P-03-21

Forsmark site investigation

Boremap mapping of percussion boreholes HFM04 and HFM05

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April 2003

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Contents

1 Introduction

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

The two percussion boreholes, HFM04 and HFM05, are located at drillsite DS 2, close to the telescopic drilled, 1000 m deep borehole KFM02A (Figures 1-1 and 2-1). HFM04 and HFM05 were drilled in order to follow up geophysical reflectors, to enable groundwater level monitoring and to gain hydrogeochemical data. Borehole HFM05 also served as a water well, providing the flushing water needed for core drilling of KFM02A.

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 small 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 judgement 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.

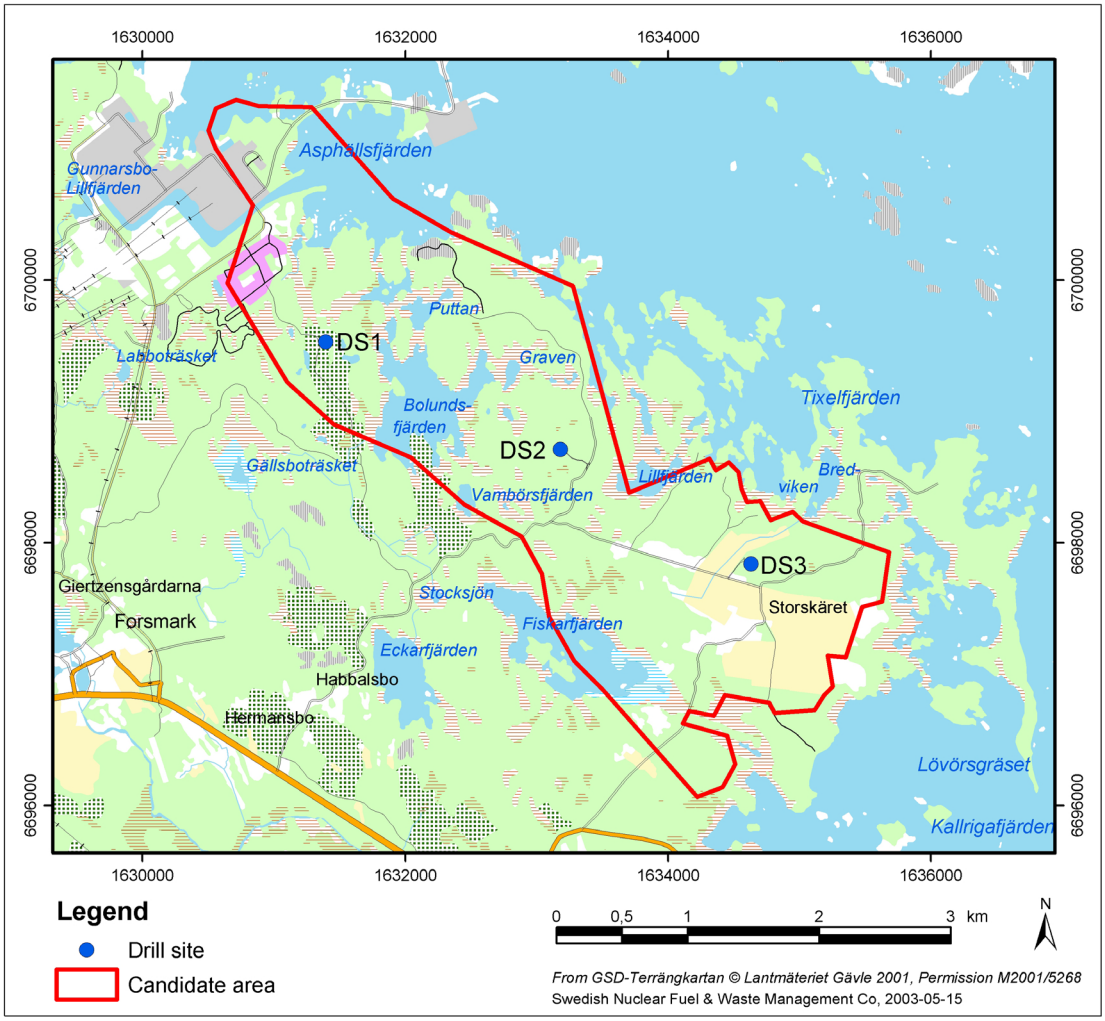

Figure 1-1. *Location of drillsites at Forsmark 2003 (DS1=drillsite 1; DS2=drillsite 2; DS3=drillsite 3).*

2 Objective and scope

The aim of this investigation was to document lithologies, ductile structures and the occurrence and character of fractures and fracture zones in the bedrock penetrated by the two percussion drilled boreholes HFM04 and HFM05. Data were collected in order to obtain a foundation for a preliminary assessment of the bedrock conditions adjacent to the telescopic drilled borehole KFM02A down to about 220 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.

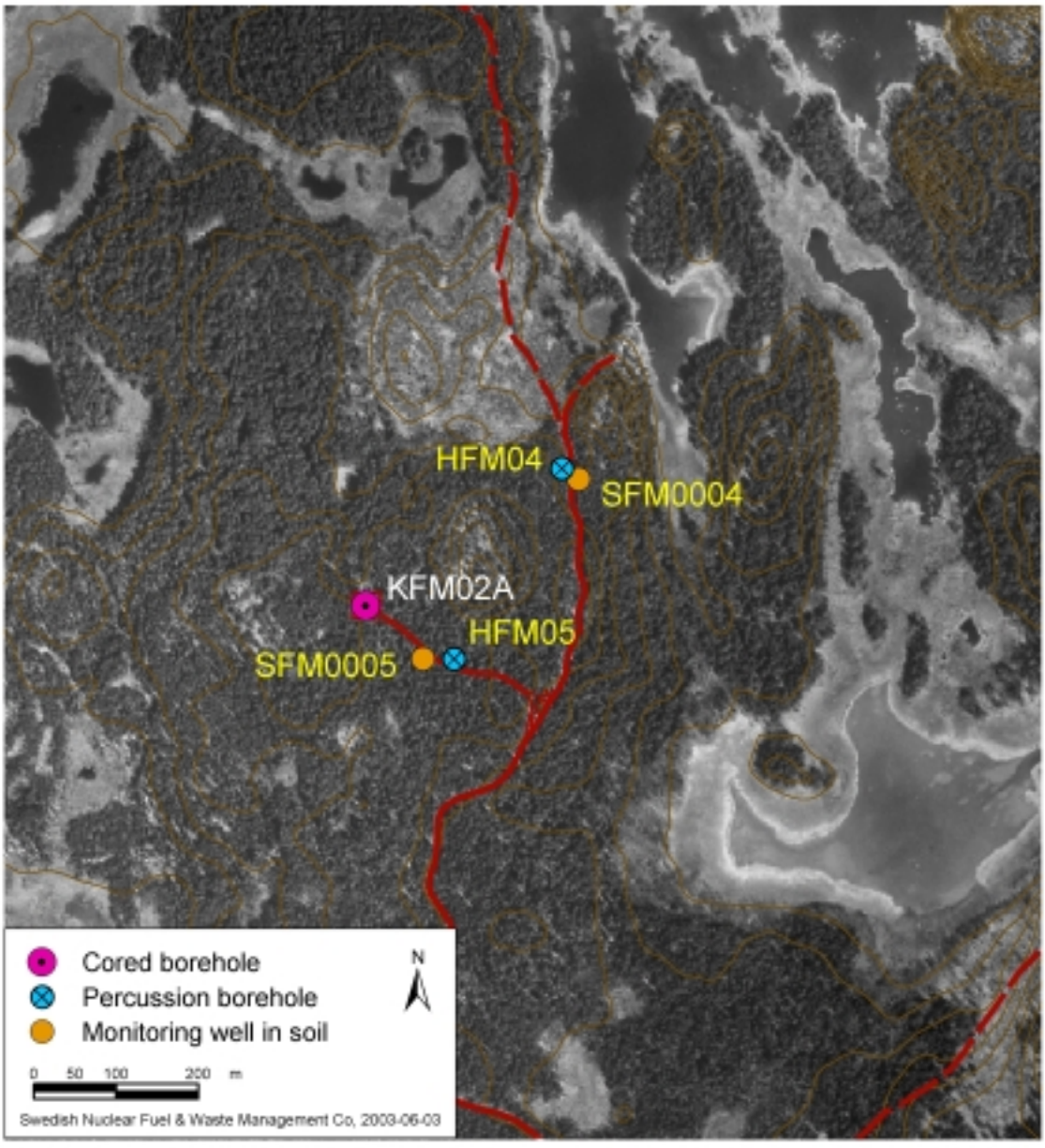

Figure 2-1. *Borehole locations at drillsite 2, Forsmark.*

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 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 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 HFM04 and HFM05 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 mapping of drill cuttings followed a routine described below.

4.1 Mapping of drill cuttings

Boremap mapping of the percussion drilled boreholes HFM04–HFM05 was performed as synchronous 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 borrkax). The method used for investigation of drill cuttings from HFM04 and HFM05 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 investgation 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 HFM04 indicated a length of 219.8 m, whereas the borehole length is 221.7 m. For HFM05 the corresponding values were 198.6 m and 200.1 m, respectively. 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 6),
- total borehole length (Appendix 6),
- deviation data (Appendix 7),
- drilling penetration rate (Appendix 8).

Measurements of borehole-directions were refined using deviation data from the SKB SICADA database (Field Note: Forsmark 58 for HFM04, and Forsmark 62 for HFM05). Geometric data for boreholes HFM04 and HFM05 are given in Table 1.

Table 1. Borehole data for HFM04 and HFM05 (values from starting point).

ID-code	Northing	Easting	Borehole length (m)	BIPS-image interval (m)	Bearing (degrees)	Inclination (degrees)	Depth to bedrock surface (m)
HFM04	6698879	1633421	221.7	12.0–220.0	336.9	–84.3	0.8
HFM05	6698647	1633290	200.1	11.0–199.0	335.6	–85.0	4.0

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 the BIPS-image of the borehole wall. During mapping of percussion boreholes, fractures can only be seen on the BIPS-images and rock samples are available merely 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 solely 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 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 (usually sealed) fracture fillings were interpreted to contain calcite.
- White to greyish fracture material was interpreted as feldspar and quartz.
- 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 in the 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. Classification of 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.

Both boreholes HFM04 and HFM05 were dominated (> 85%) by a medium-grained metagranite-granodiorite. Minor occurrences of bands, veins or segregates of felsic rocks were, however, commonly observed in the BIPS-images. Such lithological variations were often severely difficult to recognize in the drill cutting samples, and 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 uppermost, cased part of the boreholes, rock type was determined only on the basis of drill cuttings. It should be remembered that 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. For example, it may be difficult to distinguish and measure orientation of a weakly or moderately developed foliation in a rock with a strongly developed mineral lineation. Ductile structures were observed in the dominating rock type (metagranodiorite-granite) almost throughout the boreholes HFM04 and HFM05 and were also revealed in the drill cuttings. Rocks in outcrops at drillsite 2 and in the drill core from KFM02A commonly show a composite deformational fabric (L-S). Foliation is defined by biotite and lineation by elongate aggregates of quartz and feldspar. During detailed bedrock mapping of a stripped, ca 600 m^2 large outcrop at drillsite 2, a strong penetrative mineral lineation was observed throughout the outcrop, while foliation only locally clearly was developed /1/. In the BIPS-images from boreholes HFM04 and HFM05, distinct foliations were difficult to distinguish, and hence no measurements were performed. Only planar structures can be measured using the Boremap software. Orientation of linear and curved structures cannot be determined using this program.

The Boremap 3.0 and 3.2 softwares do not allow classification of ductile structures as composite. Therefore, rock type in HFM04 and HFM05 has been classified as massive, despite the fact that both the BIPS-images and the drill cutting samples clearly show that most rocks 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 to the BIPS-images

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 8). 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 borehole KFM02A, located in the vicinity of the investigated percussion boreholes, and the drill core from borehole KFM01A at drillsite 1 (Figures 1-1 and 2-1). 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 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.

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 investigation of drill cuttings are stored under Field Note Forsmark 26.

5 Results

Geology of the two percussion drilled boreholes HFM04 and -05 corresponds well with the geology of drill core KFM02A and nearby outcrops documented during the regional bedrock mapping in the area (Data in SICADA, Field Note Forsmark 22, 26, and 104). See also P-report on detailed fracture mapping of drillsite 2 /1/, (data from detailed bedrock mapping given in Appendix) 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 5.1–5.2 below, and graphical presentations of the data are given in Appendices 1–4 (WellCad- and BIPS-images with observations). Equal area stereogram projections of poles to natural and sealed fracture planes are shown in Appendix 5.

5.1 HFM04

Lithologies

Dominating rock type (ca 85%) is a lineated, medium-grained, greyish red to reddish grey metagranodiorite-granite. The rock appears as more greyish in colour towards the end of the borehole. Amphibolite constitutes approximately 5% of the borehole. Sections rich in amphibolite occur at 59–62, 110–115 and 121–147 m depth, although amphibolites are also found elsewhere. Sections interpreted to contain fine-grained leucocratic granite (approximately 5%) occur at approximately 76–79 and 182–186 m depth. Bands, veins or patches of pegmatite are observed throughout the borehole (approximately 5%). Occurrences of a few cm wide bands of leucocratic granite are abundant between 80.0–82.5 and 197.8–209.2 m depths.

Fractures

Fracture frequency calculated from BIPS-images of borehole HFM04 (available between 12.1–219.8 m) is slightly less than 1.5 fractures/m. Subhorizontal fractures (dipping 2–10^{o}) dominate (Appendix 5). Three subordinate fractures sets can be observed: one vertical N-striking set, one vertical NE-striking set and one moderately dipping (55^{o} dip) W-striking set. If present, NW-striking fracture sets would be falsely underrepresented as they would be sub-parallel to the drilling direction.

Sections with an increased frequency of fractures occur at 61.0–62.2 m, 78.1–78.7 m, 108.3–112.1 m, 126.7–127.1 m, 142.5–142.9 m and 184.7–186.9 m. Calcite sealed fractures are commonly associated with amphibolite. No crush zones were observed.

Alteration zones, interpreted to reflect oxidation and chloritization, appear between 62.6–62.7 and 63.9–64.0 m.

5.2 HFM05

Lithologies

Also in HFM05, the dominating rock type (ca 85%) is a lineated, greyish red to reddish grey, metagranodiorite-granite, tending to be more greyish towards the end of the borehole. Bands, veins or patches of pegmatite (approximately 10%) occur throughout the borehole. Wider sections with pegmatite were observed at between 54.0–56.8 and 117–124 m depth. Also amphibolite (approximately 5%) is met with throughout the borehole, typically in less than 1 m wide sections. Medium-grained granitoids (less than 1%) interpreted to represent a younger generation of felsic intrusives, are encountered at 162.8 and 164.5 m depth. Sections with a higher frequency of bands or veins (commonly thin) of fine-grained leucocratic granite (approximately 1%) occur at 154.5–177.0 and 180–184 m.

Fractures

Fracture frequency calculated from BIPS-images of borehole HFM05 (available between 11.9–198.6 m) is slightly less than 1.5 fractures/m. Gently west-dipping, roughly N-S-striking fractures dominate (Appendix 5). The distinct concentration of horizontal fractures documented in the adjacent borehole HFM04 appears to be absent. Three subordinate fracture sets are observed: one moderately to steeply dipping (65^{o} dip) SSW-striking set, one steeply dipping (70^{o} dip) NW-striking set and one sub-horizontal (20^{o} dip) NNW-striking set.

A crush/fracture zone was observed at 153.6–154.5 m, strike and dip was estimated to approximately 65/40 .

5.3 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, as well as 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. The 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.

The BIPS-image from the bottom of HFM04 (215.0–219.8 m) is of poor quality, whereas the BIPS-image from HFM05 is of poor quality in the upper part of the borehole but is improving below approximately 20 m depth. The image is, however, only sharp at about 80 m depth. The poor quality of BIPS-images from borehole HFM04 is probably caused by the presence of suspensions in the borehole fluid during BIPS-logging.

6 References

/1/ **SKB, 2003.** Forsmark – Detailed Fracture mapping at the KFM02 and KFM03 drillsites, 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.

Appendix 1

BIPS-images of HFM04

Project name: Forsmark

Image file	**: c:\borema~1\hfm04.bip**
BDT file	**: c:\borema~1\hfm04.bdt**
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Time	**: 15:04:00**
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Inclination	**: -84**
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	**: 11**
Color	**:**  **+0 +0 +0**

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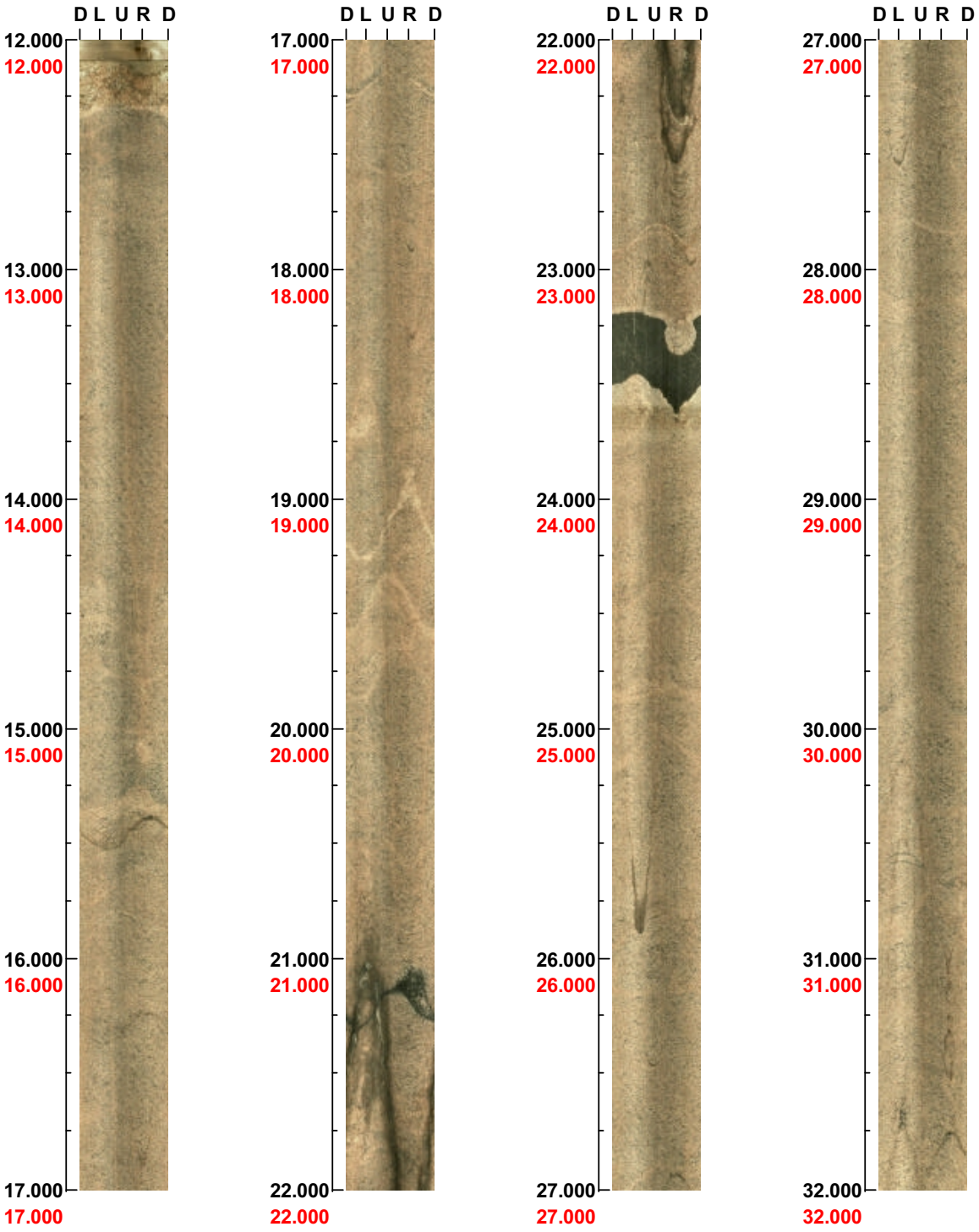
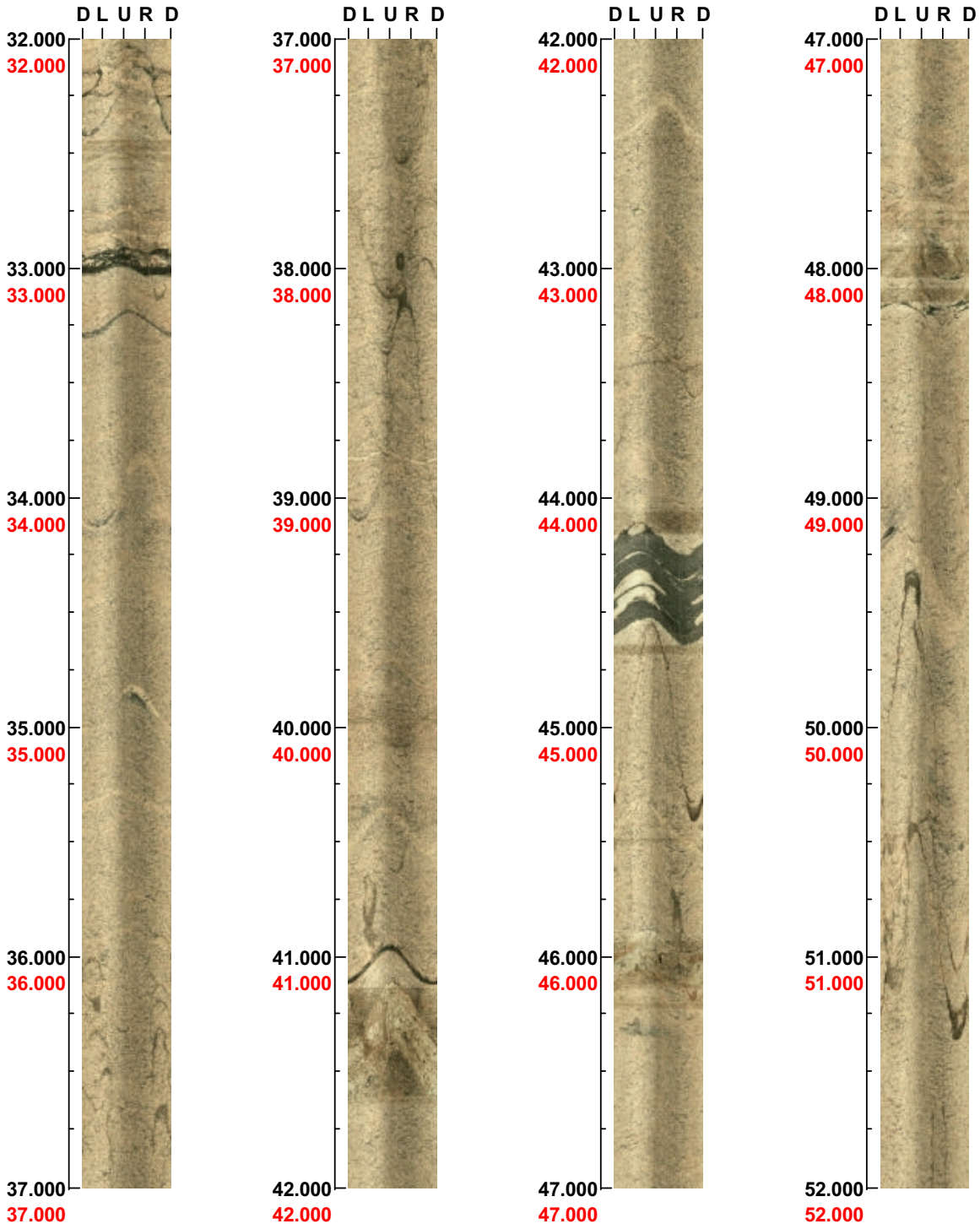
Depth range: 12.000 - 32.000 m



(1 / 11) **Scale: 1/25** **Aspect ratio: 90 %**

Project name: Forsmark
Bore hole No.: HFM04 **Azimuth: 343** **Inclination: -85**

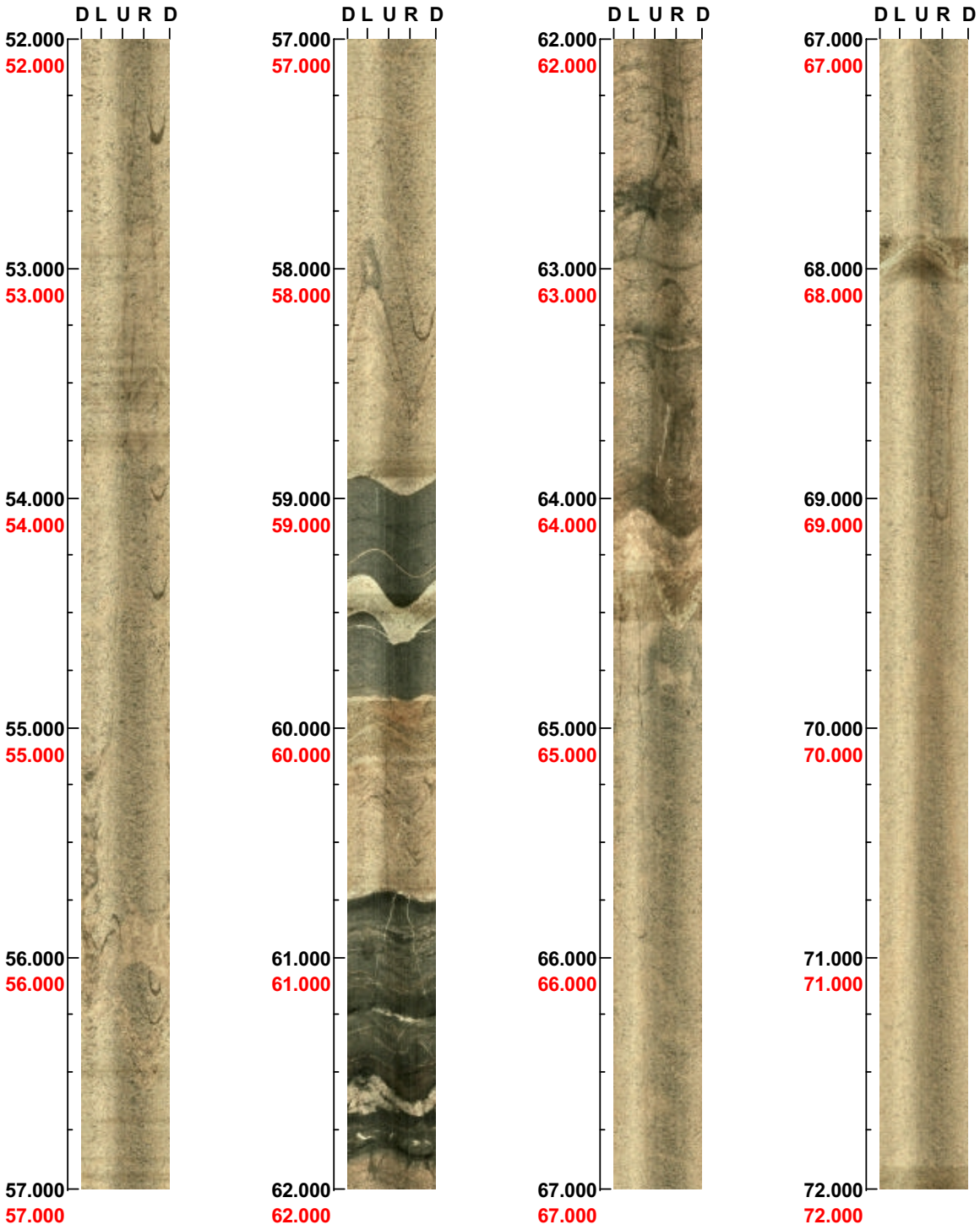
Depth range: 32.000 - 52.000 m



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

Project name: Forsmark
Bore hole No.: HFM04 **Azimuth: 7** **Inclination: -85**

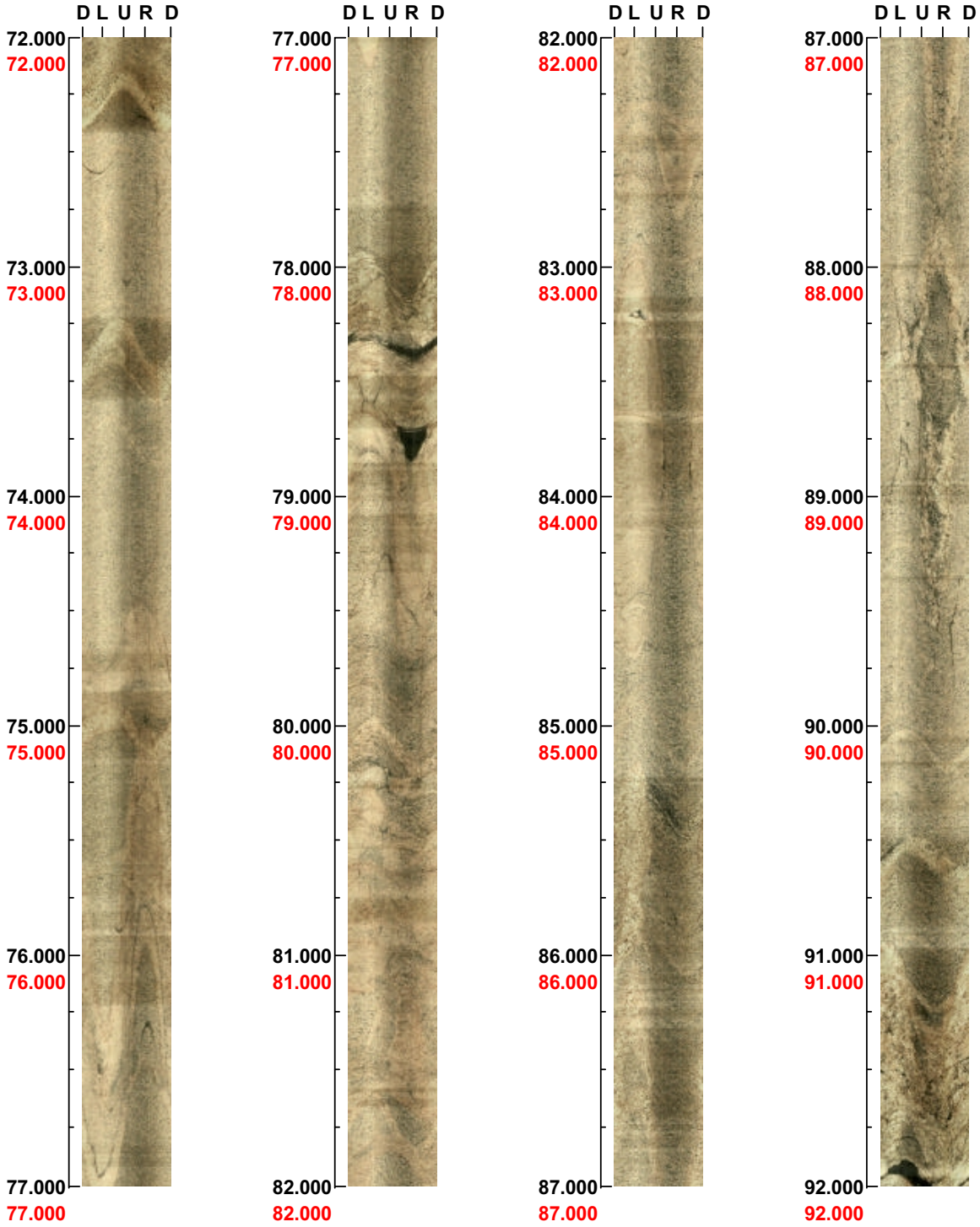
Depth range: 52.000 - 72.000 m



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

Project name: Forsmark
Bore hole No.: HFM04 **Azimuth: 10** **Inclination: -85**

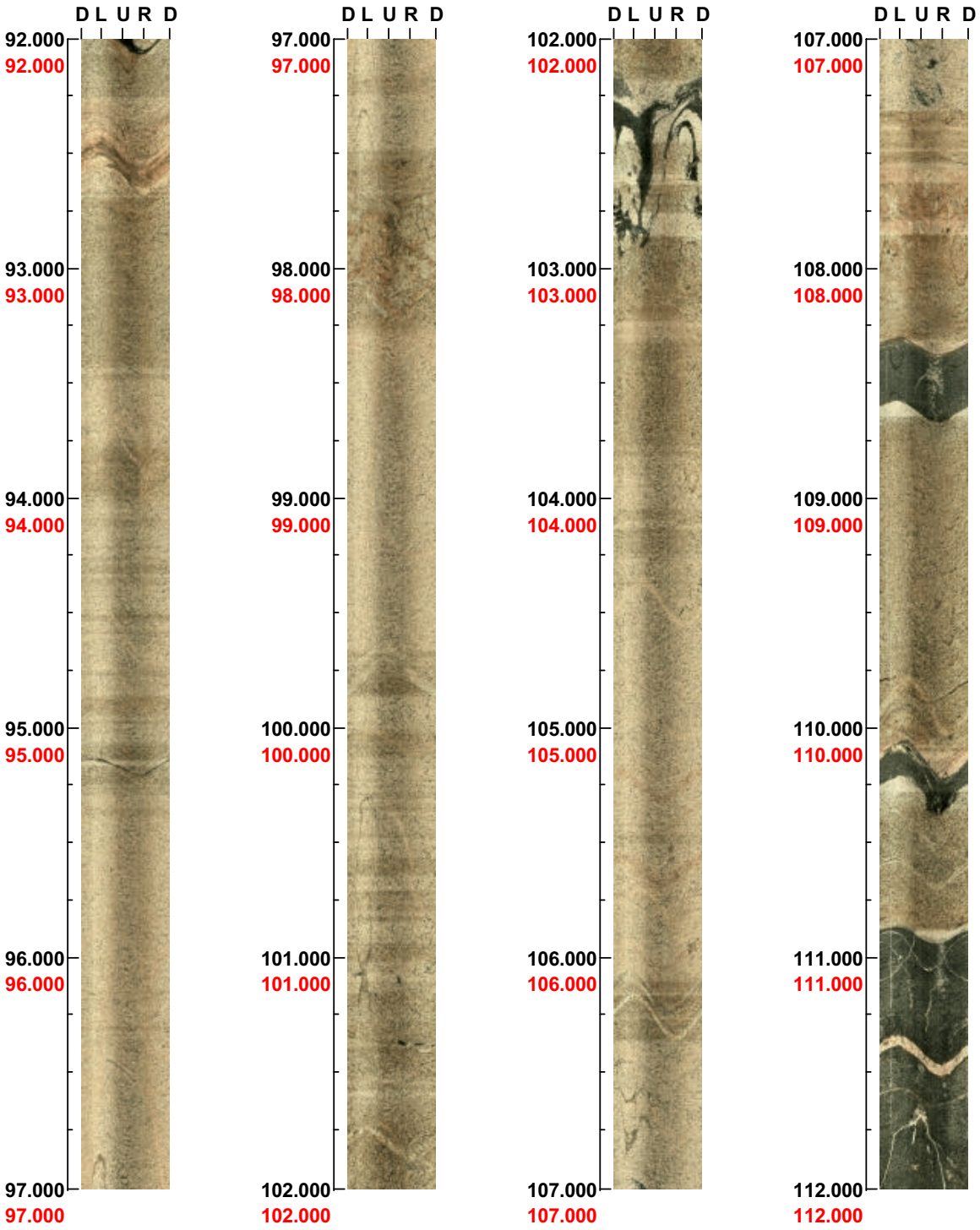
Depth range: 72.000 - 92.000 m



(4 / 11) **Scale: 1/25** **Aspect ratio: 90 %**

Project name: Forsmark
Bore hole No.: HFM04 **Azimuth: 48** **Inclination: -85**

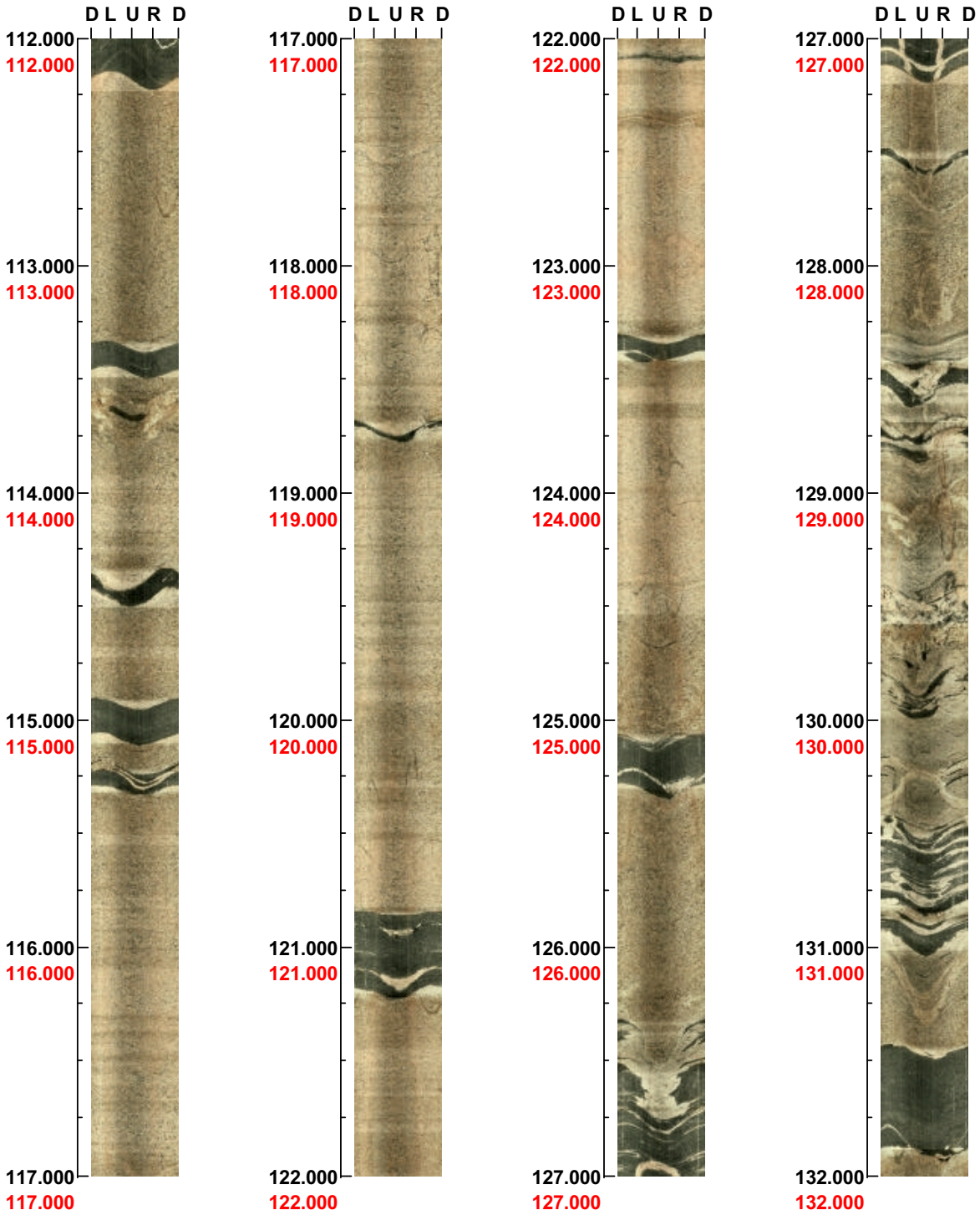
Depth range: 92.000 - 112.000 m



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

Project name: Forsmark
Bore hole No.: HFM04 **Azimuth: 72** **Inclination: -82**

Depth range: 112.000 - 132.000 m



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

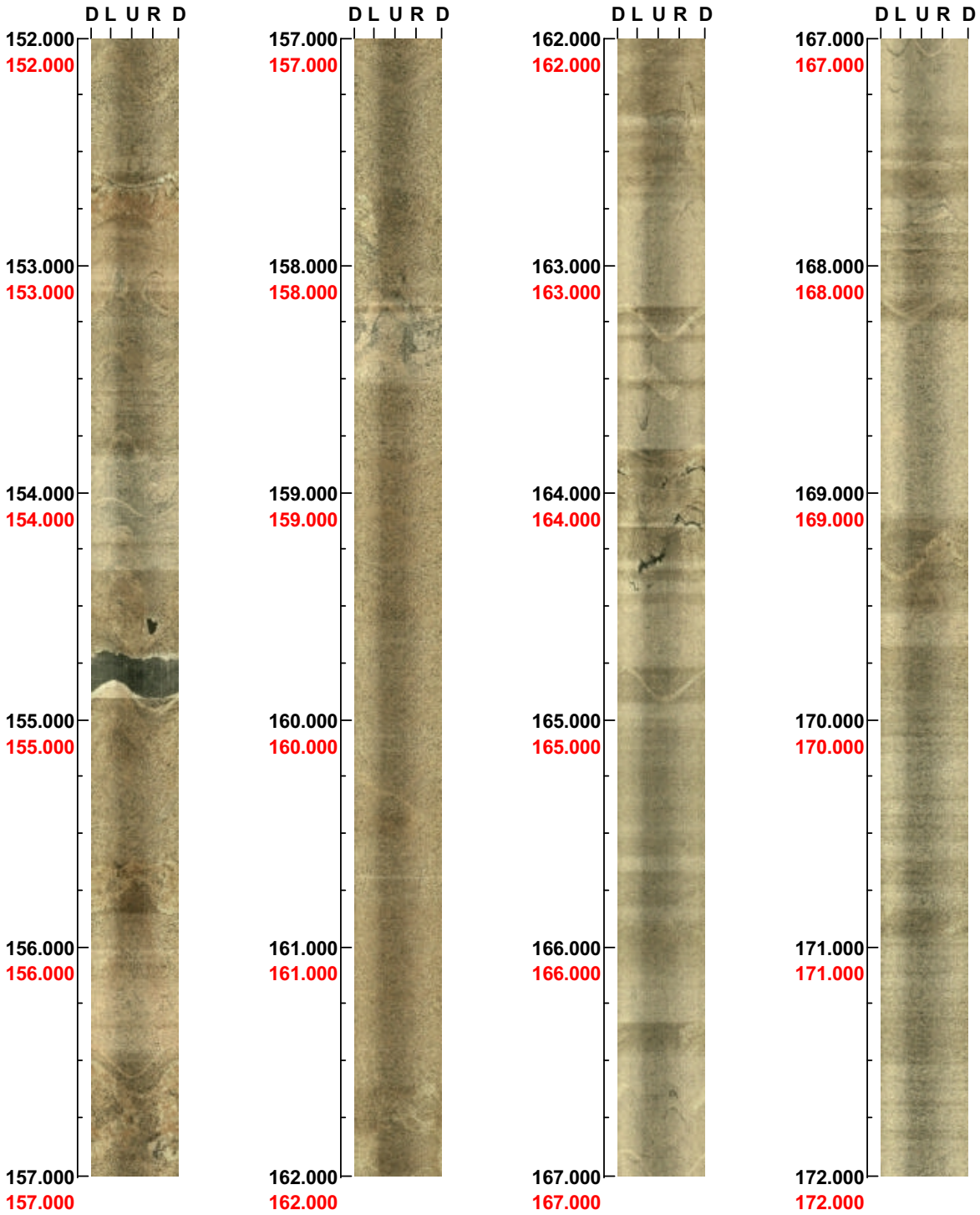
Project name: Forsmark
Bore hole No.: HFM04 **Azimuth: 80** **Inclination: -81**

Depth range: 132.000 - 152.000 m

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

Project name: Forsmark
Bore hole No.: HFM04 **Azimuth: 85** **Inclination: -78**

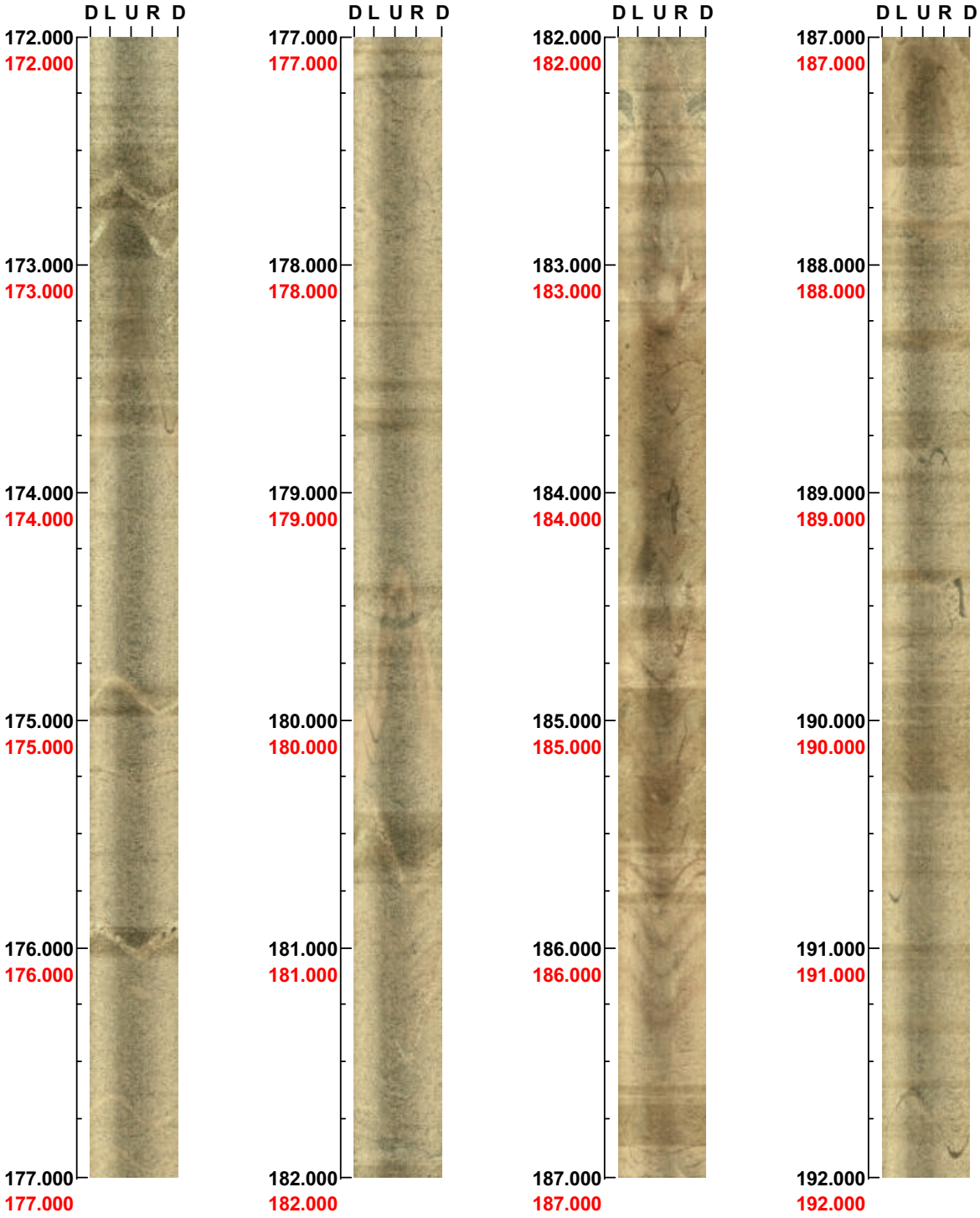
Depth range: 152.000 - 172.000 m



(8 / 11) **Scale: 1/25** **Aspect ratio: 90 %**

Project name: Forsmark
Bore hole No.: HFM04 **Azimuth: 84** **Inclination: -76**

Depth range: 172.000 - 192.000 m



(9 / 11) **Scale: 1/25** **Aspect ratio: 90 %**

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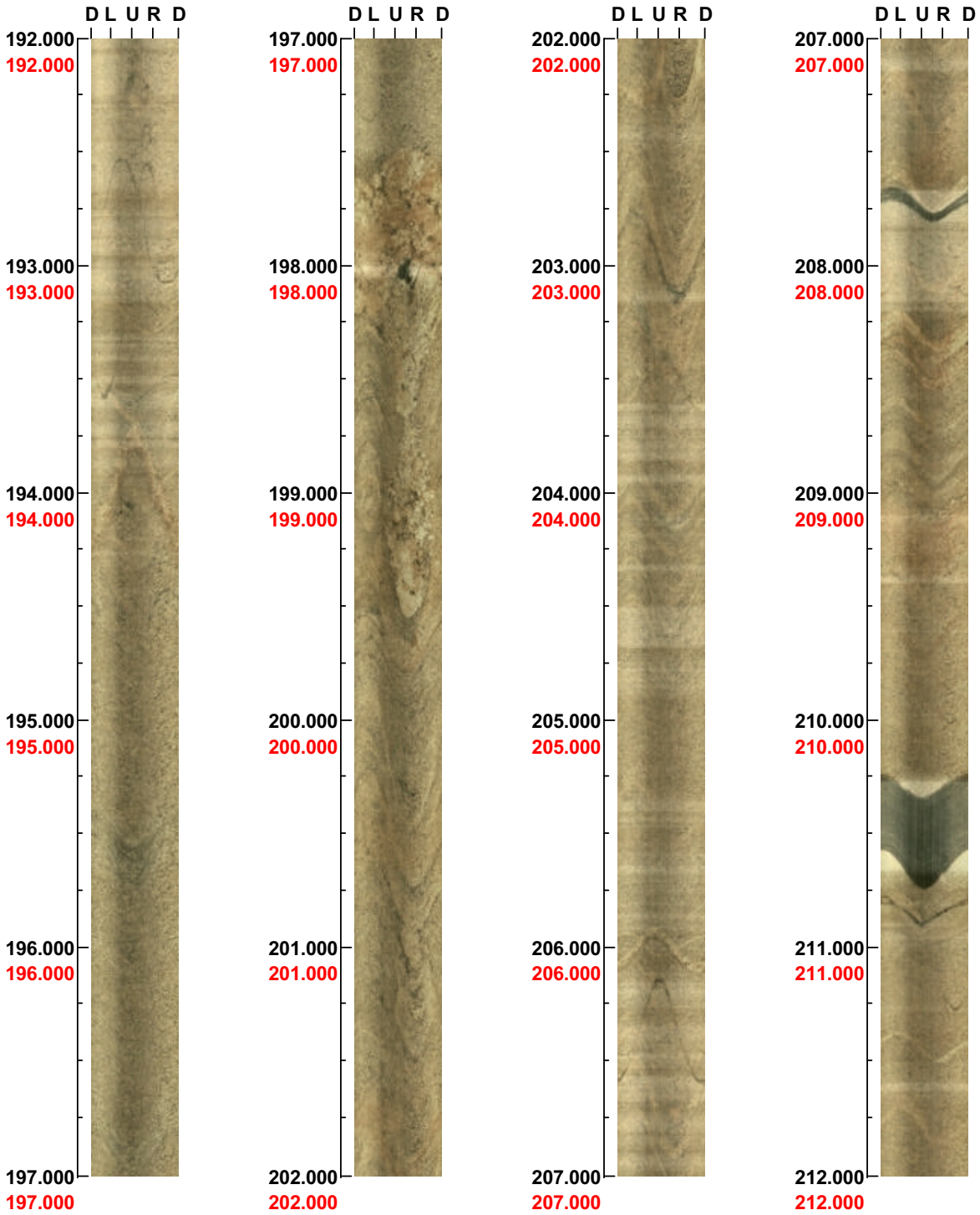
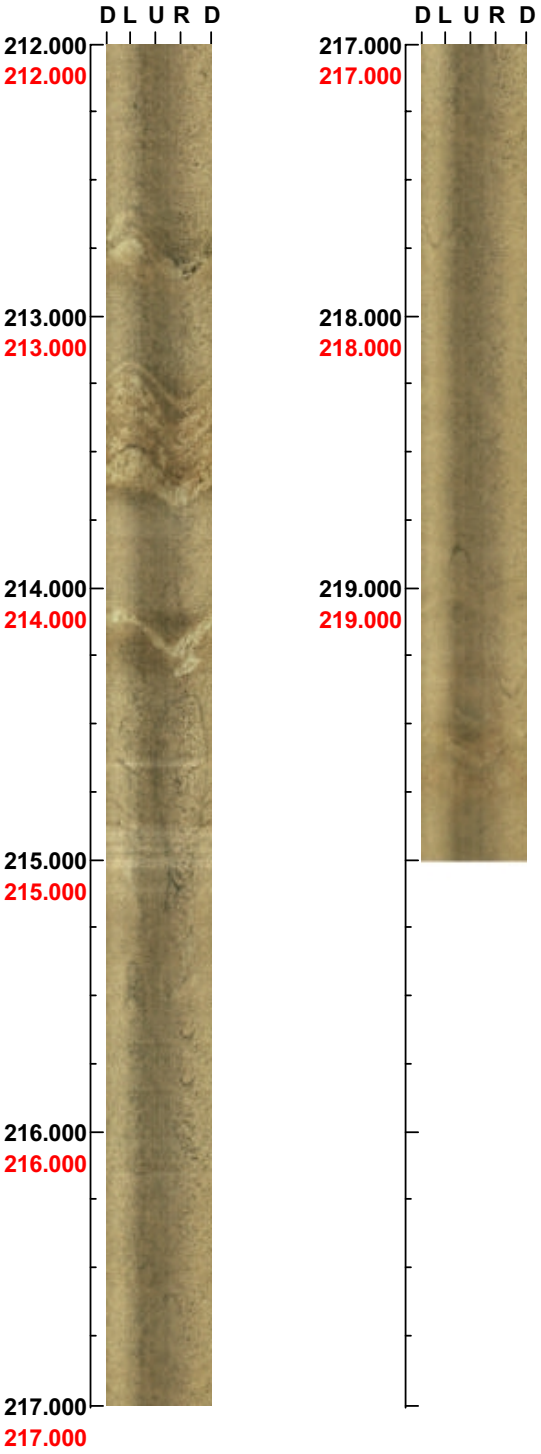
Depth range: 192.000 - 212.000 m



(10 / 11) **Scale: 1/25** **Aspect ratio: 90 %**

Project name: Forsmark
Bore hole No.: HFM04 **Azimuth: 89** **Inclination: -72**

Depth range: 212.000 - 219.999 m



(11 / 11) **Scale: 1/25** **Aspect ratio: 90 %**

Appendix 2

BIPS-images of HFM05

Project name: Forsmark

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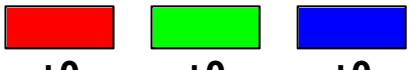
BDT file	**: c:\borema~1\hfm05.bdt**
Locality	**: FORSMARK**
Bore hole number	**: HFM05**
Date	**: 02/12/17**
Time	**: 21:32:00**
Depth range	**: 11.000 - 198.827 m**
Azimuth	**: 328**
Inclination	**: -85**
Diameter	**: 135.0 mm**
Magnetic declination	**: 0.0**
Span	**: 4**
Scan interval	**: 0.25**
Scan direction	**: To bottom**
Scale	**: 1/25**
Aspect ratio	**: 90 %**
Pages	**: 10**
Color	**:**  **+0 +0 +0**

Project name: Forsmark
Bore hole No.: HFM05 **Azimuth: 328** **Inclination: -85**

Depth range: 11.000 - 31.000 m

(1 / 10) **Scale: 1/25** **Aspect ratio: 90 %**

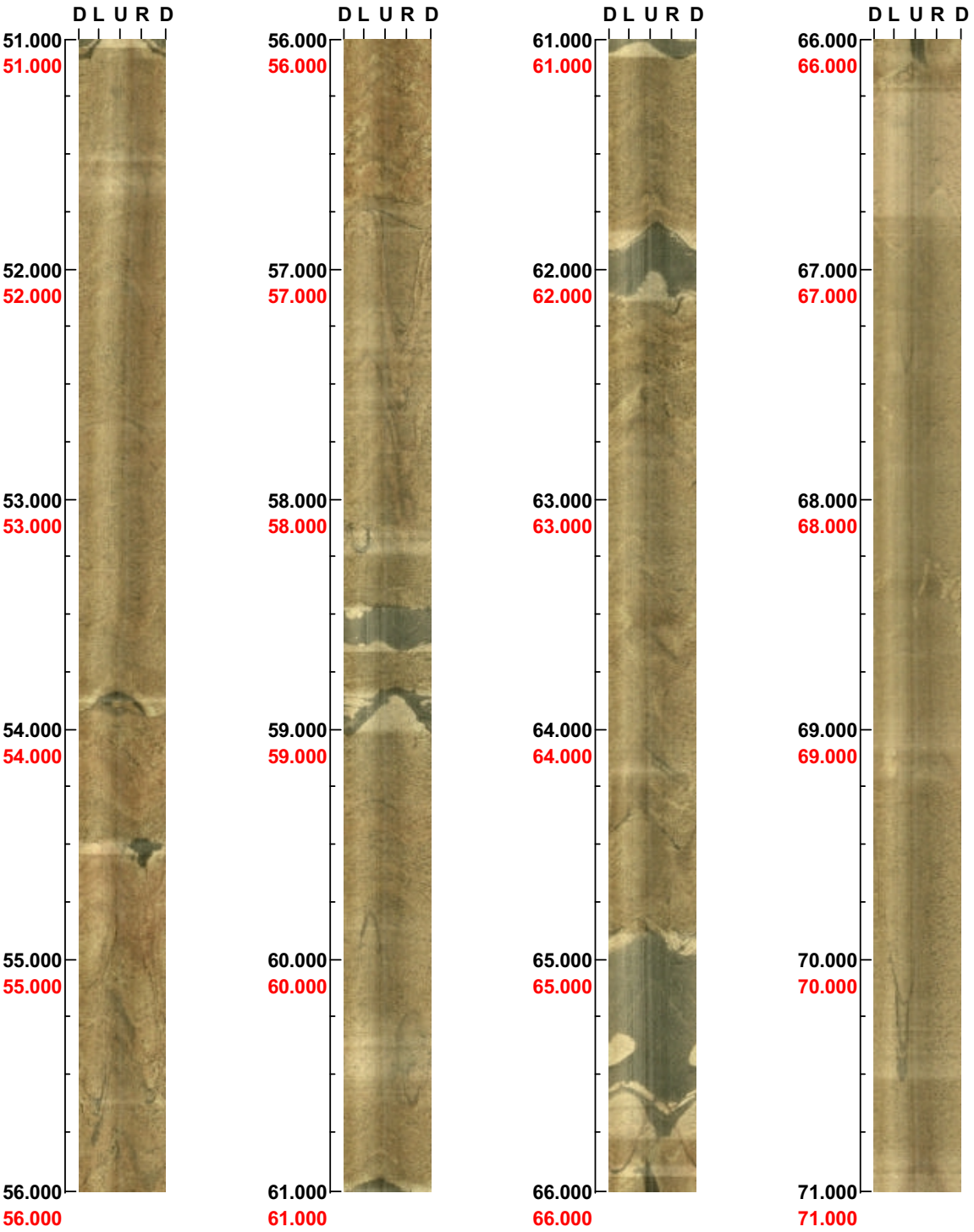
Project name: Forsmark
Bore hole No.: HFM05 **Azimuth: 317** **Inclination: -86**

Depth range: 31.000 - 51.000 m

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

Project name: Forsmark
Bore hole No.: HFM05 **Azimuth: 351** **Inclination: -87**

Depth range: 51.000 - 71.000 m



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

Project name: Forsmark
Bore hole No.: HFM05 **Azimuth: 34** **Inclination: -86**

Depth range: 71.000 - 91.000 m

(4 / 10) **Scale: 1/25** **Aspect ratio: 90 %**

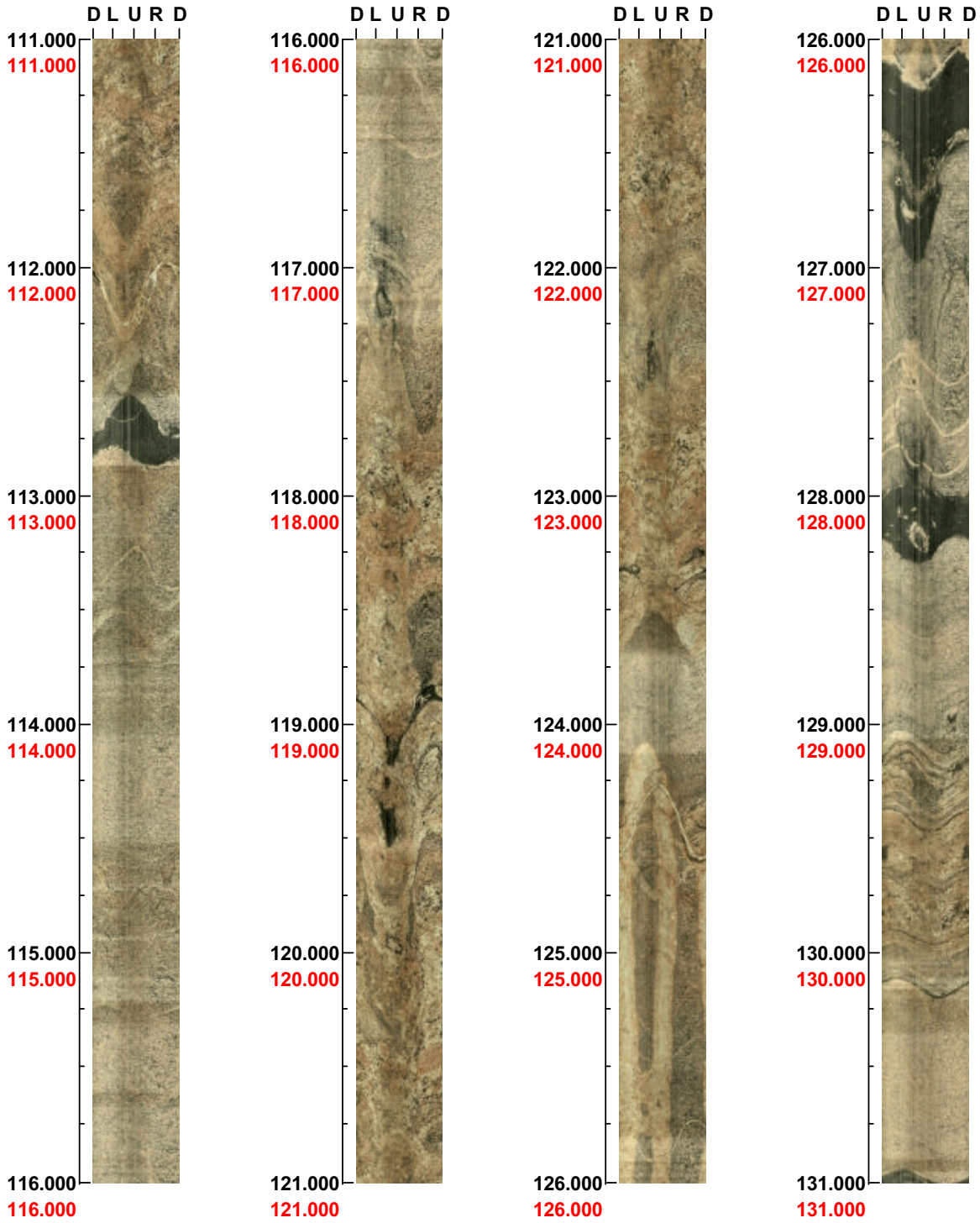
Project name: Forsmark
Bore hole No.: HFM05 **Azimuth: 68** **Inclination: -84**

Depth range: 91.000 - 111.000 m

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

Project name: Forsmark
Bore hole No.: HFM05 **Azimuth: 75** **Inclination: -81**

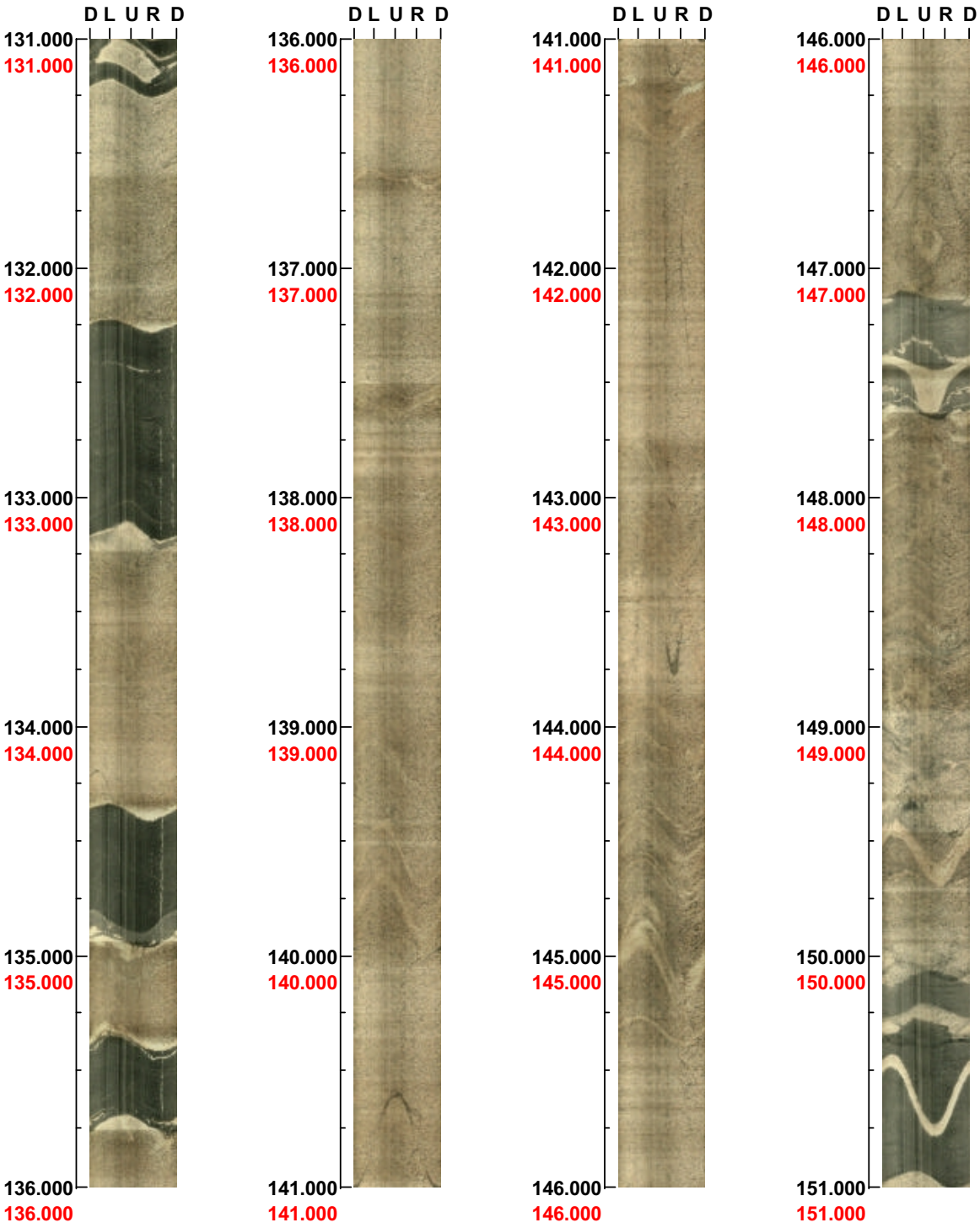
Depth range: 111.000 - 131.000 m



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

Project name: Forsmark
Bore hole No.: HFM05 **Azimuth: 77** **Inclination: -81**

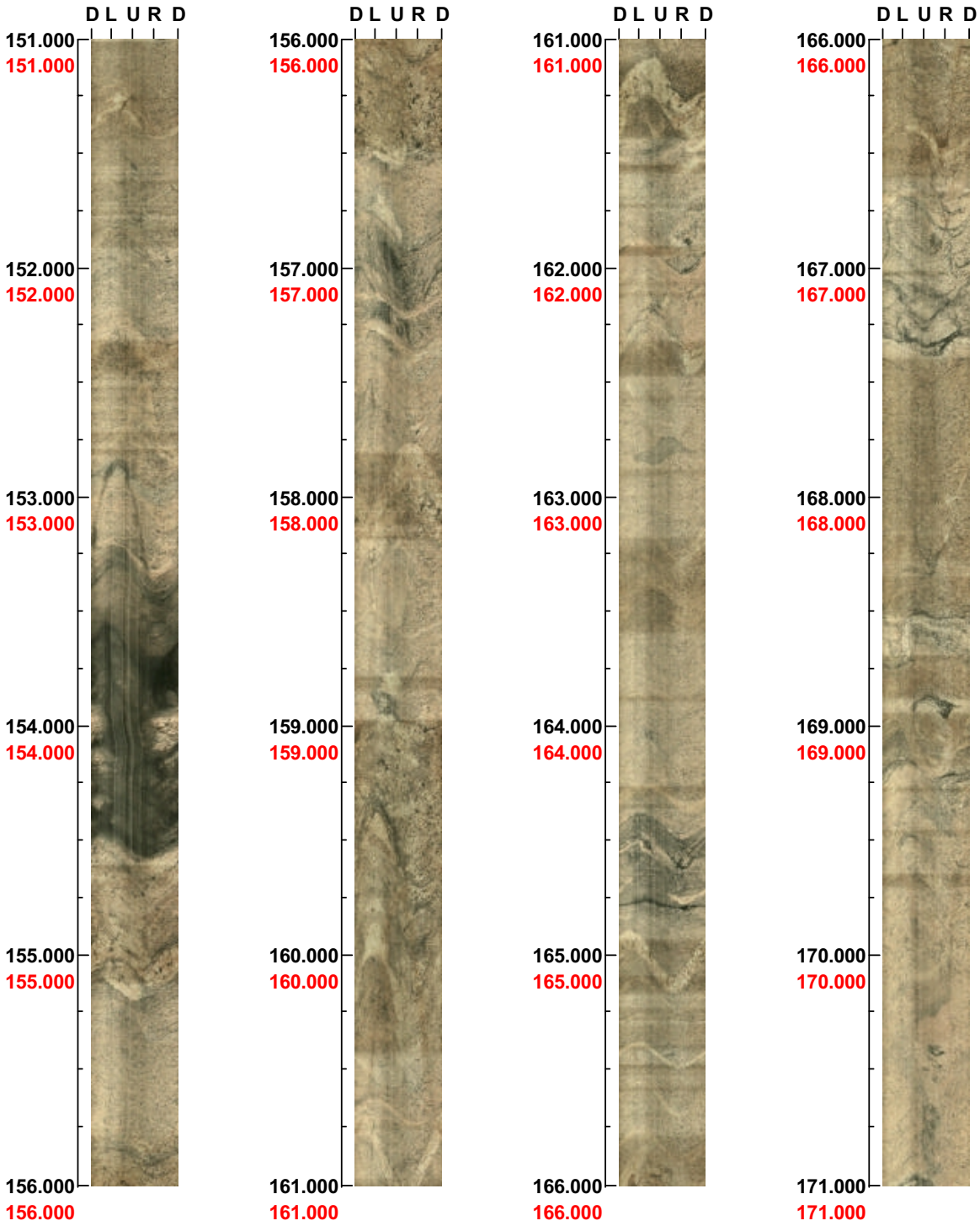
Depth range: 131.000 - 151.000 m



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

Project name: Forsmark
Bore hole No.: HFM05 **Azimuth: 80** **Inclination: -79**

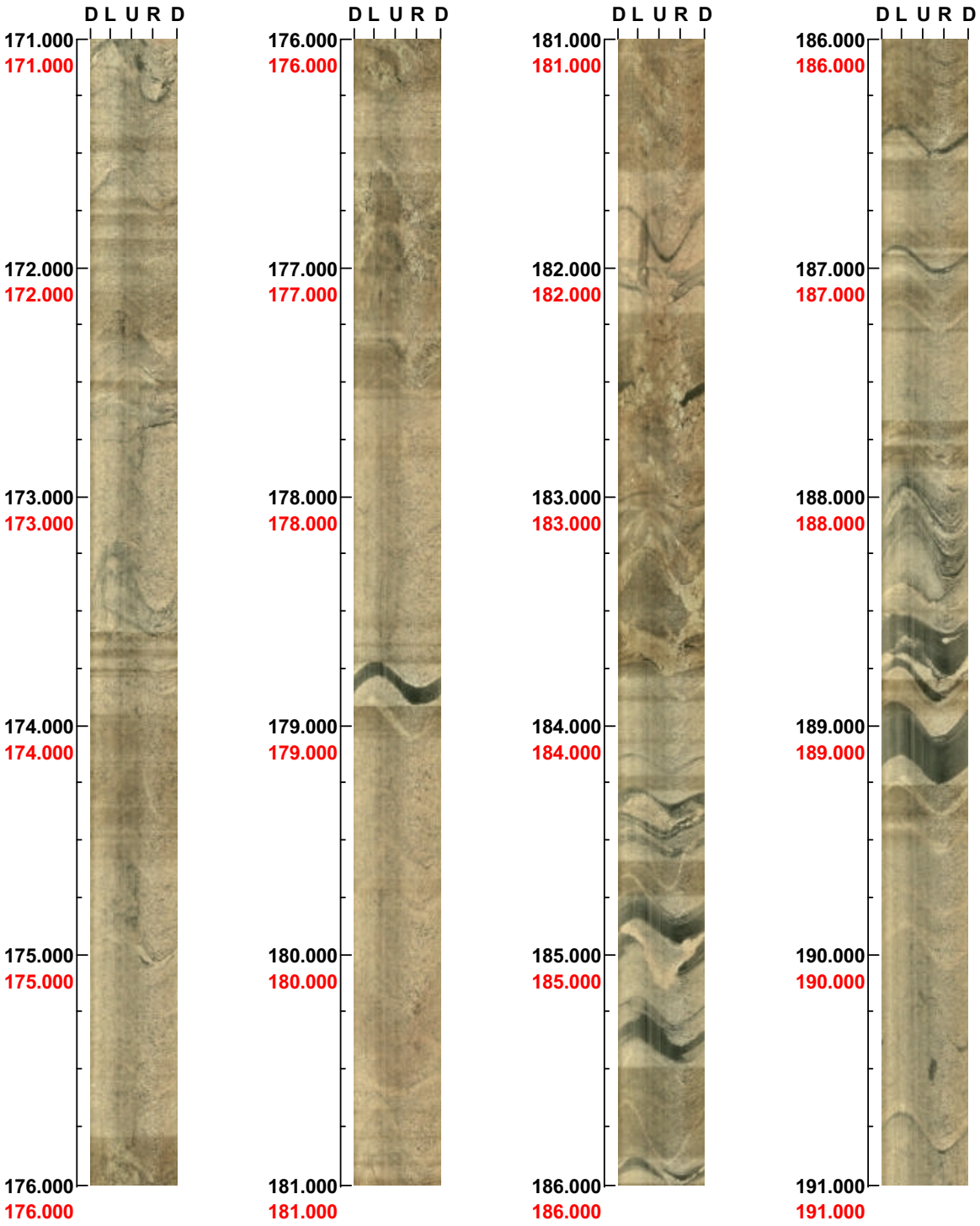
Depth range: 151.000 - 171.000 m



(8 / 10) **Scale: 1/25** **Aspect ratio: 90 %**

Project name: Forsmark
Bore hole No.: HFM05 **Azimuth: 82** **Inclination: -77**

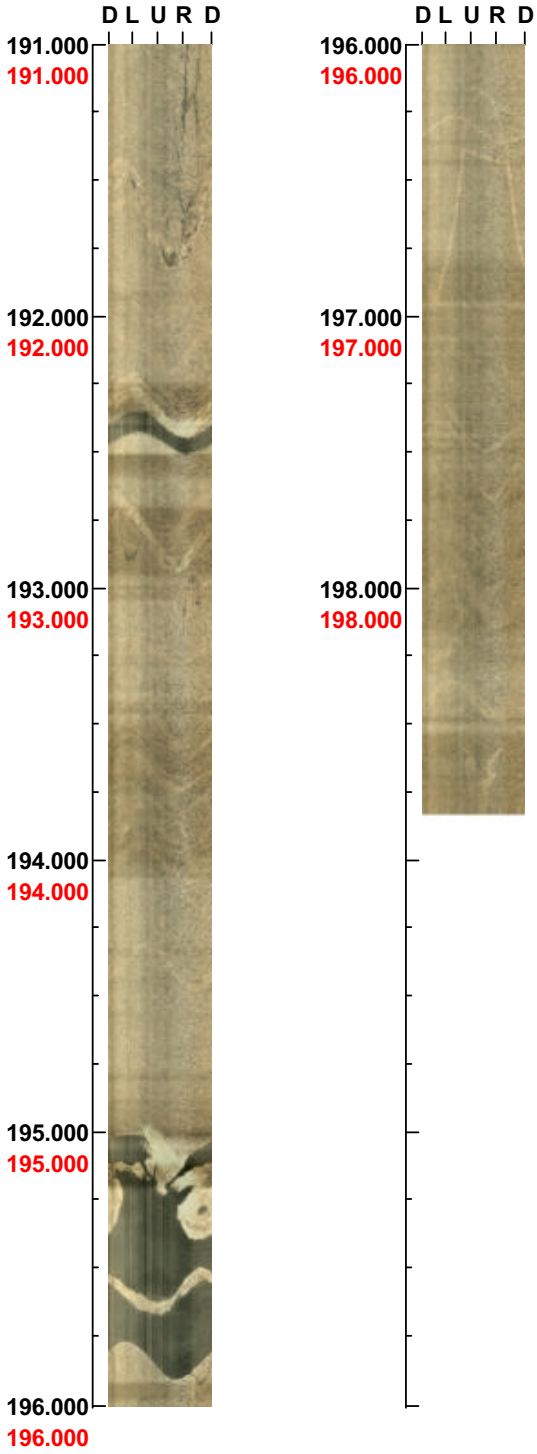
Depth range: 171.000 - 191.000 m



(9 / 10) **Scale: 1/25** **Aspect ratio: 90 %**

Project name: Forsmark
Bore hole No.: HFM05 **Azimuth: 85** **Inclination: -75**

Depth range: 191.000 - 198.827 m



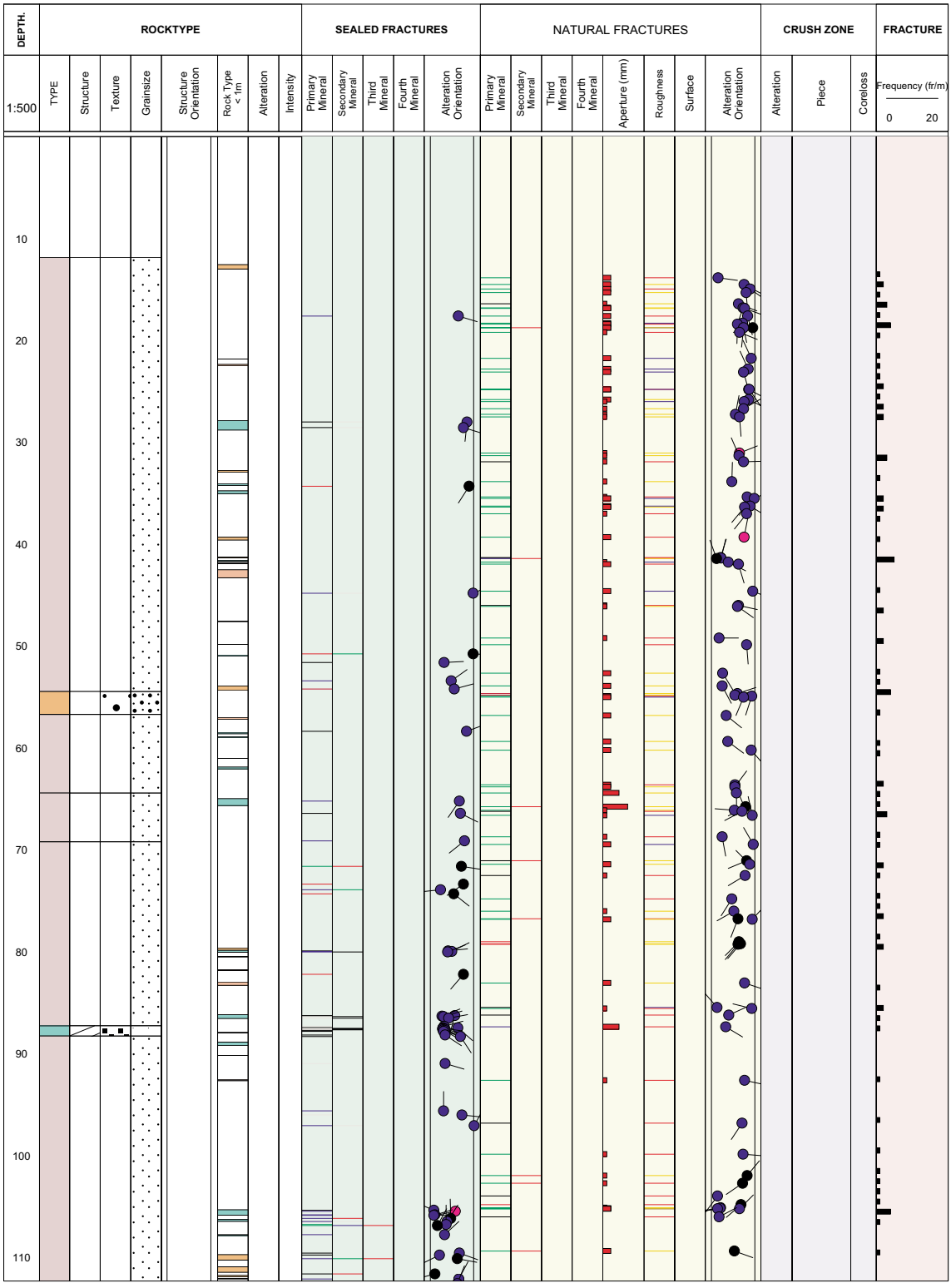
(10 / 10) **Scale: 1/25** **Aspect ratio: 90 %**

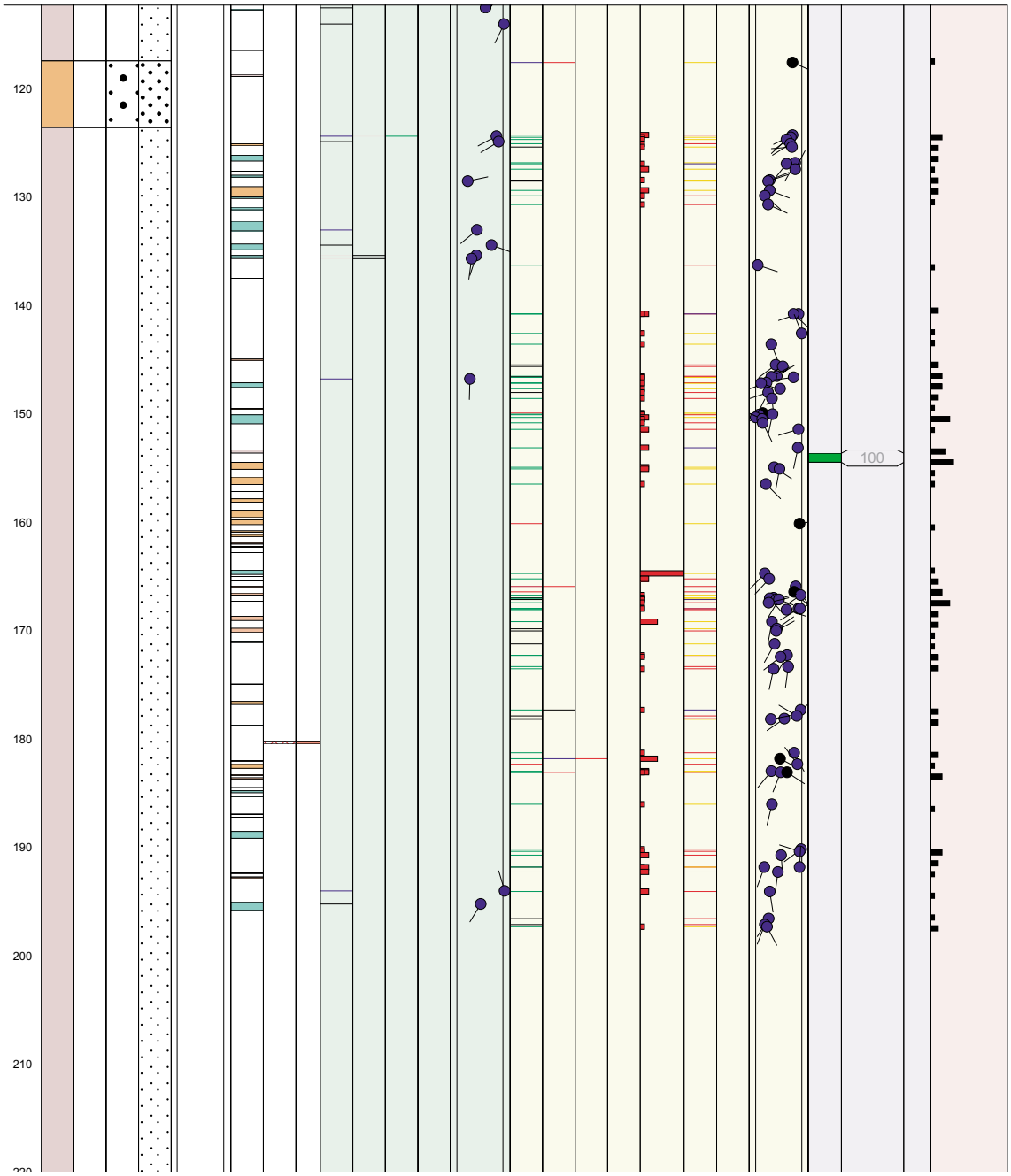
Appendix 3

WellCad diagram of HFM04

Title GEOLOGY HFM05

Site	FORSMARK	**Coordinate System**	RT90-RHB70
Borehole	HFM05	**Northing [m]**	6698647.275
Diameter [m]	0.1341	**Easting [m]**	1633289.721
Length [m]	200.1	**Elevation [m.a.s.l.]**	7.672
Bearing [°]	335.5892	**Drilling Start Date**	2002-12-04 13:18:00
Inclination [°]	-84.9608	**Drilling Stop Date**	2002-12-16 17:36:00
Remark		**Plot Date**	2003-04-10 10:16:42



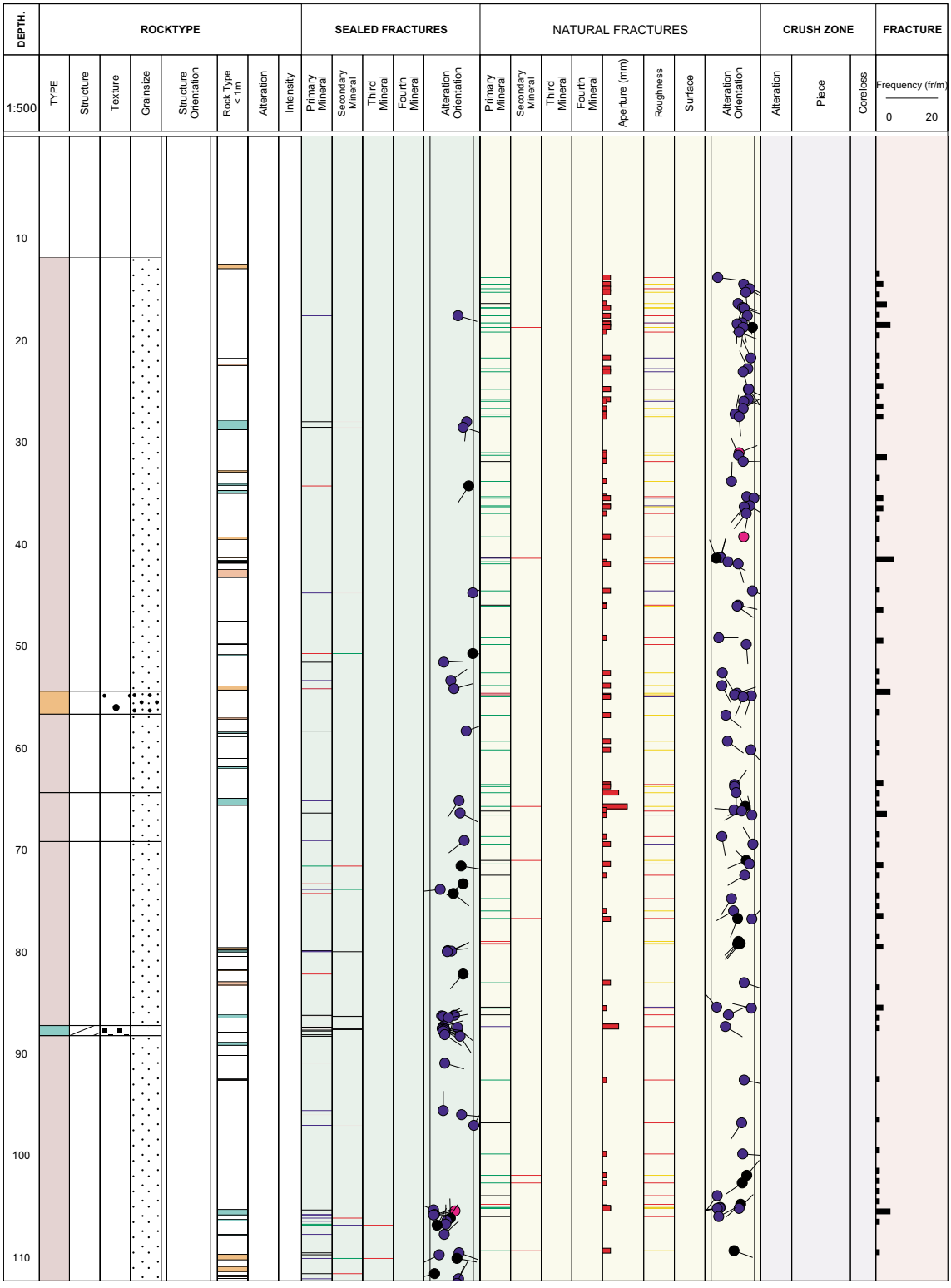

120
130
140
150
160
170
180
190
200
210
100

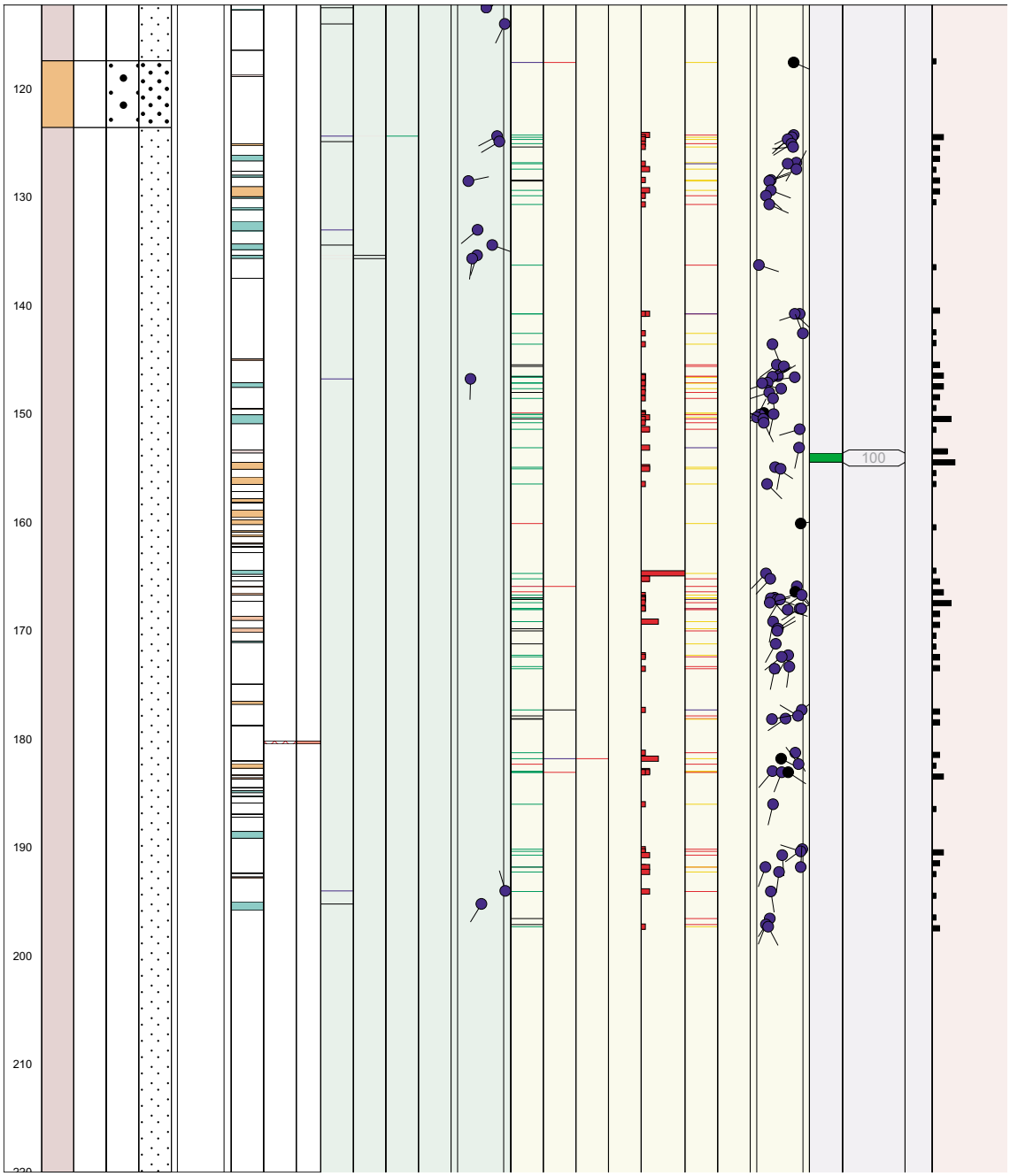
Appendix 4

WellCad diagram of HFM05

Title GEOLOGY HFM05

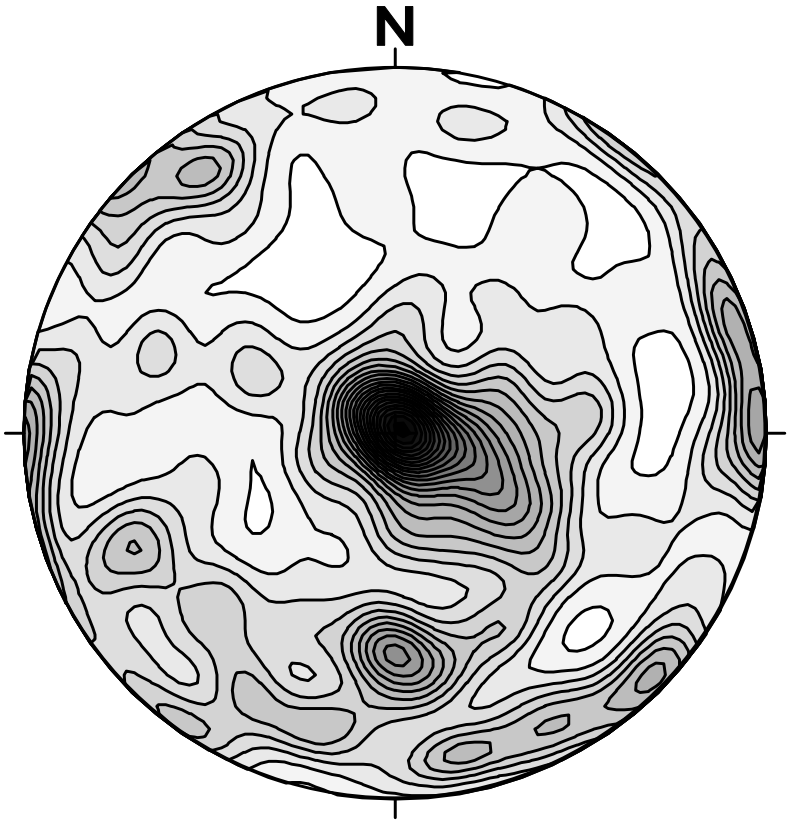
Site	FORSMARK	**Coordinate System**	RT90-RHB70
Borehole	HFM05	**Northing [m]**	6698647.275
Diameter [m]	0.1341	**Easting [m]**	1633289.721
Length [m]	200.1	**Elevation [m.a.s.l.]**	7.672
Bearing [°]	335.5892	**Drilling Start Date**	2002-12-04 13:18:00
Inclination [°]	-84.9608	**Drilling Stop Date**	2002-12-16 17:36:00
Remark		**Plot Date**	2003-04-10 10:16:42



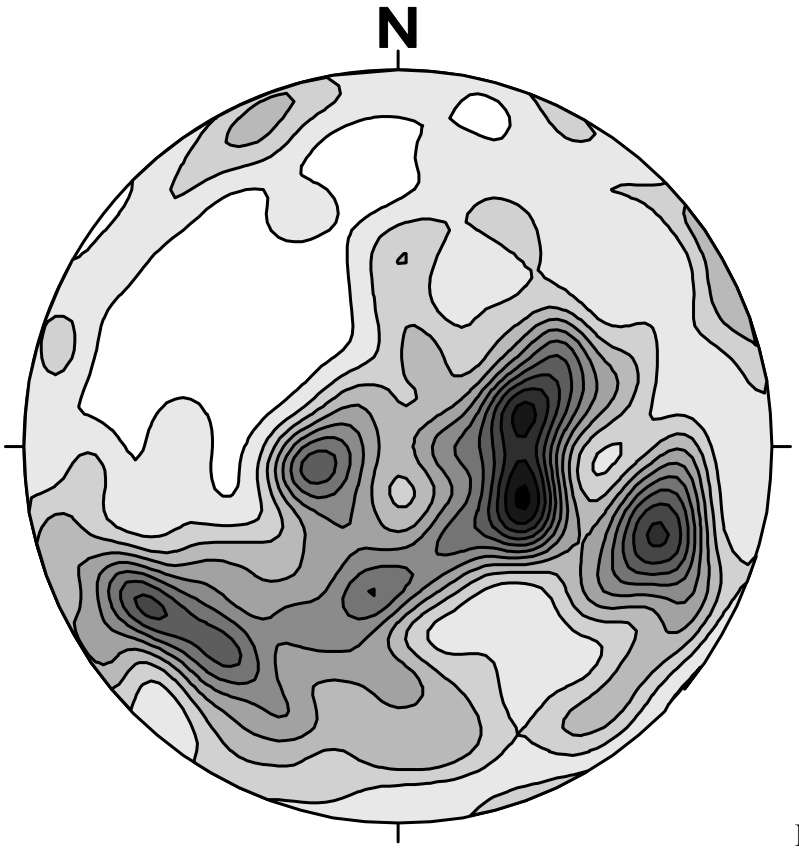

120
130
140
150
160
170
180
190
200
210
100

Appendix 5

Lower hemisphere equal area projections of poles to planes of natural and sealed fractures documented in boreholes HFM04 and HFM05



HFM04 (n=294)



HFM05 (n=239)

Appendix 6

Hole Diam T - Drilling: Borehole diameter

HFM04, 2002-11-19 13:00:00 - 2002-12-03 12:00:00 (0.000 - 221.700 m)

Sub Secup (m)	Sub Seclow (m)	Hole Diam (m)	Comment
0.000	3.000		Noex 215
3.000	12.100	0.215	
12.100	221.700	0.138	

Printout from SICADA 2003-01-31 14:25:53.

Hole Diam T - Drilling: Borehole diameter

HFM05, 2002-12-04 13:18:00 - 2002-12-16 17:36:00 (0.000 - 200.100 m)

Sub Secup (m)	Sub Seclow (m)	Hole Diam (m)	Comment
0.000	4.600	0.215	This part of the hole is drilled trough soil
4.600	11.870	0.215	
11.870	101.300	0.136	(0.1375-0.1363)byte spräckt styrfoder + krona
101.300	200.100	0.134	101.3m: 0.1355, 200.1m: 0.1341)

Printout from SICADA 2003-05-28 14:45:08.

Appendix 7

Magnetic Acc Dev T - Magnetic accelerometer deviation measurement

HFM04, 2002-11-29 09:00:00 - 2002-11-29 09:15:00 (0.000 - 219.000 m)

Bhlen (m)	Magnetic Bearing (degrees)	Dip (degrees)	Northing (m)	Easting (m)	Elevation (m)	Locala (m)	Localb (m)	Localc (m)
0.00	336.9	-84.3	8878.97	3420.73	3.87	0.00	0.00	0.00
15.00	339.5	-84.7	8880.30	3420.20	-11.06	1.44	0.03	-0.10
18.00	336.2	-85.0	8880.55	3420.09	-14.05	1.71	0.04	-0.10
21.00	340.1	-85.1	8880.79	3420.00	-17.04	1.96	0.04	-0.10
24.00	340.1	-85.6	8881.02	3419.91	-20.03	2.21	0.06	-0.20
27.00	343.6	-85.6	8881.24	3419.84	-23.02	2.44	0.08	-0.20
30.00	352.8	-85.7	8881.46	3419.80	-26.01	2.66	0.12	-0.30
33.00	356.3	-85.8	8881.68	3419.78	-29.00	2.87	0.19	-0.40
36.00	0.2	-85.8	8881.90	3419.77	-31.99	3.08	0.27	-0.50
39.00	2.2	-85.8	8882.12	3419.77	-34.99	3.28	0.36	-0.60
42.00	2.7	-85.8	8882.34	3419.78	-37.98	3.47	0.45	-0.70
45.00	0.2	-85.5	8882.57	3419.79	-40.97	3.68	0.55	-0.80
48.00	5.1	-85.6	8882.80	3419.80	-43.96	3.89	0.65	-0.90
51.00	7.3	-85.6	8883.03	3419.82	-46.95	4.09	0.76	-1.00
54.00	8.8	-85.7	8883.26	3419.86	-49.94	4.29	0.88	-1.10
57.00	10.9	-85.8	8883.48	3419.89	-52.93	4.47	1.00	-1.20
60.00	22.1	-86.1	8883.68	3419.95	-55.93	4.64	1.13	-1.30
63.00	10.4	-85.9	8883.88	3420.01	-58.92	4.80	1.26	-1.50
66.00	15.4	-86.4	8884.07	3420.05	-61.91	4.96	1.38	-1.60
69.00	26.6	-86.0	8884.26	3420.13	-64.91	5.10	1.52	-1.80
72.00	28.7	-86.0	8884.44	3420.22	-67.90	5.23	1.68	-1.90
75.00	32.4	-86.0	8884.62	3420.33	-70.89	5.36	1.85	-2.10
78.00	34.8	-85.8	8884.80	3420.45	-73.88	5.48	2.03	-2.30
81.00	40.7	-85.5	8884.98	3420.59	-76.88	5.59	2.23	-2.50
84.00	45.1	-85.4	8885.16	3420.75	-79.87	5.68	2.45	-2.70
87.00	48.8	-85.2	8885.32	3420.93	-82.86	5.77	2.68	-2.90
90.00	48.6	-84.7	8885.50	3421.13	-85.84	5.85	2.93	-3.10
93.00	51.2	-84.3	8885.68	3421.35	-88.83	5.93	3.20	-3.30
96.00	57.1	-84.3	8885.86	3421.59	-91.82	6.00	3.49	-3.50
99.00	59.8	-84.0	8886.02	3421.85	-94.80	6.04	3.80	-3.80
102.00	63.1	-83.7	8886.17	3422.13	-97.78	6.07	4.11	-4.10
105.00	68.0	-83.4	8886.31	3422.44	-100.76	6.08	4.45	-4.30
108.00	69.6	-83.0	8886.44	3422.77	-103.74	6.07	4.81	-4.60
111.00	72.6	-82.7	8886.56	3423.12	-106.72	6.04	5.18	-5.00
114.00	75.1	-82.5	8886.67	3423.49	-109.69	5.99	5.56	-5.30
117.00	76.3	-82.3	8886.76	3423.88	-112.67	5.93	5.95	-5.70
120.00	78.8	-81.9	8886.85	3424.28	-115.64	5.86	6.36	-6.00
123.00	80.1	-81.5	8886.93	3424.71	-118.61	5.76	6.78	-6.40
126.00	81.4	-81.1	8887.00	3425.16	-121.57	5.65	7.22	-6.80
129.00	82.9	-80.8	8887.07	3425.62	-124.54	5.53	7.68	-7.30
132.00	83.7	-80.2	8887.13	3426.11	-127.50	5.39	8.15	-7.70
135.00	84.4	-80.0	8887.18	3426.63	-130.45	5.24	8.65	-8.10
138.00	85.1	-79.7	8887.23	3427.15	-133.40	5.08	9.15	-8.60
141.00	85.3	-79.4	8887.27	3427.70	-136.35	4.90	9.67	-9.00
144.00	85.6	-79.1	8887.32	3428.25	-139.30	4.73	10.20	-9.50
147.00	85.2	-78.9	8887.36	3428.82	-142.25	4.55	10.74	-10.00
150.00	85.1	-78.8	8887.41	3429.40	-145.19	4.36	11.29	-10.50
153.00	84.6	-78.2	8887.47	3430.00	-148.13	4.18	11.86	-10.90
156.00	85.3	-77.9	8887.52	3430.62	-151.06	3.99	12.45	-11.40
159.00	84.8	-77.7	8887.58	3431.25	-154.00	3.79	13.05	-11.90
162.00	84.9	-77.4	8887.63	3431.89	-156.93	3.59	13.67	-12.40
165.00	85.2	-77.1	8887.69	3432.55	-159.85	3.38	14.30	-12.90
168.00	84.3	-77.0	8887.75	3433.22	-162.78	3.18	14.94	-13.40
171.00	84.1	-76.3	8887.82	3433.91	-165.69	2.97	15.60	-13.90
174.00	85.3	-75.9	8887.89	3434.63	-168.61	2.75	16.28	-14.40
177.00	85.1	-75.5	8887.95	3435.37	-171.51	2.52	16.99	-14.90
180.00	85.2	-75.1	8888.02	3436.13	-174.42	2.28	17.71	-15.40

183.00	85.8	-74.7	8888.08	3436.90	-177.31	2.03	18.45	-16.00
186.00	85.1	-74.2	8888.14	3437.71	-180.20	1.78	19.21	-16.50
189.00	86.2	-73.8	8888.20	3438.53	-183.09	1.51	20.00	-17.10
192.00	85.4	-73.6	8888.27	3439.37	-185.97	1.24	20.79	-17.60
195.00	87.7	-73.6	8888.32	3440.22	-188.84	0.95	21.59	-18.20
198.00	88.2	-73.2	8888.35	3441.07	-191.72	0.64	22.39	-18.80
201.00	88.9	-72.7	8888.37	3441.95	-194.59	0.32	23.21	-19.40
204.00	89.3	-72.4	8888.38	3442.85	-197.45	-0.02	24.04	-20.00
207.00	89.7	-72.1	8888.39	3443.77	-200.31	-0.37	24.88	-20.60
210.00	90.4	-71.8	8888.39	3444.70	-203.16	-0.74	25.74	-21.30
213.00	89.9	-71.5	8888.39	3445.64	-206.01	-1.11	26.61	-21.90
216.00	90.3	-71.4	8888.39	3446.59	-208.85	-1.49	27.48	-22.60
219.00	90.1	-70.9	8888.38	3447.56	-211.69	-1.87	28.37	-23.30

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Magnetic Acc Dev T - Magnetic accelerometer deviation measurement

HFM05, 2003-01-07 09:00:00 - 2003-01-07 15:00:00 (0.000 - 198.000 m)

Bhlen (m)	Magnetic Bearing (degrees)	Dip (degrees)	Northing (m)	Easting (m)	Elevation (m)	Locala (m)	Localb (m)	Localc (m)
0.00	335.6	-85.0	8647.27	3289.72	7.67	0.00	0.00	0.00
7.00	318.2	-84.5	8647.80	3289.37	0.70	0.63	-0.10	0.00
9.00	328.3	-85.2	8647.94	3289.26	-1.29	0.80	-0.14	0.00
11.00	328.4	-85.4	8648.08	3289.18	-3.29	0.96	-0.16	0.00
15.00	323.5	-85.0	8648.36	3288.99	-7.27	1.29	-0.22	0.00
18.00	321.8	-85.3	8648.56	3288.84	-10.26	1.54	-0.27	0.00
21.00	319.9	-85.7	8648.74	3288.69	-13.25	1.77	-0.33	-0.10
24.00	317.6	-86.2	8648.90	3288.55	-16.24	1.97	-0.39	-0.10
27.00	317.7	-86.5	8649.04	3288.42	-19.24	2.15	-0.45	-0.20
30.00	326.1	-86.7	8649.18	3288.31	-22.23	2.32	-0.50	-0.30
33.00	329.8	-86.9	8649.32	3288.22	-25.23	2.49	-0.52	-0.40
36.00	333.2	-87.2	8649.46	3288.15	-28.22	2.64	-0.53	-0.50
39.00	339.1	-87.3	8649.59	3288.09	-31.22	2.79	-0.53	-0.60
42.00	342.2	-87.4	8649.72	3288.04	-34.22	2.93	-0.52	-0.70
45.00	344.6	-87.5	8649.85	3288.00	-37.22	3.06	-0.50	-0.90
48.00	351.3	-87.6	8649.97	3287.98	-40.21	3.18	-0.47	-1.00
51.00	1.6	-87.6	8650.10	3287.97	-43.21	3.30	-0.43	-1.10
54.00	12.7	-87.6	8650.22	3287.98	-46.21	3.41	-0.36	-1.30
57.00	23.0	-87.2	8650.35	3288.03	-49.20	3.51	-0.27	-1.50
60.00	34.3	-86.9	8650.49	3288.10	-52.20	3.60	-0.15	-1.60
63.00	38.4	-86.5	8650.62	3288.20	-55.20	3.68	0.00	-1.80
66.00	45.0	-86.4	8650.76	3288.33	-58.19	3.76	0.17	-2.00
69.00	47.6	-86.1	8650.90	3288.47	-61.18	3.82	0.36	-2.20
72.00	52.7	-85.8	8651.03	3288.63	-64.18	3.88	0.56	-2.40
75.00	55.3	-85.4	8651.17	3288.82	-67.17	3.92	0.79	-2.60
78.00	59.6	-84.9	8651.30	3289.03	-70.16	3.96	1.04	-2.80
81.00	65.7	-84.6	8651.43	3289.28	-73.14	3.97	1.31	-3.10
84.00	68.8	-84.0	8651.55	3289.55	-76.13	3.96	1.61	-3.40
87.00	69.9	-83.6	8651.66	3289.85	-79.11	3.94	1.94	-3.60
90.00	71.1	-83.4	8651.77	3290.17	-82.09	3.91	2.27	-3.90
93.00	72.0	-83.0	8651.88	3290.51	-85.07	3.88	2.63	-4.20
96.00	73.0	-82.6	8652.00	3290.87	-88.05	3.83	3.00	-4.50
99.00	74.0	-82.3	8652.11	3291.25	-91.02	3.78	3.39	-4.80
102.00	75.1	-82.1	8652.22	3291.64	-93.99	3.71	3.79	-5.20
105.00	75.4	-82.8	8652.32	3292.02	-96.97	3.65	4.18	-5.50
108.00	75.3	-81.6	8652.42	3292.41	-99.94	3.58	4.58	-5.80
111.00	75.6	-81.4	8652.53	3292.84	-102.91	3.50	5.02	-6.10
114.00	76.5	-81.4	8652.64	3293.28	-105.87	3.42	5.46	-6.50
117.00	76.1	-81.2	8652.75	3293.72	-108.84	3.34	5.91	-6.80
120.00	77.3	-81.1	8652.85	3294.17	-111.80	3.25	6.36	-7.20
123.00	77.9	-80.8	8652.96	3294.63	-114.77	3.15	6.82	-7.50
126.00	76.6	-80.6	8653.06	3295.10	-117.73	3.05	7.30	-7.90
129.00	77.4	-80.3	8653.17	3295.59	-120.68	2.95	7.78	-8.20
132.00	77.5	-80.0	8653.29	3296.09	-123.64	2.85	8.29	-8.60
135.00	77.8	-79.9	8653.40	3296.60	-126.59	2.74	8.80	-9.00
138.00	78.1	-79.7	8653.51	3297.12	-129.55	2.63	9.32	-9.30
141.00	79.0	-79.3	8653.62	3297.66	-132.50	2.50	9.85	-9.70
144.00	80.2	-79.1	8653.72	3298.21	-135.44	2.37	10.39	-10.10
147.00	79.6	-78.8	8653.82	3298.77	-138.39	2.22	10.95	-10.50
150.00	80.3	-78.6	8653.92	3299.35	-141.33	2.08	11.52	-10.90
153.00	80.6	-78.3	8654.02	3299.95	-144.27	1.92	12.10	-11.30
156.00	80.4	-78.1	8654.12	3300.55	-147.21	1.77	12.69	-11.70
159.00	81.7	-78.0	8654.22	3301.16	-150.14	1.60	13.29	-12.20
162.00	82.1	-77.8	8654.31	3301.79	-153.07	1.42	13.90	-12.60
165.00	82.7	-77.5	8654.39	3302.42	-156.00	1.24	14.51	-13.00
168.00	82.8	-77.1	8654.48	3303.08	-158.93	1.04	15.14	-13.50
171.00	83.5	-76.7	8654.56	3303.75	-161.85	0.84	15.79	-13.90
174.00	83.5	-76.3	8654.64	3304.45	-164.77	0.62	16.46	-14.40
177.00	84.6	-75.9	8654.71	3305.17	-167.68	0.40	17.14	-14.90
180.00	85.1	-75.4	8654.78	3305.91	-170.59	0.15	17.84	-15.40

183.00	85.9	-74.9	8654.84	3306.67	-173.49	-0.11	18.56	-15.90
186.00	85.0	-74.1	8654.90	3307.47	-176.38	-0.38	19.32	-16.40
189.00	85.5	-73.5	8654.97	3308.31	-179.26	-0.66	20.11	-17.00
192.00	86.7	-73.2	8655.03	3309.16	-182.13	-0.97	20.91	-17.50
195.00	87.7	-72.7	8655.07	3310.04	-185.00	-1.29	21.73	-18.10
198.00	89.1	-72.4	8655.10	3310.94	-187.86	-1.64	22.56	-18.70

Printout from SICADA 2003-04-11 10:16:05.

Appendix 8

Drillpen D T - Drill Penetration Log

HFM04, 2002-11-21 11:23:00 - 2002-12-02 16:45:00 (3.150 - 221.600 m)

Bhlen (m)	Pen Time (s)	Water	Fracture	Comment
3.40	50	0	0	11:23
3.60	45	0	0	
3.80	29	0	0	
4.00	25	0	0	
4.20	23	0	0	
4.40	24	0	0	
4.60	24	0	0	
4.80	25	0	0	
5.00	24	0	0	
5.20	22	0	0	
5.40	26	0	0	
5.60	25	0	0	
5.80	21	0	0	
6.00	22	0	0	12:14
6.20	23	0	0	
6.40	22	0	0	
6.60	20	0	0	
6.80	19	0	0	
7.00	19	0	0	
7.20	20	0	0	
7.40	24	0	0	
7.60	21	0	0	
7.80	23	0	0	
8.00	23	0	0	
8.20	19	0	0	
8.40	22	0	0	
8.60	21	0	0	
8.80	22	0	0	
9.00	21	0	0	12:22
9.20	22	0	0	
9.40	22	0	0	
9.60	21	0	0	
9.80	16	0	0	
10.00	17	0	0	
10.20	19	0	0	
10.40	21	0	0	
10.60	21	0	0	
10.80	22	0	0	
11.00	21	0	0	
11.20	18	0	0	
11.40	20	0	0	
11.60	17	0	0	
11.80	17	0	0	
12.00	16	0	0	12:29
12.20	15	0	0	2002-11-28 09:05
12.40	23	0	0	
12.60	23	0	0	
12.80	23	0	0	
13.00	19	0	0	
13.20	24	0	0	
13.40	24	0	0	
13.60	23	0	0	
13.80	22	0	0	
14.00	24	0	0	
14.20	27	0	0	
14.40	25	0	0	
14.60	25	0	0	

14.80	21	0	0	
15.00	20	0	0	09:36
15.20	25	0	0	
15.40	18	0	0	
15.60	25	0	0	
15.80	23	0	0	
16.00	22	0	0	
16.20	23	0	0	
16.40	24	0	0	
16.60	23	0	0	
16.80	25	0	0	
17.00	24	0	0	
17.20	22	0	0	
17.40	24	0	0	
17.60	22	0	0	
17.80	25	0	0	
18.00	23	0	0	09:44
18.20	25	0	0	
18.40	24	0	0	
18.60	25	0	0	
18.80	23	0	0	
19.00	20	0	0	
19.20	21	0	0	
19.40	24	0	0	
19.60	20	0	0	
19.80	22	0	0	
20.00	24	0	0	
20.20	22	0	0	
20.40	25	0	0	
20.60	24	0	0	
20.80	20	0	0	
21.00	15	0	0	09:50
21.20	13	0	0	
21.40	13	0	0	
21.60	13	0	0	
21.80	13	0	0	
22.00	15	0	0	
22.20	14	0	0	
22.40	17	0	1	
22.60	20	0	1	
22.80	19	0	1	
23.00	21	0	1	
23.20	22	0	1	
23.40	29	0	1	
23.60	27	0	1	
23.80	22	0	1	
24.00	25	0	1	09:56
24.20	25	0	1	
24.40	23	0	1	
24.60	23	0	1	
24.80	24	0	1	
25.00	23	0	1	
25.20	23	0	1	
25.40	24	0	0	
25.60	25	0	0	
25.80	24	0	0	
26.00	24	0	0	13:03
26.20	24	0	0	
26.40	23	0	0	
26.60	24	0	0	
26.80	23	0	0	
27.00	20	0	0	
27.20	23	0	0	
27.40	21	0	0	
27.60	22	0	0	
27.80	22	0	0	
28.00	20	0	0	

28.20	21	0	0	
28.40	25	0	0	
28.60	24	0	0	
28.80	23	0	0	
29.00	23	0	0	10:10
29.20	22	0	0	
29.40	23	0	0	
29.60	21	0	0	
29.80	22	0	0	
30.00	22	0	0	
30.20	24	0	0	
30.40	25	0	0	
30.60	23	0	0	
30.80	24	0	0	
31.00	21	0	0	
31.20	21	0	0	
31.40	23	0	0	
31.60	24	0	0	
31.80	23	0	0	
32.00	21	0	0	10:16
32.20	22	0	0	
32.40	21	0	0	
32.60	22	0	0	
32.80	22	0	0	
33.00	14	0	0	
33.20	25	0	0	
33.40	23	0	0	
33.60	25	0	0	
33.80	23	0	0	
34.00	23	0	0	
34.20	22	0	0	
34.40	26	0	0	
34.60	25	0	0	
34.80	22	0	0	
35.00	23	0	0	10:23
35.20	22	0	0	
35.40	24	0	0	
35.60	25	0	0	
35.80	22	0	0	
36.00	22	0	0	
36.20	21	0	0	
36.40	17	0	0	
36.60	19	0	0	
36.80	18	0	0	
37.00	17	0	0	
37.20	18	0	0	
37.40	19	0	0	
37.60	24	0	0	
37.80	23	0	0	
38.00	21	0	0	10:30
38.20	20	0	0	
38.40	20	0	0	
38.60	22	0	0	
38.80	22	0	0	
39.00	20	0	0	
39.20	24	0	0	
39.40	26	0	0	
39.60	22	0	0	
39.80	23	0	0	
40.00	16	0	0	
40.20	18	0	0	
40.40	28	0	0	
40.60	22	0	0	
40.80	21	0	0	
41.00	19	0	0	10:38
41.20	19	0	0	
41.40	16	0	0	

41.60	18	0	0	
41.80	27	0	0	
42.00	20	0	0	
42.20	24	0	0	
42.40	19	0	0	
42.60	22	1	0	
42.80	27	0	0	
43.00	22	0	0	
43.20	21	0	0	
43.40	22	0	0	
43.60	21	0	0	
43.80	25	0	0	
44.00	25	0	0	10:45
44.20	27	0	0	
44.40	27	0	0	
44.60	18	0	0	
44.80	24	0	0	
45.00	20	0	0	
45.20	21	0	0	
45.40	21	0	0	
45.60	23	0	0	
45.80	19	0	0	
46.00	19	0	0	
46.20	14	0	0	
46.40	23	0	0	
46.60	27	0	0	
46.80	28	0	0	
47.00	23	0	0	10:52
47.20	28	0	0	
47.40	21	0	0	
47.60	19	0	0	
47.80	23	0	0	
48.00	18	0	0	
48.20	18	0	0	
48.40	17	0	0	
48.60	17	0	0	
48.80	20	0	0	
49.00	19	0	0	
49.20	18	0	0	
49.40	17	0	0	
49.60	19	0	0	
49.80	19	0	0	
50.00	20	0	0	10:58
50.20	18	0	0	
50.40	20	0	0	
50.60	22	0	0	
50.80	18	0	0	
51.00	17	0	0	
51.20	18	0	0	
51.40	19	0	0	
51.60	25	0	0	
51.80	25	0	0	
52.00	21	0	0	
52.20	21	0	0	
52.40	20	0	0	
52.60	25	0	0	
52.80	22	0	0	
53.00	24	0	0	11:04
53.20	21	0	0	
53.40	22	0	0	
53.60	19	0	0	
53.80	24	0	1	
54.00	16	0	0	
54.20	19	0	0	
54.40	17	0	0	
54.60	18	0	0	
54.80	16	0	0	

55.00	19	0	0	
55.20	19	0	0	
55.40	20	0	0	
55.60	20	0	0	
55.80	18	0	0	
56.00	20	0	0	11:09
56.20	25	0	0	
56.40	19	0	0	
56.60	23	0	0	
56.80	30	0	0	
57.00	22	0	0	
57.20	24	0	0	
57.40	24	0	0	
57.60	22	0	0	
57.80	28	0	0	
58.00	25	0	0	
58.20	21	0	0	
58.40	21	0	0	
58.60	21	0	0	
58.80	22	0	0	
59.00	24	0	0	11:17
59.20	33	0	0	
59.40	39	0	0	
59.60	30	0	0	
59.80	29	0	0	
60.00	27	0	0	
60.20	23	0	0	
60.40	20	0	0	
60.60	23	0	0	
60.80	21	0	0	
61.00	15	0	0	
61.20	16	0	0	
61.40	8	0	0	
61.60	11	0	0	
61.80	7	0	0	
62.00	7	0	0	11:22
62.20	18	0	0	
62.40	15	0	0	
62.60	11	0	0	
62.80	18	0	0	
63.00	9	0	0	
63.20	13	0	0	
63.40	14	0	0	
63.60	8	0	0	
63.80	11	0	0	
64.00	10	0	0	
64.20	7	0	0	
64.40	15	0	0	
64.60	19	0	0	
64.80	21	0	1	
65.00	25	0	1	13:13
65.20	25	0	1	
65.40	22	0	1	
65.60	18	0	0	
65.80	27	0	0	
66.00	21	0	0	
66.20	24	0	0	
66.40	22	0	0	
66.60	23	0	0	
66.80	22	0	0	
67.00	22	0	0	
67.20	22	0	0	
67.40	23	0	0	
67.60	23	0	0	
67.80	21	0	0	
68.00	24	0	0	13:19
68.20	29	0	0	

68.40	23	0	0	
68.60	19	0	0	
68.80	35	0	0	
69.00	27	0	0	
69.20	25	0	0	
69.40	24	0	0	
69.60	25	0	0	
69.80	24	0	0	
70.00	25	0	0	
70.20	25	0	0	
70.40	26	0	0	
70.60	26	0	0	
70.80	25	0	0	
71.00	28	0	0	13:23
71.20	34	0	0	
71.40	26	0	0	
71.60	26	0	0	
71.80	27	0	0	
72.00	25	0	0	
72.20	26	0	0	
72.40	23	0	0	
72.60	24	0	0	
72.80	25	0	0	
73.00	25	0	0	
73.20	26	0	0	
73.40	27	0	0	
73.60	25	0	0	
73.80	25	0	0	
74.00	31	0	0	13:36
74.20	36	0	0	
74.40	29	0	0	
74.60	32	0	0	
74.80	31	0	0	
75.00	29	0	0	
75.20	28	0	0	
75.40	29	0	0	
75.60	32	0	0	
75.80	27	0	0	
76.00	29	0	0	
76.20	30	0	0	
76.40	32	0	0	
76.60	32	0	0	
76.80	30	0	0	
77.00	34	0	0	13:46
77.20	40	0	0	
77.40	32	0	0	
77.60	30	0	0	
77.80	37	0	0	
78.00	31	0	0	
78.20	35	0	0	
78.40	24	0	0	
78.60	19	0	0	
78.80	26	0	0	
79.00	22	0	0	
79.20	24	0	0	
79.40	24	0	0	
79.60	22	0	0	
79.80	23	0	0	
80.00	21	0	0	13:54
80.20	22	0	0	
80.40	17	0	0	
80.60	18	0	0	
80.80	23	0	0	
81.00	18	0	0	
81.20	21	0	0	
81.40	21	0	0	
81.60	21	0	0	

81.80	22	0	0	
82.00	19	0	0	
82.20	21	0	0	
82.40	23	0	0	
82.60	22	0	0	
82.80	21	0	0	
83.00	22	0	0	14:08
83.20	30	0	0	
83.40	23	0	0	
83.60	22	0	0	
83.80	22	0	0	
84.00	20	0	0	
84.20	22	0	0	
84.40	24	0	0	
84.60	23	0	0	
84.80	23	0	0	
85.00	22	0	0	
85.20	22	0	0	
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85.80	19	0	0	
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86.20	31	0	0	
86.40	23	0	0	
86.60	21	0	0	
86.80	22	0	0	
87.00	21	0	0	
87.20	22	0	0	
87.40	21	0	0	
87.60	22	0	0	
87.80	22	0	0	
88.00	23	0	0	
88.20	20	0	0	
88.40	21	0	0	
88.60	20	0	0	
88.80	20	0	0	
89.00	20	0	0	14:23
89.20	28	0	0	
89.40	21	0	0	
89.60	23	0	0	
89.80	20	0	0	
90.00	21	0	0	
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91.40	23	0	0	
91.60	19	0	0	
91.80	18	0	0	
92.00	17	0	0	14:30
92.20	18	0	0	
92.40	19	0	0	
92.60	22	0	0	
92.80	26	0	0	
93.00	21	0	0	
93.20	21	0	0	
93.40	22	0	0	
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93.80	22	0	0	
94.00	21	0	0	
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94.60	22	0	0	
94.80	22	0	0	
95.00	23	0	0	14:39

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96.00	25	0	0	
96.20	24	0	0	
96.40	24	0	0	
96.60	22	0	0	
96.80	20	0	0	
97.00	22	0	0	
97.20	23	0	0	
97.40	25	0	0	
97.60	23	0	0	
97.80	23	0	0	
98.00	25	0	0	14:44
98.20	21	0	0	
98.40	16	0	0	
98.60	21	0	0	
98.80	24	0	0	
99.00	25	0	0	
99.20	24	0	0	
99.40	24	0	0	
99.60	25	0	0	
99.80	25	0	0	
100.00	23	0	0	
100.20	24	0	0	
100.40	25	0	0	
100.60	25	0	0	
100.80	25	0	0	
101.00	26	0	0	14:53
101.20	26	0	0	
101.40	26	0	0	
101.60	26	0	0	
101.80	22	0	0	
102.00	22	0	0	
102.20	23	0	0	
102.40	22	0	0	
102.60	24	0	0	
102.80	24	0	0	
103.00	20	0	0	
103.20	22	0	0	
103.40	25	0	0	
103.60	24	0	0	
103.80	25	0	0	
104.00	27	0	0	15:06
104.20	24	0	0	
104.40	26	0	0	
104.60	24	0	0	
104.80	25	0	0	
105.00	26	0	0	
105.20	26	0	0	
105.40	26	0	0	
105.60	26	0	0	
105.80	24	0	0	
106.00	23	0	0	
106.20	23	0	0	
106.40	25	0	0	
106.60	29	0	0	
106.80	26	0	0	
107.00	26	0	0	15:12
107.20	26	0	0	
107.40	28	0	0	
107.60	27	0	0	
107.80	24	0	0	
108.00	23	0	0	
108.20	18	0	0	
108.40	23	0	0	

108.60	25	0	0	
108.80	29	0	0	
109.00	39	0	0	
109.20	25	0	0	
109.40	21	0	0	
109.60	25	0	0	
109.80	22	0	0	
110.00	22	0	0	15:19
110.20	25	0	0	
110.40	25	0	0	
110.60	25	0	0	
110.80	25	0	0	
111.00	23	0	0	
111.20	22	0	0	
111.40	39	0	0	
111.60	39	0	0	
111.80	38	0	0	
112.00	28	0	0	
112.20	26	0	0	
112.40	28	0	0	
112.60	34	0	1	
112.80	24	0	0	
113.00	25	0	0	15:26
113.20	27	0	0	
113.40	32	0	0	
113.60	28	0	0	
113.80	28	0	0	
114.00	29	0	0	
114.20	22	0	0	
114.40	25	0	0	
114.60	21	0	0	
114.80	23	0	0	
115.00	21	0	0	
115.20	40	0	0	
115.40	65	0	0	
115.60	65	0	0	
115.80	19	0	0	
116.00	25	0	0	15:39
116.20	27	0	0	
116.40	28	0	0	
116.60	29	0	0	
116.80	29	0	0	
117.00	28	0	0	
117.20	25	0	0	
117.40	25	0	0	
117.60	25	0	0	
117.80	23	0	0	
118.00	24	0	0	
118.20	24	0	0	
118.40	22	0	0	
118.60	24	0	0	
118.80	24	0	0	
119.00	24	0	0	15:48
119.20	26	0	0	
119.40	34	0	0	
119.60	28	0	0	
119.80	23	0	0	
120.00	30	0	0	
120.20	23	0	0	
120.40	24	0	0	
120.60	24	0	0	
120.80	26	0	0	
121.00	23	0	0	
121.20	25	0	0	
121.40	27	0	0	
121.60	32	0	0	
121.80	25	0	0	

122.00	25	0	0	15:57
122.20	27	0	0	
122.40	30	0	0	
122.60	26	0	0	
122.80	26	0	0	
123.00	26	0	0	
123.20	24	0	0	
123.40	27	0	0	
123.60	26	0	0	
123.80	30	0	0	
124.00	27	0	0	
124.20	25	0	0	
124.40	27	0	0	
124.60	28	0	0	
124.80	26	0	0	
125.00	27	0	0	16:04
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125.60	26	0	0	
125.80	27	0	0	
126.00	25	0	0	
126.20	26	0	0	
126.40	26	0	0	
126.60	24	0	0	
126.80	26	0	0	
127.00	26	0	0	
127.20	28	0	0	
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127.80	26	0	0	
128.00	27	0	0	16:13
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128.60	26	0	0	
128.80	26	0	0	
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129.20	21	0	0	
129.40	23	0	0	
129.60	25	0	0	
129.80	28	0	0	
130.00	22	0	0	
130.20	19	0	0	16:22
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130.60	28	0	0	
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132.80	22	0	0	
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133.80	29	0	0	
134.00	26	0	0	09:29
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136.60	31	0	0	
136.80	29	0	0	
137.00	30	0	0	09:39
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139.80	24	0	0	
140.00	21	0	0	09:48
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142.80	29	0	0	
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144.60	26	0	0	
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147.60	28	0	0	
147.80	32	0	0	
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154.80	32	0	0	
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157.80	29	0	0	
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159.80	28	0	0	
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160.80	29	0	0	
161.00	28	0	0	10:50
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165.40	31	0	0	
165.60	30	0	0	
165.80	32	0	0	
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166.80	32	0	0	
167.00	30	0	0	11:08
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168.20	27	0	0	
168.40	33	0	0	
168.60	31	0	0	
168.80	32	0	0	
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169.40	30	0	0	
169.60	32	0	0	
169.80	32	0	0	
170.00	29	0	0	11:17
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171.40	33	0	0	
171.60	31	0	0	
171.80	32	0	0	
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172.40	30	0	0	
172.60	33	0	0	
172.80	31	0	0	
173.00	29	0	0	11:27
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173.60	34	0	0	
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174.20	33	0	0	
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174.60	28	0	0	
174.80	32	0	0	
175.00	30	0	0	
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175.80	31	0	0	
176.00	28	0	0	11:37
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177.80	29	0	0	
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178.80	27	0	0	
179.00	26	0	0	13:23
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180.60	31	0	0	
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182.00	31	0	0	13:43
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185.60	35	0	0	
185.80	36	0	0	
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186.20	32	0	0	
186.40	22	0	0	
186.60	31	0	0	
186.80	30	0	0	
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187.40	31	0	0	
187.60	27	0	0	
187.80	33	0	0	
188.00	31	0	0	14:04
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188.60	41	0	0	
188.80	34	0	0	

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189.20	32	0	0	
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190.40	32	0	0	
190.60	30	0	0	
190.80	32	0	0	
191.00	31	0	0	14:15
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191.40	34	0	0	
191.60	43	0	0	
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192.00	43	0	0	
192.20	27	0	0	
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193.80	33	0	0	
194.00	32	0	0	14:26
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194.80	32	0	0	
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195.40	36	0	0	
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195.80	35	0	0	
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197.00	35	0	0	14:37
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198.20	36	0	0	
198.40	36	0	0	
198.60	26	0	0	
198.80	28	0	0	
199.00	26	0	0	
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199.80	33	0	0	
200.00	36	0	0	14:47
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200.40	40	0	0	
200.60	43	0	0	
200.80	42	0	0	
201.00	52	0	0	
201.20	45	0	0	
201.40	43	0	0	
201.60	48	0	0	
201.80	47	0	0	
202.00	52	0	0	
202.20	52	0	0	

202.40	48	0	0	
202.60	53	0	0	
202.80	63	0	0	
203.00	58	0	0	14:56
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203.40	72	0	0	
203.60	68	0	0	
203.80	52	0	0	
204.00	60	0	0	
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204.60	93	0	0	
204.80	76	0	0	
205.00	84	0	0	
205.20	90	0	0	
205.40	100	0	0	
205.60	80	0	0	
205.80	39	0	0	
206.00	28	0	0	15:40
206.20	27	0	0	
206.40	30	0	0	
206.60	32	0	0	
206.80	34	0	0	
207.00	31	0	0	
207.20	23	0	0	
207.40	26	0	0	
207.60	32	0	0	
207.80	32	0	0	
208.00	32	0	0	
208.20	29	0	0	
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209.00	31	0	0	15:51
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209.40	32	0	0	
209.60	35	0	0	
209.80	38	0	0	
210.00	32	0	0	
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210.40	32	0	0	
210.60	32	0	0	
210.80	34	0	0	
211.00	33	0	0	
211.20	22	0	0	
211.40	25	0	0	
211.60	28	0	0	
211.80	34	0	0	
212.00	36	0	0	16:00
212.20	34	0	0	
212.40	44	0	0	
212.60	51	0	0	
212.80	40	0	0	
213.00	44	0	0	
213.20	33	0	0	
213.40	43	0	0	
213.60	45	0	0	
213.80	42	0	0	
214.00	49	0	0	
214.20	42	0	0	
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214.60	49	0	0	
214.80	60	0	0	
215.00	52	0	0	16:15
215.20	56	0	0	
215.40	63	0	0	
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215.80	61	0	0	
216.00	46	0	0	
216.20	31	0	0	
216.40	38	0	0	
216.60	38	0	0	
216.80	39	0	0	
217.00	40	0	0	
217.20	35	0	0	
217.40	36	0	0	
217.60	38	0	0	
217.80	37	0	0	
218.00	38	0	0	16:30
218.20	38	0	0	
218.40	39	0	0	
218.60	58	0	0	
218.80	42	0	0	
219.00	52	0	0	
219.20	30	0	0	
219.40	41	0	0	
219.60	45	0	0	
219.80	44	0	0	
220.00	39	0	0	
220.20	41	0	0	
220.40	42	0	0	
220.60	42	0	0	
220.80	46	0	0	
221.00	46	0	0	
221.20	45	0	0	
221.40	51	0	0	
221.60	32	0	0	2002-12-02 16:45

Printout from SICADA 2003-04-11 10:01:12.

Drillpen D T - Drill Penetration Log

HFM05, 2002-12-05 14:47:00 - 2002-12-16 17:36:00 (4.800 - 200.100 m)

Bhlen (m)	Pen Time (s)	Water	Fracture	Comment
4.80	31	0	0	021205 14:47
5.00	32	0	0	
5.20	30	0	0	
5.40	15	0	0	
5.60	21	0	0	
5.80	18	0	0	
6.00	16	0	0	
6.20	20	0	0	
6.40	21	0	0	
6.60	21	0	0	
6.80	19	0	0	
7.00	19	0	0	
7.20	22	0	0	
7.40	18	0	0	
7.60	37	0	0	
7.80	22	0	0	
8.00	18	0	0	021205 15:02
8.20	19	0	0	
8.40	18	0	0	
8.60	17	0	0	
8.80	19	0	0	
9.00	18	0	0	
9.20	18	0	0	
9.40	21	0	0	
9.60	19	0	0	
9.80	48	0	0	
10.00	16	0	0	
10.20	19	0	0	
10.40	20	0	0	
10.60	19	0	0	
10.80	15	0	0	
11.00	19	0	0	021205 15:12
11.20	19	0	0	
11.40	19	0	0	
11.60	20	0	0	
11.80	21	0	0	
12.00	18	0	0	021205 15:21
12.20	21	0	0	021211 09:55
12.40	22	0	0	
12.60	23	0	0	
12.80	24	0	0	
13.00	22	0	0	
13.20	28	0	0	
13.40	23	0	0	
13.60	22	0	0	
13.80	25	0	0	
14.00	25	0	0	021211 11:01
14.20	22	0	0	
14.40	24	0	0	
14.60	22	0	0	
14.80	22	0	0	
15.00	22	0	0	
15.20	22	0	0	
15.40	21	0	0	
15.60	21	0	0	
15.80	21	0	0	
16.00	22	0	0	
16.20	21	0	0	
16.40	22	0	0	
16.60	20	0	0	

16.80	20	0	0	
17.00	21	0	0	021211 11:10
17.20	20	0	0	
17.40	21	0	0	
17.60	22	0	0	
17.80	20	0	0	
18.00	19	0	0	
18.20	22	0	0	
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19.40	21	0	0	
19.60	23	0	0	
19.80	21	0	0	
20.00	22	0	0	021211 11:16
20.20	21	0	0	
20.40	20	0	0	
20.60	21	0	0	
20.80	23	0	0	
21.00	20	0	0	
21.20	22	0	0	
21.40	19	0	0	
21.60	23	0	0	
21.80	21	0	0	
22.00	20	0	0	
22.20	22	0	0	
22.40	22	0	0	
22.60	21	0	0	
22.80	20	0	0	
23.00	20	0	0	021211 11:23
23.20	18	0	0	
23.40	21	0	0	
23.60	22	0	0	
23.80	21	0	0	
24.00	20	0	0	
24.20	21	0	0	
24.40	20	0	0	
24.60	17	0	0	
24.80	19	0	0	
25.00	19	0	0	
25.20	20	0	0	
25.40	21	0	0	
25.60	21	0	0	
25.80	18	0	0	
26.00	21	0	0	021211 11:33
26.20	21	0	0	
26.40	21	0	0	
26.60	21	0	0	
26.80	24	0	0	
27.00	23	0	0	
27.20	21	0	0	
27.40	20	0	0	
27.60	20	0	0	
27.80	23	0	0	
28.00	33	0	0	
28.20	33	0	0	
28.40	27	0	0	
28.60	33	0	0	
28.80	27	0	0	
29.00	22	0	0	021211 11:41
29.20	22	0	0	
29.40	25	0	0	
29.60	24	0	0	
29.80	23	0	0	
30.00	22	0	0	

30.20	23	0	0	
30.40	23	0	0	
30.60	23	0	0	
30.80	21	0	0	
31.00	22	0	0	
31.20	21	0	0	
31.40	22	0	0	
31.60	24	0	0	
31.80	22	0	0	
32.00	23	0	0	021211 11:49
32.20	21	0	0	
32.40	21	0	0	
32.60	22	0	0	
32.80	22	0	0	
33.00	18	0	0	
33.20	24	0	0	
33.40	20	0	0	
33.60	21	0	0	
33.80	21	0	0	
34.00	22	0	0	
34.20	19	0	0	
34.40	20	0	0	
34.60	20	0	0	
34.80	21	0	0	
35.00	24	0	0	021211 13:25
35.20	22	0	0	
35.40	21	0	0	
35.60	30	0	0	
35.80	19	0	0	
36.00	19	0	0	
36.20	21	0	0	
36.40	17	0	0	
36.60	19	0	0	
36.80	22	0	0	
37.00	26	0	0	
37.20	22	0	0	
37.40	21	0	0	
37.60	24	0	0	
37.80	23	0	0	
38.00	24	0	0	021211 13:31
38.20	22	0	0	
38.40	25	0	0	
38.60	31	0	0	
38.80	20	0	0	
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170.20	31	0	0	
170.40	35	0	0	
170.60	24	0	0	
170.80	32	0	0	
171.00	22	0	0	
171.20	26	0	0	
171.40	27	0	0	
171.60	27	0	0	
171.80	27	0	0	
172.00	29	0	0	
172.20	29	0	0	
172.40	30	0	0	
172.60	29	0	0	
172.80	31	0	0	
173.00	28	0	0	021216 15:59
173.20	31	0	0	
173.40	45	0	0	
173.60	33	0	0	
173.80	36	0	0	
174.00	28	0	0	
174.20	26	0	0	
174.40	30	0	0	
174.60	27	0	0	
174.80	29	0	0	
175.00	31	0	0	
175.20	29	0	0	
175.40	29	0	0	
175.60	30	0	0	
175.80	31	0	0	
176.00	29	0	0	021216 16:08
176.20	33	0	0	
176.40	40	0	0	
176.60	31	0	0	
176.80	32	0	0	
177.00	25	0	0	
177.20	28	0	0	
177.40	29	0	0	

177.60	31	0	0	
177.80	32	0	0	
178.00	31	0	0	
178.20	33	0	0	
178.40	32	0	0	
178.60	32	0	0	
178.80	29	0	0	
179.00	26	0	0	021216 16:19
179.20	28	0	0	
179.40	44	0	0	
179.60	30	0	0	
179.80	35	0	0	
180.00	23	0	0	
180.20	28	0	0	
180.40	27	0	0	
180.60	28	0	0	
180.80	28	0	0	
181.00	26	0	0	
181.20	26	0	0	
181.40	28	0	0	
181.60	28	0	0	
181.80	25	0	0	
182.00	24	0	0	021216 16:28
182.20	27	0	0	
182.40	45	0	0	
182.60	25	0	0	
182.80	27	0	0	
183.00	32	0	0	
183.20	23	0	0	
183.40	21	0	0	
183.60	28	0	0	
183.80	28	0	0	
184.00	28	0	0	
184.20	30	0	0	
184.40	29	0	0	
184.60	32	0	0	
184.80	36	0	0	
185.00	34	0	0	021216 16:38
185.20	32	0	0	
185.40	36	0	0	
185.60	44	0	0	
185.80	30	0	0	
186.00	40	0	0	
186.20	30	0	0	
186.40	30	0	0	
186.60	34	0	0	
186.80	32	0	0	
187.00	30	0	0	
187.20	31	0	0	
187.40	31	0	0	
187.60	32	0	0	
187.80	34	0	0	
188.00	34	0	0	021216 16:49
188.20	33	0	0	
188.40	36	0	0	
188.60	44	0	0	
188.80	32	0	0	
189.00	32	0	0	
189.20	35	0	0	
189.40	32	0	0	
189.60	34	0	0	
189.80	38	0	0	
190.00	35	0	0	
190.20	30	0	0	
190.40	32	0	0	
190.60	33	0	0	
190.80	33	0	0	

191.00	32	0	0	021216 17:00
191.20	30	0	0	
191.40	35	0	0	
191.60	41	0	0	
191.80	35	0	0	
192.00	38	0	0	
192.20	27	0	0	
192.40	26	0	0	
192.60	33	0	0	
192.80	33	0	0	
193.00	35	0	0	
193.20	33	0	0	
193.40	35	0	0	
193.60	31	0	0	
193.80	36	0	0	
194.00	37	0	0	021216 17:12
194.20	33	0	0	
194.40	39	0	0	
194.60	39	0	0	
194.80	37	0	0	
195.00	42	0	0	
195.20	29	0	0	
195.40	34	0	0	
195.60	38	0	0	
195.80	35	0	0	
196.00	35	0	0	
196.20	55	0	0	
196.40	52	0	0	
196.60	53	0	0	
196.80	37	0	0	
197.00	40	0	0	021216 17:26
197.20	35	0	0	
197.40	43	0	0	
197.60	46	0	0	
197.80	36	0	0	
198.00	32	0	0	
198.20	42	0	0	
198.40	33	0	0	
198.60	38	0	0	
198.80	35	0	0	
199.00	37	0	0	
199.20	38	0	0	
199.40	37	0	0	
199.60	37	0	0	
199.80	41	0	0	021216 17:36
200.00		0	0	

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Drill Cuttings Samp T - Drill cuttings sampling an analysis

HFM04, 2003-01-31 12:00:00 - 2003-02-19 12:00:00 (3.150 - 221.700 m)

From Length	To Length	Colour Code Unwashed	Grainsize Code Unwashed	Colour Code Washed	Grainsize Code Washed	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)		
3.00	6.00	118	6	182	9	101057		36	32	49	10			
6.00	9.00	118	6	182	9	101057		36	32	49	10			
9.00	12.00	118	9	181	8	101057	101061	36	32	49	10	16	50	very light coloured granodiorite-granite, less biotite
12.00	15.00	148	2	181	9	101057		36	32	49	10	27		
15.00	18.00	148	2	182	9	101057		36	32	49	10	16		hematite, epidote in sealed fractures
18.00	21.00	148	2	182	9	101057		36	32	49	10	30		calcite fractures with green mineral - serpentine?
21.00	24.00	158	2	182	6	101057	102017	36	32	49	10	3	90	
24.00	27.00	108	2	182	9	101057		36	32	49	10	27		
27.00	30.00	108	2	182	9	101057		36	32	49	10	27		
30.00	33.00	148	2	118	9	101057		10	36	32	49	33		Rich in biotite which is somewhat altered. Gouge?
33.00	36.00	108	6	182	9	101057		36	32	49	10	33		
36.00	39.00	108	6	182	9	101057		36	32	49	10			
39.00	42.00	158	6	181	9	101057		36	32	49	10			
42.00	45.00	158	6	181	9	101057		36	32	49	10			
45.00	48.00	118	6	181	9	101057	102017	36	32	49	10	3	90	pyrrhotite, possibly some epidote
48.00	51.00	118	6	182	9	101057		36	32	49	10			
51.00	54.00	118	6	182	9	101057		36	32	49	10			
54.00	57.00	118	6	182	9	101057		36	32	49	10	30		
57.00	60.00	158	6	259	2	102017	101057	49	3	10	36	32	80	epidote, chlorite, concrete
60.00	63.00	118	6	182	9	101057		36	32	49	10	30		
63.00	66.00	182	9	182	9	101057		36	32	49	10			
66.00	69.00	182	9	182	9	101057		36	32	49	10			
69.00	72.00	182	9	182	9	101057		36	32	49	10	16		
72.00	75.00	128	9	182	9	101057		36	32	49	10	16		
75.00	78.00	118	6	181	9	101057		36	32	49	10	16		
78.00	81.00	118	2	181	9	101057		36	32	49	10	30		
81.00	84.00	108	2	181	9	101057		36	32	49	10	11091		X1-greenish mineral, prehnite?
84.00	87.00	108	2	181	9	101057	101061	36	32	49	10	33	90	biotite partly -> chlorite
87.00	90.00	118	6	181	9	101057		36	32	49	10			
90.00	93.00	118	6	182	9	101057	102017	36	32	49	10	3	90	also hematite, calcite and epidote
93.00	96.00	118	6	182	9	101057	102017	36	32	49	10	3	90	
96.00	99.00	118	6	182	9	101057		36	32	49	10	11091		epidote
99.00	102.00	118	6	181	9	101057		36	32	49	10			greater biotite flakes - gouge?
102.00	105.00	118	6	181	9	101057		36	32	49	10	33		epidote, biotite partly -> chlorite
105.00	108.00	118	6	182	9	101057	101061	36	32	49	10	11091	90	hematite
108.00	111.00	118	9	181	9	101057	102017	36	32	49	10	3	80	Biotite also in larger flakes, reddish plagioclase in amphibolite

111.00	114.00	118	9	181	9	101057	102017	36	32	49	10	3	80	Also pegmatite, possibly prehnite
114.00	117.00	118	9	182	9	101057	102017	36	32	49	10	3	90	biotite somewhat chloritisized, epidote
117.00	120.00	108	6	181	9	101057		36	32	49	10	16		chlorite
120.00	123.00	118	6	182	9	101057	102017	36	32	49	10	3	90	chlorite and epidote
123.00	126.00	118	6	181	9	101057	102017	36	32	49	10	3	90	chlorite and epidote
126.00	129.00	158	6	118	6	101057	102017	36	32	49	10	3	90	epidote, biotite also in greater flakes
129.00	132.00	118	6	118	6	101051	102017	36	32	49	10	3	70	some chlorite, biotite in greater flakes
132.00	135.00	128	9	118	9	101057	102017	36	32	49	10	3	90	2mm thin prehnite vein ???
135.00	138.00	182	6	182	9	101057	102017	36	32	49	10	3	90	epidote
138.00	141.00	182	6	182	9	101057	102017	36	32	49	10	3	90	epidote, hematite
141.00	144.00	118	9	118	9	101057	102017	36	32	49	10	3	90	very little epidote. Amphibolite with red plagioclase
144.00	147.00	118	9	118	6	101057	102017	36	32	49	3	10	70	also some pegmatite
147.00	150.00	108	9	118	9	101057	102017	36	32	49	10	11091		prehnite? Some hematite
150.00	153.00	118	6	118	9	101057	102017	36	32	49	10	33	90	also some pegmatite
153.00	156.00	118	6	118	9	101057	102017	36	32	49	10	3	80	also some pegmatite
156.00	159.00	118	6	118	9	101057		36	32	49	10	3		some epidote and prehnite?
159.00	162.00	118	6	111	9	101057		36	32	49	10			
162.00	165.00	108	2	108	9	101057	102017	36	32	49	10	3		biotite also in bigger flakes
165.00	168.00	108	6	108	9	101057		36	32	49	10			
168.00	171.00	108	6	108	9	101057	101061	36	32	49	10		90	
171.00	174.00	108	6	118	9	101057		36	32	49	10	33		
174.00	177.00	118	6	118	9	101057	102017	36	32	49	10	16	90	also some pegmatite
177.00	180.00	118	6	118	9	101057		36	32	49	10			
180.00	183.00	118	6	118	9	101057		36	32	49	10			
183.00	186.00	181	6	182	6	101051		36	32	49	10	33		
186.00	189.00	181	6	182	6	101051	101057	36	32	49	10	33	50	
189.00	192.00	118	6	118	9	101057	101051	36	32	49	10	33	90	also a chlorite fracture with oxidized walls
192.00	195.00	118	6	118	9	101057		36	32	49	10	11019		
195.00	198.00	118	2	118	9	101057	101061	36	32	49	10		90	
198.00	201.00	118	6	181	8	101057	101061	36	32	49	10		50	Pegmatite seems to be overrepresentated in the sample
201.00	204.00	118	2	181	8	101057	101061	36	32	49	10	33	90	
204.00	207.00	108	2	118	9	101057	101061	36	32	49	10	11091	90	greenish, almost aphanitic mineral
207.00	210.00	118	6	118	9	101057		36	32	49	10			biotite also in aggregates
210.00	213.00	118	6	118	9	101057	101061	36	32	49	10		90	biotite also in aggregates
213.00	216.00	118	6	118	9	101057		36	32	49	10			biotite also in aggregates
216.00	219.00	118	6	118	9	101057	101061	36	32	49	10		90	biotite also in aggregates
219.00	222.00	118	6	118	9	101057		36	32	49	10	11091		biotite also in aggregates

Drill Cuttings Samp T - Drill cuttings sampling an analysis

HFM05, 2003-02-19 14:47:00 - 2003-02-26 14:47:00 (4.200 - 200.100 m)

From Length (m)	To Length (m)	Colour Code Unwashed (code)	Grainsize Code Unwashed (code)	Colour Code Washed (code)	Grainsize Code Washed (code)	Rocktype A (code)	Rocktype B (code)	Mineral 1 (code)	Mineral 2 (code)	Mineral 3 (code)	Mineral 4 (code)	Mineral 5 (code)	Rock type Distr. (%)	Comment
12.00	15.00	128	6	182	9	101057		36	32	49	10	33		biotite-> chlorite
15.00	18.00	128	6	102	9	101057		36	32	49	10	11091		biotite-> chlorite, X1= probably prehnite, green almost afanitic mineral that occurs in ve
18.00	21.00	128	6	182	9	101057		36	32	49	10	11091		biotite-> chlorite
21.00	24.00	128	6	181	9	101057		36	32	49	10	33		biotite-> chlorite
24.00	27.00	128	6	102	9	101057		36	32	49	10	11091		biotite-> chlorite, traces of pyrite
27.00	30.00	158	6	182	9	101057	102017	36	49	3	32	10	70	
30.00	33.00	118	6	181	9	101057	101061	36	32	49	10	27	70	biotite-> chlorite, chlorite also in fracture
33.00	36.00	118	6	181	9	101057		36	32	49	10			Iron hydroxide? Yellow-orange coloured aphanitic mineral. biotite also in bigger aggregate
36.00	39.00	128	6	182	9	101057		36	32	49	10	33		
39.00	42.00	118	6	118	9	101057	101061	36	32	49	10		90	biotite also in bigger aggregates
42.00	45.00	128	6	182	9	101057		36	32	49	10	11091		
45.00	48.00	182	9	182	9	101057		36	32	49	10	11091		biotite -> chlorite
48.00	51.00	118	6	181	9	101057		36	32	49	10	27		traces of X1, also traces of yellowish mineral ???
51.00	54.00	128	6	181	9	101057		36	32	49	10	27		also traces of yellowish mineral???
54.00	57.00	128	6	181	9	101057	101061	36	32	49	10	27	90	hematite in fractures
57.00	60.00	118	6	119	9	101057	102017	36	49	3	32	10	60	also blackish
60.00	63.00	118	6	118	9	101057	102017	36	32	49	3	10	90	biotite -> chlorite
63.00	66.00	118	9	158	9	101057	102017	36	32	49	3	10	90	calcite with serpentine?, prehnite? Very finegrained amphibolite in contact with granodior
66.00	69.00	118	6	108	9	101057		36	32	49	10			traces of amphibole, fine biotite
69.00	72.00	118	6	182	9	101057		36	32	49	10	33		possibly traces of "prehnite"
72.00	75.00	188	2	182	9	101057		36	32	49	10	27		hematite in fractures, "prehnite" in sealed fracture
75.00	78.00	108	2	181	9	101057		36	32	49	10	3		traces of "prehnite"
78.00	81.00	108	6	117	9	101057	101061	36	32	49	10	33		
81.00	84.00	108	2	118	9	101057	102017	36	32	49	10	3		dry sample
84.00	87.00	118	6	118	9	101057	102017	36	32	49	10	3	90	humid sample
87.00	90.00	118	6	181	9	101057	102017	36	32	49	3	10	90	pyrite, uncertain "prehnite"
90.00	93.00	118	6	181	9	101057		36	32	49	10		90	dry sample
93.00	96.00	118	6	181	9	101057		36	32	49	10			humid sample
96.00	99.00	118	6	181	9	101057	102017	36	32	49	3	10		traces of calcite, pyrite, "prehnite"
99.00	102.00	182	6	182	9	101057		36	32	49	10	33		"prehnite"
102.00	105.00	118	6	128	6	101057	101051	36	32	49	10		90	finegrained, grey granitoid, feldspar-rich, little biotite, some bigger crystals of red fe
105.00	108.00	258	6	118	9	101057	102017	36	32	49	10		80	amphibolite is biotite-altered. Rich in biotite
108.00	111.00	118	6	181	9	101057	101061	36	32	49	10		90	
111.00	114.00	118	6	118	9	101057		36	32	49	10			traces of X2(Fe-hydroxid?), X3 (gult mineral) and Fe-sulfid
114.00	117.00	108	2	118	9	101057		36	32	49	10			

117.00	120.00	118	2	101	8	101057	101061	36	32	49	10		70	yellow-greenish mineral, very fine grained in pegmatite. Seems too yellow to be epidote?
120.00	123.00	118	2	117	8	101061	101057	36	32	49	10	33	70	yellow-greenish mineral, very fine grained in pegmatite. Seems too yellow to be epidote?
123.00	126.00	258	2	219	9	101057	102017	36	32	49	10		70	and pegmatite (33/33/34?), lots of biotite m.125-126
126.00	129.00	118	6	118	9	101057	102017	36	32	49	10	11091	90	and pegmatite(80/10/10?), lots of biotite m 126-126,5
129.00	132.00	108	2	128	9	101057		36	32	49	10			
132.00	135.00	118	6	118	9	101057	102017	10	49	36	32	3	80	amphibolite is biotite-altered and schistose?
135.00	138.00	118	6	218	6	101057	102017	10	49	3	36	32	60	amphibolite is biotite-altered and schistose?, traces of yellow-greenish mineral
138.00	141.00	118	6	182	9	101057		36	32	49	10			
141.00	144.00	128	6	182	9	101057		36	32	49	10			
144.00	147.00	108	6	118	9	101057		36	32	49	10			
147.00	150.00	108	2	108	9	101057	102017	36	32	49	10	3	70	amphibole is partly altered to biotite, perhaps some epidote, very white feldspar
150.00	152.70	118	6	108	9	101057	102017	49	3	32	36	10	60	
152.70	155.00	102	8	102	9	101057		36	32	49	10	11091		Washed sample?, biotite partly altered to chlorite. Fragments of aphanitic to finegrained
155.00	158.00	128	6	181	9	101057	101061	36	32	49	10	11091	90	perhaps traces of epidote, biotite also in bigger aggregates, some red grains (as in secti
158.00	161.00	118	6	118	9	101057		36	32	49	10			biotite partly altered to biotite
161.00	164.00	108	6	118	9	101057		36	32	49	10			
164.00	167.00	118	6	118	6	101057		36	32	49	10			
167.00	170.00	118	6	118	9	101057		36	32	49	10	11091		
170.00	173.00	118	6	118	6	101057		36	32	49	10	33		
173.00	176.00	118	6	118	9	101057		36	32	49	10	33		pure rock dominates, traces of epidote (?) and reddish rock fragment
176.00	179.00	118	6	118	9	101057		36	32	49	10	11091		perhaps traces of microgranite
179.00	182.00	128	6	182	9	101057	101061	36	32	49	10			
182.00	185.00	128	6	118	9	101057		36	32	49	10			
185.00	188.00	108	6	108	9	101057	102017	36	32	49	10	3	90	
188.00	191.00	108	6	108	9	101057	102017	36	32	49	10	3	80	traces of "prehnite"
191.00	194.00	118	6	118	9	101057	102017	36	32	49	10	3	90	
194.00	197.00	118	6	108	9	101057	102017	49	3	32	36	10	70	traces of chlorite, calcite. More radioactive minerals? The untreated sample has fine biot
197.00	200.00	118	6	108	9	101057		36	32	49	10			traces of chlorite, calcite, pyrite and finegrained rock as in 152.7-155m. More radioactiv

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