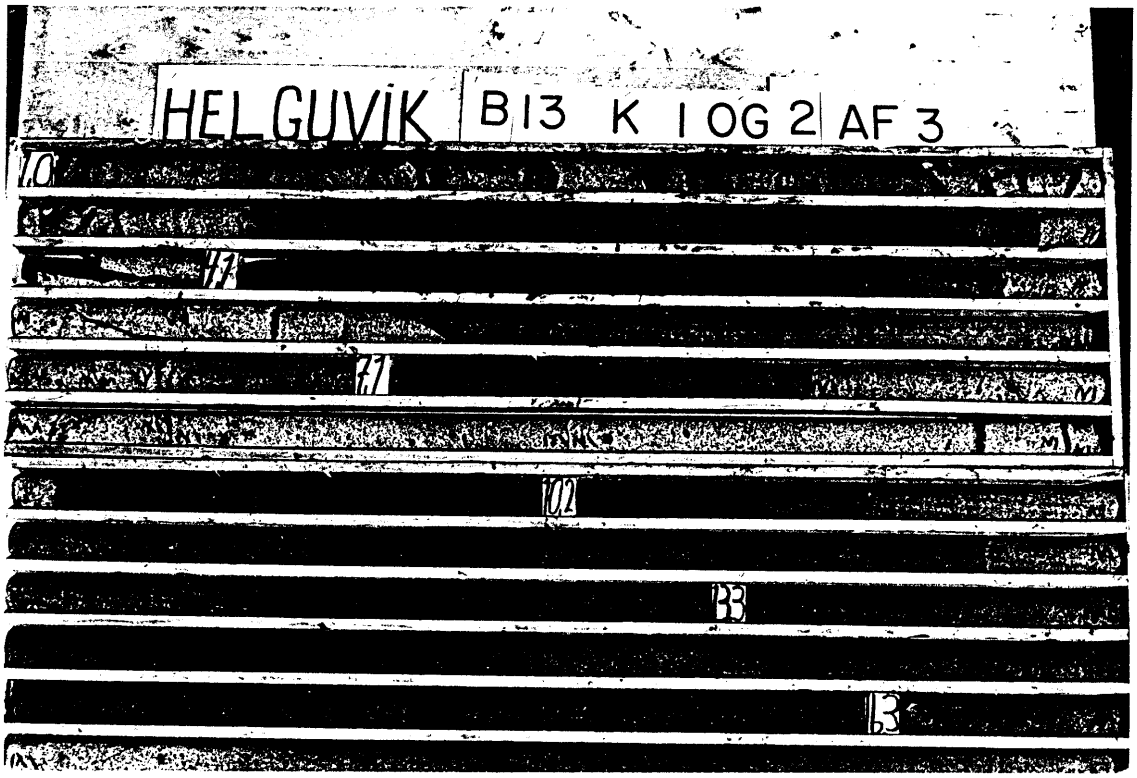
Core Photographs


HEL GUVİK B II K 1 OG 2 AF 3


HEL GUVİK B II K 3 AF 3


HEL GUVİK B 12 K 1 OG 2 AF 3
108
89
76
103
132
163


HEL GUVİK B 12 K 3 AF 3
194
224
235


HELGUVİK B13 K 1 OG 2 AF 3


HELGUVİK B13 K 3 AF 3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HELGUVIK B14 K 3 AF 3


HELGUVIK B 15 K 1 OG 2 AF 3

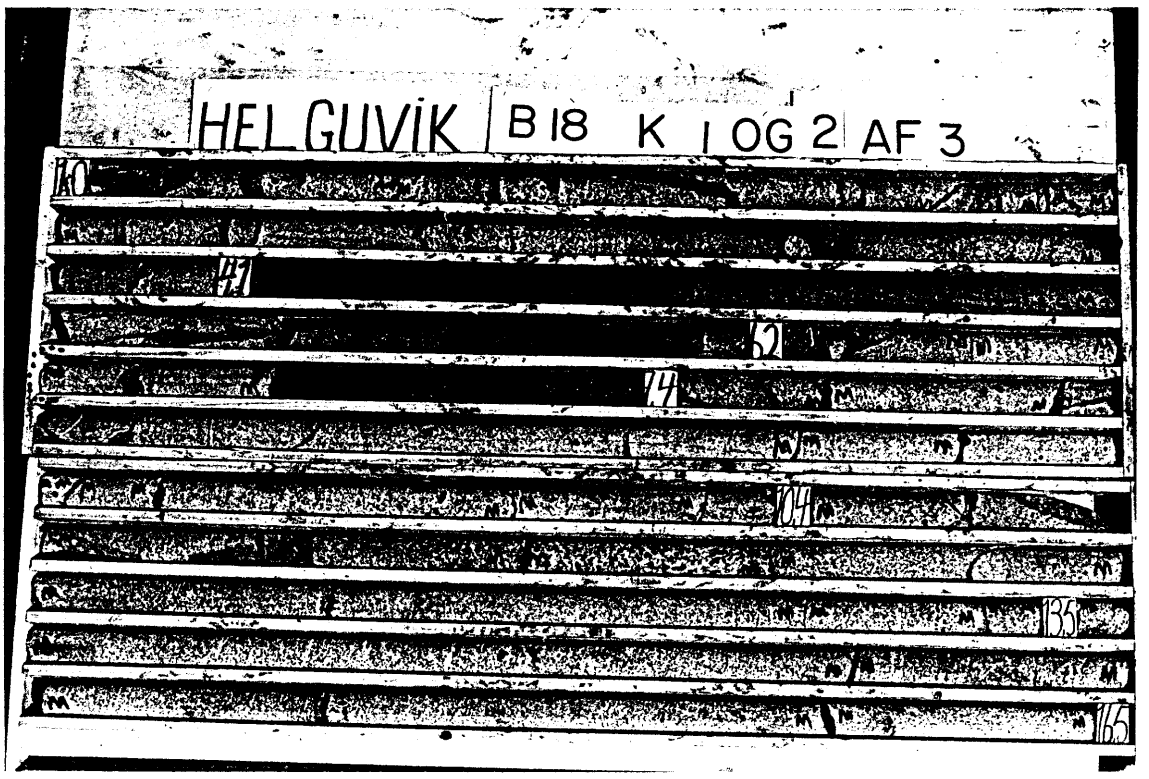

HELGUVIK B 15 K 3 AF 3


HELGUVIK B16 K 1 OG 2 AF 3


HELGUVIK B16 K 3 AF 3


HELGUVİK B17 K OG 2 AF 3
103
133
164


HELGUVİK B17 K 3 AF 3
174
175
155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140
137
152
144
104
135
165


HELGUVIK B18 K 3 AF 3
165
195
226