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Oskarshamn site investigation

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April 2004

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Abstract

Borehole KSH01 includes two boreholes, KSH01A and KSH01B. KSH01A was the first deep (c 1000 m) cored borehole, drilled within the site investigation program in the Simpevarp area. The borehole is telescopic, implying that the upper part, 0 - 100 m, is percussion drilled and has a larger diameter than the core drilled part. To cover for the missing core of the uppermost 100 m another core drilled borehole, KSH01B, was drilled adjacent to KSH01A down to 100 m.

Rock types, alterations, fractures and other structures were documented with the software Boremap. This data will be used for further interpretation of the bedrock conditions in the area down to the depth of 1000 m.

Borehole KSH01 was subdivided in three sections mainly according to principal lithologies but also in accordance with other factors like deformation, mineralogy, alteration, open and sealed fractures and veins and dykes.

Section I (0 – 240 m) is made up of homogeneous, massive, medium-grained quartz monzodiorite. Oxidized intervals are sparsely distributed and are generally only one to a few dm wide and not continuous.

Section II (204 – 628 m) is made up of massive, undeformed, hornfels altered, fine-grained to extremely fine-grained dioritoid. Frequently occurring oxidized intervals often reach a width of 5 meters. It is noteworthy that section II ends with a thick sealed network interval and a strong and rather thick mylonite which is strongly brecciated.

Section III (628 – 1000 m) is made up of rapidly alternating bands of porphyritic Ävrö granite and quartz monzodiorite. Continuous heterogeneous ductile deformations together with alternating lithologies are the most obvious characteristic that differentiate section III from sections I and II. Oxidized intervals are rather thin and sparsely distributed. Hydrothermal minerals like chalcopyrite, molybdenite and fluorite occur almost exclusively in section III.

The frequency of open fractures is highest in section II, especially where sections I and II and sections II and III meet. Open as well as sealed fractures are much more numerous in the fine-grained dioritoid in section II than in other lithologies. The strong tendency for the fine-grained dioritoid to respond to different deformation events with brittle deformation is also highlighted by common and often long intervals of oxidation and strong concentration of veins and dykes to this lithology.

Section III is extremely poor in open fractures. There is a strong correlation between the ductile deformation in section III and low to very low frequencies of open as well as sealed fractures.

Sammanfattning

Borrhål KSH01 omfattar två borrhål, KSH01A och KSH01B. KSH01A var det första djupa (ca 1000 m) kärnborrhålet som borrades inom ramarna för platsundersökningarna i Simpevarp. Borrhålet är teleskopiskt, vilket betyder att den översta delen, 0 - 100 m, är hammarborrad och har en större diameter än den kärnborrade delen. För att komplettera de översta 100 m där borrkärna saknades, borrades ytterliggare ett kärnborrhål, KSH01B, i omedelbar närhet av KSH01A.

Bergarter, omvandlingar, sprickor och andra strukturer dokumenterades i programmet Boremap. Dessa data kommer att ligga till grund för framtida tolkningar av bergets egenskaper i Simpevarpsområdet ner till 1000 m djup.

Borrhålet uppdelades i 3 sektioner huvudsakligen i enlighet med de dominerande litologierna men även med utgångspunkt från andra geologiska faktorer såsom deformationer, mineralogi, omvandlingar, öppna och läkta sprickor, samt gångar.

Sektion I (0 – 240 m) utgörs av en homogen, massiv och medelkornig kvartsmonzodiorit. Oxiderade intervaller, vanligen en eller några dm breda, förekommer sparsamt.

Sektion II (204 – 628 m) domineras av en massiv, odeformerad, hornfelsomvandlad och porfyrisk finkornig till extremt finkornig dioritoid. De tätt förekommande intervallerna med oxidation blir ofta upp till 5 m breda. Det är nämnvärt att sektion II avslutas med ett bredare intervall med läkt spricknätverk och en kraftig och ganska bred mylonit vilken delvis är kraftigt breccierad.

Sektion III (628 – 1000 m) utgörs av en ganska tät bandning av omväxlande porfyritisk Ävrögranit och kvartsmonzodiorit. Denna litologiska bandning och en kontinuerlig, heterogen, plastisk deformation, som går att följa genom hela sektionen, utgör de geologiska parametrar som tydligast särskiljer denna sektion från de två övriga. Oxiderade intervaller är ganska korta och sparsamt förekommande. Hydrotermala mineral som kopparkis, molybdenglans och fluorit förekommer nästan enbart i sektion III.

Frekvensen av öppna sprickor är högst i sektion II, speciellt i de intervall där sektionerna I och II möts kring 204 m djup och där sektionerna II och III möts kring 628 m djup. Såväl öppna som läkta sprickor är mycket vanligare förekommande i den finkorniga dioritoiden i sektion II än i andra litologier i borrhål KSH01. Detta indikerar att denna bergart har en större benägenhet att spricka upp än andra bergarter. Denna tendens att spricka upp vid olika deformationstillfällen betonas också av de vanliga, och ofta långa, intervallerna med oxidation samt den tydliga koncentrationen av gångar i denna litologi.

Sektion III är extremt fattig på såväl öppna som läkta sprickor vilket bl.a. tros hänga samman med den plastiska deformation som särskiljer denna sektion från sektionerna I och II.

Contents

1 Introduction

This document reports data gained by Boremap mapping of the core drilled, 1000 m deep, borehole KSH01A and the complementary borehole KSH01B (Figure 1-1), which is one of the activities performed within the site investigation at Simpevarp.

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 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.

KSH01 includes two boreholes: KSH01A and KSH01B. KSH01A is telescopic, which means that the uppermost 100 m was drilled by percussion drilling followed by core drilling (100 - 1000 m). Since drill core is missing for the uppermost 100 m another core drilled borehole, KSH01B, was drilled adjacent to KSH01A to cover up the interval 0 - 100 m. In this report both boreholes are referred to as KSH01.

Detailed mapping of the drill cores is essential for a three dimensional understanding of the geology at depth. The Boremap mapping is based on the use of 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. Important to keep in mind is that the mappings only represent the 76 mm wide drill holes that intersect the rock body.

This report presents the results from the Boremap mapping of the telescopic drilled borehole KSH01A, which is the first deep borehole drilled in the Simpevarp candidate area, as well as the results from the Boremap mapping of the core drilled borehole KSH01B.

Figure 1-1. *Location of the core drilled borehole KSH01A and KSH01B.*

2 Objective and scope

The principal aim of the mapping activities is to obtain a detailed documentation of geological structures and lithologies intersecting borehole KSH01. 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 3.2, loaded with the SKB:s bedrock and mineral standards. The final data presentation was made using StereoNet, WellCad v 3.2, and BIPS Image Print.

Boremap is a computerized system that unite orthodox core mapping with modern video mapping. Boremap is the brain of the system and deals with the mapping 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 quality

The BIPS-image quality was 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, which sometimes formed a spiral pattern
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 were not common but occurred more frequent deeper down in borehole KSH01A

The first BIPS-images from borehole KSH01A had to be logged a second time, because of these types of disturbances. Below 500 m depth, and especially below 800 m depth the disturbances mentioned above often made one third to half of the BIPS-image unreadable.

4 Execution

The Boremap-mapping of the telescopic drilled borehole KSH01 was performed and documented according to activity plan AP PS 400-03-005 (SKB, internal document) referring to the Method Description for Boremap mapping (SKB MD 143.006, v.1.0, SKB, internal controlling document).

KSH01 includes two boreholes. The first 100 m of KSH01A was drilled by percussion drilling and therefore no drill core was received. A core drilled borehole, KSH01B, was therefore drilled adjacent to KSH01A in order to get a representative core for the uppermost section. Borehole KSH01B covers the interval 6 – 99.30 m and borehole KSH01A covers the interval 101.67 – 1000 m. The interval 99.30 – 101.67 m is thus missing. The interval 101.67 – 1000 m was mapped in two steps. The first BIPS video film in this interval was of rather low quality why it was filmed a second time. The sub interval 101.67 – 185 m was thus mapped on the first BIPS video film and the sub intervals 185 – 500 m and 500 – 1000 m on the new BIPS video films. As a consequence, the mapping of KSH01A is combined from three different original mappings.

In this report KSH01 stands for both boreholes if nothing else is mentioned. The drill cores were displayed on inclined roller tables in their entire length and mapped with the Boremap system at Simpevarp. The core mapping was carried out without any detailed geological knowledge of the area and without access to geophysical logs.

To maintain systematic judgements in the mapping, each geologist had the same task throughout the mapping. Vladislav Stejskal was responsible for handling the drill core and Jan Ehrenborg for the delineation of structures in the BIPS-image.

4.1 Preparations

Any depth registered in the BIPS-image deviates from the true depth in the borehole. This deviation increases with depth. The depth was adjusted according to reference slots cut into the borehole wall for every fiftieth meter (Appendix: 8). The level for each slot was measured in the BIPS-images and then adjusted to the correct level using the correct depth value found in SICADA.

The orientations of the observations were adjusted to true space. Data necessary for this adjustment were borehole diameter, azimuth and inclination of the borehole; all collected from SICADA (see also Appendices: 6 and 7 in this report).

4.2 Execution of measurements

Concepts used during the Boremap mapping are defined in this chapter.

4.2.1 Fracture definitions

Definitions of different fracture types are found in "Nomenklatur vid Boremapkartering" by Larsson and Stråhle (PM, 2004-02-05 SKB, internal controlling document). Apertures for broken fractures have been mapped in accordance with the definitions in this PM.

In the mapping phase, fractures that have parted 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 and aperture. Visible apertures are measured down to 1 mm in the BIPS-image. Smaller apertures, which are hard to see in the BIPS-image, are denoted a value of 0.5 mm. Core pieces with bad fit were characterized as "probable aperture" and fractures with a dull or altered surface as "possible aperture".

All fractures in the SICADA database that possess apertures >0 mm, are interpreted as "Open" and fractures with apertures = 0 mm, are interpreted as "Sealed". "Unbroken" fractures which possess apertures >0 mm, are interpreted as "Partly open" and included in the "Open"-category. "Open" and "Sealed" fractures are finally frequency calculated and shown in the composite log (see Appendices 6 and 7).

4.2.2 Fracture alteration and joint alteration number

The joint alteration number is principally related with the thickness of, and the clay content in, a fracture. Thicker fractures rich in clay minerals therefore get joint alteration numbers 2 - 3. The absolute majority of fractures in KSH02, however, are very to extremely thin and rarely contain clay minerals and therefore get 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 but also the possibility to compare the alterations between different fractures in the same, or from different, boreholes. The subdivision is based on fracture mineralogy and was made as follows: a) fracture wall alterations, b) fracture mineral fillings assumed to have been deposited from circulating water rich solutions and c) fracture mineral fillings most likely resulting from altered wall rock material.

Joint alteration number equal to 1

Fractures without mineral fillings but with red coloured oxidized fracture walls and/or dirty greenish coloured epidotized fracture walls were both considered as alterations of the wall rock and not as fracture alteration minerals. Joint alteration was thus classified as fresh and the joint alteration number set to 1.

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

The joint alteration number for laumontite was set to 1.5 in the upper 200 - 300 m of KSH01 until it was decided that zeolites should be regarded as calcite from an alteration point of view. From 200 - 300 m and downwards laumontite was given joint alteration number 1.

Joint alteration number equal to 1.5

Fractures with traces, or a thin coating, of epidote, prehnite, hematite, chlorite and/or clay minerals were regarded as weakly altered and the joint alteration number was set to 1.5.

Joint alteration numbers higher than 1.5

When the mineral fillings were thicker and contained a few mm thick bands of clay minerals (except minerals like epidote and chlorite), the joint alteration number was set to 2. In the extremely rare cases, when a fracture contained 5 - 10 mm thick clayey bands together with epidote and chlorite the joint alteration number was set to 3.

When the alteration of a fracture was 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.

Joint alteration number 1 was quite common, 1.5 extremely common and 2 and 3 extremely rare. No fracture with higher joint alteration number was identified.

4.2.3 Mapping of broken fractures not visible in the BIPS-image

Not all fractures that cut the drill core are visible in the BIPS-images. Fractures not visible in the BIPS-images have been oriented using the guide-line method, based on the following data:

- Absolute depth.
- "Amplitude". Distance between extremes along the borehole.
- Exact orientation of the fracture trace as measured on the drill core in relation to a close lying, well defined, geological structure visible in the BIPS-image.

The error of orientating fractures using the "guide-line" method is not known but an estimation using stereo plots indicated that the error most likely is insignificant. Anyhow, the guide-line method is so far considered much better than only marking fractures non-visible in the BIPS-images as lines 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 has a more accurate orientation.

When using the "guide-line" method the difference between the 56 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.

The importance of orientating fractures that are not visible in the BIPS-images is highlighted by the fact that over 30% of the broken fractures are not visible in the BIPS-image; a figure that raises to over 50% in some sections of KSH01.

4.2.4 Definition of veins versus dikes

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

4.2.5 Use of special mineral codes

Special mineral codes have been used as follows:

X1 Epidotized wall rock.

X2 Black soft fillings of a shiny slippery mineral, probably a mixture of chlorite and a clay mineral.

X3 Whitish soft crystals as a granular crystalline coating which reacts with acid. These crystals are possibly laumontite or a mixture of laumontite and calcite.

X4 This code represents a bluish grey hard filling. It is possibly a mixture of quartz, epidote and prehnite.

X5 Molybdenite.

4.3 Data handling

The mapping was performed on-line on the SKB network, in order to obtain the best possible data security. Before every break (exceeding 15 minutes) a back-up was saved on the local disk.

The mapping was quality checked by a routine in Boremap before it was exported to and archived in SICADA. Personnel from SKB also performed random test controls and regular quality revisions.

All primary data are stored in the SKB SICADA database under Field Note: Simpevarp 101. Only these quality checked data are to be used for further interpretation and modelling.

5 Results

The results from the mapping of KSH01 are found in the SICADA database and all data for further interpretation of this mapping should be taken from the SICADA database. The BIPS-images of KSH01A and KSH01B are shown in Appendix 4 and 5 and the corresponding WellCad diagrams are found in Appendix 6 and 7. Orientations of all fractures interpreted as open are plotted in Appendix 3.

5.1 Geological summary table, general description

The Geological Summary table (see Appendix 1) is an easy to read 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 summary of a borehole.

This Geological Summary table is the result of cooperation between Jan Ehrenborg from the mapping personnel at Simpevarp and Pär Kinnbom from PO (site investigation, Oskarshamn). 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 (see Appendix 2).

The search paths can, however, yet not be used in an automatized way, therefore the geological information until now has been extracted from the SICADA database, reworked on separate Excel-files and then presented in the Geological Summary table. For 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 can not be extracted automatically is the lack of a mathematical formula to calculate frequencies for different parameters. Such a formula will be added.

The need to rework the SICADA information on separate Excel-files exists because some information is written in the Comment field for individual observations in Boremap and therefore has to be extracted manually. This problem is also being dealt with.

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 just 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.

Only the Rock Type and Alteration columns and their symbols are identical with the WellCad presentation. Although the other columns are not found in WellCad the general idea has been to follow the WellCad presentation as close as possible.

5.1.1 Columns in the Geological Summary table

The Geological summary table includes the following 23 columns:

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

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

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

Column 4. *Alteration/oxidation* is an interval column. No frequency column is presented for alteration/oxidation. The alteration/oxidation column is identical with the WellCad presentation.

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

Column 6. *Rock Occurrence/Veins+ Dykes < 1m wide* is a frequency column. This rock type column can be seen as the frequency complement to the rock type/lithology interval column. Only rock type sections narrower than 1 m can be described as rock occurrences in Boremap. Thicker rock type sections are found under rock type.

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

Column 8. *Structure/Brecciated < 1m wide* is a frequency column. Breccias <1m wide are mapped under rock occurrence in Boremap. Very narrow micro breccias along sealed/natural fracture planes are generally not considered.

Column 9. *Structure/Brecciated =/> 1m wide* is an interval column. Breccias >1m wide are mapped under rock type/structure in Boremap.

Column 10. *Structure/Mylonite < 1m wide* is a frequency column. Mylonites <1m wide are mapped under rock occurrence/structure in Boremap.

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

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

Column 13. *Structure/Foliation =/> 1m wide* is an interval column. Sections with foliation >1m wide are mapped under rock type/structure in Boremap.

Column 14. *Sealed fractures (interpreted)/All* is a frequency column. This column includes all fractures interpreted as sealed with the Boremap system. It includes sealed fractures where the drill core is not broken as well as sealed fractures interpreted to have opened up artificially during/after drilling.

Column 15. *Sealed fractures (interpreted)/Broken fractures with aperture = 0* is a frequency column. This column includes sealed fractures interpreted to have opened up artificially during/after drilling.

Column 16. *Sealed fractures (interpreted)/Sealed Fracture Network < 1m wide* is a frequency column. The sealed fracture network parameter is the only parameter that generally is evaluated directly from observation of the drill core. It can only in rare cases be observed in the BIPS-image. The reason is that these type of sealed fractures rarely are visible in the BIPS-image.

Column 17. *Sealed fractures (interpreted)/Sealed Fracture Network =/> 1m wide* is an interval column.

Column 18. *Open fractures (interpreted)/All Aperture > 0* is a frequency column. This column includes all open fractures, both fractures that with certainty were opened before drilling and fractures that probably or possibly were opened before drilling.

Column 19. *Open fractures (interpreted)/Uncertain, Aperture = 0.5 probable + 0.5 possible* is a frequency column. This column includes fractures that probably or possibly opened before drilling.

Column 20. *Open fractures (interpreted)/Certain Aperture = 0.5 certain and > 0.5* is a frequency column. This column includes fractures that with certainty were opened before drilling.

Column 21. *Open fractures (interpreted)/Joint alteration/> 1.5* is a frequency column. This column show fractures with stronger joint alteration than normal. This parameter generally goes hand in hand with the location of lithologies with a more weathered appearance.

Column 22. *Open fractures (interpreted)/Crush < 1m wide* is a frequency column. This column includes shorter sections with crush.

Column 23. *Open fractures (interpreted)/Crush =/> 1m wide* is an interval column. This column includes longer sections with crush.

5.2 Geological Summary table, KSH01

The Geological Summary table for KSH01 is presented in Appendix 1. All length information in this chapter is taken from the Geological Summary table and therefore includes an error of 5 - 10 m. It clearly shows the major change in geological parameters at 600–630 m.

The length 600 – 630 m is marked by long sections of mylonite, breccia and sealed fracture network. Thicker homogeneous and massive rock sections above 600 m are replaced by a sequence of thinner, rapidly alternating bands of varying lithologies downwards. The massive structure in the rock above 600 m is further on replaced by continuous foliation to mylonitization downwards and the oxidation disappears almost completely at the length 630 m.

Open as well as sealed fractures are few below 600 m but plentiful in the fine-grained dioritoid above 600 m.

There is a strong uncertainty whether broken fractures were open before drilling or during/after drilling. This is shown by columns 19 (Open fractures interpreted, uncertain) and 20 (Open fractures interpreted, certain) in the Geological Summary table for KSH02 (see Appendix 1). The reason for this is that the core has a tendency to break up along existing sealed fractures. It is probable that this problem is related to the geology in the Simpevarp peninsula.

5.3 Lithologies in KSH01

The authors agree with how C.H. Wahlgren (SGU = Swedish Geological Survey) interprets the geology in the Simpevarp area.

Lithologies found in KSH01 are:

1) fine-grained dioritoid,

2) quartz monzodiorite,

3) Ävrö granite,

4) veins and dykes of pegmatite and fine-grained granite,

5) mafic dykes.

Borehole KSH01 includes three lithologically different sections.

1) The upper 200 m are made up of quartz monzodiorite,

2) the section 200 - 600 m are made up of fine-grained dioritoid, and

3) the section 600 - 1000 m contain rapid alternation between bands of Ävrö granite and quartz monzodiorite.

The upper 600 m of KSH01 was lithologically homogeneous and uncomplicated whereas the interval from 600 m and downwards was more complicated. The main reason for this was that the rapid lithological changes were often accompanied by diffuse (not sharp) rock contacts.

5.3.1 Fine-grained dioritoid

The fine-grained dioritoid (SKB code 501030) is only found in three sections within the interval 204 – 628 m in KSH01. The section 204 – 248 m is intruded by three quartz monzodioritic dykes and a pegmatite dyke and shows weak oxidation at the upper contact to the quartz monzodiorite and medium to strong oxidation at the lower contact. The section 321 – 339 m is intruded by two quartz monzodiorite dykes and the section 350 – 628 m is intruded by fine-grained granite and pegmatite dykes especially at the 360 m level and by a mafic dyke at the 589 m level.

The fine-grained dioritoid is a massive, homogeneous, dark grey, fine grained to extremely fine grained, equigranular and occasionally feldspar porphyritic rock. The lack of volcanic textures and superficial deposits together with fine grain size and feldspar phenocrysts has raised the hitherto unanswered question weather this rock is a true volcanite or a sub intrusive (pers. com. C. H. Wahlgren). The fine-grained dioritoid is extremely rich in sealed and oxidized fractures, it often shows sections with oxidation and it is hornfels altered, probably by the adjacent quartz monzodiorite.

A character of fine-grained dioritoid, which differentiate it from other rock types in KSH01 is that the rock always contain a rather dense network of sealed micro-fractures, often only with oxidized walls. The dioritoid is loaded with these fractures, possibly mostly randomly oriented. The fracture walls are generally oxidized to a thickness of one to a few mm. The micro fractures are interpreted as possibly very old and might even have originated as a ”primary” feature of the rock or from the time when the dioritoid was intruded by the quartz monzodiorite. The micro fractures seem to be so strongly sealed that they now form an intimate part of the dioritoid.

5.3.2 Quartz monzodioritoid

The quartz monzodiorite (SKB code 501036) is observed in sections 0 – 205 m, 245 – 320 m and interlayered with Ävrö granite in section 690 – 1000 m.

One to a few metre thick quartz monzodiorite dykes also occur in the interval 0 – 350 m. The quartz monzodiorite is a massive, dark grey, medium grained, equigranular, and homogeneous rock. It has generally a rather fresh greyish appearance even though small greenish crystals can be observed with a hand lens indicating possible weak general epidotization.

The quartz-monzodiorite is weakly oxidized in cm-dm wide sections (rarely 1 - 6 m wide) along sealed fractures. Sections with foliation and brecciation are lacking, with the exception of the interval 248 – 322 m. Here the upper contact to the fine-grained dioritoid is thoroughly deformed by weak shearing and strong brecciation accompanied by intense alteration through oxidation, epidotization and probably also chloritization. The epidotization and chloritization gets successively weaker away from the contact at 248 m to 260 m depth, whereas the oxidation continues within the quartz monzodiorite all the way down to the lower contact between quartz monzodiorite and fine-grained dioritoid at the depth 322 m. This oxidation varies but in a general sense it gets weaker towards the depth 322 m.

The contacts between the quartz monzodiorite and the fine-grained dioritoid in the interval 0 – 350 m are either sharp or have a diffuse breccia like appearance. The contacts between the quartz monzonite and the Ävrö granite in the interval 690 – 1000 m are generally diffuse and irregular. The quartz monzodiorite and the Ävrö granite are intimately mixed, probably through magma mingling (pers. com. C.H. Wahlgren), generally giving the drill core a diffusely banded appearance in the interval 690 – 1000 m. Comparisons in the field, however, show that this banded structure might be a magma mingling breccia structure rather than pure banding. The quartz monzodiorite is in the interval 690 – 1000 m generally faintly to weakly foliated and frequently include feldspar megacrysts and Ävrö granite material probably as part of the magma mingling process.

5.3.3 Ävrö granite

The Ävrö granite (SKB code 501044) is found in the section 628 m to 1000 m. It is granite to quartz monzodiorite in composition. It makes up thicker sections in the intervals 628–690 m and 855–980 m and is interlayered with the quartz monzodiorite in the interval 768–855 m.

The Ävrö granite is faintly to strongly foliated and never completely massive. It is light pinkish grey, medium to coarse-grained and rich in feldspar phenocrysts. The colour varies from greyish to reddish and the reddish colour is believed to be a result of secondary oxidation.

Quartz can generally not be observed with the naked eye in the Ävrö granite but blue quartz has been found in the foliated section 685 – 1000 m especially in sections 640 – 660 m and 870 – 920 m. These sections with blue quartz have diffuse contacts.

5.4 Rock contacts

Rock contacts between mayor lithological units are often diffuse. In the lower part of the borehole they might have been reoriented due to ductile deformation. Although it is generally no problem to map contacts at the right depth it is often very difficult to be certain about the exact delineation of these in the BIPS-image and thus their true orientation.

A stereo plot of all rock contacts in KSH01 shows two maxima. An elongated maximum which coincides with the rather steep dipping northeast oriented mylonites and foliations and a small and low maximum showing orientations at right angle to the drill core. The strongest maxima represent rock contacts rotated by ductile deformation while the contacts outside the section with ductile deformation most likely have other orientations. The weakest maxima are representing contacts drawn approximately at right angle to the borehole since only the depth, not the orientation, was seen in the BIPS image because of diffuse contact relationships.

The true orientation of rock contacts in KSH01 can thus not be read from the BIPS-images. It is thus impossible to extrapolate the orientations of rock contacts from KSH01 to other boreholes using the strike and dip data for rock contacts. These conclusions are drawn only for borehole KSH01.

5.5 Alterations

The following types of alteration occur in KSH01; hornfels alteration, oxidation, epidotization and possible chloritization.

Since only one alteration type can be mapped with BIPS at the same depth, oxidation has been given priority over the other alteration types. This is because it is closely related to open and sealed fractures. Also epidotization occur around fractures but is sometimes confused with a possible general epidotization.

Possible chloritization has only been detected in a rather narrow section in the strongly epidotized and oxidized section from 248 m to 260 m depth mentioned earlier. The chloritization occurs below the contact between overlying quartz monzodiorite and fine-grained dioritoid at the depth 248 m.

5.5.1 Hornfels alteration

The fine-grained dioritoid is recrystalized by hornfels alteration. This has resulted in a homogeneous distribution of mm-sized light coloured porphyroblasts along minor fractures and 5 - 10 mm big dark spotty mineral aggregates with leucocratic borders. Intense growth of these spotty aggregates gives the rock a homogeneous fine- to medium grained texture. The hornfels alteration is believed to be the result of contact metamorphism caused by hot quartz monzodioritic magma.

5.5.2 Oxidation

Continuous observations in KSH01 showed that oxidation has an intimate spatial relationship with both open and sealed fractures and is usually seen as a reddish hue around these fractures. Wider sections of oxidation occur at the same depth as peaks in the amount of both open and sealed fractures.

There is also a strong spatial correlation between oxidation and lithology. Faint to strong oxidation is common all along borehole KSH01 but wider sections of more intense oxidation are clearly limited to the fine-grained dioritoid in the interval 204 m-628 m. Also the wall rock along aplite and pegmatite veins showed frequent oxidation. The fine-grained dioritoid has served as the key lithology for localization of both aplite- and pegmatite veins and oxidized sections. For some reason dykes do not show strong spatial correlation with oxidation.

The oxidation in the 65 m long section in the interval 250 – 322 m in quartz monzodiorite is possibly related to the fact that the quartz monzodiorite here might be a thicker dyke within the fine-grained dioritoid.

5.5.3 Epidotization

All of the lithologies in borehole KSH01 are probably epidotized to some degree and even if the quartz monzodiorite looks very fresh and small greyish green grains of epidote are observed with a hand lens. This is also the case at deeper levels of KSH01. The fine-grained dioritoid, however, definitely has a greenish hue in many sections and is most likely overprinted by a general epidotization. The distribution of this epidotization has not been mapped in Boremap because of identification problems.

Sealed fractures with cm-dm wide sections of epidotized wall rock, is not uncommon in KSH01. So far all detections of age relations show that the epidotization is younger than the oxidation and where they occur at the same depth the epidotization cuts and bleaches the reddish oxidized wall rock, especially in the uppermost 300 - 400 m of KSH01. Epidotization around fractures is more common in the fine-grained dioritoid than in other lithologies.

The general epidotization is interpreted as another event than the epidotization around fractures.

5.6 Ductile deformation

The ductile deformation seems to be spatially related to the enrichment in hydrothermal minerals like chalcopyrite, fluorite and molybdenite.

There is a striking difference in deformation between the uppermost 600 m with massive undeformed rocks, compared to the lowermost 400 m which are faintly to strongly foliated. The foliation occasionally grades into sections with mylonite. A narrower section with foliation occurs at 588 - 589 m depth. Otherwise the foliation starts at 608 m and continues without interruption, but with varying intensity, down to 1000 m.

The heterogeneous deformation below 600 m, with rapid changes of foliation intensity as well as dm-thin to tens of meters thick mylonites, shows that the ductile deformation is at depth localized to a section rather than a regionally deformed rock complex. Cm-dm wide, tightly folded aplite and pegmatite veins with axial plane foliation have also been observed.

Especially the mylonite that marks the upper limit of the interval with plastic deformation at 608 - 628 m, is outstanding for borehole KSH01. Age relations show that the hornfels altered fine-grained dioritoid was first cut by aplite and pegmatite veins and thereafter probably epidotized in the ductile deformation that resulted in the mylonite. The ductile deformation was followed by fracturing and strong brecciation of the mylonite, and sealed with a bluish grey mixture, of probably quartz, epidote and prehnite. Later calcite and calcite + quartz sealed fractures cut this brecciated mylonite. No spatial relation has been detected between sections of older strong foliation to mylonitization and younger open fractures.

5.7 Orientations of open fractures

5.7.1 Orientations of open fractures

The borehole has been divided into three sections (Chapter 5.3). Orientation data of all open fractures within each section is presented in the pole to plane stereograms in Appendix 3. All the orientation values presented in this chapter are strike/dip values using the right hand rule.

A semicircular high anomaly maximum with the orientation 250-280/12-16 occurs in sections I and II. It represents open fractures not visible in the BIPS-image. As a standard, fractures not visible in BIPS were mapped as if they lay at a right angle to the drill core in sections I and II. The high anomaly maximum is thus artificial. However, from 500 m and down to 1000 m fractures not visible in the BIPS-image were orientated according to the guide-line method discussed in chapter 4.2.3. For this reason the artificial anomaly does not occur in section III.

The strong overrepresentation of horizontal- to sub-horizontal open fractures compared to the extremely rare occurrences of vertical open fractures depends on the sub-vertical orientation of the borehole and does not show the true distribution of fractures. Although this effect is most clearly shown as a semi-circular belt in the periphery of the stereograms where very few fractures are plotted, it can generally be observed for all anomalies in any stereogram. This effect is stronger the longer the plotted depth interval is.

The stereograms in Appendix 3 show the orientation of all open fractures in sections I, II and III. They are dominated by a few maxima in each section.

5.7.2 General relationships between fractures and geology

Intensity peaks of open fractures are sometimes observed in close spatial relationship with oxidized sections, indicating that oxidized sections have a stronger tendency to break up during brittle deformation than other sections of KSH01. This is the case at levels 240 - 260 m, 420 - 440 m, 580 - 640 m.

The distribution of open fractures indicates a higher tendency for the fine-grained dioritoid to break up during brittle deformation compared to other rock types in KSH01. This tendency is believed to be inherited from its fine to extremely fine grain size. Fracture frequency diagrams show that the fine-grained dioritoid, fine-grained granites and pegmatite veins are much richer in open and sealed fractures than other lithologies in KSH01. The abundance of veins shows that the fine-grained dioritoid has responded to stress by brittle deformation and fracturing during both earlier and later deformation events.

There is also a tendency for areas around the upper and lower contacts of the fine-grained dioritoid (at intervals 200 - 250 m and 590 - 640 m) to be more affected by brittle deformation than other sections of borehole KSH01.

There is no general correlation between the frequency distribution of open and sealed fractures with depth. On the contrary the frequency peaks for sealed fractures at the depth levels 300 -340 m and 480 -560 m coincide with frequency minima for open fractures.

5.8 General age relationships between veins, alterations and fracture minerals

The following general age relationships have been observed between veins, alterations and fracture minerals in drill core KSH01 (from oldest to youngest):

1. Oxidation occur together with veins of fine-grained granite and pegmatite.
2. Sealed fractures with epidote together with shear structures and breccias.
3. Sealed fractures with calcite or calcite + quartz.
4. Open fractures with a thin chlorite coating.

Alterations mentioned here only deal with alterations related to fractures and not more general alterations like hornfels alteration of the fine-grained dioritoid.

Red coloured oxidation in wider sections along individual fracture walls seems to have various origins. The oldest oxidation process seems to be related to massive reddish cm-dm thick pegmatites and granitic veins, occasionally foliated.

Epidote alteration and epidote sealed fractures and shear structures - with or without oxidized wall rock - are always younger than the pegmatite-granite veins with fracture related oxidation. Epidote sealed fractures and shear structures, for example, often cut pegmatites and granite veins, and oxidized sections are often bleached by later epidotization. Whether hematite was formed in the sealed fractures together with epidote and/or earlier with the general oxidation is not known.

Breccias of oxidized wall rock are frequently sealed by quartz, epidote, chlorite and/or prehnite. They are observed along cm wide shear structures, and are occasionally cut by another set of thin shear structures.

Shear structures are frequently cut by younger sealed fractures that are sealed by calcite, quartz, quartz + epidote, chlorite, laumontite, prehnite or pyrite.

6 Discussion

Fracture orientation data are improved if the fractures that are not visible in the BIPS-images are orientated according to the guide-line method described in chapter 4.2.3.

In Boremap all geological features are represented by planes intersecting the drill core. Non-planar structures such as small scale folding, curved fractures and lineations are therefore not correctly oriented.

The most important factor for detecting fractures in BIPS-images is a good image contrast between fracture and wall rock in the images. Mapping dark fractures in dark rocks and light coloured fractures in light coloured rock can be a very difficult task. Many fractures observable in the drill core are not visible in the BIPS-image because of lack of image contrast. The opposite phenomenon also occurs: when the contrast between fracture and wall rock is excellent, even fractures not visible in the drill core can be discernible in the BIPS-image. A good example of this is the extremely large amount of micro-fractures that occur in the fine-grained dioritoid in certain intervals.

It is also a draw back for the Boremap program that different overlapping features of the same type cannot be detected at the same depth. If, for example, epidotization and oxidation occur at the same depth only one alteration type can be mapped in Boremap and thus be presented in the WellCad presentation. The other alteration type can only be mentioned in the comments.

The Geological Summary table is introduced in this report with the purpose to be a standard presentation of the SICADA information in the report to each borehole in the future. This table include the majority of the parameters mapped with Boremap. It has a handy format and gives a good general idea about the distribution of each parameter along the borehole and how the different parameters relate to each other at specific depths. It also facilitates quick general comparison of geological parameters between boreholes.

Appendix 1

Geological Summary table, KSH01

GEOLOGICAL SUMMARY KSH01A **APPENDIX:**

Site	SIMPEVARP
Borehole	KSH01A + KSH01B
Coordinate System	RT90-RHB70
Date of mapping	2004-03-09 17:57:00

ROCKTYPE SIMPEVARP: Fine-grained granite; Pegmatite; Granite; Ävrö granite; Quartz monzodiorite; Diorite / Gabbro; Fine-grained dioritoid; Fine-grained diorite-gabbro

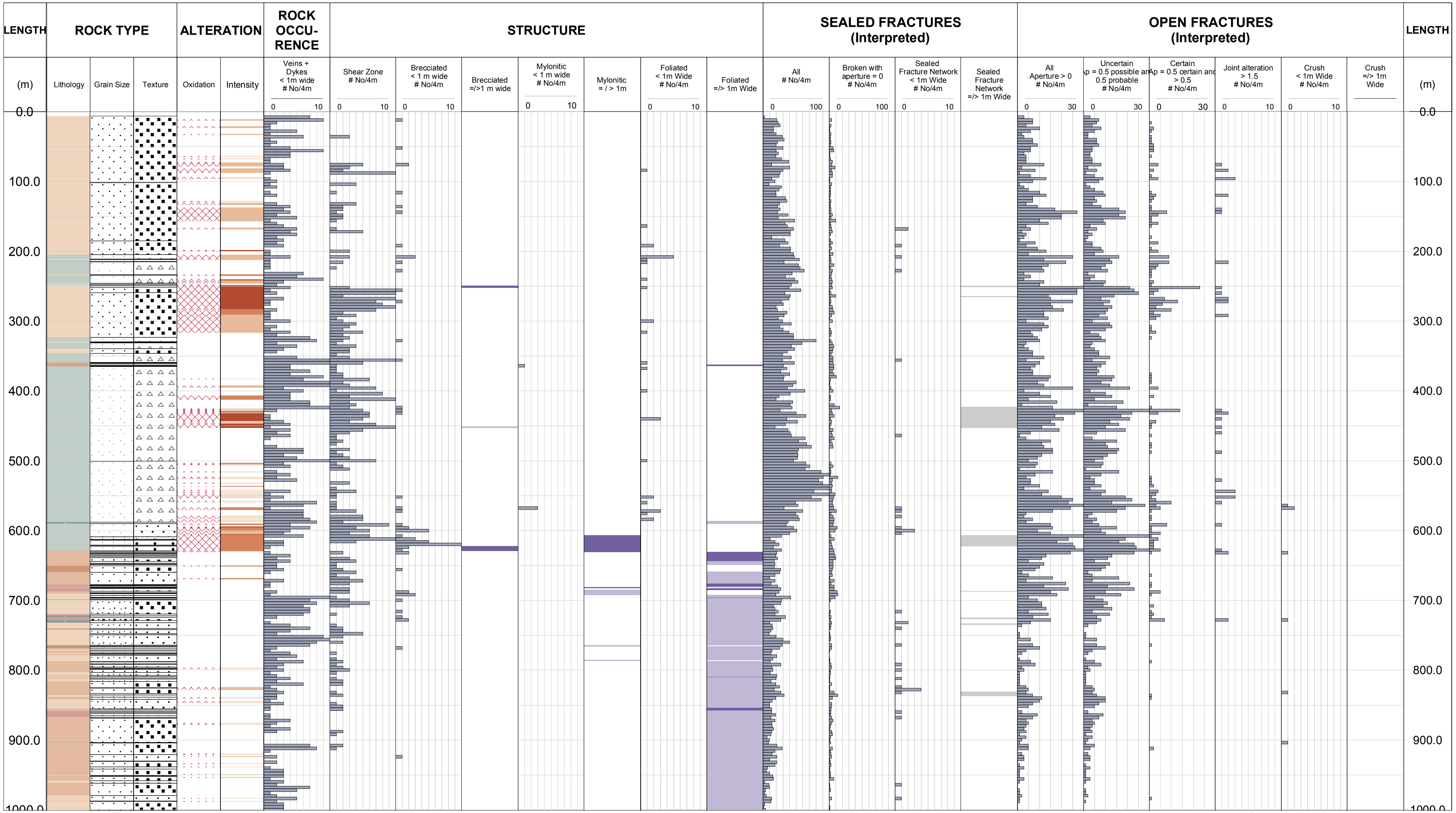
GRAINSIZE: Fine-grained; Fine to medium grained; Medium to coarse grained; Coarse-grained; Medium-grained

TEXTURE: Hornfelsed; Porphyritic; Equigranular; Un_equigranular

OXIDATION: Oxidized; Epidotisized

INTENSITY: Faint; Weak; Medium; Strong

STRUCTURE INTENSITY: Weak; Strong



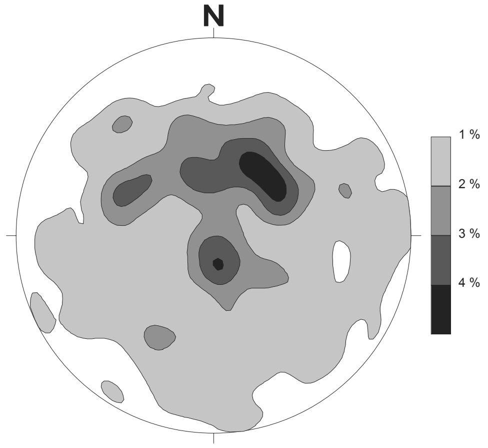
Appendix 2

Search paths for the Geological Summary table

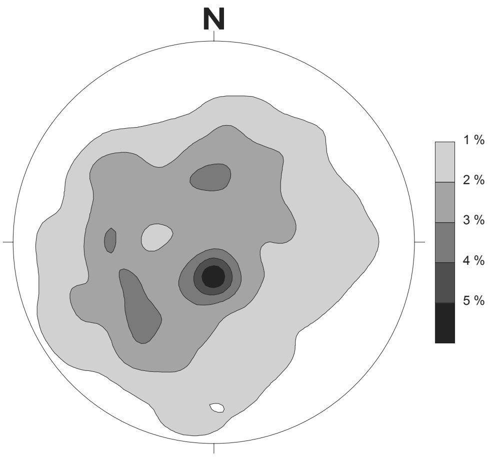
TABLE HEAD LINES		INFORMATION SOURCE				PRESENTATION
Head lines	**Sub head lines**	**Database**	**Varcode**	**First suborder**	**Second suborder**	**Interval/frequence**
Rock type	Lithology	SICADA	5	Sub 1		Interval
	Grain size	SICADA	5	Sub 5		Interval
	Texture	SICADA	5	Sub 6		Interval
Alteration	Oxidation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

Appendix 3

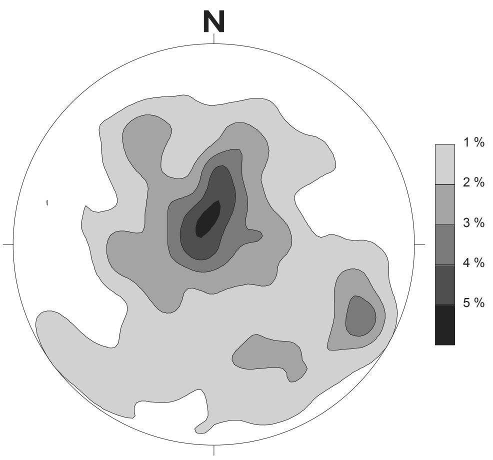
Stereographic projections of fracture data from KSH01A and KSH01B



Stereogram of poles to planes of open fractures in KSH01B and KSH01A, section I (6-204m, N=367 fractures).



Stereogram of poles to planes of open fractures in KSH01A, section II (204-628m, N=1439 fractures).



Stereogram of poles to planes of open fractures in KSH01A, section III (628-1000 m, N=488 fractures).

Appendix 4

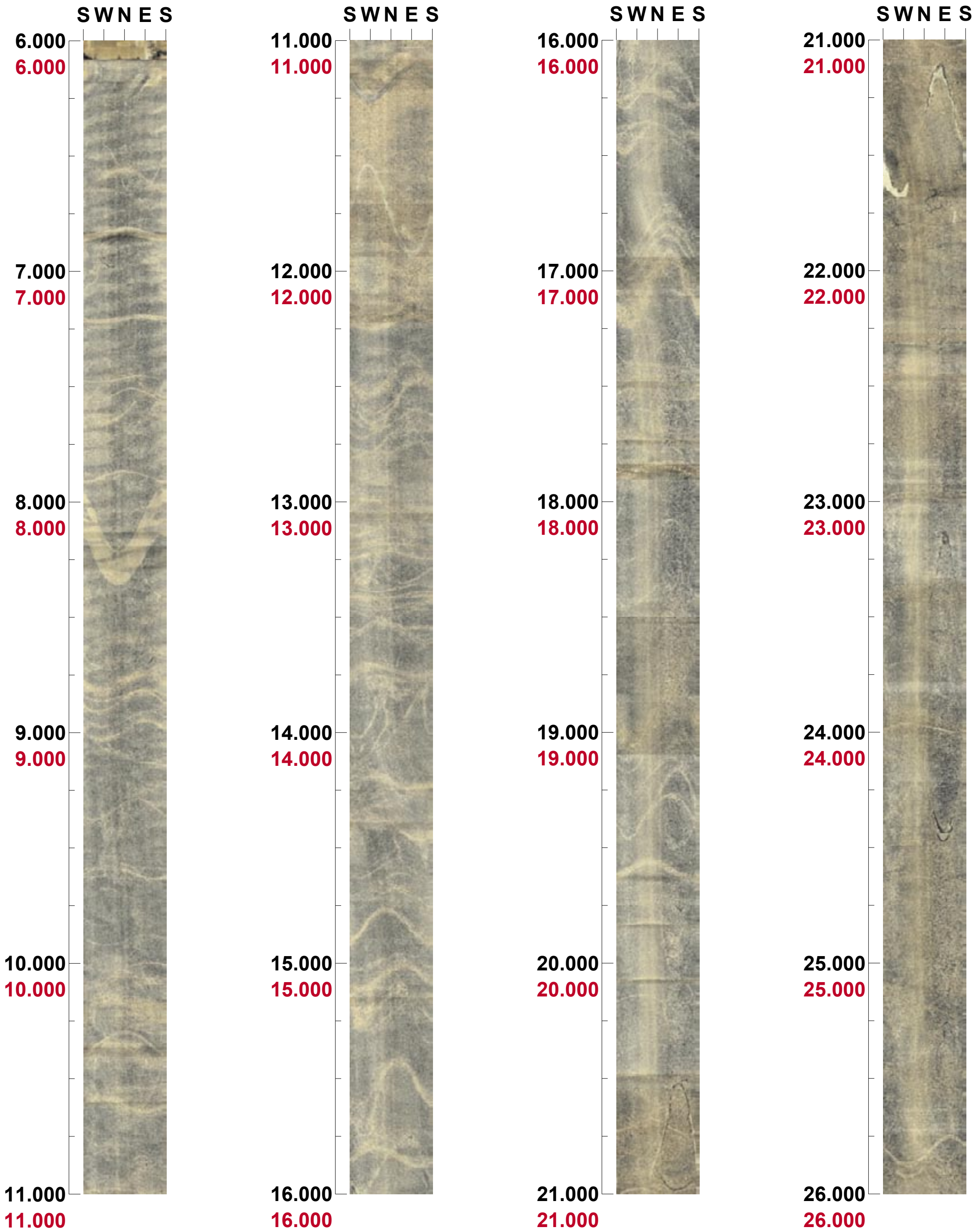
BIPS-images of KSH01B

Project name: Oskarshamn

Image file	: d:\ksh01_~1\ksh01b~1.bip
BDT file	: d:\ksh01_~1\ksh01b~1.bdt
Locality	: Simpevarp
Bore hole number	: KSH01B
Date	: 03/02/05
Time	: 21:19:00
Depth range	: 6.000 - 99.360 m
Diameter	: 76.0 mm
Magnetic declination	: 0.0
Span	: 4
Scan interval	: 0.25
Scan direction	: To bottom
Scale	: 1/25
Aspect ratio	: 150 %
Pages	: 5
Color	: +0 +0 +0

Project name: Oskarshamn
Bore hole No.: KSH01B

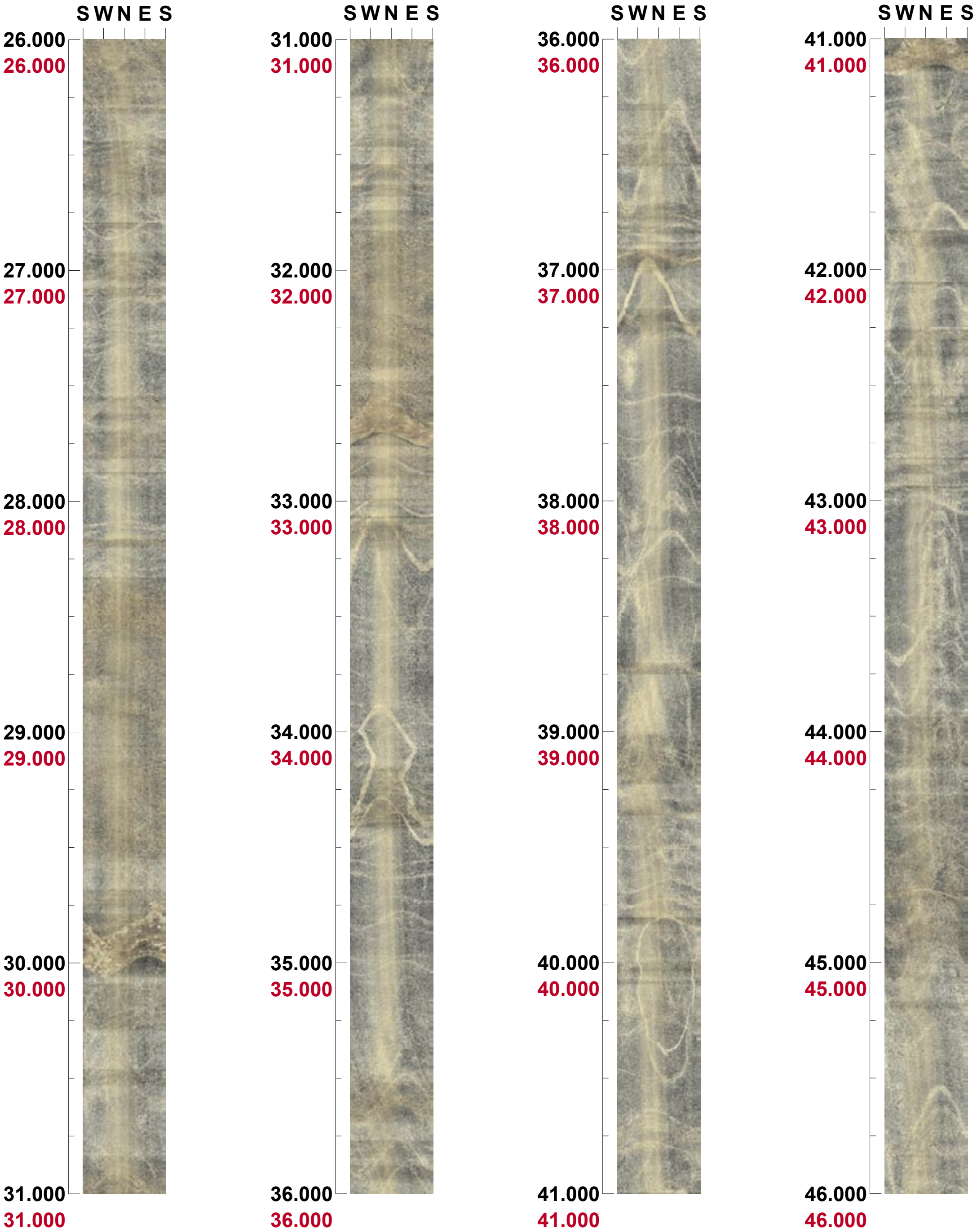
Depth range: 6.000 - 26.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01B

Depth range: 26.000 - 46.000 m



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

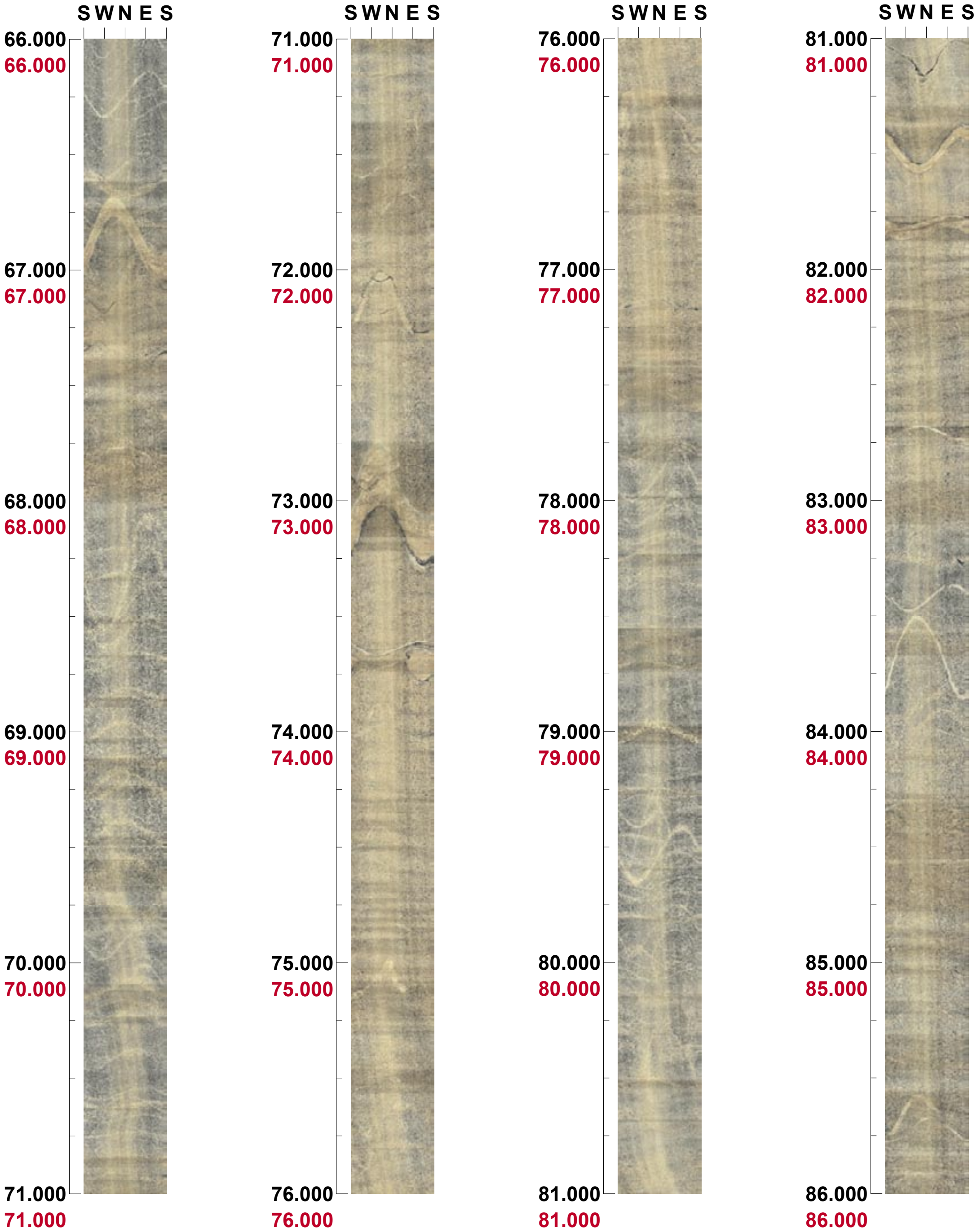
Project name: Oskarshamn
Bore hole No.: KSH01B

Depth range: 46.000 - 66.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH01B

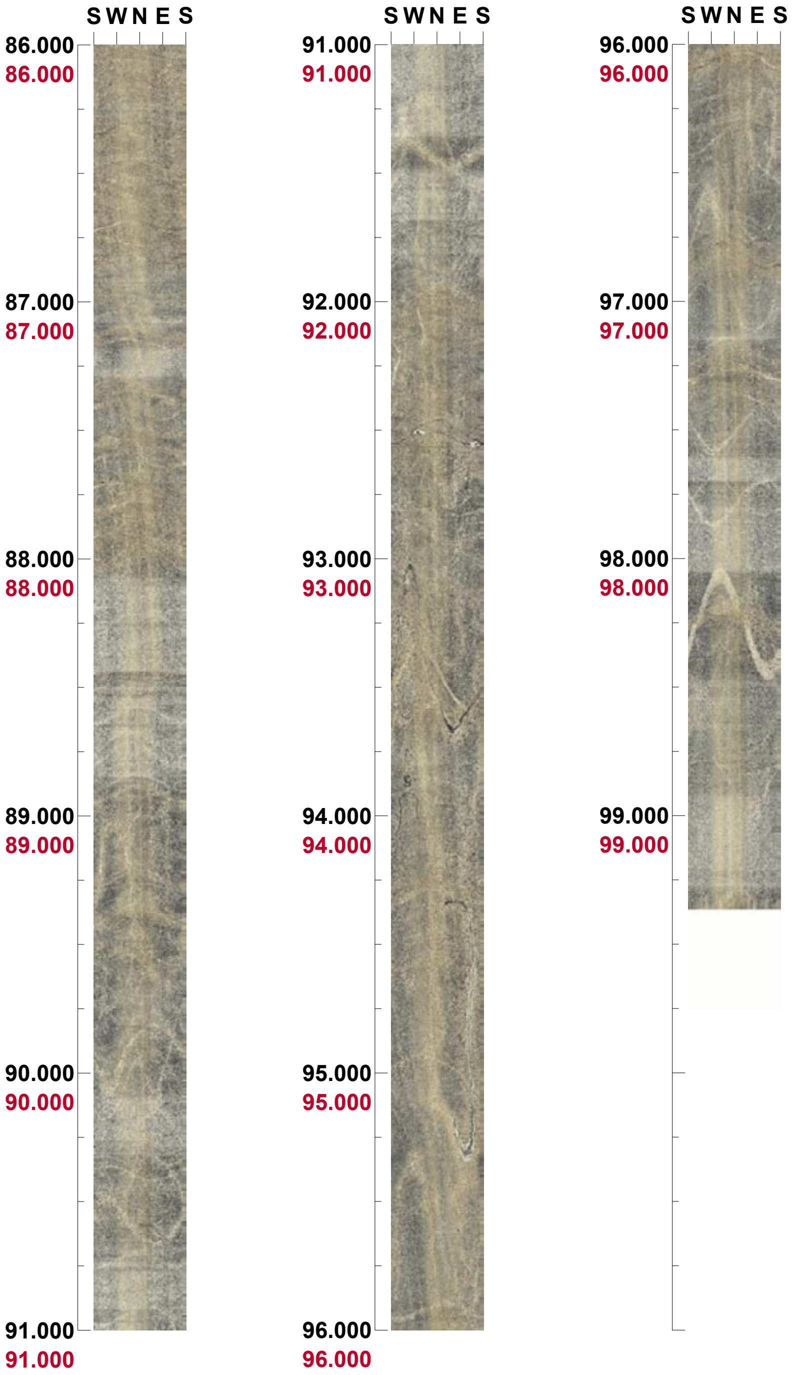
Depth range: 66.000 - 86.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01B

Depth range: 86.000 - 99.360 m



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

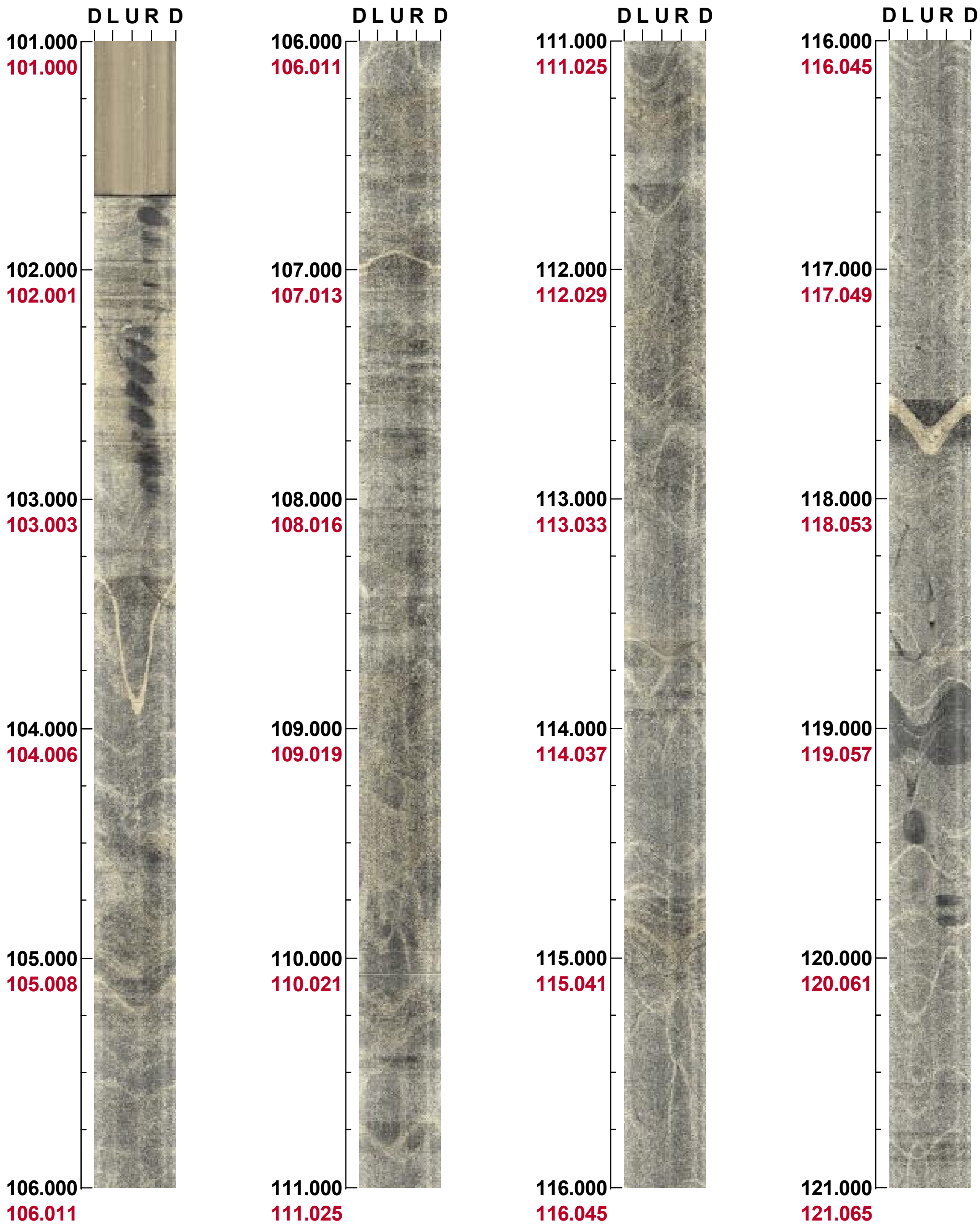
BIPS-images of KSH01A

Project name: Oskarshamn

Locality	: Simpevarp
Bore hole number	: KSH01A
Date	: 03/03/21
Time	: 17:18:00
Depth range	: 101.000 - 500.013 m
Azimuth	: 167
Inclination	: -76
Diameter	: 76.0 mm
Magnetic declination	: 0.0
Span	: 4
Scan interval	: 0.25
Scan direction	: To bottom
Scale	: 1/25
Aspect ratio	: 150 %
Pages	: 20
Color	: +0 +0 +0

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 167** **Inclination: -76**

Depth range: 101.000 - 121.000 m

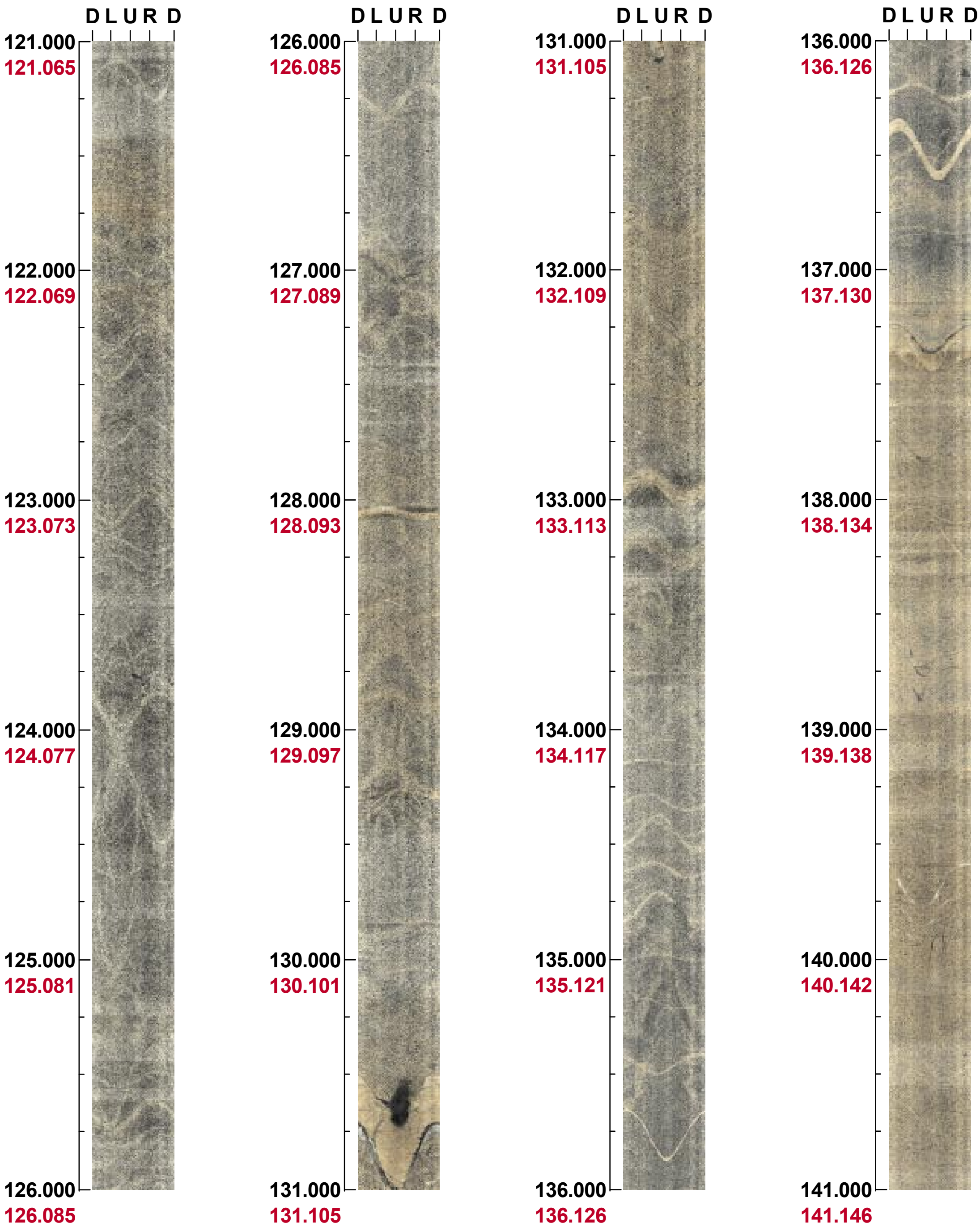


(1 / 20) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Oskarshamn

Bore hole No.: KSH01A **Azimuth: 167** **Inclination: -76**

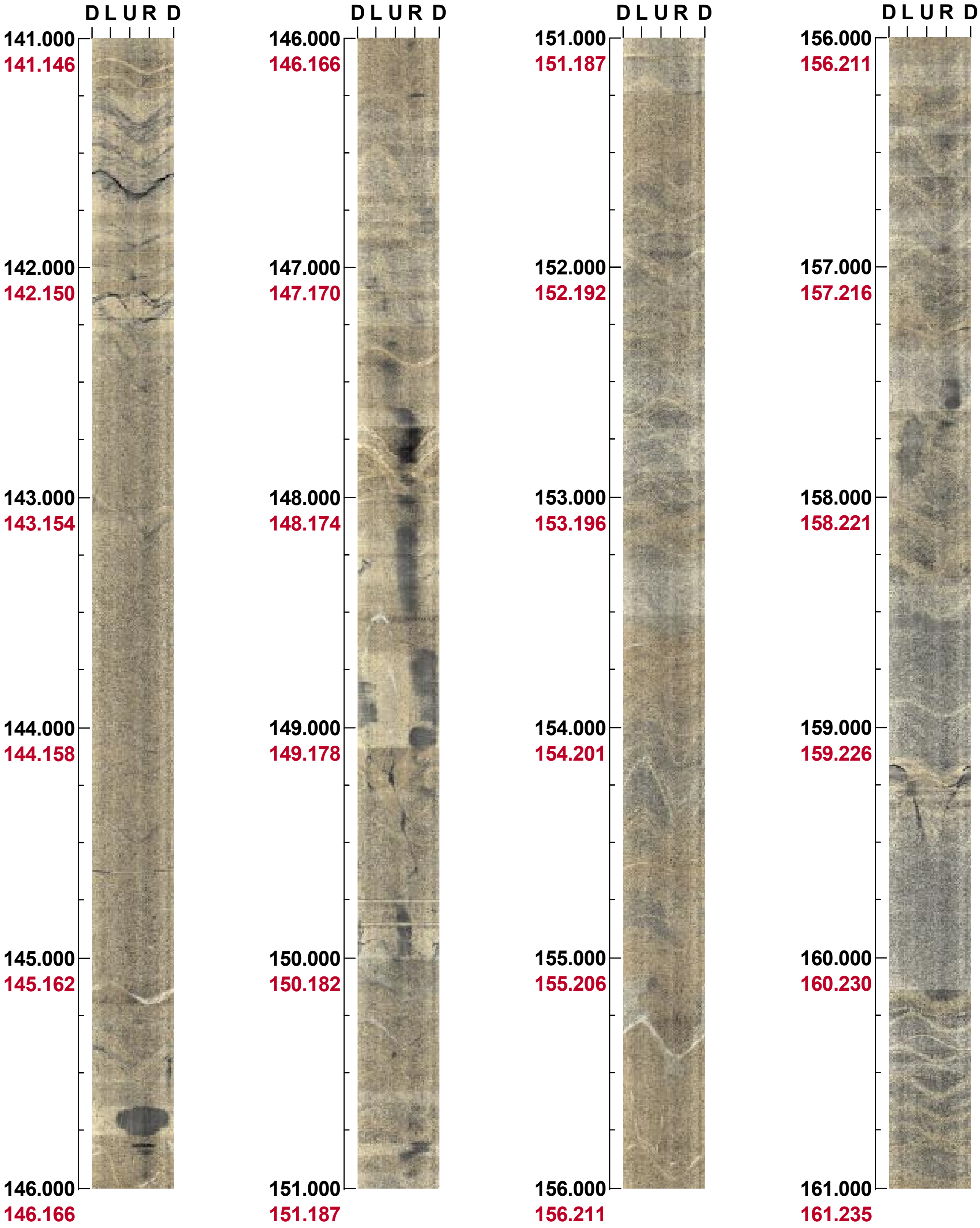
Depth range: 121.000 - 141.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01A Azimuth: 168 Inclination: -76

Depth range: 141.000 - 161.000 m

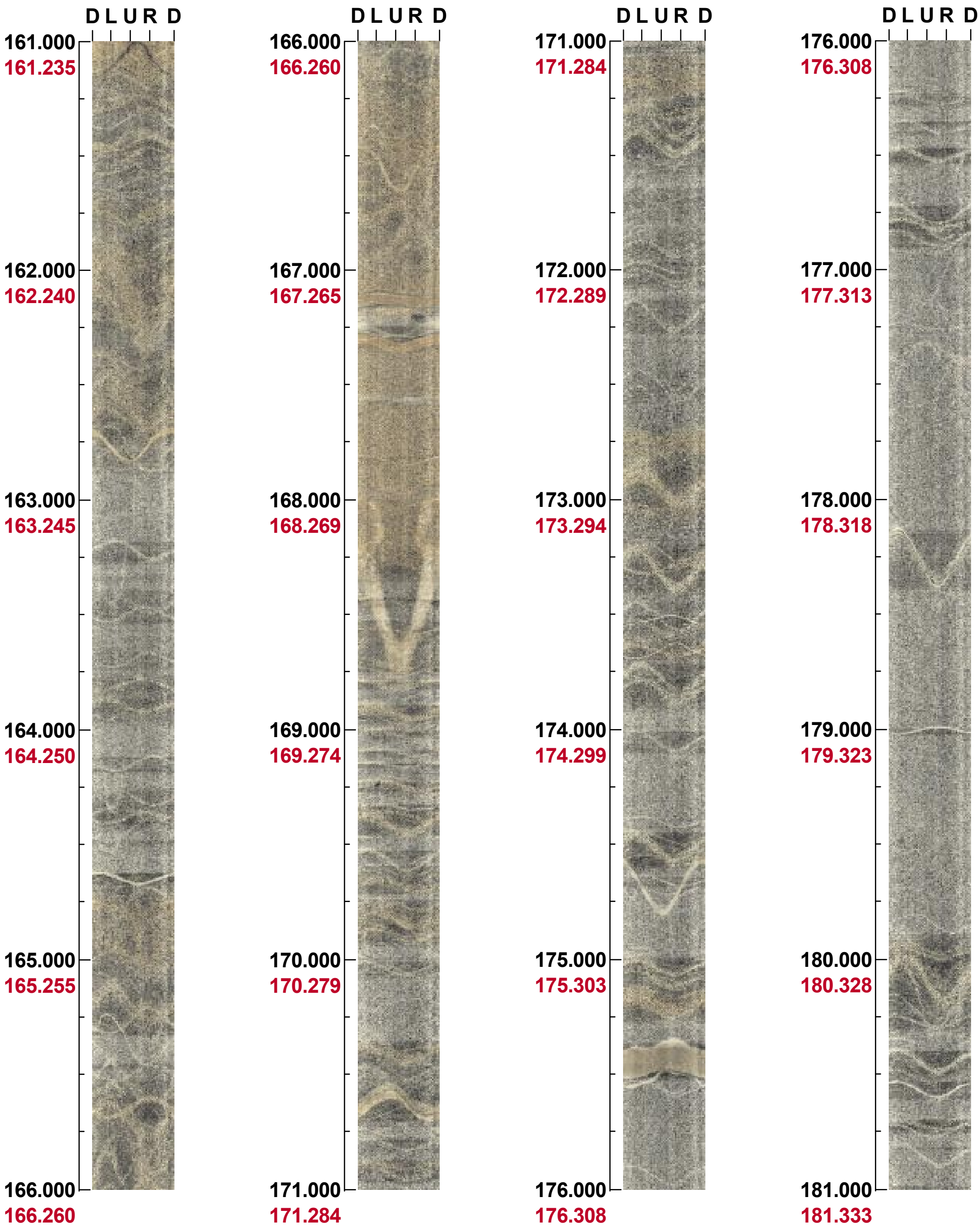


(3 / 20) Scale: 1/25 Aspect ratio: 150 %

Project name: Oskarshamn

Bore hole No.: KSH01A **Azimuth: 168** **Inclination: -76**

Depth range: 161.000 - 181.000 m

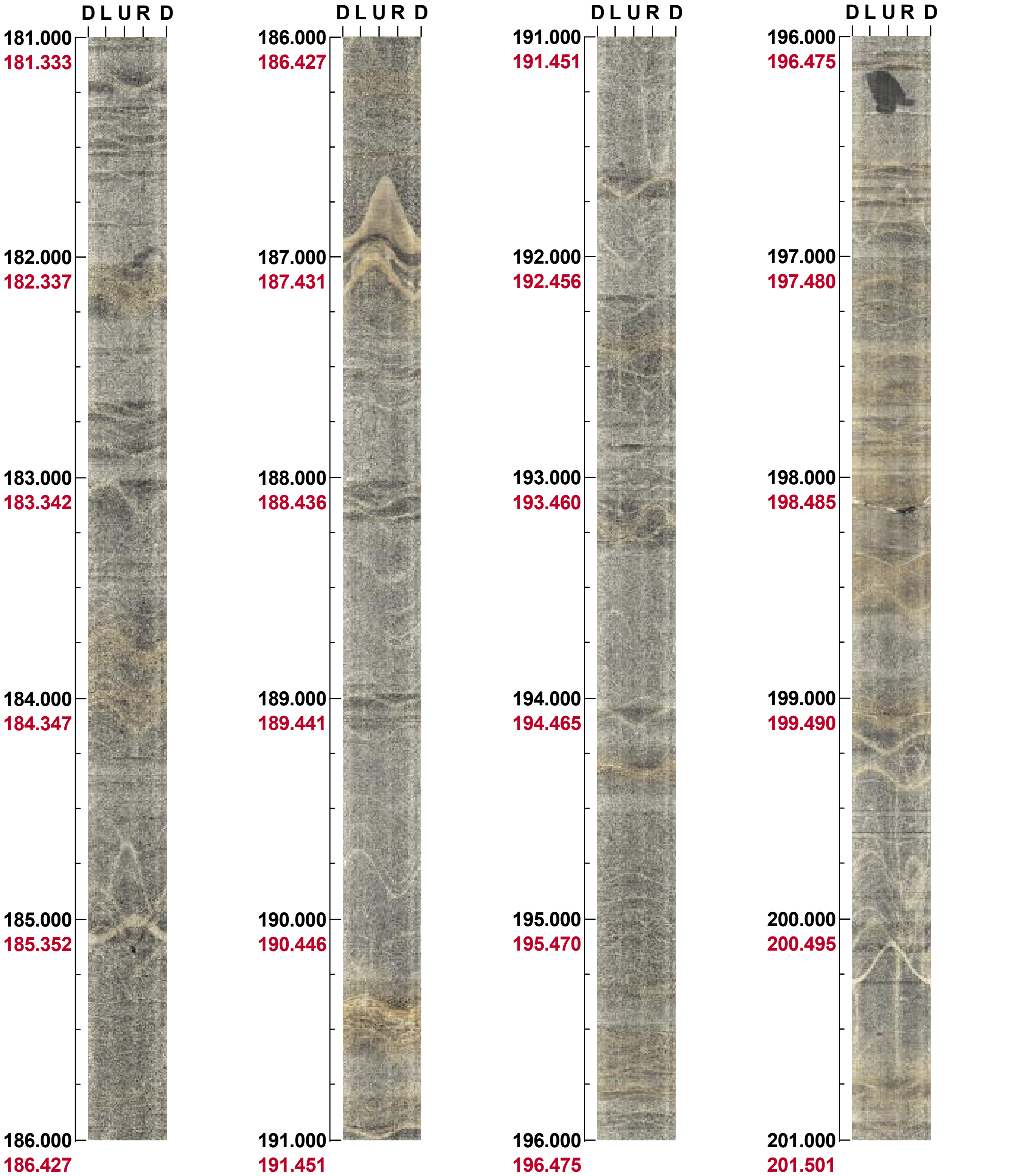


(4 / 20) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Oskarshamn

Bore hole No.: KSH01A **Azimuth: 170** **Inclination: -76**

Depth range: 181.000 - 201.000 m

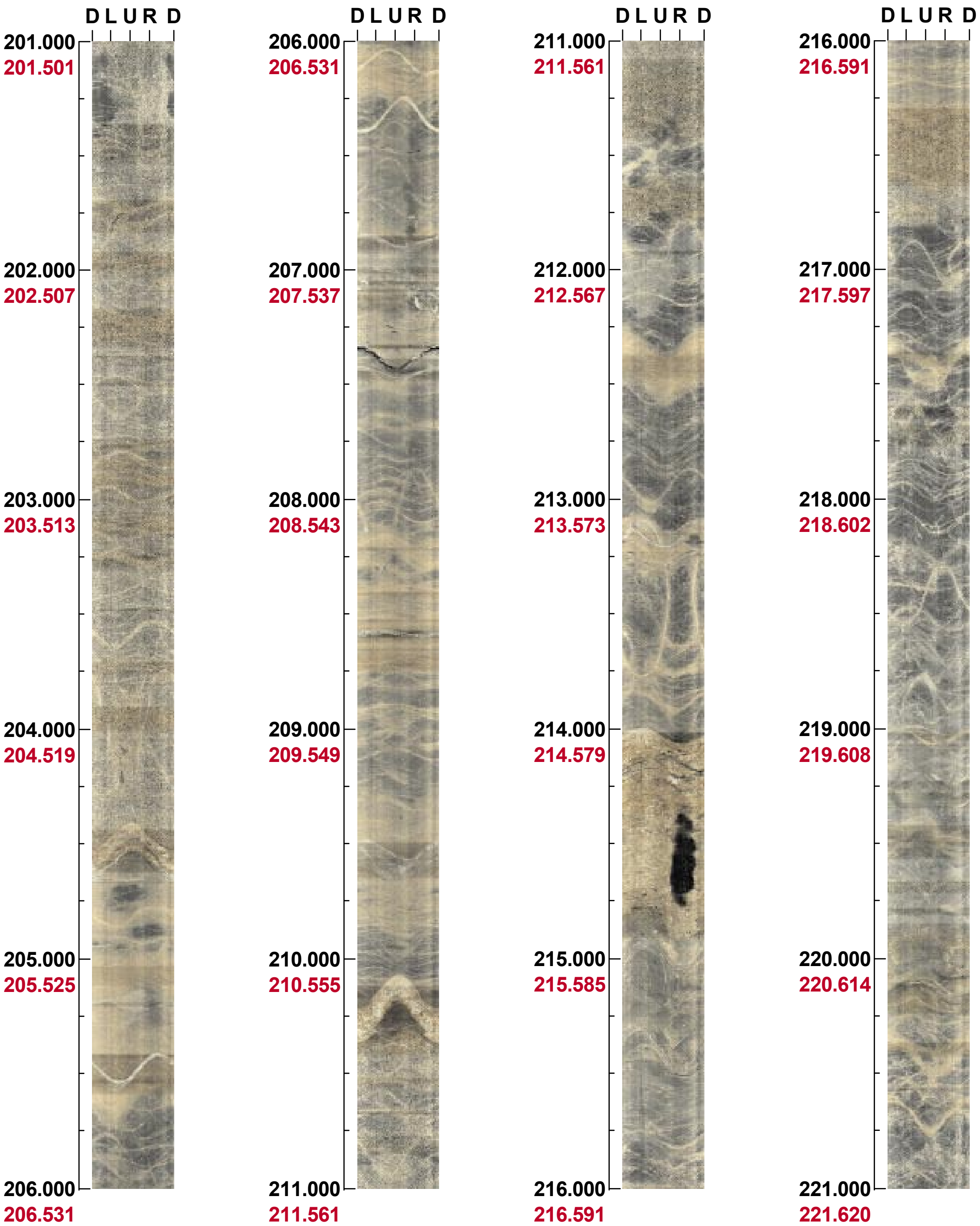


(5 / 20) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Oskarshamn

Bore hole No.: KSH01A **Azimuth: 171** **Inclination: -76**

Depth range: 201.000 - 221.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01A Azimuth: 172 Inclination: -76

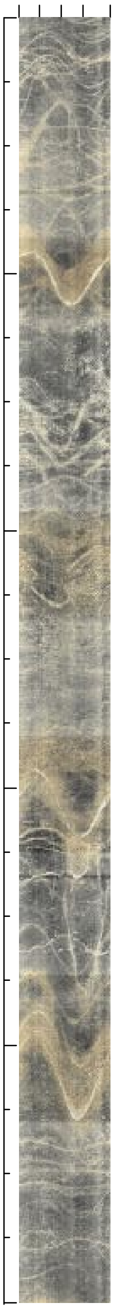
Depth range: 221.000 - 241.000 m

D L U R D

221.000
221.620
222.000
222.626
223.000
223.632
224.000
224.638
225.000
225.644
226.000
226.650

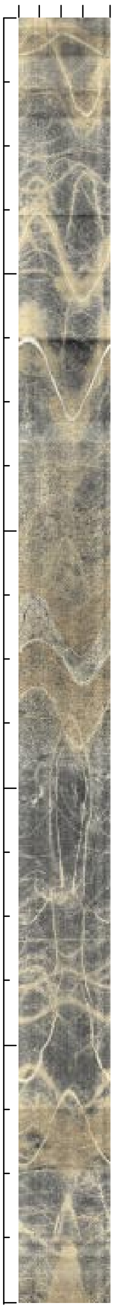
D L U R D

226.000
226.650
227.000
227.656
228.000
228.662
229.000
229.668
230.000
230.674
231.000
231.680



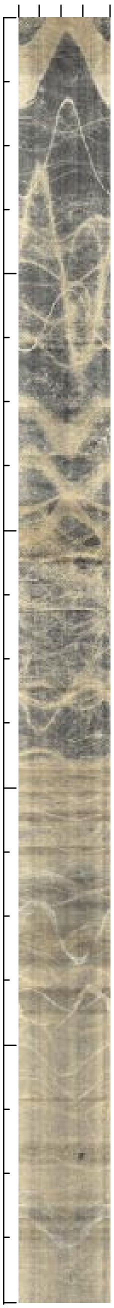
D L U R D

231.000
231.680
232.000
232.686
233.000
233.692
234.000
234.698
235.000
235.704
236.000
236.710



D L U R D

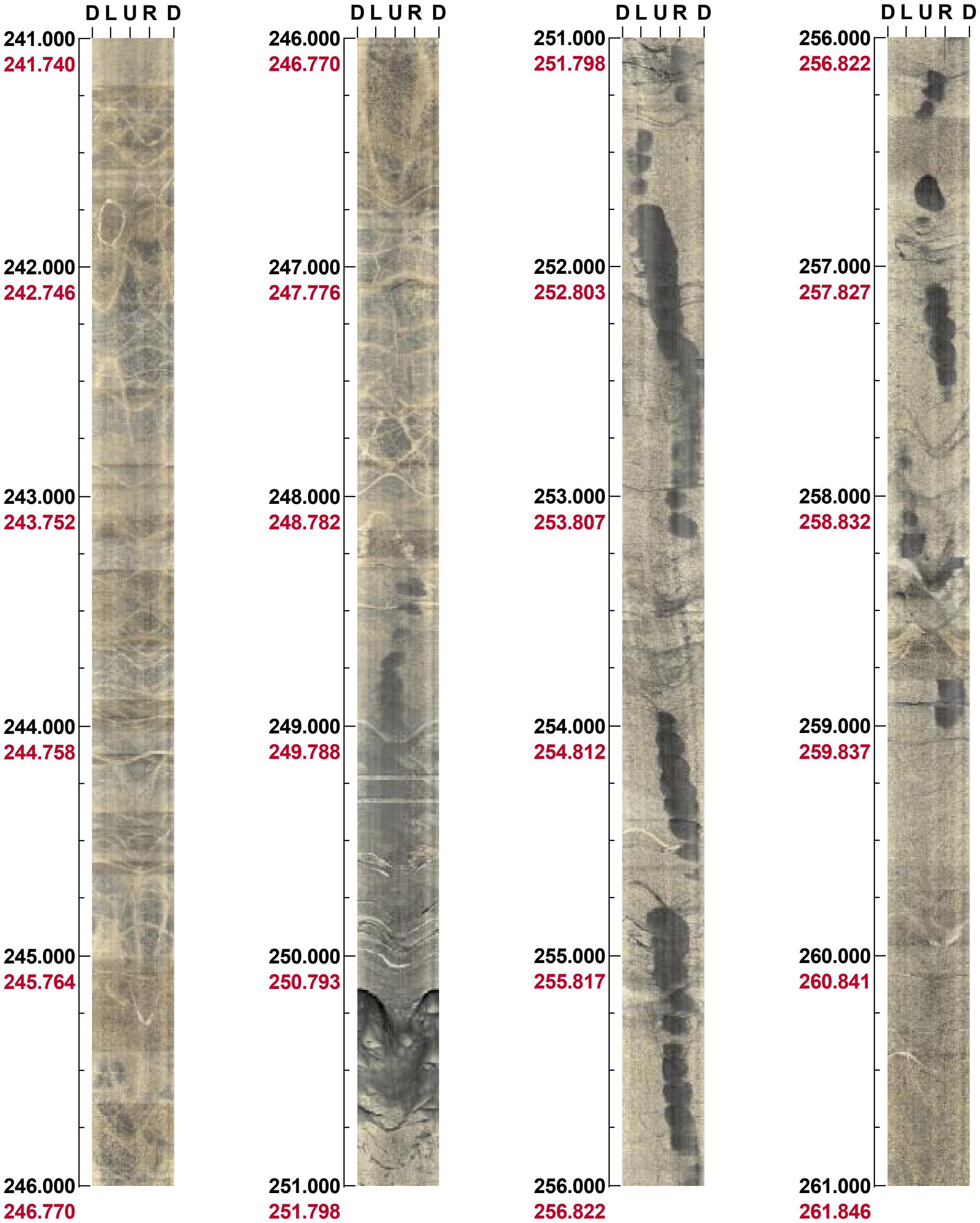
236.000
236.710
237.000
237.716
238.000
238.722
239.000
239.728
240.000
240.734
241.000
241.740



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

Project name: Oskarshamn
Bore hole No.: KSH01A   Azimuth: 172   Inclination: -76

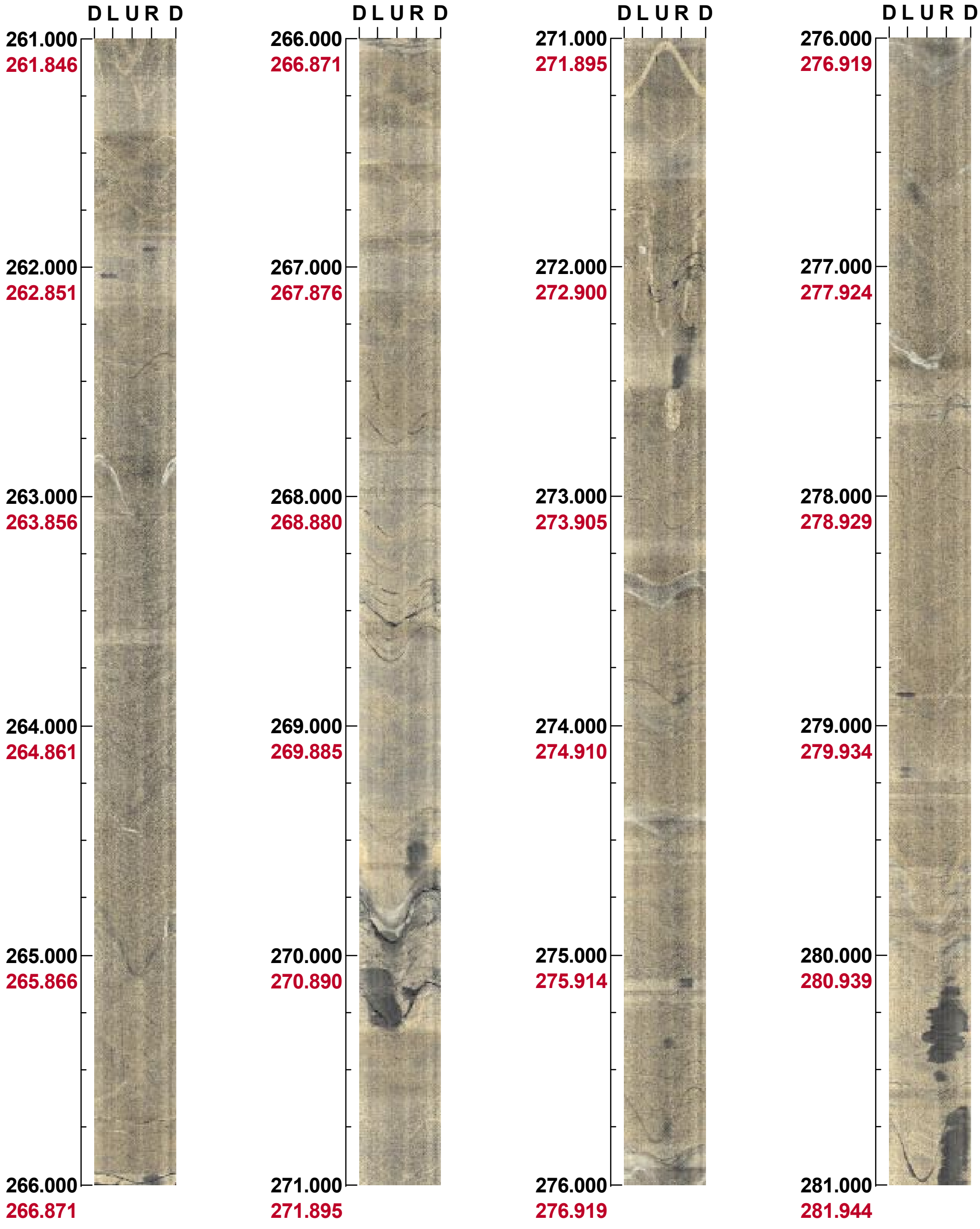
Depth range: 241.000 - 261.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01A Azimuth: 172 Inclination: -76

Depth range: 261.000 - 281.000 m



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

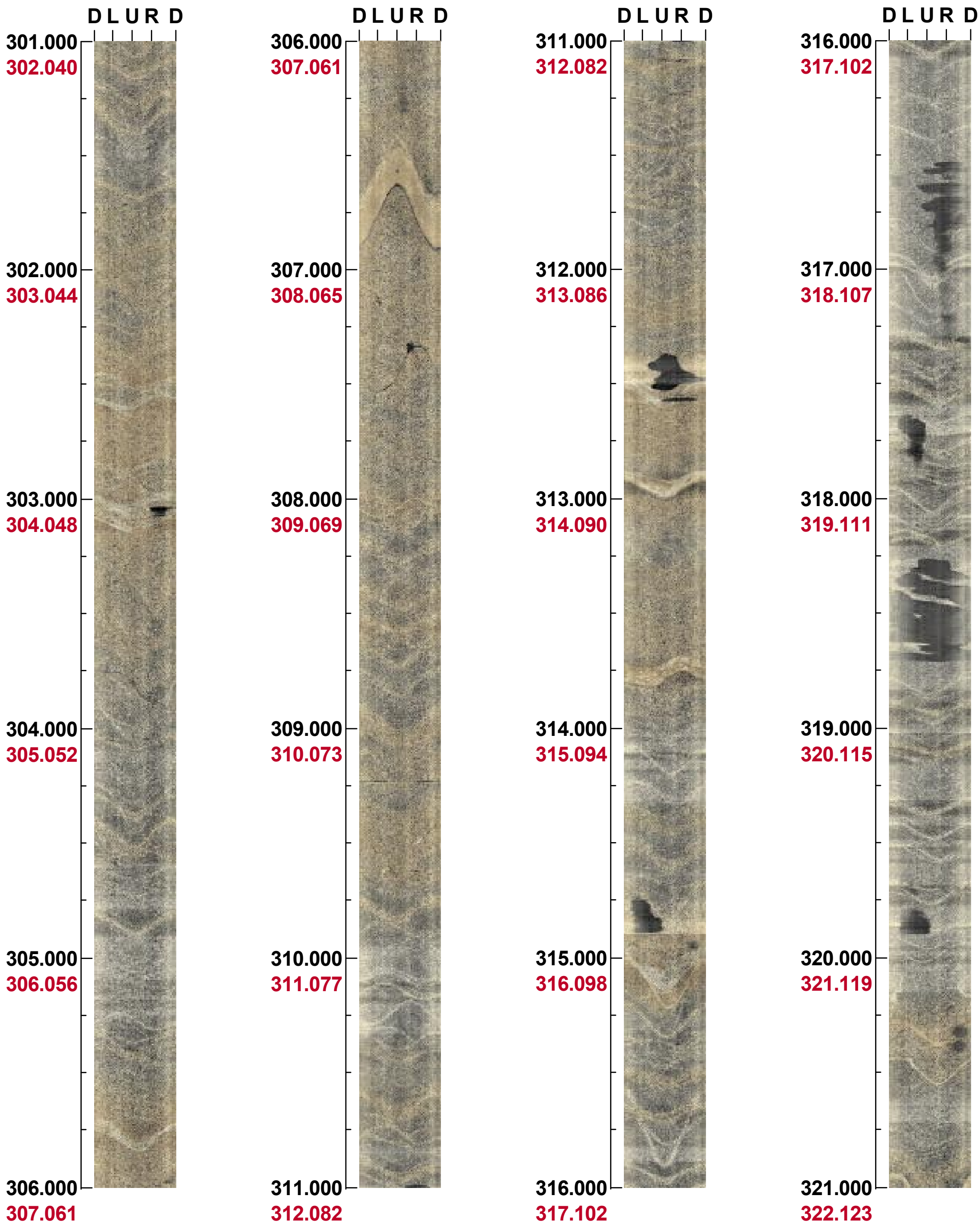
Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 172** **Inclination: -76**

Depth range: 281.000 - 301.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 173** **Inclination: -76**

Depth range: 301.000 - 321.000 m

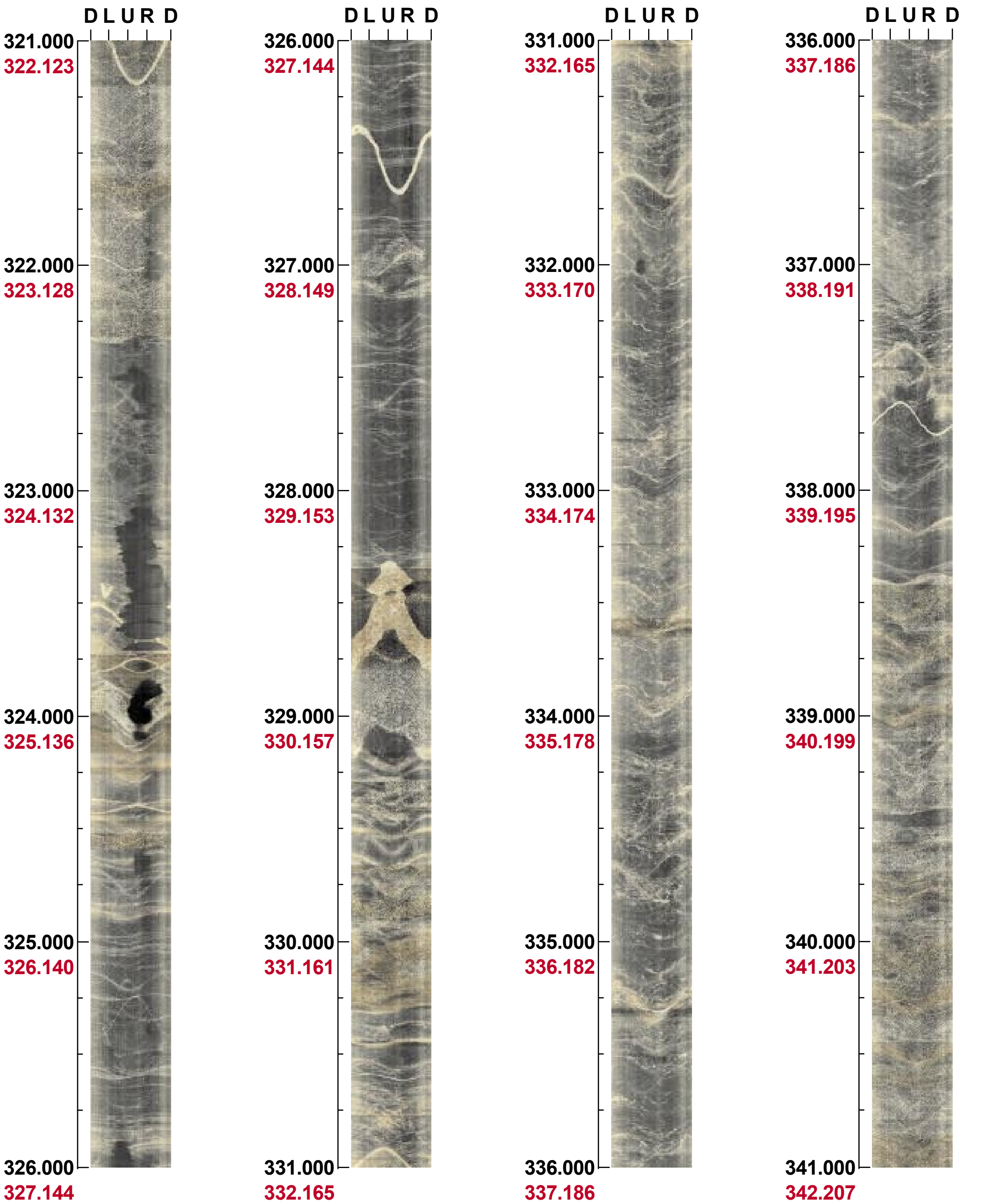


(11 / 20) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Oskarshamn

Bore hole No.: KSH01A **Azimuth: 175** **Inclination: -76**

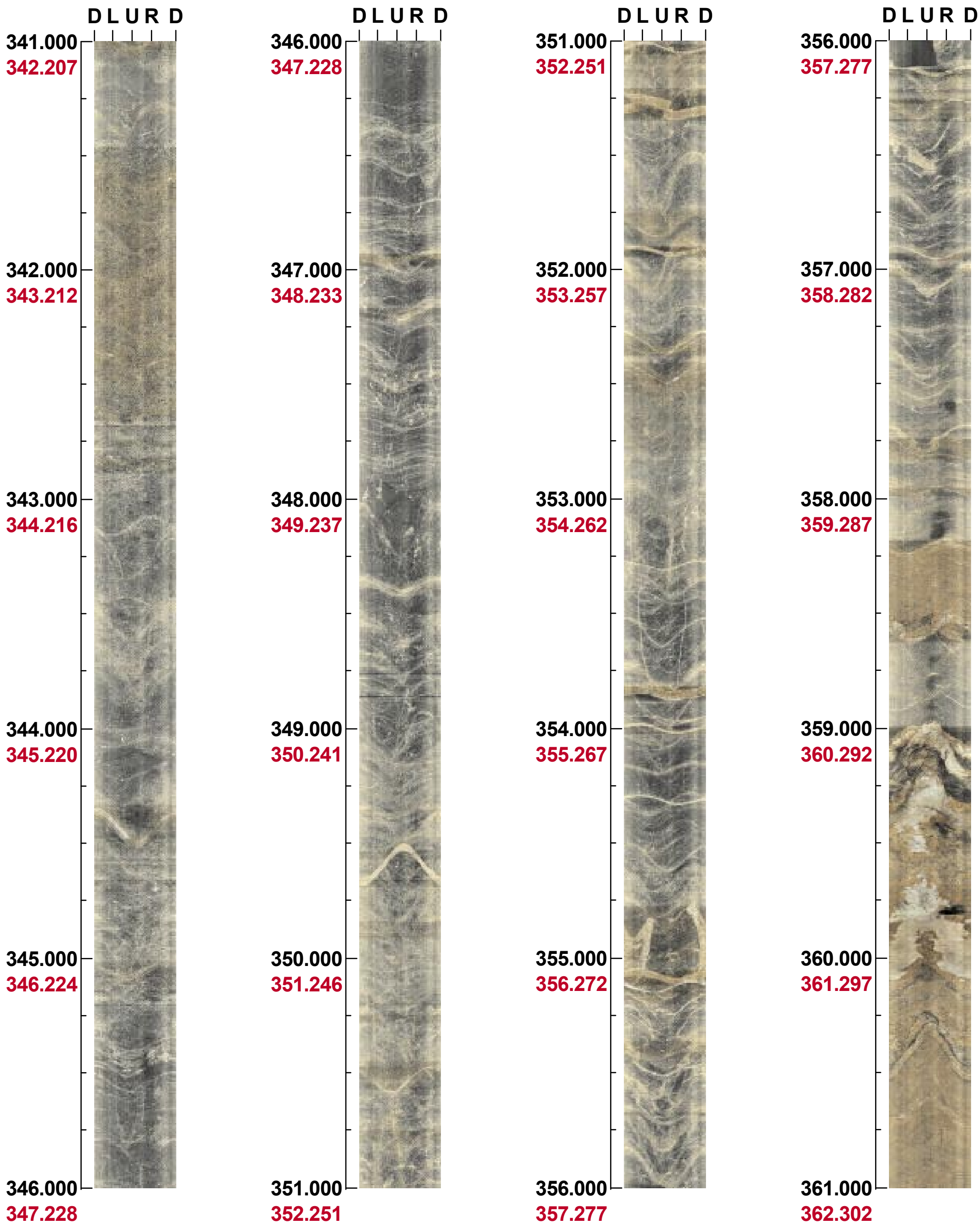
Depth range: 321.000 - 341.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 175** **Inclination: -76**

Depth range: 341.000 - 361.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 178** **Inclination: -76**

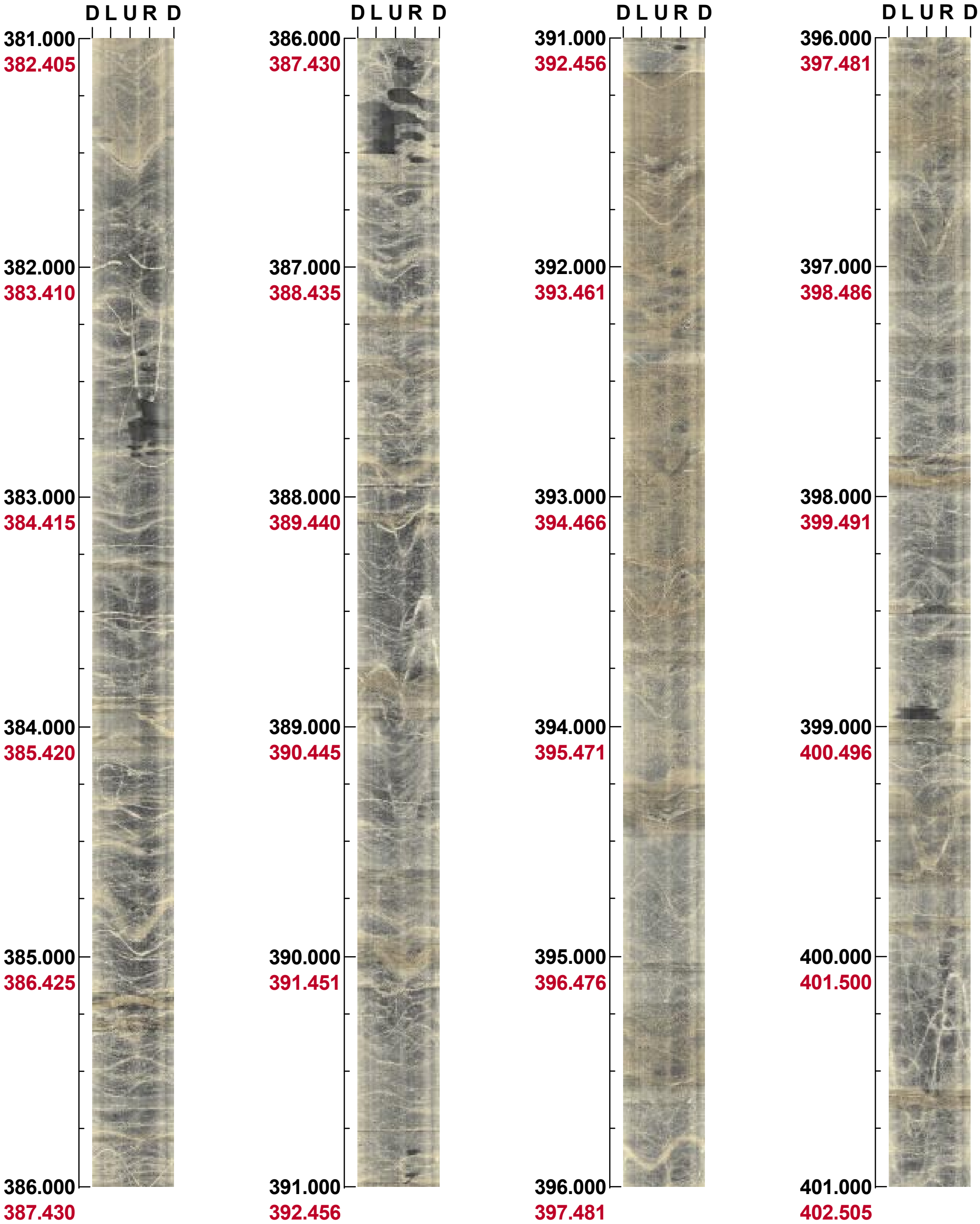
Depth range: 361.000 - 381.000 m

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

Project name: Oskarshamn

Bore hole No.: KSH01A **Azimuth: 179** **Inclination: -75**

Depth range: 381.000 - 401.000 m

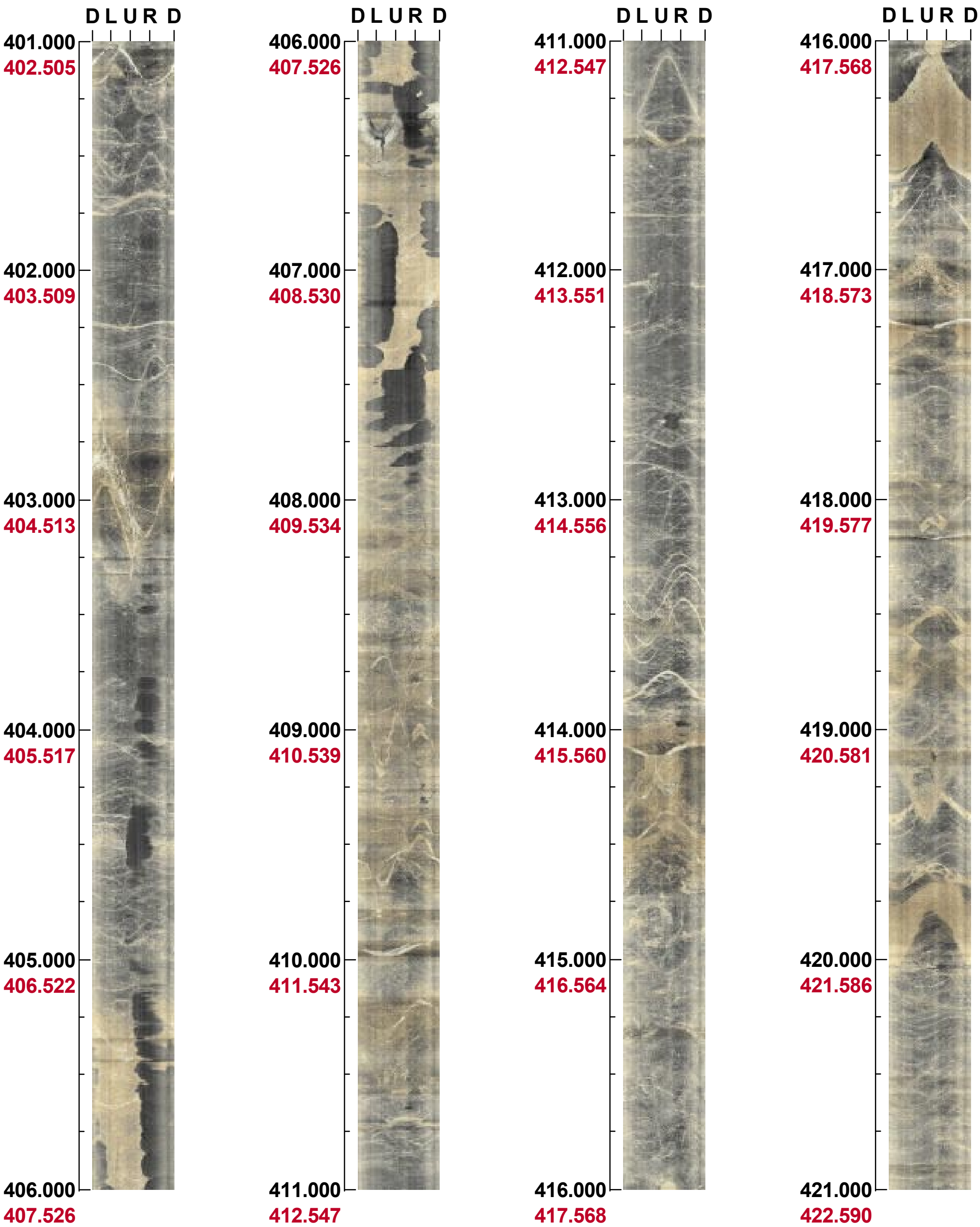


(15 / 20) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Oskarshamn

Bore hole No.: KSH01A **Azimuth: 180** **Inclination: -75**

Depth range: 401.000 - 421.000 m



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

Project name: Oskarshamn

Bore hole No.: KSH01A **Azimuth: 182** **Inclination: -75**

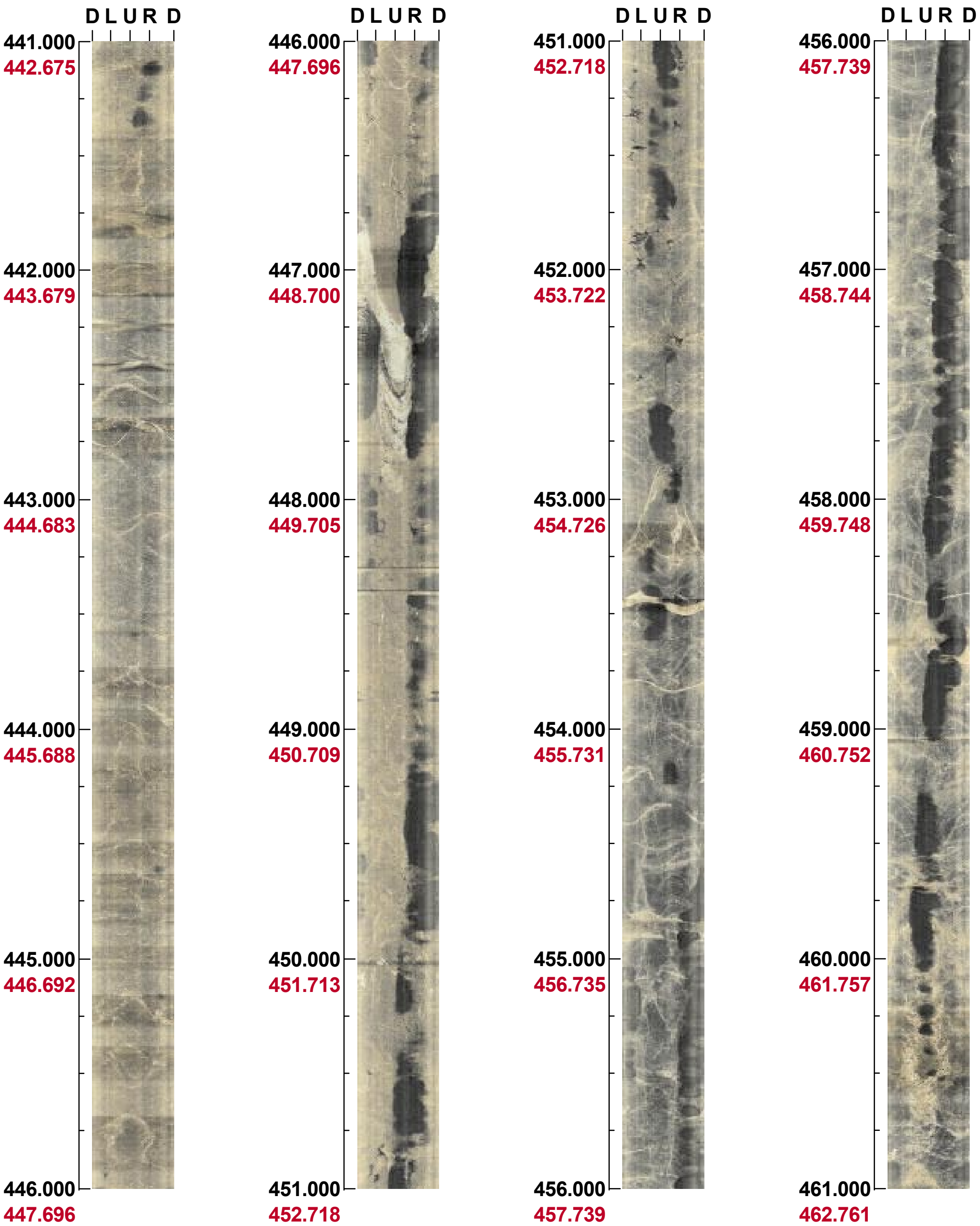
Depth range: 421.000 - 441.000 m

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

Project name: Oskarshamn

Bore hole No.: KSH01A **Azimuth: 183** **Inclination: -75**

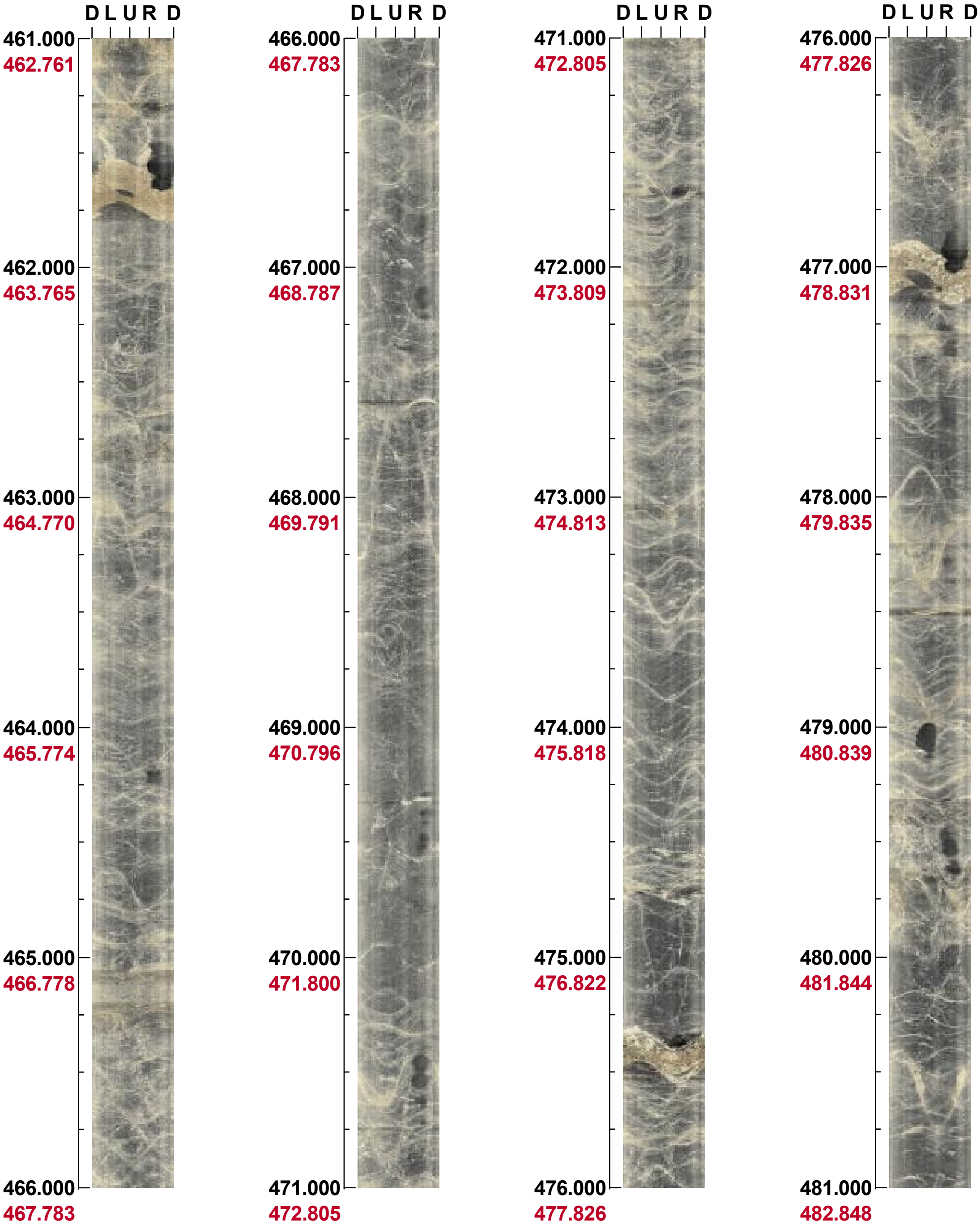
Depth range: 441.000 - 461.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01A Azimuth: 183 Inclination: -75

Depth range: 461.000 - 481.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01A Azimuth: 185 Inclination: -75

Depth range: 481.000 - 500.013 m

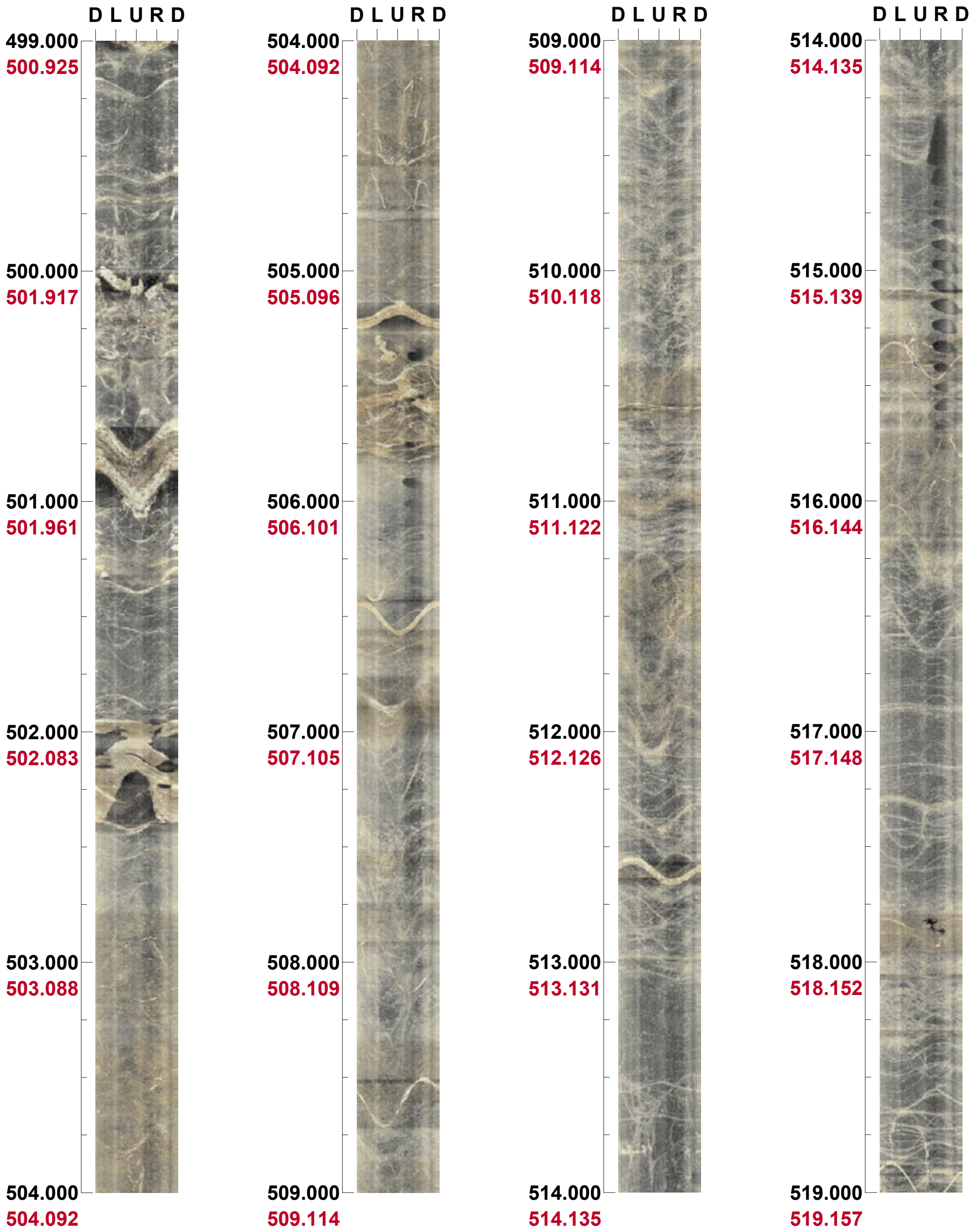
(20 / 20) Scale: 1/25 Aspect ratio: 150 %

Project name: Oskarshamn

Locality	**: Simpevarp**
Bore hole number	**: KSH01A**
Date	**: 03/03/22**
Time	**: 09:25:00**
Depth range	**: 499.000 - 998.363 m**
Azimuth	**: 187**
Inclination	**: -75**
Diameter	**: 76.0 mm**
Magnetic declination	**: 0.0**
Span	**: 4**
Scan interval	**: 0.25**
Scan direction	**: To bottom**
Scale	**: 1/25**
Aspect ratio	**: 150 %**
Pages	**: 25**
Color	**: +0 +0 +0**

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 187** **Inclination: -75**

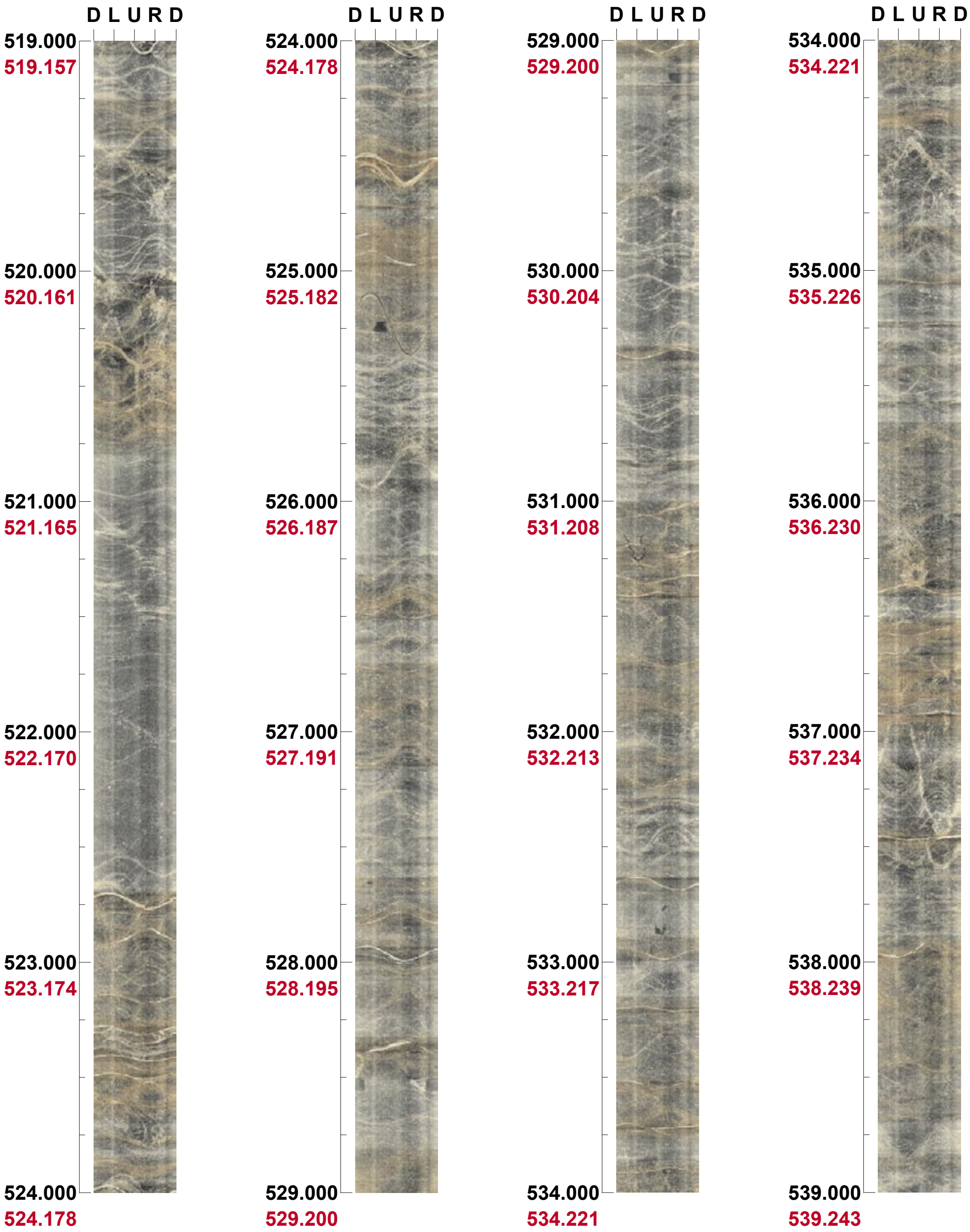
Depth range: 499.000 - 519.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01A Azimuth: 188 Inclination: -75

Depth range: 519.000 - 539.000 m



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

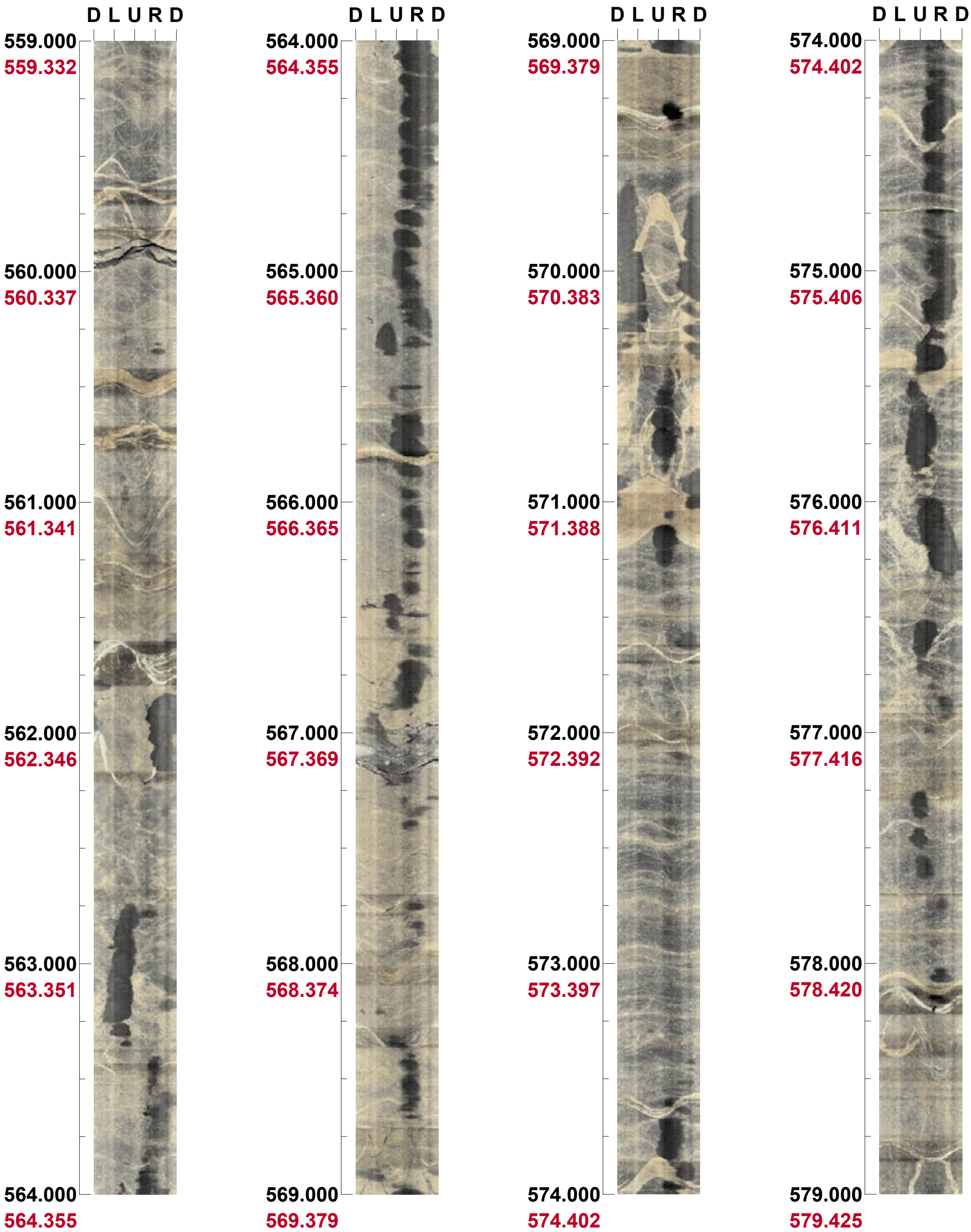
Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 189** **Inclination: -75**

Depth range: 539.000 - 559.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 190** **Inclination: -75**

Depth range: 559.000 - 579.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01A Azimuth: 191 Inclination: -75

Depth range: 579.000 - 599.000 m

D L U R D

579.000
579.425

580.000
580.430

581.000
581.434

582.000
582.439

583.000
583.444

584.000
584.448

D L U R D

584.000
584.448

585.000
585.453

586.000
586.457

587.000
587.462

588.000
588.467

589.000
589.471

D L U R D

589.000
589.471

590.000
590.476

591.000
591.481

592.000
592.485

593.000
593.490

594.000
594.495

D L U R D

594.000
594.495

595.000
595.499

596.000
596.504

597.000
597.508

598.000
598.513

599.000
599.518

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

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 192** **Inclination: -75**

Depth range: 599.000 - 619.000 m

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

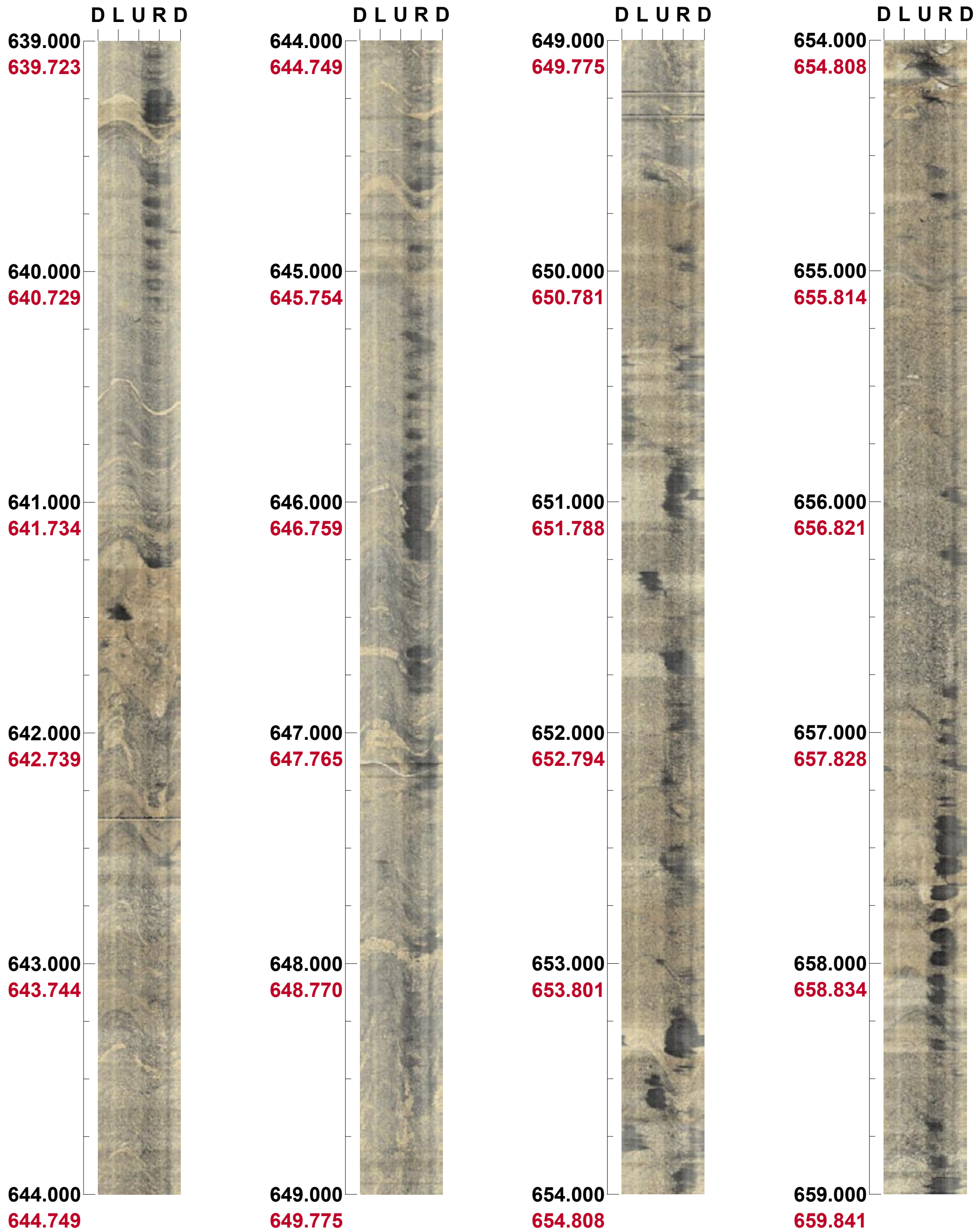
Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 194** **Inclination: -75**

Depth range: 619.000 - 639.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 194** **Inclination: -75**

Depth range: 639.000 - 659.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 196** **Inclination: -75**

Depth range: 659.000 - 679.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 197** **Inclination: -75**

Depth range: 679.000 - 699.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 198** **Inclination: -75**

Depth range: 699.000 - 719.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 199** **Inclination: -74**

Depth range: 719.000 - 739.000 m

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

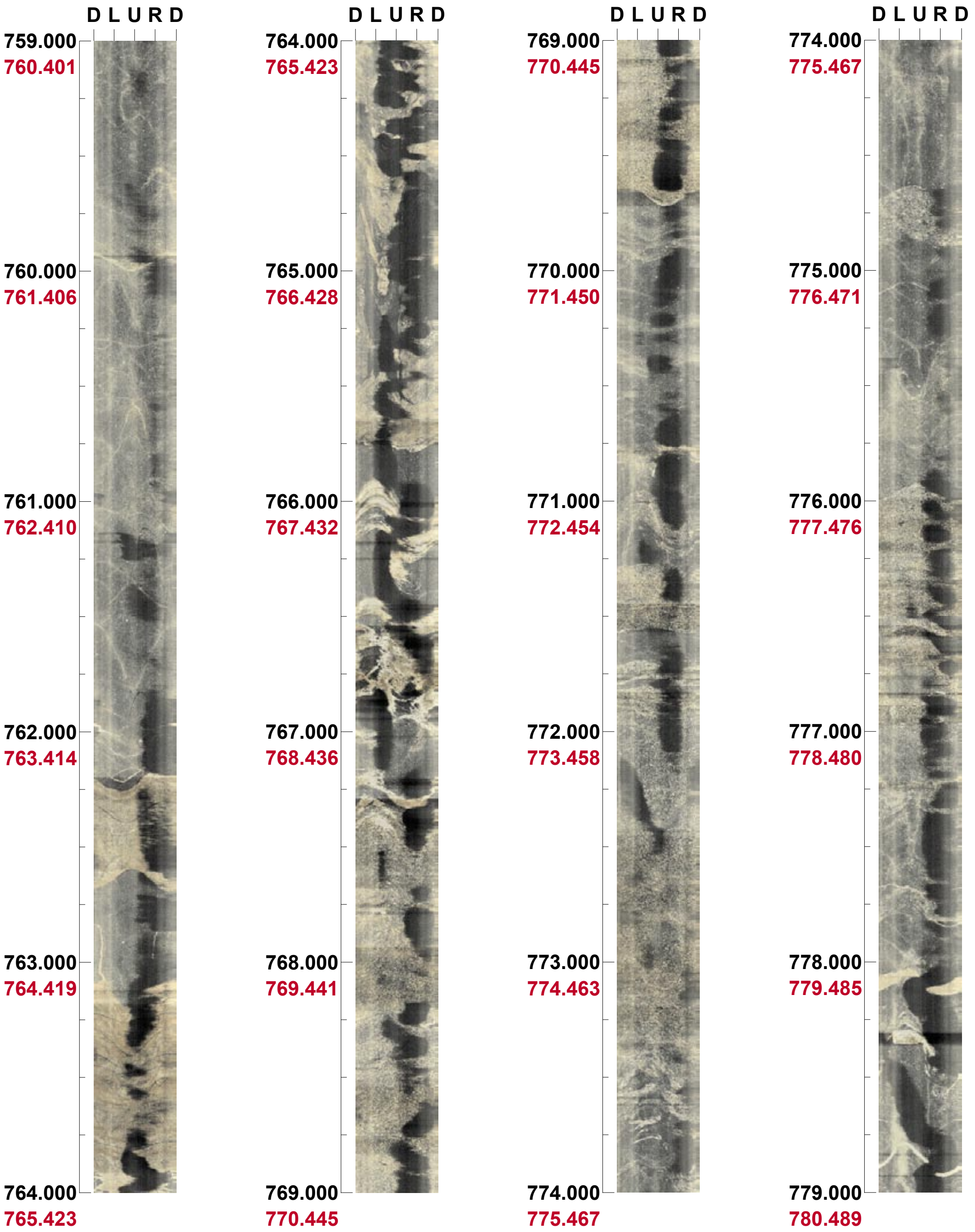
Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 200** **Inclination: -74**

Depth range: 739.000 - 759.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 200** **Inclination: -74**

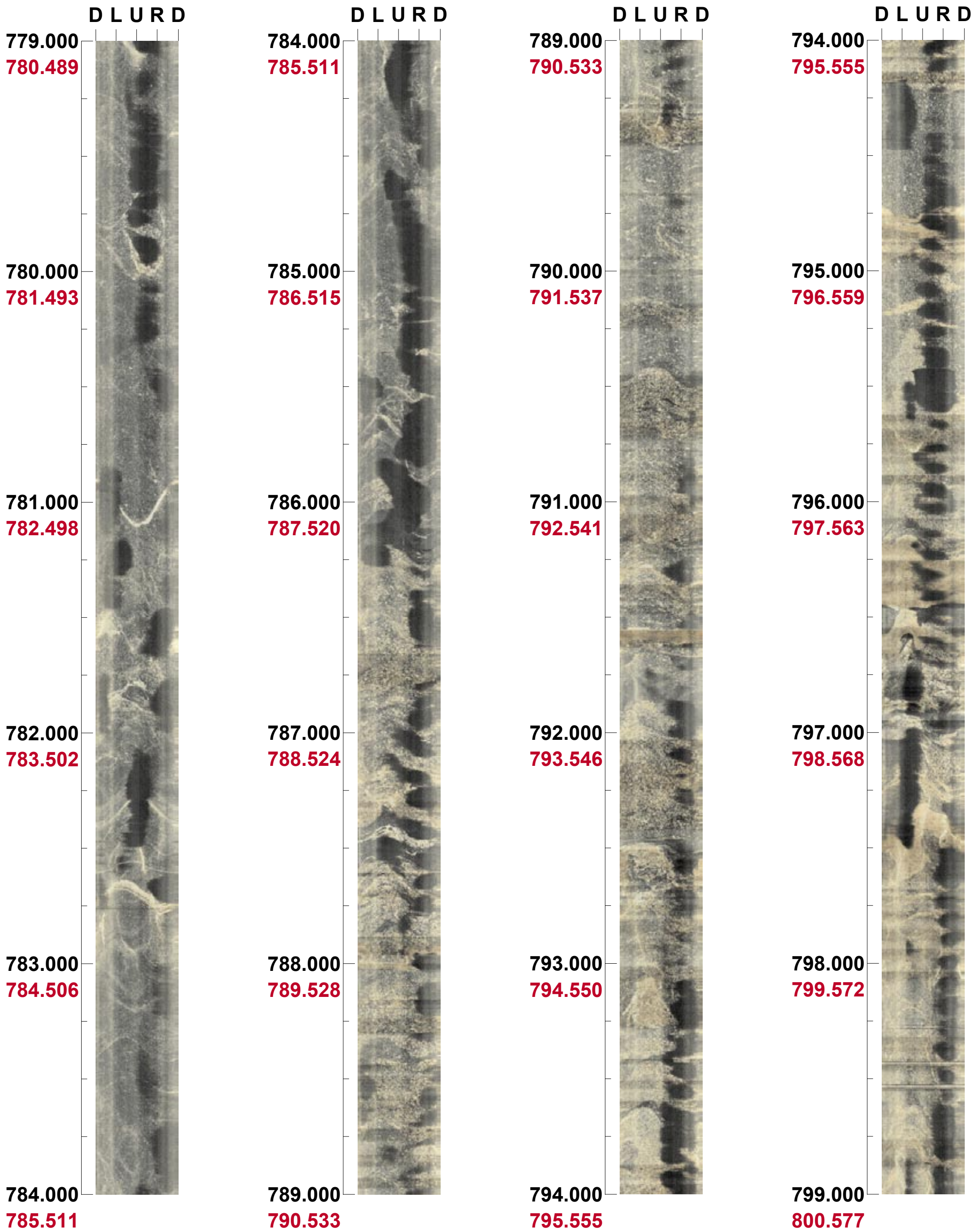
Depth range: 759.000 - 779.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 201** **Inclination: -74**

Depth range: 779.000 - 799.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01A Azimuth: 203 Inclination: -73

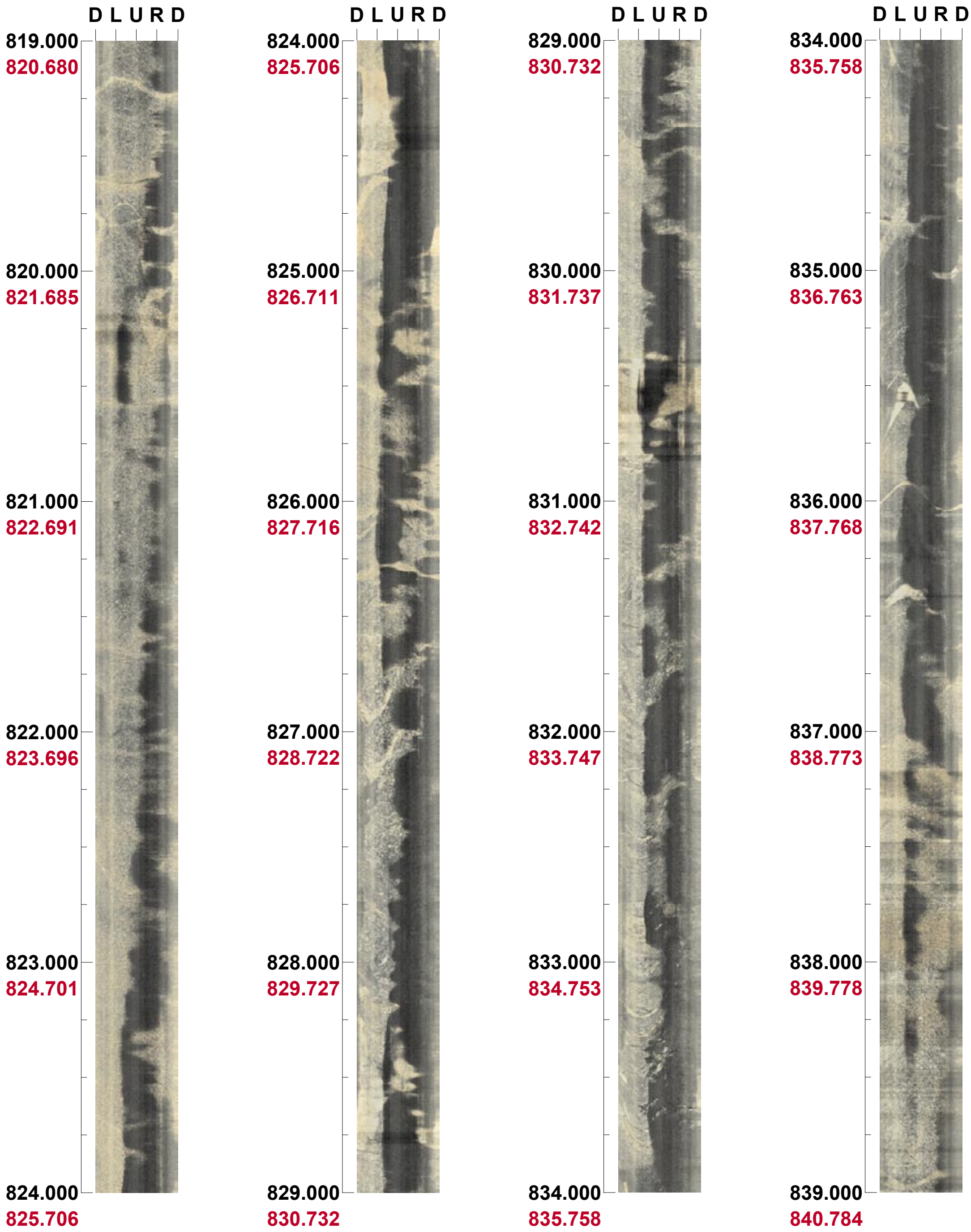
Depth range: 799.000 - 819.000 m

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

Project name: Oskarshamn

Bore hole No.: KSH01A **Azimuth: 204** **Inclination: -73**

Depth range: 819.000 - 839.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 204** **Inclination: -73**

Depth range: 839.000 - 859.000 m

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

Project name: Oskarshamn

Bore hole No.: KSH01A **Azimuth: 205** **Inclination: -72**

Depth range: 859.000 - 879.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH01A **Azimuth: 206** **Inclination: -73**

Depth range: 879.000 - 899.000 m

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

Project name: Oskarshamn

Bore hole No.: KSH01A **Azimuth: 207** **Inclination: -71**

Depth range: 899.000 - 919.000 m

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

Project name: Oskarshamn

Bore hole No.: KSH01A **Azimuth: 208** **Inclination: -70**

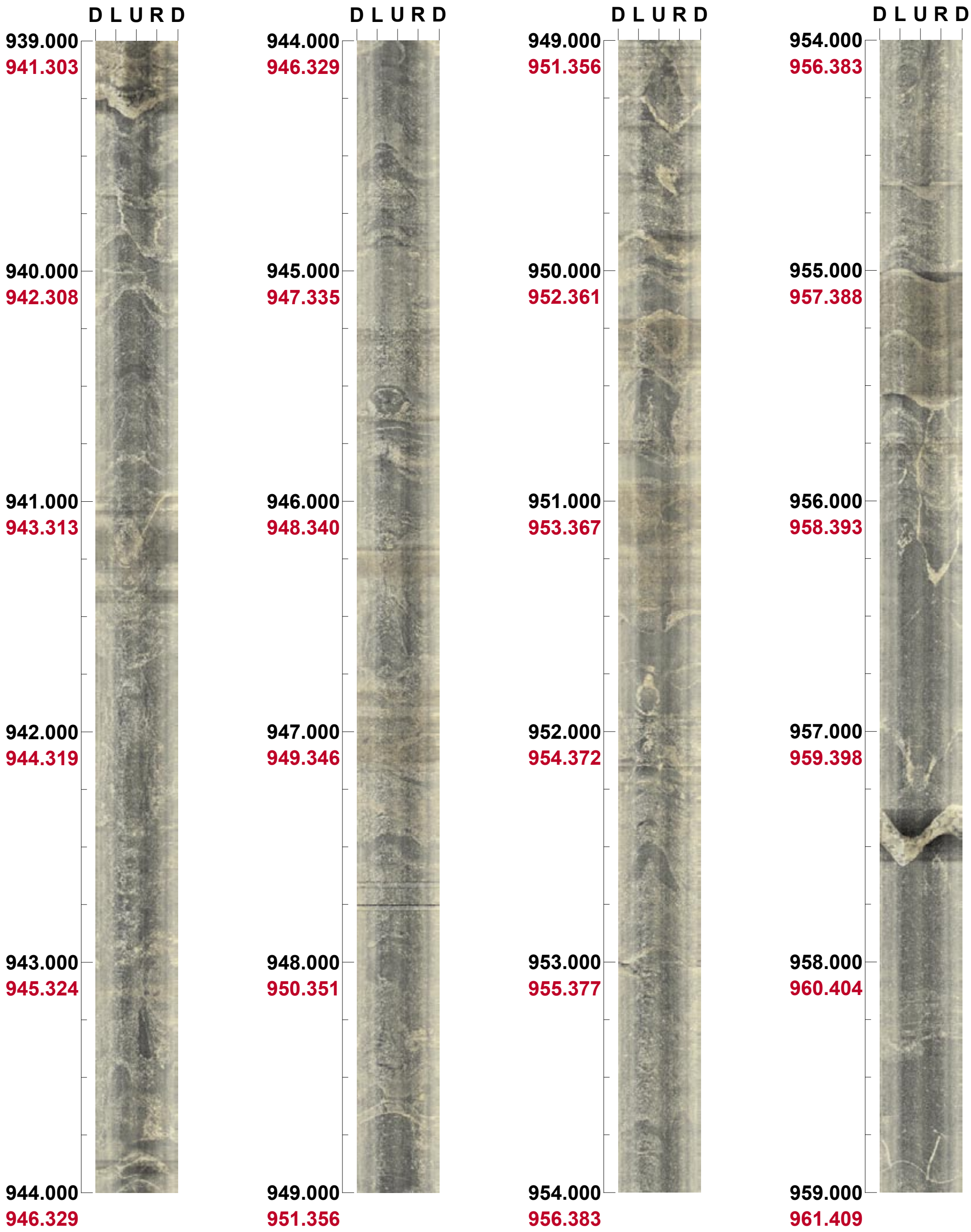
Depth range: 919.000 - 939.000 m

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

Project name: Oskarshamn

Bore hole No.: KSH01A **Azimuth: 208** **Inclination: -70**

Depth range: 939.000 - 959.000 m



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

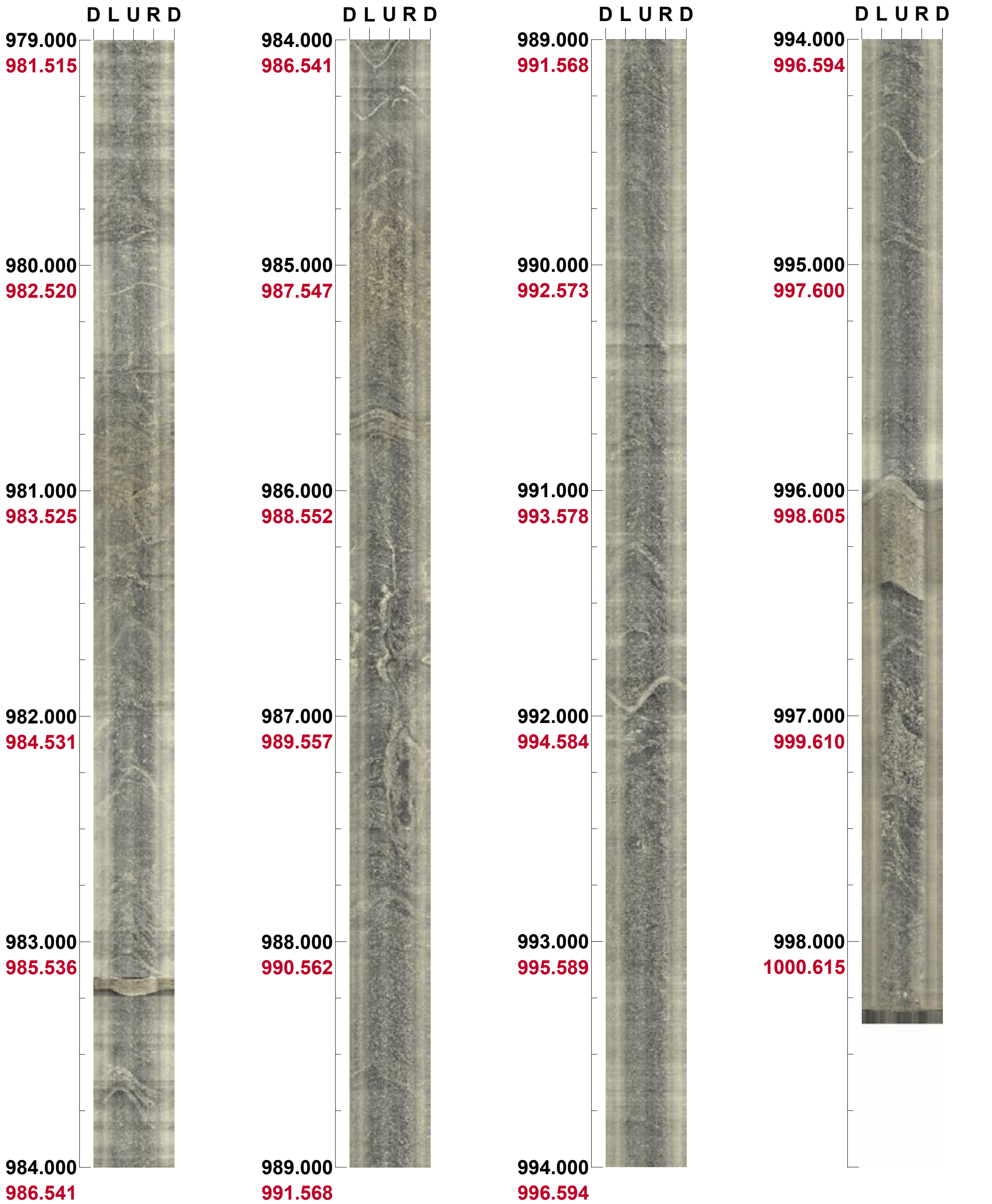
Project name: Oskarshamn
Bore hole No.: KSH01A Azimuth: 209 Inclination: -70

Depth range: 959.000 - 979.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH01A Azimuth: 209 Inclination: -69

Depth range: 979.000 - 998.363 m



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

Appendix 6

WellCad diagram of KSH01B

Title LEGEND FOR SIMPEVARP KSH01B

Site	SIMPEVARP
Borehole	KSH01B
Plot Date	2004-04-18 21:03:29

ROCKTYPE SIMPEVARP
- Dolerite / Diabas
- Fine-grained G□temargranite
- Coarse-grained G□temargranite
- Fine-grained granite
- Pegmatite
- Granite
- ˜ vr□granite
- Quartz monzodiorite
- Diorite / Gabbro
- Fine-grained dioritoid
- Fine-grained diorite-gabbro
- Sulphide mineralization
- Sandstone

ROCK ALTERATION
- Oxidized
- Chloritisized
- Epidotisized
- Weathered
- Tectonized
- Sericitisized
- Miarolitic
- Silicification
- Argillization
- Albitization
- Carbonatization
- Saussuritization
- Steatitization
- Uralitization

MINERAL
- Epidote
- Hematite
- Calcite
- Chlorite
- Pyrite
- Clay Minerals
- Oxidized Walls

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

TEXTURE
- Hornfelsed
- Porphyritic
- Ophitic
- Equigranular
- Augen-Bearing
- Non_equigranular
- Metamorphic

GRAINSIZE
- Aphanitic
- Fine grained
- Fine to Medium Grained
- Medium coarse
- Coarse grained
- Medium grained

STRUCTURE ORIENTATION
- Schistose
- Gneissic
- Bedded
- Ductile Shear Zone
- Brittle-Ducktile Shear Zone
- Viened
- Banded
- Lineated
- Massive
- Brecciated
- Mylonitic
- Foliated

INTENSITY
- No intensity
- Faint
- Weak
- Medium
- Strong

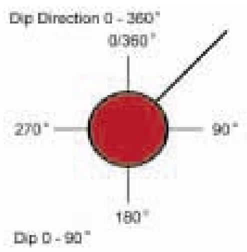
ROUGHNESS
- Planar
- Undulating
- Stepped
- Irregular

SURFACE
- Rough
- Smooth
- Slickensided

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

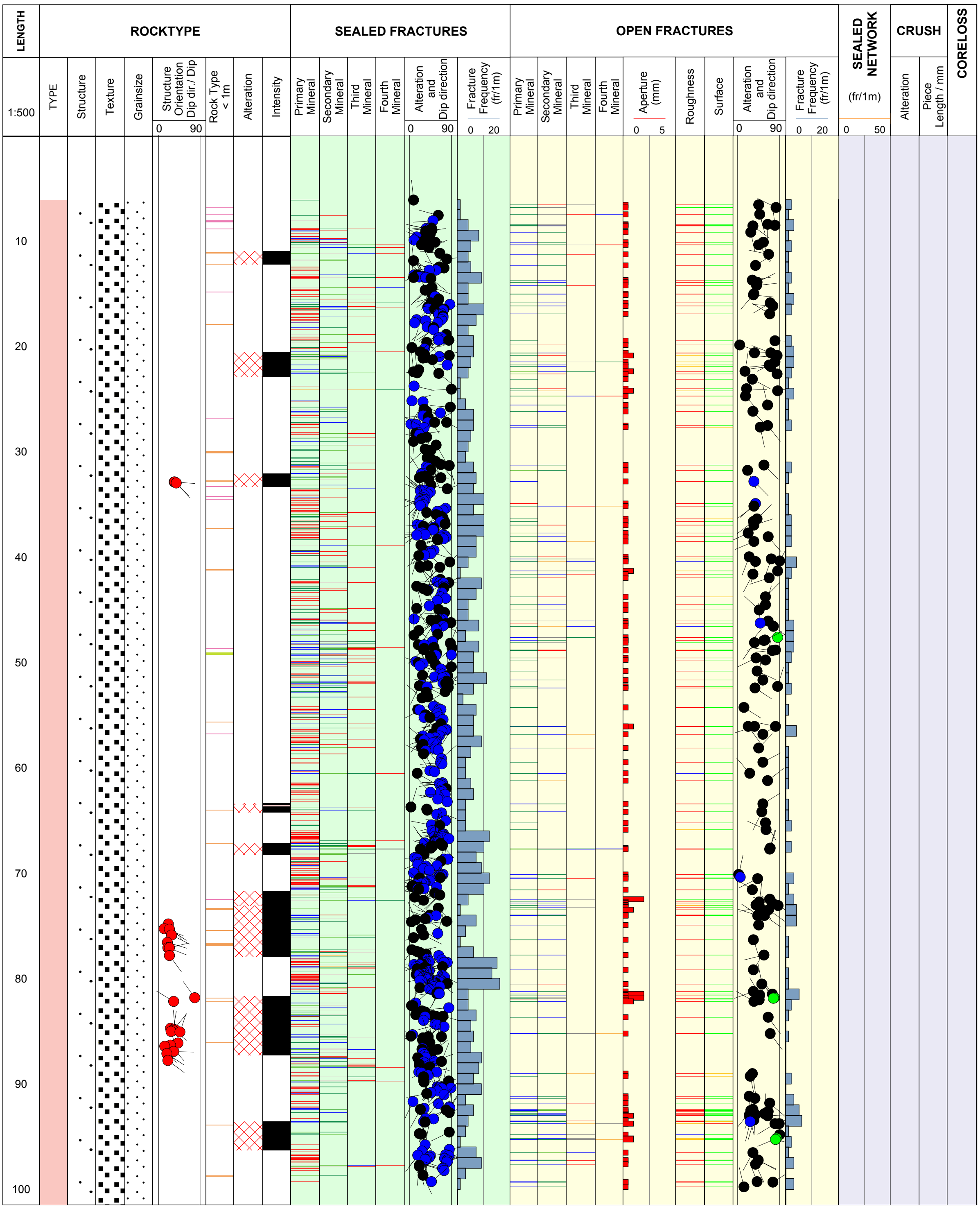
FRACTURE ALTERATION
- Fresh
- Gouge
- Completely Altered
- Highly Altered
- Moderately Altered
- Slightly Altered

FRACTURE DIRECTION



Title

Site	SIMPEVARP	**Coordinate System**	RT90-RHB70
Borehole	KSH01B	**Northing [m]**	6366014.04
Diameter [mm]	76	**Easting [m]**	1552442.89
Length [m]	100.250	**Elevation [m.a.s.l.]**	5.20
Bearing [°]	177.76	**Drilling Start Date**	2003-01-17 12:00:00
Inclination [°]	-87.87	**Drilling Stop Date**	2003-01-27 19:00:00
Date of mapping	2003-03-13 14:46:00	**Plot Date**	2004-06-09 21:04:59
Rocktype data from	p_rock_XXXXX	**Fracture data from**	p_fract_core



Appendix 7

WellCad diagram of KSH01A

Title LEGEND FOR SIMPEVARP KSH01A

Site SIMPEVARP
Borehole KSH01A
Plot Date 2004-04-18 21:03:29

ROCKTYPE SIMPEVARP
- 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

ROCK ALTERATION
- Oxidized
- Chloritisized
- Epidotisized
- Weathered
- Tectonized
- Sericitisized
- Miarolitic
- Silicification
- Argillization
- Albitization
- Carbonatization
- Saussuritization
- Steatitization
- Uralitization

MINERAL
- Epidote
- Hematite
- Calcite
- Chlorite
- Chalcopyrite
- Quartz
- Pyrite
- Clay Minerals
- Laumontite
- Prehnite
- Iron Hydroxide
- Oxidized Walls

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

TEXTURE
- Hornfelsed
- Porphyritic
- Ophitic
- Equigranular
- Augen-Bearing
- Non_equigranular
- Metamorphic

GRAINSIZE
- Aphanitic
- Fine grained
- Fine to Medium Grained
- Medium coarse
- Coarse grained
- Medium grained

STRUCTURE ORIENTATION
- Schistose
- Gneissic
- Bedded
- Ductile Shear Zone
- Brittle-Ducktile Shear Zone
- Viened
- Banded
- Lineated
- Massive
- Brecciated
- Mylonitic
- Foliated

INTENSITY
- No intensity
- Faint
- Weak
- Medium
- Strong

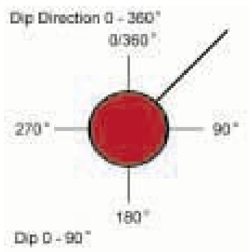
ROUGHNESS
- Planar
- Undulating
- Stepped
- Irregular

SURFACE
- Rough
- Smooth
- Slickensided

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

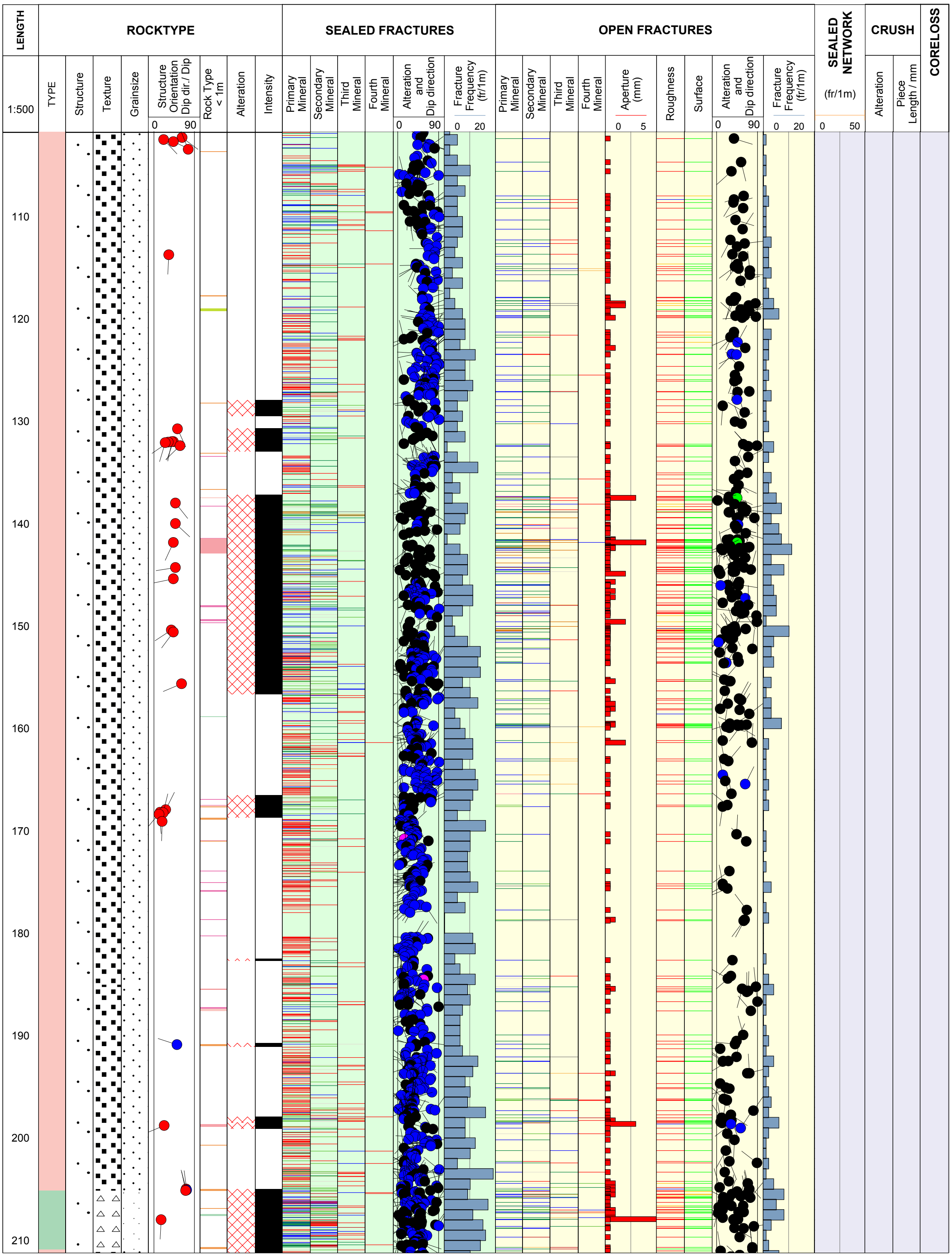
FRACTURE ALTERATION
- Fresh
- Gouge
- Completely Altered
- Highly Altered
- Moderately Altered
- Slightly Altered

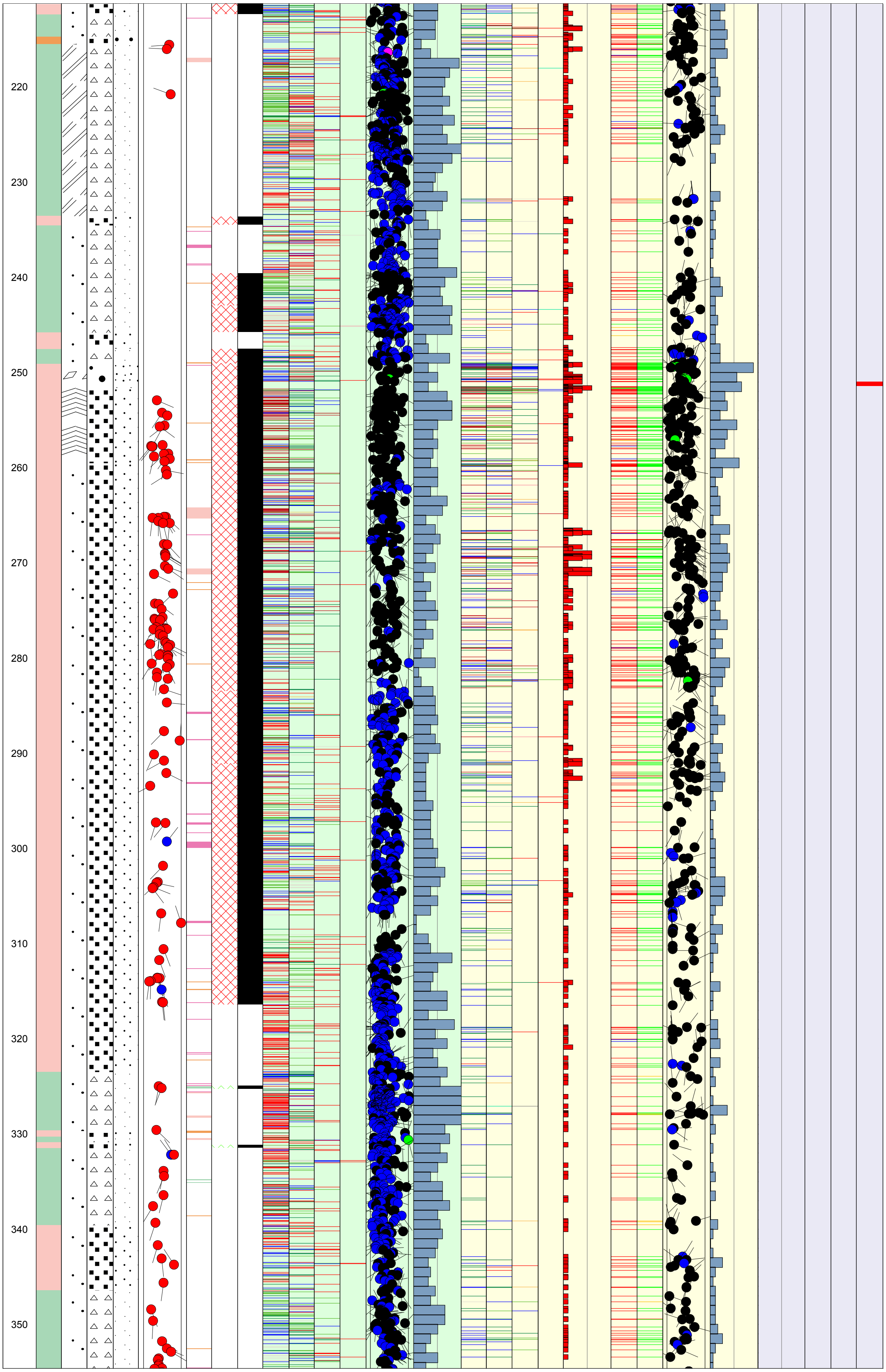
FRACTURE DIRECTION



Title

Site	SIMPEVARP	**Coordinate System**	RT90-RHB70
Borehole	KSH01A	**Northing [m]**	6366013.45
Diameter [mm]	76	**Easting [m]**	1552442.98
Length [m]	1003.000	**Elevation [m.a.s.l.]**	5.32
Bearing [°]	173.60	**Drilling Start Date**	2002-08-22 13:00:00
Inclination [°]	-80.43	**Drilling Stop Date**	2002-12-18 21:10:00
Date of mapping	2004-03-09 17:57:00	**Plot Date**	2004-06-09 21:04:59
Rocktype data from	p_rock_XXXXX	**Fracture data from**	p_fract_core

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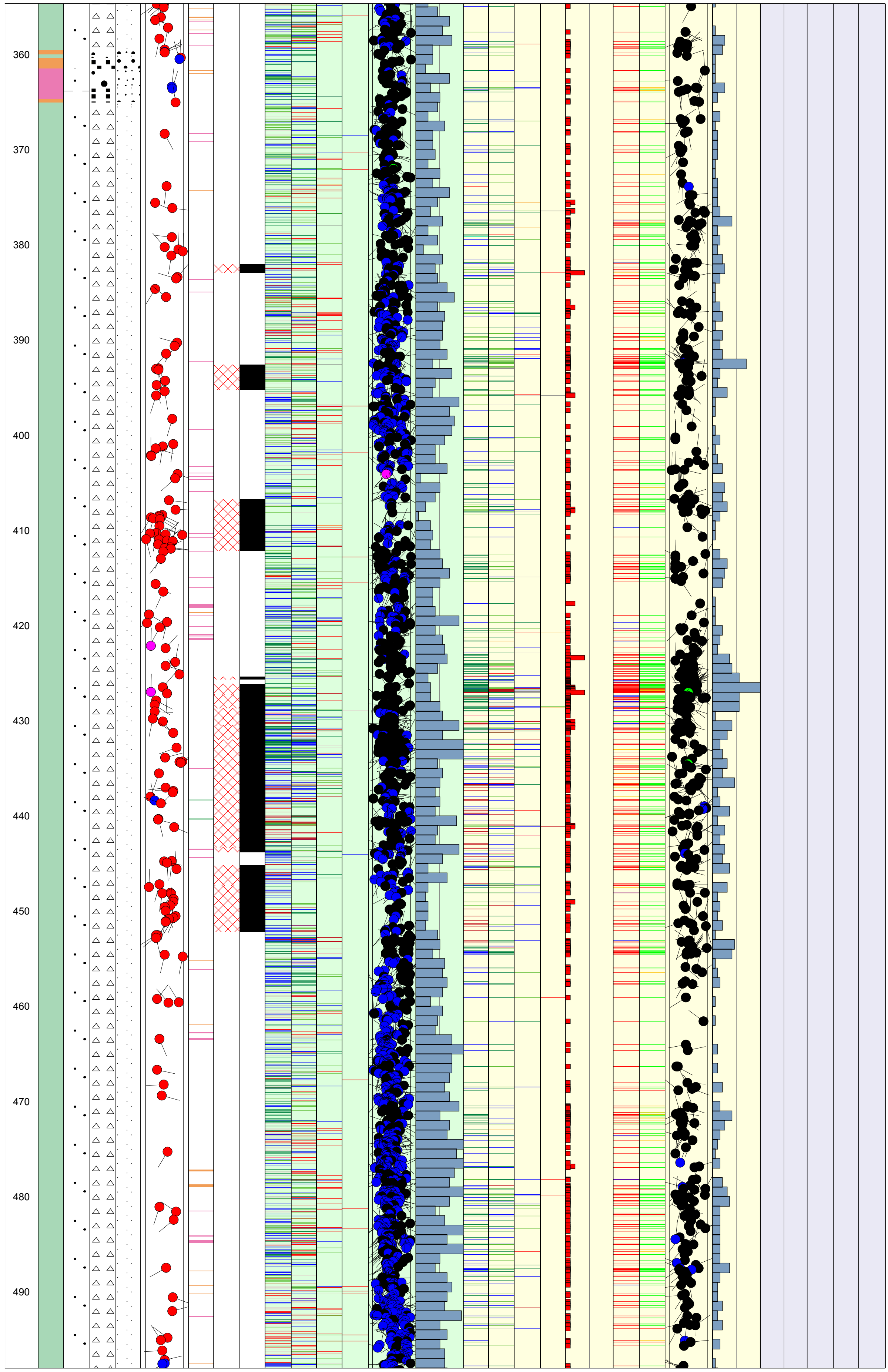
340
350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410
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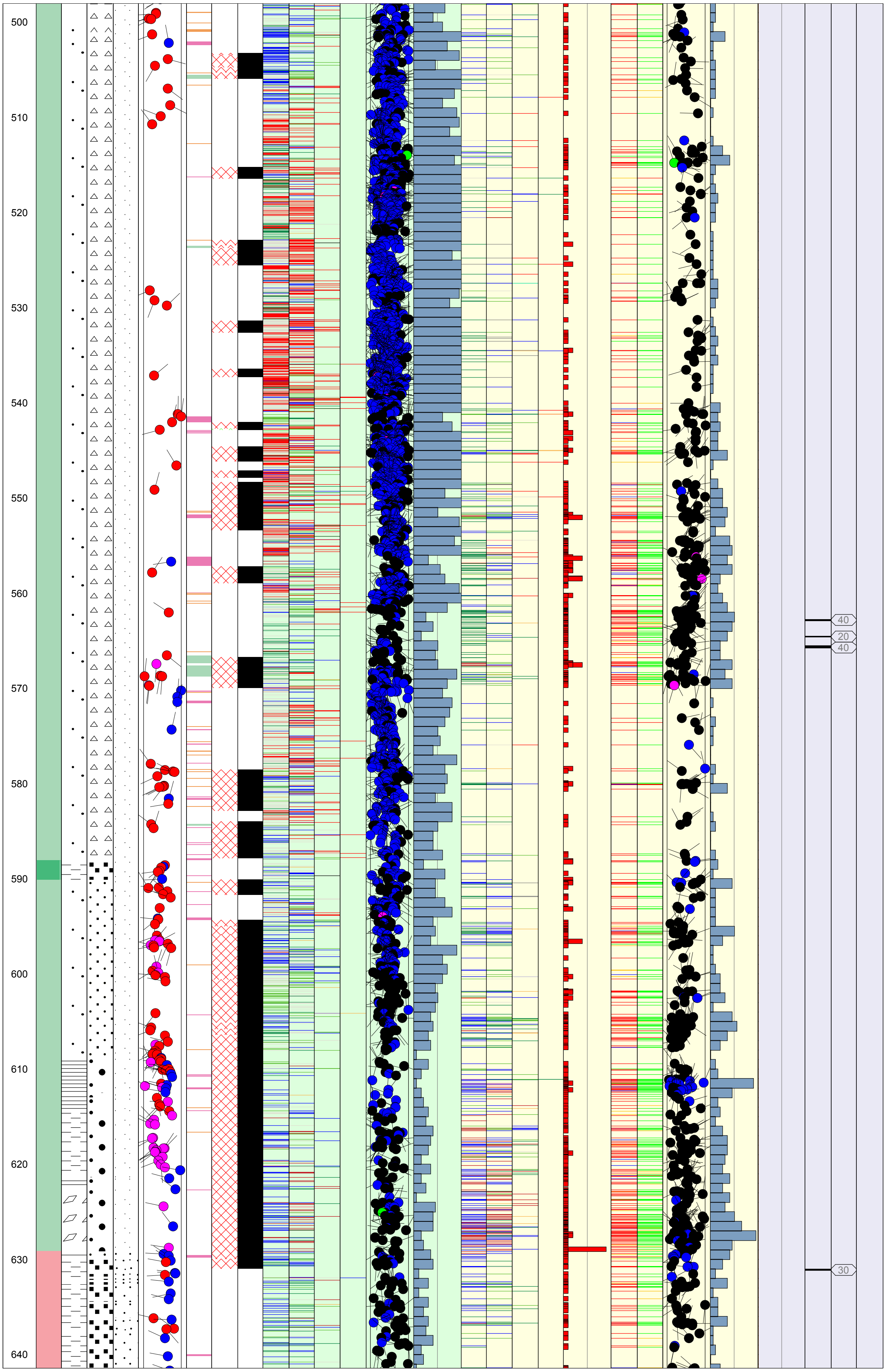
480
490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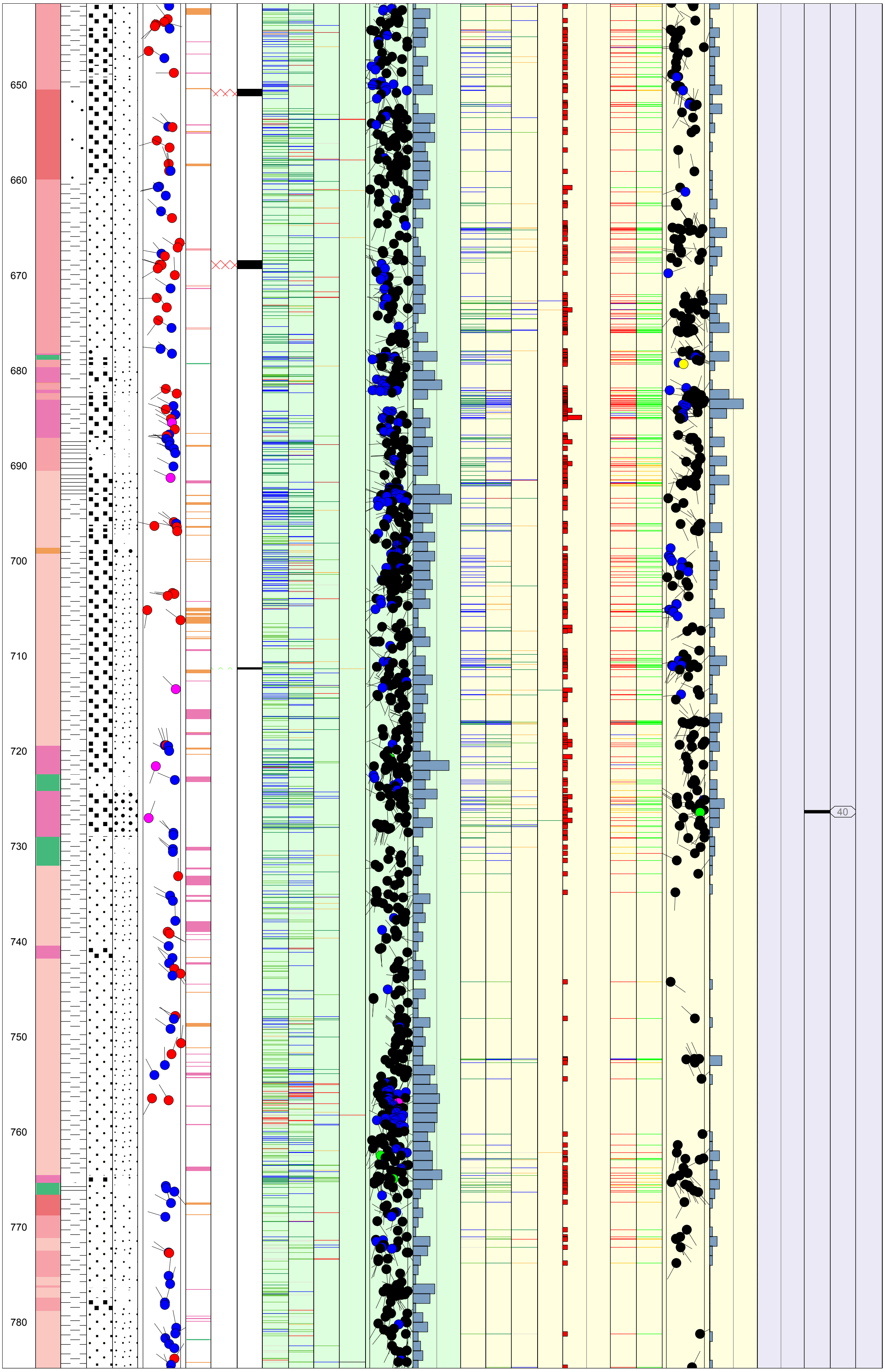
30



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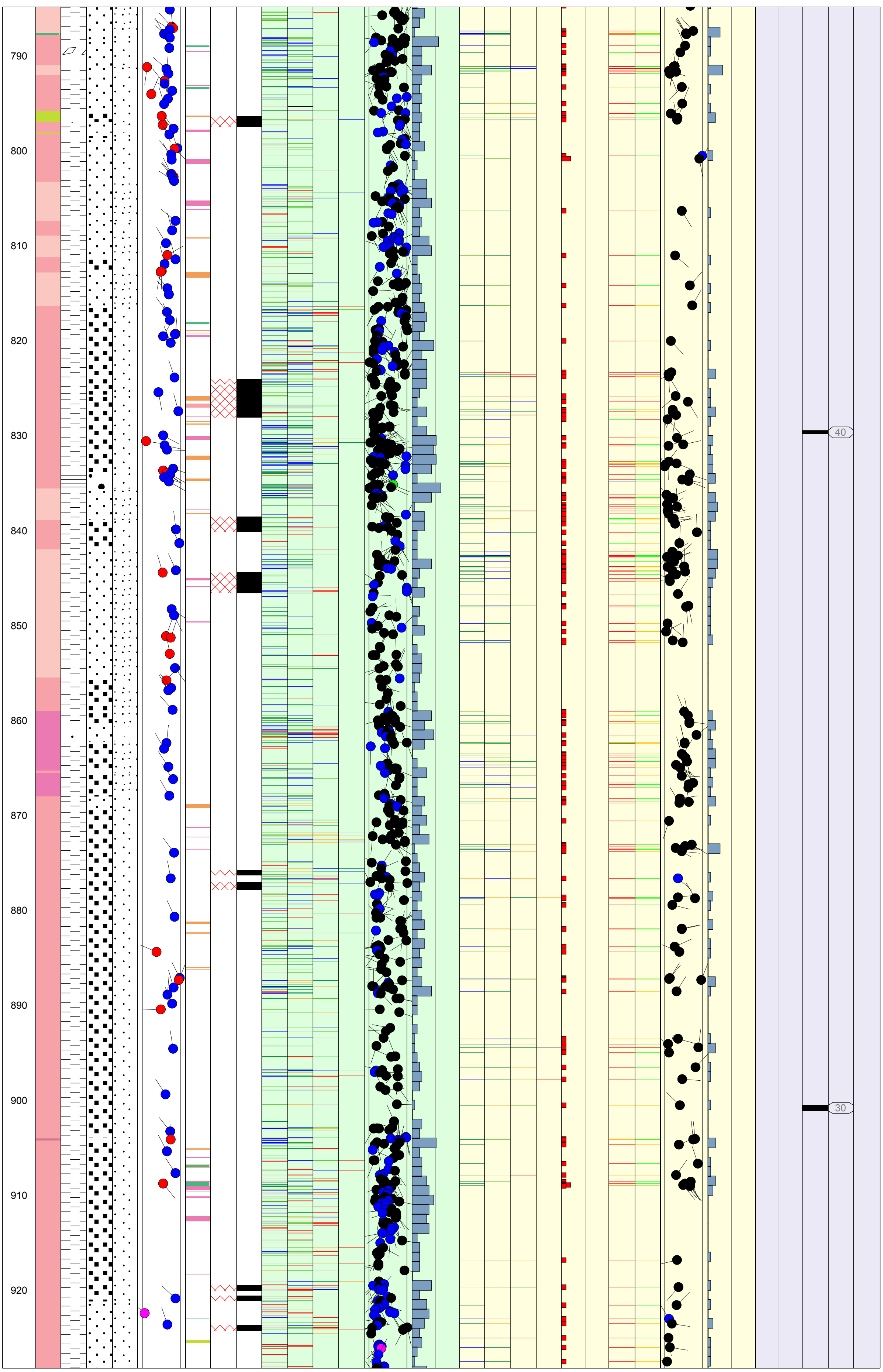
770
780
40


790
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830
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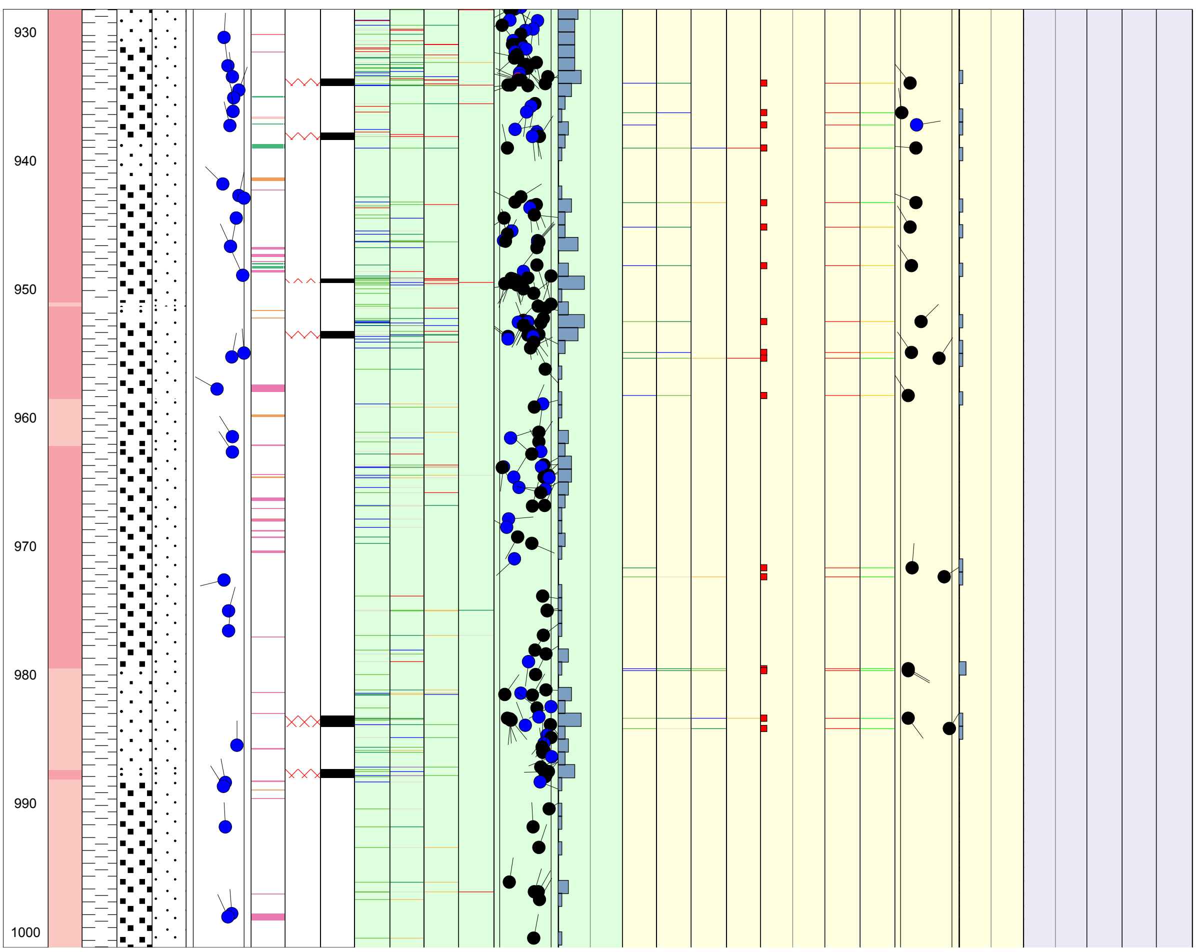
870
880
890
900
910
920
40
30


930
940
950
960
970
980
990
1000

Appendix 8

In data: Borehole length and diameter, KSH01A and KSH01B

Hole Diam T - Drilling: Borehole diameter

KSH01B, 2003-01-17 12:00:00 - 2003-01-27 19:00:00 (0.000 - 100.250 m)

Sub Secup (m)	Sub Seclow (m)	Hole Diam (m)	Comment
0.000	1.350	0.114	soildrilling
1.350	6.040	0.089	stainess casing 89/77 6.04 m
6.040	100.250	0.076	

Printout from SICADA 2004-01-27 16:49:17.

Hole Diam T - Drilling: Borehole diameter

KSH01A, 2002-10-07 16:00:00 - 2002-12-18 21:10:00 (100.240 - 1003.000 m)

Sub Secup (m)	Sub Seclow (m)	Hole Diam (m)	Comment
100.240	101.670	0.086	T-86
101.670	1003.000	0.076	Corac N3/50

Printout from SICADA 2004-01-27 16:50:35.

Appendix 9

In data: Deviation data for KSH01A and KSH01B

Magnetic Acc Dev T - Magnetic accelerometer deviation measurement

KSH01B, 2003-02-08 13:30:00 - 2003-02-09 15:00:00 (0.000 - 100.000 m)

Bhlen (m)	Magnetic Bearing (degrees)	Dip (degrees)	Northing (m)	Easting (m)	Elevation (m)	Locala (m)	Localb (m)	Localc (m)
15.00	176.0	-88.1	6366009.950	1552443.340	-9.090	0.00	0.00	-15.00
18.00	176.7	-88.2	6366009.850	1552443.340	-12.090	0.00	0.00	-15.00
21.00	177.5	-88.1	6366009.760	1552443.330	-15.090	-0.01	0.00	-15.00
24.00	177.4	-88.1	6366009.660	1552443.330	-18.090	-0.01	-0.01	-15.00
27.00	178.6	-88.5	6366009.570	1552443.340	-21.080	-0.02	-0.02	-15.00
30.00	178.2	-88.5	6366009.490	1552443.340	-24.080	-0.04	-0.02	-15.00
33.00	178.6	-88.1	6366009.400	1552443.330	-27.080	-0.05	-0.02	-15.00
36.00	178.1	-88.3	6366009.310	1552443.340	-30.080	-0.06	-0.03	-15.00
39.00	178.7	-88.3	6366009.220	1552443.340	-33.080	-0.07	-0.04	-15.00
42.00	177.8	-88.5	6366009.140	1552443.340	-36.080	-0.09	-0.04	-15.00
45.00	178.5	-88.4	6366009.060	1552443.340	-39.080	-0.11	-0.04	-15.00
48.00	178.8	-88.5	6366008.970	1552443.330	-42.080	-0.13	-0.04	-15.00
51.00	178.8	-88.3	6366008.890	1552443.340	-45.070	-0.14	-0.05	-15.00
54.00	178.0	-88.0	6366008.800	1552443.350	-48.070	-0.15	-0.06	-15.00
57.00	177.9	-88.1	6366008.700	1552443.360	-51.070	-0.15	-0.08	-15.00
60.00	178.4	-88.3	6366008.600	1552443.360	-54.070	-0.16	-0.09	-15.00
63.00	179.5	-88.5	6366008.520	1552443.360	-57.070	-0.18	-0.09	-15.00
66.00	178.5	-88.5	6366008.440	1552443.360	-60.070	-0.20	-0.09	-15.00

69.00	178.9	-88.4	6366008.360	1552443.360	-63.070	-0.22	-0.10	-15.00
72.00	178.8	-88.5	6366008.280	1552443.370	-66.070	-0.24	-0.11	-15.00
75.00	179.7	-88.5	6366008.200	1552443.370	-69.060	-0.26	-0.11	-15.00
78.00	180.3	-88.3	6366008.110	1552443.360	-72.060	-0.27	-0.11	-15.00
81.00	179.7	-88.2	6366008.020	1552443.360	-75.060	-0.28	-0.11	-15.00
84.00	179.3	-88.5	6366007.940	1552443.360	-78.060	-0.30	-0.12	-15.00
87.00	179.4	-88.4	6366007.860	1552443.360	-81.060	-0.32	-0.12	-15.00
90.00	180.2	-88.1	6366007.770	1552443.360	-84.060	-0.33	-0.13	-15.00
93.00	181.0	-88.5	6366007.680	1552443.350	-87.060	-0.34	-0.12	-15.00
96.00	179.9	-88.2	6366007.600	1552443.350	-90.060	-0.36	-0.13	-15.00

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Maxibor T - Borehole deviation: Maxibor

KSH01A, 2002-12-18 08:00:00 - 2002-12-18 11:50:00 (0.000 - 993.000 m)

Length (m) -3.00	Northing (m) 6366013.920	Easting (m) 1552442.910	Elevation (m) -8.280	Coord System RT90-RHB70	Inclination (degrees) -81.1700	Bearing (degrees) 170.4700	Local A (m) 0.0000	Local B (m) 0.0000	Local C (m) 0.0000	Extrapol Flag
0.00	6366013.470	1552442.990	-5.320	RT90-RHB70	-80.8500	171.9800	0.4600	0.0000	0.0000	
3.00	6366012.990	1552443.050	-2.350	RT90-RHB70	-80.7500	172.6400	0.9400	0.0100	0.0200	
6.00	6366012.520	1552443.110	0.610	RT90-RHB70	-80.4700	174.0800	1.4200	0.0300	0.0400	
9.00	6366012.020	1552443.170	3.570	RT90-RHB70	-80.3000	175.1700	1.9100	0.0600	0.0700	
12.00	6366011.520	1552443.210	6.520	RT90-RHB70	-80.2600	175.3600	2.4200	0.1000	0.1200	
15.00	6366011.010	1552443.250	9.480	RT90-RHB70	-80.3000	175.2800	2.9200	0.1500	0.1600	
18.00	6366010.510	1552443.290	12.440	RT90-RHB70	-80.2800	175.3000	3.4300	0.1900	0.2100	
21.00	6366010.000	1552443.330	15.390	RT90-RHB70	-80.2200	175.4800	3.9300	0.2300	0.2500	
24.00	6366009.490	1552443.370	18.350	RT90-RHB70	-80.1500	175.5800	4.4400	0.2800	0.3000	
27.00	6366008.980	1552443.410	21.310	RT90-RHB70	-80.0600	175.7900	4.9500	0.3200	0.3500	
30.00	6366008.470	1552443.450	24.260	RT90-RHB70	-79.9400	175.8100	5.4700	0.3700	0.4100	
33.00	6366007.940	1552443.490	27.210	RT90-RHB70	-79.8000	175.7800	5.9900	0.4200	0.4700	

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
-3.00	**6366013.920**	**1552442.910**	**-8.280**	**RT90-RHB70**	**-81.1700**	**170.4700**	**0.0000**	**0.0000**	**0.0000**	
36.00	6366007.410	1552443.530	30.170	RT90-RHB70	-79.6500	175.5700	6.5200	0.4700	0.5400	
39.00	6366006.880	1552443.570	33.120	RT90-RHB70	-79.4700	175.2100	7.0600	0.5200	0.6200	
42.00	6366006.330	1552443.620	36.070	RT90-RHB70	-79.3200	174.7900	7.6000	0.5600	0.7000	
45.00	6366005.780	1552443.670	39.020	RT90-RHB70	-79.1700	174.3200	8.1600	0.6000	0.8000	
48.00	6366005.210	1552443.720	41.960	RT90-RHB70	-79.0200	173.8500	8.7200	0.6400	0.9000	
51.00	6366004.650	1552443.780	44.910	RT90-RHB70	-78.8600	173.4300	9.2900	0.6700	1.0100	
54.00	6366004.070	1552443.850	47.850	RT90-RHB70	-78.7100	172.9800	9.8700	0.7000	1.1400	
57.00	6366003.490	1552443.920	50.790	RT90-RHB70	-78.5700	172.4500	10.4500	0.7300	1.2600	
60.00	6366002.900	1552444.000	53.730	RT90-RHB70	-78.3900	171.9900	11.0500	0.7500	1.4000	
63.00	6366002.300	1552444.080	56.670	RT90-RHB70	-78.2300	171.4800	11.6500	0.7700	1.5400	
66.00	6366001.700	1552444.170	59.610	RT90-RHB70	-78.0500	171.1100	12.2600	0.7800	1.7000	
69.00	6366001.080	1552444.270	62.540	RT90-RHB70	-77.9100	170.6400	12.8900	0.7800	1.8600	
72.00	6366000.460	1552444.370	65.480	RT90-RHB70	-77.7300	170.3200	13.5100	0.7900	2.0300	
75.00	6365999.830	1552444.480	68.410	RT90-RHB70	-77.6000	169.7800	14.1500	0.7800	2.2100	
78.00	6365999.200	1552444.590	71.340	RT90-RHB70	-77.4300	169.3300	14.8000	0.7800	2.4000	
81.00	6365998.560	1552444.710	74.270	RT90-RHB70	-77.2900	168.8300	15.4500	0.7600	2.5900	
84.00	6365997.910	1552444.840	77.190	RT90-RHB70	-77.1000	168.4800	16.1100	0.7500	2.8000	
87.00	6365997.250	1552444.980	80.120	RT90-RHB70	-76.9500	168.1600	16.7800	0.7200	3.0100	
90.00	6365996.590	1552445.110	83.040	RT90-RHB70	-76.7600	167.8100	17.4500	0.6900	3.2300	
93.00	6365995.920	1552445.260	85.960	RT90-RHB70	-76.6000	167.5100	18.1400	0.6600	3.4600	
96.00	6365995.240	1552445.410	88.880	RT90-RHB70	-76.4300	167.3100	18.8300	0.6300	3.7000	
99.00	6365994.550	1552445.560	91.800	RT90-RHB70	-76.2500	167.1300	19.5400	0.5900	3.9400	
102.00	6365993.860	1552445.720	94.710	RT90-RHB70	-76.1000	167.0500	20.2500	0.5500	4.2000	
105.00	6365993.160	1552445.890	97.620	RT90-RHB70	-76.0200	167.0600	20.9700	0.5000	4.4600	
108.00	6365992.450	1552446.050	100.530	RT90-RHB70	-76.0300	167.1000	21.6900	0.4600	4.7300	
111.00	6365991.740	1552446.210	103.440	RT90-RHB70	-76.0600	167.2600	22.4200	0.4200	5.0000	
114.00	6365991.040	1552446.370	106.360	RT90-RHB70	-76.1100	167.3200	23.1400	0.3800	5.2700	
117.00	6365990.340	1552446.530	109.270	RT90-RHB70	-76.1500	167.5500	23.8600	0.3400	5.5300	
120.00	6365989.640	1552446.680	112.180	RT90-RHB70	-76.1700	167.6600	24.5700	0.3000	5.7900	

Length (m) -3.00	Northing (m) 6366013.920	Easting (m) 1552442.910	Elevation (m) -8.280	Coord System RT90-RHB70	Inclination (degrees) -81.1700	Bearing (degrees) 170.4700	Local A (m) 0.0000	Local B (m) 0.0000	Local C (m) 0.0000	Extrapol Flag
123.00	6365988.940	1552446.830	115.090	RT90-RHB70	-76.1800	167.8200	25.2900	0.2700	6.0500	
126.00	6365988.240	1552446.990	118.010	RT90-RHB70	-76.1800	167.9700	26.0100	0.2300	6.3100	
129.00	6365987.530	1552447.140	120.920	RT90-RHB70	-76.2000	168.0800	26.7200	0.2000	6.5700	
132.00	6365986.830	1552447.280	123.830	RT90-RHB70	-76.2100	168.2300	27.4400	0.1700	6.8300	
135.00	6365986.130	1552447.430	126.750	RT90-RHB70	-76.2400	168.2600	28.1500	0.1400	7.0900	
138.00	6365985.440	1552447.570	129.660	RT90-RHB70	-76.2500	168.3600	28.8600	0.1200	7.3500	
141.00	6365984.740	1552447.720	132.570	RT90-RHB70	-76.2700	168.4200	29.5800	0.0900	7.6000	
144.00	6365984.040	1552447.860	135.490	RT90-RHB70	-76.3000	168.6600	30.2900	0.0600	7.8600	
147.00	6365983.340	1552448.000	138.400	RT90-RHB70	-76.3300	168.6700	31.0000	0.0400	8.1100	
150.00	6365982.650	1552448.140	141.320	RT90-RHB70	-76.3100	168.7800	31.7100	0.0200	8.3700	
153.00	6365981.950	1552448.280	144.230	RT90-RHB70	-76.3200	168.8600	32.4200	0.0000	8.6200	
156.00	6365981.260	1552448.410	147.150	RT90-RHB70	-76.3600	169.0100	33.1200	-0.0200	8.8700	
159.00	6365980.560	1552448.550	150.060	RT90-RHB70	-76.3700	169.1000	33.8300	-0.0400	9.1300	
162.00	6365979.870	1552448.680	152.980	RT90-RHB70	-76.4100	169.2300	34.5400	-0.0600	9.3800	
165.00	6365979.170	1552448.820	155.900	RT90-RHB70	-76.3800	169.4200	35.2400	-0.0700	9.6200	
168.00	6365978.480	1552448.940	158.810	RT90-RHB70	-76.3700	169.7000	35.9500	-0.0800	9.8800	
171.00	6365977.780	1552449.070	161.730	RT90-RHB70	-76.3800	169.9400	36.6600	-0.0900	10.1300	
174.00	6365977.090	1552449.190	164.640	RT90-RHB70	-76.3400	170.2000	37.3600	-0.1000	10.3800	
177.00	6365976.390	1552449.320	167.560	RT90-RHB70	-76.3400	170.3000	38.0700	-0.1000	10.6300	
180.00	6365975.690	1552449.430	170.470	RT90-RHB70	-76.3100	170.6200	38.7800	-0.1100	10.8800	
183.00	6365974.990	1552449.550	173.390	RT90-RHB70	-76.3300	170.7400	39.4900	-0.1000	11.1400	
186.00	6365974.290	1552449.660	176.300	RT90-RHB70	-76.2900	170.9700	40.2000	-0.1000	11.3900	
189.00	6365973.590	1552449.780	179.220	RT90-RHB70	-76.3300	171.0500	40.9100	-0.0900	11.6400	
192.00	6365972.890	1552449.890	182.130	RT90-RHB70	-76.3000	171.2700	41.6200	-0.0900	11.9000	
195.00	6365972.190	1552449.990	185.050	RT90-RHB70	-76.3100	171.4900	42.3300	-0.0800	12.1500	
198.00	6365971.480	1552450.100	187.960	RT90-RHB70	-76.2900	171.7500	43.0400	-0.0600	12.4100	
201.00	6365970.780	1552450.200	190.880	RT90-RHB70	-76.3200	171.8700	43.7500	-0.0500	12.6600	
204.00	6365970.080	1552450.300	193.790	RT90-RHB70	-76.3500	172.0100	44.4600	-0.0300	12.9100	
207.00	6365969.380	1552450.400	196.710	RT90-RHB70	-76.3900	172.0800	45.1700	-0.0100	13.1700	

Length (m) -3.00	Northing (m) 6366013.920	Easting (m) 1552442.910	Elevation (m) -8.280	Coord System RT90-RHB70	Inclination (degrees) -81.1700	Bearing (degrees) 170.4700	Local A (m) 0.0000	Local B (m) 0.0000	Local C (m) 0.0000	Extrapol Flag
210.00	6365968.680	1552450.500	199.620	RT90-RHB70	-76.4200	172.2000	45.8700	0.0100	13.4200	
213.00	6365967.980	1552450.590	202.540	RT90-RHB70	-76.4000	172.1900	46.5800	0.0300	13.6600	
216.00	6365967.280	1552450.690	205.450	RT90-RHB70	-76.4100	172.2400	47.2800	0.0500	13.9100	
219.00	6365966.580	1552450.780	208.370	RT90-RHB70	-76.4200	172.3000	47.9900	0.0700	14.1600	
222.00	6365965.890	1552450.880	211.290	RT90-RHB70	-76.4500	172.3100	48.6900	0.0900	14.4100	
225.00	6365965.190	1552450.970	214.200	RT90-RHB70	-76.4500	172.2900	49.3900	0.1200	14.6600	
228.00	6365964.490	1552451.070	217.120	RT90-RHB70	-76.4600	172.3000	50.1000	0.1400	14.9000	
231.00	6365963.800	1552451.160	220.040	RT90-RHB70	-76.4500	172.2500	50.8000	0.1600	15.1500	
234.00	6365963.100	1552451.260	222.950	RT90-RHB70	-76.4400	172.4100	51.5000	0.1800	15.4000	
237.00	6365962.400	1552451.350	225.870	RT90-RHB70	-76.5100	172.5900	52.2000	0.2100	15.6400	
240.00	6365961.710	1552451.440	228.790	RT90-RHB70	-76.4800	172.7300	52.9000	0.2300	15.8900	
243.00	6365961.010	1552451.530	231.700	RT90-RHB70	-76.4500	172.9200	53.6000	0.2600	16.1300	
246.00	6365960.310	1552451.610	234.620	RT90-RHB70	-76.4100	172.9600	54.3100	0.2900	16.3800	
249.00	6365959.610	1552451.700	237.530	RT90-RHB70	-76.3800	173.0000	55.0100	0.3200	16.6300	
252.00	6365958.910	1552451.790	240.450	RT90-RHB70	-76.3800	172.9500	55.7200	0.3500	16.8800	
255.00	6365958.210	1552451.870	243.370	RT90-RHB70	-76.3500	172.9000	56.4200	0.3800	17.1300	
258.00	6365957.510	1552451.960	246.280	RT90-RHB70	-76.3600	172.8700	57.1300	0.4100	17.3800	
261.00	6365956.810	1552452.050	249.200	RT90-RHB70	-76.3700	172.8800	57.8400	0.4400	17.6300	
264.00	6365956.110	1552452.140	252.110	RT90-RHB70	-76.3900	172.8900	58.5400	0.4700	17.8800	
267.00	6365955.410	1552452.220	255.030	RT90-RHB70	-76.3900	172.7700	59.2500	0.5000	18.1300	
270.00	6365954.710	1552452.310	257.940	RT90-RHB70	-76.3800	172.6400	59.9500	0.5300	18.3800	
273.00	6365954.000	1552452.400	260.860	RT90-RHB70	-76.3900	172.9600	60.6600	0.5600	18.6300	
276.00	6365953.300	1552452.490	263.780	RT90-RHB70	-76.4100	173.0800	61.3600	0.5900	18.8800	
279.00	6365952.600	1552452.570	266.690	RT90-RHB70	-76.4100	172.9100	62.0700	0.6200	19.1200	
282.00	6365951.900	1552452.660	269.610	RT90-RHB70	-76.4100	173.0600	62.7700	0.6500	19.3700	
285.00	6365951.210	1552452.750	272.520	RT90-RHB70	-76.3700	173.0700	63.4800	0.6800	19.6200	
288.00	6365950.500	1552452.830	275.440	RT90-RHB70	-76.3600	173.1700	64.1800	0.7100	19.8700	
291.00	6365949.800	1552452.920	278.350	RT90-RHB70	-76.3700	173.6100	64.8900	0.7500	20.1200	
294.00	6365949.100	1552452.990	281.270	RT90-RHB70	-76.3100	173.8600	65.6000	0.7900	20.3700	

Length (m) -3.00	Northing (m) 6366013.920	Easting (m) 1552442.910	Elevation (m) -8.280	Coord System RT90-RHB70	Inclination (degrees) -81.1700	Bearing (degrees) 170.4700	Local A (m) 0.0000	Local B (m) 0.0000	Local C (m) 0.0000	Extrapol Flag
297.00	6365948.390	1552453.070	284.180	RT90-RHB70	-76.2900	173.9000	66.3100	0.8300	20.6300	
300.00	6365947.690	1552453.150	287.100	RT90-RHB70	-76.2500	174.0900	67.0200	0.8700	20.8800	
303.00	6365946.980	1552453.220	290.010	RT90-RHB70	-76.2300	174.2200	67.7300	0.9200	21.1300	
306.00	6365946.270	1552453.290	292.930	RT90-RHB70	-76.2200	174.4600	68.4400	0.9600	21.3900	
309.00	6365945.550	1552453.360	295.840	RT90-RHB70	-76.1900	174.5800	69.1500	1.0100	21.6500	
312.00	6365944.840	1552453.430	298.750	RT90-RHB70	-76.1800	174.8300	69.8700	1.0600	21.9100	
315.00	6365944.130	1552453.490	301.670	RT90-RHB70	-76.1900	174.9300	70.5800	1.1200	22.1700	
318.00	6365943.420	1552453.560	304.580	RT90-RHB70	-76.2200	175.0500	71.2900	1.1700	22.4200	
321.00	6365942.700	1552453.620	307.490	RT90-RHB70	-76.2400	175.1500	72.0100	1.2300	22.6800	
324.00	6365941.990	1552453.680	310.410	RT90-RHB70	-76.2800	175.3900	72.7200	1.2900	22.9400	
327.00	6365941.280	1552453.740	313.320	RT90-RHB70	-76.2700	175.6700	73.4300	1.3500	23.1900	
330.00	6365940.570	1552453.790	316.240	RT90-RHB70	-76.2700	175.8300	74.1400	1.4100	23.4400	
333.00	6365939.860	1552453.840	319.150	RT90-RHB70	-76.2600	176.2700	74.8400	1.4800	23.7000	
336.00	6365939.150	1552453.890	322.060	RT90-RHB70	-76.2800	176.6000	75.5500	1.5500	23.9500	
339.00	6365938.440	1552453.930	324.980	RT90-RHB70	-76.2600	176.9600	76.2600	1.6300	24.2000	
342.00	6365937.730	1552453.970	327.890	RT90-RHB70	-76.2700	177.1900	76.9700	1.7100	24.4500	
345.00	6365937.020	1552454.000	330.810	RT90-RHB70	-76.2400	177.4900	77.6800	1.7900	24.7000	
348.00	6365936.310	1552454.030	333.720	RT90-RHB70	-76.2200	177.8200	78.3800	1.8800	24.9600	
351.00	6365935.590	1552454.060	336.640	RT90-RHB70	-76.2000	178.0400	79.0900	1.9700	25.2100	
354.00	6365934.880	1552454.080	339.550	RT90-RHB70	-76.1700	178.2500	79.8000	2.0700	25.4600	
357.00	6365934.160	1552454.110	342.460	RT90-RHB70	-76.1400	178.4900	80.5100	2.1600	25.7200	
360.00	6365933.440	1552454.130	345.370	RT90-RHB70	-76.0800	178.7900	81.2200	2.2600	25.9700	
363.00	6365932.720	1552454.140	348.290	RT90-RHB70	-76.0700	178.8700	81.9400	2.3700	26.2300	
366.00	6365932.000	1552454.160	351.200	RT90-RHB70	-76.0000	178.7800	82.6500	2.4700	26.4900	
369.00	6365931.270	1552454.170	354.110	RT90-RHB70	-75.9600	179.0700	83.3700	2.5800	26.7600	
372.00	6365930.540	1552454.180	357.020	RT90-RHB70	-75.9100	179.1400	84.0900	2.6900	27.0200	
375.00	6365929.810	1552454.190	359.930	RT90-RHB70	-75.8600	179.2300	84.8100	2.8000	27.2900	
378.00	6365929.080	1552454.200	362.840	RT90-RHB70	-75.8300	179.5800	85.5400	2.9100	27.5600	
381.00	6365928.350	1552454.210	365.750	RT90-RHB70	-75.8500	179.8800	86.2600	3.0300	27.8300	

Length (m) **-3.00**	Northing (m) **6366013.920**	Easting (m) **1552442.910**	Elevation (m) **-8.280**	Coord System **RT90-RHB70**	Inclination (degrees) **-81.1700**	Bearing (degrees) **170.4700**	Local A (m) **0.0000**	Local B (m) **0.0000**	Local C (m) **0.0000**	Extrapol Flag
384.00	6365927.610	1552454.210	368.660	RT90-RHB70	-75.8100	179.9600	86.9900	3.1500	28.0900	
387.00	6365926.880	1552454.210	371.560	RT90-RHB70	-75.7500	180.1700	87.7100	3.2700	28.3700	
390.00	6365926.140	1552454.210	374.470	RT90-RHB70	-75.7400	180.3300	88.4400	3.3900	28.6400	
393.00	6365925.400	1552454.200	377.380	RT90-RHB70	-75.7200	180.7500	89.1700	3.5200	28.9100	
396.00	6365924.660	1552454.190	380.290	RT90-RHB70	-75.6700	180.9700	89.9000	3.6500	29.1800	
399.00	6365923.920	1552454.180	383.190	RT90-RHB70	-75.6800	181.3100	90.6300	3.7800	29.4600	
402.00	6365923.180	1552454.160	386.100	RT90-RHB70	-75.6300	181.4600	91.3500	3.9200	29.7300	
405.00	6365922.430	1552454.150	389.010	RT90-RHB70	-75.6300	181.5800	92.0900	4.0700	30.0100	
408.00	6365921.690	1552454.130	391.910	RT90-RHB70	-75.6300	181.6700	92.8200	4.2100	30.2900	
411.00	6365920.940	1552454.100	394.820	RT90-RHB70	-75.6600	181.7700	93.5500	4.3500	30.5600	
414.00	6365920.200	1552454.080	397.730	RT90-RHB70	-75.6800	181.9700	94.2700	4.5000	30.8300	
417.00	6365919.460	1552454.060	400.630	RT90-RHB70	-75.6800	182.1500	95.0000	4.6500	31.1100	
420.00	6365918.720	1552454.030	403.540	RT90-RHB70	-75.6700	182.2600	95.7300	4.8000	31.3800	
423.00	6365917.980	1552454.000	406.450	RT90-RHB70	-75.6800	182.3200	96.4600	4.9500	31.6500	
426.00	6365917.240	1552453.970	409.350	RT90-RHB70	-75.6900	182.3000	97.1800	5.1000	31.9200	
429.00	6365916.490	1552453.940	412.260	RT90-RHB70	-75.7200	182.3700	97.9100	5.2500	32.1900	
432.00	6365915.760	1552453.910	415.170	RT90-RHB70	-75.7300	182.5800	98.6300	5.4100	32.4600	
435.00	6365915.020	1552453.870	418.070	RT90-RHB70	-75.7400	182.8000	99.3500	5.5600	32.7300	
438.00	6365914.280	1552453.840	420.980	RT90-RHB70	-75.7300	183.0300	100.0800	5.7200	33.0000	
441.00	6365913.540	1552453.800	423.890	RT90-RHB70	-75.7400	183.2800	100.8000	5.8800	33.2600	
444.00	6365912.800	1552453.760	426.800	RT90-RHB70	-75.7300	183.4200	101.5200	6.0400	33.5300	
447.00	6365912.060	1552453.710	429.700	RT90-RHB70	-75.6900	183.6100	102.2400	6.2100	33.7900	
450.00	6365911.320	1552453.670	432.610	RT90-RHB70	-75.7000	183.8800	102.9600	6.3800	34.0600	
453.00	6365910.580	1552453.620	435.520	RT90-RHB70	-75.7200	183.9800	103.6800	6.5500	34.3300	
456.00	6365909.850	1552453.560	438.430	RT90-RHB70	-75.7000	184.2400	104.4000	6.7200	34.5900	
459.00	6365909.110	1552453.510	441.330	RT90-RHB70	-75.6400	184.3500	105.1200	6.9000	34.8600	
462.00	6365908.370	1552453.450	444.240	RT90-RHB70	-75.5700	184.5300	105.8400	7.0800	35.1300	
465.00	6365907.620	1552453.390	447.140	RT90-RHB70	-75.5400	184.8400	106.5700	7.2600	35.4000	
468.00	6365906.870	1552453.330	450.050	RT90-RHB70	-75.5300	185.1400	107.2900	7.4500	35.6700	

Length (m) -3.00	Northing (m) 6366013.920	Easting (m) 1552442.910	Elevation (m) -8.280	Coord System RT90-RHB70	Inclination (degrees) -81.1700	Bearing (degrees) 170.4700	Local A (m) 0.0000	Local B (m) 0.0000	Local C (m) 0.0000	Extrapol Flag
471.00	6365906.130	1552453.260	452.950	RT90-RHB70	-75.5400	185.5200	108.0200	7.6400	35.9400	
474.00	6365905.380	1552453.190	455.860	RT90-RHB70	-75.5900	185.8100	108.7400	7.8300	36.2100	
477.00	6365904.640	1552453.120	458.760	RT90-RHB70	-75.6100	186.2000	109.4600	8.0300	36.4700	
480.00	6365903.900	1552453.040	461.670	RT90-RHB70	-75.6600	186.4300	110.1800	8.2300	36.7400	
483.00	6365903.160	1552452.950	464.580	RT90-RHB70	-75.6600	186.6100	110.9000	8.4300	37.0000	
486.00	6365902.420	1552452.870	467.480	RT90-RHB70	-75.6900	186.9800	111.6100	8.6400	37.2600	
489.00	6365901.680	1552452.780	470.390	RT90-RHB70	-75.7100	187.1300	112.3200	8.8500	37.5100	
492.00	6365900.950	1552452.690	473.300	RT90-RHB70	-75.7300	187.3600	113.0300	9.0600	37.7700	
495.00	6365900.220	1552452.590	476.200	RT90-RHB70	-75.7300	187.6300	113.7400	9.2800	38.0200	
498.00	6365899.480	1552452.490	479.110	RT90-RHB70	-75.7200	187.8900	114.4400	9.5000	38.2700	
501.00	6365898.750	1552452.390	482.020	RT90-RHB70	-75.7300	187.9400	115.1500	9.7200	38.5200	
504.00	6365898.020	1552452.290	484.930	RT90-RHB70	-75.7100	188.1700	115.8600	9.9400	38.7700	
507.00	6365897.280	1552452.180	487.830	RT90-RHB70	-75.7400	188.1800	116.5600	10.1700	39.0200	
510.00	6365896.550	1552452.080	490.740	RT90-RHB70	-75.7400	188.4200	117.2600	10.3900	39.2700	
513.00	6365895.820	1552451.970	493.650	RT90-RHB70	-75.7500	188.5900	117.9700	10.6200	39.5200	
516.00	6365895.090	1552451.860	496.560	RT90-RHB70	-75.7500	188.6500	118.6700	10.8500	39.7700	
519.00	6365894.360	1552451.750	499.460	RT90-RHB70	-75.7700	188.6800	119.3700	11.0800	40.0200	
522.00	6365893.630	1552451.640	502.370	RT90-RHB70	-75.7800	188.8900	120.0700	11.3100	40.2600	
525.00	6365892.910	1552451.520	505.280	RT90-RHB70	-75.8300	188.8700	120.7700	11.5400	40.5100	
528.00	6365892.180	1552451.410	508.190	RT90-RHB70	-75.8200	189.0500	121.4700	11.7700	40.7500	
531.00	6365891.450	1552451.290	511.100	RT90-RHB70	-75.8500	189.2500	122.1600	12.0100	40.9900	
534.00	6365890.730	1552451.180	514.010	RT90-RHB70	-75.8700	189.3600	122.8600	12.2400	41.2300	
537.00	6365890.010	1552451.060	516.920	RT90-RHB70	-75.8800	189.5500	123.5500	12.4800	41.4700	
540.00	6365889.290	1552450.940	519.830	RT90-RHB70	-75.8700	189.7200	124.2400	12.7200	41.7000	
543.00	6365888.560	1552450.810	522.730	RT90-RHB70	-75.8800	189.9500	124.9300	12.9600	41.9400	
546.00	6365887.840	1552450.690	525.640	RT90-RHB70	-75.9100	190.0300	125.6200	13.2100	42.1800	
549.00	6365887.120	1552450.560	528.550	RT90-RHB70	-75.8800	190.2900	126.3100	13.4500	42.4100	
552.00	6365886.400	1552450.430	531.460	RT90-RHB70	-75.8800	190.4400	127.0000	13.7000	42.6400	
555.00	6365885.680	1552450.300	534.370	RT90-RHB70	-75.8900	190.6400	127.6900	13.9500	42.8800	

Length (m) -3.00	Northing (m) 6366013.920	Easting (m) 1552442.910	Elevation (m) -8.280	Coord System RT90-RHB70	Inclination (degrees) -81.1700	Bearing (degrees) 170.4700	Local A (m) 0.0000	Local B (m) 0.0000	Local C (m) 0.0000	Extrapol Flag
558.00	6365884.970	1552450.160	537.280	RT90-RHB70	-75.9100	190.9200	128.3700	14.2000	43.1100	
561.00	6365884.250	1552450.020	540.190	RT90-RHB70	-75.9100	191.2000	129.0600	14.4600	43.3400	
564.00	6365883.530	1552449.880	543.100	RT90-RHB70	-75.8900	191.2300	129.7400	14.7100	43.5700	
567.00	6365882.810	1552449.740	546.010	RT90-RHB70	-75.8700	191.2500	130.4300	14.9700	43.8000	
570.00	6365882.100	1552449.590	548.920	RT90-RHB70	-75.8400	191.2400	131.1100	15.2300	44.0300	
573.00	6365881.380	1552449.450	551.830	RT90-RHB70	-75.7800	191.2000	131.8000	15.4900	44.2600	
576.00	6365880.650	1552449.310	554.740	RT90-RHB70	-75.7900	191.4100	132.4900	15.7500	44.4900	
579.00	6365879.930	1552449.160	557.650	RT90-RHB70	-75.7600	191.5300	133.1700	16.0200	44.7200	
582.00	6365879.210	1552449.020	560.550	RT90-RHB70	-75.7400	191.6100	133.8600	16.2800	44.9600	
585.00	6365878.480	1552448.870	563.460	RT90-RHB70	-75.7500	191.9200	134.5500	16.5500	45.1900	
588.00	6365877.760	1552448.710	566.370	RT90-RHB70	-75.8500	192.2700	135.2400	16.8200	45.4300	
591.00	6365877.050	1552448.560	569.280	RT90-RHB70	-75.8900	192.5000	135.9200	17.0900	45.6500	
594.00	6365876.330	1552448.400	572.190	RT90-RHB70	-75.8500	192.5800	136.6000	17.3700	45.8800	
597.00	6365875.620	1552448.240	575.100	RT90-RHB70	-75.7900	192.6200	137.2800	17.6400	46.1000	
600.00	6365874.900	1552448.080	578.000	RT90-RHB70	-75.7600	192.7500	137.9600	17.9200	46.3300	
603.00	6365874.180	1552447.920	580.910	RT90-RHB70	-75.7600	193.0000	138.6400	18.2000	46.5600	
606.00	6365873.460	1552447.750	583.820	RT90-RHB70	-75.7400	193.1900	139.3300	18.4800	46.7800	
609.00	6365872.740	1552447.580	586.730	RT90-RHB70	-75.7300	193.4100	140.0100	18.7700	47.0100	
612.00	6365872.020	1552447.410	589.630	RT90-RHB70	-75.7300	193.8100	140.6900	19.0600	47.2400	
615.00	6365871.300	1552447.230	592.540	RT90-RHB70	-75.7000	193.9500	141.3700	19.3500	47.4600	
618.00	6365870.580	1552447.060	595.450	RT90-RHB70	-75.7300	194.0100	142.0500	19.6400	47.6900	
621.00	6365869.860	1552446.880	598.360	RT90-RHB70	-75.7300	194.3700	142.7200	19.9400	47.9100	
624.00	6365869.150	1552446.690	601.260	RT90-RHB70	-75.7400	194.4500	143.4000	20.2400	48.1300	
627.00	6365868.430	1552446.510	604.170	RT90-RHB70	-75.7400	194.8500	144.0800	20.5400	48.3500	
630.00	6365867.720	1552446.320	607.080	RT90-RHB70	-75.7500	194.9300	144.7500	20.8400	48.5700	
633.00	6365867.000	1552446.130	609.990	RT90-RHB70	-75.7500	195.1100	145.4200	21.1500	48.7900	
636.00	6365866.290	1552445.940	612.890	RT90-RHB70	-75.7700	195.3000	146.0900	21.4600	49.0100	
639.00	6365865.580	1552445.740	615.800	RT90-RHB70	-75.7800	195.4800	146.7600	21.7700	49.2200	
642.00	6365864.870	1552445.540	618.710	RT90-RHB70	-75.7900	195.7700	147.4300	22.0800	49.4400	

Length (m) -3.00	Northing (m) 6366013.920	Easting (m) 1552442.910	Elevation (m) -8.280	Coord System RT90-RHB70	Inclination (degrees) -81.1700	Bearing (degrees) 170.4700	Local A (m) 0.0000	Local B (m) 0.0000	Local C (m) 0.0000	Extrapol Flag
645.00	6365864.160	1552445.340	621.620	RT90-RHB70	-75.7900	195.8000	148.0900	22.3900	49.6500	
648.00	6365863.450	1552445.140	624.530	RT90-RHB70	-75.7800	195.9700	148.7600	22.7100	49.8600	
651.00	6365862.740	1552444.940	627.430	RT90-RHB70	-75.7500	196.1700	149.4300	23.0300	50.0700	
654.00	6365862.040	1552444.740	630.340	RT90-RHB70	-75.7500	196.2200	150.0900	23.3500	50.2800	
657.00	6365861.330	1552444.530	633.250	RT90-RHB70	-75.7200	196.5000	150.7600	23.6700	50.4900	
660.00	6365860.620	1552444.320	636.160	RT90-RHB70	-75.6900	196.7000	151.4200	23.9900	50.7000	
663.00	6365859.910	1552444.110	639.060	RT90-RHB70	-75.6600	196.8500	152.0900	24.3200	50.9100	
666.00	6365859.200	1552443.890	641.970	RT90-RHB70	-75.6400	197.0400	152.7500	24.6500	51.1300	
669.00	6365858.480	1552443.670	644.880	RT90-RHB70	-75.6000	197.1600	153.4200	24.9800	51.3400	
672.00	6365857.770	1552443.450	647.780	RT90-RHB70	-75.5400	197.2300	154.0800	25.3200	51.5500	
675.00	6365857.060	1552443.230	650.690	RT90-RHB70	-75.4900	197.4400	154.7500	25.6500	51.7600	
678.00	6365856.340	1552443.010	653.590	RT90-RHB70	-75.4600	197.6100	155.4200	26.0000	51.9800	
681.00	6365855.620	1552442.780	656.500	RT90-RHB70	-75.3900	197.7400	156.0900	26.3400	52.2000	
684.00	6365854.900	1552442.550	659.400	RT90-RHB70	-75.3400	197.8600	156.7700	26.6900	52.4200	
687.00	6365854.180	1552442.310	662.300	RT90-RHB70	-75.2900	197.9800	157.4400	27.0300	52.6400	
690.00	6365853.450	1552442.080	665.200	RT90-RHB70	-75.2600	198.0600	158.1100	27.3900	52.8600	
693.00	6365852.730	1552441.840	668.100	RT90-RHB70	-75.2000	198.1500	158.7900	27.7400	53.0800	
696.00	6365852.000	1552441.600	671.010	RT90-RHB70	-75.1600	198.4000	159.4700	28.1000	53.3100	
699.00	6365851.270	1552441.360	673.900	RT90-RHB70	-75.1100	198.5600	160.1500	28.4600	53.5300	
702.00	6365850.540	1552441.120	676.800	RT90-RHB70	-75.0400	198.6700	160.8300	28.8200	53.7600	
705.00	6365849.810	1552440.870	679.700	RT90-RHB70	-75.0000	198.9800	161.5100	29.1900	53.9900	
708.00	6365849.070	1552440.620	682.600	RT90-RHB70	-74.9700	199.0800	162.1900	29.5600	54.2200	
711.00	6365848.340	1552440.360	685.500	RT90-RHB70	-74.9400	199.4500	162.8800	29.9300	54.4500	
714.00	6365847.600	1552440.100	688.390	RT90-RHB70	-74.8900	199.7800	163.5600	30.3100	54.6800	
717.00	6365846.860	1552439.840	691.290	RT90-RHB70	-74.8400	200.0100	164.2400	30.6900	54.9100	
720.00	6365846.130	1552439.570	694.190	RT90-RHB70	-74.8200	199.9500	164.9200	31.0800	55.1400	
723.00	6365845.390	1552439.300	697.080	RT90-RHB70	-74.8300	199.9300	165.6100	31.4600	55.3700	
726.00	6365844.650	1552439.030	699.980	RT90-RHB70	-74.7900	199.9900	166.2900	31.8500	55.6000	
729.00	6365843.910	1552438.760	702.870	RT90-RHB70	-74.7700	199.9700	166.9800	32.2400	55.8300	

Length (m) -3.00	Northing (m) 6366013.920	Easting (m) 1552442.910	Elevation (m) -8.280	Coord System RT90-RHB70	Inclination (degrees) -81.1700	Bearing (degrees) 170.4700	Local A (m) 0.0000	Local B (m) 0.0000	Local C (m) 0.0000	Extrapol Flag
732.00	6365843.170	1552438.490	705.770	RT90-RHB70	-74.7100	200.1400	167.6600	32.6200	56.0700	
735.00	6365842.430	1552438.220	708.660	RT90-RHB70	-74.6600	200.2000	168.3500	33.0200	56.3000	
738.00	6365841.680	1552437.950	711.550	RT90-RHB70	-74.6200	200.2100	169.0400	33.4100	56.5400	
741.00	6365840.940	1552437.670	714.450	RT90-RHB70	-74.6000	200.3800	169.7300	33.8000	56.7800	
744.00	6365840.190	1552437.400	717.340	RT90-RHB70	-74.5700	200.2700	170.4200	34.2000	57.0100	
747.00	6365839.440	1552437.120	720.230	RT90-RHB70	-74.5000	200.3000	171.1100	34.6000	57.2600	
750.00	6365838.690	1552436.840	723.120	RT90-RHB70	-74.4200	200.6400	171.8100	35.0000	57.5000	
753.00	6365837.940	1552436.560	726.010	RT90-RHB70	-74.3700	200.6200	172.5000	35.4000	57.7400	
756.00	6365837.180	1552436.270	728.900	RT90-RHB70	-74.3300	200.7900	173.2000	35.8100	57.9900	
759.00	6365836.420	1552435.980	731.790	RT90-RHB70	-74.3300	200.8600	173.9000	36.2200	58.2400	
762.00	6365835.660	1552435.700	734.680	RT90-RHB70	-74.3000	200.9100	174.6000	36.6300	58.4900	
765.00	6365834.910	1552435.410	737.570	RT90-RHB70	-74.2400	201.0100	175.3000	37.0400	58.7300	
768.00	6365834.140	1552435.110	740.450	RT90-RHB70	-74.2400	201.0500	176.0000	37.4500	58.9800	
771.00	6365833.380	1552434.820	743.340	RT90-RHB70	-74.1400	201.2100	176.7000	37.8700	59.2300	
774.00	6365832.620	1552434.530	746.230	RT90-RHB70	-74.1100	201.3100	177.4100	38.2900	59.4900	
777.00	6365831.850	1552434.230	749.110	RT90-RHB70	-74.0900	201.4000	178.1100	38.7100	59.7400	
780.00	6365831.090	1552433.930	752.000	RT90-RHB70	-74.1000	201.6000	178.8200	39.1300	60.0000	
783.00	6365830.320	1552433.620	754.880	RT90-RHB70	-74.1100	201.7600	179.5200	39.5500	60.2500	
786.00	6365829.560	1552433.320	757.770	RT90-RHB70	-74.1000	202.0400	180.2300	39.9800	60.5000	
789.00	6365828.800	1552433.010	760.650	RT90-RHB70	-74.0600	202.2900	180.9300	40.4100	60.7500	
792.00	6365828.040	1552432.700	763.540	RT90-RHB70	-74.0500	202.6700	181.6300	40.8500	61.0000	
795.00	6365827.280	1552432.380	766.420	RT90-RHB70	-73.9700	202.8800	182.3200	41.2900	61.2400	
798.00	6365826.510	1552432.060	769.300	RT90-RHB70	-73.9000	203.3000	183.0200	41.7300	61.4900	
801.00	6365825.750	1552431.730	772.190	RT90-RHB70	-73.8200	203.4900	183.7200	42.1800	61.7400	
804.00	6365824.980	1552431.400	775.070	RT90-RHB70	-73.8100	203.6600	184.4200	42.6400	61.9900	
807.00	6365824.220	1552431.060	777.950	RT90-RHB70	-73.7400	203.8900	185.1200	43.0900	62.2400	
810.00	6365823.450	1552430.720	780.830	RT90-RHB70	-73.6700	204.1200	185.8200	43.5600	62.4900	
813.00	6365822.680	1552430.380	783.710	RT90-RHB70	-73.6300	204.2800	186.5300	44.0200	62.7400	
816.00	6365821.910	1552430.030	786.590	RT90-RHB70	-73.6000	204.3200	187.2300	44.4900	62.9900	

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
-3.00	**6366013.920**	**1552442.910**	**-8.280**	**RT90-RHB70**	**-81.1700**	**170.4700**	**0.0000**	**0.0000**	**0.0000**	
819.00	6365821.140	1552429.680	789.460	RT90-RHB70	-73.5200	204.5600	187.9300	44.9700	63.2500	
822.00	6365820.360	1552429.330	792.340	RT90-RHB70	-73.4200	204.6300	188.6400	45.4400	63.5000	
825.00	6365819.580	1552428.970	795.220	RT90-RHB70	-73.3200	204.6300	189.3500	45.9200	63.7600	
828.00	6365818.800	1552428.610	798.090	RT90-RHB70	-73.2500	204.6200	190.0600	46.4100	64.0200	
831.00	6365818.020	1552428.250	800.960	RT90-RHB70	-73.2100	204.6100	190.7700	46.8900	64.2900	
834.00	6365817.230	1552427.890	803.830	RT90-RHB70	-73.1500	204.6600	191.4900	47.3800	64.5600	
837.00	6365816.440	1552427.530	806.710	RT90-RHB70	-73.1100	204.8000	192.2100	47.8700	64.8300	
840.00	6365815.650	1552427.160	809.580	RT90-RHB70	-73.0600	205.0200	192.9300	48.3600	65.1000	
843.00	6365814.850	1552426.790	812.450	RT90-RHB70	-73.0000	205.3300	193.6500	48.8500	65.3700	
846.00	6365814.060	1552426.420	815.320	RT90-RHB70	-72.9300	205.3800	194.3700	49.3600	65.6400	
849.00	6365813.270	1552426.040	818.180	RT90-RHB70	-72.8300	205.4800	195.0900	49.8600	65.9100	
852.00	6365812.470	1552425.660	821.050	RT90-RHB70	-72.7700	205.3200	195.8200	50.3700	66.1900	
855.00	6365811.660	1552425.280	823.910	RT90-RHB70	-72.6900	205.3300	196.5500	50.8800	66.4700	
858.00	6365810.860	1552424.900	826.780	RT90-RHB70	-72.6400	205.3500	197.2800	51.3900	66.7600	
861.00	6365810.050	1552424.510	829.640	RT90-RHB70	-72.5900	205.5100	198.0100	51.9000	67.0400	
864.00	6365809.240	1552424.130	832.510	RT90-RHB70	-72.5300	205.7100	198.7500	52.4100	67.3300	
867.00	6365808.430	1552423.740	835.370	RT90-RHB70	-72.4400	205.9700	199.4800	52.9300	67.6200	
870.00	6365807.610	1552423.340	838.230	RT90-RHB70	-72.3400	206.1400	200.2200	53.4600	67.9100	
873.00	6365806.800	1552422.940	841.090	RT90-RHB70	-72.2700	206.2900	200.9600	53.9900	68.2000	
876.00	6365805.980	1552422.530	843.940	RT90-RHB70	-72.1900	206.4500	201.7000	54.5200	68.4900	
879.00	6365805.160	1552422.130	846.800	RT90-RHB70	-72.1300	206.5100	202.4400	55.0600	68.7900	
882.00	6365804.330	1552421.710	849.650	RT90-RHB70	-72.0500	206.5700	203.1900	55.6000	69.0800	
885.00	6365803.500	1552421.300	852.510	RT90-RHB70	-71.9600	206.8000	203.9300	56.1500	69.3800	
888.00	6365802.680	1552420.880	855.360	RT90-RHB70	-71.8800	206.9400	204.6800	56.7000	69.6800	
891.00	6365801.840	1552420.460	858.210	RT90-RHB70	-71.8000	207.1300	205.4300	57.2500	69.9900	
894.00	6365801.010	1552420.030	861.060	RT90-RHB70	-71.7000	207.3700	206.1800	57.8100	70.2900	
897.00	6365800.170	1552419.600	863.910	RT90-RHB70	-71.5600	207.6700	206.9400	58.3800	70.6000	
900.00	6365799.330	1552419.160	866.760	RT90-RHB70	-71.4700	207.8400	207.6900	58.9500	70.9100	
903.00	6365798.490	1552418.710	869.600	RT90-RHB70	-71.3700	207.9800	208.4500	59.5300	71.2200	

Length (m) -3.00	Northing (m) 6366013.920	Easting (m) 1552442.910	Elevation (m) -8.280	Coord System RT90-RHB70	Inclination (degrees) -81.1700	Bearing (degrees) 170.4700	Local A (m) 0.0000	Local B (m) 0.0000	Local C (m) 0.0000	Extrapol Flag
906.00	6365797.640	1552418.260	872.440	RT90-RHB70	-71.2800	208.0400	209.2100	60.1100	71.5400	
909.00	6365796.790	1552417.810	875.290	RT90-RHB70	-71.1900	208.0400	209.9700	60.7000	71.8500	
912.00	6365795.940	1552417.360	878.120	RT90-RHB70	-71.1000	208.0200	210.7400	61.2900	72.1800	
915.00	6365795.080	1552416.900	880.960	RT90-RHB70	-71.0100	208.0400	211.5100	61.8800	72.5000	
918.00	6365794.220	1552416.440	883.800	RT90-RHB70	-70.9100	208.1000	212.2800	62.4800	72.8300	
921.00	6365793.360	1552415.980	886.630	RT90-RHB70	-70.8200	208.2400	213.0600	63.0800	73.1600	
924.00	6365792.490	1552415.510	889.470	RT90-RHB70	-70.7300	208.3800	213.8400	63.6800	73.5000	
927.00	6365791.620	1552415.040	892.300	RT90-RHB70	-70.6200	208.5600	214.6200	64.2900	73.8400	
930.00	6365790.740	1552414.570	895.130	RT90-RHB70	-70.5500	208.6900	215.4100	64.9000	74.1800	
933.00	6365789.870	1552414.090	897.960	RT90-RHB70	-70.4700	208.7700	216.1900	65.5200	74.5200	
936.00	6365788.990	1552413.600	900.790	RT90-RHB70	-70.3800	208.8000	216.9800	66.1400	74.8600	
939.00	6365788.100	1552413.120	903.610	RT90-RHB70	-70.3500	208.8300	217.7700	66.7700	75.2100	
942.00	6365787.220	1552412.630	906.440	RT90-RHB70	-70.3200	208.7500	218.5600	67.3900	75.5600	
945.00	6365786.330	1552412.150	909.260	RT90-RHB70	-70.2700	208.8800	219.3500	68.0200	75.9100	
948.00	6365785.450	1552411.660	912.090	RT90-RHB70	-70.2300	208.9100	220.1400	68.6500	76.2600	
951.00	6365784.560	1552411.170	914.910	RT90-RHB70	-70.1600	209.0100	220.9400	69.2800	76.6100	
954.00	6365783.670	1552410.670	917.730	RT90-RHB70	-70.1000	208.9800	221.7400	69.9100	76.9600	
957.00	6365782.780	1552410.180	920.550	RT90-RHB70	-70.0500	208.9400	222.5400	70.5500	77.3200	
960.00	6365781.880	1552409.680	923.370	RT90-RHB70	-70.0000	209.0000	223.3400	71.1900	77.6800	
963.00	6365780.980	1552409.180	926.190	RT90-RHB70	-69.9700	208.9600	224.1400	71.8300	78.0400	
966.00	6365780.080	1552408.690	929.010	RT90-RHB70	-69.9000	209.0600	224.9400	72.4700	78.4000	
969.00	6365779.180	1552408.190	931.830	RT90-RHB70	-69.8400	209.1700	225.7500	73.1100	78.7600	
972.00	6365778.280	1552407.680	934.640	RT90-RHB70	-69.7900	209.3400	226.5600	73.7600	79.1300	
975.00	6365777.380	1552407.170	937.460	RT90-RHB70	-69.7500	209.5800	227.3600	74.4100	79.4900	
978.00	6365776.470	1552406.660	940.270	RT90-RHB70	-69.7100	209.7400	228.1700	75.0600	79.8600	
981.00	6365775.570	1552406.150	943.090	RT90-RHB70	-69.6700	209.8900	228.9700	75.7200	80.2200	
984.00	6365774.670	1552405.630	945.900	RT90-RHB70	-69.6300	210.0500	229.7800	76.3800	80.5900	
990.00	6365772.860	1552404.570	951.520	RT90-RHB70	-69.5700	210.2800	231.3900	77.7200	81.3100	

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Appendix 10

In data: Reference marks for length adjustments for KSH01A and KSH01B

Reference Mark T - Reference mark in drillhole

KSH01A, 2003-01-09 15:56:00 - 2003-01-10 16:12:00 (110.000 - 950.000 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	200	1000	28.0	120	Yes		At 20 bar, flow 280 l/min
150.00	400.00	240	1000	28.0	120	Yes		At 20 bar, flow 280 l/min
200.00	400.00	220	1000	28.0	120	Yes		At 20 bar, flow 280 l/min
250.00	400.00	220	1000	28.0	120	Yes		At 20 bar, flow 280 l/min
300.00	400.00	220	1000	30.0	120	Yes		At 20 bar, flow 280 l/min
350.00	400.00	220	1000	35.0	120	Yes		At 20 bar, flow 280 l/min
400.00	400.00	220	1000	35.0	120	Yes		At 20 bar, flow 280 l/min
450.00	400.00	220	1000	30.0	120	Yes		At 20 bar, flow 280 l/min
500.00	400.00	220	1000	35.0	120	Yes		At 20 bar, flow 280 l/min
550.00	400.00	220	1000	35.0	180	Yes		At 20 bar, flow 280 l/min
600.00	400.00	220	1000	35.0	180	Yes		At 20 bar, flow 280 l/min
650.00	400.00	220	1000	36.0	180	Yes		At 20 bar, flow 280 l/min
700.00	400.00	220	1000	36.0	180	Yes		At 20 bar, flow 280 l/min
750.00	400.00	220	1000	37.0	180	Yes		At 20 bar, flow 280 l/min
800.00	400.00	220	1000	40.0	180	Yes		At 20 bar, flow 280 l/min
850.00	400.00	220	1000	42.0	180	Yes		At 20 bar, flow 280 l/min
899.00	400.00	220	1000	48.0	180	Yes		At 20 bar, flow 280 l/min
950.00	400.00	220	1000	46.0	180	Yes		At 20 bar, flow 280 l/min

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