

Forsmark site investigation

Boremap mapping of percussion boreholes HFM06-08

Christin Nordman, Geosigma AB

April 2003

Svensk Kärnbränslehantering AB

Swedish Nuclear Fuel
and Waste Management Co
Box 5864

SE-102 40 Stockholm Sweden

Tel 08-459 84 00

+46 8 459 84 00

Fax 08-661 57 19

+46 8 661 57 19



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This report concerns a study which was conducted for SKB. The conclusions and viewpoints presented in the report are those of the author and do not necessarily coincide with those of the client.

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1 Introduction

This document reports the data gained by Boremap mapping of three percussion boreholes drilled within the site investigation at Forsmark.

The three percussion drilled boreholes, HFM06, HFM07 and HFM08, are located at drill site 3, close to the 1000 m deep, telescopic drilled borehole KFM03A (Figures 1-1 and 2-1). HFM06–08 were drilled in order to follow up geophysical reflectors, to enable groundwater level monitoring and to gain hydrogeochemical data. Borehole HFM06 also provided the flushing water needed for drilling the core drilled part of borehole KFM03A.

The percussion drilled boreholes were after completion of drilling investigated with several logging methods, for example, conventional geophysical logging, borehole radar and TV-logging. The latter method implies logging with a colour TV-camera to produce images of the borehole wall, so called BIPS-images (Borehole Image Processing System). The method is described in SKB MD 222.006 (Metodbeskrivning för TV-loggning med BIPS).

Mapping of percussion boreholes according to the Boremap method is based on the use of BIPS-images of the borehole wall, supported by the study of drill cuttings. Although the rock is crushed into fine-grained fractions, the mineralogical composition of the samples can still be studied. During drilling, the sampling of drill cuttings is discontinuous, and this introduces a degree of uncertainty in the classification of the rock composition between the sampling points. However, the combination of BIPS-images and samples of drill cuttings offers a reasonably efficient method for a continuous mapping of the geology along the borehole.

The BIPS-images also enable the study of the distribution of fractures along the borehole. Fracture characteristics like aperture, colour of fracture minerals etc are possible to study as well. Furthermore, since the BIPS software has the potential of calculating strike and dip of planar structures such as foliations, rock contacts and fractures intersecting the borehole, also the orientation of each planar structure is documented with the Boremap method. Important to keep in mind is that drill holes (and drill cores) provide information on the shape of a rock body in one dimension only.

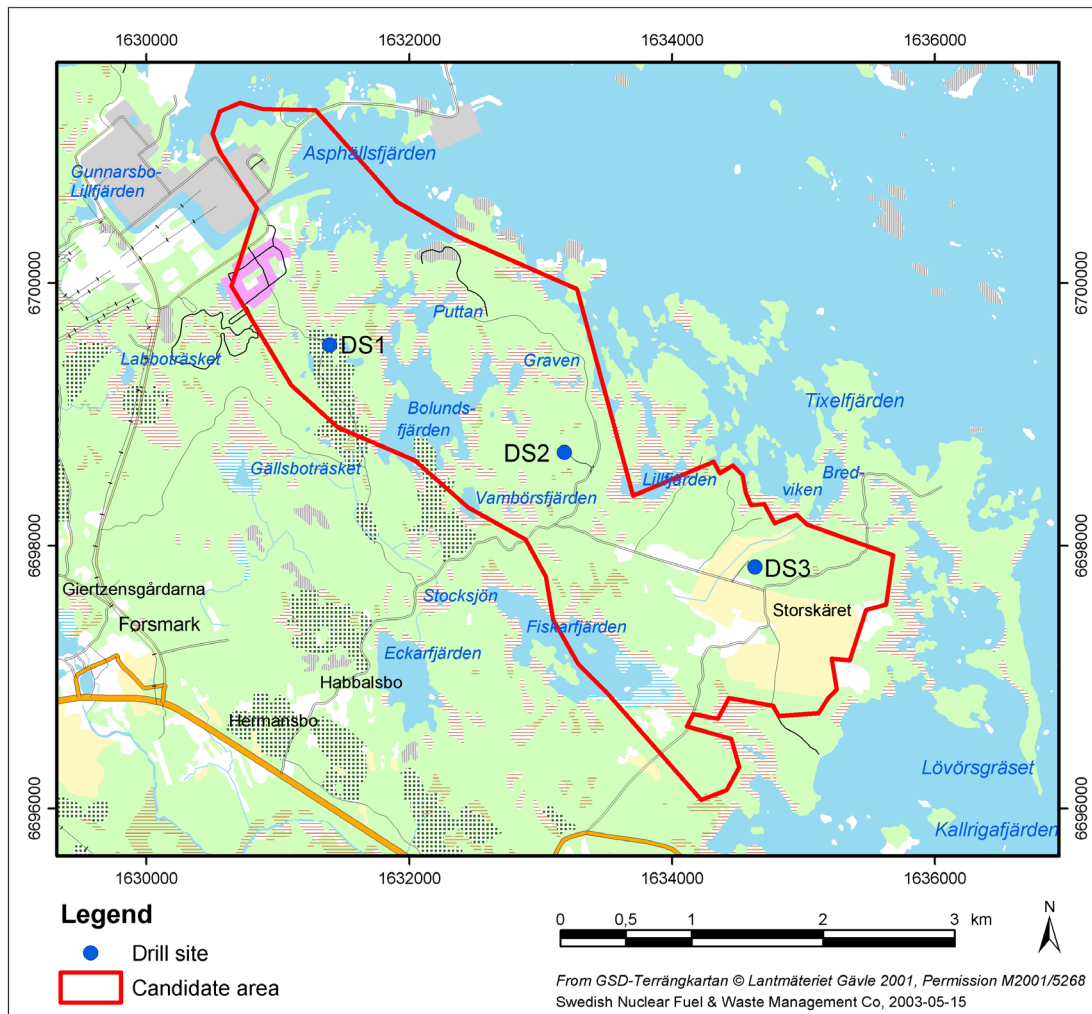


Figure 1-1. Location of drillsites at Forsmark 2003 (DS=drillsite 1; DS2=drill site 2; DS3=drill site 3).

2 Objective and scope

The aim of this activity was to document lithologies, ductile structures and the occurrence and character of fractures and fracture zones in the bedrock penetrated by the three percussion drilled boreholes HFM06–08. Data were collected in order to obtain a foundation for a preliminary assessment of the bedrock conditions adjacent to the telescopic drilled borehole KFM03A down to about 140 m. Other data obtained from the percussion drilled boreholes, such as thickness of soil cover, soil stratigraphy, groundwater level and groundwater flow, will not be treated in this paper.

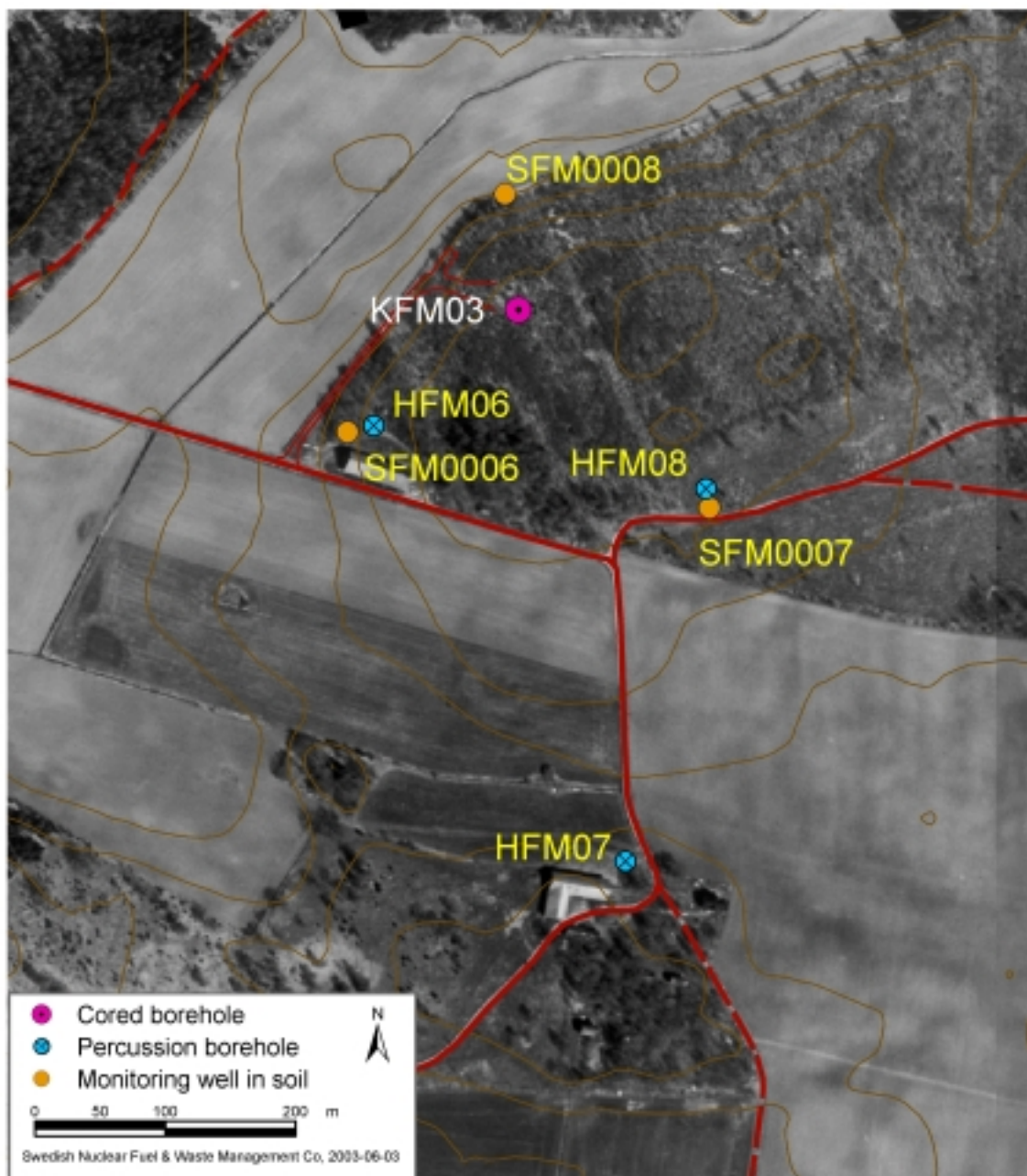


Figure 2-1. Borehole locations at drillsite 3, Forsmark.

3 Equipment and methods

3.1 Software

Mapping was performed with the latest updated version of the software Boremap 3.0 and revised in Boremap 3.2. The Boremap software calculates actual directions (strike and dip) of planar structures penetrated by the borehole (foliations, fractures, fracture zones, rock contacts etc). Data on inclination, bearing and diameter of the borehole are used as in-data for the calculations (Table 4-1). The Boremap software is loaded with the bedrock and mineral standard used by the Geological Survey of Sweden for surface mapping at the Forsmark investigation site to enable correlation with the surface geology.

Results from the investigation of drill cuttings were documented in an Excel database, while the stereographic projections were plotted in StereoNet. Schematic presentations of the boreholes were presented in WellCad.

3.2 Other equipment

Stereo microscope, a day light lamp and an ordinary kitchen strainer were used to investigate drill cuttings.

4 Execution

Boremap mapping of the percussion drilled boreholes HFM06–HFM08 was performed and documented according to activity plan AP PF 400-02-50 (SKB, internal document) referring to the SKB method description for Boremap mapping (SKB MD 143.006, Version 1.0, Metodbeskrivning för Boremap-kartering). The analytical procedures applied for investigation of drill cuttings followed a routine described below.

4.1 Mapping of drill cuttings

Boremap mapping of the percussion drilled boreholes HFM06–HFM08 was performed as a synchronised mapping of drill cuttings and BIPS-images. The applied routine for mapping of drill cuttings is somewhat simplified compared to the existing routine (i.e. without support from BIPS-images) described in SKB MD 142.001, Version 1.0 (Metodbeskrivning för undersökning av borrhax). The method used for investigation of drill cuttings from HFM06–HFM08 is outlined below.

Drill cutting samples were collected during drilling with a frequency of one sample per metre. Three samples were stored together on top of each other in one litre semi-transparent plastic boxes. A representative, untreated sample of about 200 g from the three sample batch was examined by ocular inspection with respect to sample colour and grain size. The sample was thereafter sieved in water with an ordinary kitchen strainer. Colour of the washed sample was documented (in wet condition) and then examined under a stereo microscope with respect to mineralogy, grain size and possible alterations. Together with the information obtained from the BIPS-image, these data were used for a lithological classification of the investigated borehole interval. All observations from the investigation of drill cuttings were documented in an Excel database. Data were subsequently exported to the SKB SICADA database and stored under Field Note Forsmark 26.

4.2 Preparations

Length correlations of the BIPS-images were not performed. BIPS-images for HFM06 indicated a length of 108.2 m, whereas the borehole length is 110.7 m. For HFM07 the corresponding values were 121.7 m and 122.5 m and for HFM08 142.2 m and 143.5 m. Knowing that BIPS-logging stopped approximately 30 cm before the end of the borehole and that some amount of drill cuttings always covers the bottom of the borehole, length corrections of the BIPS-images were not considered necessary.

Background data collected from SICADA prior to the Boremap mapping included:

- borehole diameter (Appendix 8),
- total borehole length (Appendix 8),
- deviation data (Appendix 9),
- drilling penetration rate (Appendix 10).

Measurements of borehole-directions were refined using deviation data from the SKB SICADA database (Field Note: Forsmark 77-79). Geometric data for boreholes HFM06–08 are given in Table 4-1.

Table 4-1. Borehole data for HFM06–HFM08 (values from starting point).

ID-code	Northing	Easting	Borehole length (m)	BIPS-image interval (m)	Bearing (degrees)	Inclination (degrees)	Depth to bedrock surface (m)
HFM06	6697759	1634520	110.70	11.0–108.3	6	–84	2.0
HFM07	6697416	1634716	122.55	17.0–121.7	338	–84	6.6
HFM08	6697703	1634778	143.50	17.0–142.2	335	–86	6.1

4.3 Execution of measurements

Available geological information is more limited for Boremap mapping of percussion drilled boreholes than for Boremap mapping of core drilled boreholes, when a continuous drillcore can be directly compared with BIPS-images of the borehole wall. During mapping of percussion boreholes, fractures can only be seen on the BIPS-images and rock samples are merely available as crushed fragments. As solid rock samples are not accessible, certain assumptions and simplifications have to be made during mapping. These are described below.

4.3.1 Fractures

As fractures could be studied entirely in the BIPS-image they could not be confidently classified as rough, smooth or slickensided, nor could their mineralogy or alteration be reliably determined. Hence, classifications of fracture minerals in the percussion boreholes should be treated with caution. The following assumptions were made:

- Width of very thin fractures (< 1 mm) were hard to measure accurately and was therefore, as a rule, interpreted as 1 mm thick or, if only vaguely observed, as 0.5 mm thick.
- Fractures were assumed to be open if not clearly observed to be sealed.
- Dark coloured fractures were interpreted to contain some amount of chlorite (such colouration may, however, also be caused by shadows in the fracture walls or by different dark coloured minerals).
- Bright white (commonly sealed) fracture fillings were interpreted to contain calcite.
- White to greyish fracture material was interpreted as feldspar and quartz.
- Greenish sealed fractures were interpreted to contain prehnite.
- Pyrite, prehnite, epidote, iron hydroxide and fragments of very fine-grained, possibly cataclastic rocks, were identified in some of the drill cutting samples. It was, however, not possible to correlate these occurrences to certain structures in the BIPS-image.

4.3.2 Rock colour

Rock colour documented during Boremap mapping was classified from the observations of drill cuttings (wet samples). Minor differences in colour of drill cutting samples were usually not recognizable in the BIPS-images and were therefore not documented in Boremap.

Rock colours in the BIPS-images appear somewhat modified and bleached, and the classification of the colour of minor rock occurrences only observed in the BIPS-image is therefore likely to be less accurate.

4.3.3 Rock contacts

Orientation of irregular or diffuse rock contacts may be difficult to observe and measure with the Boremap method, since only planar and discrete features can be accurately measured.

4.3.4 Lithologies

Lithological classifications were sometimes difficult. Occurrences of amphibolite and pegmatite were generally clearly discernible. However, from the BIPS-image only, it was in places difficult to distinguish very thin bands of amphibolite from fractures, and some misinterpretation should therefore be accounted for.

Thin bands, veins or segregates of felsic rocks were commonly observed in the BIPS-images, but were often severely difficult to recognize in the drill cutting samples. The classification of these rock occurrences was therefore mainly based on observations in the BIPS-images.

When BIPS-images were not available, i.e. at the upper, cased part of the boreholes, rock classification was based on the observations of drill cuttings only. It should be remembered that the accuracy of the classification of mineralogy, rock type and extent of secondary alteration made from observations of the drill cuttings may be affected by contamination of the samples due to mixing of rock fragments from different levels of the borehole during drilling.

4.3.5 Grain size

Classification of grain size can be difficult for minor rock occurrences. If the mineralogy of the rock type in question does not differ from the dominating rock in which it is included, it may be difficult to separate the two lithologies in the fine-grained drill cutting samples. When the rock is composed of minerals of similar colours, the grain size can be overestimated when relying too much on the BIPS-images, since single grains are hard to distinguish. This problem is especially evident for minor rock occurrences, and the grain size classification for limited rock units is therefore more uncertain.

4.3.6 Ductile deformational structures

By experience, mapping of ductile structures using only BIPS-images can be treacherous. Ductile structures were observed in the dominating rock type (metagranodiorite-granite) almost throughout the boreholes HFM06–08, and were also found in drill cuttings. Furthermore, rocks at outcrops at- and around drillsite 3 display ductile fabrics. For example, a metagranodiorite-granite (analogous to the dominating rock type in the HFM06–08 boreholes), is characterized by a strong mineral lamination defined by linear biotite and elongate aggregates of quartz and feldspar /1, 2/. Distinctively developed foliations were not recorded during detailed bedrock mapping at the location for the telescopic borehole KFM03A /1/. BIPS-images from boreholes HFM06–08 do not display distinct foliations, hence no measurements of foliations were made.

Orientation of linear and curved structures cannot be determined using the Boremap software. Therefore rock in HFM06–08 was classified as massive, despite the fact that BIPS-images as well as drill cuttings clearly show that most of the rock along the borehole have been exposed to ductile deformation.

Structural character of minor rock occurrences was generally not possible to classify.

4.3.7 Supporting data in Boremap-mapping

Data from investigation of drill-cuttings were used to support the classification of mineralogy and extent of secondary alteration in lithological units observed in the BIPS- image.

Drilling penetration rate was used as complementary data for the geological interpretation (Appendix 10). For example, major anomalies in drilling penetration rate correlated well with crush zones (increase) or thicker occurrences of amphibolite (decrease).

BIPS-images were also compared with the drill core from boreholes KFM01A and KFM02A, located at drillsites DS 1 and DS 2 (Figure 1-1). Parts of the core from borehole KFM02A and the complete core from borehole KFM01A (100–1000 m) were available on a roller table during the Boremap mapping.

4.4 Data handling

Mapping of HFM06 was performed on-line on SKB's network in order to obtain the best possible data security. Backup on local discs was made prior to every break exceeding 15 minutes. Mapping of HFM07 and HFM08 was performed on a local computer disk at Geosigma, Uppsala, and submitted to SKB after completion.

Quality of mapping was checked by a routine in the Boremap software before saving and exportation to SICADA.

All data are stored in the SKB SICADA database:

- Data from the Boremap mappings are stored under Field Note Forsmark 104.
- Data from the investigation of drill cuttings are stored under Field Note Forsmark 26.

5 Results

Geology of the three percussion drilled boreholes HFM06–08 corresponds well with the geology in outcrops at and around drillsite DS 3, documented during regional and detailed bedrock mapping (Data in SICADA, Field Note Forsmark 22). See also P-report on detailed fracture mapping at drillsite DS 3 (data from detailed bedrock mapping given in Appendix) /1/, and P-report on field data from bedrock mapping in the Forsmark area during 2002 /2/.

Results from the Boremap mapping are briefly described in Sections 5.1–5.3 below, and graphical presentations of the data are given in Appendices 1–6 (WellCad- and BIPS-images). Equal area stereogram projections of poles to natural and sealed fracture planes are shown in Appendix 7.

5.1 HFM06

Lithologies

The borehole consists mainly of metagranodiorite-granite (approximately 70%). It is linedated, medium-grained, and greyish red to reddish grey. Pegmatite and pegmatitic granite are abundant (approximately 20%) and occur throughout the borehole. Amphibolite (approximately 10%) has been observed throughout the borehole. In drill cuttings from between 68.4 and 70.8 m depth, amphibolite has been strongly altered. Most of the amphiboles have been transformed to chlorite and plagioclase is red-stained. A few occurrences of younger granitoids were observed at the end of the borehole (approximately 1%).

Fractures

Fracture frequency of HFM06 is calculated to about 2.3 fractures/m from BIPS-images of the borehole (available between 11.0–108.2 m). Orientation of fractures is shown in Appendix 7. Four fracture sets can be distinguished: one set moderately dipping (20–45°) striking SSW. The second set is steeply dipping (70–80°) and SSW-striking. The third set is moderately to steeply dipping (50–70°) and ESE-striking. The last fourth set is vertical and N-striking and might be underrepresented, since it is almost parallel to the drilling direction. The borehole appears virtually devoid of fractures between 80 and 95 m depth.

A crush/fracture zone is spatially associated with the occurrence of altered amphibolite at ca 70 m depth (see above). Strike and dip of this crush/fracture zone was estimated to approximately 010/30°. A second, minor crush/fracture zone was observed at the depth of 61.5 m with a strike and dip estimated to approximately 120/45°.

5.2 HFM07

Lithologies

Dominant rock type is a lineated, greyish red to reddish grey, metagranodiorite-granite (approximately 60%). Pegmatite and pegmatitic granite (approximately 30% of the borehole) are abundant and occur throughout the borehole. Amphibolite is also observed frequently in the borehole, but is less common (approximately 5%). Rocks interpreted to represent younger granitoids were observed at 86.4, 113.6–114.8 and 116.5–119.7 m depth (approximately 5%).

Fractures

Fracture frequency of HFM07 has been calculated to about 2.4 fractures/m from BIPS images of the borehole (available between 17.0–121.7 m). Orientation of fractures is shown in Appendix 7. Three fracture sets were observed: one moderately dipping (30–60°) WNW-striking set, one steeply dipping (70–90°) ESE-striking set, and one steeply dipping (60–80°) SSW-striking set. An increase in fracture frequency was observed between 54–67m depth. No crush/fracture zones were detected.

Secondary alteration

An alteration zone was revealed between ca 55–67 m depth. In the drill cutting samples, strong hematite pigmentation was found rock fragments and biotite was almost entirely altered to chlorite (cf Appendix 11). This alteration is interpreted to reflect oxidation and chloritization. The alteration zone is rich in fractures (mostly sealed?) and also correlates with calcite sealed fractures. In parts of the zone, it is hard to determine whether the protolith was a metagranodiorite-granite or a pegmatitic granite.

5.3 HFM08

BIPS-images of percussion borehole HFM08 are available from the interval 17.0–142.2 m. At 24.1 m depth, there is a discontinuity in the BIPS-image, suggesting that at least some decimetres of the BIPS-image are missing. Therefore the exact length information for the whole borehole is questionable. No drill cutting samples were obtained from the section between 138.0–143.5 m depth.

Lithologies

Dominant rock types are greyish red to reddish grey metagranodiorite-granite (approximately 50%), pegmatitic granite and pegmatite (together approximately 40%). The pegmatitic granite is generally medium-grained but in part more heterogeneous and coarse-grained. Amphibolite (approximately 10%) is more common in the HFM08 borehole than in the adjacent HFM06–07 boreholes (see above). Sections with amphibolite, ≥ 1 m wide, were recognized at up to seven intervals in the borehole.

Fractures

Fracture frequency of HFM08 is calculated to about 2.2 fractures/m (from BIPS-image of the borehole, available between 17.0–142.2 m). Orientation of fractures is shown in Appendix 7. Sub-horizontal to gently dipping (20–40°) fractures dominate (strike varies between SW to WNW). Fracture frequency does not vary considerably between different sections of the borehole. No fracture/crush zones was discovered.

5.4 Discussion

From the above described working procedures, it is understood that Boremap mapping of percussion drilled boreholes suffers from certain shortcomings compared to the corresponding method for core drilled boreholes. For example, classification of thin fractures as open or sealed, classification of fracture minerals, and identification of the colour and grain size of minor rock occurrences are clearly problematic. The relatively low sampling frequency of drill cuttings (one sample per metre, where three samples are stored together in the same sampling box) limits the possibility of making confident judgements of the mineralogical composition of rocks continuously along the borehole. It is, for example, almost impossible to follow up a thin amphibolite occurrence or to estimate the proportions of different rock types in the drill cuttings. The exact sampling depth is also uncertain, since transportation of drill cuttings from the bottom of the drill hole to the surface is not instantaneous. Mapping clearly benefits from synchronous analysis of supporting data from the drilling, such as drilling penetration rate and flush-water colour, and, not least, observations of drill cores from the same drillsite.

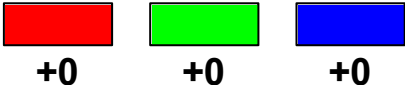
Quality of BIPS-images from boreholes HFM06–08 is good, except from near the end of borehole HFM06 (below 105 m depth) where it has been dimmed by suspensions in the borehole fluid.

6 References

- /1/ **SKB, 2003.** Forsmark – Detailed Fracture mapping at the KFM02 and KFM03 drill sites, SKB P-03-12. Svensk Kärnbränslehantering AB.
- /2/ **SKB, 2003.** Bedrock mapping – Forsmark. Stage 1 (2002) – Outcrop data including fracture data. SKB P-03-09. Svensk Kärnbränslehantering AB.

BIPS-images of HFM06

Project name: Forsmark

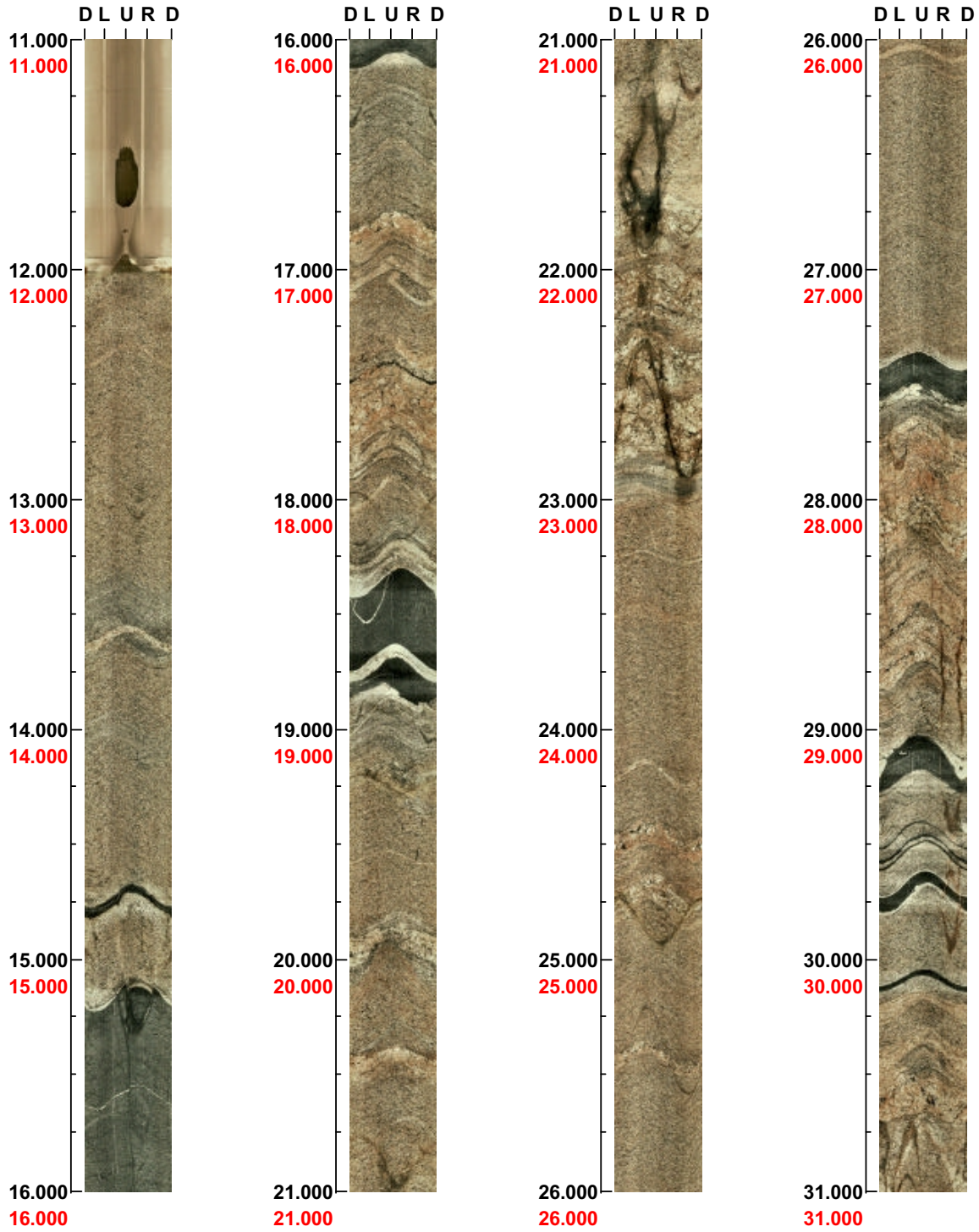
Image file : c:\borema~1\hfm06.bip
BDT file : c:\borema~1\hfm06.bdt
Locality : FORSMARK
Bore hole number : HFM06
Date : 03/02/13
Time : 13:37:00
Depth range : 11.000 - 108.328 m
Azimuth : 6
Inclination : -84
Diameter : 134.0 mm
Magnetic declination : 0.0
Span : 4
Scan interval : 0.25
Scan direction : To bottom
Scale : 1/25
Aspect ratio : 90 %
Pages : 5
Color : 

Project name: Forsmark
Bore hole No.: HFM06

Azimuth: 6

Inclination: -84

Depth range: 11.000 - 31.000 m



(1 / 5)

Scale: 1/25

Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM06

Azimuth: 17

Inclination: -84

Depth range: 31.000 - 51.000 m



(2 / 5)

Scale: 1/25

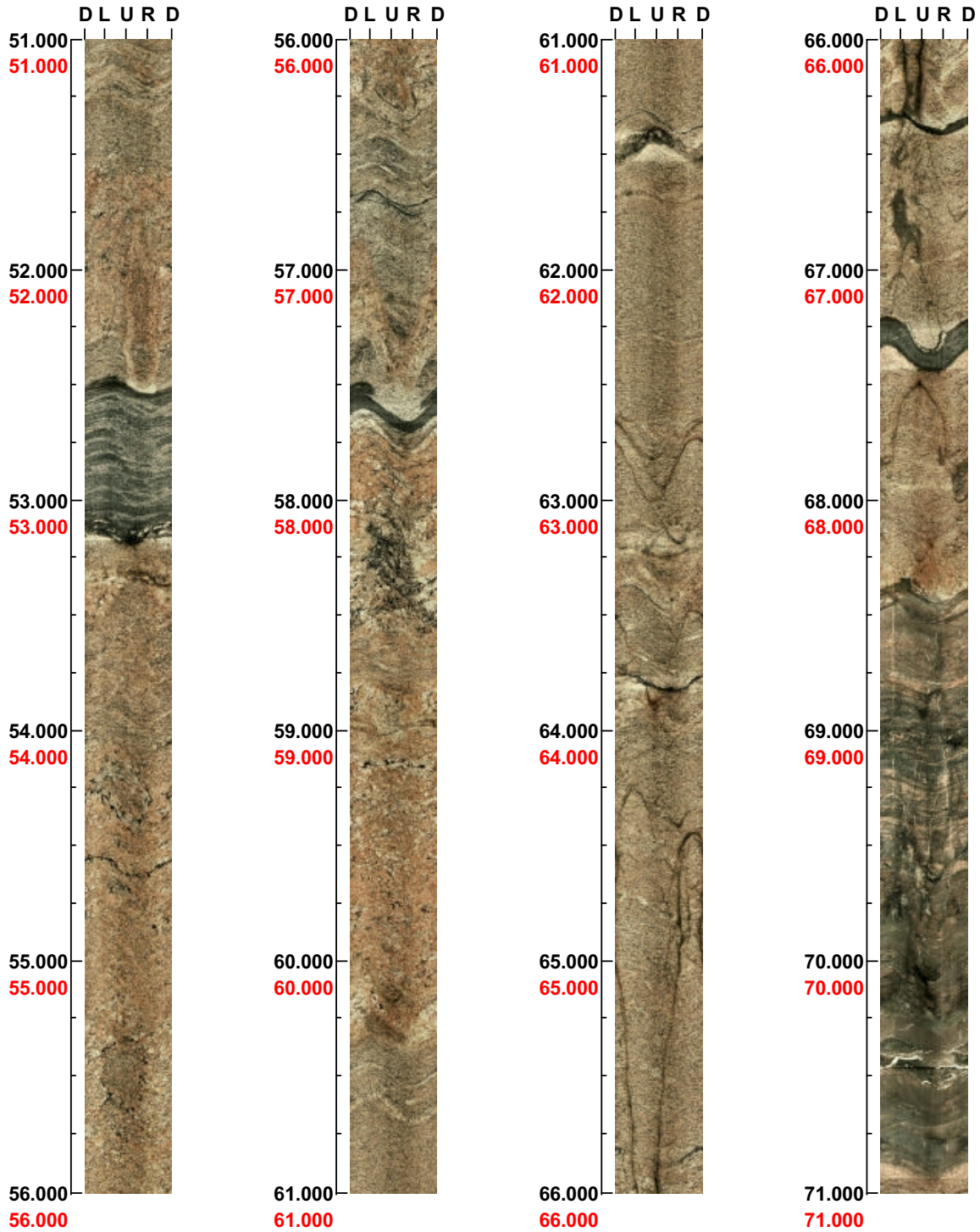
Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM06

Azimuth: 35

Inclination: -84

Depth range: 51.000 - 71.000 m



(3 / 5)

Scale: 1/25

Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM06

Azimuth: 41

Inclination: -83

Depth range: 71.000 - 91.000 m



(4 / 5)

Scale: 1/25

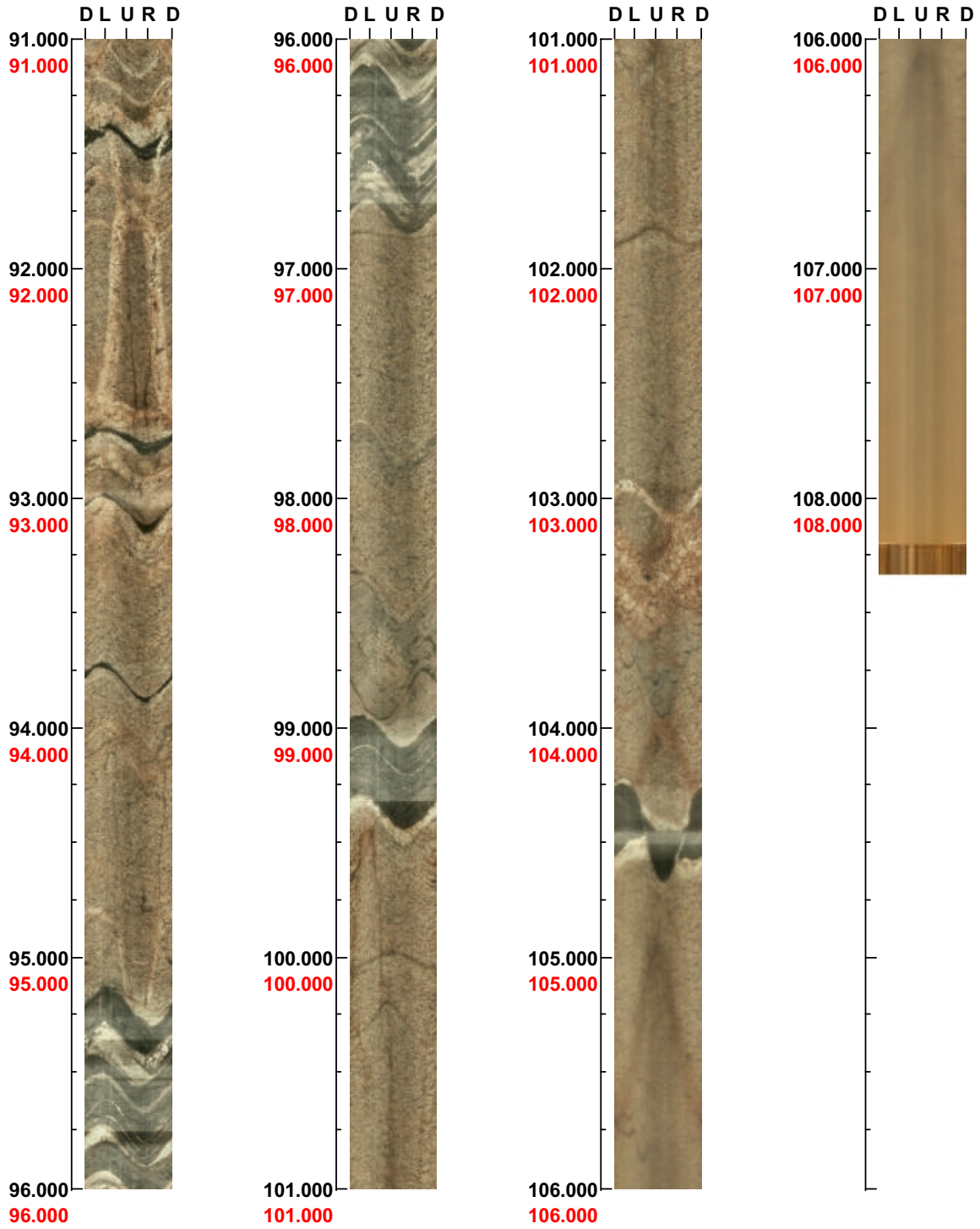
Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM06

Azimuth: 56

Inclination: -82

Depth range: 91.000 - 108.328 m



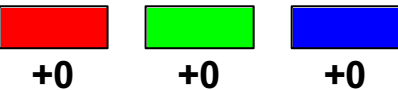
(5 / 5)

Scale: 1/25

Aspect ratio: 90 %

BIPS-images of HFM07

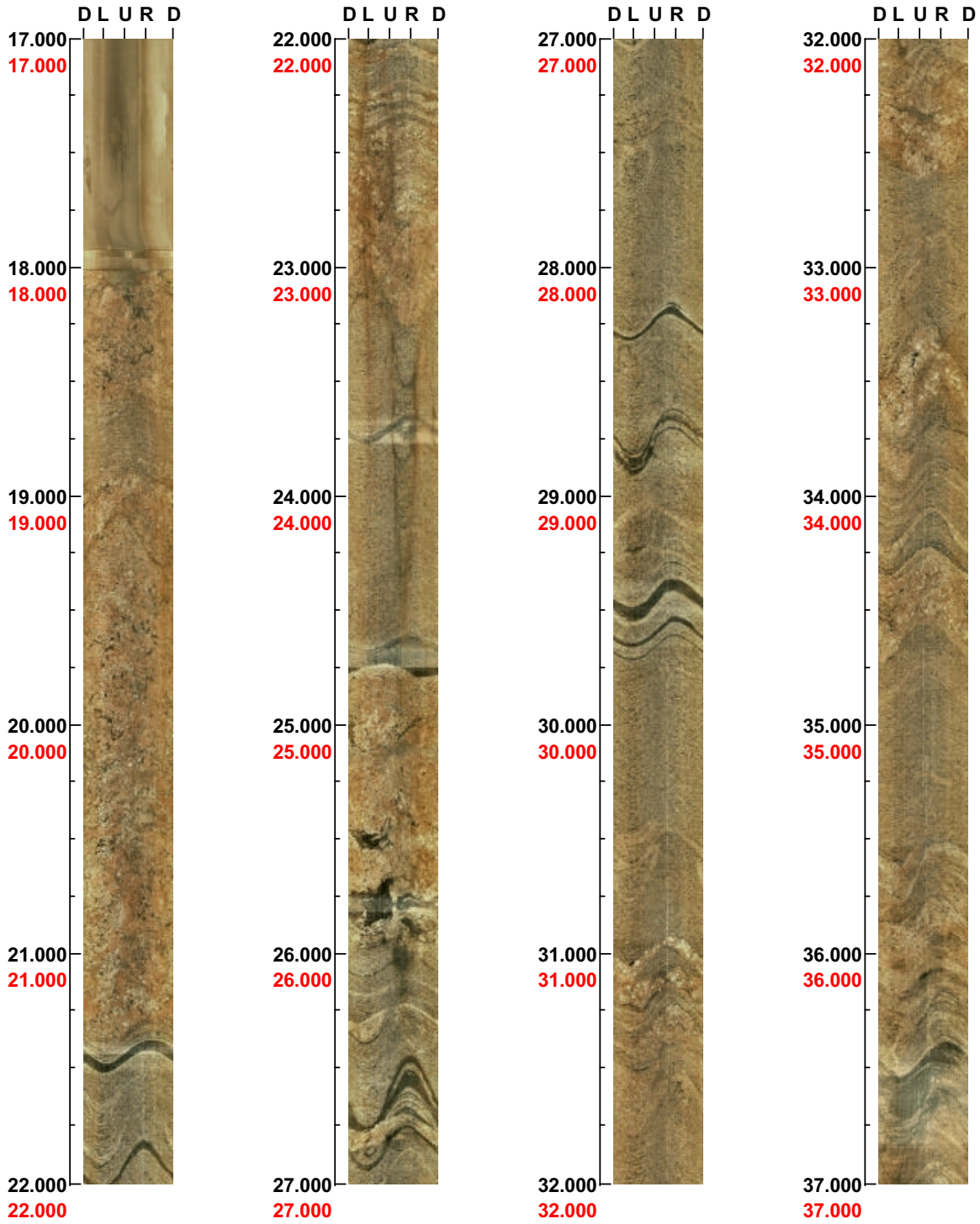
Project name: Forsmark

Image file : c:\borema~1\hfm07.bip
BDT file : c:\borema~1\hfm07.bdt
Locality : FORSMARK
Bore hole number : HFM07
Date : 03/02/14
Time : 09:01:00
Depth range : 17.000 - 121.711 m
Azimuth : 338
Inclination : -84
Diameter : 140.0 mm
Magnetic declination : 0.0
Span : 4
Scan interval : 0.25
Scan direction : To bottom
Scale : 1/25
Aspect ratio : 90 %
Pages : 6
Color : 

Project name: Forsmark
Bore hole No.: HFM07

Azimuth: 338 Inclination: -84

Depth range: 17.000 - 37.000 m

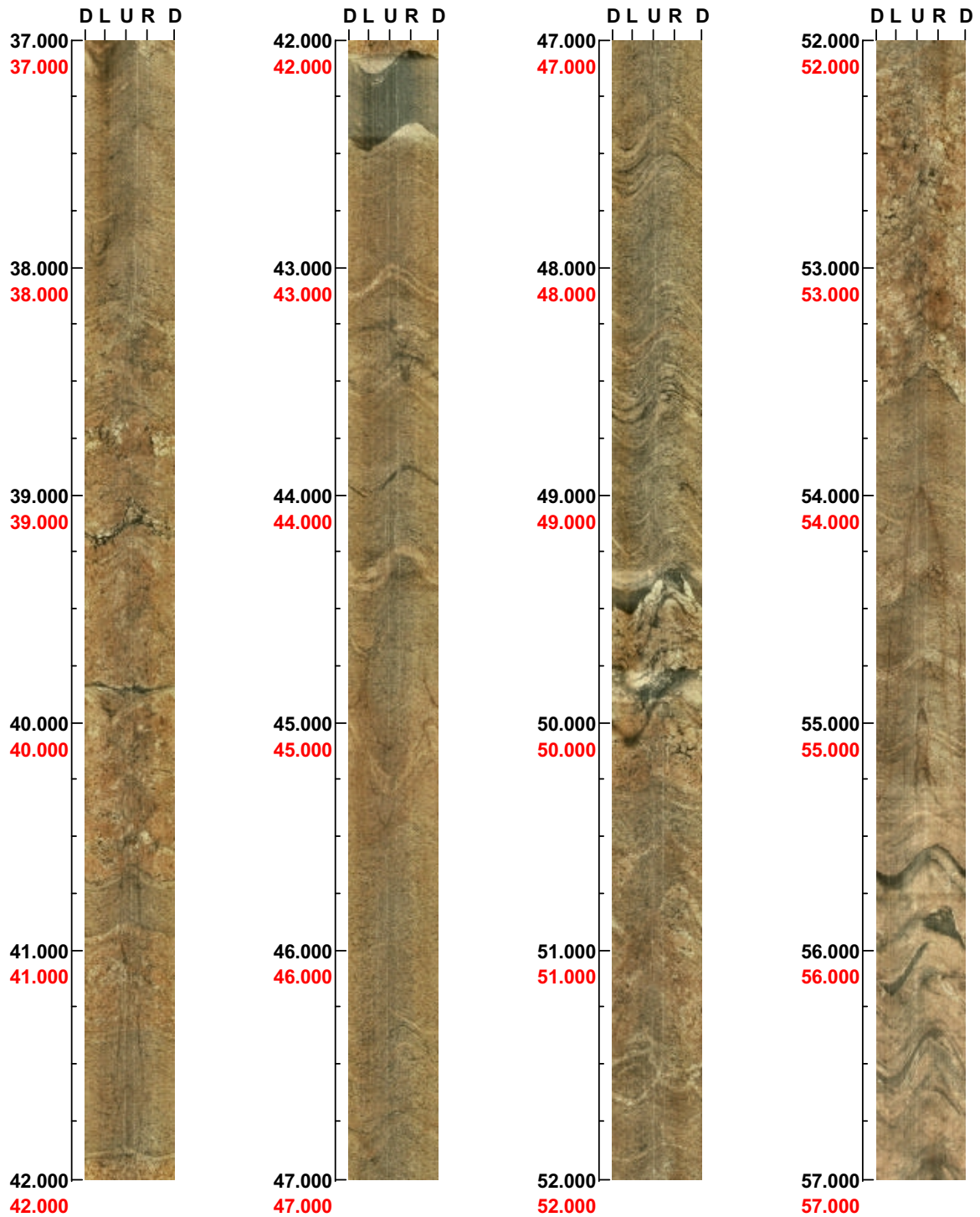


(1 / 6) Scale: 1/25 Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM07

Azimuth: 331 Inclination: -84

Depth range: 37.000 - 57.000 m



(2 / 6) Scale: 1/25 Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM07

Azimuth: 320 Inclination: -89

Depth range: 57.000 - 77.000 m



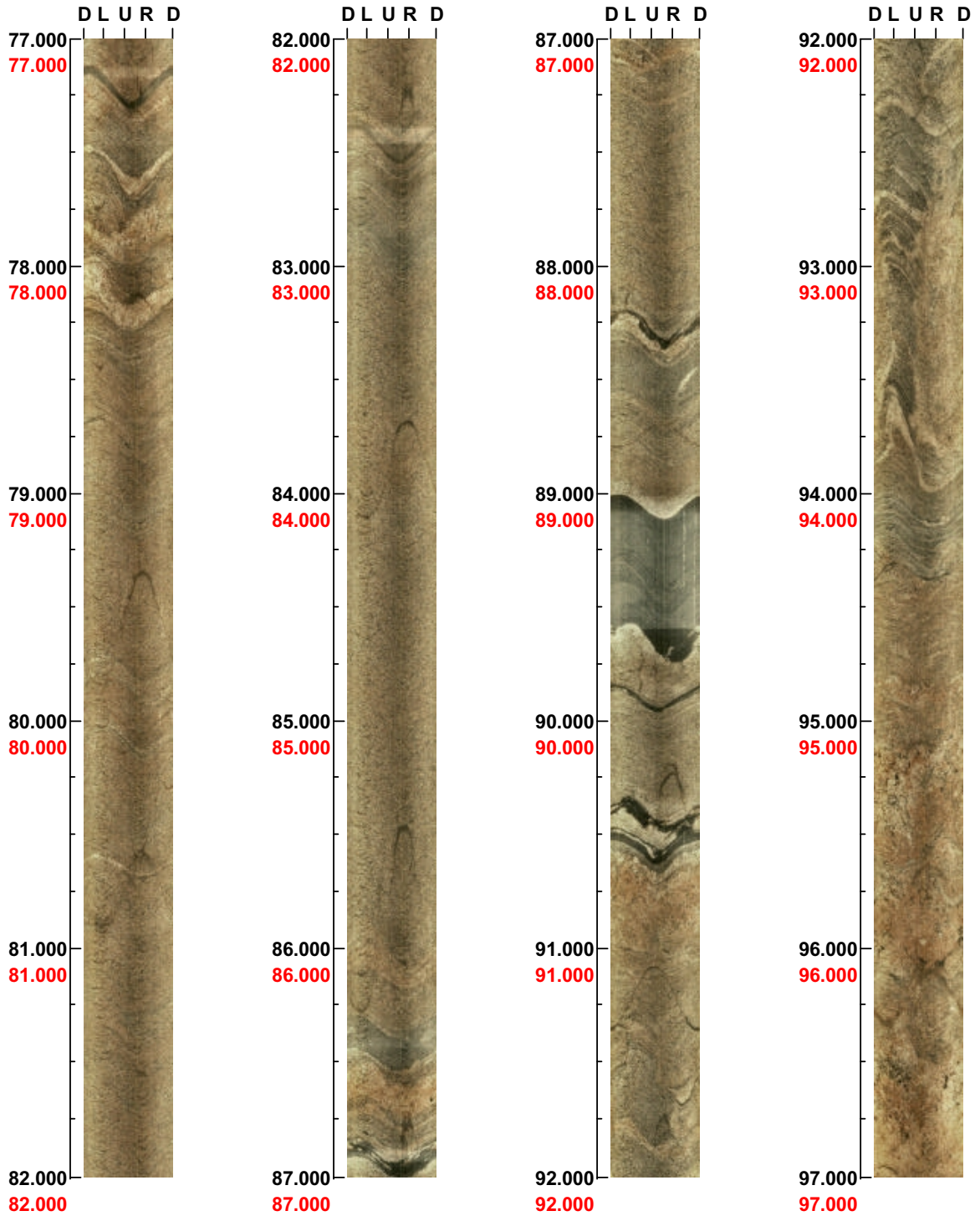
(3 / 6) Scale: 1/25 Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM07

Azimuth: 265

Inclination: -89

Depth range: 77.000 - 97.000 m



(4 / 6)

Scale: 1/25

Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM07

Azimuth: 142 Inclination: -82

Depth range: 97.000 - 117.000 m

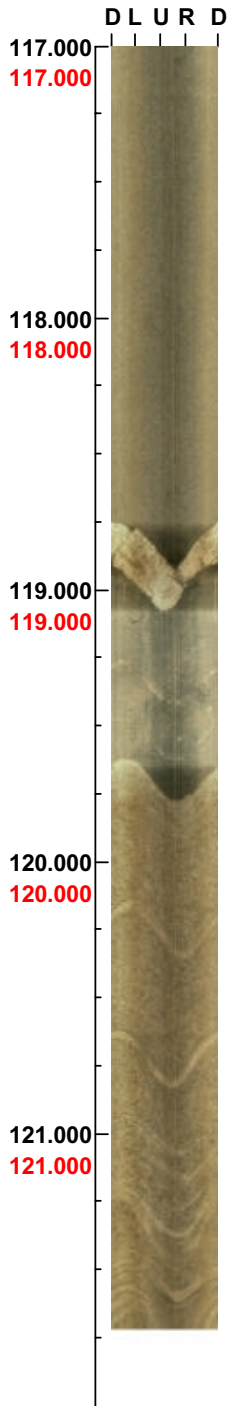


(5 / 6) Scale: 1/25 Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM07

Azimuth: 136 Inclination: -78

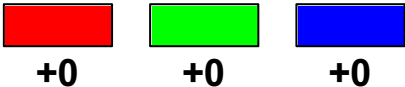
Depth range: 117.000 - 121.711 m



(6 / 6) Scale: 1/25 Aspect ratio: 90 %

BIPS-images of HFM08

Project name: Forsmark

Image file : c:\borema~1\hfm08.bip
BDT file : c:\borema~1\hfm08.bdt
Locality : FORSMARK
Bore hole number : HFM08
Date : 03/02/26
Time : 09:04:00
Depth range : 17.000 - 142.183 m
Azimuth : 355
Inclination : -86
Diameter : 138.0 mm
Magnetic declination : 0.0
Span : 4
Scan interval : 0.25
Scan direction : To bottom
Scale : 1/25
Aspect ratio : 90 %
Pages : 7
Color : 

Project name: Forsmark
Bore hole No.: HFM08

Azimuth: 355 Inclination: -86

Depth range: 17.000 - 37.000 m



(1 / 7) Scale: 1/25 Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM08

Azimuth: 0

Inclination: -87

Depth range: 37.000 - 57.000 m



(2 / 7)

Scale: 1/25

Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM08

Azimuth: 62

Inclination: -87

Depth range: 57.000 - 77.000 m



(3 / 7)

Scale: 1/25

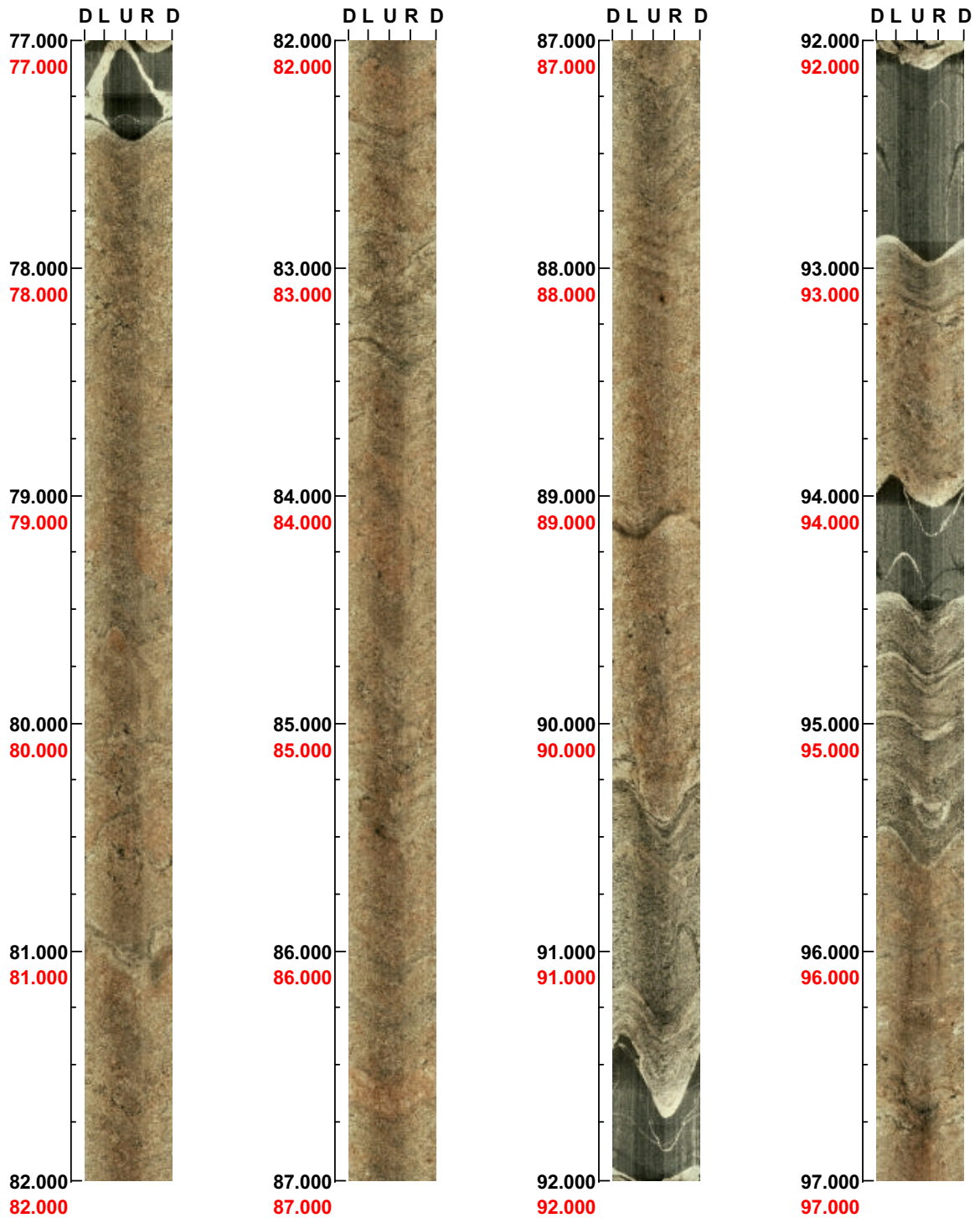
Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM08

Azimuth: 80

Inclination: -85

Depth range: 77.000 - 97.000 m



(4 / 7)

Scale: 1/25

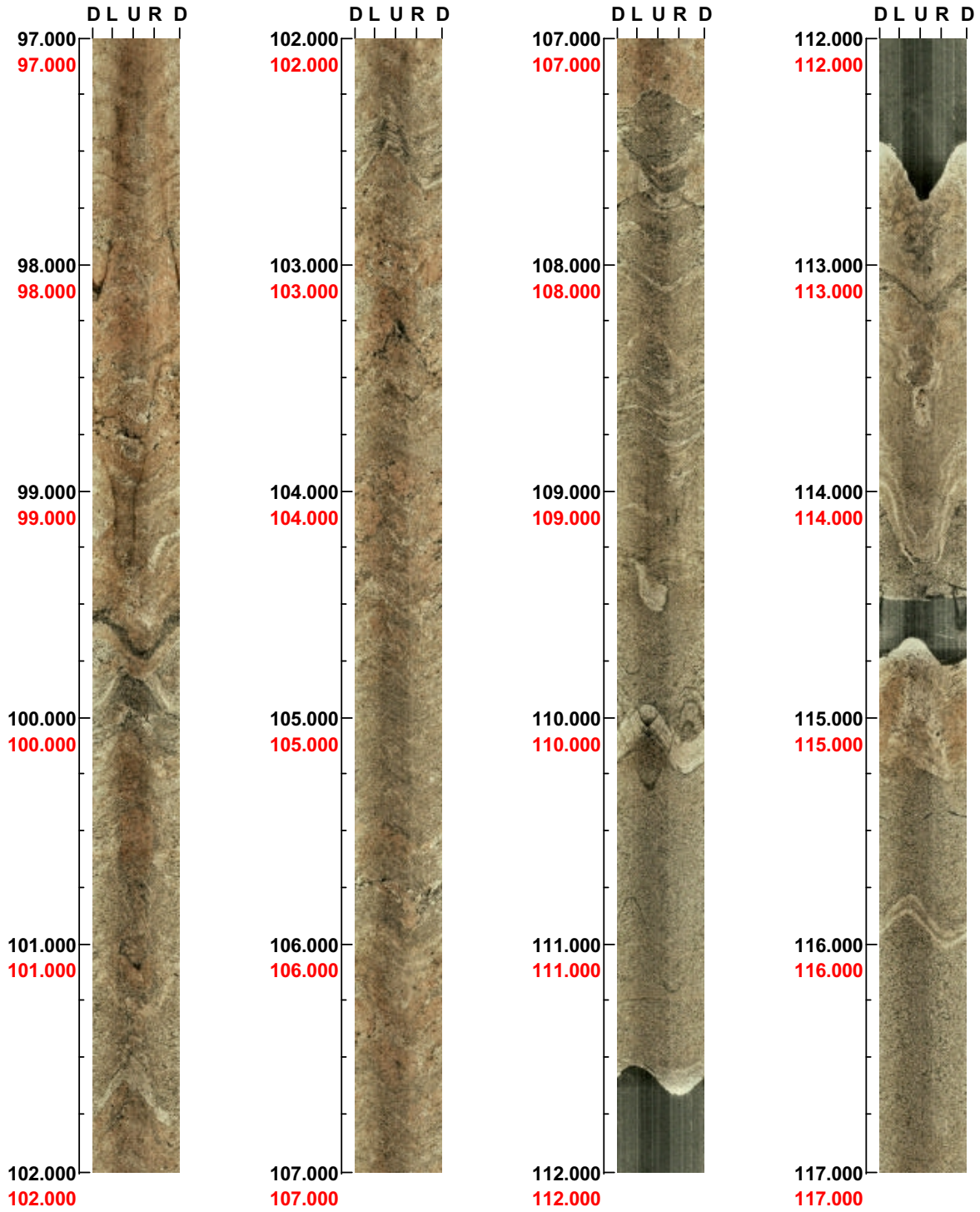
Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM08

Azimuth: 84

Inclination: -82

Depth range: 97.000 - 117.000 m



(5 / 7)

Scale: 1/25

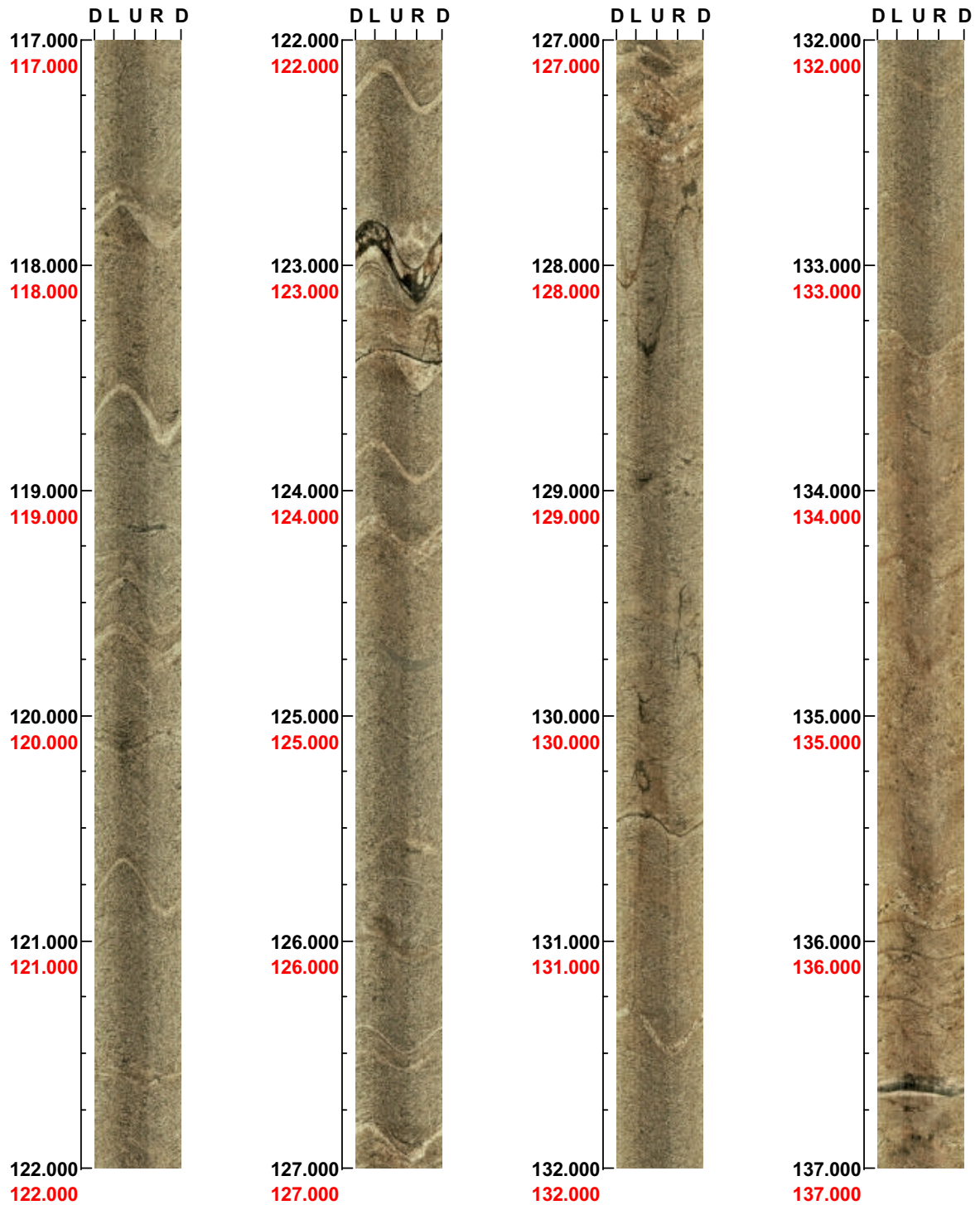
Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM08

Azimuth: 78

Inclination: -80

Depth range: 117.000 - 137.000 m



(6 / 7)

Scale: 1/25

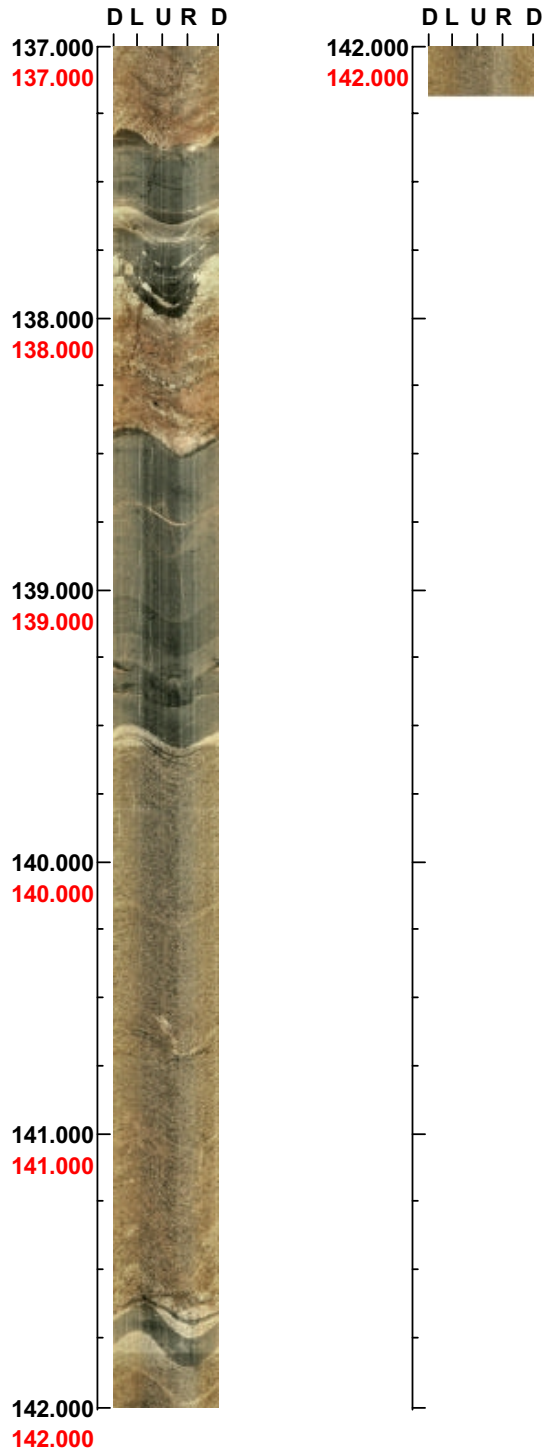
Aspect ratio: 90 %

Project name: Forsmark
Bore hole No.: HFM08

Azimuth: 83

Inclination: -78

Depth range: 137.000 - 142.183 m



(7 / 7)

Scale: 1/25

Aspect ratio: 90 %

WellCad diagram of HFM06

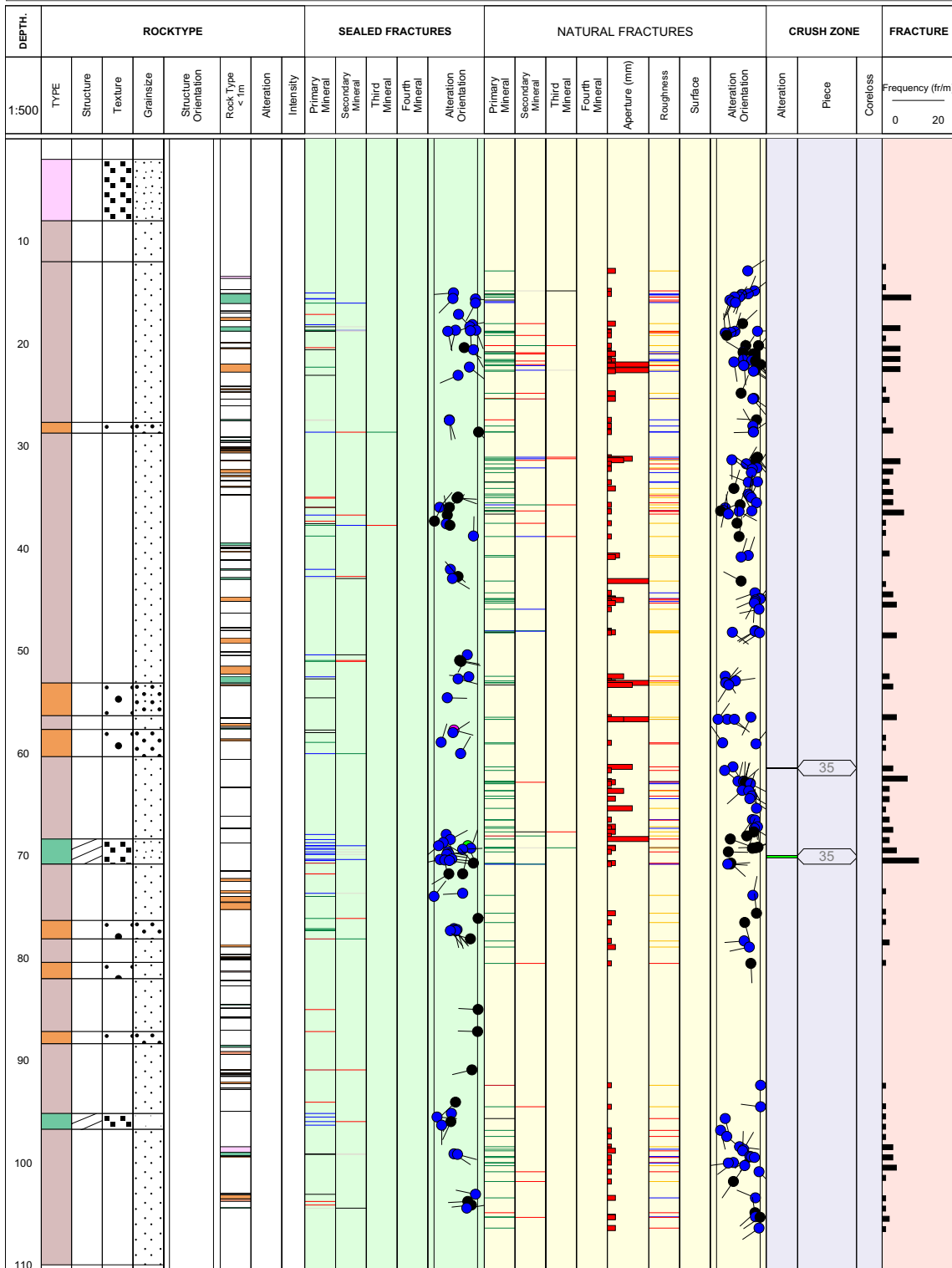


Title GEOLOGY HFM06



Site FORSMARK
Borehole HFM06
Diameter [m] 0.1335
Length [m] 110.7
Bearing [°] 2.4367
Inclination [°] -84.5983
Remark

Coordinate System RT90-RHB70
Northing [m] 6697752.012
Easting [m] 1634522.188
Elevation [m.a.s.l.] 6.637
Drilling Start Date 2002-12-18 07:00:00
Drilling Stop Date 2003-01-14 12:00:00
Plot Date 2003-04-10 10:43:51



WellCad diagram of HFM07

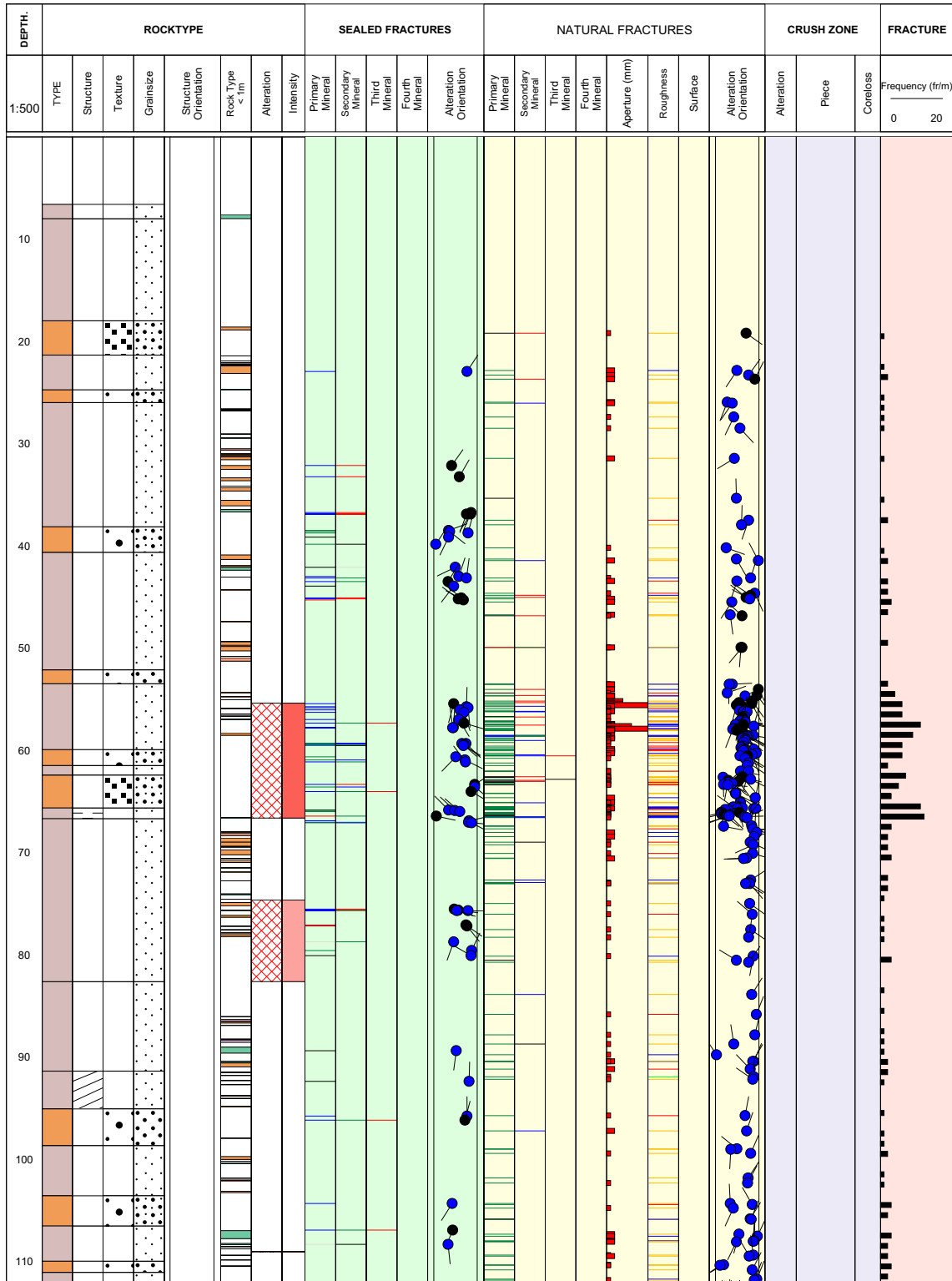


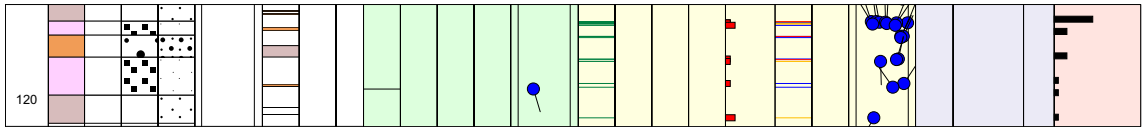
Title GEOLOGY HFM07



Site FORSMARK
Borehole HFM07
Diameter [m] 0.1396
Length [m] 122.5
Bearing [°] 342.3239
Inclination [°] -84.517
Remark

Coordinate System RT90-RHB70
Northing [m] 6697416.248
Easting [m] 1634715.687
Elevation [m.a.s.l.] 5.781
Drilling Start Date 2003-01-16 13:00:00
Drilling Stop Date 2003-01-28 13:00:00
Plot Date 2003-04-10 13:00:20





WellCad diagram of HFM08

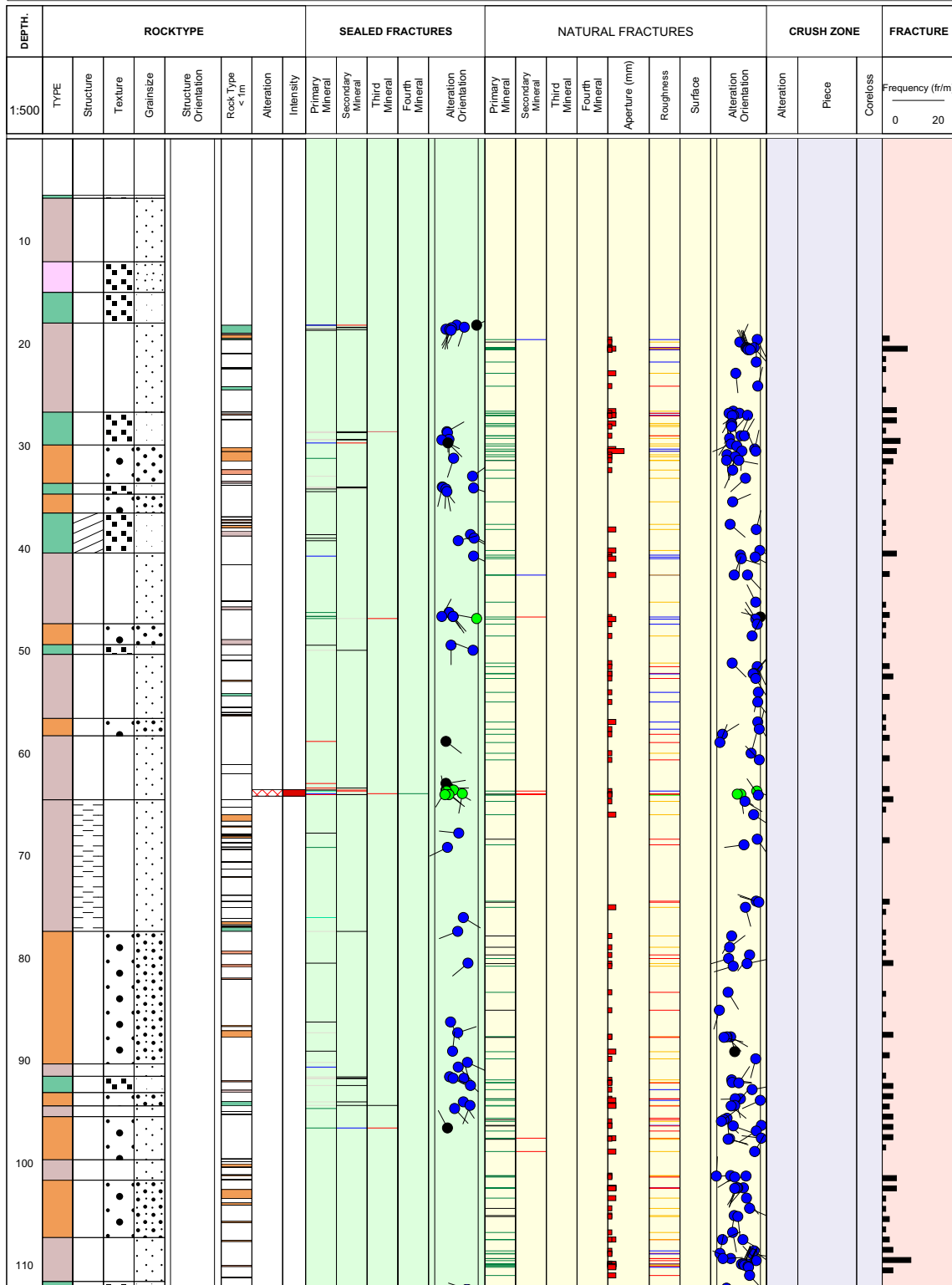


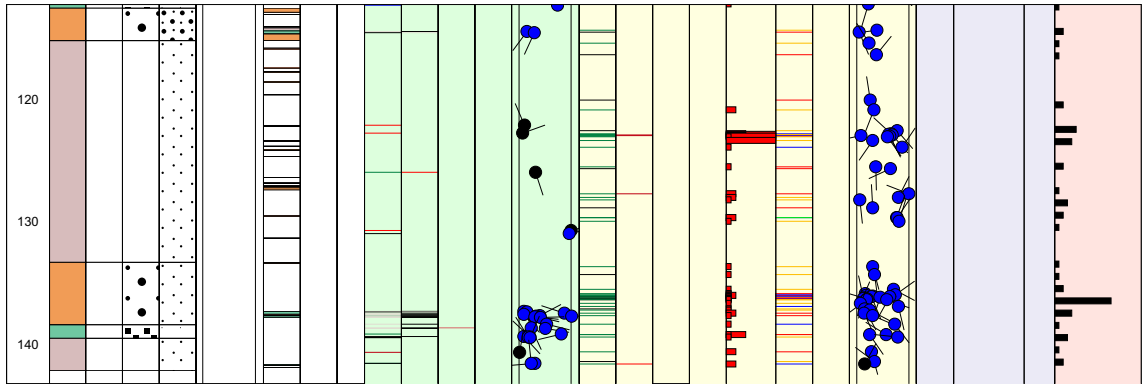
Title GEOLOGY HFM08



Site FORSMARK
Borehole HFM08
Diameter [m] 0.137
Length [m] 143.5
Bearing [°] 348.6901
Inclination [°] -84.4443
Remark

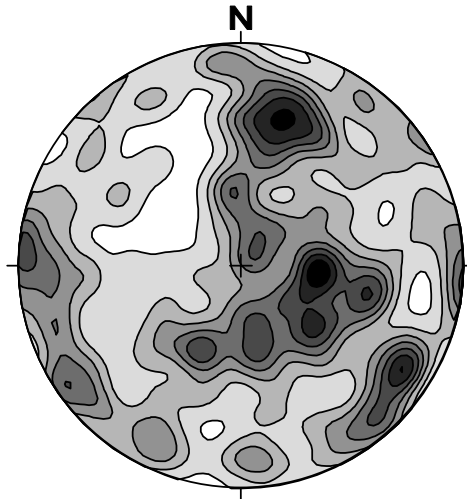
Coordinate System RT90-RHB70
Northing [m] 6697703.275
Easting [m] 1634777.502
Elevation [m.a.s.l.] 7.132
Drilling Start Date 2003-01-29 09:00:00
Drilling Stop Date 2003-02-12 12:00:00
Plot Date 2003-04-10 10:56:49



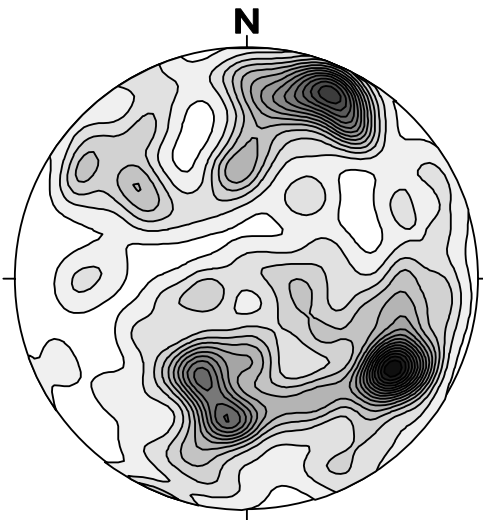


Appendix 7

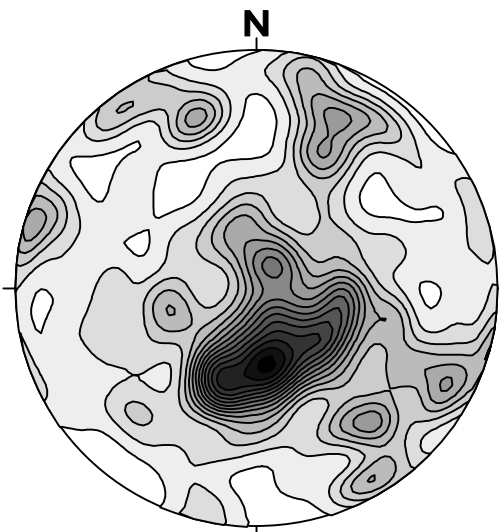
Lower hemisphere equal area projections (Schmidt net) of countered poles to planes of natural and sealed fractures documented in boreholes HFM06-HFM08



HFM06 (n=222)



HFM07 (n=251)



HFM08 (n=272)

Appendix 8

Hole Diam T - Drilling: Borehole diameter

HFM06, 2002-12-18 07:00:00 - 2003-01-14 12:00:00 (0.000 - 110.700 m)

Sub Secup (m)	Sub Seclow (m)	Hole Diam (m)	Comment
0.000	2.500		Noex 215 foderrör dy=254 mm
2.500	12.000	0.215	Rostfritt foderrör 0-12 m
12.000	110.700	0.134	

Printout from SICADA 2003-02-27 11:11:50.

Hole Diam T - Drilling: Borehole diameter

HFM07, 2003-01-16 13:00:00 - 2003-01-28 13:00:00 (0.000 - 122.500 m)

Sub Secup (m)	Sub Seclow (m)	Hole Diam (m)	Comment
0.000	7.600		Noex 215
7.600	18.000	0.214	
18.000	122.500	0.140	start diam = 140,0 mm

Printout from SICADA 2003-02-27 11:13:46.

Hole Diam T - Drilling: Borehole diameter

HFM08, 2003-01-29 09:00:00 - 2003-02-12 12:00:00 (0.000 - 143.500 m)

Sub Secup (m)	Sub Seclow (m)	Hole Diam (m)	Comment
0.000	6.100		Noex 215
0.180	110.500	0.138	138.7 start
6.100	18.000	0.213	
110.500	143.500	0.137	137.9 start efter omslipning

Printout from SICADA 2003-02-27 11:14:32.

Appendix 9

Magnetic Acc Dev T - Magnetic accelerometer deviation measurement

HFM06, 2003-01-14 10:54:00 - 2003-01-14 13:50:00 (0.000 - 110.000 m)

Bhlen (m)	Magnetic Bearing (degrees)	Dip (degrees)	Northing (m)	Easting (m)	Elevation (m)	Locala (m)	Localb (m)	Localc (m)
0.00	2.4	-84.6	7752.01	4522.19	6.63	0.00	0.00	0.00
15.00	8.1	-84.7	7753.40	4522.32	-8.30	1.40	0.07	0.00
18.00	9.8	-84.8	7753.67	4522.36	-11.29	1.67	0.10	0.00
21.00	13.2	-85.0	7753.93	4522.41	-14.28	1.93	0.14	0.00
24.00	14.3	-84.7	7754.19	4522.48	-17.27	2.20	0.20	-0.10
27.00	17.3	-84.8	7754.46	4522.55	-20.26	2.46	0.26	-0.10
30.00	22.8	-84.8	7754.71	4522.64	-23.24	2.72	0.34	-0.10
33.00	27.1	-85.0	7754.96	4522.76	-26.23	2.97	0.44	-0.10
36.00	26.7	-84.9	7755.19	4522.88	-29.22	3.21	0.55	-0.20
39.00	27.3	-84.6	7755.44	4523.00	-32.21	3.46	0.67	-0.20
42.00	29.4	-84.5	7755.69	4523.14	-35.19	3.71	0.79	-0.20
45.00	29.5	-84.5	7755.94	4523.28	-38.18	3.97	0.92	-0.30
48.00	33.6	-84.4	7756.18	4523.43	-41.17	4.22	1.06	-0.30
51.00	35.8	-84.5	7756.42	4523.59	-44.15	4.47	1.22	-0.30
54.00	37.7	-84.4	7756.66	4523.77	-47.14	4.71	1.38	-0.40
57.00	40.2	-84.4	7756.88	4523.95	-50.12	4.94	1.56	-0.40
60.00	40.6	-84.1	7757.11	4524.15	-53.11	5.18	1.74	-0.50
63.00	41.1	-83.8	7757.35	4524.35	-56.09	5.43	1.94	-0.50
66.00	45.0	-83.6	7757.59	4524.58	-59.07	5.68	2.15	-0.50
69.00	46.9	-83.4	7757.83	4524.82	-62.05	5.92	2.39	-0.60
72.00	46.8	-82.6	7758.08	4525.09	-65.03	6.18	2.64	-0.60
75.00	49.0	-82.6	7758.34	4525.38	-68.01	6.45	2.92	-0.60
78.00	50.4	-82.3	7758.59	4525.68	-70.98	6.72	3.21	-0.60
81.00	52.4	-82.1	7758.84	4525.99	-73.95	6.99	3.52	-0.60
84.00	54.3	-82.4	7759.09	4526.32	-76.93	7.24	3.83	-0.70
87.00	56.6	-82.0	7759.32	4526.65	-79.90	7.49	4.15	-0.70
90.00	49.0	-82.6	7759.56	4526.97	-82.87	7.74	4.46	-0.70
93.00	50.4	-82.6	7759.81	4527.27	-85.85	8.00	4.75	-0.70
96.00	52.4	-82.3	7760.05	4527.58	-88.82	8.26	5.05	-0.80
99.00	54.3	-82.1	7760.30	4527.90	-91.79	8.52	5.36	-0.80
102.00	56.6	-82.0	7760.53	4528.25	-94.76	8.77	5.69	-0.80
105.00	57.5	-80.7	7760.78	4528.62	-97.73	9.03	6.06	-0.80
108.00	62.0	-80.3	7761.03	4529.05	-100.69	9.30	6.48	-0.80
110.00	62.8	-80.1	7761.18	4529.35	-102.66	9.47	6.77	-0.90

Printout from SICADA 2003-04-11 10:17:03.

Magnetic Acc Dev T - Magnetic accelerometer deviation measurement

HFM07, 2003-02-25 08:00:00 - 2003-02-25 10:00:00 (0.000 - 120.000 m)

Bhlen (m)	Magnetic Bearing (degrees)	Dip (degrees)	Northing (m)	Easting (m)	Elevation (m)	Locala (m)	Localb (m)	Localc (m)
0.00	342.3	-84.5	7416.25	4715.68	5.78	0.00	0.00	0.00
9.00	333.5	-83.8	7417.10	4715.33	-3.17	0.91	-0.07	0.00
12.00	338.2	-84.4	7417.38	4715.21	-6.16	1.22	-0.11	0.10
15.00	337.9	-84.5	7417.65	4715.10	-9.14	1.51	-0.13	0.10
18.00	338.6	-84.4	7417.92	4714.99	-12.13	1.80	-0.15	0.10
21.00	340.8	-83.7	7418.21	4714.88	-15.11	2.11	-0.17	0.10
24.00	336.1	-83.4	7418.52	4714.76	-18.09	2.44	-0.19	0.10
27.00	330.9	-83.9	7418.82	4714.61	-21.08	2.77	-0.24	0.20
30.00	331.5	-84.3	7419.09	4714.46	-24.06	3.07	-0.30	0.20
33.00	326.9	-84.7	7419.33	4714.32	-27.05	3.35	-0.36	0.20
36.00	335.5	-84.9	7419.57	4714.18	-30.03	3.62	-0.42	0.20
39.00	333.8	-85.4	7419.80	4714.08	-33.02	3.87	-0.45	0.10
42.00	331.7	-86.0	7420.00	4713.97	-36.01	4.09	-0.49	0.10
45.00	333.7	-87.3	7420.16	4713.89	-39.01	4.27	-0.52	0.00
48.00	331.1	-88.0	7420.27	4713.84	-42.01	4.39	-0.54	-0.20
51.00	334.0	-88.7	7420.34	4713.80	-45.01	4.47	-0.55	-0.40
54.00	320.2	-89.3	7420.39	4713.77	-48.01	4.52	-0.56	-0.70
57.00	50.1	-89.4	7420.41	4713.77	-51.00	4.54	-0.56	-0.90
60.00	127.4	-89.3	7420.41	4713.80	-54.00	4.54	-0.53	-1.20
63.00	286.8	-89.4	7420.40	4713.80	-57.00	4.53	-0.53	-1.50
66.00	265.8	-89.5	7420.41	4713.77	-60.00	4.54	-0.56	-1.80
69.00	206.0	-89.3	7420.39	4713.75	-63.00	4.53	-0.58	-2.10
72.00	165.5	-88.3	7420.33	4713.75	-66.00	4.47	-0.60	-2.40
75.00	152.5	-86.7	7420.21	4713.80	-69.00	4.34	-0.59	-2.80
78.00	147.0	-85.2	7420.03	4713.91	-71.99	4.14	-0.54	-3.30
81.00	143.9	-84.2	7419.80	4714.07	-74.98	3.87	-0.46	-3.90
84.00	143.7	-83.0	7419.53	4714.26	-77.96	3.56	-0.35	-4.50
87.00	143.0	-82.5	7419.23	4714.49	-80.94	3.20	-0.23	-5.10
90.00	142.5	-82.0	7418.91	4714.73	-83.91	2.82	-0.09	-5.80
93.00	140.9	-81.8	7418.57	4715.00	-86.88	2.42	0.06	-6.50
96.00	140.7	-81.4	7418.23	4715.27	-89.85	2.01	0.22	-7.20
99.00	138.4	-80.9	7417.88	4715.57	-92.81	1.59	0.39	-7.90
102.00	138.6	-80.1	7417.51	4715.90	-95.77	1.13	0.59	-8.60
105.00	138.6	-79.7	7417.12	4716.25	-98.72	0.65	0.81	-9.40
108.00	137.8	-79.7	7416.72	4716.61	-101.68	0.16	1.02	-10.10
111.00	136.8	-78.8	7416.31	4716.99	-104.62	-0.34	1.26	-10.90
114.00	136.4	-78.4	7415.88	4717.39	-107.56	-0.88	1.52	-11.70
117.00	136.2	-77.7	7415.43	4717.82	-110.50	-1.44	1.79	-12.60
120.00	137.3	-76.9	7414.95	4718.27	-113.43	-2.03	2.08	-13.40

Printout from SICADA 2003-04-11 10:18:05.

Magnetic Acc Dev T - Magnetic accelerometer deviation measurement

HFM08, 2003-02-24 14:30:00 - 2003-02-24 17:00:00 (0.000 - 142.000 m)

Bhlen (m)	Magnetic Bearing (degrees)	Dip (degrees)	Northing (m)	Easting (m)	Elevation (m)	Locala (m)	Localb (m)	Localc (m)
0.00	348.7	-84.4	7703.27	4777.50	7.13	0.00	0.00	0.00
6.00	344.1	-85.4	7703.79	4777.38	1.15	0.53	-0.02	-0.10
9.00	350.1	-85.6	7704.02	4777.32	-1.84	0.77	-0.03	-0.10
12.00	345.3	-85.8	7704.24	4777.28	-4.83	0.99	-0.03	-0.20
15.00	357.1	-86.5	7704.43	4777.24	-7.82	1.19	-0.02	-0.30
18.00	355.2	-86.6	7704.61	4777.23	-10.82	1.37	0.00	-0.40
21.00	341.2	-87.1	7704.78	4777.20	-13.81	1.54	0.00	-0.50
24.00	340.1	-87.4	7704.91	4777.15	-16.81	1.68	-0.02	-0.70
27.00	357.9	-87.4	7705.04	4777.13	-19.81	1.81	-0.02	-0.80
30.00	0.3	-87.8	7705.17	4777.12	-22.80	1.94	0.00	-1.00
33.00	11.6	-88.1	7705.28	4777.13	-25.80	2.04	0.03	-1.20
36.00	18.4	-88.1	7705.37	4777.16	-28.80	2.13	0.08	-1.40
39.00	20.6	-88.1	7705.46	4777.19	-31.80	2.21	0.13	-1.60
42.00	27.5	-88.1	7705.56	4777.23	-34.80	2.29	0.19	-1.80
45.00	33.5	-88.1	7705.64	4777.28	-37.79	2.37	0.25	-2.00
48.00	23.1	-88.2	7705.73	4777.33	-40.79	2.44	0.31	-2.20
51.00	52.3	-87.6	7705.81	4777.40	-43.79	2.51	0.40	-2.50
54.00	62.5	-87.1	7705.88	4777.52	-46.79	2.56	0.53	-2.70
57.00	70.5	-86.9	7705.94	4777.66	-49.78	2.59	0.68	-3.00
60.00	75.9	-86.6	7705.99	4777.82	-52.78	2.61	0.85	-3.30
63.00	78.9	-86.1	7706.03	4778.01	-55.77	2.61	1.04	-3.50
66.00	80.5	-85.5	7706.07	4778.22	-58.76	2.61	1.26	-3.80
69.00	84.7	-85.1	7706.10	4778.47	-61.75	2.59	1.50	-4.10
72.00	86.0	-84.8	7706.12	4778.73	-64.74	2.56	1.77	-4.50
75.00	88.6	-84.2	7706.14	4779.02	-67.73	2.51	2.05	-4.80
78.00	85.8	-83.9	7706.15	4779.33	-70.71	2.47	2.36	-5.10
81.00	86.6	-83.8	7706.17	4779.65	-73.70	2.43	2.68	-5.50
84.00	85.6	-83.3	7706.20	4779.99	-76.68	2.38	3.01	-5.80
87.00	85.7	-82.9	7706.23	4780.35	-79.65	2.34	3.37	-6.10
90.00	84.1	-82.5	7706.26	4780.73	-82.63	2.30	3.75	-6.50
93.00	82.3	-82.2	7706.31	4781.12	-85.60	2.27	4.15	-6.80
96.00	85.1	-81.8	7706.35	4781.54	-88.57	2.23	4.56	-7.10
99.00	82.6	-81.4	7706.40	4781.97	-91.54	2.19	5.00	-7.40
102.00	80.5	-81.2	7706.47	4782.42	-94.51	2.17	5.45	-7.80
105.00	81.8	-81.0	7706.54	4782.88	-97.47	2.15	5.92	-8.10
108.00	81.2	-80.5	7706.61	4783.36	-100.43	2.13	6.40	-8.40
111.00	81.5	-80.3	7706.68	4783.85	-103.39	2.10	6.90	-8.70
114.00	78.9	-80.2	7706.77	4784.35	-106.35	2.09	7.40	-9.00
117.00	78.5	-79.8	7706.87	4784.86	-109.30	2.09	7.93	-9.30
120.00	78.7	-79.6	7706.98	4785.39	-112.25	2.09	8.46	-9.60
123.00	80.0	-79.3	7707.08	4785.93	-115.20	2.08	9.01	-9.90
126.00	80.6	-79.0	7707.18	4786.48	-118.15	2.07	9.58	-10.20
129.00	80.7	-78.7	7707.27	4787.06	-121.09	2.05	10.16	-10.50
132.00	82.7	-78.2	7707.36	4787.65	-124.03	2.02	10.76	-10.80
135.00	83.1	-78.2	7707.43	4788.26	-126.97	1.97	11.37	-11.10
138.00	81.9	-78.1	7707.51	4788.87	-129.90	1.93	11.98	-11.40
141.00	83.0	-77.4	7707.60	4789.50	-132.84	1.89	12.62	-11.80
142.00	83.5	-77.5	7707.62	4789.72	-133.81	1.87	12.83	-11.90

Printout from SICADA 2003-04-11 10:18:48.

Appendix 10

Drillpen D T - Drill Penetration Log

HFM06, 2002-12-19 13:17:00 - 2003-01-13 15:28:00 (2.500 - 110.700 m)

Bhlen (m)	Pen Time (s)	Water	Fracture	Comment
2.60	19	0	0	2002-12-19 13:17
2.80	28	0	0	
3.00	34	0	0	
3.20	25	0	0	
3.40	30	0	0	
3.60	31	0	0	
3.80	29	0	0	
4.00	24	0	0	
4.20	22	0	0	
4.40	20	0	0	
4.60	17	0	0	
4.80	15	0	0	
5.00	20	0	0	2002-12-19 13:23
5.20	15	0	0	
5.40	17	0	0	
5.60	15	0	0	
5.80	14	0	0	
6.00	12	0	0	
6.20	15	0	0	
6.40	16	0	0	
6.60	15	0	0	
6.80	15	0	0	
7.00	17	0	0	
7.20	14	0	0	
7.40	12	0	0	
7.60	15	0	0	
7.80	15	0	0	
8.00	20	0	0	2002-12-19 13:29
8.20	23	0	0	
8.40	16	0	0	
8.60	18	0	0	
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49.80	21	0	0	
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78.80	21	0	0	
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79.20	23	0	0	
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80.80	25	0	0	

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82.20	22	0	0	
82.40	24	0	0	
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82.80	22	0	0	
83.00	26	0	0	2003-01-13 13:55
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84.00	28	0	0	
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84.40	23	0	0	
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85.20	27	0	0	
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85.60	24	0	0	
85.80	28	0	0	
86.00	27	0	0	2003-01-13 14:08
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86.60	31	0	0	
86.80	27	0	0	
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87.20	27	0	0	
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87.80	25	0	0	
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89.60	28	0	0	
89.80	27	0	0	
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91.20	26	0	0	
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91.60	24	0	0	
91.80	27	0	0	
92.00	23	0	0	2003-01-13 14:26
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95.00	27	0	0	2003-01-13 14:37
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100.80	25	0	0	
101.00	26	0	0	
101.20	28	0	0	
101.40	26	0	0	
101.60	29	0	0	
101.80	30	0	0	
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103.80	24	0	0	
104.00	17	0	0	2003-01-13 15:07
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104.60	31	0	0	
104.80	29	0	0	
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105.80	32	0	0	
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106.80	28	0	0	
107.00	30	0	0	2003-01-13 15:18
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107.60	31	0	0	

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109.40	29	0	0
109.60	29	0	0
109.80	28	0	0
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2003-01-13 15:28

Printout from SICADA 2003-04-11 10:04:26.

Drillpen D T - Drill Penetration Log

HFM07, 2003-01-21 08:59:00 - 2003-01-27 17:21:00 (7.600 - 122.550 m)

Bhlen (m)	Pen Time (s)	Water	Fracture	Comment
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8.20	22	0	0	
8.40	23	0	0	
8.60	25	0	0	
8.80	23	0	0	
9.00	21	0	0	
9.20	18	0	0	
9.40	22	0	0	
9.60	21	0	0	
9.80	23	0	0	
10.00	23	0	0	
10.20	23	0	0	
10.40	22	0	0	
10.60	28	0	0	
10.80	25	0	0	
11.00	22	0	0	2003-01-21 09:07
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11.40	22	0	0	
11.60	18	0	0	
11.80	21	0	0	
12.00	24	0	0	
12.20	22	0	0	
12.40	23	0	0	
12.60	24	0	0	
12.80	23	0	0	
13.00	22	0	0	
13.20	25	0	0	
13.40	24	0	0	
13.60	21	0	0	
13.80	22	0	0	
14.00	18	0	0	2003-01-21 09:30
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14.40	16	0	0	
14.60	14	0	0	
14.80	17	0	0	
15.00	24	0	0	
15.20	21	0	0	
15.40	19	0	0	
15.60	22	0	0	
15.80	23	0	0	
16.00	17	0	0	
16.20	20	0	0	
16.40	15	0	0	
16.60	15	0	0	
16.80	17	0	0	
17.00	22	0	0	2003-01-21 09:36
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17.60	16	0	0	
17.80	18	0	0	2003-01-21 09:51
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18.40	18	0	0	
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18.80	18	0	0	
19.00	15	0	0	
19.20	17	0	0	
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19.80	17	0	0	
20.00	18	0	0	2003-01-27 09:20
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20.40	18	0	0	
20.60	17	0	0	
20.80	15	0	0	
21.00	16	0	0	
21.20	19	0	0	
21.40	24	0	0	
21.60	23	0	0	
21.80	19	0	0	
22.00	22	0	0	
22.20	22	0	0	
22.40	18	0	0	
22.60	15	0	0	
22.80	12	0	0	
23.00	15	0	0	2003-01-27 09:26
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23.60	17	0	0	
23.80	19	0	0	
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24.20	21	0	0	
24.40	21	0	0	
24.60	24	0	0	
24.80	18	0	0	
25.00	18	0	0	
25.20	19	0	0	
25.40	17	0	0	
25.60	16	0	0	
25.80	17	0	0	
26.00	20	0	0	2003-01-27 09:31
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26.40	20	0	0	
26.60	18	0	0	
26.80	23	0	0	
27.00	20	0	0	
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27.80	23	0	0	
28.00	25	0	0	
28.20	23	0	0	
28.40	22	0	0	
28.60	18	0	0	
28.80	19	0	0	
29.00	22	0	0	2003-01-27 09:38
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29.60	24	0	0	
29.80	23	0	0	
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30.40	21	0	0	
30.60	25	0	0	
30.80	22	0	0	
31.00	19	0	0	
31.20	20	0	0	
31.40	21	0	0	
31.60	20	0	0	
31.80	21	0	0	
32.00	19	0	0	2003-01-27 09:45
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32.80	21	0	0	

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33.20	18	0	0	
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62.00	17	0	0	2003-01-27 10:51
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67.80	18	0	0	
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69.00	20	0	0	2003-01-27 11:05
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71.00	19	0	0	2003-01-27 14:42
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75.60	23	0	0	
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87.80	24	0	0	
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92.60	23	0	0	
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95.00	24	0	0	2003-01-27 15:49
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100.80	19	0	0	
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103.60	26	0	0	
103.80	27	0	0	
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117.80	27	0	0	
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120.80	26	0	0	
121.00	26	0	0	
121.20	24	0	0	
121.40	25	0	0	
121.60	24	0	0	
121.80	24	0	0	
122.00	23	0	0	2003-01-27 17:21
122.20	25	0	0	
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Printout from SICADA 2003-04-11 10:05:36.

Drillpen D T - Drill Penetration Log

HFM08, 2003-02-03 09:11:00 - 2003-02-11 16:37:00 (6.100 - 143.500 m)

Bhlen (m)	Pen Time (s)	Water	Fracture	Comment
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6.40	15	0	0	
6.60	30	0	0	
6.80	16	0	0	
7.00	24	0	0	
7.20	23	0	0	
7.40	25	0	0	
7.60	40	0	0	
7.80	22	0	0	
8.00	26	0	0	2003-02-03 09:15
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8.40	17	0	0	
8.60	21	0	0	
8.80	21	0	0	
9.00	21	0	0	
9.20	22	0	0	
9.40	22	0	0	
9.60	23	0	0	
9.80	23	0	0	
10.00	20	0	0	
10.20	21	0	0	
10.40	21	0	0	
10.60	20	0	0	
10.80	20	0	0	
11.00	21	0	0	2003-02-03 09:23
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11.40	17	0	0	
11.60	17	0	0	
11.80	15	0	0	
12.00	17	0	0	
12.20	19	0	0	
12.40	16	0	0	
12.60	23	0	0	
12.80	22	0	0	
13.00	20	0	0	
13.20	26	0	0	
13.40	20	0	0	
13.60	21	0	0	
13.80	25	0	0	
14.00	23	0	0	2003-02-03 09:29
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14.40	24	0	0	
14.60	27	0	0	
14.80	27	0	0	
15.00	24	0	0	2003-02-03 09:34
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15.40	19	0	0	
15.60	20	0	0	
15.80	21	0	0	
16.00	19	0	0	
16.20	17	0	0	
16.40	23	0	0	
16.60	27	0	0	
16.80	33	0	0	
17.00	35	0	0	2003-02-03 09:39
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17.60	25	0	0	
17.80	22	0	0	2003-02-03 09:44

18.00	40	0	0	2003-02-10 09:45
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18.80	30	0	0	
19.00	18	0	0	
19.20	21	0	0	
19.40	24	0	0	
19.60	22	0	0	
19.80	23	0	0	
20.00	22	0	0	2003-02-10 09:49
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20.40	19	0	0	
20.60	22	0	0	
20.80	19	0	0	
21.00	22	0	0	
21.20	22	0	0	
21.40	21	0	0	
21.60	28	0	0	
21.80	22	0	0	
22.00	21	0	0	
22.20	20	0	0	
22.40	23	0	0	
22.60	23	0	0	
22.80	22	0	0	
23.00	21	0	0	2003-02-10 09:57
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23.40	23	0	0	
23.60	25	0	0	
23.80	18	0	0	
24.00	23	0	0	
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24.40	24	0	0	
24.60	24	0	0	
24.80	24	0	0	
25.00	23	0	0	
25.20	22	0	0	
25.40	23	0	0	
25.60	22	0	0	
25.80	24	0	0	
26.00	23	0	0	2003-02-10 10:04
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26.40	23	0	0	
26.60	25	0	0	
26.80	15	0	0	
27.00	21	0	0	
27.20	23	0	0	
27.40	21	0	0	
27.60	21	0	0	
27.80	20	0	0	
28.00	20	0	0	
28.20	18	0	0	
28.40	24	0	0	
28.60	25	0	0	
28.80	23	0	0	
29.00	20	0	0	2003-02-10 10:11
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29.60	25	0	0	
29.80	20	0	0	
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30.80	19	0	0	
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31.20	21	0	0	

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31.60	17	0	0	
31.80	16	0	0	
32.00	17	0	0	2003-02-10 10:18
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32.80	17	0	0	
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33.80	16	0	0	
34.00	18	0	0	
34.20	17	0	0	
34.40	21	0	0	
34.60	20	0	0	
34.80	19	0	0	
35.00	17	0	0	2003-02-10 10:23
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35.60	21	0	0	
35.80	15	0	0	
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36.40	16	0	0	
36.60	19	0	0	
36.80	20	0	0	
37.00	24	0	0	
37.20	19	0	0	
37.40	19	0	0	
37.60	16	0	0	
37.80	22	0	0	
38.00	20	0	0	2003-02-10 10:35
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38.40	22	0	0	
38.60	26	0	0	
38.80	16	0	0	
39.00	16	0	0	
39.20	19	0	0	
39.40	16	0	0	
39.60	20	0	0	
39.80	19	0	0	
40.00	16	0	0	
40.20	16	0	0	
40.40	18	0	0	
40.60	20	0	0	
40.80	22	0	0	
41.00	23	0	0	2003-02-10 10:41
41.20	25	0	0	
41.40	28	0	0	
41.60	27	0	0	
41.80	20	0	0	
42.00	21	0	0	
42.20	23	0	0	
42.40	23	0	0	
42.60	25	0	0	
42.80	23	0	0	
43.00	22	0	0	
43.20	24	0	0	
43.40	24	0	0	
43.60	23	0	0	
43.80	23	0	0	
44.00	23	0	0	2003-02-10 10:48
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45.00	22	0	0	
45.20	22	0	0	
45.40	23	0	0	
45.60	22	0	0	
45.80	22	0	0	
46.00	23	0	0	
46.20	23	0	0	
46.40	23	0	0	
46.60	21	0	0	
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47.00	21	0	0	2003-02-10 10:55
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47.80	13	0	0	
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48.40	15	0	0	
48.60	15	0	0	
48.80	16	0	0	
49.00	18	0	0	
49.20	22	0	0	
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49.80	30	0	0	
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52.00	20	0	0	
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55.00	16	0	0	
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57.40	17	0	0	
57.60	17	0	0	
57.80	16	0	0	
58.00	16	0	0	

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58.60	21	0	0	
58.80	20	0	0	
59.00	22	0	0	2003-02-10 11:24
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60.20	22	0	0	
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60.60	18	0	0	
60.80	20	0	0	
61.00	20	0	0	
61.20	19	0	0	
61.40	21	0	0	
61.60	19	0	0	
61.80	20	0	0	
62.00	22	0	0	2003-02-10 11:31
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63.20	19	0	0	
63.40	19	0	0	
63.60	19	0	0	
63.80	18	0	0	
64.00	18	0	0	
64.20	19	0	0	
64.40	22	0	0	
64.60	20	0	0	
64.80	19	0	0	
65.00	22	0	0	2003-02-10 13:48
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65.80	27	0	0	
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66.20	22	0	0	
66.40	20	0	0	
66.60	20	0	0	
66.80	21	0	0	
67.00	23	0	0	
67.20	23	0	0	
67.40	21	0	0	
67.60	23	0	0	
67.80	22	0	0	
68.00	23	0	0	2003-02-10 13:55
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68.60	29	0	0	
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69.40	22	0	0	
69.60	23	0	0	
69.80	20	0	0	
70.00	21	0	0	
70.20	21	0	0	
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71.60	23	0	0	
71.80	21	0	0	
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72.20	25	0	0	
72.40	22	0	0	
72.60	22	0	0	
72.80	22	0	0	
73.00	23	0	0	
73.20	21	0	0	
73.40	22	0	0	
73.60	22	0	0	
73.80	23	0	0	
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74.80	23	0	0	
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75.40	21	0	0	
75.60	24	0	0	
75.80	23	0	0	
76.00	22	0	0	
76.20	21	0	0	
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76.60	22	0	0	
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77.00	22	0	0	2003-02-10 14:16
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77.60	27	0	0	
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78.40	17	0	0	
78.60	18	0	0	
78.80	17	0	0	
79.00	18	0	0	
79.20	17	0	0	
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81.40	18	0	0	
81.60	17	0	0	
81.80	17	0	0	
82.00	17	0	0	
82.20	18	0	0	
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82.60	17	0	0	
82.80	17	0	0	
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83.60	23	0	0	
83.80	18	0	0	
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84.20	23	0	0	
84.40	18	0	0	
84.60	19	0	0	
84.80	20	0	0	

85.00	19	0	0	
85.20	18	0	0	
85.40	20	0	0	
85.60	19	0	0	
85.80	20	0	0	
86.00	20	0	0	2003-02-10 14:40
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86.60	19	0	0	
86.80	17	0	0	
87.00	18	0	0	
87.20	21	0	0	
87.40	18	0	0	
87.60	19	0	0	
87.80	19	0	0	
88.00	18	0	0	
88.20	20	0	0	
88.40	20	0	0	
88.60	18	0	0	
88.80	18	0	0	
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89.80	19	0	0	
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90.60	22	0	0	
90.80	27	0	0	
91.00	27	0	0	
91.20	24	0	0	
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92.40	28	0	0	
92.60	31	0	0	
92.80	30	0	0	
93.00	31	0	0	
93.20	31	0	0	
93.40	27	0	0	
93.60	20	0	0	
93.80	22	0	0	
94.00	19	0	0	
94.20	22	0	0	
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96.20	21	0	0	
96.40	23	0	0	
96.60	21	0	0	
96.80	23	0	0	
97.00	18	0	0	
97.20	23	0	0	
97.40	24	0	0	
97.60	24	0	0	
97.80	22	0	0	
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99.20	17	0	0	
99.40	20	0	0	
99.60	20	0	0	
99.80	21	0	0	
100.00	22	0	0	
100.20	23	0	0	
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100.60	24	0	0	
100.80	24	0	0	
101.00	24	0	0	2003-02-10 15:40
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101.60	25	0	0	
101.80	31	0	0	
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102.20	24	0	0	
102.40	24	0	0	
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102.80	25	0	0	
103.00	25	0	0	
103.20	22	0	0	
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103.60	21	0	0	
103.80	21	0	0	
104.00	23	0	0	2003-02-10 15:48
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104.60	25	0	0	
104.80	26	0	0	
105.00	25	0	0	
105.20	25	0	0	
105.40	26	0	0	
105.60	25	0	0	
105.80	25	0	0	
106.00	23	0	0	
106.20	21	0	0	
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111.60	29	0	0	

111.80	31	0	0	
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112.60	49	0	0	
112.80	42	0	0	
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113.80	29	0	0	
114.00	24	0	0	
114.20	26	0	0	
114.40	27	0	0	
114.60	28	0	0	
114.80	25	0	0	
115.00	40	0	0	
115.20	25	0	0	
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115.80	29	0	0	
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116.40	36	0	0	
116.60	30	0	0	
116.80	31	0	0	
117.00	29	0	0	
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117.40	30	0	0	
117.60	29	0	0	
117.80	31	0	0	
118.00	29	0	0	
118.20	27	0	0	
118.40	27	0	0	
118.60	30	0	0	
118.80	30	0	0	
119.00	29	0	0	2003-02-11 13:39
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119.60	30	0	0	
119.80	32	0	0	
120.00	26	0	0	
120.20	27	0	0	
120.40	31	0	0	
120.60	24	0	0	
120.80	29	0	0	
121.00	29	0	0	
121.20	29	0	0	
121.40	29	0	0	
121.60	30	0	0	
121.80	30	0	0	
122.00	29	0	0	2003-02-11 13:49
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122.40	32	0	0	
122.60	29	0	0	
122.80	30	0	0	
123.00	27	0	0	
123.20	28	0	0	
123.40	21	0	0	
123.60	24	0	0	
123.80	24	0	0	
124.00	27	0	0	
124.20	28	0	0	
124.40	28	0	0	
124.60	28	0	0	
124.80	29	0	0	
125.00	29	0	0	2003-02-11 13:58

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125.40	29	0	0	
125.60	32	0	0	
125.80	32	0	0	
126.00	28	0	0	
126.20	28	0	0	
126.40	29	0	0	
126.60	29	0	0	
126.80	31	0	0	
127.00	29	0	0	
127.20	28	0	0	
127.40	25	0	0	
127.60	28	0	0	
127.80	23	0	0	
128.00	24	0	0	2003-02-11 14:08
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128.40	34	0	0	
128.60	27	0	0	
128.80	27	0	0	
129.00	29	0	0	
129.20	32	0	0	
129.40	29	0	0	
129.60	27	0	0	
129.80	31	0	0	
130.00	30	0	0	
130.20	30	0	0	
130.40	29	0	0	
130.60	32	0	0	
130.80	31	0	0	
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131.20	34	0	0	
131.40	36	0	0	
131.60	32	0	0	
131.80	34	0	0	
132.00	32	0	0	
132.20	31	0	0	
132.40	34	0	0	
132.60	32	0	0	
132.80	32	0	0	
133.00	31	0	0	
133.20	31	0	0	
133.40	32	0	0	
133.60	33	0	0	
133.80	31	0	0	
134.00	28	0	0	2003-02-11 14:33
134.20	31	0	0	
134.40	29	0	0	
134.60	30	0	0	
134.80	32	0	0	
135.00	28	0	0	
135.20	29	0	0	
135.40	28	0	0	
135.60	25	0	0	
135.80	27	0	0	
136.00	28	0	0	
136.20	28	0	0	
136.40	29	0	0	
136.60	30	0	0	
136.80	37	0	0	
137.00	37	0	0	2003-02-11 14:51
137.20	344	0	0	2003-02-11 15:25
137.40	360	0	0	
137.60	330	0	0	
137.80	250	0	0	
138.00	160	0	0	
138.20	115	0	0	
138.40	100	0	0	

138.60	63	0	0	
138.80	64	0	0	
139.00	96	0	0	
139.20	118	0	0	
139.40	122	0	0	
139.60	144	0	0	
139.80	134	0	0	
140.00	129	0	0	2003-02-11 16:09
140.20	112	0	0	
140.40	129	0	0	
140.60	127	0	0	
140.80	113	0	0	
141.00	95	0	0	
141.20	92	0	0	
141.40	107	0	0	
141.60	97	0	0	
141.80	96	0	0	
142.00	98	0	0	
142.20	113	0	0	
142.40	110	0	0	
142.60	115	0	0	
142.80	117	0	0	
143.00	113	0	0	
143.20	119	0	0	
143.40	18	0	0	2003-02-11 16:37

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Appendix 11

Drill Cuttings Samp T - Drill cuttings sampling an analysis

HFM06, 2003-02-26 00:00:00 - 2003-03-04 12:00:00 (2.000 - 110.700 m)

From Length	To Length	Colour Code	Grainsize Code	Colour Code	Grainsize Code	Rocktype A	Rocktype B	Mineral 1	Mineral 2	Mineral 3	Mineral 4	Mineral 5	Rockt type	Comment
(m)	(m)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(%)	
2.00	2.30	108	9	158	6	101051	101061	36	49	32	10		80	Granitoid uncertain. foliated, traces of lightgreen metavolcanic rock(?) and red finegrain
2.50	5.00	118	6	128	6	101051	102017	36	49	32	10	40	80	Granitoid uncertain. Traces of acid metavolcanic rock, greyish violet, feldsparrich, also
5.00	8.00	82	9	82	6	101051	101061	36	49	32	10	33	90	Granitoid uncertain. Greenish-brownish shade (sericite?), traces of prehnite
8.00	11.00	108	2	28	9	101057	101061	36	49	32	10		90	biotite also in bigger flakes
11.00	14.00	8	2	118	6	101057		36	49	32	10			
14.00	17.00	118	6	209	2	101061	102017	36	49	3	32	10	60	peg/gran.gr/amph 50/10/40. epidote as fracture filling in amphibolite(15-16m). Some chlori
17.00	20.00	118	6	118	9	101061	102017	36	49	3	32	10	70	peg/gran.gr/amph 50/20/30. Amphibolite between 18-19m.
20.00	23.00	181	9	82	9	101057	101061	36	32	49	10	11091	90	Traces of ironsulphide?
23.00	26.00	118	6	82	9	101057		36	32	49	10	11091		few weathered pieces (moraine /crush?), some chlorite
26.00	29.00	118	6	82	9	101057		36	32	49	10			
29.00	32.00	81	9	28	9	101057	102017	36	32	49	10	3	90	some amphibolite with pink plagioclase
32.00	35.00	81	6	182	9	101057	101061	36	32	49	10	33	80	slight greenish tint (due to fine chlorite in microfractures?)
35.00	38.00	118	6	28	9	101057		36	32	49	10	33		slight greenish tint
38.00	41.00	81	6	118	9	101057	102017	36	32	49	10	3	90	chlorite on fracturesurface and in altered biotite, hematitepigments, traces of aphanitic
41.00	44.00	118	6	18	9	101057		36	32	49	10	11091		chlorite, greenish tint in sample, a sealed fracture with chlorite on the walls and prehni
44.00	47.00	118	6	18	9	101057	101061	36	32	49	10		90	fine biotite
47.00	50.00	118	6	118	9	101057		36	32	49	10	33		biotite somewhat chlorite altered
50.00	53.00	201	6	118	9	101057	102017	36	32	49	10	3	80	small grains rich in hematite pigments, some chlorite, amphibolite has some pink plagiocla
53.00	56.00	118	6	101	8	101061	101057	36	32	49	10	33	90	crushed to medium grained.
56.00	59.00	118	6	118	9	101057	102017	36	32	49	10	3	80	granodior.gr/pegmatite/amphibolite (80/10/10)
59.00	62.00	118	6	182	9	101057	101061	36	32	49	10	33	80	chlorite from altered biotite, possibly some prehnite?
62.00	65.00	128	6	182	9	101057		36	32	49	10			64-65m troligen pegmatite, underrepresenterat i provet, biotite slightly chlorite altered,
65.00	68.00	18	6	82	9	101057	102017	36	32	49	10	3	90	some pinkish plagioclase in amphibolite, some chlorite, epidote and possibly prehnite
68.00	71.00	252	6	252	6	102017		49	33	3	36		100	strongly altered with red plagioclase, amphibole -> chlorite, traces of epidote, laumontit
71.00	74.00	181	6	182	8	101061	102017	36	32	49	10	3	80	Peg/gran.gr/amph = 80/10/10. Amph. As at 68-71m. Chlorite also as fracture filling?
74.00	77.00	181	6	81	8	101061	102017	36	32	49	10	3	80	amphibolite as 68-71m. Possibly some prehnite
77.00	80.00	181	6	81	8	101061	102017	36	32	49	10	3	70	m 78 extra prov. 2 stora stenar (3*5*8 och 4*4*2cm stora): kraftigt röd fint medelkornig b

80.00	83.00	118	6	81	9	101057	101061	36	32	49	10	90	gran.gr/peg/finegrained black rock = 90/05/05. Black aphanitic schistose rock with quartz
83.00	86.00	118	6	18	9	101057	102017	36	32	49	10		traces of rock as 68-71m, traces of epidote
86.00	89.00	187	6	117	8	101061	102017	36	32	49	10	90	traces of rock as 68-71m. Also granodiorite-granite. Biotite somewhat copper coloured.
89.00	92.00	118	6	118	9	101057	101061	36	32	49	10	90	traces of rock as 68-71m
92.00	95.00	181	6	81	9	101057	101061	36	32	49	10	33	80 traces of rock as 68-71m
95.00	98.00	108	9	208	6	101057	102017	49	3	32	36	10	70 traces of rock as 68-71m. Amphibolite foliated. Also some pegmatite. One rusty grain.
98.00	101.00	181	6	218	6	101057	102017	49	3	32	36	10	80 untreated: dark 100-101m. Chlorite fracture filling with slickenside striation. Pyrite?, c
101.00	104.00	81	6	1	4	101061	101057	36	32	49	10	33	80 traces of rock as 68-71m. Calcite.
104.00	107.00	82	6	82	9	101057	102017	36	32	49	10	3	90 prehnite, epidote, chlorite
107.00	110.70	282	6	82	9	101057	102017	36	32	49	10	3	80 amph. 107-108m with red and white plagioclase

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Drill Cuttings Samp T - Drill cuttings sampling an analysis

HFM07, 2003-03-06 00:00:00 - 2003-03-17 00:00:00 (6.600 - 122.500 m)

From Length	To Length	Colour Code	Grainsize Code	Colour Code	Grainsize Code	Rocktype A	Rocktype B	Mineral 1	Mineral 2	Mineral 3	Mineral 4	Mineral 5	Rock type Distr.	Comment
(m)	(m)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(%)	
6.60	6.80	282	4	28	9	101057	103076	36	32	49	10	50	70	some moraine
6.80	7.00	8	4	28	9	101057	103076	36	32	49	10		70	rounded moraine grains (felsic igneous rock). Also traces of amphibolite with red plagiocl
7.00	7.10	28	8	28	9	101057	103076	36	32	49	10		70	rounded moraine grains (felsic igneous rock and tonalitic fine-mediumgrained rock?). Fe-su
7.60	10.00	28	6	82	9	101057	102017	36	32	49	10		90	amphibolite 7-8m, schistose, biotite altered to biotite.
10.00	13.00	28	6	82	9	101057		36	32	49	10		33	chlorite as alteration product from biotite
13.00	16.00	128	6	182	9	101057	101061	36	32	49	10		33	80 chlorite as alteration product from biotite
16.00	18.00	128	6	2	9	101057	101061	36	32	49	10	11091	90	X1=probalby prehnite. chlorite as alteration product from biotite. Biotite also in bigger
18.00	21.00	118	6	1	8	101061	101057	36	32	49	10		30	
21.00	24.00	28	6	82	9	101057	101061	36	32	49	10		3	50 hematite sealed fractures. Calcite. Traces of prehnite. Also some amphibolite, less than 10
24.00	27.00	8	6	8	6	101051	101061	36	32	49	10		50	80 24-25 m pinkish. Also some granodiorite-granite. Granitoid could be fresher granodiorite-g
27.00	30.00	28	6	28	6	101057		36	32	49	10			biotite also in aggregates.
30.00	33.00	28	6	2	9	101057		36	32	49	10		33	biotite partly-> chlorite
33.00	36.00	118	2	182	9	101057		36	32	49	10		27	
36.00	39.00	28	6	2	9	101057	101061	36	32	49	10		33	80 biotite chlorite altered. Calcite. Possibly traces of prehnite.
39.00	42.00	28	6	182	9	101057	101061	36	32	49	10		33	70 39-40m peg. Traces of calcite
42.00	45.00	28	6	82	9	101057		36	32	49	10		33	biotite partly-> chlorite. Trace of amphibolite.
45.00	48.00	8	6	18	6	101051	101057	36	32	49	10		70	45-46m reddish-grey.
48.00	51.00	28	6	182	9	101057	101061	36	32	49	10		90	48-49m amphibolite.
51.00	54.00	128	6	102	9	101057	101061	36	32	49	10		27	70 biotite partly chlorite altered.
54.00	57.00	42	6	202	9	101057		36	32	49	33		10	biotite almost entirely altered to chlorite.Traces of prehnite. Strongly oxidized.
57.00	60.00	42	6	202	9	101057	101061	36	32	49	33		10	90 biotite almost entirely altered to chlorite.Strongly oxidized. Calcite
60.00	63.00	42	6	202	9	101057		36	32	49	33		10	biotite altered to chlorite, oxidized. Prehnite. Traces of aphanitic to fine grained light
63.00	66.00	42	6	202	9	101057	101061	36	32	49	33		10	80 biotite altered to chlorite, oxidized. Traces of aphanitic light grey feldsparrich rock (c
66.00	69.00	82	6	2	9	101057	101061	36	32	49	10		33	90 biotite partly altered to chlorite. Calcite in fracture
69.00	72.00	118	6	128	9	101057		36	32	49	10			traces of light grey almost aphanitic feldsparrich (?) rock. With biotiterich grains that

72.00	75.00	18	6	82	9	101057		36	32	49	10	50		only trace of pyrite. Very fine biotite
75.00	78.00	18	6	2	9	101057	101061	36	32	49	10	33	90	biotite altered to chlorite.
78.00	81.00	28	6	2	9	101057		36	32	49	10	33		biotite altered to chlorite.
81.00	84.00	28	6	2	9	101057		36	32	49	10	33		biotite partly altered to chlorite.
84.00	87.00	18	6	28	9	101057	101051	36	32	49	10		90	granitoid - fine to medium grained.
87.00	90.00	19	6	218	9	101057	102017	49	3	36	32	10	70	89-90m biotite altered, schistose amphibolite (?). (amphibolite overrepresented in sample)
90.00	93.00	18	6	118	9	101057	102017	36	32	49	10	3		90-91m amphibolite.
93.00	96.00	118	9	181	8	101061	101057	36	32	49	10	11091	60	
96.00	99.00	17	9	17	8	101061	101057	36	32	49	10	11091	90	
99.00	102.00	82	9	82	9	101057	102017	36	32	49	10	3	70	100-101m amphibolite. Traces of pegmatite - less than 10% Traces of yellow greenish minera
102.00	105.00	82	9	2	9	101057	101061	36	32	49	10	33	90	some biotite chlorite altered.
105.00	108.00	181	9	118	8	101061	101057	36	32	49	10	33	80	traces of amphibolite, prehnite and pyrite
108.00	111.00	118	6	181	9	101061	102017	36	32	49	3	10	70	peg/granodiorite-granite/amph ratio approximately 50/20/30
111.00	114.00	181	9	81	9	101057	101061	36	32	49	10		60	
114.00	117.00	128	8	81	8	101061	101051	36	32	49	10		70	peg/granodiorite-granite/granitoid ratio approximately 40/30/30
117.00	120.00	59	6	208	2	101051	101061	49	10	36	32		90	traces of epidote.
120.00	122.55	108	6	108	6	101057	101051	36	32	49	10		80	

Drill Cuttings Samp T - Drill cuttings sampling an analysis

HFM08, 2003-03-06 08:15:00 - 2003-04-02 16:15:00 (5.500 - 142.200 m)

From Length	To Length	Colour Code	Grainsize Code	Colour Code	Grainsize Code	Rocktype A	Rocktype B	Mineral 1	Mineral 2	Mineral 3	Mineral 4	Mineral 5	Rock type	Comment
		Unwashed	Unwashed	Washed	Washed								Distr.	
(m)	(m)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(code)	(%)	
5.50	5.50	58	2	59	2	102017	103076	49	3	32	10	60	60	moraine grains
5.80	5.80	258	2	59	2	102017	103076	49	3	32	10	80	80	badly washed sample. Lot of fine grained material
6.10	9.00	118	2	81	9	101057		36	32	49	10	33	33	biotite as alteration product from biotite
9.00	12.00	118	6	181	9	101057	101061	36	32	49	10	50	50	
12.00	15.00	108	6	8	6	101051	102017	49	3	32	36	10	80	traces of pyrite
15.00	18.00	258	9	208	2	102017	101061	49	3	32	36	10	70	traces of pyrrhotite and pyrite
18.00	21.00	101	9	118	9	101057		36	32	49	10	33	33	washed sample. Chlorite as alteration product from biotite
21.00	24.00	118	6	81	9	101057		36	32	49	10			
24.00	27.00	89	6	218	9	101057	102017	36	32	49	10	3	70	pyrite, epidote, chlorite (from biotite). Amphibole 33-34m
27.00	30.00	205	6	208	2	102017	101057	3	49	36	32	10	90	pyrite
30.00	33.00	87	6	17	8	101061		36	32	49	10	33	33	chlorite as alteration product from biotite
33.00	36.00	87	6	87	8	101061	102017	36	32	49	10	3	90	pyrite in amphibolite, traces of chlorite in pegmatite
36.00	39.00	108	6	7	8	101061	102017	36	32	49	10	3	60	peg/granodiorite-granite/amph - 30/30/40. Traces of pyrite and chlorite. Amphibole 36-37m.
39.00	42.00	181	6	81	9	101057	101061	36	32	49	10	33	50	traces of grey aphanitic grain (feldspar?)
42.00	45.00	18	6	81	9	101057		36	32	49	10			
45.00	48.00	28	6	82	9	101057	101061	36	32	49	10	33	80	prehnite, quite stron oxidation. 45-46m red, 47-48m pink
48.00	51.00	18	6	108	9	101057	102017	36	32	49	10	3	70	perhaps also 10% pegmatite. 49-50m amphibolite
51.00	54.00	8	6	18	9	101057		36	32	49	10			traces of calcite and serpentine/chlorite?
54.00	57.00	8	6	118	8	101057	101061	36	32	49	10	50	50	with biotite flakes
57.00	60.00	18	6	118	9	101057	101061	36	32	49	10	33	60	
60.00	63.00	18	6	182	9	101057		36	32	49	10			
63.00	66.00	8	6	82	9	101057		36	32	49	10	33	33	chlorite as alteration product from biotite. Sealed hematiterich fracture,
66.00	69.00	8	6	18	9	101057		36	32	49	10	33	33	only traces of chlorite(alteration from biotite). Possibly also pegmatite?
69.00	72.00	8	6	18	9	101057		36	32	49	10	50	50	traces of pyrite

72.00	75.00	8	6	18	9	101057		36	32	49	10	33	traces of chlorite
75.00	78.00	108	6	18	9	101057	101061	36	32	49	10	11091 70	rock type ratio uncertain
78.00	81.00	8	6	81	9	101057	101061	36	32	49	10	33 80	gult, transparent mineral, very little chlorite. Rock type ratio uncertain
81.00	84.00	108	6	181	9	101057	101061	36	32	49	10	33 90	rock type ratio uncertain
84.00	87.00	108	6	1	9	101061	101057	36	32	49	10	70	
87.00	90.00	108	6	118	9	101061	101057	36	32	49	10	16 80	actually grey and white sample. Traces of very finegrained feldspar rich rock, slightly gr
90.00	93.00	19	9	108	9	101057	102017	36	32	49	10	3 60	washed sample? Grey and black sample. Traces of pyrrhotite(?), and very finegrained grey r
93.00	96.00	118	6	28	9	101057	102017	36	32	49	10	3 70	traces of pyrite and epidote. Also some pegmatite.
96.00	99.00	2	9	2	8	101061	101057	36	32	49	10	33 60	washed sample? Chlorite as alteration product from biotite
99.00	102.00	118	6	28	9	101057		36	32	49	10	33	
102.00	105.00	118	6	81	8	101061	101057	36	32	49	10	33 70	chlorite as alteration product from biotite. Traces of epidote
105.00	108.00	118	6	8	8	101061	101057	36	32	49	10	33 70	chlorite as alteration product from biotite. Traces of radioactive mineral
108.00	111.00	118	6	81	9	101057		36	32	49	10		grey 113-114m. Trace of radioactive mineral
111.00	114.00	108	6	9	2	102017	101061	49	3	36	32	10 50	black and white sample. Also some granodiorite-granite. Traces of epidote and chlorite
114.00	117.00	108	6	108	9	101057	101061	36	32	49	10	33 90	traces of calcite and epidote
117.00	120.00	108	6	108	9	101057		36	32	49	10	33	Traces of chlorite, calcite and radioactive mineral
120.00	123.00	108	6	108	9	101057		36	32	49	10	33	Traces of chlorite and radioactive mineral
123.00	126.00	108	6	118	9	101057	101061	36	32	49	10	33 90	
126.00	129.00	118	6	118	9	101057	101061	36	32	49	10	33 90	traces of pyrite
129.00	132.00	128	6	18	9	101057		36	32	49	10	33	traces of calcite, also laumontite/hematite (?) sealed fracture. More oxidized than m.126-
132.00	135.00	182	6	81	9	101057		36	32	49	10	33	traces of calcite and aphanitic, greenish grey rock with black visible grains
135.00	138.00	182	6	1	9	101057	101061	36	32	49	10	33 70	traces of radioactive mineral.