P-06-257

Oskarshamn site investigation

Boremap mapping of core drilled MDZ boreholes KLX24A and KLX25A

Karl-Johan Mattsson, Gunnar Rauséus
Geosigma AB

Jan Ehrenborg, Mírab Mineral Resurser AB

November 2007

Svensk Kärnbränslehantering AB
Swedish Nuclear Fuel
and Waste Management Co
Box 250, SE-101 24 Stockholm
Tel +46 8 459 84 00

ISSN 1651-4416
SKB P-06-257

Oskarshamn site investigation

Boremap mapping of core drilled MDZ boreholes KLX24A and KLX25A

Karl-Johan Mattsson, Gunnar Rauséus
Geosigma AB

Jan Ehrenborg, Mírab Mineral Resurser AB

November 2007

Keywords: MDZ, KLX24A, KLX25A, Geology, Drill core mapping, Boremap, Fractures, BIPS, Laxemar.

Abstract

This report presents the Boremap mapping of MDZ boreholes KLX24A and KLX25A.

The purpose of the MDZ core drilled boreholes is to obtain enhanced knowledge and understanding for the assessment of hydraulic patterns and physical properties as well as the properties and need of injection, by comparing the relation of existing structures to lithology, orientation, geophysical character, rock stress, ground-water conditions and tectonics in the area of interest.

The lithology in KLX24A is dominated by quartz monzodiorite (501036). Subordinate rock type is fine-grained granite (511058). KLX25A is totally dominated by quartz monzodiorite (501036).

Four sections in KLX24A and three sections in KLX25A have been highlighted based on anomalous fracture frequencies, alterations and structural features.

Sammanfattning

Denna rapport presenterar boremapkarteringen av MDZ borrhålen KLX24A och KLX25A.

Målsättningen med MDZ kärnborrhålen är att erhålla ökad kunskap och förståelse för bedömning av det aktuella områdets hydrauliska mönster, fysikaliska egenskaper och behov av injektering genom att sammanställa befintliga strukturers koppling till litologi, orientering, geofysisk karaktär, bergspänning, grundvattenförhållanden och tektonik.

Litologin i KLX24A domineras av kvartsmonzodiorit (501036). Underordnad bergart är finkornig diorit-gabbro (505102). Litologin i KLX25A domineras totalt av kvartsmonzodiorit (501036).

Fem sektioner i KLX24A och KLX24A samt tre sektioner i KLX25A och KLX25A kan urskiljas baserat på förhöjd sprickfrekvens, sidobergsomvandlingar och geologiska strukturer.

Contents

1 Introduction

This document reports the data gained from the mapping of MDZ boreholes (Minor Deformation Zone) KLX24A and KLX25A, in the Laxemar area, which is one of the activities performed within the site investigation at Oskarshamn The work was carried out in accordance with activity plan AP PS 400-06-103. In Table 1-1 controlling documents for performing this activity are listed. Both Activity Plan and Method Descriptions are SKB's internal controlling documents. Rock type nomenclature that has been used is shown in Table 1-2.

Table 1-1. Controlling documents for the performance of the activity.

Activity Plan	Number	Version
Boremapkartering av KLX24A, KLX25A	AP PS 400-06-103	1.0
Method Descriptions	**Number**	**Version**
Nomenklatur vid Boremapkartering	SKB MD 143.008	1.0
Method Description for Boremap mapping	SKB MD 143.006	2.0
Mätsystembeskrivning för Boremap	SKB MD 146.005	1.0
Instruktion: Regler för bergarters benämningar vid platsundersökningen i Oskarshamn	SKB MD 132.004	1.0
Instruktion för längdkalibrering vid undersökningar i kärnborrhål	SKB MD 620.010	2.0

Table 1-2. Rock type nomenclature for the site investigation at Oskarshamn.

Rock type	Rock code	Rock description
Dolerite	501027	Dolerite
Fine-grained Götemar granite	531058	Granite, fine-to medium-grained, ("Götemar granite")
Coarse-grained Götemar granite	521058	Granite, coarse-grained, ("Götemar granite")
Fine-grained granite	511058	Granite, fine-to medium-grained
Pegmatite	501061	Pegmatite
Granite	501058	Granite, medium- to coarse-grained
Ävrö granite	501044	Granite to quartz monzodiorite, generally porphyritic
Quartz monzodiorite	501036	Quartz monzonite to monzodiorite, equigranular to weakly porphyritic
Diorite/gabbro	501033	Diorite to gabbro
Fine-grained dioritoid	501030	Intermediate magmatic rock
Fine-grained diorite-gabbro	505102	Mafic rock, fine-grained
Sulphide mineralization	509010	Sulphide mineralization
Sandstone	506007	Sandstone

The MDZ boreholes are situated within the Laxemar area (Figure 1-1). Mapping of the drill cores was performed between 2006-08-30 and 2006-09-11. Table 1-3 shows the orientation of the boreholes.

Detailed mapping of the drill core is essential for a three dimensional modelling of the geology at depth. The mapping is based on the use of BIPS-image (Borehole Image Processing System) of the borehole wall and by the study of the drill core itself. The BIPS-image enables the study of orientations, since the Boremap software calculates strike and dip of planar features such as foliations, rock contacts and fractures.

Table 1-3. Orientation of the MDZ boreholes.

Borehole	Bearing (°)	Inclination (°)	Length (m)
KLX24A	095.88	–59.14	~100
KLX25A	145.73	–59.46	~50

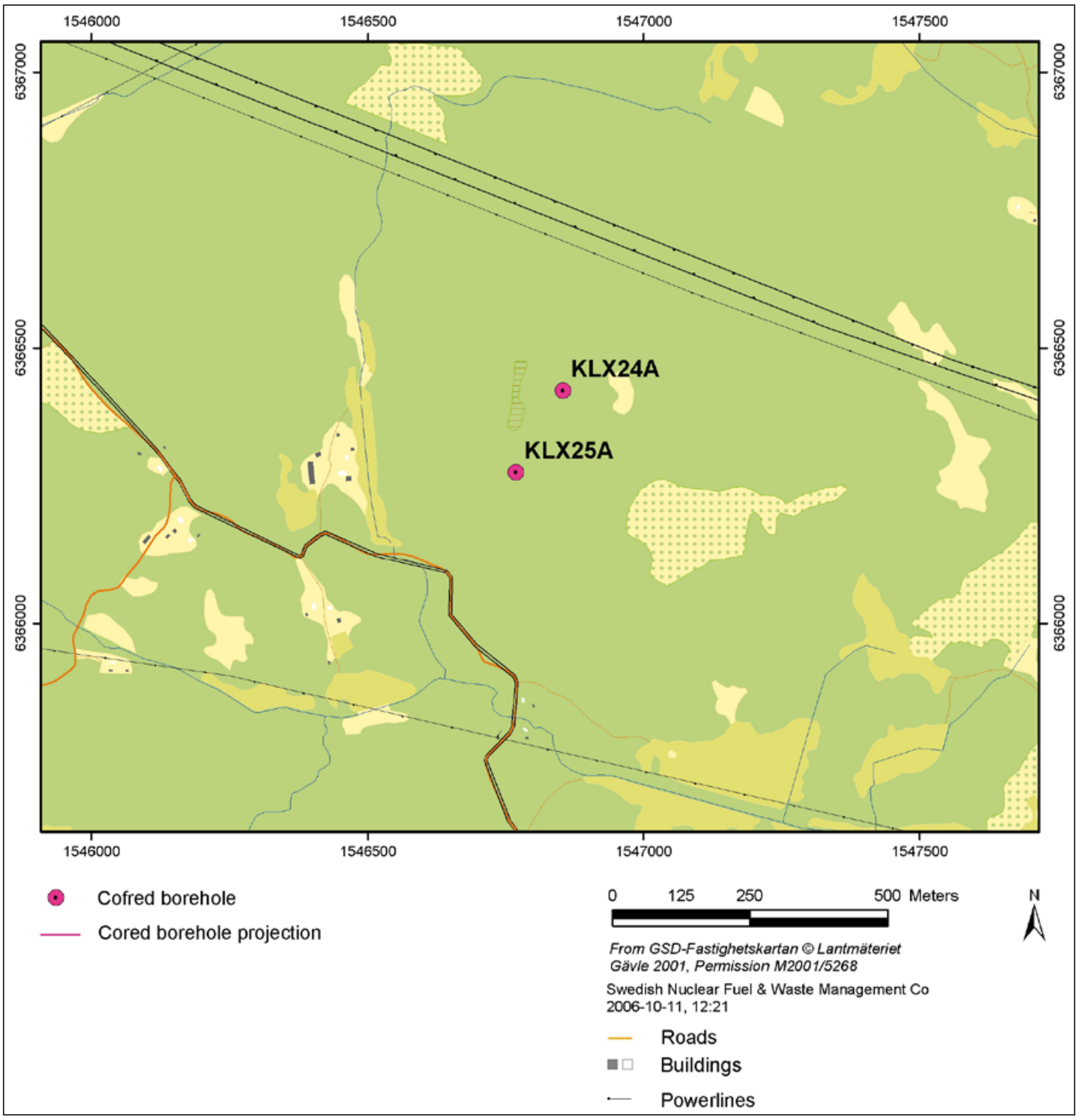


Figure 1-1. Location of the core drilled MDZ boreholes.

2 Objective and scope

The core drilled boreholes KLX24A and KLX25A are drilled within the Minor Deformation Zone program (MDZ).

The purpose of the MDZ program is to obtain enhanced knowledge and understanding for the assessment of hydraulic patterns, physical properties and the need of injection by compiling the relation of existing structures to lithology, orientation, geophysical character, rock stress, ground-water conditions and tectonics in the area of interest.

3 Equipment

3.1 Description of software

Software used for the mapping was Boremap v. 3.7, with bedrock and mineral standards of SKB. The data presentation was made using WellCad v. 4, Microsoft Access and Microsoft Excel. Boremap is the software that unites orthodox core mapping with modern video mapping, where Boremap shows the image from BIPS (Borehole Image Processing System) and extracts the geometrical parameters: length, width, strike and dip from the image.

3.2 Other equipment

The following equipment is used to facilitate the core mapping: folding rule and pen, diluted hydrochloric acid, knife, water-filled atomiser and hand lens.

3.3 BIPS-image sequences

Table 3-1. BIPS-image length.

Borehole	Length (m)
KLX24A	4.002–49.941
KLX25A	4.000–100.256

3.4 BIPS-image: resolution, contrast and quality

The visibility of thin fractures in BIPS depends on image resolution, image contrast and image quality. Resolution of the BIPS-image is perhaps the principal reason why very thin fractures as well as very thin apertures are not visible in the BIPS-image and the resolution depends on the BIPS video camera pixel size and illumination angle.

Thick fractures are always visible in both drill core and the BIPS-image. However, the visibility of thin fractures depends strongly on the contrast between the fracture and the wall rock. A bright fracture in a dark rock is clearly visible in the BIPS-image. But a bright coloured fracture in a light coloured rock might, however, be clearly visible in the drill core but not visible in the BIPS-image, especially if the fracture and wall rock have the same colour. The opposite is true for dark fractures.

In very rare cases when the BIPS-image contrast between a very thin fracture and the wall rock is very strong the fracture might be visible in the BIPS-image even if it is not visible in the drill core.

BIPS-image quality is sometimes limited due to:

1) blackish coatings probably related to the drilling equipment,
2) vertical bleached bands from the clayey mixture of drill cuttings and water,
3) light and dark bands at high angle to the drill hole related to the automatic aperture of the video camera,
4) vertical enlargements of pixels due to stick-slip movement of the camera probe.

Vertical bleached bands and blackish coatings are usually the main disturbances in the BIPS-image quality.

The image quality is classified into four levels; good, acceptable, bad and very bad. With good quality it means a more or less clear image which is easy to interpret. If the quality is acceptable it means that the image is not good, but the mapping can be performed without any problems. An image of bad quality is somewhat difficult to interpret while an image of very bad quality cannot be interpreted except from very obvious and outstanding features. When the BIPS-image quality is so bad that fractures and structures cannot be identified they can still be oriented using the guide-line method (Section 4.3.3). The BIPS-image quality for the MDZ boreholes is presented in Table 3-2.

Table 3-2. BIPS-image quality.

Borehole	Interval (m)	Quality
KLX24A	4–65	Good
	65–96	Acceptable
	96–100	Bad
KLX25A	4–40	Good
	40–50	Acceptable

4 Execution

4.1 General

Mapping of the drill core of the boreholes was performed and documented according to Activity Plan AP PS 400-06-103 (SKB, internal document) referring to the Method Description for Boremap mapping (SKB MD 143.006, v. 2.0), Nomenklatur vid Boremapkartering (SKB MD 143.008, v. 1.0), Instruktion: Regler för bergarters benämningar vid platsundersökningen i Oskarshamn (SKB MD 132.004, v. 1.0) and Instruktion för längdkalibrering vid undersökningar i kärnborrhål (SKB MD 620.010, v. 2.0), all of them SKB internal documents.

The drill cores were displayed on inclined roller tables and mapped in its entire length with the Boremap software. The core mapping was carried out without any detailed geological knowledge of the area but with access to geophysical logs from the borehole and rock samples.

The term oxidation has been used as an alteration type until the mapping of KLX05. However, research has shown that the red colour of the bedrock is actually not only a result of oxidation. Since April 2005 the term red staining is used instead of the term oxidation.

The mapping was performed by Gunnar Rauséus (Geosigma AB) and Jan Ehrenborg (Mirab).

4.2 Preparations

Any depth registered in the BIPS-image deviates from the true depth in the borehole, a deviation which increases with depth, about 0.5 m/100 m. This problem is usually eliminated by adjusting the depth of the BIPS-image to reference slots cut into the borehole walls every fiftieth meter, but the MDZ boreholes lack these reference marks.

Necessary data adjustment is borehole diameter, reference marks, length and deviation; both collected from SICADA database (Appendices 6–8). The Boremap software uses all the data extracted from SICADA database to calculate the true orientations of the different observations.

4.3 Execution of measurements

Concepts used during the core mapping, are defined in this chapter.

4.3.1 Fracture definitions

Definitions of different fracture types and aperture crush zones and sealed fracture network are found in Nomenklatur vid Boremapkartering (SKB MD 143.008, v. 1.0), SKB internal document. Apertures for broken fractures have been mapped in accordance with the definitions in MD 143.008 v. 1.0.

Two types of fractures are mapped in Boremap; broken and unbroken. Broken are fractures that split the core while unbroken fractures do not split the core. All fractures are described with their fracture minerals and other characteristics, e.g. width, aperture and roughness. Visible apertures are measured down to 1 mm in the BIPS-image. Smaller apertures, which are impossible to detect in the BIPS-image, are denoted a value of 0.5 mm. If the core pieces don't fit well, the aperture is considered "probable". If the core pieces do fit well, but the fracture surfaces are dull or altered, the aperture is considered "possible".

All fractures with apertures > 0 mm are treated as open in the SICADA database. Only few broken fractures are given the aperture = 0 mm. Unbroken fractures usually have apertures = 0 mm. Unbroken fractures that have apertures > 0 mm are interpreted as partly open and are included in the open-category. Open and sealed fractures are finally frequency calculated and shown in Appendix 1.

4.3.2 Fracture alteration and joint alteration number

Joint alteration number is principally related to the thickness of, and the clay content in a fracture. Thick fractures rich in clay minerals are given joint alteration numbers between 2 and 3. The majority of the broken fractures are very thin to extremely thin and seldom contain clay minerals. These fractures receive joint alteration numbers between 1 and 2.

A subdivision of fractures with joint alteration numbers between 1 and 2 was introduced to facilitate both the evaluation process for fracture alterations and the possibility to compare the alterations between different fractures in the boreholes. The subdivision is based on fracture mineralogy as follows:

a) fracture wall alterations,

b) fracture mineral fillings assumed to have been deposited from circulating water-rich solutions,

c) fracture mineral fillings most likely resulting from altered wall rock material.

Joint alteration number equal to 1: Fractures with or without wall rock alteration, e.g. oxidation or epidotization, and without mineral fillings is considered as fresh. The joint alteration number is thus set to 1.

Minerals such as calcite, quartz, fluorite, zeolites, laumontite and sulphides are regarded as deposited by circulating water-rich solutions and not as true fracture alteration minerals. The joint alteration number is thus set to 1.

Joint alteration number equal to 1.5: Epidote, prehnite, hematite, chlorite and/or clay minerals are regarded as fracture minerals most likely resulting from altered wall rock. A weak alteration is thus assumed and the joint alteration number was set to 1.5. Extra considerations have been given to clay minerals since the occurrence of these minerals often resulted in a higher joint alteration number.

Joint alteration numbers higher than 1.5: When the mineral fillings is thick and contain a few mm of clay minerals, often together with epidote and chlorite, the joint alteration number is set to 2. In rare cases, when a fracture contains 5–10 mm thick clay, together with chlorite, the joint alteration number is set to 3.

When the alteration of a fracture is too thick (and/or intense) to give the fracture the joint alteration number 1.5 and too thin and/or weak to give it a 2, 1.7 and 1.8 is used.

4.3.3 Mapping of fractures not visible in the BIPS-image

Not all fractures are visible in the BIPS-images, and these fractures are orientated by using the guide-line method, based on the following data:

- Amplitude (measured along the drill core) which is the interval between fracture extremes along the drill core.
- The relation between the orientations of the fracture trace, measured on the drill core and a well defined structure visible in the BIPS-image.
- Absolute depth.

Orientation of fractures and other structures with the guide-line method is done in the following way: The first step is to calculate the amplitude of the fracture trace in the BIPS-image (with 76 mm diameter) from the measured fracture amplitude in the drill core (with 50 mm diameter). The second step is the correction of strike and dip. This is done by rotating the fracture trace in the BIPS-image relative to a feature with known orientation. The fracture trace is then put at the correct depth according to the depth measured on the drill core.

The guide-line method can be used to orientate any feature that is not visible in the BIPS-image. It is also a valuable tool to control that the personnel working with the drill core is observing the same feature as the personnel delineating the trace in the BIPS-image, especially in intervals rich in fractures.

The error of orientating fractures using the guide-line method is not known but experience and an estimation using stereographic plots indicated that the error is most likely insignificant. Accordingly, the guide-line method is so far considered better than mapping lots of non-oriented fractures. The fractures in question are mapped as "non-visible in BIPS" and can therefore be separated from fractures visible in BIPS which probably have a more accurate orientation.

4.3.4 Definition of veins and dikes

Rock occurrence is the way Boremap handles the occurrence of lithology up to 1 meter wide. Chiefly two different rock occurrences are mapped: veins and dikes. These two are separated by their respectively length in the drill core; veins are set to 0–20 cm and dikes are set to 20–100 cm. Rock occurrences that covers more than 100 cm of the drill core are mapped under the feature rock type.

4.3.5 Mineral codes

In cases where properties and/or minerals are not represented in the mineral list, the following mineral codes have been used:

X1 Apophyllite (KLX24A).

X2 Apophyllite (KLX25A).

X3 Unknown mineral.

X5 Bleached fracture walls.

X7 Broken fracture with a fresh appearance and no mineral fill.

X8 Fractures with epidotized/saussuritized walls.

4.4 Data handling

Mapping of the drill core is performed on-line on the SKB network, in order to obtain the best possible data security. Before every break (> 15 minutes) a back-up is saved on the local disk. As a regular quality check every working day a summary report (from Boremap) and a WellCad plot is printed in order to find possible misprints. The mapping is also quality checked by a routine in Boremap before it is exported to and archived in SICADA database. Personnel from SKB also perform spot test controls and regular quality revisions. All primary data is stored in SKB's database SICADA and only these data are later used for interpretation and modelling.

4.5 Geological summary table, general description

A Geological summary table (Appendix 1A and 1B) is an overview of the features mapped with the Boremap software. It also facilitates comparisons between Boremap information collected from different boreholes and is more objective than a pure descriptive borehole summary. All information is taken directly from the Boremap database using simple and well defined search paths for each geological parameter (Appendix 2).

The Geological summary table consists of 23 columns, each one representing a specific geological parameter, presented as either intervals or frequencies (see Section 4.5.1 for column description). Intervals are calculated for parameters with a width ≥ 1 m and frequencies for parameters with a width < 1 m. Frequency information is treated as treated as point observations. It should be noted that parameters with a thickness of only 1 mm get the same "value" as a similar parameter with a thickness of 999 mm since both are treated as point observations and used for frequency calculations.

Parameters are sometimes related in such a way that the mapping of one parameter cause a decrease in the frequency of another parameter. This type of intimate relationship between parameters has been noted for the following cases;

- There is a decrease in the frequency of unbroken fractures with oxidised walls and without mineral fillings in intervals mapped with Alteration – red staining.
- No unbroken fractures are mapped in intervals of sealed fracture network.
- No broken fractures are mapped in intervals with crush.
- Hybrid rock and composite dikes generally include a large amount of fine to medium grained granite veins. These veins are not mapped and the frequency presented for veins + dikes in column 6 (Appendix 1A and 1B) are lower than the true frequency in composite dike intervals.

4.5.1 Columns in the Geological summary table

The Geological summary table includes the following 23 columns:

Column 1: *Rock Type/Lithology*, interval column. Only lithologies longer than 1 m are presented here. Shorter lithologies are presented in column 6. This column is identical with the ordinary WellCad presentation.

Column 2: *Rock Type/Grain size*, interval column. Interval limits follows column 1. This column is identical with the ordinary WellCad presentation.

Column 3: *Rock Type/Texture*, interval column. Interval limits follows column 1. This column is identical with the ordinary WellCad presentation.

Column 4: *Alteration/Type*, interval column. No frequency column is presented for alteration/type. The alteration/type column are identical with the ordinary WellCad presentation.

Column 5: *Alteration/intensity*, interval column. This column is identical with the ordinary WellCad presentation.

Column 6: *Rock Occurrence/Veins + Dikes < 1 m wide*, frequency column. This rock type column can be seen as the frequency complement to the rock type/lithology interval column. Only rock type sections that are thinner than 1 m can be described as rock occurrences in Boremap. Thicker rock type sections are mapped as rock type.

Column 7: *Structure/Shear Zone < 1 m wide*, frequency column. This column includes ductile shear structures as well as brittle-ductile shear structures and these are mapped as rock occurrences in Boremap. Ductile sections in mm – cm scale are mapped as shear structures and in dm – m scale as sections with foliation in column 12.

Column 8: *Structure/Brecciated < 1 m wide*, frequency column. Breccias < 1 m wide are mapped as rock occurrence in Boremap. Very thin micro breccias along sealed/natural fracture planes are generally not considered.

Column 9: *Structure/Brecciated ≥ 1 m wide*, interval column. Breccias > 1 m wide are mapped as rock type/structure in Boremap.

Column 10: *Structure/Mylonite < 1 m wide*, frequency column. Mylonites < 1 m wide are mapped as rock occurrence/structure in Boremap.

Column 11: *Structure/Mylonite ≥ 1 m wide* is an interval column. Mylonites > 1 m wide are mapped as rock type/structure in Boremap.

Column 12: *Structure/Foliated < 1 m wide* is a frequency column. Sections with foliation < 1 m wide are mapped as rock occurrence/structure in Boremap. Very thin sections with foliation are called ductile shear structures and presented in column 7.

Column 13: *Structure/Foliated ≥ 1 m wide* is an interval column. Sections with foliation ≥ 1 m wide are mapped as rock type/structure in Boremap.

Column 14: *Sealed fractures/All*, frequency column. This column includes all fractures mapped as unbroken in the Boremap system as well as unbroken fractures interpreted to have broken up artificially during/after drilling.

Column 15: *Sealed fractures/Broken fractures with aperture = 0*, frequency column. This column includes unbroken fractures interpreted to have broken up artificially during/after drilling.

Column 16: *Sealed fractures/Sealed Fracture Network < 1 m wide*, frequency column. The sealed fracture network parameter is the only parameter that is generally evaluated directly from observations of the drill core. These types of sealed fractures can only in rare cases be observed in the BIPS-image.

Column 17: *Sealed fractures/Sealed Fracture Network ≥ 1 m wide*, interval column.

Column 18: *Open fractures/All Apertures > 0*, frequency column. This column includes all broken fractures, both fractures that with certainty were open before drilling and fractures that probably or possibly were open before drilling.

Column 19: *Open fractures/Uncertain, Aperture = 0.5 probable + 0.5 possible*, frequency column. This column includes fractures that probably or possibly open before drilling.

Column 20: *Open fractures/Certain Aperture = 0.5 and > 0.5*, frequency column. This column includes fractures that with certainty were open before drilling.

Column 21: *Open fractures/Joint alteration > 1.5*, frequency column. This column show fractures with stronger joint alteration than normal. This parameter is generally correlated with the location of lithologies with a more weathered appearance.

Column 22: *Open fractures/Crush < 1 m wide*, frequency column. This column includes shorter sections with crush.

Column 23: *Open fractures/Crush ≥ 1 m wide*, interval column. This column includes longer sections with crush.

4.6 Nonconformities

The uppermost part of the boreholes is not covered by a BIPS image. These sections have not been mapped.

Due to the lack of reference marks in KLX25A, recorded length from the BIPS-logging was used.

Core loss occurs in KLX24A, in the interval 66.354–66.489 m.

5 Results

5.1 General

All results from the mapping are principally found in the appendices. Information from the SICADA database is shown in the Geological summary tables in Appendix 1 and as WellCad diagrams in Appendix 4. The BIPS-images are presented in Appendix 3A and 3B. The search paths to the Geological summary table are presented in Appendix 2 and In-data, such as borehole length, reference marks, deviation data and borehole diameter are presented in Appendices 6–8.

The MDZ boreholes KLX24A and KLX25A vary between 50.27 m and 100.45 m in length (Table 5-1).

Original data from the reported activity are stored in the primary database SICADA. Data are traceable in SICADA by the Activity Plan number (AP PF/PS 400-06-103). Only data in databases are accepted for further interpretation and modelling. The data presented in this report are regarded as copies of the original data. Data in the databases may be revised, if needed. Such revisions will not necessarily result in a revision of the P-report, although the normal procedure is that major revisions entail a revision of the P-report. Minor revisions are normally presented as supplements, available at www.skb.se.

5.2 Lithology and structures

The lithology (Table 5-2) in KLX24A is dominated by quartz monzodiorite (501036). Subordinate rock type is fine-grained granite (511058). KLX25A is totally dominated by quartz monzodiorite (501036).

Four sections in KLX24A and three sections in KLX25A are recognized by anomalous fracture frequencies, alterations and structural features.

Table 5-1. Length of the MDZ drill cores.

Borehole	Length (m)
KLX24A	0.00–100.13
KLX25A	0.22–50.24

Table 5-2. Lithology in the MDZ boreholes.

Rock type	KLX24A (%)	KLX25A (%)
Quartz monzodiorite (501036)	94.9	100.0
Fine-grained granite (511058)	5.1	

Section interval characteristics.

KLX24A

1. 13–24 m. Increased frequency of open fractures and open fractures with an aperture > 0.5 mm, sealed fracture networks, crush zones, brecciation ductile shear zones and foliation, epidotiztion and red staining occurs within this section.
2. 30–37 m. Increased frequency of open fractures and open fractures with an aperture > 0.5 mm, sealed fracture networks and foliation occurs within this section. This interval also includes an intrusion of fine-grained granite (511058).
3. 53–72 m. Increased frequency of open fractures, sealed fracture networks, crush zones, core loss, brittle-ductile and ductile shear zones, foliation, saussuritization and red staining occurs within this section.
4. 88–94 m. Increased frequency of open fractures and open fractures with an aperture > 0.5 mm, sealed fracture networks, ductile shear zones, foliation and red staining occurs within this section.

KLX25A

1. 16–18 m. Increased frequency of open fractures with an aperture > 0.5 mm, sealed fracture networks, epidotization and red staining occurs within this section.
2. 32–39 m. Increased frequency of open fractures and open fractures with an aperture > 0.5 mm, sealed fracture networks, foliation, brittle-ductile shear zone epidotization, silicification and red staining occurs within this section.
3. 44–46 m. Increased frequency of open fractures, sealed fracture networks, foliation, brittle-ductile shear zone and epidotization occurs within this section.

5.3 Fracture mineralogy

Tables 5-3 and 5-4 show the frequency of minerals and rock wall alteration in open fractures and sealed fractures respectively. For X-mineral classification, see Section 4.3.5.

The most frequently occurring minerals in sealed fractures are calcite, chlorite and oxidized walls.

Calcite and chlorite are the most frequently occurring minerals in open fractures, followed by clay minerals, pyrite and oxidized walls.

Table 5-3. Frequency of minerals and rock wall alteration in open fractures.

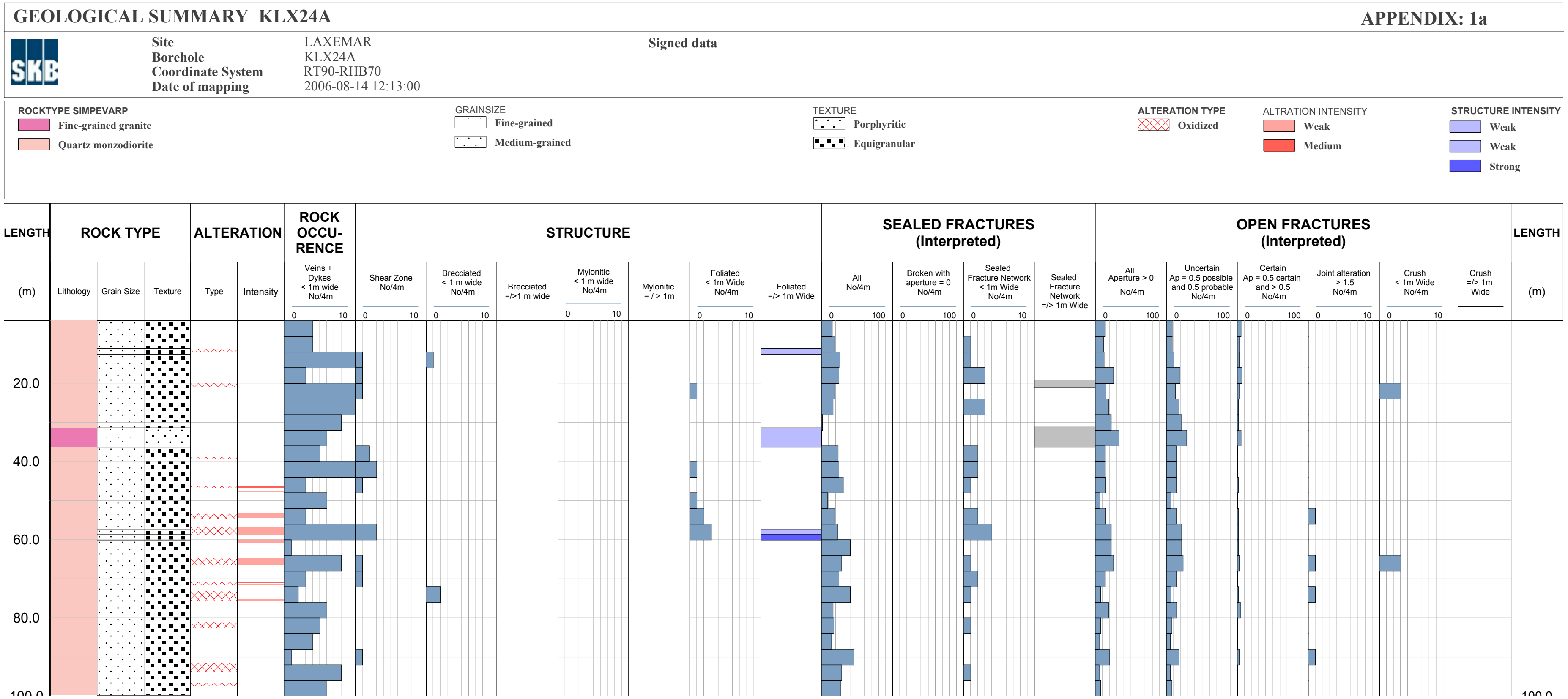
Mineral	KLX24A (%)	KLX25A (%)
Adularia	3.3	1.0
Calcite	85.9	85.7
Chalcopyrite	0.6	1.0
Chlorite	75.3	80.6
Clay Minerals	29.4	31.6
Epidote	6.4	6.1
Fluorite	–	1.0
Hematite	3.6	4.1
Iron Hydroxide	1.1	8.2
Oxidized Walls	16.1	34.7
Prehnite	3.0	–
Pyrite	25.8	22.4
Quartz	5.5	6.1
Red Feldspar	–	1.0
White Feldspar	2.8	2.0
X1	0.6	–
X2	–	1.0
X3	0.8	–
X5	1.1	1.0
X7	2.5	–
X8	1.4	1.0

Table 5-4. Frequency of minerals and rock wall alteration in sealed fractures.

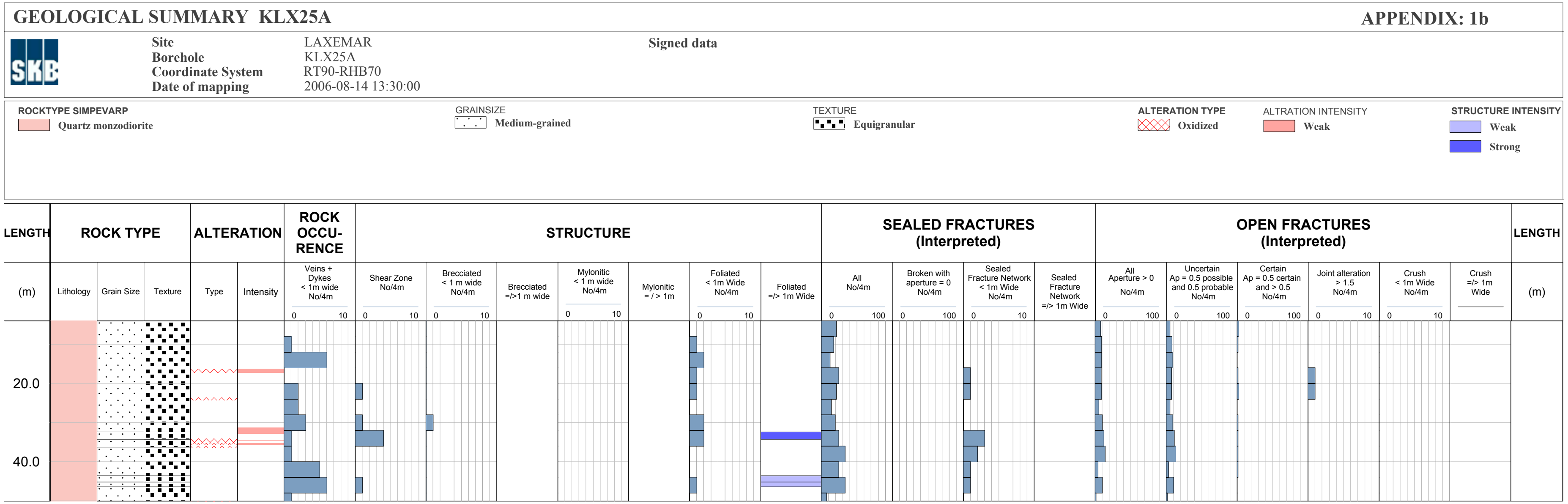
Mineral	KLX24A (%)	KLX25A (%)
Adularia	7.5	3.6
Calcite	48.6	68.1
Chlorite	37.4	36.3
Clay Minerals	0.4	2.8
Epidote	6.9	14.1
Hematite	0.4	0.8
Oxidized Walls	57.0	49.2
Prehnite	5.2	1.2
Pyrite	2.1	3.2
Quartz	5.2	16.1
Red Feldspar	1	1.2
White Feldspar	1.2	3.2
X1	0.2	–
X5	8.6	–
X7	1.3	–
X8	24.0	9.7

Appendix 1

A. Geological summary table KLX24A



B. Geological summary table KLX25A



Appendix 2

Search paths for the Geological summary table

TABLE HEAD LINES		INFORMATION SOURCE			PRESENTATION
Head lines	**Sub head lines**	**Varcode**	**First suborder**	**Second suborder**	**Interval / frequence**
Rock type	Lithology	5	Sub 1		Interval
	Grain size	5	Sub 5		Interval
	Texture	5	Sub 6		Interval
Alteration	Type	7	Sub 1 = 700		Interval
	Intensity	7	Sub 1 = 700	Sub 2	Interval
Rock occurrence	Vein + dyke	31	Sub 1 = 2 and 18		Frequence
Structure	Shear zone, < 1m wide	31	Sub 4 = 41 and 42		Frequence
	Brecciated, < 1m wide	31	Sub 4 = 7		Frequence
	Brecciated, >/= 1m wide	5 5	Sub 3 = 7 Sub 3 = 7	Sub 4; 101 and 102 = 102 Sub 4; 103 and 104 = 104	Interval
	Mylonite, < 1 m wide	31	Sub 4 = 34		Frequence
	Mylonite, >/= 1 m wide	5 5	Sub 3 = 34 Sub 3 = 34	Sub 4; 101 and 102 = 102 Sub 4; 103 and 104 = 104	Interval
	Foliated, < 1 m wide	31	Sub 4 = 81		Frequence
	Foliated, >/= 1 m wide	5 5	Sub 3 = 81 Sub 3 = 81	Sub 4; 101 and 102 = 102 Sub 4; 103 and 104 = 104	Interval
Sealed fracture	All unbroken fractures and broken fractures	3 2	 SNUM 11= 0		Frequence
	Broken fractures, Aperture = 0	2	SNum 11 = 0		Frequence
	Sealed fracture network < 1 m wide	32			Frequence
	Sealed fracture network>/= 1 m wide	32			Interval
Open fractures	All, Aperture > 0	2 and 3	SNum 11>0		Frequence
	Uncertain, Aperture = 0.5 possible and 0.5 probable	2 and 3 2 and 3	SNum 11>0 SNum 11>0	Sub 12 = 3 Sub 12 = 2	Frequence
	Certain, Aperture = 0.5 and >0.5	2 and 3	SNum 11>0	Sub 12 = 1	Frequence
	Joint alteration > 1.5	2	SNum16 > 1.5		Frequence
	Crush < 1 m wide	4			Frequence
	Crush >/= 1 m wide	4			Interval

Appendix 3

A. BIPS-image of KLX24A

Borehole Image Report

Borehole Name:	KLX24A
Mapping Name:	KLX24A_Geosigma_A
Mapping Range:	4.000 - 100.011 m
Diameter:	76.0 mm
Printed Range:	4.000 - 100.256
Pages:	6

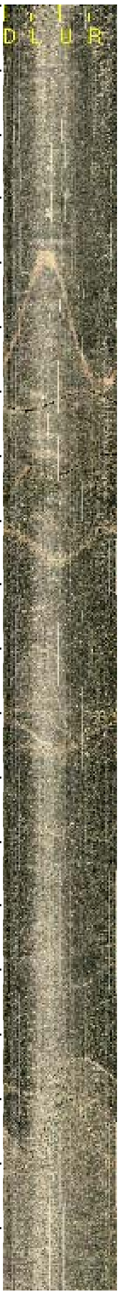
Image File Information:

File:	G:\skb\bips\oskarshamn\KLX24A\Used\KLX24A_4-100m.BIP
Date/Time:	2006-08-11 10:38:00
Start Depth:	4.000 m
End Depth:	100.256 m
Resolution:	1.00 mm/pixel (depth)
Orientation:	Gravmetric
Image height:	96256 pixels
Image width:	360 pixels
BIP Version:	BIP-III
Locality:	LAXEMAR
Borehole:	KLX24A
Scan Direction:	Down
Color adjust:	0 0 0 (RGB)

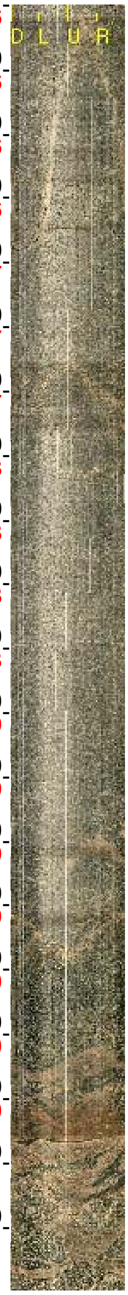
Borehole: KLX24A
Mapping: KLX24A_Geosigma_A

Depth range: 4.000 - 24.000 m
Azimuth: 98.5
Inclination: -59.1

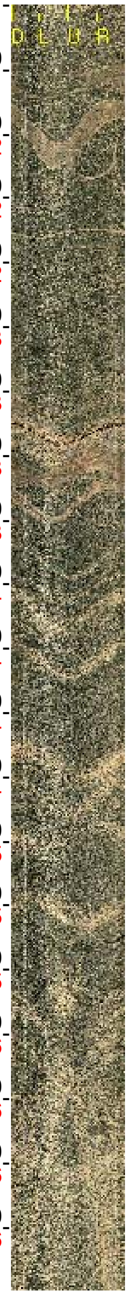
4.000 / 4.000
4.200 / 4.200
4.400 / 4.401
4.600 / 4.601
4.800 / 4.801
5.000 / 5.001
5.200 / 5.202
5.400 / 5.402
5.600 / 5.602
5.800 / 5.803
6.000 / 6.003
6.200 / 6.203
6.400 / 6.403
6.600 / 6.604
6.800 / 6.804
7.000 / 7.004
7.200 / 7.204
7.400 / 7.405
7.600 / 7.605
7.800 / 7.805



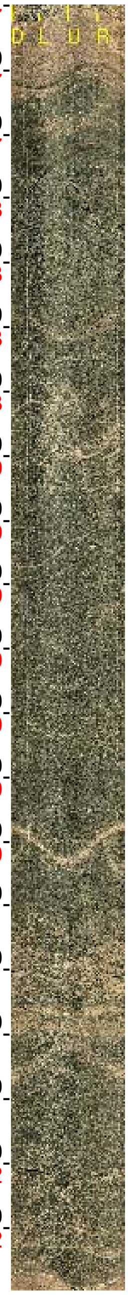
8.000 / 8.006
8.200 / 8.206
8.400 / 8.406
8.600 / 8.606
8.800 / 8.807
9.000 / 9.007
9.200 / 9.207
9.400 / 9.408
9.600 / 9.608
9.800 / 9.808
10.000 / 10.008
10.200 / 10.209
10.400 / 10.409
10.600 / 10.609
10.800 / 10.809
11.000 / 11.010
11.200 / 11.210
11.400 / 11.410
11.600 / 11.611
11.800 / 11.811



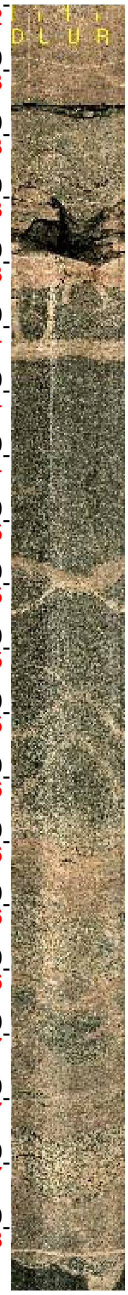
12.000 / 12.011
12.200 / 12.211
12.400 / 12.412
12.600 / 12.612
12.800 / 12.812
13.000 / 13.013
13.200 / 13.213
13.400 / 13.413
13.600 / 13.613
13.800 / 13.814
14.000 / 14.014
14.200 / 14.214
14.400 / 14.414
14.600 / 14.615
14.800 / 14.815
15.000 / 15.015
15.200 / 15.216
15.400 / 15.416
15.600 / 15.616
15.800 / 15.816



16.000 / 16.017
16.200 / 16.217
16.400 / 16.417
16.600 / 16.618
16.800 / 16.818
17.000 / 17.018
17.200 / 17.218
17.400 / 17.419
17.600 / 17.619
17.800 / 17.819
18.000 / 18.020
18.200 / 18.220
18.400 / 18.420
18.600 / 18.620
18.800 / 18.821
19.000 / 19.021
19.200 / 19.221
19.400 / 19.421
19.600 / 19.622
19.800 / 19.822



20.000 / 20.022
20.200 / 20.223
20.400 / 20.423
20.600 / 20.623
20.800 / 20.823
21.000 / 21.024
21.200 / 21.224
21.400 / 21.424
21.600 / 21.625
21.800 / 21.825
22.000 / 22.025
22.200 / 22.225
22.400 / 22.426
22.600 / 22.626
22.800 / 22.826
23.000 / 23.026
23.200 / 23.227
23.400 / 23.427
23.600 / 23.627
23.800 / 23.828

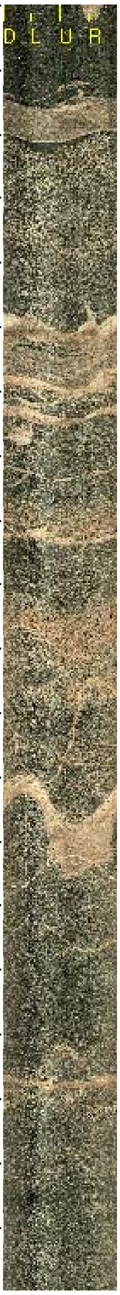


Printed: 2006-09-25 09:04:23   Scale: 1 : 20   Aspect: 150 %   2 (6)

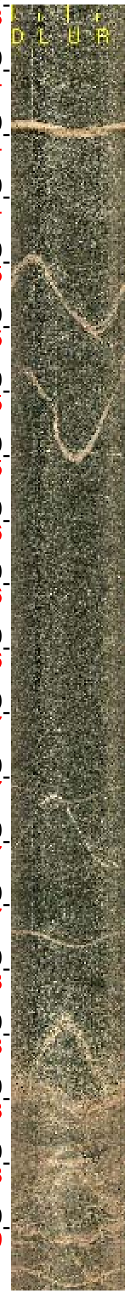
Borehole: KLX24A
Mapping: KLX24A_Geosigma_A

Depth range: 24.000 - 44.000 m
Azimuth: 99.8
Inclination: -58.8

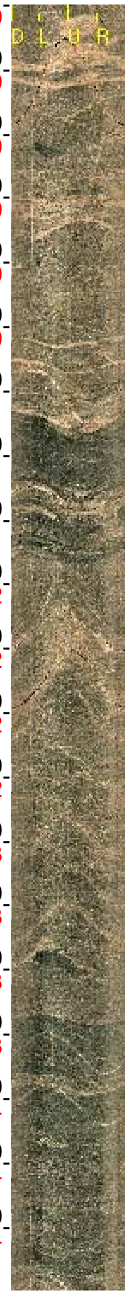
24.000
24.028
24.200
24.228
24.400
24.428
24.600
24.629
24.800
24.829
25.000
25.029
25.200
25.230
25.400
25.430
25.600
25.630
25.800
25.830
26.000
26.031
26.200
26.231
26.400
26.431
26.600
26.631
26.800
26.832
27.000
27.032
27.200
27.232
27.400
27.433
27.600
27.633
27.800
27.833



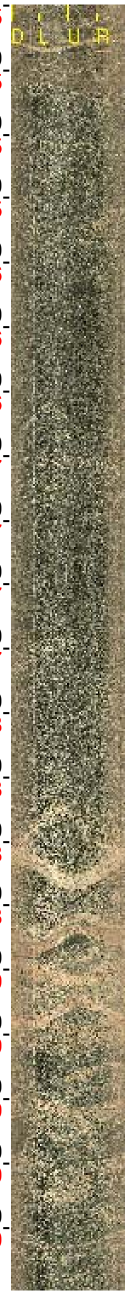
28.000
28.033
28.200
28.234
28.400
28.434
28.600
28.634
28.800
28.835
29.000
29.035
29.200
29.235
29.400
29.435
29.600
29.636
29.800
29.836
30.000
30.036
30.200
30.237
30.400
30.437
30.600
30.637
30.800
30.837
31.000
31.038
31.200
31.238
31.400
31.438
31.600
31.638
31.800
31.839



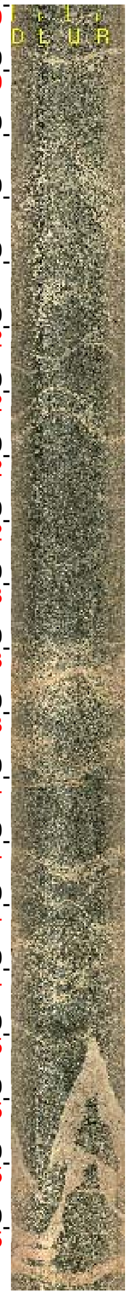
32.000
32.039
32.200
32.239
32.400
32.440
32.600
32.640
32.800
32.840
33.000
33.040
33.200
33.241
33.400
33.441
33.600
33.641
33.800
33.842
34.000
34.042
34.200
34.242
34.400
34.442
34.600
34.643
34.800
34.843
35.000
35.043
35.200
35.243
35.400
35.444
35.600
35.644
35.800
35.844



36.000
36.045
36.200
36.245
36.400
36.445
36.600
36.645
36.800
36.846
37.000
37.046
37.200
37.246
37.400
37.447
37.600
37.647
37.800
37.847
38.000
38.047
38.200
38.248
38.400
38.448
38.600
38.648
38.800
38.848
39.000
39.049
39.200
39.249
39.400
39.449
39.600
39.650
39.800
39.850



40.000
40.050
40.200
40.250
40.400
40.451
40.600
40.651
40.800
40.851
41.000
41.052
41.200
41.252
41.400
41.452
41.600
41.652
41.800
41.853
42.000
42.053
42.200
42.253
42.400
42.454
42.600
42.654
42.800
42.854
43.000
43.054
43.200
43.255
43.400
43.455
43.600
43.655
43.800
43.855



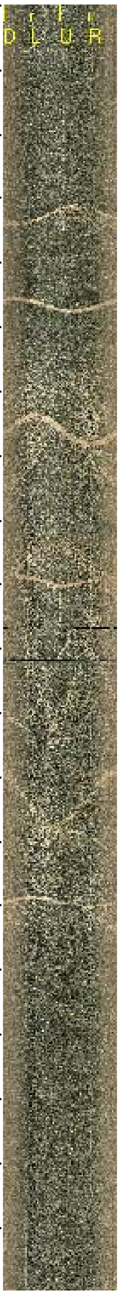
Printed: 2006-09-25 09:04:23   Scale: 1 : 20   Aspect: 150 %   3 (6)

Borehole: KLX24A
Mapping: KLX24A_Geosigma_A

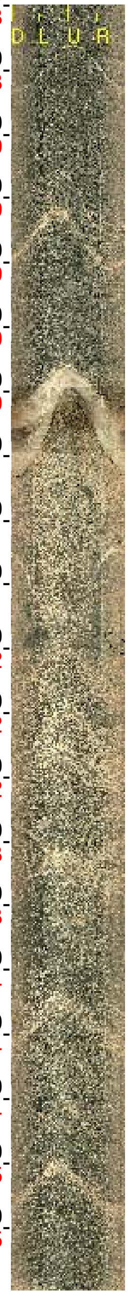
Depth range: 44.000 - 64.000 m
Azimuth: 97.9
Inclination: -58.3

44.000	44.056
44.200	44.256
44.400	44.456
44.600	44.657
44.800	44.857
45.000	45.057
45.200	45.257
45.400	45.458
45.600	45.658
45.800	45.858
46.000	46.059
46.200	46.259
46.400	46.459
46.600	46.659
46.800	46.860
47.000	47.060
47.200	47.260
47.400	47.460
47.600	47.661
47.800	47.861

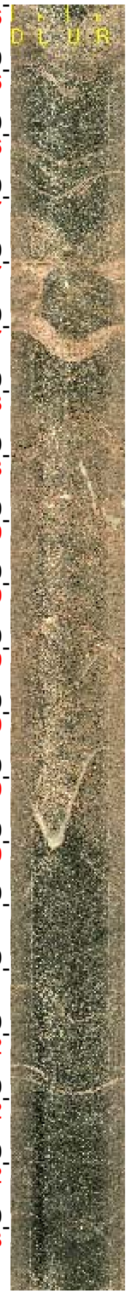
48.000	48.061
48.200	48.262
48.400	48.462
48.600	48.662
48.800	48.862
49.000	49.063
49.200	49.263
49.400	49.463
49.600	49.664
49.800	49.864
50.000	50.064
50.200	50.265
50.400	50.465
50.600	50.665
50.800	50.866
51.000	51.066
51.200	51.266
51.400	51.467
51.600	51.667
51.800	51.868



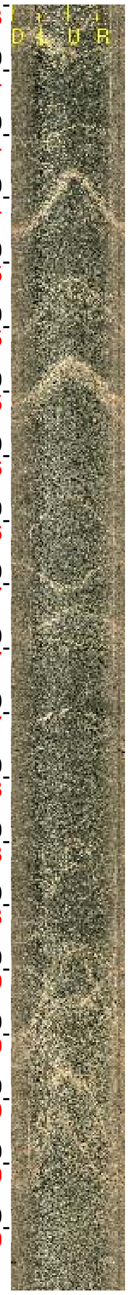
52.000	52.068
52.200	52.268
52.400	52.469
52.600	52.669
52.800	52.869
53.000	53.070
53.200	53.270
53.400	53.471
53.600	53.671
53.800	53.871
54.000	54.072
54.200	54.272
54.400	54.472
54.600	54.673
54.800	54.873
55.000	55.074
55.200	55.274
55.400	55.474
55.600	55.675
55.800	55.875



56.000	56.076
56.200	56.276
56.400	56.476
56.600	56.677
56.800	56.877
57.000	57.077
57.200	57.278
57.400	57.478
57.600	57.679
57.800	57.879
58.000	58.079
58.200	58.280
58.400	58.480
58.600	58.680
58.800	58.881
59.000	59.081
59.200	59.282
59.400	59.482
59.600	59.682
59.800	59.883



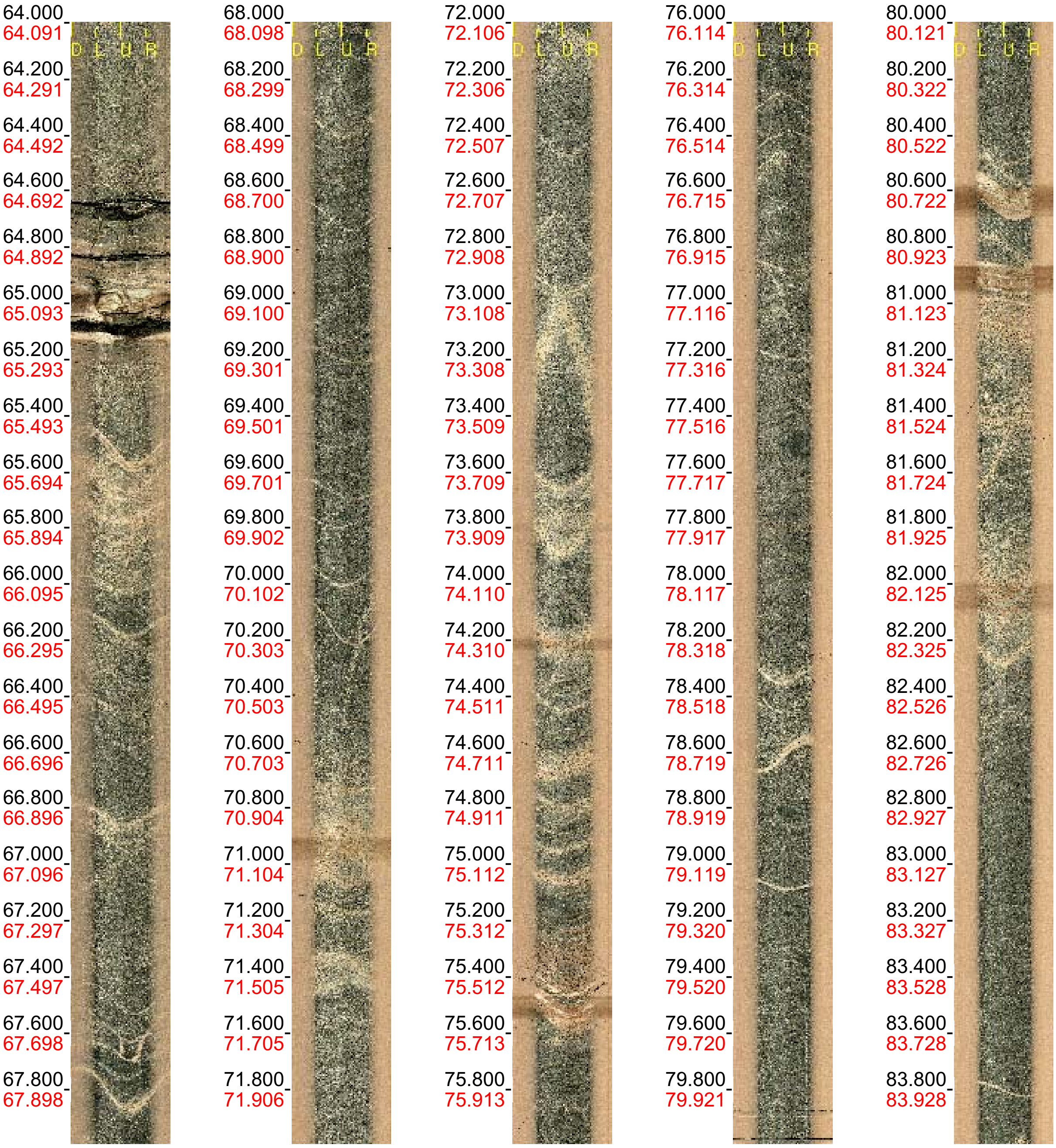
60.000	60.083
60.200	60.284
60.400	60.484
60.600	60.684
60.800	60.885
61.000	61.085
61.200	61.285
61.400	61.486
61.600	61.686
61.800	61.887
62.000	62.087
62.200	62.287
62.400	62.488
62.600	62.688
62.800	62.888
63.000	63.089
63.200	63.289
63.400	63.490
63.600	63.690
63.800	63.890



Printed: 2006-09-25 09:04:23 Scale: 1 : 20 Aspect: 150 % 4 (6)

Borehole: KLX24A
Mapping: KLX24A_Geosigma_A

Depth range: 64.000 - 84.000 m
Azimuth: 99.6
Inclination: -57.7

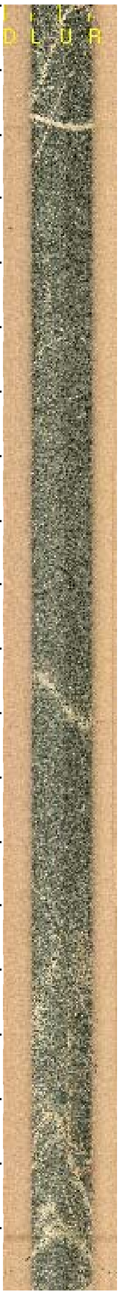


Printed: 2006-09-25 09:04:23 Scale: 1 : 20 Aspect: 150 % 5 (6)

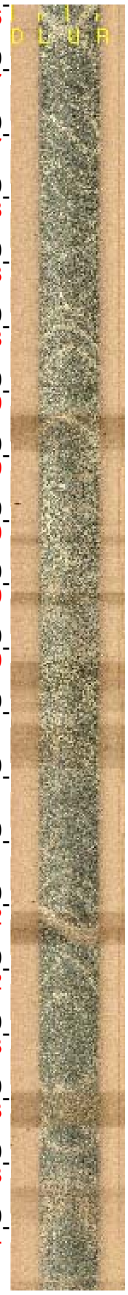
Borehole: KLX24A
Mapping: KLX24A_Geosigma_A

Depth range: 84.000 - 100.256 m
Azimuth: 99.4
Inclination: -57.0

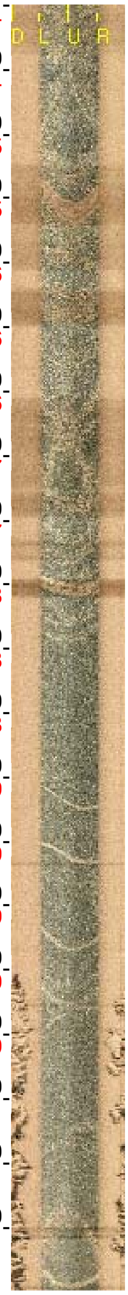
84.000
84.129
84.200
84.329
84.400
84.530
84.600
84.730
84.800
84.930
85.000
85.131
85.200
85.331
85.400
85.532
85.600
85.732
85.800
85.932
86.000
86.133
86.200
86.333
86.400
86.533
86.600
86.734
86.800
86.934
87.000
87.135
87.200
87.335
87.400
87.535
87.600
87.736
87.800
87.936



88.000
88.136
88.200
88.337
88.400
88.537
88.600
88.738
88.800
88.938
89.000
89.138
89.200
89.339
89.400
89.539
89.600
89.740
89.800
89.940
90.000
90.140
90.200
90.341
90.400
90.541
90.600
90.741
90.800
90.942
91.000
91.142
91.200
91.343
91.400
91.543
91.600
91.743
91.800
91.944



92.000
92.144
92.200
92.344
92.400
92.545
92.600
92.745
92.800
92.946
93.000
93.146
93.200
93.346
93.400
93.547
93.600
93.747
93.800
93.948
94.000
94.148
94.200
94.348
94.400
94.549
94.600
94.749
94.800
94.949
95.000
95.150
95.200
95.350
95.400
95.551
95.600
95.751
95.800
95.951



96.000
96.152
96.200
96.352
96.400
96.552
96.600
96.753
96.800
96.953
97.000
97.154
97.200
97.354
97.400
97.554
97.600
97.755
97.800
97.955
98.000
98.156
98.200
98.356
98.400
98.556
98.600
98.757
98.800
98.957
99.000
99.157
99.200
99.358
99.400
99.558
99.600
99.759
99.800
99.959

100.000
100.159
100.200
100.400
100.600
100.800
101.000
101.200
101.400
101.600
101.800
102.000
102.200
102.400
102.600
102.800
103.000
103.200
103.400
103.600
103.800

Printed: 2006-09-25 09:04:23 Scale: 1 : 20 Aspect: 150 % 6 (6)

B. BIPS-image of KLX25A

Borehole Image Report

Borehole Name:	KLX25A
Mapping Name:	KLX25A_Geosigma_C
Mapping Range:	4.000 - 49.847 m
Diameter:	76.0 mm
Printed Range:	4.000 - 50.080
Pages:	4

Image File Information:

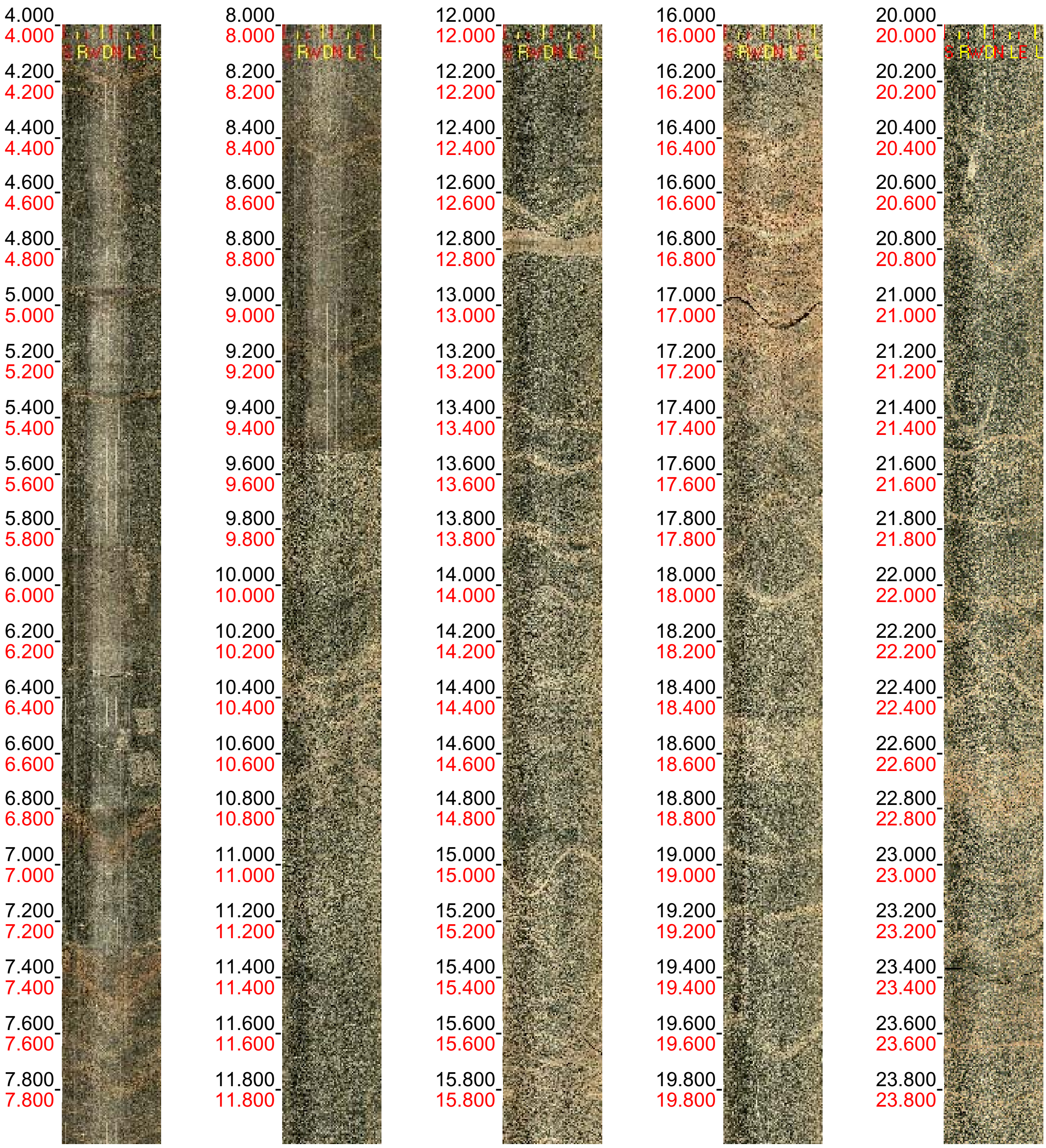
File:	G:\skb\bips\oskarshamn\KLX25A\Used\KLX25A_4-50m.BIP
Date/Time:	2006-08-12 08:48:00
Start Depth:	4.000 m
End Depth:	50.080 m
Resolution:	1.00 mm/pixel (depth)
Orientation:	Magnetic
Image height:	46080 pixels
Image width:	360 pixels
BIP Version:	BIP-III
Locality:	LAXEMAR
Borehole:	KLX25A
Scan Direction:	Down
Color adjust:	0 0 0 (RGB)

Magnetic north to borehole coord north: 2.370
Image rotation to borehole direction: 148.470

Printed: 2006-09-25 09:25:46 Scale: 1 : 20 Aspect: 150 % 1 (4)

Borehole: KLX25A
Mapping: KLX25A_Geosigma_C

Depth range: 4.000 - 24.000 m
Azimuth: 145.8
Inclination: -59.5

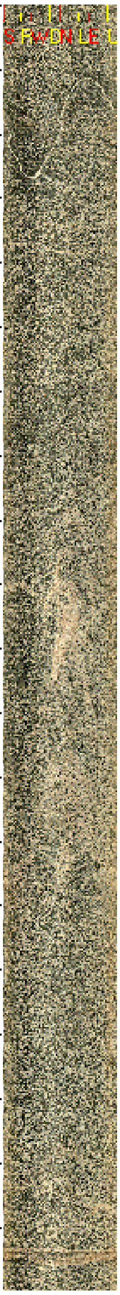


Printed: 2006-09-25 09:25:46 Scale: 1 : 20 Aspect: 150 % 2 (4)

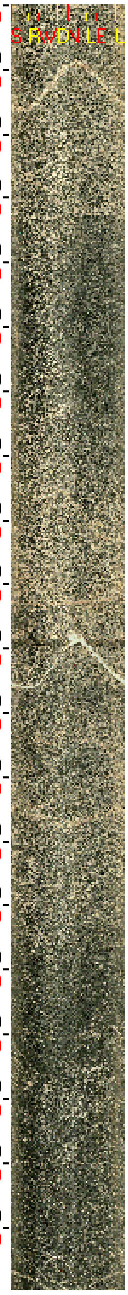
Borehole: KLX25A
Mapping: KLX25A_Geosigma_C

Depth range: 24.000 - 44.000 m
Azimuth: 146.7
Inclination: -58.9

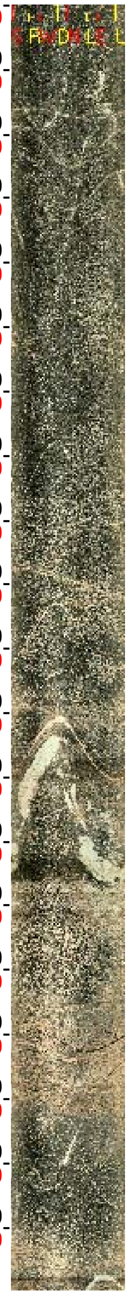
24.000 24.000
24.200 24.200
24.400 24.400
24.600 24.600
24.800 24.800
25.000 25.000
25.200 25.200
25.400 25.400
25.600 25.600
25.800 25.800
26.000 26.000
26.200 26.200
26.400 26.400
26.600 26.600
26.800 26.800
27.000 27.000
27.200 27.200
27.400 27.400
27.600 27.600
27.800 27.800



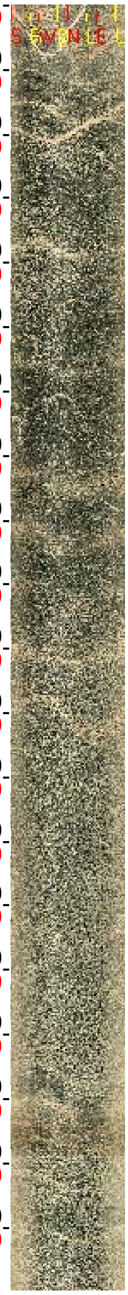
28.000 28.000
28.200 28.200
28.400 28.400
28.600 28.600
28.800 28.800
29.000 29.000
29.200 29.200
29.400 29.400
29.600 29.600
29.800 29.800
30.000 30.000
30.200 30.200
30.400 30.400
30.600 30.600
30.800 30.800
31.000 31.000
31.200 31.200
31.400 31.400
31.600 31.600
31.800 31.800



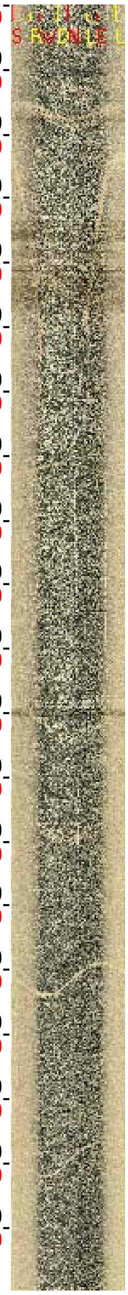
32.000 32.000
32.200 32.200
32.400 32.400
32.600 32.600
32.800 32.800
33.000 33.000
33.200 33.200
33.400 33.400
33.600 33.600
33.800 33.800
34.000 34.000
34.200 34.200
34.400 34.400
34.600 34.600
34.800 34.800
35.000 35.000
35.200 35.200
35.400 35.400
35.600 35.600
35.800 35.800



36.000 36.000
36.200 36.200
36.400 36.400
36.600 36.600
36.800 36.800
37.000 37.000
37.200 37.200
37.400 37.400
37.600 37.600
37.800 37.800
38.000 38.000
38.200 38.200
38.400 38.400
38.600 38.600
38.800 38.800
39.000 39.000
39.200 39.200
39.400 39.400
39.600 39.600
39.800 39.800



40.000 40.000
40.200 40.200
40.400 40.400
40.600 40.600
40.800 40.800
41.000 41.000
41.200 41.200
41.400 41.400
41.600 41.600
41.800 41.800
42.000 42.000
42.200 42.200
42.400 42.400
42.600 42.600
42.800 42.800
43.000 43.000
43.200 43.200
43.400 43.400
43.600 43.600
43.800 43.800

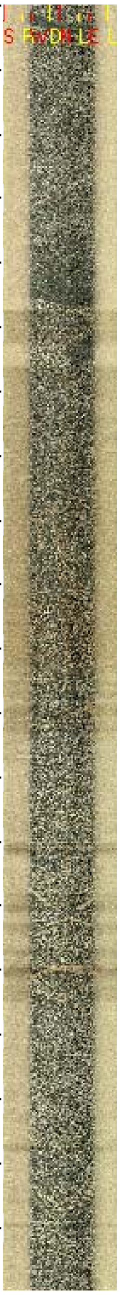


Printed: 2006-09-25 09:25:46 Scale: 1 : 20 Aspect: 150 % 3 (4)

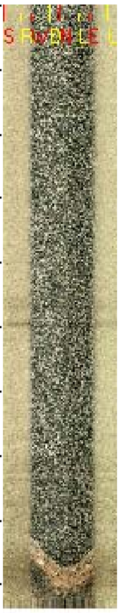
Borehole: KLX25A
Mapping: KLX25A_Geosigma_C

Depth range: 44.000 - 50.080 m
Azimuth: 147.1
Inclination: -58.3

44.000
44.000
44.200
44.200
44.400
44.400
44.600
44.600
44.800
44.800
45.000
45.000
45.200
45.200
45.400
45.400
45.600
45.600
45.800
45.800
46.000
46.000
46.200
46.200
46.400
46.400
46.600
46.600
46.800
46.800
47.000
47.000
47.200
47.200
47.400
47.400
47.600
47.600
47.800
47.800



48.000
48.000
48.200
48.200
48.400
48.400
48.600
48.600
48.800
48.800
49.000
49.000
49.200
49.200
49.400
49.400
49.600
49.600
49.800
49.800
50.000
50.200
50.400
50.600
50.800
51.000
51.200
51.400
51.600
51.800

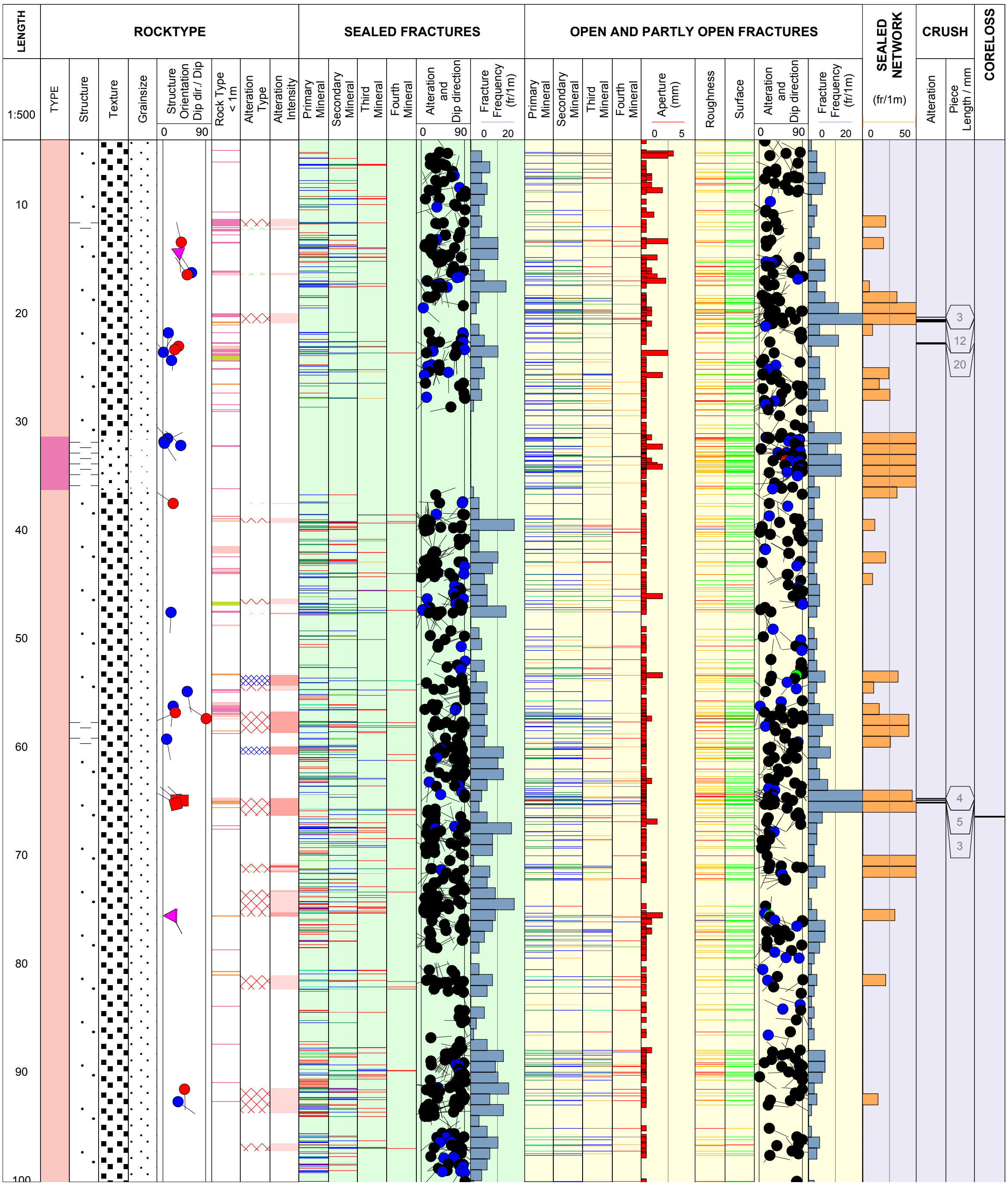


Printed: 2006-09-25 09:25:46 Scale: 1 : 20 Aspect: 150 % 4 (4)

A. WellCad diagram of KLX24A

Title GEOLOGY IN KLX24A **Appendix:**

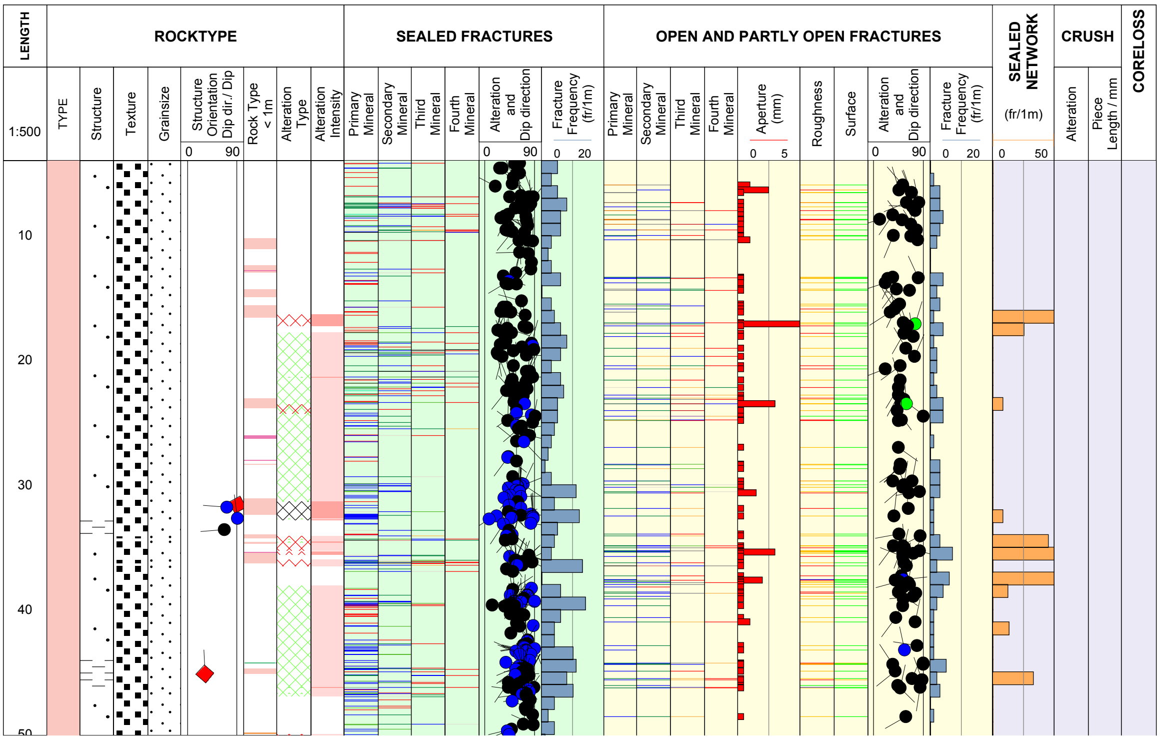
Site	LAXEMAR	**Coordinate System**	RT90-RHB70
Borehole	KLX24A	**Northing [m]**	6366423.35
Diameter [mm]	76	**Easting [m]**	1546853.80
Length [m]	100.170	**Elevation [m.a.s.l.]**	21.29
Bearing [°]	98.41	**Drilling Start Date**	2006-06-14 11:00:00
Inclination [°]	-59.14	**Drilling Stop Date**	2006-06-29 08:45:00
Date of coremapping	2006-08-14 12:13:00	**Plot Date**	2007-10-25 22:03:45
Rocktype data from	p_rock	**Signed data**	



B. WellCad diagram of KLX25A

Title GEOLOGY IN KLX25A **Appendix:**

Site	LAXEMAR	**Coordinate System**	RT90-RHB70
Borehole	KLX25A	**Northing [m]**	6366274.74
Diameter [mm]	76	**Easting [m]**	1546769.66
Length [m]	50.240	**Elevation [m.a.s.l.]**	22.84
Bearing [°]	145.73	**Drilling Start Date**	2006-07-01 14:00:00
Inclination [°]	-59.45	**Drilling Stop Date**	2006-07-04 14:00:00
Date of coremapping	2006-08-14 13:30:00	**Plot Date**	2007-10-25 22:03:45
Rocktype data from	p_rock	**Signed data**	



Appendix 5

Legend to WellCad Diagram

Title **LEGEND FOR LAXEMAR** **KLX24A**

Site	LAXEMAR
Borehole	KLX24A
Plot Date	2007-10-25 22:03:45
Signed data	

ROCKTYPE LAXEMAR

- Äspö Diorite
- Dolerite
- Fine-grained Götemargranite
- Coarse-grained Götemargranite
- Fine-grained granite
- Pegmatite
- Granite
- Ävrö granite
- Quartz monzodiorite
- Diorite / Gabbro
- Fine-grained dioritoid
- Fine-grained diorite-gabbro
- Sulphide mineralization
- Sandstone
- Soil
- Ävrö quartz monzodiorite
- Ävrö granodiorite

ROCK ALTERATION TYPE

- Oxidized
- Chloritisized
- Epidotisized
- Weathered
- Tectonized
- Sericitisized
- Quartz dissolution
- Silicification
- Argillization
- Albitization
- Carbonatization
- Saussuritization
- Steatitization
- Uralitization
- Laumontitization
- Fract zone alteration

MINERAL

- Epidote
- White Feldspar
- Hematite
- Calcite
- Chlorite
- Chalcopyrite
- Quartz
- Pyrite
- Clay Minerals
- Prehnite

STRUCTURE

- Cataclastic
- Schistose
- Gneissic
- Mylonitic
- Ductile Shear Zone
- Brittle-Ductile Zone
- Veined
- Banded
- Massive
- Foliated
- Brecciated
- Lineated

TEXTURE

- Hornfelsed
- Porphyritic
- Ophitic
- Equigranular
- Augen-Bearing
- Unequigranular
- Metamorphic

GRAINSIZE

- Aphanitic
- Fine-grained
- Fine to medium grained
- Medium to coarse grained
- Coarse-grained
- Medium-grained

STRUCTURE ORIENTATION

- Cataclastic
- Bedded
- Gneissic
- Schistose
- Brittle-Ductile Shear Zone
- Ductile Shear Zone
- Lineated
- Banded
- Veined
- Brecciated
- Foliated
- Mylonitic

ROCK ALTERATION INTENSITY

- No intensity
- Faint
- Weak
- Medium
- Strong

ROUGHNESS

- Planar
- Undulating
- Stepped
- Irregular

SURFACE

- Rough
- Smooth
- Slickensided

CRUSH ALTERATION

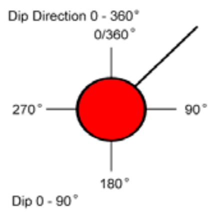
- Slightly Altered
- Moderately Altered
- Highly Altered
- Completley Altered
- Gouge
- Fresh

FRACTURE ALTERATION

- Slightly Altered
- Moderately Altered
- Highly Altered
- Completely Altered
- Gouge
- Fresh

FRACTURE DIRECTION

STRUKTURE ORIENTATION



Title LEGEND FOR LAXEMAR KLX25A

Site LAXEMAR
Borehole KLX25A
Plot Date 2007-10-25 22:03:45
Signed data

ROCKTYPE LAXEMAR

- Äspö Diorite
- Dolerite
- Fine-grained Götemargranite
- Coarse-grained Götemargranite
- Fine-grained granite
- Pegmatite
- Granite
- Ävrö granite
- Quartz monzodiorite
- Diorite / Gabbro
- Fine-grained dioritoid
- Fine-grained diorite-gabbro
- Sulphide mineralization
- Sandstone
- Soil
- Ävrö quartz monzodiorite
- Ävrö granodiorite

ROCK ALTERATION TYPE

- Oxidized
- Chloritisized
- Epidotisized
- Weathered
- Tectonized
- Sericitisized
- Quartz dissolution
- Silicification
- Argillization
- Albitization
- Carbonatization
- Saussuritization
- Steatitization
- Uralitization
- Laumontitization
- Fract zone alteration

MINERAL

- White Feldspar
- Calcite
- Chlorite
- Quartz
- Pyrite
- Clay Minerals
- Iron Hydroxide

STRUCTURE

- Cataclastic
- Schistose
- Gneissic
- Mylonitic
- Ductile Shear Zone
- Brittle-Ductile Zone
- Veined
- Banded
- Massive
- Foliated
- Brecciated
- Lineated

TEXTURE

- Hornfelsed
- Porphyritic
- Ophitic
- Equigranular
- Augen-Bearing
- Unequigranular
- Metamorphic

GRAINSIZE

- Aphanitic
- Fine-grained
- Fine to medium grained
- Medium to coarse grained
- Coarse-grained
- Medium-grained

STRUCTURE ORIENTATION

- Cataclastic
- Bedded
- Gneissic
- Schistose
- Brittle-Ductile Shear Zone
- Ductile Shear Zone
- Lineated
- Banded
- Veined
- Brecciated
- Foliated
- Mylonitic

ROCK ALTERATION INTENSITY

- No intensity
- Faint
- Weak
- Medium
- Strong

ROUGHNESS

- Planar
- Undulating
- Stepped
- Irregular

SURFACE

- Rough
- Smooth
- Slickensided

CRUSH ALTERATION

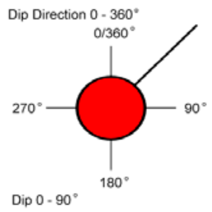
- Slightly Altered
- Moderately Altered
- Highly Altered
- Completley Altered
- Gouge
- Fresh

FRACTURE ALTERATION

- Slightly Altered
- Moderately Altered
- Highly Altered
- Completely Altered
- Gouge
- Fresh

FRACTURE DIRECTION

STRUKTURE ORIENTATION



A. In-data: Borehole length and diameter for KLX24A

KLX24A, 2006-06-14 11:00:00 - 2006-06-29 08:45:00 (0.300 - 100.170 m)

Sub Secup (m)	Sub Seclow (m)	Hole Diam (m)	Comment
0.300	2.410	0.0960	HQ
2.410	100.170	0.0758	Corac N3

Printout from SICADA 2006-08-14 12:07:22.

B. In-data: Borehole length and diameter for KLX25A

KLX25A, 2006-07-01 14:00:00 - 2006-07-04 14:00:00 (0.300 - 50.240 m)

Sub Secup (m)	Sub Seclow (m)	Corediam (m)	Comment
0.300	50.240	0.0502	

Printout from SICADA 2006-09-19 13:08:20.

Appendix 7

In-data Reference marks for depth adjustments for KLX24A

KLX24A, 2006-07-01 06:00:00 - 2006-07-01 08:00:00 (50.000 - 80.000 m)

Bhlen (m)	Rotation Speed (rpm)	Start Flow (l/h)	Stop Flow (l/h)	Stop Pressure (bar)	Cutter Time (s)	Trace Detectable	Cutter Diameter (mm)	Comment
50.00	400.00	450	1000	42.0	42			
80.00	400.00	400	1000	50.0	30			Släppte kulan 7:50

Printout from SICADA 2006-09-25 09:12:32.

A. In data: Borehole deviation data for KLX24A

SICADA - object_location

Idcode	Coord System	Northing (m)	Easting (m)	Elevation (m.a.s.l.)	Length (m)	Vertical Depth (m)	Inclination (degrees)	Bearing (degrees)	Inclination Uncert (degrees)	Bearing Uncert (degrees)	Radius Uncert (m)	Origin	Indat
KLX24A	RT90-RHB70	6366423.35	1546853.80	21.29	0.00	0.00	-59.15	98.41	0.071	0.829	0.00	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366423.12	1546855.32	18.71	3.00	2.58	-59.15	98.41	0.071	0.829	0.02	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366422.90	1546856.84	16.14	6.00	5.15	-59.16	98.37	0.071	0.829	0.04	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366422.68	1546858.37	13.56	9.00	7.73	-59.14	98.32	0.071	0.829	0.07	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366422.45	1546859.89	10.99	12.00	10.30	-59.14	98.28	0.071	0.829	0.09	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366422.23	1546861.41	8.41	15.00	12.88	-59.05	98.23	0.071	0.829	0.11	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366422.01	1546862.94	5.84	18.00	15.45	-58.98	98.23	0.071	0.829	0.13	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366421.78	1546864.47	3.27	21.00	18.02	-58.90	98.70	0.071	0.829	0.16	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366421.55	1546866.01	0.70	24.00	20.59	-58.84	98.66	0.071	0.829	0.18	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366421.32	1546867.54	-1.86	27.00	23.15	-58.73	98.66	0.071	0.829	0.20	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366421.09	1546869.09	-4.42	30.00	25.71	-58.64	98.18	0.071	0.829	0.22	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366420.87	1546870.63	-6.98	33.00	28.27	-58.55	97.80	0.071	0.829	0.25	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366420.65	1546872.19	-9.54	36.00	30.83	-58.48	98.26	0.071	0.829	0.27	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366420.42	1546873.74	-12.10	39.00	33.39	-58.39	98.68	0.071	0.829	0.29	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366420.18	1546875.30	-14.65	42.00	35.94	-58.33	98.64	0.071	0.829	0.31	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366419.95	1546876.86	-17.21	45.00	38.50	-58.23	98.06	0.071	0.829	0.34	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366419.73	1546878.42	-19.75	48.00	41.04	-58.17	98.02	0.071	0.829	0.36	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366419.50	1546879.99	-22.30	51.00	43.59	-58.08	98.52	0.071	0.829	0.38	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366419.27	1546881.56	-24.85	54.00	46.14	-57.98	98.74	0.071	0.829	0.41	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366419.02	1546883.13	-27.39	57.00	48.68	-57.88	99.14	0.071	0.829	0.43	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366418.76	1546884.71	-29.93	60.00	51.22	-57.76	99.32	0.071	0.829	0.45	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366418.50	1546886.29	-32.46	63.00	53.75	-57.66	99.80	0.071	0.829	0.48	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366418.22	1546887.87	-35.00	66.00	56.29	-57.58	99.66	0.071	0.829	0.50	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366417.95	1546889.46	-37.53	69.00	58.82	-57.51	99.66	0.071	0.829	0.52	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366417.68	1546891.05	-40.06	72.00	61.35	-57.44	99.57	0.071	0.829	0.55	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366417.42	1546892.65	-42.59	75.00	63.88	-57.34	99.47	0.071	0.829	0.57	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366417.15	1546894.24	-45.11	78.00	66.40	-57.24	99.34	0.071	0.829	0.59	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366416.89	1546895.85	-47.63	81.00	68.92	-57.15	99.44	0.071	0.829	0.62	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366416.62	1546897.46	-50.15	84.00	71.44	-57.03	99.41	0.071	0.829	0.64	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366416.35	1546899.07	-52.67	87.00	73.96	-56.95	99.41	0.071	0.829	0.66	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366416.09	1546900.68	-55.18	90.00	76.47	-56.86	99.25	0.071	0.829	0.69	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366415.82	1546902.31	-57.69	93.00	78.98	-56.75	99.50	0.071	0.829	0.71	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366415.55	1546903.93	-60.20	96.00	81.49	-56.69	99.73	0.071	0.829	0.73	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366415.27	1546905.55	-62.70	99.00	83.99	-56.60	99.73	0.071	0.829	0.76	Measured	2007-02-06 08:37
KLX24A	RT90-RHB70	6366415.16	1546906.19	-63.68	100.17	84.97	-56.60	99.73	0.071	0.829	0.77	Measured	2007-02-06 08:37

B. In data: Borehole deviation data for KLX25A

Deviations protocol – KLX25A

SICADA - object_location

Idcode	Coord System	Northing (m)	Easting (m)	Elevation (m.a.s.l.)	Length (m)	Vertical Depth (m)	Inclination (degrees)	Bearing (degrees)	Inclination Uncert (degrees)	Bearing Uncert (degrees)	Radius Uncert (m)	Origin	Indat
KLX25A	RT90-RHB70	6366274.74	1546769.66	22.84	0.00	0.00	-59.46	145.73	0.066	0.544	0.00	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366273.48	1546770.52	20.26	3.00	2.58	-59.46	145.73	0.066	0.544	0.01	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366272.22	1546771.38	17.67	6.00	5.17	-59.50	145.93	0.066	0.544	0.03	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366270.96	1546772.23	15.09	9.00	7.75	-59.46	146.14	0.066	0.544	0.04	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366269.69	1546773.08	12.50	12.00	10.34	-59.46	146.34	0.066	0.544	0.06	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366268.42	1546773.92	9.92	15.00	12.92	-59.38	146.55	0.066	0.544	0.07	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366267.14	1546774.76	7.34	18.00	15.50	-59.24	146.57	0.066	0.544	0.09	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366265.86	1546775.61	4.76	21.00	18.08	-59.13	146.55	0.066	0.544	0.10	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366264.57	1546776.46	2.19	24.00	20.65	-58.98	146.55	0.066	0.544	0.12	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366263.28	1546777.31	-0.38	27.00	23.22	-58.88	146.48	0.066	0.544	0.13	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366261.98	1546778.17	-2.95	30.00	25.78	-58.77	146.68	0.066	0.544	0.15	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366260.68	1546779.02	-5.51	33.00	28.35	-58.65	146.72	0.066	0.544	0.16	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366259.37	1546779.88	-8.07	36.00	30.91	-58.53	146.83	0.066	0.544	0.18	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366258.06	1546780.74	-10.63	39.00	33.47	-58.43	147.03	0.066	0.544	0.19	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366256.74	1546781.59	-13.18	42.00	36.02	-58.36	147.09	0.066	0.544	0.21	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366255.42	1546782.45	-15.74	45.00	38.57	-58.27	146.68	0.066	0.544	0.22	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366254.10	1546783.33	-18.29	48.00	41.13	-58.22	146.22	0.066	0.544	0.24	Measured	2007-02-06 08:38
KLX25A	RT90-RHB70	6366253.12	1546783.98	-20.19	50.24	43.03	-58.22	146.22	0.066	0.544	0.25	Measured	2007-02-06 08:38

Number of rows: 18.
Printout from SICADA 2007-10-26 13:09:45.