P-07-159

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Boremap mapping of core drilled MDZ boreholes KLX28A and KLX29A

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November 2007

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ISSN 1651-4416
SKB P-07-159

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Keywords: MDZ, KLX28A, KLX29A, Geology, Drill core mapping, Boremap, Fractures, BIPS, Laxemar.

Abstract

This report presents the Boremap mapping of MDZ boreholes KLX28A and KLX29A. KLX28A was drilled with the orientaion 190/–59° and KLX29A with the orientation 321/–60°.The mapping was conducted between 2006-11-13 and 2006-11-22.

The documentation of geological structures and lithologies intersecting borehole KLX28A and KLX29A was made using the drill core and BIPS-images. Geological structures are correctly oriented in space along the borehole with the Boremap system.

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 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 KLX28A is dominated by Ävrö granite (501044). Subordinate rock type comprises fine-grained diorite-gabbro (505102) and fine-grained granite (511058). The lithology in KLX29A is dominated by Ävrö granite (501044). Subordinate rock type is fine-grained granite (511058).

One section (26–33 m) in KLX28A and three sections (6–8 m, 16–21 m and 50–52 m) in KLX29A have been highlighted based on increased fracture frequencies, alterations and structural features.

Sammanfattning

Denna rapport presenterar boremapkarteringen av MDZ borrhålen KLX28A och KLX29A. KLX28A borrades med orienteringen 190/–59° och KLX29A med orienteringen 321/–60°. Borrhålen karterades mellan 2006-11-13 och 2006-11-19.

Dokumentationen av geologiska strukturer och litologi som genomskär borrhål KLX28A och KLX29A har studerats med borrkärna och BIPS-bilder. Geologiska strukturer har orienterats med Boremap systemet.

Målsättningen med MDZ borrhålen är att erhålla ökad kunskap och förståelse för bedömning av det aktuella områdets hydrauliska mönster och fysikaliska egenskaper genom att sammanställa befintliga strukturers koppling till litologi, geofysisk karaktär, bergspänning, grundvatten-förhållanden och tektonik.

Litologin i KLX28A domineras av Ävrö granit (501044). Underordnade bergarter är finkornig dioritoid (505102) och finkornig granit (511058). Litologin i KLX29A domineras av Ävrö granit (501044) och underordnad är finkornig granit (511058)

En sektion (26–33 m) i KLX28A samt tre sektioner (6–8 m, 16–21 m och 50–52 m) i KLX29A kan urskiljas baserat på förhöjd sprickfrekvens, bergets omvandling och geologiska strukturer.

Contents

1 Introduction

This document reports the data gained from the mapping of MDZ boreholes (Minor Deformation Zone) KLX28A and KLX29A 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 400-06-139. 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 KLX28A and KLX29A	AP PS 400-06-139	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 2006-11-13 and 2006-11-22. 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)
KLX28A	189.7	–59.22	80.25
KLX29A	321.2	–60.34	60.25

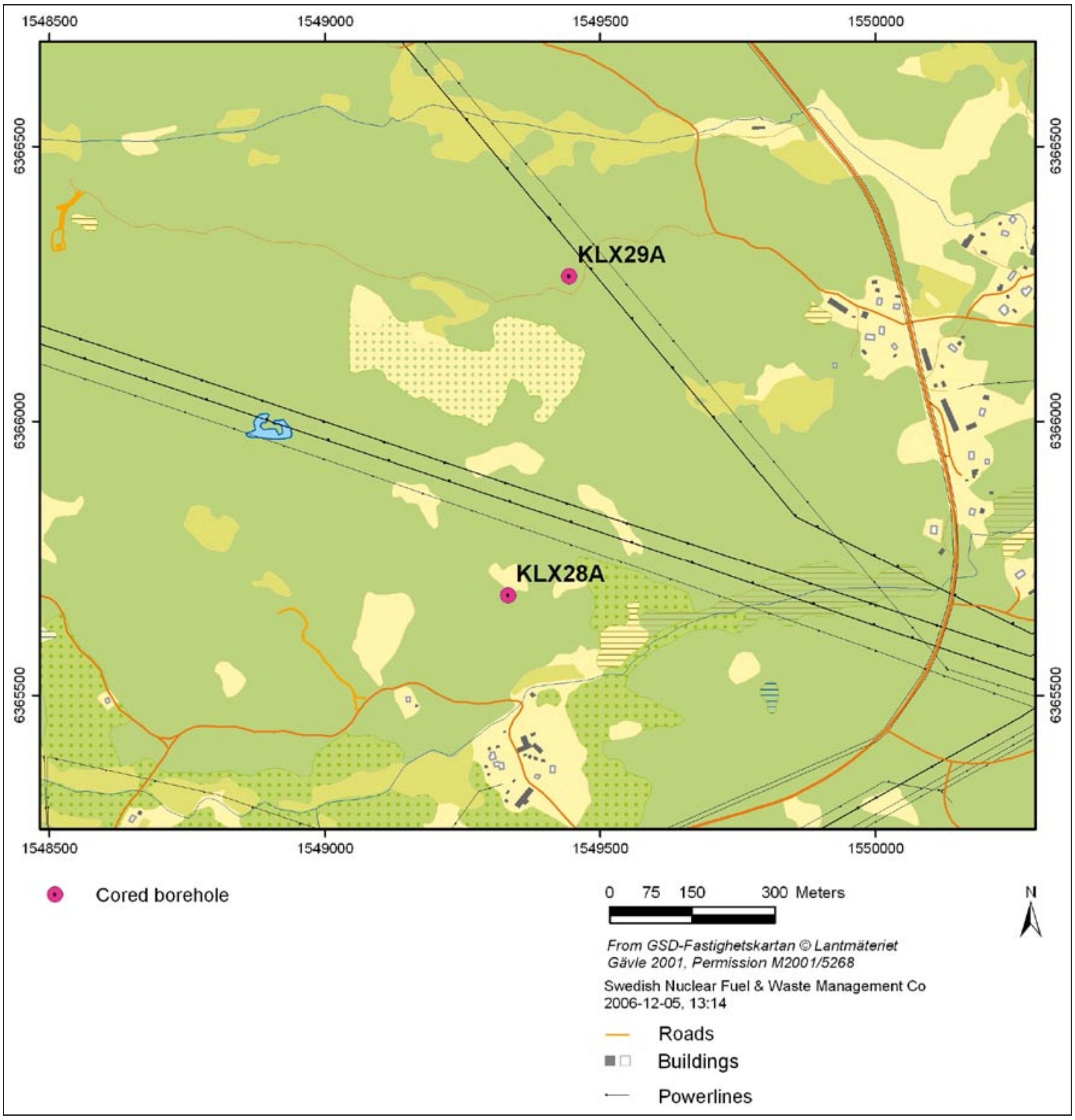


Figure 1-1. Location of KLX28A and KLX29A.

2 Objective and scope

The core drilled boreholes KLX28A and KLX29A 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 and physical properties 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)
KLX28A	4.00–79.90
KLX29A	4.00–59.17

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
KLX28A	4.00–72.00	Good
	72.00–79.90	Acceptable
KLX29A	4.00–51.80	Good
	51.80–59.20	Acceptable

4 Execution

4.1 General

Mapping of the drill core of the borehole was performed and documented according to Activity Plan AP PS 400-06-139 (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 core was 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 Karl-Johan Mattsson and Peter Dahlin (Geosigma AB).

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:

X5 Bleached fracture walls.

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

X8 Fractures with epidotized/saussuritized walls.

X9 Weathered appearance.

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 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 certainly 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 5.24 m of KLX28A and 4.00 m of KLX29A is not covered by BIPS images. In these sections only open fractures have been mapped.

Due to the lack of reference marks in KLX29A, recorded length from the BIPS-logging was used.

Core loss, in KLX29A, was mapped in the interval 7.518–7.694 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 4A and 4B. 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.

Original data from the reported activity are stored in the primary database SICADA. Data are traceable in SICADA by the Activity Plan number (AP PS 400-06-139). 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.

The MDZ boreholes KLX28A and KLX29A vary between 50.37 m and 100.14 m in length (Table 5-1).

5.2 Lithology and structures

The lithology (Table 5-2) in KLX28A and KLX29A is dominated by Ävrö granite (501044). Subordinated rock types are, for KLX28A, fine-grained diorite-gabbro (505102) and fine-grained granite (511058). In KLX29A fine-grained diorite-gabbro (505102) is subordinated rock type.

One section in KLX28A and three sections in KLX29A are recognized by anomalous fracture frequencies, alterations and structural features.

Section interval characteristics.

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

Borehole	Length (m)
KLX28A	2.85–80.26
KLX29A	0.30–60.25

Table 5-2. Lithology in the MDZ boreholes.

Rock type	KLX28A (%)	KLX29A (%)
Ävrö granite (501044)	92.7	98.1
Fine-grained diorite-gabbro (505102)	4.3	1.9
Fine-grained granite (511058)	3.0	–

KLX28A

1. 26–33 m. Increased frequency of open fractures and sealed fractures, brittle-ductile deformation zones and crush zones occurs within this section. This section is associated with a fine-grained diorite-gabbro (505102).

KLX29A

1. 6–8 m. Increased frequency of open fractures and open fractures with an aperture > 0.5 mm, sealed fractures, core loss, crush and red staining occurs within this section.
2. 16–21 m. Increased frequency of open fractures and open fractures with an aperture > 0.5 mm, sealed fractures, brecciation, ductile and brittle-ductile shear zones, saussuritization and red staining occurs within this section.
3. 50–52 m. Increased frequency of open fractures and open fractures with an aperture > 0.5 mm, sealed fractures, crush, saussuritization and red staining occurs within this section.

5.3 Fracture mineralogy

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

The most frequently occurring minerals in open fractures are for KLX28A; calcite and chlorite. Subordinated rock wall alterations and minerals are oxidized walls, pyrite, and epidote. KLX29A is dominated by calcite and chlorite and subordinated minerals are clay minerals, hematite, oxidized walls and pyrite.

Dominating minerals in sealed fractures are oxidized walls, calcite, chlorite, epidote and quartz.

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

Mineral	KLX28A (%)	KLX29A (%)
Adularia	–	1.6
Calcite	84.7	68.4
Chalcopyrite	1.0	–
Chlorite	75.9	55.6
Clay Minerals	6.4	20.9
Epidote	19.7	10.2
Galena	0.5	–
Hematite	7.4	15.5
Iron Hydroxide	–	1.1
Oxidized Walls	25.6	13.9
Prehnite	2.5	
Pyrite	20.7	15.5
Quartz	0.5	0.5
Unknown Mineral	–	0.5
X5	0.5	–
X7	3.0	1.6
X9	–	4.8

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

Mineral	KLX28A (%)	KLX29A (%)
Adularia	1.4	4.2
Calcite	47.1	60.5
Chlorite	33.0	25.3
Clay Minerals	0.3	–
Epidote	17.5	25.3
Hematite	0.3	2.3
Iron Hydroxide	–	0.4
Oxidized Walls	48.0	39.7
Prehnite	4.3	10.3
Pyrite	2.9	2.7
Quartz	19.0	20.3
Red Feldspar	3.4	1.1
White Feldspar	6.6	2.7
X5	2.9	2.3
X7	0.3	–
X8	4.9	3.4

Appendix 1

A. Geological summary table KLX28A

GEOLOGICAL SUMMARY KLX28A — **APPENDIX: 1a**

Site	LAXEMAR	Signed data
Borehole	KLX28A	
Coordinate System	RT90-RHB70	
Date of mapping	2006-11-14 08:32:00	

ROCKTYPE SIMPEVARP
- Fine-grained granite
- Ävrö granite
- Fine-grained diorite-gabbro

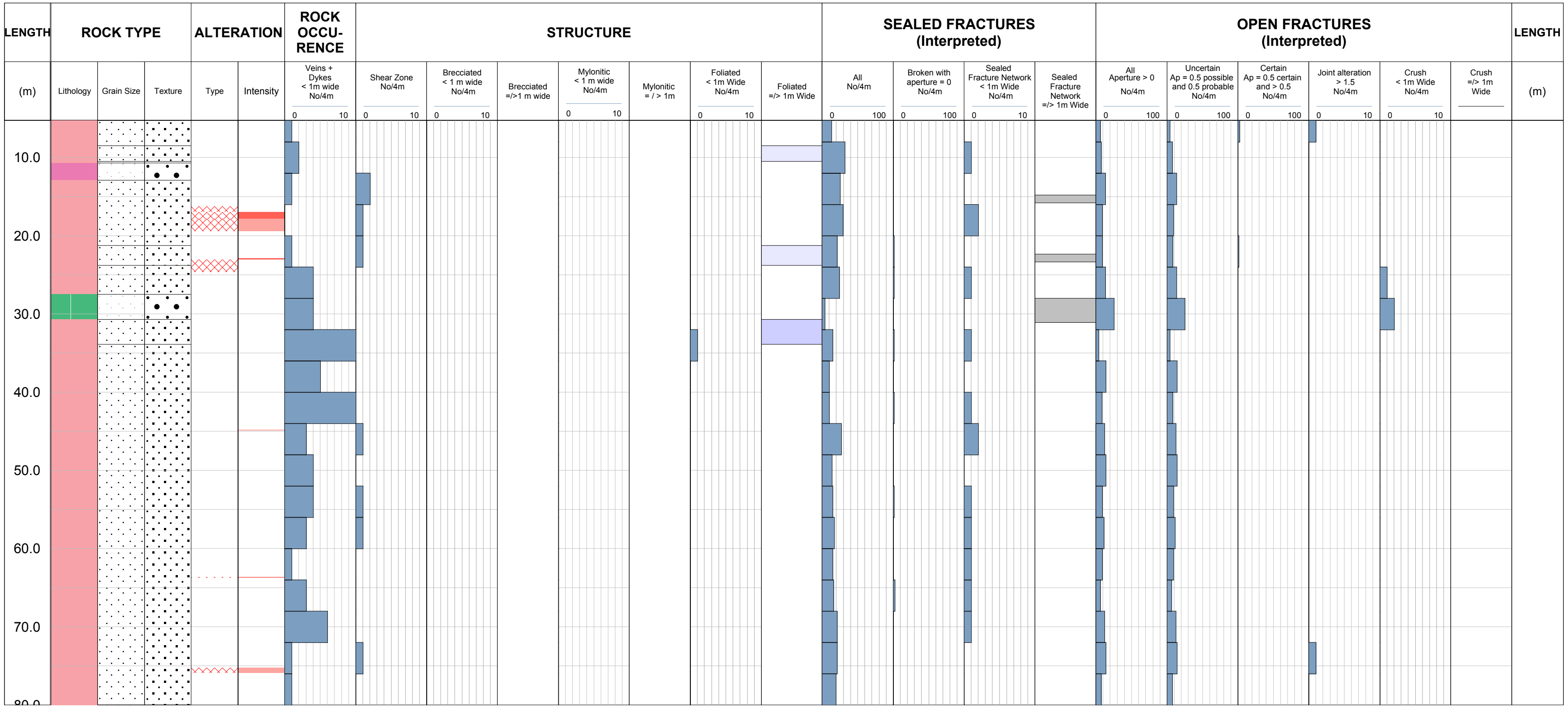
GRAINSIZE
- Fine-grained
- Medium-grained

TEXTURE
- Porphyritic
- Unequigranular

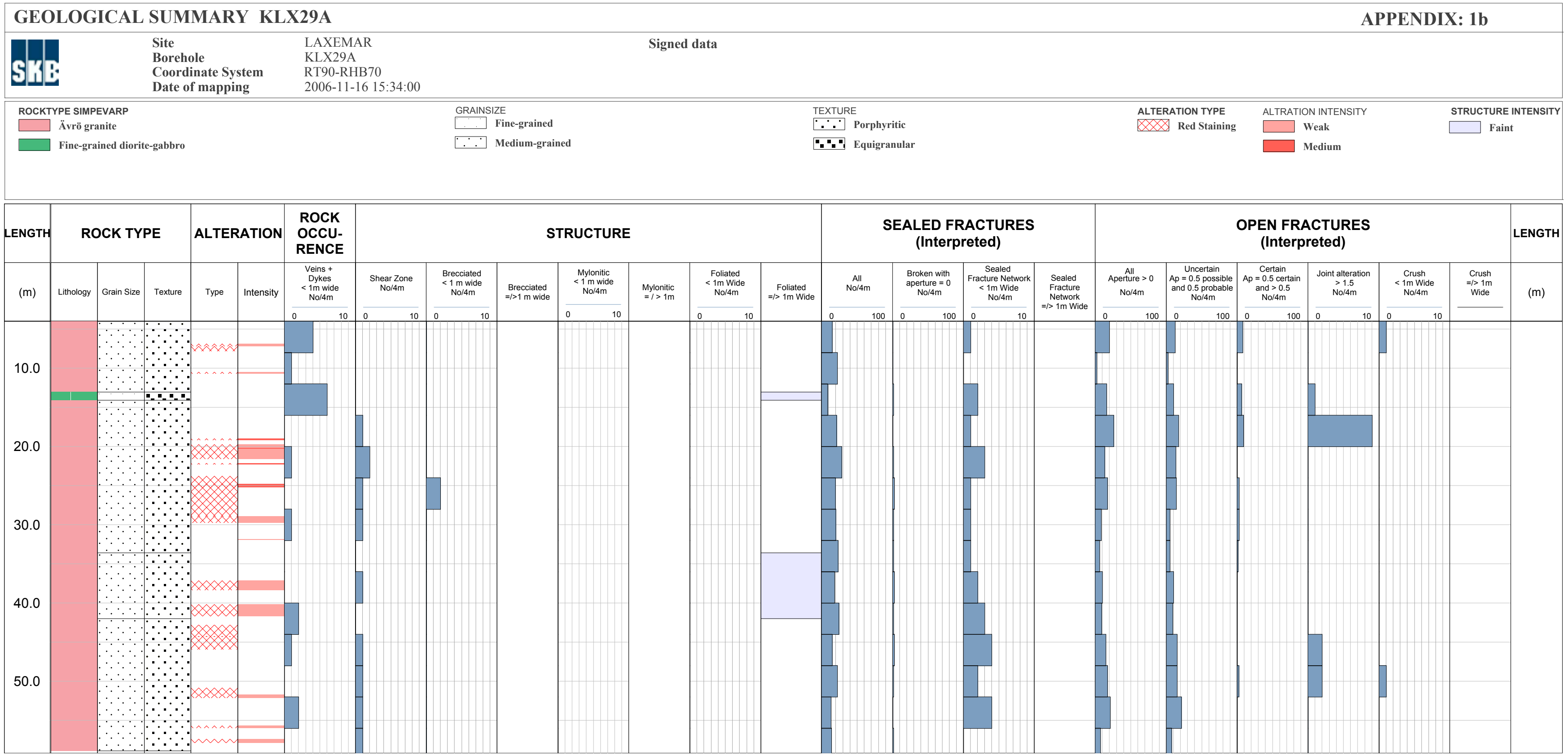
ALTERATION TYPE
- Red Staining

ALTRATION INTENSITY
- Weak
- Medium

STRUCTURE INTENSITY
- Faint
- Weak



B. Geological summary table KLX29A



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 KLX28A

Borehole Image Report

Borehole Name:	KLX28A
Mapping Name:	KLX28A_Geosigma_1
Mapping Range:	5.237 - 79.695 m
Diameter:	76.0 mm
Printed Range:	4.000 - 79.904
Pages:	5

Image File Information:

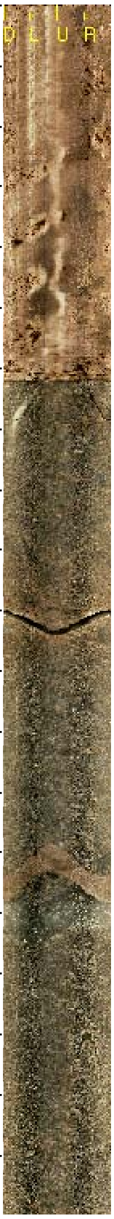
File:	G:\skb\bips\oskarshamn\KLX28A\KLX28A.BIP
Date/Time:	2006-11-08 08:15:00
Start Depth:	4.000 m
End Depth:	79.904 m
Resolution:	1.00 mm/pixel (depth)
Orientation:	Gravmetric
Image height:	75904 pixels
Image width:	360 pixels
BIP Version:	BIP-III
Locality:	LAXEMAR
Borehole:	KLX28A
Scan Direction:	Down
Color adjust:	0 0 0 (RGB)

Printed: 2006-11-22 14:44:03 Scale: 1 : 20 Aspect: 150 %

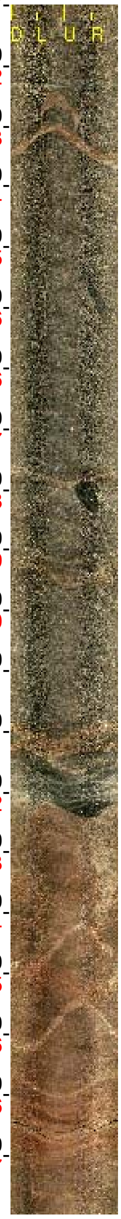
Borehole: KLX28A
Mapping: KLX28A_Geosigma_1

Depth range: 4.000 - 24.000 m
Azimuth: 0.0
Inclination: -90.0

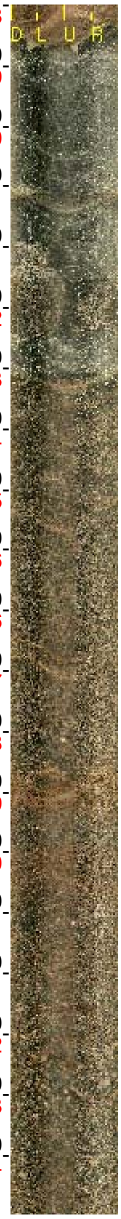
4.000	
4.200	
4.400	
4.600	
4.800	
5.000	
5.200	
5.400	5.401
5.600	5.602
5.800	5.802
6.000	6.003
6.200	6.204
6.400	6.405
6.600	6.606
6.800	6.806
7.000	7.007
7.200	7.208
7.400	7.409
7.600	7.610
7.800	7.811



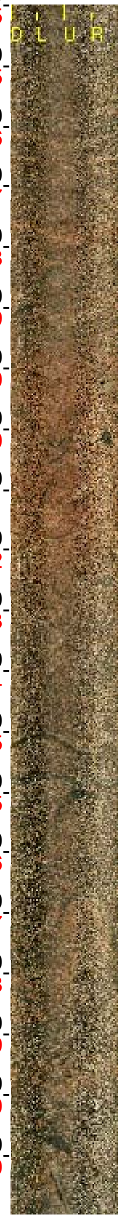
8.000	8.011
8.200	8.212
8.400	8.413
8.600	8.614
8.800	8.815
9.000	9.016
9.200	9.216
9.400	9.417
9.600	9.618
9.800	9.819
10.000	10.020
10.200	10.221
10.400	10.421
10.600	10.622
10.800	10.823
11.000	11.024
11.200	11.225
11.400	11.426
11.600	11.626
11.800	11.827



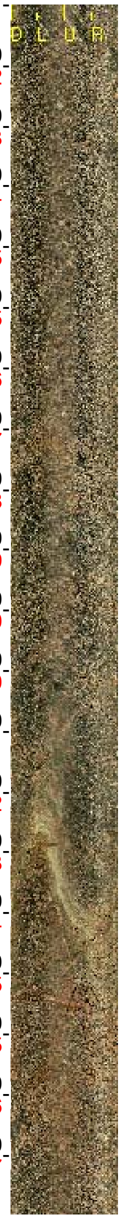
12.000	12.028
12.200	12.229
12.400	12.430
12.600	12.631
12.800	12.831
13.000	13.032
13.200	13.233
13.400	13.434
13.600	13.635
13.800	13.836
14.000	14.036
14.200	14.237
14.400	14.438
14.600	14.639
14.800	14.840
15.000	15.041
15.200	15.241
15.400	15.442
15.600	15.643
15.800	15.844



16.000	16.045
16.200	16.245
16.400	16.446
16.600	16.647
16.800	16.848
17.000	17.049
17.200	17.250
17.400	17.450
17.600	17.651
17.800	17.852
18.000	18.053
18.200	18.254
18.400	18.455
18.600	18.655
18.800	18.856
19.000	19.057
19.200	19.258
19.400	19.459
19.600	19.660
19.800	19.860



20.000	20.061
20.200	20.262
20.400	20.463
20.600	20.664
20.800	20.865
21.000	21.065
21.200	21.266
21.400	21.467
21.600	21.668
21.800	21.869
22.000	22.070
22.200	22.270
22.400	22.471
22.600	22.672
22.800	22.873
23.000	23.074
23.200	23.275
23.400	23.475
23.600	23.676
23.800	23.877

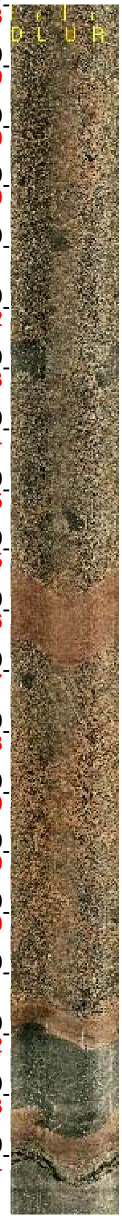


Printed: 2006-11-22 14:44:03 Scale: 1 : 20 Aspect: 150 % 2 (5)

Borehole: KLX28A
Mapping: KLX28A_Geosigma_1

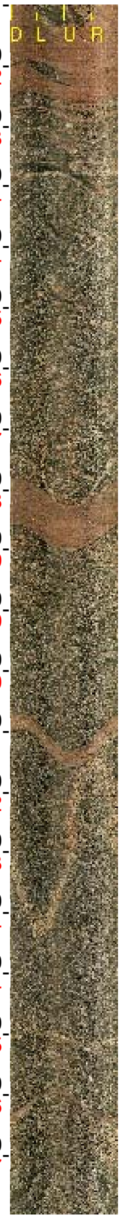
Depth range: 24.000 - 44.000 m
Azimuth: 0.0
Inclination: -90.0

24.000	24.078
24.200	24.279
24.400	24.480
24.600	24.680
24.800	24.881
25.000	25.082
25.200	25.283
25.400	25.484
25.600	25.685
25.800	25.885
26.000	26.086
26.200	26.287
26.400	26.488
26.600	26.689
26.800	26.889
27.000	27.090
27.200	27.291
27.400	27.492
27.600	27.693
27.800	27.894

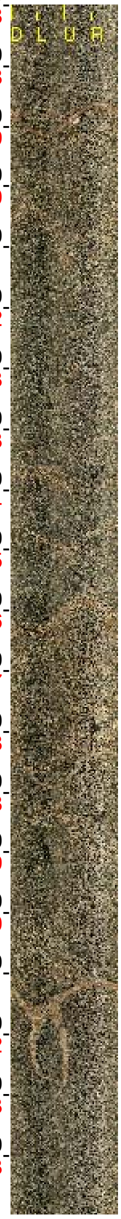


28.000	28.094
28.200	28.295
28.400	28.496
28.600	28.697
28.800	28.898
29.000	29.099
29.200	29.299
29.400	29.500
29.600	29.701
29.800	29.902
30.000	30.103
30.200	30.304
30.400	30.504
30.600	30.705
30.800	30.906
31.000	31.107
31.200	31.308
31.400	31.509
31.600	31.709
31.800	31.910

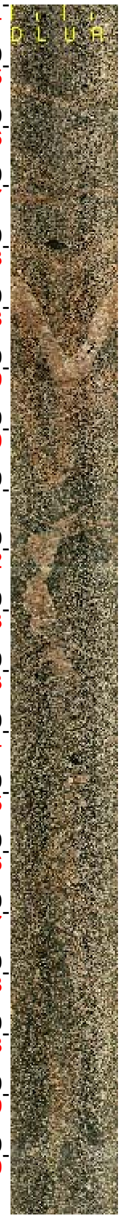
32.000	32.111
32.200	32.312
32.400	32.513
32.600	32.714
32.800	32.914
33.000	33.115
33.200	33.316
33.400	33.517
33.600	33.718
33.800	33.919
34.000	34.119
34.200	34.320
34.400	34.521
34.600	34.722
34.800	34.923
35.000	35.124
35.200	35.324
35.400	35.525
35.600	35.726
35.800	35.927



36.000	36.128
36.200	36.328
36.400	36.529
36.600	36.730
36.800	36.931
37.000	37.132
37.200	37.333
37.400	37.533
37.600	37.734
37.800	37.935
38.000	38.136
38.200	38.337
38.400	38.538
38.600	38.738
38.800	38.939
39.000	39.140
39.200	39.341
39.400	39.542
39.600	39.743
39.800	39.943



40.000	40.144
40.200	40.345
40.400	40.546
40.600	40.747
40.800	40.948
41.000	41.148
41.200	41.349
41.400	41.550
41.600	41.751
41.800	41.952
42.000	42.153
42.200	42.353
42.400	42.554
42.600	42.755
42.800	42.956
43.000	43.157
43.200	43.358
43.400	43.558
43.600	43.759
43.800	43.960

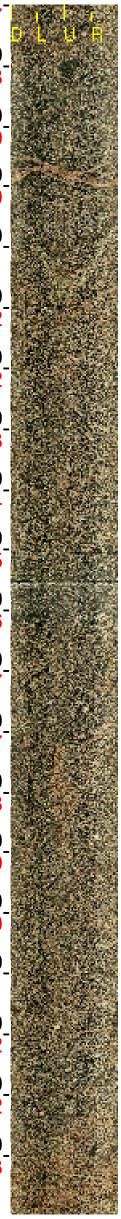


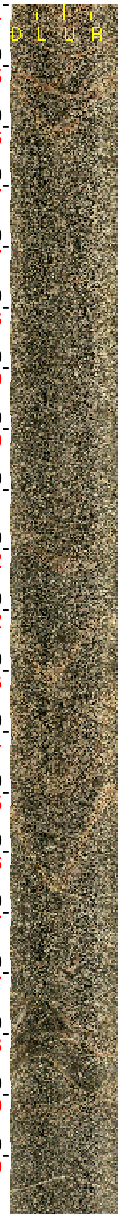
Printed: 2006-11-22 14:44:03 Scale: 1 : 20 Aspect: 150 % 3 (5)

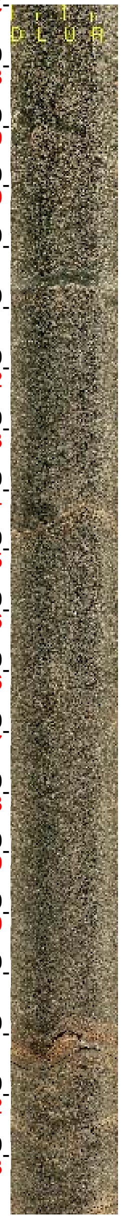
Borehole: KLX28A
Mapping: KLX28A_Geosigma_1

Depth range: 44.000 - 64.000 m
Azimuth: 0.0
Inclination: -90.0

44.000	44.161	48.000	48.177	52.000	52.194	56.000	56.211	60.000	60.227
44.200	44.362	48.200	48.378	52.200	52.395	56.200	56.411	60.200	60.428
44.400	44.563	48.400	48.579	52.400	52.596	56.400	56.612	60.400	60.629
44.600	44.763	48.600	48.780	52.600	52.797	56.600	56.813	60.600	60.830
44.800	44.964	48.800	48.981	52.800	52.997	56.800	57.014	60.800	61.031
45.000	45.165	49.000	49.182	53.000	53.198	57.000	57.215	61.000	61.231
45.200	45.366	49.200	49.382	53.200	53.399	57.200	57.416	61.200	61.432
45.400	45.567	49.400	49.583	53.400	53.600	57.400	57.616	61.400	61.633
45.600	45.768	49.600	49.784	53.600	53.801	57.600	57.817	61.600	61.834
45.800	45.968	49.800	49.985	53.800	54.002	57.800	58.018	61.800	62.035
46.000	46.169	50.000	50.186	54.000	54.202	58.000	58.219	62.000	62.236
46.200	46.370	50.200	50.387	54.200	54.403	58.200	58.420	62.200	62.436
46.400	46.571	50.400	50.587	54.400	54.604	58.400	58.621	62.400	62.637
46.600	46.772	50.600	50.788	54.600	54.805	58.600	58.821	62.600	62.838
46.800	46.972	50.800	50.989	54.800	55.006	58.800	59.022	62.800	63.039
47.000	47.173	51.000	51.190	55.000	55.207	59.000	59.223	63.000	63.240
47.200	47.374	51.200	51.391	55.200	55.407	59.200	59.424	63.200	63.441
47.400	47.575	51.400	51.592	55.400	55.608	59.400	59.625	63.400	63.641
47.600	47.776	51.600	51.792	55.600	55.809	59.600	59.826	63.600	63.842
47.800	47.977	51.800	51.993	55.800	56.010	59.800	60.026	63.800	64.043







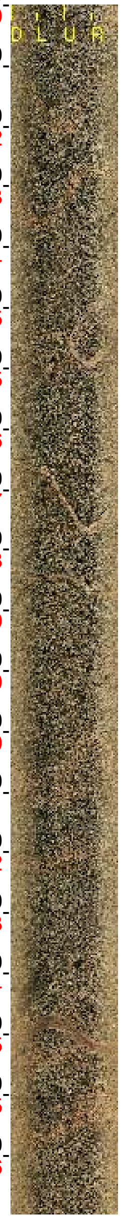
Printed: 2006-11-22 14:44:03 Scale: 1 : 20 Aspect: 150 % 4 (5)

Borehole: KLX28A
Mapping: KLX28A_Geosigma_1

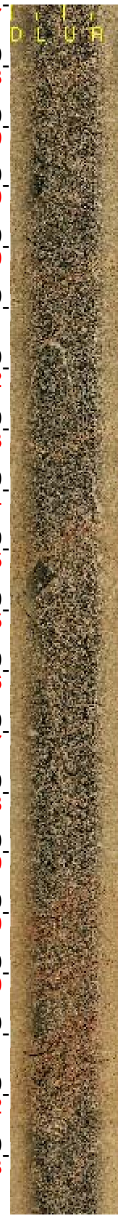
Depth range: 64.000 - 79.904 m
Azimuth: 0.0
Inclination: -90.0

64.000	64.244
64.200	64.445
64.400	64.646
64.600	64.846
64.800	65.047
65.000	65.248
65.200	65.449
65.400	65.650
65.600	65.851
65.800	66.051
66.000	66.252
66.200	66.453
66.400	66.654
66.600	66.855
66.800	67.055
67.000	67.256
67.200	67.457
67.400	67.658
67.600	67.859
67.800	68.060

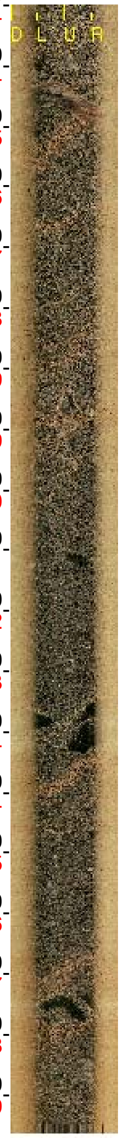
68.000	68.260
68.200	68.461
68.400	68.662
68.600	68.863
68.800	69.064
69.000	69.265
69.200	69.465
69.400	69.666
69.600	69.867
69.800	70.068
70.000	70.269
70.200	70.470
70.400	70.670
70.600	70.871
70.800	71.072
71.000	71.273
71.200	71.474
71.400	71.675
71.600	71.875
71.800	72.076



72.000	72.277
72.200	72.478
72.400	72.679
72.600	72.880
72.800	73.080
73.000	73.281
73.200	73.482
73.400	73.683
73.600	73.884
73.800	74.085
74.000	74.285
74.200	74.486
74.400	74.687
74.600	74.888
74.800	75.089
75.000	75.290
75.200	75.490
75.400	75.691
75.600	75.892
75.800	76.093



76.000	76.294
76.200	76.494
76.400	76.695
76.600	76.896
76.800	77.097
77.000	77.298
77.200	77.499
77.400	77.699
77.600	77.900
77.800	78.101
78.000	78.302
78.200	78.503
78.400	78.704
78.600	78.904
78.800	79.105
79.000	79.306
79.200	79.507
79.400	79.708
79.600	79.909
79.800	



Printed: 2006-11-22 14:44:03 Scale: 1 : 20 Aspect: 150 % 5 (5)

B. BIPS-image of KLX29A

Borehole Image Report

Borehole Name:	KLX29A
Mapping Name:	KLX29A_Geosigma_1
Mapping Range:	4.001 - 60.250 m
Diameter:	76.0 mm
Printed Range:	4.000 - 59.168
Pages:	4

Image File Information:

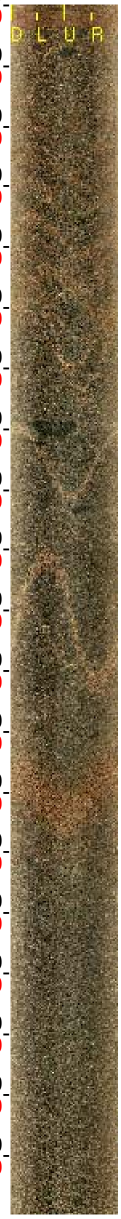
File:	G:\skb\bips\oskarshamn\KLX29A\KLX29A.BIP
Date/Time:	2006-11-07 09:29:00
Start Depth:	4.000 m
End Depth:	59.168 m
Resolution:	1.00 mm/pixel (depth)
Orientation:	Gravmetric
Image height:	55168 pixels
Image width:	360 pixels
BIP Version:	BIP-III
Locality:	LAXEMAR
Borehole:	KLX29A
Scan Direction:	Down
Color adjust:	0 0 0 (RGB)

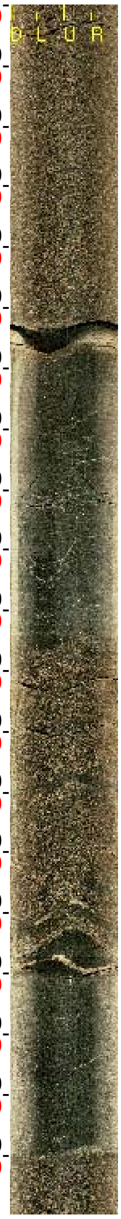
Printed: 2006-11-22 14:40:31 Scale: 1 : 20 Aspect: 150 %

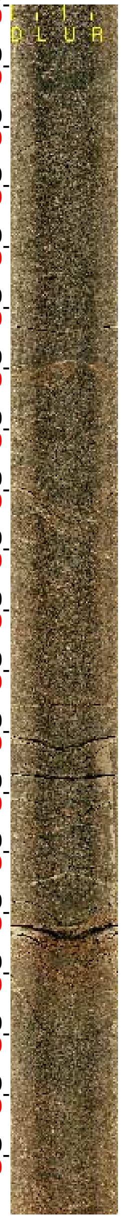
Borehole: KLX29A
Mapping: KLX29A_Geosigma_1

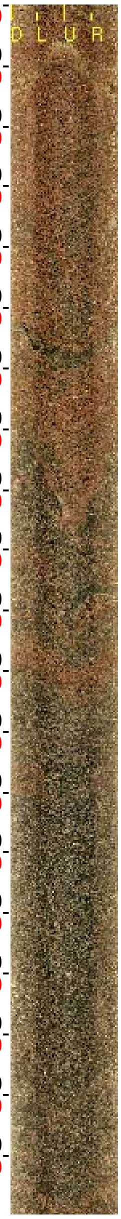
Depth range: 4.000 - 24.000 m
Azimuth: 0.0
Inclination: -90.0

4.000	8.000 / 8.000	12.000 / 12.000	16.000 / 16.000	20.000 / 20.000
4.200 / 4.200	8.200 / 8.200	12.200 / 12.200	16.200 / 16.200	20.200 / 20.200
4.400 / 4.400	8.400 / 8.400	12.400 / 12.400	16.400 / 16.400	20.400 / 20.400
4.600 / 4.600	8.600 / 8.600	12.600 / 12.600	16.600 / 16.600	20.600 / 20.600
4.800 / 4.800	8.800 / 8.800	12.800 / 12.800	16.800 / 16.800	20.800 / 20.800
5.000 / 5.000	9.000 / 9.000	13.000 / 13.000	17.000 / 17.000	21.000 / 21.000
5.200 / 5.200	9.200 / 9.200	13.200 / 13.200	17.200 / 17.200	21.200 / 21.200
5.400 / 5.400	9.400 / 9.400	13.400 / 13.400	17.400 / 17.400	21.400 / 21.400
5.600 / 5.600	9.600 / 9.600	13.600 / 13.600	17.600 / 17.600	21.600 / 21.600
5.800 / 5.800	9.800 / 9.800	13.800 / 13.800	17.800 / 17.800	21.800 / 21.800
6.000 / 6.000	10.000 / 10.000	14.000 / 14.000	18.000 / 18.000	22.000 / 22.000
6.200 / 6.200	10.200 / 10.200	14.200 / 14.200	18.200 / 18.200	22.200 / 22.200
6.400 / 6.400	10.400 / 10.400	14.400 / 14.400	18.400 / 18.400	22.400 / 22.400
6.600 / 6.600	10.600 / 10.600	14.600 / 14.600	18.600 / 18.600	22.600 / 22.600
6.800 / 6.800	10.800 / 10.800	14.800 / 14.800	18.800 / 18.800	22.800 / 22.800
7.000 / 7.000	11.000 / 11.000	15.000 / 15.000	19.000 / 19.000	23.000 / 23.000
7.200 / 7.200	11.200 / 11.200	15.200 / 15.200	19.200 / 19.200	23.200 / 23.200
7.400 / 7.400	11.400 / 11.400	15.400 / 15.400	19.400 / 19.400	23.400 / 23.400
7.600 / 7.600	11.600 / 11.600	15.600 / 15.600	19.600 / 19.600	23.600 / 23.600
7.800 / 7.800	11.800 / 11.800	15.800 / 15.800	19.800 / 19.800	23.800 / 23.800









Printed: 2006-11-22 14:40:31 Scale: 1 : 20 Aspect: 150 % 2 (4)

Borehole: KLX29A
Mapping: KLX29A_Geosigma_1

Depth range: 24.000 - 44.000 m
Azimuth: 0.0
Inclination: -90.0

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
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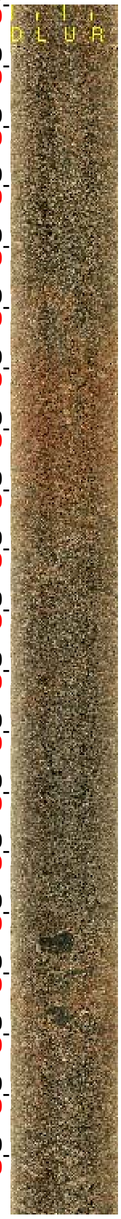

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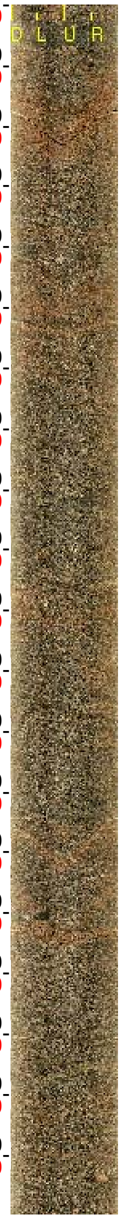

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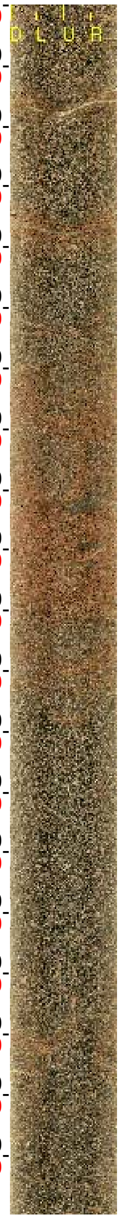

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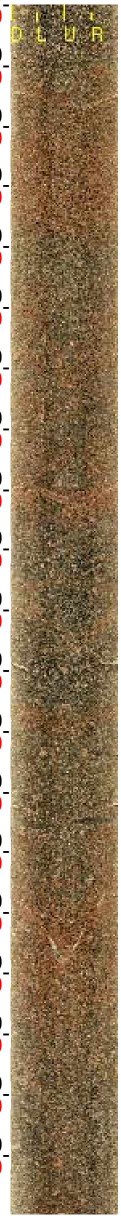

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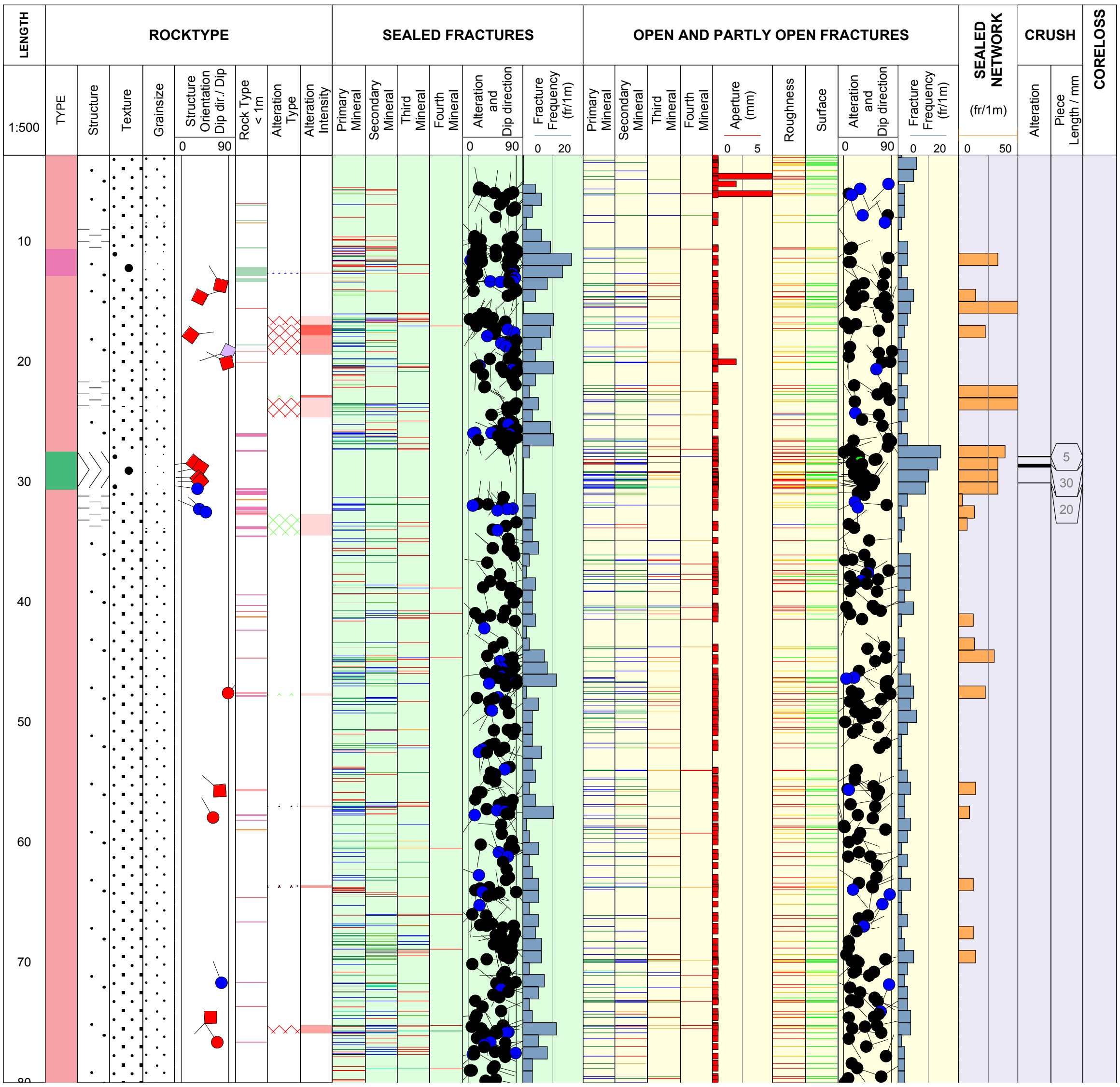
Borehole: KLX29A
Mapping: KLX29A_Geosigma_1

Depth range: 44.000 - 59.168 m
Azimuth: 0.0
Inclination: -90.0

Printed: 2006-11-22 14:40:31 Scale: 1 : 20 Aspect: 150 % 4 (4)

A. WellCad diagram of KLX28A

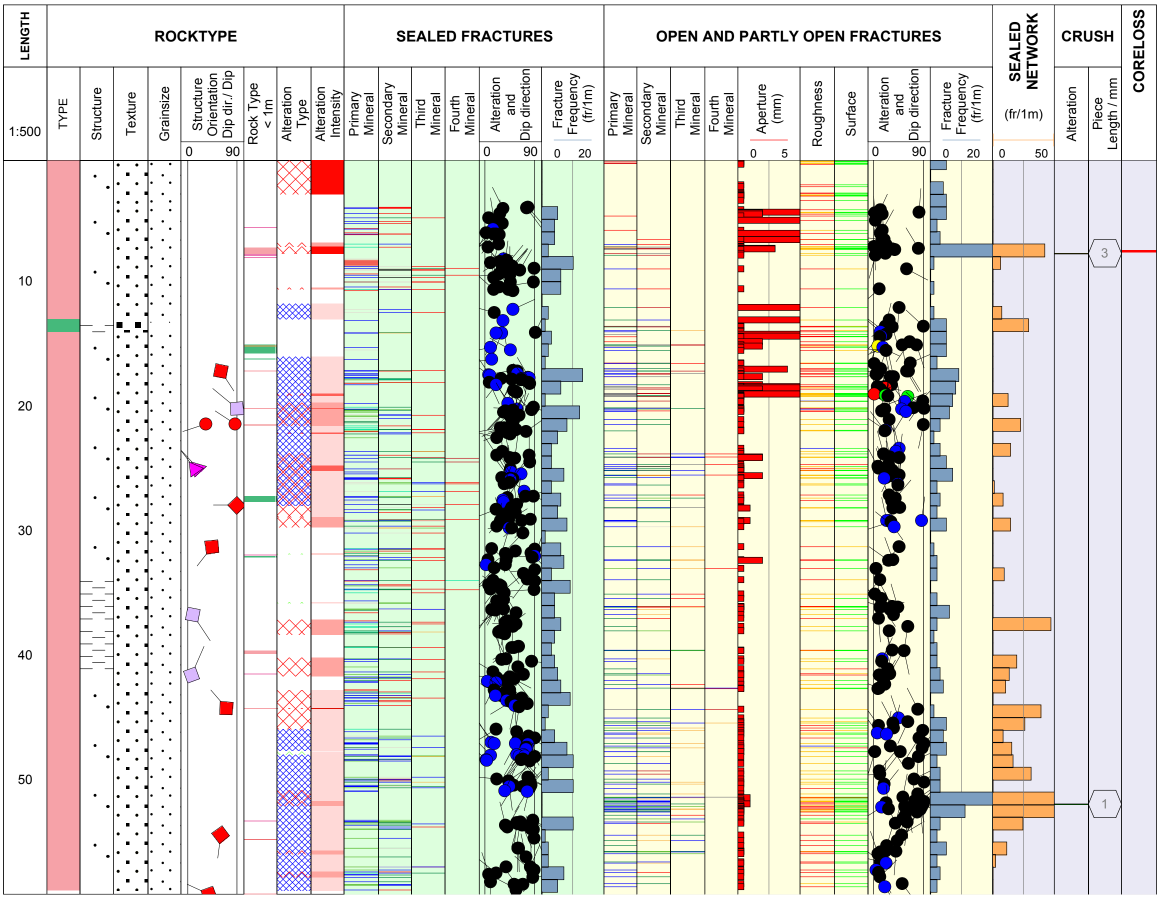
Title	**GEOLOGY IN KLX28A**	**Appendix:**	
Site	LAXEMAR	**Coordinate System**	RT90-RHB70
Borehole	KLX28A	**Northing [m]**	6365682.22
Diameter [mm]	76	**Easting [m]**	1549333.71
Length [m]	80.230	**Elevation [m.a.s.l.]**	10.05
Bearing [°]	189.70	**Drilling Start Date**	2006-09-14 16:00:00
Inclination [°]	-60.05	**Drilling Stop Date**	2006-09-20 08:55:00
Date of coremapping	2006-11-14 08:32:00	**Plot Date**	2007-10-25 22:03:45
Rocktype data from	p_rock	**Signed data**	



B. WellCad diagram of KLX29A

Title GEOLOGY IN KLX29A **Appendix:**

Site	LAXEMAR	**Coordinate System**	RT90-RHB70
Borehole	KLX29A	**Northing [m]**	6366264.54
Diameter [mm]	76	**Easting [m]**	1549443.99
Length [m]	60.250	**Elevation [m.a.s.l.]**	13.63
Bearing [°]	321.21	**Drilling Start Date**	2006-09-09 10:00:00
Inclination [°]	-60.90	**Drilling Stop Date**	2006-09-13 11:40:00
Date of coremapping	2006-11-16 15:34:00	**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	KLX28A, KLX29A

SKB

Site	LAXEMAR
Borehole	KLX28A, KLX29A
Plot Date	2006-11-23 23:04:30
Signed data	

ROCKTYPE LAXEMAR

- Äspö Diorite
- Dolerite / Diabas
- 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

ROCK ALTERATION TYPE

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

MINERAL

- Epidote
- Calcite
- Chlorite
- Quartz
- Unknown
- Pyrite
- Clay Minerals
- Zeolite
- Prehnite
- Oxidized Walls

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

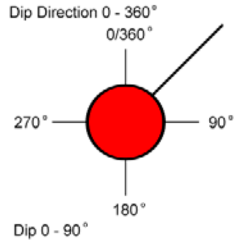
- Slightly Altered
- Moderately Altered
- Highly Altered
- Completley Altered
- Gouge
- Fresh

FRACTURE ALTERATION

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

FRACTURE DIRECTION

STRUKTURE ORIENTATION



A. In-data: Borehole length and diameter for KLX28A

KLX28A, 2006-09-14 16:00:00 - 2006-09-20 08:55:00 (0.300 - 80.230 m)

Sub Secup (m)	Sub Seclow (m)	Hole Diam (m)	Comment
0.300	2.850	0.1160	Jordborrning
2.850	5.100	0.0960	HQ
5.100	80.230	0.0758	N/3 Corac

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B. In-data: Borehole length and diameter for KLX29A

KLX29A, 2006-09-09 10:00:00 - 2006-09-13 11:40:00 (0.300 - 60.250 m)

Sub Secup (m)	Sub Seclow (m)	Hole Diam (m)	Comment
0.300	2.350	0.0960	HQ
2.350	60.250	0.0758	N/3 Corac

Printout from SICADA 2006-11-22 14:33:22.

In-data Reference marks for length adjustments for KLX28A

KLX28A, 2006-09-20 16:55:00 - 2006-09-20 18:10:00 (50.000 - 50.000 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	38.0	30			Släppte kulan kl 18:15

Printout from SICADA 2006-11-14 08:27:13.

A. In-data: Borehole deviation data for KLX28A

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
KLX28A	RT90-RHB70	6365682.22	1549333.71	10.05	0.00	0.00	-60.06	189.70	0.040	1.516	0.00	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365680.74	1549333.46	7.45	3.00	2.60	-60.06	189.70	0.040	1.516	0.04	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365679.26	1549333.21	4.85	6.00	5.20	-60.05	189.94	0.040	1.516	0.08	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365677.79	1549332.94	2.25	9.00	7.80	-60.01	190.19	0.040	1.516	0.12	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365676.31	1549332.68	-0.34	12.00	10.40	-59.93	190.43	0.040	1.516	0.16	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365674.83	1549332.40	-2.94	15.00	12.99	-59.86	190.68	0.040	1.516	0.20	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365673.35	1549332.12	-5.53	18.00	15.58	-59.75	190.92	0.040	1.516	0.24	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365671.86	1549331.84	-8.12	21.00	18.17	-59.70	190.28	0.040	1.516	0.28	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365670.37	1549331.58	-10.71	24.00	20.76	-59.61	189.23	0.040	1.516	0.32	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365668.87	1549331.34	-13.30	27.00	23.35	-59.56	188.95	0.040	1.516	0.36	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365667.37	1549331.11	-15.88	30.00	25.94	-59.47	188.65	0.040	1.516	0.40	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365665.86	1549330.89	-18.47	33.00	28.52	-59.43	187.60	0.040	1.516	0.44	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365664.34	1549330.69	-21.05	36.00	31.10	-59.38	187.60	0.040	1.516	0.48	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365662.83	1549330.47	-23.63	39.00	33.68	-59.28	189.04	0.040	1.516	0.52	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365661.31	1549330.22	-26.21	42.00	36.26	-59.15	189.46	0.040	1.516	0.56	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365659.80	1549329.96	-28.78	45.00	38.83	-59.09	190.17	0.040	1.516	0.60	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365658.28	1549329.69	-31.36	48.00	41.41	-58.98	190.17	0.040	1.516	0.64	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365656.75	1549329.44	-33.93	51.00	43.98	-58.95	188.45	0.040	1.516	0.68	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365655.22	1549329.21	-36.49	54.00	46.55	-58.86	188.35	0.040	1.516	0.73	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365653.68	1549328.99	-39.06	57.00	49.11	-58.73	188.30	0.040	1.516	0.77	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365652.14	1549328.75	-41.62	60.00	51.67	-58.61	189.24	0.040	1.516	0.81	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365650.59	1549328.51	-44.18	63.00	54.23	-58.50	188.74	0.040	1.516	0.85	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365649.04	1549328.27	-46.74	66.00	56.79	-58.42	188.38	0.040	1.516	0.89	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365647.48	1549328.04	-49.29	69.00	59.35	-58.39	188.36	0.040	1.516	0.93	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365645.93	1549327.81	-51.85	72.00	61.90	-58.29	188.36	0.040	1.516	0.97	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365644.36	1549327.60	-54.40	75.00	64.45	-58.22	187.50	0.040	1.516	1.02	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365642.80	1549327.40	-56.95	78.00	67.00	-58.18	187.00	0.040	1.516	1.06	Measured	2007-02-06 08:40
KLX28A	RT90-RHB70	6365641.63	1549327.25	-58.84	80.23	68.89	-58.18	187.00	0.040	1.516	1.09	Measured	2007-02-06 08:40

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B. In-data: Borehole deviation data for KLX29A

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
KLX29A	RT90-RHB70	6366264.54	1549443.99	13.63	0.00	0.00	-60.91	321.21	0.080	0.865	0.00	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366265.68	1549443.07	11.01	3.00	2.62	-60.81	321.21	0.080	0.865	0.02	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366266.82	1549442.16	8.39	6.00	5.24	-60.79	321.81	0.080	0.865	0.04	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366267.98	1549441.26	5.77	9.00	7.86	-60.70	322.42	0.080	0.865	0.07	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366269.15	1549440.37	3.16	12.00	10.47	-60.63	323.02	0.080	0.865	0.09	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366270.33	1549439.49	0.54	15.00	13.09	-60.57	323.63	0.080	0.865	0.11	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366271.51	1549438.61	-2.07	18.00	15.70	-60.50	323.28	0.080	0.865	0.13	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366272.70	1549437.73	-4.68	21.00	18.31	-60.47	323.63	0.080	0.865	0.16	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366273.90	1549436.86	-7.29	24.00	20.92	-60.42	323.93	0.080	0.865	0.18	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366275.10	1549435.99	-9.90	27.00	23.53	-60.33	324.37	0.080	0.865	0.20	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366276.31	1549435.12	-12.50	30.00	26.13	-60.28	324.40	0.080	0.865	0.22	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366277.52	1549434.26	-15.11	33.00	28.74	-60.19	324.51	0.080	0.865	0.25	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366278.73	1549433.39	-17.71	36.00	31.34	-60.08	324.47	0.080	0.865	0.27	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366279.95	1549432.52	-20.31	39.00	33.94	-59.99	324.47	0.080	0.865	0.29	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366281.18	1549431.65	-22.90	42.00	36.53	-59.87	324.76	0.080	0.865	0.31	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366282.42	1549430.79	-25.50	45.00	39.13	-59.77	325.63	0.080	0.865	0.34	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366283.66	1549429.93	-28.09	48.00	41.72	-59.70	325.63	0.080	0.865	0.36	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366284.91	1549429.07	-30.68	51.00	44.31	-59.57	324.86	0.080	0.865	0.38	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366286.15	1549428.19	-33.26	54.00	46.89	-59.47	324.26	0.080	0.865	0.40	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366287.39	1549427.29	-35.84	57.00	49.47	-59.40	324.08	0.080	0.865	0.43	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366288.62	1549426.40	-38.43	60.00	52.06	-59.33	323.84	0.080	0.865	0.45	Measured	2007-02-06 08:40
KLX29A	RT90-RHB70	6366288.73	1549426.32	-38.64	60.25	52.27	-59.33	323.84	0.080	0.865	0.45	Measured	2007-02-06 08:40

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