P-05-240

Oskarshamn site investigation

RAMAC, BIPS and deviation logging in boreholes KLX08, HLX30 and HLX33

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Malå Geoscience AB/RAYCON

December 2005

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Keywords: BIPS, RAMAC, Radar, TV.

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.

Abstract

This report includes the data gained in geophysical logging operations performed within the site investigation at Oskarshamn. The logging operations presented here includes borehole radar (RAMAC), BIPS and deviation logging in the core drilled borehole KLX08 and in the percussion drilled boreholes HLX30 and HLX33. All measurements were conducted by Malå Geoscience AB/RAYCON during August and September 2005.

The objective of the radar surveys is to achieve information on the rock mass around the borehole. Borehole radar is used to investigate the nature and the structure of the rock mass enclosing the boreholes.

The objective of the BIPS logging is to achieve information of the borehole including occurrence of rock types as well as determination of fracture distribution and orientation.

The objective of the deviation measurement is to achieve information on borehole coordinates as well as dip and azimuth along the borehole length.

This report describes the equipment used as well as the measurement procedures and data gained. For the BIPS survey, the result is presented as images. Radar data is presented in radargrams and the identified reflectors are listed. The deviation measurement is presented as a list of data.

The borehole radar data quality from KLX08, HLX30 and HLX33 was relatively satisfying, but in some parts of lower quality due to more conductive conditions. This conductive environment of course reduces the possibility to distinguish and interpret possible structures in the rock mass which otherwise could give a reflection. However, the borehole radar measurements resulted in approximately 374 identified radar reflectors in KLX08 and of these 61 were orientated (strike/dip). In HLX30 53 radar reflectors and in HLX33 52 reflectors were identified.

Two different logging runs has been performed in KLX08 with the BIPS system. The first run showed a lot of mud covering the lover most part of the borehole wall. Therefore a second logging was performed that resulted in much better images. The BIPS images from the percussion drilled borehole HLX30 and HLX33 showed images of very high quality.

Sammanfattning

Denna rapport omfattar geofysiska loggningar inom platsundersökningsprogrammet för Oskarshamn. Mätningarna som presenteras här omfattar borrhålsradarmätningar (RAMAC), och BIPS- loggningar i kärnborrhålet KLX08, samt i hammarborrhålen HLX30 och HLX33. I borrhålen genomfördes även avvikelsemätningar, s k krökningsmätningar. Alla mätningar är utförda av Malå Geoscience AB/RAYCON under augusti och september 2005.

Syftet med radarmätningarna är att samla information om bergmassan runt borrhålet. Borrhålsradar används till att karakterisera bergets egenskaper och strukturer i bergmassan närmast borrhålet.

Syftet med BIPS- loggningen är att skaffa information om borrhålet inkluderande förekommande bergarter och bestämning av sprickors fördelning och deras orientering.

Syftet med avvikelsemätningarna är att få fram koordinater samt lutning och riktning för punkter längs med borrhålet.

Rapporten beskriver utrustningen som använts liksom mätprocedurer och en beskrivning och tolkning av data som erhållits. För BIPS- loggningen presenteras data som plottar längs med borrhålet. Radardata presenteras i radargram och en lista över tolkade radarreflektorer ges. Avvikelsemätningen presenteras som en lista med lägesdata.

Borrhålsradardata från KLX08, HLX30 och HLX33 var relativt tillfredställande, men bitvis med sämre djuppenetration troligen till stor del beroende på en konduktiv miljö. En konduktiv miljö minskar möjligheterna att identifiera strukturer från borrhålsradardata. Dock har 374 radarreflektorer identifierats i KLX08 och av dessa har 61 orienterats (med strykning/stupning). I HLX30 har 53 radarreflektorer identifierats och i HLX33 52 reflektorer.

Två BIPS loggningar har genomförts i KLX08. Vid den första loggningen visade det sig att den nedre delen av borrhålsväggen var täckt med ett finkornigt material. Den andra loggningen genomfördes efter kvävgasblåsning och visade på en betydande kvalitetshöjning. Kvalitén på bilderna från HLX 30 och HLX 33 var väldigt bra vilket ger goda förutsättningar för en geologisk kartering.

Contents

1 Introduction

This document reports the data gained in geophysical logging operations, which is one of the activities performed within the site investigation at Oskarshamn. The logging operations presented here includes borehole radar (RAMAC, BIPS) and deviation measurements in the core drilled borehole KLX08 and in the percussion drilled boreholes HLX30 and HLX33.

The work was carried out in accordance with activity plan AP PS 400-05-058. In Table 1-1 controlling documents for performing this activity are listed. Both activity plan and method descriptions are SKB's internal controlling documents.

This report includes measurements from 0 to 990 m in KLX08, from 0 to 159 in HLX30 and from 0 to 198 m in HLX33.

The borehole KLX08 are percussion drilled with a diameter of 197 mm down to 100.2 m, from there the borehole is core drilled with a diameter of 76 mm. The percussion drilled boreholes HLX30 and HLX33 are drilled with diameter of 139 mm.

All measurements were conducted by Malå Geoscience AB/RAYCON during August and September 2005. The investigation site and location of the boreholes is shown in Figure 1-1.

The used investigation techniques comprised:

- Borehole radar measurements (Malå Geoscience AB:s RAMAC system) with dipole and directional radar antennas.
- Borehole TV logging with the so-called BIP-system (Borehole Image Processing System), which is a high resolution, side viewing, colour borehole TV system.
- Borehole deviation equipment (Flexit SmartTool from Flexit AB), measuring azimuth, inclination (dip), tool face (gravity and magnetic) and magnetic dip.

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
Borrhålsradar och BIPS KLX08, HLX30, HLX31 och HLX33	AP PS 400-05-058	1.0
Method descriptions	**Number**	**Version**
Metodbeskrivning för TV- loggning med BIPS	SKB MD 222.006	1.0
Metodbeskrivning för borrhålsradar	SKB MD 252.020	2.0
Metodbeskrivning för krökningsmätning av hammar- och kärnborrhål	SKB MD 224.001	1.0

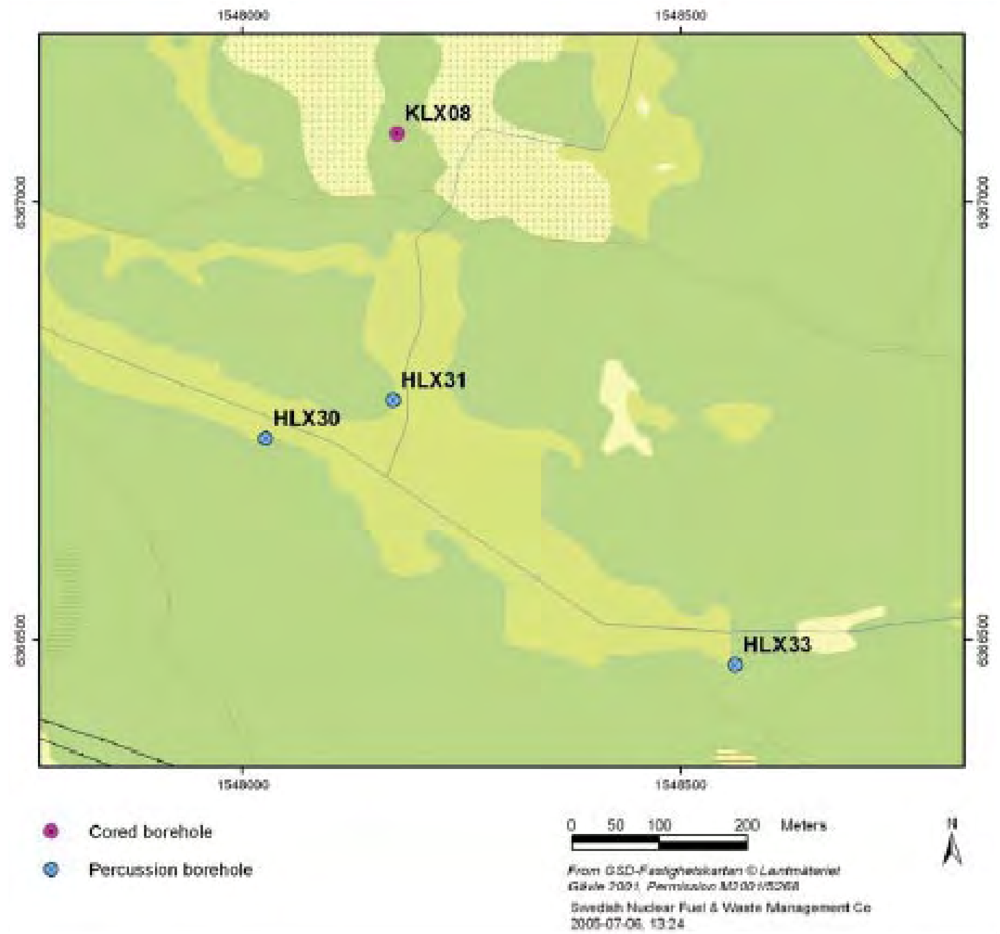


Figure 1-1. *Map of the location of the boreholes KLX08, HLX30 and HLX33, in the Laxemar subarea, Oskarshamn.*

2 Objective and scope

The objective of the radar and BIPS surveys is to achieve information on the borehole conditions (borehole wall) as well as on the rock mass around the borehole. Borehole radar is engaged to investigate the nature and the structure of the rock mass enclosing the boreholes, and borehole TV for geological surveying of the borehole including determination of rock types as well as fracture distribution and orientation.

The objective of deviation logging is to achieve information of the borehole coordinates as well as dip and azimuth along the entire borehole length.

This report describes the equipment used for the radar, BIPS and deviation surveys as well as the measurement procedures and data gained. For the BIPS survey, the result is presented as images. Radar data is presented in radargrams and the identified reflectors are listed. The deviation measurements are presented as lists of data (coordinates etc).

3 Equipment

3.1 Radar measurements RAMAC

The RAMAC GPR system owned by SKB is a fully digital GPR system where emphasis has been laid on fast survey speed and easy field operation. The system operates dipole and directional antennas (see Figure 3-1). A system description is given in the SKB internal controlling document MD 252.021.

The borehole radar system consists of a transmitter and a receiver antenna. During operation an electromagnetic pulse, within the frequency range of 20 MHz up to 250 MHz, is emitted into the bedrock. Once a feature, e.g. a water-filled fracture, with sufficiently different electrical properties is encountered, the pulse is reflected back to the receiver and recorded.

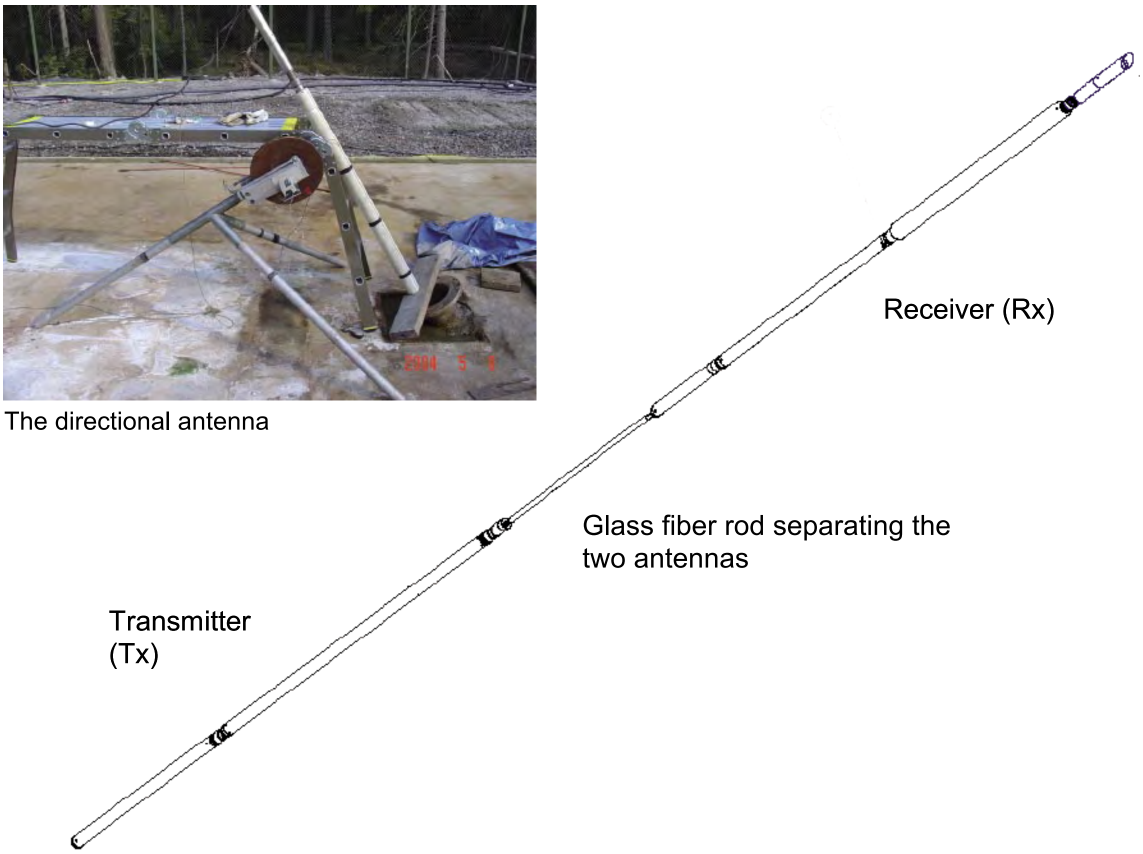


Figure 3-1. *Example of a borehole radar antenna.*

3.2 TV-Camera, BIPS

The BIPS 1500 system used is owned by SKB and described in SKB internal controlling document MD 222.005. The BIPS method for borehole logging produces a digital scan of the borehole wall. In principle, a standard CCD video camera is installed in the probe in front of a conical mirror (see Figure 3-2). An acrylic window covers the mirror part and the borehole image is reflected through the window and displayed on the cone, from where it is recorded. During the measuring operation, pixel circles are grabbed with a resolution of 360 pixels/circle.

The system orientates the BIPS images according to two alternative methods, either using a compass (vertical boreholes) or with a gravity sensor (inclined boreholes).

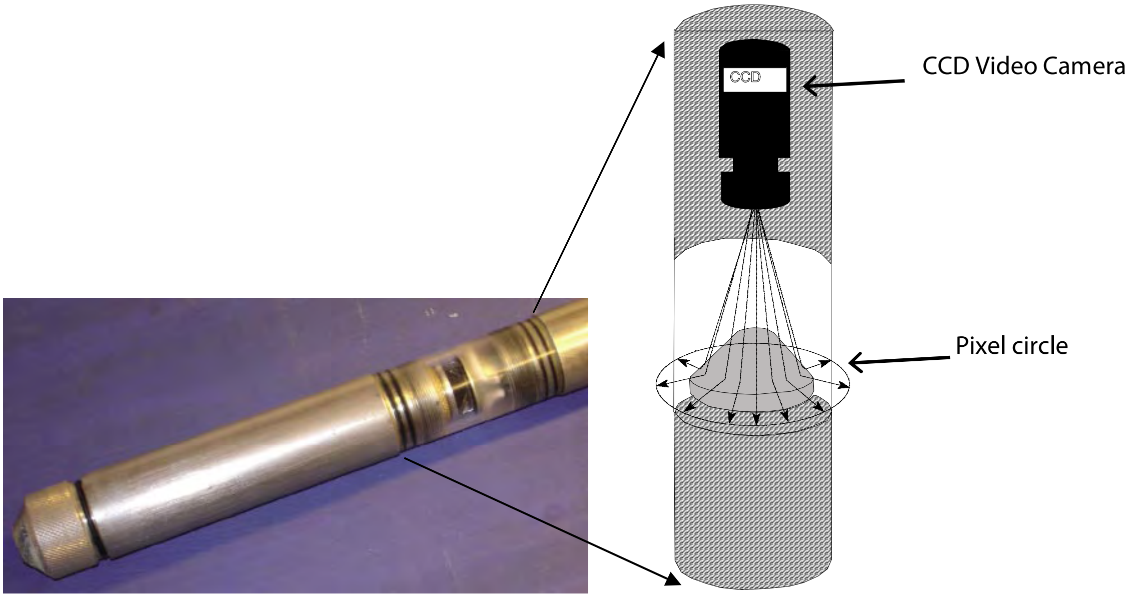


Figure 3-2. *The BIP-system. Illustration of the conical mirror scanning.*

3.3 Deviation measurements, Flexit SmartTool

The deviation measurements were carried out with the Flexit SmartTool Deviation equipment, Figure 3-3. The system is based on station readings.

The system consist of a borehole probe (SensIT) including 3-component magnetometers and accelerometers, measuring a number of different parameters. Table 3-1 describe the delivered parameters. Inside the probe the radio link is also built in were all data is downloaded after the end of the survey. The probe are controlled during the measurement either by an external PC and the software package called MeasureIT or a data pad StoreIT. For processing and reporting data the PC software MeasureIT and DisplayIt are used.

In the Flexit SmartTool system there is a magnetic integrity check to detect magnetic disturbance in the survey measurements. Magnetic disturbance results in incorrect/inaccurate azimuth values. The operator can select the average values for this parameters in the MeasureIT software and run a magnetic integrity check and if necessary change or delete azimuth values. If the azimuth value is changed the new added value by the operator is interpolated from the nearby station readings.

For more information and technical specification visit www.flexit.se.

Table 3-1. Flexit SmartTool result tables.

Dip:	Inclination of the borehole at the position for reading.
Azimuth:	Direction of the borehole at the position for reading.
Easting northing and elevation:	Co-ordinate of the borehole at the position for reading.
Mag field:	Strength of earth's magnetic field.
Mag dip:	Inclination of earth's magnetic field.
Grav field:	Indicates if the probe was moved during recording at that station.
Status:	Indicates if the azimuth value at the reading station was disturbed or changed by the operator. If the azimuth value has been edited or the magnetic integrity check have indicated a magnetic disturbance at the reading station a symbol with more than two "hands" is visible in the status field. 
Updown:	Shows the distance the actual reading station is above or below the planned straight line for the borehole given the starting direction.
Left/right:	Shows the distance the actual reading station is left or right the planned straight line for the borehole given the starting direction.
Short fall:	Shows the amount the actual point falls short of the planned survey point.

Figure 3-3. *The FlexIT SmartTool-system. Illustration of the set-up in the borehole.*

4 Execution

4.1 General

4.1.1 RAMAC Radar

The measurements in KLX08, HLX30 and HLX33 were carried out with dipole radar antennas, with frequencies of 250, 100 and 20 MHz. In KLX08 measurements were also carried out using the directional antenna, with a central frequency of 60 MHz.

During logging the dipole antennas (transmitter and receiver) were lowered continuously into the borehole and data were recorded on a field PC along the measured interval. The measurement with the directional antenna is made step wise, with a short pause for each measurement occasion. The antennas (transmitter and receiver, both for dipole and directional) are kept at a fixed separation by glass fiber rods according to Tables 4-1 to 4.3. See also Figure 3-1 and 4-1.

All measurements were performed in accordance with the instructions and guidelines from SKB (internal document MD 252.020). All cleaning of the antennas and cable was performed according to the internal document SKB MD 600.004 before the logging operation.

The functionality of the directional antenna was tested before measurements in KLX08. This was performed by measurements in the air, where the receiver antenna and the transmitter antenna are placed apart. While transmitting and measuring the receiver antenna is turned around and by that giving the direction from the receiver antenna to the transmitter antenna. The difference in direction is measured by compass and the result difference achieved from the directional antenna was about 9 degrees. This can be considered to be good due to the disturbed environment, with metallic objects etc at the test site.

For more information on system settings used in the investigation of KLX08, HLX30 and HLX33, see Tables 4-1 to 4-3 below.

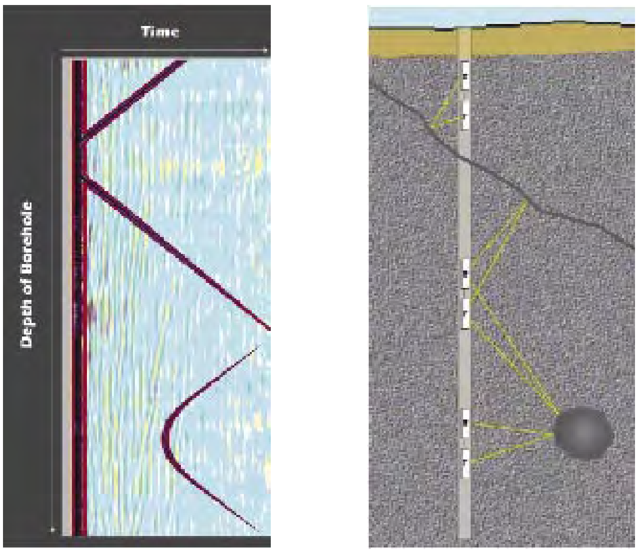


Figure 4-1. *The principle of radar borehole reflection survey and an example of result.*

Table 4-1. Radar logging information from KLX08.

Site: Oskarshamn **BH:** KLX08 **Type:** Directional/Dipole **Operator:** CG	**Logging company:** **Equipment:** **Manufacturer:** **Antenna** **Directional**	**RAYCON** **SKB RAMAC** **MALÅ GeoScience** **250 MHz**	**100 MHz**	**20 MHz**
Logging date:	05-09-07 and 05-09-08	05-09-06	05-09-06	05-09-05
Reference:	T.O.C.	T.O.C.	T.O.C.	T.O.C.
Sampling frequency (MHz):	615	2,424	891	239
Number of samples:	512	619	518	518
Number of stacks:	32	Auto	Auto	Auto
Signal position:	410.51	–0.34	–0.35	1.40
Logging from (m):	3.4	1.5	2.6	6.25
Logging to (m):	983.3	990.8	989.9	986.5
Trace interval (m):	0.5	0.1	0.2	0.25
Antenna separation (m):	5.73	2.4	3.9	10.05

Table 4-2. Radar logging information from HLX30.

Site: Oskarshamn **BH:** HLX30 **Type:** Dipole **Operator:** CG	**Logging company:** **Equipment:** **Manufacturer:** **Antenna** **250 MHz**	**RAYCON** **SKB RAMAC** **MALÅ GeoScience** **100 MHz**	**20 MHz**
Logging date:	05-08-31	05-08-31	05-08-31
Reference:	T.O.C.	T.O.C.	T.O.C.
Sampling frequency (MHz):	2,424	891	239
Number of samples:	619	518	518
Number of stacks:	Auto	Auto	Auto
Signal position:	–0.34	–0.35	–1.40
Logging from (m):	1.5	2.6	6.25
Logging to (m):	161.1	160.0	156.1
Trace interval (m):	0.1	0.2	0.25
Antenna separation (m):	2.4	3.9	10.05

Table 4-3. Radar logging information from HLX33.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**HLX33**	**Equipment:**	**SKB RAMAC**	
Type:	**Dipole**	**Manufacturer:**	**MALÅ GeoScience**	
Operator:	**CG**	**Antenna**		
		250 MHz	**100 MHz**	**20 MHz**
Logging date:		05-09-01	05-09-01	05-09-01
Reference:		T.O.C.	T.O.C.	T.O.C.
Sampling frequency (MHz):		2,424	891	239
Number of samples:		619	518	518
Number of stacks:		Auto	Auto	Auto
Signal position:		–0.34	–0.35	–1.40
Logging from (m):		1.5	2.6	6.25
Logging to (m):		199.9	198.9	195.0
Trace interval (m):		0.1	0.2	0.25
Antenna separation (m):		2.4	3.9	10.05

4.1.2 BIPS

All measurements were performed in accordance with the instructions and guidelines from SKB (internal document MD 222.006). All cleaning of the probe and cable was performed according to the internal document SKB MD 600.004 before the logging operation.

During the measurement, a pixel circle with a resolution of 360 pixels/circle was used and the digital circles were stored at every 1 mm on a MO- disc in the surface unit. The maximum speed during data collection was 1.5 m/minute.

A gravity sensor was used to measure the orientation of the images in the boreholes KLX08, HLX30 and HLX33.

In order to control the quality of the system, calibration measurements were performed in a test pipe before logging and after logging. Figure 4-2 correspond to the test logging performed before and after the logging of KLX08, HLX30 and HLX33. The results showed no difference regarding the colours and focus of the images. Results of the test loggings were included in the delivery of the raw data.

The BIPS logging information is found in the header for every single borehole presented in Appendices 4 to 6 in this report.

4.1.3 Deviation measuremnts

The deviation measurements were carried out according to the instructions and guidelines from SKB (internal document MD 224.001). All cleaning of the probe and cable was performed according to the internal document SKB MD 600.004 before the logging operation.

During the logging a measurement were performed for each 3 m. The logging was carried out in two directions, both from the surface measuring to the bottom of the borehole and a second run measuring from the bottom up to the surface. For the operation in the borehole the RAMAC/BIPS winch installed in the container was used together with the standard length measuring devices. For an accurate depth control the length recording was adjusted regularly for every 50 m by the actual marks on the logging cable.

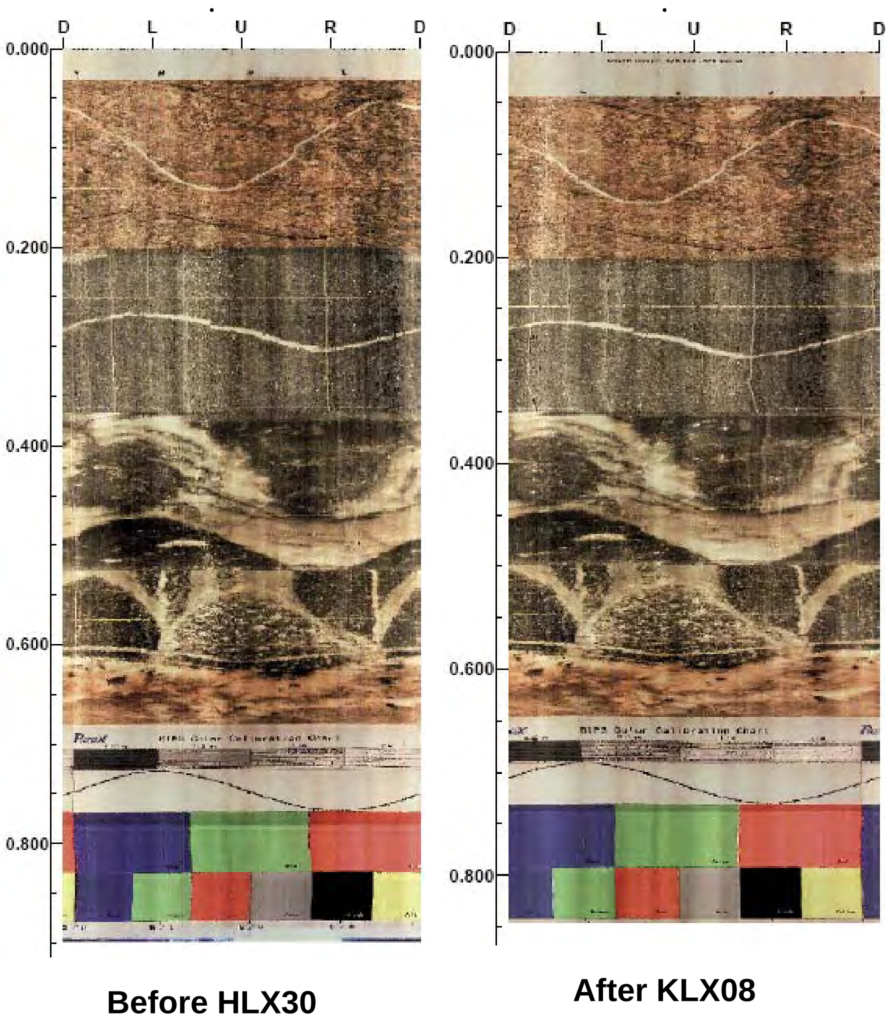


Figure 4-2. Results from logging in the test pipe before and after the logging campaign in August 31th to September 9th, 2005.

4.1.4 Length measurements

During logging the depth recording for the RAMAC systems is taken care of by a measuring wheel mounted on the cable winch. The logging is measured from TOC (Top of Casing). The length is adjusted to the bottom of casing when visible in the BIPS image.

During the BIPS logging in core drilled boreholes, where the reference marks in the borehole wall is visible on the image, the position where the depth mark is visible is marked with scotch tape on the logging cable. During BIPS logging the measured length was adjusted to true length according to depth mark visible in the BIPS image. The adjusted true length is marked with red in the image plot together with the non-adjusted measured length. The non-adjusted length is marked with black as seen in Appendices 4 to 6. The tape marks on the logging cable are then used for controlling the RAMAC measurement.

The experience we have from earlier measurements with dipole antennas in the core drilled boreholes in Forsmark and Oskarshamn for the radar logging is that the depth divergence is less than 100 cm in the deepest parts of a 1,000 m deep borehole.

The depth divergence is taken into account in the resulting tables in Chapter 5.

4.2 Analyses and Interpretation

4.2.1 Radar

The result from radar measurements is most often presented in the form of a radargram where the position of the probes is shown along one axis and the propagation is shown along the other axis. The amplitude of the received signal is shown in the radargram with a grey scale where black colour corresponds to the large positive signals and white colour to large negative signals. Grey colour corresponds to no reflected signals.

The presented data in this report is adjusted for the measurement point of the antennas. The measurement point is defined to be the central point between the transmitter and the receiver antenna.

The two basic patterns to interpret in borehole measurements are point and plane reflectors. In the reflection mode, borehole radar essentially gives a high-resolution image of the rock mass, showing the geometry of plane structures which may or may not, intersect the borehole (contact between layers, thin marker beds, fractures) or showing the presence of local features around the borehole (cavities, lenses etc).

The distance to a reflecting reflector or plane is determined by measuring the difference in arrival time between the direct and the reflected pulse. The basic assumption is that the speed of propagation is the same everywhere.

There are several ways to determine the radar wave propagation velocity. Each of them has its advantages and its disadvantages. For this logging campaign the velocity determination was performed between KLX07A and KLX07B by keeping the transmitter fixed in one borehole while moving the receiver downwards in nearby borehole. The velocity measurement was performed with the 20 MHz antennas in boreholes KLX07A and KLX07B /1/.

The result is plotted in Figure 4-3 and the calculation shows a velocity varying between 110 and 117 m/micro seconds. The lower velocities most probably represent a zone in the depth interval 40 to 60 m.

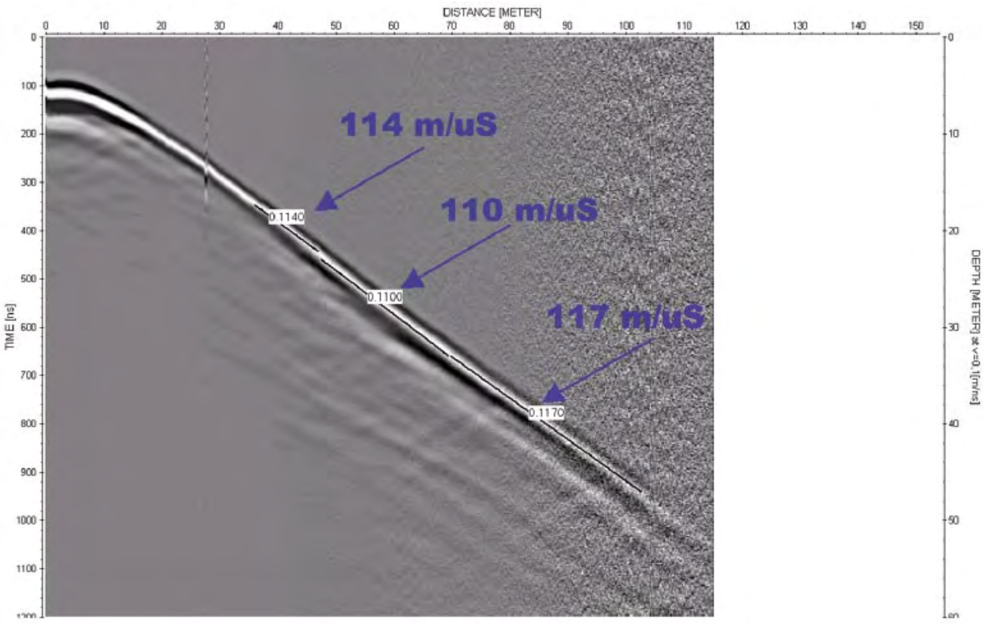


Figure 4-3. *Results from velocity measurements /1/.*

The visualization of data is made with ReflexWin, a Windows based processing software for filtering and analysis of borehole radar data. The processing steps are shown in Tables 4-4 to 4-6. It should be observed that the processing steps in Tables 4-4 to 4-6 below refer to Appendix 1 to 3 in this report. The filters applied affect the whole borehole length and are not always suitable in all parts, depending on the geological conditions and conductivity of the borehole fluid. During interpretation further processing can be done, most often in form of bandpass filtering. This filtering can be applied just in parts of the borehole, where needed.

For the interpretation of the intersection angle between the borehole axis and the planes visible on the radargrams the RadinterSKB software has been used. The interpreted intersection points and intersection angles of the detected structures are presented in the Tables 5-4 to 5-6 and are also visible on the radargrams in Appendices 1 to 3.

Table 4-4. Processing steps for borehole radar data from KLX08.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**		
BH:	**KLX08**	**Equipment:**	**SKB RAMAC**		
Type:	**Directional/Dipole**	**Manufacturer:**	**MALÅ GeoScience**		
Interpret:	**JG**	**Antenna**			
		Directional	**250 MHz**	**100 MHz**	**20 MHz**
Processing:		Move start time (–49 samples)	Move start time (–20)	Move start time (–38.5)	Move start time (–80)
		DC shift (400–510)	DC shift (190–230)	DC shift (450–540)	DC shift (1,900–2,100)
		Time gain (start 73 lin 150 exp 5)	Gain (Start 22 lin 1.5 exp 1.1)	Gain (Start 52 lin 1.44 exp 0.6)	Gain (Start 108 lin 2.1 exp 0.2)
		(FIR)			Bandpass (10/40)

Table 4-5. Processing steps for borehole radar data from HLX30.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**HLX30**	**Equipment:**	**SKB RAMAC**	
Type:	**Dipole**	**Manufacturer:**	**MALÅ GeoScience**	
Interpret:	**JG**	**Antenna**		
		250 MHz	**100 MHz**	**20 MHz**
Processing:		Move start time (–24)	Move start time (–42)	Move start time (–83)
		DC removal (190–230)	DC removal (460–530)	DC removal (1,900–2,100)
		Gain (Start 30 Linear 1.5 exp. 1.2)	Gain (Start 65 linear 4.5 exp 0.6)	Gain (Start 100 Linear 6.2, exp 0.13)

Table 4-6. Processing steps for borehole radar data from HLX33.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**HLX33**	**Equipment:**	**SKB RAMAC**	
Type:	**Dipole**	**Manufacturer:**	**MALÅ GeoScience**	
Interpret:	**JG**	**Antenna**		
		250 MHz	**100 MHz**	**20 MHz**
Processing:		Move start time (–21)	Move start time (–37)	Move start time (–79)
		DC removal (190–230)	DC removal (460–540)	DC removal (1,900–2,100)
		Gain (Start 60 Linear 0.09 exp. 2.9)	Gain (Start 57 linear 1.7 exp 0.6)	Gain (Start 120 Linear 3, exp 0.2)

4.2.2 BIPS

The visualization of data is made with BDPP, a Windows based processing software for filtering, presentation and analysis of BIPS data. As no fracture mapping of the BIPS image is performed, the raw data was delivered on a CD-ROM together with printable pictures in *.pdf format before the field crew left the investigation site.

The printed results were delivered with measured length, together with adjusted length according to the length marks visible in the BIPS image. For printing of the BIPS images the printing software BIPP from RaaX was used.

4.2.3 Deviation meausrements

The resulting data from the deviation measurements were corrected according to the magnetic north, 2.33 degrees east in RT90.

4.3 Nonconformities

There was no access to borehole HLX31 during the two field logging campaign. The reason for this was jammed equipment that blocked the borehole.

5 Results

The results from the BIPS measurements for KLX08, HLX30 and HLX33 were delivered as raw data (*.bip-files) on CD-ROM disks and MO-disks to SKB together with printable BIPS pictures in *.pdf format before the field crew left the investigation site. The information of the measurements was registered in SICADA, and the digital data and VHS tapes stored by SKB.

The RAMAC radar data was delivered as raw data (file format *.rd3 or *.rd5) for KLX08, HLX30 and HLX33 with corresponding information files (file format *.rad) whereas the data processing steps and results are presented in this report. Relevant information, including the interpretation presented in this report, was inserted into the SKB database SICADA.

The results from the deviation measurement were delivered to SKB in form of raw Flexit files and Excel-files, and also presented in Appendices 7 to 9 in this report. Each reading station depth are referred from TOC in the appendices.

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

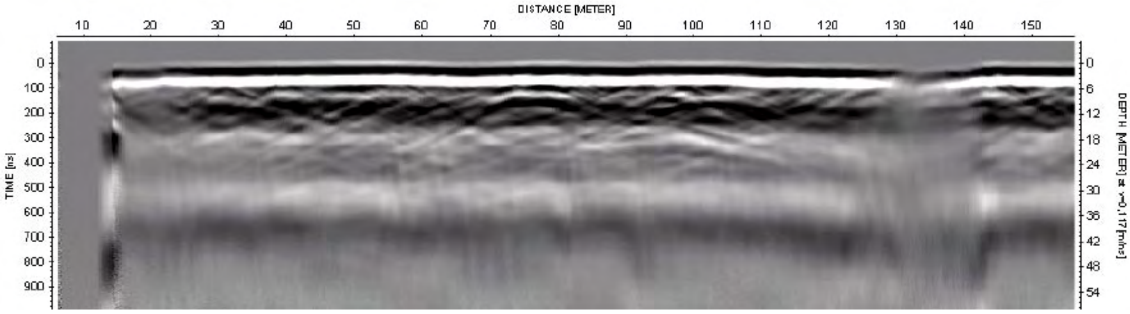
5.1 RAMAC logging

The results of the interpretation of the radar measurements are presented in Tables 5-1 to 5-6 and 5-10. Radardata is also visualized in Appendices 1 to 3. It should be remembered that the images in Appendices 1 to 3 are only a composite picture of all events 360 degrees around the borehole, and do not reflect the orientation of the structures.

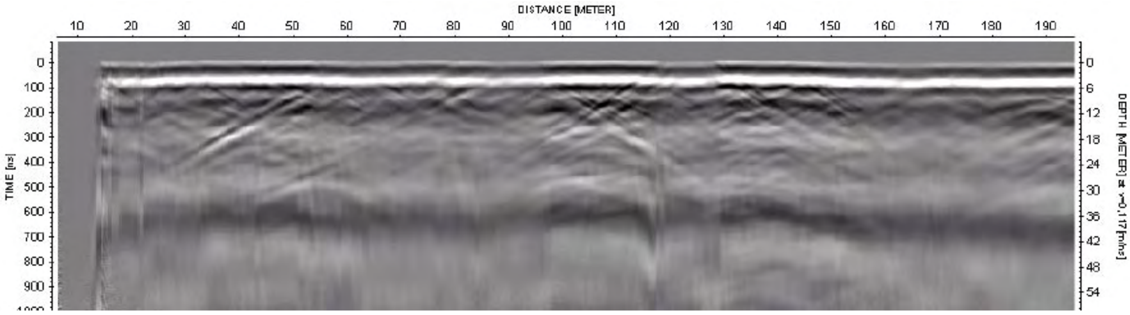
Only the larger clearly visible structures are interpreted in RadinterSKB. Overviews of the four different boreholes are given in Figure 5-1 below. A number of minor structures also exist, indicated in Appendices 1 to 3. Often a number of structures can be noticed, but most probably lying so close to each other that it is impossible to distinguish one from the other (see Figure 5-2). Larger structures parallel to the borehole, if present, are also indicated in Appendices 1 to 3. It should also be pointed out that reflections interpreted will always get an intersection point with the borehole, but being located further away. They may in some cases not reach the borehole.

The data quality from KLX08, HLX30 and HLX33, (as seen in Appendices 1 to 3) is satisfying, but in relatively large parts of lower quality due to more conductive conditions. This is seen for all the three boreholes (see for instance 250 MHz data in Appendices 2 and 3 and 100 MHz for KLX08 between 100 and 130 m in Appendix 1). A conductive environment makes the radar wave to attenuate, which decreases the penetration. This conductive environment of course also reduces the possibility to distinguish and interpret possibly structures in the rock which otherwise could give a reflection.

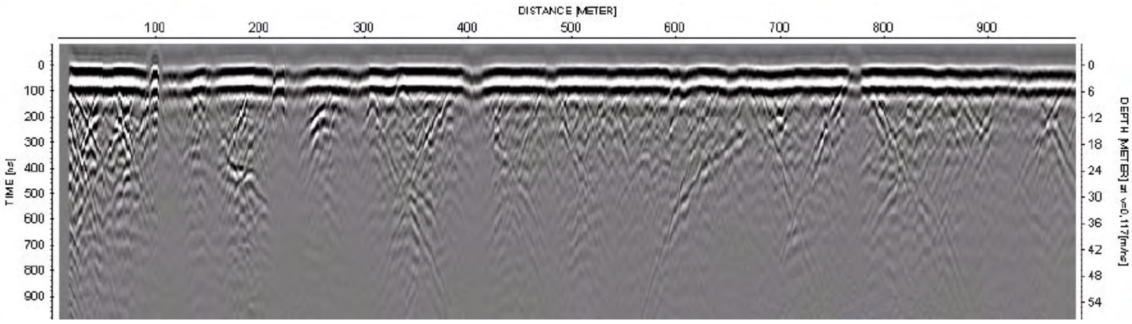
This effect is also seen in the directional antenna for KLX08, which makes it more difficult to interpret the direction to the identified structures.



HLX30



HLX33



KLX08

Figure 5-1. *An overview (20 MHz data) of the radar data for the three different boreholes; HLX30, HLX33 and KLX08. Observe that the length (x-scale) differs between the different boreholes.*

Further on, depending on the size of the borehole, the conductivity and the antenna frequency, so called ringing can be achieved, which again makes the interpretation of single structures quite complicated. This is seen for instance in the data from KLX08, (250 and 100 MHz data) for the first 100 m, where the borehole diameter is larger. See also Figure 5-3.

In parts with an increased conductivity and thereby a decreased depth penetration most often only the edges of structures can be distinguished, giving an intersection angle of 90 degrees. This is especially seen in the 250 MHz data for HLX30 and HLX33, in Appendices 2 and 3.

As also seen in Appendices 1 to 3 the resolution and penetration of radar waves depend on the antenna frequency used. Low antenna frequency gives less resolution but higher penetration depth compared to a higher frequency. If structures can be identified with all three antenna frequencies, it can probably be explained by that the structure is quite significant.

In Table 5-1 to 5-3 below the distribution of identified structures along the borehole are listed for KLX08, HLX30 and HLX33.

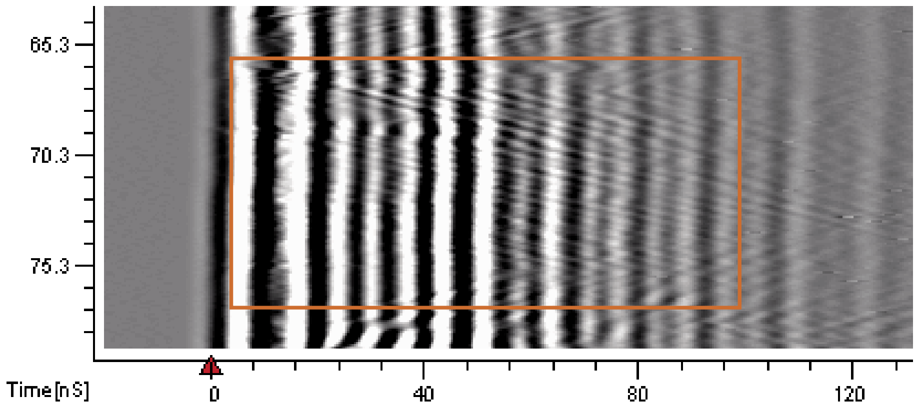


Figure 5-2. Example of data from HLX30 where a number of structures are seen (inside the marked area) but lying so close to each other, that one can not be distinguished from the other.

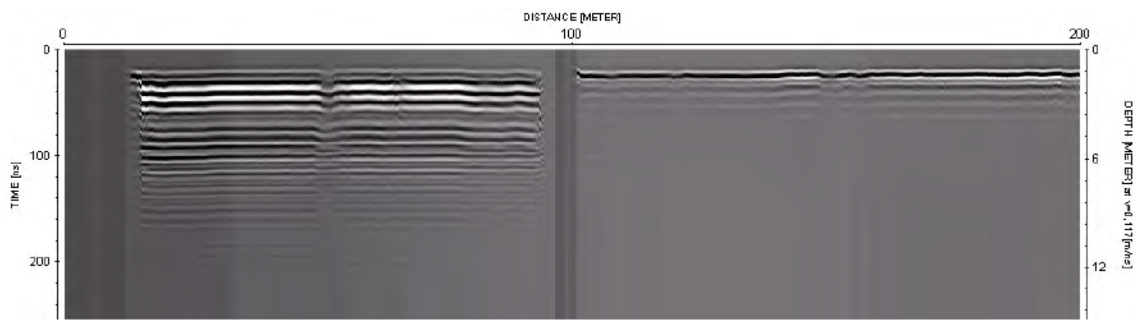


Figure 5-3. Example of raw data from KLX08. The effect of the two different borehole diameters are clearly seen, in the amount of so called ringing, in the upper part compared to the lower part of the picture.

Table 5-1. Identified structures as a function of depth in KLX08.

Depth (m)	No of structures
–100	12
100–150	19
150–200	25
200–250	17
250–300	18
300–350	22
350–400	19
400–450	19
450–500	24
500–550	24
550–600	22
600–650	23
650–700	26
700–750	19
750–800	18
800–850	14
850–900	15
900–950	22
950–1,000	15
1,000–	1

Table 5-2. Identified structures as a function of depth in HLX30.

Depth (m)	No of structures
–20	2
20–40	5
40–60	9
60–80	11
80–100	11
100–120	4
120–140	4
140–160	4
160–180	3
180–	–

Table 5-3. Identified structures as a function of depth in HLX33.

Depth (m)	No of structures
–20	4
20–40	4
40–60	5
60–80	3
80–100	4
100–120	5
120–140	8
140–160	6
160–180	4
180–	9

Tables 5-4 to 5-6 summarises the interpretation of radar data from KLX08, HLX30 and HLX33. For KLX8 the direction to the reflector is also given. As seen some radar reflectors in Table 5-4 are marked with ±, which indicates an uncertainty in the interpretation of direction. The direction can in these cases be ± 180 degrees. The direction to the reflector (the plane) is defined in Figure 5-4. This direction and the intersection angle are also recalculated to strike and dip, also given in the tables below. The plane strike is the angle between the line of the plane's cross-section with the surface and the Magnetic North direction. A strike of 0 degrees implies a dip to the east while a strike of 180 degrees implies a dip to the west. It counts clockwise and can vary from 0 to 359 degrees. The plane dip is the angle between the plane and the surface. It can vary between 0 and 90 degrees.

Observe that a structure can have several different angles, if the structure is undulating, and thereby also different intersection depths is given. This is seen for structure 227 in Table 5-4 and Appendix 1. To this structure, most likely, also structure 227x belongs.

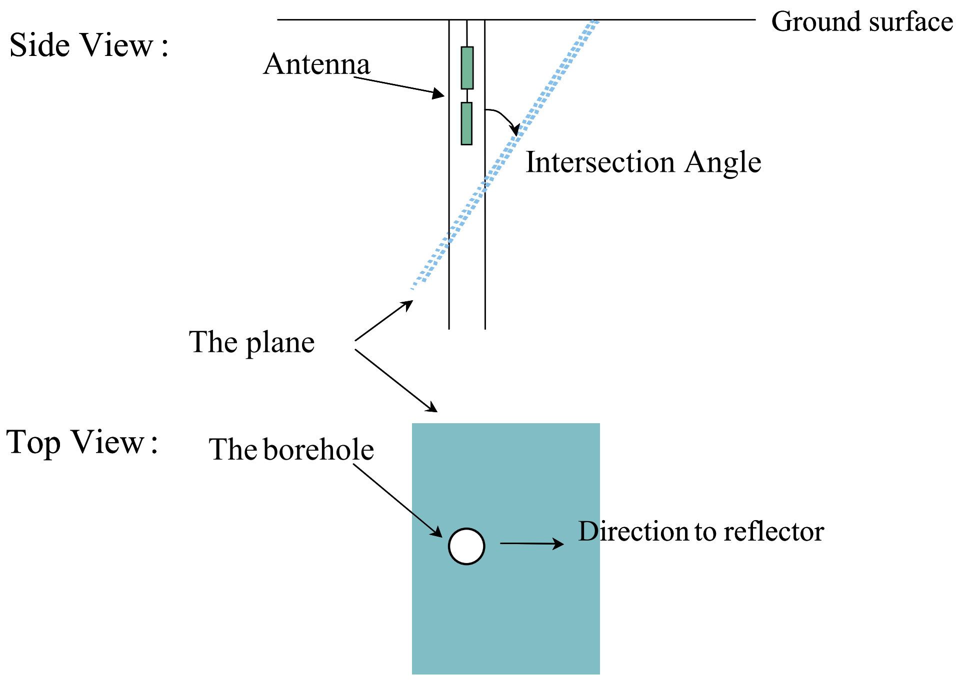


Figure 5-4. Definition of direction to reflector as presented in Table 5-4.

Table 5-4. Interpretation of radar reflectors from the dipole antennas 250, 100 and 20 MHz, and the directional antenna 60 MHz in borehole KLX08.

RADINTER MODEL INFORMATION
(Directional antenna)

Site:	**Oskarshamn**
Borehole name:	**KLX08**
Nominal velocity (m/μs):	**117.0**

Name	Intersection depth	Intersection angle	Direction to reflector	Dip 1	Strike 1	Dip 2	Strike 2
4	17	69					
2	18	65					
3	19.8	61					
8	49.3	53					
5	54	60					
6	56.2	56					
7	58.4	60					
47	65.5	15					
9	70.1	77					
10	81.6	62					
11	85	57					
12	90.3	58					
14	105.4	50	27	67	307		
13x	106.3	28					
15	107.4	56					
13	109.2	44					
13xx	109.6	42					
17x	115.0	28					
22	118.5	77					
16	119.6	75					
17	119.9	34	144	35	51		
18	122.9	43	171	18	88		
19	123.7	43					
20	128.8	50					
21	131.0	54					
23	139.9	58					
24	144.7	51					
25	145.3	53					
26	146.0	69					
27	146.9	52					
28	148.9	64	168 ±	7	337	55	282
337	150.8	53					
337x	151.3	64					
29	151.5	59					
30	154.6	61					
32	156.4	60					
33	158.0	76					
339	162.9	57					
31	163.2	23					
38	165.1	62					

RADINTER MODEL INFORMATION
(Directional antenna)

Site:	**Oskarshamn**
Borehole name:	**KLX08**
Nominal velocity (m/μs):	**117.0**

Name	Intersection depth	Intersection angle	Direction to reflector	Dip 1	Strike 1	Dip 2	Strike 2
34	167.8	76					
35	169.4	66					
37	171.0	56	288 ±	51	252	37	1
36	172.4	55	153 ±	14	19	60	271
39	173.7	60					
41	175.8	54					
42	177.4	60					
40	177.7	44					
44	182.5	61					
338	184.0	43					
43	186.3	60	144 ±	19	21	59	275
45	192.8	49					
49	193.3	57					
46	194.9	59	279 ±	45	251	37	349
48	198.7	50	6	67	300		
50	198.0	63					
51	201.4	54					
52	202.6	56					
53	204.2	50					
54	206.2	50					
55	209.6	46					
56	210.8	51					
57	212.6	55					
58	214.2	56					
59	216.6	63					
60	220.0	60					
63	223.1	53					
62	228.6	47					
65	230.2	61	243 ±	30	236	49	331
61	232.0	36					
68	233.7	56					
66	234.4	56					
67	242.4	49	9	71	303		
71	253.0	57					
69	254.6	59					
70	255.8	64	183 ±	4	279	55	298
72	261.8	46					
73	262.8	49	345 ±	69	286	13	69
335	266.8	16					
324	268.9	49					
336	271.1	39					
74	276.8	41					

RADINTER MODEL INFORMATION
(Directional antenna)

Site: Oskarshamn
Borehole name: KLX08
Nominal velocity (m/μs): 117.0

Name	Intersection depth	Intersection angle	Direction to reflector	Dip 1	Strike 1	Dip 2	Strike 2
75	278.6	46					
76	280.1	46	168	15	82		
340	282.5	36					
77	284.1	50					
78	286.1	52					
79	288.6	55					
80	290.2	55	171 ±	8	76	65	291
81	295.2	58					
323	299.7	61					
84	300.0	67	90 ±	37	338	37	259
82	300.3	55					
85x	300.5	9					
83	300.8	63					
101	310.2	23					
85	313.0	14	276 ±	80	219	75	24
86	313.6	56					
87	314.0	63					
88	323.2	46					
350	323.6	34	282 ±	66	237	55	20
322	326.7	55					
89	329.7	52					
90	331.6	51					
92	333.6	52					
97	334.9	35					
91	335.2	67					
94	337.3	44					
93	337.7	58					
95	340.1	58					
99	341.1	43					
96	345.5	49					
98	349.0	47					
102	359.1	46					
103	361.9	67					
104	364.3	56					
100x	366.9	35					
100	367.2	45					
106	375.5	66	168 ±	6	23	59	292
107	378.1	46					
105	383.3	13					
321	385.2	47					
108	385.5	41					
109	385.5	51					

RADINTER MODEL INFORMATION
(Directional antenna)

Site:	**Oskarshamn**
Borehole name:	**KLX08**
Nominal velocity (m/μs):	**117.0**

Name	Intersection depth	Intersection angle	Direction to reflector	Dip 1	Strike 1	Dip 2	Strike 2
113	387.1	45					
114	388.5	44					
110	389.5	28					
119	389.6	10					
355	392.5	23	267 ±	68	219	72	15
111	395.6	40					
115	398.4	47					
116	399.9	54					
112	400.2	31	357	89	296		
112x	402.4	25					
117	405.2	65					
118	407.5	65					
120	412.5	51					
125	414.1	31					
122	419.4	55					
123	423.0	73					
121	428.4	49					
124	427.9	66					
126	439.0	49					
127x	440.7	48					
128	441.4	58					
341	441.5	36					
127	441.9	42					
129	446.5	44	177	16	111		
131	446.7	58					
132	447.2	41					
132x	449.3	59					
133	452.0	45					
134	452.5	64					
135	453.5	62					
136	455.6	48					
137	455.8	69					
140	460.0	32	63	74	350		
138	460.0	77	348 ±	43	296	18	303
130	460.7	20	99 ±	67	25	76	228
143	465.5	57					
139	466.0	52	183 ±	9	131	70	301
154	466.1	31					
141	466.8	20					
144	468.7	38					
351	472.9	57	183 ±	4	146	64	301
150	477.6	60					

RADINTER MODEL INFORMATION
(Directional antenna)

Site: **Oskarshamn**
Borehole name: **KLX08**
Nominal velocity (m/μs): **117.0**

Name	Intersection depth	Intersection angle	Direction to reflector	Dip 1	Strike 1	Dip 2	Strike 2
153	479.0	63					
146	479.9	62	342 ±	59	289	9	9
145	481.0	30					
147	482.3	60					
342	484.3	47					
149	484.7	38					
148	484.8	61					
151	496.9	40	198	20	160		
152	498.7	41					
156	503.2	49					
155	503.5	32					
320	503.8	72					
142	504.0	12					
157	505.0	55	255 ±	39	236	51	344
158	507.4	63					
160	508.3	68					
159	509.9	63	258 ±	35	250	44	338
161	510.7	67					
172	516.3	57	162 ±	10	32	63	288
319	519.2	76					
162	522.0	59					
163	523.4	61					
164	526.3	56					
171	532.2	44					
165	534.0	54					
166	536.3	51					
352	537.6	57	15	63	308		
167	539.2	49					
168	542.9	45					
169	544.0	71					
170	547.8	60					
173	549.3	60					
179	549.9	63					
174	552.1	62					
334	554.9	59					
175	556.1	62					
177	558.5	46					
176	559.8	42	342 ±	75	286	17	72
184	560.3	21					
353	562.0	61	321 ±	56	277	19	7
178	565.6	55					
180	566.6	56					

RADINTER MODEL INFORMATION
(Directional antenna)

Site: Oskarshamn
Borehole name: KLX08
Nominal velocity (m/μs): 117.0

Name	Intersection depth	Intersection angle	Direction to reflector	Dip 1	Strike 1	Dip 2	Strike 2
181	567.0	63	180 ±	4	299	57	299
182	569.7	55					
183	571.7	35					
185	572.6	20					
187	584.4	21					
186	585.3	16					
189	585.5	34					
318	587.8	60					
190	587.8	45					
188	591.0	75					
195	595.7	59					
193	595.8	50					
191	598.3	22					
317	600.9	63					
194	605.9	58					
316	609.0	57					
196xx	613.0	18	330 ±	81	90	46	78
313	614.5	48					
203	614.9	54					
192	615.0	16					
196	615.9	21					
197	616.3	49					
198	618.2	55					
314	620.1	45					
199	622.9	46					
196x	624.4	17	126	56	52		
200	628.4	44					
312	631.3	48					
343	632.0	30					
201	634.5	41					
202	637.2	37					
315	642.4	51					
204	644.4	48	342	75	286		
205	645.7	56					
344	647.0	52					
344xx	649.4	30					
206	652.2	43					
207	653.3	44					
209x	653.7	28					
209xx	655.5	36					
209	656.2	36	60 ±	72	346	44	207
344x	656.5	39					

RADINTER MODEL INFORMATION
(Directional antenna)

Site: **Oskarshamn**
Borehole name: **KLX08**
Nominal velocity (m/μs): **117.0**

Name	Intersection depth	Intersection angle	Direction to reflector	Dip 1	Strike 1	Dip 2	Strike 2
208	665.9	16					
227x	664.0	22	333	84	94		
332	667.6	53					
210	670.9	49					
214	671.8	79					
227	672.6	34	333	84	277		
211	673.4	75	357 ±	44	298	18	301
213	674.6	55					
212	678.8	33					
311	680.5	58					
226	681.1	20	162 ±	40	93	81	102
230	681.7	38					
310	688.4	70					
309	690.0	70					
331	690.3	43					
333	691.4	54					
215	692.3	62	3 ±	56	301	6	286
216	692.3	24					
345	696.8	24					
218	699.4	17					
220	701.5	55					
217	708.5	31					
219	710.1	73					
221	712.8	64					
357	714.7	38	144	31	56		
222	715.8	63					
223	718.2	59					
224	721.4	52					
225	721.9	32	69	74	256		
228	726.8	33					
235	728.1	39					
232	736.1	63					
229	736.8	32	75	70	359		
231	738.9	34					
308	734.3	73					
307	735.1	63					
233	736.8	45					
234	743.6	69					
238	744.5	22					
330	751.2	17	102	70	31		
236	757.0	59					
345x	758.9	12					

RADINTER MODEL INFORMATION
(Directional antenna)

Site:	**Oskarshamn**
Borehole name:	**KLX08**
Nominal velocity (m/μs):	**117.0**

Name	Intersection depth	Intersection angle	Direction to reflector	Dip 1	Strike 1	Dip 2	Strike 2
239	762.0	44					
354	762.6	55	267	46	241		
306	763.7	43					
240	765.2	43					
241	769.1	41					
242	771.2	42					
243	773.4	36					
243	773.4	36	261	55	223		
244	775.9	30					
244x	776.4	34					
246	777.6	42					
247	781.5	35					
245	782.8	47					
248	786.1	68					
237	787.8	10					
249	800.2	41					
253	802.8	24	78	16	7		
250	802.9	41					
251	804.4	50					
346	807.2	33					
254	808.6	51					
252	812.5	54					
256	821.4	38					
255	822.5	53					
258	826.7	48					
259	832.4	42					
257	832.6	78	78	36	321	31	274
260	842.1	60					
270	842.2	41					
261	851.6	26					
261x	854.5	27	168	34	100		
262	856.2	24					
263	863.5	24					
329	866.9	48					
347	871.7	19					
264	872.0	62					
265	874.5	62	345 ±	56	292	9	345
328	876.9	27					
328x	877.9	24					
305	882.0	55					
266	888.8	53					
267	892.9	61					

RADINTER MODEL INFORMATION
(Directional antenna)

Site:	**Oskarshamn**
Borehole name:	**KLX08**
Nominal velocity (m/µs):	**117.0**

Name	Intersection depth	Intersection angle	Direction to reflector	Dip 1	Strike 1	Dip 2	Strike 2
268	894.5	61	318 ±	53	278	21	356
271	897.3	70					
269	901.8	55	162	33	89		
272	910.5	25					
276	912.7	52					
348	913.0	19					
273	913.4	58					
275	914.6	60					
274	916.2	60					
279	925.0	29					
304	925.1	51					
327	925.2	21					
281	927.0	56					
282	930.1	59					
325	931.2	36					
283	934.4	52					
356	936.3	29					
284	936.7	55					
287	938.0	49					
285	938.5	63					
286	939.6	60					
280	942.3	20					
288	944.1	45	177 ±	14	111	76	297
278	949.9	22					
291	950.1	66					
289	950.9	59	165 ±	8	14	62	291
290	957.2	51					
300	958.8	47					
303	965.2	53					
326	967.2	57					
301	971.8	18					
295	976.1	55					
293	977.6	52	165	11	61		
298	980.5	19					
297	980.6	64					
294	983.3	43					
296	991.8	28					
302	995.0	38					
299	997.8	28	183	29	125		
349	1,005.6	58					

Table 5-5. Interpretation of radar reflectors from the dipole antennas 250, 100 and 20 MHz, in borehole HLX30.

RADINTER MODEL INFORMATION
(20, 100 and 250 MHz Dipole Antennas)

Site: Oskarshamn
Borehole name: HLX30
Nominal velocity (m/μs): 117.0

Reflector type	Name	Intersection depth	Intersection angle
PLANE	1	16.1	80
PLANE	2	18.1	65
PLANE	3	20.4	63
PLANE	4	22.0	64
PLANE	6	27.9	54
PLANE	44	29.4	61
PLANE	5	31.8	62
PLANE	7	40.0	61
PLANE	8	42.1	62
PLANE	9	45.4	59
PLANE	45	47.2	63
PLANE	50	47.9	24
PLANE	30	52.4	73
PLANE	32	53.3	32
PLANE	10	53.8	74
PLANE	15	57.3	68
PLANE	11	61.3	80
PLANE	12	62.1	61
PLANE	13	64.1	67
PLANE	14	64.3	59
PLANE	48	67.7	52
PLANE	16	69.5	76
PLANE	17	70.4	61
PLANE	18	71.1	67
PLANE	19	74.8	62
PLANE	28	76.1	61
PLANE	20	78.5	49
PLANE	25	80.2	66
PLANE	46	82.2	57
PLANE	21	85.6	58
PLANE	23	85.6	68
PLANE	22	87.2	64
PLANE	24	87.6	70
PLANE	26	88.8	68
PLANE	51	90.4	56
PLANE	53	93.0	32
PLANE	27	94.1	61
PLANE	31	97.3	61
PLANE	29	101.9	55

RADINTER MODEL INFORMATION (20, 100 and 250 MHz Dipole Antennas)			
Site:		**Oskarshamn**	
Borehole name:		**HLX30**	
Nominal velocity (m/μs):		**117.0**	
Reflector type	**Name**	**Intersection depth**	**Intersection angle**
PLANE	33	109.6	60
PLANE	34	111.8	55
PLANE	35	115.5	54
PLANE	36	128.0	59
PLANE	37	129.4	58
PLANE	38	134.6	63
PLANE	39	136.0	63
PLANE	42	146.7	70
PLANE	41	150.2	79
PLANE	40	152.4	50
PLANE	43	152.6	61
PLANE	49	166.0	55
PLANE	47	150.8	73
PLANE	52	168.6	75

Table 5-6. Interpretation of radar reflectors from the dipole antennas 250, 100 and 20 MHz, in borehole HLX33.

RADINTER MODEL INFORMATION (20, 100 and 250 MHz Dipole Antennas)			
Site:		**Oskarshamn**	
Borehole name:		**HLX33**	
Nominal velocity (m/μs):		**117.0**	
Reflector type	**Name**	**Intersection depth**	**Intersection angle**
PLANE	1	14.8	61
PLANE	2	17.1	46
PLANE	4	18.9	80
PLANE	3	19.9	51
PLANE	5	29.4	55
PLANE	6	34.2	74
PLANE	7	35.9	68
PLANE	8	38.5	65
PLANE	9	45.2	62
PLANE	10	47.4	67
PLANE	11	53.5	54
PLANE	32	58.7	62
PLANE	12	59.4	49
PLANE	13	62.3	51
PLANE	14	67.2	46
PLANE	15	77.9	71
PLANE	16	85.1	45
PLANE	17	89.4	50

RADINTER MODEL INFORMATION (20, 100 and 250 MHz Dipole Antennas)			
Site:	**Oskarshamn**		
Borehole name:	**HLX33**		
Nominal velocity (m/μs):	**117.0**		
Reflector type	**Name**	**Intersection depth**	**Intersection angle**
PLANE	18	92.5	58
PLANE	49	94.4	50
PLANE	19	101.1	54
PLANE	20x	102.4	39
PLANE	20	105.3	53
PLANE	48	109.8	33
PLANE	34	116.5	55
PLANE	33	121.0	46
PLANE	22	121.6	64
PLANE	21	123.1	67
PLANE	21x	127.0	46
PLANE	25	133.2	41
PLANE	23	134.7	63
PLANE	24	136.7	69
PLANE	29	139.2	79
PLANE	47	142.7	19
PLANE	27	145.3	52
PLANE	28	147.3	49
PLANE	30	153.5	47
PLANE	31	153.8	55
PLANE	35	158.6	42
PLANE	37	160.7	72
PLANE	36	161.4	43
PLANE	38	170.1	33
PLANE	45	172.4	64
PLANE	40	181.8	71
PLANE	39	182.0	32
PLANE	41	184.2	66
PLANE	46	195.1	52
PLANE	42	197.3	41
PLANE	43	208.7	39
PLANE	44	214.0	35
PLANE	50	223.1	38
PLANE	51	231.6	44

In Appendices 1 to 3, the amplitude of the first arrival is plotted against the depth, for the 250 MHz dipole antennas. The amplitude variation along the borehole indicates changes of the electrical conductivity of the volume of rock surrounding the borehole. A decrease in this amplitude may indicate fracture zones, clay or rock volumes with increases in water content, i.e. increases in electric conductivity. The decrease in amplitude is shown in Tables 5-7 to 5-9.

Table 5-7. Borehole length intervals in KLX08 with decreased amplitude for the 250 MHz antenna.

Length (m)	Length (m)
0–100	480–485
105–125	540
150–160	565–570
195–200	590
210–220	615
230–240	645–660
245	675
280	765–780
285	815
290–300	825
315	855
325	885–900
395–415	915
420	925–950
445	960–980
465	990

Table 5-8. Borehole length intervals in HLX30 with decreased amplitude for the 250 MHz antenna.

Length (m)	Length (m)
10–20	85–90
40	130–140
60–70	150

Table 5-9. Borehole length intervals in HLX33 with decreased amplitude for the 250 MHz antenna.

Length (m)	Length (m)
10–30	90
50	120–125
55–70	150–200
85	

Finally, the structures considered as the most important (clear in the radargram, identified with several antenna frequencies, stretching out far from the borehole wall etc) are listed in Table 5-10 below.

Table 5-10. Some important structures in KLX08, HLX30 and HLX33.

Borehole	KLX08	HLX30	HLX33
Structures	5, 8, 10, 28, 32, 37, 48, 55, 58, 73, 76, 84,85, 90, 106, 112, 119, 127, 129, 130, 140, 143, 196, 209, 209x, 211, 243, 244,335, 339, 340, 344, 344x, 345, 345x, 354	11, 12, 13, 17, 22, 24, 36, 38, 39 and 50	3, 11, 14, 16, 21, 21x, 23, 48 and 49

Observe that it is can be very difficult to classify different structures in an objective manner, along a borehole. This is due to the fact that the water quality (the conductivity) amongst others varies along the borehole length and by that reason affects the results of the radar logging, by for instance attenuating the radar waves differently. Also the intersection angle of the identified structures affects the amplitude on the resulting radargram. A small angle will most often give a increased amplitude than a larger angle, and by that a more clear structure.

5.2 BIPS logging

The BIPS pictures from KLX08, HLX30and HLX33 are presented in Appendices 4 to 6.

In order to control the quality of the system, calibration measurements were performed in a test pipe before and after the logging. The resulting images displayed with no difference regarding the colours and focus of the images. Results of the test loggings were included in the delivery of the raw data.

To get the best possible depth accuracy, the BIPS images are adjusted to the reference mark on the cable for the logging in KLX08. For the other boreholes the marks on the logging cable at 110 m and 150 m were used for adjustment of the depth.

The error in the depth recording depends mainly on the tension of the cable and error of the depth readings from the measuring wheel. The adjusted depth is showed in red colour and the recording depth have black colour in the printouts.

Two different logging runs has been performed in KLX08 with the BIPS system. The first run performed on September 8th showed a lot of mud covering the lover most part of the borehole wall. Therefore a second logging was performed on September 26th after cleaning with nitrogen gas. The second run showed much better images due to lesser mud content and in general a better water quality. In this report the second logging is presented in Appendix 4.

The BIPS images from the percussion drilled borehole HLX30 and HLX33 showed images of very high quality.

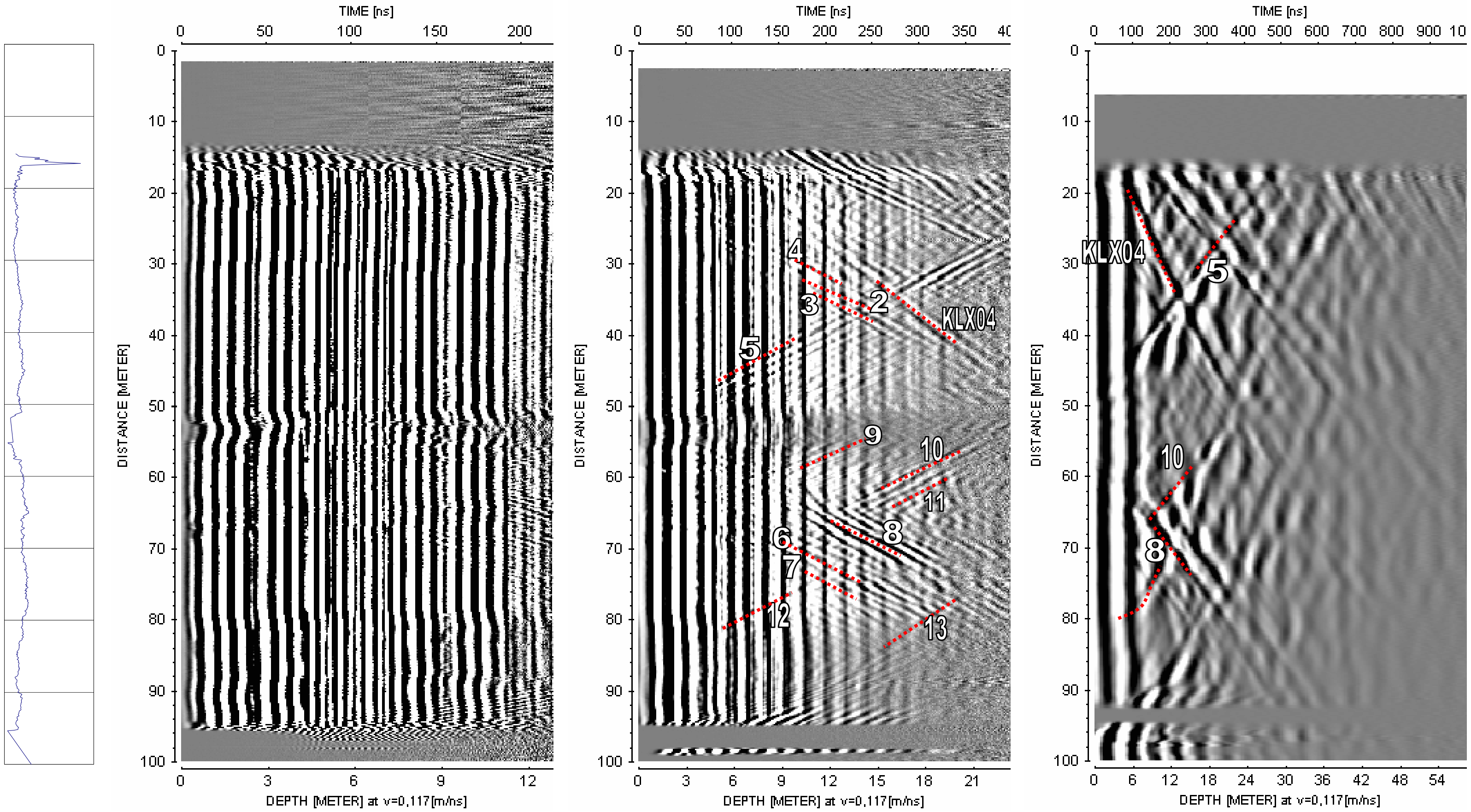
References

/1/ **Gustafsson J, Gustafsson C, 2005.** Oskarshamn site investigation. RAMAC and BIPS logging in boreholes KLX07A, KLX07B, HLX34 and HLX35 and deviation logging in boreholes KLX07B, HLX34 and HLX35. SKB P-05-231. Svensk Kärnbränslehantering AB.

Appendix 1

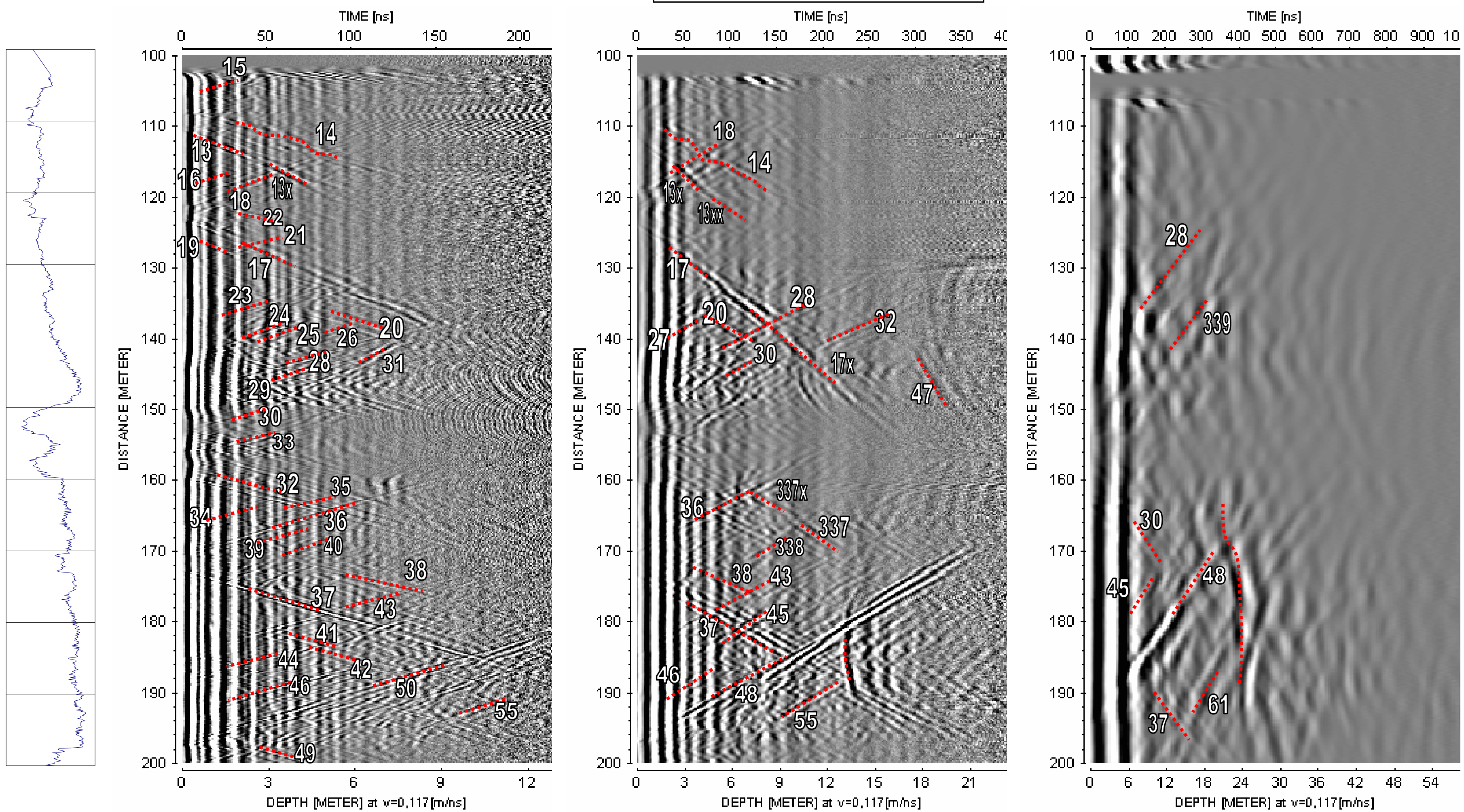
Radar logging in KLX08, 0 to 990 m, dipole antennas 250, 100 and 20 MHz

LAXEMAR KLX08



250 MHz **100 MHz** **20 MHz**

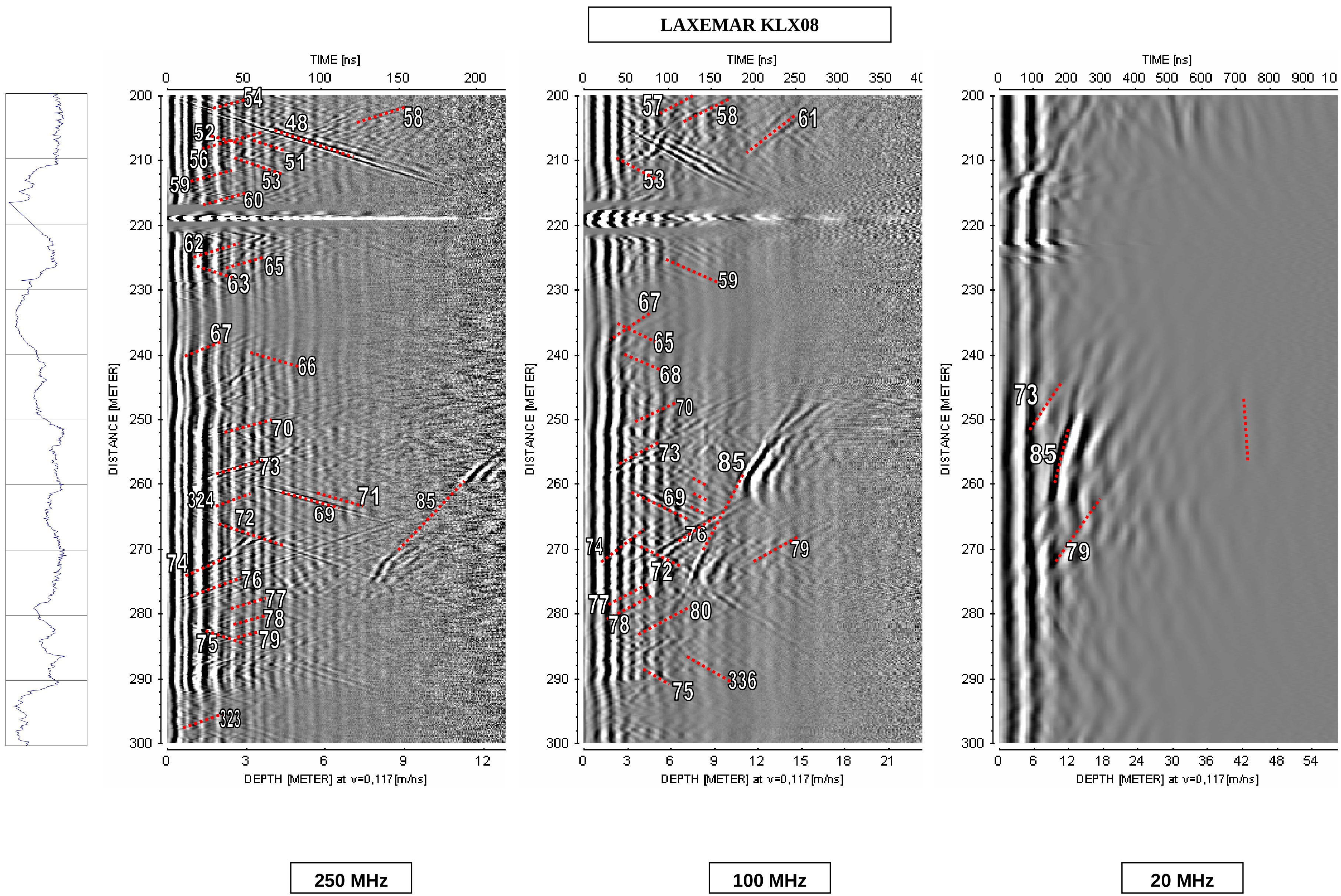
LAXEMAR KLX08



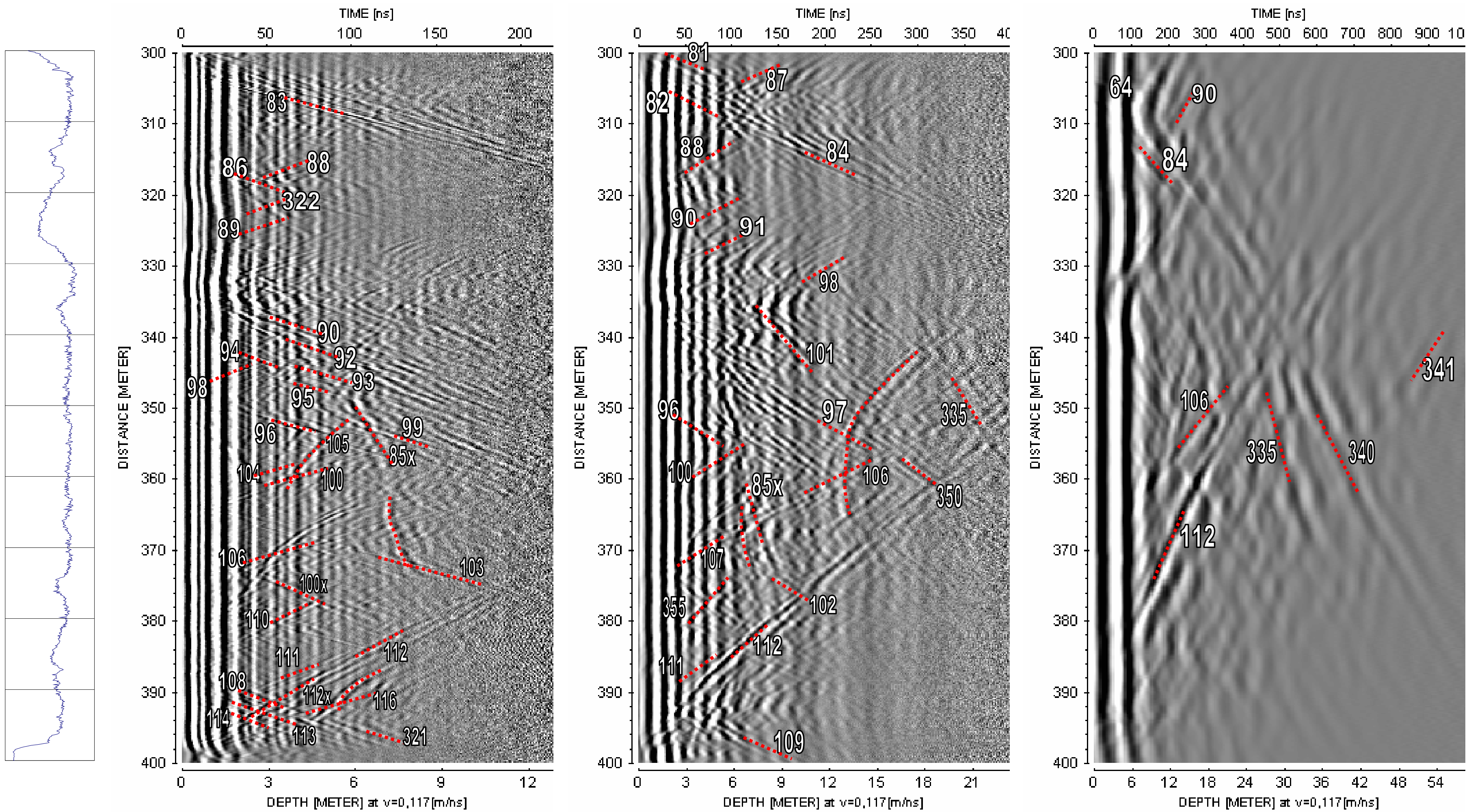
250 MHz

100 MHz

20 MHz


LAXEMAR KLX08
TIME [ns]
DISTANCE [METER]
DEPTH [METER] at v=0,117 [m/ns]
250 MHz
100 MHz
20 MHz

LAXEMAR KLX08

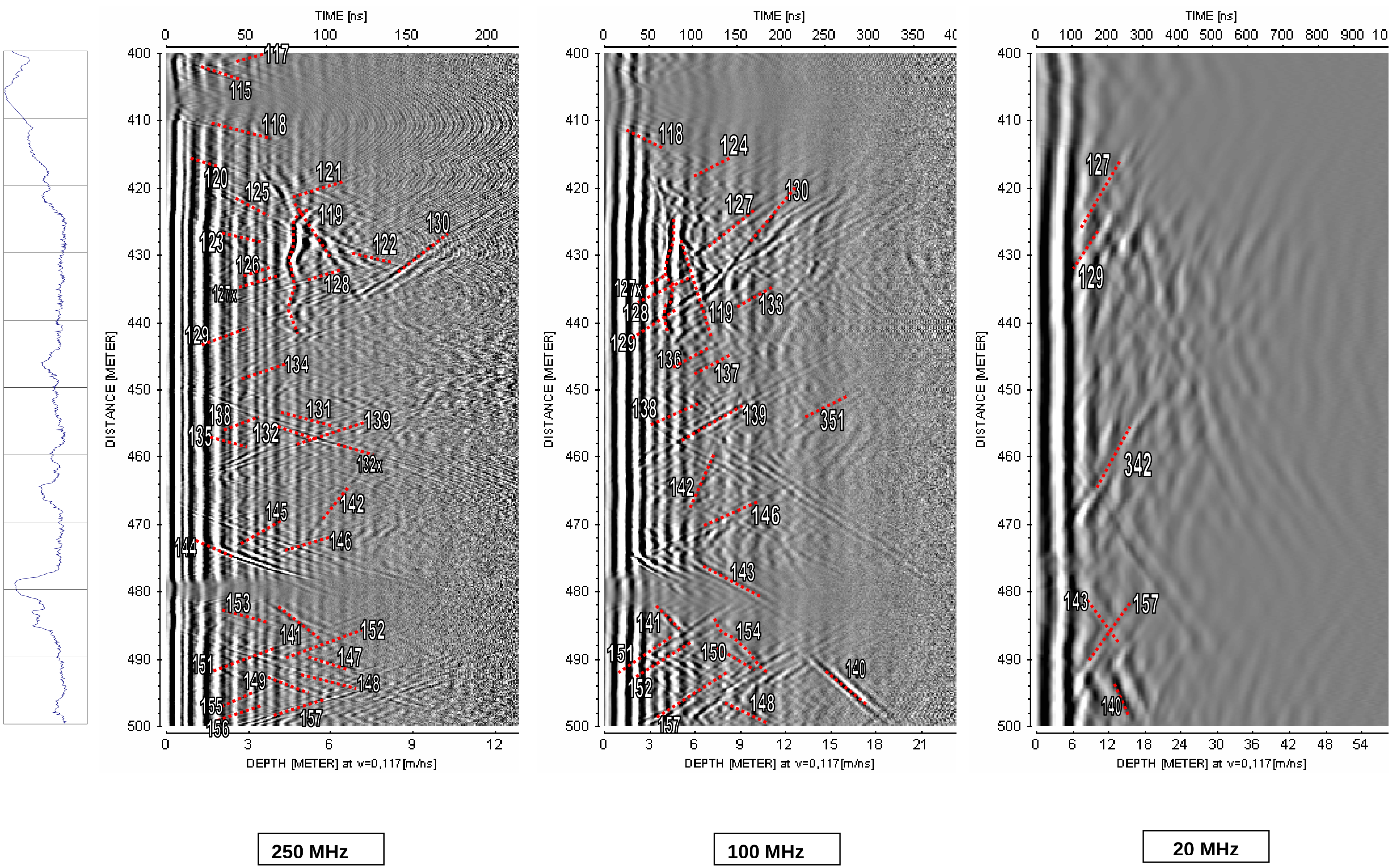


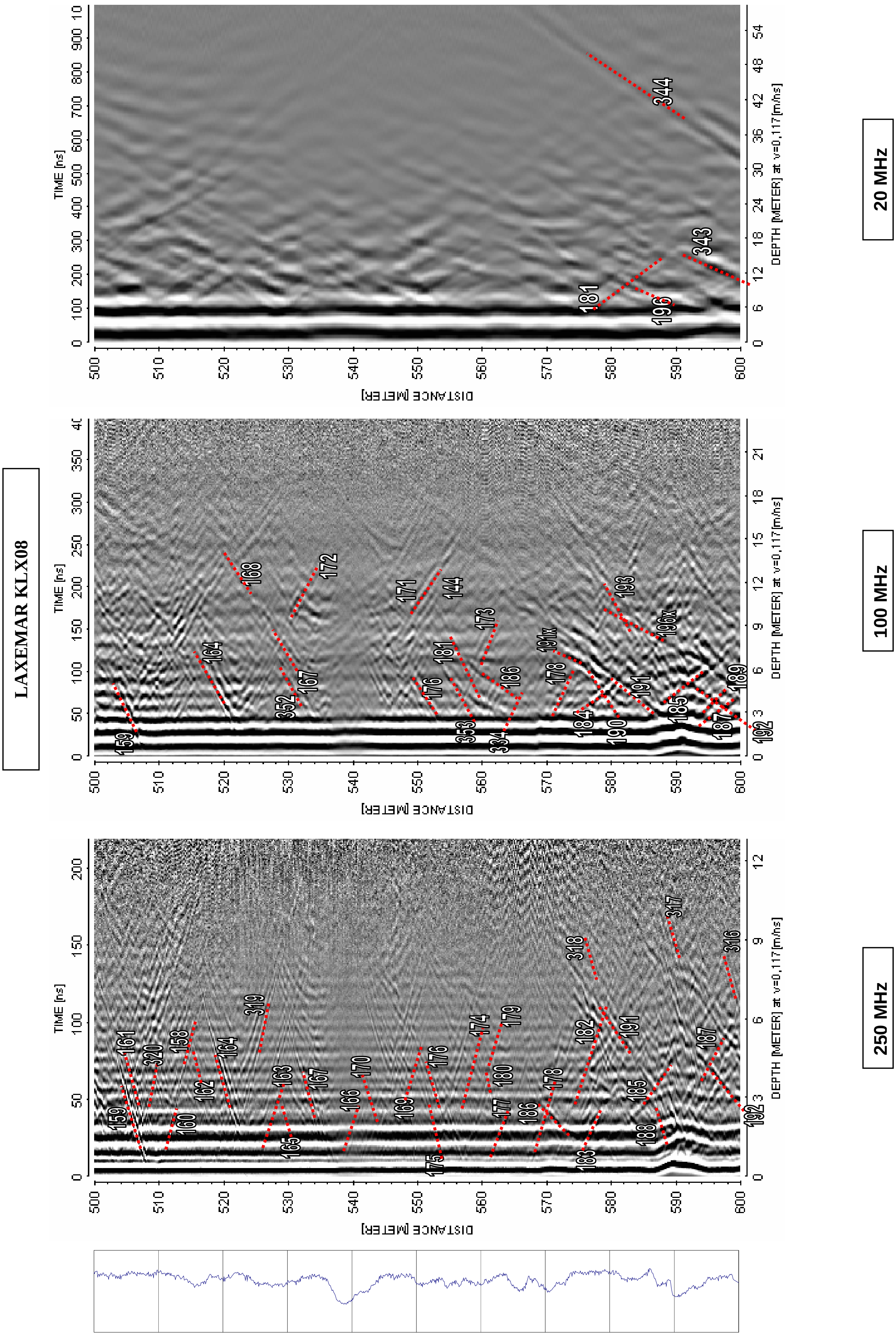
250 MHz

100 MHz

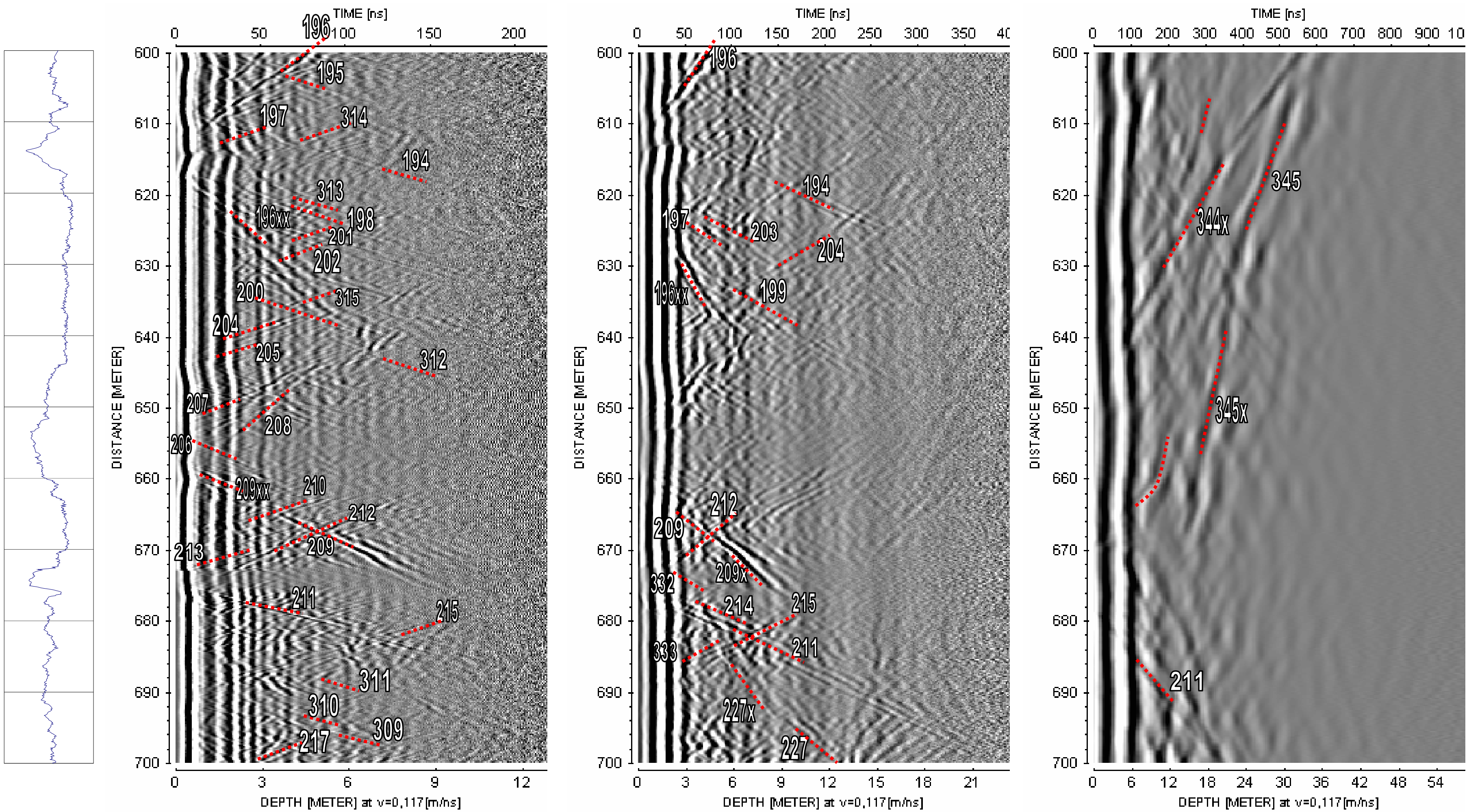
20 MHz

LAXEMAR KLX08



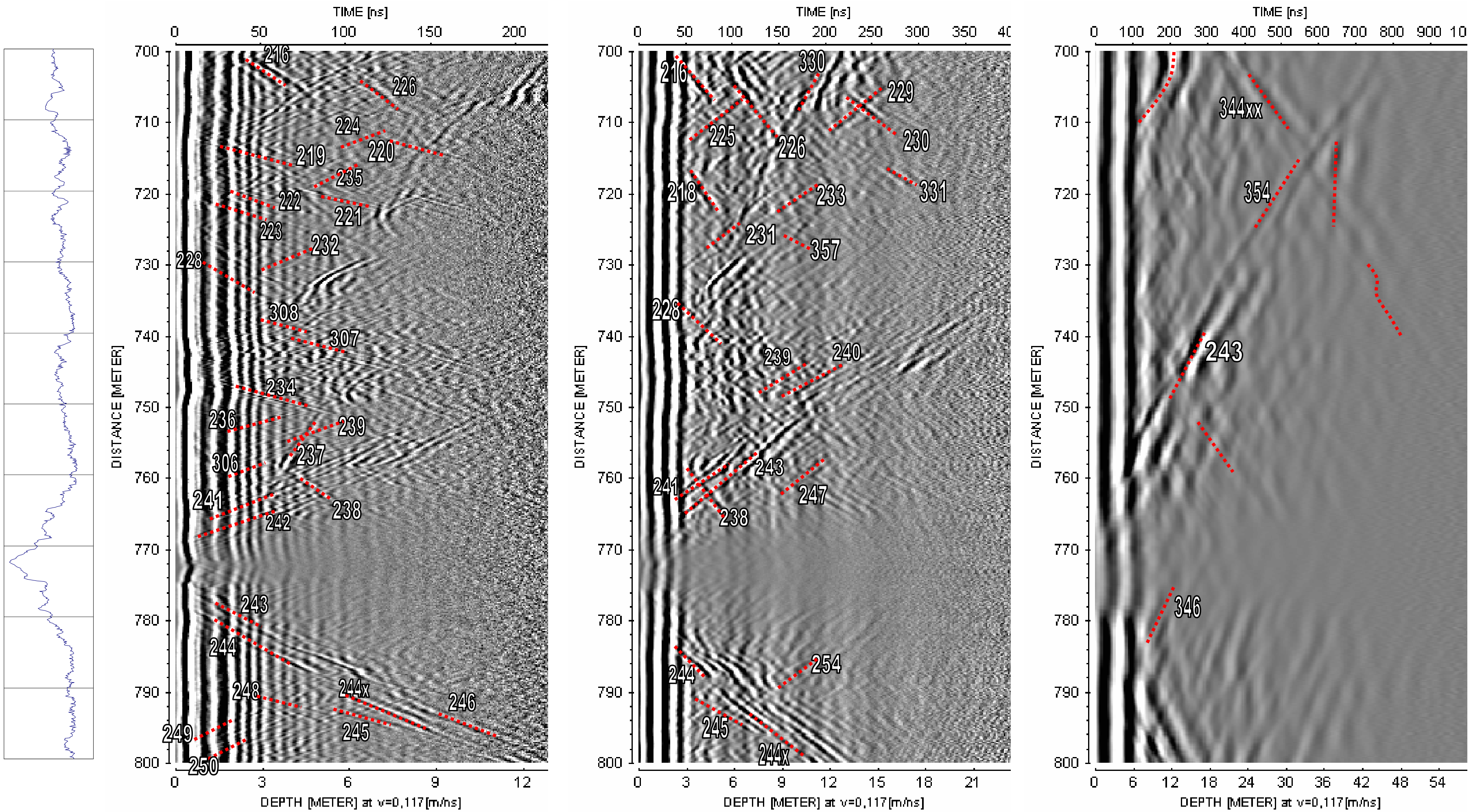

LAXEMAR KLX08
250 MHz
100 MHz
20 MHz
TIME [ns]
DISTANCE [METER]
DEPTH [METER] at v=0,117 [m/ns]

LAXEMAR KLX08



250 MHz **100 MHz** **20 MHz**

LAXEMAR KLX08

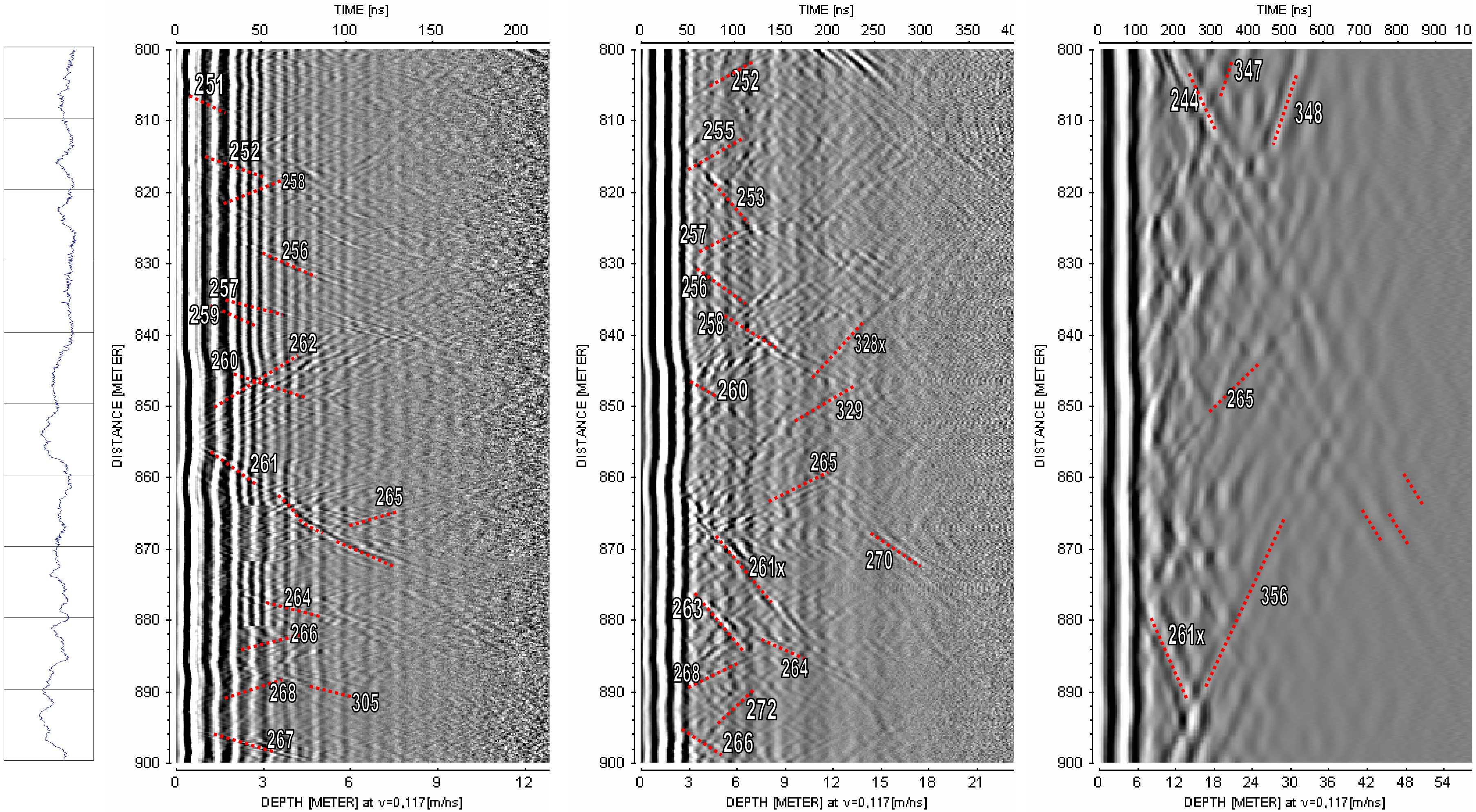


250 MHz

100 MHz

20 MHz

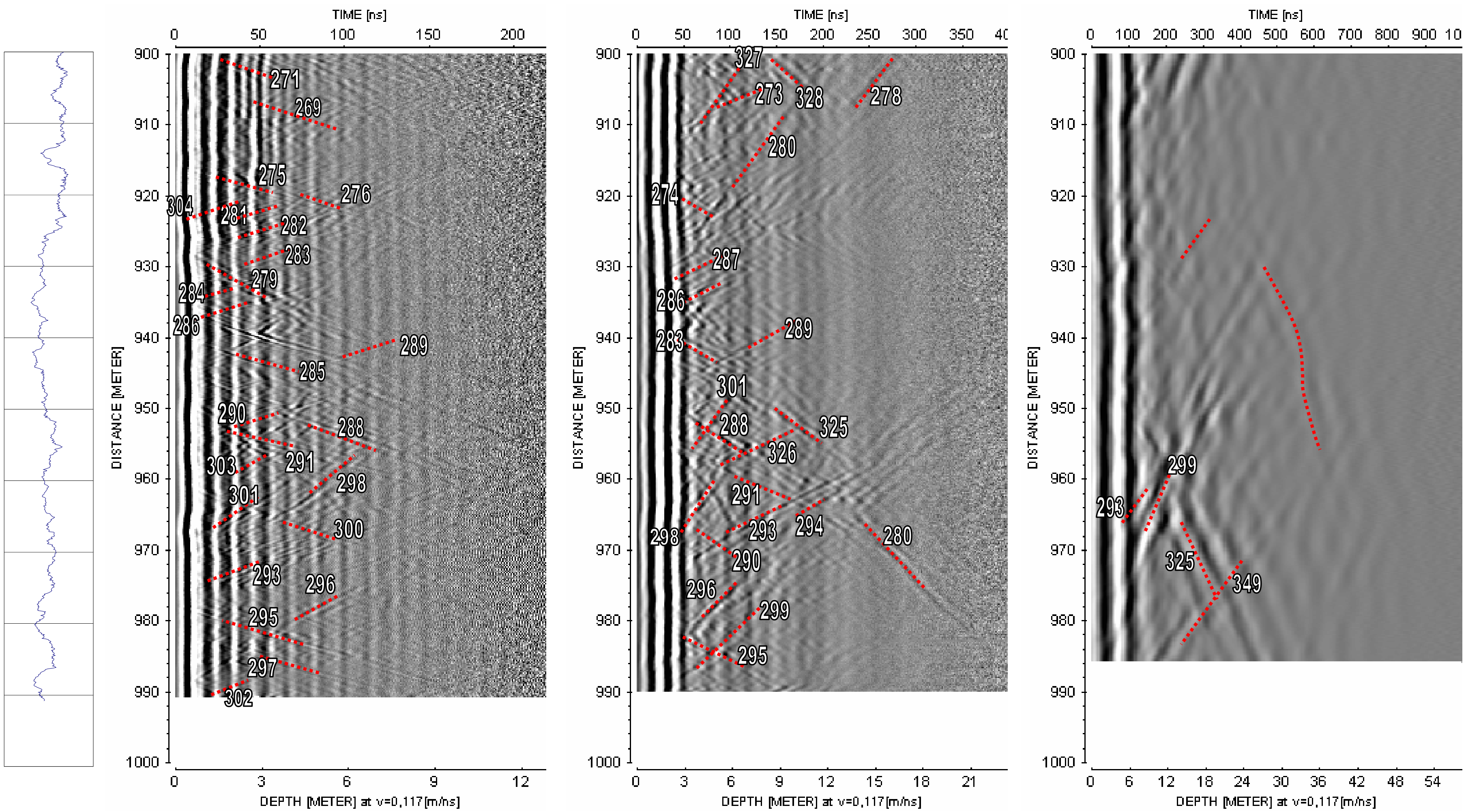
LAXEMAR KLX08



250 MHz

100 MHz

LAXEMAR KLX08



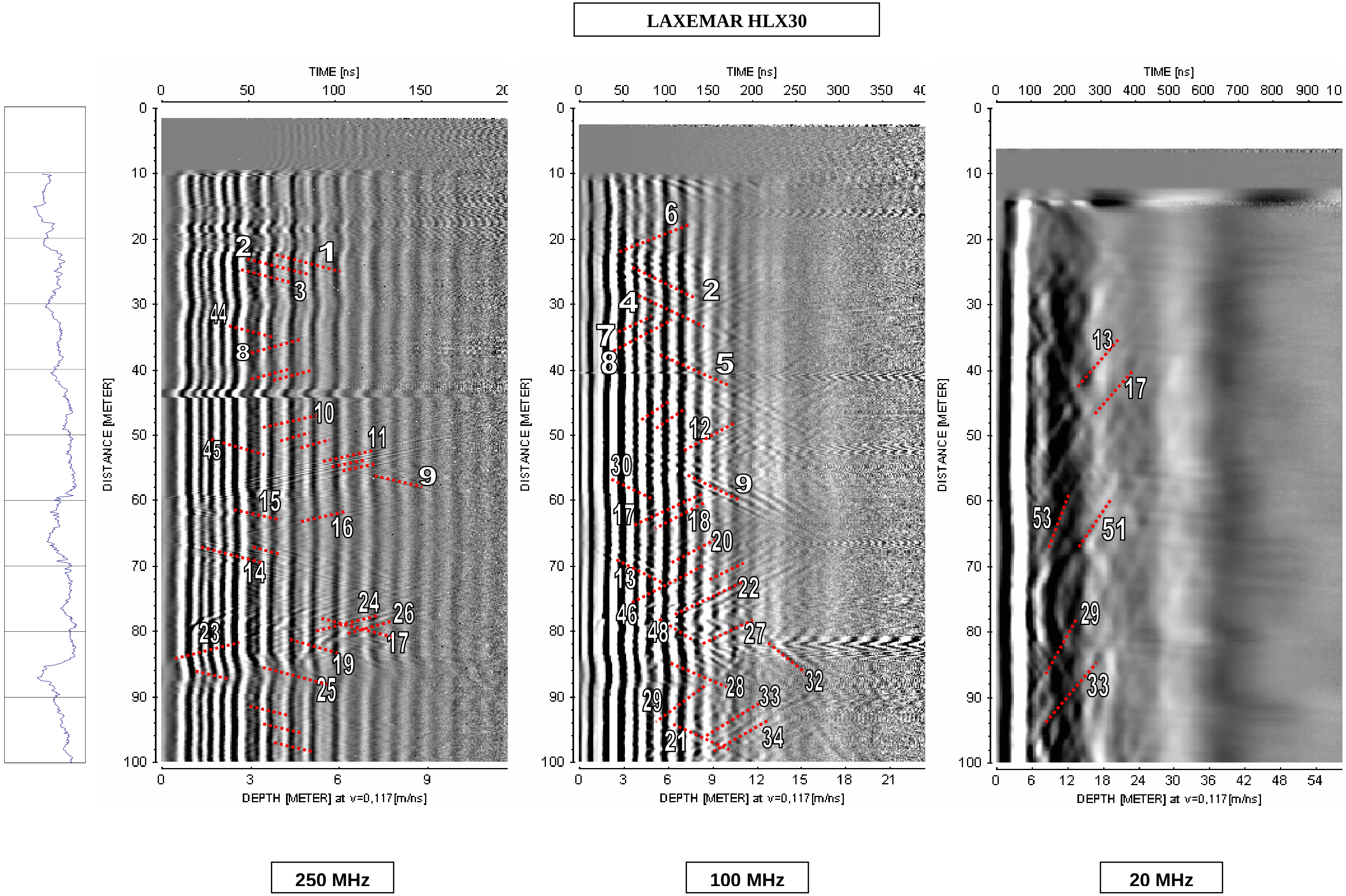
250 MHz

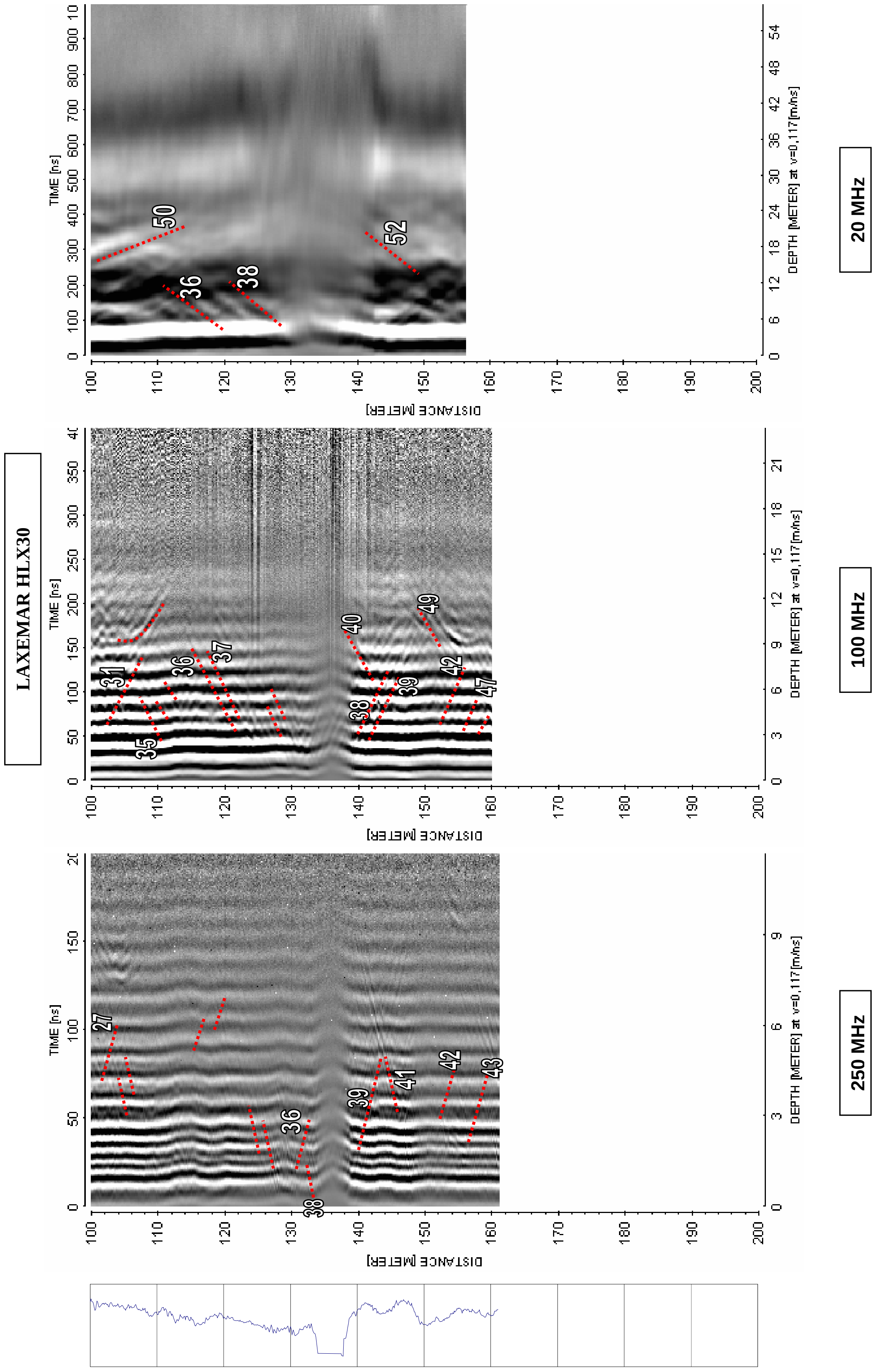
100 MHz

20 MHz

Appendix 2

Radar logging in HLX30, 0 to 159 m, dipole antennas 250, 100 and 20 MHz



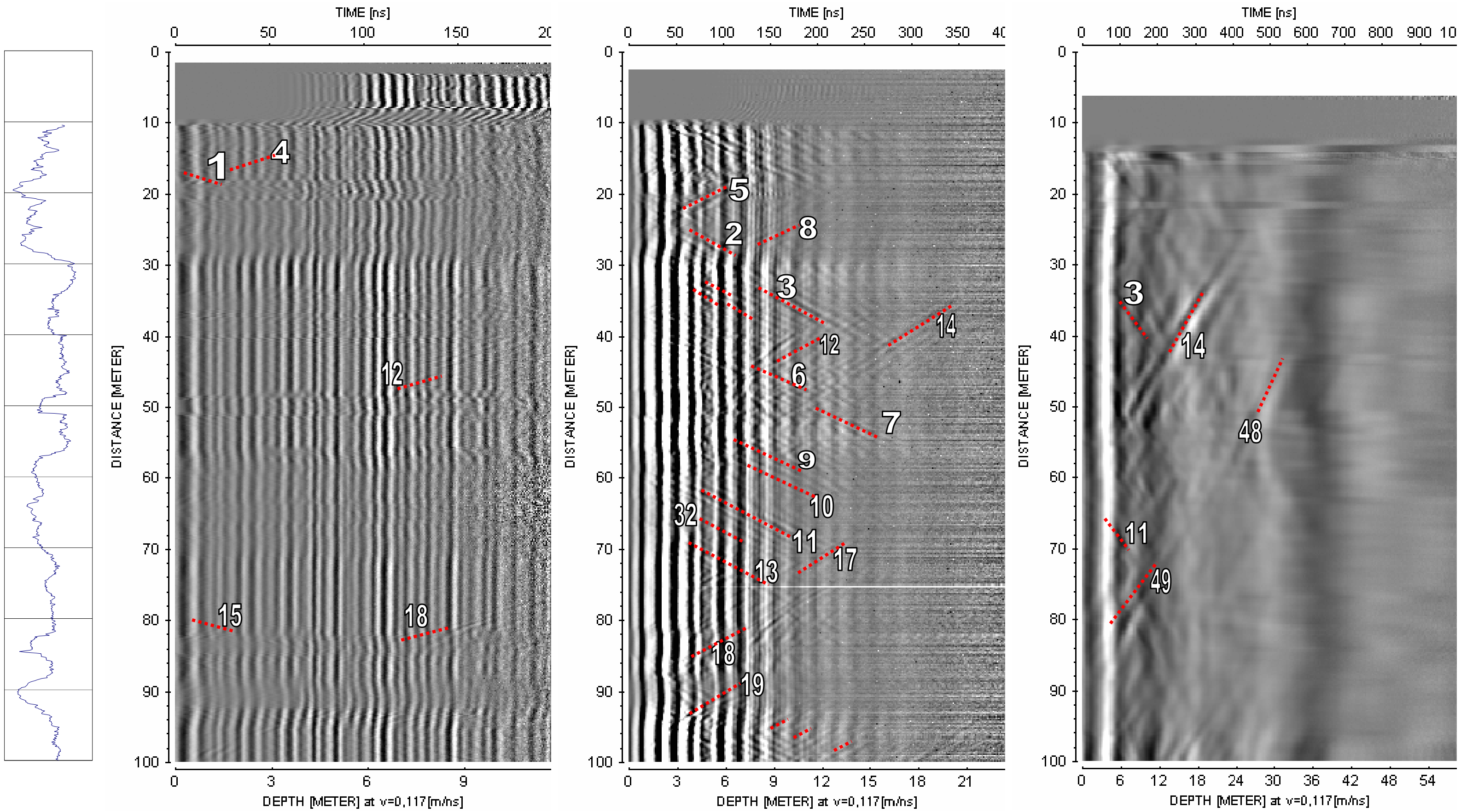


LAXEMAR HLX30
250 MHz
100 MHz
20 MHz
TIME [ns]
DISTANCE [METER]
DEPTH [METER] at v=0,117[m/ns]

Appendix 3

Radar logging in HLX33, 0 to 198 m, dipole antennas 250, 100 and 20 MHz

LAXEMAR HLX33

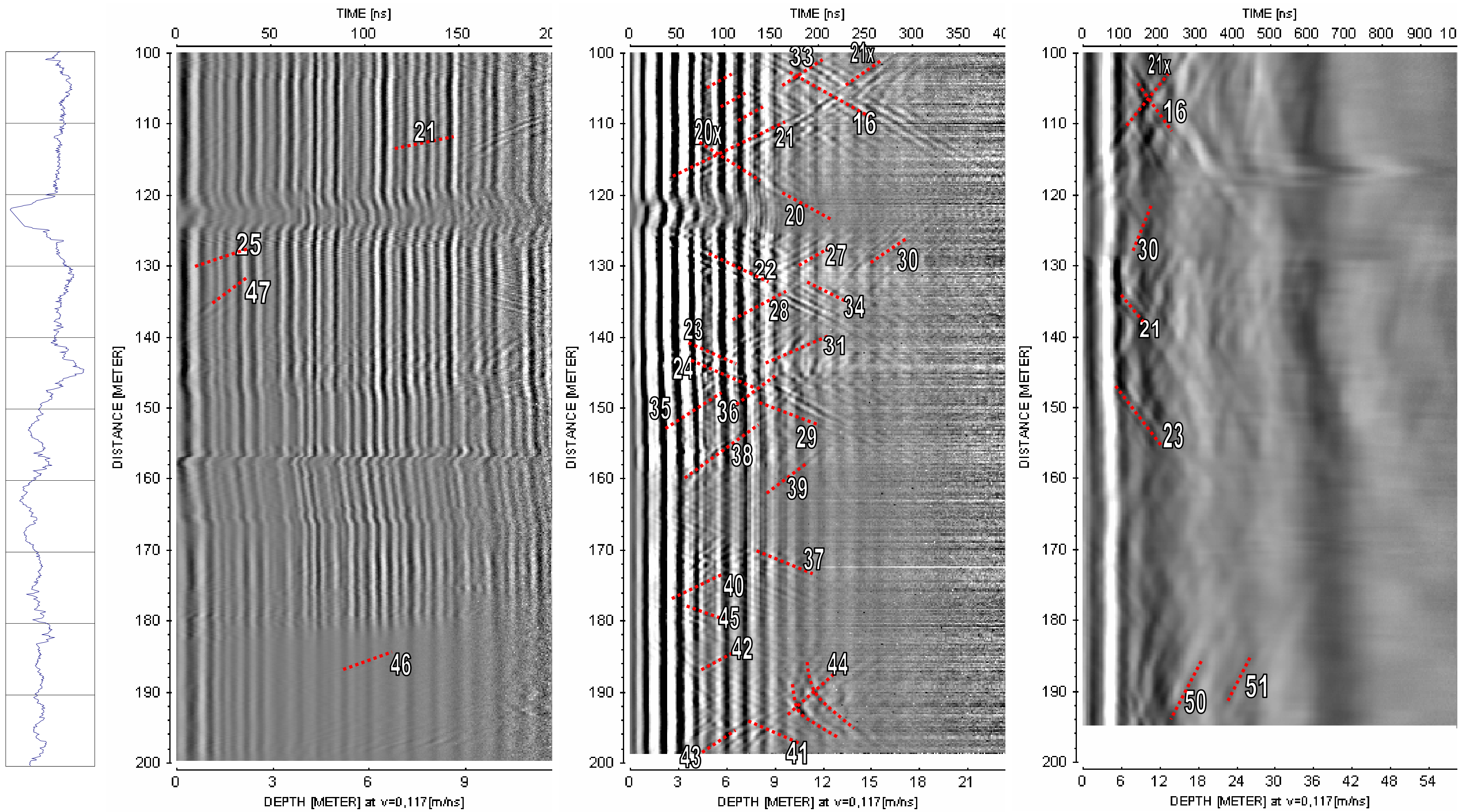


250 MHz

100 MHz

20 MHz

LAXEMAR HLX33



250 MHz **100 MHz** **20 MHz**

Appendix 4

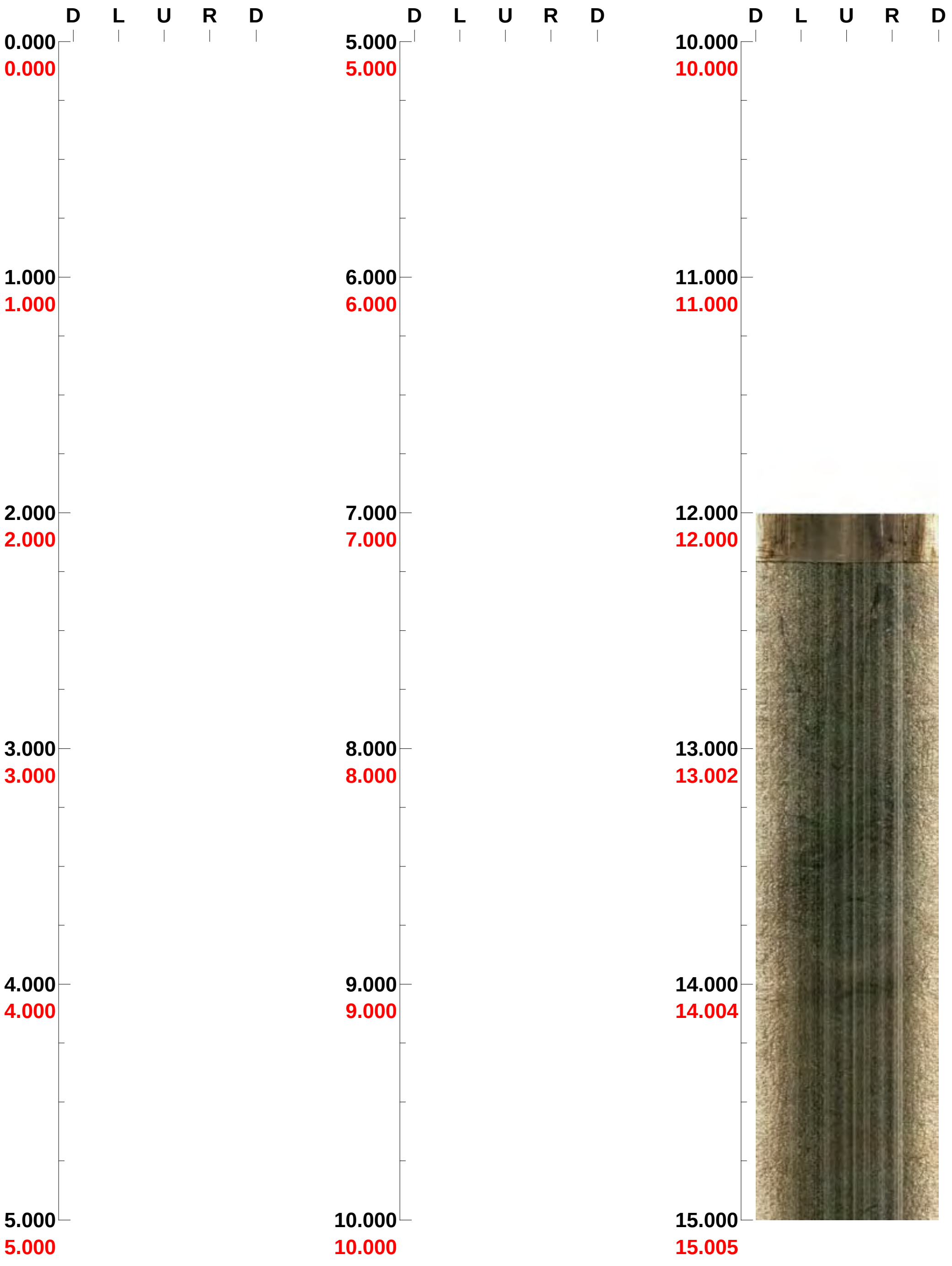
BIPS logging in KLX08, 12 to 964 m

Project name: Laxemar

Image file	**: c:\work\r5450l~1\klx08\bips\klx08_0.bip**
BDT file	**: c:\work\r5450l~1\klx08\bips\klx08_0.bdt**
Locality	**: LAXEMAR**
Bore hole number	**: KLX08**
Date	**: 05/09/08**
Time	**: 06:51:00**
Depth range	**: 12.000 - 96.450 m**
Azimuth	**: 199**
Inclination	**: -60**
Diameter	**: 198.0 mm**
Magnetic declination	**: 0.0**
Span	**: 4**
Scan interval	**: 0.25**
Scan direction	**: To bottom**
Scale	**: 1/25**
Aspect ratio	**: 125 %**
Pages	**: 7**
Color	**: +0 +0 +0**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 0.000 - 15.000 m



(1 / 7) **Scale: 1/25** **Aspect ratio: 125 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

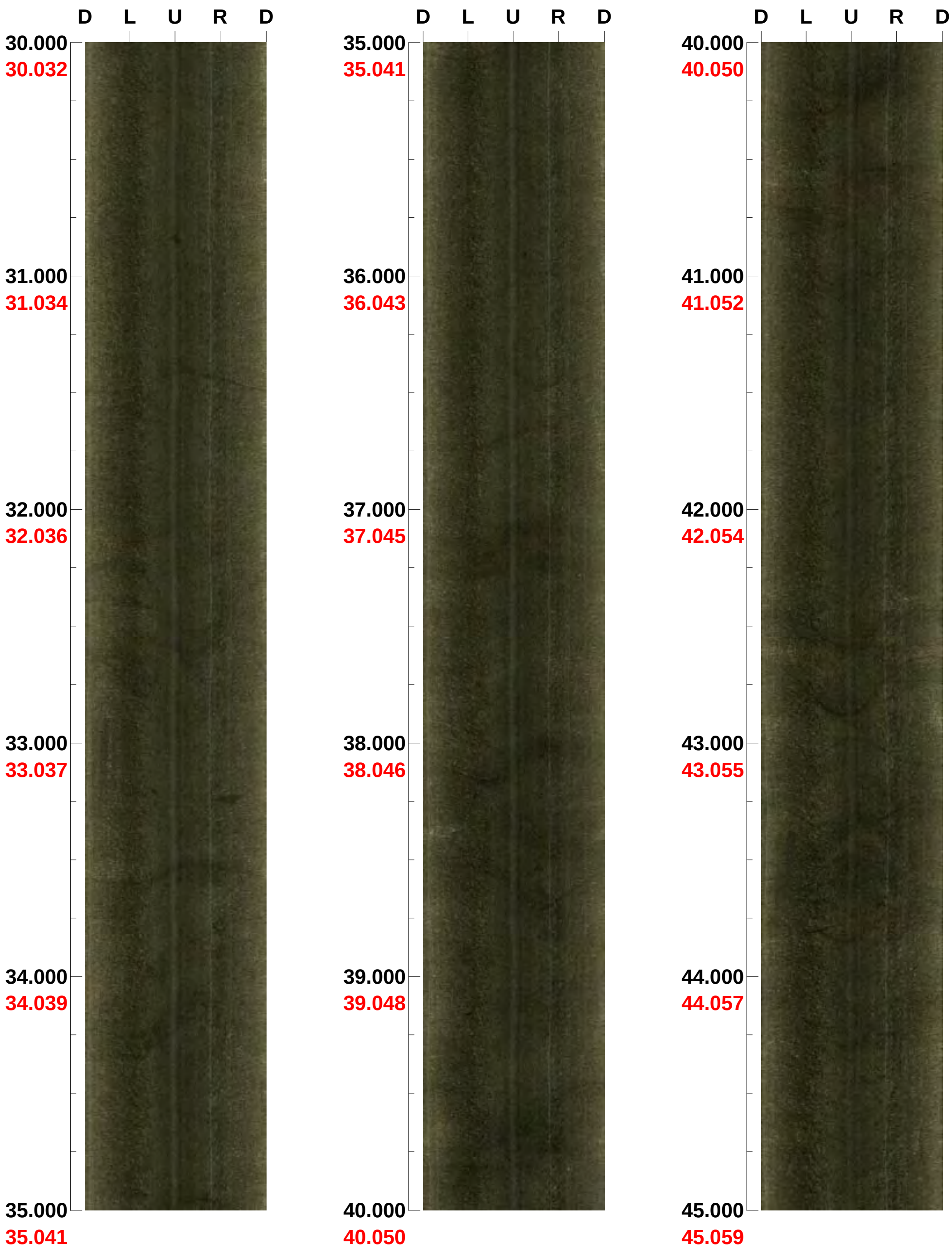
Depth range: 15.000 - 30.000 m

(2 / 7) **Scale: 1/25** **Aspect ratio: 125 %**

Project name: Laxemar
Bore hole No.: KLX08

Azimuth: 199 Inclination: -60

Depth range: 30.000 - 45.000 m

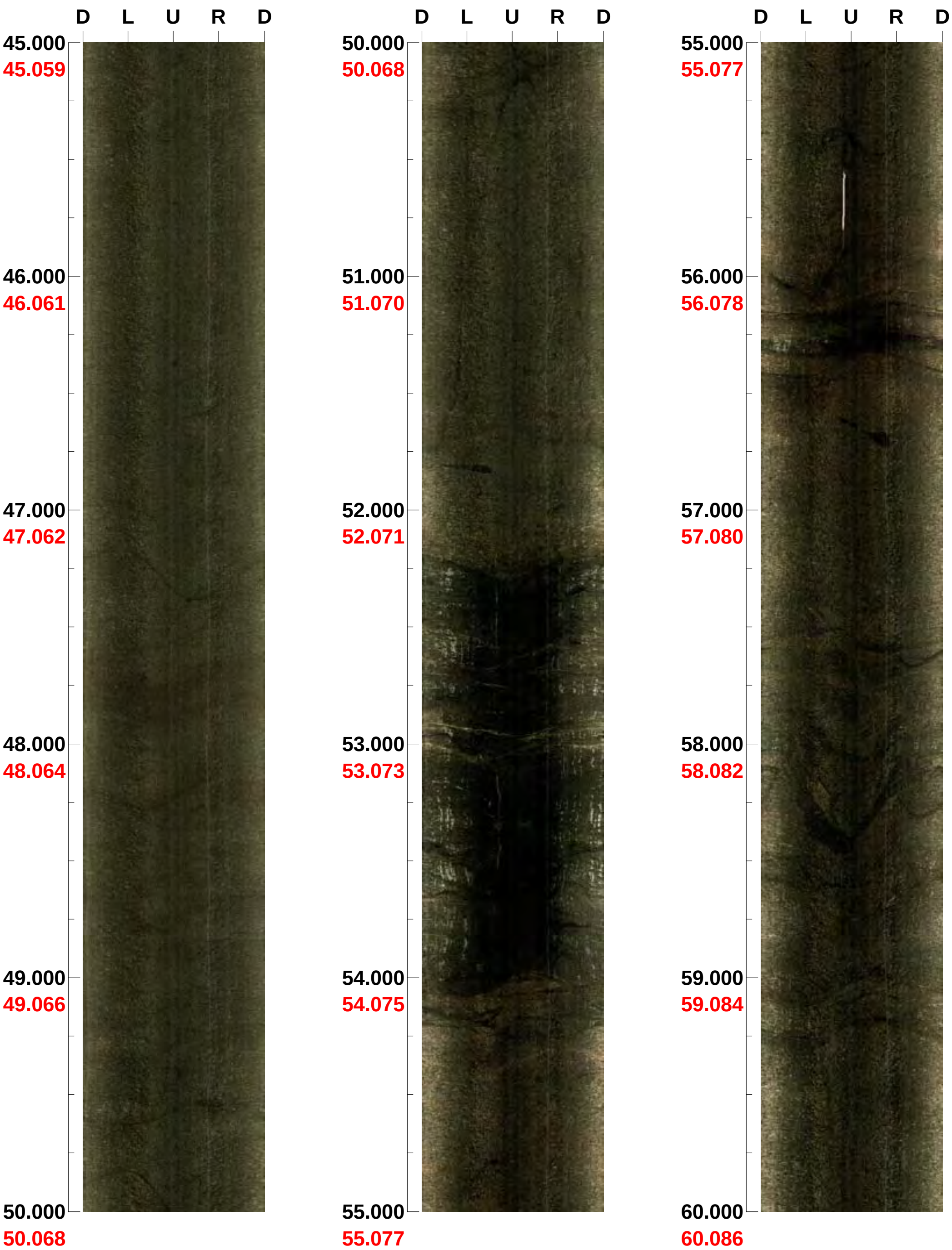


(3 / 7) Scale: 1/25 Aspect ratio: 125 %

Project name: Laxemar

Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 45.000 - 60.000 m



(4 / 7) **Scale: 1/25** **Aspect ratio: 125 %**

Project name: Laxemar

Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

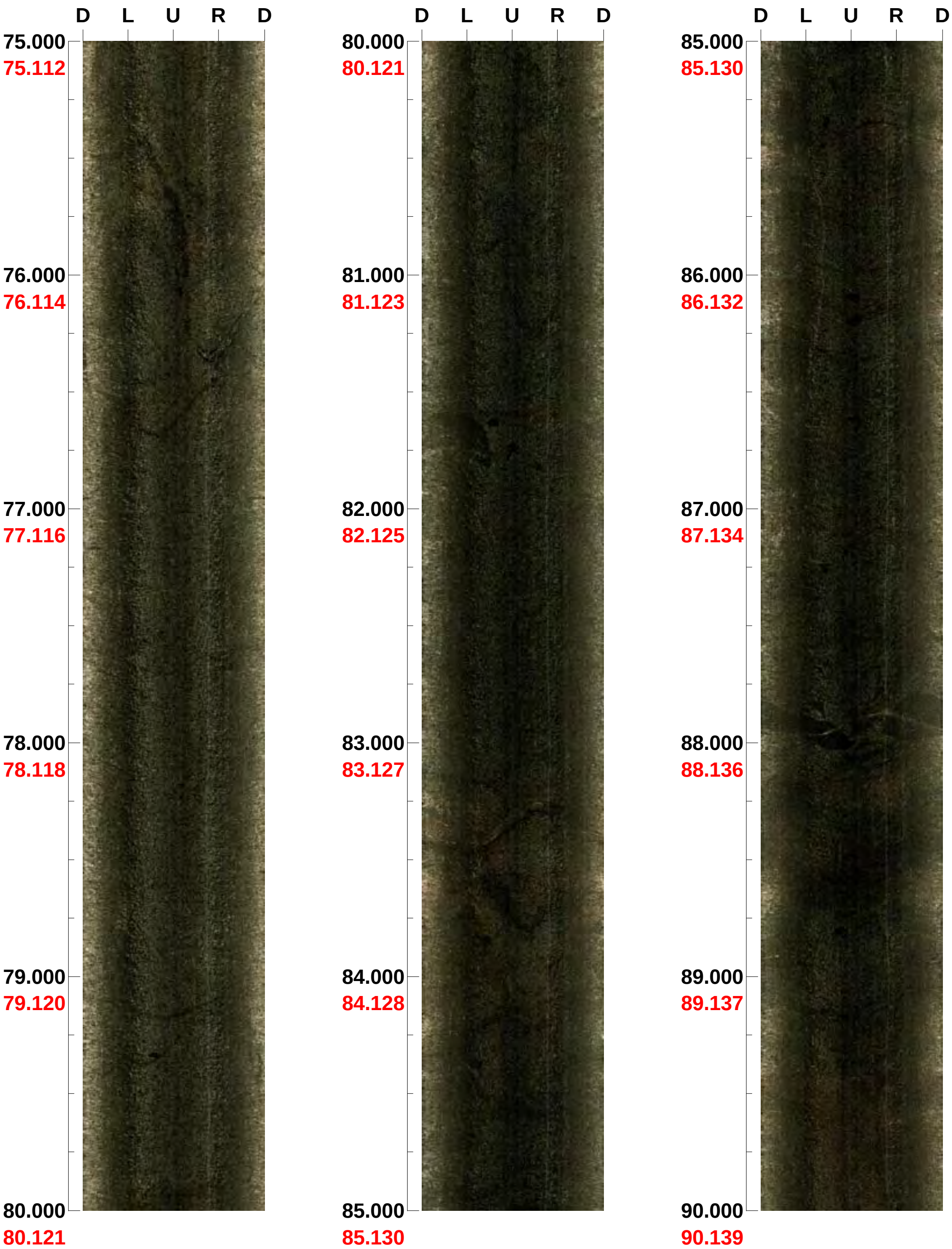
Depth range: 60.000 - 75.000 m

(5 / 7) **Scale: 1/25** **Aspect ratio: 125 %**

Project name: Laxemar
Bore hole No.: KLX08

Azimuth: 199 Inclination: -60

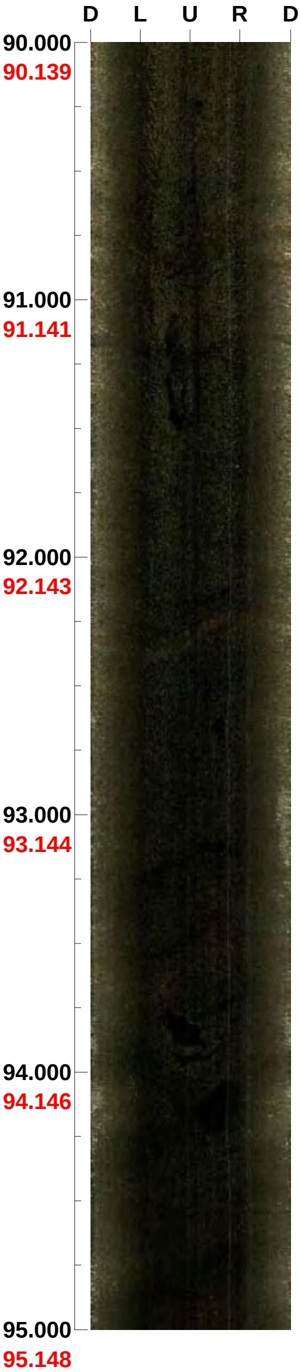
Depth range: 75.000 - 90.000 m

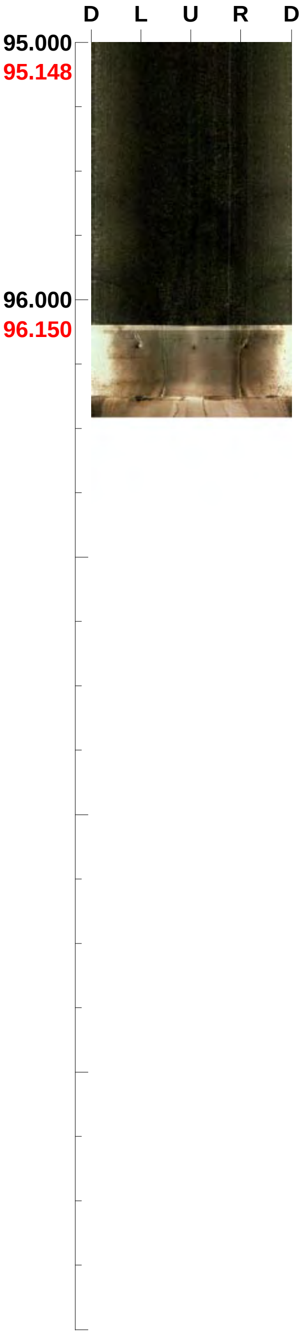


(6 / 7) Scale: 1/25 Aspect ratio: 125 %

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 90.000 - 96.450 m





(7 / 7) **Scale: 1/25** **Aspect ratio: 125 %**

Project name: Laxemar

Image file	**: c:\work\r5450l~1\klx08\bips\klx08_1.bip**
BDT file	**: c:\work\r5450l~1\klx08\bips\klx08_1.bdt**
Locality	**: LAXEMAR**
Bore hole number	**: KLX08**
Date	**: 05/09/07**
Time	**: 08:39:00**
Depth range	**: 100.000 - 987.303 m**
Azimuth	**: 199**
Inclination	**: -60**
Diameter	**: 76.0 mm**
Magnetic declination	**: 0.0**
Span	**: 4**
Scan interval	**: 0.25**
Scan direction	**: To bottom**
Scale	**: 1/25**
Aspect ratio	**: 175 %**
Pages	**: 28**
Color	**: +0 +0 +0**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 100.000 - 120.000 m

(1 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

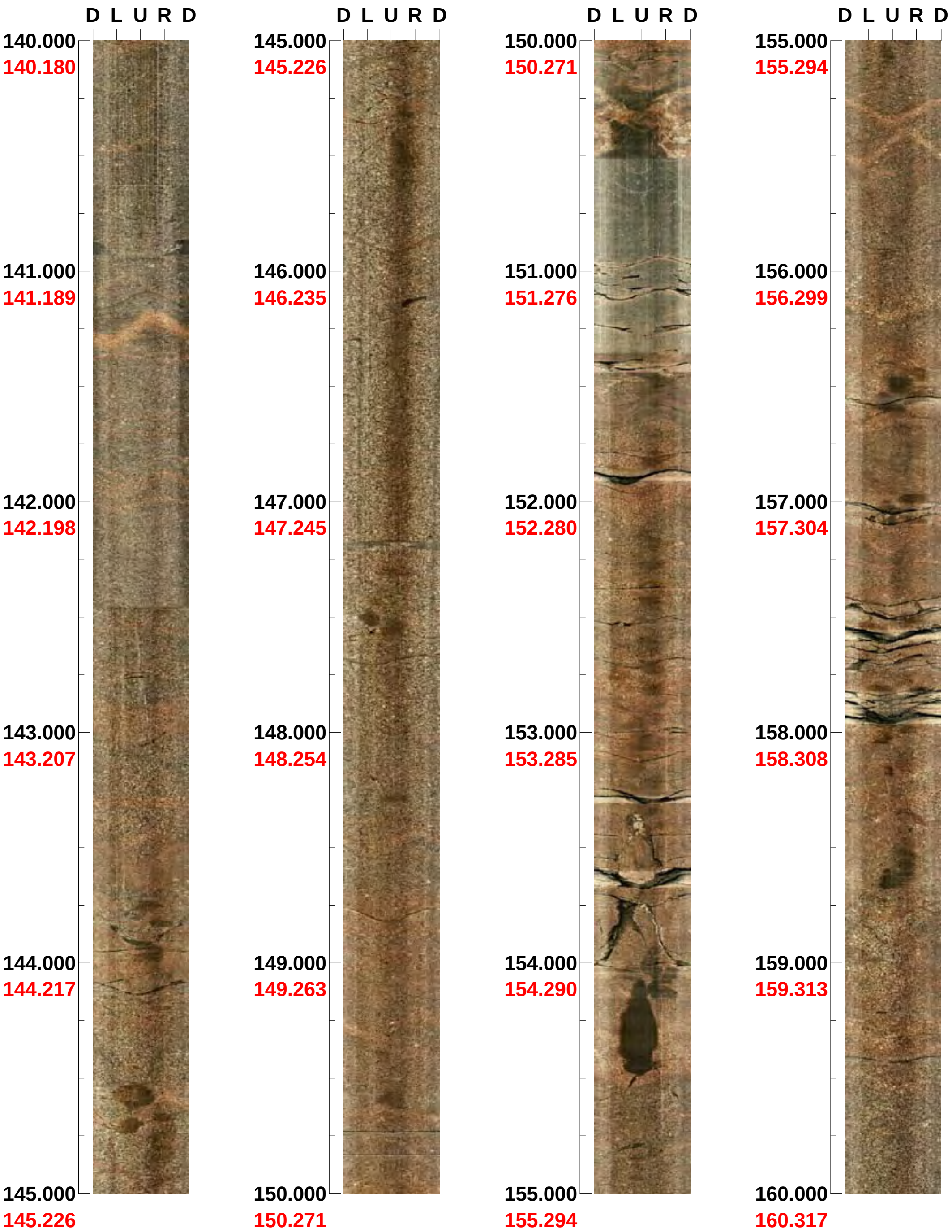
Project name: Laxemar
Bore hole No.: KLX08 Azimuth: 199 Inclination: -60

Depth range: 120.000 - 140.000 m

(2 / 28) Scale: 1/25 Aspect ratio: 175 %

Project name: Laxemar
Bore hole No.: KLX08 Azimuth: 199 Inclination: -60

Depth range: 140.000 - 160.000 m



(3 / 28) Scale: 1/25 Aspect ratio: 175 %

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 160.000 - 180.000 m

(4 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 Azimuth: 199 Inclination: -60

Depth range: 180.000 - 200.000 m

(5 / 28) Scale: 1/25 Aspect ratio: 175 %

Project name: Laxemar
Bore hole No.: KLX08 Azimuth: 199 Inclination: -60

Depth range: 200.000 - 220.000 m

(6 / 28) Scale: 1/25 Aspect ratio: 175 %

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 220.000 - 240.000 m

(7 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar

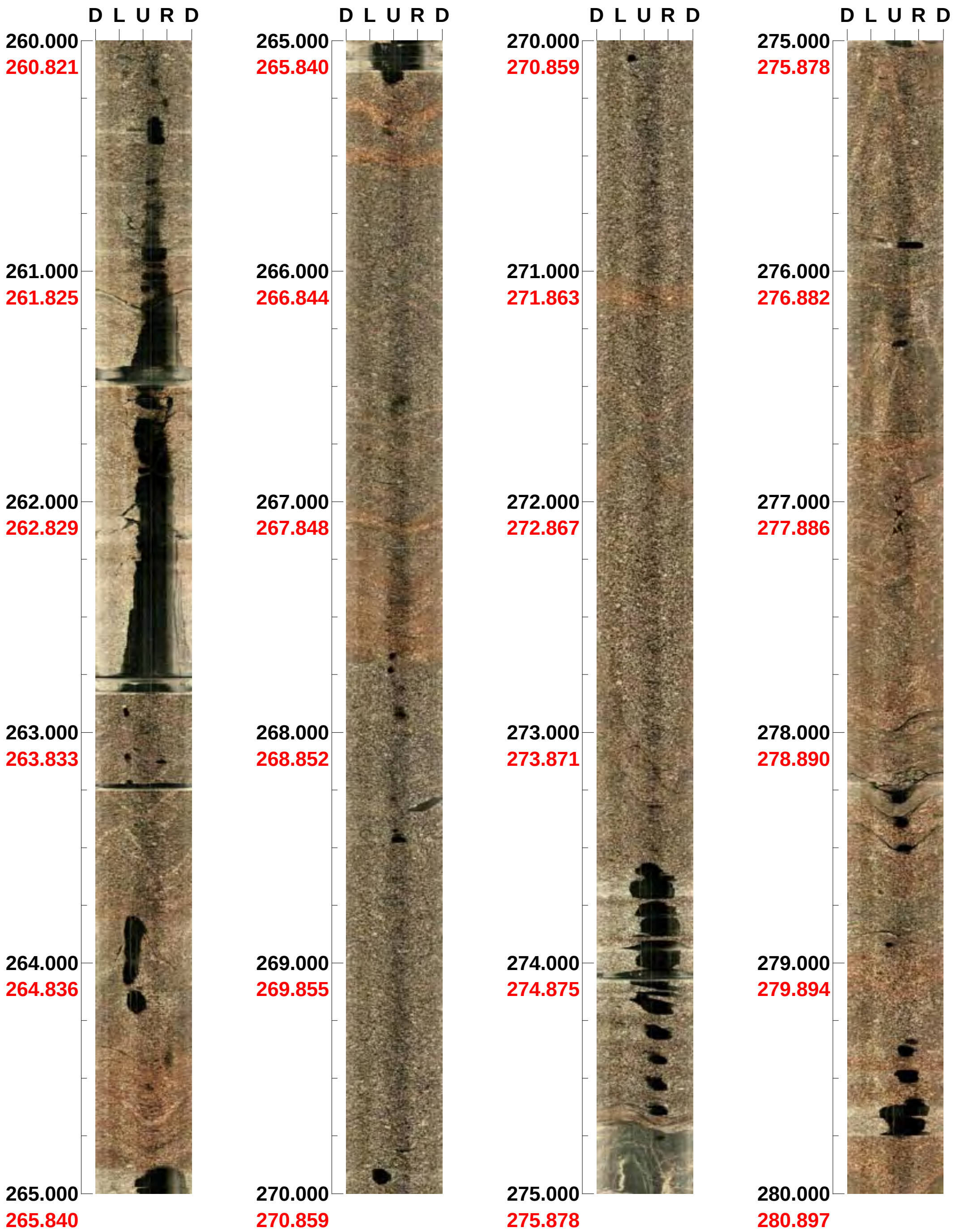
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 240.000 - 260.000 m

(8 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 260.000 - 280.000 m



(9 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

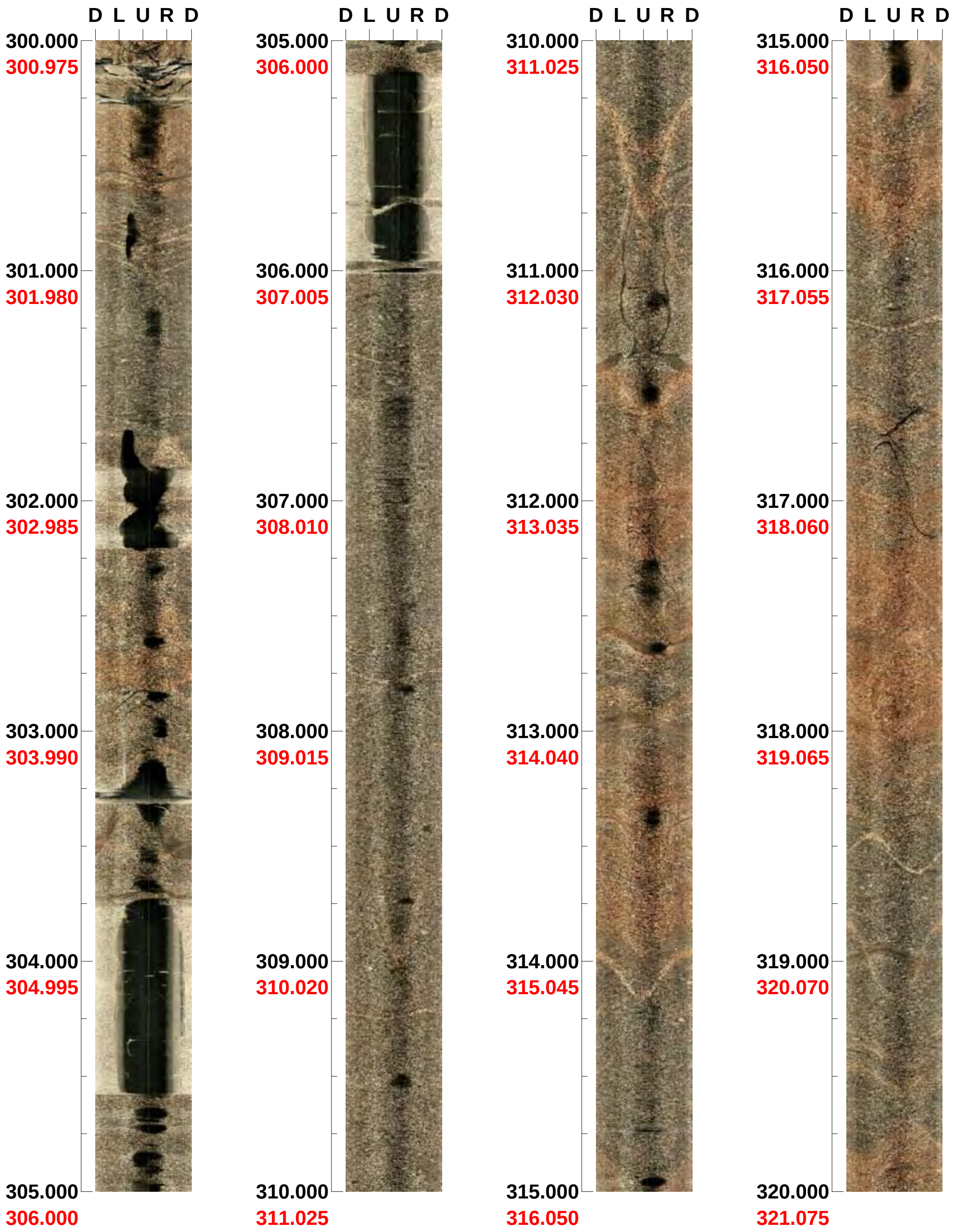
Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 280.000 - 300.000 m

(10 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 300.000 - 320.000 m



(11 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 Azimuth: 199 Inclination: -60

Depth range: 320.000 - 340.000 m

(12 / 28) Scale: 1/25 Aspect ratio: 175 %

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 340.000 - 360.000 m

(13 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 360.000 - 380.000 m

(14 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

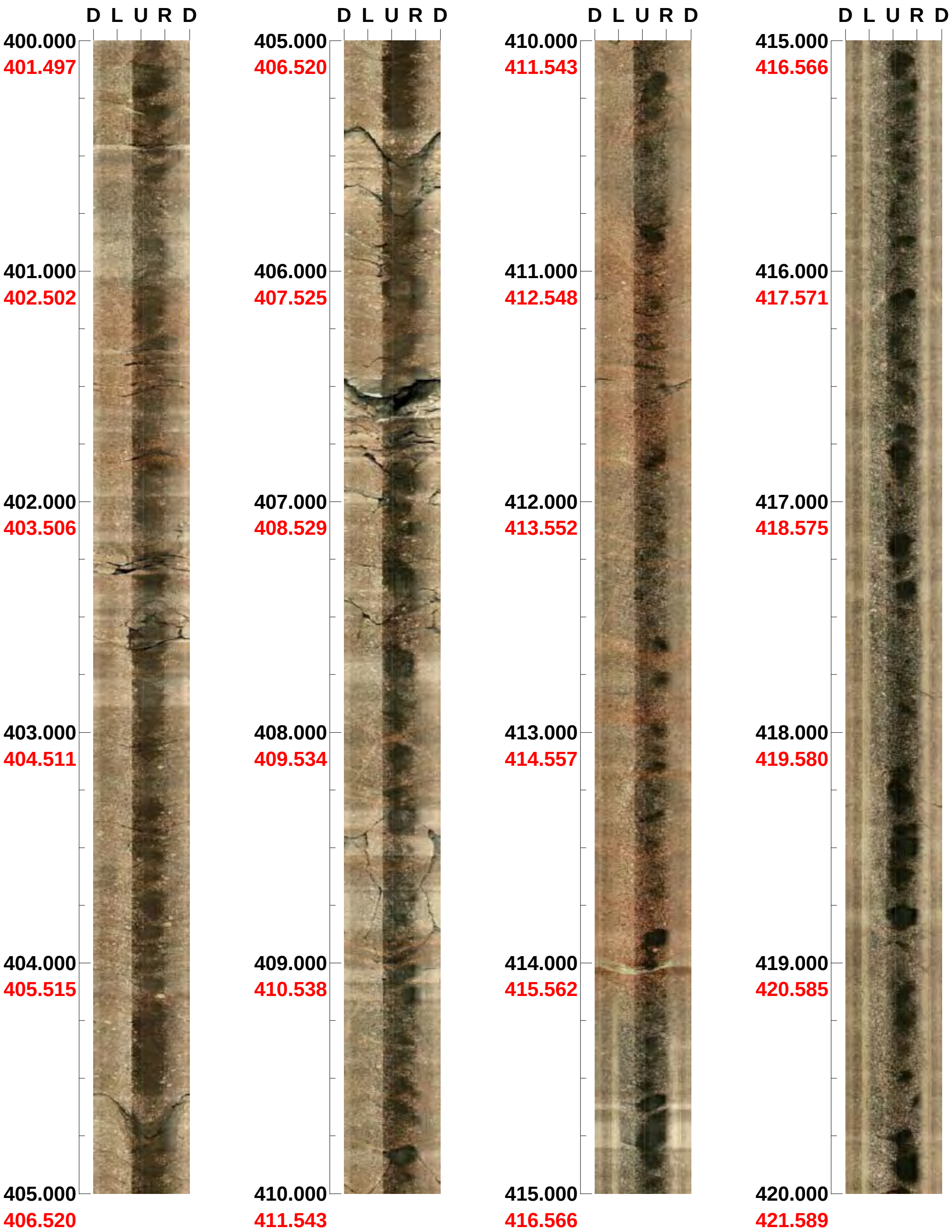
Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 380.000 - 400.000 m

(15 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 400.000 - 420.000 m



(16 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar

Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 420.000 - 440.000 m

(17 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar

Bore hole No.: KLX08 Azimuth: 199 Inclination: -60

Depth range: 440.000 - 460.000 m

(18 / 28) Scale: 1/25 Aspect ratio: 175 %

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 460.000 - 480.000 m

(19 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

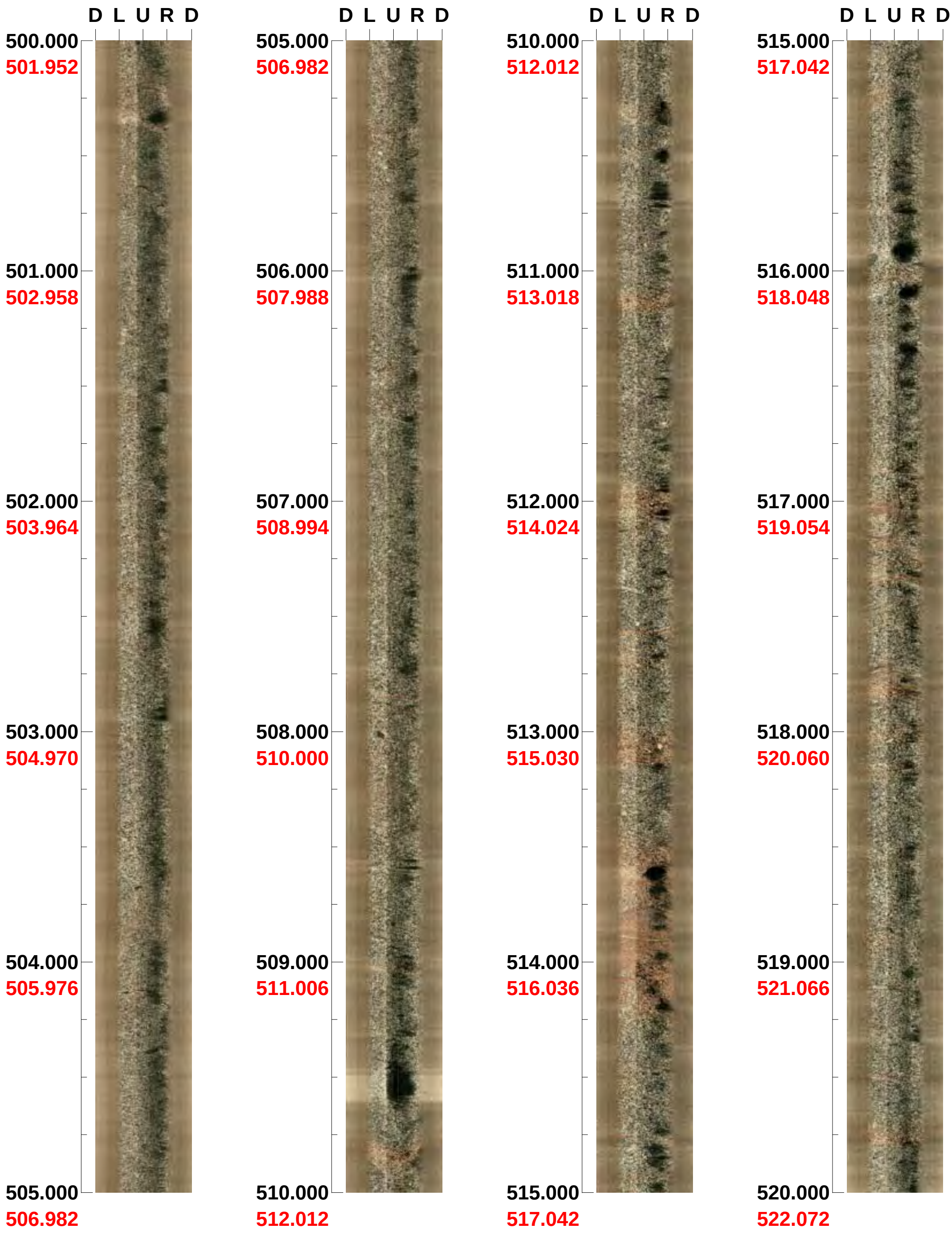
Project name: Laxemar
Bore hole No.: KLX08 Azimuth: 199 Inclination: -60

Depth range: 480.000 - 500.000 m

(20 / 28) Scale: 1/25 Aspect ratio: 175 %

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

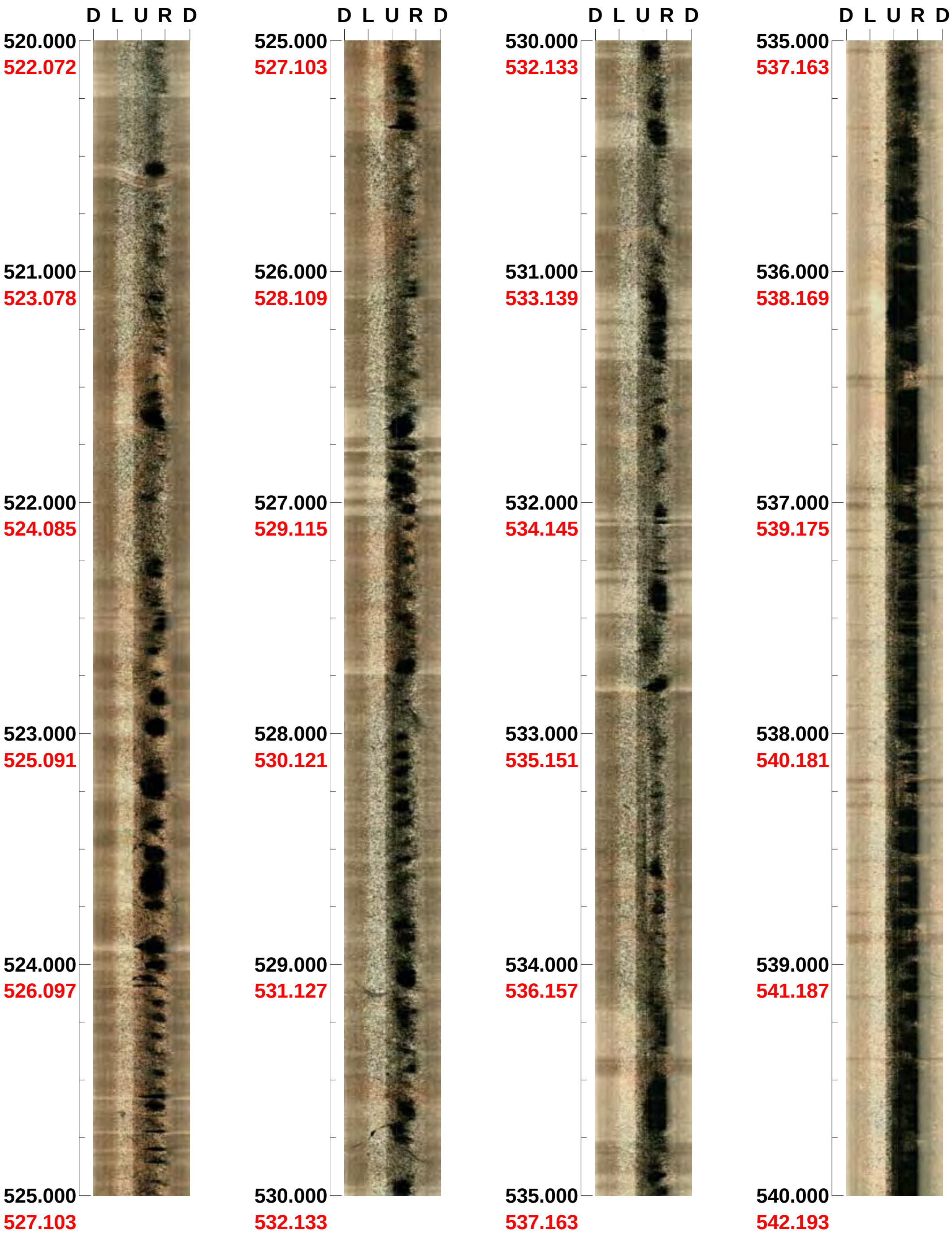
Depth range: 500.000 - 520.000 m



(21 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 Azimuth: 199 Inclination: -60

Depth range: 520.000 - 540.000 m



(22 / 28) Scale: 1/25 Aspect ratio: 175 %

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 540.000 - 560.000 m

(23 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 560.000 - 580.000 m

(24 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 580.000 - 600.000 m

(25 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 Azimuth: 199 Inclination: -60

Depth range: 600.000 - 620.000 m

(26 / 28) Scale: 1/25 Aspect ratio: 175 %

Project name: Laxemar

Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 620.000 - 640.000 m

(27 / 28) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 Azimuth: 199 Inclination: -60

Depth range: 640.000 - 660.000 m

(2 / 19) Scale: 1/25 Aspect ratio: 175 %

Project name: Laxemar

Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 660.000 - 680.000 m

(3 / 19) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 680.000 - 700.000 m

(4 / 19) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

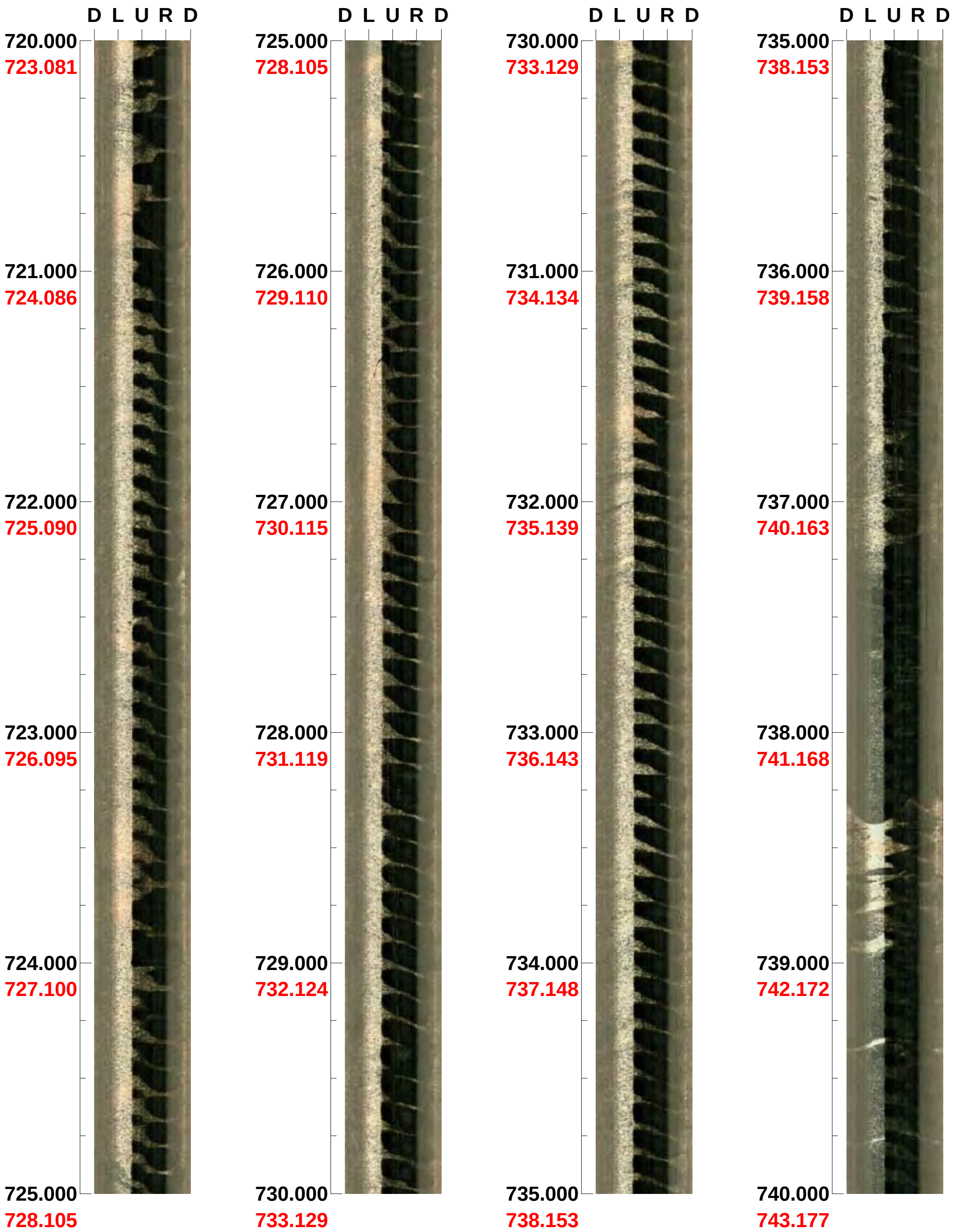
Depth range: 700.000 - 720.000 m

(5 / 19) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar

Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

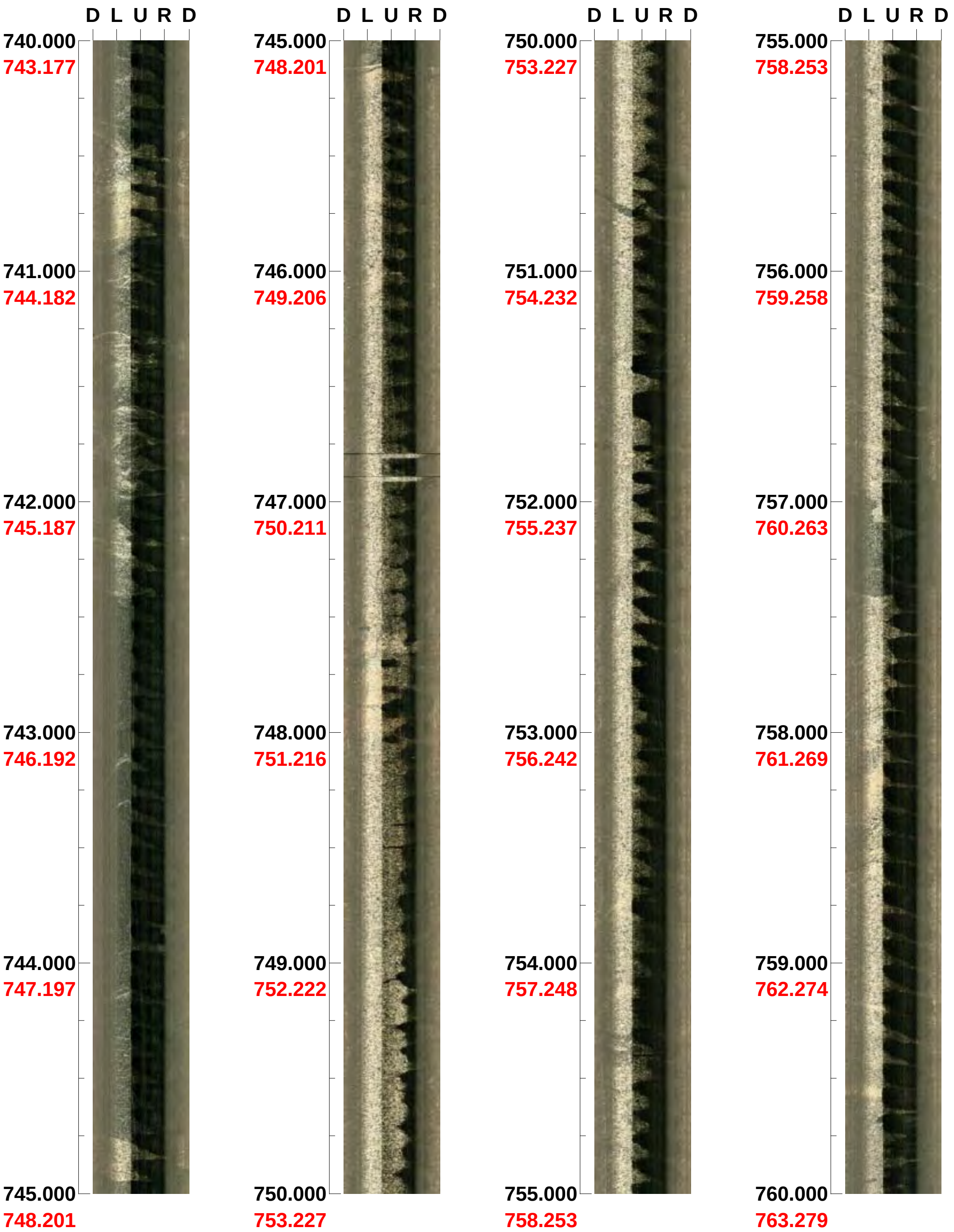
Depth range: 720.000 - 740.000 m



(6 / 19) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 740.000 - 760.000 m



(7 / 19) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 760.000 - 780.000 m

(8 / 19) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar

Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 780.000 - 800.000 m

(9 / 19) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 800.000 - 820.000 m

(10 / 19) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 820.000 - 840.000 m

(11 / 19) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

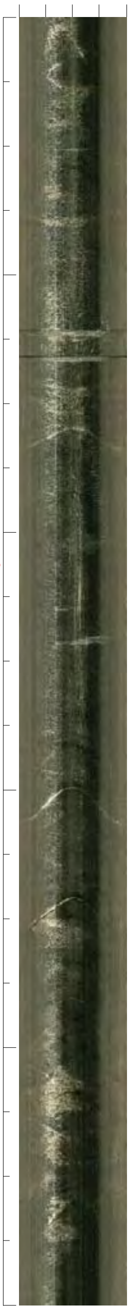
Depth range: 840.000 - 860.000 m

D L U R D

840.000 843.750
841.000 844.756
842.000 845.763
843.000 846.769
844.000 847.776
845.000 848.782

D L U R D

845.000 848.782
846.000 849.789
847.000 850.794
848.000 851.800
849.000 852.805
850.000 853.811



D L U R D

850.000 853.811
851.000 854.816
852.000 855.821
853.000 856.827
854.000 857.832
855.000 858.838

D L U R D

855.000 858.838
856.000 859.843
857.000 860.849
858.000 861.854
859.000 862.859
860.000 863.865

(12 / 19) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 860.000 - 880.000 m

(13 / 19) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 880.000 - 900.000 m

(14 / 19) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 900.000 - 920.000 m

(15 / 19) **Scale: 1/25** **Aspect ratio: 175 %**

Project name: Laxemar
Bore hole No.: KLX08 Azimuth: 199 Inclination: -60

Depth range: 920.000 - 940.000 m

(16 / 19) Scale: 1/25 Aspect ratio: 175 %

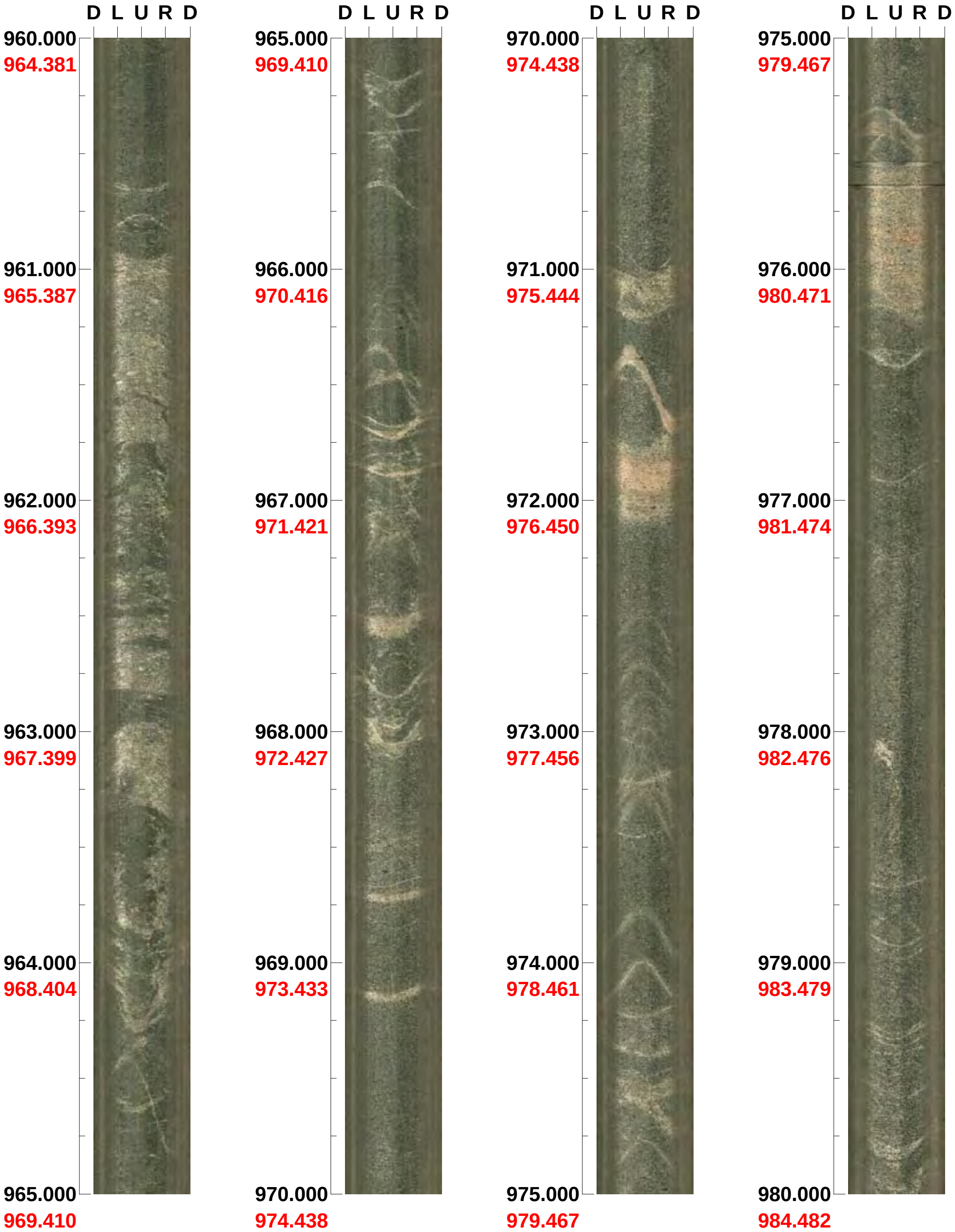
Project name: Laxemar
Bore hole No.: KLX08 Azimuth: 199 Inclination: -60

Depth range: 940.000 - 960.000 m

(17 / 19) Scale: 1/25 Aspect ratio: 175 %

Project name: Laxemar
Bore hole No.: KLX08 Azimuth: 199 Inclination: -60

Depth range: 960.000 - 980.000 m



(18 / 19) Scale: 1/25 Aspect ratio: 175 %

Project name: Laxemar
Bore hole No.: KLX08 **Azimuth: 199** **Inclination: -60**

Depth range: 980.000 - 987.334 m

(19 / 19) **Scale: 1/25** **Aspect ratio: 175 %**

BIPS logging in HLX30, 9 to 162 m

Project name: Laxemar

Image file	: c:\work\r5450l~1\hlx30\bips\hlx30.bip
BDT file	: c:\work\r5450l~1\hlx30\bips\hlx30.bdt
Locality	: LAXEMAR
Bore hole number	: HLX30
Date	: 05/08/31
Time	: 10:03:00
Depth range	: 9.000 - 162.215 m
Azimuth	: 56
Inclination	: -61
Diameter	: 140.0 mm
Magnetic declination	: 0.0
Span	: 4
Scan interval	: 0.25
Scan direction	: To bottom
Scale	: 1/25
Aspect ratio	: 100 %
Pages	: 9
Color	: +0 +0 +0

Project name: Laxemar
Bore hole No.: HLX30 **Azimuth: 56** **Inclination: -61**

Depth range: 0.000 - 20.000 m

(1 / 9) **Scale: 1/25** **Aspect ratio: 100 %**

Project name: Laxemar
Bore hole No.: HLX30 **Azimuth: 56** **Inclination: -61**

Depth range: 20.000 - 40.000 m

(2 / 9) **Scale: 1/25** **Aspect ratio: 100 %**

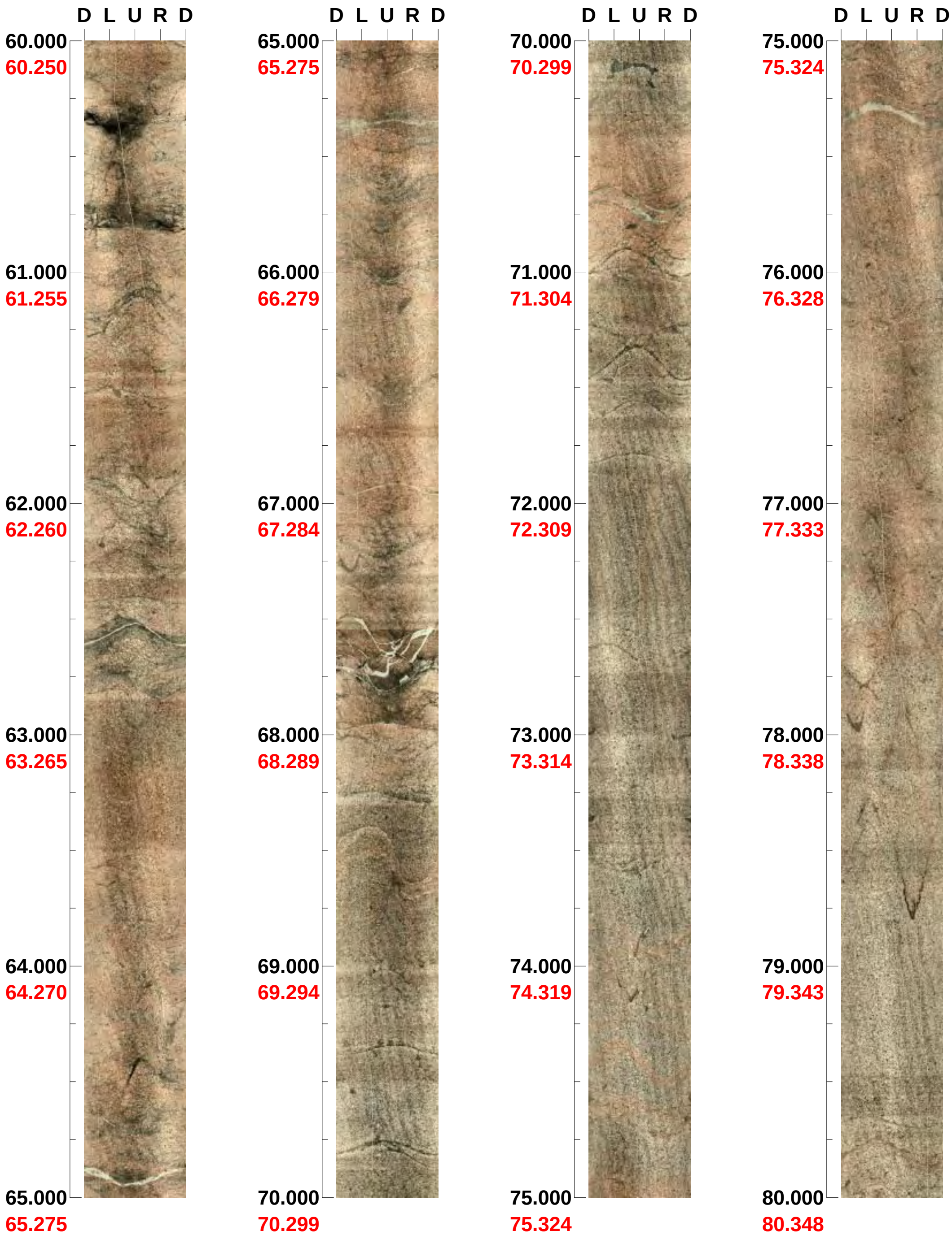
Project name: Laxemar
Bore hole No.: HLX30 **Azimuth: 56** **Inclination: -61**

Depth range: 40.000 - 60.000 m

(3 / 9) **Scale: 1/25** **Aspect ratio: 100 %**

Project name: Laxemar
Bore hole No.: HLX30 **Azimuth: 56** **Inclination: -61**

Depth range: 60.000 - 80.000 m



(4 / 9) **Scale: 1/25** **Aspect ratio: 100 %**

Project name: Laxemar
Bore hole No.: HLX30 **Azimuth: 56** **Inclination: -61**

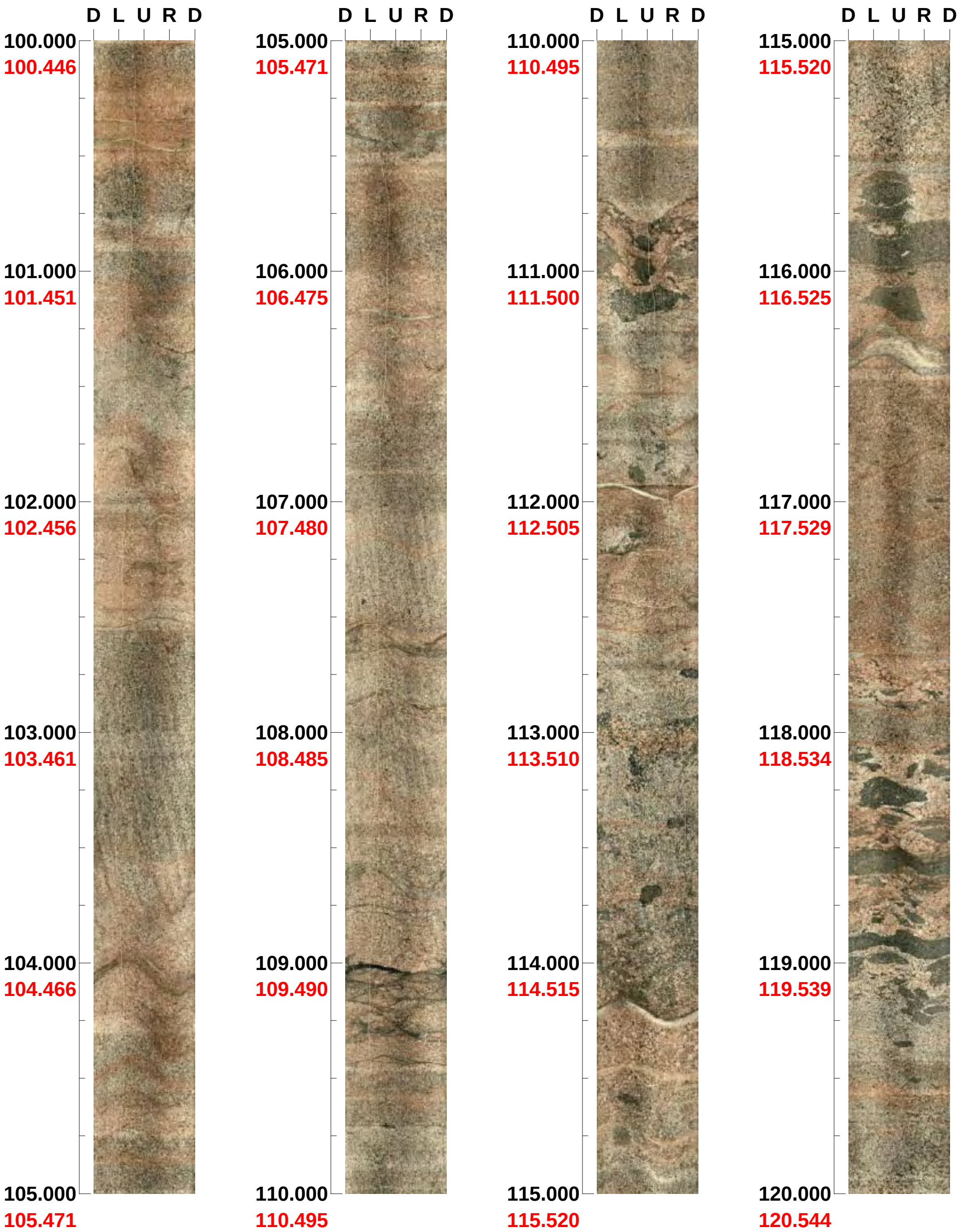
Depth range: 80.000 - 100.000 m

(5 / 9) **Scale: 1/25** **Aspect ratio: 100 %**

Project name: Laxemar

Bore hole No.: HLX30 **Azimuth: 56** **Inclination: -61**

Depth range: 100.000 - 120.000 m



(6 / 9) **Scale: 1/25** **Aspect ratio: 100 %**

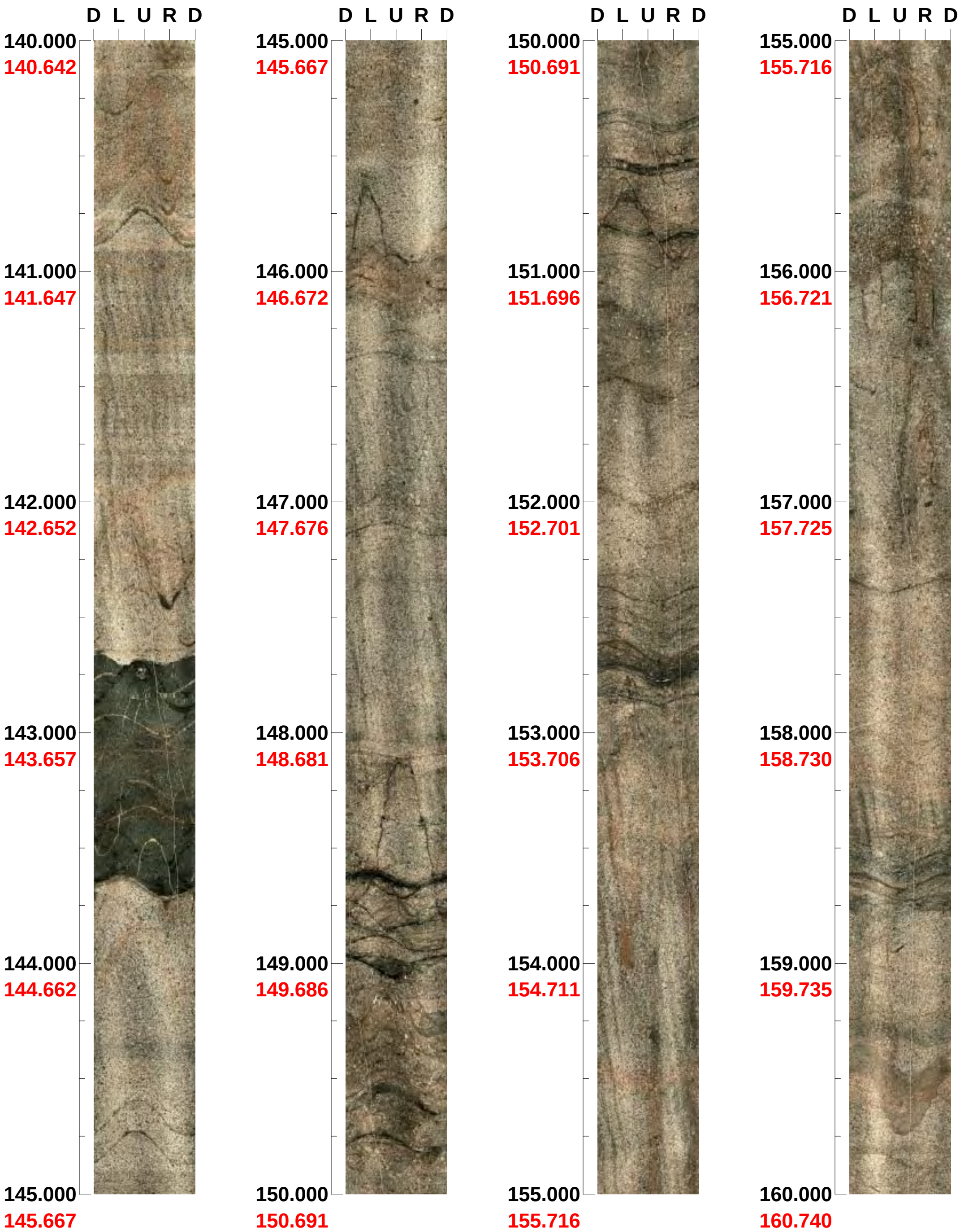
Project name: Laxemar
Bore hole No.: HLX30 **Azimuth: 56** **Inclination: -61**

Depth range: 120.000 - 140.000 m

(7 / 9) **Scale: 1/25** **Aspect ratio: 100 %**

Project name: Laxemar
Bore hole No.: HLX30 **Azimuth: 56** **Inclination: -61**

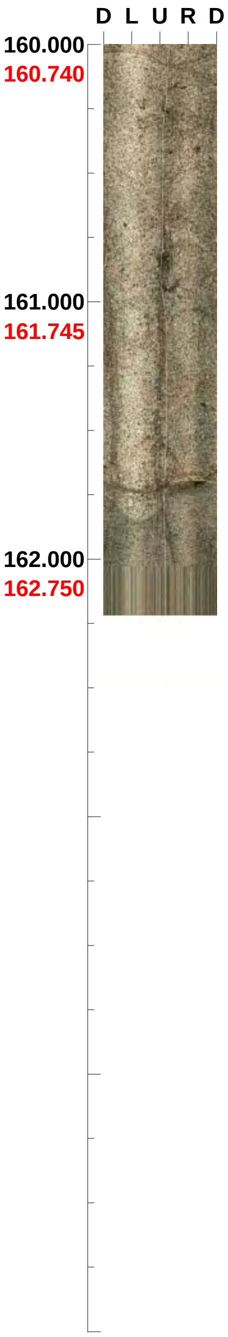
Depth range: 140.000 - 160.000 m



(8 / 9) **Scale: 1/25** **Aspect ratio: 100 %**

Project name: Laxemar
Bore hole No.: HLX30 Azimuth: 56 Inclination: -61

Depth range: 160.000 - 162.215 m



(9 / 9) Scale: 1/25 Aspect ratio: 100 %

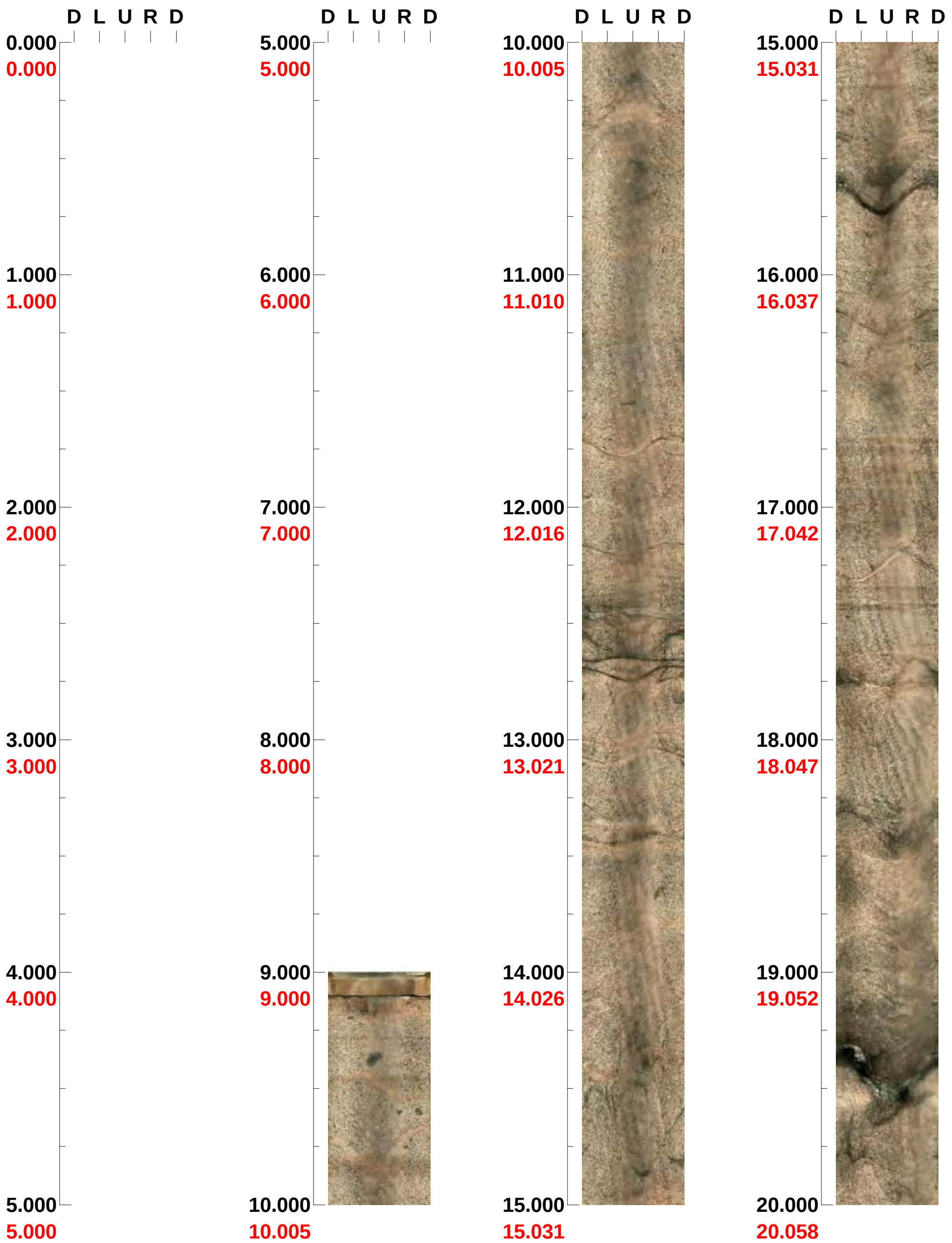
BIPS logging in HLX33, 9 to 201 m

Project name: Laxemar

Image file	: c:\work\r5450l~1\hlx33\bips\hlx33.bip
BDT file	: c:\work\r5450l~1\hlx33\bips\hlx33.bdt
Locality	: LAXEMAR
Bore hole number	: HLX33
Date	: 05/08/31
Time	: 16:57:00
Depth range	: 9.000 - 200.791 m
Azimuth	: 22
Inclination	: -59
Diameter	: 140.0 mm
Magnetic declination	: 0.0
Span	: 4
Scan interval	: 0.25
Scan direction	: To bottom
Scale	: 1/25
Aspect ratio	: 100 %
Pages	: 11
Color	: +0 +0 +0

Project name: Laxemar
Bore hole No.: HLX33 **Azimuth: 22** **Inclination: -59**

Depth range: 0.000 - 20.000 m



(1 / 11) **Scale: 1/25** **Aspect ratio: 100 %**

Project name: Laxemar
Bore hole No.: HLX33 **Azimuth: 22** **Inclination: -59**

Depth range: 20.000 - 40.000 m

(2 / 11) **Scale: 1/25** **Aspect ratio: 100 %**

Project name: Laxemar
Bore hole No.: HLX33 Azimuth: 22 Inclination: -59

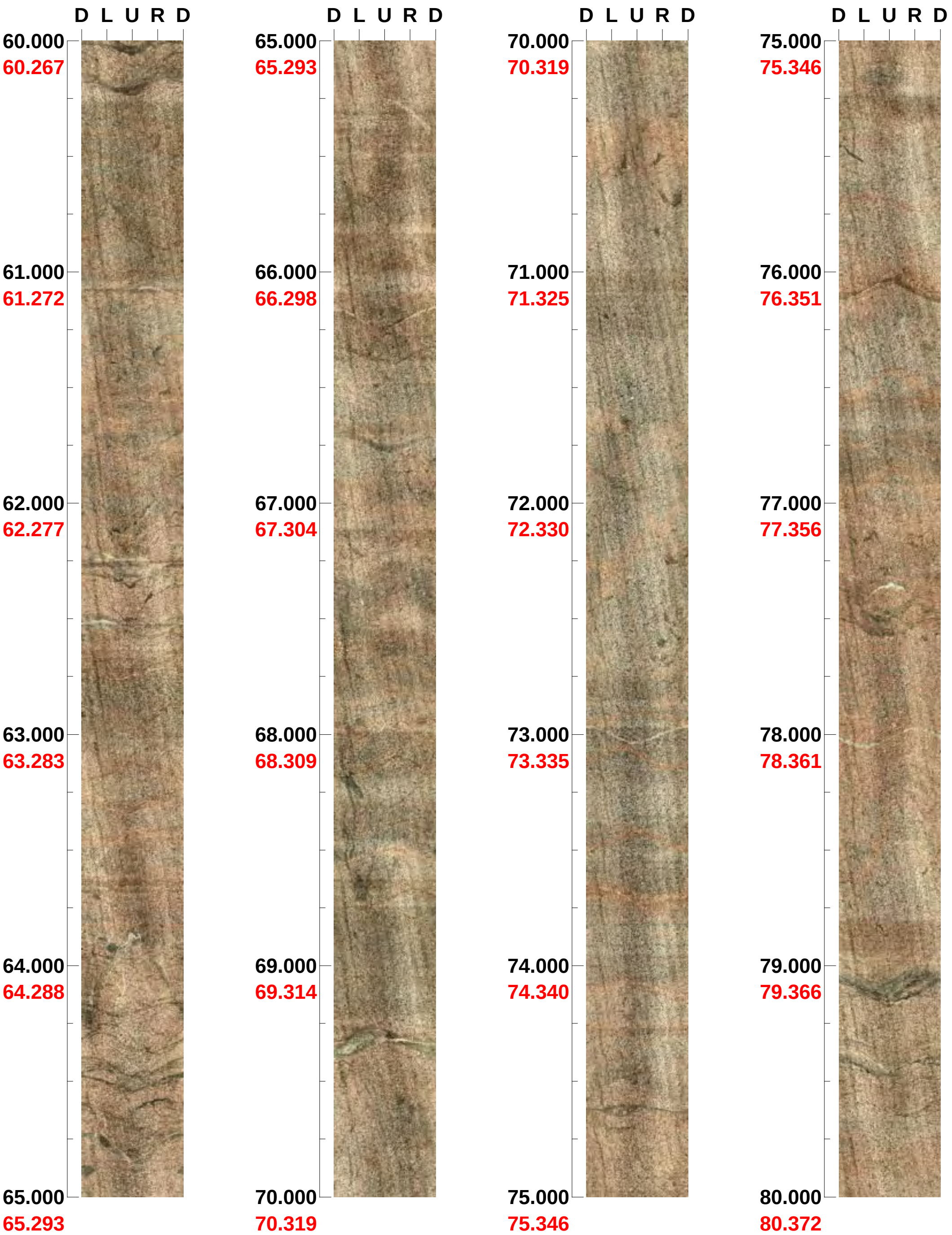
Depth range: 40.000 - 60.000 m

(3 / 11) Scale: 1/25 Aspect ratio: 100 %

Project name: Laxemar

Bore hole No.: HLX33 **Azimuth: 22** **Inclination: -59**

Depth range: 60.000 - 80.000 m



(4 / 11) **Scale: 1/25** **Aspect ratio: 100 %**

Project name: Laxemar
Bore hole No.: HLX33 **Azimuth: 22** **Inclination: -59**

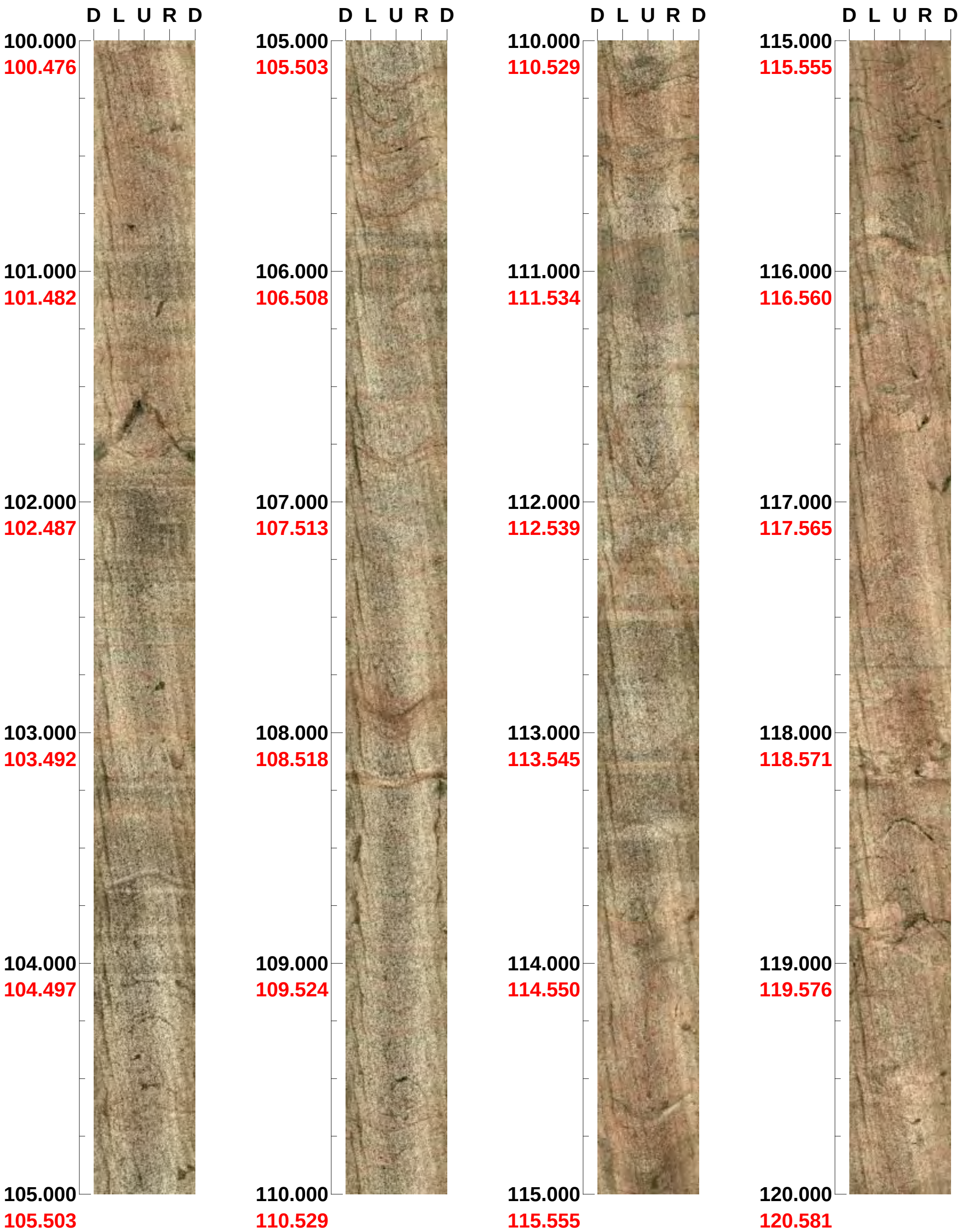
Depth range: 80.000 - 100.000 m

(5 / 11) **Scale: 1/25** **Aspect ratio: 100 %**

Project name: Laxemar

Bore hole No.: HLX33 **Azimuth: 22** **Inclination: -59**

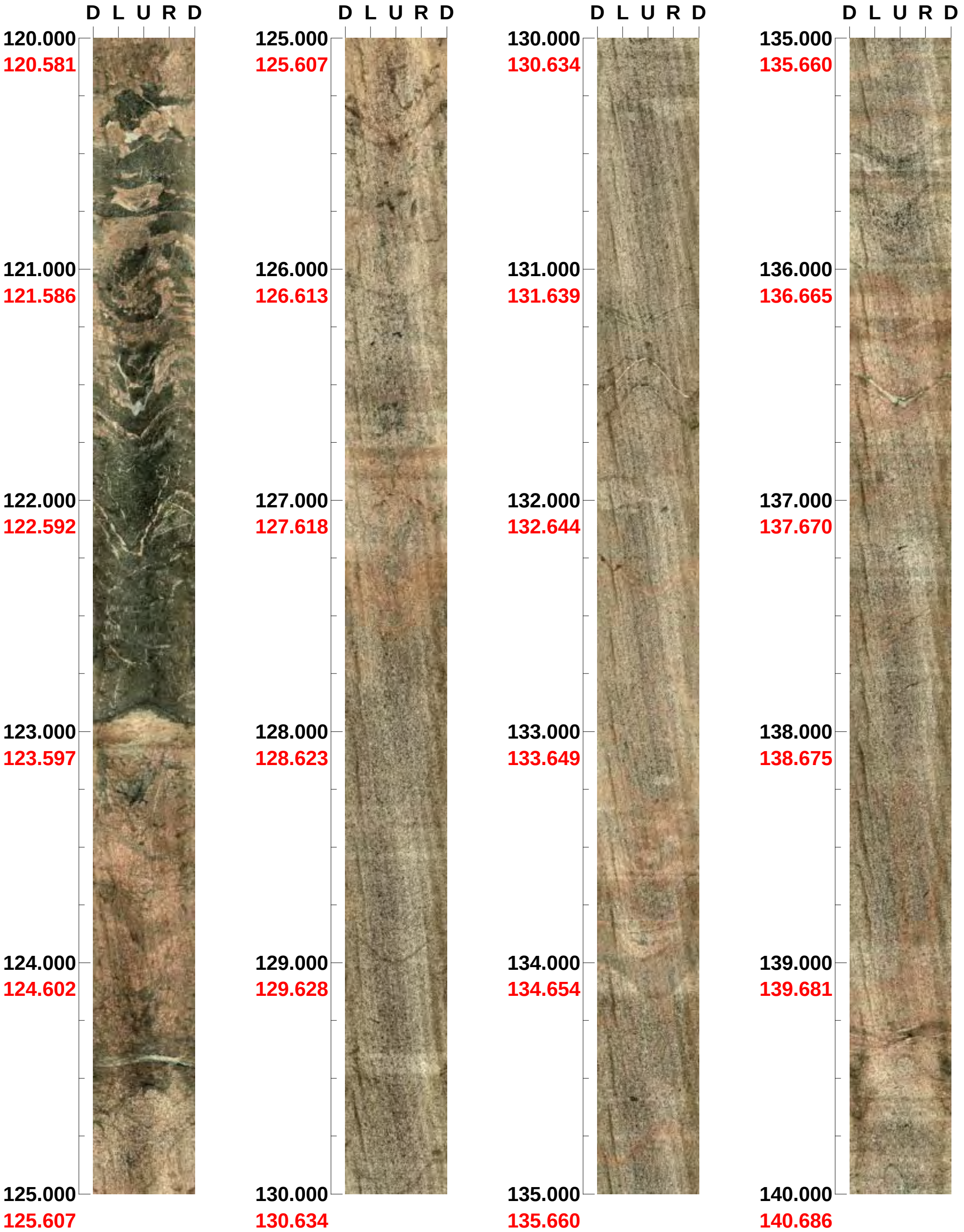
Depth range: 100.000 - 120.000 m



(6 / 11) **Scale: 1/25** **Aspect ratio: 100 %**

Project name: Laxemar
Bore hole No.: HLX33 Azimuth: 22 Inclination: -59

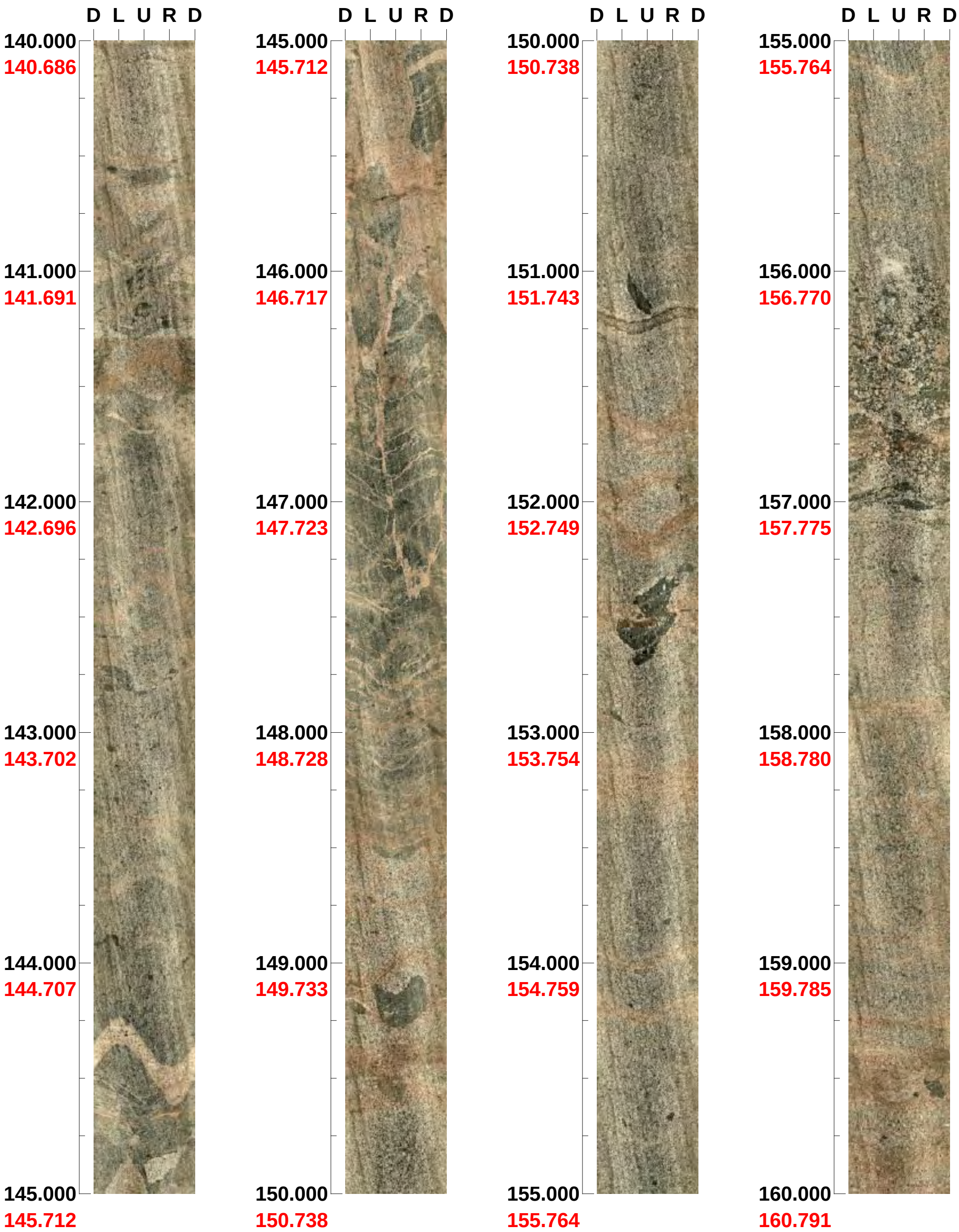
Depth range: 120.000 - 140.000 m



(7 / 11) Scale: 1/25 Aspect ratio: 100 %

Project name: Laxemar
Bore hole No.: HLX33 Azimuth: 22 Inclination: -59

Depth range: 140.000 - 160.000 m



(8 / 11) Scale: 1/25 Aspect ratio: 100 %

Project name: Laxemar

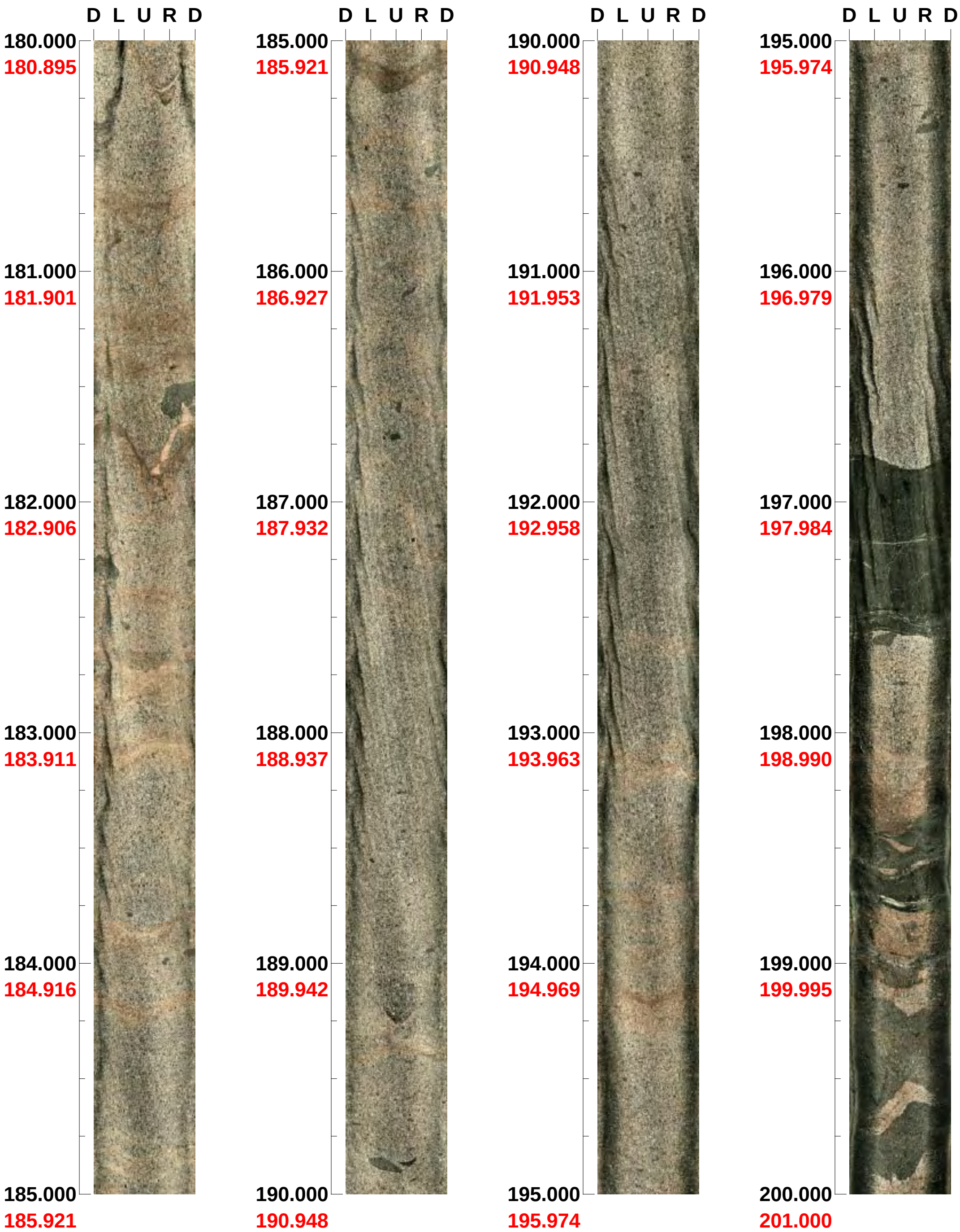
Bore hole No.: HLX33 **Azimuth: 22** **Inclination: -59**

Depth range: 160.000 - 180.000 m

(9 / 11) **Scale: 1/25** **Aspect ratio: 100 %**

Project name: Laxemar
Bore hole No.: HLX33 Azimuth: 22 Inclination: -59

Depth range: 180.000 - 200.000 m

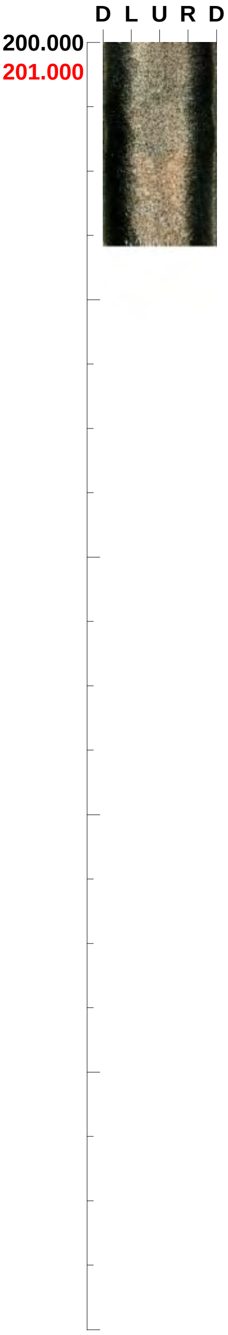


(10 / 11) Scale: 1/25 Aspect ratio: 100 %

Project name: Laxemar

Bore hole No.: HLX33 **Azimuth: 22** **Inclination: -59**

Depth range: 200.000 - 200.791 m



(11 / 11) **Scale: 1/25** **Aspect ratio: 100 %**

Deviation logging in KLX08, 0 to 990 m

New MeasureIT files

Survey name:	**KLX08 in**
Survey date:	06/09/2005 13:40:48
Project:	PLU
Location:	Laxemar
Country:	Sweden
Survey company:	Mala GeoScience / RAYCON
Surveyed by:	Christer Gustafsson
Survey type:	STANDARD
Operating conditions:	
General comments:	
Client name:	SKB
Client ID number:	
Client reference:	Leif Stenberg
Drill company:	
Drill rig:	
Drill diameter:	197mm / 76mm
Survey direction:	INTO hole
Survey run on:	Wireline
Magnetic Var.:	2,33 degrees East of North

FLEXIT

Conventions	
Linear units:	Metres
Angular units:	Degrees
Temperature units:	Centigrade
Co-ordinate system:	0 North
Elevation positive	Up
Dip origin:	0 Horizontal
Dip positive:	Up

Magnetic Integrity Check (MagIC)

	Mid value	± limit	
Field strength:	49600	1000	nano Tesla
Magnetic dip:	71.4	1.5	Degrees

SURVEY	Actual start	End of survey	Difference
Station:	0,0	990,0	990,0
East:	1548176,71	1547917,27	-259,44
North:	6367079,10	6366641,77	-437,33
Elevation:	24,31	-824,05	-848,36
Dip:	-60,44	-56,95	3,49
Azimuth:	199,00	212,56	13,56

OFFSETS at end

Offsets relative to:
ACTUAL START

14,54 metres upwards
102,93 metres right
6,39 metres shortfall

Printed on: 2005-09-07 19:42:15

Page 1 of 12

Survey name : KLX08 in
Survey date : 06/09/2005 13:40:48
Printed on 2005-09-07 19:42:42

Station	Dip	Azimuth	Easting	Northing	Elevation	Mag.Field	Mag.Dip	Grav.Field	Status	UpDown	LeftRight	Shortfall
Metres	Degrees	Degrees	Metres	Metres	Metres	nT	Degrees	G	*	Metres	Metres	Metres
0,0	-60,44	199,00	1548176,71	6367079,10	24,31	14936	-44,39	1,000711	✍✍✍	0,00	0,00	0,00
3,0	-60,52	199,00	1548176,23	6367077,71	21,70	31357	59,20	1,002026	✍✍✍✍	0,00	0,00	0,00
6,0	-60,07	199,00	1548175,75	6367076,30	19,10	19616	61,58	1,001510	✍✍✍✍	0,00	0,00	0,00
9,0	-59,56	199,00	1548175,26	6367074,87	16,50	31464	65,38	0,999987	✍✍✍✍	0,04	0,00	0,00
12,0	-59,70	199,00	1548174,76	6367073,44	13,92	59389	79,82	0,998147	✍✍✍✍	0,08	0,00	0,00
15,0	-59,71	199,00	1548174,27	6367072,01	11,33	50676	72,65	0,997612	✍✍✍	0,12	0,00	0,00
18,0	-59,56	198,83	1548173,78	6367070,57	8,74	50207	71,92	1,001654	✍	0,16	0,00	0,00
21,0	-59,55	200,09	1548173,27	6367069,14	6,15	50479	71,35	1,000644	✍	0,21	0,01	0,00
24,0	-59,70	200,61	1548172,74	6367067,72	3,56	50355	71,27	1,000139	✍	0,25	0,05	0,00
27,0	-59,80	201,36	1548172,20	6367066,31	0,97	50109	71,57	0,999486	✍	0,28	0,10	0,00
30,0	-59,78	200,16	1548171,67	6367064,90	-1,62	50061	71,31	1,000855	✍	0,32	0,14	0,00
33,0	-59,83	200,55	1548171,14	6367063,48	-4,21	50153	71,17	1,000228	✍	0,35	0,18	0,00
36,0	-59,89	199,99	1548170,62	6367062,07	-6,81	49817	71,47	1,000436	✍	0,38	0,21	0,00
39,0	-59,91	200,85	1548170,10	6367060,66	-9,40	50012	71,45	1,000525	✍	0,41	0,25	0,00
42,0	-59,76	200,08	1548169,57	6367059,25	-12,00	49954	71,45	1,000839	✍	0,44	0,29	0,00
45,0	-59,93	200,84	1548169,04	6367057,83	-14,59	49963	71,19	0,999862	✍	0,47	0,33	-0,01
48,0	-59,82	200,26	1548168,51	6367056,42	-17,19	50006	71,09	1,000601	✍	0,50	0,37	-0,01
51,0	-59,97	201,33	1548167,98	6367055,02	-19,78	49929	71,26	0,999025	✍	0,52	0,42	-0,01
54,0	-59,85	201,52	1548167,43	6367053,62	-22,38	50113	71,31	0,999008	✍	0,55	0,48	-0,01
57,0	-59,90	200,98	1548166,89	6367052,21	-24,97	49974	70,98	0,999733	✍	0,58	0,54	-0,01
60,0	-59,92	201,43	1548166,34	6367050,81	-27,57	49887	71,37	0,999030	✍	0,60	0,60	-0,01
63,0	-59,89	200,84	1548165,80	6367049,41	-30,16	49889	70,94	0,999232	✍	0,63	0,65	-0,01
66,0	-59,97	200,77	1548165,26	6367048,00	-32,76	49930	71,08	0,999404	✍	0,66	0,70	-0,01
69,0	-59,85	200,55	1548164,73	6367046,60	-35,36	49838	71,23	1,000321	✍	0,68	0,74	-0,01
72,0	-59,97	200,55	1548164,21	6367045,19	-37,95	49781	71,10	0,999422	✍	0,71	0,78	-0,01
75,0	-59,91	200,24	1548163,68	6367043,78	-40,55	49647	71,43	0,999726	✍	0,74	0,82	-0,01
78,0	-60,04	200,36	1548163,16	6367042,37	-43,15	49888	71,19	0,999501	✍	0,76	0,85	-0,01
81,0	-60,00	201,26	1548162,63	6367040,97	-45,74	49854	71,14	0,999240	✍	0,78	0,90	-0,01
84,0	-59,98	202,22	1548162,07	6367039,58	-48,34	49352	71,79	0,999610	✍	0,80	0,97	-0,01
87,0	-59,95	200,47	1548161,53	6367038,18	-50,94	49486	70,93	0,999874	✍	0,83	1,03	-0,01
90,0	-59,98	199,60	1548161,01	6367036,77	-53,54	49868	70,70	0,999536	✍	0,85	1,06	-0,01
93,0	-59,78	199,61	1548160,51	6367035,35	-56,13	49740	70,97	0,999729	✍	0,88	1,08	-0,01
96,0	-59,25	200,00	1548159,99	6367033,92	-58,72	49539	71,79	1,000330	✍✍	0,93	1,10	-0,01

Survey name : KLX08 in
Survey date : 06/09/2005 13:40:48
Printed on 2005-09-07 19:42:42

Station Metres	Dip Degrees	Azimuth Degrees	Easting Metres	Northing Metres	Elevation Metres	Mag.Field nT	Mag.Dip Degrees	Grav.Field G	Status *	UpDown Metres	LeftRight Metres	Shortfall Metres
99,0	-59,88	200,00	1548159,47	6367032,49	-61,30	48430	71,13	0,997839	✍✍	0,97	1,13	-0,01
102,0	-59,94	200,51	1548158,95	6367031,08	-63,90	49711	70,87	0,997400	✍	1,00	1,16	-0,01
105,0	-59,87	201,00	1548158,42	6367029,67	-66,49	49668	72,28	0,999007	✍✍	1,03	1,20	-0,02
108,0	-59,95	201,00	1548157,88	6367028,27	-69,09	49624	72,05	0,998866	✍	1,06	1,26	-0,02
111,0	-60,00	201,67	1548157,33	6367026,87	-71,69	49360	71,09	0,998858	✍	1,08	1,32	-0,02
114,0	-60,06	201,17	1548156,79	6367025,47	-74,29	49741	70,76	0,999118	✍	1,10	1,38	-0,02
117,0	-60,12	203,46	1548156,22	6367024,09	-76,89	49719	71,23	0,998700	✍	1,11	1,47	-0,02
120,0	-60,15	204,06	1548155,62	6367022,72	-79,49	50505	71,37	0,998549	✍	1,13	1,59	-0,02
123,0	-60,13	203,49	1548155,01	6367021,36	-82,09	50294	71,08	0,999169	✍	1,14	1,72	-0,02
126,0	-60,08	203,04	1548154,42	6367019,98	-84,69	49803	71,24	0,999005	✍	1,15	1,83	-0,03
129,0	-60,08	203,08	1548153,84	6367018,61	-87,29	49116	70,98	0,998858	✍	1,16	1,93	-0,03
132,0	-60,05	202,62	1548153,26	6367017,23	-89,89	49549	70,80	0,999039	✍	1,18	2,03	-0,03
135,0	-60,03	202,83	1548152,68	6367015,84	-92,49	49340	71,05	0,999247	✍	1,20	2,13	-0,03
138,0	-60,02	202,98	1548152,09	6367014,46	-95,09	49653	70,97	0,998904	✍	1,22	2,23	-0,03
141,0	-60,01	203,17	1548151,51	6367013,08	-97,69	49499	70,93	0,998816	✍	1,24	2,34	-0,03
144,0	-59,95	203,23	1548150,91	6367011,70	-100,28	49899	70,91	0,998818	✍	1,26	2,45	-0,04
147,0	-60,00	203,78	1548150,32	6367010,33	-102,88	49973	71,46	0,999066	✍	1,28	2,57	-0,04
150,0	-60,02	204,08	1548149,71	6367008,96	-105,48	49844	71,96	0,998782	✍	1,29	2,70	-0,04
153,0	-59,99	203,98	1548149,10	6367007,59	-108,08	49744	71,78	0,999014	✍	1,31	2,83	-0,04
156,0	-60,02	204,25	1548148,48	6367006,22	-110,68	49818	71,93	0,998850	✍	1,33	2,96	-0,05
159,0	-60,05	204,21	1548147,87	6367004,85	-113,28	49438	71,30	0,999126	✍	1,34	3,10	-0,05
162,0	-60,08	204,48	1548147,25	6367003,49	-115,88	49735	71,22	0,999266	✍	1,36	3,24	-0,05
165,0	-60,10	204,07	1548146,64	6367002,12	-118,48	49434	71,08	0,999097	✍	1,37	3,38	-0,06
168,0	-60,11	204,96	1548146,02	6367000,76	-121,08	50026	71,17	0,999010	✍	1,38	3,52	-0,06
171,0	-60,14	205,37	1548145,38	6366999,41	-123,68	49923	71,54	0,999132	✍	1,39	3,68	-0,07
174,0	-60,18	204,95	1548144,75	6366998,06	-126,28	49585	71,07	0,999214	✍	1,40	3,84	-0,07
177,0	-60,22	205,06	1548144,12	6366996,71	-128,88	49606	71,13	0,999218	✍	1,40	4,00	-0,07
180,0	-60,26	205,18	1548143,48	6366995,36	-131,49	49649	71,17	0,999028	✍	1,41	4,15	-0,08
183,0	-60,28	205,52	1548142,85	6366994,02	-134,09	49582	71,20	0,998969	✍	1,41	4,32	-0,08
186,0	-60,29	205,97	1548142,20	6366992,68	-136,70	49625	71,08	0,998473	✍	1,41	4,49	-0,09
189,0	-60,28	205,65	1548141,55	6366991,34	-139,30	49477	71,31	0,998817	✍	1,40	4,67	-0,09
192,0	-60,27	206,25	1548140,90	6366990,00	-141,91	49604	71,22	0,999160	✍	1,40	4,85	-0,10
195,0	-60,25	206,51	1548140,24	6366988,67	-144,51	49770	71,46	0,999061	✍	1,40	5,04	-0,10

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Station	Dip	Azimuth	Easting	Northing	Elevation	Mag.Field	Mag.Dip	Grav.Field	Status	UpDown	LeftRight	Shortfall
Metres	Degrees	Degrees	Metres	Metres	Metres	nT	Degrees	G	*	Metres	Metres	Metres
198,0	-60,24	206,47	1548139,58	6366987,33	-147,12	50123	71,50	0,999092	✍	1,40	5,24	-0,11
201,0	-60,21	206,61	1548138,91	6366986,00	-149,72	49909	71,20	0,999009	✍	1,40	5,43	-0,12
204,0	-60,17	207,14	1548138,24	6366984,67	-152,33	49705	71,33	0,999197	✍	1,40	5,64	-0,12
207,0	-60,16	207,39	1548137,55	6366983,34	-154,93	49732	71,01	0,999199	✍	1,40	5,85	-0,13
210,0	-60,16	207,73	1548136,86	6366982,02	-157,53	49986	71,53	0,999178	✍	1,40	6,07	-0,14
213,0	-60,16	208,43	1548136,16	6366980,70	-160,13	49939	71,76	0,999054	✍	1,40	6,31	-0,15
216,0	-60,17	208,25	1548135,45	6366979,39	-162,73	49925	71,75	0,998670	✍	1,40	6,55	-0,16
219,0	-60,22	208,67	1548134,74	6366978,08	-165,34	49966	71,83	0,999041	✍	1,39	6,79	-0,17
222,0	-60,18	208,62	1548134,03	6366976,77	-167,94	49852	71,44	0,998587	✍	1,39	7,04	-0,18
225,0	-60,12	209,30	1548133,30	6366975,46	-170,54	49802	71,74	0,999249	✍	1,38	7,30	-0,19
228,0	-60,11	209,47	1548132,57	6366974,16	-173,14	49941	71,87	0,999010	✍	1,38	7,57	-0,20
231,0	-60,08	209,42	1548131,83	6366972,86	-175,74	49879	71,80	0,998902	✍	1,37	7,84	-0,21
234,0	-60,07	209,87	1548131,09	6366971,56	-178,34	49732	71,61	0,998904	✍	1,37	8,12	-0,23
237,0	-60,04	210,01	1548130,35	6366970,26	-180,94	49621	71,17	0,999245	✍	1,37	8,40	-0,24
240,0	-59,93	210,54	1548129,59	6366968,96	-183,54	49948	71,26	0,998702	✍	1,36	8,70	-0,26
243,0	-59,94	209,62	1548128,84	6366967,66	-186,14	49843	70,61	0,998965	✍	1,37	8,99	-0,27
246,0	-59,91	208,83	1548128,10	6366966,35	-188,73	49656	70,09	0,998973	✍	1,37	9,25	-0,28
249,0	-59,83	210,52	1548127,36	6366965,04	-191,33	49950	71,10	0,999097	✍	1,38	9,53	-0,29
252,0	-59,78	210,31	1548126,59	6366963,74	-193,92	49851	70,82	0,999167	✍	1,39	9,83	-0,31
255,0	-59,70	211,57	1548125,82	6366962,45	-196,51	49914	70,67	0,999129	✍	1,39	10,14	-0,33
258,0	-59,67	211,06	1548125,03	6366961,15	-199,10	50170	70,96	0,999235	✍	1,40	10,47	-0,34
261,0	-59,68	211,00	1548124,25	6366959,85	-201,69	50612	71,35	0,998957	✍✍	1,41	10,78	-0,36
264,0	-59,74	210,46	1548123,48	6366958,55	-204,28	50379	71,29	0,999046	✍	1,42	11,09	-0,38
267,0	-59,74	210,05	1548122,71	6366957,25	-206,87	50183	71,47	0,998936	✍	1,44	11,39	-0,39
270,0	-59,76	211,61	1548121,94	6366955,95	-209,47	49961	70,63	0,998988	✍	1,44	11,69	-0,41
273,0	-59,77	211,68	1548121,15	6366954,66	-212,06	49482	70,76	0,999113	✍	1,45	12,03	-0,42
276,0	-59,76	212,00	1548120,35	6366953,38	-214,65	50106	71,04	0,999019	✍	1,45	12,36	-0,44
279,0	-59,75	212,12	1548119,55	6366952,10	-217,24	50187	71,43	0,998881	✍	1,45	12,70	-0,46
282,0	-59,78	212,20	1548118,74	6366950,82	-219,83	50377	71,49	0,999013	✍	1,45	13,05	-0,48
285,0	-59,78	212,80	1548117,93	6366949,55	-222,43	49676	71,36	0,999117	✍	1,45	13,40	-0,50
288,0	-59,76	212,68	1548117,12	6366948,28	-225,02	50360	71,72	0,998657	✍	1,45	13,76	-0,53
291,0	-59,69	213,62	1548116,29	6366947,01	-227,61	50023	71,58	0,999043	✍	1,44	14,13	-0,55
294,0	-59,64	213,79	1548115,45	6366945,75	-230,20	50189	71,80	0,999108	✍	1,44	14,51	-0,57

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Station Metres	Dip Degrees	Azimuth Degrees	Easting Metres	Northing Metres	Elevation Metres	Mag.Field nT	Mag.Dip Degrees	Grav.Field G	Status *	UpDown Metres	LeftRight Metres	Shortfall Metres
297,0	-59,62	214,00	1548114,60	6366944,49	-232,79	50221	71,93	0,998954	✍	1,44	14,90	-0,60
300,0	-59,57	213,69	1548113,76	6366943,23	-235,37	50172	72,08	0,999119	✍	1,44	15,29	-0,62
303,0	-59,46	214,25	1548112,91	6366941,97	-237,96	49690	70,82	0,999262	✍	1,44	15,68	-0,65
306,0	-59,35	214,83	1548112,04	6366940,71	-240,54	49791	70,91	0,999157	✍	1,45	16,09	-0,68
309,0	-59,31	214,56	1548111,17	6366939,45	-243,12	49769	70,75	0,998871	✍	1,46	16,51	-0,71
312,0	-59,29	213,82	1548110,31	6366938,19	-245,70	49957	71,24	0,999001	✍	1,47	16,91	-0,73
315,0	-59,32	214,03	1548109,45	6366936,92	-248,28	49963	70,94	0,999201	✍	1,48	17,30	-0,76
318,0	-59,33	213,95	1548108,60	6366935,65	-250,86	49738	70,68	0,999222	✍	1,49	17,70	-0,79
321,0	-59,32	213,05	1548107,75	6366934,37	-253,44	49890	70,43	0,998738	✍	1,51	18,08	-0,81
324,0	-59,34	213,17	1548106,92	6366933,09	-256,02	50418	70,51	0,999248	✍	1,53	18,46	-0,83
327,0	-59,31	213,48	1548106,08	6366931,81	-258,60	49904	71,02	0,999089	✍	1,54	18,83	-0,86
330,0	-59,31	212,97	1548105,24	6366930,53	-261,18	49986	71,73	0,998878	✍	1,56	19,21	-0,88
333,0	-59,31	213,60	1548104,40	6366929,25	-263,76	49938	70,91	0,998383	✍	1,58	19,59	-0,91
336,0	-59,31	213,89	1548103,55	6366927,98	-266,34	49872	70,98	0,999155	✍	1,60	19,98	-0,93
339,0	-59,30	213,74	1548102,69	6366926,70	-268,92	49670	70,91	0,998991	✍	1,61	20,37	-0,96
342,0	-59,30	213,23	1548101,85	6366925,43	-271,50	49640	70,79	0,999041	✍	1,63	20,75	-0,98
345,0	-59,29	213,42	1548101,01	6366924,15	-274,08	49671	70,83	0,999089	✍	1,65	21,13	-1,00
348,0	-59,32	213,51	1548100,16	6366922,87	-276,66	49761	70,91	0,999426	✍	1,66	21,51	-1,03
351,0	-59,32	213,47	1548099,32	6366921,59	-279,24	49766	70,87	0,999285	✍	1,68	21,90	-1,05
354,0	-59,35	213,37	1548098,48	6366920,31	-281,82	49765	70,62	0,999024	✍	1,70	22,28	-1,08
357,0	-59,33	213,30	1548097,63	6366919,04	-284,40	49698	70,84	0,998886	✍	1,71	22,66	-1,10
360,0	-59,35	213,43	1548096,79	6366917,76	-286,98	49629	70,81	0,998836	✍	1,73	23,04	-1,13
363,0	-59,31	213,10	1548095,95	6366916,48	-289,56	49817	70,78	0,999016	✍	1,74	23,41	-1,15
366,0	-59,28	213,21	1548095,12	6366915,20	-292,14	49666	70,79	0,998808	✍	1,76	23,79	-1,17
369,0	-59,25	213,53	1548094,27	6366913,92	-294,72	49785	70,86	0,999224	✍	1,78	24,17	-1,20
372,0	-59,24	213,99	1548093,42	6366912,64	-297,30	49719	71,05	0,998980	✍	1,80	24,56	-1,22
375,0	-59,24	214,01	1548092,56	6366911,37	-299,88	49664	70,79	0,998815	✍	1,82	24,96	-1,25
378,0	-59,28	213,46	1548091,71	6366910,09	-302,45	49688	70,88	0,999271	✍	1,84	25,35	-1,28
381,0	-59,27	213,91	1548090,86	6366908,82	-305,03	49606	70,70	0,998817	✍	1,85	25,74	-1,30
384,0	-59,27	213,52	1548090,01	6366907,54	-307,61	50521	72,00	0,998937	✍	1,87	26,12	-1,33
387,0	-59,26	214,70	1548089,15	6366906,27	-310,19	49765	70,92	0,999049	✍	1,89	26,52	-1,35
390,0	-59,27	214,74	1548088,28	6366905,01	-312,77	49945	70,77	0,998904	✍	1,90	26,94	-1,38
393,0	-59,26	213,76	1548087,41	6366903,75	-315,35	50228	70,63	0,999018	✍	1,91	27,34	-1,41

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Station	Dip	Azimuth	Easting	Northing	Elevation	Mag.Field	Mag.Dip	Grav.Field	Status	UpDown	LeftRight	Shortfall
Metres	Degrees	Degrees	Metres	Metres	Metres	nT	Degrees	G	*	Metres	Metres	Metres
396,0	-59,28	212,54	1548086,58	6366902,46	-317,93	49285	69,98	0,998583	✍	1,93	27,72	-1,43
399,0	-59,27	212,08	1548085,76	6366901,17	-320,50	50525	70,75	0,999205	✍	1,96	28,07	-1,45
402,0	-59,27	213,48	1548084,93	6366899,88	-323,08	50371	71,35	0,998797	✍	1,98	28,44	-1,48
405,0	-59,25	213,54	1548084,08	6366898,60	-325,66	50512	71,44	0,998803	✍	2,00	28,82	-1,50
408,0	-59,24	212,76	1548083,24	6366897,31	-328,24	49923	70,68	0,998874	✍	2,02	29,19	-1,52
411,0	-59,23	212,68	1548082,41	6366896,02	-330,82	49822	70,71	0,999066	✍	2,04	29,56	-1,55
414,0	-59,25	213,28	1548081,58	6366894,74	-333,40	49767	70,57	0,998917	✍	2,07	29,93	-1,57
417,0	-59,23	212,63	1548080,74	6366893,45	-335,97	49481	70,10	0,998862	✍	2,09	30,30	-1,59
420,0	-59,20	212,43	1548079,92	6366892,15	-338,55	49695	70,12	0,998876	✍	2,12	30,66	-1,62
423,0	-59,17	213,12	1548079,08	6366890,86	-341,13	49610	70,51	0,999227	✍	2,14	31,02	-1,64
426,0	-59,15	212,93	1548078,25	6366889,57	-343,70	49776	70,51	0,999022	✍	2,17	31,40	-1,66
429,0	-59,16	213,08	1548077,41	6366888,28	-346,28	49754	70,64	0,999015	✍	2,20	31,77	-1,68
432,0	-59,12	213,47	1548076,56	6366887,00	-348,85	49359	70,79	0,999138	✍	2,23	32,15	-1,71
435,0	-59,12	213,25	1548075,72	6366885,71	-351,43	49681	70,75	0,998887	✍	2,25	32,53	-1,73
438,0	-59,13	212,69	1548074,88	6366884,42	-354,00	49710	70,70	0,999049	✍	2,28	32,90	-1,76
441,0	-59,12	213,29	1548074,04	6366883,13	-356,58	49825	70,86	0,999223	✍	2,31	33,27	-1,78
444,0	-59,10	213,06	1548073,20	6366881,84	-359,15	50978	71,13	0,999214	✍	2,34	33,65	-1,80
447,0	-59,08	213,40	1548072,35	6366880,55	-361,73	49864	70,29	0,999201	✍	2,37	34,03	-1,83
450,0	-59,04	213,28	1548071,51	6366879,26	-364,30	49612	70,56	0,998883	✍	2,40	34,41	-1,85
453,0	-59,00	212,92	1548070,66	6366877,97	-366,87	49808	70,81	0,998867	✍	2,43	34,79	-1,88
456,0	-59,02	212,94	1548069,82	6366876,67	-369,44	50220	70,59	0,999020	✍	2,47	35,16	-1,90
459,0	-59,02	213,39	1548068,98	6366875,38	-372,02	49918	70,51	0,999162	✍	2,50	35,54	-1,92
462,0	-58,99	212,96	1548068,13	6366874,08	-374,59	49613	70,66	0,999161	✍	2,53	35,92	-1,95
465,0	-58,95	213,33	1548067,29	6366872,79	-377,16	49678	70,35	0,998921	✍	2,57	36,30	-1,97
468,0	-58,95	212,87	1548066,44	6366871,49	-379,73	49521	70,82	0,999001	✍	2,61	36,67	-2,00
471,0	-58,93	212,98	1548065,60	6366870,19	-382,30	49714	70,71	0,998769	✍	2,65	37,04	-2,02
474,0	-58,94	212,96	1548064,76	6366868,90	-384,87	49738	70,61	0,999061	✍	2,68	37,42	-2,04
477,0	-58,94	215,11	1548063,89	6366867,61	-387,44	50471	71,58	0,999066	✍	2,72	37,82	-2,07
480,0	-58,95	213,85	1548063,02	6366866,34	-390,01	49647	70,82	0,999136	✍	2,75	38,23	-2,10
483,0	-58,97	213,52	1548062,16	6366865,05	-392,58	49837	71,05	0,998987	✍	2,78	38,62	-2,12
486,0	-58,96	213,02	1548061,31	6366863,76	-395,15	49776	70,82	0,998609	✍	2,81	39,01	-2,15
489,0	-58,96	212,87	1548060,47	6366862,46	-397,72	49910	71,03	0,998830	✍	2,85	39,38	-2,17
492,0	-58,98	213,56	1548059,62	6366861,17	-400,29	49912	70,84	0,999261	✍	2,89	39,76	-2,20

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Station Metres	Dip Degrees	Azimuth Degrees	Easting Metres	Northing Metres	Elevation Metres	Mag.Field nT	Mag.Dip Degrees	Grav.Field G	Status *	UpDown Metres	LeftRight Metres	Shortfall Metres
495,0	-58,98	212,69	1548058,78	6366859,87	-402,86	50036	71,01	0,998952	✓	2,92	40,14	-2,22
498,0	-58,96	212,91	1548057,94	6366858,57	-405,43	49893	70,80	0,999214	✓	2,96	40,50	-2,24
501,0	-58,94	213,66	1548057,09	6366857,28	-408,00	49669	70,93	0,998969	✓	3,00	40,89	-2,27
504,0	-58,94	213,13	1548056,24	6366855,98	-410,57	49858	70,98	0,998812	✓	3,03	41,27	-2,29
507,0	-58,93	213,10	1548055,39	6366854,69	-413,14	49784	70,92	0,999079	✓	3,07	41,65	-2,32
510,0	-58,95	212,90	1548054,55	6366853,39	-415,71	49803	70,68	0,999153	✓	3,11	42,02	-2,34
513,0	-58,94	213,15	1548053,71	6366852,09	-418,28	50016	70,81	0,999371	✓	3,15	42,40	-2,37
516,0	-58,94	213,14	1548052,86	6366850,80	-420,85	49720	70,87	0,999162	✓	3,19	42,78	-2,39
519,0	-58,92	212,67	1548052,02	6366849,50	-423,42	49755	70,88	0,999231	✓	3,22	43,15	-2,41
522,0	-58,93	212,66	1548051,18	6366848,19	-425,99	49320	71,31	0,998698	✓	3,27	43,51	-2,44
525,0	-58,93	212,66	1548050,35	6366846,89	-428,56	49508	70,86	0,999172	✓	3,31	43,88	-2,46
528,0	-58,91	212,97	1548049,51	6366845,59	-431,13	49581	70,97	0,998502	✓	3,35	44,25	-2,48
531,0	-58,91	212,23	1548048,67	6366844,28	-433,70	49802	70,95	0,998957	✓	3,39	44,61	-2,50
534,0	-58,88	211,97	1548047,85	6366842,97	-436,27	49894	71,11	0,998909	✓	3,43	44,97	-2,52
537,0	-58,93	211,44	1548047,03	6366841,65	-438,84	49836	71,96	0,998932	✓	3,48	45,31	-2,54
540,0	-58,92	211,54	1548046,23	6366840,33	-441,41	49829	71,13	0,998909	✓	3,53	45,64	-2,56
543,0	-58,91	212,21	1548045,41	6366839,02	-443,97	49776	70,76	0,998760	✓	3,57	45,99	-2,58
546,0	-58,87	212,11	1548044,58	6366837,70	-446,54	49975	70,97	0,998968	✓	3,62	46,34	-2,61
549,0	-58,85	212,54	1548043,75	6366836,39	-449,11	50039	70,90	0,999250	✓	3,67	46,70	-2,63
552,0	-58,85	212,69	1548042,92	6366835,09	-451,68	49948	70,73	0,999381	✓	3,71	47,06	-2,65
555,0	-58,83	213,30	1548042,07	6366833,78	-454,25	49715	70,86	0,999039	✓	3,75	47,44	-2,67
558,0	-58,83	212,67	1548041,23	6366832,48	-456,81	49760	70,82	0,998758	✓	3,80	47,81	-2,70
561,0	-58,85	213,26	1548040,38	6366831,18	-459,38	49962	70,81	0,999070	✓	3,84	48,19	-2,72
564,0	-58,83	212,96	1548039,53	6366829,88	-461,95	49574	70,92	0,999115	✓	3,88	48,57	-2,75
567,0	-58,85	212,67	1548038,69	6366828,57	-464,51	49656	70,75	0,999111	✓	3,93	48,94	-2,77
570,0	-58,84	213,10	1548037,85	6366827,27	-467,08	49777	70,79	0,999075	✓	3,97	49,31	-2,79
573,0	-58,87	213,11	1548037,00	6366825,97	-469,65	49679	70,68	0,999241	✓	4,01	49,69	-2,82
576,0	-58,83	212,69	1548036,16	6366824,67	-472,22	49791	70,87	0,998838	✓	4,06	50,06	-2,84
579,0	-58,84	212,97	1548035,32	6366823,36	-474,78	49839	70,99	0,998768	✓	4,10	50,43	-2,86
582,0	-58,81	212,45	1548034,48	6366822,06	-477,35	50003	70,93	0,999133	✓	4,15	50,80	-2,89
585,0	-58,85	212,41	1548033,65	6366820,75	-479,92	50910	70,51	0,998842	✓	4,20	51,16	-2,91
588,0	-58,86	213,00	1548032,81	6366819,44	-482,48	49319	70,45	0,999068	✓	4,24	51,53	-2,93
591,0	-58,86	212,24	1548031,97	6366818,13	-485,05	49275	70,88	0,999160	✓	4,28	51,89	-2,95

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Station Metres	Dip Degrees	Azimuth Degrees	Easting Metres	Northing Metres	Elevation Metres	Mag.Field nT	Mag.Dip Degrees	Grav.Field G	Status *	UpDown Metres	LeftRight Metres	Shortfall Metres
594,0	-58,85	212,11	1548031,15	6366816,82	-487,62	49541	70,58	0,998678	✍	4,33	52,25	-2,98
597,0	-58,87	213,68	1548030,30	6366815,52	-490,19	49089	71,08	0,999071	✍	4,37	52,62	-3,00
600,0	-58,83	212,75	1548029,45	6366814,22	-492,75	49627	70,20	0,998878	✍	4,42	53,00	-3,02
603,0	-58,83	213,11	1548028,61	6366812,92	-495,32	49484	70,37	0,998893	✍	4,46	53,37	-3,05
606,0	-58,83	214,04	1548027,75	6366811,62	-497,89	49513	70,93	0,999117	✍	4,50	53,76	-3,07
609,0	-58,83	212,82	1548026,89	6366810,33	-500,46	49148	70,88	0,998990	✍	4,54	54,15	-3,10
612,0	-58,85	212,78	1548026,05	6366809,02	-503,02	49499	69,73	0,999131	✍	4,59	54,52	-3,12
615,0	-58,82	213,23	1548025,21	6366807,72	-505,59	49614	70,98	0,998641	✍	4,63	54,90	-3,15
618,0	-58,82	213,06	1548024,36	6366806,42	-508,16	49734	70,78	0,998972	✍	4,67	55,28	-3,17
621,0	-58,82	213,26	1548023,51	6366805,12	-510,72	49546	70,76	0,999340	✍	4,72	55,66	-3,19
624,0	-58,82	213,17	1548022,66	6366803,82	-513,29	49943	70,74	0,999080	✍	4,76	56,04	-3,22
627,0	-58,79	213,15	1548021,81	6366802,52	-515,86	50098	70,68	0,999341	✍	4,81	56,42	-3,24
630,0	-58,79	212,94	1548020,96	6366801,22	-518,42	50269	71,15	0,998781	✍	4,85	56,80	-3,27
633,0	-58,77	213,07	1548020,11	6366799,91	-520,99	50066	70,79	0,998821	✍	4,90	57,17	-3,29
636,0	-58,75	213,01	1548019,26	6366798,61	-523,55	50229	71,01	0,999087	✍	4,95	57,55	-3,32
639,0	-58,74	213,16	1548018,42	6366797,30	-526,12	49757	70,75	0,999082	✍	4,99	57,93	-3,34
642,0	-58,73	213,91	1548017,56	6366796,01	-528,68	50134	70,84	0,999123	✍	5,04	58,32	-3,37
645,0	-58,74	212,72	1548016,70	6366794,70	-531,25	50334	70,86	0,998958	✍	5,09	58,70	-3,39
648,0	-58,76	212,74	1548015,86	6366793,39	-533,81	50110	70,63	0,998993	✍	5,14	59,07	-3,42
651,0	-58,81	213,21	1548015,01	6366792,09	-536,38	50190	70,75	0,999118	✍	5,18	59,45	-3,44
654,0	-58,80	212,10	1548014,17	6366790,78	-538,94	49829	70,89	0,999091	✍	5,23	59,82	-3,46
657,0	-58,81	214,06	1548013,33	6366789,48	-541,51	49651	71,16	0,999417	✍	5,27	60,19	-3,49
660,0	-58,81	214,18	1548012,45	6366788,19	-544,07	50144	70,97	0,999055	✍	5,31	60,60	-3,51
663,0	-58,80	212,86	1548011,60	6366786,90	-546,64	49930	70,60	0,998723	✍	5,35	60,99	-3,54
666,0	-58,79	213,15	1548010,75	6366785,60	-549,21	50157	70,43	0,999178	✍	5,40	61,36	-3,56
669,0	-58,80	212,98	1548009,90	6366784,29	-551,77	50067	70,77	0,998937	✍	5,45	61,74	-3,59
672,0	-58,78	213,26	1548009,05	6366782,99	-554,34	50873	72,12	0,999025	✍	5,49	62,12	-3,61
675,0	-58,77	212,05	1548008,21	6366781,68	-556,90	49570	70,75	0,998594	✍	5,54	62,49	-3,64
678,0	-58,79	212,73	1548007,38	6366780,37	-559,47	49563	70,67	0,998983	✍	5,59	62,85	-3,66
681,0	-58,77	212,50	1548006,54	6366779,06	-562,03	49840	70,82	0,999036	✍	5,64	63,22	-3,68
684,0	-58,75	213,10	1548005,70	6366777,75	-564,60	49095	71,05	0,998876	✍	5,69	63,59	-3,70
687,0	-58,69	212,37	1548004,86	6366776,44	-567,16	49310	70,43	0,998719	✍	5,74	63,96	-3,73
690,0	-58,69	214,57	1548004,00	6366775,14	-569,73	49709	71,15	0,998956	✍	5,79	64,35	-3,75

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Station Metres	Dip Degrees	Azimuth Degrees	Easting Metres	Northing Metres	Elevation Metres	Mag.Field nT	Mag.Dip Degrees	Grav.Field G	Status *	UpDown Metres	LeftRight Metres	Shortfall Metres
693,0	-58,68	213,05	1548003,13	6366773,84	-572,29	49422	70,98	0,999339	✍	5,83	64,74	-3,78
696,0	-58,65	213,19	1548002,28	6366772,54	-574,85	48970	70,59	0,998910	✍	5,88	65,12	-3,80
699,0	-58,64	212,94	1548001,42	6366771,23	-577,41	49348	70,72	0,999274	✍	5,94	65,50	-3,83
702,0	-58,66	213,63	1548000,57	6366769,92	-579,98	49524	71,12	0,999285	✍	5,99	65,89	-3,85
705,0	-58,70	214,16	1547999,70	6366768,63	-582,54	49368	70,79	0,999103	✍	6,04	66,29	-3,88
708,0	-58,71	213,00	1547998,84	6366767,33	-585,10	49425	71,03	0,998909	✍✍	6,08	66,68	-3,91
711,0	-58,71	213,19	1547997,99	6366766,03	-587,67	49675	70,73	0,999099	✍	6,13	67,06	-3,93
714,0	-58,69	213,13	1547997,13	6366764,72	-590,23	49808	70,97	0,999038	✍	6,18	67,44	-3,96
717,0	-58,67	213,06	1547996,28	6366763,41	-592,79	49320	70,92	0,999110	✍	6,23	67,82	-3,98
720,0	-58,66	213,81	1547995,42	6366762,11	-595,35	49610	70,98	0,999123	✍	6,28	68,21	-4,01
723,0	-58,63	212,93	1547994,56	6366760,81	-597,92	49765	71,03	0,998856	✍	6,33	68,60	-4,03
726,0	-58,63	212,74	1547993,72	6366759,50	-600,48	49738	70,89	0,999143	✍	6,39	68,97	-4,06
729,0	-58,61	213,15	1547992,87	6366758,19	-603,04	49847	70,96	0,998642	✍	6,44	69,35	-4,08
732,0	-58,60	213,55	1547992,01	6366756,88	-605,60	49427	71,27	0,998980	✍	6,50	69,74	-4,11
735,0	-58,59	213,15	1547991,15	6366755,58	-608,16	49792	70,93	0,999169	✍	6,55	70,12	-4,13
738,0	-58,60	212,99	1547990,30	6366754,26	-610,72	49781	70,85	0,998888	✍	6,61	70,50	-4,16
741,0	-58,60	213,83	1547989,44	6366752,96	-613,28	49638	71,04	0,999047	✍	6,66	70,89	-4,18
744,0	-58,59	213,19	1547988,57	6366751,66	-615,84	49333	70,31	0,998840	✍	6,71	71,28	-4,21
747,0	-58,59	212,42	1547987,72	6366750,34	-618,40	49747	70,91	0,998733	✍	6,77	71,66	-4,23
750,0	-58,60	213,05	1547986,88	6366749,03	-620,96	49496	70,90	0,998907	✍	6,83	72,03	-4,26
753,0	-58,56	212,08	1547986,04	6366747,71	-623,52	49357	70,99	0,999001	✍	6,89	72,40	-4,28
756,0	-58,54	212,53	1547985,20	6366746,39	-626,08	49361	70,81	0,999187	✍	6,95	72,76	-4,30
759,0	-58,53	213,00	1547984,35	6366745,07	-628,64	49555	70,93	0,999058	✍	7,01	73,13	-4,33
762,0	-58,53	211,50	1547983,52	6366743,75	-631,20	49146	70,65	0,998892	✍	7,07	73,49	-4,35
765,0	-58,49	212,71	1547982,69	6366742,42	-633,76	49236	71,17	0,999099	✍	7,14	73,84	-4,37
768,0	-58,50	213,54	1547981,83	6366741,10	-636,32	49289	71,49	0,999319	✍	7,20	74,23	-4,39
771,0	-58,43	213,77	1547980,96	6366739,80	-638,87	49444	71,52	0,999153	✍	7,26	74,62	-4,42
774,0	-58,48	213,46	1547980,09	6366738,49	-641,43	49503	71,28	0,999725	✍	7,32	75,02	-4,45
777,0	-58,47	212,07	1547979,24	6366737,17	-643,99	49732	70,99	0,998792	✍	7,38	75,39	-4,47
780,0	-58,47	213,01	1547978,40	6366735,85	-646,54	49205	70,95	0,998937	✍	7,44	75,76	-4,50
783,0	-58,45	213,05	1547977,54	6366734,53	-649,10	49552	70,89	0,999281	✍	7,51	76,14	-4,52
786,0	-58,43	212,84	1547976,69	6366733,22	-651,66	49511	71,01	0,999166	✍	7,57	76,52	-4,55
789,0	-58,42	211,99	1547975,85	6366731,89	-654,21	49518	70,88	0,999059	✍	7,64	76,88	-4,57

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Station	Dip	Azimuth	Easting	Northing	Elevation	Mag.Field	Mag.Dip	Grav.Field	Status	UpDown	LeftRight	Shortfall
Metres	Degrees	Degrees	Metres	Metres	Metres	nT	Degrees	G	*	Metres	Metres	Metres
792,0	-58,42	213,34	1547975,00	6366730,57	-656,77	49594	70,97	0,999174	✍	7,71	77,25	-4,59
795,0	-58,41	213,18	1547974,14	6366729,25	-659,32	49803	70,99	0,999093	✍	7,77	77,64	-4,62
798,0	-58,39	213,39	1547973,27	6366727,94	-661,88	49365	70,57	0,999246	✍	7,83	78,03	-4,64
801,0	-58,38	212,58	1547972,42	6366726,62	-664,43	49962	70,37	0,999338	✍	7,90	78,41	-4,67
804,0	-58,34	212,76	1547971,57	6366725,30	-666,99	49807	70,81	0,999156	✍	7,97	78,78	-4,69
807,0	-58,35	212,32	1547970,72	6366723,97	-669,54	49647	70,55	0,998812	✍	8,04	79,15	-4,72
810,0	-58,31	212,67	1547969,87	6366722,64	-672,09	49860	70,60	0,999122	✍	8,11	79,52	-4,74
813,0	-58,28	213,12	1547969,02	6366721,32	-674,65	49634	70,86	0,998974	✍	8,19	79,90	-4,76
816,0	-58,27	214,11	1547968,15	6366720,00	-677,20	49679	71,04	0,999157	✍	8,25	80,29	-4,79
819,0	-58,26	213,32	1547967,27	6366718,69	-679,75	49617	70,67	0,998949	✍	8,32	80,69	-4,82
822,0	-58,24	213,14	1547966,40	6366717,37	-682,30	49794	70,67	0,998771	✍	8,40	81,08	-4,85
825,0	-58,22	213,59	1547965,54	6366716,05	-684,85	49612	70,77	0,998828	✍	8,47	81,47	-4,87
828,0	-58,18	213,49	1547964,66	6366714,73	-687,40	49761	70,82	0,999115	✍	8,54	81,87	-4,90
831,0	-58,13	213,50	1547963,79	6366713,41	-689,95	49720	70,50	0,998580	✍	8,62	82,27	-4,93
834,0	-58,12	213,65	1547962,91	6366712,09	-692,50	49536	70,67	0,998492	✍	8,69	82,67	-4,95
837,0	-58,08	213,56	1547962,04	6366710,77	-695,04	49671	70,93	0,999239	✍	8,77	83,07	-4,98
840,0	-58,05	213,71	1547961,16	6366709,45	-697,59	49615	71,06	0,999220	✍	8,85	83,47	-5,01
843,0	-58,04	213,28	1547960,28	6366708,13	-700,14	49890	70,74	0,999061	✍	8,93	83,86	-5,04
846,0	-58,03	212,62	1547959,42	6366706,79	-702,68	49684	70,34	0,999109	✍	9,02	84,25	-5,06
849,0	-58,01	212,57	1547958,56	6366705,46	-705,23	50128	69,65	0,998956	✍	9,10	84,62	-5,09
852,0	-58,01	213,65	1547957,69	6366704,12	-707,77	49229	71,05	0,998922	✍	9,19	85,01	-5,11
855,0	-58,02	213,33	1547956,82	6366702,80	-710,31	49528	70,76	0,998774	✍	9,27	85,41	-5,14
858,0	-57,99	213,77	1547955,94	6366701,47	-712,86	49800	70,94	0,999240	✍	9,36	85,80	-5,17
861,0	-57,96	213,10	1547955,06	6366700,15	-715,40	49539	70,62	0,999029	✍	9,44	86,20	-5,20
864,0	-57,92	213,40	1547954,19	6366698,82	-717,94	49909	70,71	0,998999	✍	9,53	86,59	-5,22
867,0	-57,90	213,02	1547953,31	6366697,48	-720,49	49911	70,61	0,998897	✍	9,62	86,98	-5,25
870,0	-57,88	213,01	1547952,45	6366696,14	-723,03	49951	70,78	0,998722	✍	9,71	87,37	-5,28
873,0	-57,78	213,07	1547951,57	6366694,81	-725,57	49832	70,31	0,998864	✍	9,80	87,76	-5,30
876,0	-57,72	213,13	1547950,70	6366693,46	-728,10	49807	70,50	0,998682	✍	9,90	88,15	-5,33
879,0	-57,68	212,33	1547949,83	6366692,12	-730,64	49650	70,55	0,998907	✍	10,01	88,53	-5,36
882,0	-57,67	213,34	1547948,96	6366690,77	-733,17	49358	70,82	0,998546	✍	10,11	88,91	-5,38
885,0	-57,67	213,79	1547948,08	6366689,43	-735,71	49193	71,05	0,998986	✍	10,21	89,32	-5,41
888,0	-57,59	213,29	1547947,19	6366688,09	-738,24	49684	70,80	0,999082	✍	10,31	89,72	-5,44

FLEXIT: SmartTool drillhole survey result table.

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Station Metres	Dip Degrees	Azimuth Degrees	Easting Metres	Northing Metres	Elevation Metres	Mag.Field nT	Mag.Dip Degrees	Grav.Field G	Status *	UpDown Metres	LeftRight Metres	Shortfall Metres
891,0	-57,58	213,22	1547946,31	6366686,75	-740,78	49479	70,88	0,999058	✍	10,42	90,11	-5,47
894,0	-57,54	214,19	1547945,41	6366685,41	-743,31	50075	70,86	0,998851	✍	10,52	90,52	-5,50
897,0	-57,51	212,84	1547944,52	6366684,07	-745,84	49885	70,72	0,998887	✍	10,63	90,93	-5,53
900,0	-57,47	212,63	1547943,65	6366682,71	-748,37	49408	70,66	0,999099	✍	10,74	91,31	-5,56
903,0	-57,46	213,06	1547942,78	6366681,35	-750,90	49434	70,77	0,998753	✍	10,86	91,70	-5,58
906,0	-57,43	212,92	1547941,90	6366680,00	-753,43	49524	70,86	0,999008	✍	10,97	92,09	-5,61
909,0	-57,42	213,13	1547941,02	6366678,65	-755,95	49624	70,76	0,998745	✍	11,09	92,48	-5,64
912,0	-57,40	213,24	1547940,13	6366677,29	-758,48	49766	70,91	0,999099	✍	11,20	92,87	-5,67
915,0	-57,39	212,43	1547939,26	6366675,94	-761,01	49222	70,81	0,999205	✍	11,32	93,26	-5,69
918,0	-57,35	212,81	1547938,39	6366674,57	-763,54	49709	70,71	0,998730	✍	11,44	93,64	-5,72
921,0	-57,36	212,13	1547937,52	6366673,21	-766,06	49709	70,60	0,998820	✍	11,57	94,02	-5,75
924,0	-57,39	211,41	1547936,67	6366671,83	-768,59	50129	71,16	0,998648	✍	11,69	94,38	-5,77
927,0	-57,35	212,00	1547935,82	6366670,46	-771,12	49909	71,01	0,998720	✍	11,82	94,73	-5,80
930,0	-57,34	212,71	1547934,95	6366669,09	-773,64	49757	70,38	0,998629	✍	11,94	95,10	-5,82
933,0	-57,32	213,70	1547934,06	6366667,73	-776,17	49578	70,39	0,999146	✍	12,06	95,50	-5,85
936,0	-57,31	213,09	1547933,17	6366666,38	-778,69	49375	70,31	0,998523	✍	12,18	95,91	-5,88
939,0	-57,32	212,62	1547932,29	6366665,02	-781,22	49415	70,59	0,998979	✍	12,30	96,29	-5,91
942,0	-57,29	212,76	1547931,42	6366663,66	-783,74	49863	70,52	0,998946	✍	12,43	96,68	-5,93
945,0	-57,27	213,15	1547930,53	6366662,30	-786,27	49678	70,55	0,998980	✍	12,55	97,07	-5,96
948,0	-57,24	213,23	1547929,65	6366660,94	-788,79	49856	70,81	0,998665	✍	12,67	97,47	-5,99
951,0	-57,23	212,95	1547928,76	6366659,58	-791,31	49916	70,58	0,999091	✍	12,80	97,86	-6,02
954,0	-57,21	212,36	1547927,88	6366658,21	-793,83	49655	70,53	0,998986	✍	12,93	98,24	-6,05
957,0	-57,21	212,35	1547927,01	6366656,84	-796,36	49584	70,66	0,998985	✍	13,06	98,62	-6,07
960,0	-57,17	212,53	1547926,14	6366655,47	-798,88	49573	70,42	0,998578	✍	13,19	99,00	-6,10
963,0	-57,13	212,52	1547925,27	6366654,09	-801,40	49779	70,84	0,998837	✍	13,32	99,38	-6,13
966,0	-57,11	213,23	1547924,38	6366652,73	-803,92	49830	70,47	0,999075	✍	13,45	99,77	-6,16
969,0	-57,09	212,98	1547923,49	6366651,36	-806,43	49877	70,41	0,998889	✍	13,59	100,17	-6,19
972,0	-57,08	212,95	1547922,61	6366649,99	-808,95	49709	70,76	0,998864	✍	13,72	100,56	-6,22
975,0	-57,03	212,86	1547921,72	6366648,62	-811,47	49936	71,07	0,998801	✍	13,85	100,95	-6,24
978,0	-57,03	213,14	1547920,83	6366647,25	-813,99	49613	70,87	0,998694	✍	13,99	101,35	-6,27
981,0	-57,02	213,11	1547919,94	6366645,89	-816,50	49829	70,74	0,998701	✍	14,13	101,74	-6,30
984,0	-57,02	213,42	1547919,04	6366644,52	-819,02	49895	70,82	0,998777	✍	14,26	102,15	-6,33
987,0	-56,96	212,78	1547918,15	6366643,15	-821,54	49602	70,77	0,998863	✍	14,40	102,55	-6,36

Survey name : KLX08 in
Survey date : 06/09/2005 13:40:48

Printed on 2005-09-07 19:42:43

Station	Dip	Azimuth	Easting	Northing	Elevation	Mag.Field	Mag.Dip	Grav.Field	Status	UpDown	LeftRight	Shortfall
Metres	Degrees	Degrees	Metres	Metres	Metres	nT	Degrees	G	*	Metres	Metres	Metres
990,0	-56,95	212,56	1547917,27	6366641,77	-824,05	49499	70,86	0,998682	✍	14,54	102,93	-6,39

Deviation logging in HLX30, 0 to 159 m

New MeasureIT files

Survey name:	**HLX30 in**
Survey date:	31/08/2005 13:51:50
Project:	PLU
Location:	Laxemar
Country:	Sweden
Survey company:	Mala GeoScience / RAYCON
Surveyed by:	Christer Gustafsson
Survey type:	STANDARD
Operating conditions:	
General comments:	
Client name:	SKB
Client ID number:	
Client reference:	Leif Stenberg
Drill company:	
Drill rig:	
Drill diameter:	140
Survey direction:	INTO hole
Survey run on:	Wireline
Magnetic Var.:	2,33 degrees East of North

FLEXIT

Conventions

Linear units:	Metres
Angular units:	Degrees
Temperature units:	Centigrade
Co-ordinate system:	0 North
Elevation positive	Up
Dip origin:	0 Horizontal
Dip positive:	Up

Magnetic Integrity Check (MagIC)

	Mid value	± limit	
Field strength:	49600	1000	nano Tesla
Magnetic dip:	71.4	1.5	Degrees

SURVEY	Actual start	End of survey	Difference
Station:	0,0	159,0	159,0
East:	1548026,73	1548086,35	59,62
North:	6366730,73	6366767,62	36,89
Elevation:	12,18	-130,39	-142,57
Dip:	-60,86	-68,60	-7,74
Azimuth:	56,00	59,73	3,73

OFFSETS at end

Offsets relative to:
ACTUAL START

8,23 metres downwards
2,76 metres right
0,36 metres shortfall

Printed on: 2005-09-08 17:26:11

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FLEXIT: SmartTool drillhole survey result table.

Survey name : HLX30 in
Survey date : 31/08/2005 13:51:50
Printed on 2005-09-08 17:26:36

Station	Dip	Azimuth	Easting	Northing	Elevation	Mag.Field	Mag.Dip	Grav.Field	Status	UpDown	LeftRight	Shortfall
Metres	Degrees	Degrees	Metres	Metres	Metres	nT	Degrees	G	*	Metres	Metres	Metres
0,0	-60,86	56,00	1548026,73	6366730,73	12,18	50158	72,48	1,002148	✍	0,00	0,00	0,00
3,0	-61,04	56,35	1548027,94	6366731,54	9,56	49679	71,90	0,999503	✍	0,00	0,00	0,00
6,0	-60,46	55,69	1548029,15	6366732,36	6,94	49674	71,62	0,997753	✍	0,00	0,00	0,00
9,0	-60,62	55,90	1548030,38	6366733,19	4,33	50138	71,31	0,999102	✍	0,02	0,00	0,00
12,0	-61,17	56,14	1548031,59	6366734,01	1,71	50138	71,30	0,999258	✍	0,02	0,00	0,00
15,0	-61,20	55,89	1548032,78	6366734,82	-0,92	50187	71,19	0,999106	✍	0,00	0,00	0,00
18,0	-61,34	56,29	1548033,98	6366735,62	-3,55	50223	71,22	0,999255	✍	-0,02	0,00	0,00
21,0	-61,58	56,09	1548035,17	6366736,42	-6,19	50175	71,20	0,999092	✍	-0,05	0,01	0,00
24,0	-61,83	56,43	1548036,35	6366737,21	-8,83	50073	71,28	0,999290	✍	-0,10	0,01	0,00
27,0	-62,09	56,98	1548037,53	6366737,98	-11,48	50233	71,28	0,999219	✍	-0,16	0,03	0,00
30,0	-62,07	56,79	1548038,71	6366738,75	-14,13	50151	71,25	0,999128	✍	-0,22	0,05	0,00
33,0	-62,27	57,15	1548039,88	6366739,51	-16,78	50251	71,28	0,999063	✍	-0,29	0,08	0,00
36,0	-62,31	57,56	1548041,06	6366740,27	-19,44	50260	71,32	0,999361	✍	-0,36	0,11	0,00
39,0	-62,39	57,63	1548042,23	6366741,01	-22,09	50325	71,13	0,999318	✍	-0,44	0,15	-0,01
42,0	-62,41	57,82	1548043,41	6366741,76	-24,75	49861	71,36	0,998988	✍	-0,52	0,19	-0,01
45,0	-62,42	57,18	1548044,58	6366742,50	-27,41	50092	71,46	0,999096	✍	-0,61	0,23	-0,01
48,0	-62,45	57,93	1548045,75	6366743,25	-30,07	49924	71,51	0,998699	✍	-0,69	0,26	-0,01
51,0	-62,55	58,22	1548046,93	6366743,98	-32,73	49254	71,41	0,999253	✍	-0,78	0,31	-0,01
54,0	-62,56	57,53	1548048,10	6366744,71	-35,39	49603	71,38	0,999274	✍	-0,86	0,36	-0,01
57,0	-62,63	58,17	1548049,27	6366745,45	-38,06	49491	71,20	0,999143	✍	-0,96	0,40	-0,01
60,0	-62,76	56,73	1548050,43	6366746,19	-40,72	50128	71,13	0,999316	✍	-1,05	0,44	-0,02
63,0	-62,89	57,86	1548051,58	6366746,93	-43,39	50151	71,31	0,999286	✍	-1,16	0,47	-0,02
66,0	-62,60	57,08	1548052,74	6366747,67	-46,06	50213	71,38	0,998859	✍	-1,26	0,51	-0,02
69,0	-62,77	58,47	1548053,90	6366748,40	-48,73	50172	71,22	0,999054	✍	-1,35	0,55	-0,02
72,0	-62,72	59,07	1548055,08	6366749,11	-51,39	49617	71,37	0,999364	✍	-1,45	0,61	-0,02
75,0	-62,88	57,93	1548056,25	6366749,83	-54,06	49570	70,83	0,999198	✍	-1,55	0,67	-0,03
78,0	-62,81	58,86	1548057,41	6366750,55	-56,73	49840	70,96	0,999112	✍	-1,66	0,73	-0,03
81,0	-62,95	58,90	1548058,58	6366751,26	-59,40	49604	71,23	0,999252	✍	-1,77	0,80	-0,03
84,0	-63,18	57,75	1548059,74	6366751,97	-62,07	50437	70,94	0,998989	✍	-1,88	0,86	-0,03
87,0	-63,39	58,85	1548060,89	6366752,68	-64,75	50200	71,10	0,998964	✍	-2,01	0,91	-0,04
90,0	-63,29	59,00	1548062,04	6366753,37	-67,44	50251	71,31	0,998996	✍	-2,14	0,98	-0,04
93,0	-63,56	60,10	1548063,20	6366754,05	-70,12	49916	71,45	0,999274	✍	-2,28	1,06	-0,05
96,0	-63,53	60,45	1548064,36	6366754,72	-72,80	49835	71,39	0,999198	✍	-2,42	1,16	-0,05

FLEXIT: SmartTool drillhole survey result table.

Survey name : HLX30 in
Survey date : 31/08/2005 13:51:50
Printed on 2005-09-08 17:26:36

Station Metres	Dip Degrees	Azimuth Degrees	Easting Metres	Northing Metres	Elevation Metres	Mag.Field nT	Mag.Dip Degrees	Grav.Field G	Status *	UpDown Metres	LeftRight Metres	Shortfall Metres
99,0	-63,95	57,54	1548065,50	6366755,40	-75,50	49773	71,26	0,998960	✍	-2,58	1,23	-0,06
102,0	-63,97	60,63	1548066,63	6366756,08	-78,19	49168	71,54	0,999274	✍	-2,74	1,30	-0,06
105,0	-64,40	59,99	1548067,76	6366756,72	-80,89	50275	71,27	0,999274	✍	-2,92	1,40	-0,07
108,0	-64,37	59,50	1548068,88	6366757,38	-83,60	50640	71,22	0,999504	✍✍	-3,11	1,48	-0,08
111,0	-64,72	59,00	1548069,99	6366758,03	-86,31	48353	70,45	0,999388	✍✍	-3,30	1,56	-0,08
114,0	-65,11	60,00	1548071,08	6366758,68	-89,02	48906	70,21	0,998974	✍	-3,51	1,63	-0,09
117,0	-65,38	59,42	1548072,17	6366759,31	-91,75	50254	71,31	0,999611	✍	-3,75	1,72	-0,10
120,0	-65,70	59,00	1548073,24	6366759,95	-94,48	48484	71,05	0,999713	✍✍	-3,99	1,79	-0,11
123,0	-65,73	58,83	1548074,29	6366760,59	-97,21	49934	71,40	0,999206	✍	-4,25	1,85	-0,12
126,0	-66,12	58,87	1548075,34	6366761,22	-99,95	50295	71,37	0,999261	✍	-4,51	1,91	-0,14
129,0	-66,40	59,31	1548076,38	6366761,84	-102,70	50365	71,51	0,999340	✍	-4,80	1,97	-0,15
132,0	-66,69	59,21	1548077,40	6366762,45	-105,45	50504	71,54	0,999242	✍	-5,10	2,04	-0,17
135,0	-66,62	59,01	1548078,42	6366763,06	-108,20	50522	71,65	0,999099	✍	-5,40	2,11	-0,18
138,0	-66,91	61,23	1548079,45	6366763,65	-110,96	49201	71,18	0,999038	✍	-5,71	2,19	-0,20
141,0	-67,05	60,72	1548080,47	6366764,22	-113,72	49575	71,00	0,999917	✍	-6,04	2,29	-0,22
144,0	-67,56	61,38	1548081,49	6366764,78	-116,49	49525	71,37	0,999718	✍	-6,38	2,40	-0,24
147,0	-67,50	59,04	1548082,48	6366765,35	-119,26	50304	70,94	0,999800	✍	-6,73	2,48	-0,26
150,0	-67,86	59,11	1548083,46	6366765,94	-122,04	50264	70,90	0,999532	✍	-7,09	2,54	-0,28
153,0	-67,89	60,77	1548084,44	6366766,50	-124,82	49629	70,53	0,999534	✍	-7,46	2,62	-0,31
156,0	-68,32	59,13	1548085,41	6366767,06	-127,60	50176	71,38	0,999839	✍	-7,84	2,70	-0,33
159,0	-68,60	59,73	1548086,35	6366767,62	-130,39	50506	71,13	0,999909	✍	-8,23	2,76	-0,36

Appendix 9

Deviation logging in HLX33, 0 to 198 m

New MeasureIT files

Survey name:	HLX33 in
Survey date:	01/09/2005 12:18:20
Project:	PLU
Location:	Laxemar
Country:	Sweden
Survey company:	Mala GeoScience / RAYCON
Surveyed by:	Christer Gustafsson
Survey type:	STANDARD
Operating conditions:	
General comments:	
Client name:	SKB
Client ID number:	
Client reference:	Leif Stenberg
Drill company:	
Drill rig:	
Drill diameter:	140
Survey direction:	INTO hole
Survey run on:	Wireline
Magnetic Var.:	2,33 degrees East of North

Conventions	
Linear units:	Metres
Angular units:	Degrees
Temperature units:	Centigrade
Co-ordinate system:	0 North
Elevation positive	Up
Dip origin:	0 Horizontal
Dip positive:	Up

Magnetic Integrity Check (MagIC)	Mid value	± limit	
Field strength:	49600	1000	nano Tesla
Magnetic dip:	71.4	1.5	Degrees

SURVEY	Actual start	End of survey	Difference
Station:	0,0	198,0	198,0
East:	1548562,71	1548598,03	35,32
North:	6366471,74	6366557,85	86,11
Elevation:	12,20	-162,47	-174,67
Dip:	-59,38	-65,71	-6,33
Azimuth:	21,80	23,12	1,32

OFFSETS at end
Offsets relative to: ACTUAL START
8,88 metres downwards
0,82 metres right
0,28 metres shortfall

Printed on: 2005-09-09 00:43:06

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FLEXIT: SmartTool drillhole survey result table.

Survey name : HLX33 in
Survey date : 01/09/2005 12:18:20

Printed on 2005-09-09 00:43:15

Station Metres	Dip Degrees	Azimuth Degrees	Easting Metres	Northing Metres	Elevation Metres	Mag.Field nT	Mag.Dip Degrees	Grav.Field G	Status *	UpDown Metres	LeftRight Metres	Shortfall Metres
0,0	-59,38	21,80	1548562,71	6366471,74	12,20	50208	71,42	1,001337	✍	0,00	0,00	0,00
3,0	-58,91	22,03	1548563,28	6366473,17	9,63	50195	71,64	1,001584	✍	0,01	0,00	0,00
6,0	-58,65	22,00	1548563,86	6366474,61	7,06	50147	71,21	0,999314	✍	0,04	0,01	0,00
9,0	-59,03	22,88	1548564,45	6366476,05	4,49	49819	71,44	0,998540	✍	0,07	0,03	0,00
12,0	-59,34	21,35	1548565,03	6366477,47	1,92	50230	71,26	0,999329	✍	0,08	0,03	0,00
15,0	-58,88	21,94	1548565,60	6366478,90	-0,66	50287	71,50	0,999713	✍	0,10	0,03	0,00
18,0	-59,32	22,48	1548566,18	6366480,33	-3,23	50313	71,49	1,000046	✍	0,11	0,04	0,00
21,0	-59,61	21,79	1548566,76	6366481,74	-5,82	50263	71,36	0,998004	✍	0,10	0,05	0,00
24,0	-59,73	22,22	1548567,33	6366483,15	-8,41	50263	71,57	1,000241	✍	0,09	0,06	0,00
27,0	-60,02	22,14	1548567,89	6366484,54	-11,00	50342	71,63	0,999674	✍	0,06	0,07	0,00
30,0	-60,20	22,84	1548568,47	6366485,92	-13,60	49901	71,46	1,000256	✍	0,03	0,08	0,00
33,0	-60,47	22,27	1548569,04	6366487,29	-16,21	49938	71,30	0,999627	✍	-0,02	0,10	0,00
36,0	-60,56	21,89	1548569,59	6366488,66	-18,82	50280	71,18	0,999527	✍	-0,08	0,11	0,00
39,0	-60,70	22,93	1548570,15	6366490,02	-21,43	50421	71,28	0,999728	✍	-0,15	0,13	0,00
42,0	-60,79	21,63	1548570,71	6366491,38	-24,05	49446	71,41	1,000116	✍	-0,22	0,14	0,00
45,0	-60,85	23,01	1548571,26	6366492,73	-26,67	49660	71,54	0,999755	✍	-0,30	0,15	0,00
48,0	-61,01	23,00	1548571,83	6366494,07	-29,29	49017	69,85	0,999729	✍✍	-0,38	0,18	-0,01
51,0	-61,06	23,22	1548572,40	6366495,41	-31,92	49204	71,27	1,000031	✍	-0,47	0,22	-0,01
54,0	-61,20	21,94	1548572,96	6366496,75	-34,54	49197	71,24	0,999333	✍	-0,56	0,24	-0,01
57,0	-61,32	21,77	1548573,50	6366498,08	-37,18	50576	71,57	0,999613	✍	-0,66	0,24	-0,01
60,0	-61,34	21,88	1548574,03	6366499,42	-39,81	50181	71,31	0,999987	✍	-0,76	0,24	-0,01
63,0	-61,51	21,89	1548574,57	6366500,75	-42,44	50260	71,56	1,000526	✍	-0,87	0,24	-0,01
66,0	-61,50	21,79	1548575,10	6366502,08	-45,08	50309	71,35	0,999797	✍	-0,98	0,24	-0,02
69,0	-61,50	21,36	1548575,62	6366503,41	-47,72	49919	71,42	1,000037	✍	-1,09	0,24	-0,02
72,0	-61,53	21,92	1548576,15	6366504,74	-50,35	49879	71,49	1,000059	✍	-1,20	0,23	-0,02
75,0	-61,61	21,16	1548576,68	6366506,07	-52,99	50132	71,16	0,999990	✍	-1,32	0,22	-0,02
78,0	-61,64	21,29	1548577,19	6366507,40	-55,63	50164	71,54	0,999989	✍	-1,43	0,21	-0,03
81,0	-61,67	21,29	1548577,71	6366508,73	-58,27	49979	71,64	1,000000	✍	-1,55	0,20	-0,03
84,0	-61,75	21,87	1548578,23	6366510,05	-60,91	49630	71,70	1,000290	✍	-1,68	0,19	-0,03
87,0	-61,88	21,08	1548578,75	6366511,37	-63,56	50340	71,39	1,000145	✍	-1,80	0,18	-0,03
90,0	-61,75	21,01	1548579,26	6366512,69	-66,20	49901	71,13	1,000598	✍	-1,93	0,17	-0,04
93,0	-61,98	22,48	1548579,78	6366514,00	-68,85	49780	71,74	1,000411	✍	-2,06	0,16	-0,04
96,0	-61,99	22,16	1548580,32	6366515,31	-71,49	50102	71,70	1,000882	✍	-2,20	0,18	-0,04

FLEXIT: SmartTool drillhole survey result table.

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Station Metres	Dip Degrees	Azimuth Degrees	Easting Metres	Northing Metres	Elevation Metres	Mag.Field nT	Mag.Dip Degrees	Grav.Field G	Status *	UpDown Metres	LeftRight Metres	Shortfall Metres
99,0	-62,06	21,79	1548580,85	6366516,61	-74,14	49640	71,67	1,000428	✍	-2,34	0,18	-0,04
102,0	-62,13	22,00	1548581,37	6366517,91	-76,80	50041	71,34	1,000656	✍	-2,48	0,18	-0,05
105,0	-62,18	22,39	1548581,90	6366519,21	-79,45	50057	71,55	1,000512	✍	-2,62	0,19	-0,05
108,0	-62,23	21,89	1548582,43	6366520,51	-82,10	49701	71,54	1,000536	✍	-2,77	0,20	-0,06
111,0	-62,25	22,79	1548582,96	6366521,80	-84,76	49863	71,70	1,000454	✍	-2,92	0,21	-0,06
114,0	-62,20	22,36	1548583,49	6366523,09	-87,41	49602	71,79	1,000777	✍	-3,07	0,23	-0,06
117,0	-62,24	22,41	1548584,03	6366524,38	-90,06	50030	71,76	1,001061	✍	-3,22	0,25	-0,07
120,0	-62,39	22,41	1548584,56	6366525,67	-92,72	50210	70,93	1,000881	✍	-3,37	0,26	-0,07
123,0	-62,32	21,71	1548585,08	6366526,96	-95,38	50519	70,87	1,000981	✍	-3,53	0,27	-0,07
126,0	-62,48	21,67	1548585,59	6366528,25	-98,04	50210	70,85	1,001107	✍	-3,69	0,27	-0,08
129,0	-62,48	22,83	1548586,12	6366529,54	-100,70	49920	71,23	1,000985	✍	-3,85	0,28	-0,08
132,0	-62,50	23,12	1548586,66	6366530,81	-103,36	49799	71,57	1,001094	✍	-4,01	0,31	-0,09
135,0	-62,53	23,48	1548587,21	6366532,08	-106,02	50447	71,45	1,001255	✍	-4,18	0,34	-0,09
138,0	-62,58	21,55	1548587,74	6366533,36	-108,68	50416	71,41	1,001581	✍	-4,34	0,36	-0,10
141,0	-62,55	23,01	1548588,26	6366534,64	-111,35	49328	71,61	1,001331	✍	-4,51	0,37	-0,10
144,0	-62,59	21,66	1548588,79	6366535,92	-114,01	48938	70,86	1,001322	✍	-4,68	0,38	-0,11
147,0	-62,65	21,67	1548589,30	6366537,20	-116,67	48106	70,31	1,001478	✍	-4,85	0,38	-0,11
150,0	-62,74	22,54	1548589,81	6366538,48	-119,34	49338	71,00	1,001906	✍	-5,02	0,39	-0,12
153,0	-62,77	22,13	1548590,34	6366539,75	-122,00	49189	71,09	1,001713	✍	-5,20	0,40	-0,12
156,0	-62,93	23,00	1548590,86	6366541,01	-124,67	49193	69,82	1,001468	✍✍	-5,38	0,42	-0,13
159,0	-63,01	23,46	1548591,40	6366542,26	-127,35	48969	70,74	1,001830	✍	-5,57	0,45	-0,13
162,0	-63,20	23,40	1548591,94	6366543,51	-130,02	50633	71,59	1,001707	✍✍	-5,76	0,49	-0,14
165,0	-63,37	23,40	1548592,47	6366544,75	-132,70	50173	71,51	1,001603	✍	-5,97	0,53	-0,15
168,0	-63,46	23,71	1548593,01	6366545,98	-135,38	48781	71,04	1,001579	✍	-6,18	0,57	-0,16
171,0	-63,82	22,62	1548593,53	6366547,20	-138,07	48918	70,77	1,001339	✍	-6,40	0,60	-0,16
174,0	-63,87	22,69	1548594,04	6366548,42	-140,77	49744	71,32	1,001896	✍	-6,64	0,62	-0,17
177,0	-64,08	22,39	1548594,55	6366549,64	-143,46	49783	71,01	1,001680	✍	-6,88	0,64	-0,18
180,0	-64,27	23,34	1548595,06	6366550,84	-146,16	49305	71,39	1,001288	✍	-7,13	0,66	-0,19
183,0	-64,72	23,24	1548595,57	6366552,03	-148,87	48851	70,99	1,001776	✍	-7,40	0,70	-0,21
186,0	-64,67	23,30	1548596,07	6366553,21	-151,58	48825	71,20	1,001491	✍	-7,68	0,73	-0,22
189,0	-65,05	22,14	1548596,57	6366554,38	-154,30	48843	71,17	1,001918	✍	-7,96	0,75	-0,23
192,0	-65,21	23,43	1548597,05	6366555,55	-157,02	48905	70,98	1,001465	✍	-8,26	0,77	-0,25
195,0	-65,16	22,54	1548597,55	6366556,70	-159,74	48836	71,35	1,001029	✍	-8,57	0,80	-0,26

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Station	Dip	Azimuth	Easting	Northing	Elevation	Mag.Field	Mag.Dip	Grav.Field	Status	UpDown	LeftRight	Shortfall
Metres	Degrees	Degrees	Metres	Metres	Metres	nT	Degrees	G	*	Metres	Metres	Metres
198,0	-65,71	23,12	1548598,03	6366557,85	-162,47	50425	72,08	1,001560	✍	-8,88	0,82	-0,28