

Forsmark site investigation

Geophysical borehole logging in boreholes KFM08C, KFM10A, HFM30, HFM31, HFM33, HFM34, HFM35 and HFM38

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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 authors and do not necessarily coincide with those of the client.

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Abstract

Geophysical borehole logging has been performed in boreholes KFM08C, KFM10A, HFM30, HFM31, HFM33, HFM34, HFM35 and HFM38 all situated in Forsmark, Sweden.

The objective of the survey is to determine the physical properties of the rock mass around the borehole, e.g. to determine rock types and quantify the fracture frequency and localise deformation zones in the rock. Geophysical borehole logging was used to measure changes in physical properties in the borehole fluid and the bedrock surrounding the boreholes.

All boreholes were recorded from Top Of Casing (TOC). The logging in KFM08C was recorded to approximately 950 m, KFM10C was recorded to approximately 500 m, HFM30 was recorded to approximately 200 m, HFM31 was recorded to approximately 200 m, HFM33 was recorded to approximately 140 m, HFM34 was recorded to approximately 200 m, HFM35 was recorded to approximately 200 m and HFM38 was recorded to approximately 195 m.

The present report comprises a description of the applied equipment and the performed logging program, the fieldwork, data delivery and a presentation and discussion of the results.

Composite sheets of all the processed logs are included in Appendix 1–8.

Sammanfattning

Geofysisk borrhålsloggning har genomförts i borrhålen KFM08C, KFM10A, HFM30, HFM31, HFM33, HFM34, HFM35 och HFM38 i Forsmark.

Syftet med geofysisk borrhålsloggning är att bestämma bergets fysikaliska egenskaper för att bestämma bergartsfördelningen i det genomborrade bergpartiet samt att kvantifiera sprickfrekvensen och att lokalisera deformationszoner. Med geofysisk borrhålsloggning mäts bergets och borrhålsvattnets fysikaliska egenskaper i borrhålet och omgivande berg.

Den geofysiska borrhålsloggningen genomfördes i KFM08C från TOC (Top Of Casing, överkanten på det borrhör som sticker upp över markytan) till ca 950 m, i KFM10A från TOC till ca 500 m, i HFM30 från TOC till ca 200 m, i HFM31 från TOC till ca 200 m, i HFM33 från TOC till ca 140 m, i HFM34 från TOC till ca 200 m, i HFM35 från TOC till ca 200 m och i HFM38 från TOC till ca 195 m.

Rapporten beskriver använd utrustning, genomfört loggningsprogram, fältarbete, leverans av data och en diskussion av resultatet.

Processerade loggar presenteras i Appendix 1–8.

Contents

1	Introduction	7
2	Objective and scope	17
3	Equipment	19
4	Execution	21
4.1	General	21
4.2	Nonconformities	21
5	Results	23
5.1	Presentation	23
5.2	Orientation, alignment and stretch of logs	23
5.2.1	Orientation of images	23
5.2.2	Overlapping data	23
5.2.3	Alignment of data	24
5.2.4	Stretch of logs	24
5.2.5	Removing of data	24
5.2.6	Repicking of sonic log	24
5.3	Calculated log curves	24
5.3.1	Calculation of coordinates	24
5.4	Borehole KFM08C	24
5.5	Borehole KFM10A	26
5.6	Borehole HFM30	26
5.7	Borehole HFM31	27
5.8	Borehole HFM33	27
5.9	Borehole HFM34	27
5.10	Borehole HFM35	27
5.11	Borehole HFM38	27
6	Data delivery	29
Appendix 1	Borehole KFM08C. Drawing no. 1.1. Borehole logs	33
Appendix 2	Borehole KFM10A. Drawing no. 2.1. Borehole logs	45
Appendix 3	Borehole HFM30. Drawing no. 3.1. Borehole logs	53
Appendix 4	Borehole HFM31. Drawing no. 4.1. Borehole logs	57
Appendix 5	Borehole HFM33. Drawing no. 5.1. Borehole logs	61
Appendix 6	Borehole HFM34. Drawing no. 6.1. Borehole logs	65
Appendix 7	Borehole HFM35. Drawing no. 7.1. Borehole logs	69
Appendix 8	Borehole HFM38. Drawing no. 8.1. Borehole logs	73

1 Introduction

This document reports the results gained by the geophysical borehole logging in boreholes KFM08C, KFM10A, HFM30, HFM31, HFM33, HFM34, HFM35 and HFM38, which is one of the activities performed within the site investigation at Forsmark. The work was carried out in accordance with activity plan AP PF 400-06-050 (SKB internal controlling document). In Table 1-1 controlling documents for performing this activity are listed.

All measurements were conducted by RAMBØLL during the period June 6 to 8 and July 18 to 22, 2006. The boreholes were recorded from Top Of Casing (TOC) to the bottom of the boreholes. The location of the boreholes is shown in Figure 1-1. The technical data from the boreholes is shown in Table 1-2 and in Figure 1-2 to Figure 1-9.

The delivered raw and processed data have been inserted in the database of SKB (SICADA) and data are traceable by the activity plan number.

Table 1-1. Controlling documents for the performance of the activity (SKB internal controlling documents).

Activity plan	Number	Version
Geofysisk borrhålsloggning i KFM08C, KFM10A, HFM30, HFM31, HFM33, HFM34, HFM35 och HFM38	AP PF 400-06-050	1.0
Method descriptions	Number	Version
Metodbeskrivning för geofysisk borrhålsloggning	SKB MD 221.002	2.0
Metodbeskrivning för krökningsmätning av hammar- och kärnborrhål	SKB MD 224.001	1.0

Table 1-2. Technical data for the boreholes.

	KFM08C	KFM10A	HFM30	HFM31	HFM33	HFM34
Coordinates (RT90)	6700495.88 1631187.57	6698629.17 1631715.90	6697930.95 1631819.57	6700860.44 1629207.28	6701042.57 1632222.99	6701325.06 1632470.21
Elevation (RHB70)	2.47	4.51	3.13	6.07	2.62	2.45
Azimuth	35.9	10.4	28.8	311.8	271.6	30.5
Inclination	-60.46	-50.05	-55.50	-69.23	-58.97	-58.65
Length (m)	951.08	500.16	200.75	200.75	140.20	200.75
Casing Length (m)	102.23	62.85	18.03	9.03	12.35	12.08
Borehole diameter (mm)	77.3	75.8	138.7	138.5	139.0	136.8

	HFM35	HFM38
Coordinates (RT90)	6701555.86 1632320.51	6700701.28 1631301.71
Elevation (RHB70)	1.90	2.21
Azimuth	32.96	93.62
Inclination	-59.19	-54.45
Length (m)	200.75	200.75
Casing Length (m)	12.04	9.05
Borehole diameter (mm)	135.6	136.0

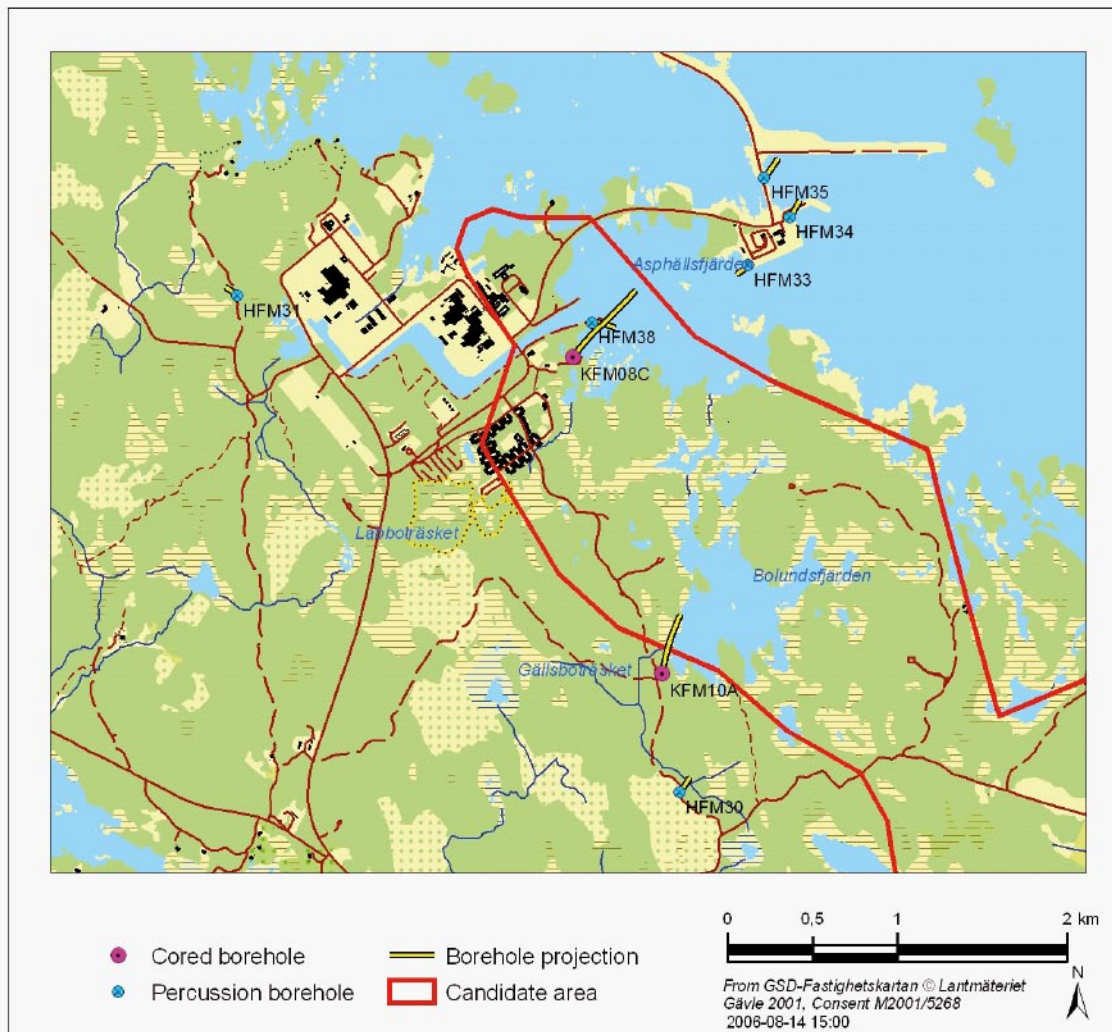
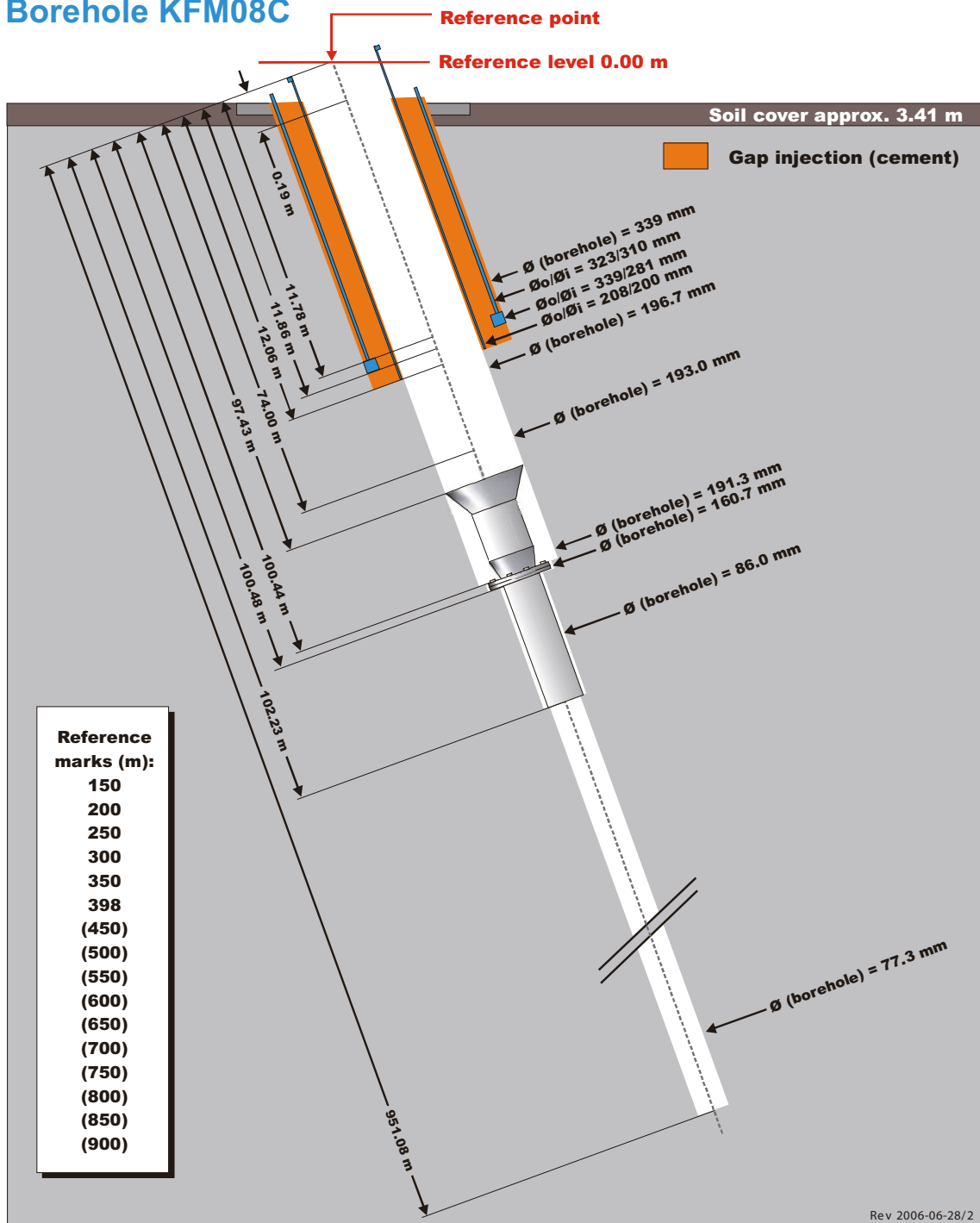


Figure 1-1. General overview over the Forsmark area showing the location of the boreholes.

Technical data

Borehole KFM08C



Drilling reference point

Northing: 6700495.88 (m), RT90 2,5 gon V 0:-15

Easting: 1631187.57 (m), RT90 2,5 gon V 0:-15

Elevation: 2.47 (m), RHB 70

Orientation

Bearing (degrees): 35.88°

Inclination (degrees): -60.46°

Borehole

Length: 951.08 m

Percussion drilling period

Drilling start date: 2005-12-06

Drilling stop date: 2005-12-19

Core drilling period

Drilling start date: 2006-01-30

Drilling stop date: 2006-05-09

Figure 1-2. Technical description of borehole KFM08C.

Technical data

Borehole KFM10A

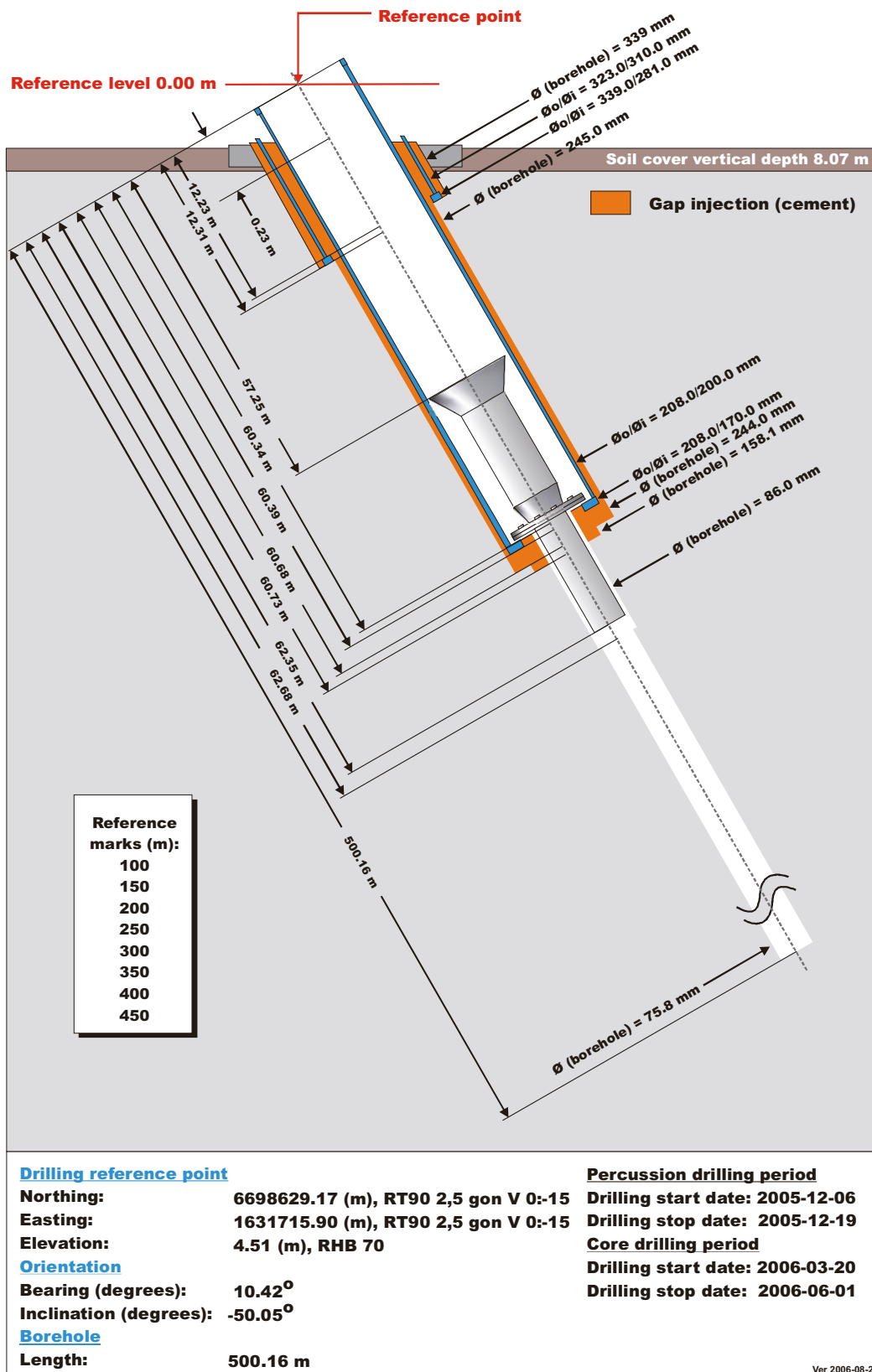
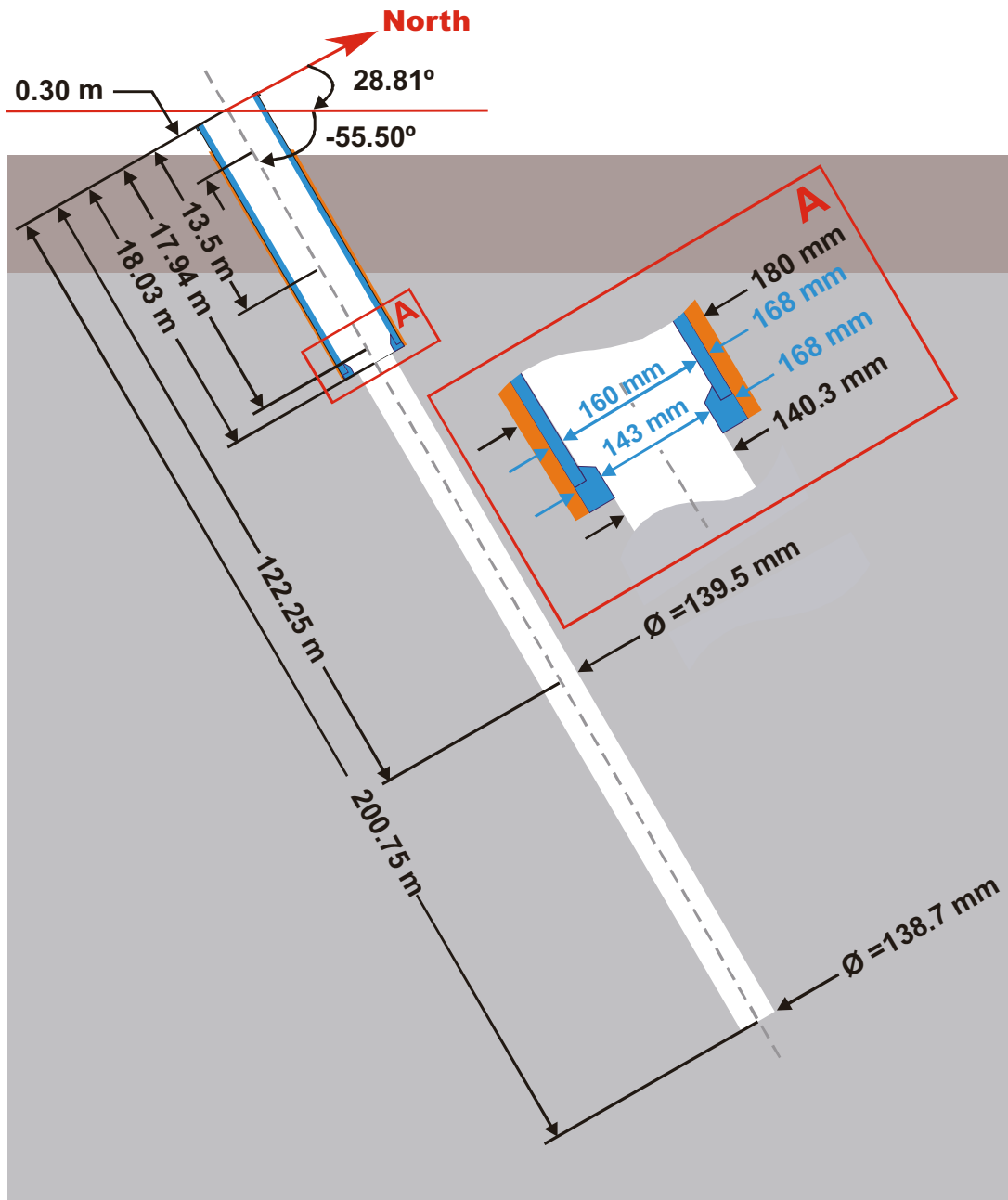


Figure 1-3. Technical description of borehole KFM10A.

Technical data

Borehole HFM30



Drilling reference point

Northing: 6697930.952 (m), RT90 2,5 gon V 0:-15
 Easting: 1631819.567 (m), RT90 2,5 gon V 0:-15
 Elevation: 3.128 (m), RHB 70

Drilling period

Drilling start date: 2006-05-03
 Drilling stop date: 2006-05-11

rev 2006-05-22

Figure 1-4. Technical description of borehole HFM30.

Technical data

Borehole HFM31

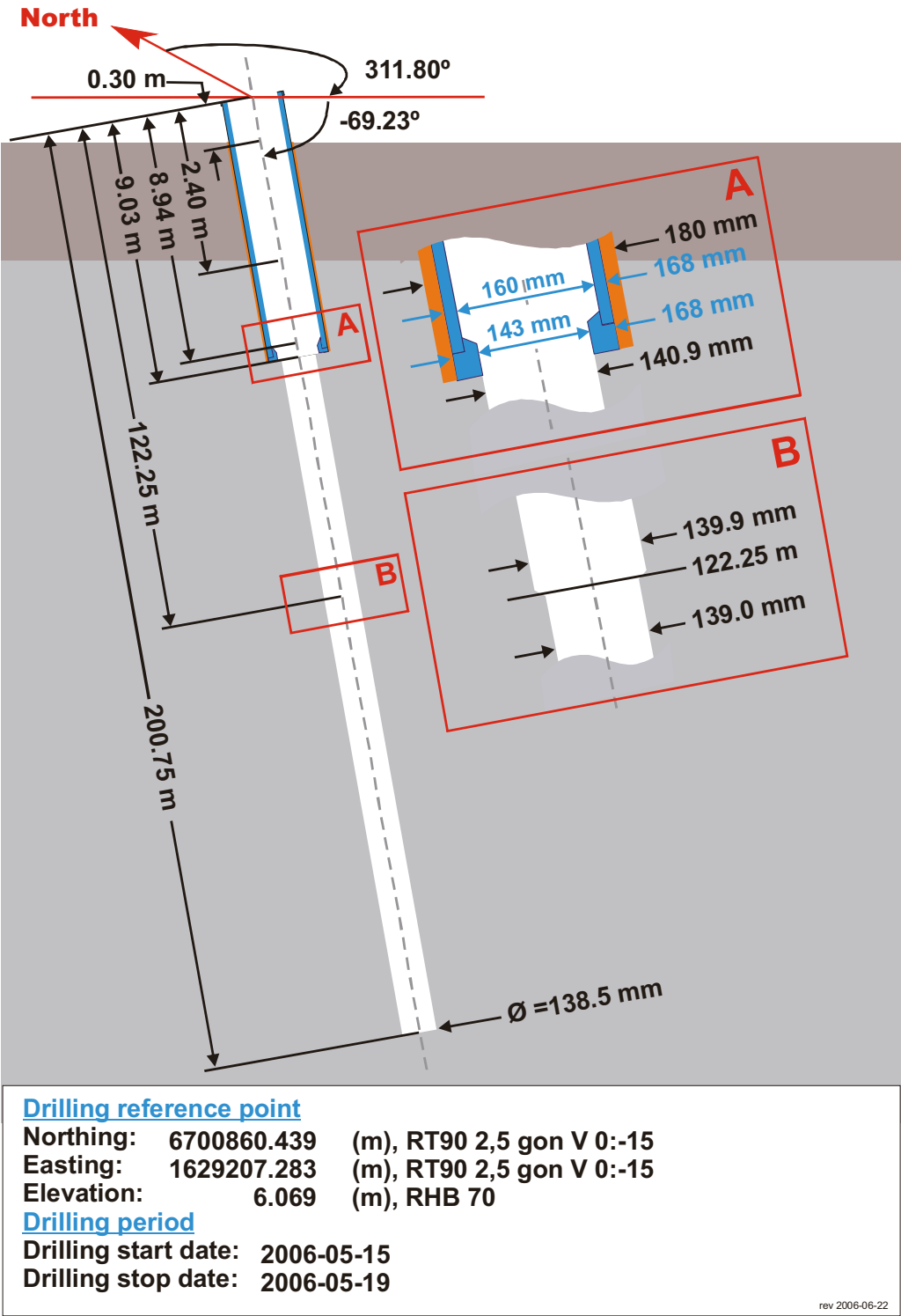


Figure 1-5. Technical description of borehole HFM31.

Technical data

Borehole HFM33

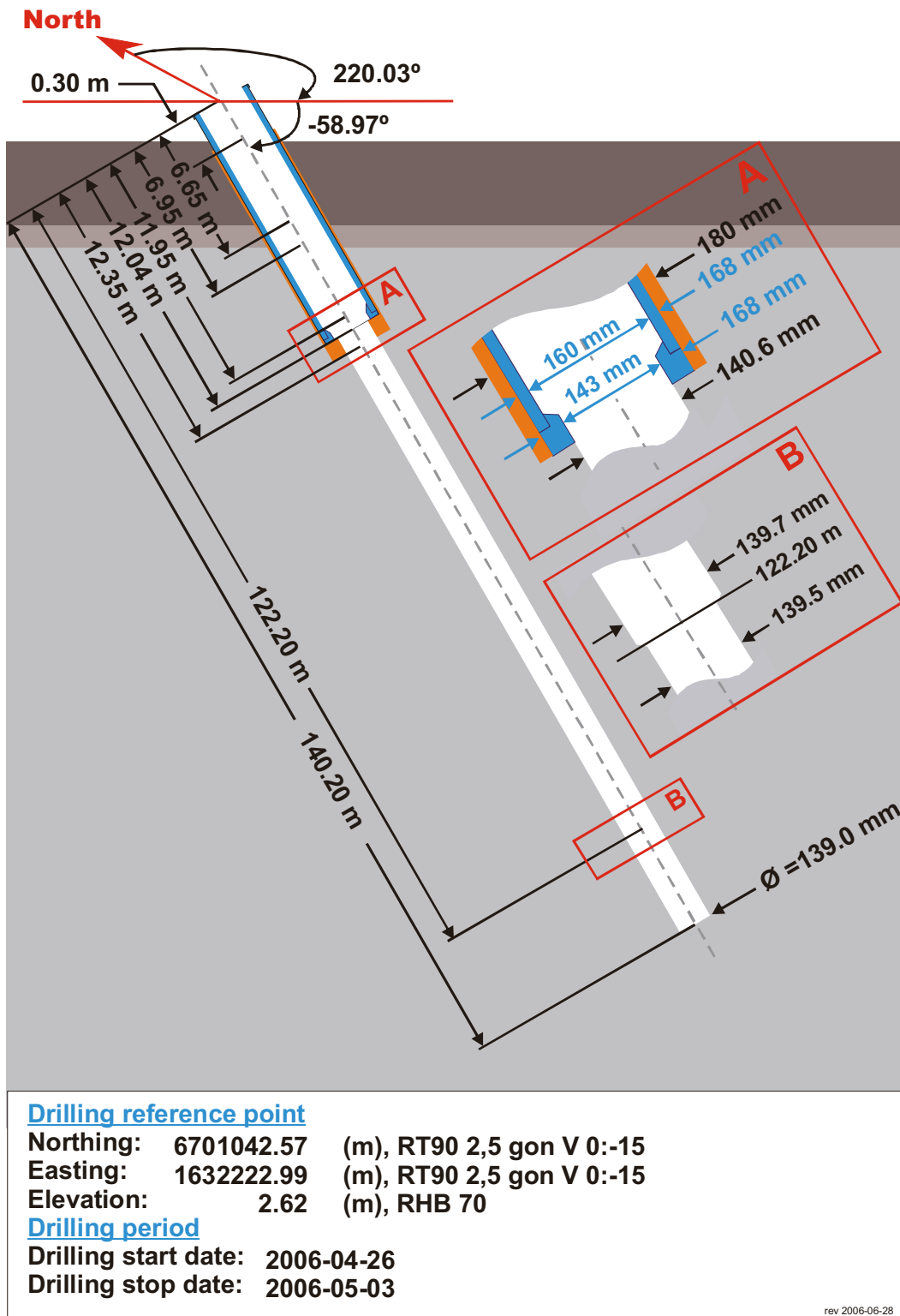


Figure 1-6. Technical description of borehole HFM33.

Technical data

Borehole HFM34

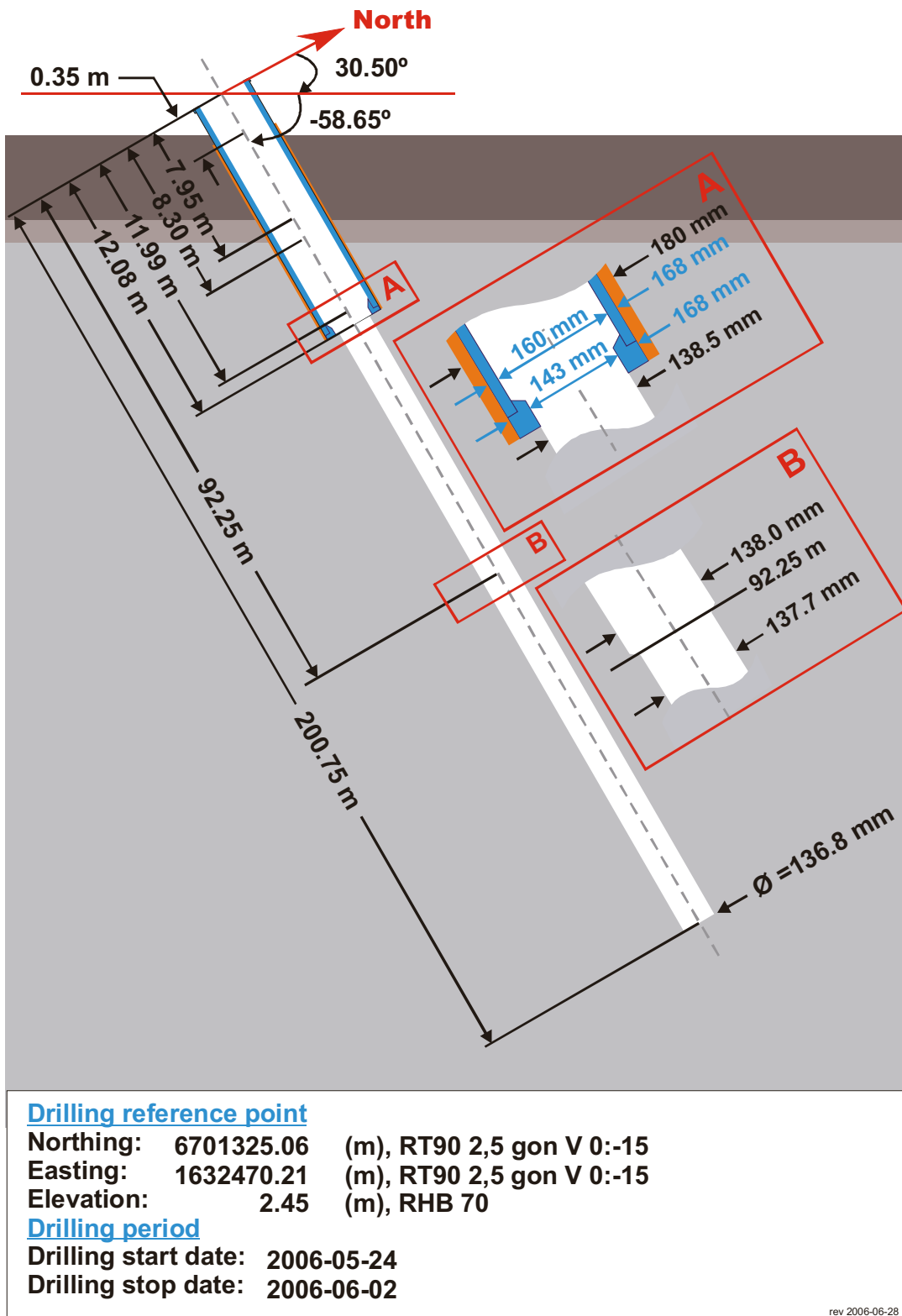
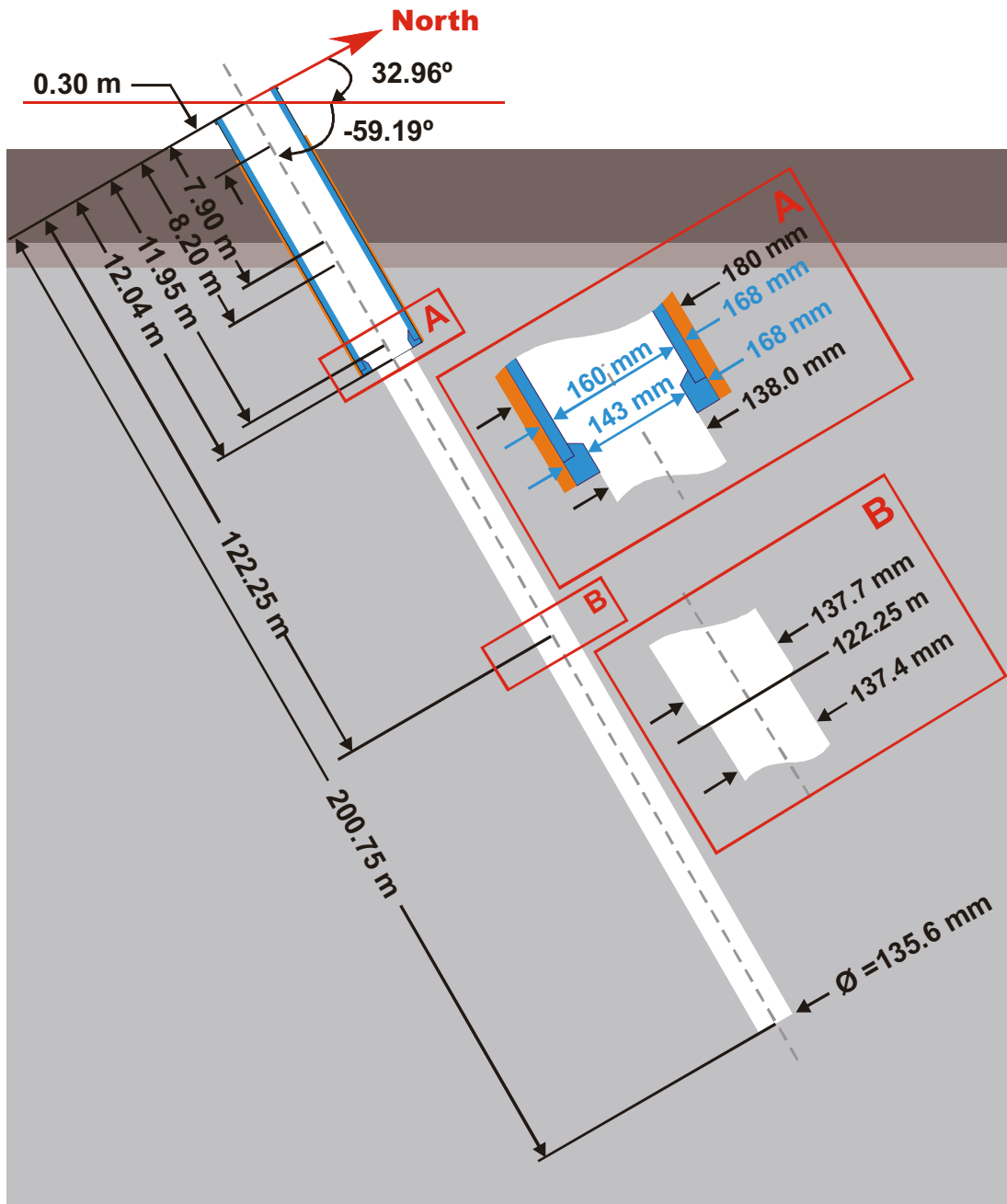


Figure 1-7. Technical description of borehole HFM34.

Technical data

Borehole HFM35



Drilling reference point

Northing: 6701555.86 (m), RT90 2,5 gon V 0:-15
 Easting: 1632320.51 (m), RT90 2,5 gon V 0:-15
 Elevation: 1.90 (m), RHB 70

Drilling period

Drilling start date: 2006-06-06
 Drilling stop date: 2006-06-14

rev 2006-06-24

Figure 1-8. Technical description of borehole HFM35.

Technical data

Borehole HFM38



Drilling reference point

Northing: 6700701.28 (m), RT90 2,5 gon V 0:-15
 Easting: 1631301.71 (m), RT90 2,5 gon V 0:-15
 Elevation: 2.21 (m), RHB 70

Drilling period

Drilling start date: 2006-06-14
 Drilling stop date: 2006-06-22

rev 2006-06-24

Figure 1-9. Technical description of borehole HFM38.

2 Objective and scope

The objective of the survey is to receive information of the borehole itself, and from the rock mass around the borehole. Geophysical borehole logging was used to measure changes in physical properties in the borehole fluid and the bedrock surrounding the boreholes. Acoustic televiewer was used for determination of the deviation of the borehole (azimuth and inclination) as well as to determine the length marks in the core-drilled boreholes, KFM08C and KFM10A.

This field report describes the equipment used as well as the measurement procedures. Geophysical borehole logging data is presented in graphs as a function of borehole length on drawings listed in Table 2-1.

Table 2-1. Appendix and drawing no.

Borehole	Drawing no.	Appendix
KFM08C	1.1	1
KFM10A	2.1	2
KFM30	3.1	3
KFM31	4.1	4
KFM33	5.1	5
KFM34	6.1	6
KFM35	7.1	7
KFM38	8.1	8

3 Equipment

The geophysical borehole logging program were performed with 7 multi tool probes and resulted in a suite of 16 log types, listed in Table 5-1 in Chapter 5. The tools and recorded logs are listed in Table 3-1.

Table 3-1. Logging tools and logs recorded.

Tool	Recorded logs	Dimension	Source detector spacing and type	Tool position in borehole	Tool used in borehole
Century 8144. Normal resistivity.	Normal resistivity (16 and 64 inch), single point resistance and natural gamma.	237 · 5.3 cm			All boreholes
Century 8622. Magnetic susceptibility.	Magnetic susceptibility, natural gamma.	203 · 4.1 cm			All boreholes
Century 9042. Fluid temperature and fluid resistivity.	Fluid temperature, fluid resistivity and natural gamma.	137 · 4.1 cm			All boreholes
Century 9072. 3 m focused guard.	3 m focused guard log resistivity and natural gamma.	310 · 6.4 cm			All boreholes
Century 9139. Compensated gamma density.	Compensated Gamma density, natural gamma, 140 cm focused guard log resistivity, 1-arm caliper.	380.3 · 5.6 cm	20.3 cm 125 m 200 mCi Cs137	Sidewall. Gamma source focused.	All boreholes
Century 9310. Sonic.	Full wave form travel-time providing P and S-wave velocity picking, compensated P-wave travel-time and natural gamma.	300 · 6.0 cm	Near 91.4 cm Far 121.9 cm	Centralized.	All boreholes
RG 25 112 000. HiRAT Acoustic Televiewer.	Full waveform acoustic amplitude and travel-time, 360° orientated acoustic image, 360° very high resolution caliper, borehole azimuth and dip and natural gamma.	246 · 4 cm		Centralized.	All boreholes

4 Execution

4.1 General

In general the measurement procedures follow the SKB method description (MD 221.002, SKB internal controlling document). The logging program was executed in the period June 6 to 8 and July 18 to 22, 2006. All relevant logging events are described in the daily report sheets delivered to SICADA and are traceable by the activity plan number.

The fluid resistivity and temperature logs are recorded in downward direction, as the first log run. All other log types are recorded running the tool in upward direction in the borehole.

The applied logging equipment was calibrated and cleaned before arriving at the site according to SKB cleaning level 2 (SKB internal controlling document SKB MD 600.004). Furthermore, all equipment was wiped with alcohol before it was lowered into the borehole.

For control, each log run is normally recorded both in downward and in upward direction using the down run as a repeat section. For logging tool 9139 a repeated section is recorded in upward direction for control of the data. The position of the probe in the borehole is shown on both the recording computer and the winch. On the winch the tension of the cable is also shown. The winch will automatically stop, if the tension changes rapidly. The tension was recorded on all log runs using Century equipment, except for tool 9310.

All data was recorded with max. 10 cm sample interval. The speed of the logging for the 9139 tool was 5 m/min, for the 8622 tool 20 m/min and for all other tools 10 m/min, except for the HiRAT Acoustic tool where the speed was 2 m/min in borehole KFM08C and KFM10A.

4.2 Nonconformities

The logging has been performed in accordance with the activity plan AP PF 400-06-050.

5 Results

5.1 Presentation

All relevant logging events were described in the daily report sheets, which were delivered separately.

The logs presented in Appendix 1–8 are presented in Table 5-1.

5.2 Orientation, alignment and stretch of logs

5.2.1 Orientation of images

The orientation of the results from the HiRAT Acoustic tool, are processed in the tool while recording, using the magnetometers and accelerometers in the tool.

5.2.2 Overlapping data

If the log data from one probe have been recorded in more than one file, the files are merged using events in both files. Overlapping in data is always used from the topmost-recorded file (overlapping data are never the mean value from two log runs).

Table 5-1. Logs presented in drawings no. 1.1 through 8.1 in Appendices 1 to 8.

Log	Log name short	Unit	Tool	Recorded/ calculated in borehole
Fluid temperature	TEMP(FL)	Deg C	9042	All
Fluid resistivity	RES(FL)	Ohm-m	9042	All
Normal resistivity 16 inch	RES(16N)	Ohm-m	8144	All
Normal resistivity 64 inch	RES(64N)	Ohm-m	8144	All
Lateral resistivity	LATERAL	Ohm-m	8144	All
Single point resistance	SPR	Ohm	8144	All
Self potential	SP	mV	8144	All
Magnetic susceptibility	MAGSUSCEP	SI·10 ⁻⁵	8622	All
Caliper, 1-arm	CALIPER1	mm	9139	All
Gamma-gamma density	DENSITY	kg/m ³	9139	All
Focused guard log resistivity, 127 cm	RES(SG)	Ohm-m	9139	All
Natural gamma	GAM(NAT)	μR/h	9072	All
Focused guard log resistivity, 300 cm	RES(DG)	Ohm-m	9072	All
P-wave velocity	P-VEL	m/s	9310	All
Full wave form, near receiver	AMP(N)	μs	9310	All
Full wave form, far receiver	AMP(F)	μs	9310	All
Caliper, high resolution. 360°	CALIPER 3D	mm	HiRAT	All
High resolution 1D Caliper	CALIPER MEAN	mm	HiRAT	All
Borehole azimuth magnetic north	AZIMUTH MN	Deg	HiRAT	All
Borehole inclination from horizontal	DIP	Deg	HiRAT	All
360° orientated acoustic travel time	TRAVEL TIME	100 ns	HiRAT	All
360° orientated acoustic travel time	AMPLITUDE	–	HiRAT	All

5.2.3 Alignment of data

In order to obtain an exact length calibration, the track marks made while drilling are used. In boreholes without track marks, gamma events in the top and the bottom of the borehole are used. The connection between the track marks and the logs is obtained from the HiRAT Acoustic tool. The lengths from the track marks and from the HiRAT tool are used to make a new length scale in WellCAD. All log files are shifted using the new length scale.

5.2.4 Stretch of logs

There is a minor difference in the length registration between up- and down runs for the used winch. The size of the defect is about 1.5 m/km. To compensate for this the logs are stretched using another new length scale for each tool. The length scale is made by using gamma events from the tool compared with the same gamma events from the HiRAT tool. The events in both files are matched, and the new length scale is made and added to the log. The bottom of the borehole is considered in stretching the logs in case that no data will occur below the bottom of the borehole.

5.2.5 Removing of data

The processing of the data includes removing of spikes, negative and unrealistic values and data in the casing.

5.2.6 Repicking of sonic log

The sonic velocity is normally calculated using an automatic picking routine in the sonic tool, 9310. In inclined boreholes the routine is often picking the wrong arrivals, due to so-called “road noise”. Therefore the sonic logs have been manually re-picked in WellCAD using the full wave signal.

5.3 Calculated log curves

The different logs are calculated as described in Table 5-2.

5.3.1 Calculation of coordinates

To convert the measured azimuth and inclination to grid-coordinates, one needs to take into account the magnetic declination at the site at the time of data acquisition. The actual declination was found by means of the current International Geomagnetic Reference Field (IGRF). The actual values can be found below. Disturbances from solar storms etc were not taken into account. By means of the “Radius Of Curvature” method implemented in WellCad, the azimuth and inclination were converted to northing, easting and TVD coordinates relative to the top of the borehole. In the same calculation, the magnetic declination was added. Finally, the relative coordinates were added to the given coordinate in RT90 for the top of the borehole. The coordinates were calculated from 5 m below the casing bottom.

5.4 Borehole KFM08C

In order to obtain an exact length calibration in borehole KFM08C, the reference track marks made while drilling are used. The correlation between the track marks and the logs is obtained from the HiRAT Acoustic tool.

The reference track marks in the borehole and the recorded track marks from the HiRAT are observed at the length given in Table 5-3.

Table 5-2. Calculated log curves.

Log	Description of log calculation
Caliper, 1-arm	The Caliper was converted from [cm] to [mm] units by multiplying [cm] with 10.
Gamma-gamma density	The Gamma-gamma was converted from [g/cm ³] to [kg/m ³] units by multiplying with 1,000.
Focused guard log resistivity, 140 cm	–
Natural gamma	The natural gamma log was converted from CPS to μ R/h by multiplying the constant 0.077. This constant was computed from the logs previously performed in borehole KLX02 located in Oskarshamn.
Fluid temperature	–
Fluid resistivity	–
Normal resistivity 16 inch	–
Normal resistivity 64 inch	–
Lateral resistivity	–
Single point resistance	–
Self-potential	The SP value was converted from [mV] to [V] by dividing with 1,000
Focused guard log resistivity, 300 cm	–
P-wave velocity	The P-VEL velocity is calculated using the difference in distance between the far and near receiver divided by time difference between the first arrival from the far and near signal. $(121.9 \text{ cm} - 91.4 \text{ cm}) / (\text{Time}(\text{far}) - \text{Time}(\text{near}))$.
Full wave form, near receiver	–
Full wave form, far receiver	–
Magnetic susceptibility	The magnetic susceptibility was converted for CGS units to SI units by multiplying the CGS value by 4π .
Caliper, high resolution. 360°. CALIPER 3D	The Caliper 3D is calculated using the acoustic travel time and the velocity in the borehole fluid. The velocity in the fluid is calculated using the fluid temperature and fluid conductivity.
High resolution 1D Caliper CALIPER MEAN	The Caliper mean is calculated using the mean travel time from the acoustic televiewer, the fluid temperature, fluid velocity and the internal travel time in the acoustic televiewer.
Borehole azimuth magnetic north	See 5.3.1
Borehole Inclination from lateral	See 5.3.1
360° orientated acoustic travel time	–
360° orientated acoustic amplitude	–

Table 5-3. The reference track marks in the borehole and the recorded track marks from the HiRAT in borehole KFM08C.

Reference mark	HiRAT recorded
102.23	102.23
150.00	150.131
200.00	200.267
250.00	250.328
300.00	300.435
350.00	350.565
398.00	398.688
450.00	450.802
600.00	601.28
750.00	751.627
800.00	801.822
850.00	851.92
900.00	902.12

To compensate for the difference between the reference track marks and the recorded track marks, the logs are stretched. The result from the stretching is a new length scale. The new length scale is applied to the HiRAT file. In this way a perfect match between given length of the reference marks and the recorded data is obtained. By means of alignment of the observed gamma events in KFM08C, between all log runs, the obtained reference mark correlation is transferred to the other logs.

The complete log suite for borehole KFM08C is presented as composite log sheets in drawing 1.1 in Appendix 1. The logs presented in drawing no. 1.1 are listed in Table 5-1.

5.5 Borehole KFM10A

In order to obtain an exact length calibration in borehole KFM10A, the reference track marks made while drilling are used. The correlation between the track marks and the logs is obtained from the HiRAT Acoustic tool.

The reference track marks in the borehole and the recorded track marks from the HiRAT are observed at the length values given in Table 5-4.

To compensate for the difference between the reference track marks and the recorded track marks the logs are stretched. The result from the stretching is a new length scale. The new length scale is applied to the HiRAT file. In this way a perfect match between given length values of the reference marks and the recorded data is obtained. By means of alignment of the observed gamma events in KFM10A, between all log runs, the obtained reference mark correlation is transferred to the other logs.

The complete log suite for borehole KFM10A is presented as composite log sheets in drawing 2.1 in Appendix 2. The logs presented in drawing no. 2.1 are listed in Table 5-1.

5.6 Borehole HFM30

Using the natural gamma from the 9042 as reference, the natural gamma logs from the other probes are aligned to the same length. A new length scale is added to each log and afterwards the logs are stretched using different gamma events.

The complete log suite for borehole HFM30 is presented as composite log sheets in drawing 3.1 in Appendix 3. The logs presented in drawing no. 3.1 are listed in Table 5-1.

Table 5-4. The reference track marks in the borehole and the recorded track marks from the HiRAT in borehole KFM10A.

Reference mark	HIRAT recorded
100.00	100
150.00	150.12
200.00	200.25
250.00	250.371
300.00	300.477
350.00	350.,572
400.00	400.735
450.00	450.825

5.7 Borehole HFM31

Using the natural gamma from the 9042 as reference, the natural gamma logs from the other probes are aligned to the same length. A new length scale is added to each log and afterwards the logs are stretched using different gamma events.

The complete log suite for borehole HFM31 is presented as composite log sheet in drawing no. 4.1 in Appendix 4. The logs presented in drawing no. 4.1 are listed in Table 5-1.

5.8 Borehole HFM33

Using the natural gamma from the 9042 as reference, the natural gamma logs from the other probes are aligned to the same length. A new length scale is added to each log and afterwards the logs are stretched using different gamma events.

The complete log suite for borehole HFM33 is presented as composite log sheet in drawing no. 5.1 in Appendix 5. The logs presented in drawing no. 5.1 are listed in Table 5-1.

5.9 Borehole HFM34

Using the natural gamma from the 9042 as reference, the natural gamma logs from the other probes are aligned to the same length. A new length scale is added to each log and afterwards the logs are stretched using different gamma events.

The complete log suite for borehole HFM34 is presented as composite log sheet in drawing no. 6.1 in Appendix 6. The logs presented in drawing no. 6.1 are listed in Table 5-1.

5.10 Borehole HFM35

Using the natural gamma from the 9042 as reference, the natural gamma logs from the other probes are aligned to the same length. A new length scale is added to each log and afterwards the logs are stretched using different gamma events.

The complete log suite for borehole HFM35 is presented as composite log sheet in drawing no. 7.1 in Appendix 7. The logs presented in drawing no. 7.1 are listed in Table 5-1.

5.11 Borehole HFM38

Using the natural gamma from the 9042 as reference, the natural gamma logs from the other probes are aligned to the same length. A new length scale is added to each log and afterwards the logs are stretched using different gamma events.

The complete log suite for borehole HFM38 is presented as composite log sheet in drawing no. 8.1 in Appendix 8. The logs presented in drawing no. 8.1 are listed in Table 5-1.

6 Data delivery

The geophysical logging data, recorded in Century and Robertson format, were delivered directly after the termination of the field activities. The recorded data files used in the processing have also been delivered in WellCAD format, Table 6-1.

The delivered data have been inserted in the database (SICADA) of SKB and are traceable by the activity plan number.

The processed files shown on the drawings have been delivered in WellCAD, Table 6-2, and as EXCEL-files (one for each borehole) in SICADA format, Table 6-3.

Table 6-1. Recorded log files in Century or Robertson format used for processing.

Borehole	Probe	Log direction	WellCAD File	Description
KFM08C	8144	Up	KFM08C_07-18-06_11-50_8144C_01_4.37_951.59_ORIG.log	Start Length: 951.59 m End Length: 4.37 m
KFM08C	8622	Up	KFM08C_07-20-06_12-58_8622C_1_3.00_957.50_ORIG.log	Start Length: 957.5 m End Length: 3 m
KFM08C	9042	Down	KFM08C_07-18-06_08-42_9042C_01_0.42_951.02_ORIG.log	Start Length: 0.42 m End Length: 951.02 m
KFM08C	9072	Up	KFM08C_07-18-06_14-04_9072C_1_3.30_951.80_ORIG.log	Start Length: 951.8 m End Length: 3.3 m
KFM08C	9139	Up	KFM08C_07-19-06_18-10_9139A_02_3.49_952.97_ORIG.log	Start Length: 952.97 m End Length: 3.49 m
KFM08C	9310	Up	KFM08C_07-20-06_08-52_9310C2_02_150.40_951.72_ORIG.log	Start Length: 951.72 m End Length: 150.4 m
KFM08C	9310	Up	KFM08C_07-20-06_10-44_9310C2_02_3.24_212.55_ORIG.log	Start Length: 212.55 m End Length: 3.24 m
KFM08C	9310	Down	KFM08C_07-20-06_07-11_9310C2_02_0.24_946.25_ORIG.log	Start Length: 0.24 m End Length: 946.25 m
KFM08C	HiRAT	Up	KFM08C_HIRAT_180pixels_up_run2.HED	Start Length: 950 m End Length: 0 m
KFM08C	HiRAT	Up	KFM08C_HIRAT_180pixels_up_run5.HED	Start Length: 100 m End Length: 0 m
KFM10A	8144	Up	KFM10A_06-08-06_12-56_8144C_10_0.10_498.60_ORIG.log	Start Length: 498.6 m End Length: 0.1 m
KFM10A	8622	Up	KFM10A_06-08-06_19-18_8622C_10_-1.20_499.50_ORIG.log	Start Length: 499.5 m End Length: -1.2 m
KFM10A	9042	Down	KFM10A_06-08-06_11-18_9042C_10_0.20_499.90_ORIG.log	Start Length: 0.2 m End Length: 499.9 m
KFM10A	9072	Up	KFM10A_06-08-06_14-12_9072C_10_0.80_499.70_ORIG.log	Start Length: 499.7 m End Length: 0.8 m
KFM10A	9139	Up	KFM10A_06-08-06_15-48_9139A_10_2.10_499.60_ORIG.log	Start Length: 499.6 m End Length: 2.1 m
KFM10A	9310	Down	KFM10A_06-08-06_17-30_9310C2_10_0.20_500.20_ORIG.log	Start Length: 0.2 m End Length: 500.2 m
KFM10A	9310	Up	KFM10A_06-08-06_18-08_9310C2_10_-1.00_498.70_ORIG.log	Start Length: 498.7 m End Length: -1 m
KFM10A	HiRAT	Up	KFM10A_hirat_180pixels_up_run2.HED	Start Length: 496 m End Length: 0 m

Borehole	Probe	Log direction	WellCAD File	Description
HFM30	8144	Down	HFM30_06-07-06_15-11_8144C_.10_-0.40_199.90_ORIG.log	Start Length: -0.4 m End Length: 199.9 m
HFM30	8622	Up	HFM30_06-07-06_20-08_8622C_.10_-0.50_200.00_ORIG.log	Start Length: 200 m End Length: -0.5 m
HFM30	9042	Down	HFM30_06-07-06_14-29_9042C_.10_0.20_200.60_ORIG.log	Start Length: 0.2 m End Length: 200.6 m
HFM30	9072	Up	HFM30_06-07-06_16-27_9072C_.10_1.80_200.20_ORIG.log	Start Length: 200.2 m End Length: 1.8 m
HFM30	9139	Up	HFM30_06-07-06_17-06_9139A_.10_7.70_200.10_ORIG.log	Start Length: 200.1 m End Length: 7.7 m
HFM30	9310	Up	HFM30_06-07-06_15-52_9310C2_.10_0.30_199.20_ORIG.log	Start Length: 199.2 m End Length: 0.3 m
HFM30	HiRAT	Up	HFM30_hirat_180pixels_up_run1.HED	Start Length: 199 m End Length: 0 m
HFM31	8144	Up	HFM31_06-06-06_08-19_8144C_.10_-0.30_200.20_ORIG.log	Start Length: 200.2 m End Length: -0.3 m
HFM31	8622	Up	HFM31_06-06-06_11-27_8622C_.10_1.70_199.50_ORIG.log	Start Length: 199.5 m End Length: 1.7 m
HFM31	9042	Down	HFM31_06-06-06_07-13_9042C_.10_0.20_200.50_ORIG.log	Start Length: 0.2 m End Length: 200.5 m
HFM31	9072	Up	HFM31_06-06-06_08-58_9072C_.10_1.30_200.20_ORIG.log	Start Length: 200.2 m End Length: 1.3 m
HFM31	9139	Up	HFM31_06-06-06_09-50_9139A_.10_1.70_200.20_ORIG.log	Start Length: 200.2 m End Length: 1.7 m
HFM31	9310	Up	HFM31_06-06-06_10-52_9310C2_.10_2.00_199.40_ORIG.log	Start Length: 199.4 m End Length: 2 m
HFM31	HiRAT	Up	HFM31_hirat_180pixels_up_run1.HED	Start Length: 198 m End Length: 0 m
HFM33	8144	Up	HFM33_06-07-06_07-38_8144C_.10_1.10_139.50_ORIG.log	Start Length: 139.5 m End Length: 1.1 m
HFM33	8622	Up	HFM33_06-07-06_09-52_8622C_.10_1.10_139.50_ORIG.log	Start Length: 139.5 m End Length: 1.1 m
HFM33	9042	Down	HFM33_06-07-06_06-53_9042C_.10_1.80_140.10_ORIG.log	Start Length: 1.8 m End Length: 140.1 m
HFM33	9072	Up	HFM33_06-07-06_08-01_9072C_.10_1.40_140.00_ORIG.log	Start Length: 140 m End Length: 1.4 m
HFM33	9139	Up	HFM33_06-07-06_08-41_9139A_.10_1.40_139.70_ORIG.log	Start Length: 139.7 m End Length: 1.4 m
HFM33	9310	Up	HFM33_06-07-06_09-24_9310C2_.10_1.30_139.00_ORIG.log	Start Length: 139 m End Length: 1.3 m
HFM33	HiRAT	Up	HFM33_hirat_180pixels_up_run1.HED	Start Length: 137 m End Length: 113 m
HFM33	HiRAT	Up	HFM33_hirat_180pixels_up_run2.HED	Start Length: 113 m End Length: 0 m
HFM34	8144	Up	HFM34_06-06-06_15-35_8144C_.10_-0.50_200.20_ORIG.log	Start Length: 200.2 m End Length: -0.5 m
HFM34	8622	Up	HFM34_06-06-06_18-33_8622C_.10_-0.20_197.00_ORIG.log	Start Length: 197 m End Length: -0.2 m
HFM34	9042	Down	HFM34_06-06-06_14-44_9042C_.10_4.10_199.40_ORIG.log	Start Length: 4.1 m End Length: 199.4 m
HFM34	9072	Up	HFM34_06-06-06_16-15_9072C_.10_-0.30_199.60_ORIG.log	Start Length: 199.6 m End Length: -0.3 m

Borehole	Probe	Log direction	WellCAD File	Description
HFM34	9139	Up	HFM34_06-06-06_17-04_9139A_10_2.00_197.60_ORIG.log	Start Length: 197.6 m End Length: 2 m
HFM34	9310	Up	HFM34_06-06-06_18-00_9310C2_10_-0.30_196.40_ORIG.log	Start Length: 196.4 m End Length: -0.3 m
HFM34	HiRAT	Up	HFM34_hirat_180pixels_up_run1.HED	Start Length: 197 m End Length: 0 m
HFM35	8144	Up	HFM35_07-21-06_16-14_8144C_10_-0.50_201.60_ORIG.log	Start Length: 201.6 m End Length: -0.5 m
HFM35	8622	Up	HFM35_07-21-06_19-33_8622C_10_-0.50_198.80_ORIG.log	Start Length: 198.8 m End Length: -0.5 m
HFM35	9042	Down	HFM35_07-21-06_15-16_9042C_10_0.20_199.90_ORIG.log	Start Length: 0.2 m End Length: 199.9 m
HFM35	9072	Up	HFM35_07-21-06_16-49_9072C_02_-0.26_199.48_ORIG.log	Start Length: 199.48 m End Length: -0.26 m
HFM35	9139	Up	HFM35_07-21-06_17-24_9139A_02_8.05_199.46_ORIG.log	Start Length: 199.46 m End Length: 8.05 m
HFM35	9310	Down	HFM35_07-21-06_18-25_9310C2_10_9.20_199.00_ORIG.log	Start Length: 9.2 m End Length: 199 m
HFM35	9310	Up	HFM35_07-21-06_18-57_9310C2_10_-0.40_198.40_ORIG.log	Start Length: 198.4 m End Length: -0.4 m
HFM35	HiRAT	Up	HFM35_HIRAT_180pixels_up_run2.HED	Start Length: 200 m End Length: 0 m
HFM38	8144	Up	HFM38_07-20-06_19-39_8144C_02_3.28_194.64_ORIG.log	Start Length: 194.64 m End Length: 3.28 m
HFM38	8622	Up	HFM38_07-21-06_09-55_8622C_10_-0.40_194.80_ORIG.log	Start Length: 194.8 m End Length: -0.4 m
HFM38	9042	Down	HFM38_07-20-06_18-25_9042C_02_0.22_199.64_ORIG.log	Start Length: 0.22 m End Length: 199.64 m
HFM38	9072	Up	HFM38_07-20-06_20-11_9072C_02_-0.04_194.56_ORIG.log	Start Length: 194.56 m End Length: -0.04 m
HFM38	9139	Up	HFM38_07-21-06_07-31_9139A_02_6.50_194.42_ORIG.log	Start Length: 194.42 m End Length: 6.5 m
HFM38	9310	Down	HFM38_07-21-06_09-02_9310C2_10_0.20_194.30_ORIG.log	Start Length: 0.2 m End Length: 194.3 m
HFM38	9310	Up	HFM38_07-21-06_09-22_9310C2_10_-0.30_193.30_ORIG.log	Start Length: 193.3 m End Length: -0.3 m
HFM38	HiRAT	Up	HFM38_HIRAT_180pixels_up_run3.HED	Start Length: 165 m End Length: 0 m
HFM38	HiRAT	Up	HFM38_HIRAT_180pixels_up_run5.HED	Start Length: 192 m End Length: 159 m

Table 6-2. Drawing files in WellCad format.

Borehole	Drawing	WellCad file
KFM08C	1.1	KFM08C_Presentation.WCL
KFM10A	2.1	KFM10A_Presentation.WCL
HFM30	3.1	HFM30_Presentation.WCL
HFM31	4.1	HFM31_Presentation.WCL
HFM33	5.1	HFM33_Presentation.WCL
HFM34	6.1	HFM34_Presentation.WCL
HFM35	7.1	HFM35_Presentation.WCL
HFM38	8.1	HFM38_Presentation.WCL

Table 6-3. Data files in SICADA format.

Sheet	Comment
"Borehole"_CALIPER1_GP040	- Caliper logging.xls
"Borehole"_CALIPER MEAN_GP041	- 3-D caliper.xls
"Borehole"_TEMP(FL)_RES(FL)_GP060	- Fluid temperature and resistivity logging.xls
"Borehole"_DENSITY_GP090	- Density logging.xls
"Borehole"_MAGSUSCEP_GP110	- Magnetic susceptibility logging.xls
"Borehole"_GAM(NAT)_GP120	- Natural gamma logging.xls
"Borehole"_SPR_GP150	- Single point resistance logging.xls
"Borehole"_RES(64N)_GP160	- Resistivity, normal 1.6 m (64 in).xls
"Borehole"_RES(MG)_GP161	- Resistivity, focused 140 cm.xls
"Borehole"_RES(DG)_GP162	- Resistivity, focused 300 cm.xls
"Borehole"_LATERAL_GP163	- Resistivity, lateral 1.6–0.1 m.xls
"Borehole"_RES(16N)_GP164	- Resistivity, normal 0.4 m (16 in).xls
"Borehole"_P-VEL_GP175	- Fullwave sonic.xls
"Borehole"_GP830	- Acoustic televiewer.xls
"Borehole"_SP_GP180	- Self potential logging.xls

Borehole KFM08C. Drawing no. 1.1. Borehole logs


Co-ordinates in RT90 2,5 gon V 0:-15

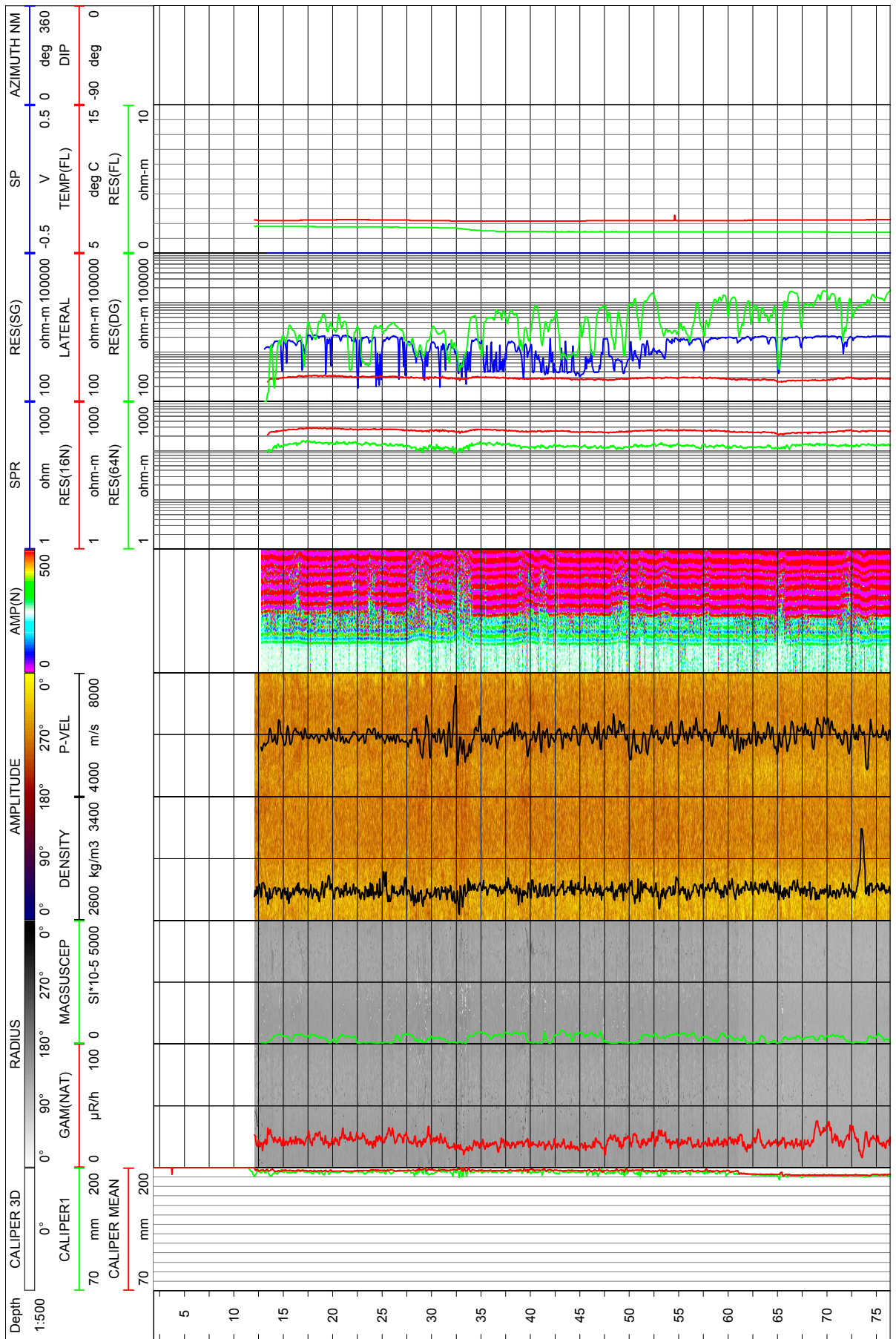
Northing: 6700495.88 Easting: 1631187.57 Elevation: 2.47

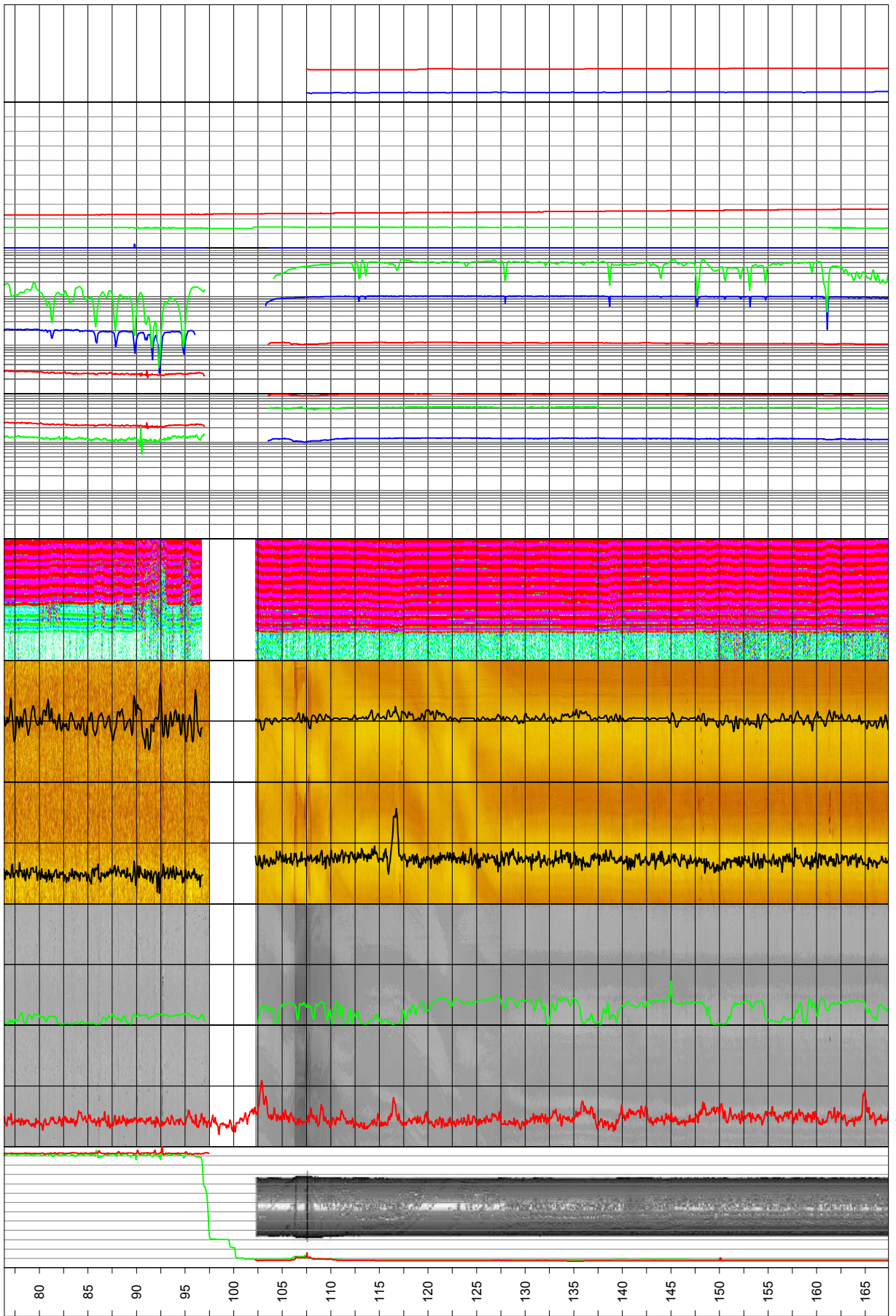
Diameter: 77.3 mm
 Reaming Diameter: 193 mm
 Outer Casing: 323 mm
 Inner Casing: 310
 Casing Length: 13.06
 Borehole Length: 951.08
 Cone: 97.43
 Inclination at ground surface: -60.64
 Azimuth: 35.88
 Comments:

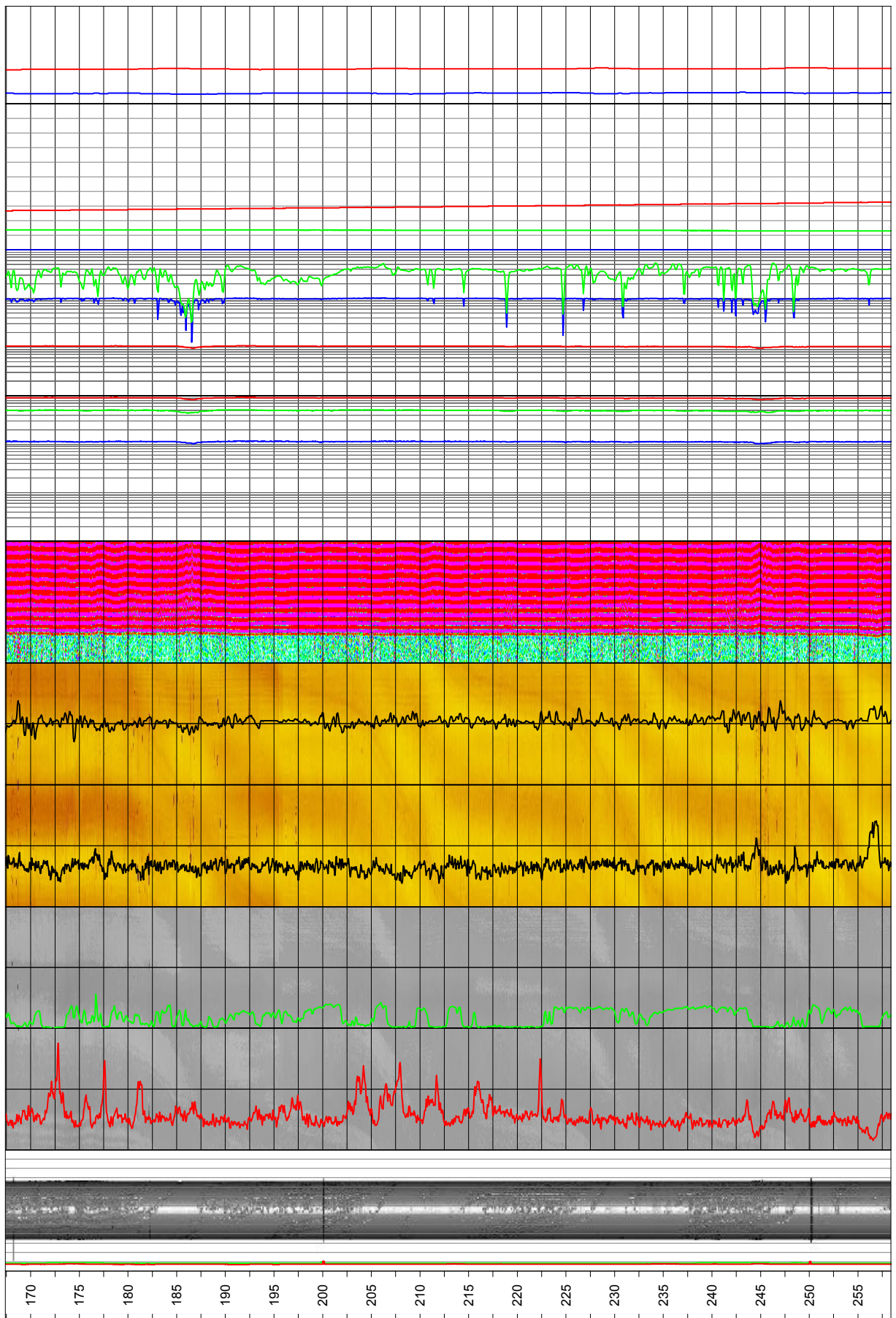
Borehole logging programme

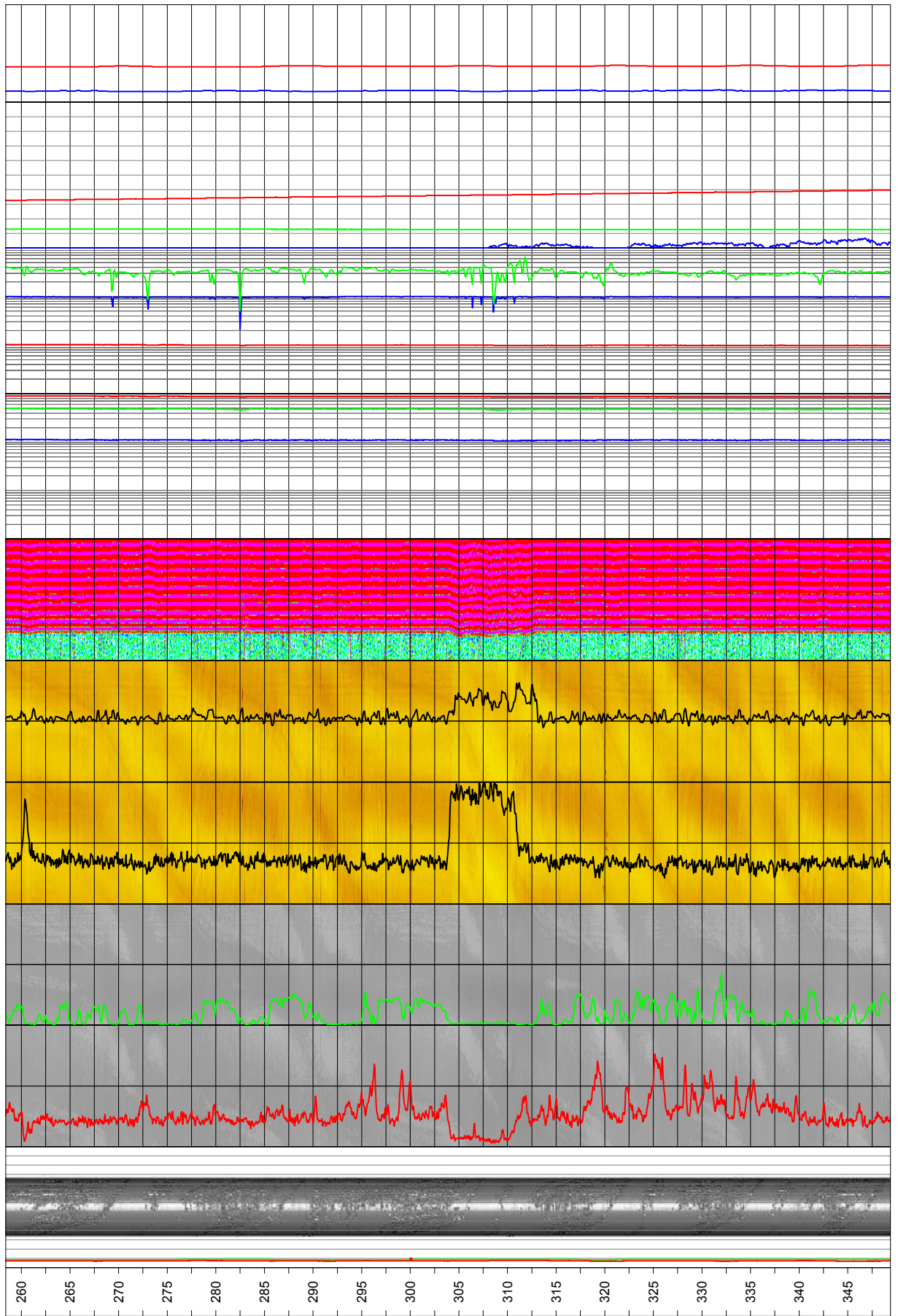
Name	Description	Tool	Unit
CALIPER1	Caliper, 1-arm	9139	mm
DENSITY	Gamma-gamma density	9139	kg/m ³
RES(SG)	Focused guard log resistivity, 128 cm	9139	ohm-m
GAM(NAT)	Natural gamma	9072	µR/h
TEMP(FL)	Fluid temperature	9042	deg C
RES(FL)	Fluid resistivity	9042	ohm-m
RES(DG)	Focused guard log resistivity, 300cm	9072	ohm-m
P-VEL	P-wave velocity	9310	m/s
AMP(N)	Full wave form, near receiver	9310	µs
AMP(F)	Full wave form, far receiver	9310	µs
MAGSUSCEP	Magnetic susceptibility	8622	SI*10-5
CALIPER 3D	Caliper, high resolution 360 degrees	HiRAT	mm
CALIPER MEAN	High resolution 1D caliper	HiRAT	mm
AZIMUTH MN	Borehole azimuth magnetic north	HiRAT	deg
DIP	Borehole inclination from horizontal	HiRAT	deg
RADIUS	360 degrees orientated acoustic radius	HiRAT	mm
AMPLITUDE	360 degrees orientated acoustic amplitude	HiRAT	-
THORIUM	Spectral gamma, Thorium component	9080	PPM
URANIUM	Spectral gamma, Uranium component	9080	PPM
POTASSIUM	Spectral gamma, Potassium component	9080	percent
RES(16N)	Normal resistivity 16 inch	8144	ohm-m
RES(64N)	Normal resistivity 64 inch	8144	ohm-m
LATERAL	Lateral resistivity	8144	ohm-m
SPR	Single point resistivity	8144	ohm
SP	Self Potential	8144	V

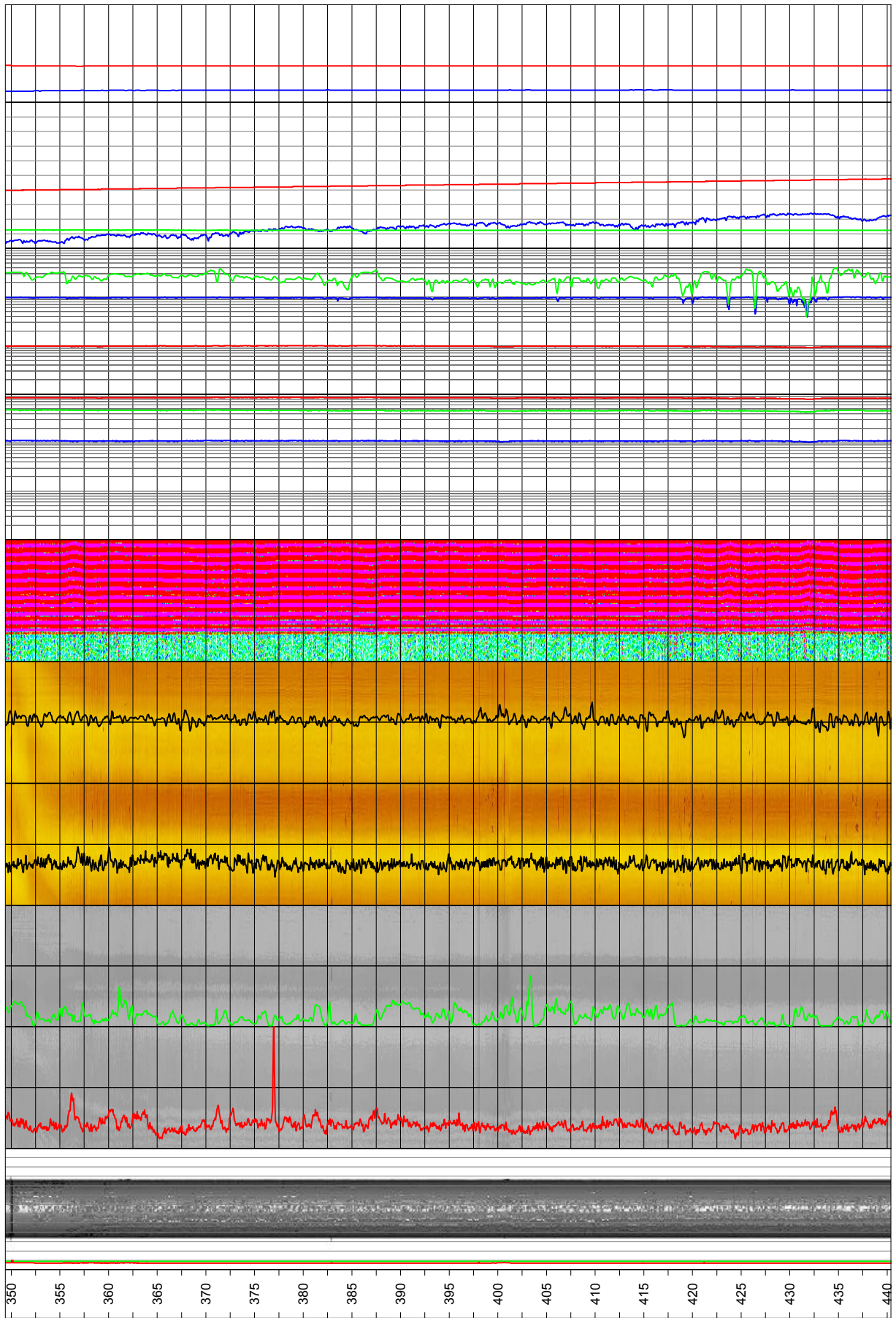
Rev. 0	Date 2006-08-15	Drawn by JJJ	Control UTN	Approved UTN	 <small>Ramboll, Bredevej 2, DK-2830 Virum Phone + 45 45 98 60 00, Fax + 45 45 98 67 00</small>
Job 547310A	Scale 1:500				
<hr/> <h2>SKB geophysical borehole logging</h2> <h3>Borehole KFM08C</h3> <hr/> <p>Presentation</p>					Filename: KFM08C_Presentation.wcl Drawing no.: 1.1

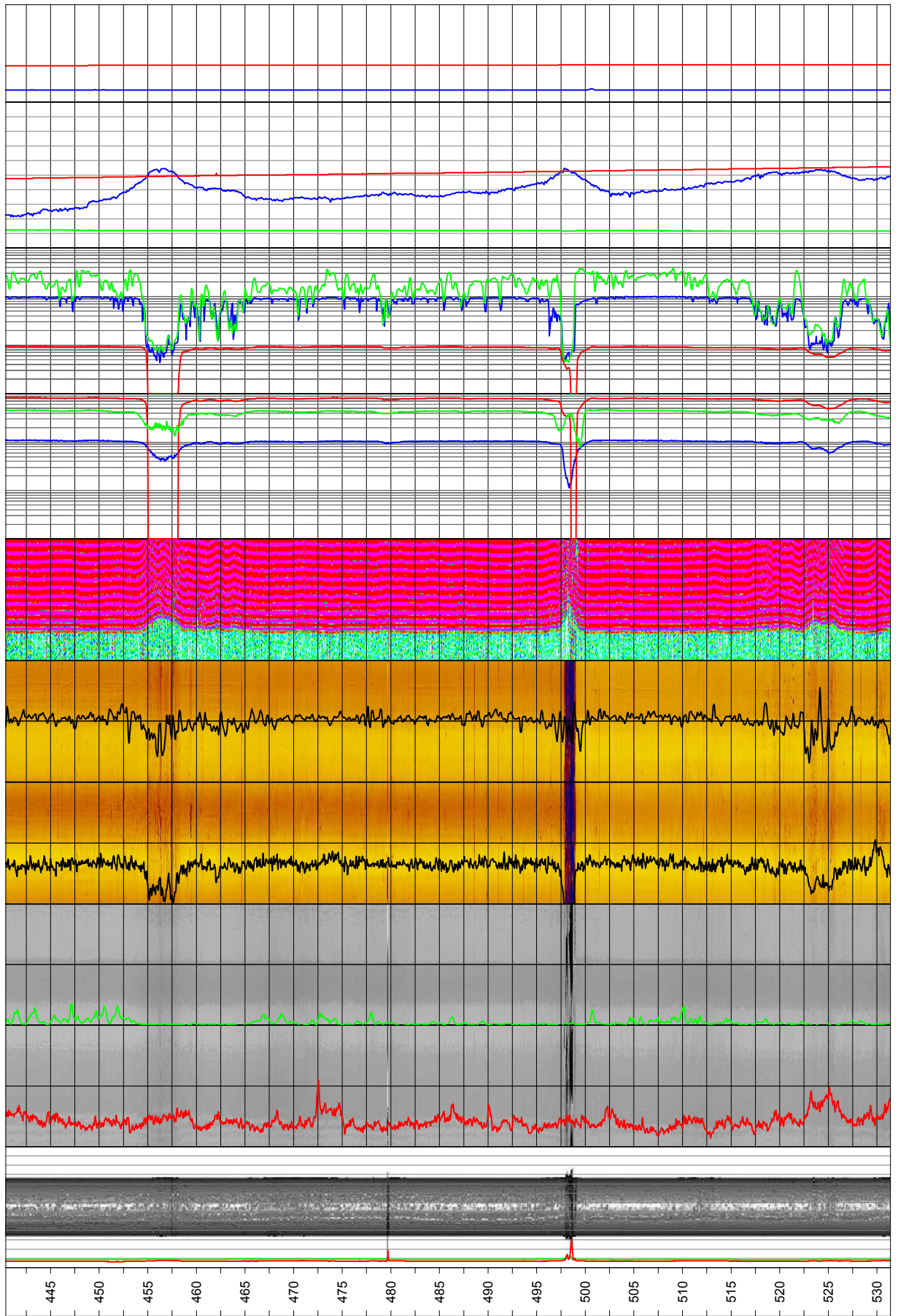


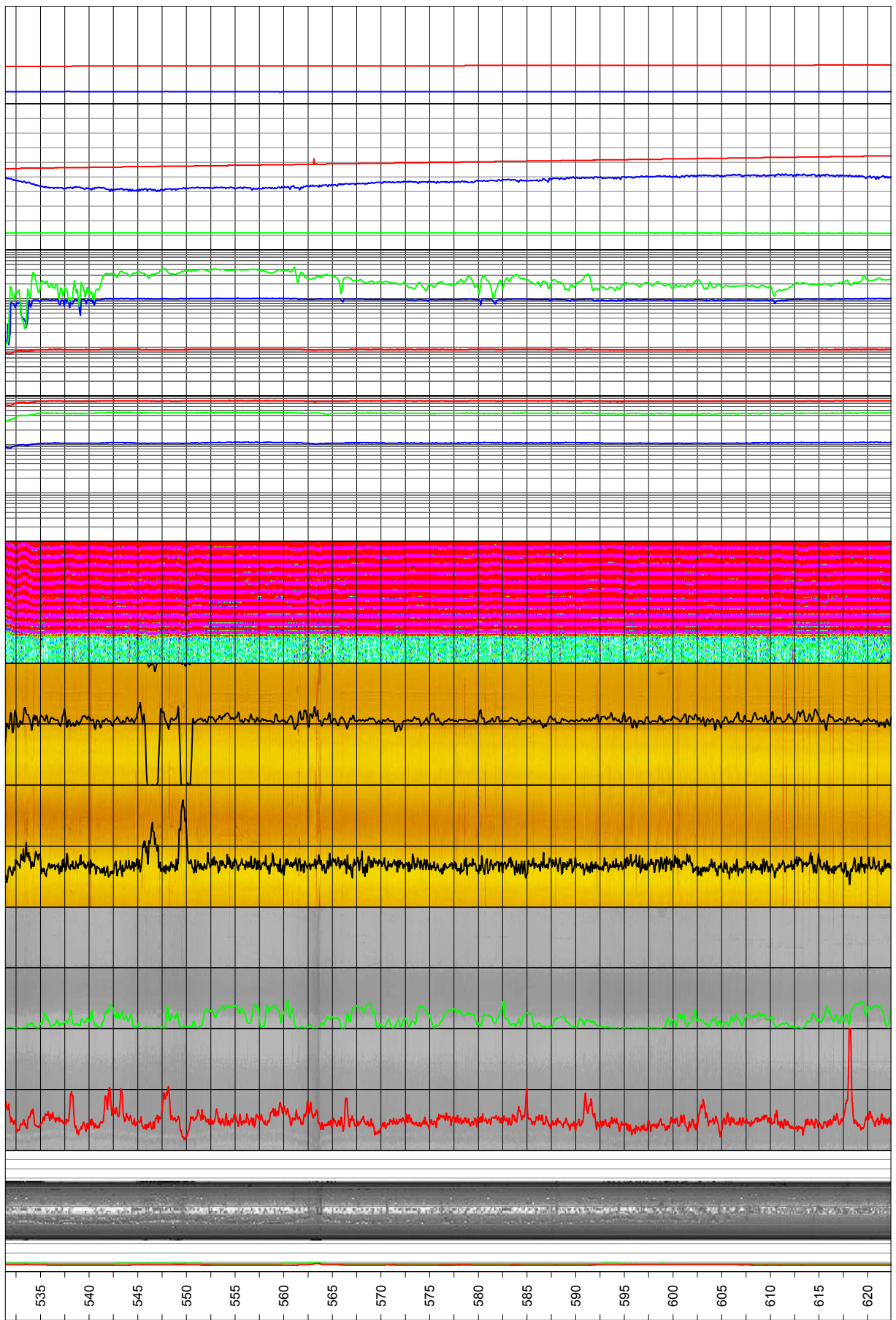


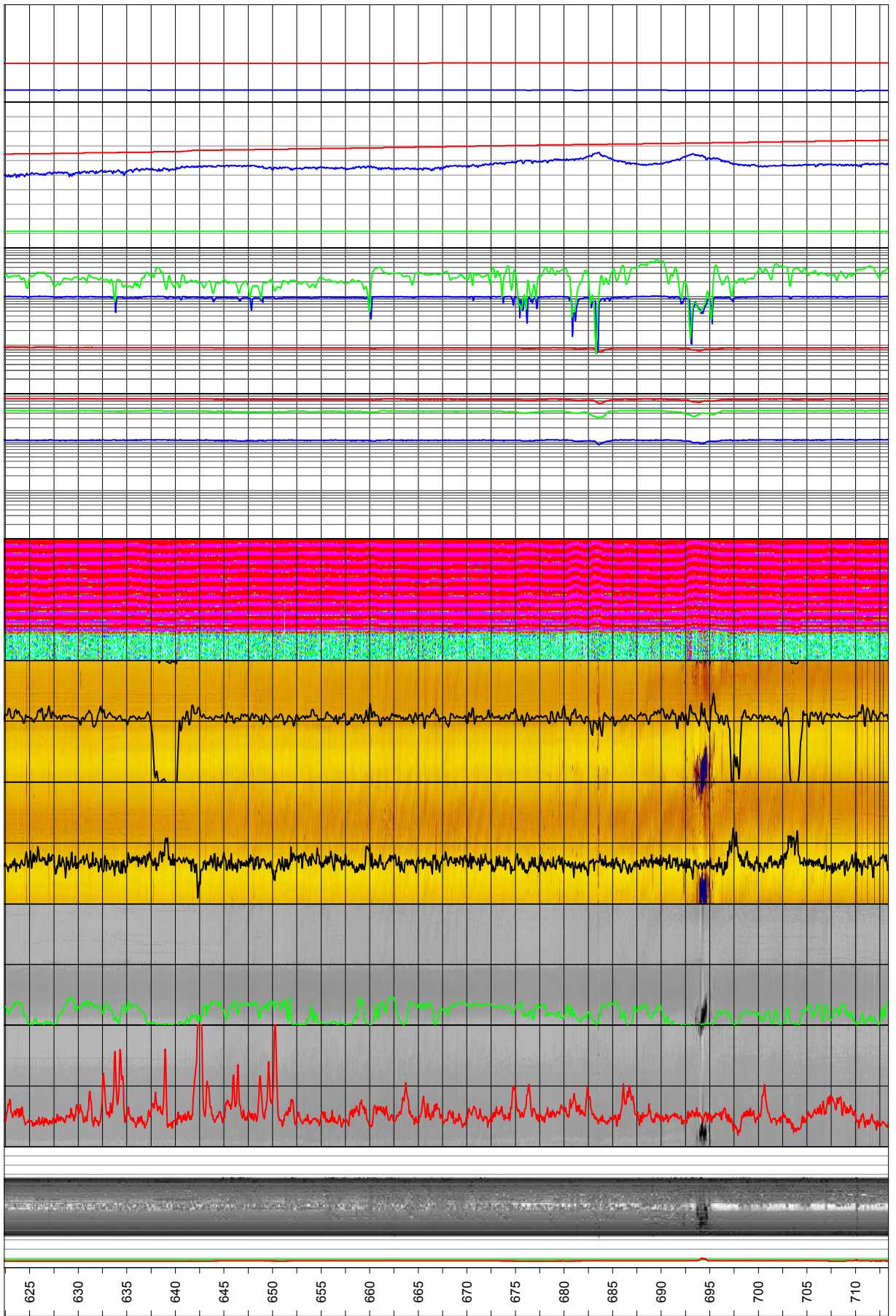


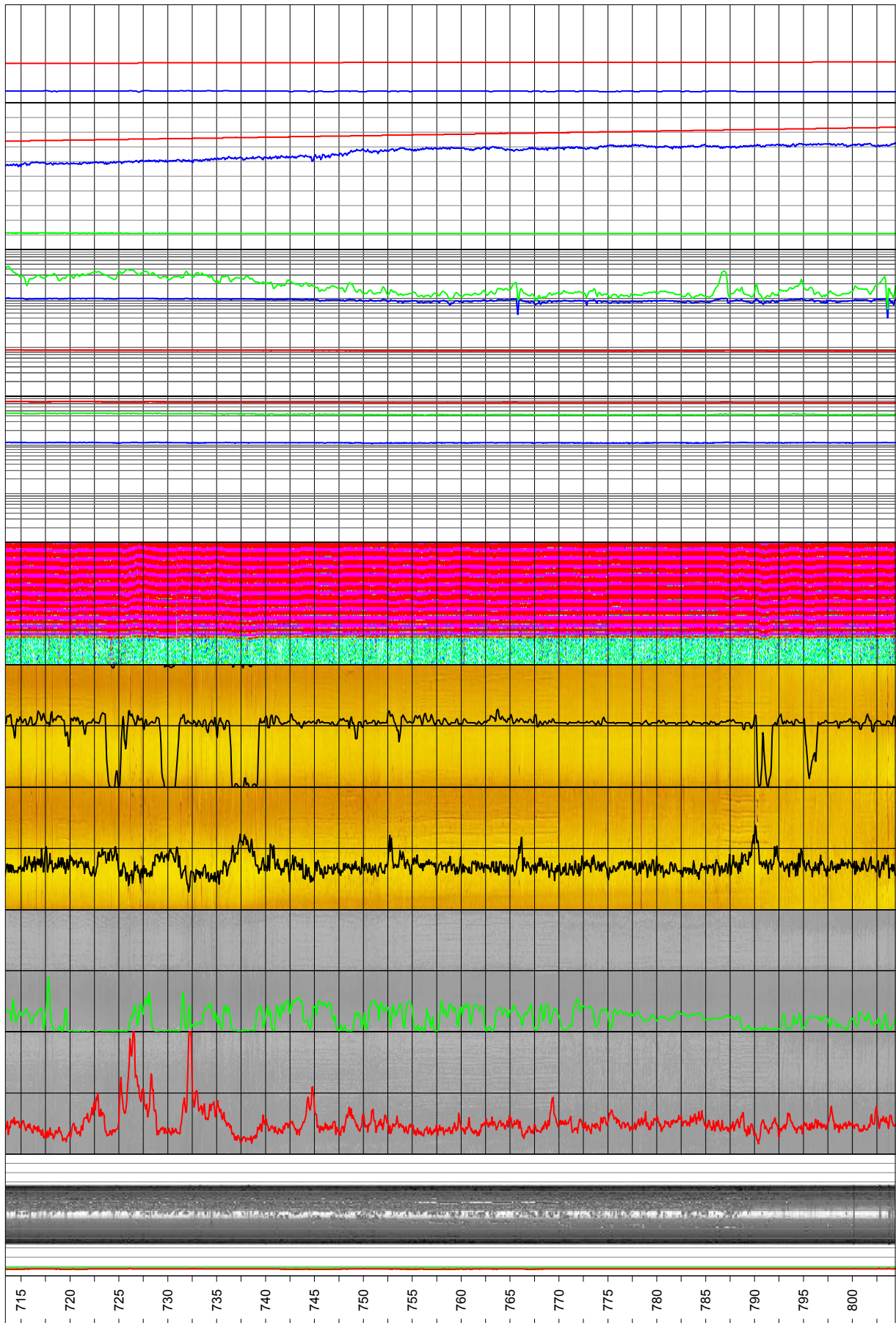


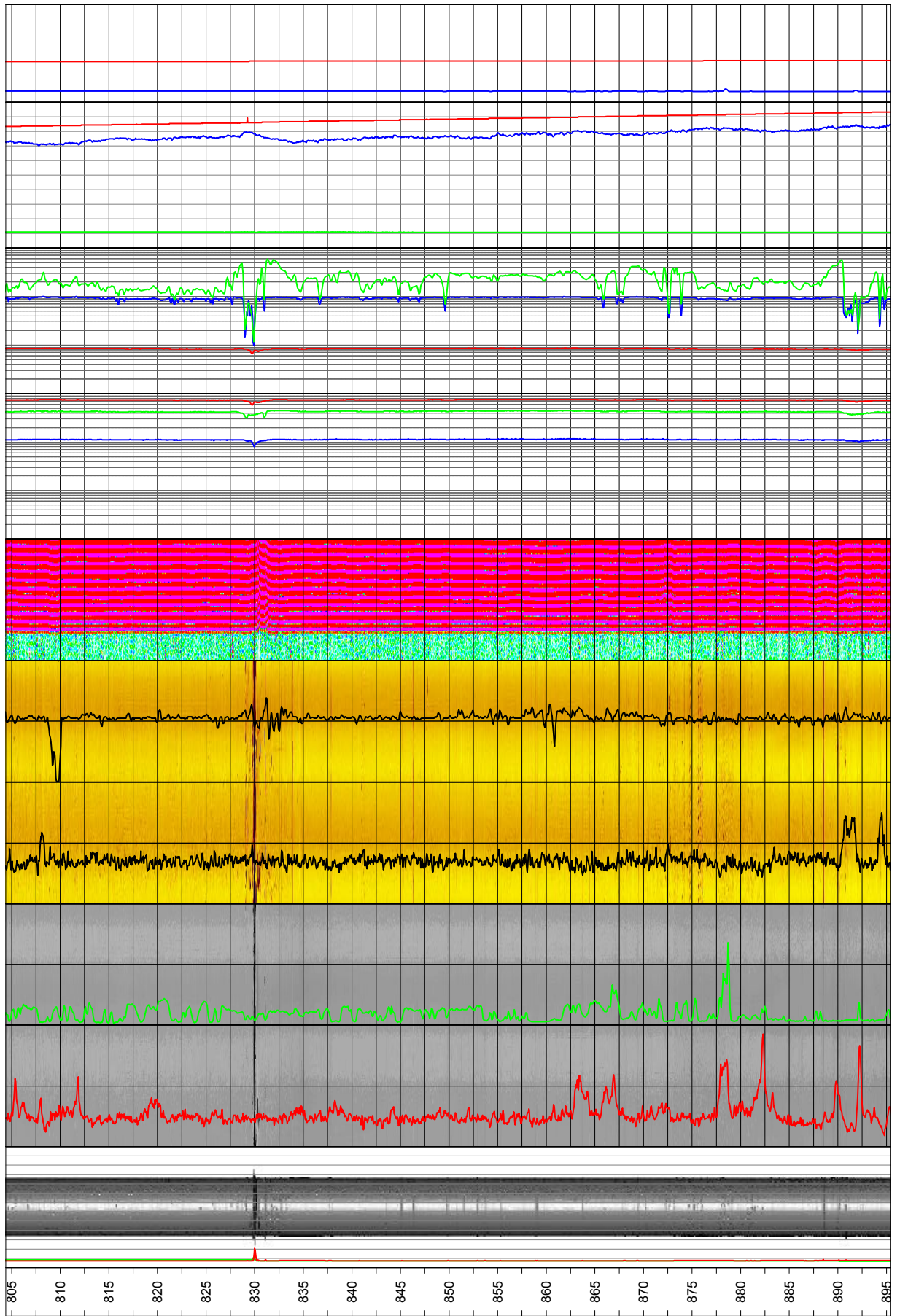


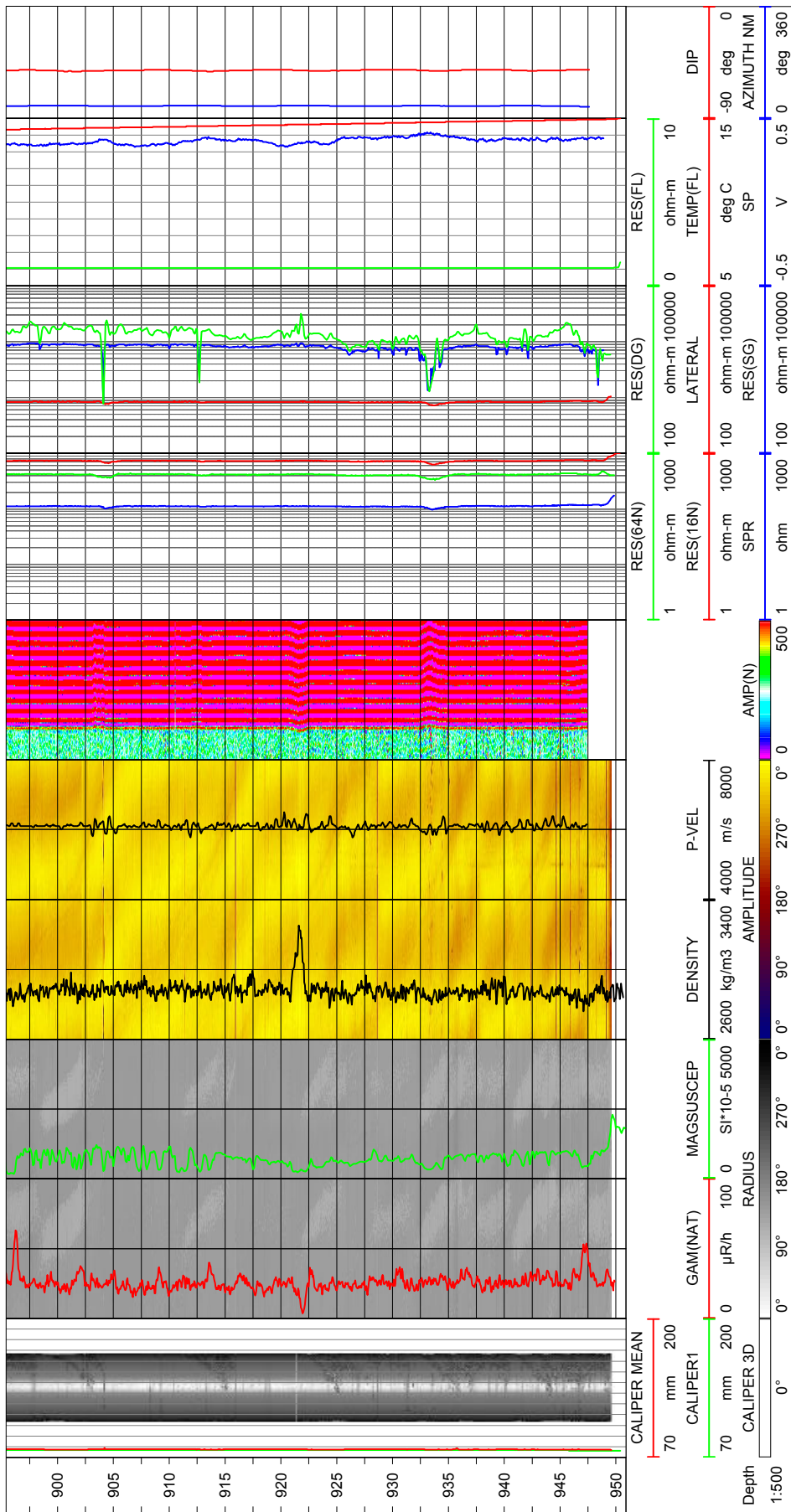












Borehole KFM10A. Drawing no. 2.1. Borehole logs


Co-ordinates in RT90 2,5 gon V 0:-15

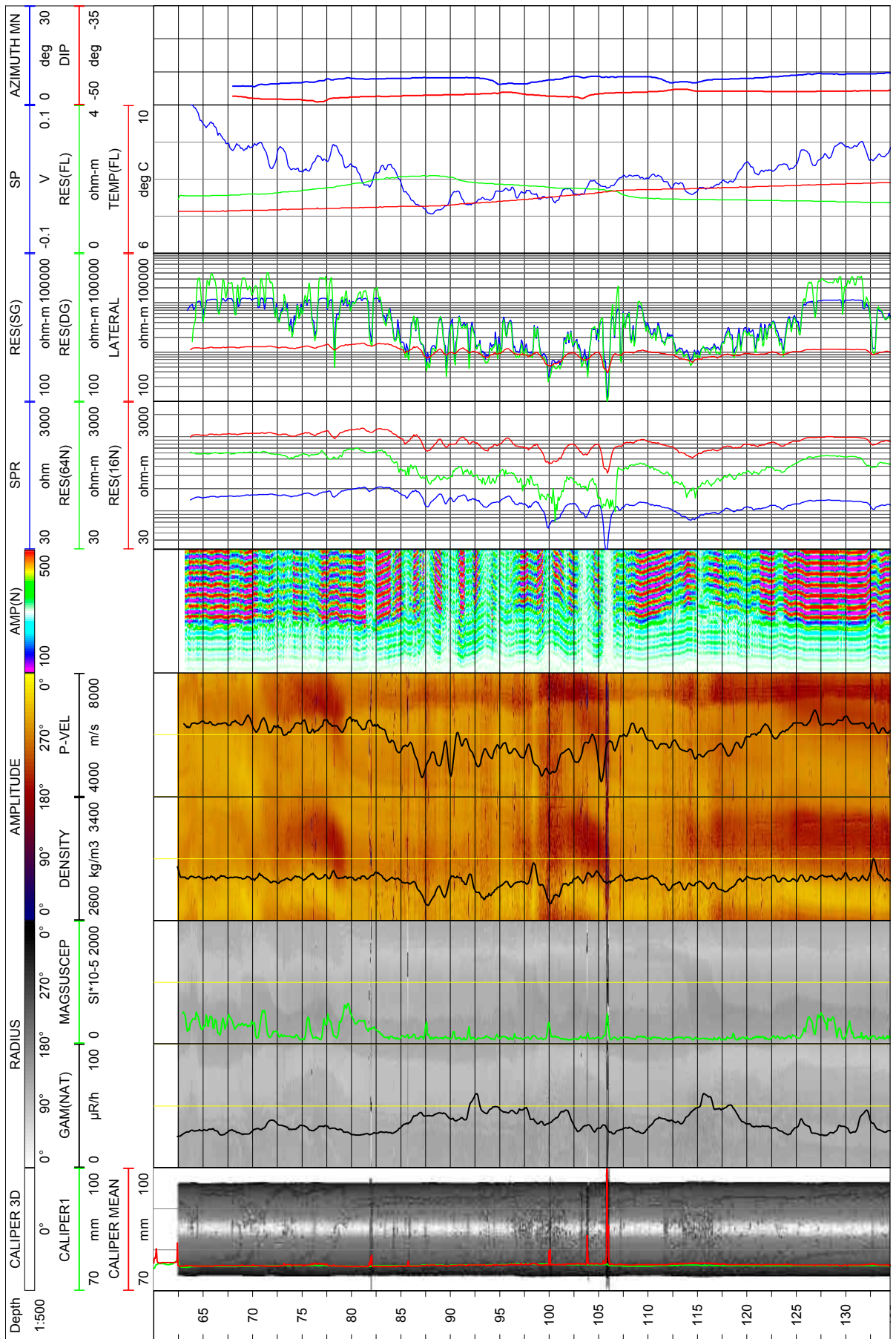
Northing: 6698629.17m Easting: 1631715.90m Elevation: 4.51m, RHB70

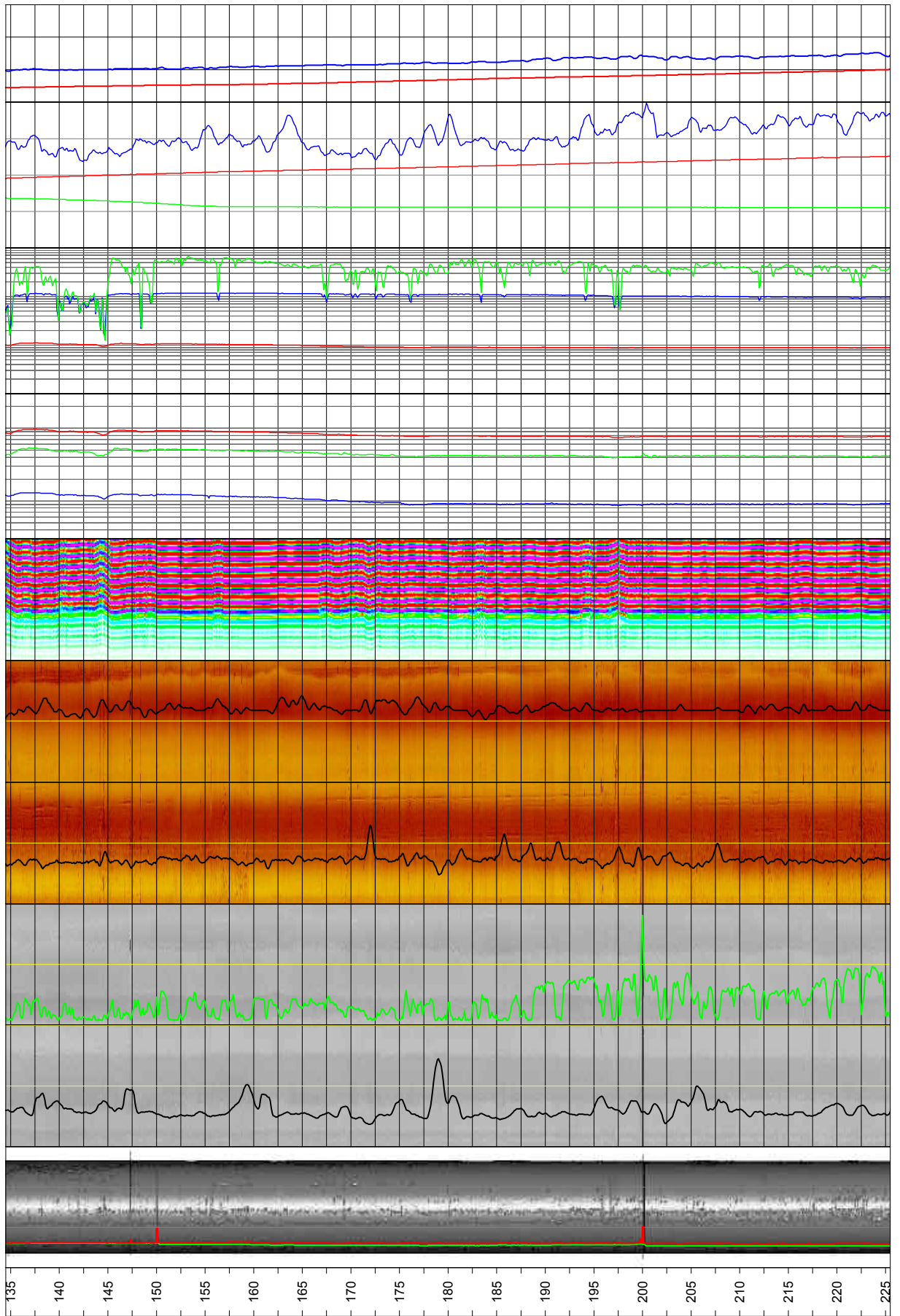
Diameter: 75.8mm
 Reaming Diameter:
 Outer Casing:
 Inner Casing: 77mm
 Borehole Length: 500.16m
 Cone:
 Inclination at ground surface: -50,05°
 Azimuth: 10.42° GN
 Comments:

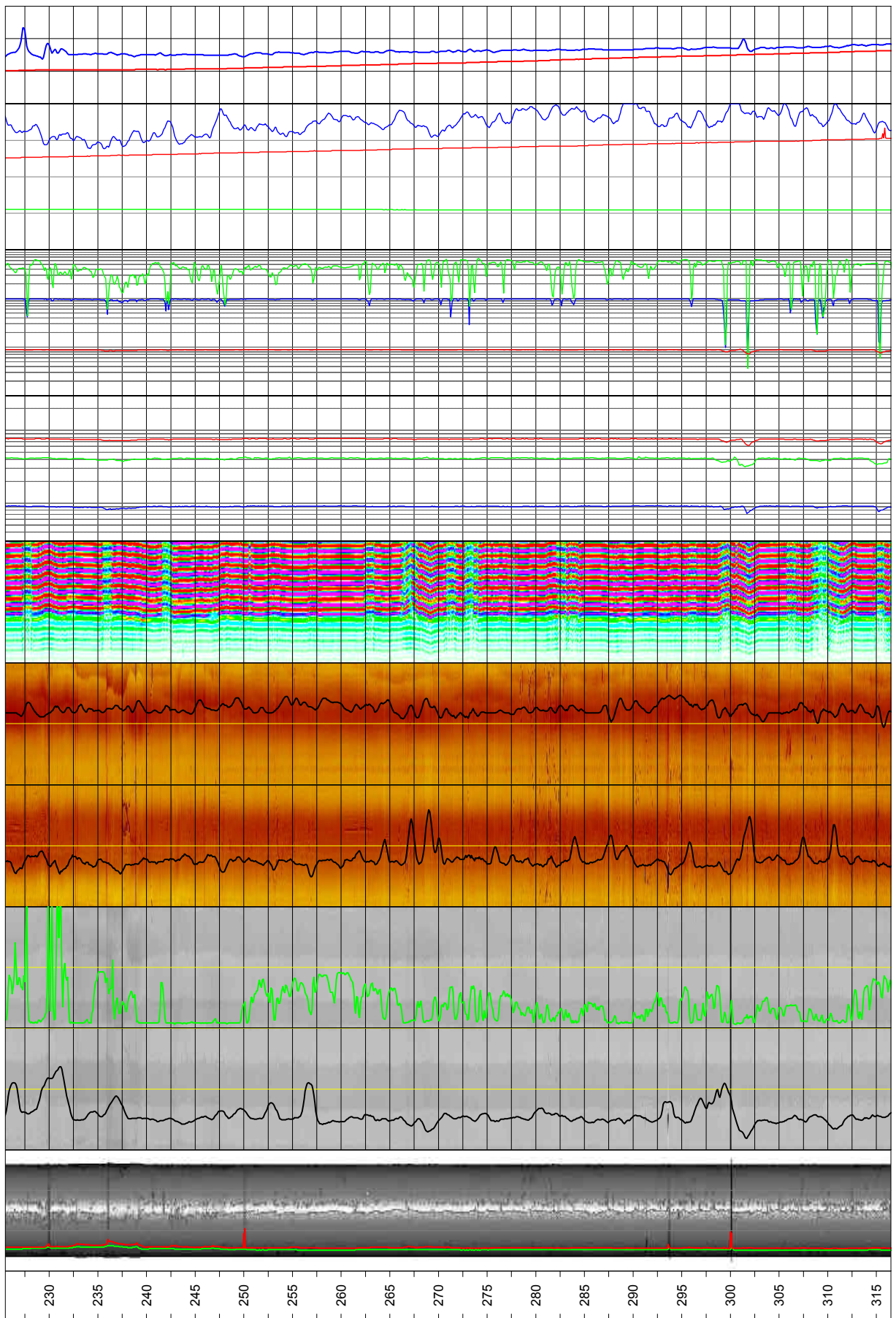
Borehole logging programme

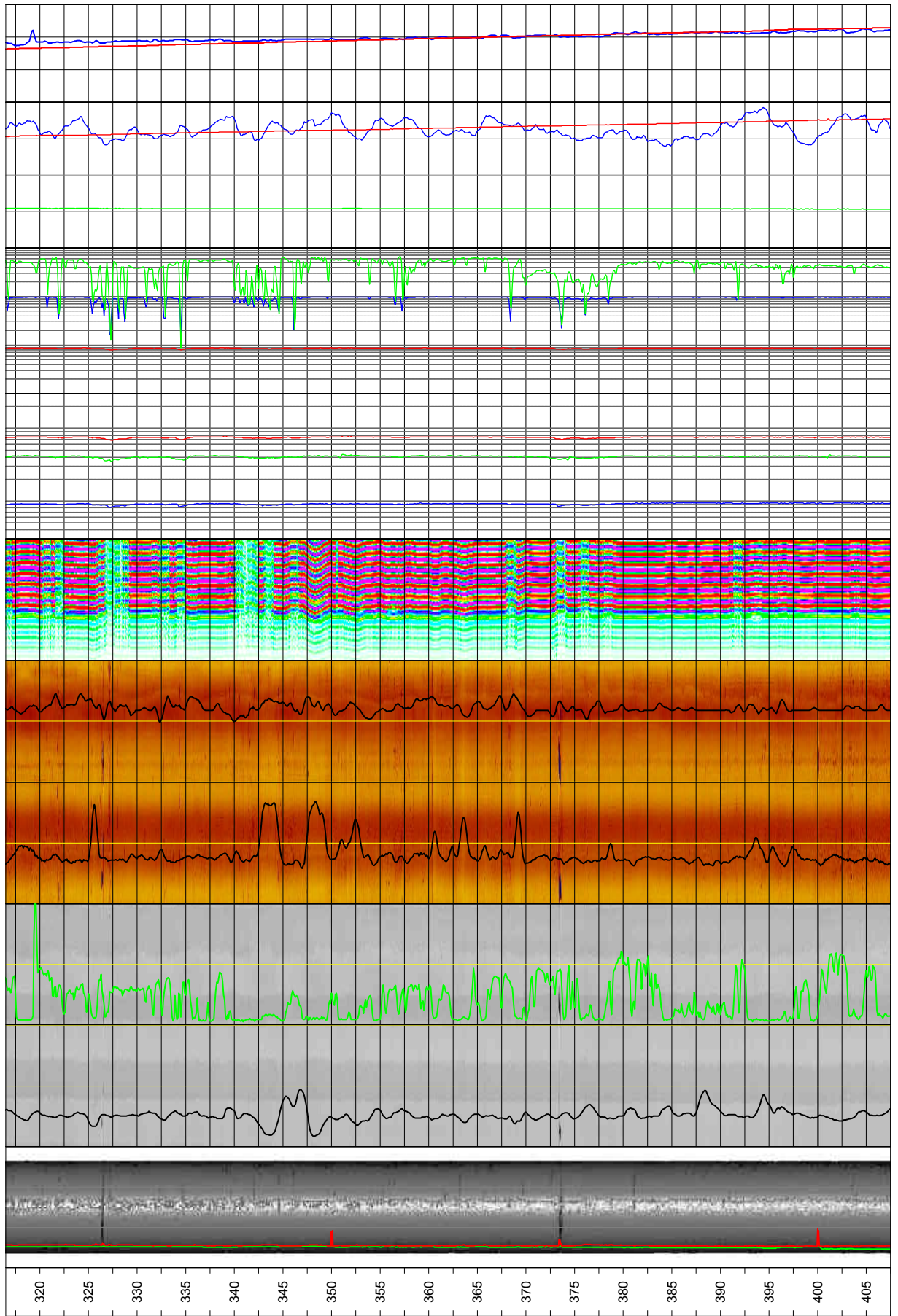
Name	Description	Tool	Unit
CALIPER1	Caliper, 1-arm	9139	mm
DENSITY	Gamma-gamma density	9139	kg/m ³
RES(SG)	Focused guard log resistivity, 128 cm	9139	ohm-m
GAM(NAT)	Natural gamma	9072	µR/h
TEMP(FL)	Fluid temperature	9042	deg C
RES(FL)	Fluid resistivity	9042	ohm-m
RES(DG)	Focused guard log resistivity, 300cm	9072	ohm-m
P-VEL	P-wave velocity	9310	m/s
AMP(N)	Full wave form, near receiver	9310	µs
AMP(F)	Full wave form, far receiver	9310	µs
MAGSUSCEP	Magnetic susceptibility	8622	SI*10-5
CALIPER 3D	Caliper, high resolution 360 degrees	HiRAT	mm
CALIPER MEAN	High resolution 1D caliper	HiRAT	mm
AZIMUTH MN	Borehole azimuth magnetic north	HiRAT	deg
DIP	Borehole inclination from horizontal	HiRAT	deg
RADIUS	360 degrees orientated acoustic radius	HiRAT	mm
AMPLITUDE	360 degrees orientated acoustic amplitude	HiRAT	-
THORIUM	Spectral gamma, Thorium component	9080	PPM
URANIUM	Spectral gamma, Uranium component	9080	PPM
POTASSIUM	Spectral gamma, Potassium component	9080	percent
RES(16N)	Normal resistivity 16 inch	8144	ohm-m
RES(64N)	Normal resistivity 64 inch	8144	ohm-m
LATERAL	Lateral resistivity	8144	ohm-m
SPR	Single point resistivity	8144	ohm
SP	Self Potential	8144	V

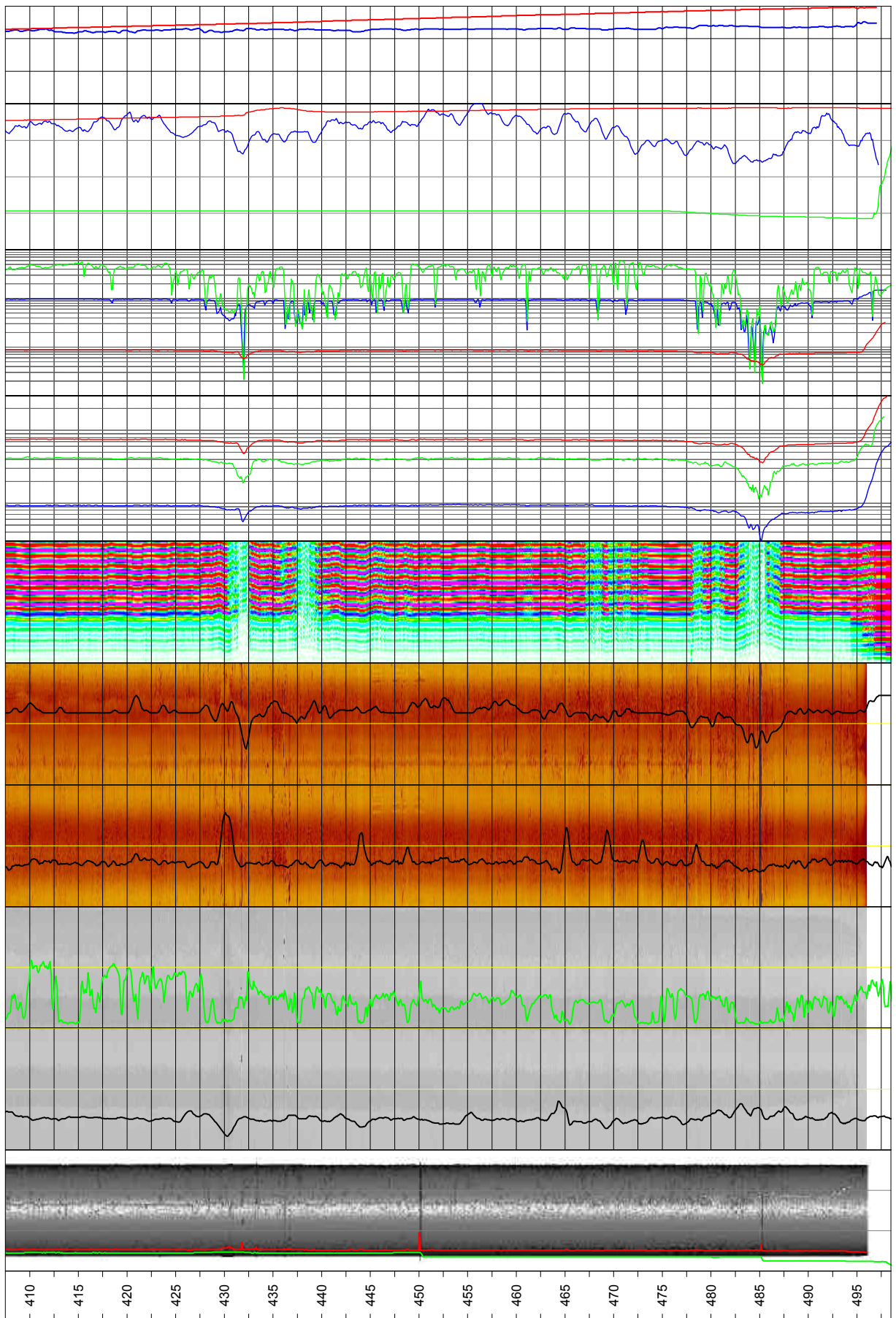
Rev. 0	Date 2006-06-20	Drawn by JRI	Control TVP	Approved UTN	 <small>Ramboll, Bredevej 2, DK-2830 Virum Phone + 45 45 98 60 00, Fax + 45 45 98 67 00</small>
Job 547310A	Scale 1:500				
<hr/> <h2>SKB geophysical borehole logging</h2> <h3>Borehole KFM10A</h3> <hr/> <p>Presentation</p>					Filename: KFM10A_Presentation.wcl Drawing no.: 2.1











Borehole HFM30. Drawing no. 3.1. Borehole logs


Co-ordinates in RT90 2,5 gon V 0:-15

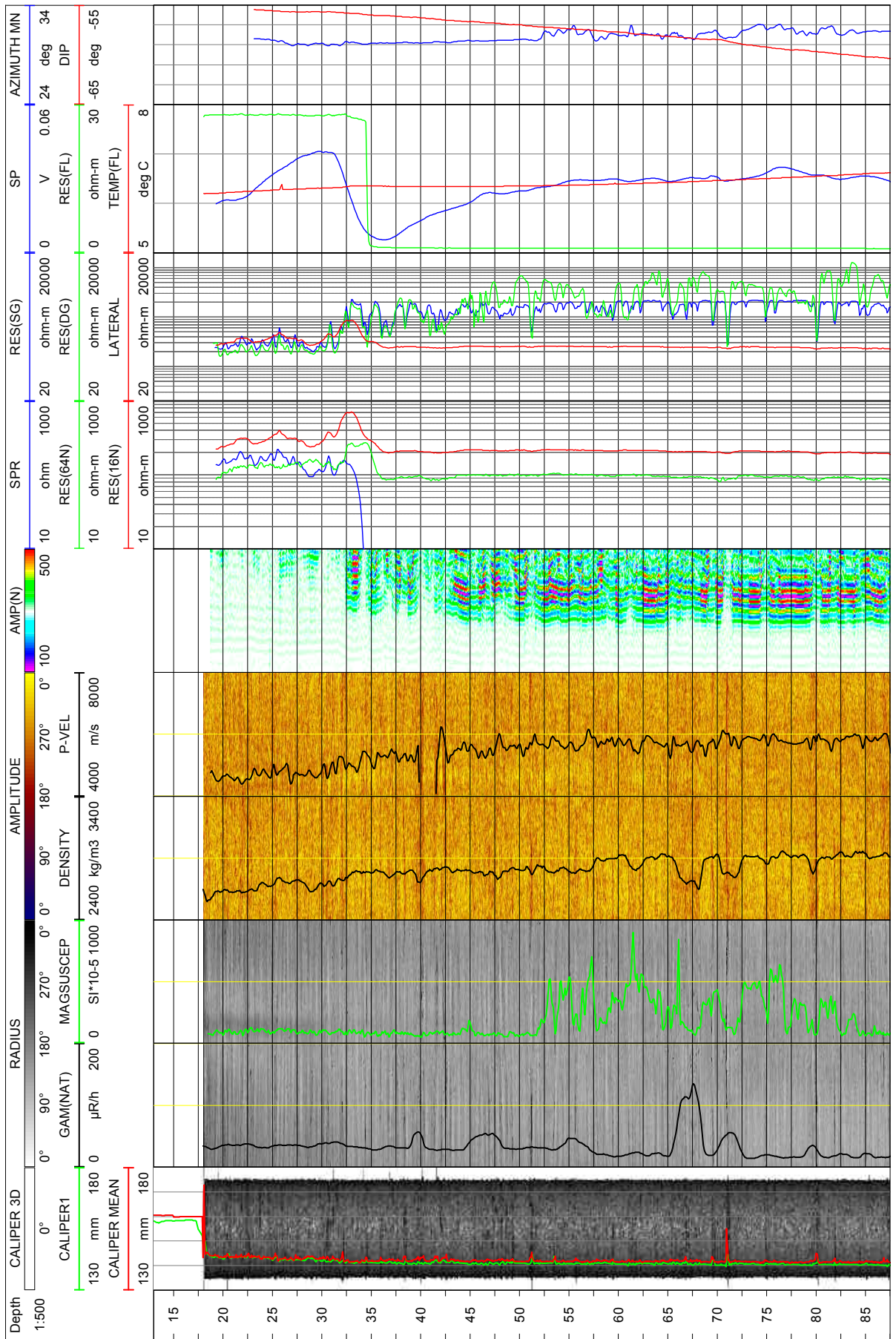
Northing: 6697930.952m Easting: 1631819.567m Elevation: 3.128m, RHB70

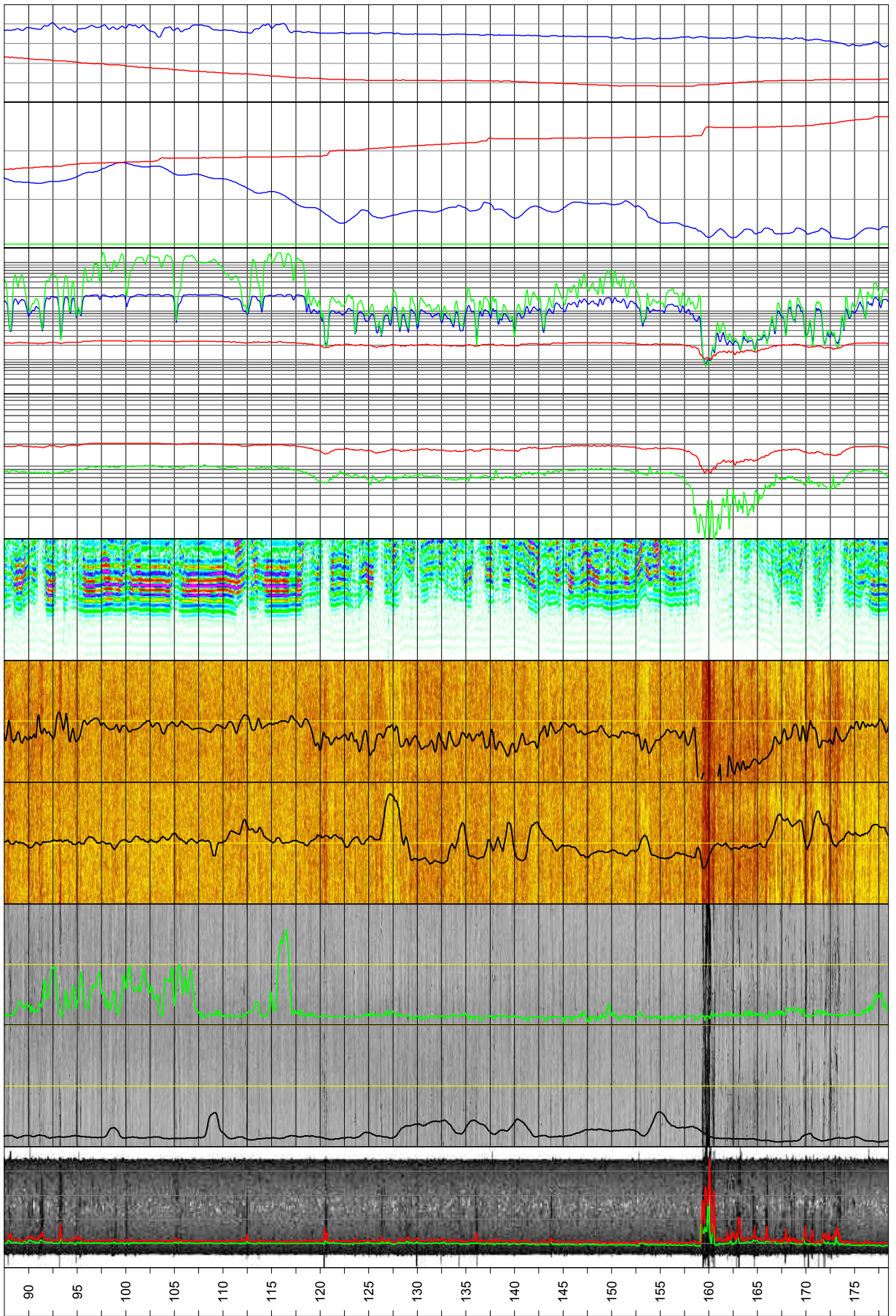
Diameter: 138.7-140.3mm
 Reaming Diameter: 180mm
 Outer Casing: 168mm
 Inner Casing: 160mm
 Casing Length: 18.03m
 Borehole Length: 200.75m
 Cone:
 Inclination at ground surface: -55.50°
 Azimuth: 28.81° GN
 Comments:

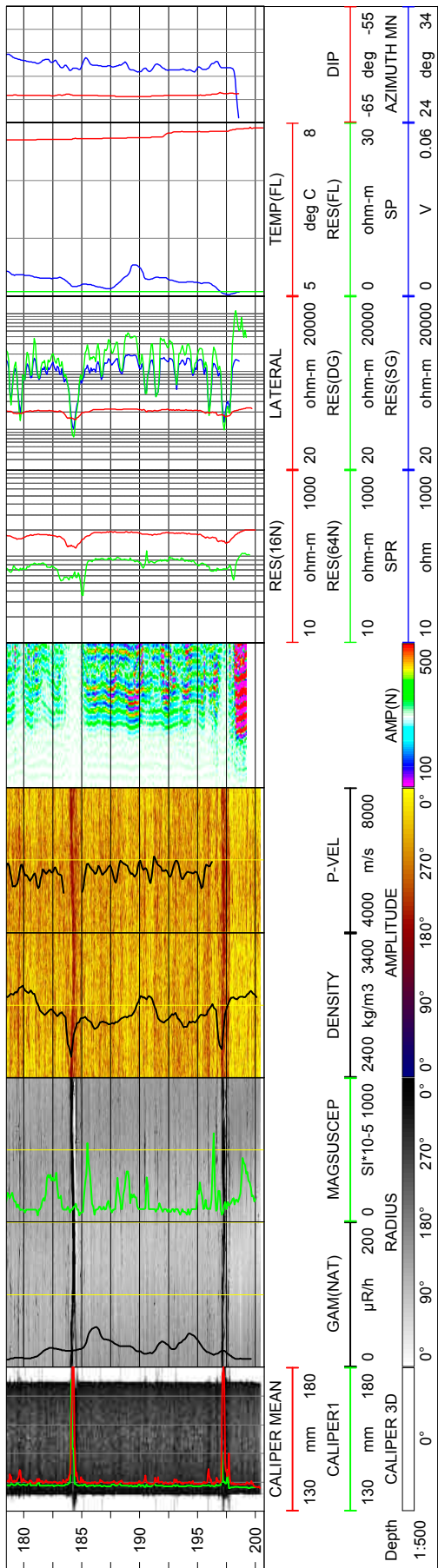
Borehole logging programme

Name	Description	Tool	Unit
CALIPER1	Caliper, 1-arm	9139	mm
DENSITY	Gamma-gamma density	9139	kg/m ³
RES(SG)	Focused guard log resistivity, 128 cm	9139	ohm-m
GAM(NAT)	Natural gamma	9072	µR/h
TEMP(FL)	Fluid temperature	9042	deg C
RES(FL)	Fluid resistivity	9042	ohm-m
RES(DG)	Focused guard log resistivity, 300cm	9072	ohm-m
P-VEL	P-wave velocity	9310	m/s
AMP(N)	Full wave form, near receiver	9310	µs
AMP(F)	Full wave form, far receiver	9310	µs
MAGSUSCEP	Magnetic susceptibility	8622	SI*10-5
CALIPER 3D	Caliper, high resolution 360 degrees	HiRAT	mm
CALIPER MEAN	High resolution 1D caliper	HiRAT	mm
AZIMUTH MN	Borehole azimuth magnetic north	HiRAT	deg
DIP	Borehole inclination from horizontal	HiRAT	deg
RADIUS	360 degrees orientated acoustic radius	HiRAT	mm
AMPLITUDE	360 degrees orientated acoustic amplitude	HiRAT	-
THORIUM	Spectral gamma, Thorium component	9080	PPM
URANIUM	Spectral gamma, Uranium component	9080	PPM
POTASSIUM	Spectral gamma, Potassium component	9080	percent
RES(16N)	Normal resistivity 16 inch	8144	ohm-m
RES(64N)	Normal resistivity 64 inch	8144	ohm-m
LATERAL	Lateral resistivity	8144	ohm-m
SPR	Single point resistivity	8144	ohm
SP	Self Potential	8144	V

Rev. 0	Date 2006-06-23	Drawn by JRI	Control UTN	Approved UTN	 <small>Ramboll, Bredevej 2, DK-2830 Virum Phone + 45 45 98 60 00, Fax + 45 45 98 67 00</small>
Job 547310A	Scale 1:500				
<hr/> <h2>SKB geophysical borehole logging</h2> <h3>Borehole HFM30</h3> <hr/> <p>Presentation</p>					Filename: HFM30_Presentation.wcl Drawing no.: 3.1







Borehole HFM31. Drawing no. 4.1. Borehole logs

Co-ordinates in RT90 2,5 gon V 0:-15

Northing: 6700860.439m Easting: 1629207.283m Elevation:6.069m, RHB70

Diameter: 138.5-140.9mm

Reaming Diameter:

Outer Casing: 168mm

Inner Casing: 160mm

Borehole Length: 200.75m

Cone:


Inclination at ground surface: -69.23°

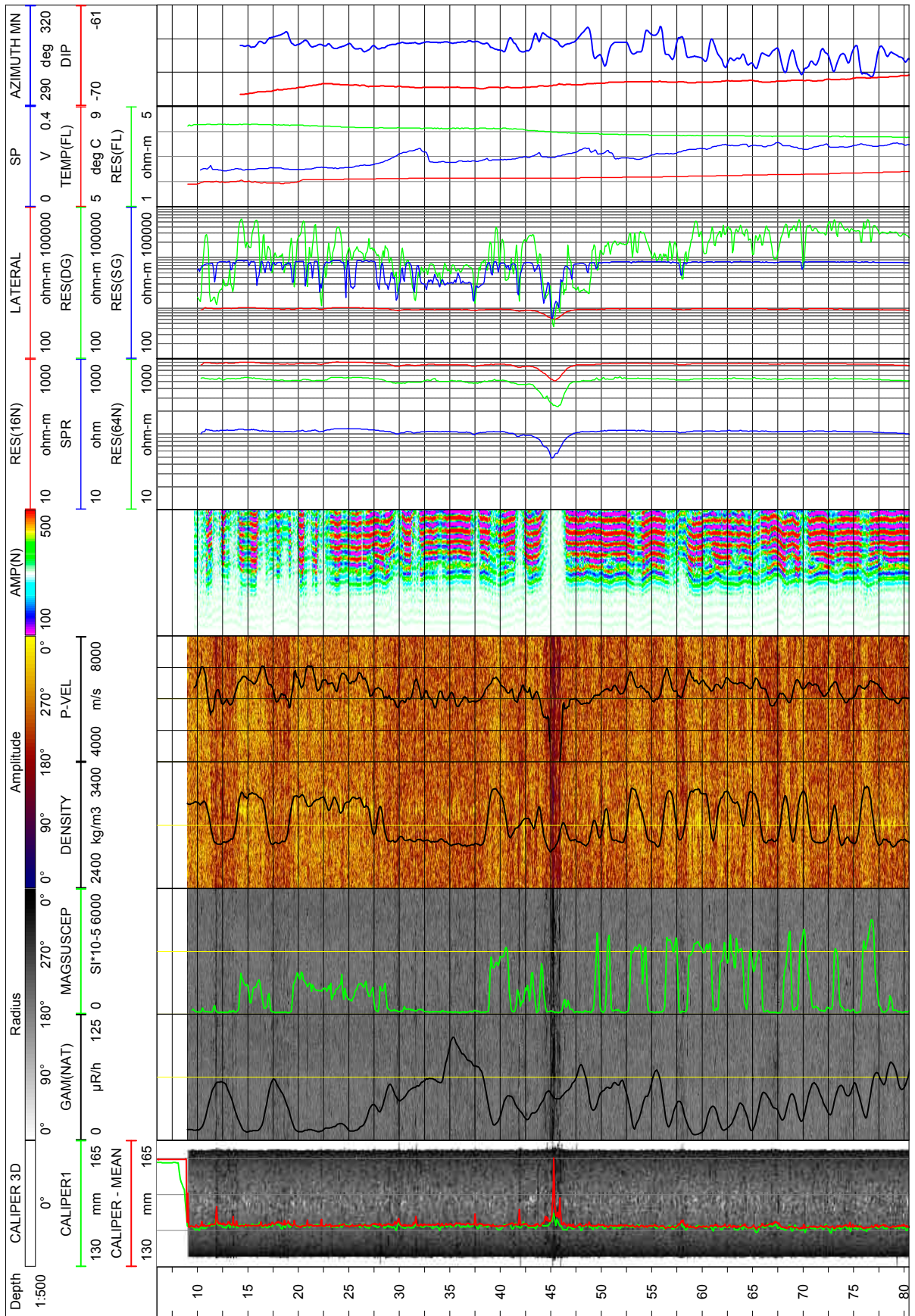
Azimuth: 311,80°GN

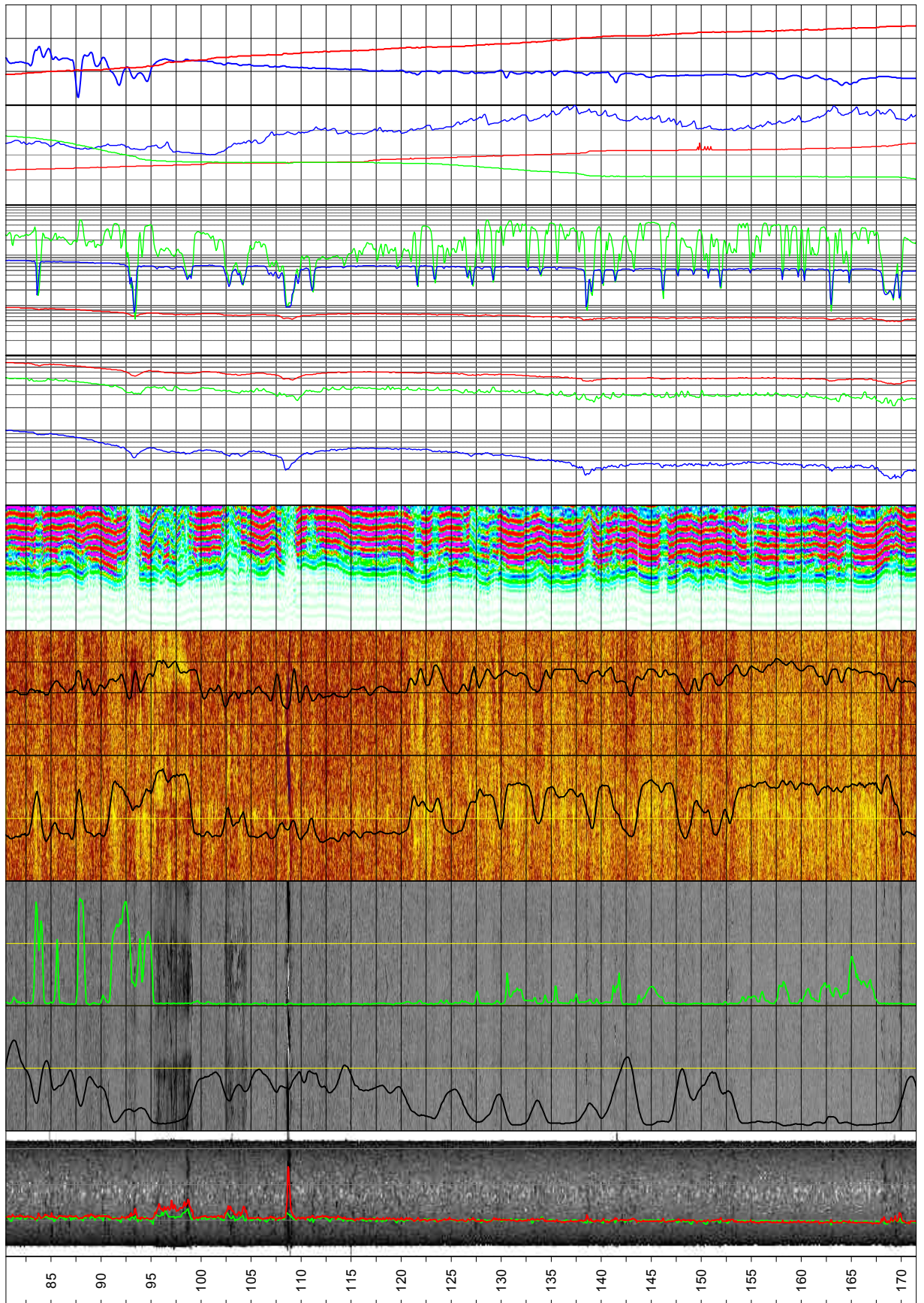
Comments:

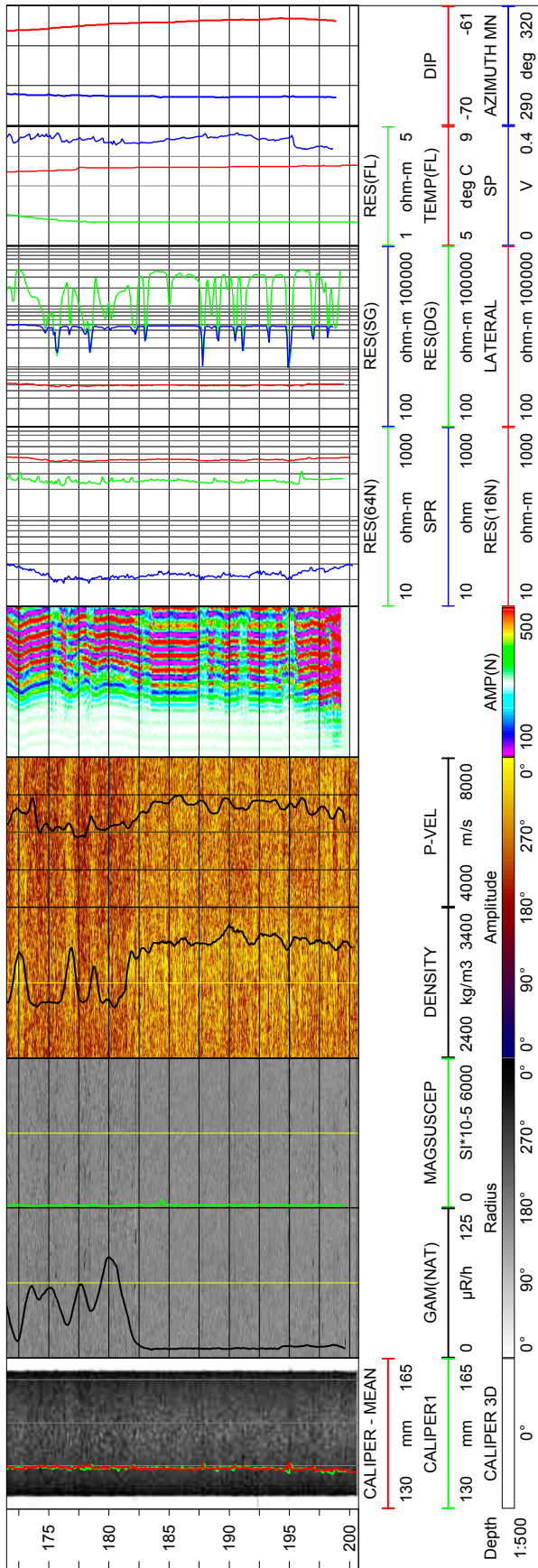
Borehole logging programme

Name	Description	Tool	Unit
CALIPER1	Caliper, 1-arm	9139	mm
DENSITY	Gamma-gamma density	9139	kg/m ³
RES(SG)	Focused guard log resistivity, 128 cm	9139	ohm-m
GAM(NAT)	Natural gamma	9072	µR/h
TEMP(FL)	Fluid temperature	9042	deg C
RES(FL)	Fluid resistivity	9042	ohm-m
RES(DG)	Focused guard log resistivity, 300cm	9072	ohm-m
P-VEL	P-wave velocity	9310	m/s
AMP(N)	Full wave form, near receiver	9310	µs
AMP(F)	Full wave form, far receiver	9310	µs
MAGSUSCEP	Magnetic susceptibility	8622	SI*10-5
CALIPER 3D	Caliper, high resolution 360 degrees	HiRAT	mm
CALIPER MEAN	High resolution 1D caliper	HiRAT	mm
AZIMUTH MN	Borehole azimuth magnetic north	HiRAT	deg
DIP	Borehole inclination from horizontal	HiRAT	deg
RADIUS	360 degrees orientated acoustic radius	HiRAT	mm
AMPLITUDE	360 degrees orientated acoustic amplitude	HiRAT	-
THORIUM	Spectral gamma, Thorium component	9080	PPM
URANIUM	Spectral gamma, Uranium component	9080	PPM
POTASSIUM	Spectral gamma, Potassium component	9080	percent
RES(16N)	Normal resistivity 16 inch	8144	ohm-m
RES(64N)	Normal resistivity 64 inch	8144	ohm-m
LATERAL	Lateral resistivity	8144	ohm-m
SPR	Single point resistivity	8144	ohm
SP	Self Potential	8144	V

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Job 547310A	Scale 1:500				
<hr/> <p>SKB geophysical borehole logging Borehole HFM31</p> <hr/>					Filename: HFM31_Presentation.wcl Drawing no.: 4.1







Borehole HFM33. Drawing no. 5.1. Borehole logs


Co-ordinates in RT90 2,5 gon V 0:-15

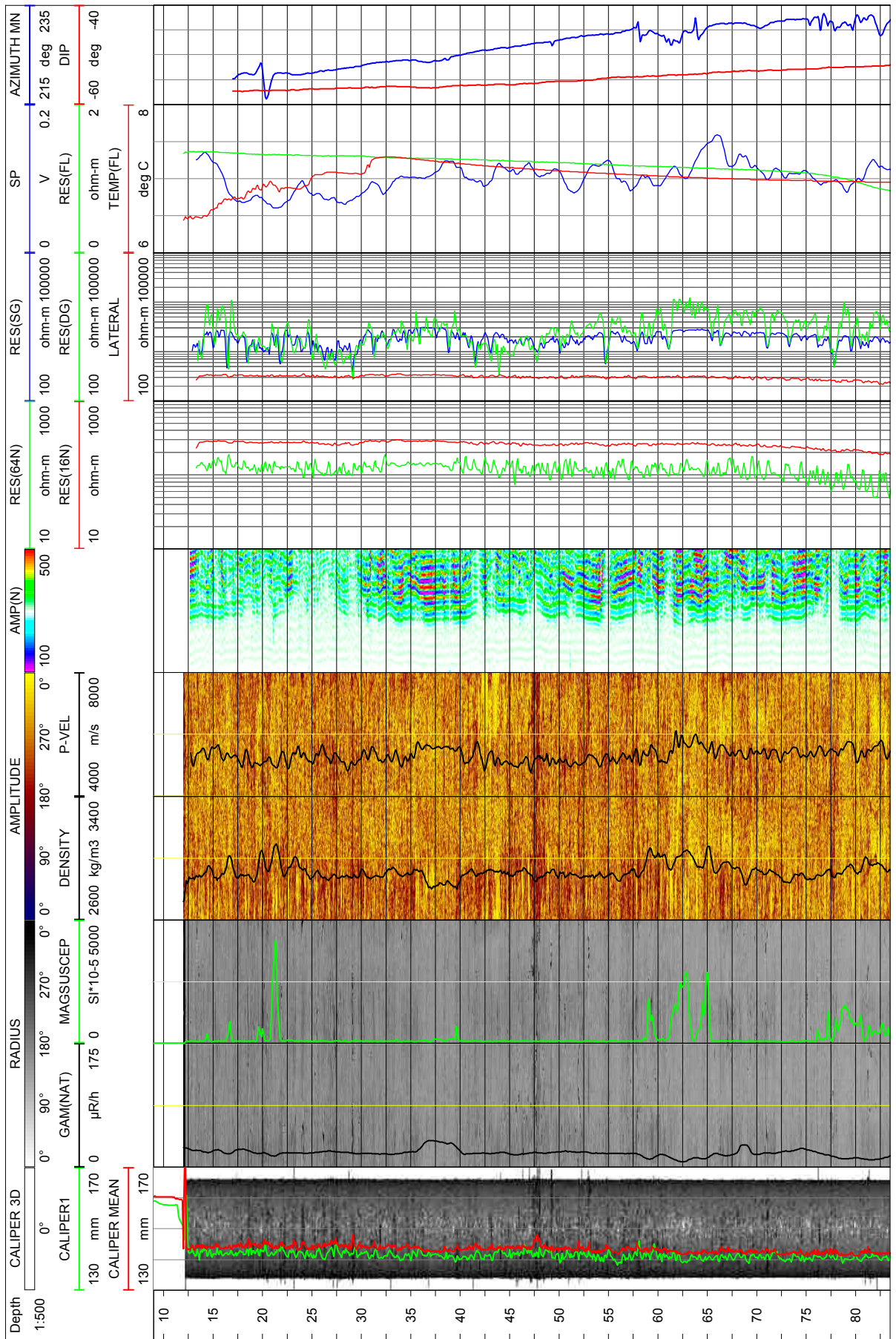
Northing: 6701042.567m Easting: 1632222.988m Elevation: 2.617m, RHB70

Diameter: 139.0-140.6mm
 Reaming Diameter: 180mm
 Outer Casing: 168mm
 Inner Casing: 160mm
 Casing Length: 12.04m
 Borehole Length: 140.2m
 Cone:
 Inclination at ground surface: -58.97°
 Azimuth: 271.64° GN
 Comments:

Borehole logging programme

Name	Description	Tool	Unit
CALIPER1	Caliper, 1-arm	9139	mm
DENSITY	Gamma-gamma density	9139	kg/m ³
RES(SG)	Focused guard log resistivity, 128 cm	9139	ohm-m
GAM(NAT)	Natural gamma	9072	µR/h
TEMP(FL)	Fluid temperature	9042	deg C
RES(FL)	Fluid resistivity	9042	ohm-m
RES(DG)	Focused guard log resistivity, 300cm	9072	ohm-m
P-VEL	P-wave velocity	9310	m/s
AMP(N)	Full wave form, near receiver	9310	µs
AMP(F)	Full wave form, far receiver	9310	µs
MAGSUSCEP	Magnetic susceptibility	8622	SI*10-5
CALIPER 3D	Caliper, high resolution 360 degrees	HiRAT	mm
CALIPER MEAN	High resolution 1D caliper	HiRAT	mm
AZIMUTH MN	Borehole azimuth magnetic north	HiRAT	deg
DIP	Borehole inclination from horizontal	HiRAT	deg
RADIUS	360 degrees orientated acoustic radius	HiRAT	mm
AMPLITUDE	360 degrees orientated acoustic amplitude	HiRAT	-
THORIUM	Spectral gamma, Thorium component	9080	PPM
URANIUM	Spectral gamma, Uranium component	9080	PPM
POTASSIUM	Spectral gamma, Potassium component	9080	percent
RES(16N)	Normal resistivity 16 inch	8144	ohm-m
RES(64N)	Normal resistivity 64 inch	8144	ohm-m
LATERAL	Lateral resistivity	8144	ohm-m
SPR	Single point resistivity	8144	ohm
SP	Self Potential	8144	V

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Job 547310A	Scale 1:500				
<hr/> <p>SKB geophysical borehole logging Borehole HFM33</p> <hr/> <p>Presentation</p>					Filename: HFM33_Presentation.wcl Drawing no.: 5.1




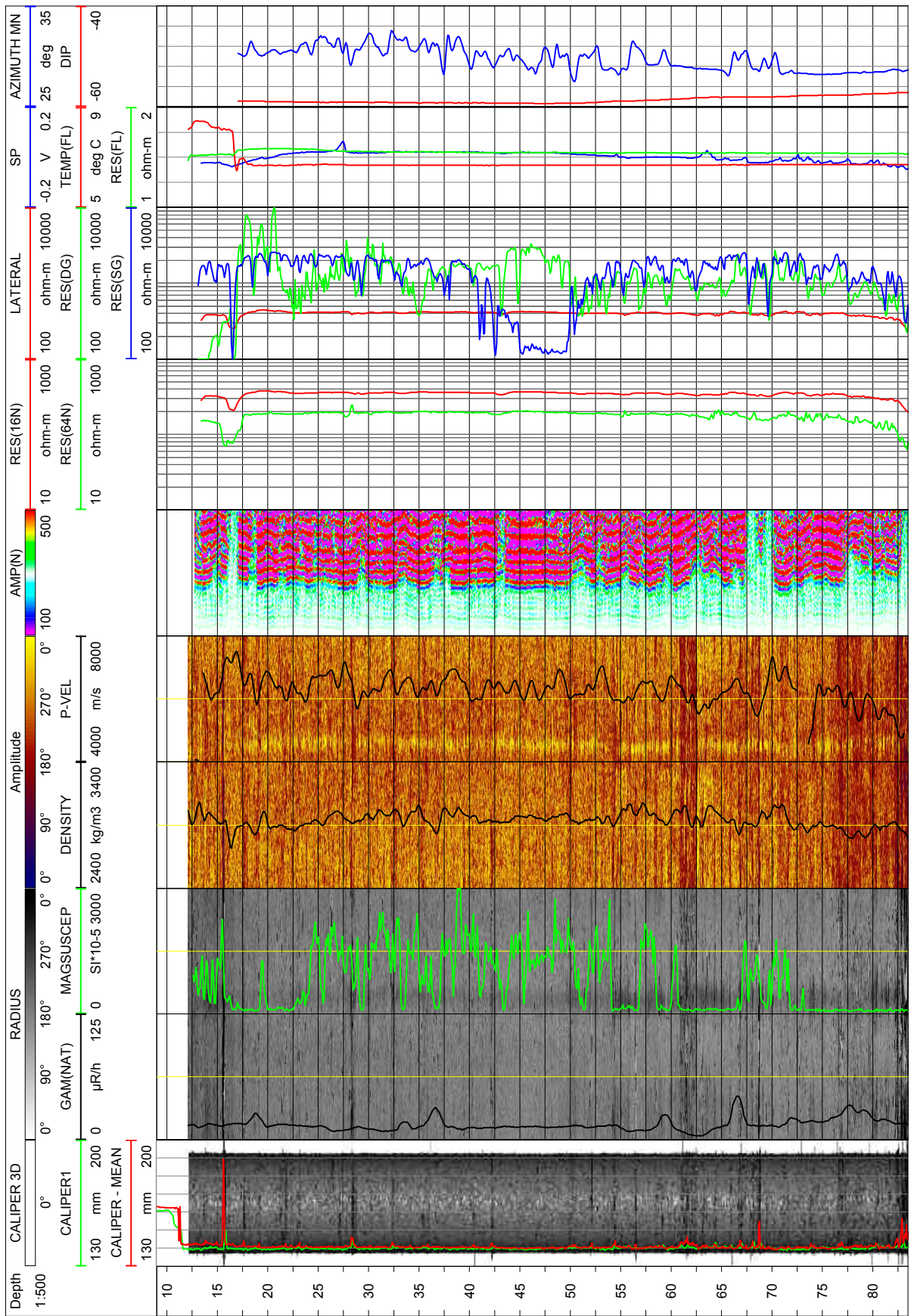
Borehole HFM34. Drawing no. 6.1. Borehole logs

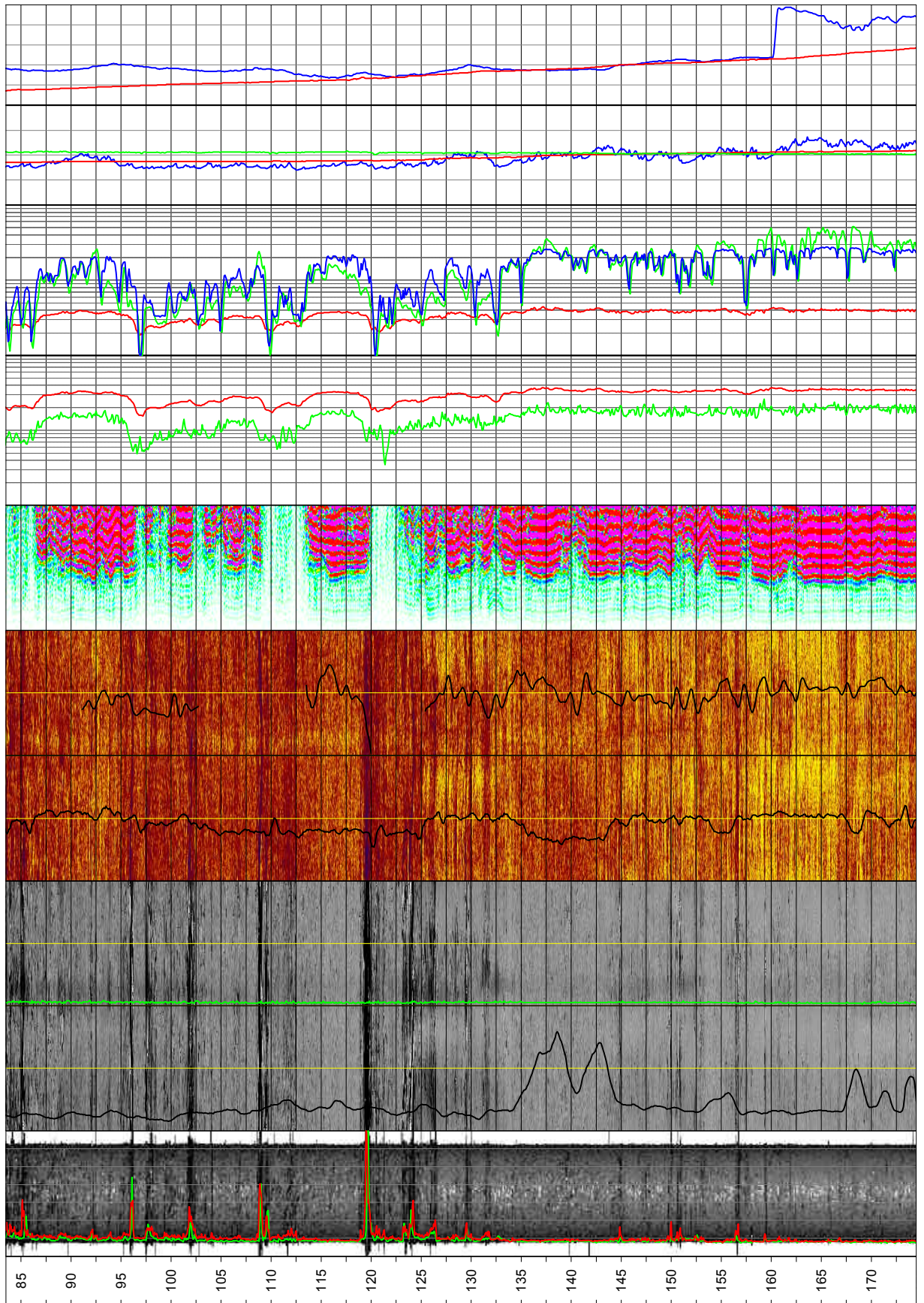
Co-ordinates in RT90 2,5 gon V 0:-15
 Northing: 6701325 m Easting: 1632471 m Elevation:
 Diameter: 136.8-138.5mm
 Reaming Diameter:
 Outer Casing: 168mm
 Inner Casing: 160mm
 Borehole Length: 200.75m
 Cone:
 Inclination at ground surface: -59°
 Azimuth: 31°GN
 Comments:

Borehole logging programme

Name	Description	Tool	Unit
CALIPER1	Caliper, 1-arm	9139	mm
DENSITY	Gamma-gamma density	9139	kg/m ³
RES(SG)	Focused guard log resistivity, 128 cm	9139	ohm-m
GAM(NAT)	Natural gamma	9072	µR/h
TEMP(FL)	Fluid temperature	9042	deg C
RES(FL)	Fluid resistivity	9042	ohm-m
RES(DG)	Focused guard log resistivity, 300cm	9072	ohm-m
P-VEL	P-wave velocity	9310	m/s
AMP(N)	Full wave form, near receiver	9310	µs
AMP(F)	Full wave form, far receiver	9310	µs
MAGSUSCEP	Magnetic susceptibility	8622	SI*10-5
CALIPER 3D	Caliper, high resolution 360 degrees	HiRAT	mm
CALIPER MEAN	High resolution 1D caliper	HiRAT	mm
AZIMUTH MN	Borehole azimuth magnetic north	HiRAT	deg
DIP	Borehole inclination from horizontal	HiRAT	deg
RADIUS	360 degrees orientated acoustic radius	HiRAT	mm
AMPLITUDE	360 degrees orientated acoustic amplitude	HiRAT	-
THORIUM	Spectral gamma, Thorium component	9080	PPM
URANIUM	Spectral gamma, Uranium component	9080	PPM
POTASSIUM	Spectral gamma, Potassium component	9080	percent
RES(16N)	Normal resistivity 16 inch	8144	ohm-m
RES(64N)	Normal resistivity 64 inch	8144	ohm-m
LATERAL	Lateral resistivity	8144	ohm-m
SPR	Single point resistivity	8144	ohm
SP	Self Potential	8144	V

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Job 547310A	Scale 1:500				
<hr/> <h2>SKB geophysical borehole logging</h2> <h3>Borehole HFM34</h3> <hr/>					Filename: HFM34_Presentation.wcl Drawing no.: 6.1





Borehole HFM35. Drawing no. 7.1. Borehole logs

Co-ordinates in RT90 2,5 gon V 0:-15

Northing: 6701555.86m Easting: 1632320.51m Elevation: 1.90m, RHB70

Diameter: 135.3-138mm

Reaming Diameter: 180mm

Outer Casing: 168mm

Inner Casing: 160mm

Borehole Length: 200.75m

Cone:


Inclination at ground surface: -59.19°

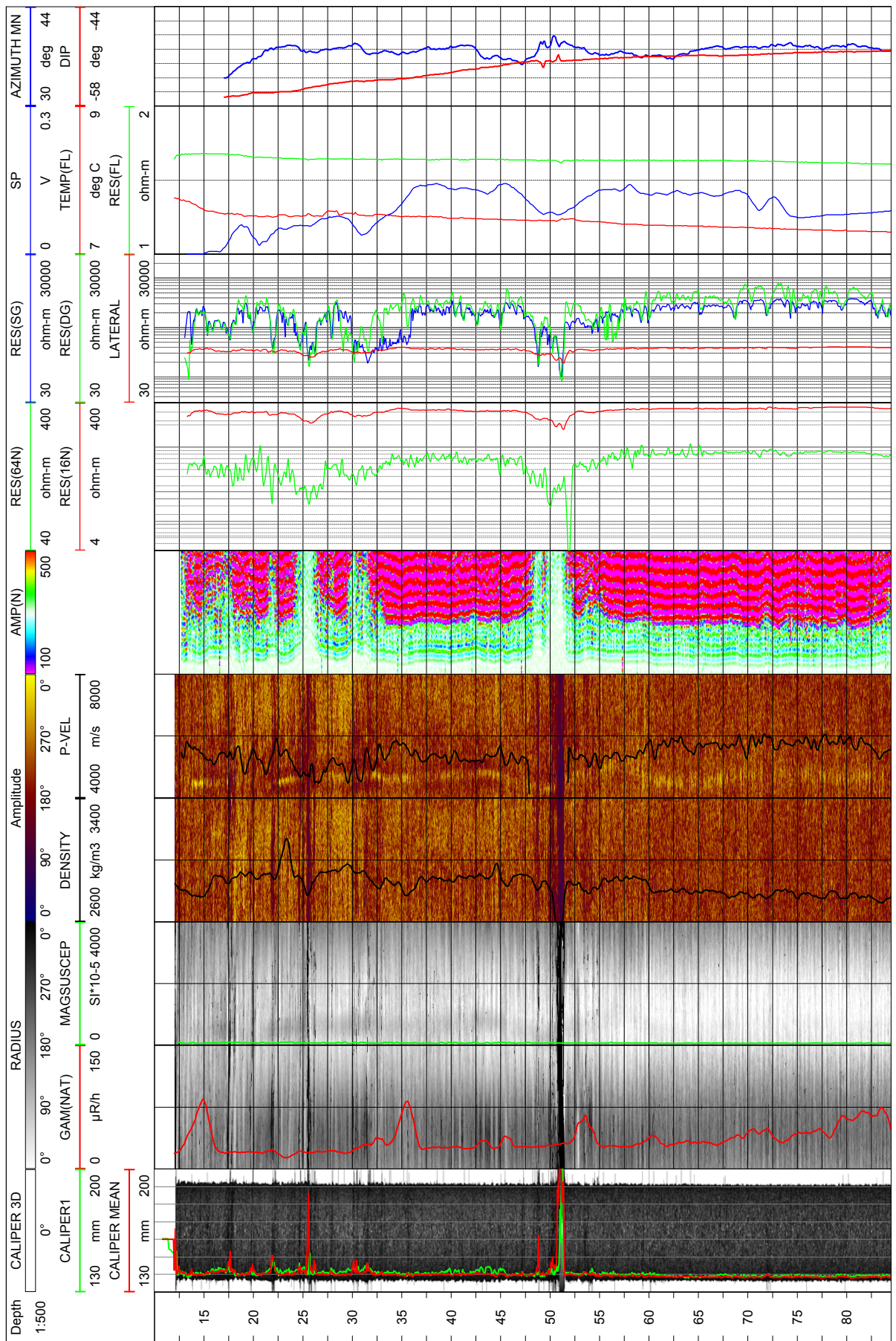
Azimuth: 32.96°GN

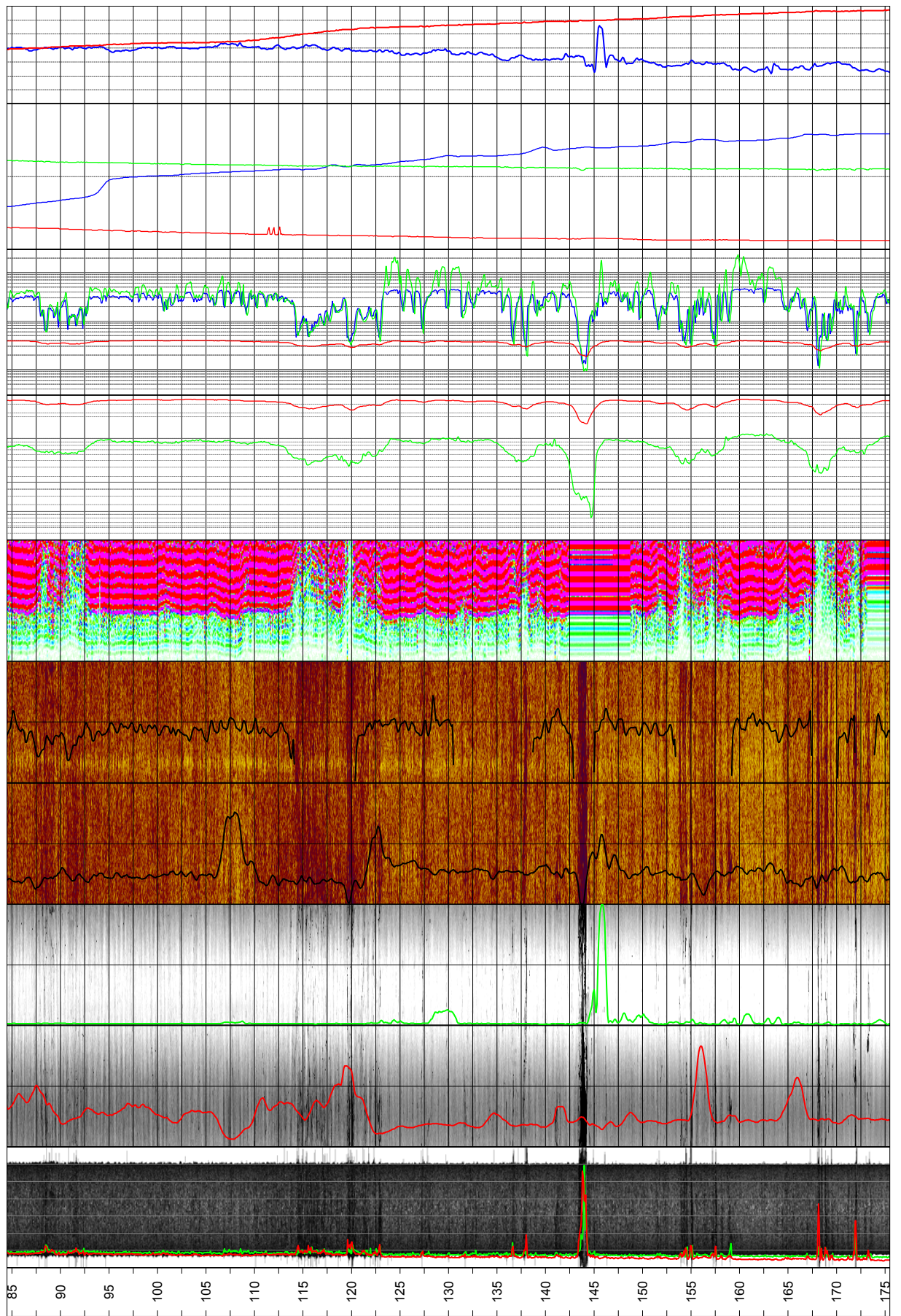
Comments:

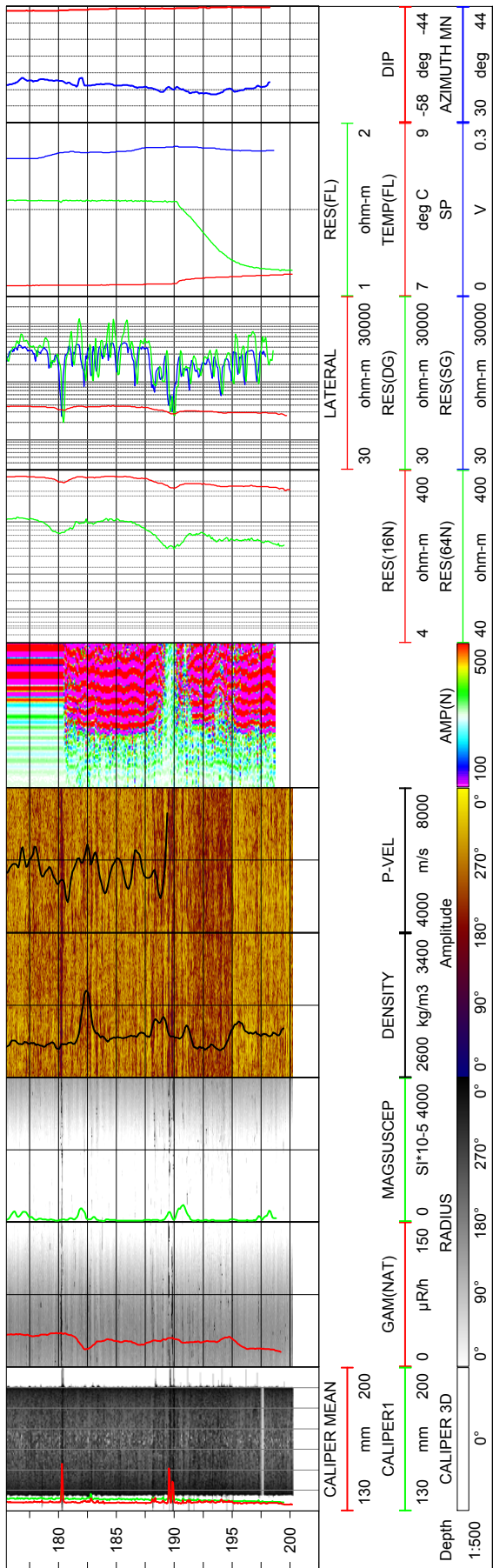
Borehole logging programme

Name	Description	Tool	Unit
CALIPER1	Caliper, 1-arm	9139	mm
DENSITY	Gamma-gamma density	9139	kg/m ³
RES(SG)	Focused guard log resistivity, 128 cm	9139	ohm-m
GAM(NAT)	Natural gamma	9072	µR/h
TEMP(FL)	Fluid temperature	9042	deg C
RES(FL)	Fluid resistivity	9042	ohm-m
RES(DG)	Focused guard log resistivity, 300cm	9072	ohm-m
P-VEL	P-wave velocity	9310	m/s
AMP(N)	Full wave form, near receiver	9310	µs
AMP(F)	Full wave form, far receiver	9310	µs
MAGSUSCEP	Magnetic susceptibility	8622	SI*10-5
CALIPER 3D	Caliper, high resolution 360 degrees	HiRAT	mm
CALIPER MEAN	High resolution 1D caliper	HiRAT	mm
AZIMUTH MN	Borehole azimuth magnetic north	HiRAT	deg
DIP	Borehole inclination from horizontal	HiRAT	deg
RADIUS	360 degrees orientated acoustic radius	HiRAT	mm
AMPLITUDE	360 degrees orientated acoustic amplitude	HiRAT	-
THORIUM	Spectral gamma, Thorium component	9080	PPM
URANIUM	Spectral gamma, Uranium component	9080	PPM
POTASSIUM	Spectral gamma, Potassium component	9080	percent
RES(16N)	Normal resistivity 16 inch	8144	ohm-m
RES(64N)	Normal resistivity 64 inch	8144	ohm-m
LATERAL	Lateral resistivity	8144	ohm-m
SPR	Single point resistivity	8144	ohm
SP	Self Potential	8144	V

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Job 547310A	Scale 1:500				
<hr/> <p>SKB geophysical borehole logging Borehole HFM35</p> <hr/>					Filename: HFM35_Presentation.wcl Drawing no.: 7.1







Borehole HFM38. Drawing no. 8.1. Borehole logs


Co-ordinates in RT90 2,5 gon V 0:-15

Northing: 6700701.28 Easting: 1631301.71 Elevation: 2.21

Diameter: 136 mm
 Reaming Diameter: 180 mm
 Outer Casing: 168 mm
 Inner Casing: 160 mm
 Casing Length: 9.05 m
 Borehole Length: 200.75 m
 Cone:
 Inclination at ground surface: -54.45
 Azimuth: 93.62
 Comments:

Borehole logging programme

Name	Description	Tool	Unit
CALIPER1	Caliper, 1-arm	9139	mm
DENSITY	Gamma-gamma density	9139	kg/m ³
RES(SG)	Focused guard log resistivity, 128 cm	9139	ohm-m
GAM(NAT)	Natural gamma	9072	µR/h
TEMP(FL)	Fluid temperature	9042	deg C
RES(FL)	Fluid resistivity	9042	ohm-m
RES(DG)	Focused guard log resistivity, 300cm	9072	ohm-m
P-VEL	P-wave velocity	9310	m/s
AMP(N)	Full wave form, near receiver	9310	µs
AMP(F)	Full wave form, far receiver	9310	µs
MAGSUSCEP	Magnetic susceptibility	8622	SI*10-5
CALIPER 3D	Caliper, high resolution 360 degrees	HiRAT	mm
CALIPER MEAN	High resolution 1D caliper	HiRAT	mm
AZIMUTH MN	Borehole azimuth magnetic north	HiRAT	deg
DIP	Borehole inclination from horizontal	HiRAT	deg
RADIUS	360 degrees orientated acoustic radius	HiRAT	mm
AMPLITUDE	360 degrees orientated acoustic amplitude	HiRAT	-
THORIUM	Spectral gamma, Thorium component	9080	PPM
URANIUM	Spectral gamma, Uranium component	9080	PPM
POTASSIUM	Spectral gamma, Potassium component	9080	percent
RES(16N)	Normal resistivity 16 inch	8144	ohm-m
RES(64N)	Normal resistivity 64 inch	8144	ohm-m
LATERAL	Lateral resistivity	8144	ohm-m
SPR	Single point resistivity	8144	ohm
SP	Self Potential	8144	V

Rev. 0	Date 2006-08-28	Drawn by JJJ	Control UTN	Approved UTN	 <small>Ramboll, Bredevej 2, DK-2830 Virum Phone + 45 45 98 60 00, Fax + 45 45 98 67 00</small>
Job 547310A	Scale 1:500				
<hr/> <h2>SKB geophysical borehole logging</h2> <h3>Borehole HFM38</h3> <hr/> <p>Presentation</p>					Filename: HFM38_Presentation.wcl Drawing no.: 8.1

