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Oskarshamn site investigation

Boremap mapping of core drilled boreholes KLX05

Jan Ehrenborg, Mirab Mineral Resurser AB

Peter Dahlin, Geosigma AB

December 2005

Svensk Kärnbränslehantering AB

Swedish Nuclear Fuel
and Waste Management Co
Box 5864

SE-102 40 Stockholm Sweden

Tel 08-459 84 00

+46 8 459 84 00

Fax 08-661 57 19

+46 8 661 57 19



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Keywords: KLX05, Geology, Drill core mapping, Boremap, Fractures, Simpevarp, BIPS.

This report concerns a study which was conducted for SKB. The conclusions and viewpoints presented in the report are those of the authors and do not necessarily coincide with those of the client.

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Abstract

Borehole KLX05 is a deep (~ 1,000 m) cored borehole, drilled within the site investigation program in the Oskarhamn area since 2003. The borehole was drilled between October 2004 and January 2005. The drill core of KLX05 covers the interval 100–1,000 m, while the uppermost 100 m was percussion drilled.

Rock types, alterations, fractures and other structures were studied using the drill core and BIPS-images and the information was documented in the software Boremap. All these data will be used in further interpretation of the bedrock conditions in the area down to a depth of approximately 1,000 m.

KLX05 is in the interval 100–475 m made up of a rock sequence with frequently alternating Ävrö granite (501044), granite (501058), fine-grained granite (511058), diorite/gabbro (501033) and fine-grained dioritoid (501030). The interval 475–995 m in KLX05 is almost exclusively made up of quartz monzodiorite (501036), with the exception of fine-grained granite (511058) in the interval 690–750 m. The subdivision of KLX05 is principally based on lithological variations since geological structures and fractures do not show any pronounced frequency maxima. These sections are; section I: 100–325 m, section II: 325–475 m, section III: 475–650 m, section IV: 650–815 m, section V: 815–995 m.

KLX05 does not show any outstanding geological features except for the frequently alternating lithology in the upper half of the bore hole.

Sammanfattning

KLX05 är ett djupt (ca 1 000 m) kärnborrhål som borrats inom ramen för Platsundersökningen i Oskarshamnsområdet, sedan 2003. Borrhålet borrades i Laxemar under slutet av 2004 och början av 2005. KLX05 är ungefär 1 000 m långt. De översta 100 m är hammarborrade, medan 100–1 000 m är kärnborrade.

Bergarter, omvandlingar, sprickor och andra strukturer dokumenterades med hjälp av borrhäls- och BIPS-bild och matades in i Boremap. Dessa data kommer att användas som underlag vid tolkningar och modelleringar av berggrunden ner till 1 000 meters djup.

Övre delen av KLX05, 100–475 m, utgörs av växlande litologi bestående av Ävrögranit (501044), granit (501058), finkornig granit (511058), diorit-gabbro (501033) och finkornig dioritoid (501030). Intervallet 475–995 m består nästan enbart av kvarts-monozodiorit (501036) med undantaget en finkornig granit (511058) i intervallet 690–750 m. Sektioneringen av KLX05 har i huvudsak gjorts utifrån litologiska variationer, eftersom andra egenskaper inte har varit till hjälp. De litologiska sektionerna är enligt följande; sektion I: 100–325 m, sektion II: 325–475 m, sektion III: 475–650 m, sektion IV: 650–815 m och sektion V: 815–995 m.

KLX05 har inga framträdande geologiska drag förutom den stora variationen i litologi i borrhälsens övre del.

Contents

1	Introduction	7
2	Objective and scope	9
3	Equipment	11
3.1	Description of Software	11
3.2	Other equipment	11
3.3	BIPS-image video film sequences	11
3.4	BIPS-image video film quality	11
3.4.1	BIPS-image resolution	11
3.4.2	BIPS-image contrast	11
3.4.3	BIPS-image quality	12
4	Execution	13
4.1	General	13
4.2	Preparations	13
4.3	Execution of measurements	13
4.3.1	Fracture definitions	13
4.3.2	Fracture alteration and joint alteration number	14
4.3.3	Mapping of fractures not visible in the BIPS-image	15
4.3.4	Definition of veins and dikes	15
4.3.5	Mineral codes	16
4.4	Data handling	16
4.5	Geological Summary table, general description	16
4.5.1	Columns in the Geological Summary table	17
5	Results	19
5.1	Geological Summary table, KLX05	19
5.2	Orientation of broken fractures	21
5.3	Fracture mineralogies	21
6	Discussion	23
Appendix 1	Geological Summary table, KLX05	25
Appendix 2	Search paths for the Geological Summary table	27
Appendix 3	Stereographic projections of open fractures, KLX05	29
Appendix 4	BIPS-images of KLX05	31
Appendix 5	WellCad diagram of KLX05	69
Appendix 6	In-data: Borehole length and diameter for KLX05	75
Appendix 7	In-data: Deviation data for KLX05	77
Appendix 8	In-data: Reference marks for length adjustments for KLX05	85

1 Introduction

This document reports the data gained by Boremap mapping of the borehole within the Laxemar area, which is one of the activities performed within the site investigation in the Oskarshamn area. The work was carried out in accordance with activity plan AP PS 400-05-018. In Table 1-1 controlling documents for performing this activity are listed. Both activity plan and method descriptions are SKB's internal controlling documents.

Since 2002, SKB investigates two potential sites for a deep deposition of nuclear waste in the Swedish Precambrian basement at approximately 500 m depth. These places are Forsmark in northern Uppland and Simpevarp/Laxemar area in eastern Småland. In order to make a preliminary evaluation of the rock mass down to a depth of about 1 km at these sites, SKB has initiated a drilling program using core drilled boreholes.

The borehole KLX05 was drilled in 2005 and the borehole is situated within the Laxemar area (Figure 1-1). KLX05 is telescopic, which means that the uppermost 100 m was drilled by percussion drilling followed by core drilling (100–1,000 m). No drill core thus exists for the uppermost 100 m.

Detailed mapping of the drill cores is essential for a three dimensional understanding of the geology at depth. The mapping is based on the use of so called BIPS-images of the borehole wall and by the study of the drill core itself. The BIPS-images enable the study of orientations, since the Boremap software calculates strike and dip of planar structures such as foliations, rock contacts and fractures. Also the fracture apertures in the rock can be estimated.

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

Activity plan	Number	Version
Boremapkartering av KLX05	AP PS 400-05-018	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

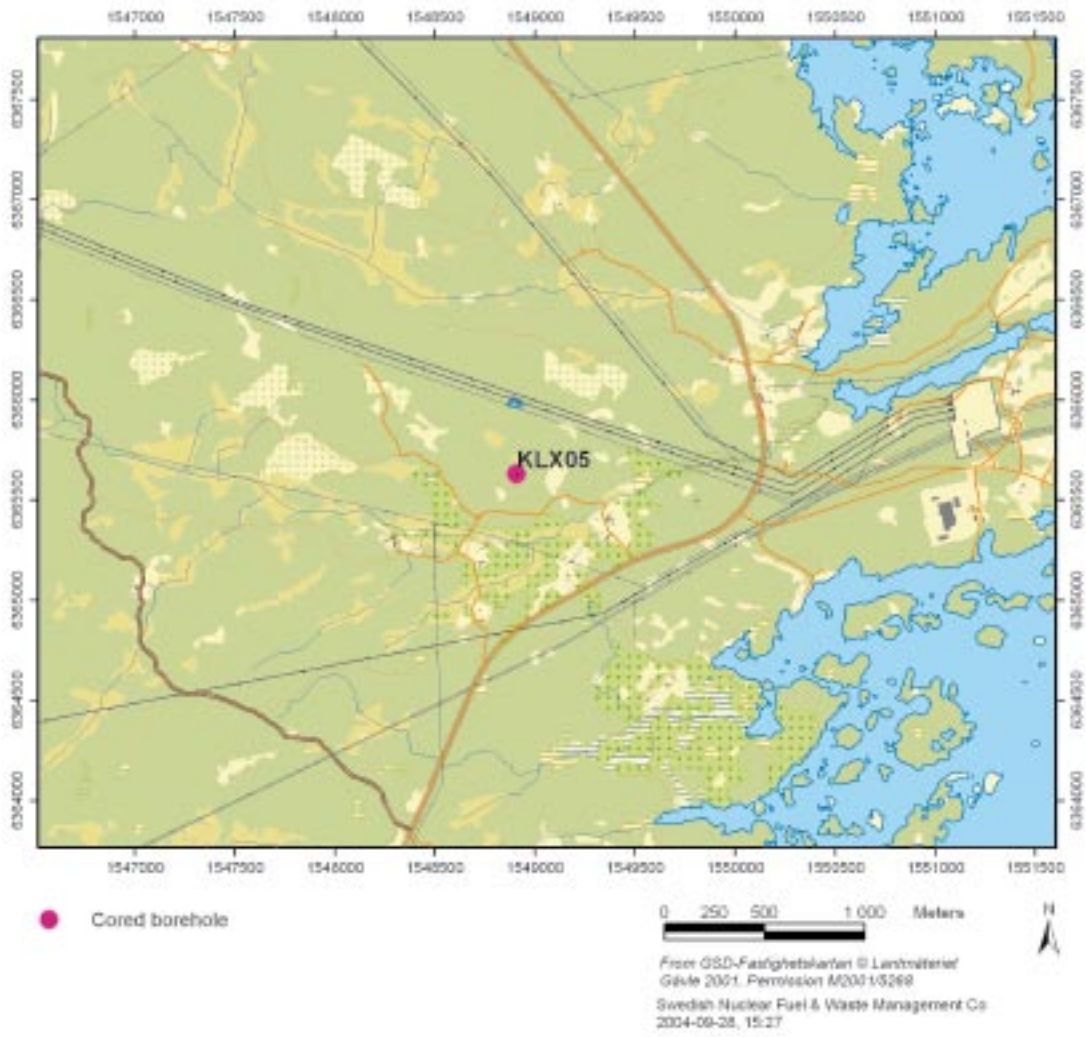


Figure 1-1. Location of the core drilled borehole KLX05.

2 Objective and scope

The principal aim of the mapping activities presented in this report is to obtain a detailed documentation of geological structures and lithologies intersecting borehole KLX05. Geological structures will be correctly oriented in space along the borehole. The results will serve as a platform for forthcoming investigations of the drill core, as well as various site descriptive modelling.

3 Equipment

3.1 Description of Software

The mapping was performed in Boremap v. 3.6, with bedrock and mineral standards of SKB. The final data presentation was made using StereoNet, WellCad v. 4, and BIPS Image Print.

Boremap is the software that unite orthodox core mapping with modern video mapping. The software deals with the mapping data as well as the internal communication between programs. Boremap shows the video 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 was used to facilitate the core mapping: folding rule and pen, hydrochloric acid, knife, water-filled atomizer and hand lens.

3.3 BIPS-image video film sequences

The BIPS video film of KLX05 covers the interval 108 – 991m.

3.4 BIPS-image video film quality

The main reasons why thinner fractures are visible or not in the BIPS-image are image resolution, image contrast and image quality.

3.4.1 BIPS-image resolution

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

3.4.2 BIPS-image contrast

Thicker fractures are always visible in both drill core and the BIPS-image. However, the visibility of thinner fractures depends strongly on the colour contrast between the fracture and the wall rock.

A light coloured fracture in a dark rock is easily visible in the BIPS-image. A light 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 the rare case 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. Such fractures were given the mineral code X9 in first mineral fill.

3.4.3 BIPS-image quality

The BIPS-image quality is sometimes limited by disturbances such as:

- 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 right angle to the drill core related to the automatic aperture of the video camera,
- 4) vertical enlargements of pixels due to stick-slip movement of the camera probe.

Problems related to the video camera aperture and the enlargement of pixels are can be neglected in KLX05.

The main disturbances for the BIPS-image quality in KLX05 are vertical bleached bands but also blackish coatings.

The image quality is classified into four classes; good, acceptable, bad and very bad. With good quality means a more or less clear, easy to interpret the image. With acceptable quality means that the image is not really good, but that the mapping can be performed without problems. An image with bad quality is somewhat difficult to interpret and an image with very bad quality cannot be interpreted and only very obvious and outstanding features can be mapped. It should be remembered that even if only 10–20% of the image is visible this is often enough for an acceptable interpretation. When the BIPS-image quality is so bad that fractures and structures can not be identified in the BIPS-image, they can still be oriented using the *guide-line method* (Section 4.3.3). Better cleaning of the borehole could increase the mapping quality drastically. The BIPS-image quality in KLX05 is presented in Table 3-1.

Table 3-1. BIPS-image quality.

Sec up (m)	Sec low (m)	Interval (m)	Quality
108	310	202	Good – Acceptable
310	460	150	Acceptable – Bad
460	490	30	Good – Acceptable
490	550	60	Acceptable – Bad
550	585	35	Good – Acceptable
585	620	55	Acceptable – Bad
620	650	30	Good – Acceptable
650	860	210	Acceptable – Bad
860	875	15	Bad – Very Bad
875	995	120	Acceptable – Bad

4 Execution

4.1 General

The Boremap-mapping of the telescopic drilled borehole KLX05 was performed and documented according to activity plan AP PS 400-05-018 (SKB, internal document) referring to the Method Description for Boremap mapping (SKB MD 143.006, v.2.0, SKB, internal controlling document).

The first 100 m of KLX05 was drilled by percussion drilling and therefore no drill core was received. The core to borehole KLX05 covers the interval 100.40–1,000.16 m.

The whole drill core was displayed on inclined roller tables in its entire length and mapped with the Boremap system at Simpevarp. The core mapping was carried out without any detailed geological knowledge of the area but with access to geophysical logs.

Generalized geophysical logs were available during Boremap mapping of the borehole.

The mapping was performed by Jan Ehrenborg (Mírab Mineral Resurser AB) 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. This problem was eliminated by adjusting the depth according to reference slots cut into the borehole every fiftieth meter (Appendix 10). The level for each slot was measured in the BIPS-images and then adjusted to the correct level using the correct depth value from the SICADA database.

The different orientations of the observations were adjusted to true space. Data necessary for this adjustment were borehole diameter and deviation; both collected from SICADA database (Appendices 8 and 9).

4.3 Execution of measurements

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

4.3.1 Fracture definitions

Definition of different fracture types, also crush and sealed fracture network, are found in a PM “Nomenklatur vid boremapkartering” (internal SKB document). Apertures for broken fractures have been mapped in accordance with the definitions in this PM.

In the mapping phase, fractures that split the core are mapped as BROKEN and fractures that have not parted the core are mapped as UNBROKEN. All fractures are described with their fracture minerals and other characteristics, such as 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. Core pieces with bad fit are characterized as “probable aperture” and fractures with good fit but a dull or altered surface as “possible aperture”.

All fractures that possess apertures > 0 mm, are in SICADA database interpreted as OPEN. Only few BROKEN fractures are given the aperture = 0 mm. UNBROKEN fractures usually have apertures = 0 mm. If UNBROKEN fractures possess apertures > 0 mm, they are interpreted as partly open and included in the OPEN-category. OPEN and SEALED fractures are finally frequency calculated and shown in (Appendices 1 and 5).

4.3.2 Fracture alteration and joint alteration number

The joint alteration number is principally related to the thickness of, and the clay content in, a fracture. Thicker fractures rich in clay minerals therefore get joint alteration numbers 2–3. The majority of the fractures in the core are very thin to extremely thin and seldom contain clay minerals and therefore receive a 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 and is 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 were considered as fresh. The joint alteration number is thus set to 1.

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

Joint alteration number equal to 1.5: Minerals as epidote, prehnite, hematite, chlorite and/or clay minerals is regarded as fracture minerals most likely resulting from altered wall rock material. A weak alteration is thus assumed and the joint alteration number is 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 thicker and contain a few mm thick bands of clay minerals, often together with minerals like epidote and chlorite, the joint alteration number is set to 2. In rare cases, when a fracture contains 5–10 mm thick clayey bands, 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 were 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:

- Absolute depth.
- Amplitude (measured along the drill core). The amplitude is the interval along a drill core which is cut by a fracture, i.e. from upper to lower extremes of a fracture 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.

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. Anyhow, the *guide-line method* is so far considered better than only marking fractures that are non-visible in the BIPS-images as planes perpendicular to the borehole. 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.

When using the *guide-line method* the difference between the 50 mm drill core diameter and the 76 mm borehole diameter must be considered. This difference result in displacements of the structures seen in the drill core compared with the structures seen in the BIPS-image which represents the borehole walls. This displacement is zero for structures that cut the drill core at right angle and successively becomes larger as the orientation of the structure approximates the direction of the drill core axis. This displacement always has to be corrected for, since displacements of a few cm are common even if they seldom reach 10 cm.

Orientation of fractures and other structures with the *guide-line method* is performed in the following way: The first step in the guide-line method is to correct the amplitude of the fracture trace in the BIPS-image to the higher amplitude value. 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 is then located at the correct depth according to the depth measured on the drill core.

The *guide-line method* can be used to orientate any fracture/structure that is not visible or 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 fracture/structure as the personnel delineating the fracture trace in the BIPS-image, especially in intervals rich in fractures.

4.3.4 Definition of veins and dikes

Veins and dykes are differentiated by their respectively width. Veins are set to 0–20 cm wide and dykes are set to 20–100 cm wide. Since the maximum width of *rock occurrence* is 100 cm wider dykes are mapped under the feature *rock type*.

4.3.5 Mineral codes

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

- X5 whitish, bleached feldspar.
- X6 the drill core is broken at right angle to the drill core and the broken surfaces have a polished appearance. This is believed to indicate that a sealed fracture broke up during drilling and where the two drill core parts have rotated against each other wearing away the mineral fill.
- X7 broken fracture with a fresh appearance and no mineral fill.
- X8 fractures with epidotized walls.
- X9 sealed fractures visible in the BIPS-image but not in the drill core.

4.4 Data handling

The mapping 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.

The mapping is 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. Only these data are to be used for further interpretation and modelling.

4.5 Geological Summary table, general description

The Geological Summary table (Appendix 1) is an overview of the geological parameters mapped with the Boremap system. It also facilitates comparisons between Boremap information collected from different boreholes and is more objective than a pure descriptive borehole summary.

The Geological Summary table is the result of cooperation between Jan Ehrenborg from the mapping personnel at Simpevarp and Pär Kinnbom from PO (site investigation, Simpevarp). The aim was to make a standard form in handy A4-size, where all information is taken directly from the SICADA database by using simple and well defined search paths for each geological parameter (Appendix 2).

The search paths are, however, yet not automatic and the geological information therefore has to be extracted from the SICADA database before it is reworked on separate Excel-files and finally presented in the Geological Summary table. At the moment it is only possible to extract the Rock Type and Alteration parameters directly from the SICADA database.

The main reason why the information in the SICADA database cannot be extracted automatically is the lack of a mathematical formula for calculation of frequencies for different parameters. Such a formula will be added.

The Geological summary table is made up of 23 columns, each one representing a specific geological parameter. The geological parameters are presented as either intervals or

frequencies. Intervals are calculated for parameters with a width ≥ 1 m and frequencies for parameters with a width < 1 m. Frequency information is treated as if it does not have any extension along the borehole axis. They are treated as point observations. It should be noted that parameters with a thickness of only 1 mm therefore has 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 oxidized walls and without mineral fillings in intervals mapped with *Alteration – oxidation*.
- No *unbroken fractures* are mapped in intervals of *sealed fracture network*.
- *Broken fractures* are usually not mapped in intervals with *crush*.
- Composite dykes generally include a large amount of fine to medium grained granite veins. These veins are not mapped and the frequency presented for veins + dykes in column 6 (Appendix 1) are lower than the true frequency in composite dyke 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 / Oxidation*, interval column. No frequency column is presented for alteration/oxidation. The alteration/oxidation column is 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 + Dykes < 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.

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 / Foliation < 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 / Foliation ≥ 1 m wide* is an interval column. Sections with foliation > 1 m wide are mapped as rock type/s

structure in Boremap.

Column 14: *Sealed fractures / All*, frequency column. This column includes all fractures mapped as unbroken in the Boremap system and this includes unbroken fractures where the drill core is not broken 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 were probably or possibly open before drilling.

Column 20: *Open fractures / Certain Aperture = 0.5 certain 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.

5 Results

The result of the Boremap mapping of KLX05 is principally found in the Appendices. The information from SICADA and Boremap database has been compressed to the size of an A4-sheet in the Geological Summary table, Appendix 1. The search paths for the Geological Summary table are presented in Appendix 2. Stereographic diagrams of the orientations of open fractures are presented in Appendix 3. The BIPS-image of KLX05 is shown in Appendix 4 and the corresponding WellCad diagram in Appendix 5. In-data, like borehole length, borehole diameter, borehole orientation data and are presented in Appendices 6, 7 and 8.

5.1 Geological Summary table, KLX05

The uppermost 450 m in KLX05 comprise a rock sequence with rapid lithological changes. The interval 450–1,000 m is almost exclusively made up of quartz monzodiorite (501036), with the exception of the interval 690–750 m, where fine-grained granite (511058) dominates.

Oxidized intervals occur through the whole borehole and are generally from a few metres up to 50 m in thickness and show strong variation in intensity. The strongest oxidation occurs in the interval 100–215 m.

Veins and dykes are common through the whole borehole, with exception of a stronger anomaly of veins and dykes which can be found in the interval 650–815 m.

Shear structures occur through the whole borehole and show a weak frequency maximum in the interval 480–620 m.

Only a few very thin breccias occur in KLX05.

Three thin mylonites occur in KLX05. Two of them are found in a strongly oxidized section in the interval 480–485 m.

Thin intervals with foliation are found through the whole borehole. The interval 650–815 m shows a stronger and more continuous foliation, compared to the rest of the borehole.

Neither sealed nor open fractures (interpreted) show pronounced frequency maxima in KLX05. The Geological Summary table, however, shows a weak increase in the fracture frequencies below 650 m and low frequency maxima for open fractures (interpreted) in the interval 690–710 m.

Neither sequences of high joint alteration numbers nor intervals with crush have been mapped in KLX05.

There is a strong uncertainty whether fractures that break the core were open in the bedrock or were opened during/after drilling. This is shown in column 19 (Open fractures interpreted, uncertain) and 20 (Open fractures interpreted, certain). The reason for the uncertainty is that the core has a tendency to break up along existing sealed fractures.

As can be seen in the Geological Summary table (Appendix 1) geological structures and fractures in KLX05 do not show pronounced frequency maxima that can be helpful when subdividing the borehole into sections. The subdivision of the core into five sections was thus based almost exclusively on lithological variations.

No well defined weakness zone of brittle character was mapped in KLX05.

Section I (100–325 m) shows frequent variation between 1–40 m thick parts of primarily Ävrö granite (501044), granite (501058) and fine-grained granite (511058). The interval 100–215 m shows the most continuous oxidation in KLX05.

Section II (325–475 m) shows the same frequent alternation of 1–35 m thick parts of different lithologies as in section I. The lithologies are, however, different: diorite/gabbro (501033) and small intervals of Ävrö granite (501044). This section is the least oxidized one in KLX05.

Section III (475–650 m) is strongly dominated by quartz monzodiorite (501036) which is interrupted by few thin veins and dykes of pegmatite. The interval 480–485 m shows a strong oxidation and contains two thin mylonites.

Section IV (650–815 m) is also dominated by the quartz monzodiorite (501036) but is interrupted by an occurrence of fine-grained granite (511058) in the interval 690–750 m. This section differs from the other sections in KLX05 by the occurrence of an almost continuous weak to strong foliation. The strong foliation is concentrated to the fine-grained granite (511058) in the interval 690–750 m.

Section V (815–995 m) is entirely made up of quartz monzodiorite (501044), except for two 1 m thick intervals of fine-grained dioritoid (501030) and pegmatite (501061) respectively.

All length information in this chapter is taken from the Geological Summary table (Appendix 1) and may therefore have an error of 5–10 m. The Geological Summary table for KLX05 is presented in Appendix 1. Rock types mapped in KLX05 are shown in Table 5-1.

Table 5-1. Rock types in KLX05.

%	Rock Type
49.2	501036 Quartz monzodiorite
17.3	501044 Ävrö granite
12.6	511058 Fine-grained granite
10.3	501033 Diorite/gabbro
7.8	501058 Granite
2.0	501061 Pegmatite
0.4	501030 Fine-grained dioritoid
0.4	505102 Fine-grained diorite-gabbro

5.2 Orientation of broken fractures

The orientation of broken fractures is presented in pole diagrams, one for each 100 m interval (see Appendix 3). Fracture orientation values are strike/dip values using the right hand rule.

The orientation of borehole KLX05 at ground level is 190/–65.

Broken fractures not visible in the BIPS-image were oriented according to the *guide-line method* (see Section 4.3.3).

There is a general strong overrepresentation of broken fractures cutting the borehole at high angles compared to fractures cutting the borehole at low angles. This results in artificially high anomaly values for fractures cutting the borehole at high angles and in semi circular distortion of anomaly shapes in the stereographic plots. These effects are stronger the longer the plotted depth interval. It is therefore not recommended to plot intervals longer than 100 m in the same stereogram.

A sub-horizontal fracture set (5–10°, rarely up to 25°) showing strong variation in strike occurs in the interval 100–500 m. The strongest anomalies occur in the intervals 100–200 m and 400–500 m.

A steeply dipping (80–90° dip) fracture set striking W-E to WNW-ESE occurs through the whole borehole. The dip changes to 75° in the interval 900–1,000 m.

Another steeply dipping fracture set (70–90° dip) strike NNW-SSE can be seen through the whole borehole.

The fourth and fifth important fracture sets in KLX05 strike NW-SE (WNW-ESE) and have moderate dip angles (20–40°, rarely 55° dip) towards NE and SW. These fracture sets occur in the interval 300–1,000 m.

A NE-striking fracture set with medium dip angles (20–45° dip) occur as weak anomalies in the interval 200–600 m with the exception of the interval 300–400 m with a strong anomaly.

The anomaly pattern for broken fractures in KLX05 is rather simple. The two steeply dipping fracture sets striking W-E to WNW-ESE and NNW-SSE clearly dominates the fracture orientations through the whole borehole.

5.3 Fracture mineralogies

Percentages of open fracture minerals are shown in Table 5-2 and percentages of sealed fracture minerals are shown in Table 5-3. The total amount of open fractures is 319 (average 0.361 open fractures per meter). The total amount of sealed fracture is 3,219 (average 3,643 sealed fractures per meter).

Table 5-2. Percentages of fracture minerals in open fractures, KLX05.

%	Mineral
30.7	Chlorite
30.5	Calcite
19.9	Clay Minerals
9.3	Pyrite
2.8	Epidote
2.8	Oxidized Walls
0.8	Quartz
0.4	Adularia
0.2	Hematite
0.2	Unknown Mineral
0.1	Iron Hydroxide
0.1	Sericite

Table 5-3. Percentages of mineral fillings in sealed fractures in KLX05.

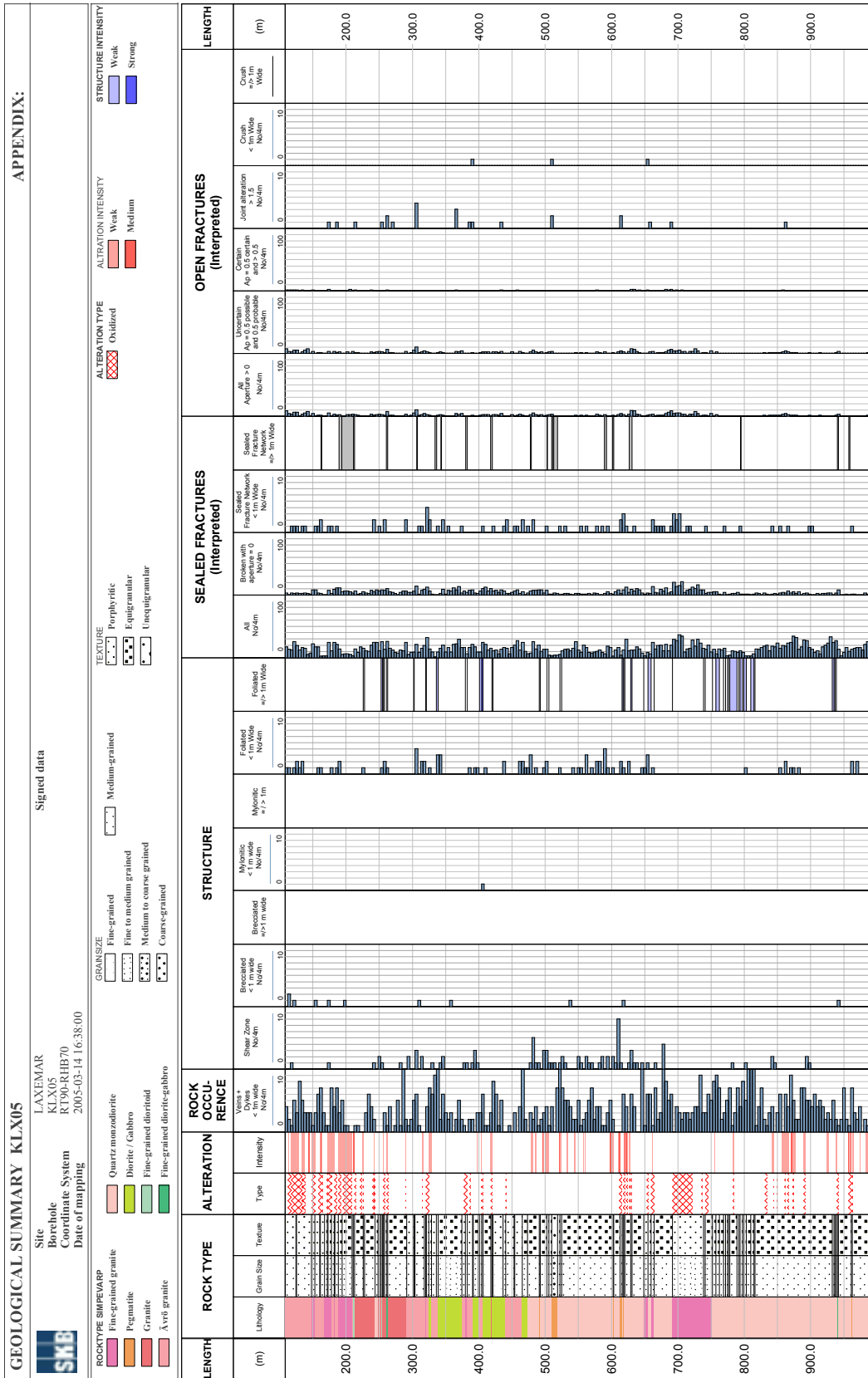
%	Mineral
22.8	Calcite
20.7	Chlorite
12.6	Quartz
12.3	Oxidized Walls
9.3	Epidote
5.8	Pyrite
5.5	Clay Minerals
2.0	Adularia
0.6	White Feldspar

6 Discussion

The mapping of KLX05 has been executed in the same way as earlier mapped boreholes with the exception of *width* for fractures, structures and veins. The width in these cases was earlier measured on the drill core but in KLX05 it was measured in the BIPS-image when possible. However, if the measured fracture width was thinner in the BIPS-image than in the drill core, the width measured on the drill core was used.

Appendix 1

Geological Summary table, KLX05



Search paths for the Geological Summary table

TABLE HEAD LINES		INFORMATION SOURCE		PRESENTATION
Head lines	Sub head lines	Varcode	First suborder	Second suborder
Rock type	Lithology	5	Sub 1	
	Grain size	5	Sub 5	
	Texture	5	Sub 6	
Alteration	Oxidation	7	Sub 1 = 700	
	Oxidation intensity	7	Sub 1 = 700	Sub 2
Rock occurrence Structure	Vein + dyke	31	Sub 1 = 2 or 18	
	Shear zone	31	Sub 4 = 41 or 42	
	Brecciated, < 1m wide	31	Sub 4 = 7	
	Brecciated, >/= 1m wide	5 5	Sub 3 = 7 Sub 3 = 7	Sub 4; 101 or 102 = 102 Sub 4; 103 or 104 = 104
Sealed fracture	Mylonite, < 1 m wide	31	Sub 4 = 34	
	Mylonite, >/= 1 m wide	5 5	Sub 3 = 34 Sub 3 = 34	Sub 4; 101 or 102 = 102 Sub 4; 103 or 104 = 104
	Foliation zone, < 1 m wide	31	Sub 4 = 81	
	Foliation zone, >/= 1 m wide	5 5	Sub 3 = 81 Sub 3 = 81	Sub 4; 101 or 102 = 102 Sub 4; 103 or 104 = 104
	All unbroken fractures and broken fractures	3		
	Broken fractures, Aperture = 0	2	SNUM 11= 0	
	Sealed fracture network < 1 m wide	32		
	Sealed fracture network >/= 1 m wide	32		
	All, Aperture > 0	2 and 3	SNUM 11>0	
	Uncertain, Aperture = 0.5 possible and 0.5 probable	2 and 3	SNUM 11>0	Sub 12 = 3
Open fractures	Certain, Aperture = 0.5 certain	2 and 3	SNUM 11>0	Sub 12 = 2
	Joint alteration > 1.5	2	SNUM16 > 1.5	Sub 12 = 1
	Crush < 1 m wide	4		
	Crush >/= 1 m wide	4		

Stereographic projections of open fractures, KLX05

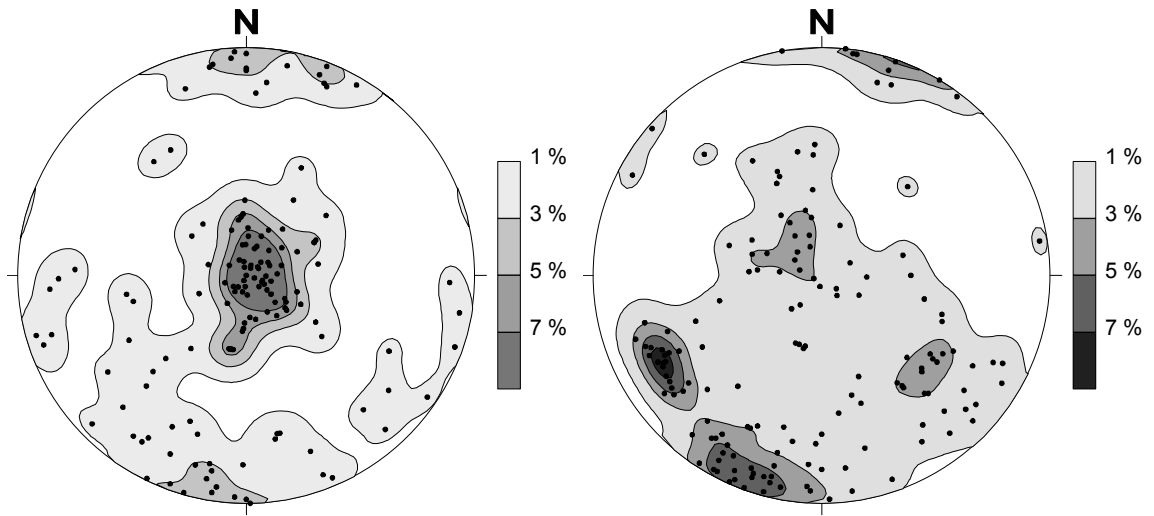


Figure 1: Broken fractures 100-200m (n=152) **Figure 2: Broken fractures 200-300m (n=157)**

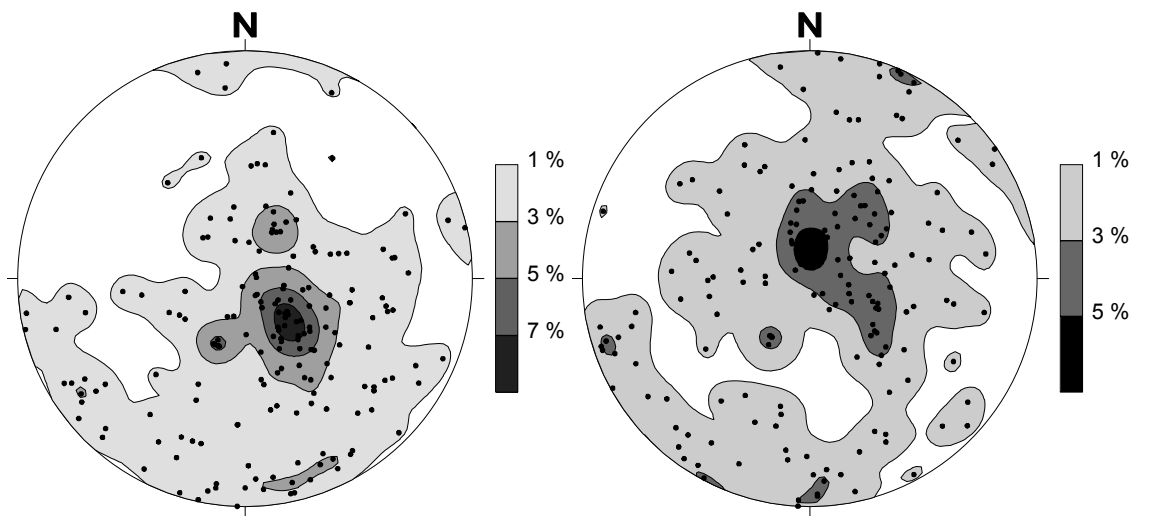


Figure 3: Broken fractures 300-400m (n=188) **Figure 4: Broken fractures 400-500m (n=182)**

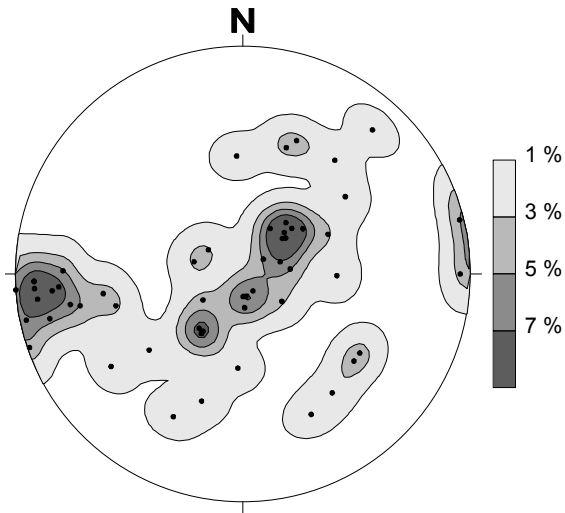


Figure 5: Broken fractures 500-600m (n=56)

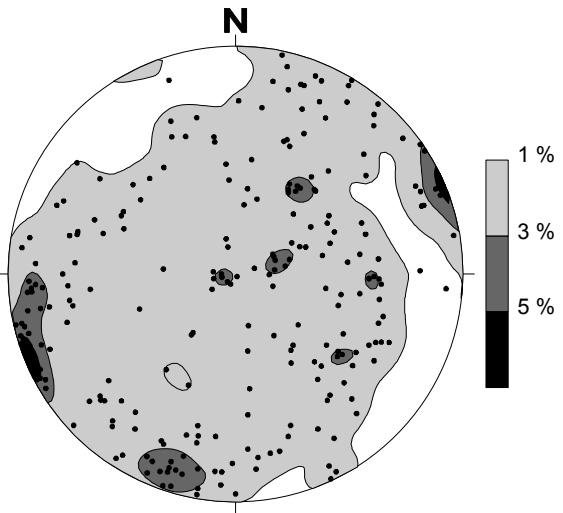


Figure 6: Broken fractures 600-700m (n=249)

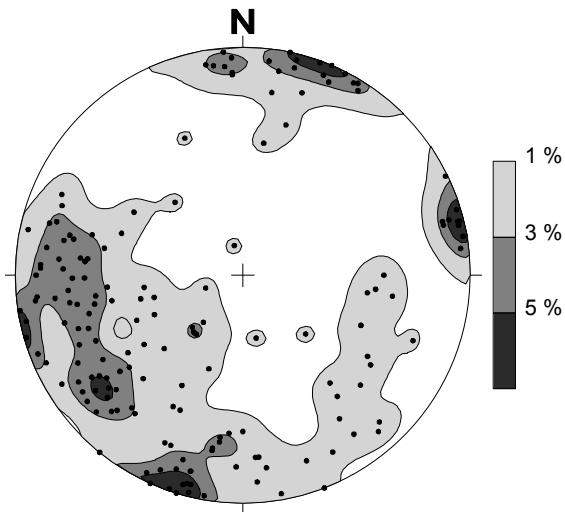


Figure 7: Broken fractures 700-800 (n=173)

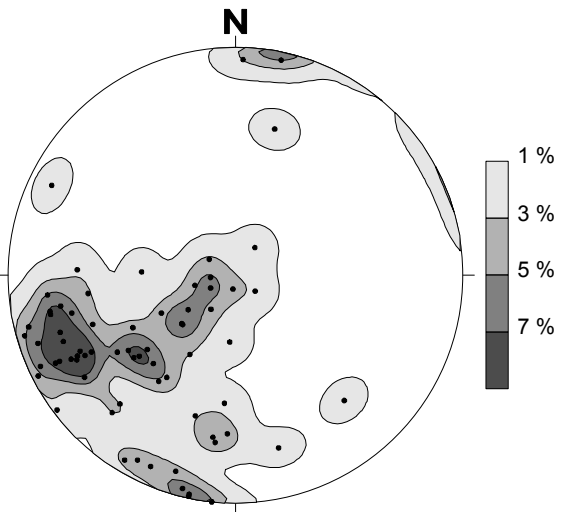


Figure 8: Broken fractures 800-900m (n=71)

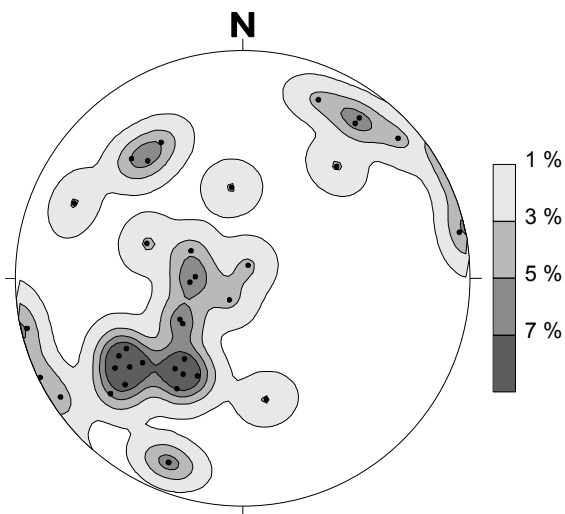


Figure 9: Broken fractures 900-996m (n=37)

BIPS-images of KLX05

Borehole Image Report

Borehole Name: KLX05
Mapping Name: KLX05_JEPD_A
Mapping Range: 108.000 - 991.584 m
Diameter: 76.0 mm
Printed Range: 108.000 - 991.584
Pages: 37

Image File Information:

File: C:\PROGRAM\Boremap\KLX05\KLX05_108-991m.BIP
Date/Time: 2005-03-23 09:02:00
Start Depth: 108.000 m
End Depth: 991.584 m
Resolution: 1.00 mm/pixel (depth)
Orientation: Gravmetric
Image height: 883584 pixels
Image width: 360 pixels
BIP Version: BIP-III
Locality: LAXEMAR
Borehole: KLX05
Scan Direction: Down
Color adjust: 0 0 0 (RGB)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 108.000 - 133.000 m
Azimuth: 189.5
Inclination: -63.5



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

2 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 133.000 - 158.000 m
Azimuth: 191.1
Inclination: -63.3



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

3 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 158.000 - 183.000 m
Azimuth: 191.9
Inclination: -63.1



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

4 (37)

Borehole: K LX05
Mapping: K LX05_JEPD_A

Depth range: 183.000 - 208.000 m
Azimuth: 192.9
Inclination: -63.4



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

5 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 208.000 - 233.000 m
Azimuth: 194.2
Inclination: -63.4



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

6 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 233.000 - 258.000 m
Azimuth: 195.7
Inclination: -63.7



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

7 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 258.000 - 283.000 m
Azimuth: 197.9
Inclination: -63.6



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

8 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 283.000 - 308.000 m
Azimuth: 199.5
Inclination: -64.0



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

9 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 308.000 - 333.000 m
Azimuth: 201.1
Inclination: -64.2



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

10 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 333.000 - 358.000 m
Azimuth: 203.2
Inclination: -64.4



Printed: 2005-04-18 22:25:59

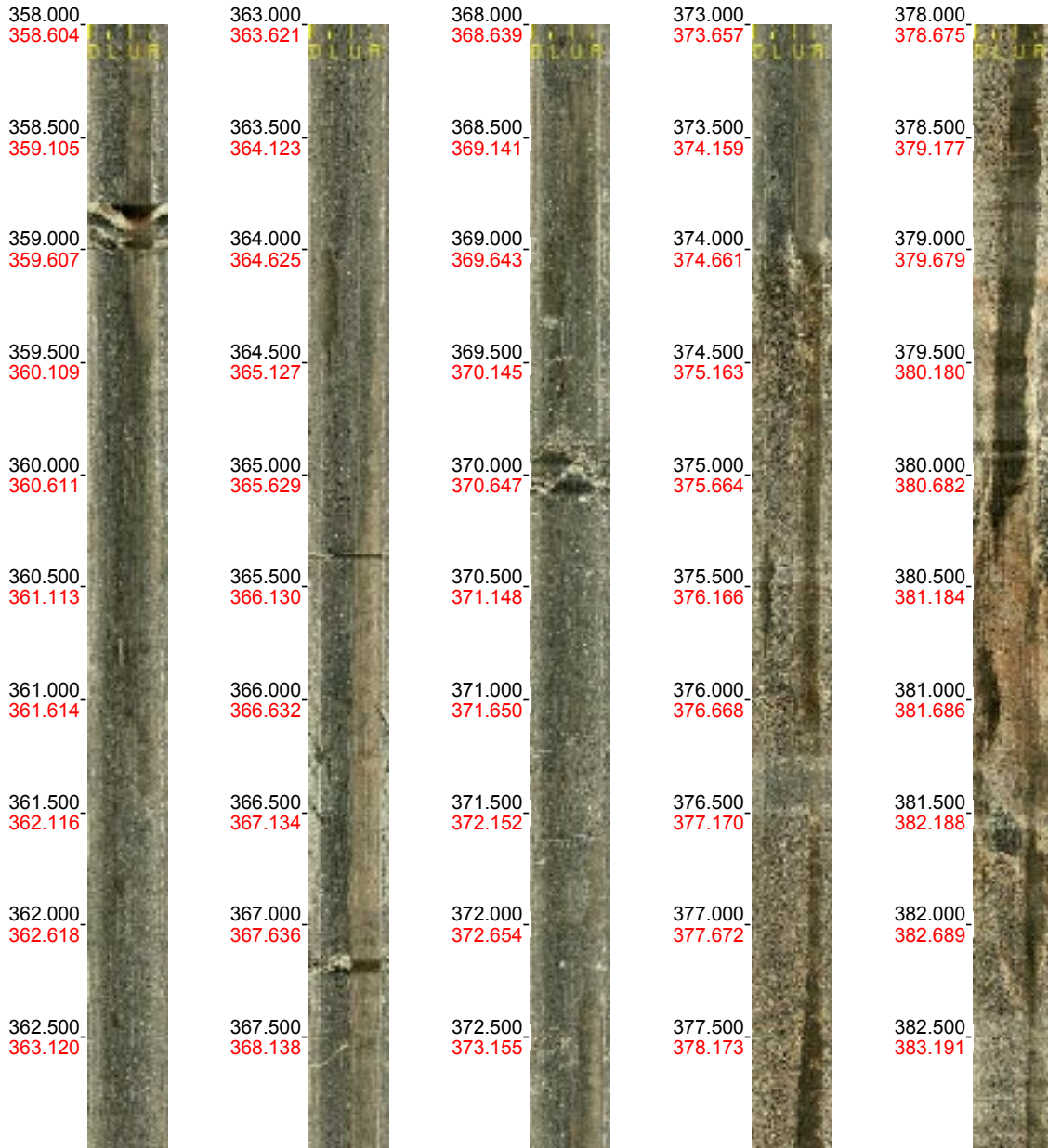
Scale: 1 : 25

Aspect: 150 %

11 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 358.000 - 383.000 m
Azimuth: 205.0
Inclination: -64.3



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

12 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 383.000 - 408.000 m
Azimuth: 206.4
Inclination: -64.7



Printed: 2005-04-18 22:25:59

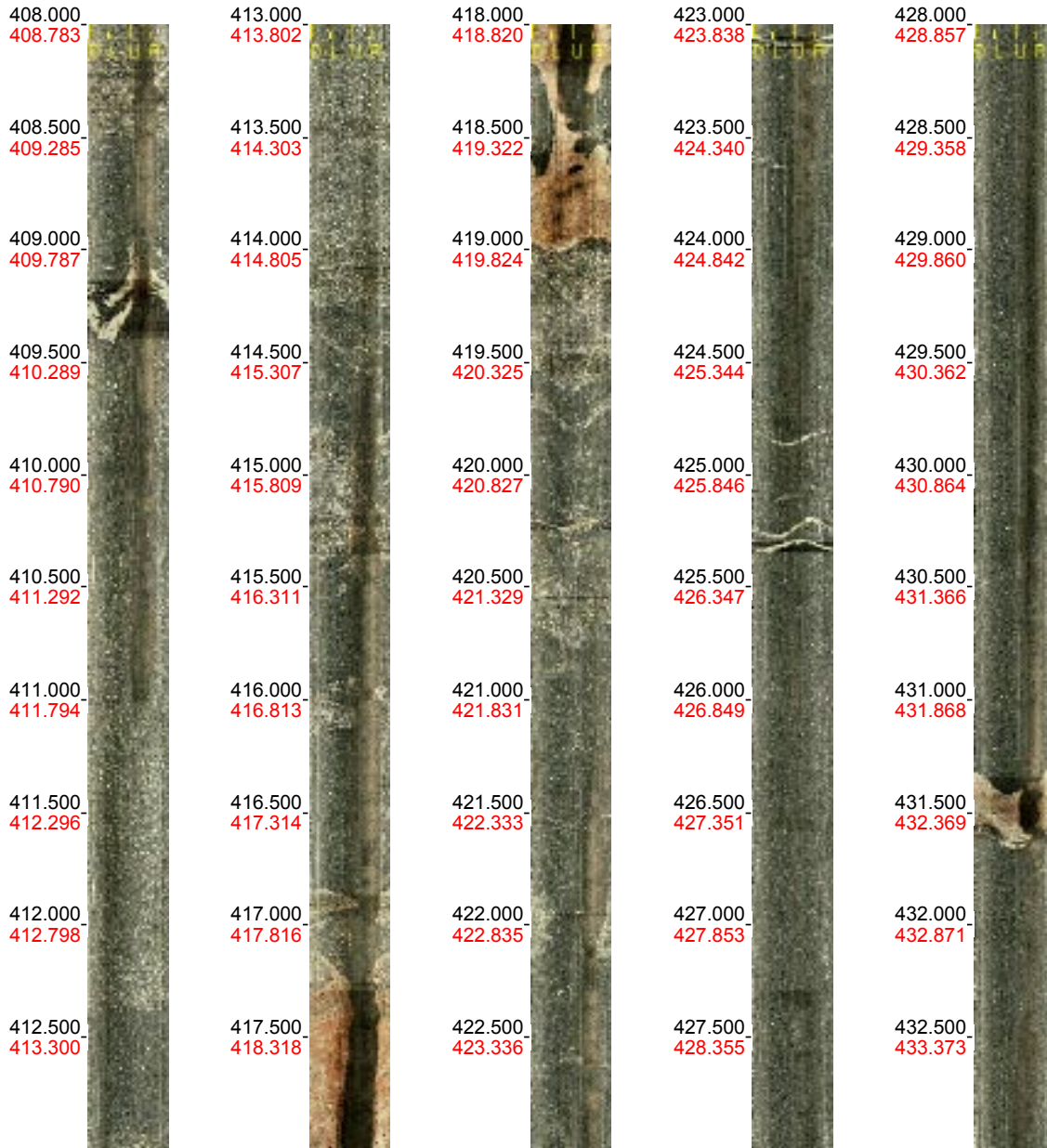
Scale: 1 : 25

Aspect: 150 %

13 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 408.000 - 433.000 m
Azimuth: 208.4
Inclination: -64.6



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

14 (37)

Borehole: K LX05
Mapping: K LX05_JEPD_A

Depth range: 433.000 - 458.000 m
Azimuth: 210.6
Inclination: -64.8



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

15 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 458.000 - 483.000 m
Azimuth: 212.3
Inclination: -64.5



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

16 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 483.000 - 508.000 m
Azimuth: 214.2
Inclination: -64.7



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

17 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 508.000 - 533.000 m
Azimuth: 215.3
Inclination: -64.3



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

18 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 533.000 - 558.000 m
Azimuth: 215.9
Inclination: -64.4



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

19 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 558.000 - 583.000 m
Azimuth: 216.0
Inclination: -64.1



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

20 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 583.000 - 608.000 m
Azimuth: 217.8
Inclination: -64.2



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

21 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 608.000 - 633.000 m
Azimuth: 215.6
Inclination: -64.2



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

22 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 633.000 - 658.000 m
Azimuth: 215.6
Inclination: -64.2



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

23 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 658.000 - 683.000 m
Azimuth: 217.9
Inclination: -64.0



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

24 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 683.000 - 708.000 m
Azimuth: 215.7
Inclination: -63.1



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

25 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 708.000 - 733.000 m
Azimuth: 217.2
Inclination: -63.2



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

26 (37)

Borehole: K LX05
Mapping: K LX05_JEPD_A

Depth range: 733.000 - 758.000 m
Azimuth: 218.7
Inclination: -63.4



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

27 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 758.000 - 783.000 m
Azimuth: 220.5
Inclination: -63.2



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

28 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 783.000 - 808.000 m
Azimuth: 222.9
Inclination: -63.2



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

29 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 808.000 - 833.000 m
Azimuth: 224.4
Inclination: -63.4



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

30 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 833.000 - 858.000 m
Azimuth: 225.9
Inclination: -63.8



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

31 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 858.000 - 883.000 m
Azimuth: 227.8
Inclination: -63.8



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

32 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 883.000 - 908.000 m
Azimuth: 229.3
Inclination: -63.6



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

33 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 908.000 - 933.000 m
Azimuth: 230.7
Inclination: -63.5



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

34 (37)

Borehole: K LX05
Mapping: K LX05_JEPD_A

Depth range: 933.000 - 958.000 m
Azimuth: 233.5
Inclination: -63.3



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

35 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 958.000 - 983.000 m
Azimuth: 235.3
Inclination: -63.2



Printed: 2005-04-18 22:25:59

Scale: 1 : 25

Aspect: 150 %

36 (37)

Borehole: KLX05
Mapping: KLX05_JEPD_A

Depth range: 983.000 - 991.584 m
Azimuth: 237.1
Inclination: -63.3




Printed: 2005-04-18 22:25:59

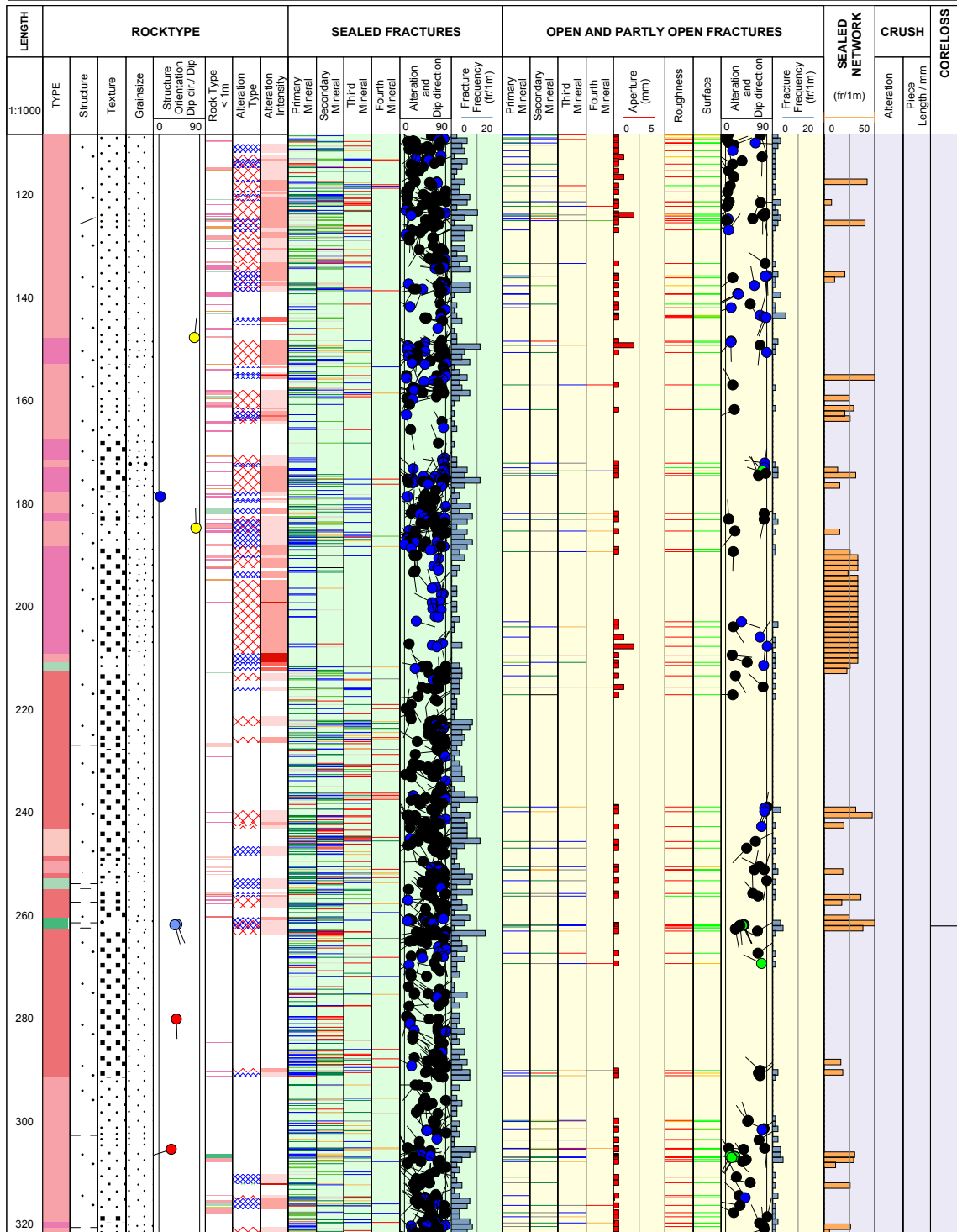
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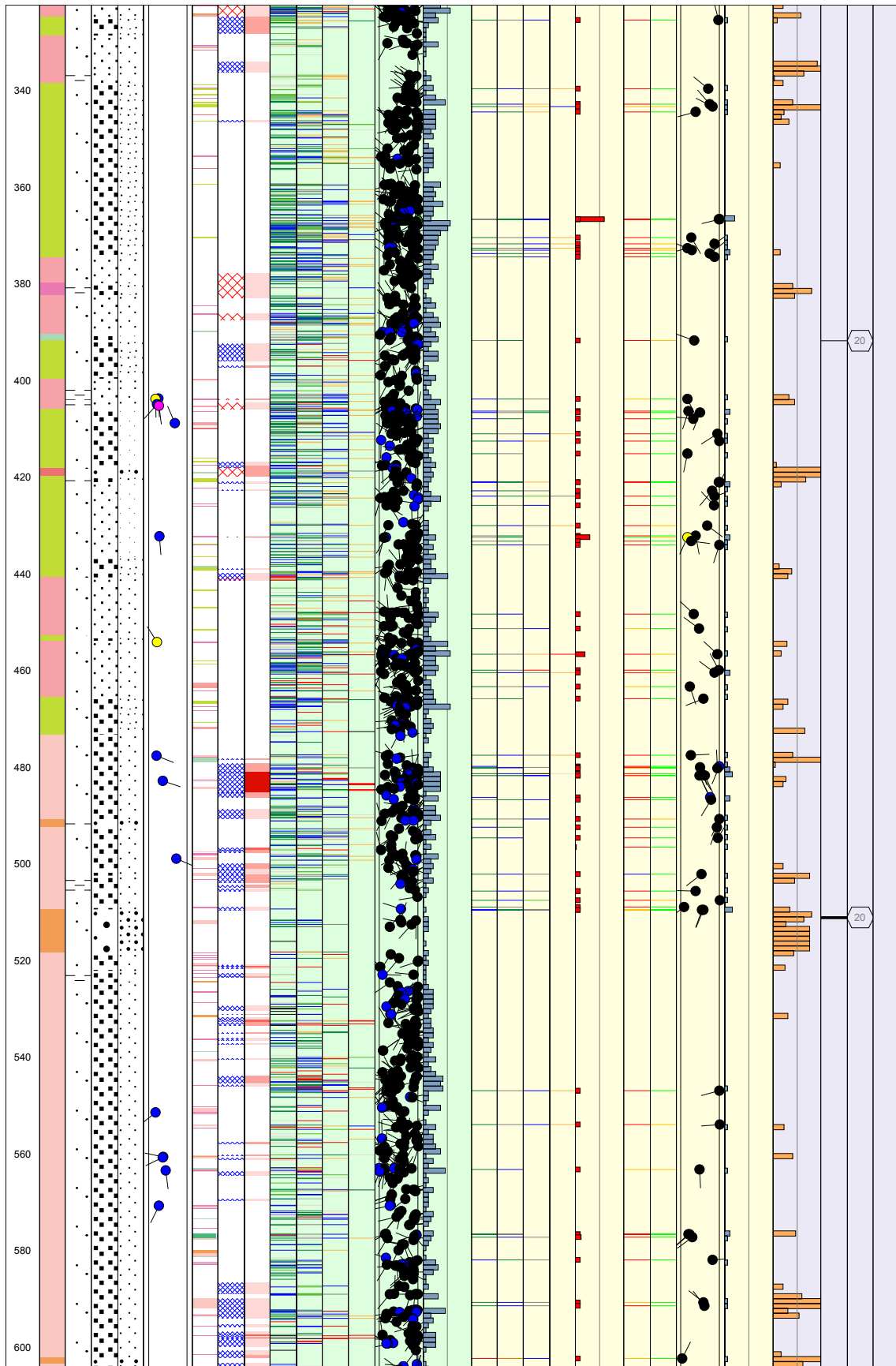
Aspect: 150 %

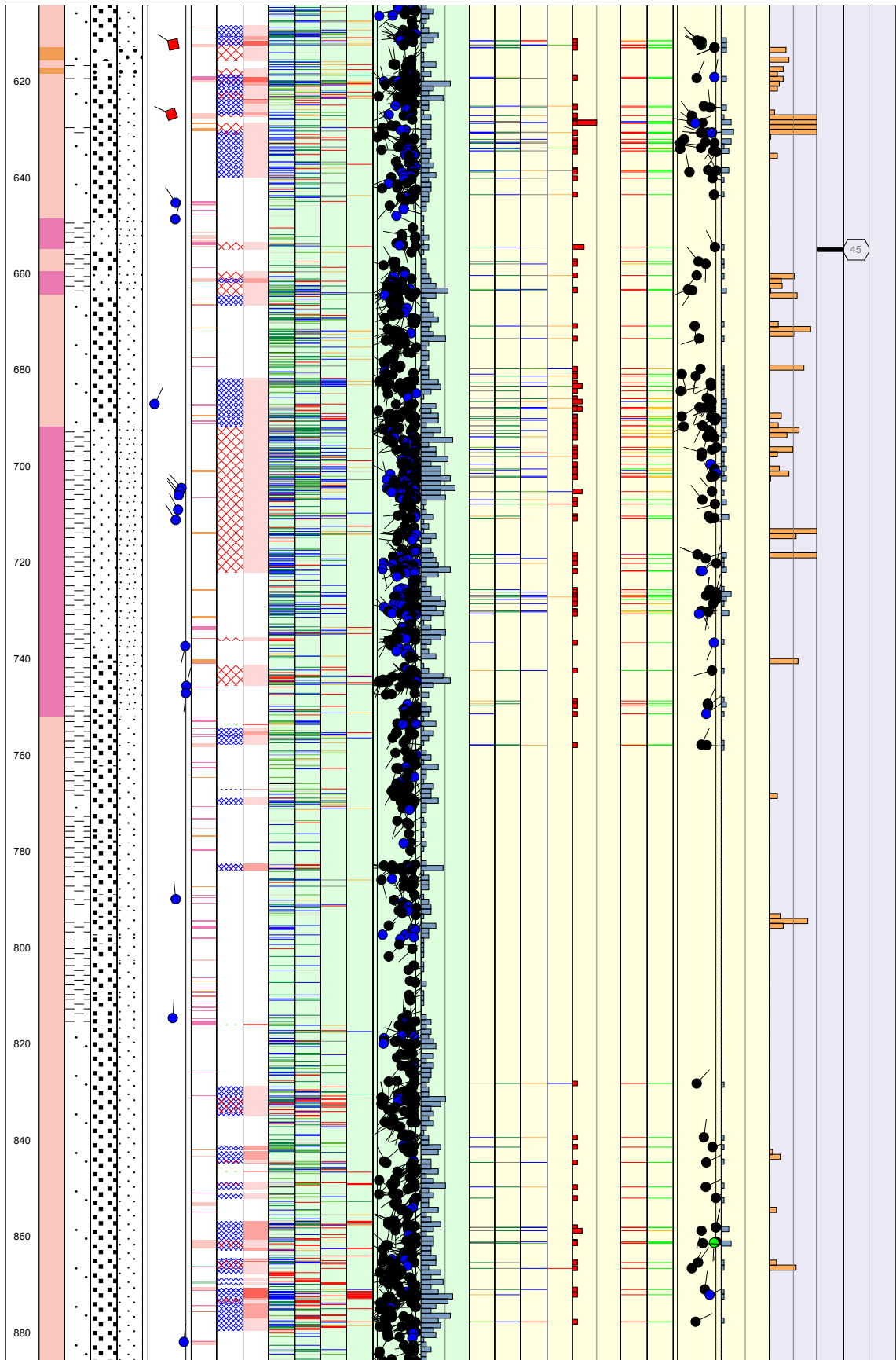
37 (37)

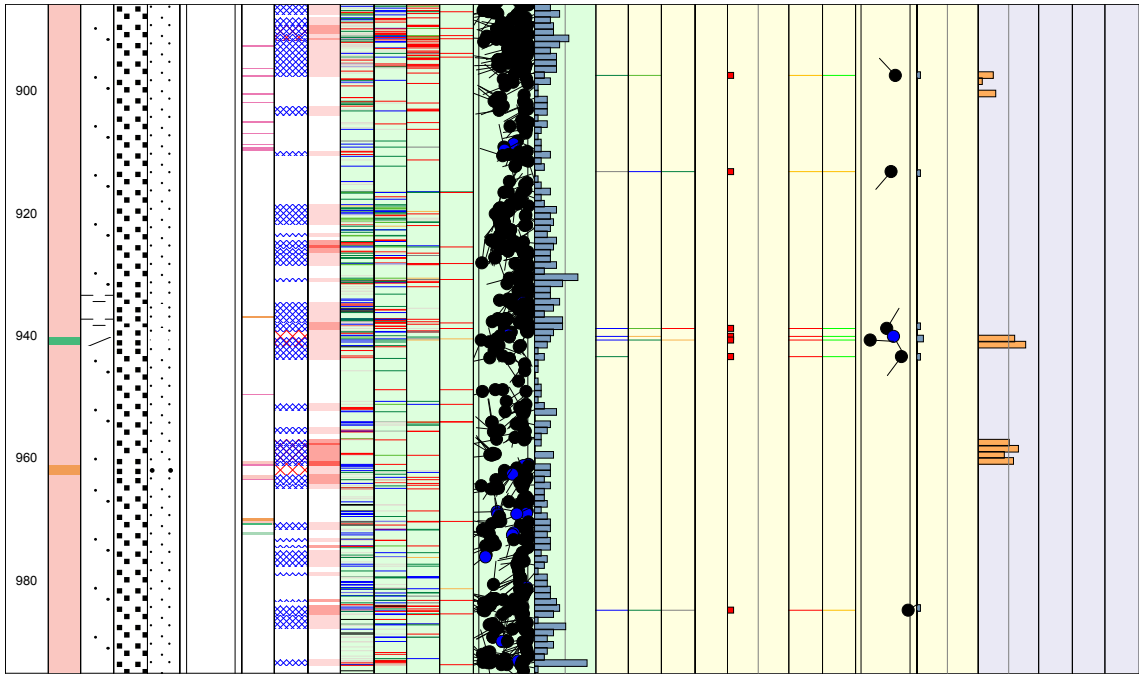
WellCad diagram of KLX05

Title GEOLOGY IN KLX05		Appendix:		
	Site	LAXEMAR	Coordinate System	RT90-RHB70
	Borehole	KLX05	Northing [m]	6365632.52
	Diameter [mm]	76	Easting [m]	1548909.46
	Length [m]	1000.160	Elevation [m.a.s.l.]	17.56
	Bearing [°]	190.05	Drilling Start Date	2004-08-11 07:00:00
	Inclination [°]	-65.15	Drilling Stop Date	2004-08-25 11:30:00
	Date of coremapping	2005-03-14 16:38:00	Plot Date	2006-06-18 21:12:46
	Rocktype data from	p_rock	Signed data	









Title	LEGEND FOR LAXEMAR	KLX05
	Site Borehole Plot Date Signed data	LAXEMAR KLX05 2006-06-19 21:12:01

ROCKTYPE LAXEMAR <ul style="list-style-type: none"> Dolerite / Diabas Fine-grained Göttemargranite Coarse-grained Göttemargranite 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 <ul style="list-style-type: none"> Oxidized Chloritized Epidotized Weathered Tectonized Sericitized Quartz dissolution Silicification Argillization Albitization Carbonatization Saussuritization Steatitization Uralitization Laumontitization Fract zone alteration 	MINERAL <ul style="list-style-type: none"> Epidote Hematite Calcite Chlorite Quartz Unknown Pyrite Clay Minerals Zeolite Prehnite 	
STRUCTURE <ul style="list-style-type: none"> Cataclastic Schistose Gneissic Mylonitic Ductile Shear Zone Brittle-Ductile Zone Veined Banded Massive Foliated Brecciated Lineated 	STRUCTURE ORIENTATION <ul style="list-style-type: none"> Schistose Gneissic Bedded Cataclastic Ductile Shear Zone Brittle-Ductile Shear Zone Veined Banded Lineated Brecciated Mylonitic Foliated 	ROCK ALTERATION INTENSITY <ul style="list-style-type: none"> No intensity Faint Weak Medium Strong 	FRACTURE ALTERATION <ul style="list-style-type: none"> Slightly Altered Moderately Altered Highly Altered Completely Altered Gouge Fresh
TEXTURE <ul style="list-style-type: none"> Hornfelsed Porphyritic Ophitic Equigranular Augen-Bearing Unequigranular Metamorphic 	GRAINSIZE <ul style="list-style-type: none"> Aphanitic Fine-grained Fine to medium grained Medium to coarse grained Coarse-grained Medium-grained 	ROUGHNESS <ul style="list-style-type: none"> Planar Undulating Stepped Irregular 	SURFACE <ul style="list-style-type: none"> Rough Smooth Slickensided
		CRUSH ALTERATION <ul style="list-style-type: none"> Slightly Altered Moderately Altered Highly Altered Completely Altered Gouge Fresh 	FRACTURE DIRECTION STRUCTURE ORIENTATION

In-data: Borehole length and diameter for KLX05

Hole Diam T - Drilling: Borehole diameter

KLX05, 2004-10-01 14:00:00 - 2005-01-22 13:45:00 (0.000 - 1000.160 m)

Sub Secup (m)	Sub Seclow (m)	Hole Diam (m)	Comment
75.100	76.480	0.086	T-86 (cement)
76.480	1000.160	0.076	Corac N/3 (cement till 100.40 m) 996.81-1000-16 m "Hålet blockerat av järnskrot"

Printout from SICADA 2005-03-29 18:57:58.

In-data: Deviation data for KLX05

Maxibor T - Borehole deviation: Maxibor

KLX05, 2005-01-23 07:23:00 - 2005-01-23 12:20:00 (15.000 - 941.000 m)

Length (m)	Northing (m)	Easting (m)	Elevation (m)	Coord System	Inclination (degrees)	Bearing (degrees)	Local A (m)	Local B (m)	Local C (m)	Extrapol Flag
15.00	6365627.07	1548908.23	-4.05	RT90-RHB70	-64.64	190.90	0.0000	0.0000	0.0000	
18.00	6365625.81	1548907.99	-1.34	RT90-RHB70	-64.61	190.92	1.2800	0.0000	0.0000	
21.00	6365624.55	1548907.74	1.37	RT90-RHB70	-64.61	190.87	2.5700	0.0000	0.0000	
24.00	6365623.28	1548907.50	4.08	RT90-RHB70	-64.62	190.86	3.8600	0.0000	0.0000	
27.00	6365622.02	1548907.26	6.79	RT90-RHB70	-64.58	190.84	5.1400	0.0000	0.0000	
30.00	6365620.75	1548907.02	9.50	RT90-RHB70	-64.53	190.81	6.4300	0.0000	0.0100	
33.00	6365619.49	1548906.77	12.21	RT90-RHB70	-64.50	190.94	7.7200	0.0000	0.0100	
36.00	6365618.22	1548906.53	14.92	RT90-RHB70	-64.50	190.98	9.0100	0.0000	0.0200	
39.00	6365616.95	1548906.28	17.63	RT90-RHB70	-64.52	190.92	10.3000	0.0000	0.0300	
42.00	6365615.68	1548906.04	20.33	RT90-RHB70	-64.53	190.96	11.5900	0.0000	0.0300	
45.00	6365614.42	1548905.79	23.04	RT90-RHB70	-64.41	190.99	12.8800	0.0000	0.0400	
48.00	6365613.15	1548905.55	25.75	RT90-RHB70	-64.33	190.99	14.1800	0.0000	0.0500	
51.00	6365611.87	1548905.30	28.45	RT90-RHB70	-64.33	190.89	15.4800	0.0000	0.0700	
54.00	6365610.59	1548905.05	31.16	RT90-RHB70	-64.29	190.88	16.7800	0.0000	0.0800	
57.00	6365609.32	1548904.81	33.86	RT90-RHB70	-64.20	190.82	18.0800	0.0000	0.1000	
60.00	6365608.03	1548904.56	36.56	RT90-RHB70	-64.14	190.89	19.3900	0.0000	0.1300	
63.00	6365606.75	1548904.32	39.26	RT90-RHB70	-64.04	190.82	20.7000	0.0000	0.1500	
66.00	6365605.46	1548904.07	41.96	RT90-RHB70	-64.04	190.76	22.0100	0.0000	0.1800	
69.00	6365604.17	1548903.82	44.65	RT90-RHB70	-64.06	190.66	23.3200	0.0000	0.2100	
72.00	6365602.88	1548903.58	47.35	RT90-RHB70	-64.03	190.60	24.6300	-0.0100	0.2500	
75.00	6365601.59	1548903.34	50.05	RT90-RHB70	-64.12	190.56	25.9500	-0.0200	0.2800	
78.00	6365600.30	1548903.10	52.75	RT90-RHB70	-64.26	190.64	27.2600	-0.0200	0.3000	
81.00	6365599.02	1548902.86	55.45	RT90-RHB70	-64.09	190.67	28.5600	-0.0300	0.3200	
84.00	6365597.73	1548902.62	58.15	RT90-RHB70	-63.91	190.70	29.8700	-0.0400	0.3500	
87.00	6365596.43	1548902.37	60.84	RT90-RHB70	-63.78	190.80	31.1900	-0.0400	0.3900	
90.00	6365595.13	1548902.12	63.53	RT90-RHB70	-63.66	190.75	32.5200	-0.0400	0.4400	
93.00	6365593.82	1548901.87	66.22	RT90-RHB70	-63.55	190.68	33.8500	-0.0500	0.4900	
96.00	6365592.51	1548901.63	68.91	RT90-RHB70	-63.58	190.32	35.1800	-0.0500	0.5400	
99.00	6365591.20	1548901.39	71.60	RT90-RHB70	-63.60	189.67	36.5200	-0.0600	0.6000	
102.00	6365589.88	1548901.16	74.28	RT90-RHB70	-63.74	189.29	37.8500	-0.0900	0.6500	
105.00	6365588.57	1548900.95	76.97	RT90-RHB70	-63.59	189.71	39.1800	-0.1300	0.7000	
108.00	6365587.26	1548900.72	79.66	RT90-RHB70	-63.46	189.84	40.5100	-0.1600	0.7600	
111.00	6365585.94	1548900.50	82.34	RT90-RHB70	-63.35	190.00	41.8500	-0.1800	0.8200	
114.00	6365584.61	1548900.26	85.03	RT90-RHB70	-63.31	190.14	43.2000	-0.2000	0.8800	
117.00	6365583.29	1548900.02	87.71	RT90-RHB70	-63.34	190.40	44.5400	-0.2200	0.9500	
120.00	6365581.96	1548899.78	90.39	RT90-RHB70	-63.33	190.64	45.8900	-0.2300	1.0200	

123.00	6365580.64	1548899.53	93.07	RT90-RHB70	-63.28	190.81	47.2400	-0.2400	1.0900
126.00	6365579.31	1548899.28	95.75	RT90-RHB70	-63.24	190.93	48.5900	-0.2400	1.1600
129.00	6365577.99	1548899.02	98.43	RT90-RHB70	-63.26	191.10	49.9400	-0.2400	1.2300
132.00	6365576.66	1548898.76	101.10	RT90-RHB70	-63.24	191.22	51.2900	-0.2400	1.3100
135.00	6365575.34	1548898.50	103.78	RT90-RHB70	-63.21	191.25	52.6400	-0.2300	1.3800
138.00	6365574.01	1548898.24	106.46	RT90-RHB70	-63.19	191.36	53.9900	-0.2200	1.4500
141.00	6365572.69	1548897.97	109.14	RT90-RHB70	-63.18	191.49	55.3400	-0.2100	1.5300
144.00	6365571.36	1548897.70	111.82	RT90-RHB70	-63.18	191.66	56.7000	-0.2000	1.6100
147.00	6365570.03	1548897.43	114.49	RT90-RHB70	-63.18	191.73	58.0500	-0.1800	1.6800
150.00	6365568.71	1548897.15	117.17	RT90-RHB70	-63.17	191.85	59.4000	-0.1600	1.7600
153.00	6365567.38	1548896.87	119.85	RT90-RHB70	-63.16	191.94	60.7600	-0.1400	1.8400
156.00	6365566.06	1548896.59	122.52	RT90-RHB70	-63.16	192.01	62.1100	-0.1100	1.9100
159.00	6365564.73	1548896.31	125.20	RT90-RHB70	-63.15	192.06	63.4700	-0.0800	1.9900
162.00	6365563.41	1548896.03	127.88	RT90-RHB70	-63.16	192.15	64.8200	-0.0600	2.0700
165.00	6365562.08	1548895.74	130.55	RT90-RHB70	-63.17	192.21	66.1700	-0.0300	2.1500
168.00	6365560.76	1548895.46	133.23	RT90-RHB70	-63.18	192.31	67.5300	0.0000	2.2200
171.00	6365559.44	1548895.17	135.91	RT90-RHB70	-63.20	192.37	68.8800	0.0400	2.3000
174.00	6365558.12	1548894.88	138.59	RT90-RHB70	-63.23	192.49	70.2300	0.0700	2.3700
177.00	6365556.80	1548894.59	141.27	RT90-RHB70	-63.24	192.61	71.5800	0.1100	2.4500
180.00	6365555.48	1548894.29	143.94	RT90-RHB70	-63.27	192.76	72.9300	0.1500	2.5200
183.00	6365554.16	1548893.99	146.62	RT90-RHB70	-63.30	192.88	74.2800	0.1900	2.5900
186.00	6365552.85	1548893.69	149.30	RT90-RHB70	-63.33	193.02	75.6300	0.2400	2.6600
189.00	6365551.54	1548893.39	151.98	RT90-RHB70	-63.36	193.15	76.9800	0.2900	2.7300
192.00	6365550.23	1548893.08	154.67	RT90-RHB70	-63.38	193.29	78.3200	0.3400	2.7900
195.00	6365548.92	1548892.78	157.35	RT90-RHB70	-63.41	193.39	79.6600	0.4000	2.8600
198.00	6365547.61	1548892.46	160.03	RT90-RHB70	-63.46	193.52	81.0000	0.4600	2.9200
201.00	6365546.31	1548892.15	162.71	RT90-RHB70	-63.51	193.64	82.3400	0.5200	2.9800
204.00	6365545.01	1548891.84	165.40	RT90-RHB70	-63.54	193.85	83.6800	0.5800	3.0400
207.00	6365543.71	1548891.52	168.09	RT90-RHB70	-63.54	194.05	85.0200	0.6500	3.1000
210.00	6365542.41	1548891.19	170.77	RT90-RHB70	-63.54	194.21	86.3500	0.7200	3.1500
213.00	6365541.12	1548890.86	173.46	RT90-RHB70	-63.53	194.41	87.6800	0.8000	3.2100
216.00	6365539.82	1548890.53	176.14	RT90-RHB70	-63.53	194.61	89.0200	0.8800	3.2600
219.00	6365538.53	1548890.19	178.83	RT90-RHB70	-63.54	194.82	90.3500	0.9700	3.3200
222.00	6365537.24	1548889.85	181.51	RT90-RHB70	-63.54	195.05	91.6900	1.0600	3.3700
225.00	6365535.95	1548889.50	184.20	RT90-RHB70	-63.59	195.29	93.0200	1.1600	3.4300
228.00	6365534.66	1548889.15	186.89	RT90-RHB70	-63.62	195.56	94.3500	1.2600	3.4800
231.00	6365533.37	1548888.79	189.57	RT90-RHB70	-63.65	195.79	95.6800	1.3700	3.5300
234.00	6365532.09	1548888.43	192.26	RT90-RHB70	-63.66	196.07	97.0100	1.4800	3.5800
237.00	6365530.81	1548888.06	194.95	RT90-RHB70	-63.66	196.32	98.3300	1.6000	3.6200
240.00	6365529.54	1548887.69	197.64	RT90-RHB70	-63.68	196.59	99.6600	1.7300	3.6700
243.00	6365528.26	1548887.31	200.33	RT90-RHB70	-63.70	196.86	100.9800	1.8600	3.7100
246.00	6365526.99	1548886.92	203.02	RT90-RHB70	-63.68	197.15	102.3000	2.0000	3.7600
249.00	6365525.72	1548886.53	205.71	RT90-RHB70	-63.66	197.38	103.6300	2.1400	3.8000

252.00	6365524.45	1548886.13	208.39	RT90-RHB70	-63.68	197.61	104.9500	2.2900	3.8400
255.00	6365523.18	1548885.73	211.08	RT90-RHB70	-63.71	197.89	106.2700	2.4500	3.8900
258.00	6365521.92	1548885.32	213.77	RT90-RHB70	-63.72	198.10	107.5900	2.6100	3.9300
261.00	6365520.65	1548884.91	216.46	RT90-RHB70	-63.74	198.33	108.9100	2.7800	3.9600
264.00	6365519.39	1548884.49	219.15	RT90-RHB70	-63.78	198.56	110.2200	2.9500	4.0000
267.00	6365518.14	1548884.07	221.85	RT90-RHB70	-63.81	198.75	111.5400	3.1200	4.0400
270.00	6365516.88	1548883.65	224.54	RT90-RHB70	-63.83	198.91	112.8500	3.3000	4.0700
273.00	6365515.63	1548883.22	227.23	RT90-RHB70	-63.84	199.08	114.1600	3.4900	4.1000
276.00	6365514.38	1548882.79	229.92	RT90-RHB70	-63.89	199.23	115.4700	3.6800	4.1300
279.00	6365513.14	1548882.35	232.62	RT90-RHB70	-63.94	199.45	116.7700	3.8700	4.1500
282.00	6365511.89	1548881.91	235.31	RT90-RHB70	-63.97	199.68	118.0800	4.0600	4.1800
285.00	6365510.65	1548881.47	238.01	RT90-RHB70	-64.02	199.88	119.3800	4.2700	4.2000
288.00	6365509.42	1548881.02	240.70	RT90-RHB70	-64.09	200.08	120.6800	4.4700	4.2200
291.00	6365508.19	1548880.57	243.40	RT90-RHB70	-64.14	200.28	121.9700	4.6800	4.2300
294.00	6365506.96	1548880.12	246.10	RT90-RHB70	-64.18	200.51	123.2600	4.8900	4.2400
297.00	6365505.73	1548879.66	248.80	RT90-RHB70	-64.20	200.73	124.5500	5.1100	4.2500
300.00	6365504.51	1548879.20	251.50	RT90-RHB70	-64.21	200.93	125.8400	5.3300	4.2500
303.00	6365503.29	1548878.73	254.20	RT90-RHB70	-64.24	201.08	127.1200	5.5600	4.2600
306.00	6365502.08	1548878.26	256.91	RT90-RHB70	-64.29	201.23	128.4000	5.7900	4.2600
309.00	6365500.86	1548877.79	259.61	RT90-RHB70	-64.31	201.46	129.6800	6.0200	4.2600
312.00	6365499.65	1548877.32	262.31	RT90-RHB70	-64.31	201.65	130.9600	6.2600	4.2600
315.00	6365498.45	1548876.84	265.02	RT90-RHB70	-64.34	201.84	132.2400	6.5100	4.2500
318.00	6365497.24	1548876.35	267.72	RT90-RHB70	-64.35	202.07	133.5200	6.7500	4.2500
321.00	6365496.04	1548875.86	270.42	RT90-RHB70	-64.37	202.24	134.7900	7.0000	4.2400
324.00	6365494.84	1548875.37	273.13	RT90-RHB70	-64.43	202.52	136.0600	7.2600	4.2300
327.00	6365493.64	1548874.88	275.84	RT90-RHB70	-64.41	202.88	137.3300	7.5200	4.2200
330.00	6365492.45	1548874.37	278.54	RT90-RHB70	-64.40	203.07	138.6000	7.7900	4.2100
333.00	6365491.25	1548873.87	281.25	RT90-RHB70	-64.47	203.14	139.8600	8.0600	4.1900
336.00	6365490.06	1548873.36	283.95	RT90-RHB70	-64.52	203.38	141.1300	8.3400	4.1700
339.00	6365488.88	1548872.85	286.66	RT90-RHB70	-64.51	203.68	142.3900	8.6100	4.1500
342.00	6365487.70	1548872.33	289.37	RT90-RHB70	-64.50	203.85	143.6500	8.9000	4.1300
345.00	6365486.52	1548871.80	292.08	RT90-RHB70	-64.47	204.06	144.9100	9.1900	4.1100
348.00	6365485.34	1548871.28	294.79	RT90-RHB70	-64.38	204.30	146.1700	9.4800	4.0900
351.00	6365484.15	1548870.74	297.49	RT90-RHB70	-64.35	204.50	147.4300	9.7900	4.0700
354.00	6365482.97	1548870.21	300.19	RT90-RHB70	-64.35	204.74	148.6900	10.0900	4.0500
357.00	6365481.79	1548869.66	302.90	RT90-RHB70	-64.34	204.97	149.9500	10.4000	4.0300
360.00	6365480.61	1548869.11	305.60	RT90-RHB70	-64.33	205.17	151.2100	10.7200	4.0100
363.00	6365479.44	1548868.56	308.31	RT90-RHB70	-64.34	205.35	152.4700	11.0400	3.9900
366.00	6365478.26	1548868.00	311.01	RT90-RHB70	-64.33	205.39	153.7300	11.3600	3.9700
369.00	6365477.09	1548867.45	313.72	RT90-RHB70	-64.40	205.45	154.9900	11.6900	3.9500
372.00	6365475.92	1548866.89	316.42	RT90-RHB70	-64.46	205.67	156.2400	12.0100	3.9300
375.00	6365474.75	1548866.33	319.13	RT90-RHB70	-64.49	205.86	157.4900	12.3400	3.9000
378.00	6365473.59	1548865.77	321.83	RT90-RHB70	-64.53	206.01	158.7400	12.6800	3.8600

381.00	6365472.43	1548865.20	324.54	RT90-RHB70	-64.55	206.33	159.9900	13.0100	3.8300
384.00	6365471.28	1548864.63	327.25	RT90-RHB70	-64.52	206.70	161.2300	13.3500	3.7900
387.00	6365470.12	1548864.05	329.96	RT90-RHB70	-64.51	206.93	162.4700	13.7100	3.7500
390.00	6365468.97	1548863.46	332.67	RT90-RHB70	-64.53	207.14	163.7100	14.0600	3.7200
393.00	6365467.82	1548862.88	335.38	RT90-RHB70	-64.55	207.37	164.9500	14.4200	3.6800
396.00	6365466.68	1548862.28	338.09	RT90-RHB70	-64.55	207.63	166.1900	14.7900	3.6300
399.00	6365465.54	1548861.69	340.79	RT90-RHB70	-64.53	207.85	167.4200	15.1600	3.5900
402.00	6365464.40	1548861.08	343.50	RT90-RHB70	-64.54	208.00	168.6500	15.5400	3.5400
405.00	6365463.26	1548860.48	346.21	RT90-RHB70	-64.56	208.14	169.8900	15.9200	3.5000
408.00	6365462.12	1548859.87	348.92	RT90-RHB70	-64.57	208.40	171.1200	16.3000	3.4500
411.00	6365460.99	1548859.26	351.63	RT90-RHB70	-64.57	208.69	172.3500	16.6800	3.4000
414.00	6365459.86	1548858.64	354.34	RT90-RHB70	-64.57	208.95	173.5700	17.0800	3.3500
417.00	6365458.73	1548858.01	357.05	RT90-RHB70	-64.61	209.20	174.8000	17.4800	3.2900
420.00	6365457.61	1548857.39	359.76	RT90-RHB70	-64.67	209.54	176.0200	17.8800	3.2400
423.00	6365456.49	1548856.75	362.47	RT90-RHB70	-64.69	209.89	177.2400	18.2900	3.1700
426.00	6365455.38	1548856.12	365.18	RT90-RHB70	-64.69	210.11	178.4500	18.7100	3.1100
429.00	6365454.27	1548855.47	367.89	RT90-RHB70	-64.69	210.38	179.6600	19.1300	3.0400
432.00	6365453.16	1548854.82	370.61	RT90-RHB70	-64.72	210.63	180.8700	19.5600	2.9700
435.00	6365452.06	1548854.17	373.32	RT90-RHB70	-64.74	210.86	182.0700	19.9900	2.9000
438.00	6365450.96	1548853.51	376.03	RT90-RHB70	-64.73	211.13	183.2800	20.4300	2.8200
441.00	6365449.87	1548852.85	378.75	RT90-RHB70	-64.72	211.39	184.4800	20.8700	2.7500
444.00	6365448.77	1548852.18	381.46	RT90-RHB70	-64.71	211.66	185.6800	21.3200	2.6700
447.00	6365447.68	1548851.51	384.17	RT90-RHB70	-64.73	211.91	186.8800	21.7700	2.5900
450.00	6365446.59	1548850.83	386.88	RT90-RHB70	-64.73	212.12	188.0700	22.2300	2.5100
453.00	6365445.51	1548850.15	389.60	RT90-RHB70	-64.72	212.29	189.2700	22.7000	2.4300
456.00	6365444.43	1548849.47	392.31	RT90-RHB70	-64.70	212.46	190.4600	23.1600	2.3400
459.00	6365443.34	1548848.78	395.02	RT90-RHB70	-64.67	212.64	191.6500	23.6300	2.2600
462.00	6365442.26	1548848.09	397.73	RT90-RHB70	-64.67	212.71	192.8400	24.1100	2.1800
465.00	6365441.18	1548847.40	400.44	RT90-RHB70	-64.69	212.94	194.0400	24.5900	2.0900
468.00	6365440.11	1548846.70	403.16	RT90-RHB70	-64.67	213.24	195.2200	25.0700	2.0000
471.00	6365439.03	1548845.99	405.87	RT90-RHB70	-64.66	213.48	196.4100	25.5600	1.9100
474.00	6365437.96	1548845.29	408.58	RT90-RHB70	-64.68	213.66	197.6000	26.0500	1.8200
477.00	6365436.90	1548844.58	411.29	RT90-RHB70	-64.70	213.88	198.7800	26.5500	1.7300
480.00	6365435.83	1548843.86	414.00	RT90-RHB70	-64.71	214.09	199.9600	27.0500	1.6400
483.00	6365434.77	1548843.14	416.72	RT90-RHB70	-64.74	214.28	201.1400	27.5500	1.5400
486.00	6365433.71	1548842.42	419.43	RT90-RHB70	-64.78	214.54	202.3100	28.0600	1.4400
489.00	6365432.66	1548841.70	422.14	RT90-RHB70	-64.81	214.86	203.4900	28.5700	1.3400
492.00	6365431.61	1548840.97	424.86	RT90-RHB70	-64.82	215.15	204.6500	29.0900	1.2300
495.00	6365430.57	1548840.23	427.57	RT90-RHB70	-64.80	215.45	205.8200	29.6100	1.1200
498.00	6365429.53	1548839.49	430.29	RT90-RHB70	-64.78	215.66	206.9800	30.1400	1.0000
501.00	6365428.49	1548838.75	433.00	RT90-RHB70	-64.74	215.86	208.1400	30.6800	0.8900
504.00	6365427.45	1548838.00	435.71	RT90-RHB70	-64.66	215.63	209.3000	31.2200	0.7800
507.00	6365426.41	1548837.25	438.43	RT90-RHB70	-64.55	215.22	210.4700	31.7600	0.6700

510.00	6365425.35	1548836.50	441.13	RT90-RHB70	-64.50	215.16	211.6400	32.2900	0.5700
513.00	6365424.30	1548835.76	443.84	RT90-RHB70	-64.44	215.11	212.8200	32.8200	0.4800
516.00	6365423.24	1548835.02	446.55	RT90-RHB70	-64.39	215.21	214.0000	33.3500	0.3800
519.00	6365422.18	1548834.27	449.25	RT90-RHB70	-64.33	215.45	215.1800	33.8800	0.2900
522.00	6365421.12	1548833.51	451.96	RT90-RHB70	-64.28	215.59	216.3600	34.4200	0.2000
525.00	6365420.06	1548832.76	454.66	RT90-RHB70	-64.24	215.65	217.5500	34.9700	0.1100
528.00	6365419.00	1548832.00	457.36	RT90-RHB70	-64.21	215.86	218.7300	35.5100	0.0300
531.00	6365417.94	1548831.23	460.06	RT90-RHB70	-64.24	216.01	219.9100	36.0600	-0.0600
534.00	6365416.89	1548830.47	462.77	RT90-RHB70	-64.25	216.15	221.0900	36.6200	-0.1500
537.00	6365415.84	1548829.70	465.47	RT90-RHB70	-64.20	215.82	222.2700	37.1700	-0.2400
540.00	6365414.78	1548828.93	468.17	RT90-RHB70	-64.11	215.15	223.4600	37.7200	-0.3300
543.00	6365413.71	1548828.18	470.87	RT90-RHB70	-64.03	215.05	224.6500	38.2600	-0.4100
546.00	6365412.63	1548827.42	473.56	RT90-RHB70	-64.01	215.22	225.8500	38.8000	-0.4800
549.00	6365411.56	1548826.67	476.26	RT90-RHB70	-64.00	215.42	227.0500	39.3400	-0.5500
552.00	6365410.49	1548825.90	478.96	RT90-RHB70	-63.99	215.61	228.2400	39.8900	-0.6300
555.00	6365409.42	1548825.14	481.65	RT90-RHB70	-64.01	215.80	229.4400	40.4400	-0.7000
558.00	6365408.35	1548824.37	484.35	RT90-RHB70	-64.01	216.02	230.6300	40.9900	-0.7800
561.00	6365407.29	1548823.60	487.05	RT90-RHB70	-64.02	216.28	231.8200	41.5500	-0.8600
564.00	6365406.23	1548822.82	489.74	RT90-RHB70	-64.03	216.47	233.0100	42.1100	-0.9400
567.00	6365405.17	1548822.04	492.44	RT90-RHB70	-64.05	216.69	234.1900	42.6800	-1.0200
570.00	6365404.12	1548821.25	495.14	RT90-RHB70	-64.06	216.92	235.3800	43.2500	-1.1100
573.00	6365403.07	1548820.46	497.84	RT90-RHB70	-64.07	217.12	236.5500	43.8200	-1.2000
576.00	6365402.02	1548819.67	500.53	RT90-RHB70	-64.10	217.33	237.7300	44.4000	-1.2900
579.00	6365400.98	1548818.88	503.23	RT90-RHB70	-64.14	217.54	238.9000	44.9900	-1.3900
582.00	6365399.94	1548818.08	505.93	RT90-RHB70	-64.19	217.77	240.0700	45.5700	-1.4900
585.00	6365398.91	1548817.28	508.63	RT90-RHB70	-64.23	218.04	241.2400	46.1600	-1.5900
588.00	6365397.88	1548816.48	511.34	RT90-RHB70	-64.24	218.12	242.4000	46.7600	-1.7000
591.00	6365396.86	1548815.67	514.04	RT90-RHB70	-64.30	217.69	243.5600	47.3600	-1.8100
594.00	6365395.83	1548814.88	516.74	RT90-RHB70	-64.35	216.95	244.7200	47.9400	-1.9200
597.00	6365394.79	1548814.10	519.44	RT90-RHB70	-64.31	216.69	245.8900	48.5100	-2.0200
600.00	6365393.75	1548813.32	522.15	RT90-RHB70	-64.30	216.31	247.0600	49.0800	-2.1200
603.00	6365392.70	1548812.55	524.85	RT90-RHB70	-64.35	215.79	248.2300	49.6400	-2.2200
606.00	6365391.65	1548811.79	527.56	RT90-RHB70	-64.34	215.67	249.4100	50.1800	-2.3100
609.00	6365390.59	1548811.03	530.26	RT90-RHB70	-64.33	215.27	250.5900	50.7300	-2.4000
612.00	6365389.53	1548810.28	532.96	RT90-RHB70	-64.40	214.55	251.7800	51.2600	-2.4900
615.00	6365388.46	1548809.55	535.67	RT90-RHB70	-64.36	214.45	252.9600	51.7800	-2.5800
618.00	6365387.39	1548808.81	538.37	RT90-RHB70	-64.32	214.59	254.1500	52.3000	-2.6600
621.00	6365386.32	1548808.07	541.08	RT90-RHB70	-64.32	214.82	255.3400	52.8200	-2.7400
624.00	6365385.25	1548807.33	543.78	RT90-RHB70	-64.29	215.07	256.5300	53.3500	-2.8300
627.00	6365384.19	1548806.58	546.48	RT90-RHB70	-64.29	215.21	257.7200	53.8800	-2.9100
630.00	6365383.13	1548805.83	549.19	RT90-RHB70	-64.28	215.44	258.9100	54.4200	-3.0000
633.00	6365382.07	1548805.08	551.89	RT90-RHB70	-64.25	215.69	260.0900	54.9600	-3.0900
636.00	6365381.01	1548804.32	554.59	RT90-RHB70	-64.25	215.87	261.2700	55.5100	-3.1700

639.00	6365379.95	1548803.55	557.29	RT90-RHB70	-64.26	216.11	262.4500	56.0600	-3.2600
642.00	6365378.90	1548802.79	560.00	RT90-RHB70	-64.26	216.34	263.6300	56.6100	-3.3600
645.00	6365377.85	1548802.01	562.70	RT90-RHB70	-64.26	216.55	264.8100	57.1700	-3.4500
648.00	6365376.80	1548801.24	565.40	RT90-RHB70	-64.25	216.80	265.9800	57.7400	-3.5500
651.00	6365375.76	1548800.46	568.10	RT90-RHB70	-64.24	217.05	267.1600	58.3100	-3.6400
654.00	6365374.72	1548799.67	570.80	RT90-RHB70	-64.09	217.53	268.3300	58.8800	-3.7400
657.00	6365373.68	1548798.87	573.50	RT90-RHB70	-63.84	217.97	269.5000	59.4700	-3.8400
660.00	6365372.64	1548798.06	576.20	RT90-RHB70	-63.77	217.54	270.6800	60.0700	-3.9300
663.00	6365371.58	1548797.25	578.89	RT90-RHB70	-63.80	216.55	271.8600	60.6600	-4.0100
666.00	6365370.52	1548796.46	581.58	RT90-RHB70	-63.70	215.75	273.0600	61.2400	-4.0800
669.00	6365369.44	1548795.69	584.27	RT90-RHB70	-63.52	215.29	274.2600	61.8000	-4.1500
672.00	6365368.35	1548794.91	586.95	RT90-RHB70	-63.40	215.28	275.4800	62.3500	-4.2000
675.00	6365367.25	1548794.14	589.64	RT90-RHB70	-63.31	215.32	276.7000	62.9000	-4.2400
678.00	6365366.15	1548793.36	592.32	RT90-RHB70	-63.25	215.38	277.9300	63.4600	-4.2800
681.00	6365365.05	1548792.58	595.00	RT90-RHB70	-63.25	215.51	279.1600	64.0200	-4.3200
684.00	6365363.95	1548791.79	597.67	RT90-RHB70	-63.24	215.77	280.3900	64.5800	-4.3500
687.00	6365362.86	1548791.00	600.35	RT90-RHB70	-63.20	216.05	281.6100	65.1500	-4.3900
690.00	6365361.76	1548790.21	603.03	RT90-RHB70	-63.20	216.27	282.8400	65.7200	-4.4300
693.00	6365360.67	1548789.41	605.71	RT90-RHB70	-63.22	216.43	284.0600	66.3000	-4.4800
696.00	6365359.59	1548788.60	608.39	RT90-RHB70	-63.23	216.53	285.2800	66.8900	-4.5200
699.00	6365358.50	1548787.80	611.07	RT90-RHB70	-63.24	216.67	286.5000	67.4700	-4.5700
702.00	6365357.42	1548786.99	613.74	RT90-RHB70	-63.26	216.85	287.7100	68.0600	-4.6200
705.00	6365356.34	1548786.18	616.42	RT90-RHB70	-63.23	217.01	288.9300	68.6500	-4.6700
708.00	6365355.26	1548785.37	619.10	RT90-RHB70	-63.22	217.15	290.1400	69.2400	-4.7200
711.00	6365354.18	1548784.55	621.78	RT90-RHB70	-63.23	217.31	291.3500	69.8400	-4.7700
714.00	6365353.11	1548783.74	624.46	RT90-RHB70	-63.23	217.50	292.5600	70.4400	-4.8200
717.00	6365352.03	1548782.91	627.14	RT90-RHB70	-63.23	217.66	293.7700	71.0500	-4.8800
720.00	6365350.96	1548782.09	629.82	RT90-RHB70	-63.24	217.86	294.9800	71.6600	-4.9400
723.00	6365349.90	1548781.26	632.49	RT90-RHB70	-63.24	218.10	296.1800	72.2700	-5.0000
726.00	6365348.84	1548780.43	635.17	RT90-RHB70	-63.24	218.37	297.3800	72.8900	-5.0600
729.00	6365347.78	1548779.59	637.85	RT90-RHB70	-63.23	218.60	298.5800	73.5100	-5.1200
732.00	6365346.72	1548778.74	640.53	RT90-RHB70	-63.25	218.83	299.7800	74.1400	-5.1900
735.00	6365345.67	1548777.90	643.21	RT90-RHB70	-63.27	219.12	300.9700	74.7700	-5.2600
738.00	6365344.62	1548777.05	645.89	RT90-RHB70	-63.27	219.38	302.1600	75.4100	-5.3300
741.00	6365343.58	1548776.19	648.57	RT90-RHB70	-63.26	219.62	303.3500	76.0500	-5.4100
744.00	6365342.54	1548775.33	651.25	RT90-RHB70	-63.26	219.83	304.5300	76.7000	-5.4800
747.00	6365341.50	1548774.46	653.93	RT90-RHB70	-63.28	220.02	305.7100	77.3500	-5.5600
750.00	6365340.47	1548773.60	656.61	RT90-RHB70	-63.28	220.29	306.8900	78.0100	-5.6500
753.00	6365339.44	1548772.72	659.29	RT90-RHB70	-63.29	220.51	308.0600	78.6700	-5.7300
756.00	6365338.42	1548771.85	661.97	RT90-RHB70	-63.31	220.68	309.2400	79.3400	-5.8200
759.00	6365337.39	1548770.97	664.65	RT90-RHB70	-63.34	220.90	310.4100	80.0100	-5.9100
762.00	6365336.38	1548770.09	667.33	RT90-RHB70	-63.36	221.14	311.5700	80.6800	-6.0100
765.00	6365335.36	1548769.20	670.01	RT90-RHB70	-63.36	221.36	312.7300	81.3600	-6.1100

768.00	6365334.35	1548768.31	672.69	RT90-RHB70	-63.36	221.54	313.8900	82.0400	-6.2100
771.00	6365333.35	1548767.42	675.37	RT90-RHB70	-63.37	221.74	315.0500	82.7200	-6.3100
774.00	6365332.34	1548766.53	678.05	RT90-RHB70	-63.39	221.97	316.2000	83.4100	-6.4100
777.00	6365331.34	1548765.63	680.74	RT90-RHB70	-63.39	222.25	317.3600	84.1100	-6.5200
780.00	6365330.35	1548764.73	683.42	RT90-RHB70	-63.37	222.53	318.5000	84.8100	-6.6300
783.00	6365329.36	1548763.82	686.10	RT90-RHB70	-63.37	222.76	319.6500	85.5100	-6.7500
786.00	6365328.37	1548762.90	688.78	RT90-RHB70	-63.38	222.93	320.7900	86.2200	-6.8700
789.00	6365327.39	1548761.99	691.46	RT90-RHB70	-63.42	223.09	321.9300	86.9300	-6.9800
792.00	6365326.41	1548761.07	694.15	RT90-RHB70	-63.44	223.31	323.0700	87.6500	-7.1100
795.00	6365325.43	1548760.15	696.83	RT90-RHB70	-63.45	223.55	324.2000	88.3700	-7.2300
798.00	6365324.46	1548759.23	699.51	RT90-RHB70	-63.46	223.76	325.3300	89.0900	-7.3600
801.00	6365323.49	1548758.30	702.20	RT90-RHB70	-63.48	223.97	326.4500	89.8200	-7.4900
804.00	6365322.53	1548757.37	704.88	RT90-RHB70	-63.49	224.15	327.5800	90.5500	-7.6300
807.00	6365321.57	1548756.44	707.57	RT90-RHB70	-63.52	224.32	328.7000	91.2900	-7.7700
810.00	6365320.61	1548755.50	710.25	RT90-RHB70	-63.56	224.51	329.8100	92.0200	-7.9100
813.00	6365319.66	1548754.57	712.94	RT90-RHB70	-63.58	224.72	330.9300	92.7600	-8.0500
816.00	6365318.71	1548753.63	715.62	RT90-RHB70	-63.58	224.87	332.0300	93.5000	-8.2000
819.00	6365317.76	1548752.68	718.31	RT90-RHB70	-63.60	225.03	333.1400	94.2500	-8.3500
822.00	6365316.82	1548751.74	721.00	RT90-RHB70	-63.62	225.21	334.2500	95.0000	-8.5100
825.00	6365315.88	1548750.79	723.69	RT90-RHB70	-63.65	225.43	335.3500	95.7500	-8.6600
828.00	6365314.94	1548749.85	726.37	RT90-RHB70	-63.66	225.63	336.4400	96.5000	-8.8200
831.00	6365314.01	1548748.89	729.06	RT90-RHB70	-63.66	225.78	337.5400	97.2600	-8.9800
834.00	6365313.09	1548747.94	731.75	RT90-RHB70	-63.69	225.94	338.6300	98.0200	-9.1500
837.00	6365312.16	1548746.99	734.44	RT90-RHB70	-63.72	226.11	339.7200	98.7900	-9.3200
840.00	6365311.24	1548746.03	737.13	RT90-RHB70	-63.74	226.32	340.8000	99.5500	-9.4900
843.00	6365310.32	1548745.07	739.82	RT90-RHB70	-63.76	226.53	341.8900	100.3200	-9.6600
846.00	6365309.41	1548744.11	742.51	RT90-RHB70	-63.76	226.71	342.9600	101.1000	-9.8400
849.00	6365308.50	1548743.14	745.20	RT90-RHB70	-63.77	226.88	344.0400	101.8700	-10.0200
852.00	6365307.60	1548742.17	747.89	RT90-RHB70	-63.78	227.04	345.1100	102.6500	-10.2100
855.00	6365306.69	1548741.20	750.58	RT90-RHB70	-63.78	227.23	346.1800	103.4300	-10.3900
858.00	6365305.79	1548740.23	753.28	RT90-RHB70	-63.78	227.49	347.2500	104.2200	-10.5800
861.00	6365304.90	1548739.25	755.97	RT90-RHB70	-63.76	227.70	348.3100	105.0100	-10.7700
864.00	6365304.00	1548738.27	758.66	RT90-RHB70	-63.73	227.89	349.3800	105.8000	-10.9600
867.00	6365303.11	1548737.29	761.35	RT90-RHB70	-63.70	228.08	350.4400	106.6000	-11.1600
870.00	6365302.22	1548736.30	764.04	RT90-RHB70	-63.68	228.29	351.5000	107.4000	-11.3500
873.00	6365301.34	1548735.30	766.73	RT90-RHB70	-63.66	228.53	352.5500	108.2100	-11.5500
876.00	6365300.46	1548734.31	769.41	RT90-RHB70	-63.61	228.72	353.6100	109.0200	-11.7500
879.00	6365299.58	1548733.30	772.10	RT90-RHB70	-63.58	228.90	354.6600	109.8400	-11.9500
882.00	6365298.70	1548732.30	774.79	RT90-RHB70	-63.56	229.14	355.7100	110.6600	-12.1500
885.00	6365297.83	1548731.29	777.47	RT90-RHB70	-63.53	229.38	356.7600	111.4900	-12.3500
888.00	6365296.96	1548730.27	780.16	RT90-RHB70	-63.52	229.59	357.8100	112.3200	-12.5500
891.00	6365296.09	1548729.26	782.85	RT90-RHB70	-63.50	229.86	358.8500	113.1600	-12.7600
894.00	6365295.23	1548728.23	785.53	RT90-RHB70	-63.48	230.08	359.8900	114.0000	-12.9700

897.00	6365294.37	1548727.20	788.21	RT90-RHB70	-63.46	230.31	360.9300	114.8500	-13.1800
900.00	6365293.51	1548726.17	790.90	RT90-RHB70	-63.43	230.52	361.9700	115.7000	-13.3900
903.00	6365292.66	1548725.14	793.58	RT90-RHB70	-63.43	230.72	363.0000	116.5500	-13.6100
906.00	6365291.81	1548724.10	796.26	RT90-RHB70	-63.42	230.99	364.0300	117.4100	-13.8300
909.00	6365290.96	1548723.06	798.95	RT90-RHB70	-63.40	231.24	365.0600	118.2800	-14.0500
912.00	6365290.12	1548722.01	801.63	RT90-RHB70	-63.40	231.49	366.0800	119.1500	-14.2700
915.00	6365289.29	1548720.96	804.31	RT90-RHB70	-63.38	231.72	367.1000	120.0200	-14.5000
918.00	6365288.45	1548719.90	806.99	RT90-RHB70	-63.35	231.96	368.1200	120.9000	-14.7300
921.00	6365287.62	1548718.84	809.68	RT90-RHB70	-63.33	232.21	369.1400	121.7800	-14.9600
924.00	6365286.80	1548717.78	812.36	RT90-RHB70	-63.32	232.43	370.1500	122.6700	-15.1900
927.00	6365285.98	1548716.71	815.04	RT90-RHB70	-63.28	232.68	371.1600	123.5700	-15.4300
930.00	6365285.16	1548715.64	817.72	RT90-RHB70	-63.26	232.91	372.1600	124.4600	-15.6700
933.00	6365284.34	1548714.56	820.40	RT90-RHB70	-63.25	233.18	373.1600	125.3700	-15.9100
936.00	6365283.54	1548713.48	823.07	RT90-RHB70	-63.24	233.42	374.1600	126.2800	-16.1500
939.00	6365282.73	1548712.39	825.75	RT90-RHB70	-63.24	233.71	375.1600	127.1900	-16.4000
942.00	6365281.93	1548711.31	828.43	RT90-RHB70	-63.22	233.96	376.1500	128.1100	-16.6500
945.00	6365281.14	1548710.21	831.11	RT90-RHB70	-63.23	234.22	377.1400	129.0300	-16.9100
948.00	6365280.35	1548709.12	833.79	RT90-RHB70	-63.22	234.52	378.1200	129.9600	-17.1700
951.00	6365279.56	1548708.02	836.47	RT90-RHB70	-63.19	234.81	379.1000	130.8900	-17.4300
954.00	6365278.78	1548706.91	839.14	RT90-RHB70	-63.17	235.08	380.0700	131.8300	-17.7000
957.00	6365278.01	1548705.80	841.82	RT90-RHB70	-63.19	235.35	381.0400	132.7700	-17.9700
960.00	6365277.24	1548704.69	844.50	RT90-RHB70	-63.19	235.62	382.0100	133.7200	-18.2400
963.00	6365276.47	1548703.57	847.18	RT90-RHB70	-63.23	235.87	382.9700	134.6700	-18.5200
966.00	6365275.71	1548702.45	849.86	RT90-RHB70	-63.25	236.14	383.9300	135.6300	-18.8000
969.00	6365274.96	1548701.33	852.53	RT90-RHB70	-63.26	236.40	384.8800	136.5800	-19.0900
972.00	6365274.22	1548700.21	855.21	RT90-RHB70	-63.28	236.63	385.8200	137.5500	-19.3800
975.00	6365273.47	1548699.08	857.89	RT90-RHB70	-63.29	236.89	386.7700	138.5100	-19.6800
981.00	6365272.01	1548696.82	863.25	RT90-RHB70	-63.28	237.17	388.6300	140.4600	-20.2900

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Appendix 8

In-data: Reference marks for length adjustments for KLX05

Reference Mark T - Reference mark in drillhole

KLX05, 2005-02-08 13:00:00 - 2005-02-09 14:00:00 (110.000 - 900.000 m)

Bhlen (m)	Rotation Speed (rpm)	Start Flow (l/min)	Stop Flow (l/min)	Stop Pressure (bar)	Cutter Time (s)	Trace Detectable	Cutter Diameter (mm)	Comment
110.00	400.00	240	1000	38.0	71	Yes		
150.00	400.00	260	1000	38.0	66	Yes		
200.00	400.00	360	1000	40.0	79	Yes		
250.00	400.00	400	1000	39.0	86	Yes		
300.00	400.00	320	1000	38.0	93	Yes		
350.00	400.00	320	1000	40.0	74	Yes		
400.00	400.00	300	1000	40.0	72	Yes		
450.00	400.00	300	1000	40.0	76	Yes		
500.00	400.00	280	1000	36.0	73	Yes		
550.00	400.00	300	1000	40.0	86	Yes		
600.00	400.00	280	1000	40.0	89	Yes		
650.00	400.00	280	1000	44.0	120	Yes		
700.00	400.00	500	1000	40.0	126	Yes		Lite för högt flöde men provar att fräsa, allt ok
750.00	400.00	500	1000	40.0	123	Yes		Lite för högt flöde men provar att fräsa, allt ok
800.00	400.00	240	1000	40.0	138	Yes		Lite för högt flöde men provar att fräsa, allt ok
850.00	400.00	260	1000	40.0	258	Yes		Lite för högt flöde men provar att fräsa, allt ok
900.00	400.00	360	1000	40.0	360	Yes		Lite för högt flöde men provar att fräsa, allt ok

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