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Oskarshamn site investigation

Geophysical borehole logging in borehole KLX03, HLX21, HLX22, HLX23, HLX24 and HLX25

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Abstract

Geophysical borehole logging has been performed in boreholes KLX03, HLX21, HLX22, HLX23, HLX24 and HLX25 situated in Laxemar in Oskarshamn, 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.

The logging in KLX03 was recorded from 100 m to 1,000 m, HLX21 was recorded from 0 to 150 m, HLX22 and HLX23 was recorded from 0 to 160 m, HLX24 was recorded from 0 to 175 and HLX25 was recorded from 0 to 200 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 to 6.

Sammanfattning

Geofysisk borrhålsloggning har genomförts i borrhålen KLX03, HLX21, HLX22, HLX23, HLX24 och HLX25 i delområde Laxemar, Oskarshamn.

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 KLX03 från 100 m till 1 000 m, HLX21 mättes från 0 till 100 m, HLX22 och HLX23 mättes från 0 till 160 m, HLX24 mättes från 0 till 175 m och HLX15 mättes från 0 till 150 m.

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

Processerade loggar presenteras i Appendix 1 till 6.

Contents

1 Introduction

This document reports the results gained by the geophysical borehole logging in boreholes KLX03, HLX21, HLX22, HLX23, HLX24 and HLX25, which is one of the activities performed within the site investigation at Oskarshamn. The work was carried out in accordance with activity plan AP PS 400-04-081 (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 September 30 to October 3, 2004. All boreholes were recorded from Top Of Casing (TOC) to the bottom of the borehole. The technical data from the boreholes are shown in Table 1-2. The locations of the boreholes are shown in Figure 1-1.

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

Activity plan	Number	Version
Geofysisk borrhålsloggning i KLX03, HLX21, HLX22, HLX23, HLX24 and HLX25	AP PS 400-04-081	1.0
Method descriptions	**Number**	**Version**
Metodbeskrivning för geofysisk borrhålsloggning	SKB MD 221.002	1.0
Metodbeskrivning för krökningsmätning av hammar- och kärnborrhål	SKB MD 224.001	1.0

Table 1-2. Technical data from core boreholes KLX03 and percussion drilled boreholes HLX21, HLX22, HLX23, HLX24 and HLX25.

Boreholes parameter	KLX03	HLX21	HLX22	HLX23	HLX24	HLX25
Co-ordinates (RT90)	X: 6366112.593 Y: 1547718.925	X: 6366568.750 Y: 1549632.363	X: 6366487.834 Y: 1549661.542	X: 6366578.005 Y: 1548888.673	X: 6366503.722 Y: 1548865.890	X: 6366783.974 Y: 1547776.324
Elevation (RHB70)	Z: 18.486 m	Z: 10.312 m	Z: 10.057 m	Z: 14.690 m	Z: 12.769 m	Z: 20.656 m
Inclination (from horizontal)	–74.931°	–56.991°	–59.436°	–58.184°	–58.394°	–58.585°
Azimuth	199.043°	185.541°	13.451°	182.893°	358.692°	17.935°
Length	1,000.42 m	150.3 m	163.20 m	160.2 m	175.2 m	202.50 m
Casing	0–11,65 m ∅ 323/311 mm 0–100.00 m ∅ 208/200 mm 100.00–100.05 m ∅ 208/170 mm	0–8.94 m ∅ 168/160 mm 8.94–9.03 m ∅ 168/147 mm	0–8.94 m ∅ 168/160 mm 8.94–9.03 m ∅ 168/147 mm	0–5.94 m ∅ 168/160 mm 5.94–6.03 m ∅ 168/147 mm	0–8.94 m ∅ 168/160 mm 8.94–9.03 m ∅ 168/147 mm	0–5.94 m ∅ 168/160 mm 5.94–6.03 m ∅ 168/147 mm
Cone	100.05 m–101.45 m 100/ 77 mm					
Borehole diameter	76 mm (100.35–1,000.42 m)	190 mm (0–9.1 m) 138 mm (9.1–50.3 m)	∅ 190 mm (0–9.1 m) ∅ 138 mm (9.1–163.20 m)	∅ 190 mm (0–6.1 m) ∅ 138.5 mm (6.1–160.2 m)	∅ 190 mm (0–9.1 m) ∅ 139 mm (9.1–175.2 m)	∅ 190 mm (0–6.12 m) ∅ 135 mm (6.12–202.50 m)
Cleaning level	Level 2	Level 1	Level 1	Level 1	Level 1	Level 1

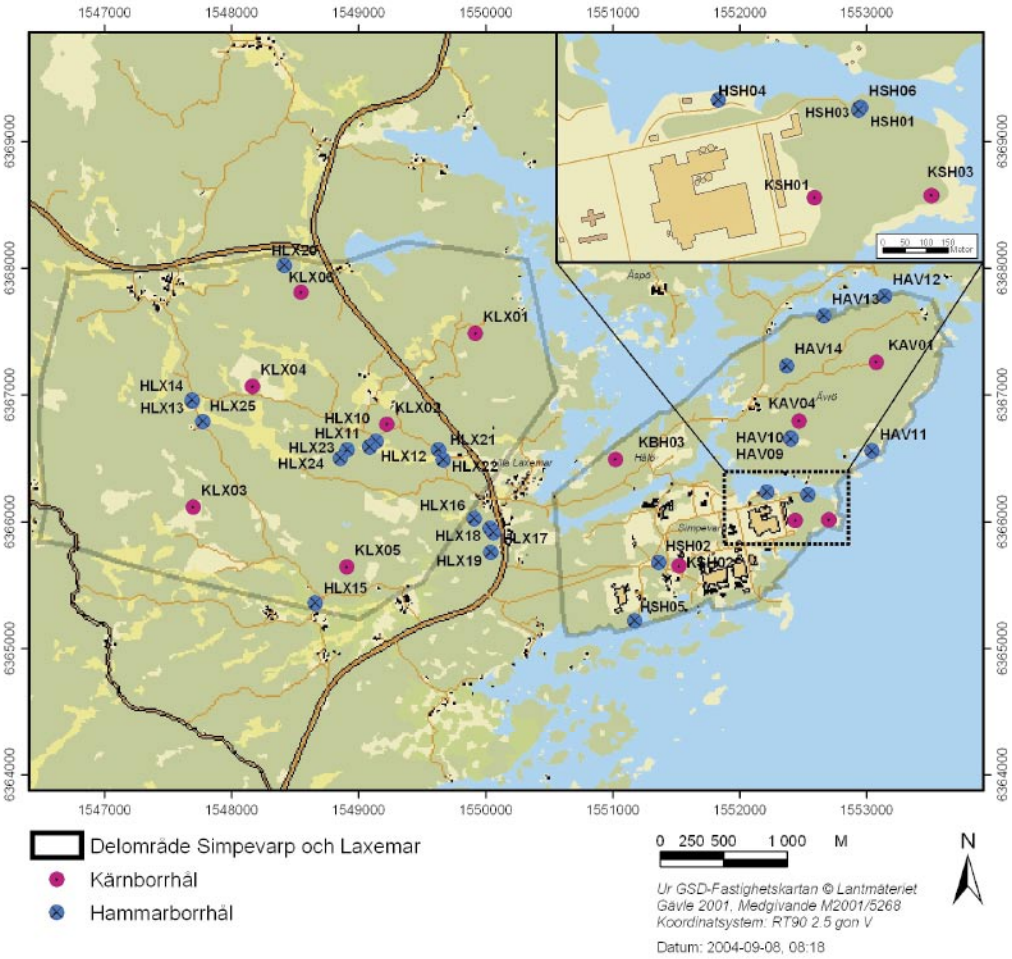

Figure 1-1. *General overview over the Simpevarp and Laxemar subareas.*

The delivered raw and processed data have been inserted in the database of SKB (SICADA). The SICADA field note reference to the present activity is presented in Table 1-3.

Table 1-3. Data references.

Subactivity	Database	Identity number
Geofysisk borrhålsloggning KLX03	SICADA	Field note 496

2 Objective and scope

The objective of the survey is to both 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 borehole, KLX03.

This field report describes the equipment used as well the measurement procedures. Geophysical borehole logging data is presented in graphs as a function of depth in drawing no 1.1 for borehole KLX03 in Appendix 1, drawing no 2.1 for borehole HLX21 in Appendix 2, drawing no 3.1 for borehole HLX22 in Appendix 3, drawing no 4.1 for borehole HLX23 in Appendix 4, drawing no 5.1 for borehole HLX24 in Appendix 5 and drawing no 6.1 for borehole HLX25 in Appendix 6.

3 Equipment

The geophysical borehole logging program in all boreholes was performed with 6 multi tool probes and resulted in a suite of 19 log types, listed in Table 5-1. The tools and recorded logs are listed in Table 3-1.

Table 3-1. Logging tools and logs recorded in KLX03, HLX21, HLX22, HLX23, HLX24 and HLX25.

Tool	Recorded logs	Dimension	Source detector spacing and type	Tool position in borehole
Century 8044 Normal resistivity, fluid temperature and fluid resistivity.	Normal resistivity (16 and 64 inch), single point resistance, fluid resistivity, fluid temperature and natural gamma.	237×5.3 cm		
Century 8622 Magnetic susceptibility.	Magnetic susceptibility, natural gamma.	203×4.1 cm		
Century 9030 Gamma density.	Gamma density, natural gamma, 140 cm focused guard log resistivity, 10 cm 1-arm calliper.	307×5.6 cm	20.3 cm 125 mCi Cs137	Sidewall. Gamma source focused.
Century 9072 3 m focused guard.	3 m focused guard log resistivity and natural gamma.	310×6.4 cm		
Century 9310 Sonic.	Full wave form travel-time providing P and S-wave velocity picking, compensated P-wave travel-time and natural gamma.	283.2×5.1 cm	Near 2 ft. Far 3 ft.	Centralized.
RG 25 112 000 iRAT Acoustic televiewer.	Full waveform acoustic amplitude and travel-time, 360° orientated acoustic image, 360° very high resolution caliper, borehole azimuth and dip.	246×4 cm		Centralized.

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 September 30 to October 3, 2004. All relevant logging events were described in the daily report sheets delivered to SICADA field note no 496.

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. The cleaning was done according to SKB cleaning level 2 (SKB internal controlling document SKB MD 600.004) before arriving at the site. Furthermore, all equipment was wiped with alcohol before it was lowered into the boreholes.

A function test of the deviations measurements in the HiRAT tool was performed before arriving at the site, following SKB internal controlling document SKB MD 224.001.

For control, each log run is normally recorded both in down and in upward direction using the down run as a repeat section. For logging tool 9030 recording a repeat section in upward direction controls the data. The depth 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 tool 9310.

All data was recorded with max.10 cm sample interval. The speed of the logging tools was in general 10 m/min for the used log runs.

4.2 Nonconformities

The calculated values for the Caliper Mean log were not reliable for KLX03 and HLX22. The Caliper Mean log is therefore not included in the presentation for these two boreholes.

5 Results

5.1 Presentation

All relevant logging events were described in the daily report sheet which was delivered separately.

Logs presented in drawings no 1.1 in Appendix 1, no 2.1 in Appendix 2, no 3.1 in Appendix 3, no 4.1 in Appendix 4, no 5.1 in Appendix 5 and in no 6.1 in Appendix 6 are presented in Table 5-1.

Table 5-1. Logs presented in drawings no 1.1–6.1 in Appendices 1–6.

Log	Log name short	Unit	Tool
Fluid temperature	TEMP(FL)	deg C	8044
Fluid resistivity	RES(FL)	ohm-m	8044
Normal resistivity 16 inch	RES(16N)	ohm-m	8044
Normal resistivity 64 inch	RES(64N)	ohm-m	8044
Lateral resistivity	LATERAL	ohm-m	8044
Single point resistance	SPR	ohm	8044
Magnetic susceptibility	MAGSUSCEP	SI*10^{-5}	8622
Caliper, 1-arm	CALIPER1	mm	9030
Gamma-gamma density	DENSITY	kg/m^3	9030
Focused guard log resistivity, 140 cm	RES(MG)	ohm-m	9030
Natural gamma	GAM(NAT)	μR/h	9030
Focused guard log resistivity, 300 cm	RES(DG)	ohm-m	9072
P-wave velocity	P-VEL	m/s	9310
Full wave form, near receiver	AMP(N)	μs	9310
Full wave form, far receiver	AMP(F)	μs	9310
Caliper, high resolution. 360°	CALIPER 3D	Mm	HiRAT
High resolution 1D Caliper	CALIPER MEAN	Mm	HiRAT
Borehole azimuth magnetic north	AZIMUTH MN	Deg	HiRAT
Borehole Inclination from horizontal	DIP	Deg	HiRAT
360° orientated acoustic travel time	TRAVEL TIME	100 ns	HiRAT
360° orientated acoustic travel time	AMPLITUDE	–	HiRAT

5.2 Orientations, alignment and stretch of logs

5.2.1 Orientation of images

The orientation of the results from the HiRAT Acoustic tool, are done after recording. The orientation is done using the raw data from the magnetometers and accelerometers, where spikes and disturbed data are deleted or filtered away.

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).

5.2.3 Alignment of data

In order to obtain an exact depth 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 depths from the track marks and from the HiRAT tool are used to make a new depth scale in WellCAD. All log files are shifted using the new depth scale.

5.2.4 Stretch of logs

There is a minor difference in the used winch between up- and down runs in the depth registration. The size of the defect is about 1.5 m/km. To compensate for this the logs are stretched using another new depth scale for each tool. The depth 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 depth scale is made and added to the log.

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 all sonic logs have been manually repicked in WellCAD using the full wave signal.

5.3 Calculated log curves

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

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 μR/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	–
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 the difference between the first arrival from the far and near signal. (121.9 cm–91.4 cm)/ (Time(far)–Time(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 acoustical televiewer, the fluid temperature, fluid velocity and the internal travel time in the acoustical 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 travel time	–

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.

Latitude: 57 deg, 25 min, 04 sec

Longitude: 16 deg, 35 min, 57 sec

Elevation: 0.00 km

Date of Interest: 30/09/2004

Declination = 3° 15' E

5.4 Borehole KLX03

In order to obtain an exact depth calibration in borehole KLX03, the track marks made while drilling are used. The connection between the track marks and the logs is obtained from the HiRAT Acoustic tool.

To obtain a common depth reference point, the track mark at 107.35 m in the HiRAT file is used as the marker at depth 110 m. The HiRAT tool is therefore shifted 2.65 m down. The same correction value is used for the whole boring.

The reference mark made in the borehole, the recorded track marks from the HiRAT and the corrected depth are observed in the following depths, Table 5-3.

Table 5-3. The reference mark made in the borehole, the recorded track marks form the HiRAT and the corrected depth.

HIRAT recorded	HIRAT after shift
107.35	110.00
147.38	150.03
197.43	200.08
247.44	250.09
297.49	300.14
347.52	350.17
396.56	399.21
397.57	400.22
447.63	450.28
497.67	500.32
547.71	550.36
597.77	600.42
647.85	650.50
697.91	700.56
747.97	750.62
798.11	800.76
848.15	850.80
898.29	900.94
948.44	951.09

A new depth scale is made using the corrected depth shown in Table 5-3. The new depth scale is applied to the HiRAT file. In this way a perfect match between given depths of the reference marks and the recorded data is obtained. By means of alignment of the observed gamma events in KLX03, between all logruns, the obtained reference mark correlation is transferred to the other logs.

The calculated values for the Caliper Mean log were not reliable. The Caliper Mean log is therefore not included in the presentation for KLX03.

The complete log suite for borehole KLX03 is presented as composite log sheets in drawing no 1.1 in Appendix 1. The logs presented in drawing no 1.1 are listed in Table 5-1.

5.5 Borehole HLX21

Using the natural gamma from the 8044 as reference, the natural gamma logs from the other probes are aligned to the same depth. A new depth scale is added to each log and afterwards the logs are stretched using the events shown in Table 5-4.

Table 5-4. Gamma events in borehole HLX21.

Events	Depths
Top event	18.82
Bottom event	146.22

The complete log suite for borehole HLX21 is presented as composite log sheet in drawing no 2.1 in Appendix 2. The logs presented in drawing no 2.1 are listed in Table 5-1.

5.6 Borehole HLX22

Using the natural gamma from the 8044 as reference, the natural gamma logs from the other probes are aligned to the same depth, and the shift correction value for the other tools is found. These values are shown in Table 5-5.

Table 5-5. Shift correction value in borehole HLX22.

Tool	Shift correction value
8044	0.00
8622	–0.30
9030	0.50
9072	0.00
9310	–0.20
HiRAT	–0.05

The calculated values for the Caliper Mean log were not reliable. The Caliper Mean log is therefore not included in the presentation for HLX22.

The complete log suite for borehole HLX22 is presented as composite log sheet in drawing no 3.1 in Appendix 3. The logs presented in drawing no 3.1 are listed in Table 5-1.

5.7 Borehole HLX23

Using the natural gamma from the 8044 as reference, the natural gamma logs from the other probes are aligned to the same depth, and the shift correction value for the other tools is found. These values are shown in Table 5-6.

Table 5-6. Shift correction value in borehole HLX23.

Tool	Shift correction value
8044	0.00
8622	0.20
9030	0.00
9072	0.08
9310	0.31
HiRAT	0.51

The complete log suite for borehole HLX23 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 HLX24

Using the natural gamma from the 8044 as reference, the natural gamma logs from the other probes are aligned to the same depth, and the shift correction value for the other tools is found. These values are shown in Table 5-7.

Table 5-7. Shift correction value in borehole HLX24.

Tool	Shift correction value
8044	0.00
8622	–0.20
9030	0.01
9072	–0.21
9310	–0.11
HiRAT	0.00

The complete log suite for borehole HLX24 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 HLX25

Using the natural gamma from the 8044 as reference, the natural gamma logs from the other probes are aligned to the same depth, and the shift correction value for the other tools is found. These values are shown in Table 5-8.

Table 5-8. Shift correction value in borehole HLX25.

Tool	Shift correction value
8044	0.00
8622	–0.20
9030	0.01
9072	–0.21
9310	–0.11
HiRAT	0.00

The complete log suite for borehole HLX25 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.

6 Data delivery

Geophysical logging data from the measurements, 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. The SICADA reference to the present activity is field note no 496.

The processed files shown on the drawings have been delivered in both WellCAD, Table 6-2, and the different 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
KLX03	8044	Down	KLX03_09-30-04_13-02_8044C_.01_0.27_ 990.10_ORIG.log	Start Depth: 0.27 m. End Depth: 990.1 m
KLX03	8622	Up	KLX03_09-30-04_18-36_8622C_.01_71.42_ 999.68_ORIG.log	Start Depth: 999.68 m. End Depth: 71.42 m
KLX03	9030	Up	KLX03_10-01-04_18-00_9030CA_.1_3.50_ 1001.00_ORIG.log	Start Depth: 1,001 m. End Depth: 3.5 m
KLX03	9072	Up	KLX03_10-01-04_10-41_9072C_.1_-2.10_ 388.40_ORIG.log	Start Depth: 388.4 m. End Depth: –2.1 m
KLX03	9072	Up	KLX03_10-01-04_09-23_9072C_.1_379.40_ 999.40_ORIG.log	Start Depth: 999.4 m. End Depth: 379.4 m
KLX03	9310	Up	KLX03_10-01-04_12-12_9310C2_.10_-4.40_ 999.80_ORIG.log	Start Depth: 999.8 m. End Depth: –4.4 m
HLX21	8044	Down	HLX21_10-02-04_13-06_8044C_.10_0.10_ 149.90_ORIG.log	Start Depth: 0.1 m. End Depth: 149.9 m
HLX21	8622	Up	HLX21_10-02-04_14-23_8622C_.10_-0.40_ 149.40_ORIG.log	Start Depth: 149.4 m. End Depth: –0.4 m
HLX21	9030	Up	HLX21_10-02-04_15-51_9030CA_.10_3.70_ 149.80_ORIG.log	Start Depth: 149.8 m. End Depth: 3.7 m
HLX21	9072	Up	HLX21_10-02-04_14-00_9072C_.10_2.30_ 149.40_ORIG.log	Start Depth: 149.4 m. End Depth: 2.3 m
HLX21	9310	Up	HLX21_10-02-04_15-12_9310C2_.10_2.00_ 148.70_ORIG.log	Start Depth: 148.7 m. End Depth: 0.2 m
HLX21	HiRAT	Up	HLX21_HiRAT_90_pixels_up_run2.HED	Start Depth: 150 m. End Depth: 0 m
HLX22	8044	Down	HLX22_10-02-04_09-03_8044C_.1_0.10_ 162.60_ORIG.log	Start Depth: 0.1 m. End Depth: 162.6 m
HLX22	8622	Up	HLX22_10-02-04_10-14_8622C_.1_-0.50_ 162.50_ORIG.log	Start Depth: 162.5 m. End Depth: –0.5 m
HLX22	9030	Up	HLX22_10-02-04_12-20_9030CA_.10_3.80_ 161.60_ORIG.log	Start Depth: 161.6 m. End Depth: 3.8 m
HLX22	9072	Up	HLX22_10-02-04_09-45_9072C_.1_-0.60_ 162.50_ORIG.log	Start Depth: 162.5 m. End Depth: –0.6 m
HLX22	9310	Up	HLX22_10-02-04_11-12_9310C2_.10_-0.40_ 161.70_ORIG.log	Start Depth: 161.7 m. End Depth: –0.4 m
HLX22	HiRAT	Up	HLX22_HiRAT_90_pixels_up_run2.HED	Start Depth: 162 m. End Depth: 0 m

Borehole	Probe	Log direction	WellCAD File	Description
HLX23	8044	Down	HLX23_10-02-04_16-39_8044C_.10_0.10_ 159.80_ORIG.log	Start Depth: 0.1 m. End Depth: 159.8 m
HLX23	8622	Up	HLX23_10-02-04_17-38_8622C_.10_1.60_ 159.30_ORIG.log	Start Depth: 159.3 m. End Depth: 1.6 m
HLX23	9030	Up	HLX23_10-02-04_19-12_9030CA_.10_0.30_ 159.70_ORIG.log	Start Depth: 159.7 m. End Depth: 0.3 m
HLX23	9072	Up	HLX23_10-02-04_17-13_9072C_.10_0.40_ 159.80_ORIG.log	Start Depth: 159.8 m. End Depth: 0.4 m
HLX23	9310	Up	HLX23_10-02-04_18-33_9310C2_.10_0.30_ 158.60_ORIG.log	Start Depth: 158.6 m. End Depth: 0.3 m
HLX23	HiRAT	Up	HLX23_HiRAT_90_pixels_up_run2.HED	Start Depth: 160 m. End Depth: 0 m
HLX24	8044	Down	HLX24_10-03-04_09-06_8044C_.10_0.10_ 174.70_ORIG.log	Start Depth: 0.1 m. End Depth: 174.7 m
HLX24	8622	Up	HLX24_10-03-04_10-15_8622C_.10_3.20_ 174.80_ORIG.log	Start Depth: 174.8 m. End Depth: 3.2 m
HLX24	9030	Up	HLX24_10-03-04_12-03_9030CA_.10_3.60_ 174.10_ORIG.log	Start Depth: 174.1 m. End Depth: 3.6 m
HLX24	9072	Up	HLX24_10-03-04_09-47_9072C_.10_3.40_ 174.50_ORIG.log	Start Depth: 174.5 m. End Depth: 3.4 m
HLX24	9310	Up	HLX24_10-03-04_11-10_9310C2_.10_3.20_ 173.50_ORIG.log	Start Depth: 173.5 m. End Depth: 3.2 m
HLX24	HiRAT	Up	HLX24_HiRAT_90_pixels_up_run2.HED	Start Depth: 175 m. End Depth: 0 m
HLX25	8044	Down	HLX25_10-03-04_13-12_8044C_.10_0.10_ 204.60_ORIG.log	Start Depth: 0.1 m. End Depth: 204.6 m
HLX25	8622	Up	HLX25_10-03-04_14-29_8622C_.10_3.10_ 202.30_ORIG.log	Start Depth: 202.3 m. End Depth: 3.1 m
HLX25	9030	Up	HLX25_10-03-04_16-06_9030CA_.10_3.60_ 202.20_ORIG.log	Start Depth: 202.2 m. End Depth: 3.6 m
HLX25	9072	Up	HLX25_10-03-04_13-57_9072C_.10_1.70_ 202.30_ORIG.log	Start Depth: 202.3 m. End Depth: 1.7 m
HLX25	9310	Up	HLX25_10-03-04_15-29_9310C2_.10_1.50_ 201.00_ORIG.log	Start Depth: 201 m. End Depth: 1.5 m
HLX25	HiRAT	Up	HLX25_HiRAT_90_pixels_up_run2.HED	Start Depth: 202 m. End Depth: 0 m

Table 6-2. Drawing files in WellCad format.

Borehole	Drawing	WellCad file
KLX03	1.1	KLX03_Presentation.WCL
HLX21	2.1	HLX21_Presentation.WCL
HLX22	3.1	HLX22_Presentation.WCL
HLX23	4.1	HLX23_Presentation.WCL
HLX24	5.1	HLX24_Presentation.WCL
HLX25	6.1	HLX25_Presentation.WCL

Table 6-3. Data files in excel for each borehole. Files in SICADA format.

Sheet	Comment
“Borehole”_GP040 – Caliper logging.xls	
“Borehole”_GP041 – 3-D caliper.xls	Not included for borehole KLX03 and HLX22
“Borehole”_GP060 – Fluid temperature and resistivity logging.xls	
“Borehole”_GP090 – Density logging.xls	
“Borehole”_GP110 – Magnetic susceptibility logging.xls	
“Borehole”_GP120 – Natural gamma logging.xls	
“Borehole”_GP150 – Single point resistance logging.xls	
“Borehole”_GP160 – Resistivity, normal 1.6 m (64 in).xls	
“Borehole”_GP161 – Resistivity, focused 140 cm.xls	
“Borehole”_GP162 – Resistivity, focused 300 cm.xls	
“Borehole”_GP163 – Resistivity, lateral 1.6–0.1 m.xls	
“Borehole”_GP164 – Resistivity, normal 0.4 m (16 in).xls	
“Borehole”_GP175 – Fullwave sonic.xls	
“Borehole”_GP830 – Acoustic televiewer.xls	

Borehole KLX03. Drawing no 1.1. Borehole logs

Borehole No. KLX03

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

Northing: 6366112.593 Easting: 1547718.925 Elevation: 18.486

Diameter:	Ø76 mm
Reaming Diameter:	
Outer Casing:	323 mm
Inner Casing:	311 mm
Borehole Length:	1000.42 m
Cone:	
Inclination at ground surface:	-74.931 deg
Azimuth:	199.043 deg
Comments:	

Borehole logging programme

Name	Description	Tool	Unit
CALIPER1	Caliper, 1-arm	9030	mm
DENSITY	Gamma-gamma density	9030	kg/m³
RES(MG)	Focused guard log resistivity, 140cm	9030	ohm-m
GAM(NAT)	Natural gamma	9030	µR/h
TEMP(FL)	Fluid temperature	8044	deg C
RES(FL)	Fluid resistivity	8044	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
TRAVEL TIME	360 degrees orientated acoustic travel time	HiRAT	100 ns
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	8044	ohm-m
RES(64N)	Normal resistivity 64 inch	8044	ohm-m
LATERAL	Lateral resistivity	8044	ohm-m
SPR	Single point resistivity	8044	ohm

Rev.	Date	Drawn by	Control	Approved
0	2004-10-26	FDH	UTN	UTN

Job 360210A

Scale 1:500

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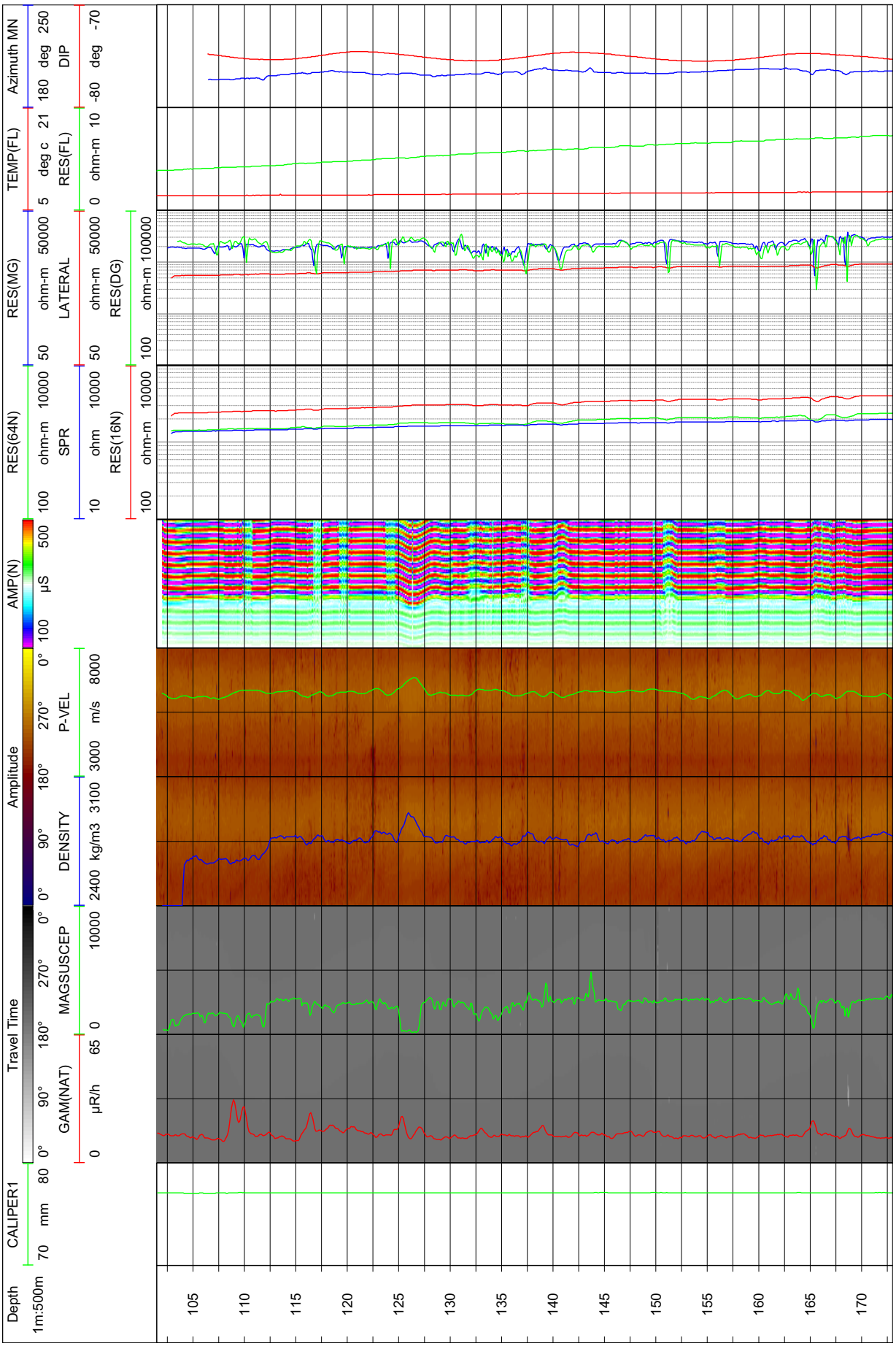
SKB geophysical borehole logging
Borehole KLX03.

Presentation

Filename: KLX03_Presentation.wcl

Drawing no.: **1.1**


Depth
1m:500m
CALIPER1
70 mm 80
Travel Time
0° 90° 180° 270° 0°
GAM(NAT)
0 µR/h 65
MAGSUSCEP
0 10000
Amplitude
0° 90° 180° 270° 0°
DENSITY
2400 kg/m3 3100
P-VEL
3000 m/s 8000
AMP(N)
100 µS 500
RES(64N)
100 ohm-m 10000
SPR
10 ohm 10000
RES(16N)
100 ohm-m 10000
RES(MG)
50 ohm-m 50000
LATERAL
50 ohm-m 50000
RES(DG)
100 ohm-m 100000
TEMP(FL)
5 deg c 21
RES(FL)
0 ohm-m 10
Azimuth MN
180 deg 250
DIP
-80 deg -70
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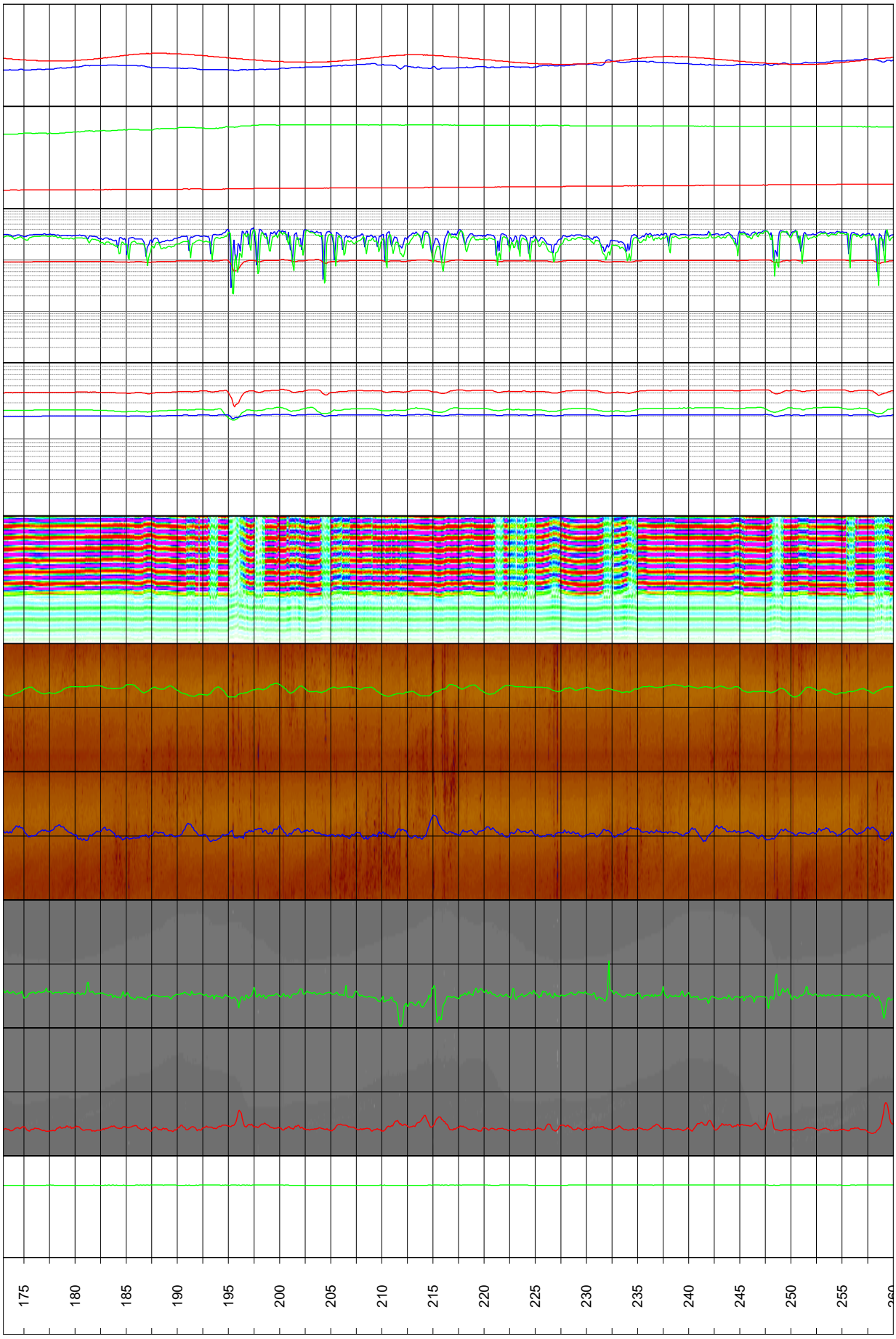
110
115
120
125
130
135
140
145
150
155
160
165
170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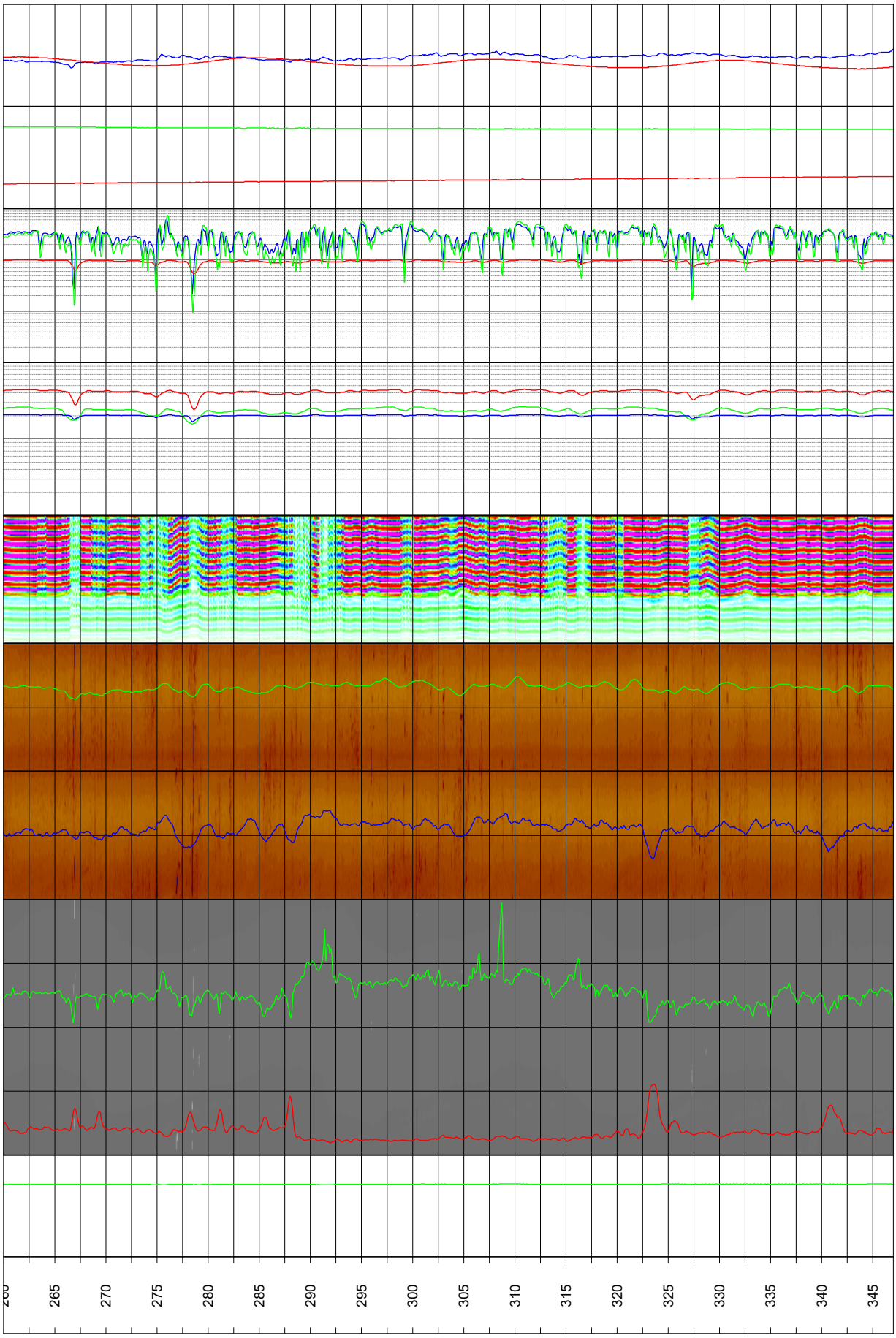
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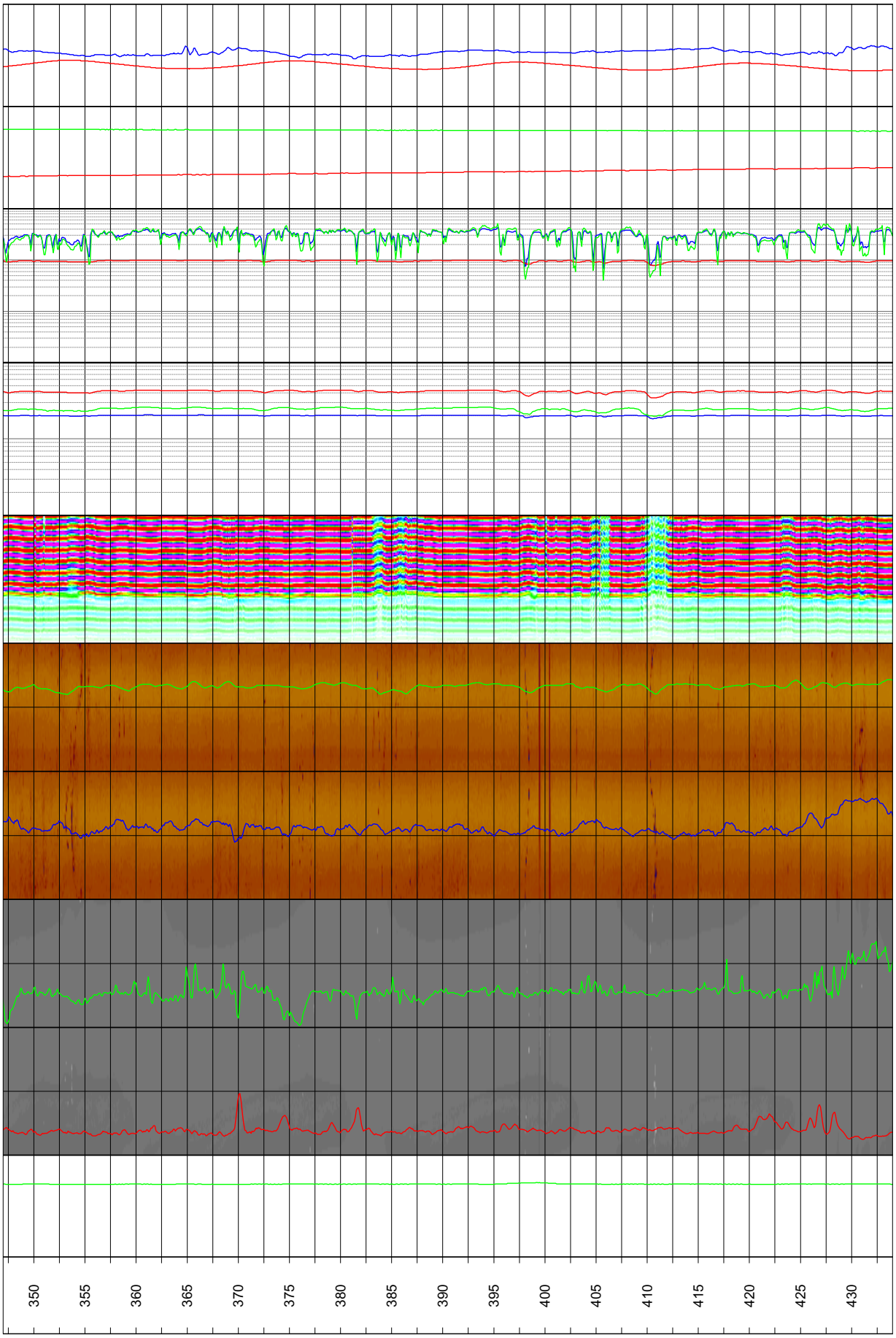
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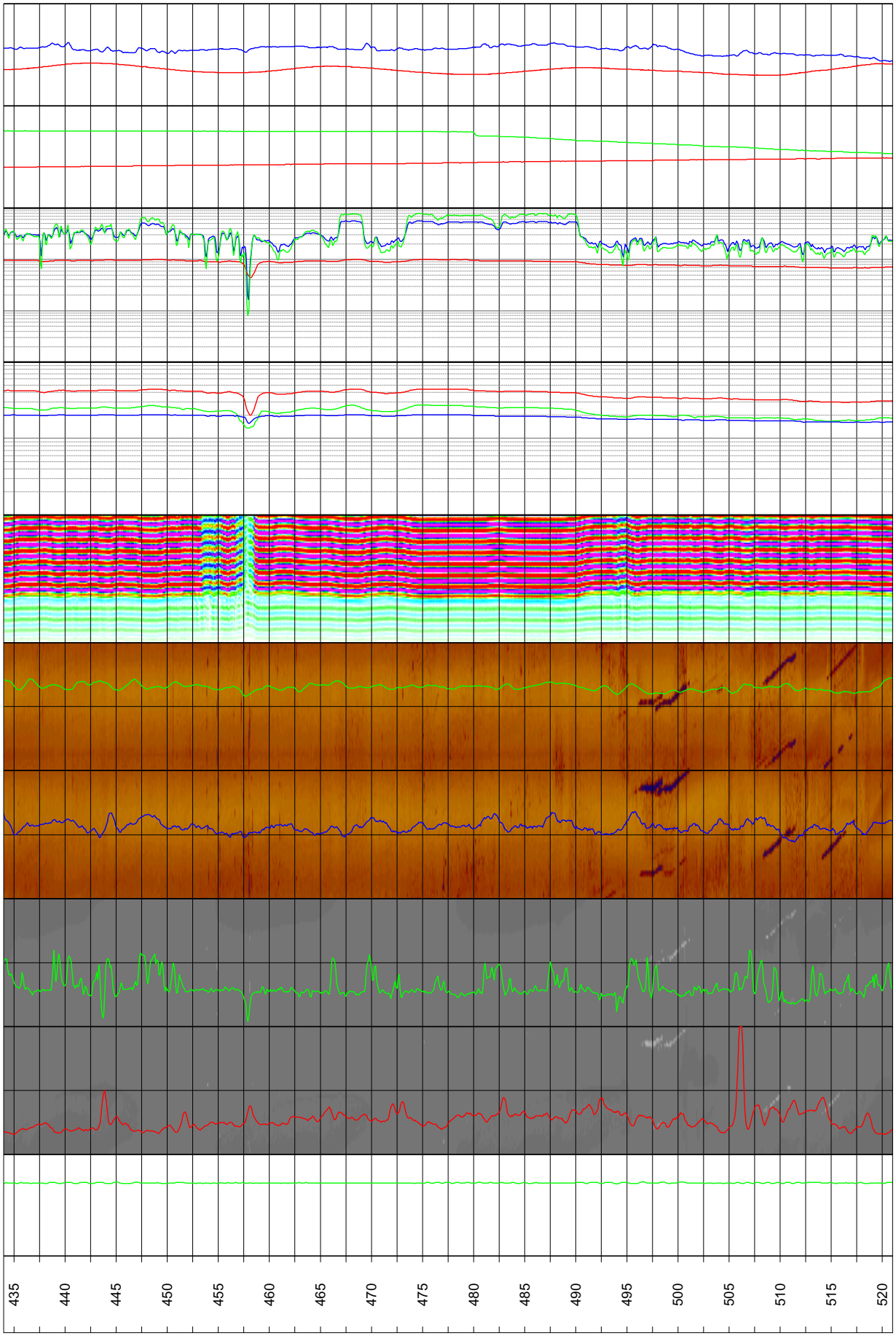
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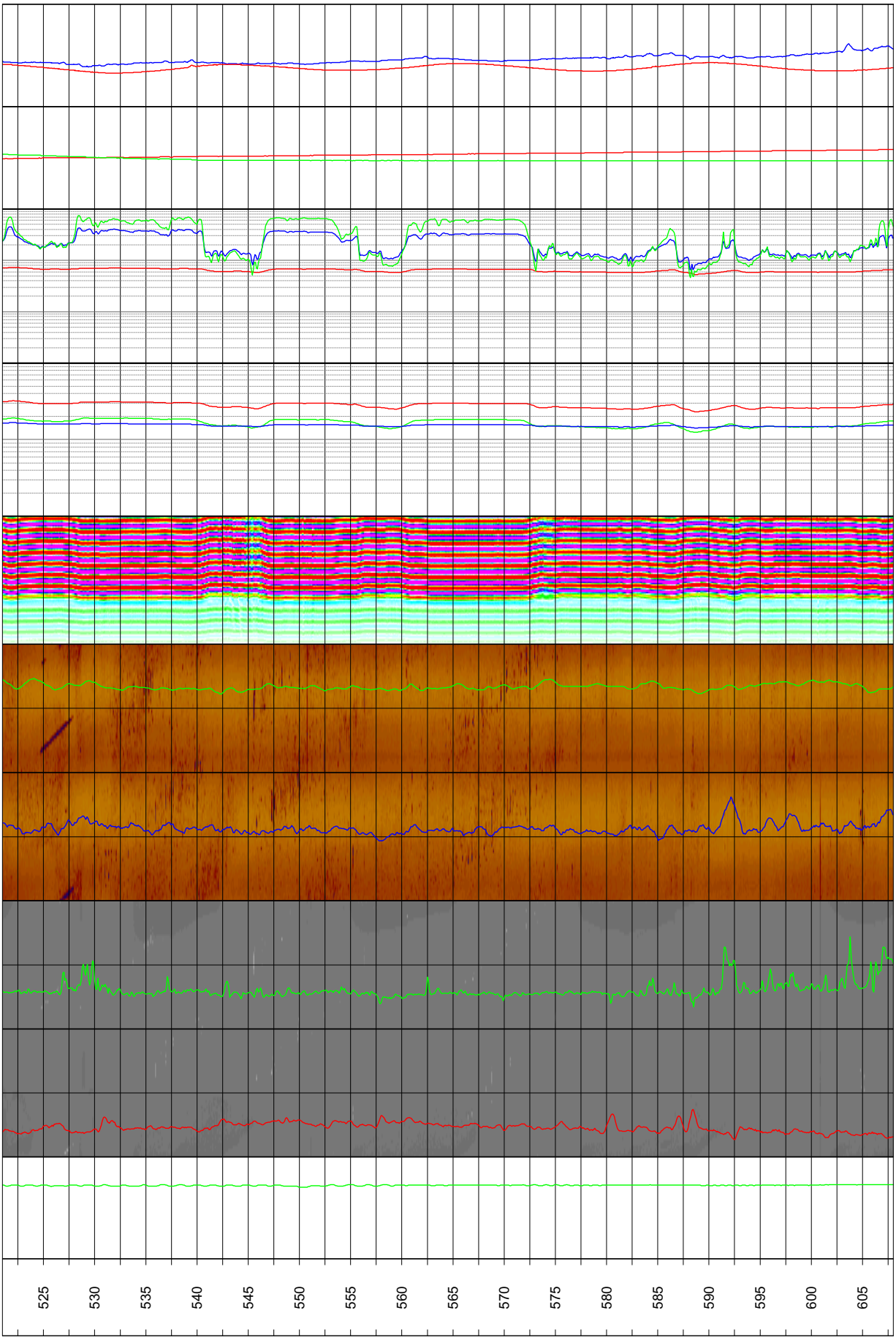
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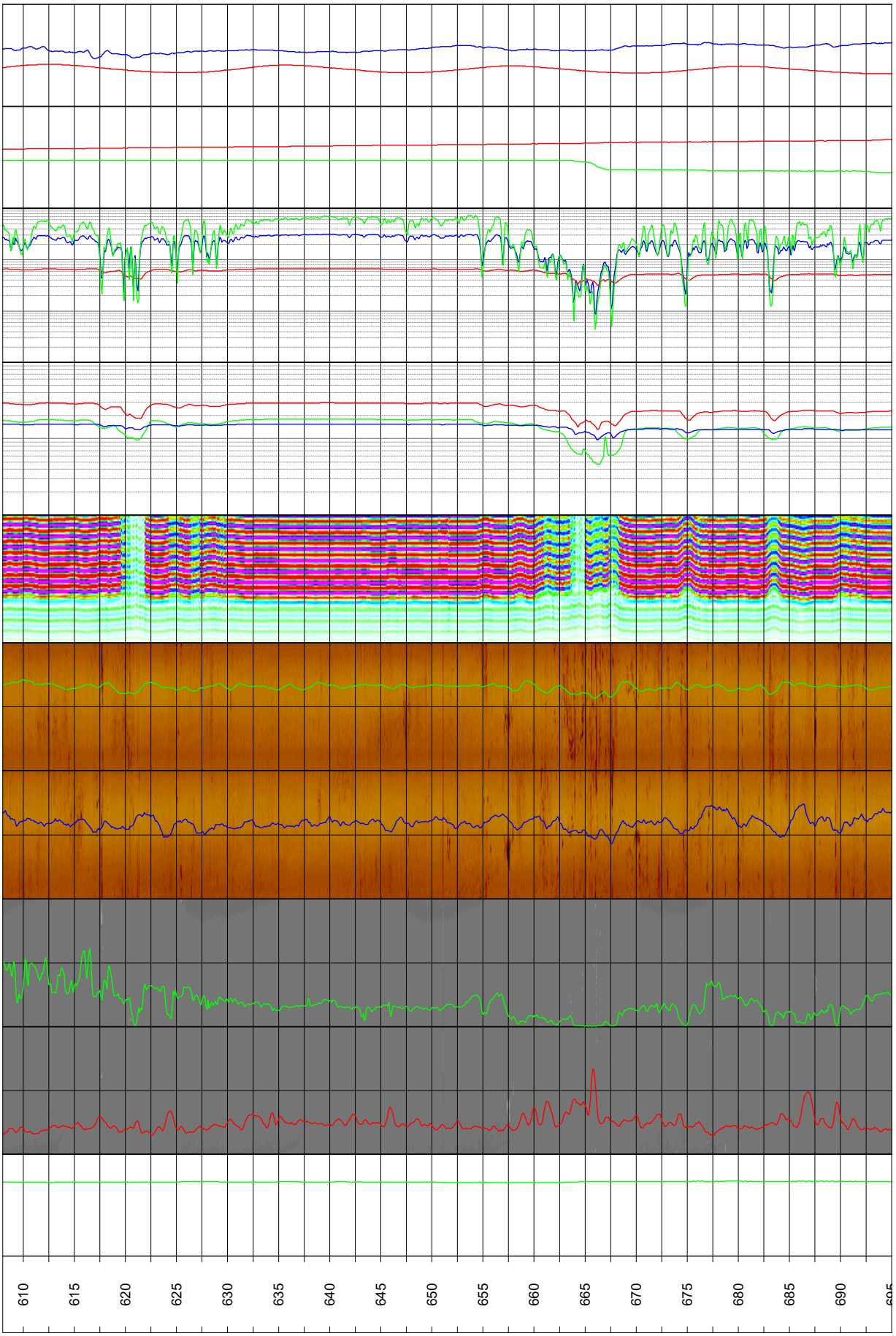
605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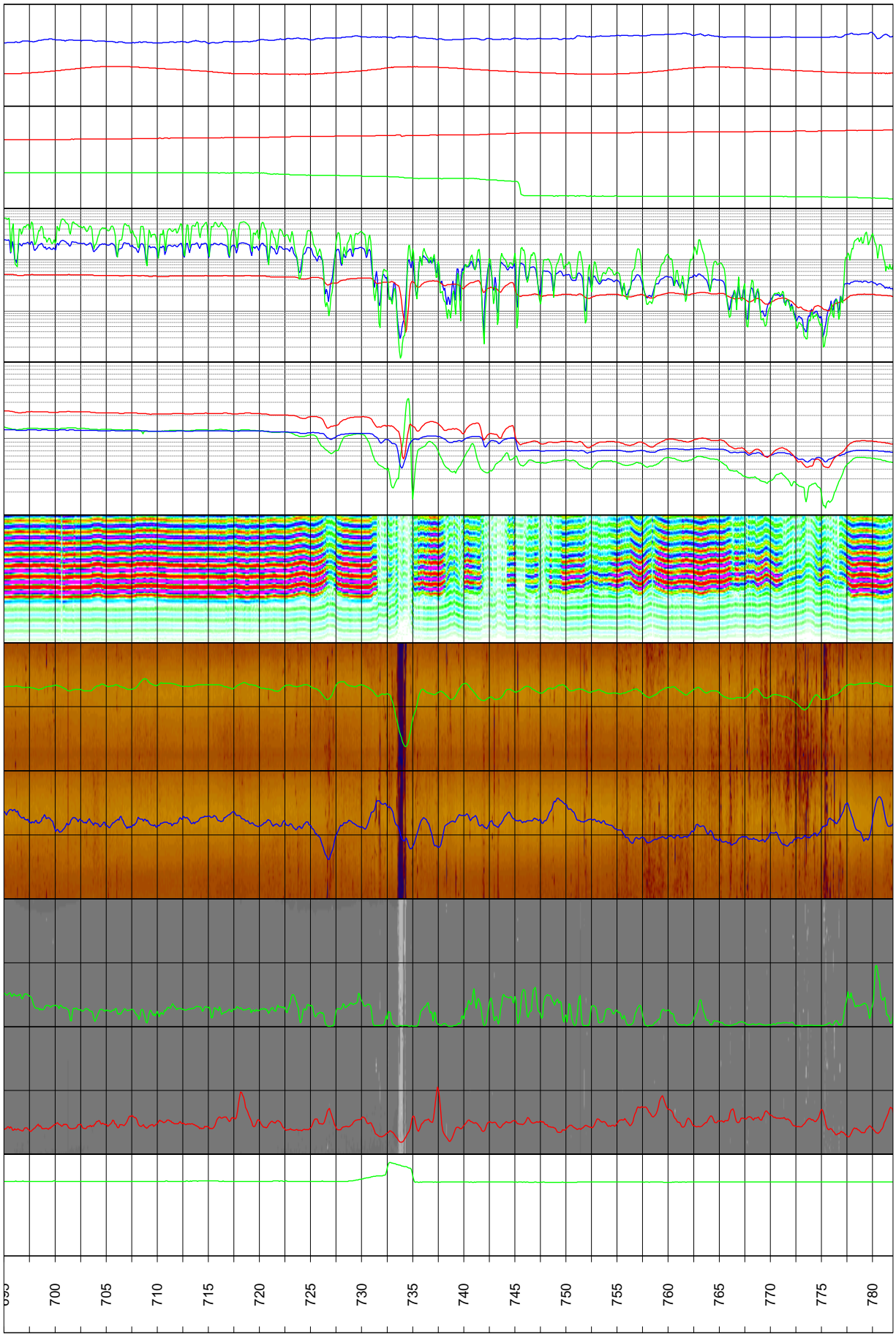
675
680
685
690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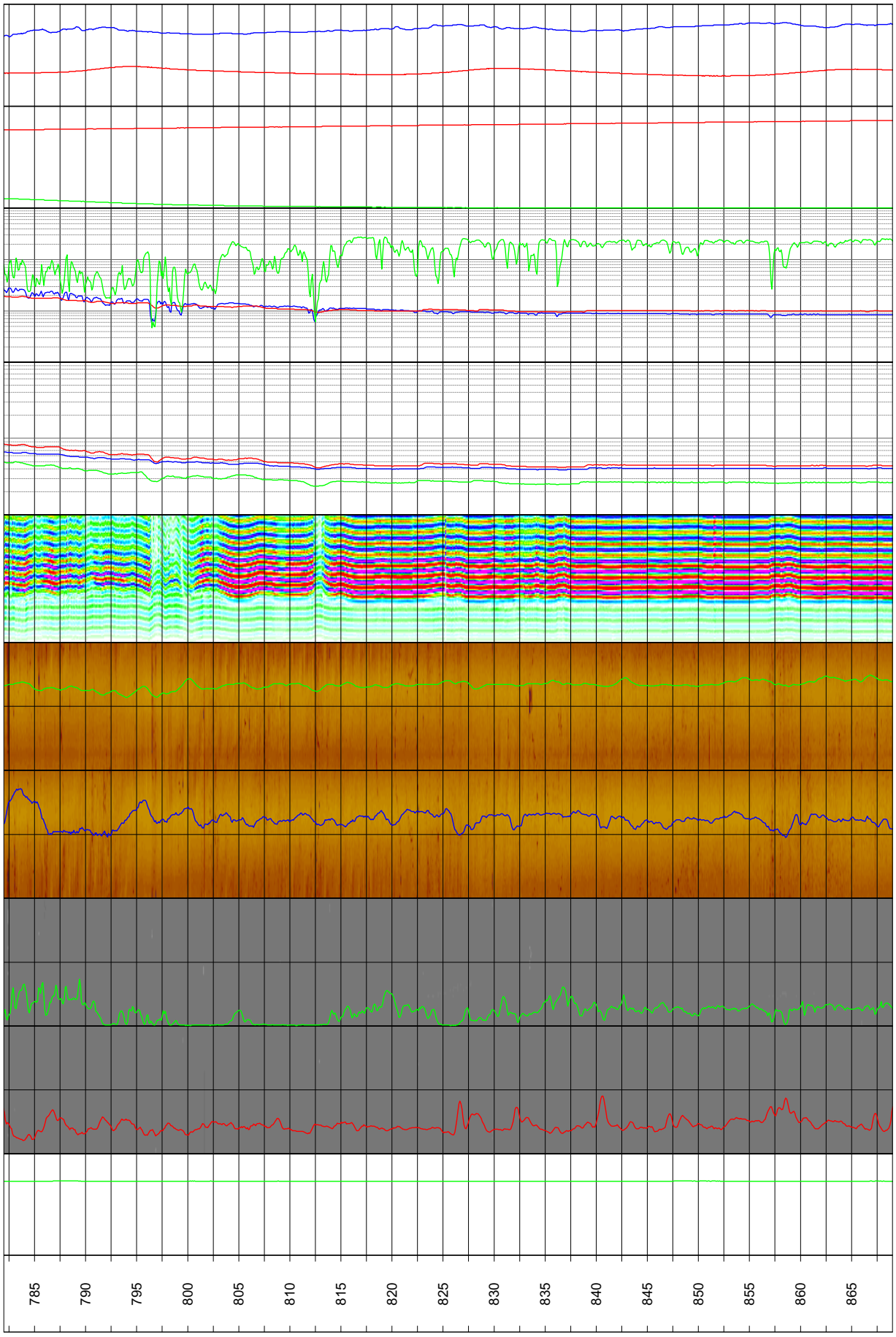
760
765
770
775
780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810
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825
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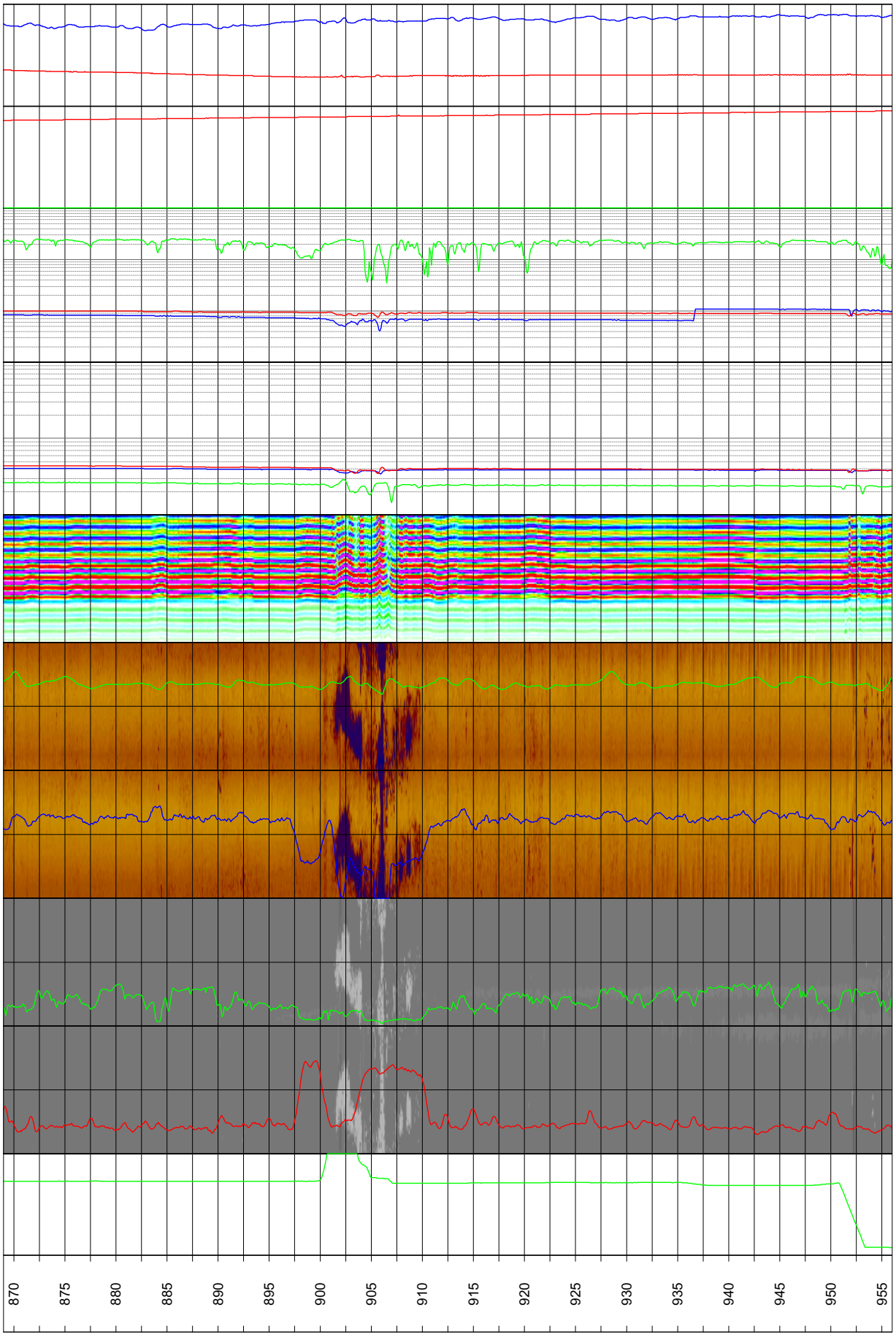
835
840
845
850
855
860
865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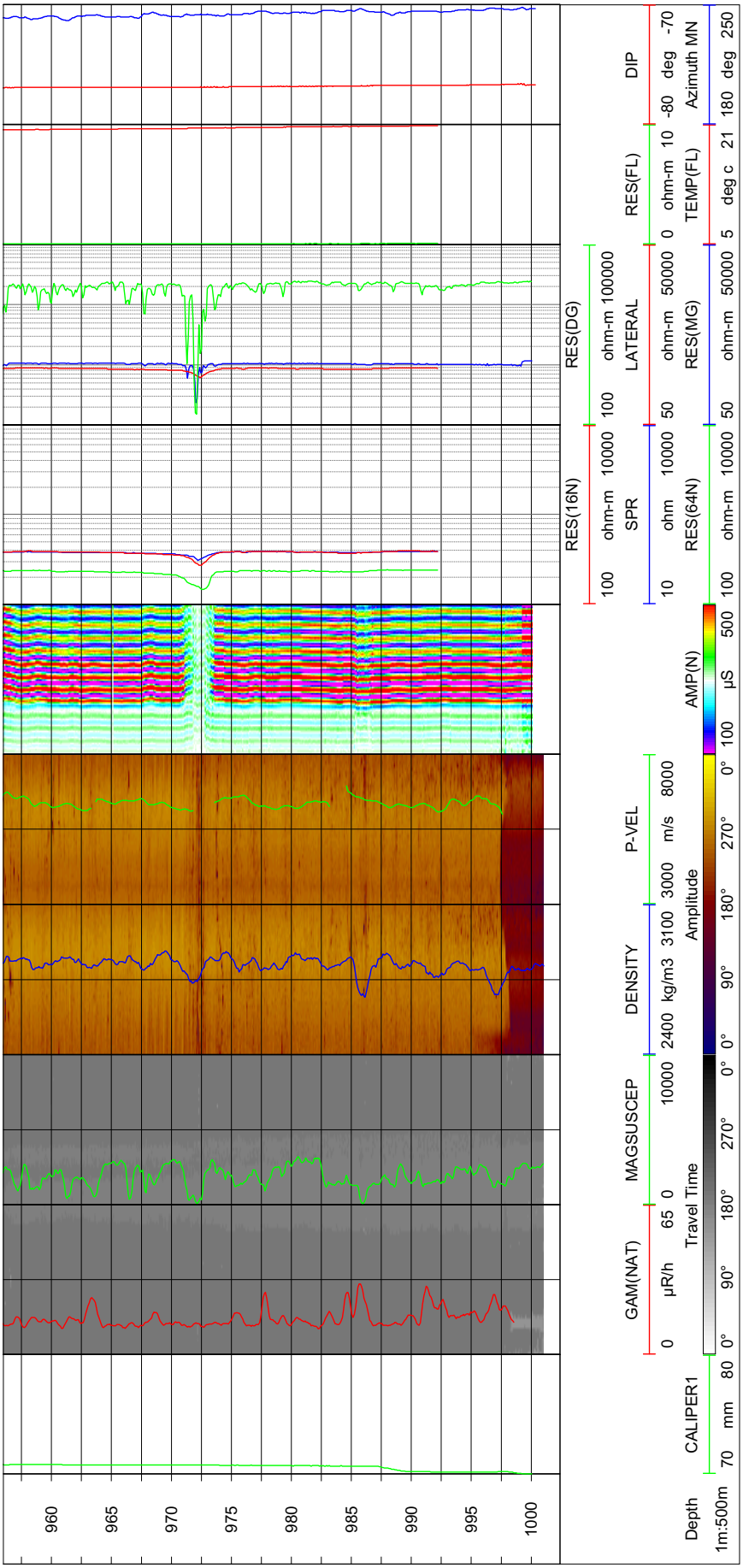
940
945
950
955


Depth
1m:500m
960
965
970
975
980
985
990
995
1000
CALIPER1
70 mm 80
0° 90° 180° 270° 0°
GAM(NAT)
0 µR/h 65
Travel Time
MAGSUSCEP
0 10000
DENSITY
2400 kg/m3 3100
Amplitude
P-VEL
3000 m/s 8000
0° 90° 180° 270° 0°
AMP(N)
100 µS 500
RES(16N)
100 ohm-m 10000
RES(DG)
100 ohm-m 100000
SPR
10 ohm 10000
LATERAL
50 ohm-m 50000
RES(FL)
0 ohm-m 10
DIP
-80 deg -70
RES(64N)
100 ohm-m 10000
RES(MG)
50 ohm-m 50000
TEMP(FL)
5 deg c 21
Azimuth MN
180 deg 250

Borehole HLX21. Drawing no 2.1. Borehole logs

Borehole No. HLX21

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

Northing: 6366568.750 Easting: 1549632.363 Elevation: 10.312

Diameter:	Ø138.5 mm
Reaming Diameter:	
Outer Casing:	168 mm
Inner Casing:	160 mm
Borehole Length:	150.3 m
Cone:	
Inclination at ground surface:	-56.991 deg
Azimuth:	185.541 deg
Comments:	

Borehole logging programme

Name	Description	Tool	Unit
CALIPER1	Caliper, 1-arm	9030	mm
DENSITY	Gamma-gamma density	9030	kg/m³
RES(MG)	Focused guard log resistivity, 140cm	9030	ohm-m
GAM(NAT)	Natural gamma	9030	µR/h
TEMP(FL)	Fluid temperature	8044	deg C
RES(FL)	Fluid resistivity	8044	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
TRAVEL TIME	360 degrees orientated acoustic travel time	HiRAT	100 ns
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	8044	ohm-m
RES(64N)	Normal resistivity 64 inch	8044	ohm-m
LATERAL	Lateral resistivity	8044	ohm-m
SPR	Single point resistivity	8044	ohm

Rev.	Date	Drawn by	Control	Approved
0	2004-10-24	JIJ	FDH	UTN

Job 360210A

Scale 1:500

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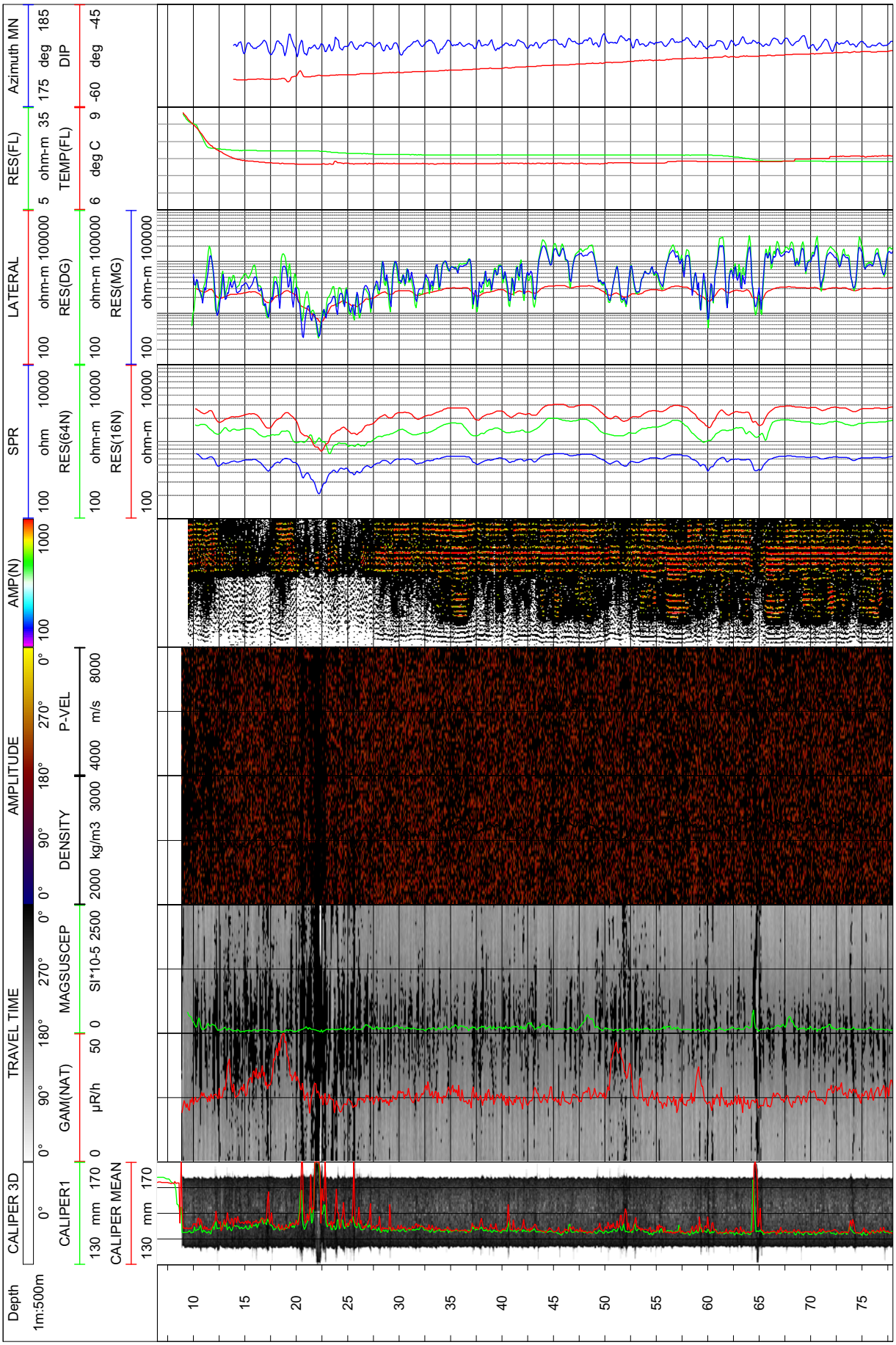
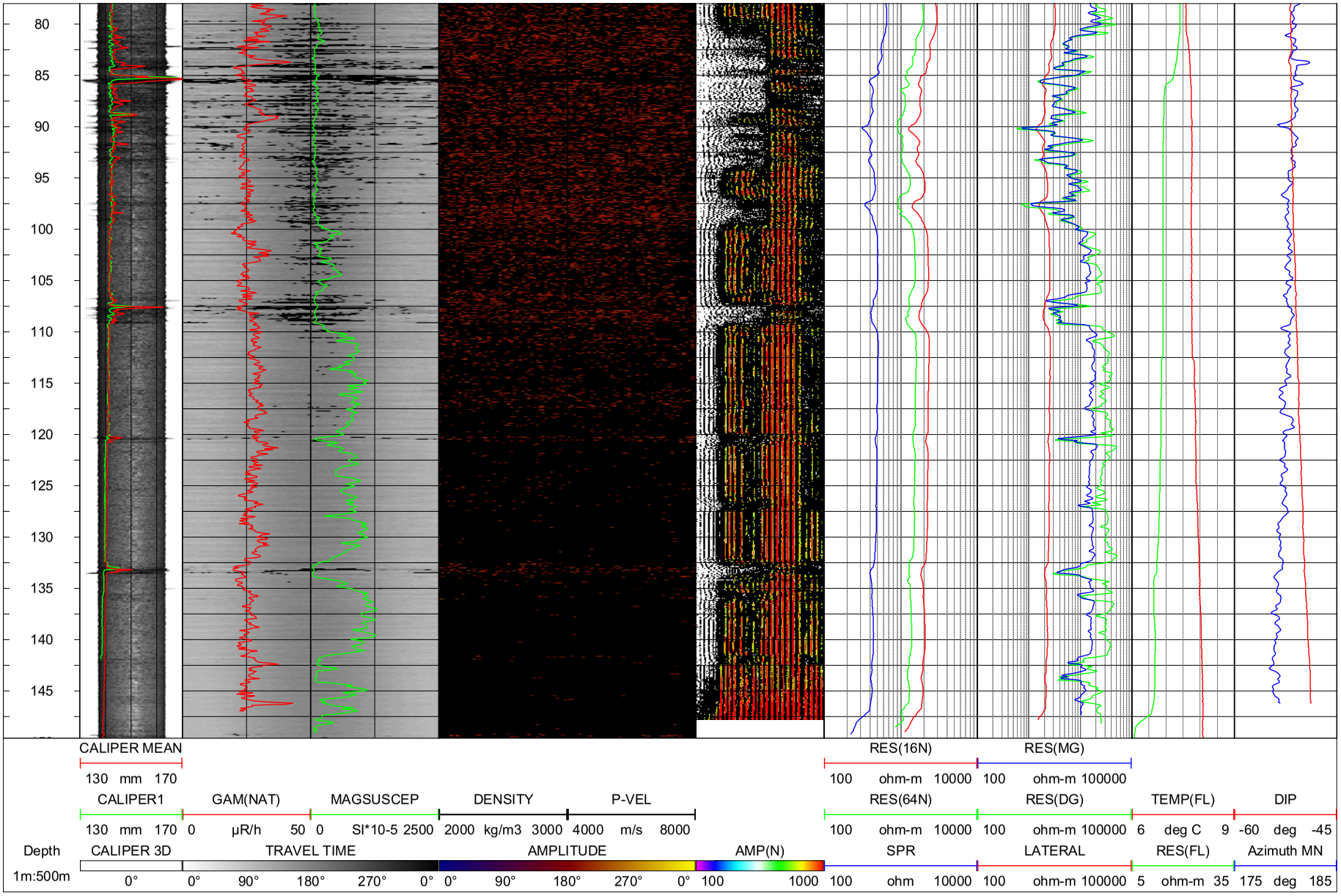
SKB geophysical borehole logging
Borehole HLX21. Laxemar.

Presentation

Filename: HLX21_Presentation.wcl

Drawing no.: **2.1**


Depth
1m:500m
CALIPER 3D
TRAVEL TIME
AMPLITUDE
AMP(N)
SPR
LATERAL
RES(FL)
Azimuth MN
0° 0° 90° 180° 270° 0° 90° 180° 270° 0° 100 1000 100 ohm 10000 100 ohm-m 100000 5 ohm-m 35 175 deg 185
CALIPER1 GAM(NAT) MAGSUSCEP DENSITY P-VEL RES(64N) RES(DG) TEMP(FL) DIP
130 mm 170 0 µR/h 50 0 SI*10-5 2500 2000 kg/m3 3000 4000 m/s 8000 100 ohm-m 10000 100 ohm-m 100000 6 deg C 9 -60 deg -45
CALIPER MEAN RES(16N) RES(MG)
130 mm 170 100 ohm-m 10000 100 ohm-m 100000
10 15 20 25 30 35 40 45 50 55 60 65 70 75


80
85
90
95
100
105
110
115
120
125
130
135
140
145
CALIPER MEAN
130 mm 170
CALIPER1
130 mm 170
GAM(NAT)
0 µR/h 50
MAGSUSCEP
0 SI*10-5 2500
DENSITY
2000 kg/m3 3000 4000
P-VEL
m/s 8000
Depth
1m:500m
CALIPER 3D
0°
TRAVEL TIME
0° 90° 180° 270° 0°
AMPLITUDE
0° 90° 180° 270° 0°
AMP(N)
100 1000
RES(16N)
100 ohm-m 10000
RES(MG)
100 ohm-m 100000
RES(64N)
100 ohm-m 10000
RES(DG)
100 ohm-m 100000
TEMP(FL)
6 deg C 9
DIP
-60 deg -45
SPR
100 ohm 10000
LATERAL
100 ohm-m 100000
RES(FL)
5 ohm-m 35
Azimuth MN
175 deg 185

Borehole HLX22. Drawing no 3.1. Borehole logs

Borehole No. HLX22

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

Northing: 6366487.834 Easting: 1549661.542 Elevation: 10.057

Diameter:	Ø138.5 mm
Reaming Diameter:	
Outer Casing:	168 mm
Inner Casing:	160 mm
Borehole Length:	163.2 m
Cone:	
Inclination at ground surface:	-59.436 deg
Azimuth:	13.451 deg
Comments:	

Borehole logging programme

Name	Description	Tool	Unit
CALIPER1	Caliper, 1-arm	9030	mm
DENSITY	Gamma-gamma density	9030	kg/m³
RES(MG)	Focused guard log resistivity, 140cm	9030	ohm-m
GAM(NAT)	Natural gamma	9030	µR/h
TEMP(FL)	Fluid temperature	8044	deg C
RES(FL)	Fluid resistivity	8044	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
TRAVEL TIME	360 degrees orientated acoustic travel time	HiRAT	100 ns
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	8044	ohm-m
RES(64N)	Normal resistivity 64 inch	8044	ohm-m
LATERAL	Lateral resistivity	8044	ohm-m
SPR	Single point resistivity	8044	ohm

Rev.	Date	Drawn by	Control	Approved
0	2004-10-26	FDH	UTN	UTN

Job 360210A

Scale 1:500

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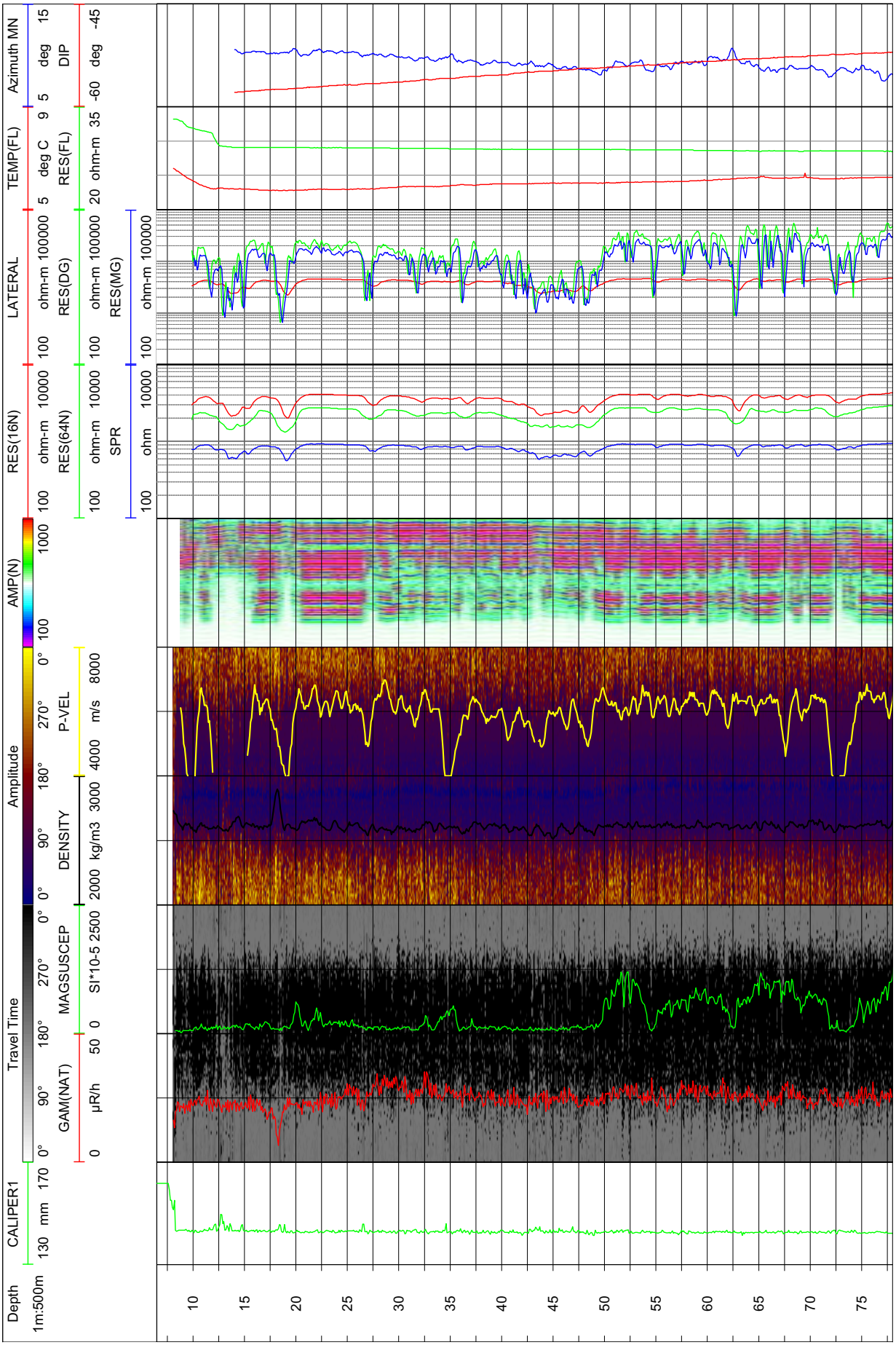
SKB geophysical borehole logging

Borehole HLX22. Laxemar.

Presentation

Filename: HLX22_Presentation.wcl

Drawing no.: **3.1**


Depth
1m:500m
CALIPER1
130 mm 170
Travel Time
0° 90° 180° 270° 0°
GAM(NAT)
0 µR/h 50
0 SI*10-5 2500
MAGSUSCEP
Amplitude
0° 90° 180° 270° 0°
2000 kg/m3 3000
DENSITY
4000 m/s 8000
P-VEL
AMP(N)
100 1000
RES(16N)
100 ohm-m 10000
RES(64N)
100 ohm-m 10000
SPR
100 ohm 10000
LATERAL
100 ohm-m 100000
RES(DG)
100 ohm-m 100000
RES(MG)
100 ohm-m 100000
TEMP(FL)
5 deg C 9
RES(FL)
20 ohm-m 35
Azimuth MN
5 deg 15
DIP
-60 deg -45
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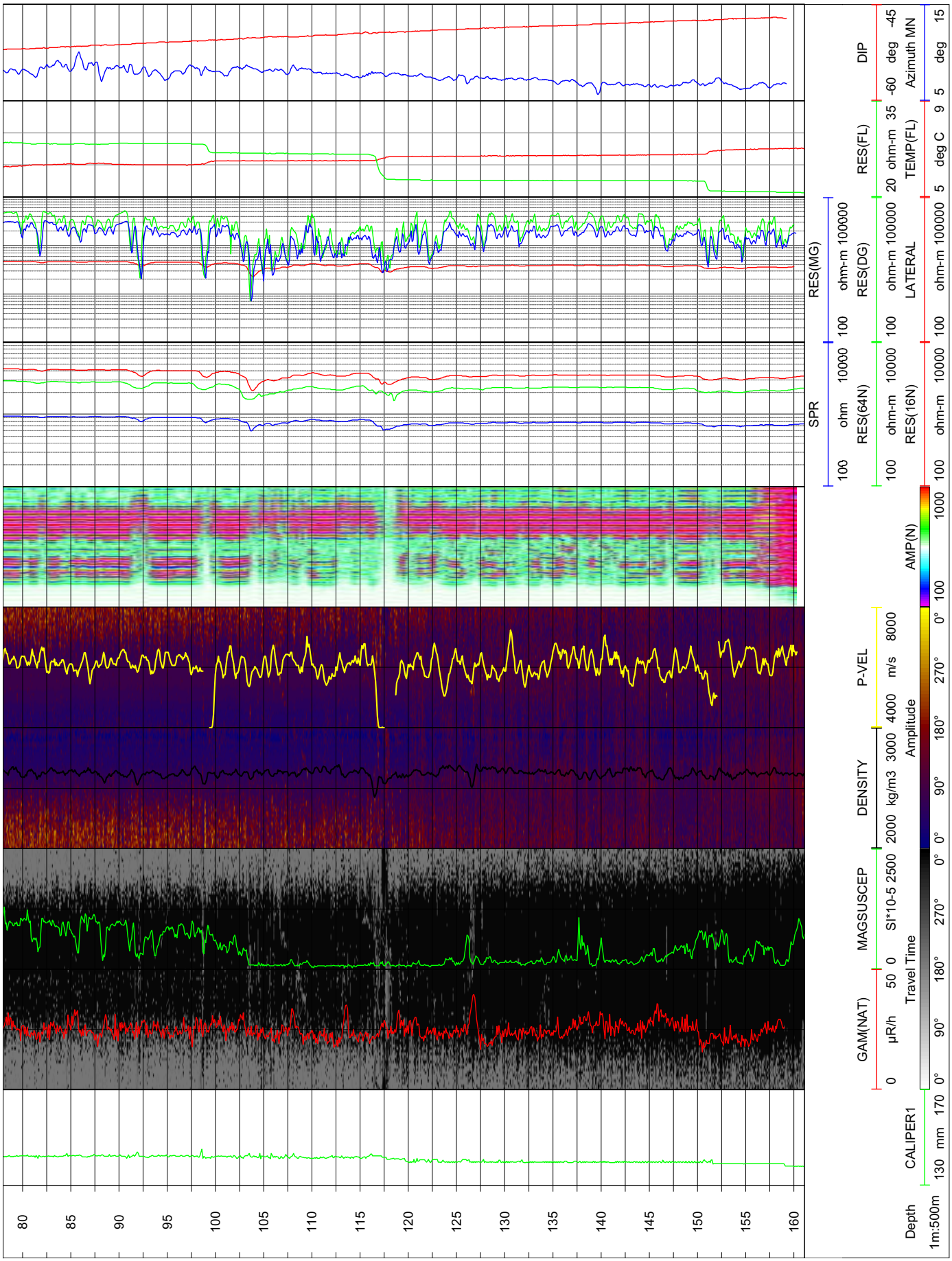
15
20
25
30
35
40
45
50
55
60
65
70
75


Depth
1m:500m
CALIPER1
130 mm 170
GAM(NAT)
0 µR/h 50
MAGSUSCEP
0 SI*10-5 2500
DENSITY
2000 kg/m3 3000
P-VEL
4000 m/s 8000
Travel Time
0° 90° 180° 270°
Amplitude
0° 90° 180° 270° 0°
AMP(N)
100 1000
SPR
100 ohm 10000
RES(MG)
100 ohm-m 100000
RES(64N)
100 ohm-m 10000
RES(DG)
100 ohm-m 100000
RES(16N)
100 ohm-m 10000
LATERAL
100 ohm-m 100000
RES(FL)
20 ohm-m 35
TEMP(FL)
5 deg C 9
DIP
-60 deg -45
Azimuth MN
5 deg 15
80
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160

Borehole HLX23. Drawing no 4.1. Borehole logs

Borehole No. HLX23

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

Northing: 6366578.005 Easting: 1548888.673 Elevation: 14.690

Diameter:	Ø138.5 mm
Reaming Diameter:	
Outer Casing:	168 mm
Inner Casing:	160 mm
Borehole Length:	160.2 m
Cone:	
Inclination at ground surface:	-58.184 deg.
Azimuth:	182.893 deg.
Comments:	

Borehole logging programme

Name	Description	Tool	Unit
CALIPER1	Caliper, 1-arm	9030	mm
DENSITY	Gamma-gamma density	9030	kg/m³
RES(MG)	Focused guard log resistivity, 140cm	9030	ohm-m
GAM(NAT)	Natural gamma	9030	µR/h
TEMP(FL)	Fluid temperature	8044	deg C
RES(FL)	Fluid resistivity	8044	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
TRAVEL TIME	360 degrees orientated acoustic travel time	HiRAT	100 ns
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	8044	ohm-m
RES(64N)	Normal resistivity 64 inch	8044	ohm-m
LATERAL	Lateral resistivity	8044	ohm-m
SPR	Single point resistivity	8044	ohm

Rev.	Date	Drawn by	Control	Approved
0	2004-10-26	KLK	UTN	UTN

Job 360210A

Scale 1:500

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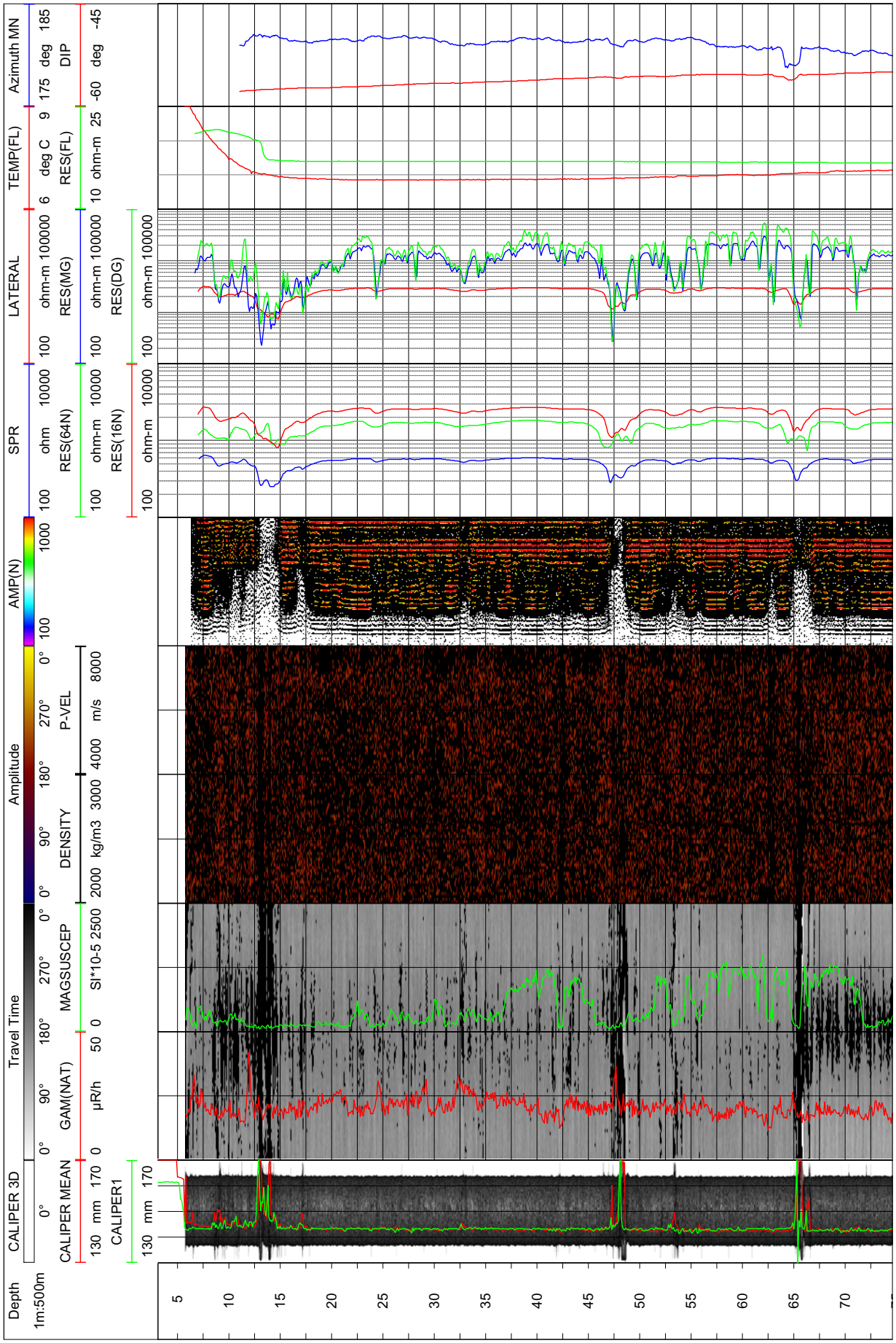
SKB geophysical borehole logging

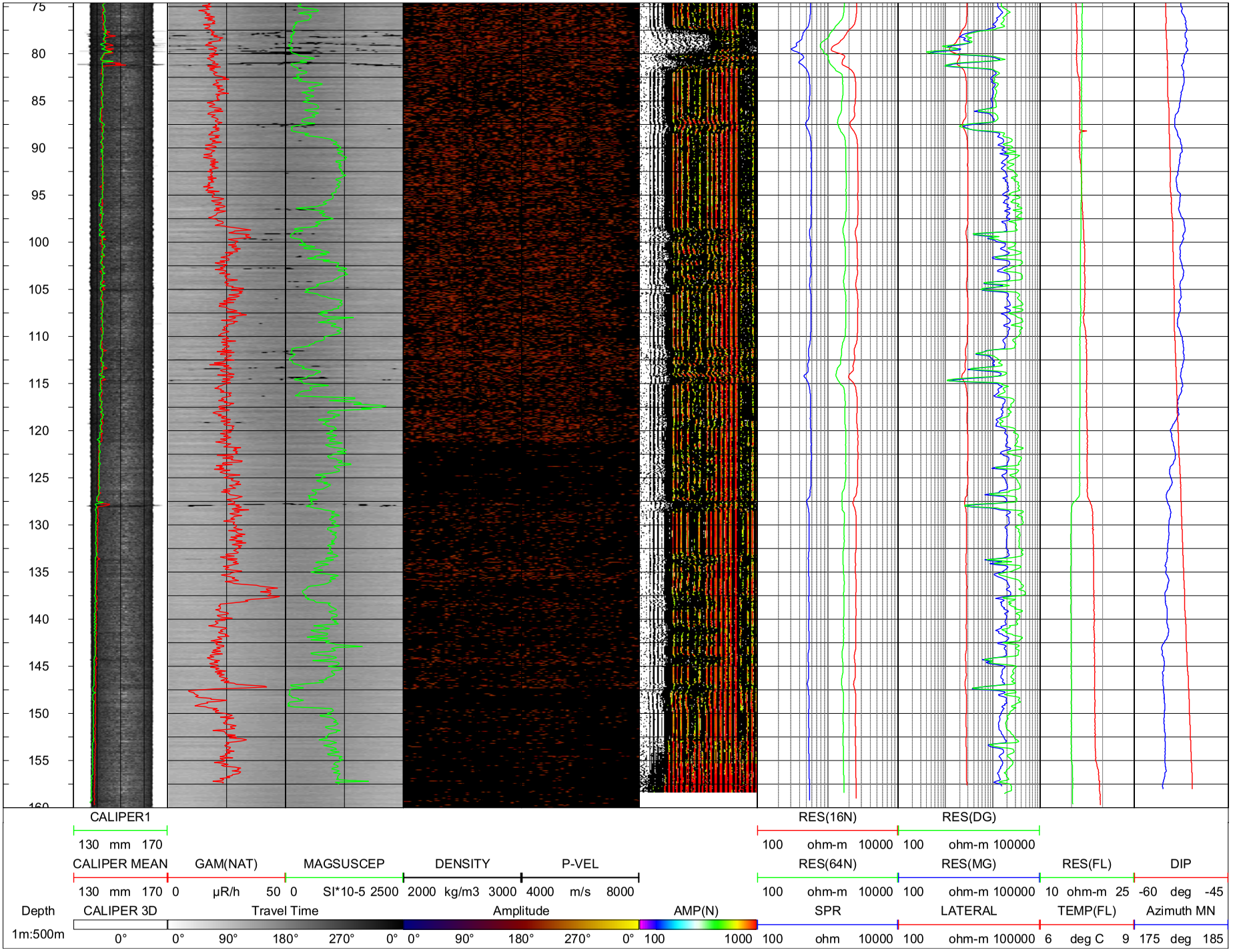
Borehole HLX23. Laxemar.

Presentation

Filename: HLX23_Presentation.wcl

Drawing no.: **4.1**


Depth
1m:500m
CALIPER 3D
0° 0° 90° 180° 270° 0°
130 mm 170
CALIPER MEAN
130 mm 170
CALIPER1
Travel Time
GAM(NAT)
0 µR/h 50
MAGSUSCEP
0 SI*10-5 2500
DENSITY
2000 kg/m3 3000
Amplitude
0° 90° 180° 270° 0°
P-VEL
4000 m/s 8000
AMP(N)
100 1000
SPR
100 ohm 10000
RES(64N)
100 ohm-m 10000
RES(16N)
100 ohm-m 10000
LATERAL
100 ohm-m 100000
RES(MG)
100 ohm-m 100000
RES(DG)
100 ohm-m 100000
TEMP(FL)
6 deg C 9
RES(FL)
10 ohm-m 25
Azimuth MN
175 deg 185
DIP
-60 deg -45
5
10
15
20
25
30
35
40
45
50
55
60
65
70


75
80
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160
CALIPER1
130 mm 170
CALIPER MEAN
130 mm 170
GAM(NAT)
0 µR/h 50
MAGSUSCEP
0 SI*10-5 2500
DENSITY
2000 kg/m3 3000
P-VEL
4000 m/s 8000
Depth
1m:500m
CALIPER 3D
0°
Travel Time
0° 90° 180° 270° 0°
Amplitude
0° 90° 180° 270° 0°
AMP(N)
100 1000
RES(16N)
100 ohm-m 10000
RES(DG)
100 ohm-m 100000
RES(64N)
100 ohm-m 10000
RES(MG)
100 ohm-m 100000
RES(FL)
10 ohm-m 25
DIP
-60 deg -45
SPR
100 ohm 10000
LATERAL
100 ohm-m 100000
TEMP(FL)
6 deg C 9
Azimuth MN
175 deg 185

Borehole HLX24. Drawing no 5.1. Borehole logs

Borehole No. HLX24

Co-ordinates in

Northing: 6366503.722 Easting: 1548865.890 Elevation: 12.769

Diameter:	Ø139 mm
Reaming Diameter:	
Outer Casing:	Ø168 mm
Inner Casing:	Ø160 mm
Borehole Length:	175.2 m
Cone:	
Inclination at ground surface:	-58.394 deg.
Azimuth:	358.692 deg.
Comments:	

Borehole logging programme

Name	Description	Tool	Unit
CALIPER1	Caliper, 1-arm	9030	mm
DENSITY	Gamma-gamma density	9030	kg/m³
RES(MG)	Focused guard log resistivity, 140cm	9030	ohm-m
GAM(NAT)	Natural gamma	9030	µR/h
TEMP(FL)	Fluid temperature	8044	deg C
RES(FL)	Fluid resistivity	8044	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 lateral	HiRAT	deg
TRAVEL TIME	360 degrees orientated acoustic travel time	HiRAT	100 ns
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	8044	ohm-m
RES(64N)	Normal resistivity 64 inch	8044	ohm-m
LATERAL	Lateral resistivity	8044	ohm-m
SPR	Single point resistivity	8044	ohm

Rev.	Date	Drawn by	Control	Approved
0	2004-10-26	KLK	UTN	UTN

Job 360210A

Scale 1:500

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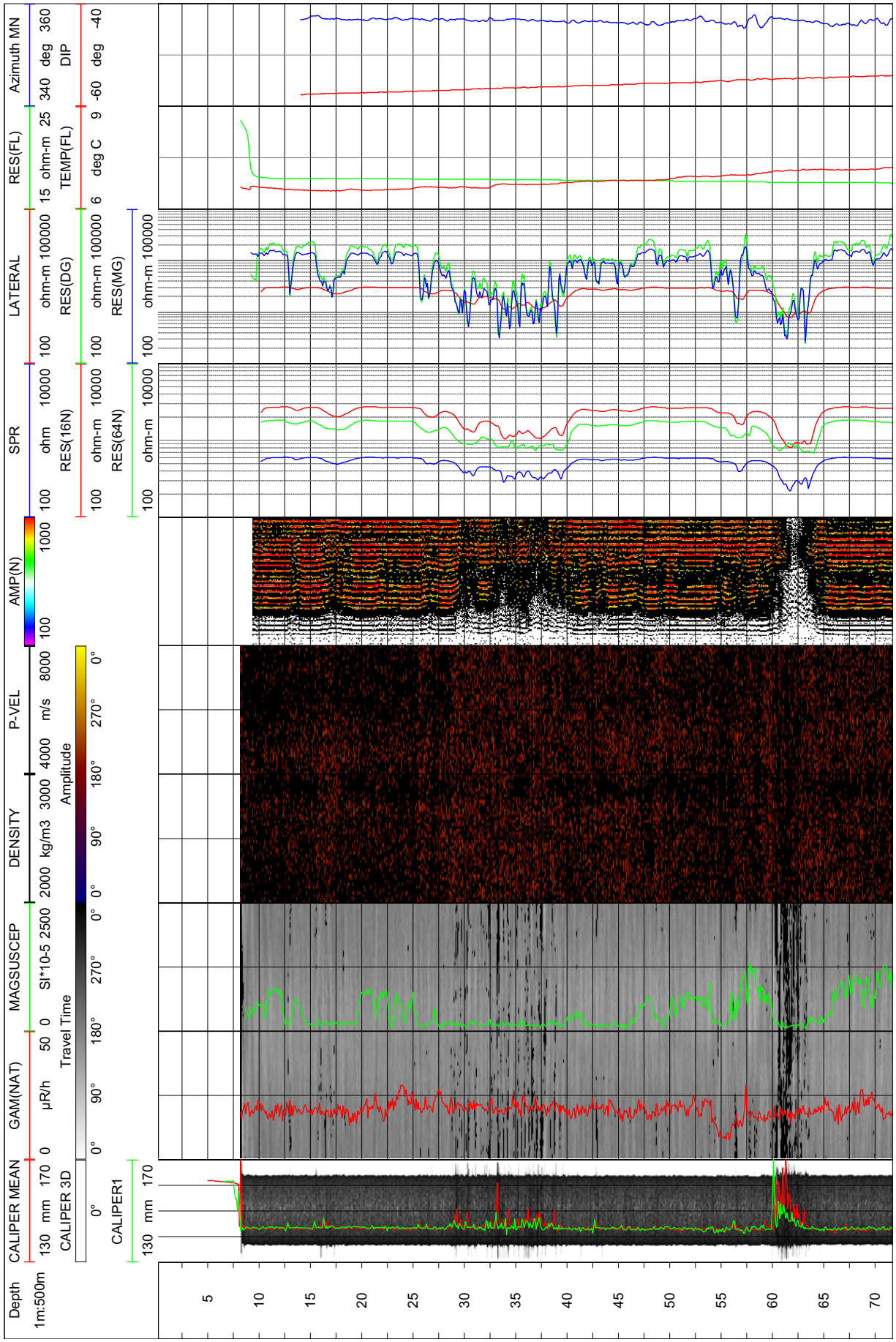
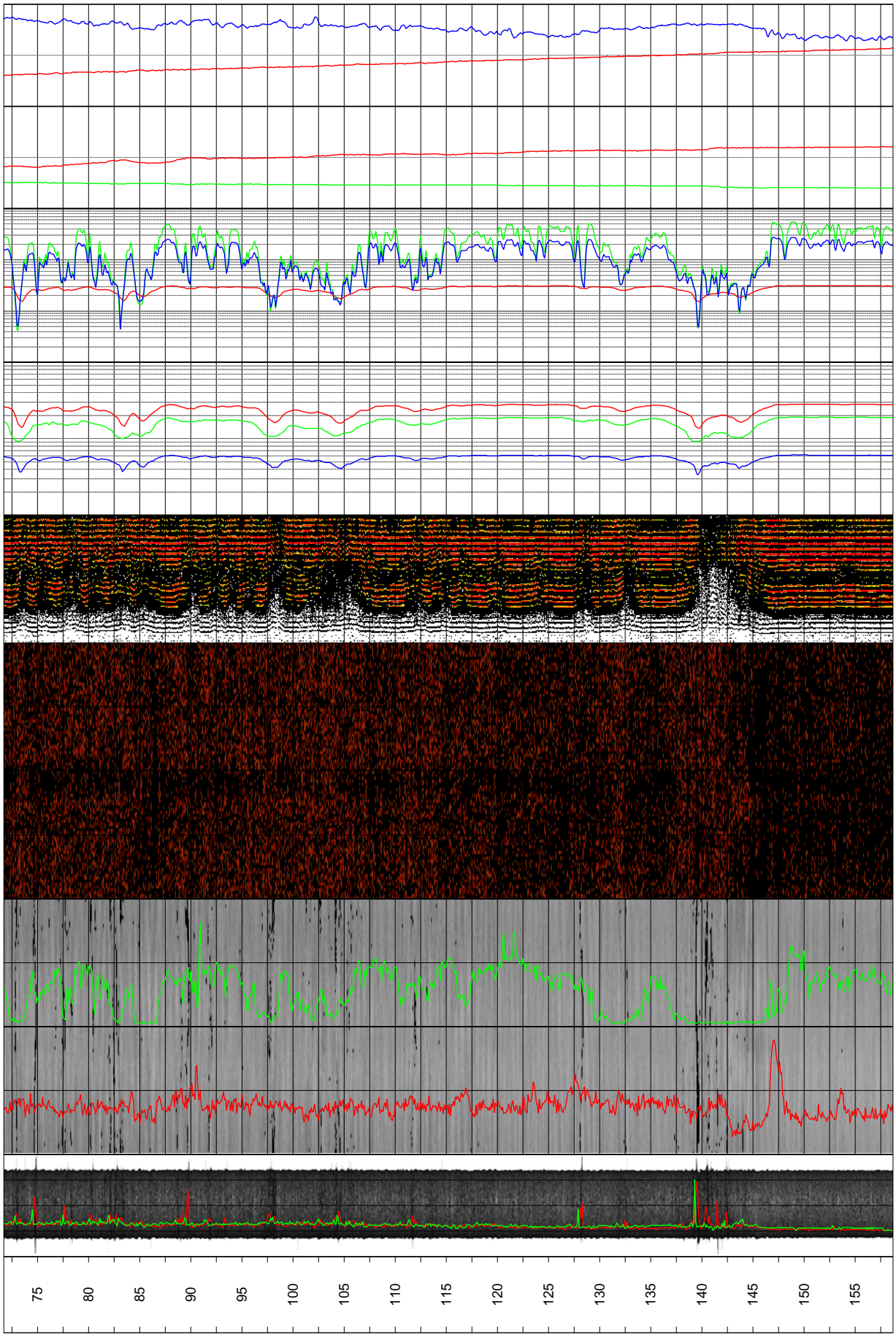
SKB geophysical borehole logging
Borehole HLX24. Laxemar.

Presentation

Filename: HLX24_Presentation.wcl

Drawing no.: **5.1**


Depth
1m:500m
CALIPER MEAN
130 mm 170
CALIPER 3D
0° 0°
CALIPER1
130 mm 170
GAM(NAT)
0 µR/h 50
0° 90° 180° 270° 0°
MAGSUSCEP
0 SI*10-5 2500
Travel Time
DENSITY
2000 kg/m3 3000
P-VEL
4000 m/s 8000
Amplitude
AMP(N)
100 1000
SPR
100 ohm 10000
RES(16N)
100 ohm-m 10000
RES(64N)
100 ohm-m 10000
LATERAL
100 ohm-m 100000
RES(DG)
100 ohm-m 100000
RES(MG)
100 ohm-m 100000
RES(FL)
15 ohm-m 25
TEMP(FL)
6 deg C 9
Azimuth MN
340 deg 360
DIP
-60 deg -40
5
10
15
20
25
30
35
40
45
50
55
60
65
70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80
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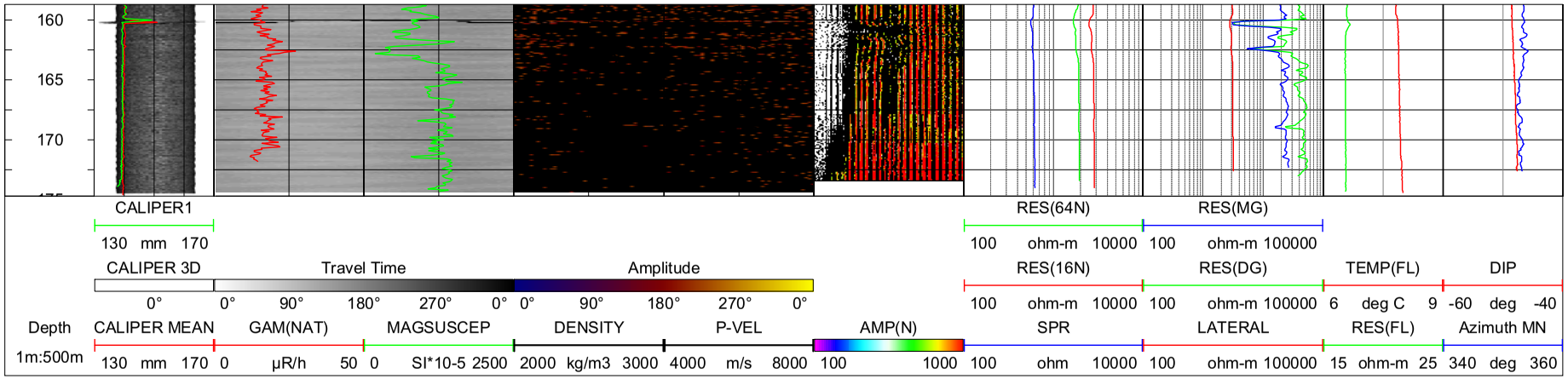
125
130
135
140
145
150
155


160
165
170
CALIPER1
130 mm 170
CALIPER 3D
Travel Time
Amplitude
0° 0° 90° 180° 270° 0° 0° 90° 180° 270° 0°
RES(64N)
RES(MG)
100 ohm-m 10000 100 ohm-m 100000
RES(16N)
RES(DG)
TEMP(FL)
DIP
100 ohm-m 10000 100 ohm-m 100000 6 deg C 9 -60 deg -40
Depth
1m:500m
CALIPER MEAN
GAM(NAT)
MAGSUSCEP
DENSITY
P-VEL
AMP(N)
SPR
LATERAL
RES(FL)
Azimuth MN
130 mm 170 0 µR/h 50 0 SI*10-5 2500 2000 kg/m3 3000 4000 m/s 8000 100 1000 100 ohm 10000 100 ohm-m 100000 15 ohm-m 25 340 deg 360

Borehole HLX25. Drawing no 6.1. Borehole logs

Borehole No. HLX25

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

Northing: 6366783.974 Easting: 1547776.324 Elevation: 20.656

Diameter:	Ø 135 mm
Reaming Diameter:	
Outer Casing:	Ø 168 mm
Inner Casing:	Ø 160 mm
Borehole Length:	202.50 m
Cone:	
Inclination at ground surface:	-58.585 deg.
Azimuth:	17.935 deg.
Comments:	

Borehole logging programme

Name	Description	Tool	Unit
CALIPER1	Caliper, 1-arm	9030	mm
DENSITY	Gamma-gamma density	9030	kg/m³
RES(MG)	Focused guard log resistivity, 140cm	9030	ohm-m
GAM(NAT)	Natural gamma	9030	µR/h
TEMP(FL)	Fluid temperature	8044	deg C
RES(FL)	Fluid resistivity	8044	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
TRAVEL TIME	360 degrees orientated acoustic travel time	HiRAT	100 ns
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	8044	ohm-m
RES(64N)	Normal resistivity 64 inch	8044	ohm-m
LATERAL	Lateral resistivity	8044	ohm-m
SPR	Single point resistivity	8044	ohm

Rev.	Date	Drawn by	Control	Approved
0	2004-10-28	KLK	UTN	UTN

Job 360210A

Scale 1:500

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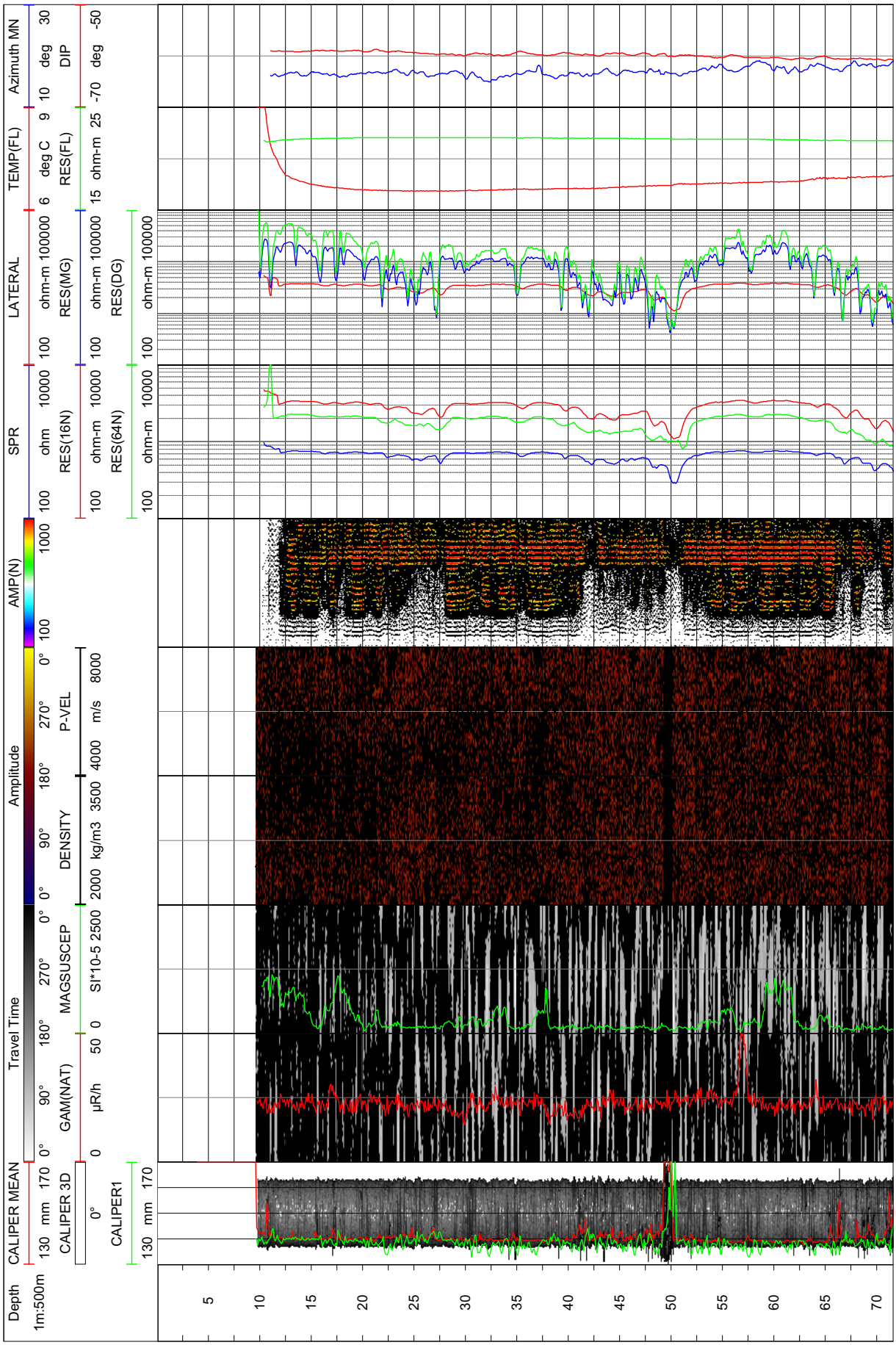
SKB geophysical borehole logging

Borehole HLX25. Laxemar.

Presentation

Filename: HLX25_Presentation.wcl

Drawing no.: **6.1**


Depth
1m:500m
CALIPER MEAN
130 mm 170
CALIPER 3D
0°
CALIPER1
130 mm 170
Travel Time
0° 90° 180° 270° 0°
GAM(NAT)
0 µR/h 50
MAGSUSCEP
0 SI*10-5 2500
DENSITY
2000 kg/m3 3500
Amplitude
0° 90° 180° 270° 0°
P-VEL
4000 m/s 8000
AMP(N)
100 1000
SPR
100 ohm 10000
RES(16N)
100 ohm-m 10000
RES(64N)
100 ohm-m 10000
LATERAL
100 ohm-m 100000
RES(MG)
100 ohm-m 100000
RES(DG)
100 ohm-m 100000
TEMP(FL)
6 deg C 9
RES(FL)
15 ohm-m 25
Azimuth MN
10 deg 30
DIP
-70 deg -50
5
10
15
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35
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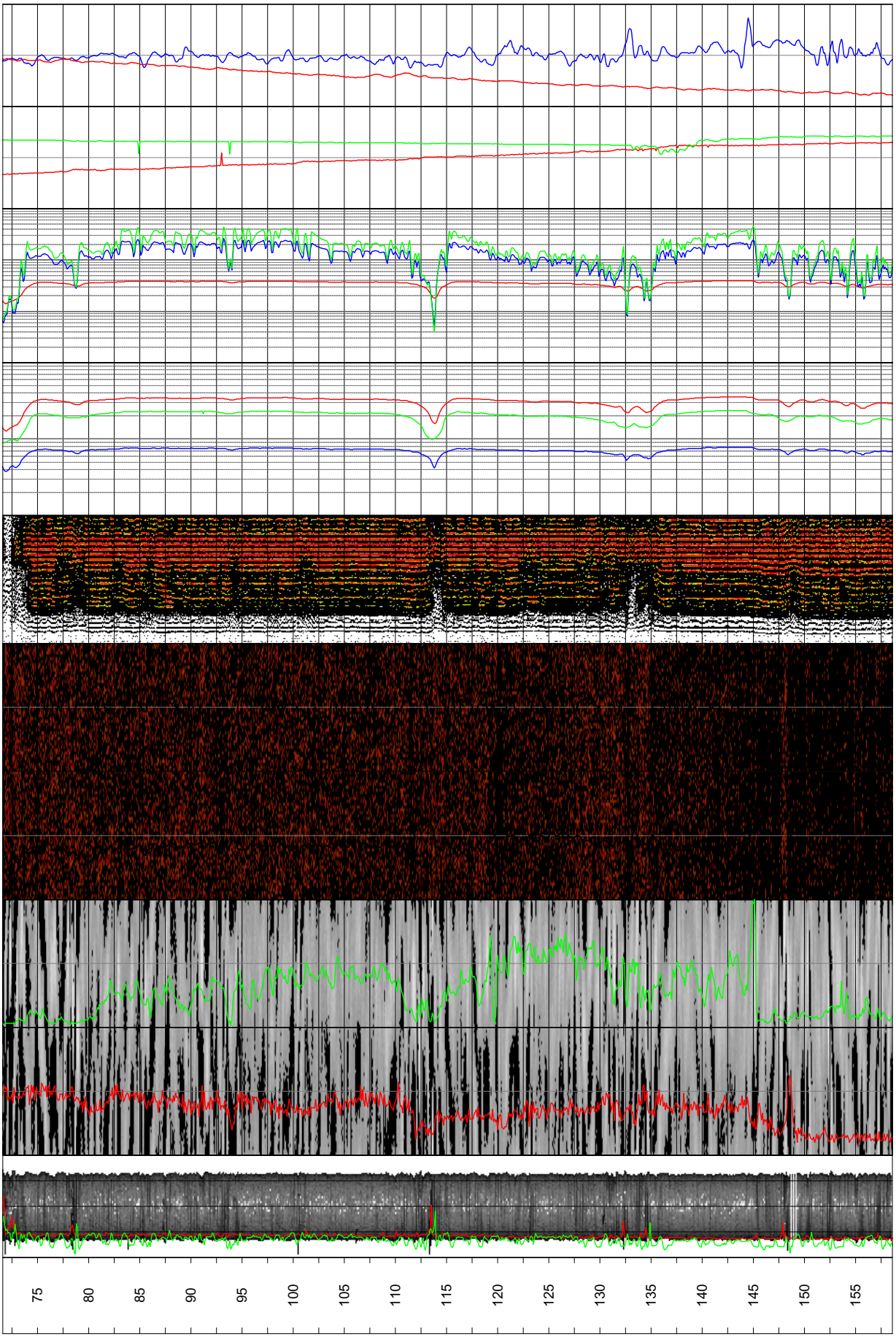
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80
85
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120
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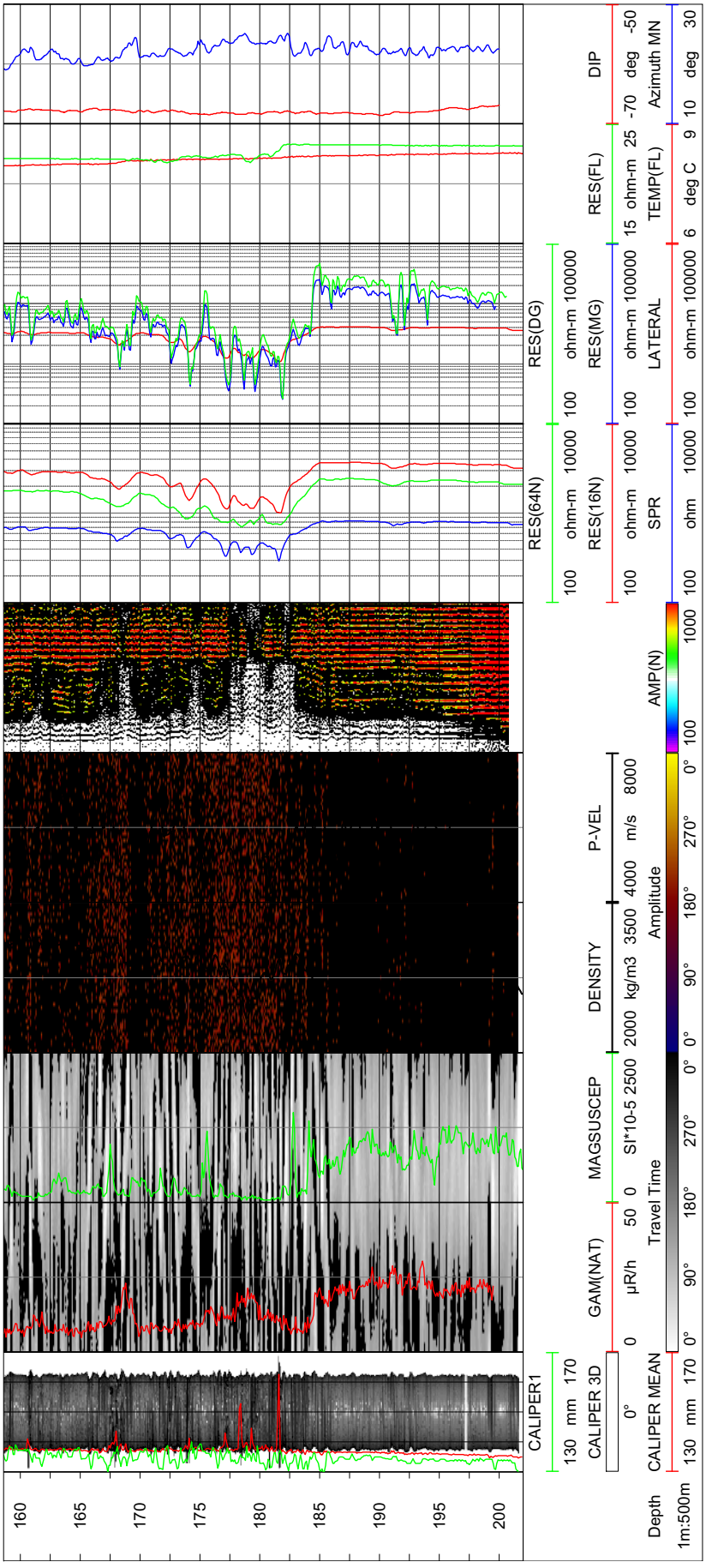
155


160
165
170
175
180
185
190
195
200
CALIPER1
130 mm 170
CALIPER 3D
0°
CALIPER MEAN
130 mm 170
GAM(NAT)
0 µR/h 50
0° 90° 180° 270° 0°
MAGSUSCEP
0 SI*10-5 2500
0° 90° 180° 270° 0°
DENSITY
2000 kg/m3 3500
Travel Time
Amplitude
4000 m/s 8000
P-VEL
0° 90° 180° 270° 0°
AMP(N)
100 1000
RES(64N)
100 ohm-m 10000
RES(DG)
100 ohm-m 100000
RES(16N)
100 ohm-m 10000
RES(MG)
100 ohm-m 100000
SPR
100 ohm 1000
LATERAL
100 ohm-m 100000
RES(FL)
15 ohm-m 25
TEMP(FL)
6 deg C 9
DIP
-70 deg -50
Azimuth MN
10 deg 30
Depth
1m:500m