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Oskarshamn site investigation

RAMAC, BIPS and deviation logging in borehole KLX27A

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Keywords: BIPS, RAMAC, Radar, TV, Deviation logging, Flexit.

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 KLX27A. All measurements were conducted by Malå Geoscience AB during December 2007 and February 2008.

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 KLX27A was good. In parts with lower quality, this is most probably 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. The borehole radar measurements resulted in 171 identified radar reflectors in KLX27A and of these 29 were orientated (strike/dip).

The BIPS images in the core drilled part of the borehole shows good quality along the borehole. Between 14 and 72 metres the images are very dark and it is almost impossible to see the borehole walls due to the larger borehole diameter and lack of light.

Sammanfattning

Denna rapport omfattar geofysiska loggningar inom platsundersökningsprogrammet för Oskarshamn. Mätningarna som presenteras här omfattar borrhålsradarmätningar (RAMAC), och BIPS- loggningar i kärnborrhålet KLX27A. I borrhålet genomfördes även avvikelsemätningar, s k krökningsmätningar. Alla mätningar är utförda av Malå Geoscience AB under december 2007 och februari 2008.

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 krökningsmätningarna är att mäta lutning och riktning och därmed få fram koordinater 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. Krökningsmätningen presenteras som en lista med lägesdata.

Borrhålsradardata från KLX27A var bra. I delar med sämre djuppenetration är detta troligen till stor del beroende på en konduktiv miljö. En konduktiv miljö minskar möjligheterna att identifiera strukturer från borrhålsradardata. 171 radarreflektorer har identifierats i KLX27A och av dessa har 29 orienterats (med strykning/stupning).

BIPS bilderna är av god kvalitet i den delen av borrhålet som är kärnborrat. Den upprymda övre delen mellan 14 meter ner till 72 meter är däremot mycket dålig. Det är främst den stora borrhålsdiametern och svaga belysningen som är orsaken.

Contents

1 Introduction

This report presents 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) and BIPS in the core drilled borehole KLX27A. Deviation measurements were also carried out.

The work was carried out in accordance with Activity Plan AP PS 400-07-064. In Table 1-1 the controlling documents for performing this activity are listed. Both the Activity Plan and Method Descriptions are SKB's internal controlling documents.

This report includes measurements from 0 to 650 m in KLX27A. The borehole was core drilled with a diameter of 76 mm from 77 m depth.

All measurements were conducted by Malå Geoscience AB during December 2007 and February 2008. The investigation site and location of the borehole 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's internal controlling documents).

Activity Plan	Number	Version
Borrhålsradar, BIPS och Flexit-mätning i KLX27A	AP PS 400-07-064	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	3.0
Metodbeskrivning för krökningsmätning av hammar- och kärnborrhål	SKB MD 224.001	1.0

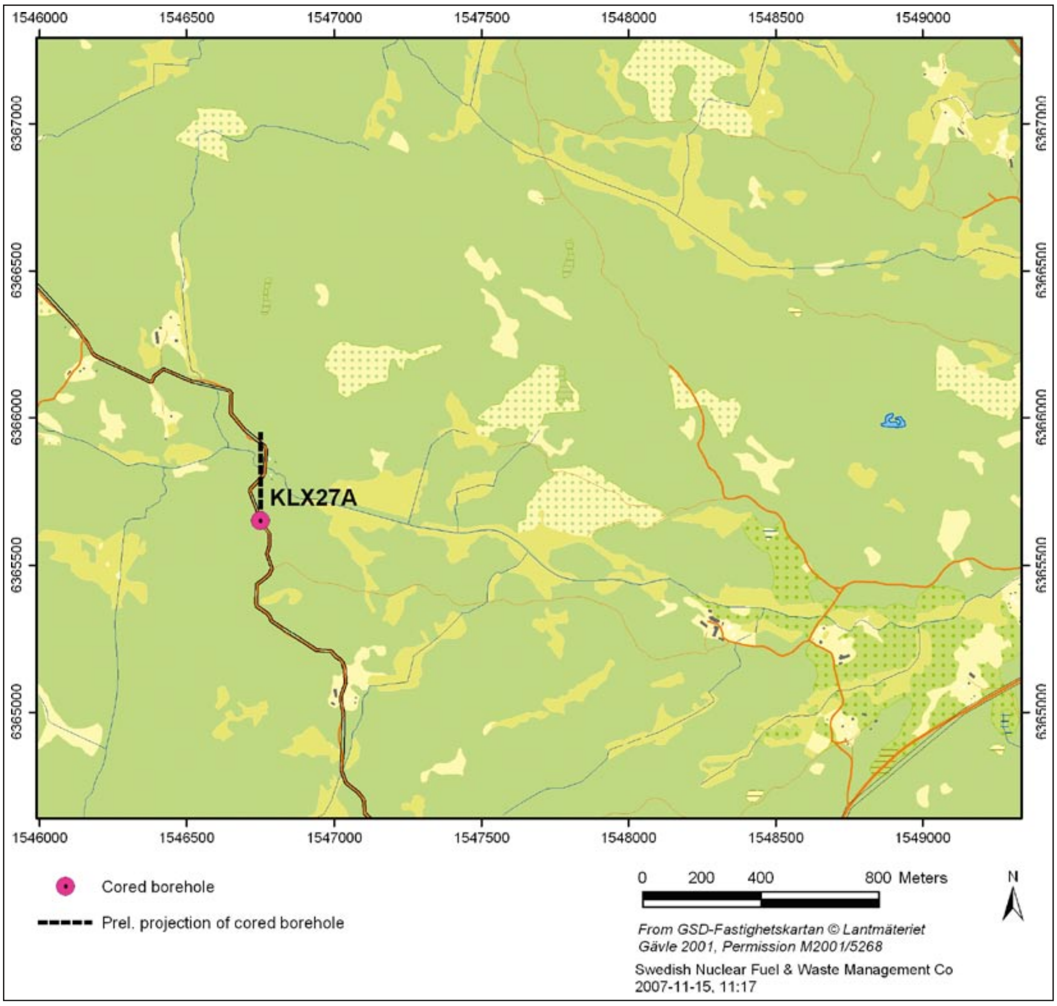


Figure 1-1. *Map of the location of the borehole KLX27A in the Laxemar subarea, Oskarshamn.*

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.

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).

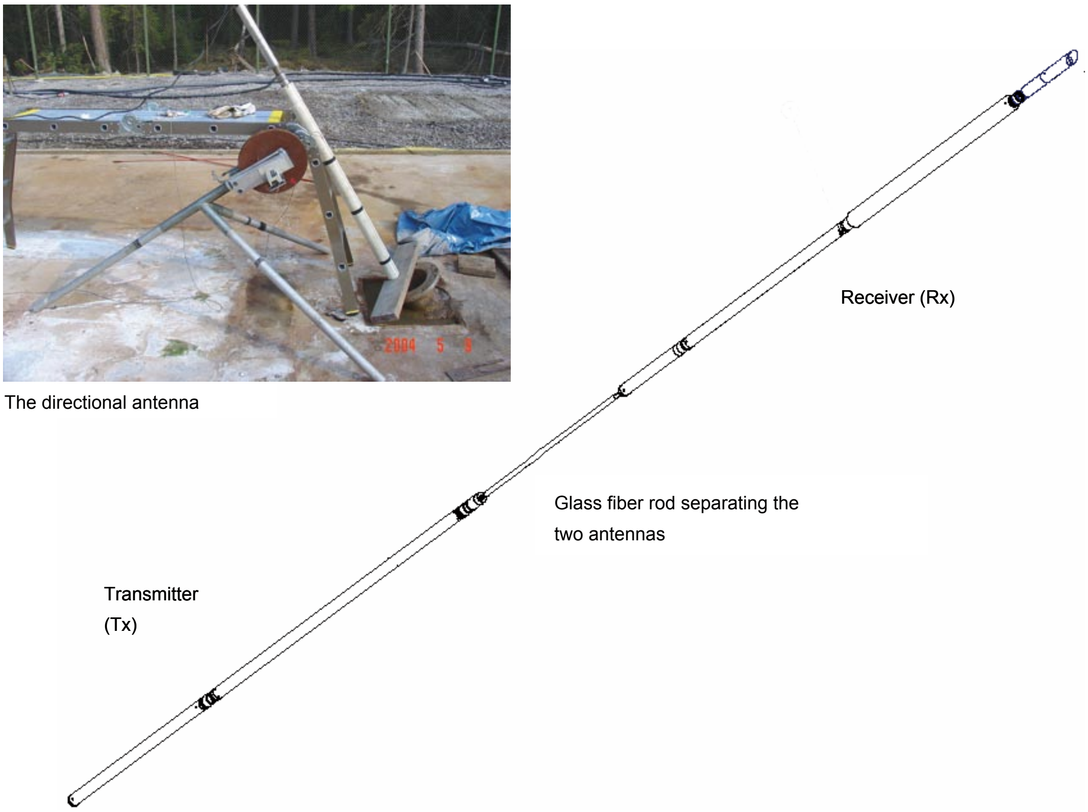


Figure 3-1. *Example of a borehole radar antenna.*

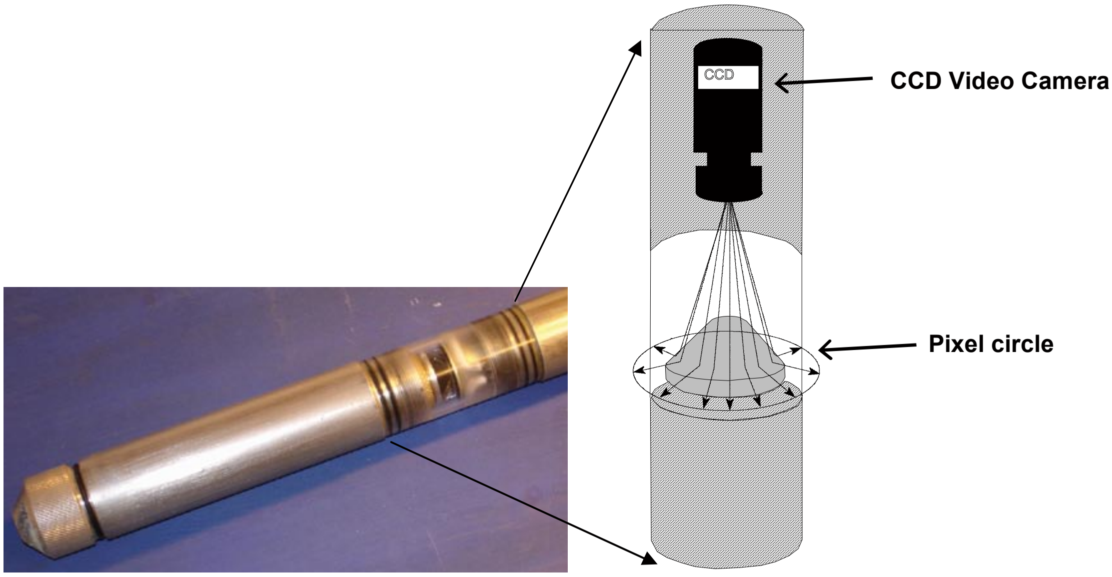


Figure 3-2. The BIP-system. Illustration of the conical mirror scanning.

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.

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

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.

4 Execution

4.1 General

4.1.1 RAMAC Radar

The measurements in KLX27A were carried out with dipole radar antennas, with frequencies of 250, 100 and 20 MHz. Measurements were also carried out with a 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 was made step wise, with a short pause for each measurement occasion. The antennas (transmitter and receiver, both for dipole and directional) were kept at a fixed separation by glass fiber rods according to Table 4-1. See also Figures 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 KLX27A. 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 approximately 8 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 KLX27A see Table 4-1 below.

Table 4-1. Radar logging information from KLX27A.

Site:	**Oskarshamn**	**Logging company:**	**MALÅ GeoScience**		
BH:	**KLX27A**	**Equipment:**	**SKB RAMAC**		
Type:	**Directional/Dipole**	**Manufacturer:**	**MALÅ GeoScience**		
Operator:	**CG**	**Antenna**			
		Directional	**250 MHz**	**100 MHz**	**20 MHz**
Logging date:		2008-02-19	2007-12-06	2007-12-06	2007-12-07
Reference:		TOC	TOC	TOC	TOC
Sampling frequency (MHz):		615	2,424	891	239
Number of samples:		512	619	518	518
Number of stacks:		32	Auto	Auto	Auto
Signal position:		410.5	–0.37	–0.37	–1.42
Logging from (m):		78.4	1.5	2.6	6.25
Logging to (m):		638.4	646.3	646.0	636.9
Trace interval (m):		0.5	0.1	0.2	0.25
Antenna separation (m):		5.73	2.4	3.9	10.05

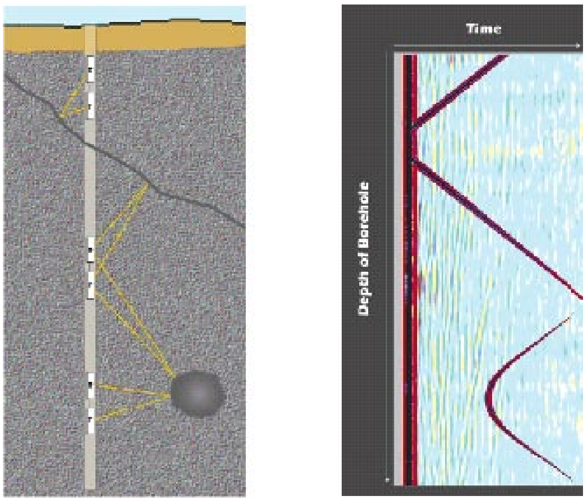


Figure 4-1. The principle of radar borehole reflection survey and an example of result.

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 based on an air bulb in an alcohol liquid was used to measure the orientation of the images in the borehole KLX27A.

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 shows the results of the test logging performed before and after the logging campaign in December 2007. 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 presented in Appendix 2 in this report.

4.1.3 Deviation measurements

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 was 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 of the borehole up to the surface. For the operation in the core drilled boreholes 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 metre by the actual marks on the logging cable. Maximum depth error for the measuring wheel is 0.5%.

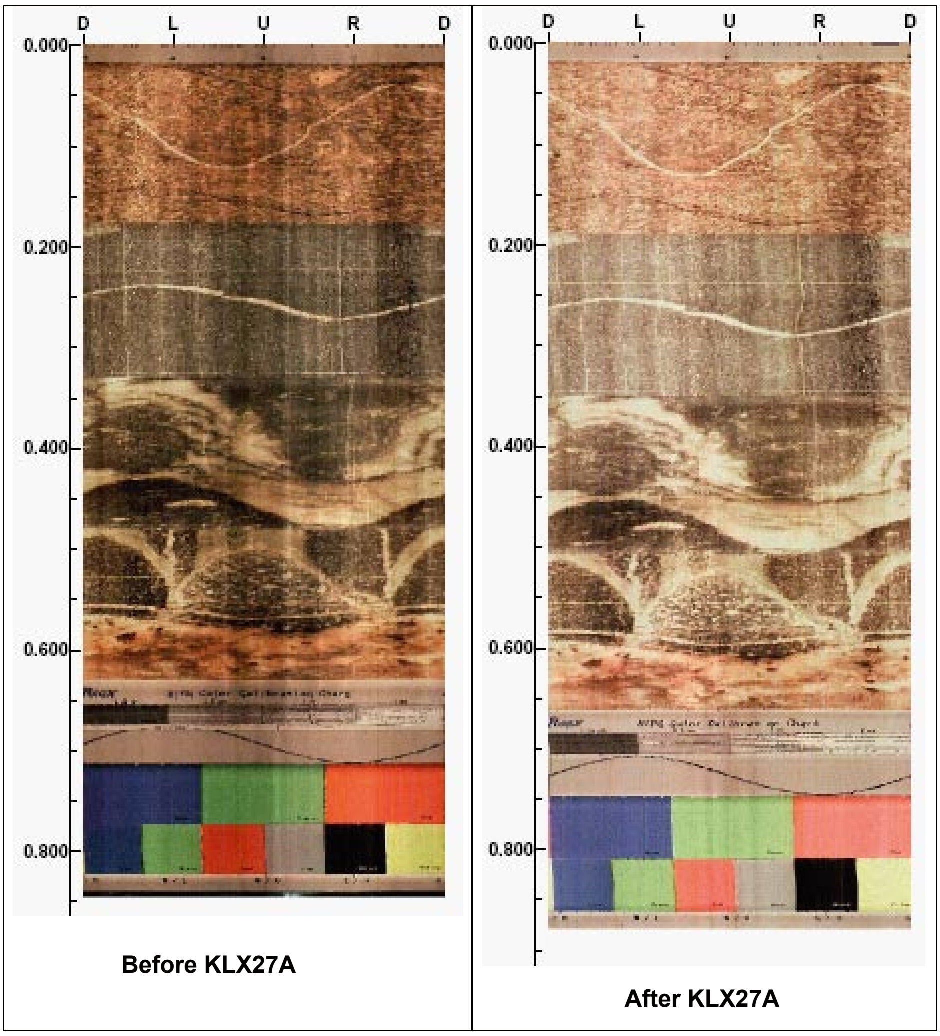


Figure 4-2. Results from logging in the test pipe before and after the logging campaign in December, 2007.

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 Appendix 2. 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 metre deep borehole.

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

4.2 Analyses and Interpretatoin

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 radar wave propagation and reflection 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 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 object 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 earlier performed between KLX07A and KLX07B by keeping the transmitter fixed in one borehole while moving the receiver downwards in a nearby borehole was used. 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 fracture zone in the depth interval 40 to 60 m.

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 Table 4-2. It should be observed that the processing steps in Table 4-2 below refer to Appendix 1 in this report.

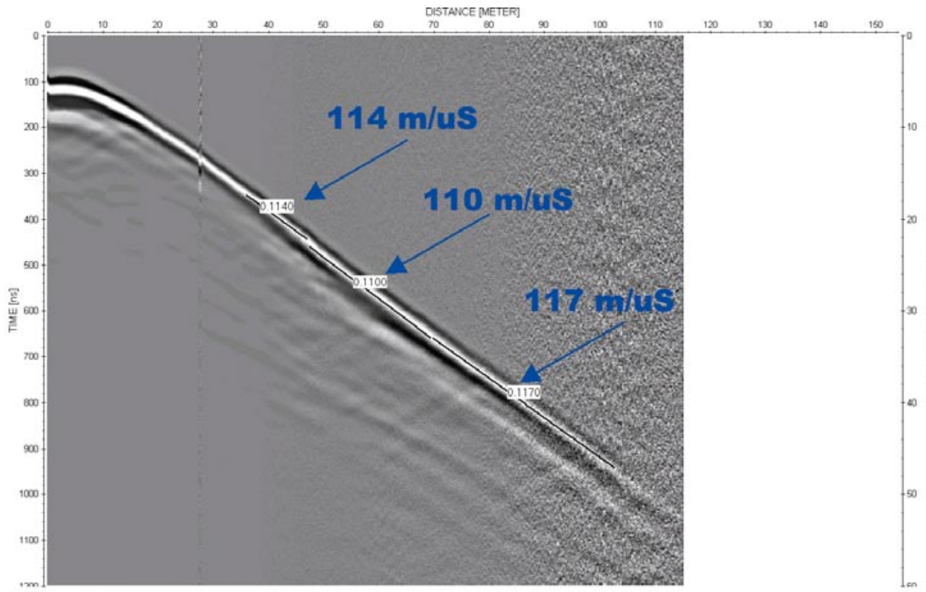


Figure 4-3. Results from velocity measurements /1/.

Table 4-2. Processing steps for borehole radar data from KLX27A.

Site:	**Oskarshamn**	**Logging company:**	**MALÅ GeoScience/RAYCON**		
BH:	**KLX27A**	**Equipment:**	**SKB RAMAC**		
Type:	**Directional/Dipole**	**Manufacturer:**	**MALÅ GeoScience**		
Interpret:	**JG**	**Antenna**			
		Directional	**250 MHz**	**100 MHz**	**20 MHz**
Processing:		Move start time (–41 samples)	Move start time (–25.3)	Move start time (–37.8)	Move start time (–86.8)
		DC shift (409–511)	DC shift (190–230)	DC shift (470–530)	DC shift (1,800–2,000)
		Time gain (start 76 lin 100 exp 1)	Gain (start 9 lin 14 exp 1)	Gain (start 35 lin 3 exp 0.4)	Gain (start 72 lin 4.3 exp 0.1)
		(FIR)			

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 Table 5-2 and are also visible on the radargrams in Appendix 1.

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 measurements

The resulting data from the deviation measurements were corrected relatively to the magnetic North, 2.73 degrees east of RT90 North for the presentation in Appendix 3. For delivery to SICADA the azimuth was delivered relatively to magnetic North.

4.3 Nonconformities

During the logging campaign in December 2007 the directional antenna failed, so this logging was carried out in February 2008 instead.

5 Results

The results from the BIPS measurements for KLX27A 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 (dipole antennas) or *.rd5 (directional antenna) for KLX27A 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 Appendix 3 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 5-4. Radar data is also visualized in Appendix 1. It should be remembered that the images in Appendix 1 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. An overview of the borehole are given in Figure 5-1 below. A number of minor structures also exist but not interpreted as indicated in Appendix 1. 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. Larger structures parallel to the borehole, if present, are also indicated in Appendix 1, see Figure 5-2. 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 KLX27A (as seen in Appendix1) is good, but in smaller parts of lower quality due to more conductive conditions. 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.

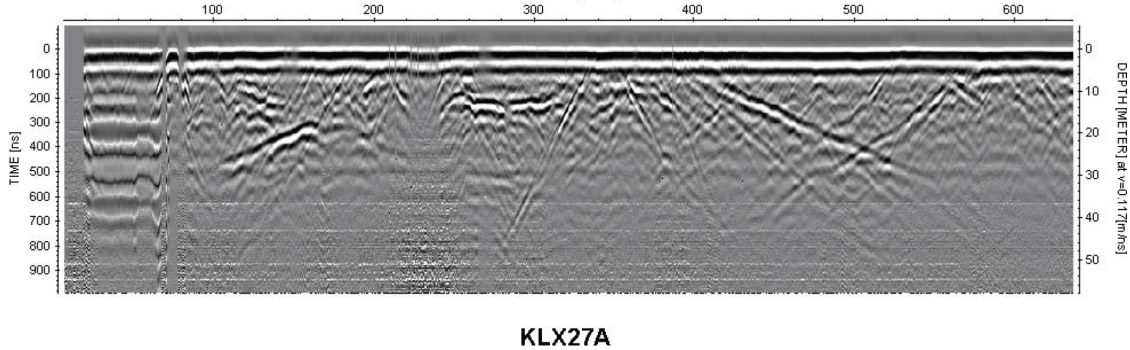


Figure 5-1. An overview (20 MHz data) of the radar data for the borehole KLX27A.

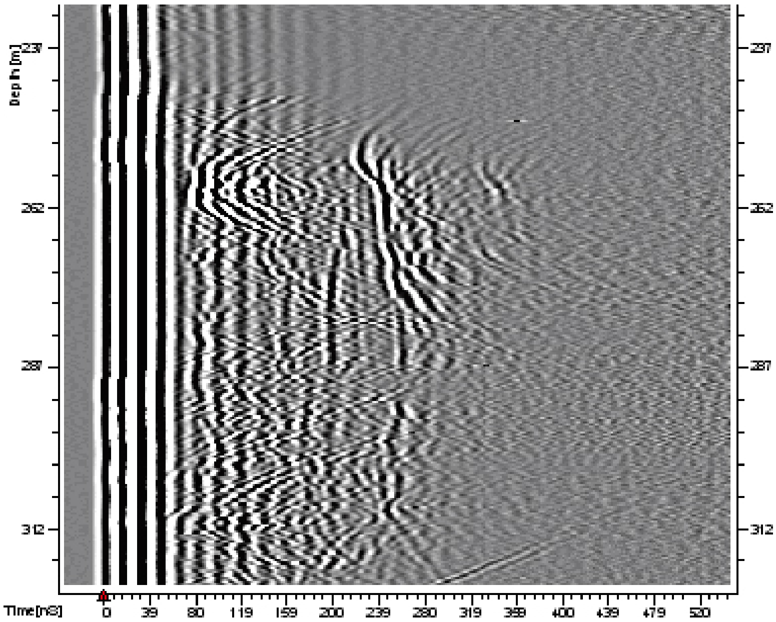


Figure 5-2. *An example of the 100 MHz data with several sub-parallel structures between 250 and 310 metres.*

The effect of a conductive environment is also seen in the directional antenna for KLX27A, which makes it more difficult to interpret the direction to the identified structures.

As also seen in Appendix 1 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 5-1below the distribution of identified structures along the borehole are listed for KLX27A.

Table 5-1. Identified structures as a function of depth in KLX27A.

Depth (m)	No. of structures
–50	13
50–100	20
100–150	16
150–200	15
200–250	13
250–300	15
300–350	14
350–400	20
400–450	8
450–500	9
500–550	7
550–600	13
600–650	7

Table 5-2 summarises the interpretation of radar data from KLX27A. The direction to the reflector (object) is also given. As seen some radar reflectors in Table 5-2 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 (object) is defined in Figure 5-3. As the borehole inclination is less than 85° the direction to object is calculated using gravity roll. The direction to object and the intersection angle are recalculated to strike and dip, also given in Table 5-2. The plane strike is the angle between line of the plane's cross-section with the surface and the Magnetic North direction. It counts clockwise and can be between 0 and 359 degrees. A strike of 0 degrees implies a dip to the east while a strike of 180 degrees implies a dip to the west. 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 instance for structure 88 in Table 5-2 and Appendix 1. To this structure, most likely, also structure 88x, 88xx and 88xxx belongs.

Table 5-2. Interpretation of radar reflectors from the dipole antennas 250, 100 and 20 MHz, and the directional antenna 60 MHz in borehole KLX27A.

RADINTER MODEL INFORMATION
(Directional antenna)

Site: Oskarshamn
Borehole name: KLX27A
Nominal velocity (m/μs): 117.0

Name	Intersection depth	Inter-section angle	RadInter direction to object (gravity roll)	Dip 1	Strike 1	Dip 2	Strike 2
25	11.6	7	351	72	261		
5	16.4	76					
1	19.9	74					
2	21.4	68					
3	25.4	78					
4	26.3	79					
8	31.1	46					
6	32.1	49					
7	33.9	60					
9	43.3	65					
11	47.8	61					
19x	48.4	13					
12	49.1	70					
13	50.3	80					
14	51.7	74					
137	53.7	39					
28	54.9	10					
15	55.9	68					
16	57.3	69					
17	58.9	59					
19	64.7	22					
10	66.7	18					
18	70.0	86					
20	81.2	62					
21	84.0	47					
23	86.9	49					
24	88.0	69					
22	89.0	59					

RADINTER MODEL INFORMATION
(Directional antenna)

Site: Oskarshamn
Borehole name: KLX27A
Nominal velocity (m/μs): 117.0

Name	Intersection depth	Inter-section angle	RadInter direction to object (gravity roll)	Dip 1	Strike 1	Dip 2	Strike 2
30	89.5	16					
26	91.0	48					
27	93.5	66					
29	98.7	50					
31	92.9	15					
32	102.8	48					
149	103.7	56					
148	106.5	54					
33	108.5	78					
34	114.0	71					
35	120.3	75					
147	127.6	63					
36x	129.6	12					
38	130.4	62					
37	131.0	43	84 ±	55	159	50	25
39	133.0	56					
36	133.4	10					
40	138.7	66					
41	143.4	48					
42	144.0	58					
153	146.4	21	237 ±	57	346	86	149
43	151.1	59					
146	157.0	62					
47	160.7	57					
45	163.0	58	354 ±	59	86	10	251
46	167.3	65	6	50	94		
44	168.0	49					
48	171.4	64					
138	173.5	52	240 ±	33	15	56	137
49	180.0	67					
55	181.5	47					
51	186.7	42					
52	189.0	50					
50	192.3	56					
53x	195.8	49					
53	196.6	42	183	20	276		
56	204.5	50					
57	209.0	56					
145	211.2	9					
154	215.4	11	135	63	219		
58	216.4	57					
59	218.4	59					
60	220.9	76					
61	223.1	63					

RADINTER MODEL INFORMATION
(Directional antenna)

Site: Oskarshamn
Borehole name: KLX27A
Nominal velocity (m/μs): 117.0

Name	Intersection depth	Inter-section angle	RadInter direction to object (gravity roll)	Dip 1	Strike 1	Dip 2	Strike 2
61x	225.2	50					
62	226.8	51					
63	232.6	50					
64	237.5	59					
65	241.8	68	195 ±	6	314	49	45
66	251.4	62					
67	253.6	83	24 ±	34	44	17	23
150	255.8	75					
68	261.2	51					
69	264.8	55					
70	268.3	58					
71	274.6	60					
54	275.9	11					
72	277.5	61					
74	279.0	64					
73	280.4	61					
75	290.7	81					
76	294.4	79					
77	296.6	52					
54x	297.4	10	141.0	62.0	226.0		
78	304.0	62					
139	306.2	56					
144	311.5	45					
79	314.1	22					
80	324.1	43					
81	326.7	59	231 ±	23	330	49	75
82	337.0	76	348 ±	40	79	13	97
85	337.9	20					
82x	338.0	65					
83	342.9	58					
83x	343.1	55	162	13	211		
86	343.4	19					
83xx	344.1	63					
84	344.9	45	279	54	6		
88xxxx	349.7	9					
88xxx	355.7	11					
87x	357.0	29					
87	358.7	28					
88xx	367.0	13	306	87	147		
89x	368.3	21					
88x	369.6	15					
90	370.4	67	222 ±	18	276	48	12
88	372.0	16					
91	373.0	77					

RADINTER MODEL INFORMATION
(Directional antenna)

Site: Oskarshamn
Borehole name: KLX27A
Nominal velocity (m/µs): 117.0

Name	Intersection depth	Inter-section angle	RadInter direction to object (gravity roll)	Dip 1	Strike 1	Dip 2	Strike 2
91x	373.5	61					
89	374.5	25	276	71	275		
92	379.0	53					
95	384.8	33					
97	385.2	19					
93	386.4	81					
94	386.6	65					
140	389.2	62					
96	396.9	21	99 ±	68	108	75	307
98	399.9	66					
101	399.9	77					
99	406.5	19	270 ±	73	298	73	101
100	420.6	21	21 ±	84	284	47	291
141	421.4	54					
102	436.7	57					
103	443.0	29					
103x	443.1	35	318	76	49		
104	448.0	76					
143	448.8	76					
105	469.7	69					
107	472.1	19					
106	472.3	63					
151	480.8	17	288 ±	82	17	66	182
109	483.1	62					
108	485.5	23					
110	485.9	64					
111	498.4	66					
112	496.5	52	45 ±	59	120	26	357
113	509.0	60					
114	513.5	65					
115	528.7	39	123 ±	42	188	69	45
152	535.9	22	165 ±	42	249	87	246
116	535.5	31	336 ±	84	51	36	215
117	542.8	38					
118	545.8	31					
119	552.8	43					
120	554.9	37					
121	561.0	54					
122	565.2	66					
124	573.2	53					
123	573.8	28	174 ±	35	261	89	84
123x	577.5	40					
126	582.6	50					
127	593.9	31					

RADINTER MODEL INFORMATION
(Directional antenna)

Site: Oskarshamn
Borehole name: KLX27A
Nominal velocity (m/μs): 117.0

Name	Intersection depth	Inter-section angle	RadInter direction to object (gravity roll)	Dip 1	Strike 1	Dip 2	Strike 2
125	594.0	20	297	83	33		
128	594.0	50					
129	596.5	68					
130	598.4	65					
142	617.8	72					
132	626.6	21					
131	629.6	30					
133	636.4	26					
133x	642.0	20					
135	642.1	64					
134	642.8	20					

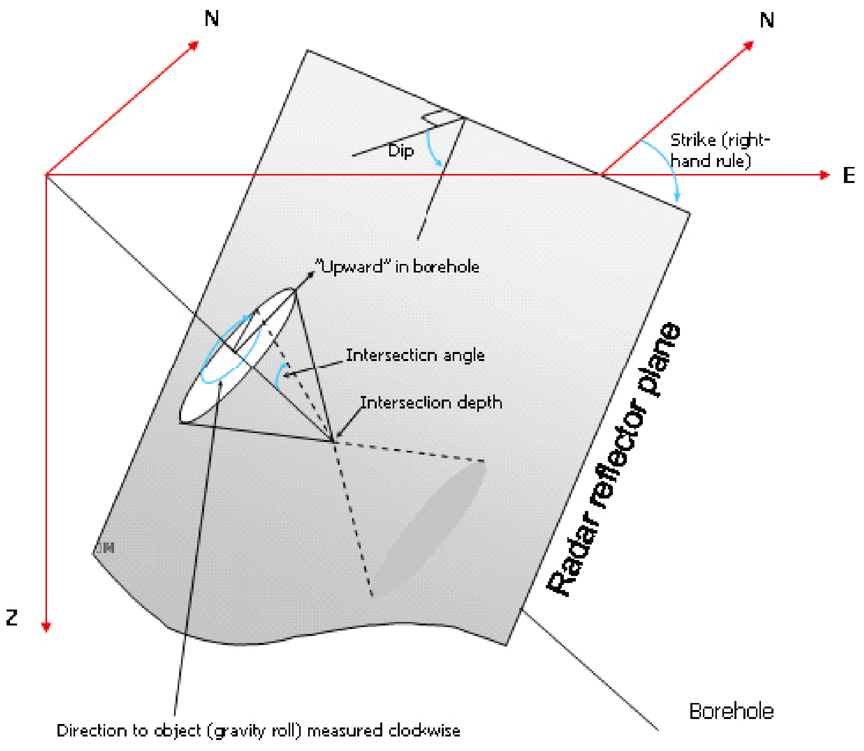


Figure 5-3. *Definition of intersection angle, direction to object using gravity roll, dip and strike using the right hand rule as presented in Table 5-2.*

In Appendix 1, 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 Table 5-3.

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 5-4 below.

Table 5-3. Borehole length intervals in KLX27A with decreased amplitude for the 250 MHz antenna.

Length (m)	Length (m)
90	240
105–110	335–345
130	370
165–175	390–395
180	585
195–200	635
210	645
225–230	

Table 5-4. Some important structures in KLX27A.

Borehole	KLX27A
Structures	15, 16, 28, 36, 36x, 37, 45, 53, 53x, 54, 54x, 61, 61x, 83, 83x, 83xx, 85, 88, 88x, 88xx, 88xxx, 88xxxx, 89, 89x, 96, 99, 103, 103x, 115, 116, 123, 125, 125x, 127, 149, 153 and 154

Observe that it 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 intersection angle will most often give an increased amplitude compared to a larger intersection angle, and by that a more clear structure.

5.2 BIPS logging

The BIPS pictures from KLX27A are presented in Appendix 2.

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.

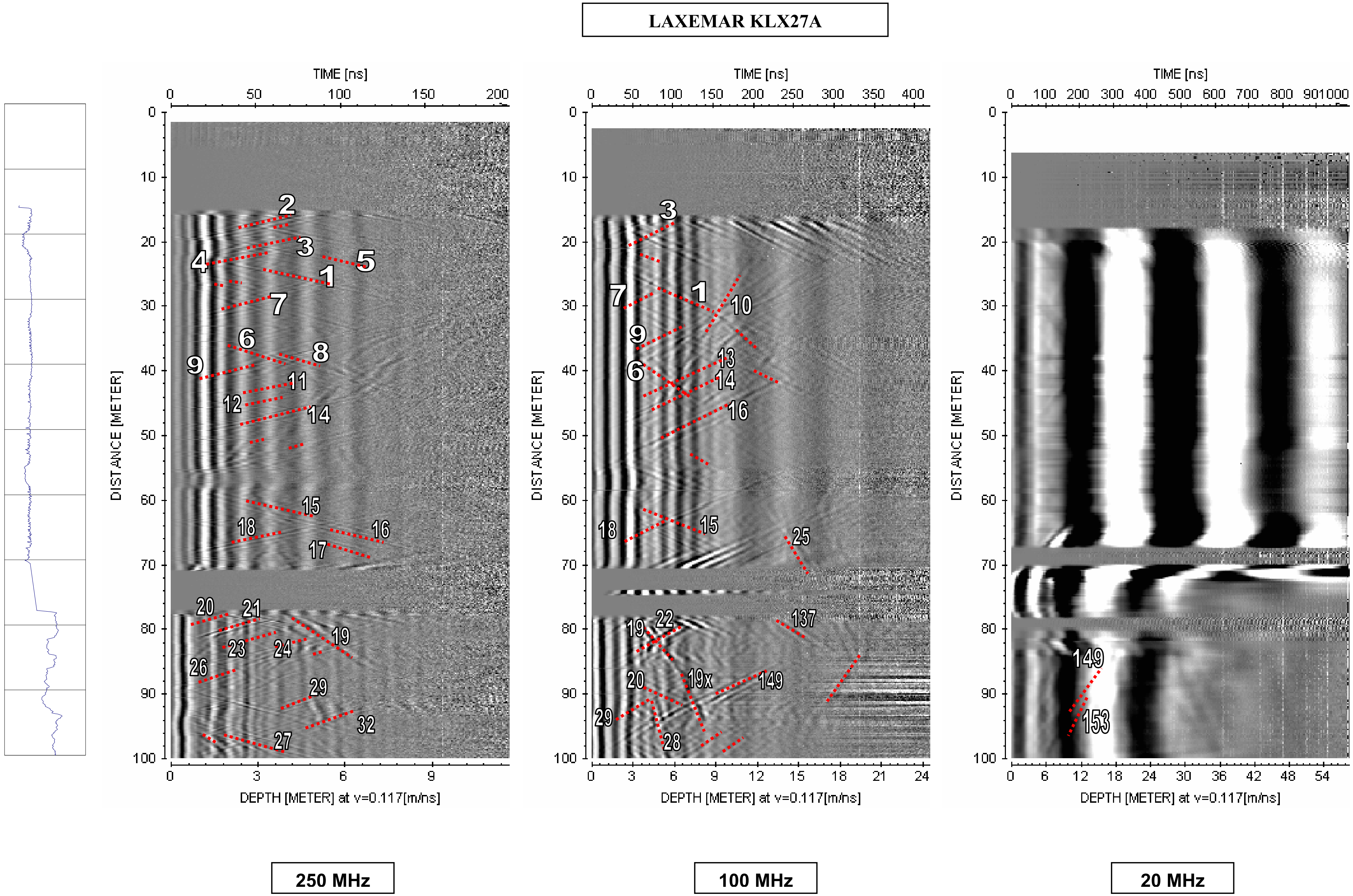
The error in the depth recording depends mainly on the tension of the cable and error of the depth readings from the measuring wheel. The adjusted depth is showed in red colour and the recording depth have black colour in the printouts.

The BIPS images in the core drilled part of the borehole shows good quality along the borehole. Small amount of discoloring effect of the borehole walls make the geological mapping easy. Between 14 and 72 metres the images are very dark and it is almost impossible to see the borehole walls due to the larger borehole diameter and lack of light.

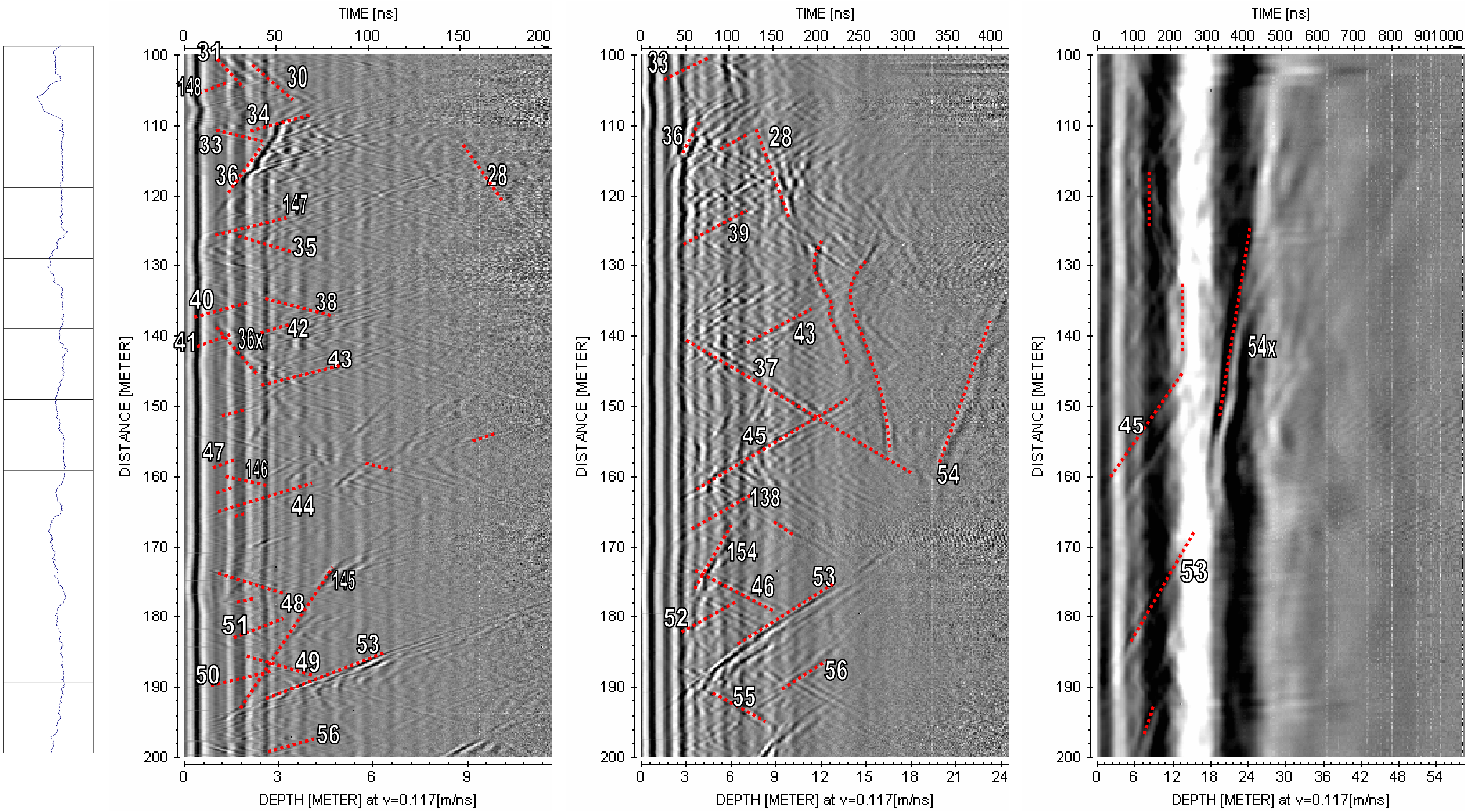
References

/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.

Radar logging in KLX27A, 0 to 644 m, dipole antennas 250, 100 and 20 MHz.

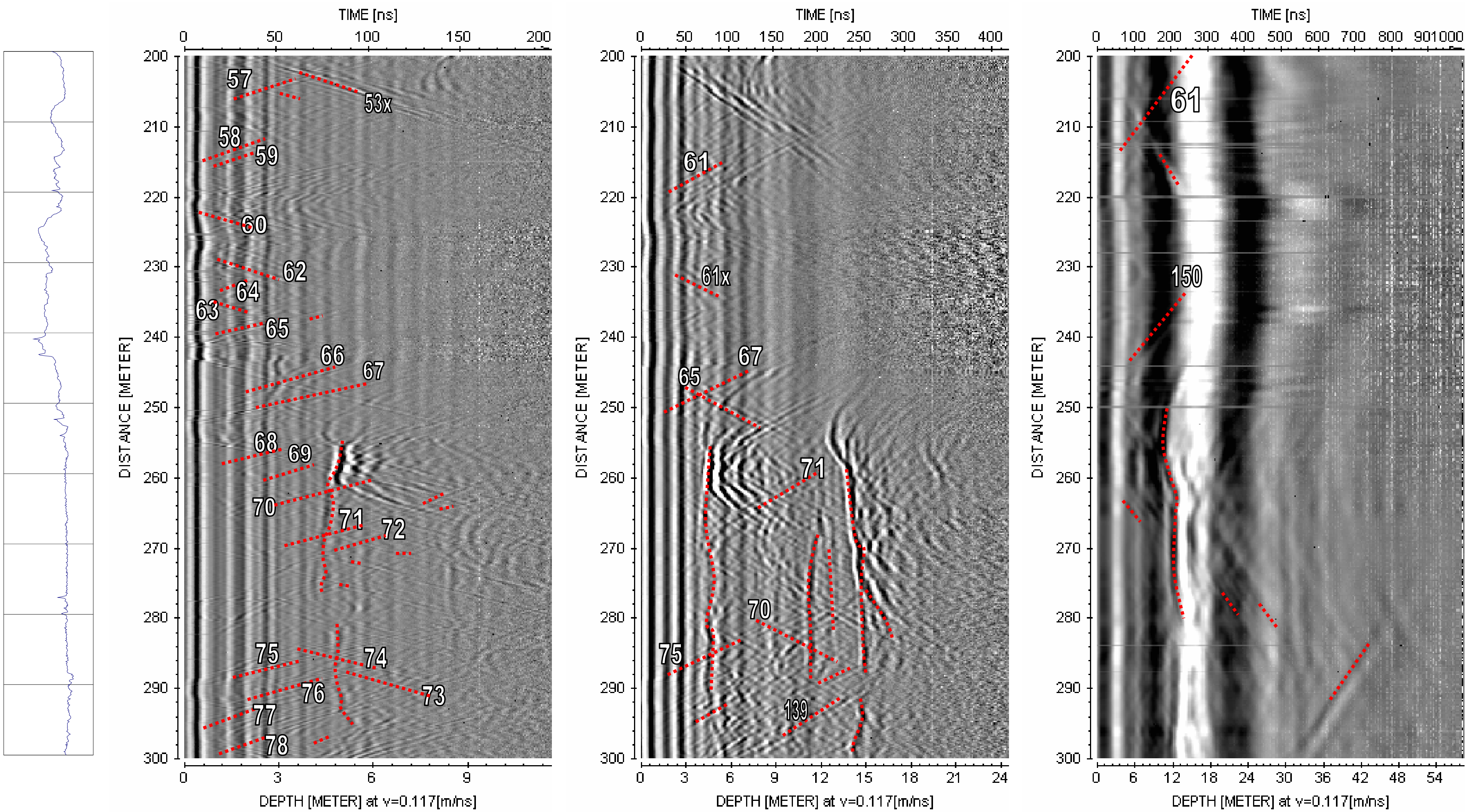


LAXEMAR KLX27A



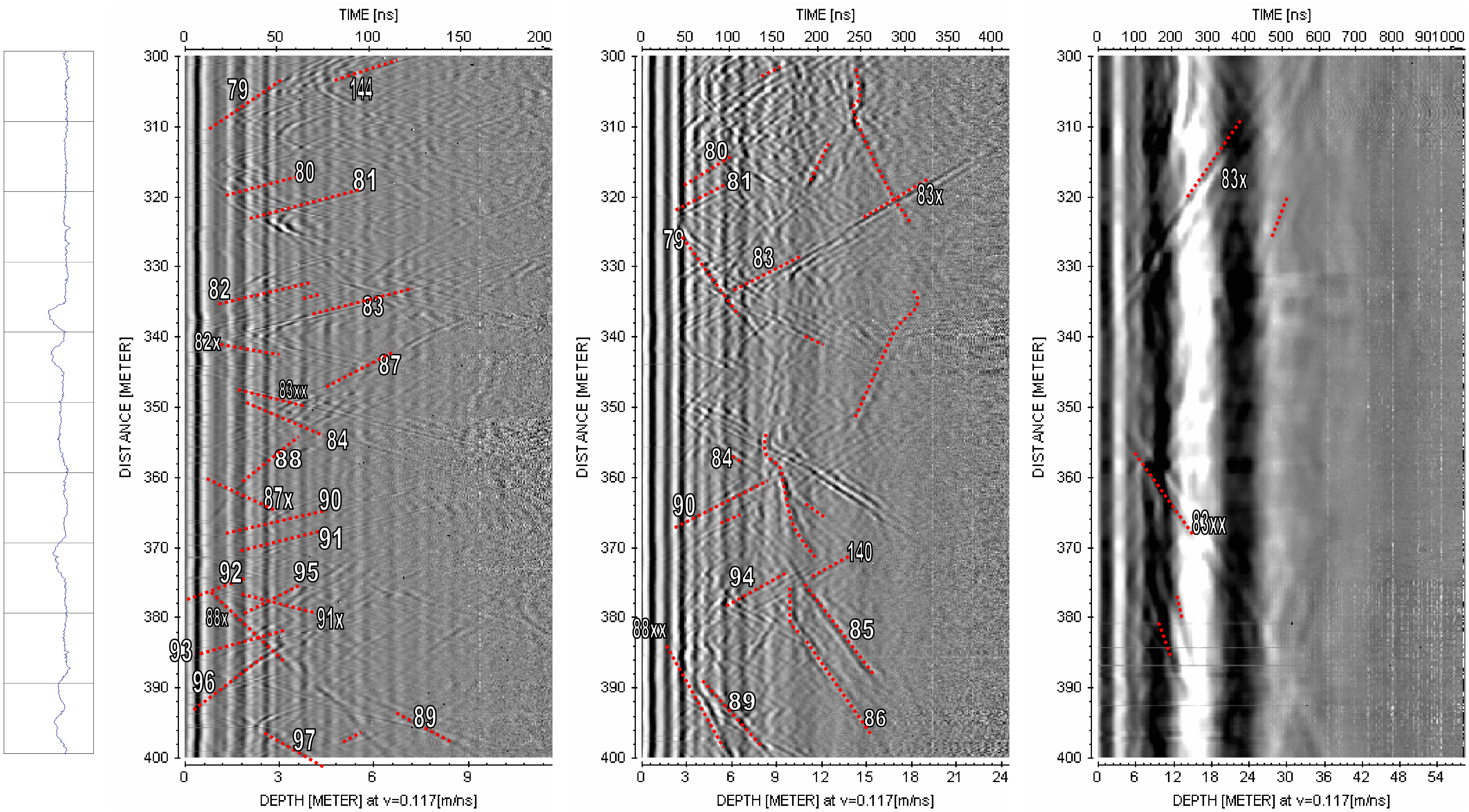
250 MHz **100 MHz** **20 MHz**

LAXEMAR KLX27A



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

LAXEMAR KLX27A

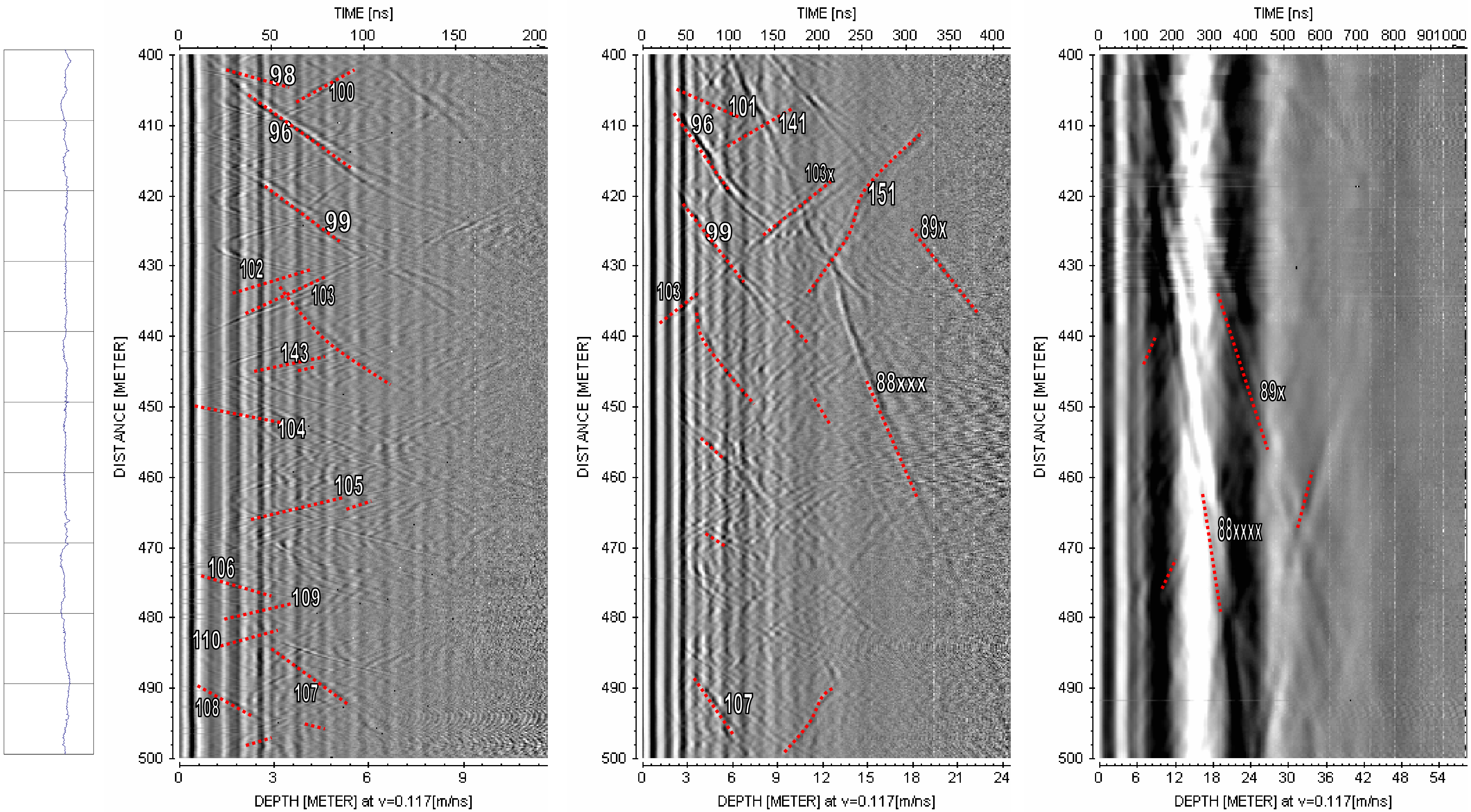


250 MHz

100 MHz

20 MHz

LAXEMAR KLX27A

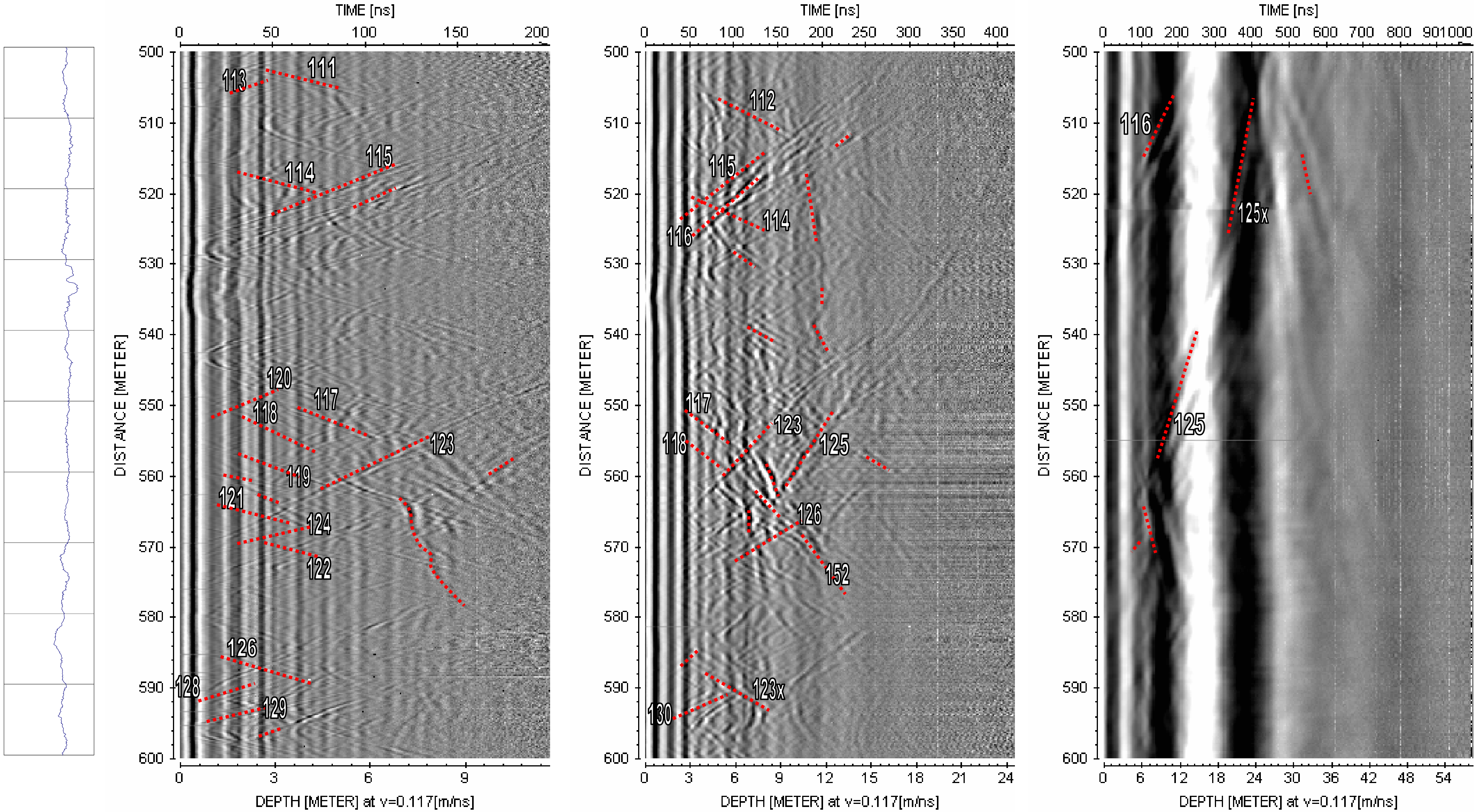


250 MHz

100 MHz

20 MHz

LAXEMAR KLX27A

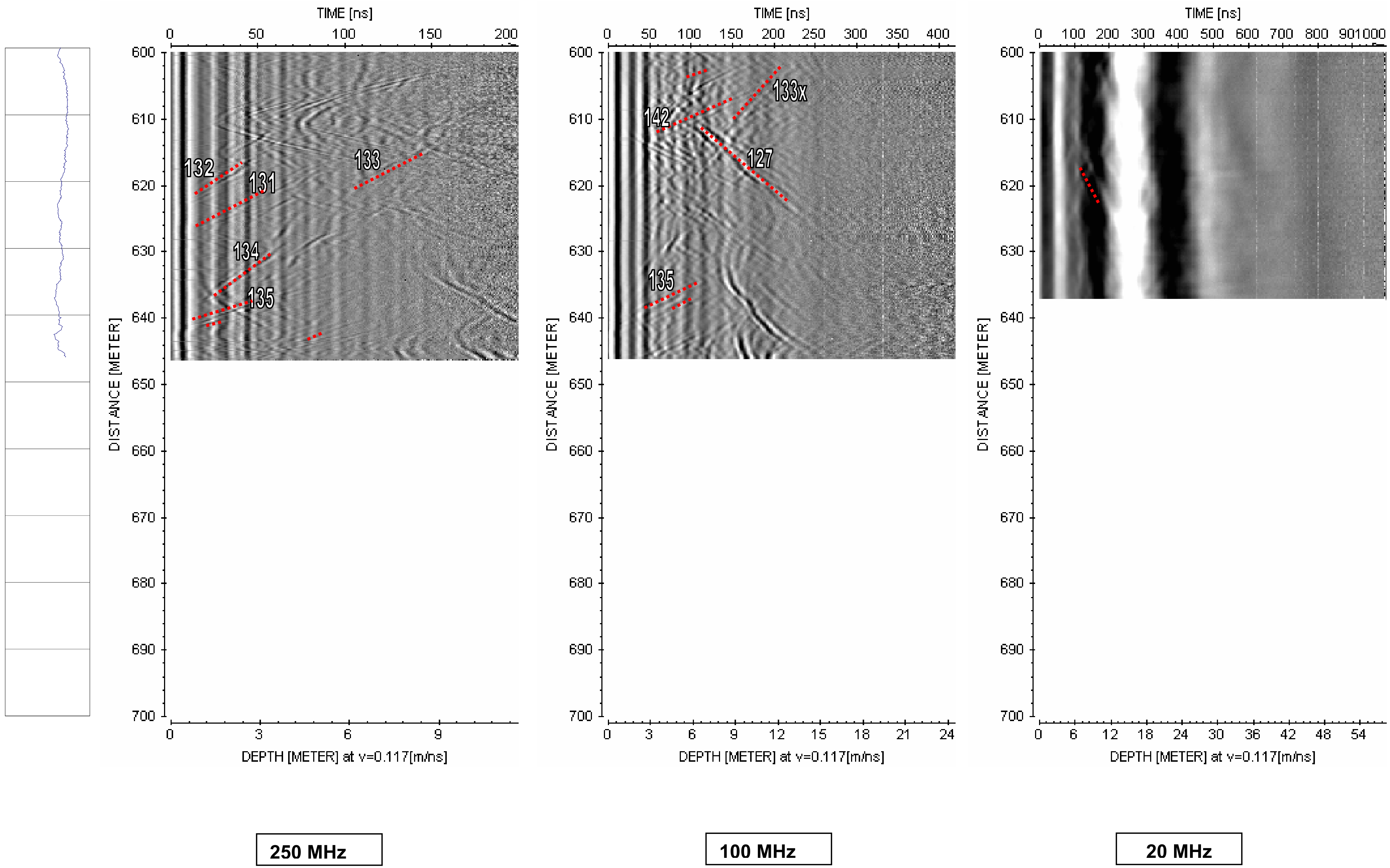


250 MHz

100 MHz

20 MHz

LAXEMAR KLX27A



BIPS logging in KLX27A, 14 to 646 m

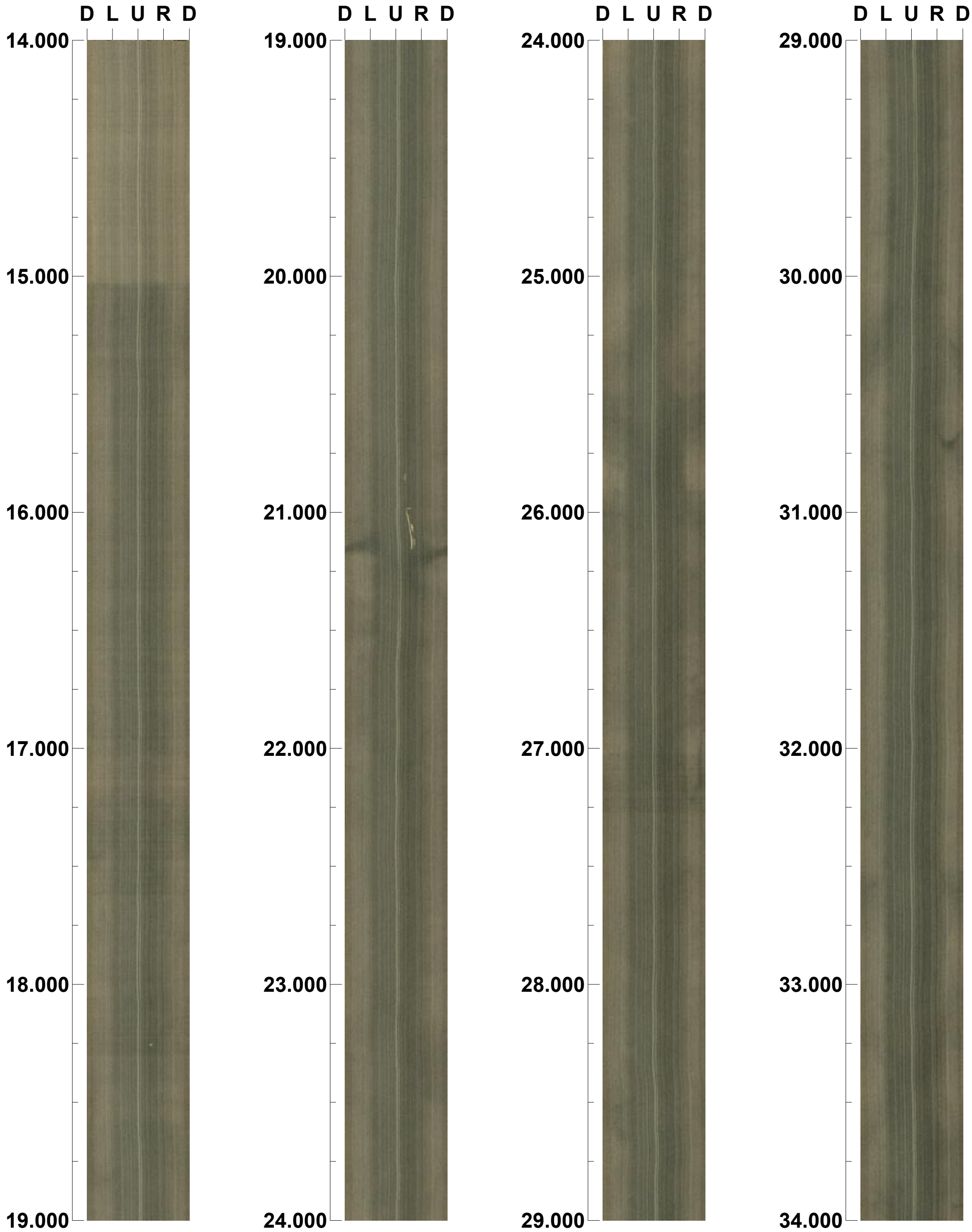
Project name: Laxemar

Image file	: c:\work\r5683k~1\bips\14_72m.bip
BDT file	: c:\work\r5683k~1\bips\14_72m.bdt
Locality	: LAXEMAR
Bore hole number	: KLX27A
Date	: 07/12/06
Time	: 07:14:00
Depth range	: 14.000 - 72.307 m
Azimuth	: 1
Inclination	: -65
Diameter	: 197.0 mm
Magnetic declination	: 0.0
Span	: 4
Scan interval	: 0.25
Scan direction	: To bottom
Scale	: 1/25
Aspect ratio	: 70 %
Pages	: 3
Color	: +0 +0 +0

Project name: Laxemar

Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 14.000 - 34.000 m



(1 / 3) **Scale: 1/25** **Aspect ratio: 70 %**

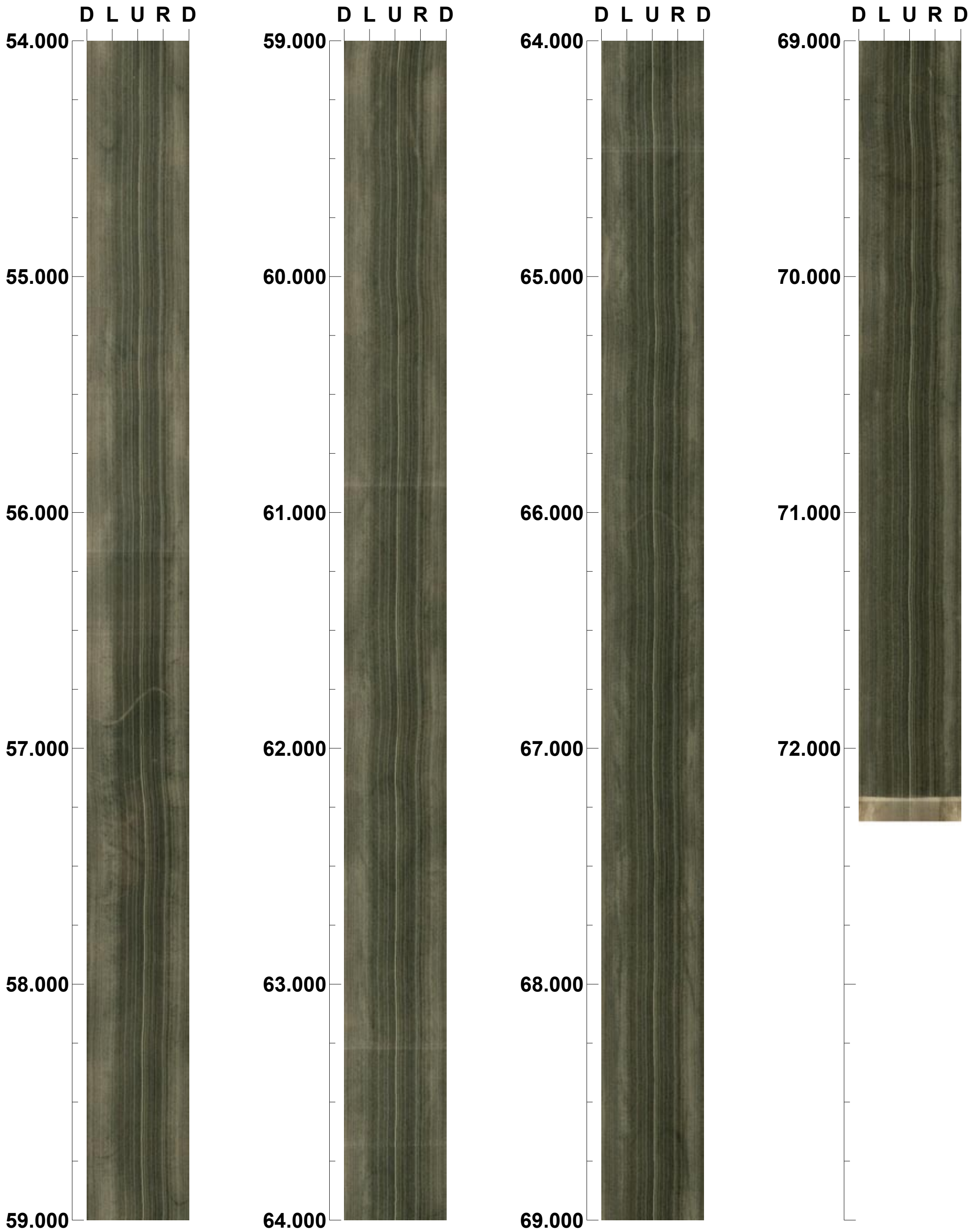
Project name: Laxemar
Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 34.000 - 54.000 m

(2 / 3) **Scale: 1/25** **Aspect ratio: 70 %**

Project name: Laxemar
Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 54.000 - 72.307 m



(3 / 3) **Scale: 1/25** **Aspect ratio: 70 %**

Project name: Laxemar

Image file	: c:\work\r5683k~1\bips\klx27a~2.bip
BDT file	: c:\work\r5683k~1\bips\klx27a~2.bdt
Locality	: LAXEMAR
Bore hole number	: KLX27A
Date	: 07/12/06
Time	: 08:33:00
Depth range	: 76.000 - 520.003 m
Azimuth	: 1
Inclination	: -65
Diameter	: 76.0 mm
Magnetic declination	: 0.0
Span	: 4
Scan interval	: 0.25
Scan direction	: To bottom
Scale	: 1/25
Aspect ratio	: 150 %
Pages	: 23
Color	: +0 +0 +0

Project name: Laxemar
Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 60.000 - 80.000 m

D L U R D

60.000
60.000
61.000
61.000
62.000
62.000
63.000
63.000
64.000
64.000
65.000
65.000

D L U R D

65.000
65.000
66.000
66.000
67.000
67.000
68.000
68.000
69.000
69.000
70.000
70.000

D L U R D

70.000
70.000
71.000
71.000
72.000
72.000
73.000
73.000
74.000
74.000
75.000
75.000

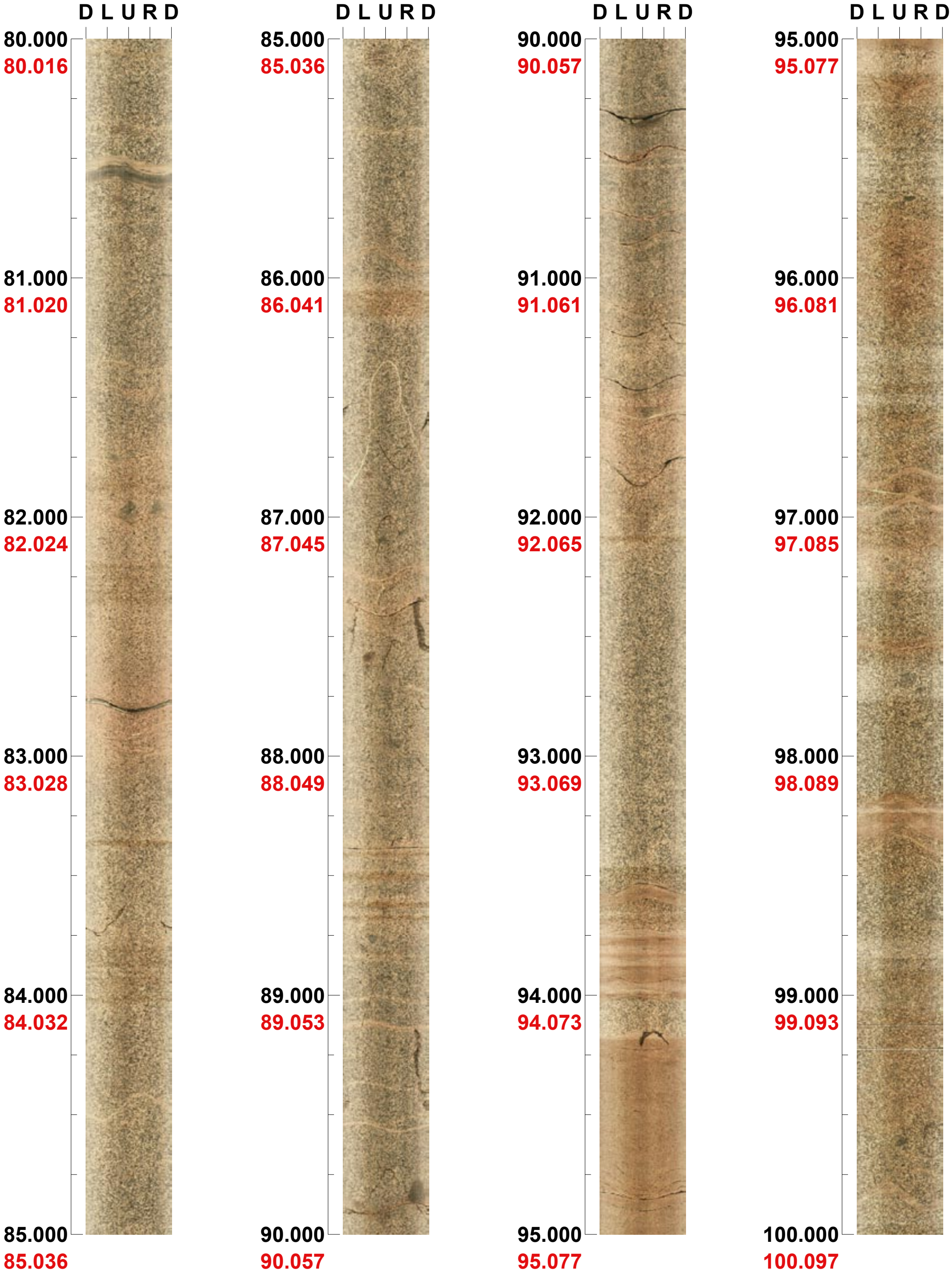
D L U R D

75.000
75.000
76.000
76.000
77.000
77.004
78.000
78.008
79.000
79.012
80.000
80.016

(1 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar
Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 80.000 - 100.000 m

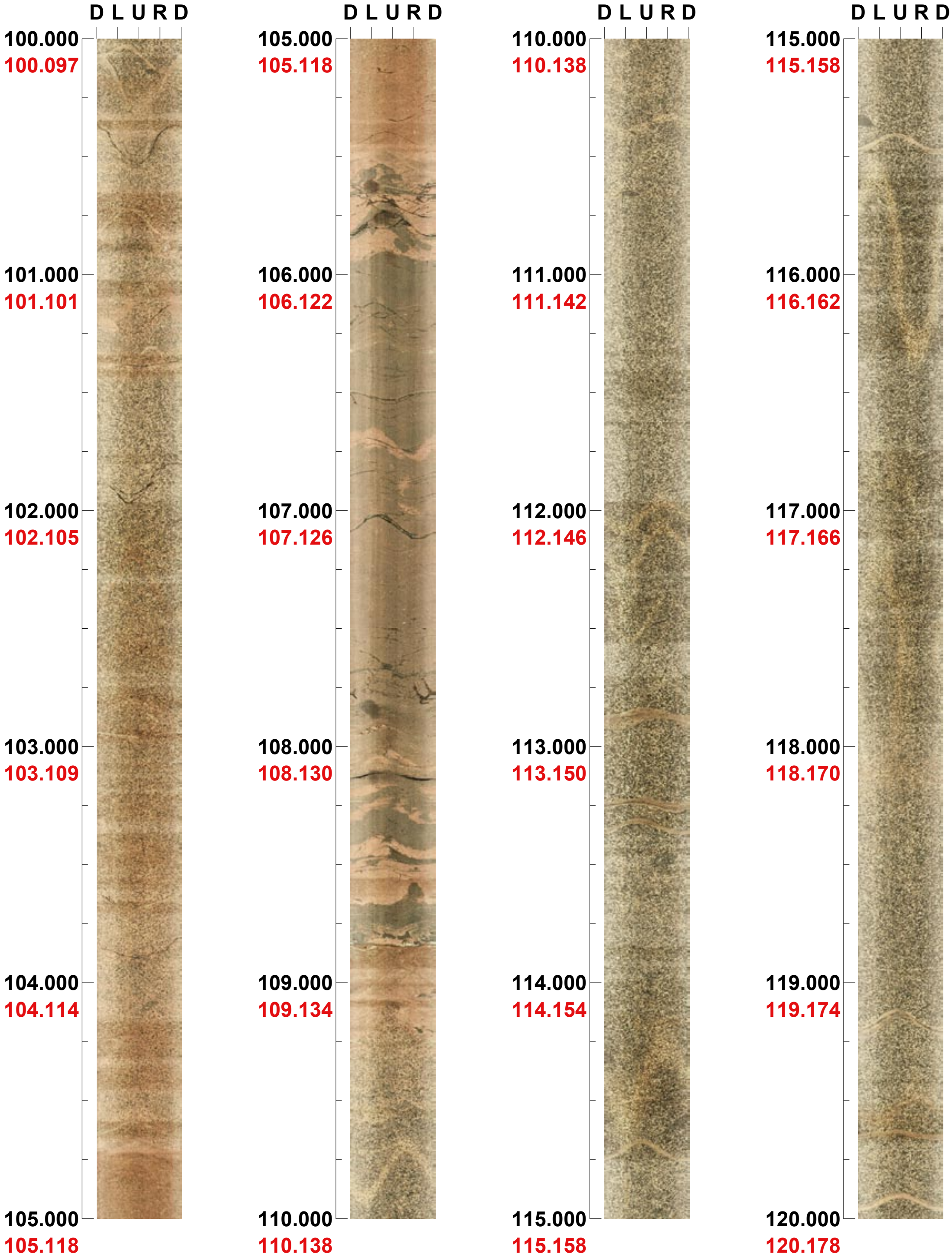


(2 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar

Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 100.000 - 120.000 m



(3 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar

Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

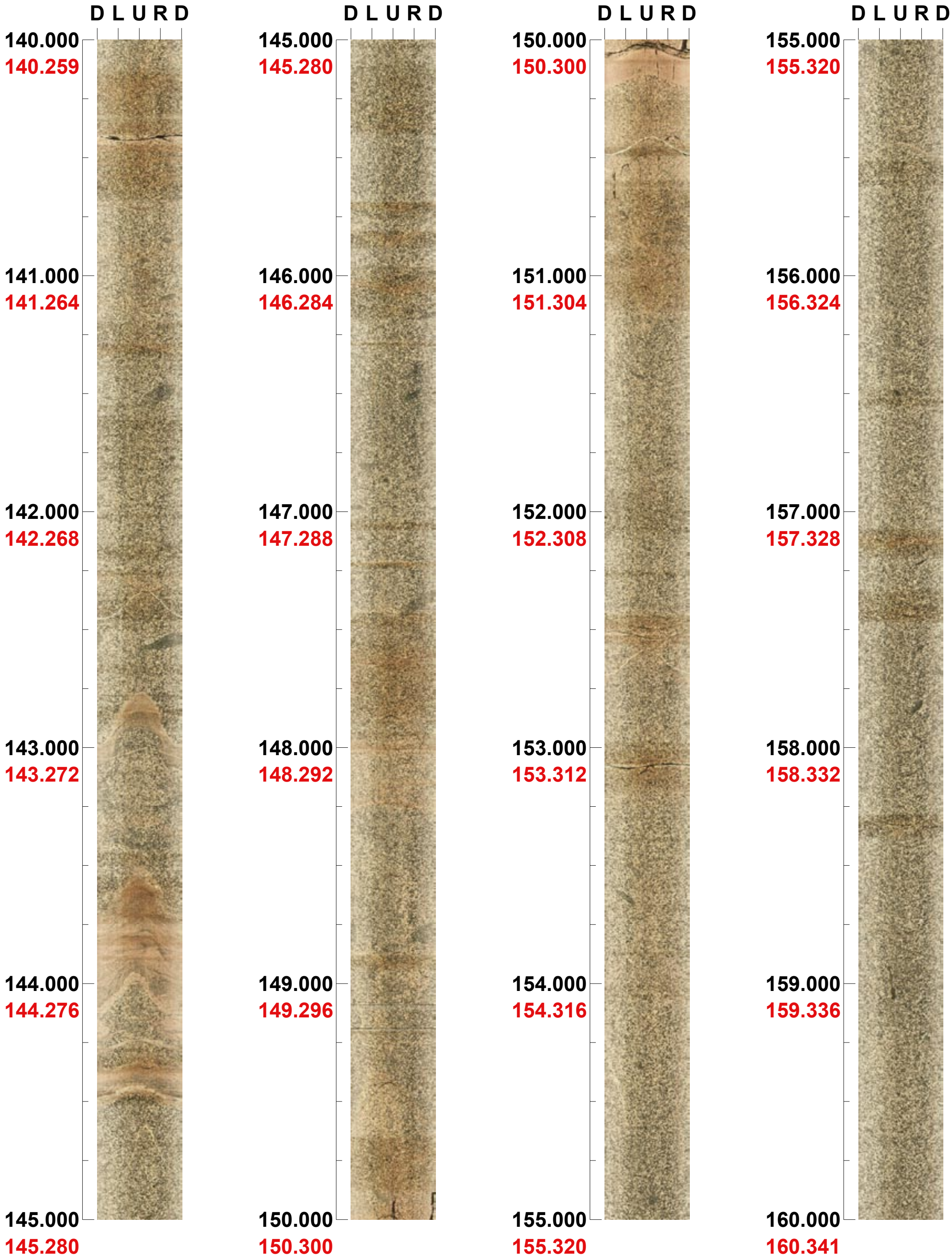
Depth range: 120.000 - 140.000 m

(4 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar

Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

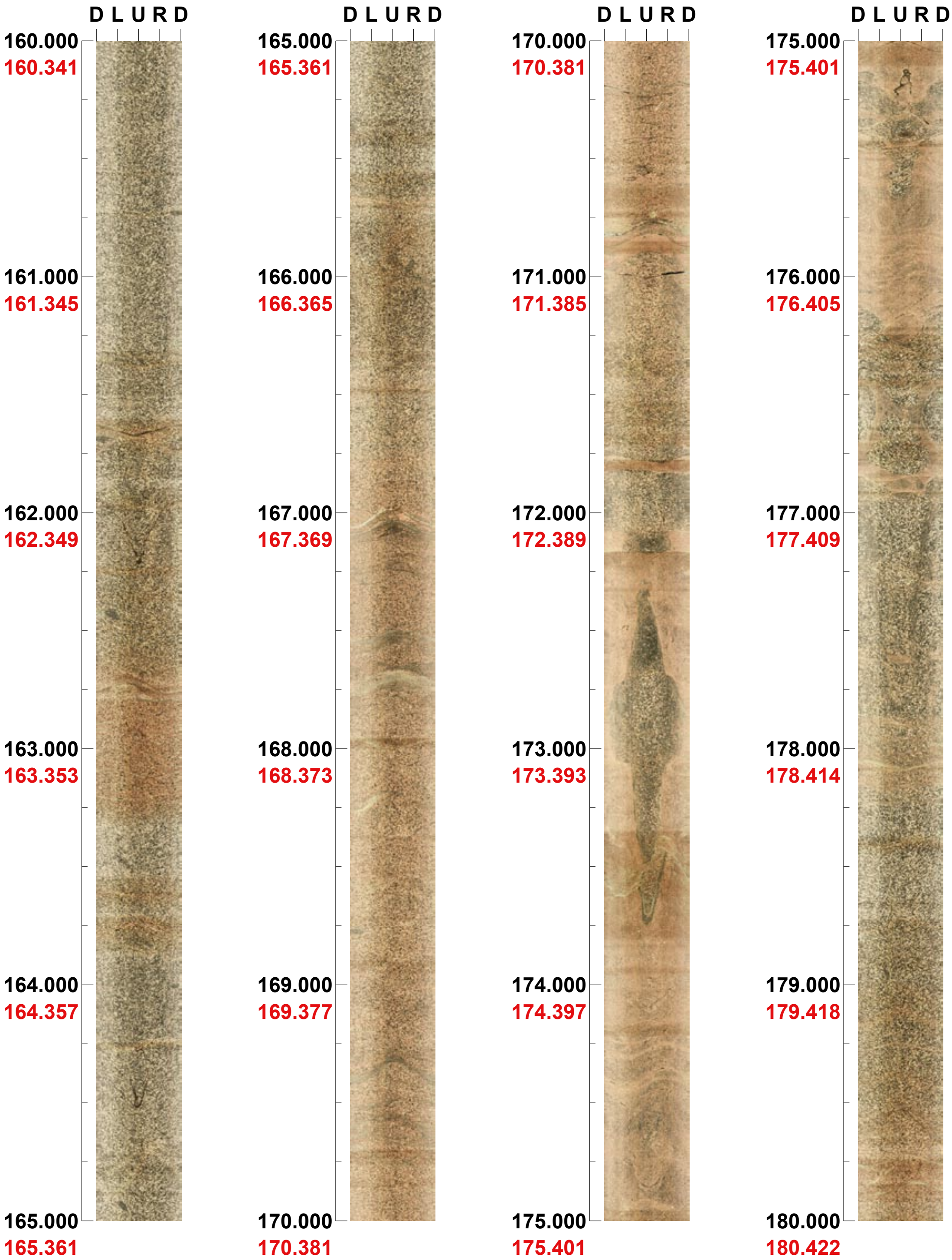
Depth range: 140.000 - 160.000 m



(5 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar
Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 160.000 - 180.000 m

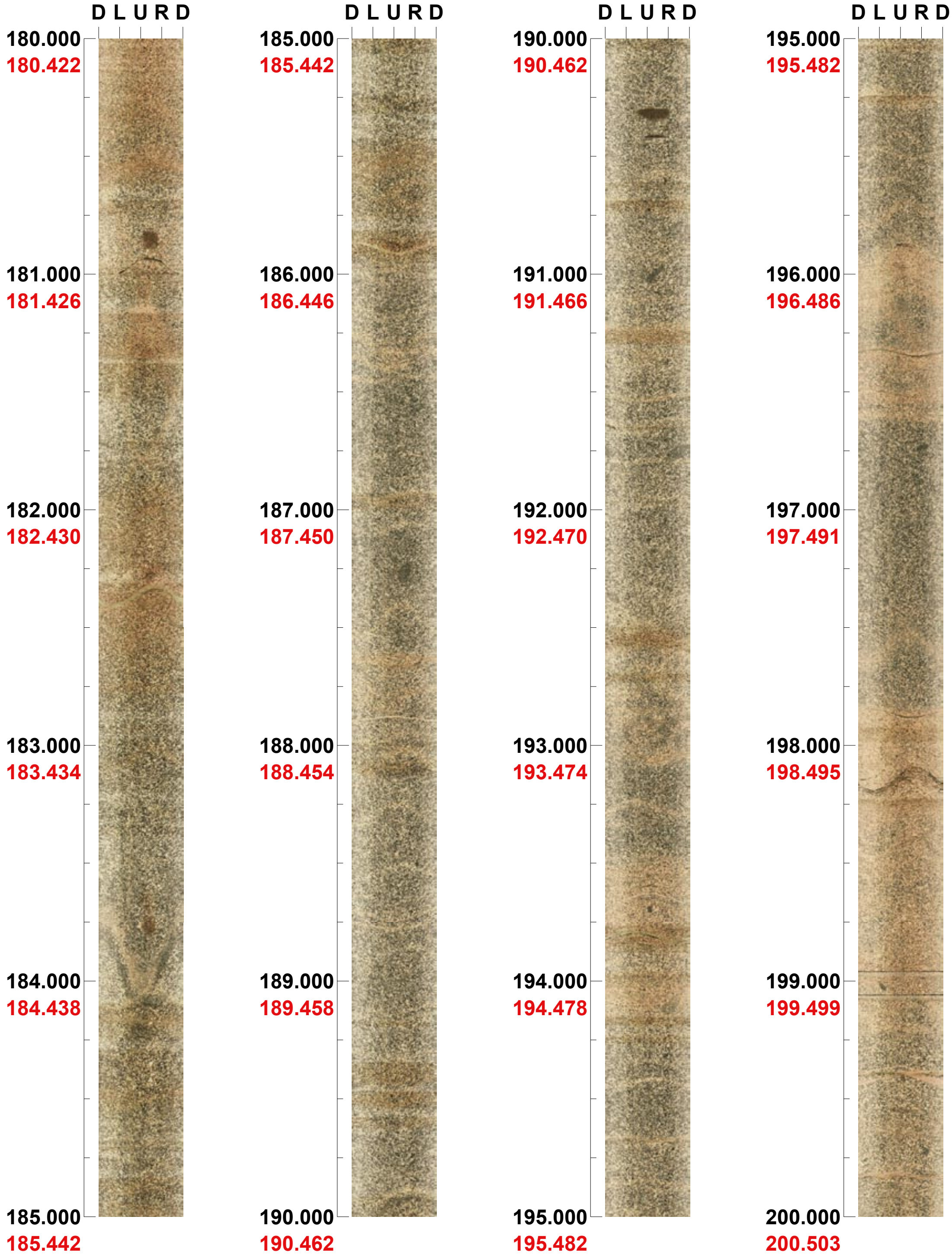


(6 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar

Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 180.000 - 200.000 m



(7 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar

Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 200.000 - 220.000 m

(8 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar

Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 220.000 - 240.000 m

(9 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar
Bore hole No.: KLX27A

Azimuth: 1

Inclination: -65

Depth range: 240.000 - 260.000 m

(10 / 23)

Scale: 1/25

Aspect ratio: 150 %

Project name: Laxemar

Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 260.000 - 280.000 m

(11 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar

Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 280.000 - 300.000 m

(12 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar
Bore hole No.: KLX27A Azimuth: 1 Inclination: -65

Depth range: 300.000 - 320.000 m

(13 / 23) Scale: 1/25 Aspect ratio: 150 %

Project name: Laxemar
Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 320.000 - 340.000 m

D L U R D

320.000
320.989
321.000
321.993
322.000
322.997
323.000
324.001
324.000
325.005
325.000
326.009

D L U R D

325.000
326.009
326.000
327.014
327.000
328.018
328.000
329.022
329.000
330.026
330.000
331.030

D L U R D

330.000
331.030
331.000
332.034
332.000
333.038
333.000
334.042
334.000
335.046
335.000
336.050

D L U R D

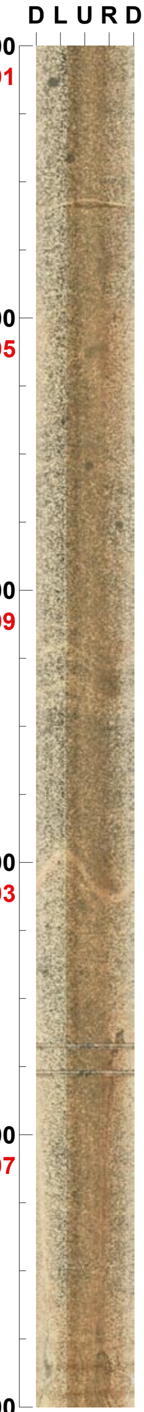
335.000
336.050
336.000
337.054
337.000
338.058
338.000
339.062
339.000
340.066
340.000
341.070

(14 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

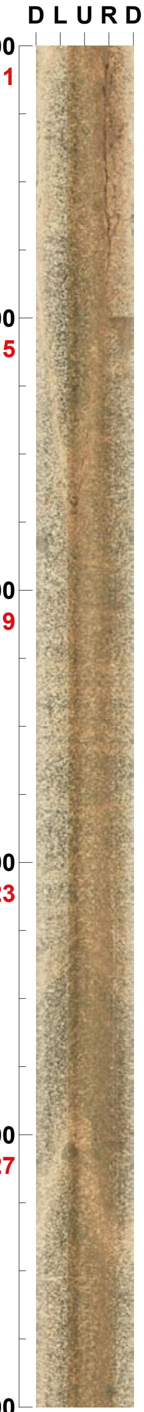
Project name: Laxemar
Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 340.000 - 360.000 m

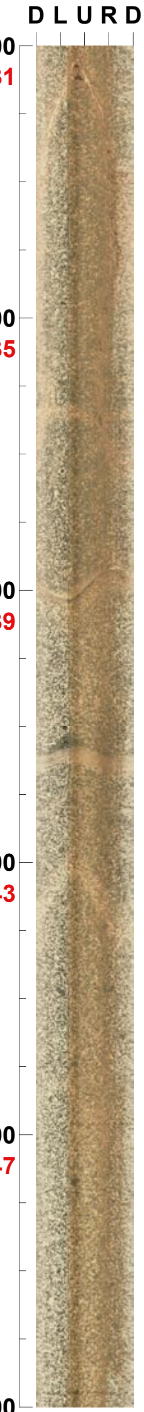
340.000 341.070
341.000 342.074
342.000 343.078
343.000 344.082
344.000 345.086
345.000 346.091



345.000 346.091
346.000 347.095
347.000 348.099
348.000 349.103
349.000 350.107
350.000 351.111



350.000 351.111
351.000 352.115
352.000 353.119
353.000 354.123
354.000 355.127
355.000 356.131



355.000 356.131
356.000 357.135
357.000 358.139
358.000 359.143
359.000 360.147
360.000 361.151

(15 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar
Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

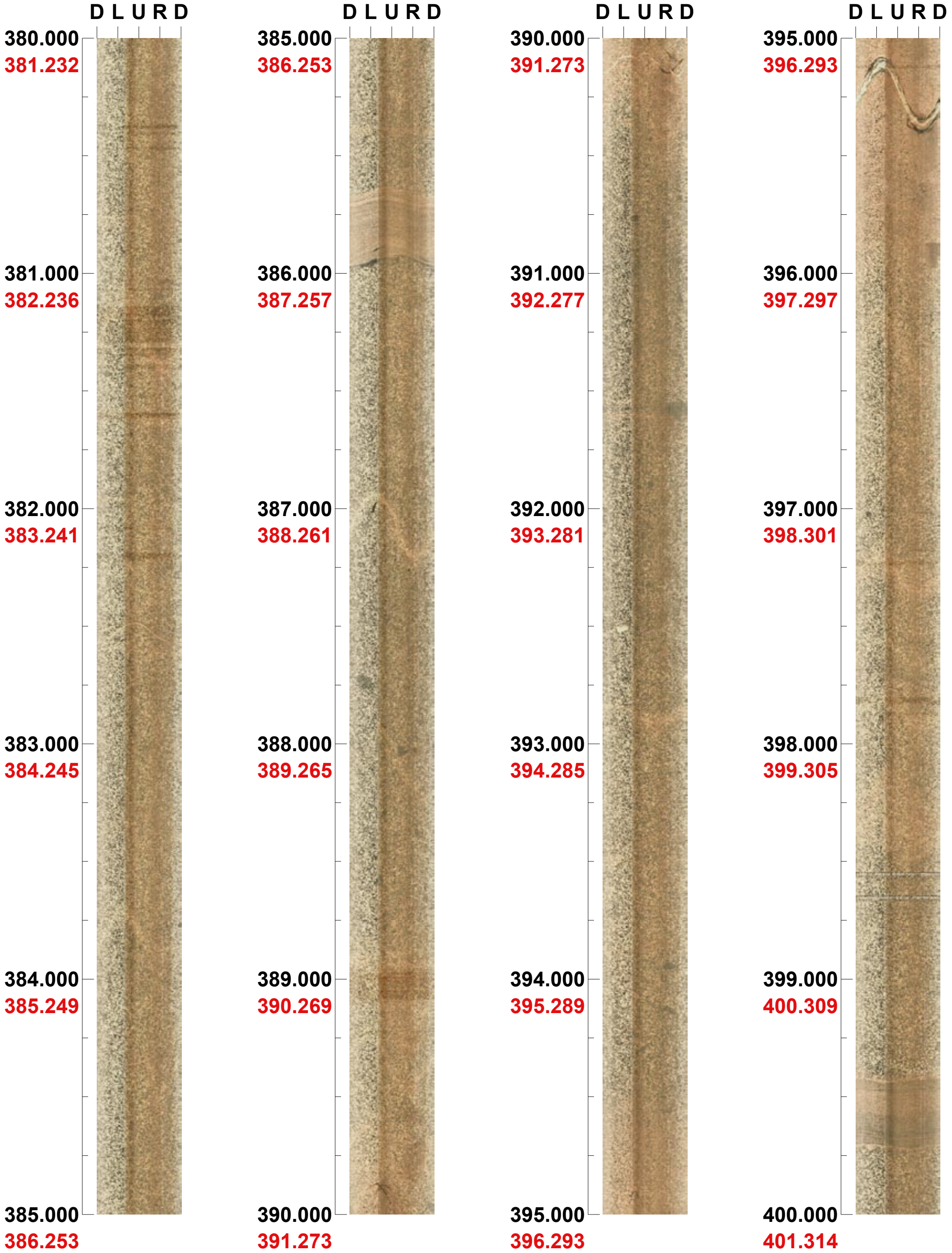
Depth range: 360.000 - 380.000 m

(16 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar

Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 380.000 - 400.000 m



(17 / 23) Scale: 1/25 Aspect ratio: 150 %

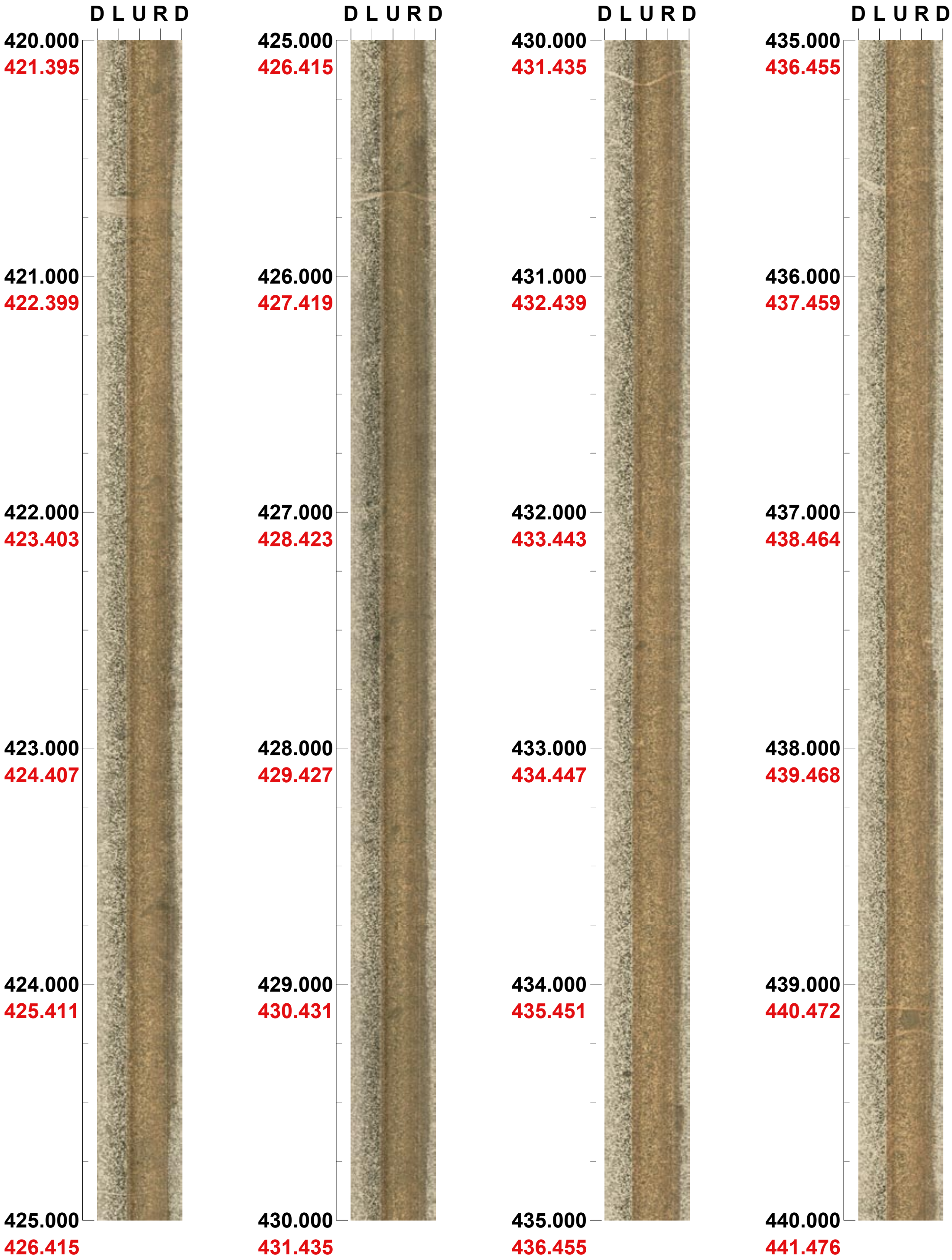
Project name: Laxemar
Bore hole No.: KLX27A Azimuth: 1 Inclination: -65

Depth range: 400.000 - 420.000 m

(18 / 23) Scale: 1/25 Aspect ratio: 150 %

Project name: Laxemar
Bore hole No.: KLX27A Azimuth: 1 Inclination: -65

Depth range: 420.000 - 440.000 m



(19 / 23) Scale: 1/25 Aspect ratio: 150 %

Project name: Laxemar

Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 440.000 - 460.000 m

(20 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

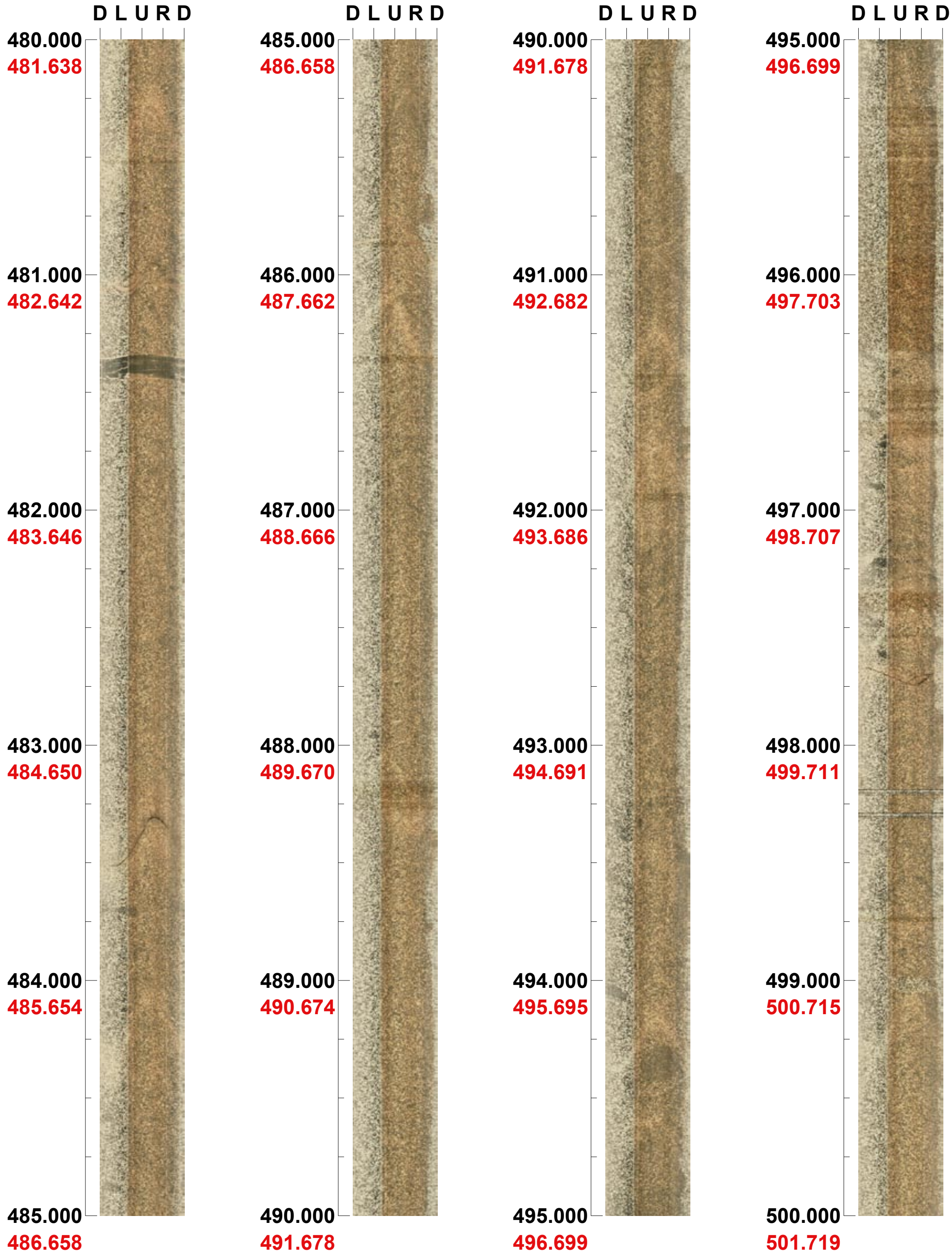
Project name: Laxemar
Bore hole No.: KLX27A Azimuth: 1 Inclination: -65

Depth range: 460.000 - 480.000 m

(21 / 23) Scale: 1/25 Aspect ratio: 150 %

Project name: Laxemar
Bore hole No.: KLX27A Azimuth: 1 Inclination: -65

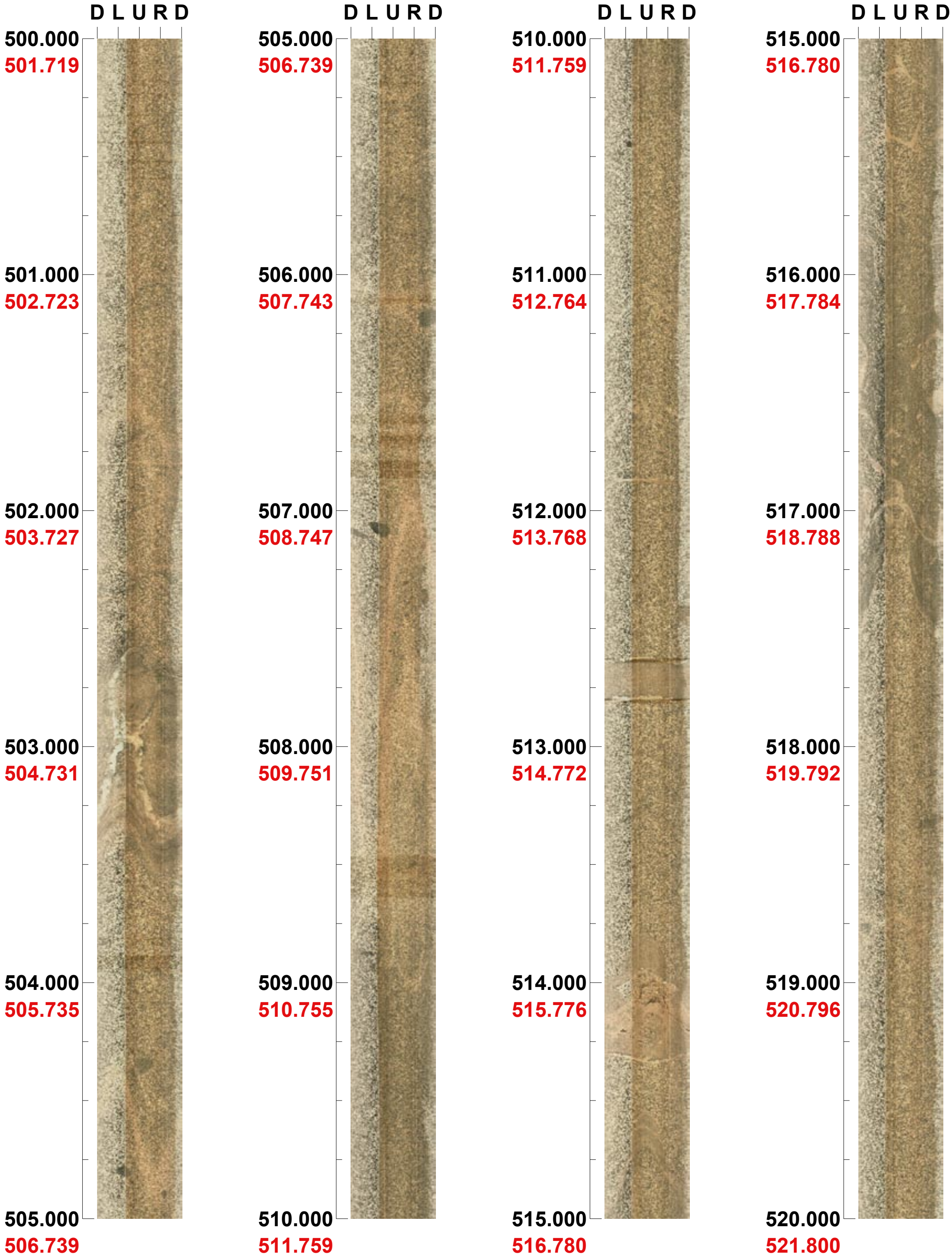
Depth range: 480.000 - 500.000 m



(22 / 23) Scale: 1/25 Aspect ratio: 150 %

Project name: Laxemar
Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 500.000 - 520.000 m



(23 / 23) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar
Bore hole No.: KLX27A Azimuth: 1 Inclination: -65

Depth range: 520.000 - 540.000 m

D L U R D

520.000 / 521.800
521.000 / 522.801
522.000 / 523.803
523.000 / 524.804
524.000 / 525.806
525.000 / 526.807

D L U R D

525.000 / 526.807
526.000 / 527.809
527.000 / 528.810
528.000 / 529.811
529.000 / 530.813
530.000 / 531.814

D L U R D

530.000 / 531.814
531.000 / 532.816
532.000 / 533.817
533.000 / 534.818
534.000 / 535.820
535.000 / 536.821

D L U R D

535.000 / 536.821
536.000 / 537.823
537.000 / 538.824
538.000 / 539.826
539.000 / 540.827
540.000 / 541.828

(1 / 7) Scale: 1/25 Aspect ratio: 150 %

Project name: Laxemar

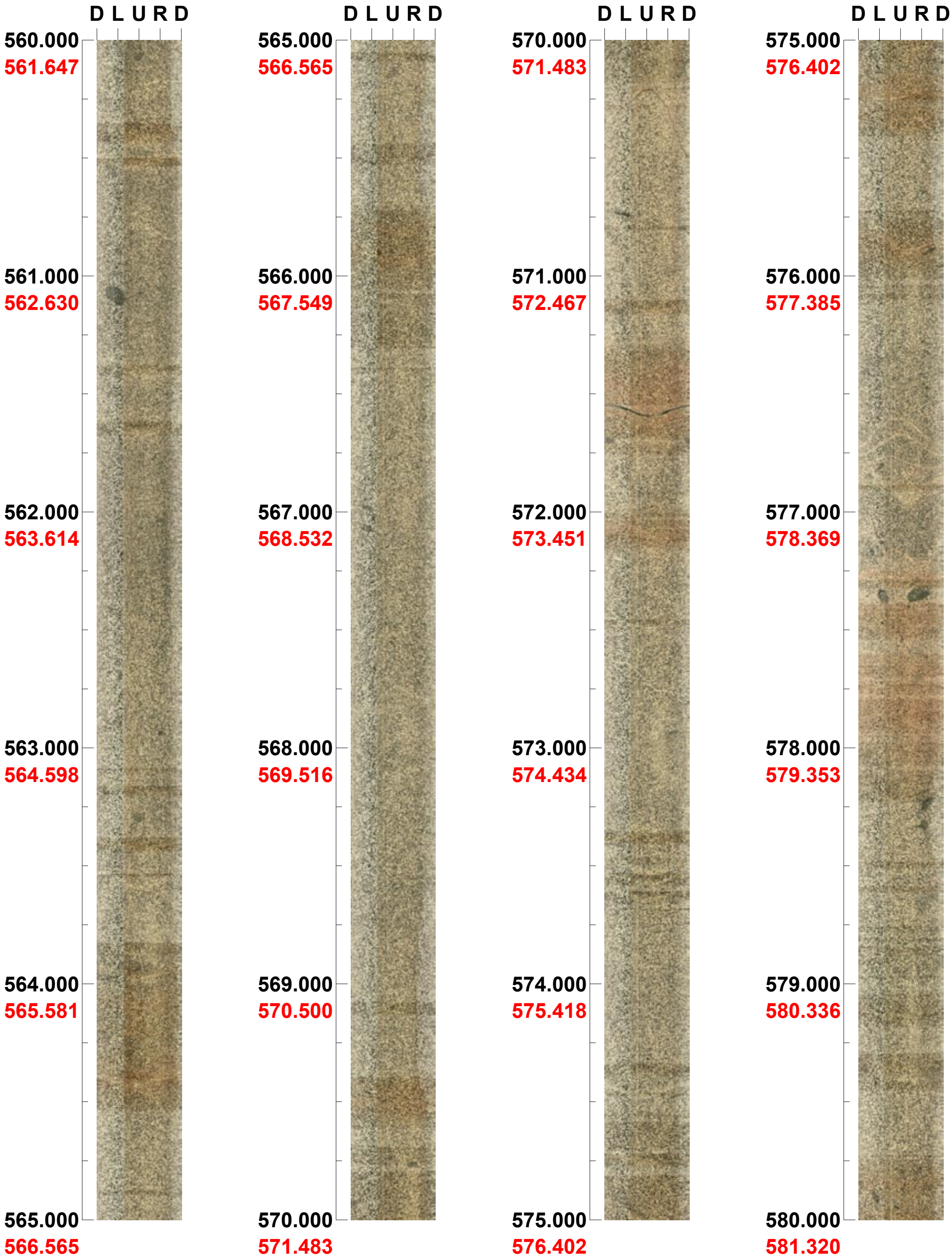
Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 540.000 - 560.000 m

(2 / 7) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar
Bore hole No.: KLX27A Azimuth: 1 Inclination: -65

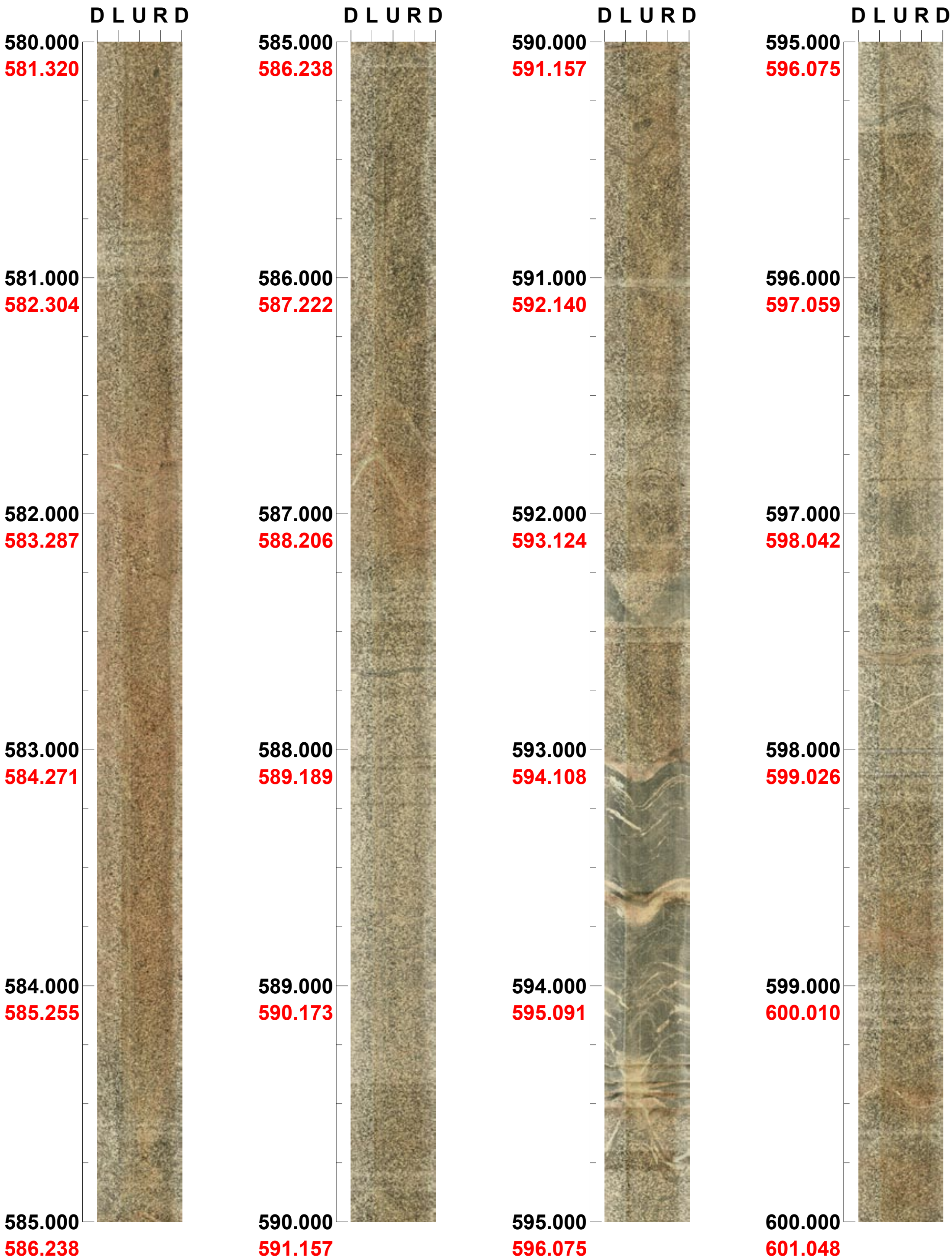
Depth range: 560.000 - 580.000 m



(3 / 7) Scale: 1/25 Aspect ratio: 150 %

Project name: Laxemar
Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

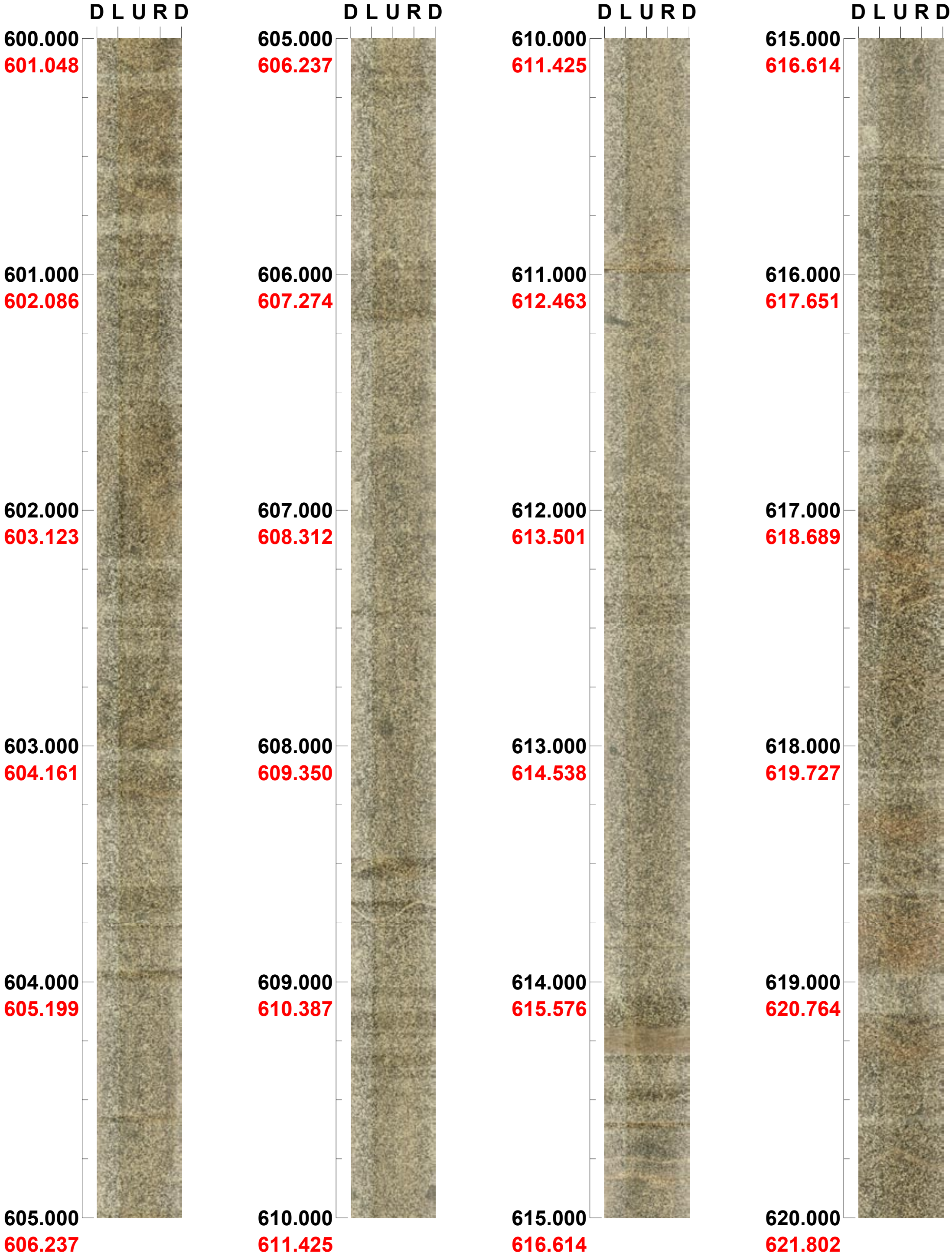
Depth range: 580.000 - 600.000 m



(4 / 7) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar
Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 600.000 - 620.000 m



(5 / 7) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar

Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

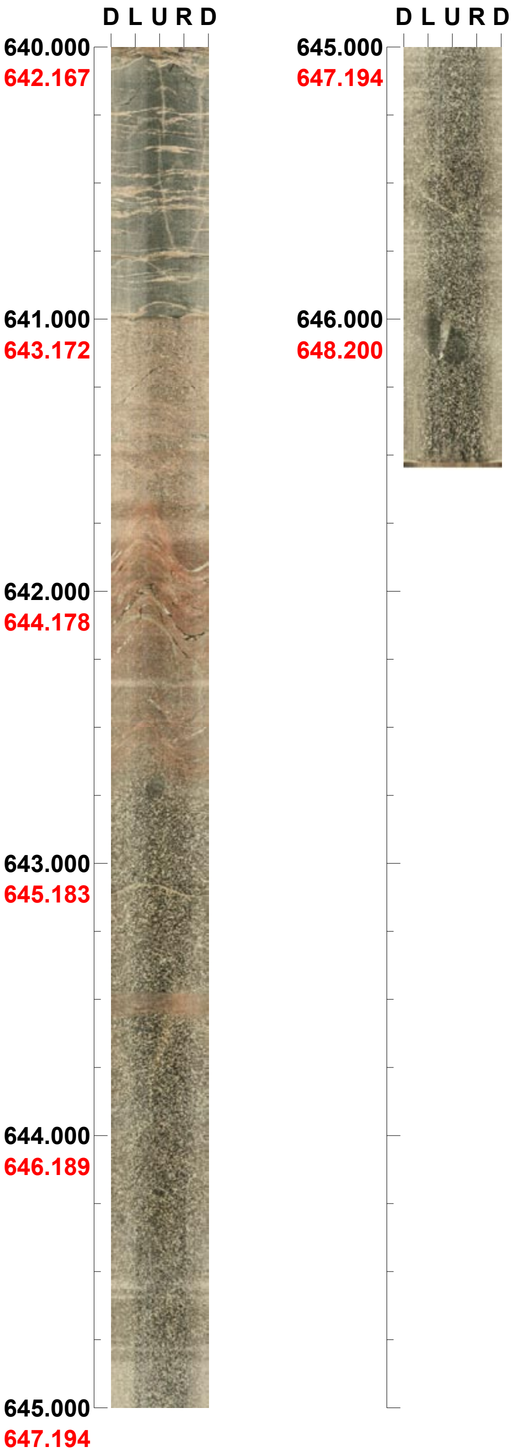
Depth range: 620.000 - 640.000 m

(6 / 7) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Laxemar

Bore hole No.: KLX27A **Azimuth: 1** **Inclination: -65**

Depth range: 640.000 - 646.541 m



(7 / 7) **Scale: 1/25** **Aspect ratio: 150 %**

Deviation logging in KLX27A, 0 to 645 m

KLX27A

Survey name:	**KLX27A OUT**
Survey date:	05/12/2007 22:00:23
Project:	PLU
Location:	Laxemar

FLEXIT

Country:	Sweden		
Survey company:	MALÅ GeoScience / RAYCON		
Surveyed by:	Christer Gustafsson		
Survey type:	STANDARD		
Operating conditions:			
General comments:			
Client name:	SKB		
Client ID number:	APPS 400-07-064		
Client reference:	Leif Stenberg		
Drill company:			
Drill rig:			
Drill diameter:	76	Survey run on:	Wireline
Survey direction:	INTO hole	Magnetic Var.:	2,73 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:	49700	1000	nano Tesla
Magnetic dip:	71	1.5	Degrees

SURVEY	Actual start	End of survey	Difference
Station:	0,0	645,0	645,0
East:	1546742,63	1546745,94	3,31
North:	6365608,29	6365892,35	284,06
Elevation:	16,98	-561,99	-578,97
Dip:	-65,34	-61,45	3,89
Azimuth:	0,73	0,91	0,18

OFFSETS at end

Offsets relative to:
ACTUAL START

16,59 metres upwards
0,32 metres left
0,31 metres shortfall

Printed on: 2008-03-25 08:47:49

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Survey name : KLX27A OUT

Survey date : 05/12/2007 22:00:23

Printed on 2008-03-25 08:48:52

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	-65,34	0,73	1546742,63	6365608,29	16,98	62644	65,43	0,999275	✍✍✍	0,00	0,00	0,00
3,0	-65,42	0,93	1546742,65	6365609,54	14,25	25225	76,05	0,998832	✍✍✍	0,00	0,00	0,00
6,0	-65,36	1,13	1546742,67	6365610,79	11,53	96220	72,80	0,997894	✍✍✍	0,00	0,01	0,00
9,0	-65,24	1,33	1546742,70	6365612,04	8,80	51374	71,01	0,997904	✍✍	0,00	0,02	0,00
12,0	-65,12	1,60	1546742,73	6365613,30	6,08	50149	71,09	0,997751	✍	0,01	0,04	0,00
15,0	-64,93	1,25	1546742,76	6365614,57	3,36	50319	71,15	0,997839	✍	0,02	0,05	0,00
18,0	-65,04	1,87	1546742,80	6365615,84	0,64	50445	71,73	0,997615	✍	0,04	0,07	0,00
21,0	-65,11	1,83	1546742,84	6365617,10	-2,08	49528	71,09	0,998178	✍	0,05	0,09	0,00
24,0	-65,12	0,92	1546742,87	6365618,36	-4,80	50015	71,30	0,997644	✍	0,07	0,11	0,00
27,0	-65,06	1,32	1546742,89	6365619,62	-7,52	49479	71,23	0,999553	✍	0,08	0,12	0,00
30,0	-65,15	1,97	1546742,93	6365620,89	-10,25	49372	71,09	0,997332	✍	0,09	0,14	0,00
33,0	-65,30	1,54	1546742,97	6365622,14	-12,97	49476	71,23	0,997455	✍	0,10	0,16	0,00
36,0	-65,13	1,96	1546743,01	6365623,40	-15,69	49431	71,11	0,998846	✍	0,10	0,18	0,00
39,0	-65,05	1,83	1546743,05	6365624,66	-18,41	49600	71,27	0,998345	✍	0,12	0,21	0,00
42,0	-65,06	2,51	1546743,10	6365625,93	-21,13	49547	71,12	0,997614	✍	0,13	0,24	0,00
45,0	-65,10	1,66	1546743,14	6365627,19	-23,85	49519	71,24	0,997636	✍	0,14	0,27	0,00
48,0	-65,02	2,51	1546743,19	6365628,45	-26,58	49551	71,11	0,997570	✍	0,16	0,30	0,00
51,0	-65,27	1,18	1546743,23	6365629,72	-29,30	49520	71,20	1,000255	✍	0,17	0,32	0,00
54,0	-65,22	0,84	1546743,25	6365630,97	-32,02	50043	70,73	0,998042	✍	0,17	0,33	0,00
57,0	-65,22	1,40	1546743,28	6365632,23	-34,75	49440	71,15	0,998524	✍	0,18	0,34	0,00
60,0	-65,29	1,50	1546743,31	6365633,48	-37,47	49330	71,31	0,997976	✍	0,18	0,35	0,00
63,0	-65,18	1,77	1546743,34	6365634,74	-40,19	49387	71,02	0,998096	✍	0,19	0,37	0,00
66,0	-65,14	0,24	1546743,37	6365636,00	-42,92	49775	71,06	0,998193	✍	0,20	0,38	0,00
69,0	-63,73	1,88	1546743,39	6365637,29	-45,62	49503	70,22	0,997173	✍	0,25	0,39	0,00
72,0	-65,11	1,63	1546743,43	6365638,59	-48,33	49703	70,40	0,999849	✍	0,29	0,41	0,00
75,0	-65,18	1,53	1546743,46	6365639,85	-51,05	49361	70,78	1,000409	✍	0,30	0,43	0,00
78,0	-65,17	1,94	1546743,50	6365641,11	-53,77	49246	70,79	0,997653	✍	0,31	0,45	0,00
81,0	-65,16	2,05	1546743,55	6365642,37	-56,50	49528	70,92	0,997368	✍	0,32	0,48	0,00
84,0	-65,13	1,63	1546743,59	6365643,63	-59,22	49258	70,83	0,997792	✍	0,33	0,50	0,00
87,0	-65,12	2,67	1546743,63	6365644,89	-61,94	49394	70,83	0,997542	✍	0,34	0,54	0,00
90,0	-65,05	1,46	1546743,68	6365646,15	-64,66	49354	70,77	0,997358	✍	0,35	0,57	0,00
93,0	-65,06	1,41	1546743,71	6365647,42	-67,38	49640	70,98	0,997869	✍	0,37	0,58	0,00
96,0	-65,01	1,02	1546743,74	6365648,68	-70,10	49896	71,02	0,997531	✍	0,38	0,59	0,00

FLEXIT: SmartTool drillhole survey result table.

Survey name : KLX27A OUT

Survey date : 05/12/2007 22:00:23

Printed on 2008-03-25 08:48:52

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
99,0	-64,97	1,69	1546743,77	6365649,95	-72,82	49562	70,63	0,997474	✍	0,40	0,61	0,00
102,0	-64,91	1,79	1546743,81	6365651,22	-75,54	50174	70,62	0,997632	✍	0,42	0,63	0,00
105,0	-64,88	0,97	1546743,84	6365652,49	-78,25	50529	71,03	0,997456	✍	0,45	0,64	0,00
108,0	-64,87	1,61	1546743,87	6365653,77	-80,97	49522	70,91	0,997797	✍	0,47	0,65	0,00
111,0	-64,85	1,46	1546743,90	6365655,04	-83,68	49609	70,82	0,997595	✍	0,50	0,67	0,00
114,0	-64,84	1,48	1546743,93	6365656,32	-86,40	49545	70,85	0,997481	✍	0,52	0,69	0,00
117,0	-64,84	1,78	1546743,97	6365657,59	-89,12	49566	70,76	0,997428	✍	0,55	0,71	0,00
120,0	-64,80	1,71	1546744,01	6365658,87	-91,83	49938	70,82	0,997485	✍	0,57	0,73	-0,01
123,0	-64,80	1,93	1546744,05	6365660,14	-94,55	49256	70,75	0,997560	✍	0,60	0,76	-0,01
126,0	-64,78	1,04	1546744,08	6365661,42	-97,26	49660	70,96	0,997810	✍	0,63	0,77	-0,01
129,0	-64,77	1,85	1546744,11	6365662,70	-99,97	49390	70,77	0,997533	✍	0,66	0,79	-0,01
132,0	-64,76	1,24	1546744,15	6365663,98	-102,69	49407	70,73	0,997552	✍	0,69	0,81	-0,01
135,0	-64,70	1,32	1546744,18	6365665,26	-105,40	49461	70,73	0,997639	✍	0,72	0,82	-0,01
138,0	-64,65	1,61	1546744,21	6365666,54	-108,11	49538	70,73	0,997647	✍	0,76	0,84	-0,01
141,0	-64,61	1,52	1546744,25	6365667,83	-110,82	49389	70,80	0,997698	✍	0,79	0,85	-0,01
144,0	-64,61	1,54	1546744,28	6365669,11	-113,53	49394	70,78	0,997883	✍	0,83	0,87	-0,01
147,0	-64,60	1,31	1546744,31	6365670,40	-116,24	49517	70,77	0,997624	✍	0,87	0,89	-0,01
150,0	-64,57	1,20	1546744,34	6365671,69	-118,95	49408	70,82	0,998014	✍	0,91	0,90	-0,01
153,0	-64,58	1,05	1546744,37	6365672,97	-121,66	49252	70,87	0,997593	✍	0,95	0,91	-0,01
156,0	-64,58	1,26	1546744,39	6365674,26	-124,37	49386	70,72	0,997957	✍	0,99	0,92	-0,01
159,0	-64,54	0,86	1546744,41	6365675,55	-127,08	49508	70,99	0,997590	✍	1,03	0,93	-0,01
162,0	-64,52	1,61	1546744,44	6365676,84	-129,79	49142	70,68	0,997501	✍	1,07	0,94	-0,01
165,0	-64,51	0,40	1546744,47	6365678,13	-132,50	49842	70,64	0,997342	✍	1,12	0,94	-0,01
168,0	-64,48	0,15	1546744,47	6365679,42	-135,20	49844	70,62	0,997292	✍	1,16	0,93	-0,01
171,0	-64,49	0,55	1546744,48	6365680,71	-137,91	49687	71,12	0,997773	✍	1,21	0,92	-0,01
174,0	-64,47	0,62	1546744,49	6365682,01	-140,62	49752	71,25	0,997434	✍	1,25	0,92	-0,01
177,0	-64,51	0,61	1546744,51	6365683,30	-143,33	49816	71,02	0,997626	✍	1,30	0,92	-0,01
180,0	-64,54	0,86	1546744,52	6365684,59	-146,03	49802	71,46	0,997775	✍	1,34	0,92	-0,01
183,0	-64,56	1,43	1546744,55	6365685,88	-148,74	49716	71,08	0,997395	✍	1,38	0,93	-0,01
186,0	-64,60	1,10	1546744,58	6365687,17	-151,45	49341	70,52	0,997607	✍	1,42	0,94	-0,01
189,0	-64,60	1,41	1546744,61	6365688,45	-154,16	49449	70,58	0,997595	✍	1,46	0,95	-0,01
192,0	-64,61	0,84	1546744,63	6365689,74	-156,87	49223	70,71	0,997845	✍	1,50	0,96	-0,01
195,0	-64,60	1,02	1546744,65	6365691,02	-159,58	49345	70,57	0,997988	✍	1,53	0,97	-0,01

Survey name : KLX27A OUT

Survey date : 05/12/2007 22:00:23

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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
198,0	-64,61	1,55	1546744,68	6365692,31	-162,29	49373	70,89	0,997624	✍	1,57	0,98	-0,01
201,0	-64,57	0,71	1546744,71	6365693,60	-165,00	49771	70,47	0,997230	✍	1,61	0,99	-0,01
204,0	-64,53	1,04	1546744,73	6365694,89	-167,71	49450	70,70	0,997415	✍	1,65	0,99	-0,01
207,0	-64,53	1,22	1546744,75	6365696,18	-170,42	49864	71,05	0,997748	✍	1,70	1,00	-0,01
210,0	-64,52	0,87	1546744,77	6365697,47	-173,13	49802	71,02	0,997680	✍	1,74	1,01	-0,01
213,0	-64,52	0,28	1546744,79	6365698,76	-175,84	49786	70,89	0,997619	✍	1,78	1,00	-0,01
216,0	-64,54	0,23	1546744,79	6365700,05	-178,55	50042	70,95	0,997791	✍	1,82	0,99	-0,01
219,0	-64,56	0,43	1546744,80	6365701,34	-181,25	50091	70,93	0,997502	✍	1,86	0,98	-0,01
222,0	-64,52	0,68	1546744,81	6365702,63	-183,96	49974	70,76	0,997431	✍	1,91	0,98	-0,01
225,0	-64,44	0,45	1546744,83	6365703,92	-186,67	50024	70,74	0,997139	✍	1,95	0,98	-0,01
228,0	-64,40	0,59	1546744,84	6365705,21	-189,38	50054	70,76	0,997355	✍	2,00	0,97	-0,02
231,0	-64,42	0,39	1546744,85	6365706,51	-192,08	50049	70,71	0,997833	✍	2,05	0,97	-0,02
234,0	-64,42	0,27	1546744,86	6365707,80	-194,79	50031	70,59	0,997926	✍	2,10	0,96	-0,02
237,0	-64,40	0,17	1546744,86	6365709,10	-197,49	50112	70,52	0,997493	✍	2,15	0,94	-0,02
240,0	-64,34	0,57	1546744,87	6365710,40	-200,20	49645	70,60	0,997636	✍	2,20	0,94	-0,02
243,0	-64,28	1,11	1546744,89	6365711,70	-202,90	49555	70,59	0,997413	✍	2,25	0,94	-0,02
246,0	-64,26	0,74	1546744,91	6365713,00	-205,60	49751	70,73	0,997752	✍	2,31	0,94	-0,02
249,0	-64,21	0,82	1546744,93	6365714,30	-208,31	50430	70,54	0,997470	✍	2,36	0,94	-0,02
252,0	-64,20	1,81	1546744,96	6365715,61	-211,01	49436	70,43	0,997470	✍	2,42	0,96	-0,02
255,0	-64,16	1,44	1546744,99	6365716,92	-213,71	49293	70,31	0,997320	✍	2,48	0,98	-0,02
258,0	-64,13	1,58	1546745,03	6365718,22	-216,41	49359	70,39	0,997763	✍	2,55	1,00	-0,02
261,0	-64,08	1,58	1546745,06	6365719,53	-219,11	49461	70,25	0,997681	✍	2,61	1,02	-0,02
264,0	-64,08	1,04	1546745,09	6365720,84	-221,80	49304	70,45	0,997504	✍	2,68	1,03	-0,02
267,0	-64,05	1,02	1546745,12	6365722,16	-224,50	49416	70,50	0,997712	✍	2,74	1,04	-0,02
270,0	-64,04	1,38	1546745,15	6365723,47	-227,20	49303	70,54	0,997586	✍	2,81	1,05	-0,02
273,0	-64,03	1,25	1546745,18	6365724,78	-229,90	49378	70,66	0,997546	✍	2,88	1,06	-0,02
276,0	-64,04	0,87	1546745,20	6365726,10	-232,59	49275	70,68	0,997555	✍	2,95	1,07	-0,03
279,0	-64,03	1,13	1546745,22	6365727,41	-235,29	49266	70,53	0,997675	✍	3,02	1,07	-0,03
282,0	-64,00	1,15	1546745,25	6365728,72	-237,99	49438	70,44	0,997804	✍	3,09	1,08	-0,03
285,0	-64,00	1,27	1546745,28	6365730,04	-240,68	49254	70,43	0,997669	✍	3,16	1,09	-0,03
288,0	-64,04	1,42	1546745,31	6365731,35	-243,38	49298	70,63	0,997727	✍	3,23	1,11	-0,03
291,0	-64,02	1,16	1546745,34	6365732,67	-246,08	50172	71,02	0,997664	✍	3,29	1,12	-0,03
294,0	-64,00	1,37	1546745,37	6365733,98	-248,77	49456	70,63	0,997339	✍	3,36	1,13	-0,03

Survey name : KLX27A OUT

Survey date : 05/12/2007 22:00:23

Printed on 2008-03-25 08:48:53

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	-63,98	0,41	1546745,39	6365735,30	-251,47	49404	70,66	0,997911	✍	3,43	1,14	-0,03
300,0	-63,98	1,23	1546745,41	6365736,61	-254,17	49270	70,70	0,997466	✍	3,50	1,14	-0,03
303,0	-63,98	0,81	1546745,43	6365737,93	-256,86	49154	70,81	0,997475	✍	3,58	1,15	-0,03
306,0	-63,98	0,29	1546745,44	6365739,24	-259,56	49521	70,83	0,997707	✍	3,65	1,14	-0,03
309,0	-63,98	0,85	1546745,46	6365740,56	-262,25	49233	70,63	0,997788	✍	3,72	1,14	-0,03
312,0	-63,98	1,10	1546745,48	6365741,87	-264,95	49200	70,73	0,997559	✍	3,79	1,14	-0,04
315,0	-63,98	1,20	1546745,50	6365743,19	-267,65	49405	70,65	0,997498	✍	3,86	1,15	-0,04
318,0	-63,99	1,08	1546745,53	6365744,51	-270,34	49333	70,66	0,997563	✍	3,93	1,16	-0,04
321,0	-63,95	1,12	1546745,56	6365745,82	-273,04	49262	70,52	0,997595	✍	4,00	1,17	-0,04
324,0	-63,96	1,03	1546745,58	6365747,14	-275,73	49323	70,78	0,997740	✍	4,07	1,18	-0,04
327,0	-63,94	1,02	1546745,60	6365748,46	-278,43	49314	70,67	0,998056	✍	4,15	1,19	-0,04
330,0	-63,96	1,24	1546745,63	6365749,77	-281,12	49347	70,34	0,997423	✍	4,22	1,19	-0,04
333,0	-63,97	1,04	1546745,66	6365751,09	-283,82	49265	70,70	0,997627	✍	4,29	1,20	-0,04
336,0	-63,93	0,31	1546745,67	6365752,41	-286,51	49257	70,67	0,997662	✍	4,36	1,20	-0,04
339,0	-63,94	0,68	1546745,68	6365753,73	-289,21	49421	70,48	0,997610	✍	4,44	1,20	-0,04
342,0	-63,93	0,70	1546745,70	6365755,04	-291,90	49344	70,82	0,997922	✍	4,51	1,20	-0,04
345,0	-63,93	0,84	1546745,72	6365756,36	-294,60	49200	70,74	0,997450	✍	4,59	1,20	-0,04
348,0	-63,94	0,68	1546745,73	6365757,68	-297,29	49216	71,02	0,997629	✍	4,66	1,20	-0,05
351,0	-63,94	0,80	1546745,75	6365759,00	-299,99	49627	70,76	0,997635	✍	4,73	1,20	-0,05
354,0	-63,93	359,79	1546745,76	6365760,32	-302,68	49359	70,79	0,997557	✍	4,81	1,19	-0,05
357,0	-63,91	0,44	1546745,76	6365761,64	-305,38	49353	70,69	0,997507	✍	4,88	1,17	-0,05
360,0	-63,90	0,44	1546745,77	6365762,95	-308,07	49296	70,54	0,997569	✍	4,96	1,17	-0,05
363,0	-63,90	0,39	1546745,78	6365764,27	-310,77	49461	70,35	0,997233	✍	5,03	1,16	-0,05
366,0	-63,86	0,87	1546745,79	6365765,60	-313,46	49265	70,40	0,997538	✍	5,11	1,16	-0,05
369,0	-63,87	0,57	1546745,81	6365766,92	-316,15	49618	70,79	0,997923	✍	5,18	1,16	-0,05
372,0	-63,86	0,55	1546745,82	6365768,24	-318,85	49484	70,67	0,997658	✍	5,26	1,15	-0,05
375,0	-63,87	0,65	1546745,84	6365769,56	-321,54	49366	70,60	0,997343	✍	5,34	1,15	-0,05
378,0	-63,84	0,71	1546745,85	6365770,88	-324,23	49168	70,69	0,997459	✍	5,42	1,15	-0,06
381,0	-63,79	0,74	1546745,87	6365772,20	-326,93	49252	70,74	0,997851	✍	5,50	1,15	-0,06
384,0	-63,76	0,37	1546745,88	6365773,53	-329,62	49294	70,62	0,997675	✍	5,58	1,15	-0,06
387,0	-63,76	0,55	1546745,89	6365774,86	-332,31	49221	70,94	0,997939	✍	5,66	1,14	-0,06
390,0	-63,76	0,30	1546745,90	6365776,18	-335,00	49189	70,55	0,997713	✍	5,74	1,13	-0,06
393,0	-63,74	0,92	1546745,92	6365777,51	-337,69	49272	70,83	0,997569	✍	5,83	1,13	-0,06

Survey name : KLX27A OUT

Survey date : 05/12/2007 22:00:23

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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	-63,71	359,83	1546745,93	6365778,84	-340,38	49356	70,90	0,997626	✍	5,91	1,12	-0,06
399,0	-63,71	359,93	1546745,92	6365780,17	-343,07	49171	70,79	0,997626	✍	6,00	1,10	-0,06
402,0	-63,74	0,62	1546745,93	6365781,49	-345,76	49385	70,72	0,997822	✍	6,08	1,09	-0,06
405,0	-63,71	0,28	1546745,94	6365782,82	-348,45	49253	70,59	0,997635	✍	6,16	1,08	-0,07
408,0	-63,69	0,62	1546745,95	6365784,15	-351,14	49310	70,77	0,997570	✍	6,25	1,08	-0,07
411,0	-63,67	359,95	1546745,96	6365785,48	-353,83	49687	70,74	0,997556	✍	6,34	1,07	-0,07
414,0	-63,64	0,06	1546745,96	6365786,81	-356,52	49268	70,70	0,997663	✍	6,42	1,05	-0,07
417,0	-63,61	359,71	1546745,95	6365788,15	-359,20	49406	70,68	0,997788	✍	6,51	1,03	-0,07
420,0	-63,56	0,05	1546745,95	6365789,48	-361,89	49291	70,61	0,997792	✍	6,61	1,01	-0,07
423,0	-63,56	0,19	1546745,95	6365790,82	-364,58	49195	70,70	0,997770	✍	6,70	1,00	-0,07
426,0	-63,53	0,40	1546745,96	6365792,15	-367,26	48959	70,60	0,997652	✍	6,79	0,99	-0,08
429,0	-63,52	0,30	1546745,97	6365793,49	-369,95	49056	70,64	0,997789	✍	6,89	0,98	-0,08
432,0	-63,48	0,61	1546745,98	6365794,83	-372,63	49283	70,49	0,997600	✍	6,98	0,97	-0,08
435,0	-63,46	0,20	1546745,99	6365796,17	-375,32	49163	70,59	0,997749	✍	7,08	0,96	-0,08
438,0	-63,45	359,94	1546745,99	6365797,51	-378,00	49287	70,95	0,997697	✍	7,18	0,95	-0,08
441,0	-63,41	0,23	1546745,99	6365798,85	-380,68	49276	70,72	0,997706	✍	7,28	0,93	-0,08
444,0	-63,36	0,41	1546746,00	6365800,19	-383,37	49308	70,41	0,997820	✍	7,38	0,92	-0,09
447,0	-63,38	0,03	1546746,01	6365801,54	-386,05	49103	70,28	0,997892	✍	7,49	0,91	-0,09
450,0	-63,37	359,47	1546746,00	6365802,88	-388,73	49028	70,33	0,997712	✍	7,59	0,89	-0,09
453,0	-63,33	359,46	1546745,99	6365804,23	-391,41	49035	70,48	0,997795	✍	7,69	0,86	-0,09
456,0	-63,36	359,75	1546745,98	6365805,57	-394,09	48885	70,39	0,998017	✍	7,80	0,83	-0,09
459,0	-63,33	359,58	1546745,97	6365806,92	-396,77	49143	70,40	0,997809	✍	7,90	0,81	-0,09
462,0	-63,34	359,96	1546745,97	6365808,27	-399,45	48994	70,07	0,997773	✍	8,00	0,79	-0,10
465,0	-63,30	359,77	1546745,96	6365809,61	-402,13	49408	70,67	0,997836	✍	8,11	0,76	-0,10
468,0	-63,30	358,64	1546745,94	6365810,96	-404,81	49418	70,85	0,997237	✍	8,22	0,73	-0,10
471,0	-63,27	359,70	1546745,92	6365812,31	-407,49	49154	70,68	0,997358	✍	8,32	0,69	-0,10
474,0	-63,29	359,63	1546745,92	6365813,66	-410,17	49324	70,55	0,997591	✍	8,43	0,67	-0,11
477,0	-63,27	359,79	1546745,91	6365815,01	-412,85	49437	70,90	0,997697	✍	8,54	0,64	-0,11
480,0	-63,26	359,81	1546745,90	6365816,36	-415,53	49436	70,82	0,997521	✍	8,65	0,62	-0,11
483,0	-63,24	359,90	1546745,90	6365817,71	-418,21	49347	70,79	0,997765	✍	8,76	0,60	-0,11
486,0	-63,25	359,95	1546745,90	6365819,06	-420,89	49392	70,77	0,997829	✍	8,87	0,58	-0,11
489,0	-63,20	359,77	1546745,90	6365820,41	-423,57	49189	70,65	0,997413	✍	8,98	0,56	-0,12
492,0	-63,19	0,03	1546745,89	6365821,76	-426,25	49280	70,54	0,997726	✍	9,09	0,54	-0,12

FLEXIT: SmartTool drillhole survey result table.

Survey name : KLX27A OUT

Survey date : 05/12/2007 22:00:23

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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
495,0	-63,18	359,25	1546745,89	6365823,12	-428,92	49242	70,53	0,998008	✍	9,20	0,52	-0,12
498,0	-63,18	359,72	1546745,87	6365824,47	-431,60	49714	70,92	0,997733	✍	9,31	0,49	-0,12
501,0	-63,16	0,88	1546745,88	6365825,82	-434,28	49433	71,02	0,997866	✍	9,43	0,48	-0,12
504,0	-63,14	0,04	1546745,89	6365827,18	-436,96	48936	70,60	0,997830	✍	9,54	0,47	-0,13
507,0	-63,17	359,79	1546745,89	6365828,53	-439,63	49097	70,63	0,997696	✍	9,66	0,45	-0,13
510,0	-63,10	359,90	1546745,89	6365829,89	-442,31	49223	70,42	0,997608	✍	9,77	0,43	-0,13
513,0	-63,08	0,14	1546745,89	6365831,25	-444,98	49157	70,32	0,997812	✍	9,89	0,41	-0,13
516,0	-63,05	0,19	1546745,89	6365832,61	-447,66	49175	70,61	0,997698	✍	10,01	0,40	-0,14
519,0	-63,01	359,74	1546745,89	6365833,97	-450,33	49217	70,75	0,997874	✍	10,13	0,38	-0,14
522,0	-62,96	0,25	1546745,89	6365835,33	-453,00	49715	70,73	0,997869	✍	10,25	0,36	-0,14
525,0	-62,92	359,92	1546745,89	6365836,69	-455,68	49363	70,77	0,997809	✍	10,38	0,35	-0,14
528,0	-62,88	0,35	1546745,89	6365838,06	-458,35	49379	70,83	0,997618	✍	10,50	0,33	-0,15
531,0	-62,32	0,17	1546745,90	6365839,44	-461,01	49532	70,40	0,979865	✍	10,65	0,32	-0,15
534,0	-62,86	0,21	1546745,90	6365840,82	-463,67	49404	70,60	0,997901	✍	10,79	0,31	-0,15
537,0	-62,81	359,91	1546745,91	6365842,19	-466,34	49305	70,42	0,997471	✍	10,92	0,29	-0,16
540,0	-62,80	359,88	1546745,90	6365843,56	-469,01	49861	70,69	0,997759	✍	11,06	0,27	-0,16
543,0	-62,79	359,72	1546745,90	6365844,93	-471,68	48893	69,77	0,998005	✍	11,19	0,25	-0,16
546,0	-62,71	359,77	1546745,89	6365846,31	-474,35	49115	70,37	0,997831	✍	11,32	0,23	-0,17
549,0	-62,69	359,76	1546745,89	6365847,68	-477,01	49109	70,36	0,997711	✍	11,46	0,20	-0,17
552,0	-62,66	359,40	1546745,88	6365849,06	-479,68	49704	70,99	0,997673	✍	11,60	0,18	-0,17
555,0	-62,65	359,74	1546745,87	6365850,44	-482,34	50283	70,54	0,997915	✍	11,74	0,15	-0,18
558,0	-62,62	0,04	1546745,86	6365851,82	-485,01	49199	70,01	0,997601	✍	11,88	0,13	-0,18
561,0	-62,61	0,16	1546745,87	6365853,20	-487,67	49116	70,41	0,997875	✍	12,02	0,11	-0,18
564,0	-62,58	359,51	1546745,86	6365854,58	-490,33	48976	70,15	0,998010	✍	12,17	0,09	-0,19
567,0	-62,55	359,67	1546745,85	6365855,96	-493,00	49098	70,16	0,997521	✍	12,31	0,06	-0,19
570,0	-62,55	0,05	1546745,85	6365857,34	-495,66	49268	70,58	0,998059	✍	12,46	0,04	-0,19
573,0	-62,52	0,18	1546745,85	6365858,73	-498,32	49176	70,36	0,997845	✍	12,61	0,03	-0,20
576,0	-62,51	0,26	1546745,86	6365860,11	-500,98	49393	70,36	0,997951	✍	12,75	0,02	-0,20
579,0	-62,48	0,16	1546745,86	6365861,50	-503,64	49026	70,35	0,997467	✍	12,90	0,00	-0,20
582,0	-62,46	0,27	1546745,87	6365862,88	-506,30	49187	70,85	0,997854	✍	13,05	-0,01	-0,21
585,0	-62,46	0,16	1546745,87	6365864,27	-508,96	49304	70,59	0,997456	✍	13,20	-0,02	-0,21
588,0	-62,41	0,15	1546745,88	6365865,66	-511,62	49236	70,08	0,997909	✍	13,36	-0,03	-0,22
591,0	-62,39	358,69	1546745,86	6365867,05	-514,28	50082	70,23	0,997744	✍	13,51	-0,07	-0,22

FLEXIT: SmartTool drillhole survey result table.

Survey name : KLX27A OUT
Survey date : 05/12/2007 22:00:23

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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	-62,39	359,88	1546745,85	6365868,44	-516,94	49661	70,70	0,998260	✍	13,66	-0,10	-0,22
597,0	-62,37	358,50	1546745,83	6365869,83	-519,60	49704	70,83	0,997685	✍	13,82	-0,14	-0,23
600,0	-62,37	359,40	1546745,80	6365871,22	-522,25	49143	70,40	0,997559	✍	13,97	-0,18	-0,23
603,0	-62,37	358,63	1546745,78	6365872,61	-524,91	49292	70,70	0,997720	✍	14,13	-0,22	-0,24
606,0	-62,33	359,23	1546745,75	6365874,00	-527,57	49034	70,57	0,998018	✍	14,28	-0,27	-0,24
609,0	-62,32	359,10	1546745,73	6365875,40	-530,23	48859	70,17	0,997834	✍	14,44	-0,31	-0,25
612,0	-62,31	359,65	1546745,71	6365876,79	-532,88	48840	70,30	0,998101	✍	14,60	-0,34	-0,25
615,0	-62,22	359,53	1546745,70	6365878,19	-535,54	48961	70,44	0,997542	✍	14,76	-0,37	-0,25
618,0	-62,14	0,09	1546745,70	6365879,59	-538,19	48998	70,43	0,997806	✍	14,92	-0,39	-0,26
621,0	-62,05	0,31	1546745,70	6365880,99	-540,84	49033	70,29	0,997809	✍	15,09	-0,40	-0,26
624,0	-61,98	0,40	1546745,71	6365882,40	-543,49	49067	70,49	0,997684	✍	15,27	-0,41	-0,27
627,0	-61,92	0,53	1546745,73	6365883,81	-546,14	49111	70,64	0,997869	✍	15,44	-0,42	-0,27
630,0	-61,85	0,90	1546745,74	6365885,22	-548,79	49164	70,65	0,998029	✍	15,63	-0,42	-0,28
633,0	-61,77	1,23	1546745,77	6365886,64	-551,43	49265	70,55	0,997727	✍	15,81	-0,41	-0,28
636,0	-61,68	1,31	1546745,80	6365888,06	-554,07	49041	70,41	0,997598	✍	16,00	-0,40	-0,29
639,0	-61,59	2,49	1546745,85	6365889,48	-556,71	50223	70,49	0,997713	✍	16,19	-0,37	-0,30
642,0	-61,48	1,83	1546745,90	6365890,91	-559,35	49163	69,87	0,997411	✍	16,39	-0,33	-0,30
645,0	-61,45	0,91	1546745,94	6365892,35	-561,99	49320	71,01	0,997350	✍	16,59	-0,32	-0,31