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Oskarshamn site investigation

RAMAC, BIPS and deviation logging in boreholes KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G

Jaana Gustafsson, Christer Gustafsson
Malå Geoscience AB/RAYCON

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Svensk Kärnbränslehantering AB
Swedish Nuclear Fuel
and Waste Management Co
Box 5864
SE-102 40 Stockholm Sweden
Tel 08-459 84 00
+46 8 459 84 00
Fax 08-661 57 19
+46 8 661 57 19

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Keywords: BIPS, RAMAC, Radar, TV.

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 boreholes KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G. All measurements were conducted by Malå Geoscience AB/RAYCON during February 2006.

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 KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G was 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 15 identified radar reflectors in KLX09B and of these 4 were orientated (strike/dip). The corresponding figures for KLX09C, KXL09D, KLX09E and KLX09G are 25 and 6, 24 and 6, 31 and 6 and 21 and 6. In KLX09F 29 radar reflectors were identified.

The BIPS images from KLX09B and KLX09C are of good quality. The other boreholes logged in this project have quality problem due to mud covering the lower most part of the borehole wall.

Sammanfattning

Denna rapport omfattar geofysiska loggningar inom platsundersökningsprogrammet för Oskarshamn. Mätningarna som presenteras här omfattar borrhålsradarmätningar (RAMAC), och BIPS-loggningar i kärnborrhålen KLX09B, KLX09C, KLX09D, KLX09E, KLX09F och KLX09G. I borrhålen genomfördes även avvikelsemätningar, s k krökningsmätningar. Alla mätningar är utförda av Malå Geoscience AB/RAYCON under februari 2006.

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 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. Krökningsmätningen presenteras som en lista med lägesdata.

Borrhålsradardata från KLX09B, KLX09C, KLX09D, KLX09E, KLX09F och KLX09G var tillfredställande, men i delar var djuppenetration sämre troligen till stor del beroende på en konduktiv miljö. En konduktiv miljö minskar möjligheterna att identifiera strukturer från borrhålsradardata. Dock har 15 radarreflektorer identifierats i KLX09B och av dessa har 4 orienterats (med strykning/stupning). Motsvarande siffror för KLX09C, KLX09D, KLX09E, och KLX09G är 25 och 6, 24 och 6, 31 och 6 och 21 och 6. I KLX09F identifierades 29 radarreflektorer.

BIPS-bilderna från KLX09B och KLX09C håller en bra kvalitet. Övriga borrhål i projektet har kvalitetsbrister eftersom slam täcker den nedre delen av borrhålsväggen längs borrhålen.

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, BIPS and deviation measurements in the core drilled boreholes KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G).

The work was carried out in accordance with activity plan AP PS 400-06-016. 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 95 m in KLX09B, from 0 to 115 in KLX09C, from 0 to 117 in KLX09D, from 0 to 115 in KLX09E, from 0 to 147 in KLX09F and from 0 to 97 m in KLX09G.

The boreholes KLX09B to KLX09G are core drilled with a diameter of 76 mm.

All measurements were conducted by Malå Geoscience AB/RAYCON during February 2006. The investigation site and location of the boreholes is shown in Figures 1-1 and 1-2.

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, BIPS samt krökningsmätning i KLX09B–KLX09G	AP PS 400-06-016	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

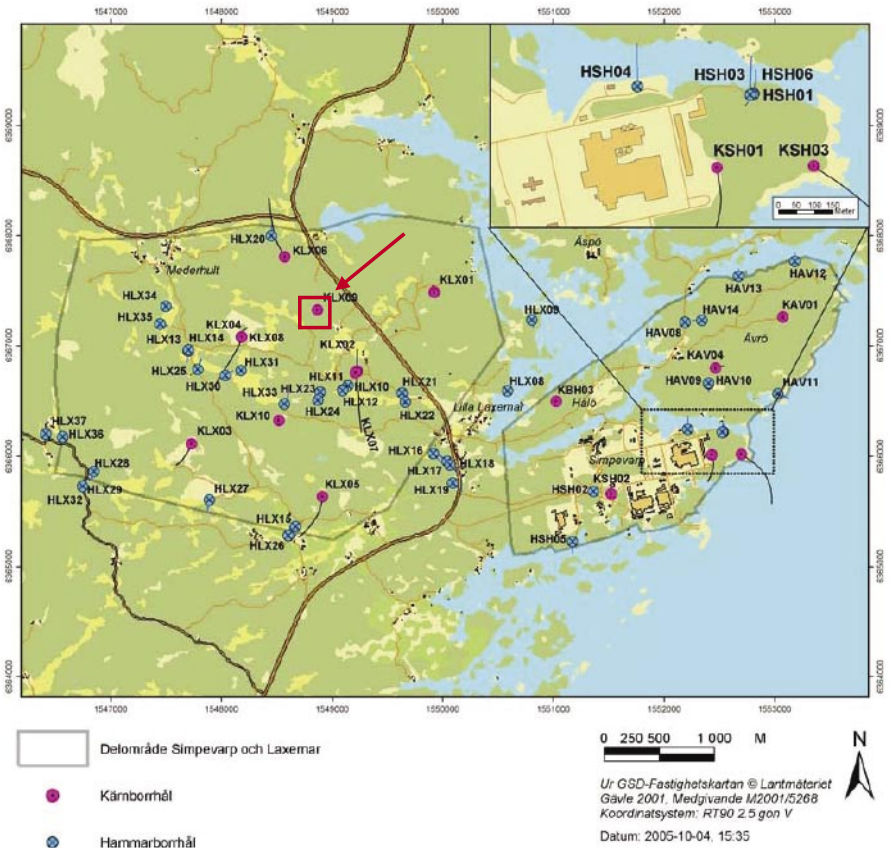


Figure 1-1. *Overview map of the location of the boreholes KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G, in the Laxemar subarea, Oskarshamn.*

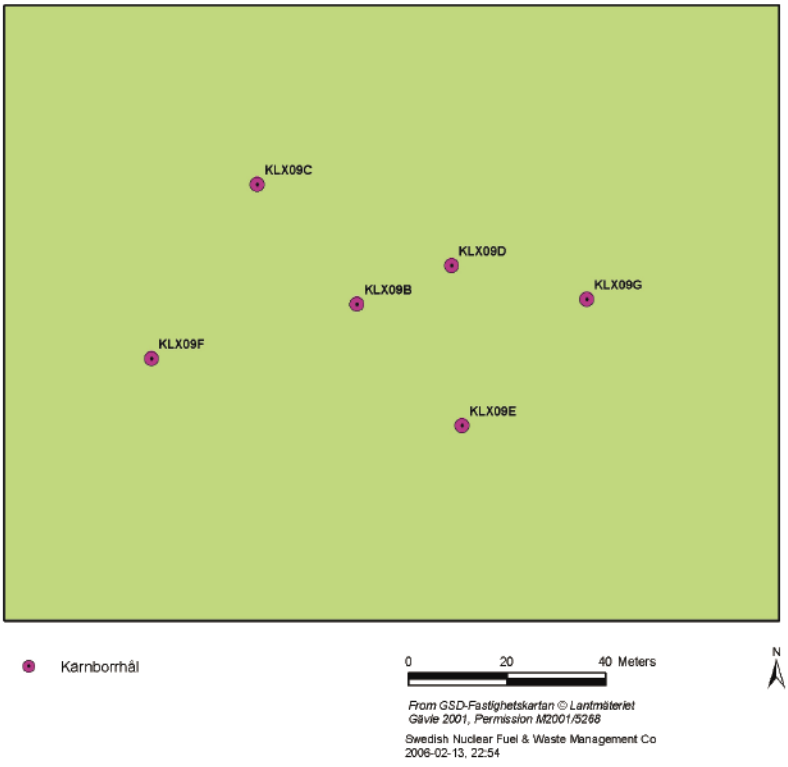


Figure 1-2. *Detailed map of the location of the boreholes KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G.*

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.

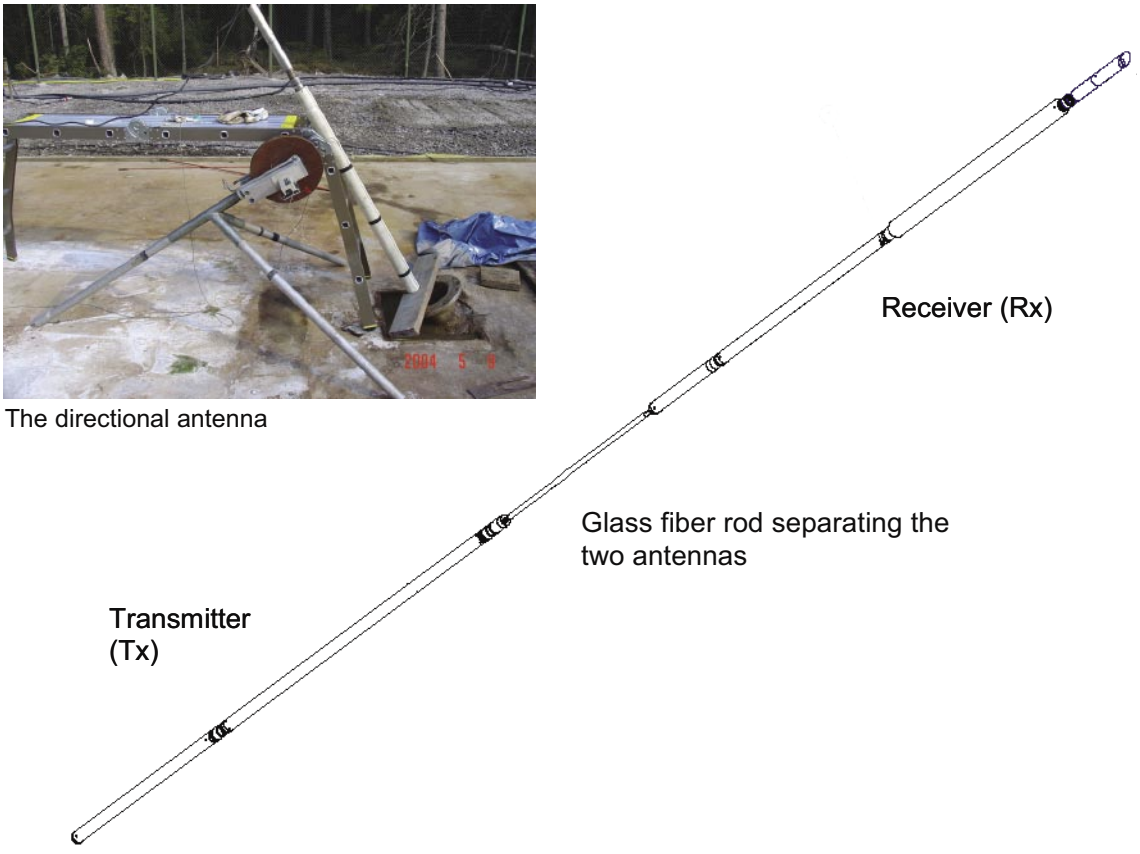


Figure 3-1. *Example of a borehole radar antenna.*

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).

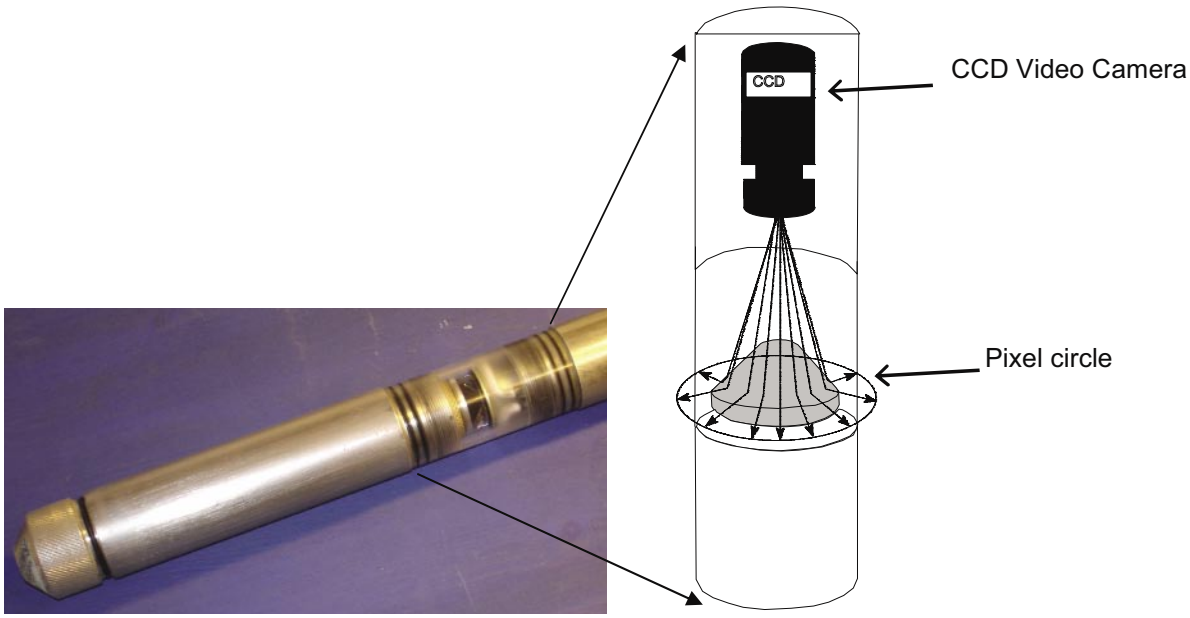


Figure 3-2. *The BIP-system. Illustration of the conical mirror scanning.*

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 has 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

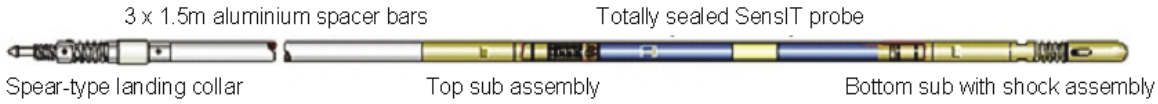


Figure 3-3. *The FlexIT SmartTool-system. Illustration of the set-up in the borehole.*

4 Execution

4.1 General

4.1.1 RAMAC Radar

The measurements in KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G were carried out with dipole radar antennas, with frequencies of 250, 100 and 20 MHz. In KLX09B, KLX09C, KLX09D, KLX09E and KLX09G measurements were also carried out with 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 4-6. 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 KLX09B and after the measurements in KLX09C. 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 15 degrees for the two tests. This can be considered to be satisfying due to the disturbed environment, with trees, metallic objects etc at the test site.

For more information on system settings used in the investigation of KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G, see Tables 4-1 to 4-6 below.

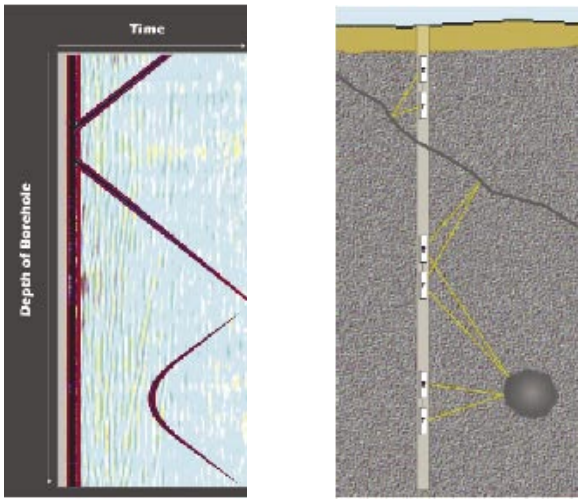


Figure 4-1. *The principle of radar borehole reflection survey and an example of result.*

Table 4-1. Radar logging information from KLX09B.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**KLX09B**	**Equipment:**	**SKB RAMAC**	
Type:	**Directional/Dipole**	**Manufacturer:**	**MALÅ GeoScience**	
Operator:	**CG**	**Antenna**		
	Directional	**250 MHz**	**100 MHz**	**20 MHz**
Logging date:	2006-02-07	2006-02-07	2006-02-07	2006-02-07
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	1.42
Logging from (m):	13.4	1.5	2.6	6.25
Logging to (m):	93.4	97	97.1	93.1
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 KLX09C.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**KLX09C**	**Equipment:**	**SKB RAMAC**	
Type:	**Directional/Dipole**	**Manufacturer:**	**MALÅ GeoScience**	
Operator:	**CG**	**Antenna**		
	Directional	**250 MHz**	**100 MHz**	**20 MHz**
Logging date:	2006-02-09	2006-02-09	2006-02-09	2006-02-09
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	1.42
Logging from (m):	12.4	2.5	3.6	7.25
Logging to (m):	113.4	117.4	116.9	112.1
Trace interval (m):	0.5	0.1	0.2	0.25
Antenna separation (m):	5.73	2.4	3.9	10.05

Table 4-3. Radar logging information from KLX09D.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**KLX09D**	**Equipment:**	**SKB RAMAC**	
Type:	**Directional/Dipole**	**Manufacturer:**	**MALÅ GeoScience**	
Operator:	**CG**	**Antenna**		
	Directional	**250 MHz**	**100 MHz**	**20 MHz**
Logging date:	2006-02-08	2006-02-08	2006-02-08	2006-02-08
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	1.42
Logging from (m):	13.4	2.5	3.6	7.25
Logging to (m):	114.4	118.5	116.6	112.3
Trace interval (m):	0.5	0.1	0.2	0.25
Antenna separation (m):	5.73	2.4	3.9	10.05

Table 4-4. Radar logging information from KLX09E.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**KLX09E**	**Equipment:**	**SKB RAMAC**	
Type:	**Directional/Dipole**	**Manufacturer:**	**MALÅ GeoScience**	
Operator:	**CG**	**Antenna**		
	Directional	**250 MHz**	**100 MHz**	**20 MHz**
Logging date:	2006-02-08	2006-02-08	2006-02-08	2006-02-08
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	1.42
Logging from (m):	11.4	2.5	3.6	7.25
Logging to (m):	114.9	116.5	116.2	112.2
Trace interval (m):	0.5	0.1	0.2	0.25
Antenna separation (m):	5.73	2.4	3.9	10.05

Table 4-5. Radar logging information from KLX09F.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**KLX09F**	**Equipment:**	**SKB RAMAC**	
Type:	**Dipole**	**Manufacturer:**	**MALÅ GeoScience**	
Operator:	**CG**	**Antenna**		
		250 MHz	**100 MHz**	**20 MHz**
Logging date:		2006-02-09	2006-02-09	2006-02-09
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	1.42
Logging from (m):		2.5	3.6	7.25
Logging to (m):		148.5	148.6	144.3
Trace interval (m):		0.1	0.2	0.25
Antenna separation (m):		2.4	3.9	10.05

Table 4-6. Radar logging information from KLX09G.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**KLX09G**	**Equipment:**	**SKB RAMAC**	
Type:	**Directional/Dipole**	**Manufacturer:**	**MALÅ GeoScience**	
Operator:	**CG**	**Antenna**		
	Directional	**250 MHz**	**100 MHz**	**20 MHz**
Logging date:	2006-02-08	2006-02-08	2006-02-08	2006-02-08
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	1.42
Logging from (m):	13.4	1.5	2.6	6.25
Logging to (m):	93.4	98.4	97.6	93.2
Trace interval (m):	0.5	0.1	0.2	0.25
Antenna separation (m):	5.73	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 KLX09C, KLX09D, KLX09E, KLX09F and KLX09G. In KLX09B the magnetic sensor was used.

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 show the result of the test logging performed before and after the logging of KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G. 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 7 to 12 in this report.

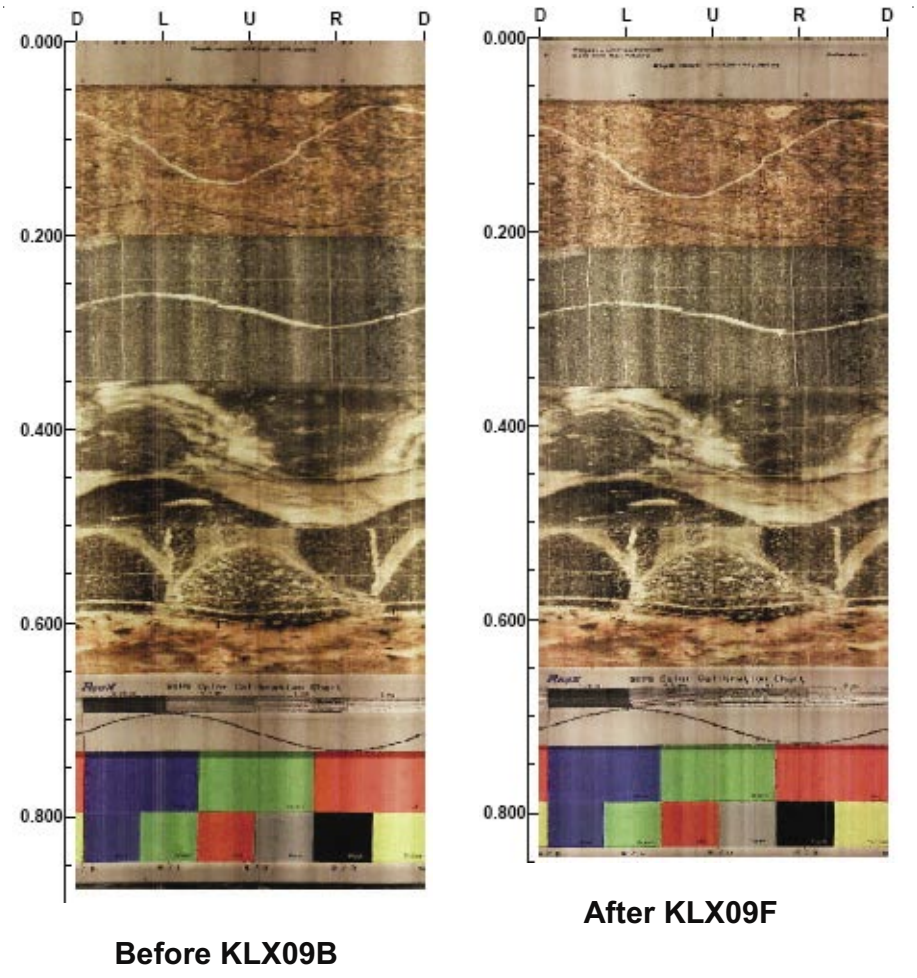


Figure 4-2. *Results from logging in the test pipe before and after the logging campaign in February 6th to 10th, 2006.*

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 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 metre by the actual marks on the logging cable.

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 earlier 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. No reference marks is performed in the boreholes, so for that reason the old marks on the logging cable is used for depth adjustment of BIPS and radar data. The adjusted true length is marked with red in the BIPS image plot together with the non-adjusted measured length. The non-adjusted length is marked with black as seen in Appendices 7 to 12. 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 meter 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 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 the large positive signals and white colour to large negative signals. Grey colour corresponds to no reflected signals.

The presented data in this report are 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 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 a 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 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 Tables 4-7 to 4-12. It should be observed that the processing steps in Tables 4-7 to 4-12 below refer to Appendices 1 to 6 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 5-7 to 5-12 and are also visible on the radargrams in Appendices 1 to 6.

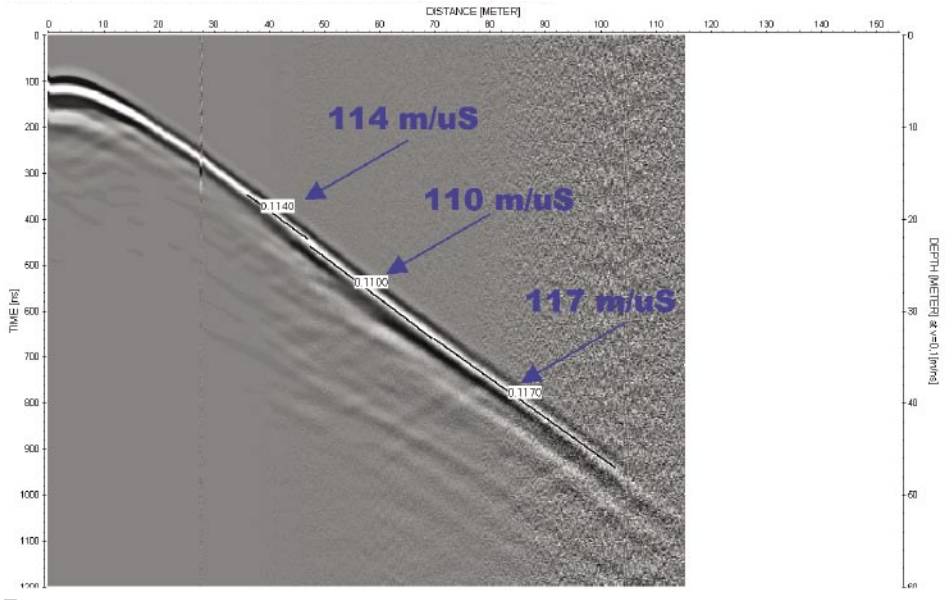


Figure 4-3. *Results from velocity measurements /1/.*

Table 4-7. Processing steps for borehole radar data from KLX09B.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**KLX09B**	**Equipment:**	**SKB RAMAC**	
Type:	**Directional/Dipole**	**Manufacturer:**	**MALÅ GeoScience**	
Interpret:	**JG**	**Antenna**		
	Directional	**250 MHz**	**100 MHz**	**20 MHz**
Logging date:	2006-02-07	2006-02-07	2006-02-07	2006-02-07
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	1.42
Logging from (m):	13.4	1.5	2.6	6.25
Logging to (m):	93.4	97	97.1	93.1
Trace interval (m):	0.5	0.1	0.2	0.25
Antenna separation (m):	5.73	2.4	3.9	10.05

Table 4-8. Processing steps for borehole radar data from KLX09C.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**KLX09C**	**Equipment:**	**SKB RAMAC**	
Type:	**Directional/Dipole**	**Manufacturer:**	**MALÅ GeoScience**	
Interpret:	**JG**	**Antenna**		
	Directional	**250 MHz**	**100 MHz**	**20 MHz**
Processing:	Move start time (–46 samples) DC shift (430–511) Time gain (start 81 lin 100 exp 1) (FIR)	Move start time (–19.9) DC shift (190–230) Gain (start 19 lin 0.9 exp 1)	Move start time (–43.9) DC shift (470–530) Gain (start 36 lin 1.2 exp 0.6)	Move start time (–98.6) DC shift (1,800–2,100) Gain (start 122 lin 2.3 exp 0.2)

Table 4-9. Processing steps for borehole radar data from KLX09D.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**KLX09D**	**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) DC shift (430–511) Time gain (start 81 lin 100 exp 1) (FIR)	Move start time (–18.7) DC shift (190–230) Gain (start 25 lin 1.7 exp 1.2)	Move start time (–45.6) DC shift (470–530) Gain (start 40 lin 1.4 exp 0.6)	Move start time (–84.5) DC shift (1,800–2,100) Gain (start 131 lin 10.7 exp 0)

Table 4-10. Processing steps for borehole radar data from KLX09E.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**KLX09E**	**Equipment:**	**SKB RAMAC**	
Type:	**Directional/Dipole**	**Manufacturer:**	**MALÅ GeoScience**	
Interpret:	**JG**	**Antenna**		
	Directional	**250 MHz**	**100 MHz**	**20 MHz**
Processing:	Move start time (–47 samples) DC shift (430–511) Time gain (start 81 lin 80 exp 1) (FIR)	Move start time (–20.1) DC shift (190–230) Gain (start 12 lin 1.4 exp 1.2)	Move start time (–43.9) DC shift (450–530) Gain (start 55 lin 3 exp 0.6)	Move start time (–107) DC shift (1,800–2,100) Gain (start 110 lin 1.7 exp 0.3)

Table 4-11. Processing steps for borehole radar data from KLX09F.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**KLX09F**	**Equipment:**	**SKB RAMAC**	
Type:	**Directional/Dipole**	**Manufacturer:**	**MALÅ GeoScience**	
Interpret:	**JG**	**Antenna**		
		250 MHz	**100 MHz**	**20 MHz**
Processing:		Move start time (–20) DC removal (190–230) Gain (start 22 lin 1.7 exp 1.2)	Move start time (–42) DC removal (470–530) Gain (start 31 lin 1.4 exp 0.5)	Move start time (–98.6) DC removal (1,800–2,100) Gain (start 152 lin 1.4, exp 0.2)

Table 4-12. Processing steps for borehole radar data from KLX09G.

Site:	**Oskarshamn**	**Logging company:**	**RAYCON**	
BH:	**KLX09G**	**Equipment:**	**SKB RAMAC**	
Type:	**Directional/Dipole**	**Manufacturer:**	**MALÅ GeoScience**	
Interpret:	**JG**	**Antenna**		
	Directional	**250 MHz**	**100 MHz**	**20 MHz**
Processing:	Move start time (–47 samples) DC shift (430–511) Time gain (start 81 lin 100 exp 1) (FIR)	Move start time (–20.5) DC shift (190–230) Gain (start 15 lin 1.7 exp 1)	Move start time (–47.8) DC shift (470–530) Gain (start 39 lin 1.4 exp 0.6)	Move start time (–95.6) DC shift (1,800–2,100) Gain (start 138 lin 37 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 measurements

The resulting data from the deviation measurements were corrected relatively to the magnetic North, 2.53 degrees east of RT90 North for the presentation in Appendices 13 to 18. For delivery to SICADA the azimuth was delivered relatively to magnetic North.

4.3 Nonconformities

The measurements with the directional antenna in KLX09F could not be carried out, as the antenna probe could not pass the casing edge.

5 Results

The results from the BIPS measurements for KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G 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 KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G 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 13 to 18 in this report. Data were recorded both in and out from the borehole. In this report only the logging in to the borehole is presented. 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

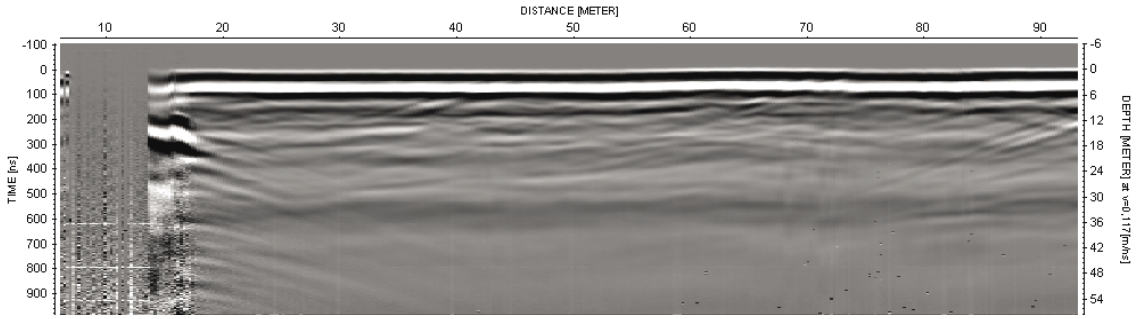
The results of the interpretation of the radar measurements are presented in Tables 5-1 to 5-19. Radar data are also visualized in Appendices 1 to 6. It should be remembered that the images in Appendices 1 to 6 are only a composite picture of all events 360 degrees around the borehole, and do not reflect the orientation of the structures.

Only the larger clearly visible structures are interpreted in RadinterSKB. Overviews of the six different boreholes are given in Figures 5-1 and 5-2 below. A number of minor structures also exist, indicated in Appendices 1 to 6. 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 Appendices 1 to 6. 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.

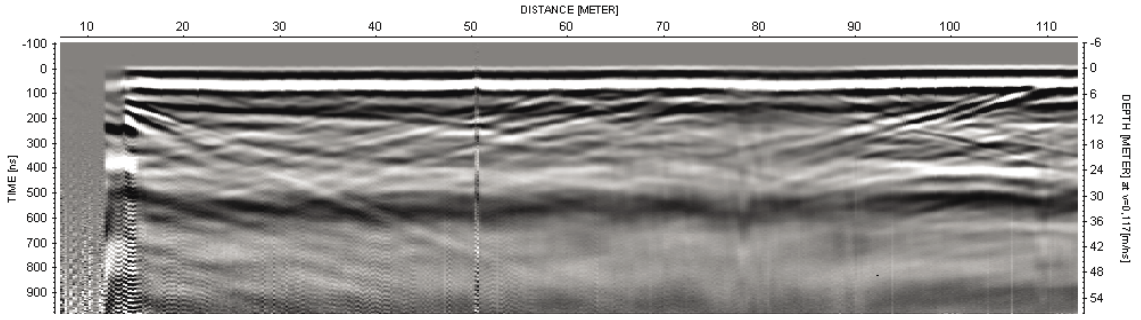
In Figure 5-3 the location of the boreholes KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G together with KLX09, is shown. As seen some of these seven boreholes are quite closely located, and can be identified in the radardata as clear hyperbolas or as a reflector (see the Appendices).

From the directional antenna loggings the direction (given as the RadInter Object direction) from KLX09B, KLX09C and KLX09D to KLX09 could be determined as follows:

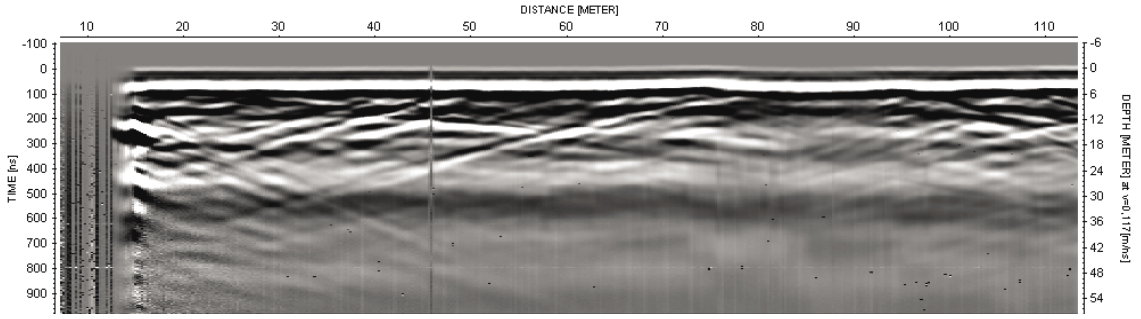
- From KLX09B to KLX09 approximately 140 degrees.
- From KLX09C to KLX09 approximately 270 degrees.
- From KLX09D to KLX09 approximately 285 degrees.



KLX09B



KLX09C

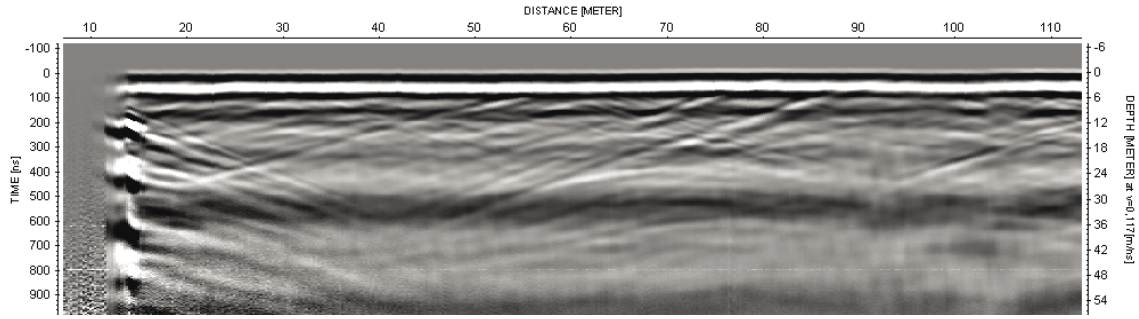


KLX09D

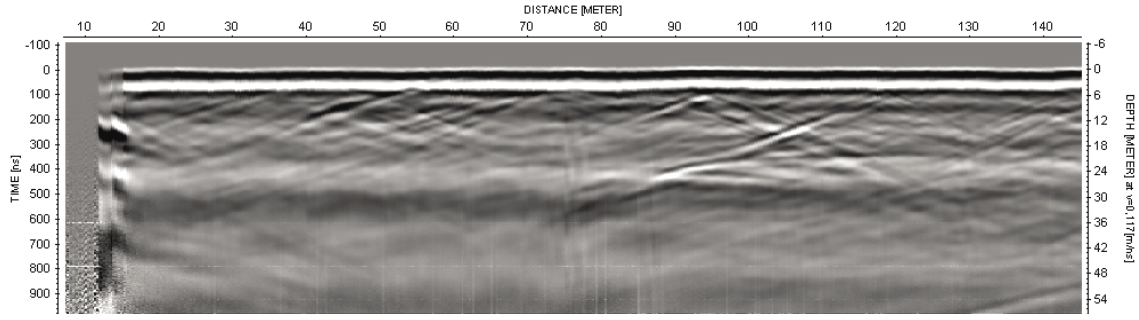
Figure 5-1. *An overview (20 MHz data) of the radar data for the boreholes; KLX09B, KLX09C and KLX09D. Observe that the length (x-scale) differs between the different boreholes.*

The data quality from KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G, (as seen in Appendices 1 to 6) is relatively good, but in parts of lower quality due to more conductive conditions. This is seen for instance in 100 MHz data for KLX09D and KLX09E. 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 possible structures in the rock which otherwise could give a reflection.

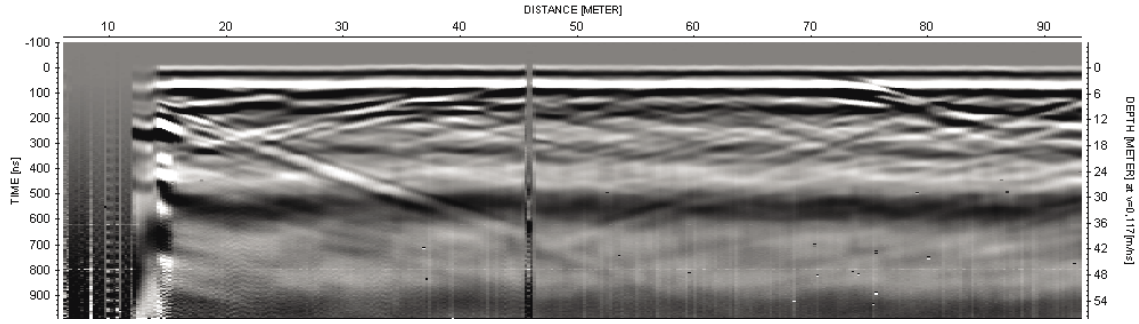
This effect is also seen in the directional antenna for KLX09B, KLX09C, KLX09D, KLX09E and KLX09G, which makes it more difficult to interpret the direction to the identified structures.



KLX09E



KLX09F



KLX09G

Figure 5-2. *An overview (20 MHz data) of the radar data for the boreholes; KLX09E, KLX09F and KLX09G. Observe that the length (x-scale) differs between the different boreholes.*

As also seen in Appendices 1 to 6 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 5-6 below the distribution of identified structures along the borehole are listed for KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G.

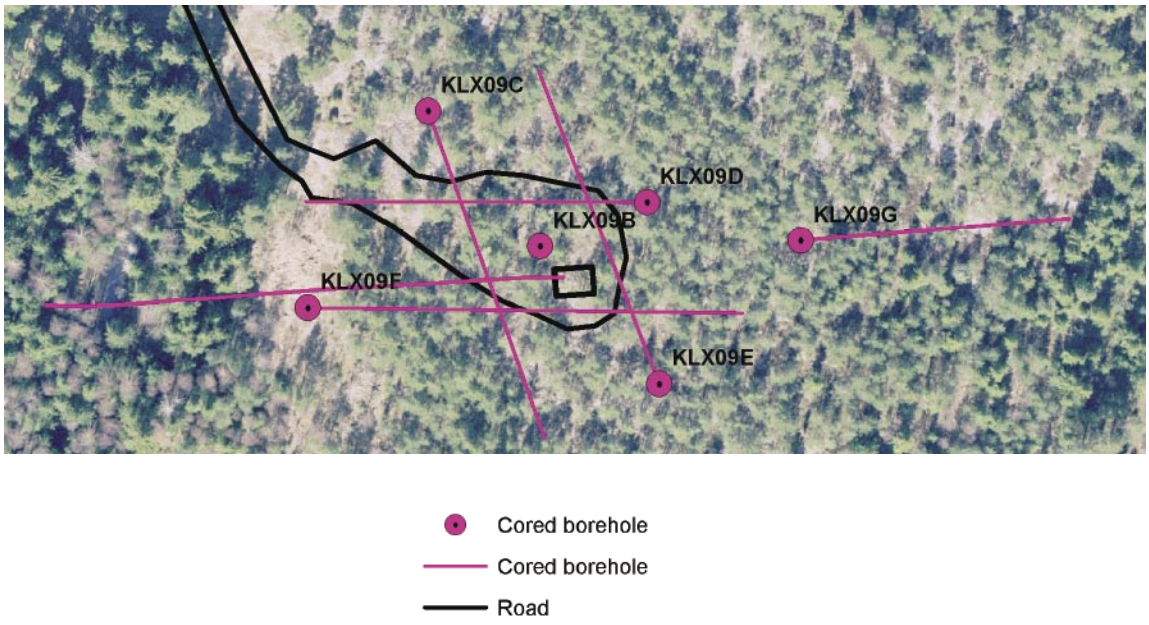


Figure 5-3. *Plan of drill-site KLX09, with the seven boreholes KLX09 (unmarked), KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G. Observe that the projection of the boreholes are based on the real measured deviations.*

Table 5-1. Identified structures as a function of depth in KLX09B.

Depth (m)	No. of structures
–20	1
20–40	1
40–60	5
60–80	1
80–100	2
100–120	2
120–140	–
140–160	–
160–180	–
180–	3

Table 5-2. Identified structures as a function of depth in KLX09C.

Depth (m)	No. of structures
–20	7
20–40	–
40–60	6
60–80	3
80–100	2
100–120	3
120–	3

Table 5-3. Identified structures as a function of depth in KLX09D.

Depth (m)	No. of structures
–20	2
20–40	5
40–60	4
60–80	5
80–100	6
100–	2

Table 5-4. Identified structures as a function of depth in KLX09E.

Depth (m)	No. of structures
–20	5
20–40	2
40–60	5
60–80	5
80–100	8
100–120	4
120–	2

Table 5-5. Identified structures as a function of depth in KLX09F.

Depth (m)	No. of structures
–20	2
20–40	4
40–60	2
60–80	3
80–100	3
100–120	8
120–140	5
140–160	–
160–	2

Table 5-6. Identified structures as a function of depth in KLX09G.

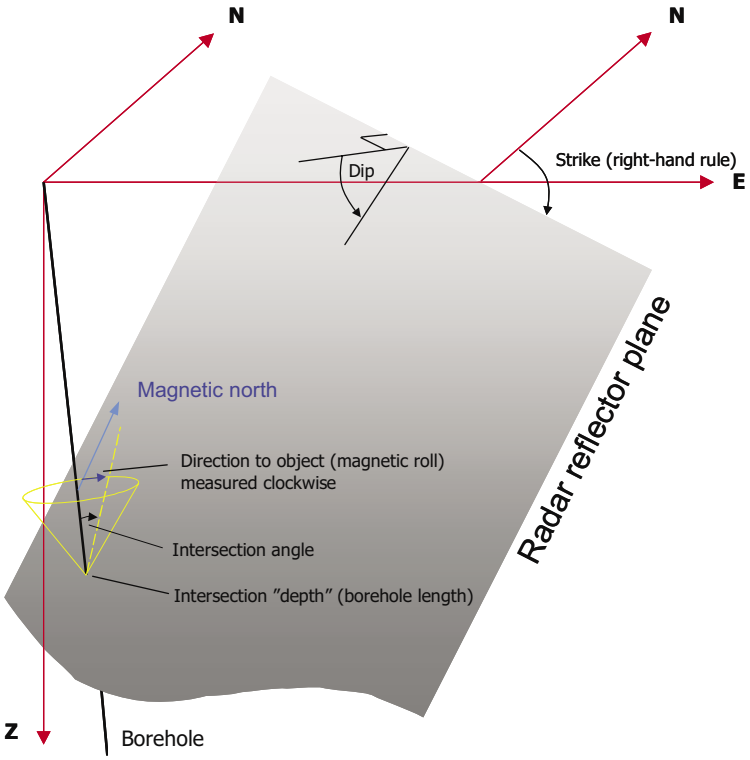
Depth (m)	No. of structures
–20	2
20–40	3
40–60	6
60–80	5
80–100	4
100–	1

Tables 5-7 to 5-12 summarises the interpretation of radar data from KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G. The direction to the reflectors are given for KLX09B, KLX09C, KLX09D, KLX09E and KLX09G. As seen some radar reflectors in the tables below 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. When the borehole inclination is less than 85 degrees the direction to object is calculated using gravity roll, otherwise magnetic roll is used. These direction and the intersection angles 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. It counts clockwise and can vary from 0 to 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.

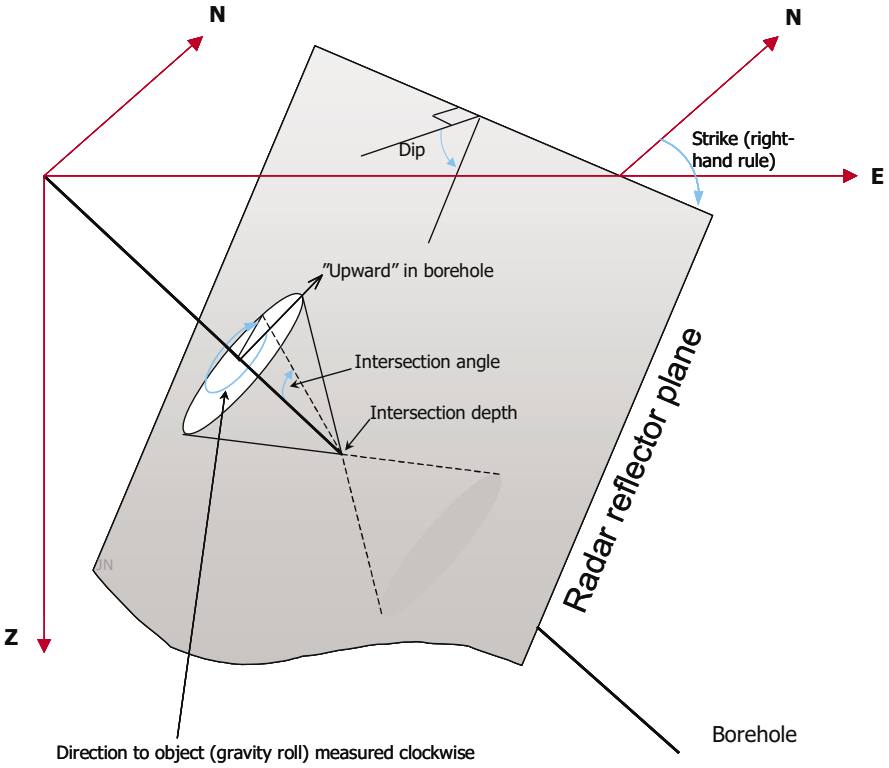
Observe that a structure can have several different angles, if the structure is undulating, and thereby also different intersection depths are given. This is seen for structure 11 in Table 5-7 and Appendix 1. To this structure, most likely, also structure 11x belongs.

Table 5-7. Interpretation of radar reflectors from the dipole antennas 250, 100 and 20 MHz, and the directional antenna 60 MHz in borehole KLX09B.

Radinter model information (Directional antenna)							
Site:	**Oskarshamn**						
Borehole name:	**KLX09B**						
Nominal velocity (m/µs):	**117.0**						
Name	**Intersection depth**	**Intersection angle**	**RadInter direction to object (magnetic roll)**	**Dip 1**	**Strike 1**	**Dip 2**	**Strike 2**
2	15.1	61					
6	29.8	24					
1	42.4	25					
7	48.5	59					
3	50.6	57	123 ±	32	213	32	33
4	54.4	46					
5	56.3	49					
8	78.9	71	198 ±	18	288	18	108
10	84.6	60					
9	85.8	28					
14	110.9	44					
13	113.3	57	252	33	342		
11	182.6	6	216	84	306		
12	294.5	2					
11x	443.3	2					



A) Magnetic roll



A) Gravity roll

Figure 5-4. *Definitions of the RadInter direction to reflectors as presented in Tables 5-7 to 5-12. A) Magnetic roll. B) Gravity roll.*

Table 5-8. Interpretation of radar reflectors from the dipole antennas 250, 100 and 20 MHz, and the directional antenna 60 MHz in borehole KLX09C.

Radinter model information (Directional antenna)

Site: Oskarshamn
Borehole name: KLX09C
Nominal velocity (m/µs): 117.0

Name	Intersection depth	Intersection angle	RadInter direction to object (gravity roll)	Dip 1	Strike 1	Dip 2	Strike 2
3	–72.0	8	324	73	32		
2	–25.6	13					
1	–1.5	14					
7	10.6	51					
4	14.8	33					
5	16.2	31					
10	16.5	47					
8	42.8	9					
9	43.7	24					
11	45.3	60	306 ±	53	221	27	312
12	50.8	58					
21	53.1	27					
13	56.9	44					
16	67.9	23	39	89	105		
14	72.0	38	153	24	13		
17	75.9	26					
15	82.9	72					
25	86.3	69	186 ±	11	238	53	253
26	107.1	33					
22	111.2	57					
23	114,4	79					
18	117.4	40					
19	122.1	34	276	64	184		
24	125.5	59					
20	128.4	33					

Table 5-9. Interpretation of radar reflectors from the dipole antennas 250, 100 and 20 MHz, and the directional antenna 60 MHz in borehole KLX09D.

Radinter model information (Directional antenna)							
Site:		**Oskarshamn**					
Borehole name:		**KLX09D**					
Nominal velocity (m/µs):		**117.0**					
Name	**Intersection depth**	**Intersection angle**	**RadInter direction to object (gravity roll)**	**Dip 1**	**Strike 1**	**Dip 2**	**Strike 2**
23	–89.0	6	282	89	106		
21	0.6	21	339	81	163		
1	20.0	79					
22	20.7	41	351 ±	80	356	20	162
3	26.8	40					
2	29.8	67					
4	31.8	30					
5	45.7	37					
6	49.3	62					
9	54.5	34					
7	58.3	43	9	71	9		
18	62.1	20					
8	63.4	41					
12	65.6	44					
13	69.0	44					
15	77.5	20					
14	83.5	59					
15x	84.0	26					
11	88.1	75	39 ±	44	17	21	335
10	89.9	14					
19	92.9	35					
20	96.1	52					
16	103.9	67					
17	106.6	71	9 ±	50	7	11	347

Table 5-10. Interpretation of radar reflectors from the dipole antennas 250, 100 and 20 MHz, and the directional antenna 60 MHz in borehole KLX09E.

Radinter model information (Directional antenna)							
Site:		**Oskarshamn**					
Borehole name:		**KLX09E**					
Nominal velocity (m/µs):		**117.0**					
Name	**Intersection depth**	**Intersection angle**	**RadInter direction to object (gravity roll)**	**Dip 1**	**Strike 1**	**Dip 2**	**Strike 2**
28	–39.5	10	147	56	208		
2xx	6.5	15	75	85	138		
2	6.9	12					
1	9.4	50					
2x	17.2	22					
3	25.9	57					
4	35.9	48					
5	41.7	58					
6	42.7	47					
10	49.1	38					
7	52.9	18					
9	58.0	65					
11	60.8	55					
8	68.9	38	60 ±	71	115	44	334
12	70.5	60					
16	71.5	32					
15	75.4	52					
20	83.2	55					
13	83.2	28	258	61	342		
14	87.8	49					
14x	88.6	40					
17	90.0	50					
18	93.7	47					
19	97.6	46	96 ±	47	133	53	10
27	98.7	44					
21	101.4	49					
22	107.0	44					
23	112.3	65					
24	118.3	49					
25	128.4	62	162 ±	9	153	59	58
26	138.4	42					

Table 5-11. Interpretation of radar reflectors from the dipole antennas 250, 100 and 20 MHz, in borehole KLX09F.

Radinter model information (20, 100 and 250 MHz Dipole Antennas)			
Site:		**Oskarshamn**	
Borehole name:		**KLX09F**	
Nominal velocity (m/µs):		**117.0**	
Reflector type	**Name**	**Intersection depth**	**Intersection angle**
PLANE	1	14.9	56
PLANE	2	17.9	25
PLANE	2x	23.2	37
PLANE	7	25.5	16
PLANE	4	32.5	41
PLANE	3	33.3	56
PLANE	5	47.4	55
PLANE	6	50.0	34
PLANE	9	60.0	57
PLANE	8	68.8	34
PLANE	10	74.7	54
PLANE	12	81.1	59
PLANE	11	82.7	55
PLANE	25	99.2	21
PLANE	18	106.9	54
PLANE	14	107.4	33
PLANE	15	107.6	42
PLANE	20	110.0	51
PLANE	13	111.3	16
PLANE	16	111.4	45
PLANE	28	111.9	33
PLANE	17	117.1	16
PLANE	19	123.6	45
PLANE	24	125.9	40
PLANE	21	132.8	18
PLANE	23	133.5	41
PLANE	22	135.5	42
PLANE	27	160.1	45
PLANE	29	276.7	26

Table 5-12. Interpretation of radar reflectors from the dipole antennas 250, 100 and 20 MHz, and the directional antenna 60 MHz in borehole KLX09G.

Radinter model information (Directional antenna)							
Site:		Oskarshamn					
Borehole name:		KLX09G					
Nominal velocity (m/µs):		117.0					
Name	**Intersection depth**	**Intersection angle**	**RadInter direction to object (gravity roll)**	**Dip 1**	**Strike 1**	**Dip 2**	**Strike 2**
1	3.8	27	321	86	140		
22	11.0	36					
3	23.4	33	9 ±	88	181	28	10
2	26.1	34					
6	34.9	62					
4	41.9	32	186	29	4		
7	42.8	22					
9	42.9	47	321 ±	68	146	25	273
5	48.8	20					
10	52.8	45	171 ±	16	330	77	167
11	54.6	44					
19	63.4	49					
12	66.6	34					
13	68.1	35					
14	70.1	46					
17	72.9	34					
16	81.1	34					
15	84.1	26					
20	94.5	41					
21	96.6	67					
18	109.4	46	174 ±	13	335	74	169

In Appendices 1 to 6, 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 5-13 to 5-18.

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 5-19 below.

Table 5-13. Borehole length intervals in KLX09B with decreased amplitude for the 250 MHz antenna.

Length (m)	Length (m)
50	75–80

Table 5-14. Borehole length intervals in KLX09C with decreased amplitude for the 250 MHz antenna.

Length (m)	Length (m)
70	115–120
85–90	

Table 5-15. Borehole length intervals in KLX09D with decreased amplitude for the 250 MHz antenna.

Length (m)	Length (m)
80–90	100–105

Table 5-16. Borehole length intervals in KLX09E with decreased amplitude for the 250 MHz antenna.

Length (m)	Length (m)
25	95–105

Table 5-17. Borehole length intervals in KLX09F with decreased amplitude for the 250 MHz antenna.

Length (m)	Length (m)
0–10	120
70	135
75–85	

Table 5-18. Borehole length intervals in KLX09G with decreased amplitude for the 250 MHz antenna.

Length (m)	Length (m)
25–30	55
40	

Table 5-19. Some important structures in KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G.

Borehole	KLX09B	KLX09C	KLX09D	KLX09E	KLX09F	KLX09G
Structures	3, 5, 8, 11, 11x and 13	3, 15, 18, 19 and 21	7, 8, 15, 19 and 23	7, 8, 14, 14x, 19 and 26	6, 8, 12 and 15	1, 4, 5, 10, 15, 18 and 21

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 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 KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G are presented in Appendices 7 to 12.

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.

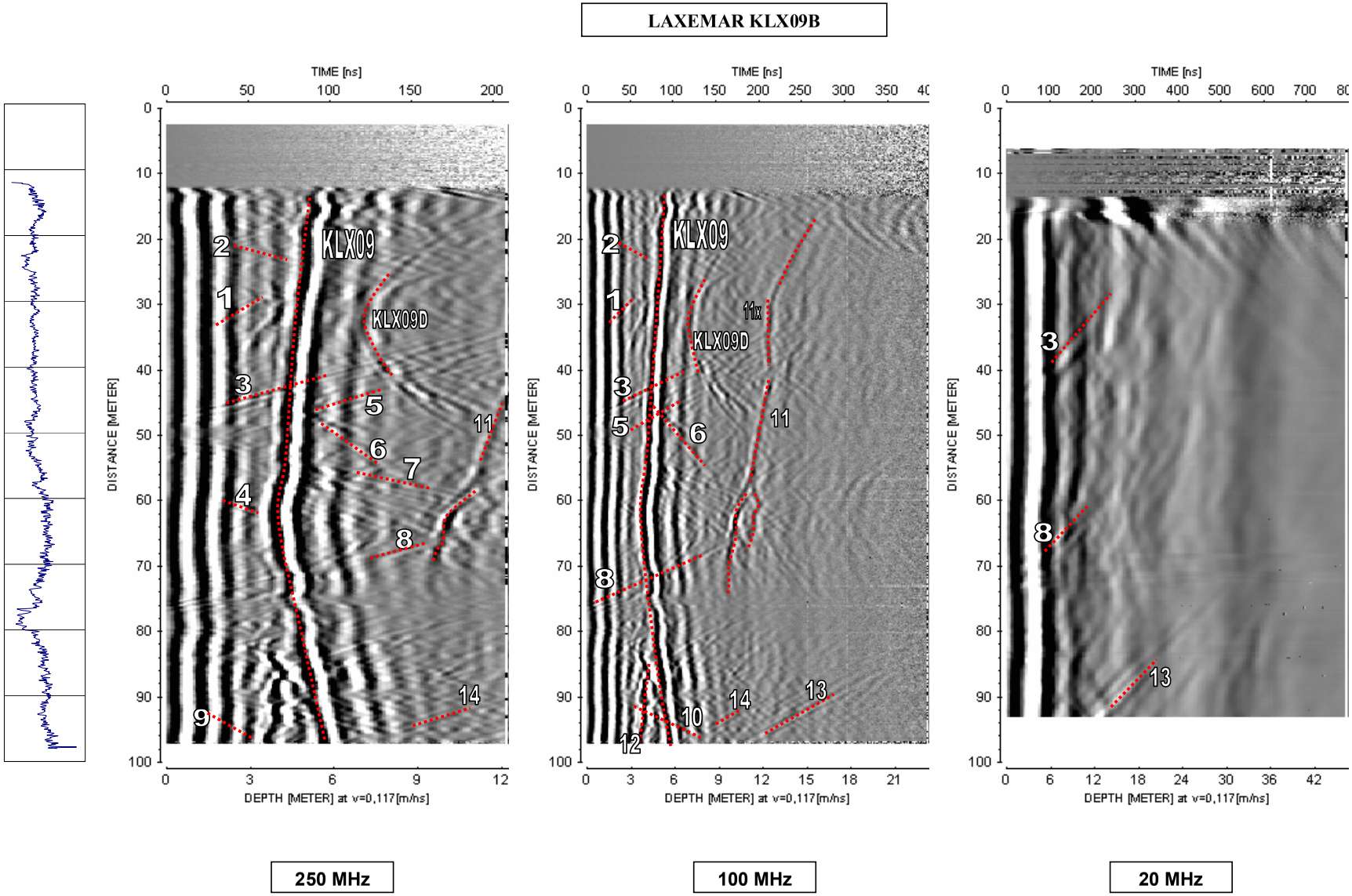
To get the best possible depth accuracy, the BIPS images are adjusted to the reference mark on the cable from previous loggings in core drilled boreholes. The error in the depth recording depends mainly on the tension of the cable and error of the depth readings from the measuring wheel. The adjusted depth is showed in red colour and the recording depth have black colour in the printouts.

During the logging of KLX09B, KLX09C, KLX09D, KLX09E, KLX09F and KLX09G the water conditions was good along the boreholes. In boreholes KLX09B and KLX09C the images was of very good quality. In KLX09D, KLX09E, KLX09F and KLX09G the lower most part of the borehole wall is covered with mud and limits the visibility strongly. Still there is no problem to interpret the structures intersecting the borehole.

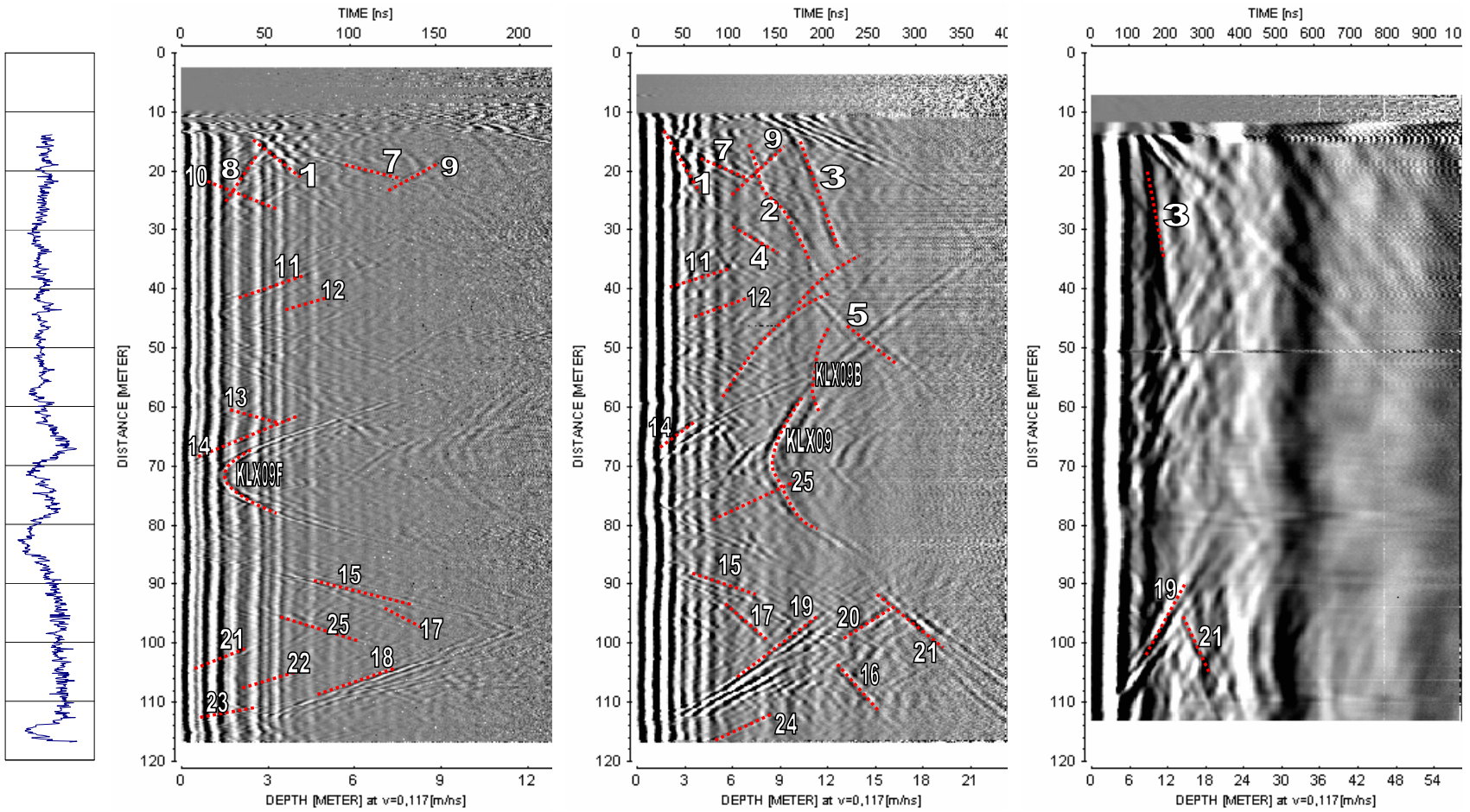
References

/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.

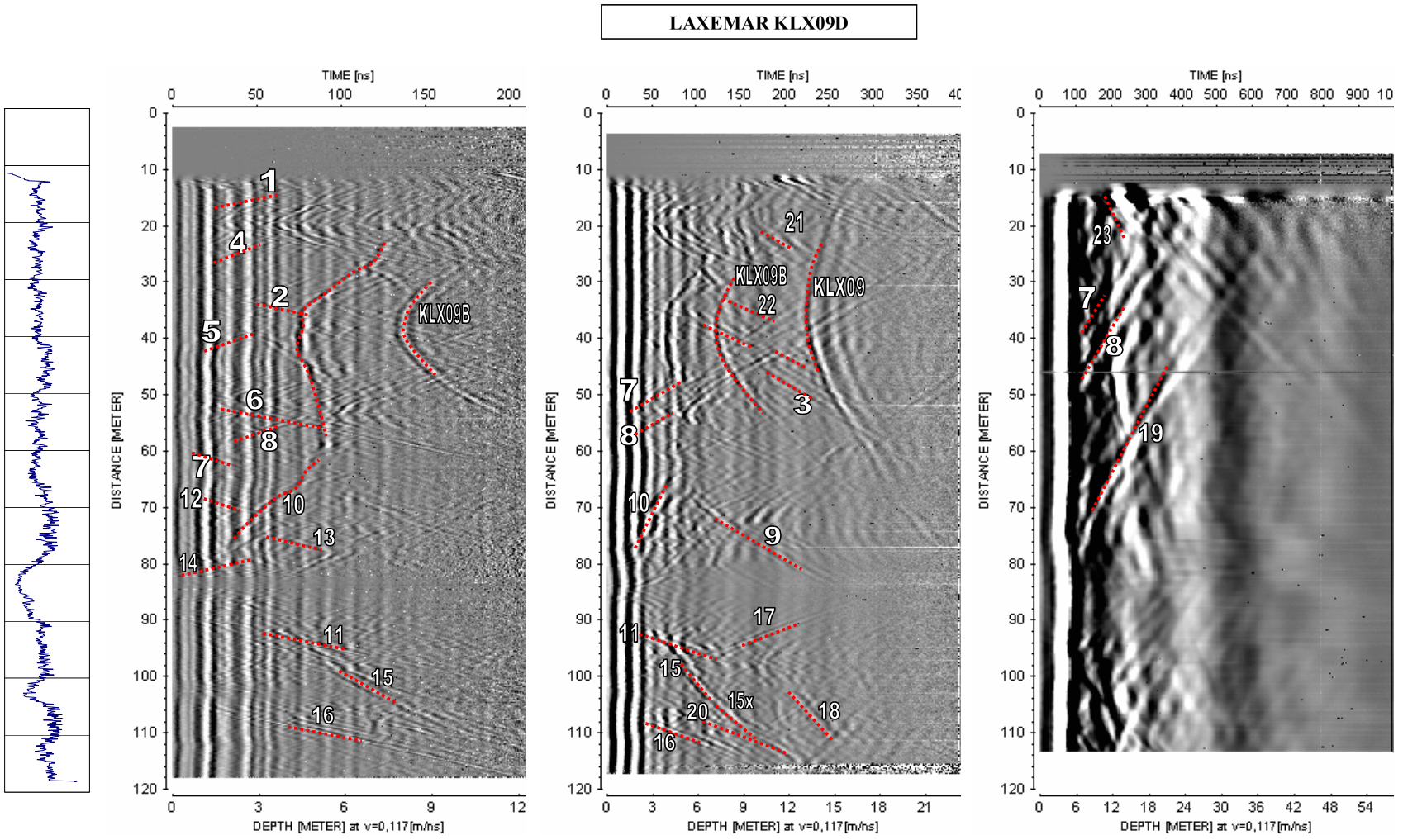
Radar logging in KLX09B, 0 to 95 m, dipole antennas 250, 100 and 20 MHz



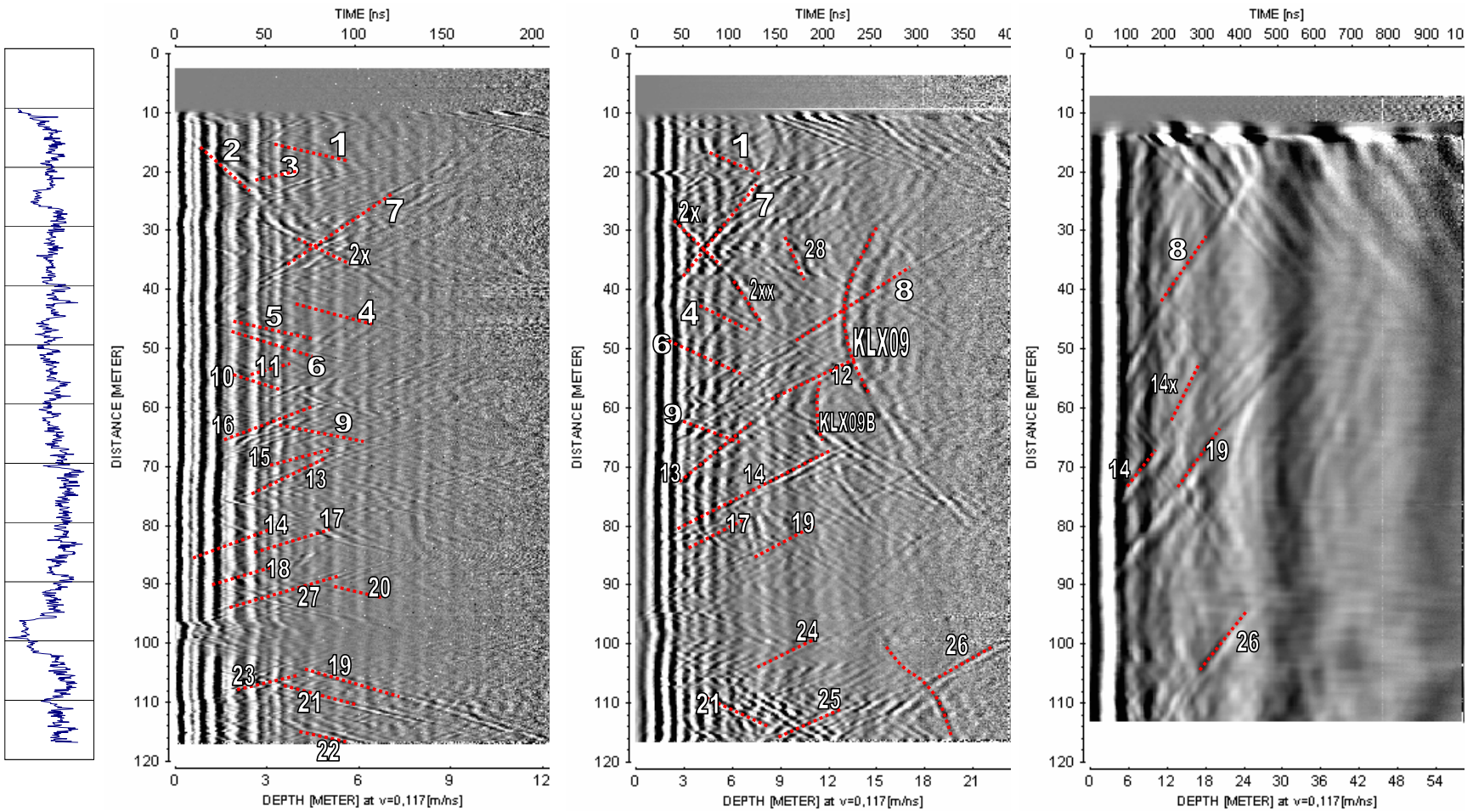
Radar logging in KLX09C, 0 to 116 m, dipole antennas 250, 100 and 20 MHz



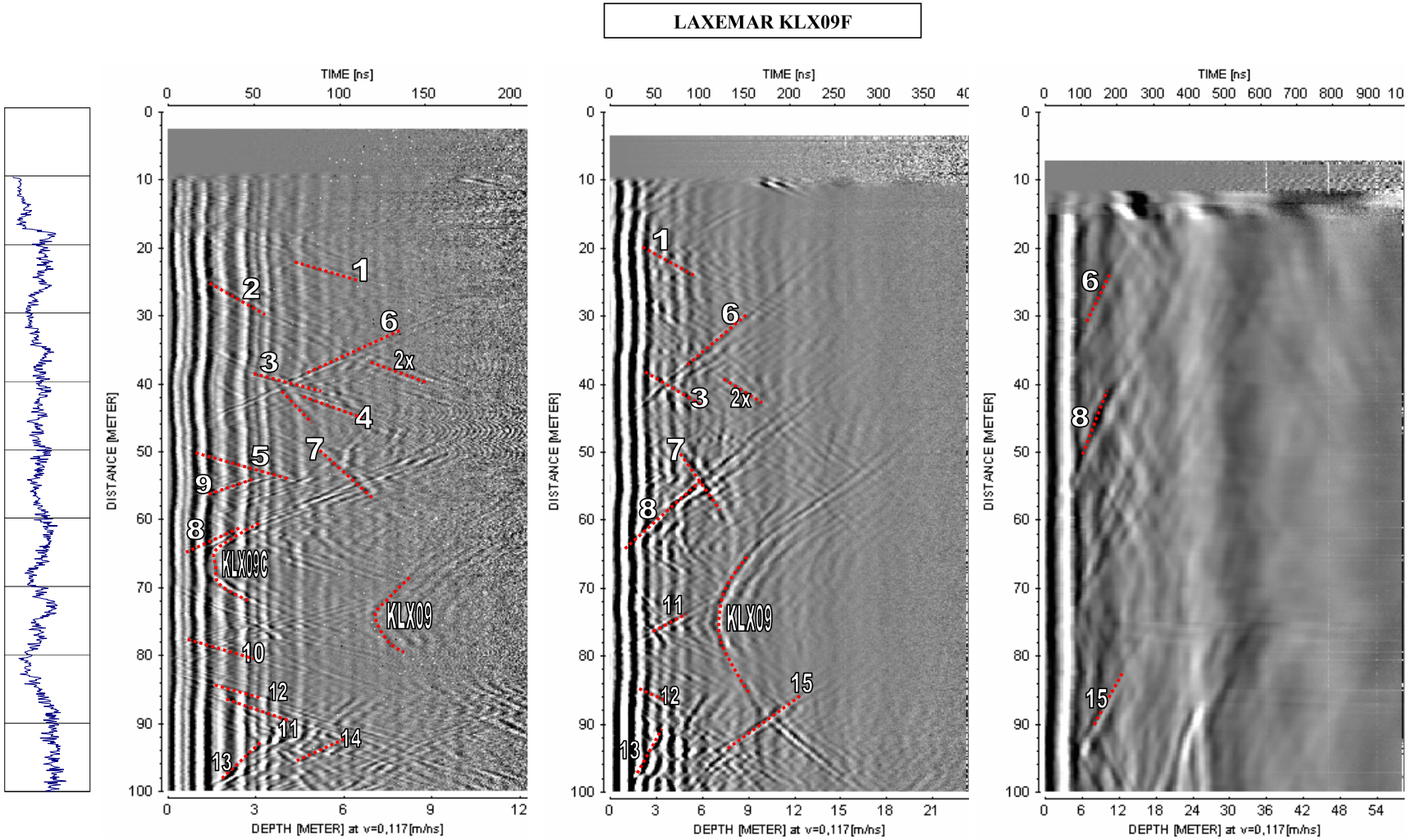
Radar logging in KLX09D, 0 to 117 m, dipole antennas 250, 100 and 20 MHz

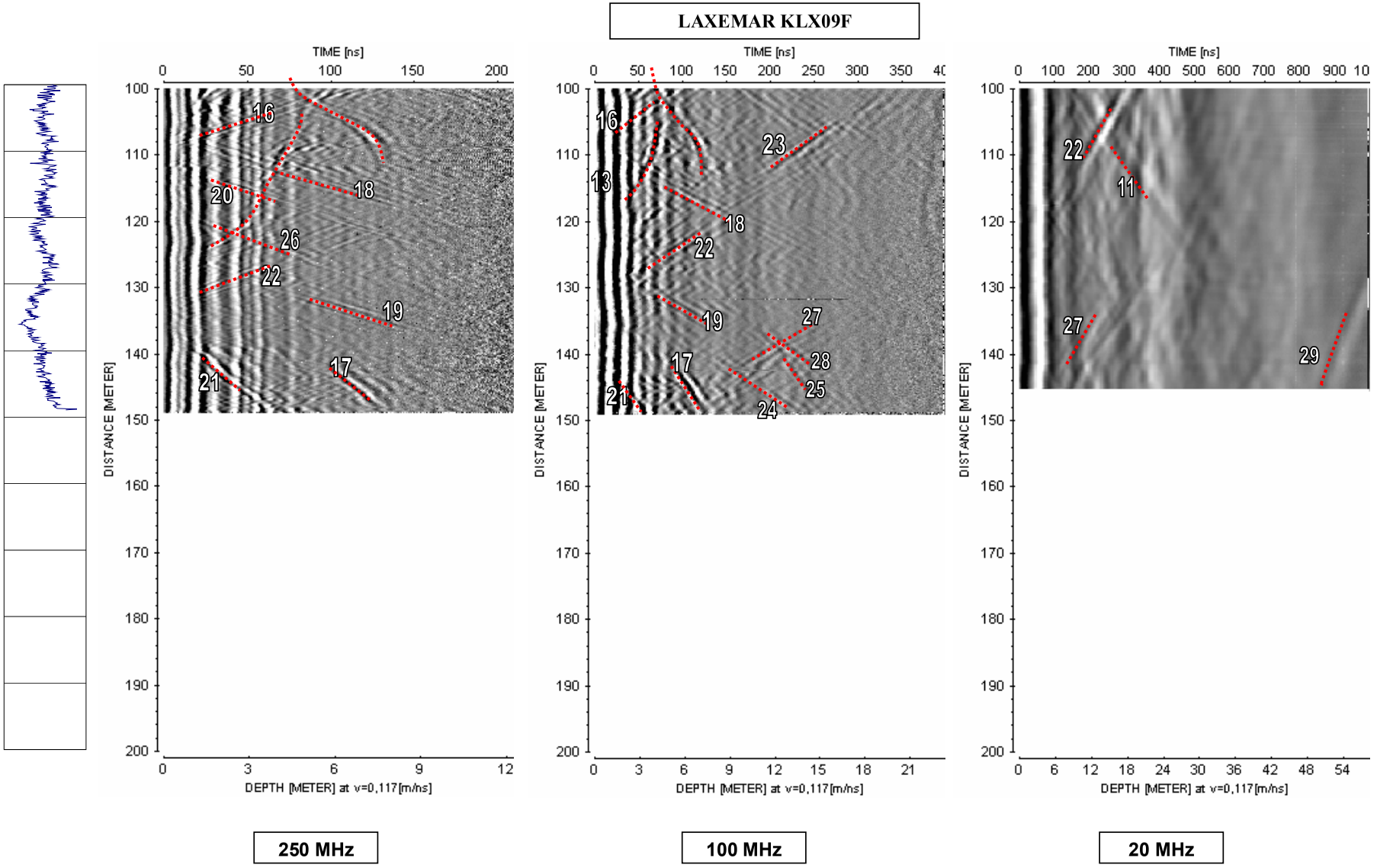


Radar logging in KLX09E, 0 to 115 m, dipole antennas 250, 100 and 20 MHz

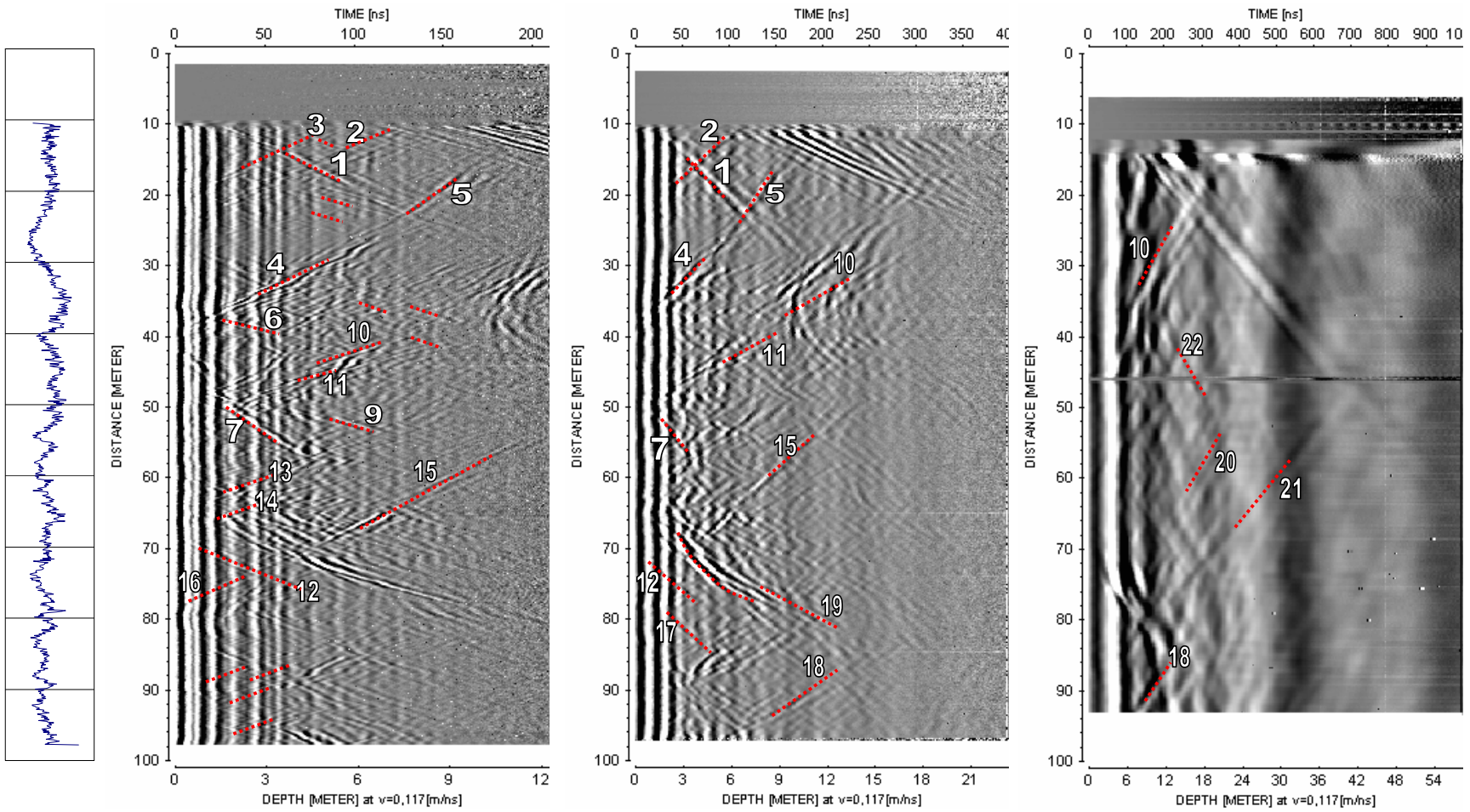


Radar logging in KLX09F, 0 to 147 m, dipole antennas 250, 100 and 20 MHz




LAXEMAR KLX09F
TIME [ns]
DISTANCE [METER]
DEPTH [METER] at v=0,117[m/ns]
250 MHz
100 MHz
20 MHz

Radar logging in KLX09G, 0 to 97 m, dipole antennas 250, 100 and 20 MHz



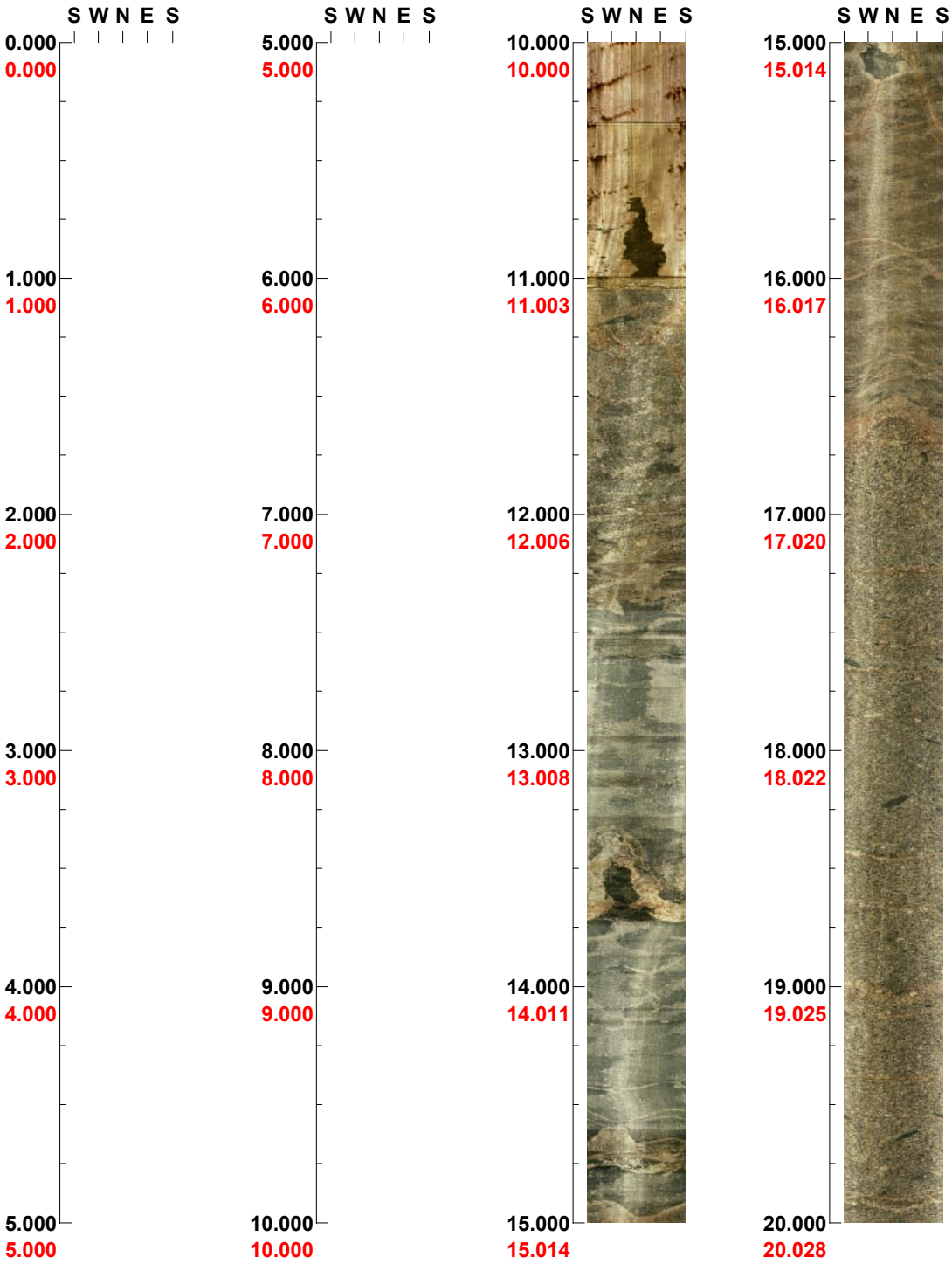
BIPS logging in KLX09B, 10 to 99 m

Project name: Laxemar

Image file	**: c:\work\r5500s~1\bips\klx09b.bip**
BDT file	**: c:\work\r5500s~1\bips\klx09b.bdt**
Locality	**: LAXEMAR**
Bore hole number	**: KLX09B**
Date	**: 06/02/06**
Time	**: 16:48:00**
Depth range	**: 10.000 - 99.844 m**
Azimuth	**: 0**
Inclination	**: -90**
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	**: 5**
Color	**:**  **+0 +0 +0**

Project name: Laxemar
Bore hole No.: KLX09B **Azimuth: 0** **Inclination: -90**

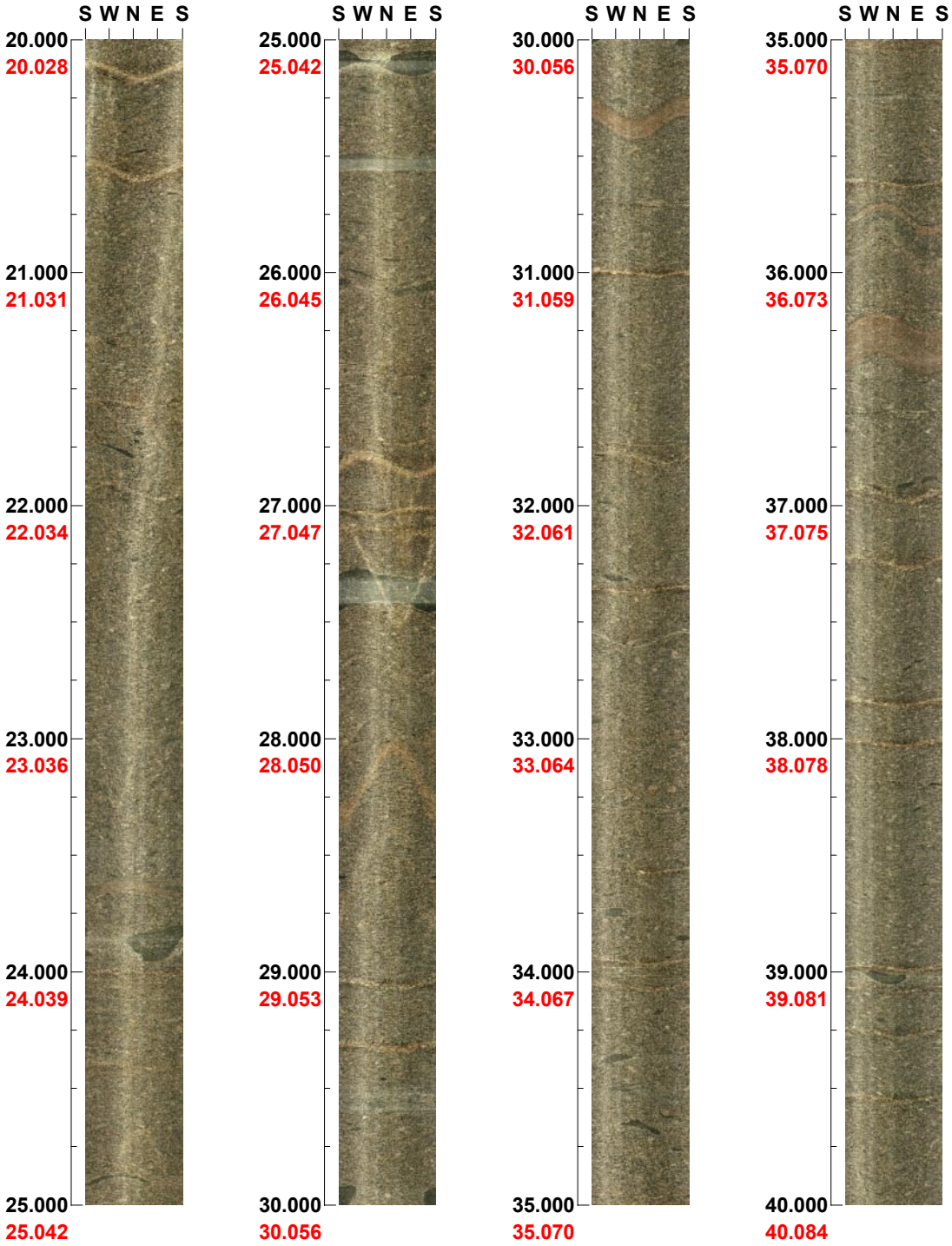
Depth range: 0.000 - 20.000 m



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

Project name: Laxemar
Bore hole No.: KLX09B **Azimuth: 0** **Inclination: -90**

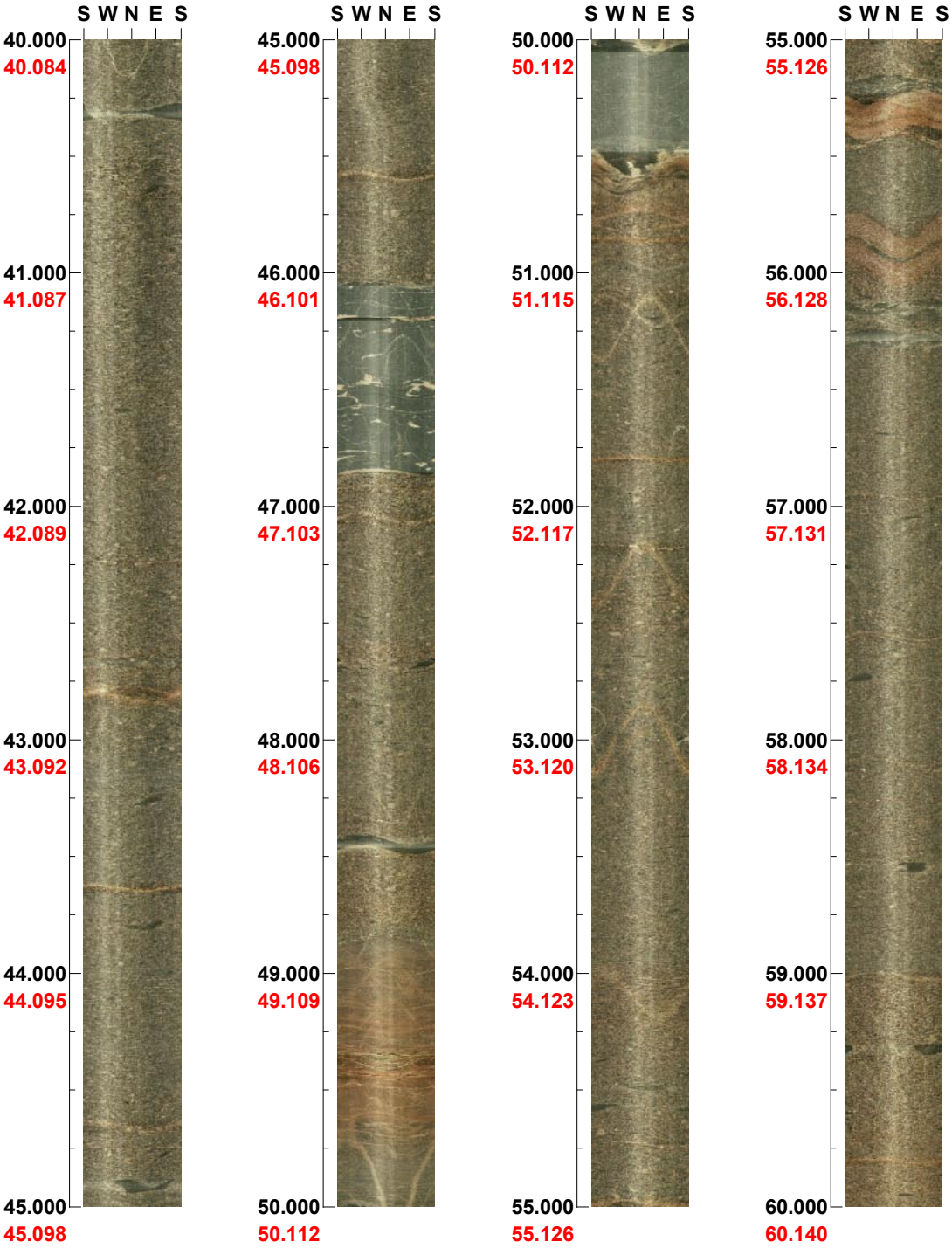
Depth range: 20.000 - 40.000 m



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

Project name: Laxemar
Bore hole No.: KLX09B **Azimuth: 0** **Inclination: -90**

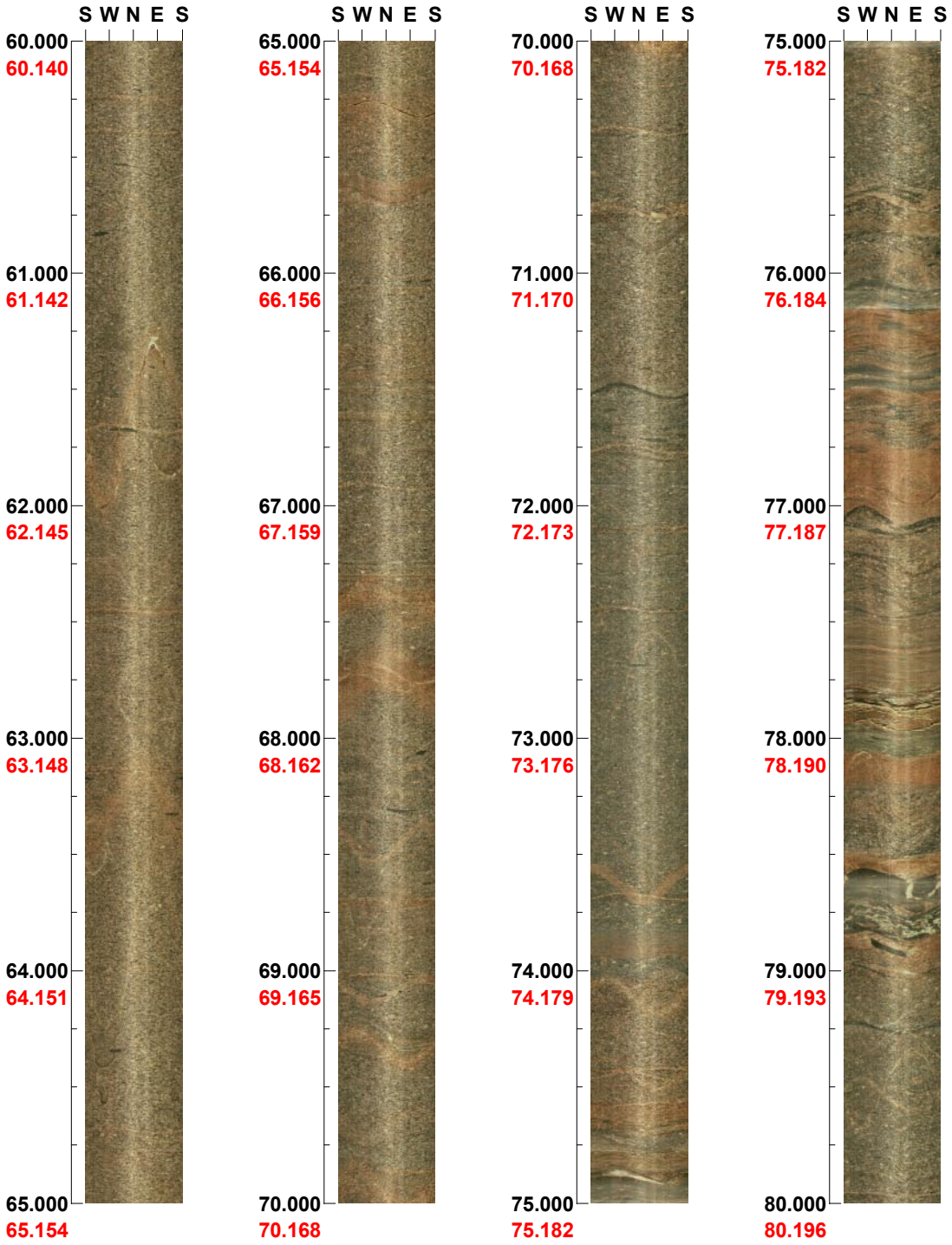
Depth range: 40.000 - 60.000 m



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

Project name: Laxemar
Bore hole No.: KLX09B **Azimuth: 0** **Inclination: -90**

Depth range: 60.000 - 80.000 m



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

Project name: Laxemar
Bore hole No.: KLX09B **Azimuth: 0** **Inclination: -90**

Depth range: 80.000 - 99.844 m

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

Appendix 8

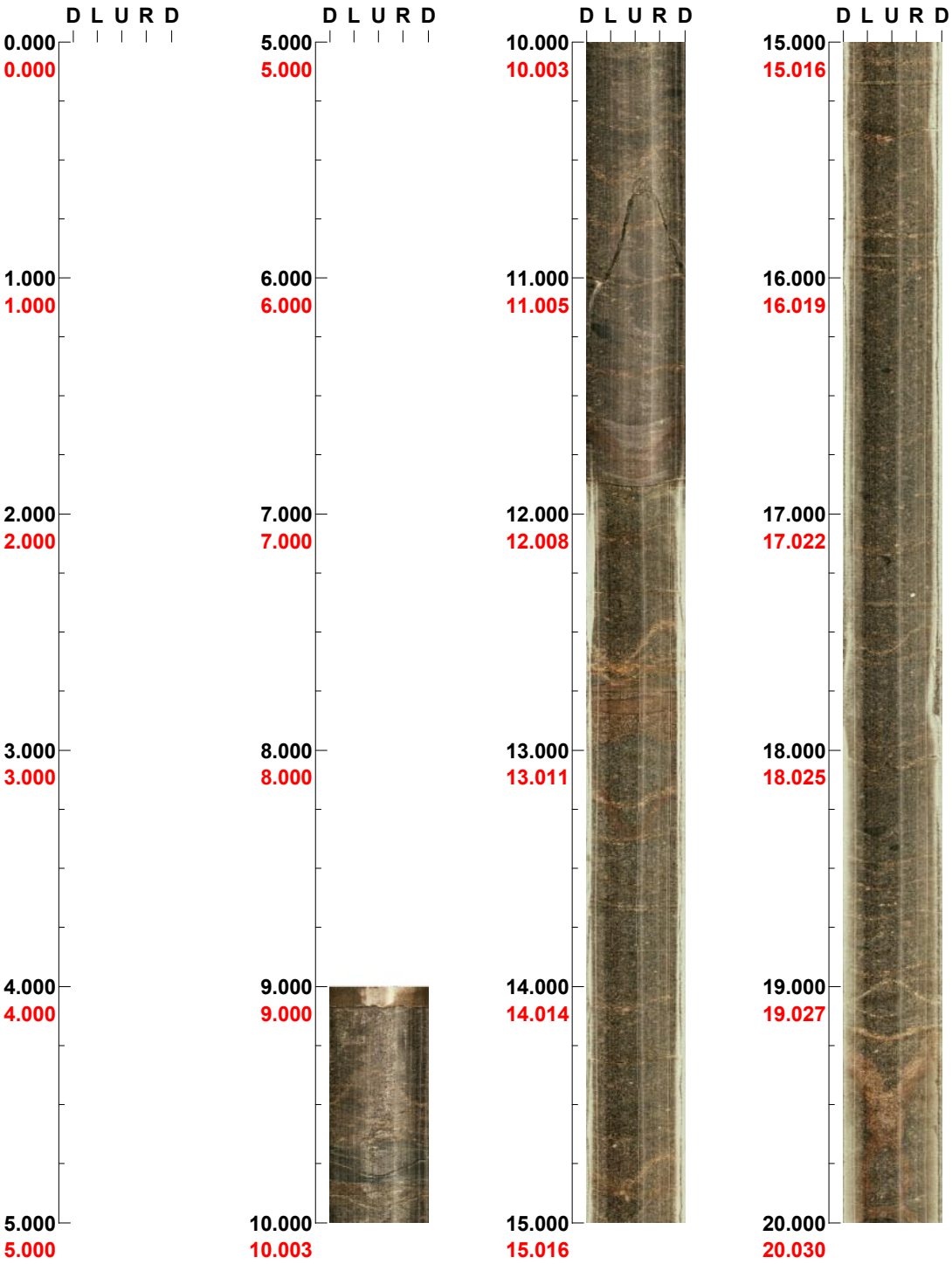
BIPS logging in KLX09C, 9 to 118 m

Project name: Laxemar

Image file	**: c:\work\r5500s~1\bips\klx09c.bip**
BDT file	**: c:\work\r5500s~1\bips\klx09c.bdt**
Locality	**: LAXEMAR**
Bore hole number	**: KLX09C**
Date	**: 06/02/09**
Time	**: 15:44:00**
Depth range	**: 9.000 - 118.621 m**
Azimuth	**: 160**
Inclination	**: -59**
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	**: 6**
Color	**:**  **+0 +0 +0**

Project name: Laxemar
Bore hole No.: KLX09C **Azimuth: 160** **Inclination: -59**

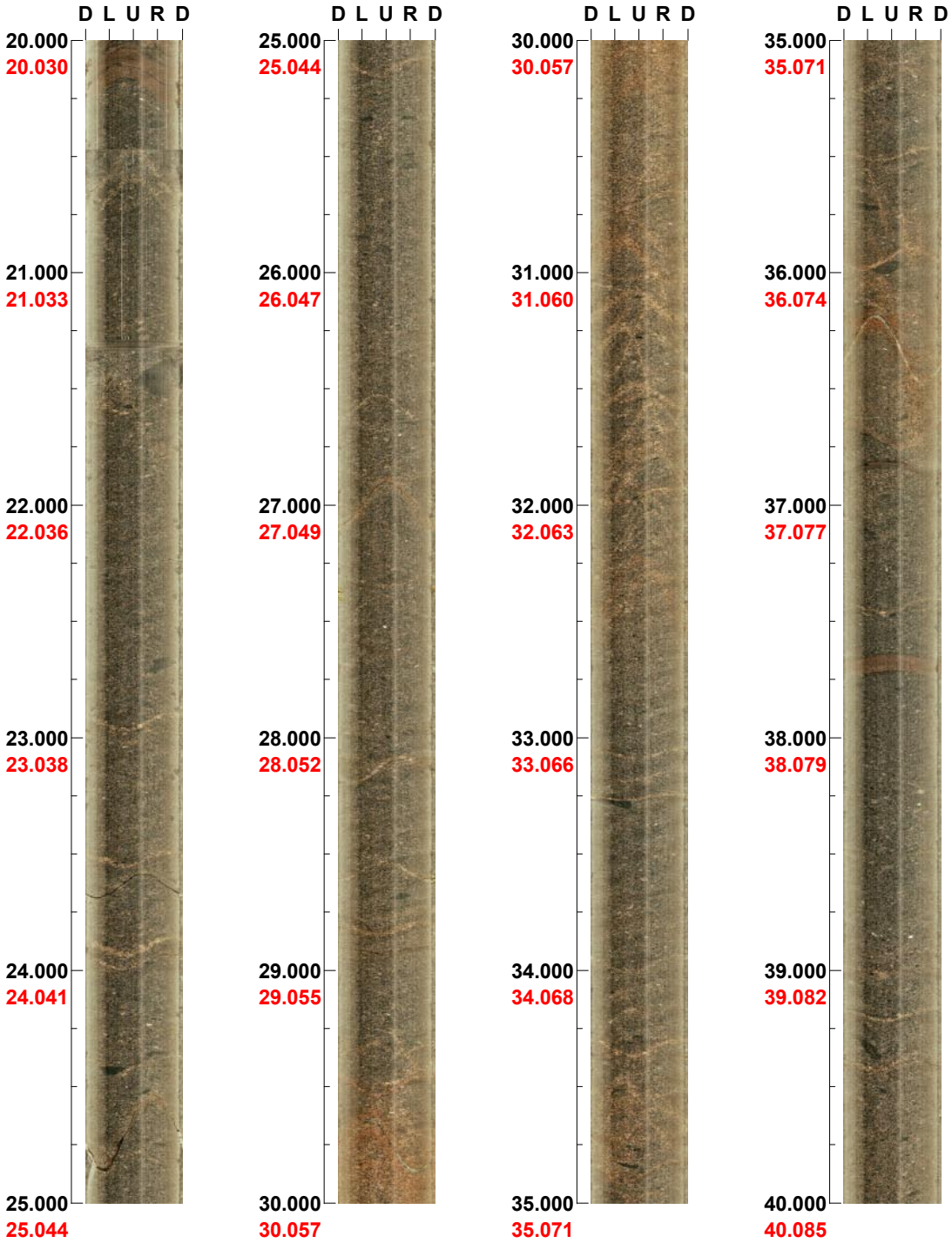
Depth range: 0.000 - 20.000 m



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

Project name: Laxemar
Bore hole No.: KLX09C **Azimuth: 160** **Inclination: -59**

Depth range: 20.000 - 40.000 m



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

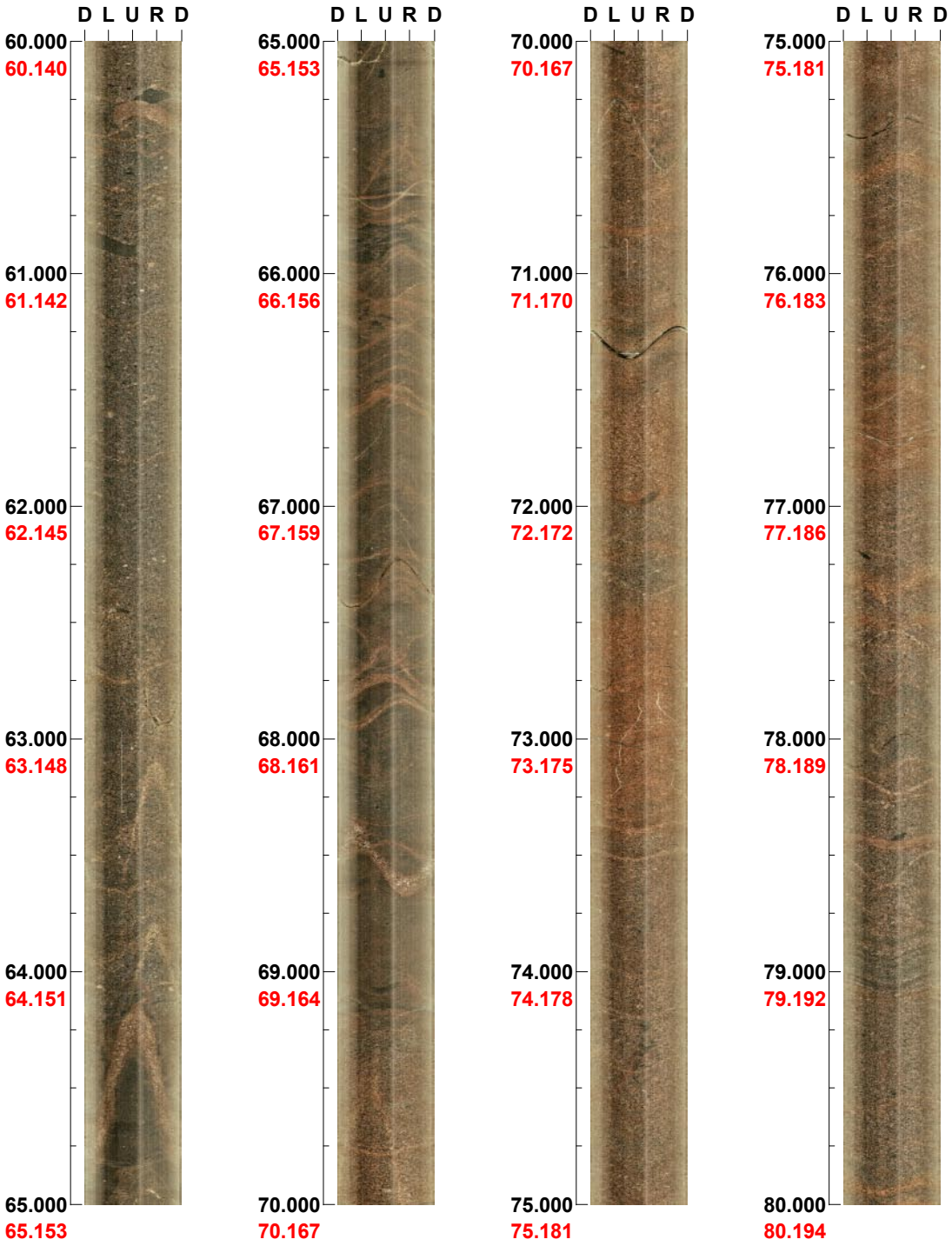
Project name: Laxemar
Bore hole No.: KLX09C **Azimuth: 160** **Inclination: -59**

Depth range: 40.000 - 60.000 m

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

Project name: Laxemar
Bore hole No.: KLX09C **Azimuth: 160** **Inclination: -59**

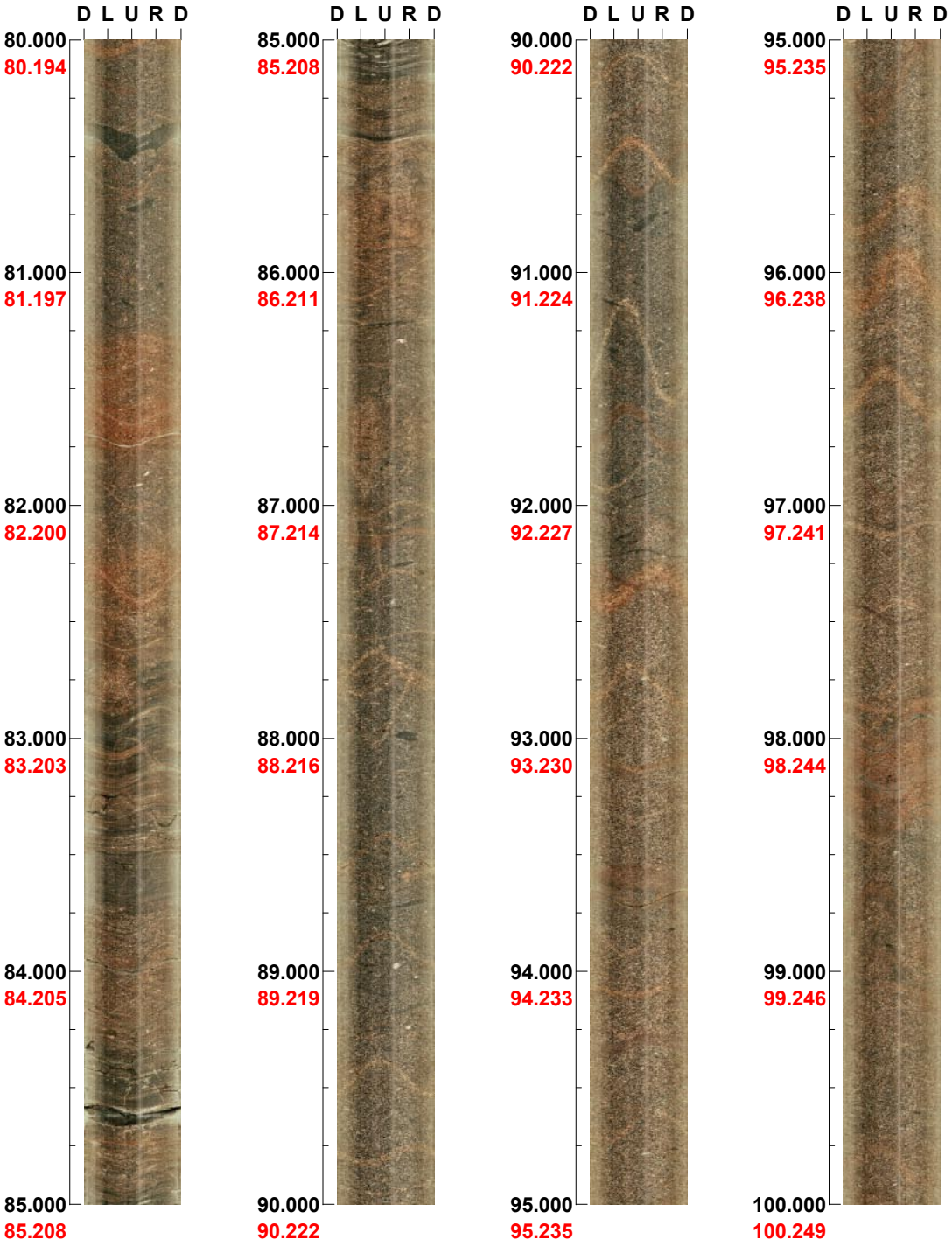
Depth range: 60.000 - 80.000 m



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

Project name: Laxemar
Bore hole No.: KLX09C **Azimuth: 160** **Inclination: -59**

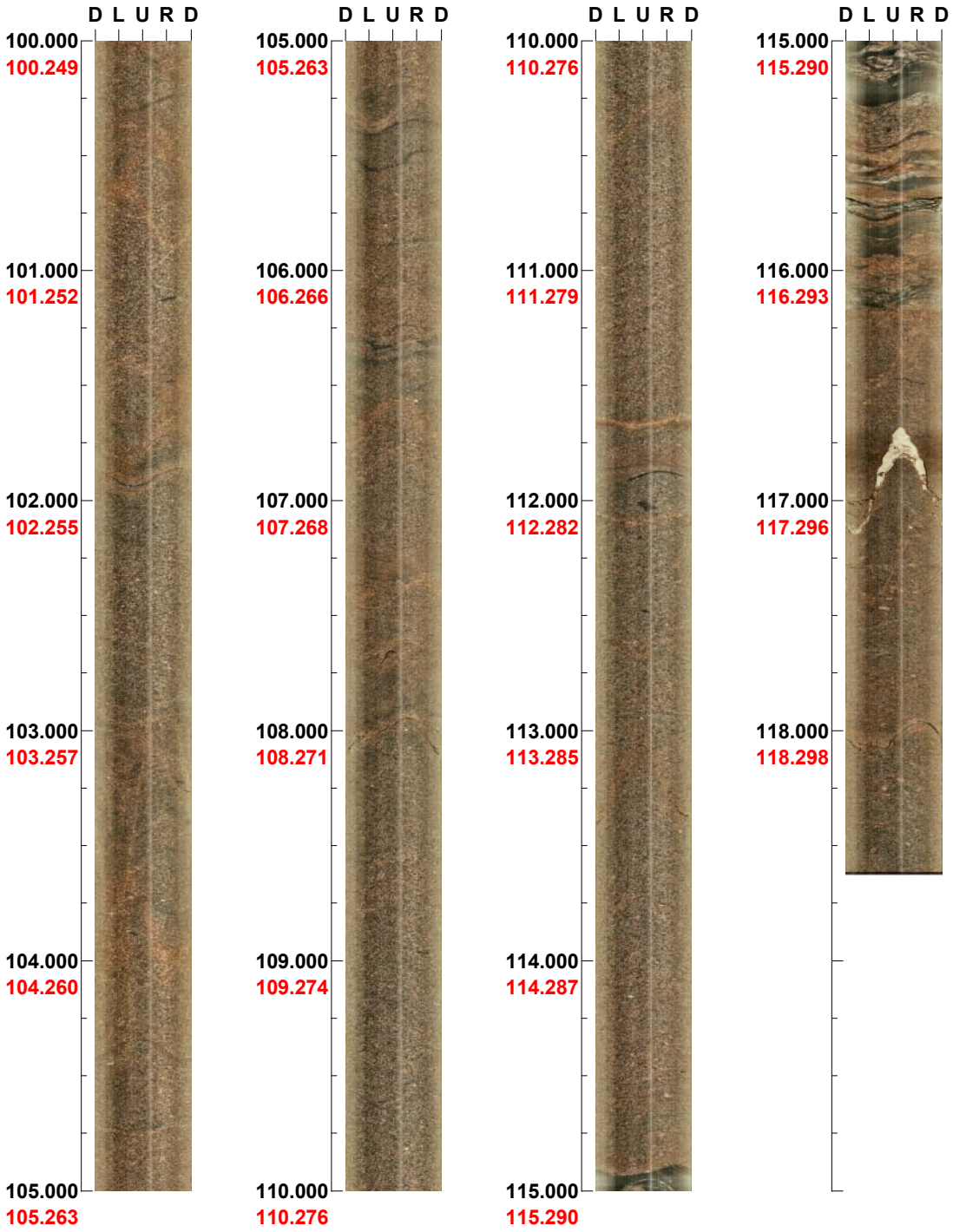
Depth range: 80.000 - 100.000 m



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

Project name: Laxemar
Bore hole No.: KLX09C **Azimuth: 160** **Inclination: -59**

Depth range: 100.000 - 118.621 m



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

Appendix 9

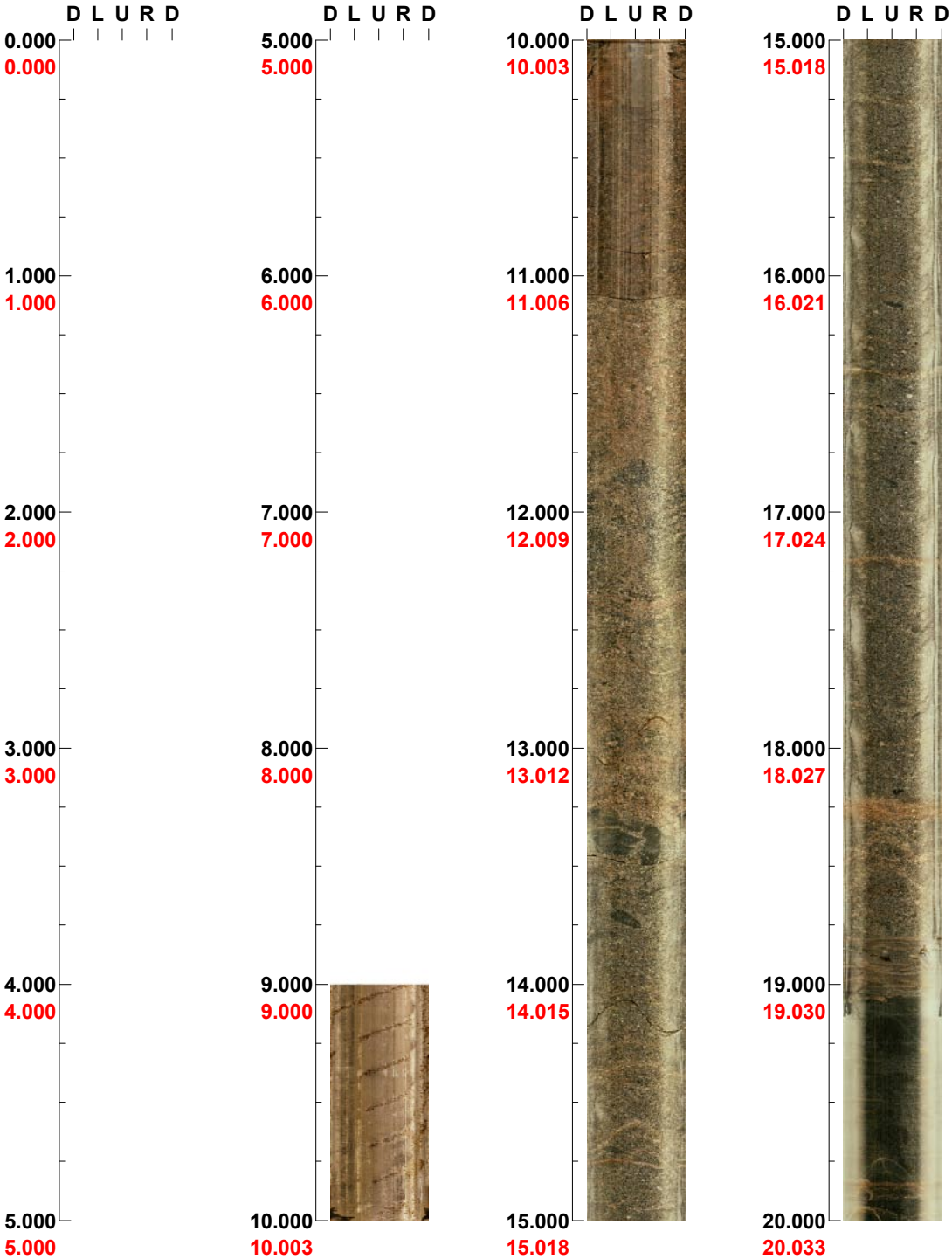
BIPS logging in KLX09D, 9 to 119 m

Project name: Laxemar

Image file	**: c:\work\r5500s~1\bips\klx09d.bip**
BDT file	**: c:\work\r5500s~1\bips\klx09d.bdt**
Locality	**: LAXEMAR**
Bore hole number	**: KLX09D**
Date	**: 06/02/07**
Time	**: 14:58:00**
Depth range	**: 9.000 - 119.497 m**
Azimuth	**: 270**
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	**: 6**
Color	**: +0 +0 +0**

Project name: Laxemar
Bore hole No.: KLX09D **Azimuth: 270** **Inclination: -60**

Depth range: 0.000 - 20.000 m



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

Project name: Laxemar
Bore hole No.: KLX09D **Azimuth: 270** **Inclination: -60**

Depth range: 20.000 - 40.000 m

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

Project name: Laxemar
Bore hole No.: KLX09D Azimuth: 270 Inclination: -60

Depth range: 40.000 - 60.000 m

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

Project name: Laxemar
Bore hole No.: KLX09D **Azimuth: 270** **Inclination: -60**

Depth range: 60.000 - 80.000 m

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

Project name: Laxemar
Bore hole No.: KLX09D **Azimuth: 270** **Inclination: -60**

Depth range: 80.000 - 100.000 m

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

Project name: Laxemar
Bore hole No.: KLX09D **Azimuth: 270** **Inclination: -60**

Depth range: 100.000 - 119.497 m

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

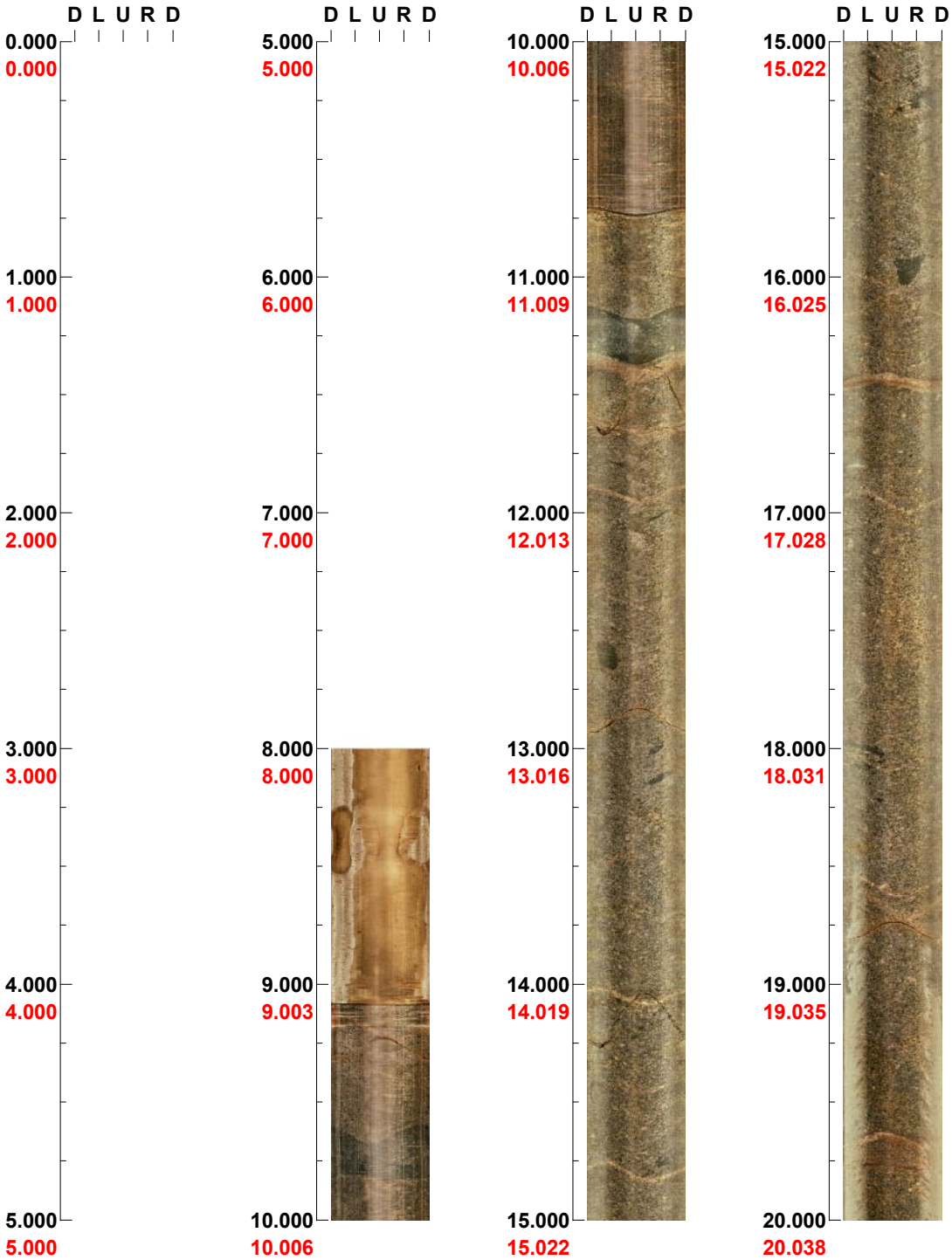
BIPS logging in KLX09E, 8 to 119 m

Project name: Laxemar

Image file	**: c:\work\r5500s~1\bips\klx09e.bip**
BDT file	**: c:\work\r5500s~1\bips\klx09e.bdt**
Locality	**: LAXEMAR**
Bore hole number	**: KLX09E**
Date	**: 06/02/08**
Time	**: 15:17:00**
Depth range	**: 8.000 - 119.719 m**
Azimuth	**: 339**
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	**: 6**
Color	**:**  **+0 +0 +0**

Project name: Laxemar
Bore hole No.: KLX09E **Azimuth: 339** **Inclination: -60**

Depth range: 0.000 - 20.000 m



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

Project name: Laxemar
Bore hole No.: KLX09E **Azimuth: 339** **Inclination: -60**

Depth range: 20.000 - 40.000 m

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

Project name: Laxemar
Bore hole No.: KLX09E **Azimuth: 339** **Inclination: -60**

Depth range: 40.000 - 60.000 m

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

Project name: Laxemar
Bore hole No.: KLX09E **Azimuth: 339** **Inclination: -60**

Depth range: 60.000 - 80.000 m

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

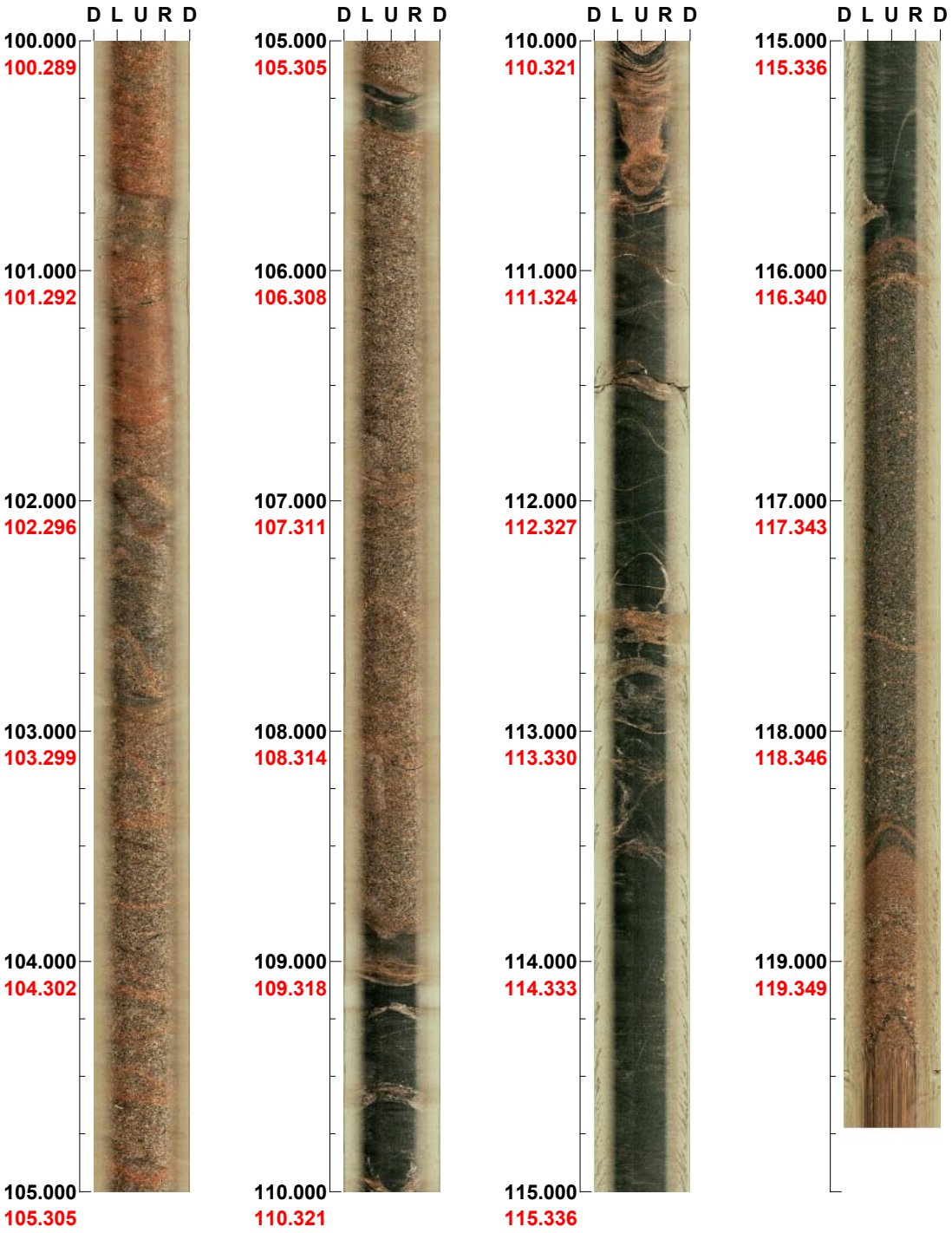
Project name: Laxemar
Bore hole No.: KLX09E **Azimuth: 339** **Inclination: -60**

Depth range: 80.000 - 100.000 m

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

Project name: Laxemar
Bore hole No.: KLX09E **Azimuth: 339** **Inclination: -60**

Depth range: 100.000 - 119.719 m



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

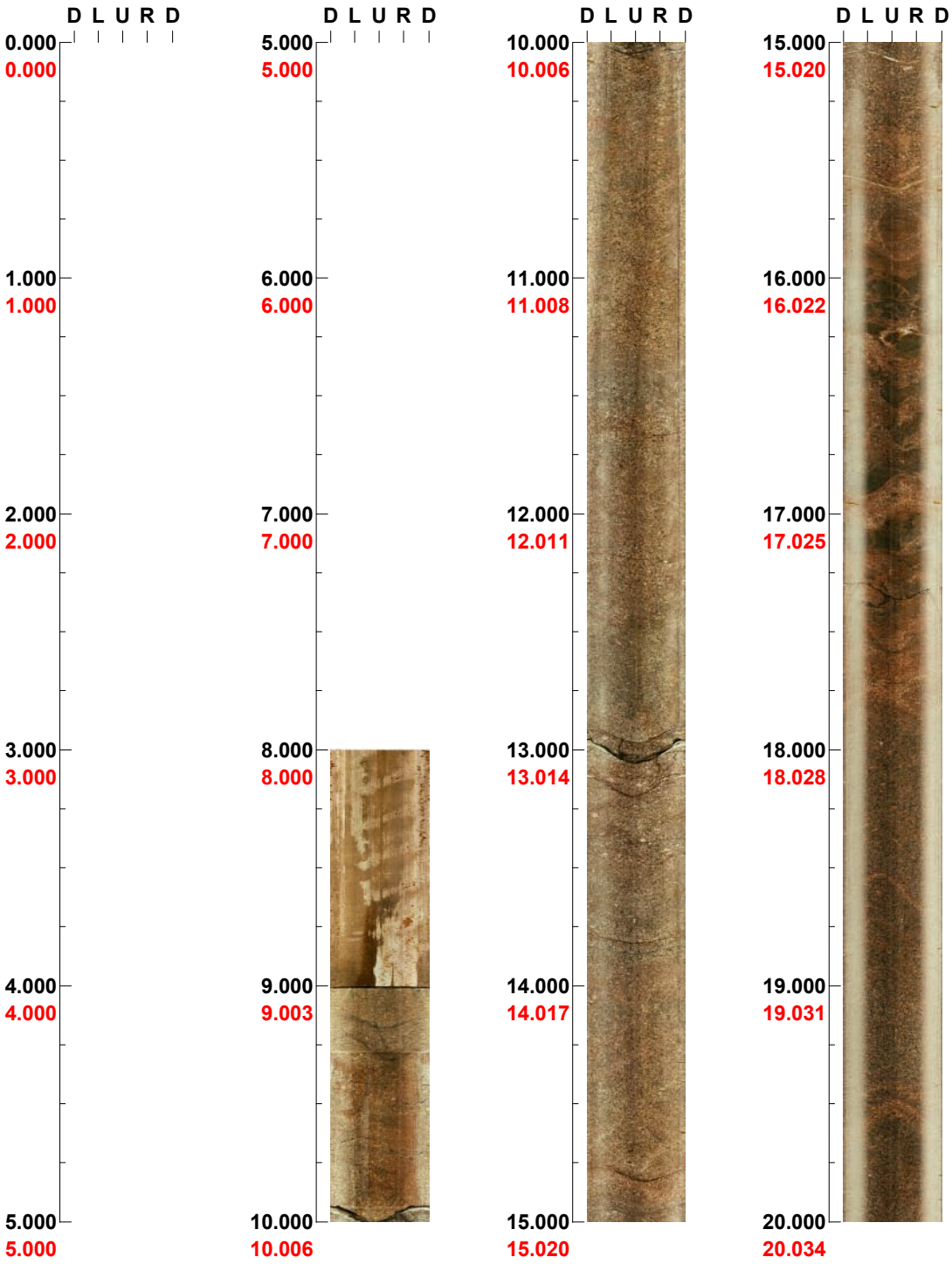
BIPS logging in KLX09F, 8 to 151 m

Project name: Laxemar

Image file	**: c:\work\r5500s~1\bips\klx09f.bip**
BDT file	**: c:\work\r5500s~1\bips\klx09f.bdt**
Locality	**: LAXEMAR**
Bore hole number	**: KLX09F**
Date	**: 06/02/09**
Time	**: 08:26:00**
Depth range	**: 8.000 - 151.196 m**
Azimuth	**: 91**
Inclination	**: -59**
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	**: 8**
Color	**:**  **+0 +0 +0**

Project name: Laxemar
Bore hole No.: KLX09F **Azimuth: 91** **Inclination: -59**

Depth range: 0.000 - 20.000 m



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

Project name: Laxemar
Bore hole No.: KLX09F **Azimuth: 91** **Inclination: -59**

Depth range: 20.000 - 40.000 m

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

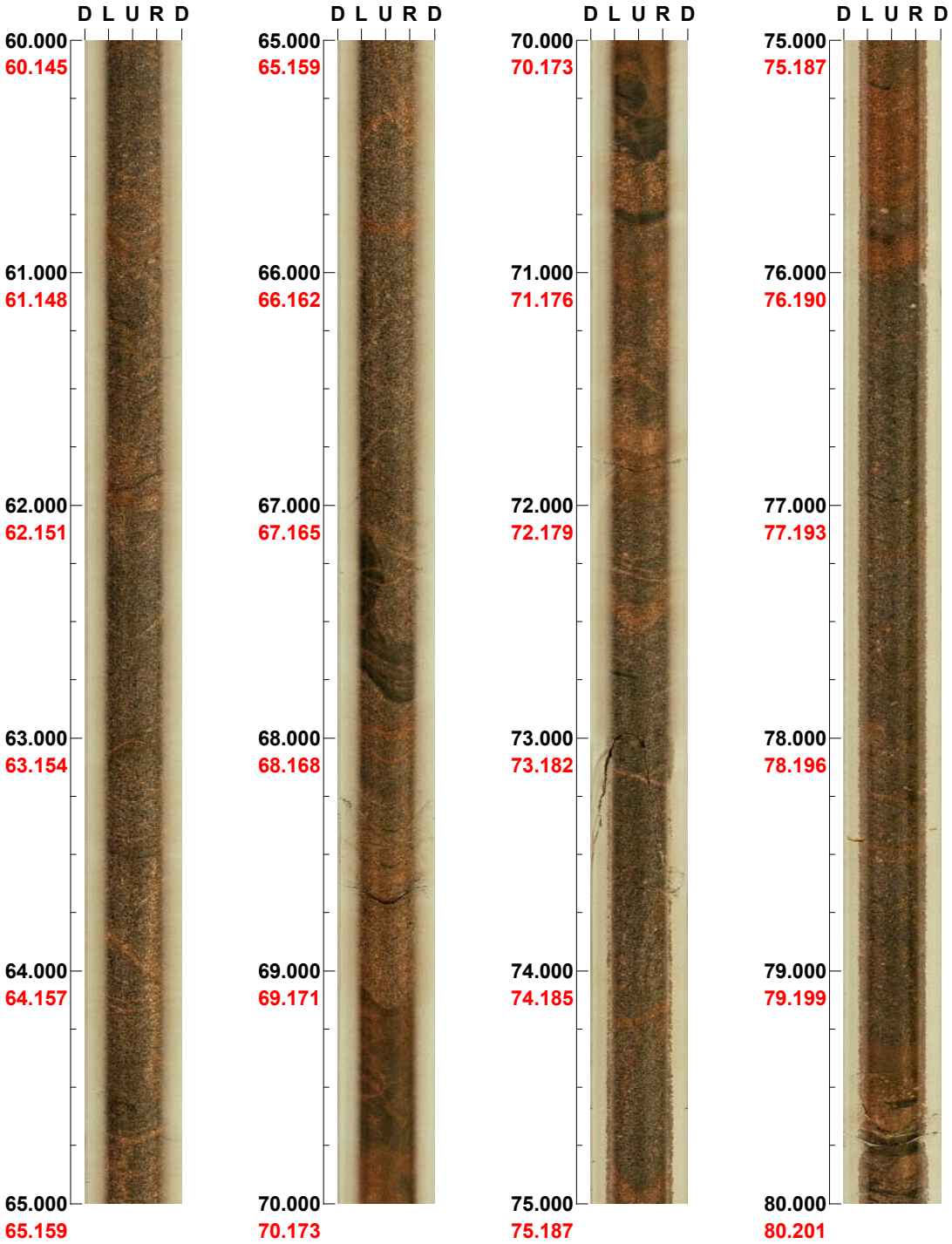
Project name: Laxemar
Bore hole No.: KLX09F **Azimuth: 91** **Inclination: -59**

Depth range: 40.000 - 60.000 m

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

Project name: Laxemar
Bore hole No.: KLX09F **Azimuth: 91** **Inclination: -59**

Depth range: 60.000 - 80.000 m



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

Project name: Laxemar
Bore hole No.: KLX09F **Azimuth: 91** **Inclination: -59**

Depth range: 80.000 - 100.000 m

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

Project name: Laxemar
Bore hole No.: KLX09F **Azimuth: 91** **Inclination: -59**

Depth range: 100.000 - 120.000 m

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

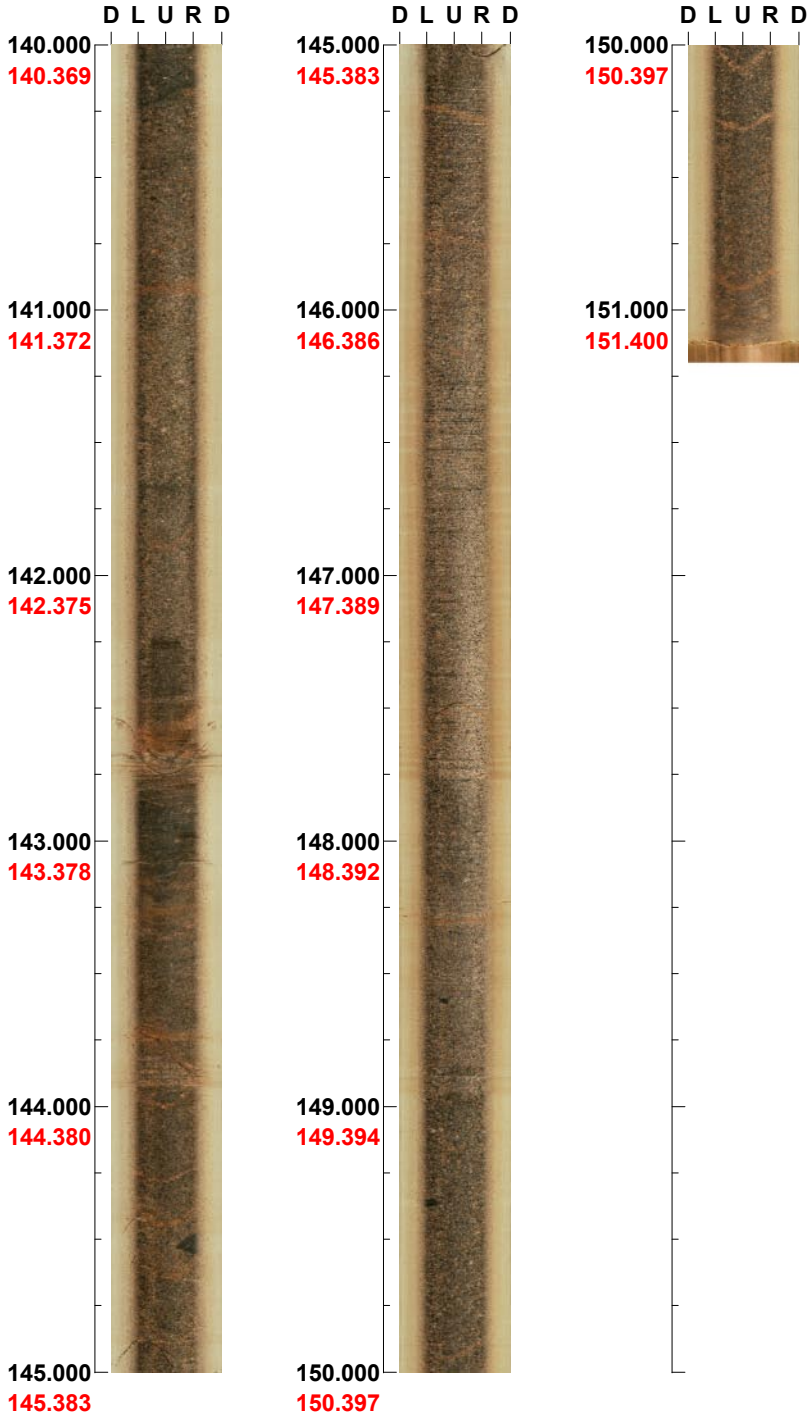
Project name: Laxemar
Bore hole No.: KLX09F **Azimuth: 91** **Inclination: -59**

Depth range: 120.000 - 140.000 m

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

Project name: Laxemar
Bore hole No.: KLX09F **Azimuth: 91** **Inclination: -59**

Depth range: 140.000 - 151.196 m



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

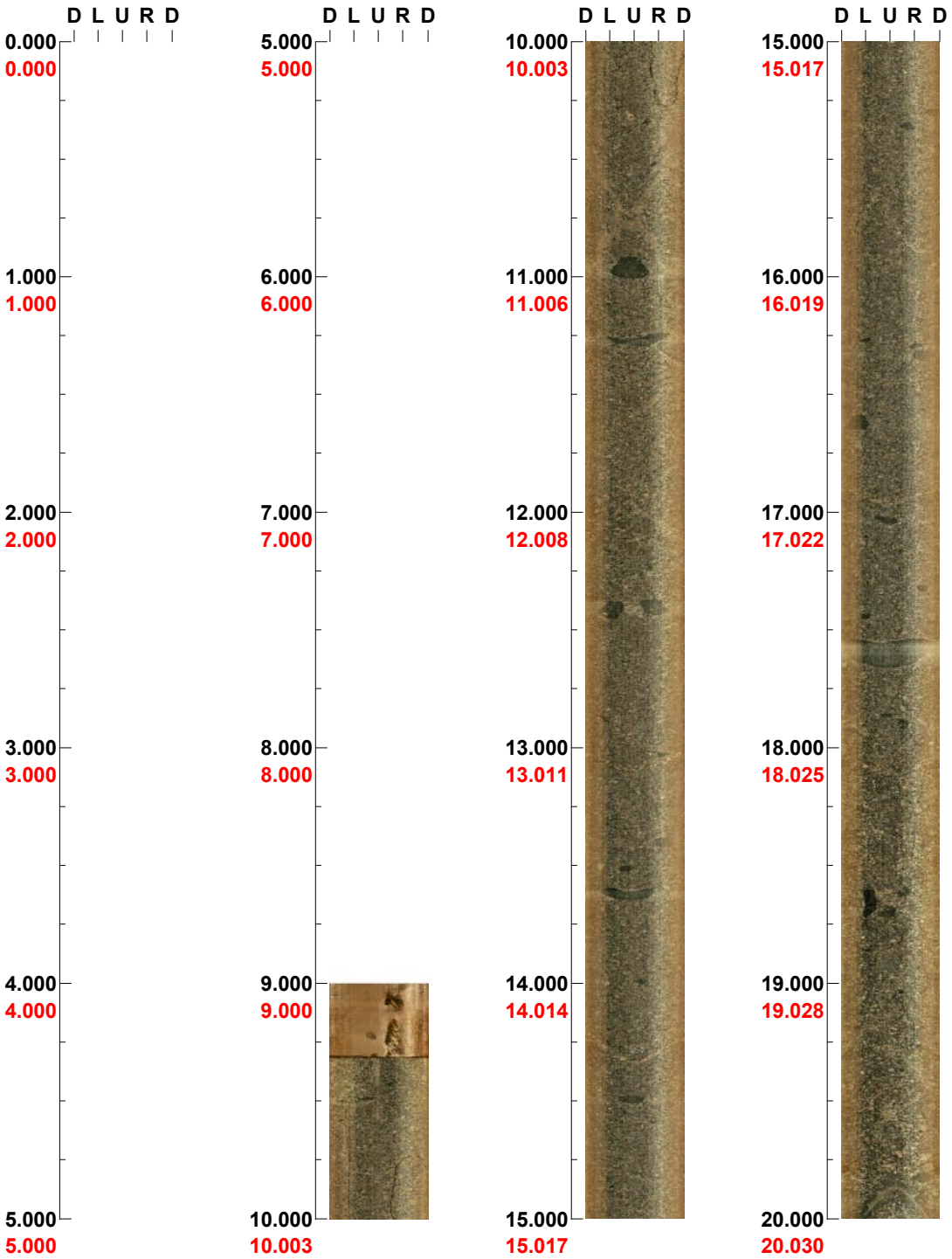
BIPS logging in KLX09G, 9 to 99 m

Project name: Laxemar

Image file	**: c:\work\r5500s~1\bips\klx09g.bip**
BDT file	**: c:\work\r5500s~1\bips\klx09g.bdt**
Locality	**: LAXEMAR**
Bore hole number	**: KLX09G**
Date	**: 06/02/07**
Time	**: 16:32:00**
Depth range	**: 9.000 - 99.543 m**
Azimuth	**: 85**
Inclination	**: -61**
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	**: 5**
Color	**:**  **+0 +0 +0**

Project name: Laxemar
Bore hole No.: KLX09G **Azimuth: 85** **Inclination: -61**

Depth range: 0.000 - 20.000 m



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

Project name: Laxemar
Bore hole No.: KLX09G **Azimuth: 85** **Inclination: -61**

Depth range: 20.000 - 40.000 m

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

Project name: Laxemar
Bore hole No.: KLX09G **Azimuth: 85** **Inclination: -61**

Depth range: 40.000 - 60.000 m

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

Project name: Laxemar
Bore hole No.: KLX09G **Azimuth: 85** **Inclination: -61**

Depth range: 60.000 - 80.000 m

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

Project name: Laxemar
Bore hole No.: KLX09G **Azimuth: 85** **Inclination: -61**

Depth range: 80.000 - 99.543 m

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

Deviation logging in KLX09B, 0 to 99 m

New MeasureIT files

Survey name:	**KLX09B**
Survey date:	07/02/2006 08:45:19
Project:	PLU
Location:	Laxemar

Country:	Sweden
Survey company:	RAYCON
Surveyed by:	Christer Gustafsson
Survey type:	STANDARD
Operating conditions:	
General comments:	
Client name:	SKB
Client ID number:	AP PS 400-06-16
Client reference:	Leif Stenberg
Drill company:	
Drill rig:	
Drill diameter:	76
Survey direction:	INTO hole
Survey run on:	Wireline
Magnetic Var.:	2,53 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	99,0	99,0
East:	1548859,01	1548858,89	-0,12
North:	6367329,07	6367328,71	-0,36
Elevation:	23,62	-75,38	-99,00
Dip:	-89,50	-89,74	-0,24
Azimuth:	167,81	225,56	57,75

OFFSETS at end

Offsets relative to:
ACTUAL START

0,55 metres downwards
0,20 metres right
0,00 metres shortfall

Printed on: 2006-05-02 10:03:51

Survey name : KLX09B

Survey date : 07/02/2006 08:45:19

Printed on 2006-05-02 10:04:52

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	-89,50	167,81	1548859,01	6367329,07	23,62	47199	70,10	1,000283	✍	0,00	0,00	0,00
3,0	-89,83	153,19	1548859,01	6367329,05	20,62	50154	71,19	1,000615	✍	-0,01	0,00	0,00
6,0	-89,78	193,30	1548859,02	6367329,04	17,62	49681	70,98	1,000740	✍	-0,03	0,00	0,00
9,0	-89,71	171,77	1548859,02	6367329,03	14,62	49485	70,61	1,001051	✍	-0,04	0,00	0,00
12,0	-89,89	248,29	1548859,01	6367329,02	11,62	50698	71,69	1,000429	✍	-0,06	0,01	0,00
15,0	-89,78	175,67	1548859,01	6367329,01	8,62	50300	71,29	1,000679	✍	-0,08	0,01	0,00
18,0	-89,64	195,16	1548859,01	6367329,00	5,62	49955	71,19	1,000142	✍	-0,09	0,02	0,00
21,0	-89,80	198,08	1548859,01	6367328,98	2,62	49162	70,29	0,999823	✍	-0,10	0,02	0,00
24,0	-89,76	194,11	1548859,00	6367328,97	-0,38	49484	70,69	0,999765	✍	-0,12	0,03	0,00
27,0	-89,72	235,83	1548858,99	6367328,96	-3,38	49610	70,85	0,999768	✍	-0,14	0,04	0,00
30,0	-89,73	201,32	1548858,99	6367328,95	-6,38	49645	70,86	0,999767	✍	-0,16	0,05	0,00
33,0	-89,75	194,80	1548858,98	6367328,94	-9,38	49662	70,78	0,999888	✍	-0,17	0,05	0,00
36,0	-89,85	168,32	1548858,98	6367328,93	-12,38	49123	70,32	0,999881	✍	-0,19	0,06	0,00
39,0	-89,65	208,88	1548858,98	6367328,92	-15,38	49511	70,59	0,999836	✍	-0,20	0,06	0,00
42,0	-89,67	208,76	1548858,97	6367328,90	-18,38	49627	71,01	0,999650	✍	-0,22	0,08	0,00
45,0	-89,70	206,65	1548858,96	6367328,89	-21,38	50540	71,51	0,999586	✍	-0,23	0,09	0,00
48,0	-89,71	200,92	1548858,95	6367328,87	-24,38	50622	71,54	0,999830	✍	-0,24	0,10	0,00
51,0	-89,90	168,79	1548858,95	6367328,86	-27,38	49539	71,02	0,999941	✍	-0,26	0,10	0,00
54,0	-89,93	234,25	1548858,95	6367328,86	-30,38	50351	71,27	0,999696	✍	-0,28	0,10	0,00
57,0	-89,69	208,36	1548858,95	6367328,85	-33,38	49435	70,96	0,999770	✍	-0,30	0,11	0,00
60,0	-89,72	207,81	1548858,94	6367328,84	-36,38	49852	71,36	0,999646	✍	-0,32	0,12	0,00
63,0	-89,73	199,37	1548858,93	6367328,82	-39,38	49833	71,32	0,999951	✍	-0,33	0,13	0,00
66,0	-89,75	196,46	1548858,93	6367328,81	-42,38	50023	71,18	0,999826	✍	-0,35	0,13	0,00
69,0	-89,82	190,52	1548858,93	6367328,80	-45,38	49735	71,30	1,000066	✍	-0,36	0,14	0,00
72,0	-89,94	156,06	1548858,93	6367328,79	-48,38	49553	71,25	1,000001	✍	-0,38	0,14	0,00
75,0	-89,73	205,35	1548858,92	6367328,78	-51,38	50102	71,57	0,999584	✍	-0,40	0,14	0,00
78,0	-89,74	203,26	1548858,92	6367328,77	-54,38	49869	71,37	0,999644	✍	-0,42	0,15	0,00
81,0	-89,75	196,72	1548858,91	6367328,76	-57,38	49822	71,30	0,999827	✍	-0,43	0,16	0,00
84,0	-89,86	180,82	1548858,91	6367328,75	-60,38	49821	71,23	0,999698	✍	-0,45	0,16	0,00
87,0	-89,95	184,21	1548858,91	6367328,74	-63,38	49575	71,20	0,999817	✍	-0,47	0,16	0,00
90,0	-89,90	189,39	1548858,91	6367328,74	-66,38	50097	71,38	0,999574	✍	-0,49	0,17	0,00
93,0	-89,68	220,06	1548858,90	6367328,73	-69,38	49485	71,18	0,999832	✍	-0,51	0,17	0,00
96,0	-89,74	214,28	1548858,90	6367328,72	-72,38	49816	71,36	0,999522	✍	-0,53	0,19	0,00

Survey name : KLX09B
Survey date : 07/02/2006 08:45:19
Printed on 2006-05-02 10:04:52

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
99,0	-89,74	225,56	1548858,89	6367328,71	-75,38	49788	71,32	0,999828	✍	-0,55	0,20	0,00

Deviation logging in KLX09C, 0 to 117 m

New MeasureIT files

Survey name:	**KLX09C**
Survey date:	09/02/2006 18:39:54
Project:	PLU
Location:	Laxemar

Country:	Sweden
Survey company:	RAYCON
Surveyed by:	Christer Gustafsson
Survey type:	STANDARD
Operating conditions:	
General comments:	
Client name:	SKB
Client ID number:	AP PS 400-06-16
Client reference:	Leif Stenberg
Drill company:	
Drill rig:	
Drill diameter:	76
Survey direction:	INTO hole
Survey run on:	Wireline
Magnetic Var.:	2,53 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	117,0	117,0
East:	1548838,82	1548854,21	15,39
North:	6367353,82	6367294,31	-59,51
Elevation:	23,75	-75,75	-99,50
Dip:	-59,19	-57,22	1,97
Azimuth:	160,39	169,43	9,04

OFFSETS at end

Offsets relative to:
ACTUAL START

1,61 metres upwards
5,47 metres right
0,18 metres shortfall

Printed on: 2006-05-02 10:09:05

Survey name : KLX09C
Survey date : 09/02/2006 18:39:54
Printed on 2006-05-02 10:09:16

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	-59,19	160,39	1548838,82	6367353,82	23,75	50399	71,58	1,001978	✍	0,00	0,00	0,00
3,0	-59,55	160,70	1548839,33	6367352,38	21,17	50359	71,42	0,996773	✍	-0,01	0,00	0,00
6,0	-59,65	161,84	1548839,82	6367350,94	18,58	50430	71,34	0,996602	✍	-0,03	0,03	0,00
9,0	-59,35	161,95	1548840,29	6367349,50	16,00	49734	71,22	0,996618	✍	-0,05	0,07	0,00
12,0	-59,26	162,63	1548840,76	6367348,04	13,42	50138	71,01	0,996760	✍	-0,06	0,12	0,00
15,0	-59,14	162,31	1548841,22	6367346,57	10,84	50198	71,17	0,996527	✍	-0,06	0,17	0,00
18,0	-59,11	161,91	1548841,69	6367345,11	8,27	49909	71,21	0,996966	✍	-0,06	0,22	0,00
21,0	-59,03	162,81	1548842,16	6367343,64	5,69	49889	70,88	0,996610	✍	-0,05	0,27	0,00
24,0	-58,97	162,85	1548842,61	6367342,16	3,12	49787	70,89	0,996667	✍	-0,04	0,34	0,00
27,0	-58,92	162,66	1548843,07	6367340,68	0,55	49934	71,11	0,996885	✍	-0,03	0,40	0,00
30,0	-58,83	163,34	1548843,53	6367339,20	-2,02	49707	71,17	0,996839	✍	-0,02	0,47	0,00
33,0	-58,76	163,48	1548843,97	6367337,71	-4,58	49666	71,18	0,996870	✍	0,00	0,56	-0,01
36,0	-58,66	164,19	1548844,40	6367336,22	-7,15	49606	71,12	0,996814	✍	0,03	0,65	-0,01
39,0	-58,62	163,26	1548844,84	6367334,72	-9,71	49637	70,98	0,996901	✍	0,05	0,74	-0,01
42,0	-58,52	164,22	1548845,28	6367333,21	-12,27	49821	71,04	0,996861	✍	0,08	0,83	-0,01
45,0	-58,47	164,10	1548845,71	6367331,71	-14,83	49609	71,07	0,996930	✍	0,12	0,93	-0,01
48,0	-58,37	165,77	1548846,12	6367330,19	-17,38	49867	71,31	0,996670	✍	0,15	1,06	-0,02
51,0	-58,30	164,79	1548846,52	6367328,67	-19,94	49945	71,09	0,996953	✍	0,19	1,19	-0,02
54,0	-58,21	164,93	1548846,93	6367327,14	-22,49	49539	71,27	0,996804	✍	0,23	1,32	-0,02
57,0	-58,16	165,62	1548847,33	6367325,61	-25,04	49878	71,11	0,997104	✍	0,28	1,45	-0,02
60,0	-58,06	165,34	1548847,73	6367324,08	-27,58	49927	71,02	0,996786	✍	0,33	1,59	-0,03
63,0	-58,01	165,53	1548848,13	6367322,54	-30,13	49543	70,94	0,996936	✍	0,39	1,73	-0,03
66,0	-57,97	166,11	1548848,52	6367321,00	-32,67	50025	71,41	0,996599	✍	0,44	1,88	-0,04
69,0	-57,96	166,29	1548848,90	6367319,45	-35,22	50251	71,55	0,996701	✍	0,50	2,04	-0,04
72,0	-57,91	166,64	1548849,27	6367317,91	-37,76	50269	71,46	0,996692	✍	0,56	2,21	-0,05
75,0	-57,89	167,17	1548849,63	6367316,35	-40,30	50246	71,48	0,996598	✍	0,62	2,39	-0,05
78,0	-57,85	167,08	1548849,99	6367314,80	-42,84	49744	71,24	0,996983	✍	0,68	2,58	-0,06
81,0	-57,82	167,12	1548850,34	6367313,24	-45,38	50035	71,52	0,996857	✍	0,74	2,77	-0,07
84,0	-57,78	167,31	1548850,70	6367311,68	-47,92	50139	71,88	0,996436	✍	0,80	2,96	-0,07
87,0	-57,75	167,01	1548851,05	6367310,12	-50,46	50004	71,01	0,996584	✍	0,87	3,14	-0,08
90,0	-57,70	167,36	1548851,41	6367308,56	-52,99	49802	70,78	0,996500	✍	0,93	3,33	-0,09
93,0	-57,64	168,10	1548851,75	6367306,99	-55,53	50086	71,40	0,996808	✍	1,00	3,54	-0,09
96,0	-57,57	168,80	1548852,07	6367305,42	-58,06	50228	71,48	0,996875	✍	1,07	3,76	-0,10

Survey name : KLX09C

Survey date : 09/02/2006 18:39:54

Printed on 2006-05-02 10:09:16

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	-57,54	168,57	1548852,39	6367303,84	-60,59	50070	71,28	0,996700	✍	1,14	4,00	-0,11
102,0	-57,48	168,61	1548852,70	6367302,26	-63,12	50079	71,70	0,996977	✍	1,21	4,23	-0,12
105,0	-57,43	169,31	1548853,01	6367300,68	-65,65	49971	71,19	0,996697	✍	1,29	4,47	-0,13
108,0	-57,39	169,08	1548853,32	6367299,09	-68,18	49734	71,13	0,996663	✍	1,37	4,71	-0,14
111,0	-57,33	169,11	1548853,62	6367297,50	-70,70	49820	71,29	0,996623	✍	1,45	4,96	-0,16
114,0	-57,30	169,69	1548853,92	6367295,91	-73,23	49988	71,90	0,996580	✍	1,53	5,21	-0,17
117,0	-57,22	169,43	1548854,21	6367294,31	-75,75	50074	71,34	0,997486	✍	1,61	5,47	-0,18

Deviation logging in KLX09D, 0 to 117 m

New MeasureIT files

Survey name:	**KLX09D**
Survey date:	07/02/2006 19:19:59
Project:	PLU
Location:	Laxemar

Country:	Sweden
Survey company:	RAYCON
Surveyed by:	Christer Gustafsson
Survey type:	STANDARD
Operating conditions:	
General comments:	
Client name:	SKB
Client ID number:	AP PS 400-06-16
Client reference:	Leif Stenberg
Drill company:	
Drill rig:	
Drill diameter:	76
Survey direction:	INTO hole
Survey run on:	Wireline
Magnetic Var.:	2,53 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	117,0	117,0
East:	1548878,22	1548818,00	-60,22
North:	6367336,99	6367338,65	1,66
Elevation:	23,10	-77,18	-100,28
Dip:	-60,31	-57,75	2,56
Azimuth:	270,15	272,16	2,01

OFFSETS at end

Offsets relative to:
ACTUAL START

2,65 metres upwards
1,50 metres right
0,05 metres shortfall

Printed on: 2006-05-02 10:45:02

Survey name : KLX09D

Survey date : 07/02/2006 19:19:59

Printed on 2006-05-02 10:45:07

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	-60,31	270,15	1548878,22	6367336,99	23,10	49266	70,77	0,998913	✍	0,00	0,00	0,00
3,0	-60,25	269,97	1548876,73	6367336,99	20,49	49327	71,28	1,001899	✍	0,00	0,00	0,00
6,0	-60,14	268,57	1548875,24	6367336,97	17,89	49652	71,22	1,001314	✍	0,01	-0,03	0,00
9,0	-60,01	270,79	1548873,75	6367336,96	15,29	49608	71,16	1,001740	✍	0,02	-0,04	0,00
12,0	-59,94	269,97	1548872,24	6367336,97	12,69	49759	71,17	1,001071	✍	0,04	-0,03	0,00
15,0	-59,93	269,78	1548870,74	6367336,97	10,10	49745	71,19	1,001432	✍	0,06	-0,04	0,00
18,0	-59,87	273,09	1548869,24	6367337,01	7,50	50326	71,74	1,001488	✍	0,08	0,00	0,00
21,0	-59,81	270,47	1548867,73	6367337,06	4,91	49884	71,02	1,001666	✍	0,10	0,04	0,00
24,0	-59,76	270,21	1548866,22	6367337,06	2,32	49472	70,89	1,001656	✍	0,13	0,04	0,00
27,0	-59,68	270,61	1548864,71	6367337,08	-0,28	49487	70,86	1,001297	✍	0,16	0,05	0,00
30,0	-59,62	270,89	1548863,19	6367337,10	-2,86	49742	71,34	1,001214	✍	0,19	0,07	0,00
33,0	-59,54	270,56	1548861,67	6367337,11	-5,45	49556	71,26	1,001615	✍	0,23	0,08	0,00
36,0	-59,49	268,96	1548860,15	6367337,11	-8,04	49268	70,72	1,001542	✍	0,27	0,07	0,00
39,0	-59,43	270,07	1548858,63	6367337,09	-10,62	49732	71,07	1,001558	✍	0,32	0,05	0,00
42,0	-59,38	271,20	1548857,10	6367337,11	-13,20	49408	70,97	1,001948	✍	0,37	0,07	0,00
45,0	-59,30	271,58	1548855,57	6367337,15	-15,78	49447	70,93	1,001542	✍	0,42	0,10	0,00
48,0	-59,25	272,41	1548854,04	6367337,20	-18,36	50326	71,64	1,001390	✍	0,47	0,15	0,00
51,0	-59,15	271,14	1548852,51	6367337,25	-20,94	49626	70,94	1,001710	✍	0,53	0,19	-0,01
54,0	-59,10	272,37	1548850,97	6367337,30	-23,51	49653	71,35	1,001717	✍	0,59	0,24	-0,01
57,0	-59,03	271,35	1548849,43	6367337,35	-26,09	49928	71,30	1,001494	✍	0,65	0,28	-0,01
60,0	-58,97	271,61	1548847,88	6367337,39	-28,66	49553	70,85	1,001848	✍	0,72	0,32	-0,01
63,0	-58,89	273,01	1548846,33	6367337,45	-31,23	50008	71,51	1,001274	✍	0,79	0,38	-0,01
66,0	-58,83	271,92	1548844,78	6367337,52	-33,80	49594	71,57	1,001604	✍	0,87	0,44	-0,01
69,0	-58,74	273,06	1548843,23	6367337,58	-36,36	50000	71,66	1,001649	✍	0,95	0,50	-0,01
72,0	-58,66	272,66	1548841,68	6367337,66	-38,93	49878	71,67	1,001679	✍	1,03	0,58	-0,02
75,0	-58,60	273,08	1548840,12	6367337,74	-41,49	49825	71,57	1,001357	✍	1,12	0,65	-0,02
78,0	-58,54	270,54	1548838,55	6367337,79	-44,05	49436	70,95	1,001776	✍	1,21	0,70	-0,02
81,0	-58,48	273,47	1548836,99	6367337,84	-46,61	50289	71,89	1,001612	✍	1,30	0,75	-0,02
84,0	-58,41	272,25	1548835,42	6367337,92	-49,16	49898	71,58	1,001547	✍	1,40	0,82	-0,02
87,0	-58,40	273,47	1548833,85	6367338,00	-51,72	49840	71,89	1,001646	✍	1,49	0,89	-0,03
90,0	-58,32	272,15	1548832,28	6367338,08	-54,27	49688	71,18	1,001533	✍	1,59	0,97	-0,03
93,0	-58,28	272,48	1548830,70	6367338,14	-56,82	50027	71,18	1,001835	✍	1,70	1,03	-0,03
96,0	-58,22	272,37	1548829,12	6367338,21	-59,37	49741	71,17	1,001695	✍	1,81	1,09	-0,03

Survey name : KLX09D

Survey date : 07/02/2006 19:19:59

Printed on 2006-05-02 10:45:07

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	-58,15	272,29	1548827,54	6367338,27	-61,92	49470	71,25	1,001873	✍	1,92	1,15	-0,04
102,0	-58,10	272,61	1548825,96	6367338,34	-64,47	49714	71,70	1,001940	✍	2,03	1,21	-0,04
105,0	-58,02	271,86	1548824,38	6367338,40	-67,02	49473	71,40	1,002116	✍	2,15	1,27	-0,04
108,0	-57,95	272,31	1548822,79	6367338,46	-69,56	49637	71,33	1,001337	✍	2,27	1,32	-0,05
111,0	-57,89	272,08	1548821,19	6367338,52	-72,10	49535	71,17	1,001677	✍	2,39	1,38	-0,05
114,0	-57,84	272,60	1548819,60	6367338,59	-74,64	50075	71,64	1,001514	✍	2,52	1,44	-0,05
117,0	-57,75	272,16	1548818,00	6367338,65	-77,18	49623	71,21	1,001663	✍	2,65	1,50	-0,05

Deviation logging in KLX09E, 0 to 117 m

New MeasureIT files

Survey name:	**KLX09E**
Survey date:	08/02/2006 17:31:26
Project:	PLU
Location:	Laxemar

Country:	Sweden
Survey company:	RAYCON
Surveyed by:	Christer Gustafsson
Survey type:	STANDARD
Operating conditions:	
General comments:	
Client name:	SKB
Client ID number:	AP PS 400-06-16
Client reference:	Leif Stenberg
Drill company:	
Drill rig:	
Drill diameter:	76
Survey direction:	INTO hole
Survey run on:	Wireline
Magnetic Var.:	2,53 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	117,0	117,0
East:	1548880,37	1548862,99	-17,38
North:	6367304,45	6367361,48	57,03
Elevation:	22,16	-78,48	-100,64
Dip:	-60,45	-58,20	2,25
Azimuth:	338,90	346,18	7,28

OFFSETS at end
Offsets relative to: ACTUAL START
2,10 metres upwards
4,31 metres right
0,13 metres shortfall

Printed on: 2006-05-02 10:34:06

Survey name : KLX09E

Survey date : 08/02/2006 17:31:26

Printed on 2006-05-02 10:34:17

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	-60,45	338,90	1548880,37	6367304,45	22,16	49207	71,56	0,999973	✍	0,00	0,00	0,00
3,0	-59,98	339,09	1548879,84	6367305,84	19,56	49365	71,48	0,998920	✍	0,01	0,00	0,00
6,0	-60,24	339,93	1548879,31	6367307,24	16,96	49343	70,92	0,998760	✍	0,03	0,02	0,00
9,0	-60,22	340,55	1548878,81	6367308,64	14,35	49191	71,15	0,998873	✍	0,04	0,05	0,00
12,0	-60,20	339,54	1548878,30	6367310,04	11,75	49232	71,24	0,999036	✍	0,05	0,08	0,00
15,0	-60,24	339,61	1548877,78	6367311,44	9,14	49206	71,28	0,998550	✍	0,07	0,10	0,00
18,0	-60,26	340,74	1548877,28	6367312,84	6,54	49484	71,34	0,998965	✍	0,08	0,13	0,00
21,0	-60,24	341,64	1548876,80	6367314,25	3,93	50070	71,46	0,998720	✍	0,09	0,19	0,00
24,0	-60,19	340,40	1548876,31	6367315,66	1,33	49796	70,86	0,999134	✍	0,10	0,25	0,00
27,0	-60,10	341,27	1548875,82	6367317,07	-1,27	49691	71,05	0,998991	✍	0,11	0,30	0,00
30,0	-60,01	341,59	1548875,34	6367318,49	-3,87	49178	71,24	0,999225	✍	0,13	0,36	0,00
33,0	-59,94	342,78	1548874,88	6367319,92	-6,47	49995	70,47	0,998968	✍	0,15	0,45	0,00
36,0	-59,89	342,18	1548874,43	6367321,35	-9,06	49264	70,97	0,998850	✍	0,18	0,54	-0,01
39,0	-59,84	342,43	1548873,97	6367322,79	-11,66	49161	71,27	0,998754	✍	0,21	0,63	-0,01
42,0	-59,74	342,26	1548873,52	6367324,23	-14,25	49495	71,10	0,999108	✍	0,24	0,72	-0,01
45,0	-59,65	341,53	1548873,05	6367325,66	-16,84	49206	71,20	0,999246	✍	0,28	0,80	-0,01
48,0	-59,59	341,71	1548872,57	6367327,10	-19,43	49367	70,99	0,998819	✍	0,32	0,88	-0,01
51,0	-59,50	342,50	1548872,10	6367328,55	-22,02	49429	71,01	0,999401	✍	0,37	0,96	-0,01
54,0	-59,48	344,03	1548871,66	6367330,01	-24,60	50570	71,24	0,998978	✍	0,41	1,08	-0,02
57,0	-59,43	342,57	1548871,22	6367331,47	-27,18	49424	71,40	0,999167	✍	0,46	1,19	-0,02
60,0	-59,35	342,62	1548870,77	6367332,93	-29,77	49581	71,75	0,999063	✍	0,51	1,29	-0,02
63,0	-59,34	342,84	1548870,31	6367334,39	-32,35	49274	71,31	0,999333	✍	0,57	1,39	-0,02
66,0	-59,25	343,17	1548869,86	6367335,85	-34,93	49716	71,61	0,999351	✍	0,63	1,50	-0,03
69,0	-59,12	343,56	1548869,42	6367337,33	-37,50	49817	71,14	0,999176	✍	0,69	1,62	-0,03
72,0	-59,09	344,13	1548869,00	6367338,81	-40,08	49698	71,27	0,999312	✍	0,76	1,76	-0,03
75,0	-59,06	343,90	1548868,57	6367340,29	-42,65	49640	71,31	0,999497	✍	0,82	1,89	-0,04
78,0	-58,95	343,90	1548868,14	6367341,77	-45,22	49799	71,30	0,999409	✍	0,89	2,03	-0,04
81,0	-58,89	344,71	1548867,72	6367343,26	-47,79	49694	71,35	0,998919	✍	0,97	2,17	-0,04
84,0	-58,84	345,01	1548867,32	6367344,76	-50,36	49777	71,42	0,998859	✍	1,04	2,34	-0,05
87,0	-58,78	345,59	1548866,92	6367346,26	-52,92	49890	71,42	0,999568	✍	1,12	2,51	-0,06
90,0	-58,77	345,00	1548866,53	6367347,77	-55,49	49904	71,54	0,999548	✍	1,20	2,68	-0,06
93,0	-58,73	345,60	1548866,13	6367349,27	-58,05	50046	71,69	0,999119	✍	1,28	2,86	-0,07
96,0	-58,51	345,86	1548865,75	6367350,79	-60,62	49895	71,44	0,999363	✍	1,37	3,04	-0,07

Survey name : KLX09E
Survey date : 08/02/2006 17:31:26
Printed on 2006-05-02 10:34:17

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	-58,42	344,71	1548865,35	6367352,30	-63,17	49376	71,14	0,999216	✍	1,46	3,22	-0,08
102,0	-58,33	345,47	1548864,95	6367353,82	-65,73	49429	71,31	0,999222	✍	1,56	3,39	-0,09
105,0	-58,26	346,56	1548864,57	6367355,35	-68,28	49957	71,20	0,999481	✍	1,67	3,58	-0,10
108,0	-58,25	345,65	1548864,19	6367356,89	-70,83	49417	71,23	0,999531	✍	1,77	3,78	-0,10
111,0	-58,18	345,54	1548863,79	6367358,42	-73,38	49586	70,69	0,999213	✍	1,88	3,96	-0,11
114,0	-58,13	344,59	1548863,39	6367359,95	-75,93	48941	71,62	0,999575	✍	1,99	4,13	-0,12
117,0	-58,20	346,18	1548862,99	6367361,48	-78,48	49325	71,10	0,999707	✍	2,10	4,31	-0,13

Deviation logging in KLX09F, 0 to 147 m

New MeasureIT files

Survey name:	**KLX09F**
Survey date:	09/02/2006 11:39:20
Project:	PLU
Location:	Laxemar

Country:	Sweden
Survey company:	RAYCON
Surveyed by:	Christer Gustafsson
Survey type:	STANDARD
Operating conditions:	
General comments:	
Client name:	SKB
Client ID number:	AP PS 400-06-16
Client reference:	Leif Stenberg
Drill company:	
Drill rig:	
Drill diameter:	76
Survey direction:	INTO hole
Survey run on:	Wireline
Magnetic Var.:	2,53 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	147,0	147,0
East:	1548817,26	1548893,77	76,51
North:	6367318,02	6367309,03	-8,99
Elevation:	19,57	-105,54	-125,11
Dip:	-59,84	-56,63	3,21
Azimuth:	90,67	101,31	10,64

OFFSETS at end
Offsets relative to: ACTUAL START
3,38 metres upwards
8,10 metres right
0,34 metres shortfall

Printed on: 2006-05-02 10:37:11

Survey name : KLX09F

Survey date : 09/02/2006 11:39:20

Printed on 2006-05-02 10:37:21

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	-59,84	90,67	1548817,26	6367318,02	19,57	50227	71,21	1,000993	✍	0,00	0,00	0,00
3,0	-59,79	90,86	1548818,77	6367318,00	16,98	49860	71,37	0,999607	✍	0,00	0,00	0,00
6,0	-59,69	91,47	1548820,28	6367317,97	14,39	50119	71,39	1,000150	✍	0,01	0,02	0,00
9,0	-59,44	91,60	1548821,80	6367317,93	11,80	50060	71,41	1,000155	✍	0,02	0,04	0,00
12,0	-59,41	91,72	1548823,32	6367317,88	9,22	49995	71,36	1,000254	✍	0,04	0,06	0,00
15,0	-59,39	91,67	1548824,85	6367317,84	6,63	49939	71,42	1,000744	✍	0,06	0,09	0,00
18,0	-59,35	92,53	1548826,38	6367317,78	4,05	49867	71,29	1,000708	✍	0,09	0,13	0,00
21,0	-59,26	91,88	1548827,91	6367317,72	1,47	49434	71,37	1,000260	✍	0,12	0,17	0,00
24,0	-59,22	93,08	1548829,44	6367317,66	-1,11	49067	71,23	1,000856	✍	0,15	0,22	0,00
27,0	-59,20	93,69	1548830,97	6367317,57	-3,68	49716	71,54	1,000514	✍	0,18	0,29	0,00
30,0	-59,13	94,44	1548832,51	6367317,46	-6,26	49253	71,04	1,000802	✍	0,21	0,38	0,00
33,0	-59,09	93,49	1548834,05	6367317,35	-8,83	49524	71,00	1,000609	✍	0,25	0,47	-0,01
36,0	-59,07	93,91	1548835,58	6367317,25	-11,41	49973	71,07	1,001234	✍	0,29	0,55	-0,01
39,0	-59,02	94,66	1548837,12	6367317,14	-13,98	50133	70,71	1,001627	✍	0,32	0,65	-0,01
42,0	-59,01	95,00	1548838,66	6367317,01	-16,55	50215	70,55	1,000908	✍	0,36	0,76	-0,01
45,0	-59,02	94,72	1548840,20	6367316,88	-19,12	49802	71,13	1,001667	✍	0,40	0,88	-0,01
48,0	-58,98	95,00	1548841,74	6367316,74	-21,69	49904	70,96	1,001428	✍	0,44	0,99	-0,02
51,0	-58,96	95,91	1548843,28	6367316,60	-24,26	49664	70,84	1,001365	✍	0,48	1,12	-0,02
54,0	-58,91	96,78	1548844,82	6367316,43	-26,83	49887	71,34	1,001666	✍	0,53	1,27	-0,02
57,0	-58,91	96,50	1548846,36	6367316,25	-29,40	49065	71,12	1,001327	✍	0,57	1,43	-0,03
60,0	-58,86	96,10	1548847,90	6367316,08	-31,97	50128	71,43	1,001747	✍	0,61	1,58	-0,03
63,0	-58,85	96,13	1548849,44	6367315,91	-34,54	50100	71,39	1,001680	✍	0,66	1,73	-0,04
66,0	-58,87	96,62	1548850,98	6367315,74	-37,11	50215	71,37	1,001729	✍	0,70	1,89	-0,04
69,0	-58,77	96,71	1548852,52	6367315,56	-39,67	50236	71,40	1,001528	✍	0,75	2,05	-0,05
72,0	-58,68	96,81	1548854,07	6367315,38	-42,24	50121	71,38	1,001588	✍	0,80	2,21	-0,05
75,0	-58,57	98,54	1548855,62	6367315,17	-44,80	49802	70,50	1,001891	✍	0,85	2,40	-0,06
78,0	-58,50	96,50	1548857,17	6367314,96	-47,36	50288	71,70	1,001864	✍	0,91	2,59	-0,06
81,0	-58,39	96,68	1548858,73	6367314,78	-49,91	50290	71,72	1,001799	✍	0,97	2,75	-0,07
84,0	-58,33	96,94	1548860,29	6367314,60	-52,47	49822	71,29	1,001688	✍	1,04	2,92	-0,07
87,0	-58,19	97,16	1548861,86	6367314,40	-55,02	49818	71,20	1,001452	✍	1,12	3,10	-0,08
90,0	-58,11	97,61	1548863,43	6367314,20	-57,57	49834	71,20	1,001546	✍	1,20	3,28	-0,09
93,0	-58,05	97,29	1548865,00	6367313,99	-60,11	49649	71,15	1,001857	✍	1,28	3,47	-0,09
96,0	-57,95	97,16	1548866,58	6367313,79	-62,66	49795	71,52	1,001819	✍	1,37	3,65	-0,10

Survey name : KLX09F

Survey date : 09/02/2006 11:39:20

Printed on 2006-05-02 10:37:21

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	-57,90	98,29	1548868,16	6367313,58	-65,20	49579	71,13	1,002099	✍	1,46	3,85	-0,11
102,0	-57,82	98,46	1548869,74	6367313,35	-67,74	49578	71,15	1,002042	✍	1,55	4,06	-0,12
105,0	-57,72	98,49	1548871,32	6367313,11	-70,28	50428	71,40	1,002343	✍	1,64	4,28	-0,13
108,0	-57,60	98,37	1548872,91	6367312,88	-72,81	49753	71,42	1,001904	✍	1,74	4,49	-0,14
111,0	-57,53	99,01	1548874,50	6367312,63	-75,35	49738	71,20	1,001845	✍	1,85	4,72	-0,15
114,0	-57,49	99,21	1548876,09	6367312,38	-77,88	49535	71,28	1,001947	✍	1,96	4,95	-0,16
117,0	-57,33	99,35	1548877,68	6367312,12	-80,40	49743	71,35	1,001773	✍	2,07	5,20	-0,17
120,0	-57,22	100,00	1548879,28	6367311,84	-82,93	49735	70,94	1,001728	✍	2,18	5,45	-0,18
123,0	-57,12	100,44	1548880,88	6367311,56	-85,45	49780	71,30	1,001649	✍	2,30	5,72	-0,20
126,0	-56,99	100,70	1548882,49	6367311,26	-87,97	49758	71,40	1,001599	✍	2,43	6,00	-0,21
129,0	-56,93	102,13	1548884,09	6367310,93	-90,48	49559	71,06	1,001625	✍	2,55	6,31	-0,23
132,0	-56,85	100,51	1548885,70	6367310,61	-92,99	49565	71,00	1,001687	✍	2,68	6,61	-0,25
135,0	-56,82	101,15	1548887,31	6367310,30	-95,51	49664	71,03	1,001527	✍	2,82	6,90	-0,27
138,0	-56,74	100,70	1548888,92	6367309,99	-98,02	49623	71,10	1,001780	✍	2,96	7,19	-0,28
141,0	-56,69	101,32	1548890,54	6367309,68	-100,52	49733	71,35	1,001742	✍	3,10	7,49	-0,30
144,0	-56,66	101,41	1548892,15	6367309,35	-103,03	49673	71,23	1,002317	✍	3,24	7,79	-0,32
147,0	-56,63	101,31	1548893,77	6367309,03	-105,54	49433	71,06	1,002305	✍	3,38	8,10	-0,34

Deviation logging in KLX09G, 0 to 96 m

New MeasureIT files

Survey name:	**KLX09G**
Survey date:	07/02/2006 19:19:59
Project:	PLU
Location:	Laxemar

Country:	Sweden
Survey company:	RAYCON
Surveyed by:	Christer Gustafsson
Survey type:	STANDARD
Operating conditions:	
General comments:	
Client name:	SKB
Client ID number:	AP PS 400-06-16
Client reference:	Leif Stenberg
Drill company:	
Drill rig:	
Drill diameter:	76
Survey direction:	INTO hole
Survey run on:	Wireline
Magnetic Var.:	2,53 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	96,0	96,0
East:	1548905,77	1548953,91	48,14
North:	6367330,09	6367330,35	0,26
Elevation:	19,62	-63,41	-83,03
Dip:	-61,09	-58,43	2,66
Azimuth:	85,41	93,60	8,19

OFFSETS at end

Offsets relative to:
ACTUAL START

1,89 metres upwards
3,59 metres right
0,11 metres shortfall

Printed on: 2006-05-02 10:40:29

Survey name : KLX09G

Survey date : 07/02/2006 19:19:59

Printed on 2006-05-02 10:40:37

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	-61,09	85,41	1548905,77	6367330,09	19,62	50088	72,15	0,999801	✍	0,00	0,00	0,00
3,0	-61,11	85,84	1548907,22	6367330,20	16,99	49479	71,00	1,000134	✍	0,00	0,01	0,00
6,0	-61,11	87,38	1548908,66	6367330,29	14,37	49715	70,81	1,000245	✍	0,00	0,04	0,00
9,0	-60,96	87,39	1548910,11	6367330,35	11,74	49542	70,85	1,000124	✍	0,00	0,09	0,00
12,0	-60,91	88,06	1548911,57	6367330,41	9,12	49583	70,83	1,000346	✍	0,01	0,14	0,00
15,0	-60,88	87,48	1548913,03	6367330,47	6,50	49572	70,67	1,000172	✍	0,02	0,20	0,00
18,0	-60,76	86,88	1548914,49	6367330,54	3,88	49728	70,93	0,999729	✍	0,03	0,25	0,00
21,0	-60,70	88,23	1548915,95	6367330,60	1,26	49806	71,13	1,000210	✍	0,05	0,30	0,00
24,0	-60,57	87,22	1548917,42	6367330,66	-1,35	49593	71,08	1,000267	✍	0,07	0,36	0,00
27,0	-60,49	88,26	1548918,90	6367330,72	-3,96	49611	71,23	1,000159	✍	0,10	0,42	0,00
30,0	-60,43	88,13	1548920,38	6367330,76	-6,57	49822	71,18	1,000533	✍	0,13	0,50	-0,01
33,0	-60,33	88,97	1548921,86	6367330,80	-9,18	49612	71,12	1,000160	✍	0,17	0,58	-0,01
36,0	-60,27	89,08	1548923,35	6367330,83	-11,79	49547	71,29	1,000216	✍	0,21	0,67	-0,01
39,0	-60,23	89,54	1548924,83	6367330,85	-14,39	49568	71,24	1,000184	✍	0,25	0,77	-0,01
42,0	-60,08	89,51	1548926,33	6367330,86	-16,99	49474	71,15	1,000803	✍	0,29	0,88	-0,01
45,0	-60,03	89,89	1548927,82	6367330,87	-19,59	49707	71,11	1,000225	✍	0,34	0,99	-0,02
48,0	-59,91	89,93	1548929,33	6367330,87	-22,19	49716	71,24	1,000299	✍	0,40	1,11	-0,02
51,0	-59,84	89,91	1548930,83	6367330,87	-24,79	49717	71,04	1,000505	✍	0,46	1,23	-0,02
54,0	-59,75	89,54	1548932,34	6367330,88	-27,38	49544	71,29	1,000392	✍	0,52	1,34	-0,02
57,0	-59,62	89,88	1548933,86	6367330,89	-29,97	49912	71,41	1,000352	✍	0,59	1,45	-0,03
60,0	-59,52	89,80	1548935,37	6367330,89	-32,56	49627	71,19	1,000177	✍	0,67	1,57	-0,03
63,0	-59,43	88,94	1548936,90	6367330,91	-35,14	50036	71,33	1,000478	✍	0,75	1,68	-0,03
66,0	-59,33	90,70	1548938,43	6367330,91	-37,72	49355	71,17	1,000109	✍	0,84	1,79	-0,04
69,0	-59,25	91,25	1548939,96	6367330,88	-40,30	49549	71,23	1,000120	✍	0,92	1,94	-0,04
72,0	-59,19	90,86	1548941,49	6367330,86	-42,88	49749	71,21	1,000688	✍	1,02	2,09	-0,05
75,0	-59,08	91,08	1548943,03	6367330,83	-45,45	49524	71,20	1,000342	✍	1,11	2,24	-0,05
78,0	-58,99	91,81	1548944,58	6367330,79	-48,03	49552	71,34	1,000155	✍	1,21	2,41	-0,06
81,0	-58,93	92,58	1548946,12	6367330,73	-50,60	49381	71,00	1,000410	✍	1,31	2,59	-0,07
84,0	-58,83	92,71	1548947,67	6367330,66	-53,16	49745	71,15	1,000291	✍	1,42	2,78	-0,07
87,0	-58,75	91,33	1548949,22	6367330,61	-55,73	49993	71,29	1,000317	✍	1,53	2,96	-0,08
90,0	-58,65	93,60	1548950,78	6367330,54	-58,29	50014	71,01	1,000240	✍	1,65	3,15	-0,09
93,0	-58,53	93,31	1548952,34	6367330,44	-60,85	48974	71,01	1,000233	✍	1,76	3,37	-0,10
96,0	-58,43	93,60	1548953,91	6367330,35	-63,41	49257	71,12	1,000080	✍	1,89	3,59	-0,11