P-04-131

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ISSN 1651-4416
SKB P-04-131

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Keywords: KSH02, Geology, Drill core mapping, Boremap, Fractures, Simpevarp.

Abstract

Borehole KSH02 is the second deep (approx. 1000 m) cored borehole, drilled within the site investigation program in the Simpevarp area in 2003. The borehole is telescopic and the upper 100 m was enlarged by later percussion drilling and has therefore a larger diameter than the interval 100–1000 m.

Rock types, alterations, fractures and other structures were studied in the drill core and documented in the software Boremap. All these data will be used in further interpretation of the bedrock conditions in the area down to 1000 m depth.

Fine-grained dioritoid is the only principal lithology in KSH02. This rock type was divided in rock sub-types showing that the fine-grained dioritoid is extremely heterogeneous on a detailed scale.

The homogeneous lithology together with lack of structures as well as specific weakness sections did not allow a clear subdivision of KSH02 into longer sections, based on the variation in geological parameters.

However, a combination of oxidation intervals, shear structures, sealed fracture network, and open fracture (interpreted) frequencies indicate a fourfold subdivision of KSH02.

Section I, 0–200 m, is continuously rich in open fractures (interpreted) but almost lack shear structures and oxidized intervals.

Section II, 200–470 m, varies in the open fracture (interpreted) frequency, is rather rich in shear structures and oxidized all through the section. This section contains several intervals with sealed fracture network.

Section III, 470–865 m, is rich in open fractures (interpreted), almost lack shear structures and is oxidized all through the section. High joint alteration numbers and intervals with crush are also common in this section.

Section IV, 865–1000 m, has low frequencies of open fractures (interpreted), few shear structures and lack oxidation, sealed fracture network, high joint alteration numbers and intervals with crush. Section IV is, however, rich in veins and dykes.

Coincidence between frequency peaks for crush, high joint alteration numbers, open fractures (interpreted), sealed fracture network and oxidation indicate thinner, probably < 10 m wide, weakness sections, for example, at 300 m, 525 m and 665 m. These rather thin weakness sections do, however, not separate longer intervals in KSH02 with significant differences in lithology or other geological parameters.

Sammanfattning

Borrhål KSH02 är det andra djupa (ca 1000 m) kärnborrhålet, som borrats inom ramarna för platsundersökningarna i Simpevarp under 2003. Borrhålet är teleskopiskt och de övre 100 m utvidgades senare genom hammarborrning och har därför en större diameter än intervallet 100–1000 m.

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

Finkornig dioritoid är, förutom gångar, den enda litologin i KSH02. Denna bergartstyp karterades med avseende på undertyper, såsom finkorniga, medelkorniga och hornfels-omvandlade varianter, vilket visade att den finkorniga dioritoiden är extremt heterogen i detaljerad skala.

Den homogena litologin tillsammans med en generell avsaknad av strukturer och specifika svaghetssektioner gjorde det omöjligt att göra en klar uppdelning av KSH02 i längre sektioner baserade på tydliga variationer hos geologiska parametrar.

Emellertid så indikerade en kombination av oxiderade intervaller, skjuvstrukturer, läkta spricknätverk (tolkade) och frekvensen av öppna sprickor (tolkade) en fyrfaldig underindelning av KSH02.

Sektion I, 0–200 m, är kontinuerligt rik på öppna sprickor (tolkade) men saknar nästan helt skjuvstrukturer och oxiderade intervaller.

Sektion II, 200–470 m, har varierande frekvens av öppna sprickor (tolkade) och är genomgående ganska rik på skjuvstrukturer och oxiderade intervall i hela sektionen. Denna sektion håller flera intervall med läkta spricknätverk.

Sektion III, 470–865 m, är rik på öppna sprickor (tolkade) men saknar nästan helt skjuvstrukturer. Hela sektionen III är oxiderad. Höga sprickomvandlingstal och intervaller med kross är också vanliga i denna sektion.

Sektion IV, 865–1000 m, har låg frekvens av öppna sprickor (tolkade), få skjuvstrukturer och saknar oxidation, läkta spricknätverk, höga sprickomvandlingstal och intervall med kross. Sektion IV har emellertid hög frekvens av gångar.

Möjligheten att, upp till 10 m långa, svaghetssektioner förekommer i KSH02 indikeras av att flera geologiska parametrar förekommer på samma djup. Så är exempelvis fallet vid djupen 300 m, 525 m och 665 m där intervaller med kross förekommer tillsammans med höga sprickomvandlingstal, höga frekvenser av öppna sprickor (tolkade) samt läkta spricknätverk och oxidation. Dessa svaghetssektioner verkar emellertid endast utgöra korta klart avgränsade strukturer i KSH02. De delar inte upp borrhålet i längre intervaller med signifikanta olikheter hos de geologiska parametrarna mellan de olika intervallerna.

Contents

1 Introduction

This document reports data gained by Boremap mapping of the core drilled, 1000 m deep, borehole KSH02A (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.

KSH02 is core drilled from 0–1000 m, but the borehole diameter has been enlarged by later percussion drilling for the uppermost 100.3 m. This section has a borehole diameter of 248 mm, while the section 100.3–1000 m has a diameter of 76 mm. The borehole was drilled in 2003.

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 bedrock where this is intersected by the drill holes.

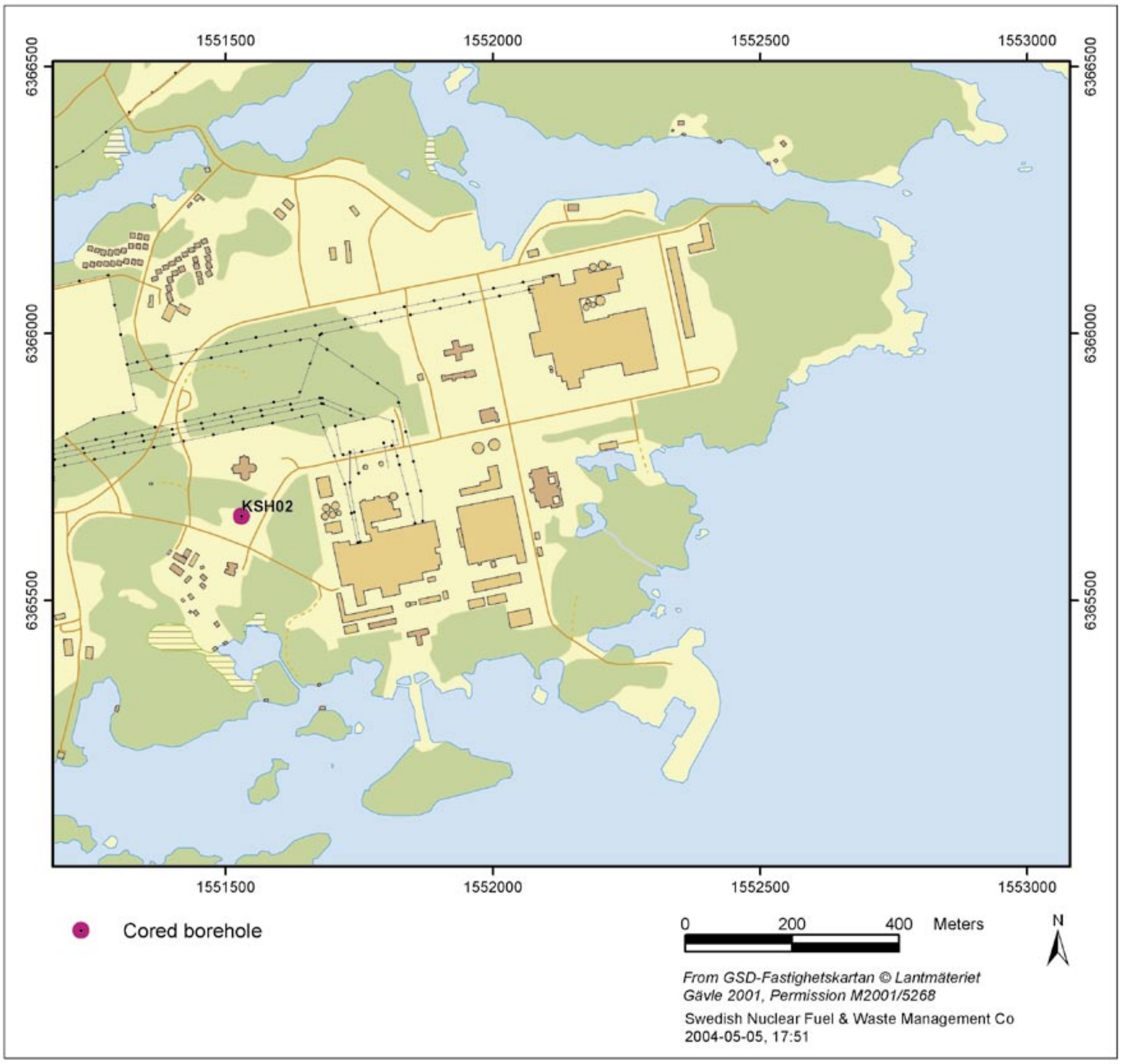


Figure 1-1. *Location of the core drilled borehole KSH02.*

2 Objective and scope

The principal aim of the mapping activities presented in this report is to obtain a detailed documentation of geological structures and lithologies intersecting borehole KSH02. Geological structures will be correctly orientated 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 3.3.2, loaded with the bedrock and mineral standards of SKB. 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 video film sequences

The BIPS video film of KSH02 is made up of three sequences covering the intervals 19.8–97.0 m, 80–573 m and 571–1000 m. These three video filmed sequences overlap and the lack of interval 0–19.8 m depends on that the borehole wall was covered with concrete.

3.4 BIPS-image video film quality

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

3.4.1 BIPS-image resolution

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

3.4.2 BIPS-image contrast

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

A light fracture in a dark rock is easily visible in the BIPS-image. A light fracture in a light rock might, however, be clearly visible in the drill core but not visible in the BIPS-image, especially if the fracture and wall rock have the same colour. The opposite is true for dark fractures.

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

3.4.3 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.

Problems related to the video camera aperture and enlargement of pixels are neglect able in KSH02. Blackish coatings occurred only in a few dispersed 4 to 13 m wide intervals and did not cause any problems for the mapping.

The main disturbances for the BIPS-image quality in KSH02 are vertical bleached bands. These bands occur through all of KSH02 but were very disturbing for the mapping only in the interval 63–85 m and somewhat disturbing in the intervals 95–105 m and 513–533 m. These disturbances do, however, not affect the mapping except perhaps in the interval 66–80 m where the image quality is extremely bad.

The image quality is classified into four classes; good, acceptable, bad and very bad. With good quality means an image that is more or less clear, and is easy to interpret. With acceptable quality means that the image is not really good but that the mapping can be performed without problems. An image with bad quality is somewhat difficult to interpret and an image with very bad quality can not be interpreted and only extremely thick and outstanding fractures can eventually be mapped.

The BIPS-image quality was good to excellent for over 90% of the borehole. Sections 150 m to 170 m long with good to excellent quality, alternate with 3–10 m long sections with acceptable quality. Intervals with acceptable quality were, for example, 95–105 m, 302–315 m, 513–521 m and 754–760 m. Below 700 m the image quality was not acceptable for aperture determinations.

Very bad quality only occurred in the interval 63–85 m as a consequence of a dense clay suspension. The video film covering the interval 80–573 m unfortunately did not overlap with this interval. However, thick unbroken fractures could be observed in the interval 63–85 m. These unbroken fractures were used for the delineation and orientation of broken fractures of which none were visible in this interval.

4 Execution

The Boremap-mapping of the telescopic drilled borehole KSH02 was performed and documented according to activity plan AP PS 400-03-037 (SKB, internal document) referring to the Method Description for Boremap mapping (SKB MD 143.006, v 1.0, SKB, internal controlling document).

KSH02 was drilled in two steps. In the first step the borehole was core drilled down to 97 m depth (drill core available in the interval 19.8–97 m). Since the borehole was observed to be instable it was filled with concrete. Thereafter it was core drilled again in a second step and was also prolonged down to 1000 m depth. Because the new borehole deviated from the first one, overlapping occurs in the interval 76–97 m. The borehole diameter was later enlarged by percussion drilling in the section 0–100.3 m.

The drill cores were displayed on inclined roller tables and mapped in their entire length 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, a deviation which increases with depth. This problem was eliminated by adjusting the depth according to reference slots cut into the borehole 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 difference between the original length of the BIPS-image and the adjusted length of the BIPS-image increased systematically from 0 m at the surface to about 3 m at 500 m depth in KSH02. The adjusted BIPS values for KSH02 generally differed from the marked depths registered by the drilling personnel with only 5 cm–20 cm, although larger discrepancies were observed.

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 (Appendices: 6 and 7).

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 impossible 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 data base 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 Appendix 5).

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 thin 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 and the possibility to compare the alterations between different fractures in the boreholes. The subdivision is based on fracture mineralogy and was 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 fracture wall alterations were considered as alterations of the wall rock and not as fracture alteration minerals. Examples are fractures without mineral fillings but with red coloured oxidized fracture walls and/or dirty greenish coloured epidotized fracture walls. The joint alteration was classified as fresh for these fractures 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 open fractures and not as true fracture alteration minerals. The joint alteration number was thus set to 1 also for these minerals.

Joint alteration number equal to 1.5

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

Joint alteration numbers higher than 1.5

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

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. Such fractures were orientated using the guide-line method, based on the following data:

- Absolute depth.
- Amplitude (measured along the drill core).The amplitude is the interval along a drill core which is cut by a fracture.
- Exact orientation of the fracture trace, 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 stereographic plots indicated that the error is most likely insignificant. Anyhow, the guide-line method is so far considered much better than only marking fractures that are non-visible in the BIPS-images as planes perpendicular to the borehole. The fractures in question are mapped as “non-visible in BIPS” and can therefore be separated from fractures visible in BIPS which have a more accurate orientation.

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

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

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

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 KSH02.

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.

Veins within composite dykes were not mapped.

4.2.5 Use of mineral codes

Extra mineral codes have been used as follows:

X1 Yellowish green soft mineral, possibly clay, zeolite or a mixture of both.

X8 Epidotized walls.

X9 Sealed fractures visible in the BIPS-image but not in the drill core.

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 spot test controls and regular quality revisions.

All primary data are stored in the SKB SICADA database under field note no Simpevarp 225. Only these data are to be used for further interpretation and modelling.

5 Results

The results of the Boremap mapping of KSH02 are principally found in the Appendices. The information in SICADA has been compressed to the size of an A4-sheet in the Geological Summary table, Appendix 1. The search paths for this table are presented in Appendix 2. Stereographic diagrams of the orientation of open fractures are presented in Appendix 3. The BIPS-images of KSH02 are shown in Appendix 4 and corresponding WellCad diagram in Appendix 5. In data, like borehole length and diameter, are presented in Appendices 6, 7 and 8.

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, Simpevarp). The aim was to make a standard form in handy A4-size, where all information is taken directly from the SICADA database by using simple and well defined search paths for each geological parameter (see Appendix 2).

The search paths cannot, however, yet be used in an automatic way and therefore the geological information has first been extracted from the SICADA database, then reworked on separate Excel-files and last presented in the Geological Summary table. At the moment it is only possible to extract the Rock Type and Alteration parameters directly from the SICADA database.

The main reason why the information in the SICADA database cannot be extracted automatically is the lack of a mathematical formula 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 only 1 mm therefore has the same "value" as a similar parameter with a thickness of 999 mm since both are treated as point observations and used for frequency calculations.

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 < 1 m 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 mapped as rock type.

Column 7. *Structure/Shear Zone < 1 m 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 sections in mm–cm scale are mapped as shear structures and in dm–m scale as sections with foliation.

Column 8. *Structure/Brecciated < 1 m wide* is a frequency column. Breccias < 1 m 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 ≥ 1 m wide* is an interval column. Breccias > 1 m wide are mapped under rock type/structure in Boremap.

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

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

Column 12. *Structure/Foliation < 1m wide* is a frequency column. Sections with foliation < 1 m 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 > 1 m 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 broken 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 broken up artificially during/after drilling.

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

Column 17. *Sealed fractures (interpreted)/Sealed Fracture Network ≥ 1 m 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 open before drilling and fractures that probably or possibly were open 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 open 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 open 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 < 1 m wide* is a frequency column. This column includes shorter sections with crush.

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

5.2 Geological summary table, KSH02

The Geological Summary table for KSH02 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.

The table clearly shows that KSH02 is made up of only one principal lithology, the fine-grained dioritoid. The fine-grained dioritoid (SKB code 503105) is a massive, homogeneous, dark grey, fine grained to extremely fine grained plagioclase and pyroxene (amphibole?) porphyritic rock, which grades into a massive, equigranular, medium-grained type without sharp contacts. Rapid changes without sharp contacts in dm-, m- or tens of meters scale between a hornfels altered sub-type, a porphyritic sub-type (with variations in types and concentrations of phenocrysts) and an equigranular massive sub-type support the idea of a banded sub-intrusive origin for this rock.

To get an idea about the heterogeneity within the fine-grained dioritoid in KSH02, an attempt was made to map the rock sub-types. It must, however, be made very clear that this mapping was very subjective and could be done successfully only in oxidized sections and around oxidized fractures. The oxidation highlighted the colour contrasts that were necessary to map texture, grain size and phenocryst content.

The mineralogy, grain size and texture columns show the rapidly alternating rock sub types within the dioritoid.

Structures are few in KSH02. Neither sections with mylonites nor sections with wider breccias were observed. Shear structures/foliation only occur in thin sparsely distributed sections.

Sealed fractures are evenly distributed along the borehole. Sections of sealed fracture network are quite common except for the interval 800–1000 m where they are lacking. An exceptional high frequency of longer intervals with sealed fracture network occurs from 250 m to 580 m.

Open fractures show a broad frequency peak in the interval 475–800 m which is rich in oxidation. Joint alteration peaks coincide with sealed fracture network and oxidation at approximately 300 m, 525 m and 665 m. The joint alteration peak at 300 m is also close to two sections with crush that are over 1 m wide in the interval 285–295 m. The Joint alteration peak at 875 m coincides with a high peak of open fractures and a low peak of sealed fracture network.

Open fractures show a minimum around 200 m and below 875 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 Orientation of open fractures

Stereograms for open fractures for each 100 m interval in KSH02 are presented in Appendix 3. The stereographic information is from plan to pole plot data based on orientation values from strike/dip values for fracture orientations using the right hand rule.

The orientation for borehole KSH02 at ground level is 330/-85.85.

Open fractures not visible in the BIPS-image were mapped as planes at right angle to the borehole. These fractures show up as a small artificial semicircular high anomaly maxima at right angle to the borehole in the stereographic plots. It should be noted that the location of this artificial maxima varies with depth according to the deviation of the borehole.

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

In the interval 0–100 m two fracture sets occur: one approximately S-striking dipping 20° and one E-striking dipping 30°. The latter fracture set can also be observed in the intervals 100–200 m and 600–1000 m striking E-ESE and dipping 25–45°.

Other pervading fracture sets are as follows: one striking SW dipping approximately 30°, one N- to NNE-striking set dipping 30–45° and one ENE-striking set dipping 40–45° as well as a WNW-NW-striking sub-horizontal (30° dip) fracture set that is turning more W-striking in the interval 700–800 m. These fracture sets are not dominating in all depth intervals.

Two fracture sets seem to be restricted to certain depth intervals: one SSE-striking dipping 30° in the interval 800–900 m and one SW-striking dipping 30° in the interval 900–1000 m.

Few sub-vertical fracture sets are observed: one SSW-SW-striking dipping 80° in the interval 0–200 m, one N-NNE-striking dipping 70–75° in the interval 200–300 m and 900–1000 m, and one NE-striking dipping 80° in the interval 200–300m.

6 Discussion

Fine-grained dioritoid is the only lithology in KSH02 except minor veins and dykes. The dioritoid commonly have different appearances in grain size, texture and types of phenocrysts. No sharp contacts exist between these different dioritoid sub-types. Different fine-grained dioritoid sub-types were thus mapped throughout this borehole.

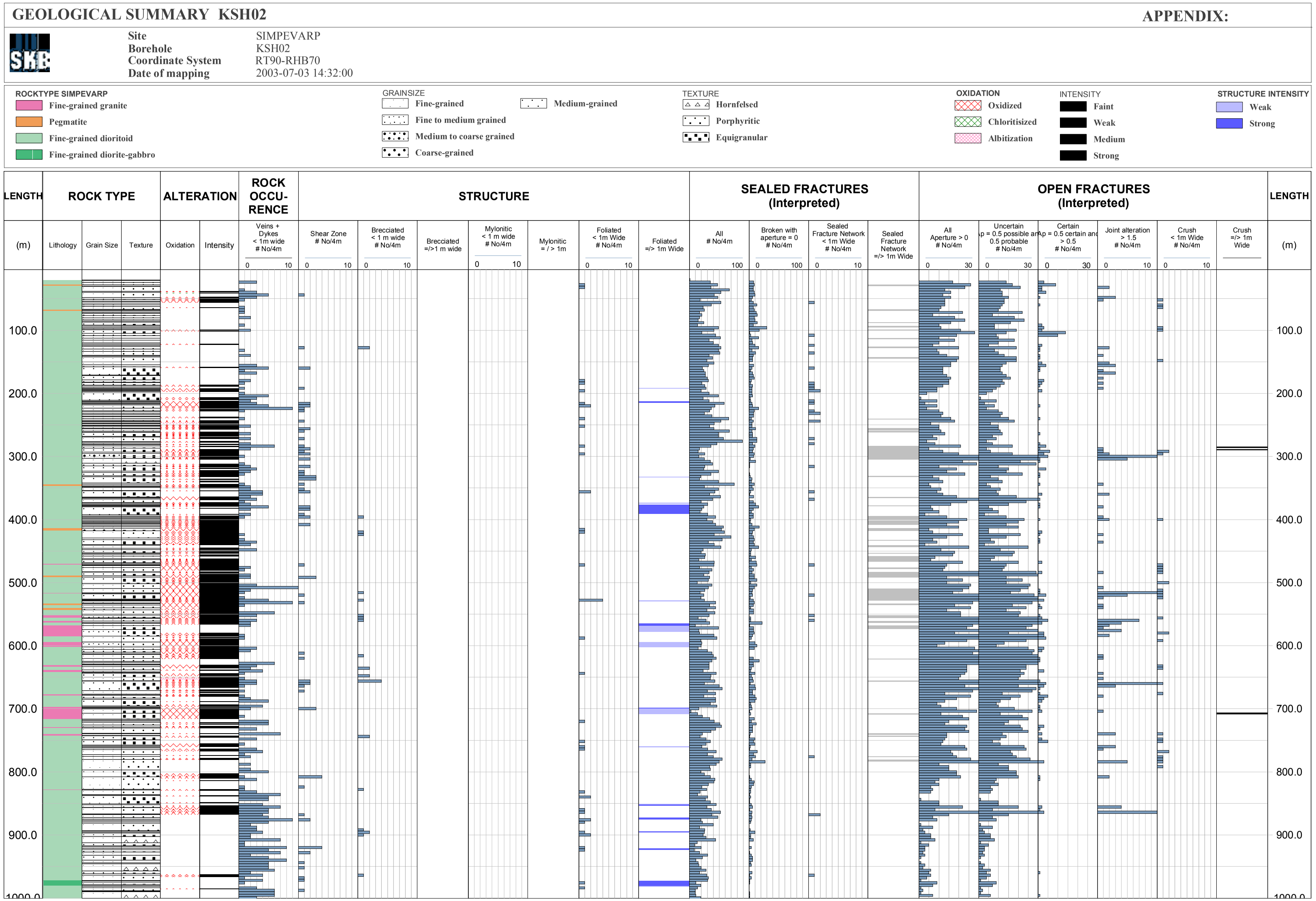
Fractures that are not visible in the BIPS-image were, if possible, mapped by using "the guide line method". In rare cases fractures that are not visible in the BIPS-image were mapped as if they were oriented 90˚ towards the borehole axis.

Fractures that are visible in BIPS, but not in the drill core, and haved "oxidized walls" as first mineral fill in KSH01, were mapped with X9 as first mineral fill in KSH02. The reason why the mineral fill was changed from oxidized walls to X9 was that thin coating of chlorite (more rarely calcite or epidote) always was observed on these fractures when they accidentally broke up during drill core handling. The occurrence of X9 fractures was a surprise since they can not be seen in the drill core. This resulted in a meeting in August 19th 2003 where this fracture type was discussed. It was then decided that only fractures visible in the drill core should be mapped. The only exceptions are fractures that are very obvious in the BIPS-image but still not visible in the drill core. Such fractures should be mapped with the X9 as first mineral fill, also in the future.

In November 2003 the apertures of broken fractures were re-examined in BIPS, but not in the drill core.

In February 2004 apertures of broken fractures with no aperture (aperture = 0), were re-examined by using both BIPS and the drill core. The aperture confidence was set according to "Nomenklatur vid Boremapkartering" by Larsson and Stråhle (PM, 2004-02-05).

Geological summary table, KSH02



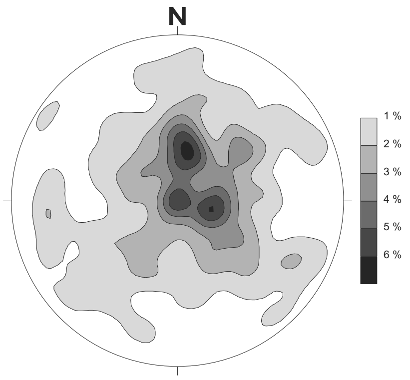
Appendix 2

Search paths for the geological summary table

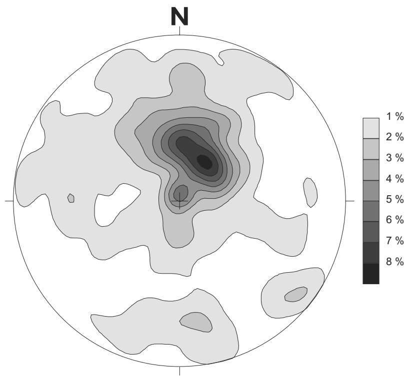
TABLE HEAD LINES		INFORMATION SOURCE				PRESENTATION
Head lines	Sub head lines	Database	Varcode	First suborder	Second suborder	Interval/frequence
Rock type	Lithology	SICADA	5	Sub 1		Interval
	Grain size	SICADA	5	Sub 5		Interval
	Texture	SICADA	5	Sub 6		Interval
Alteration	Oxidation	SICADA	7	Sub 1 = 700		Interval
		SICADA	7	Sub 2 = 101 and 102 = weak		Interval
			7	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 and 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

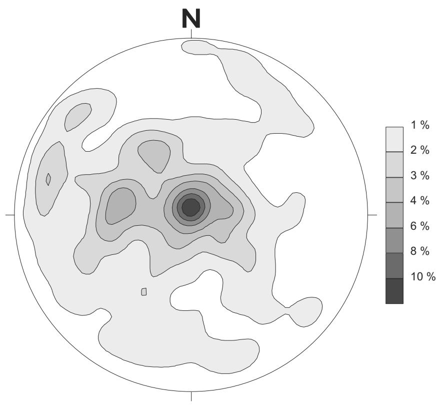
Stereographic projections of open fractures, KSH02



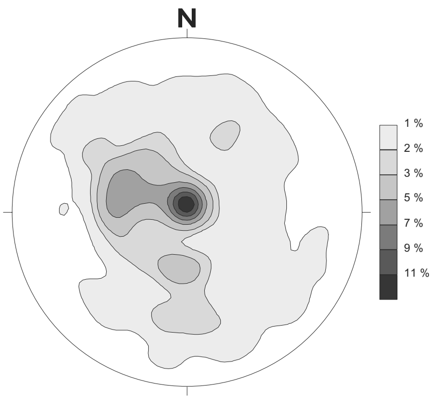
KSH02 0-100 m (312 fractures)



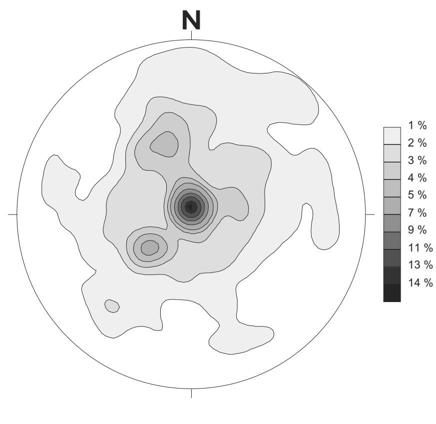
KSH02 100-200 m (347 fractures)



KSH02 200-300 m (281 fractures)

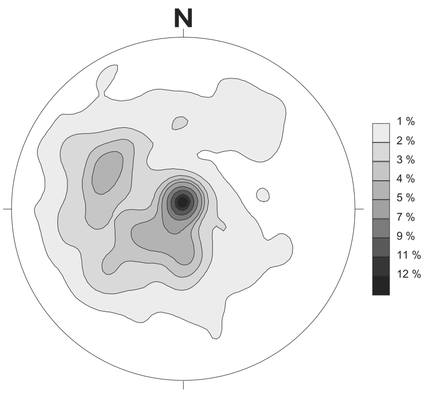


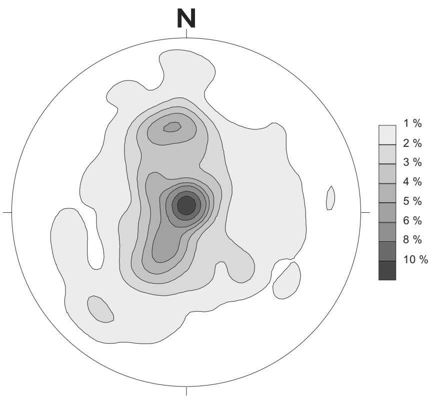
KSH02 300-400 m (379 fractures)



KSH02 400-500 m (387 fractures)

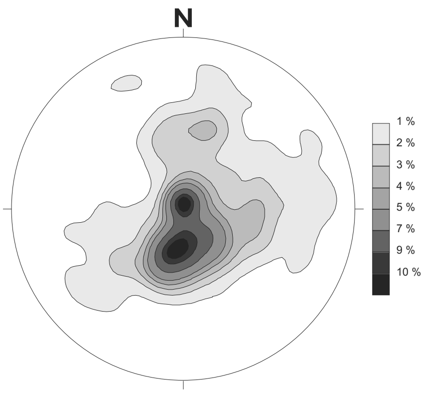
Stereograms of poles to planes of open fractures with aperture in borehole KSH02, Schmidt's Net, lower hemisphere.

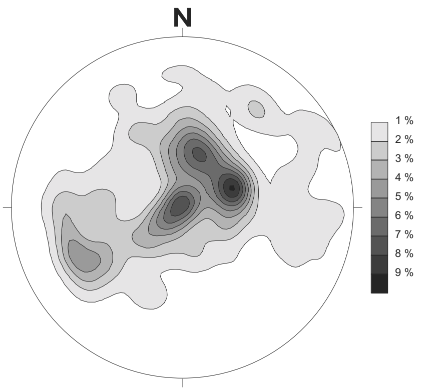




KSH02 500-600 m (657 fractures)

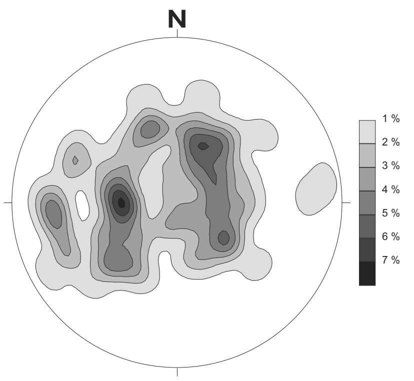
KSH02 600-700 m (647 fractures)





KSH02 700-800 m (478 fractures)

KSH02 800-900 m (223 fractures)



..KSH02 900-1000 m (88 fractures)

Stereograms of poles to planes of open fractures with aperture in borehole KSH02, Schmidt's Net, lower hemisphere.

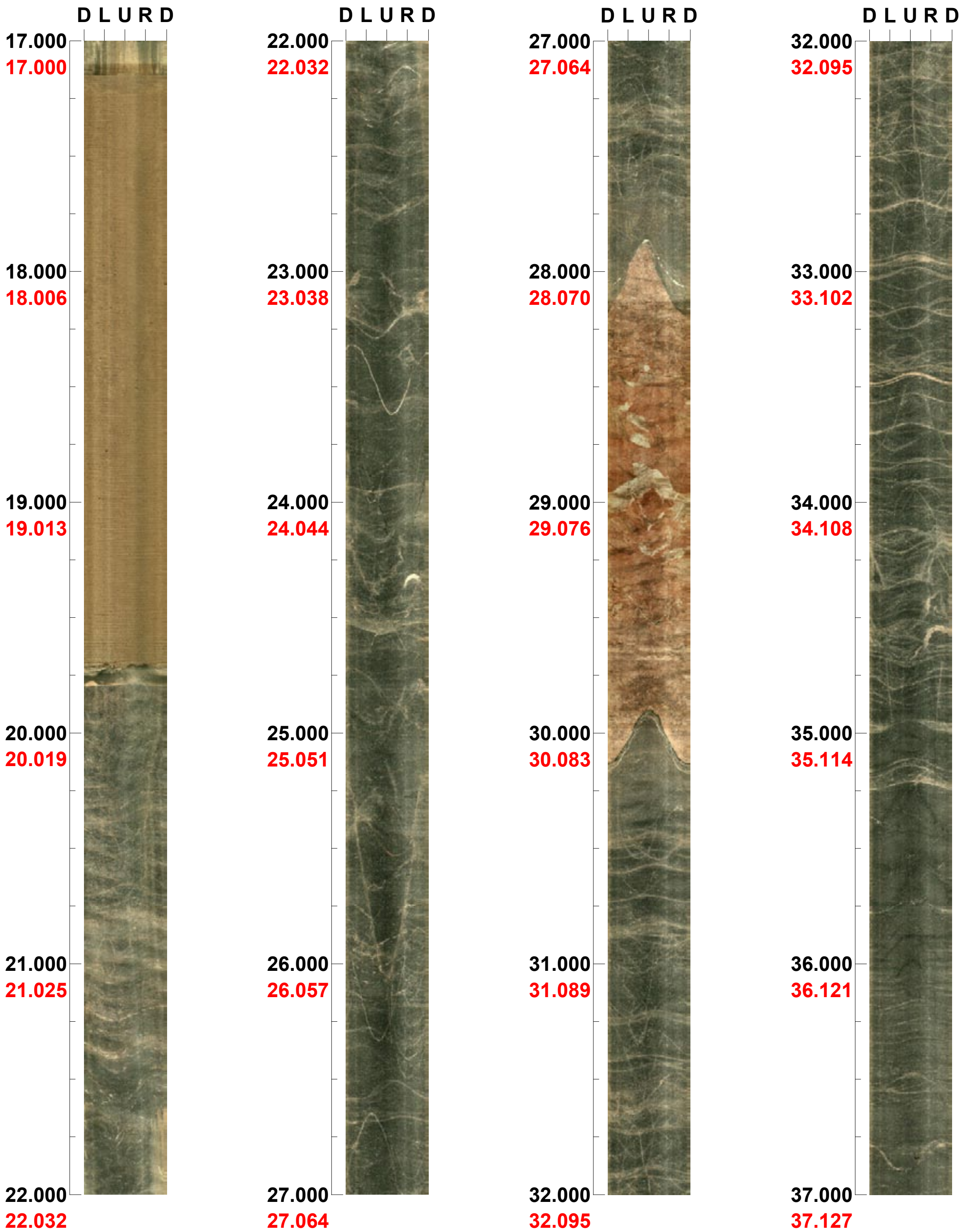
BIPS-images of KSH02

Project name: Oskarshamn

Locality	**: Simpevarp**
Bore hole number	**: KSH02**
Date	**: 03/02/08**
Time	**: 22:26:00**
Depth range	**: 17.000 - 96.999 m**
Azimuth	**: 327**
Inclination	**: -85**
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	**: 4**
Color	**: +0 +0 +0**

Project name: Oskarshamn
Bore hole No.: KSH02 **Azimuth: 327** **Inclination: -85**

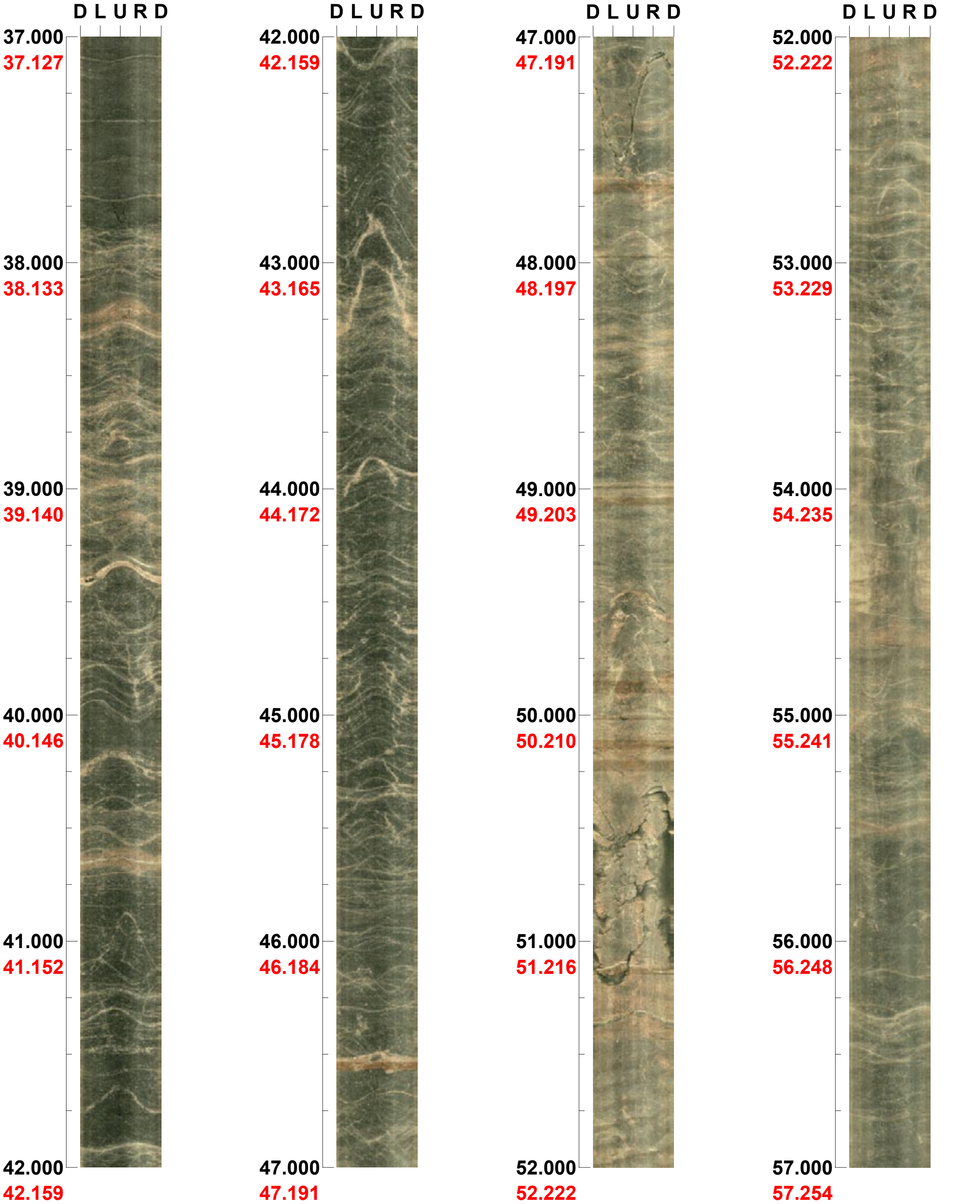
Depth range: 17.000 - 37.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH02 **Azimuth: 329** **Inclination: -85**

Depth range: 37.000 - 57.000 m

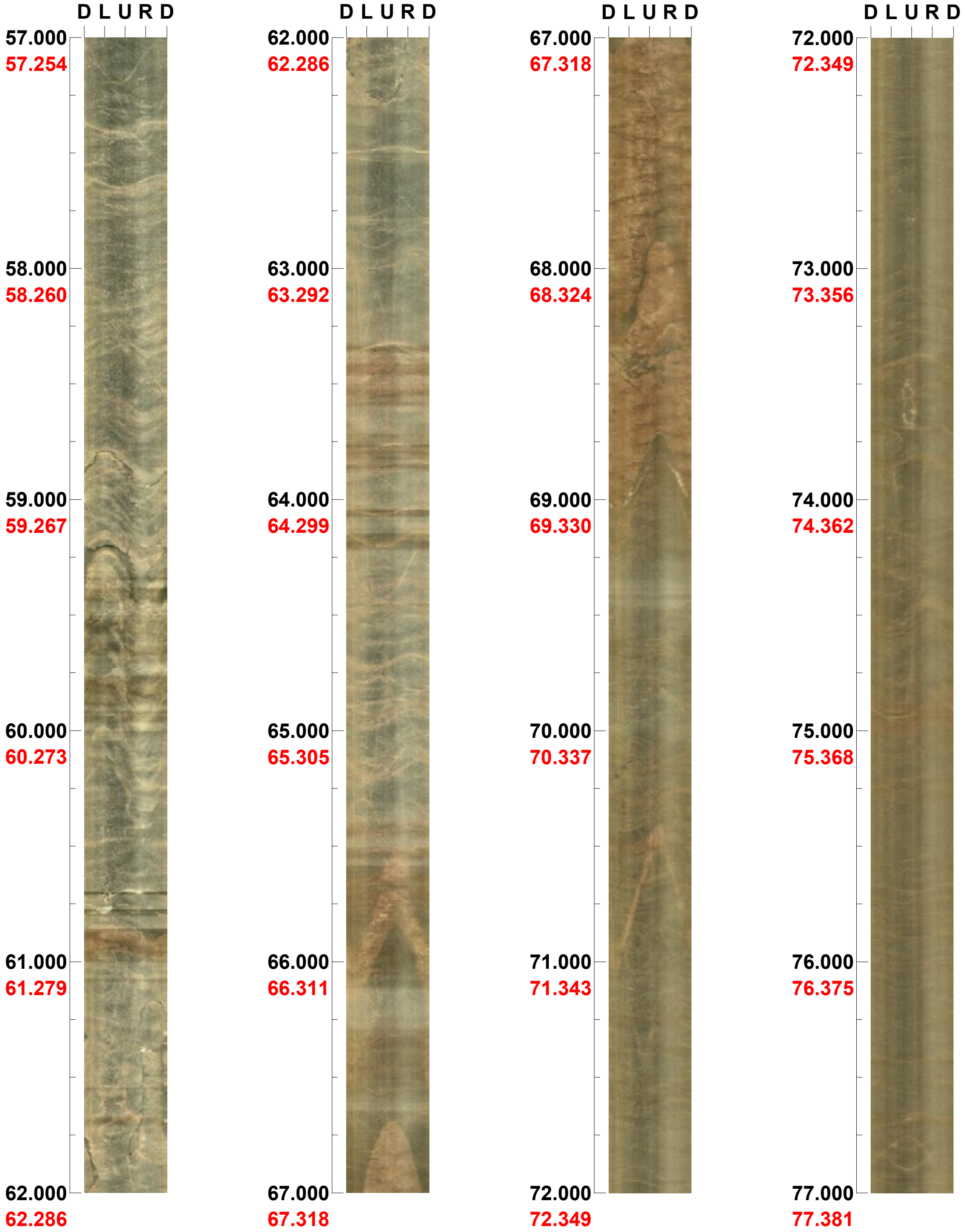


(2 / 4) **Scale: 1/25** **Aspect ratio: 150 %**

Project name: Oskarshamn

Bore hole No.: KSH02 **Azimuth: 329** **Inclination: -85**

Depth range: 57.000 - 77.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH02 **Azimuth: 325** **Inclination: -86**

Depth range: 77.000 - 96.999 m

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

Project name: Oskarshamn

Locality	**: Simpevarp**
Bore hole number	**: KSH02**
Date	**: 03/06/29**
Time	**: 22:06:00**
Depth range	**: 79.000 - 573.444 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	**: 25**
Color	**: +0 +0 +0**

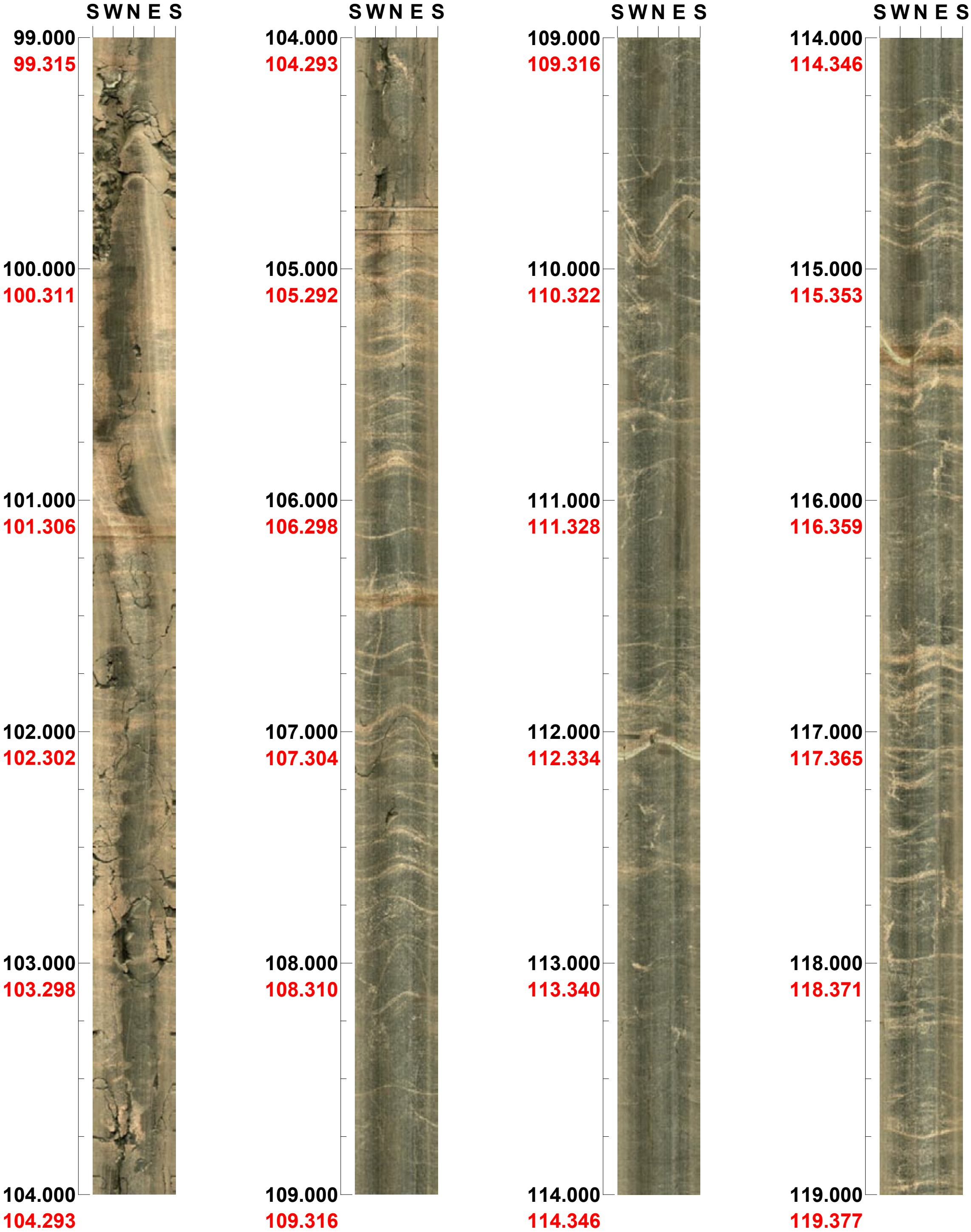
Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 79.000 - 99.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 99.000 - 119.000 m



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

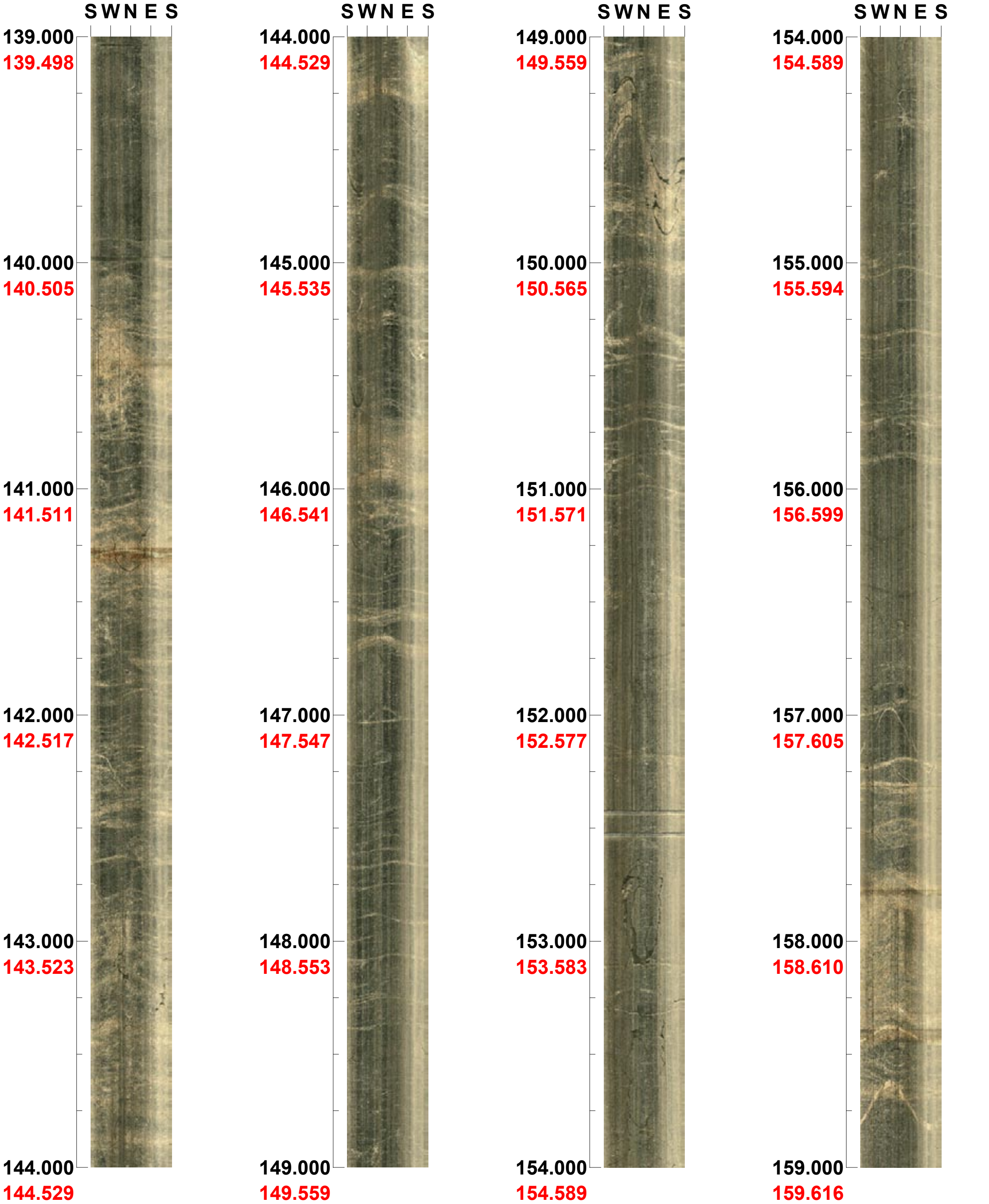
Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 119.000 - 139.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 139.000 - 159.000 m



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

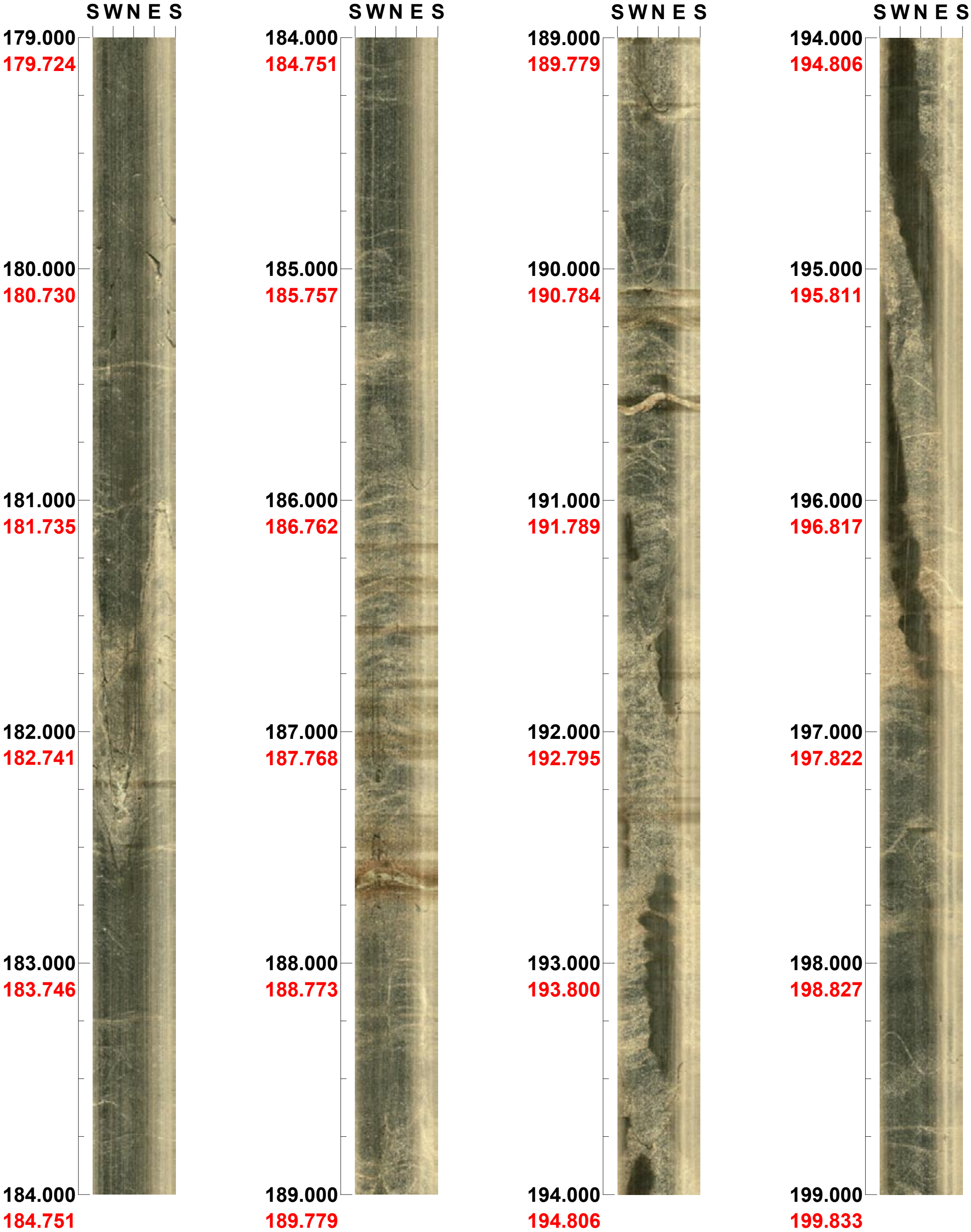
Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 159.000 - 179.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

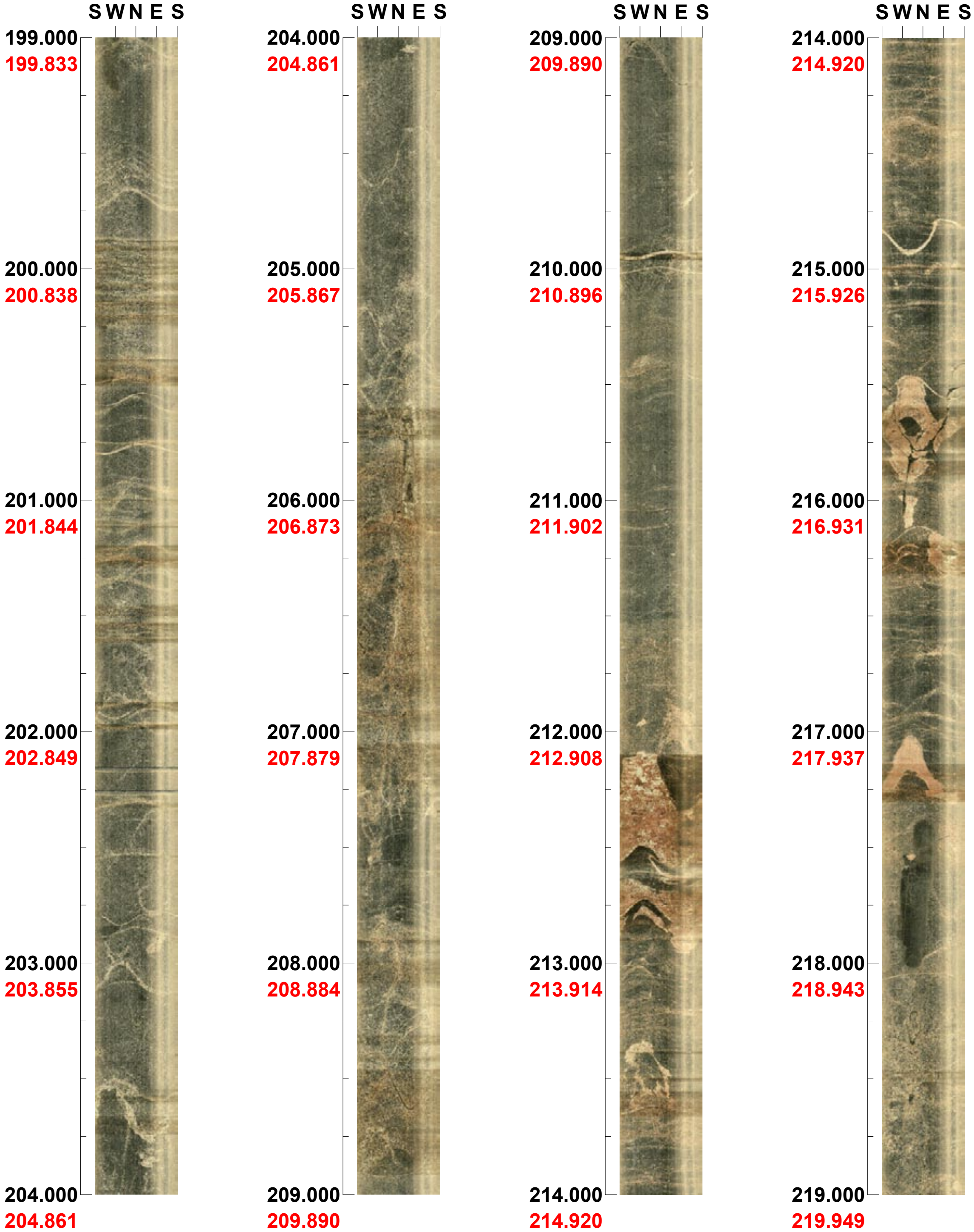
Depth range: 179.000 - 199.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 199.000 - 219.000 m



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

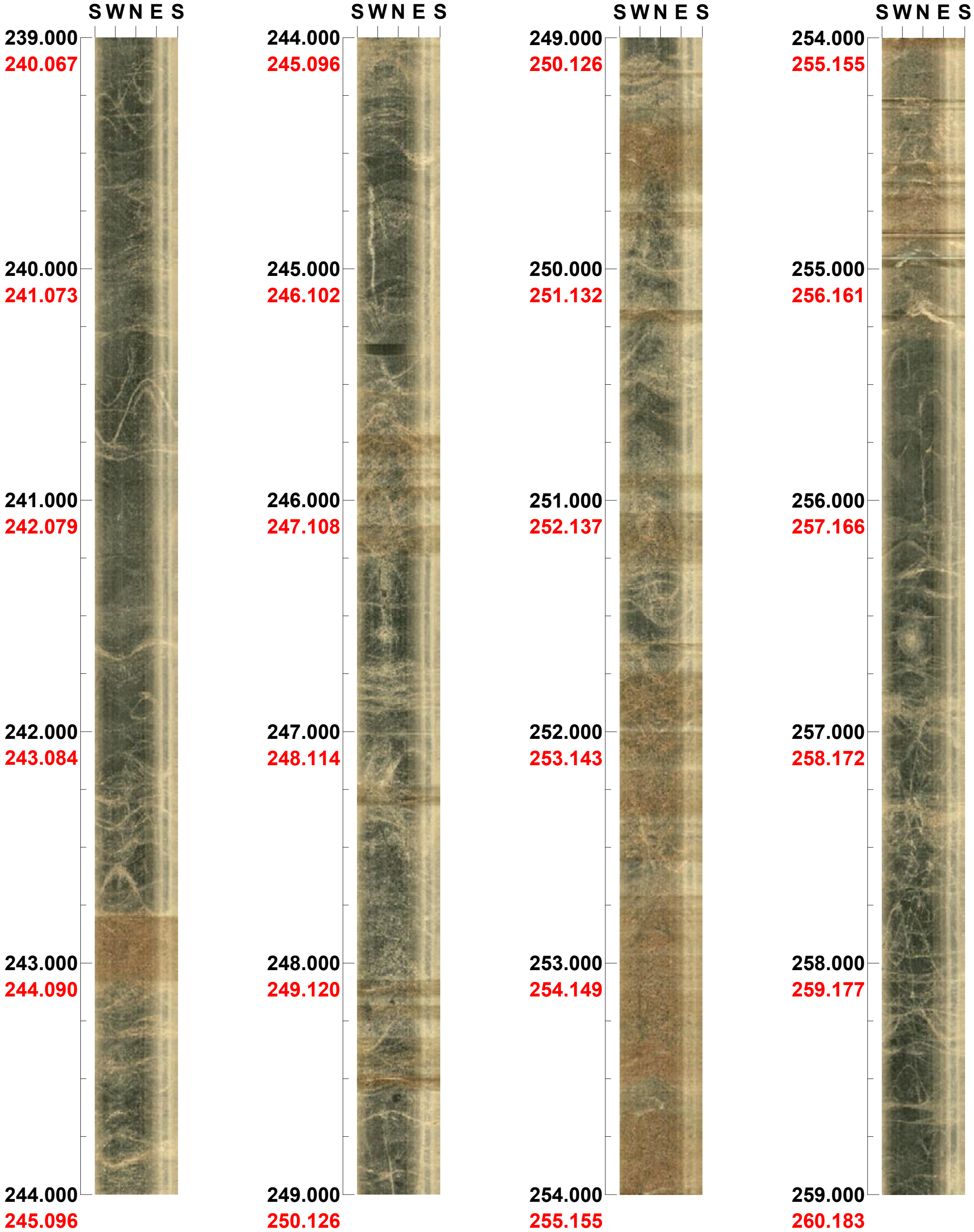
Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 219.000 - 239.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 239.000 - 259.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 259.000 - 279.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 279.000 - 299.000 m

S W N E S

279.000
280.291

280.000
281.297
281.000
282.302
282.000
283.308
283.000
284.313
284.000
285.319

S W N E S

284.000
285.319

285.000
286.324
286.000
287.329
287.000
288.335
288.000
289.340
289.000
290.346

S W N E S

289.000
290.346

290.000
291.351
291.000
292.357
292.000
293.362
293.000
294.368
294.000
295.373

S W N E S

294.000
295.373

295.000
296.378
296.000
297.384
297.000
298.389
298.000
299.395
299.000
300.400

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 299.000 - 319.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 319.000 - 339.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 339.000 - 359.000 m

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

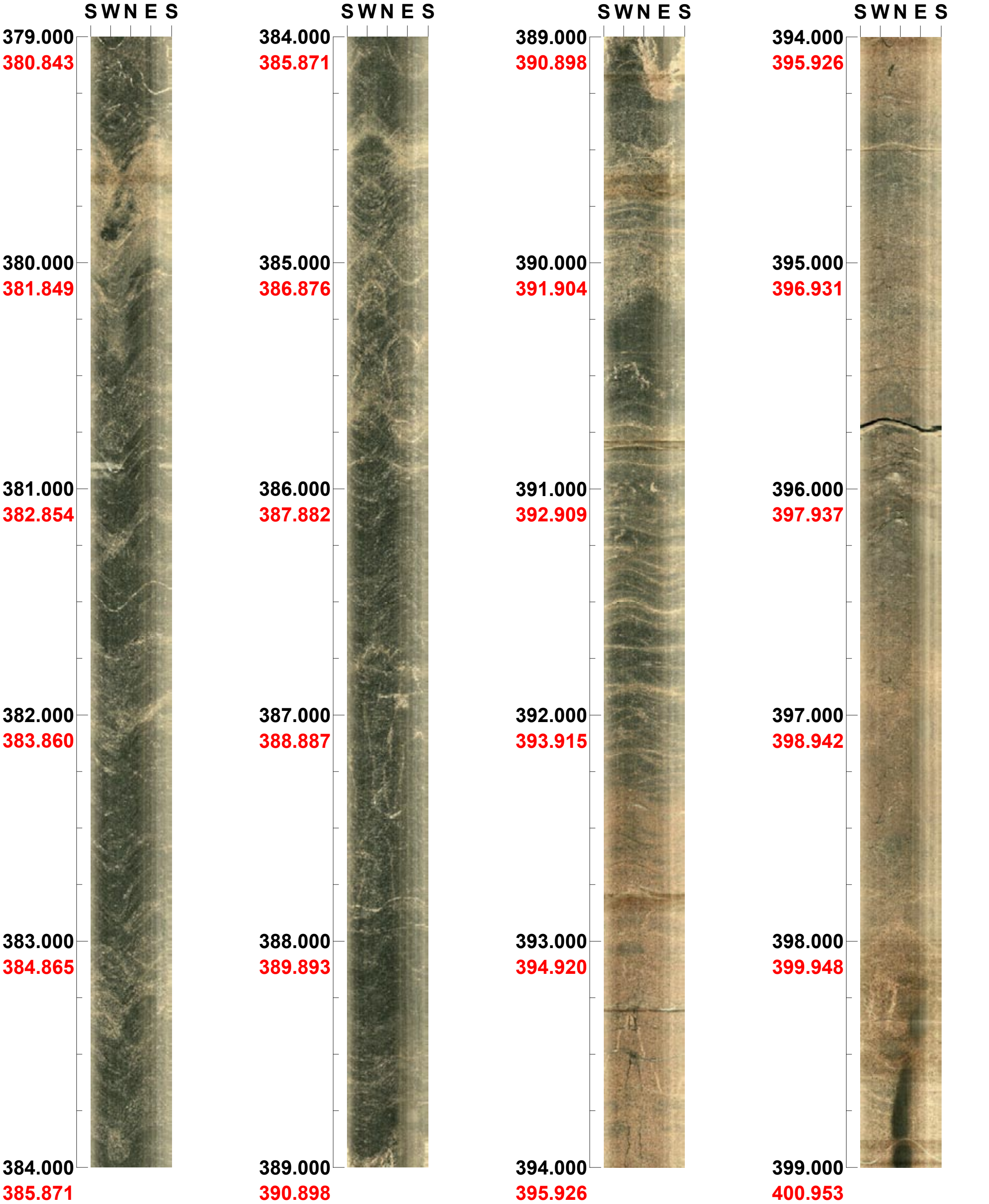
Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 359.000 - 379.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 379.000 - 399.000 m



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

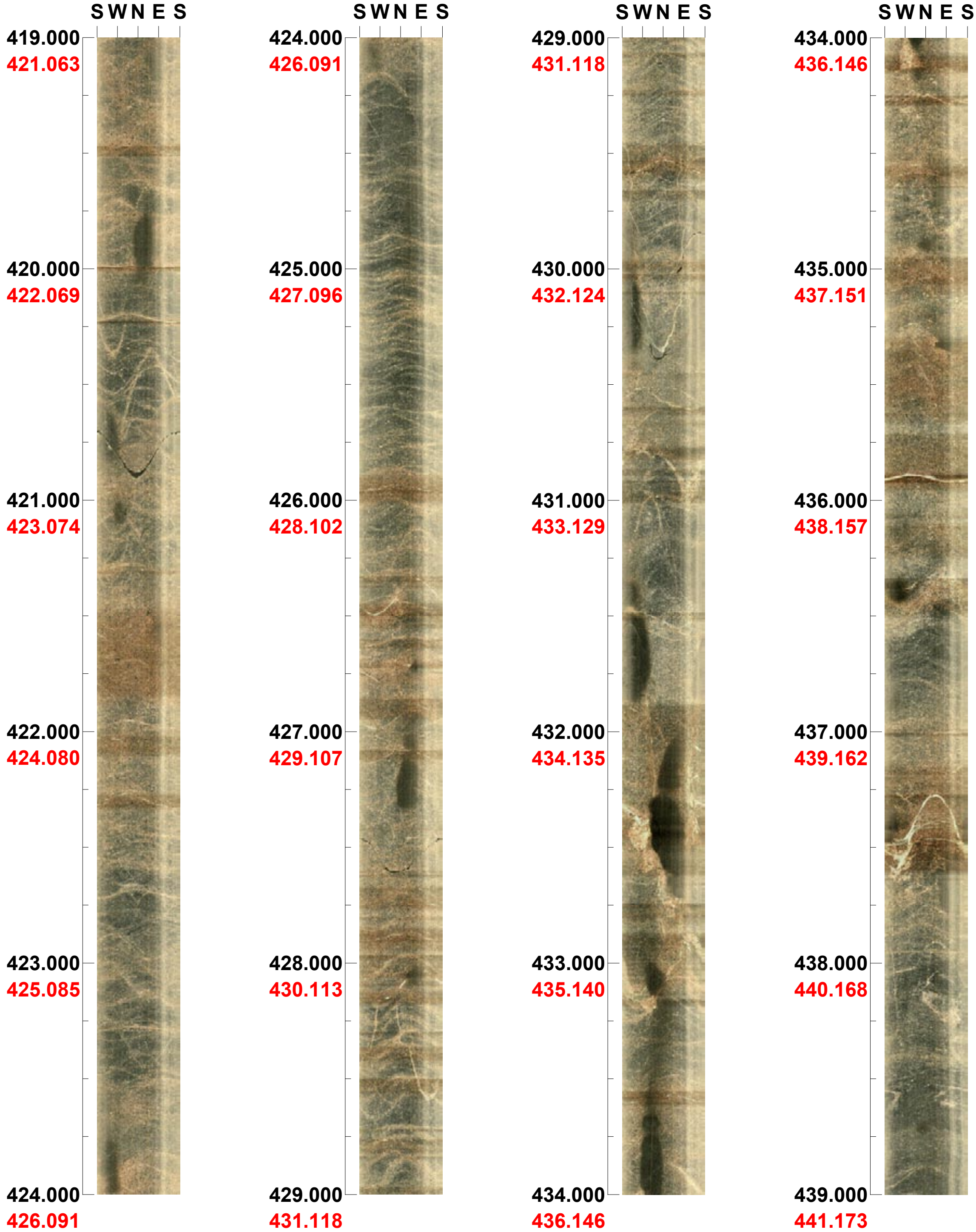
Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 399.000 - 419.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 419.000 - 439.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 439.000 - 459.000 m

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

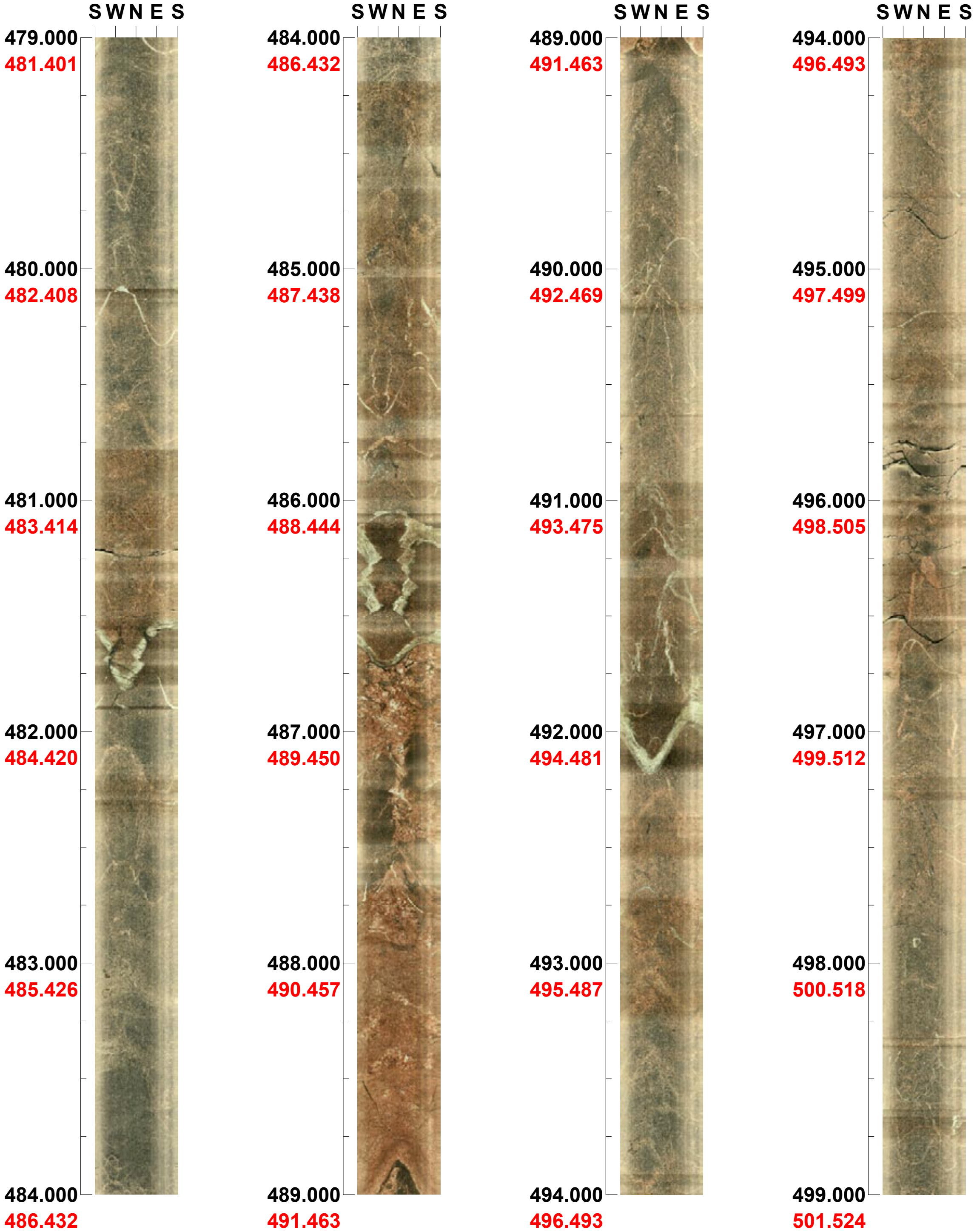
Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 459.000 - 479.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

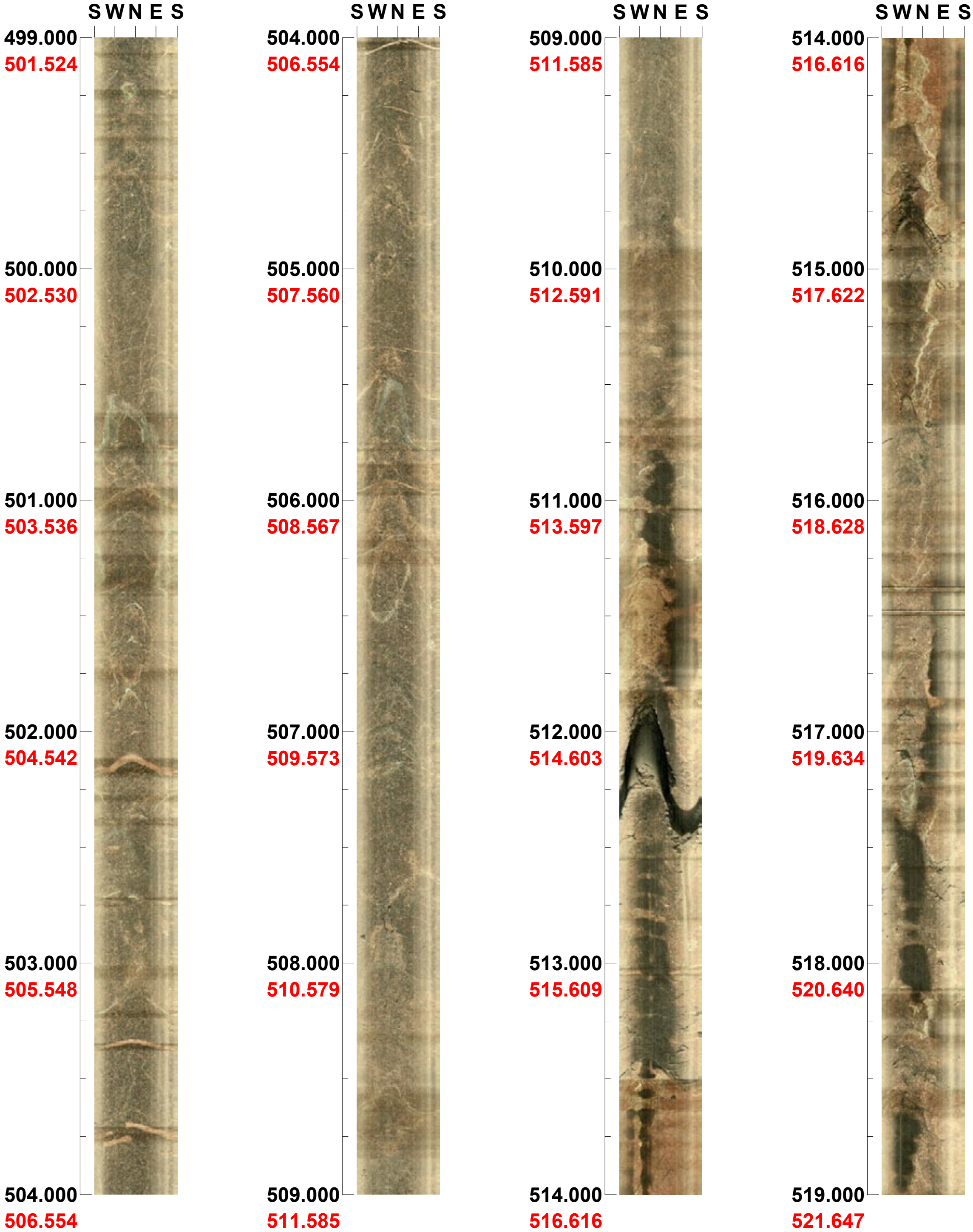
Depth range: 479.000 - 499.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 499.000 - 519.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 519.000 - 539.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 539.000 - 559.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 559.000 - 573.444 m

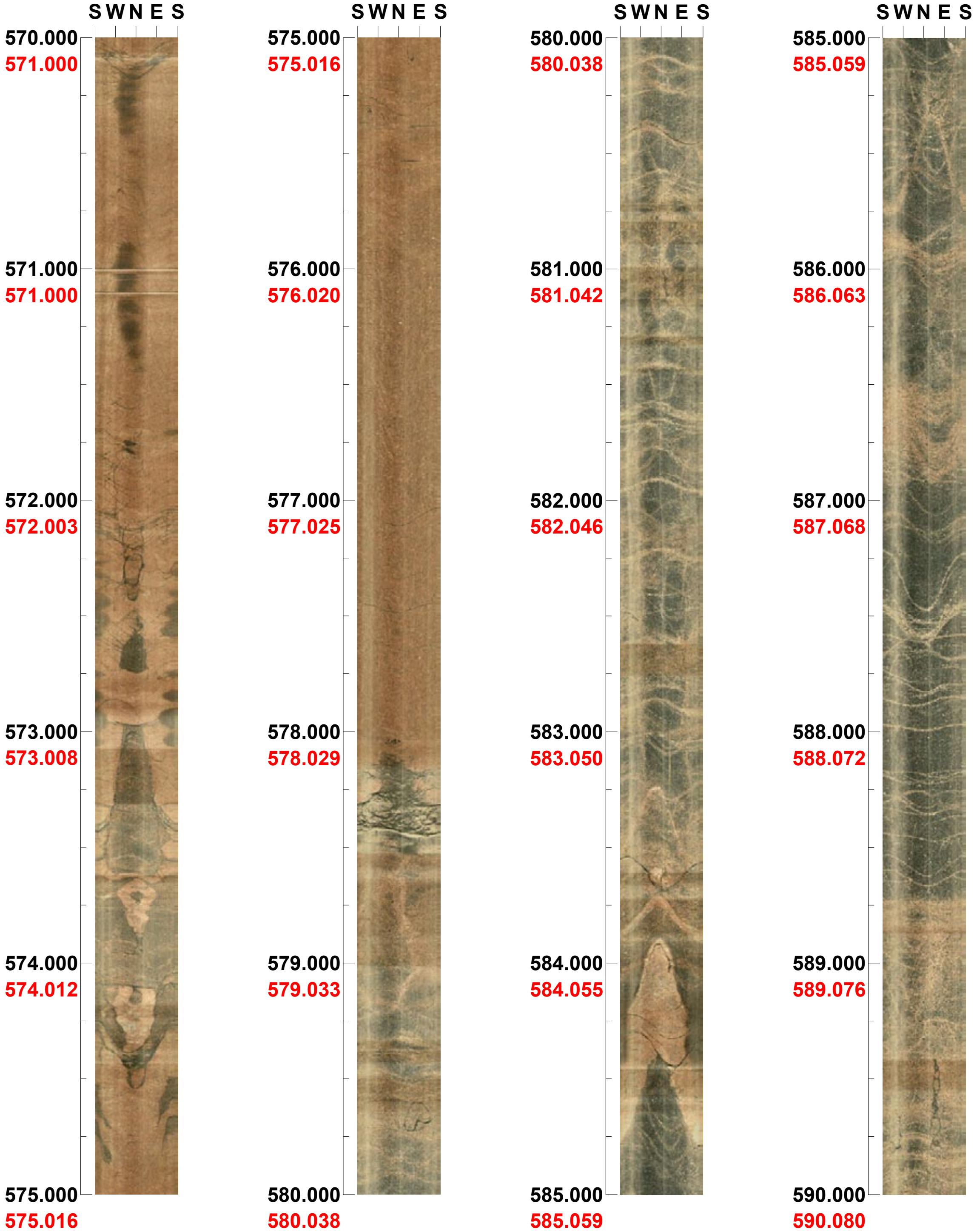
(25 / 25)   Scale: 1/25   Aspect ratio: 150 %

Project name: Oskarshamn

Locality	**: Simpevarp**
Bore hole number	**: KSH02**
Date	**: 03/06/30**
Time	**: 05:09:00**
Depth range	**: 570.000 - 998.031 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	**: 22**
Color	**: +0 +0 +0**

Project name: Oskarshamn
Bore hole No.: KSH02

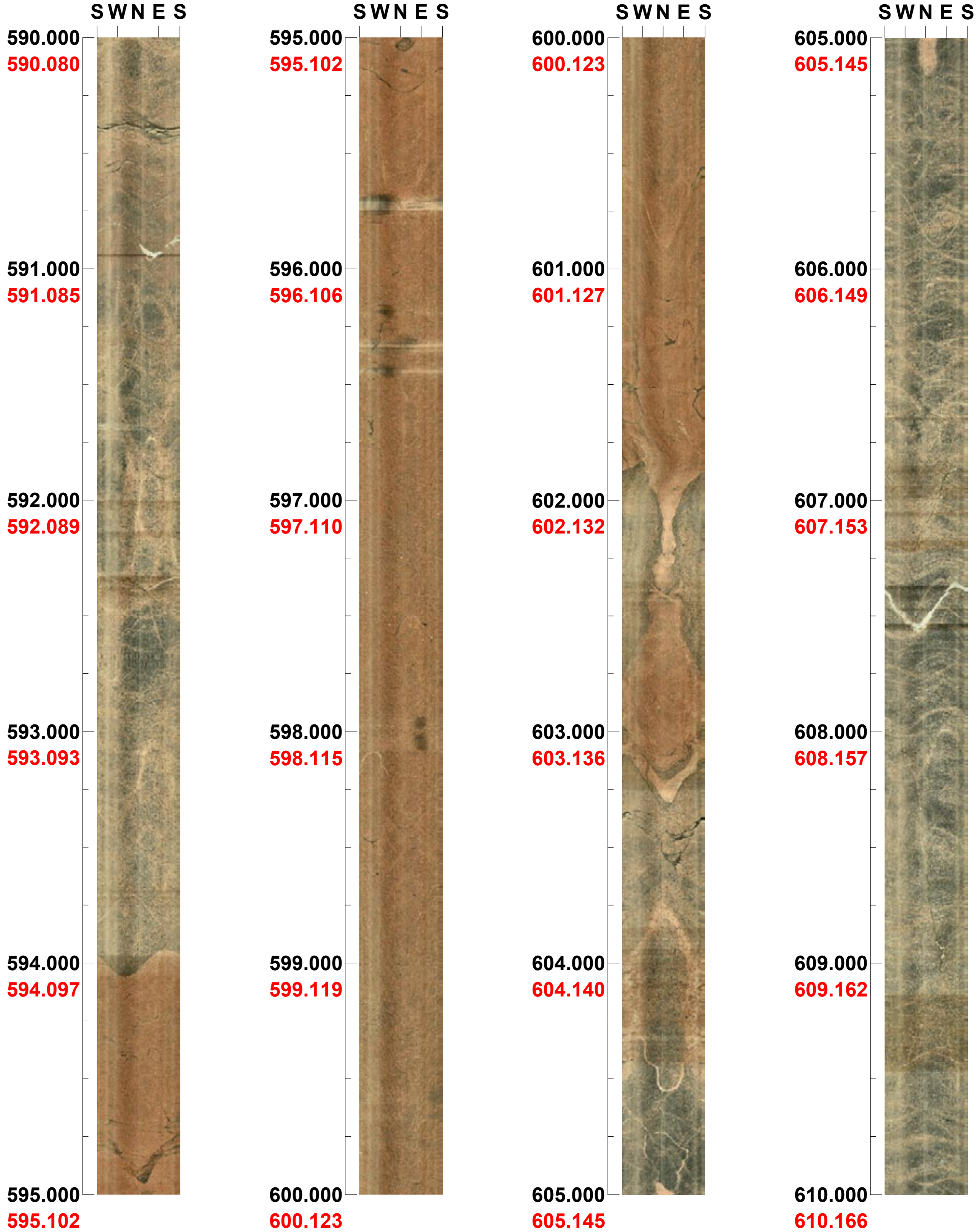
Depth range: 570.000 - 590.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 590.000 - 610.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 610.000 - 630.000 m

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

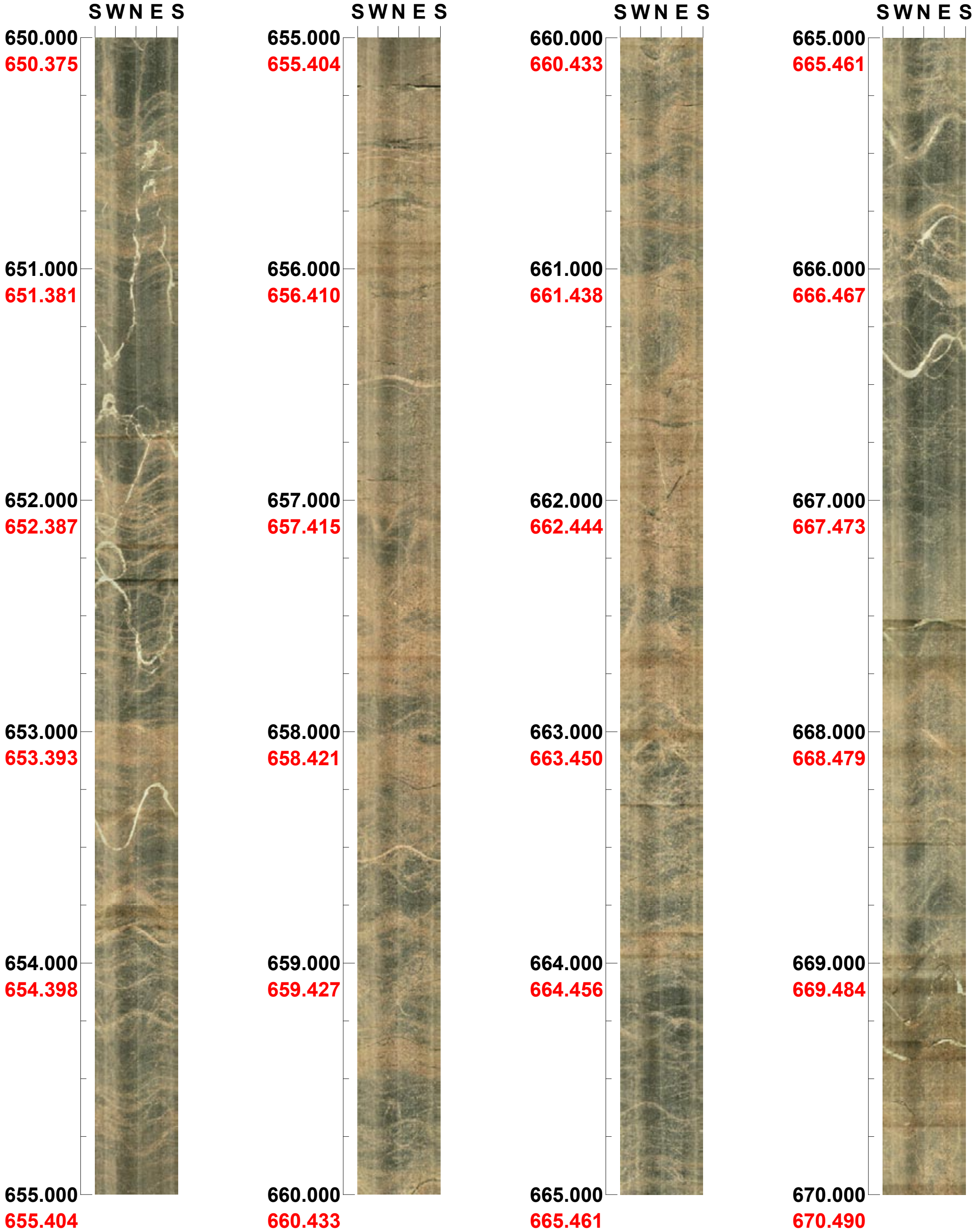
Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 630.000 - 650.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 650.000 - 670.000 m



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

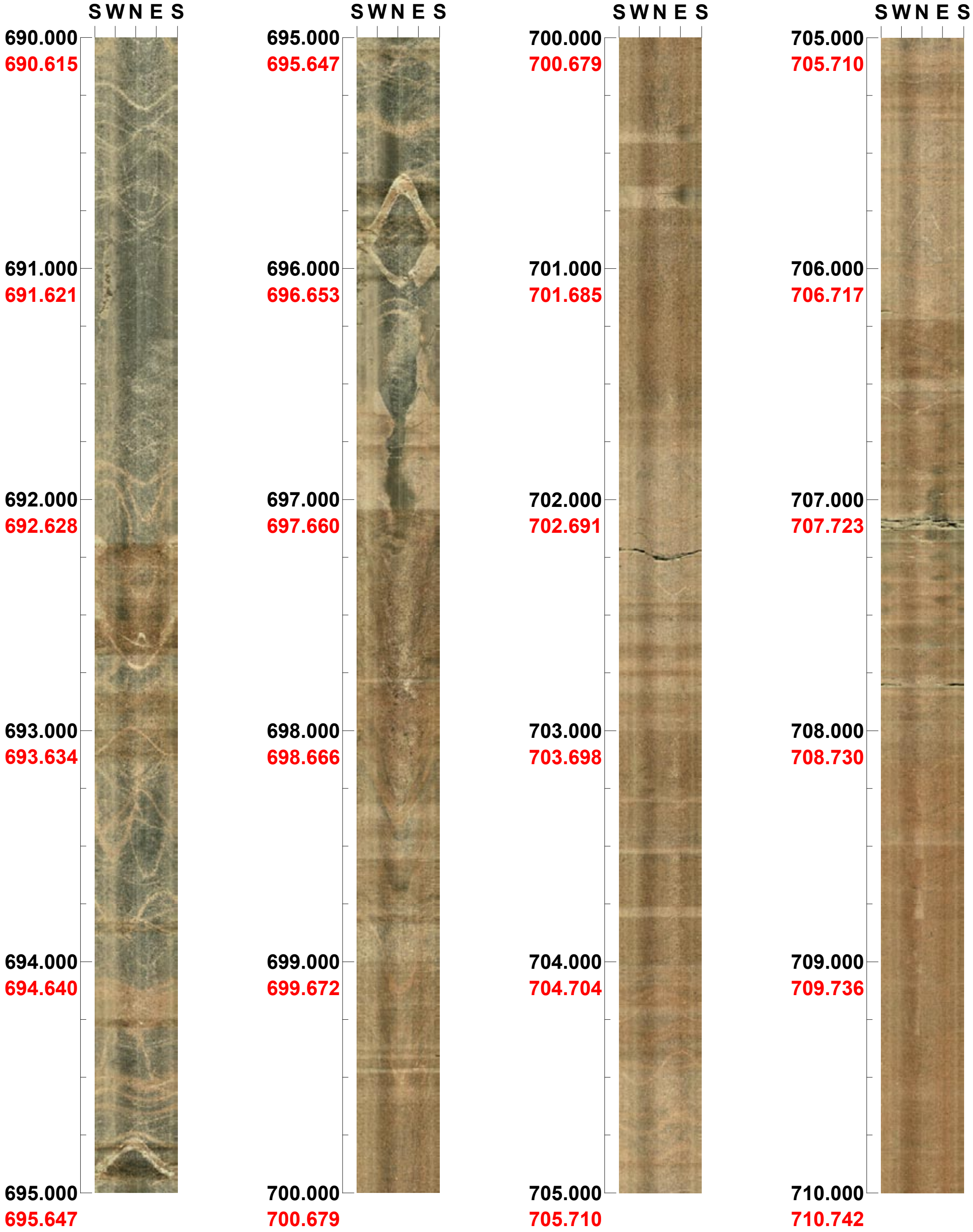
Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 670.000 - 690.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 690.000 - 710.000 m



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

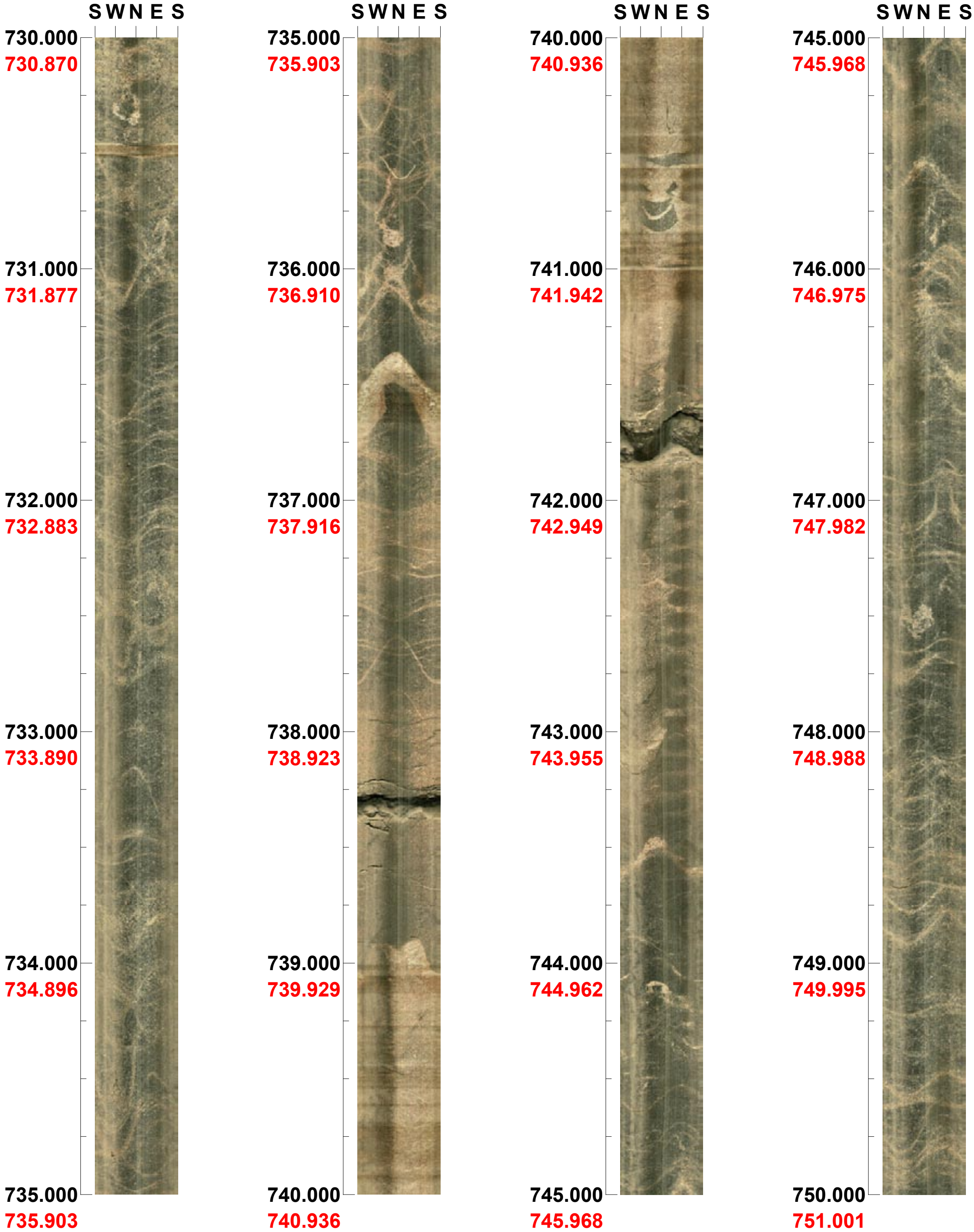
Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 710.000 - 730.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

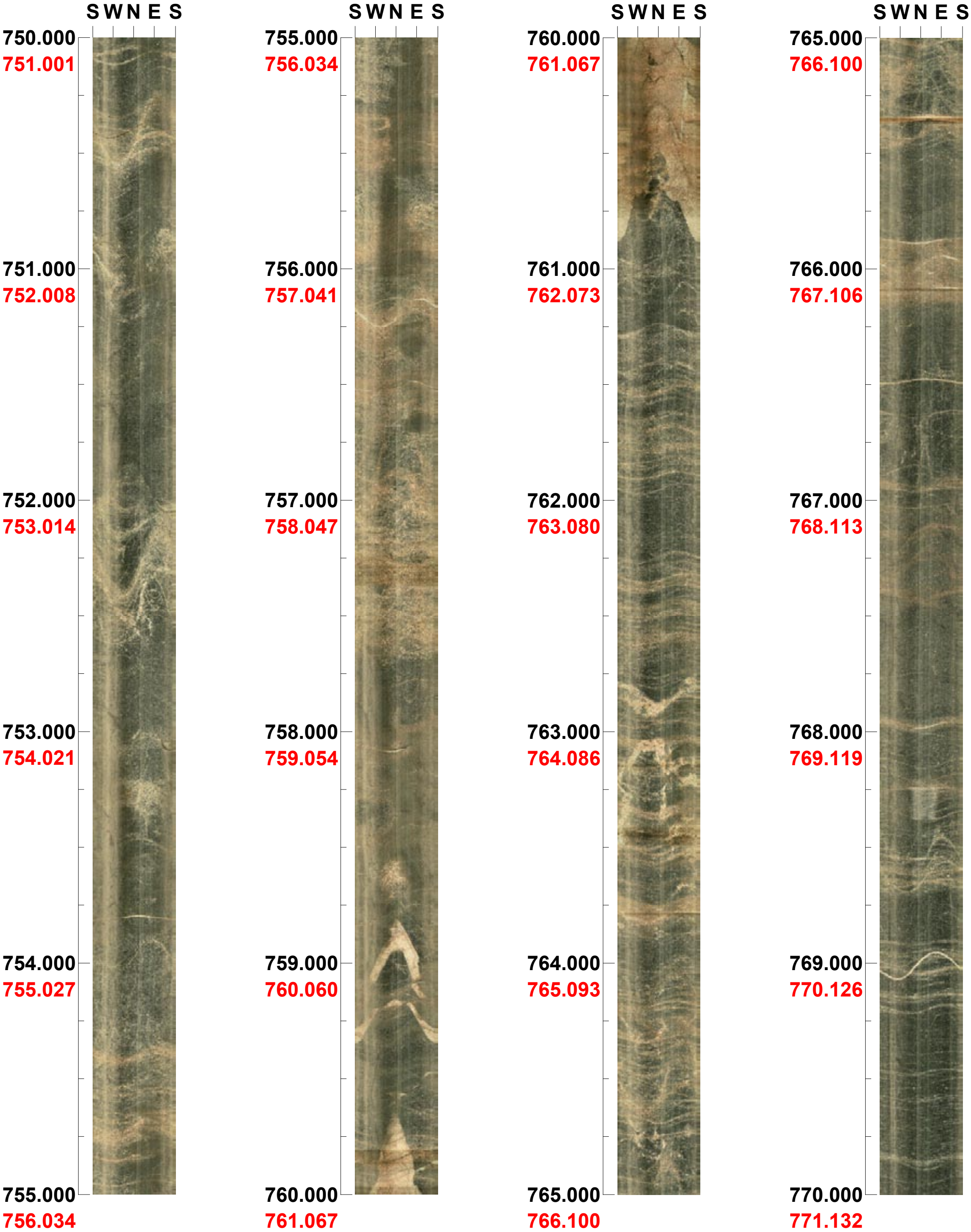
Depth range: 730.000 - 750.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 750.000 - 770.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 770.000 - 790.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 790.000 - 810.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 810.000 - 830.000 m

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

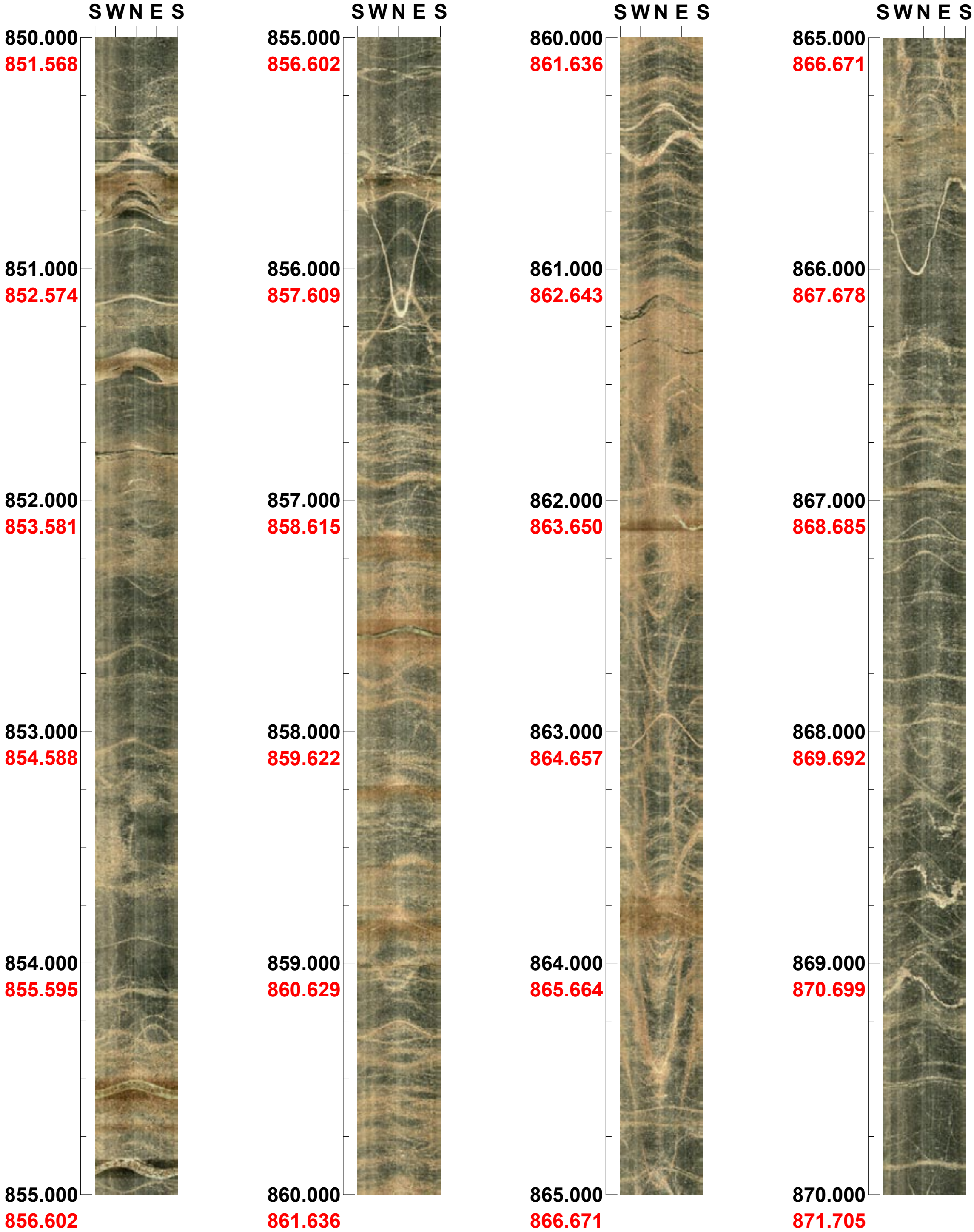
Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 830.000 - 850.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 850.000 - 870.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 870.000 - 890.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 890.000 - 910.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 910.000 - 930.000 m

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

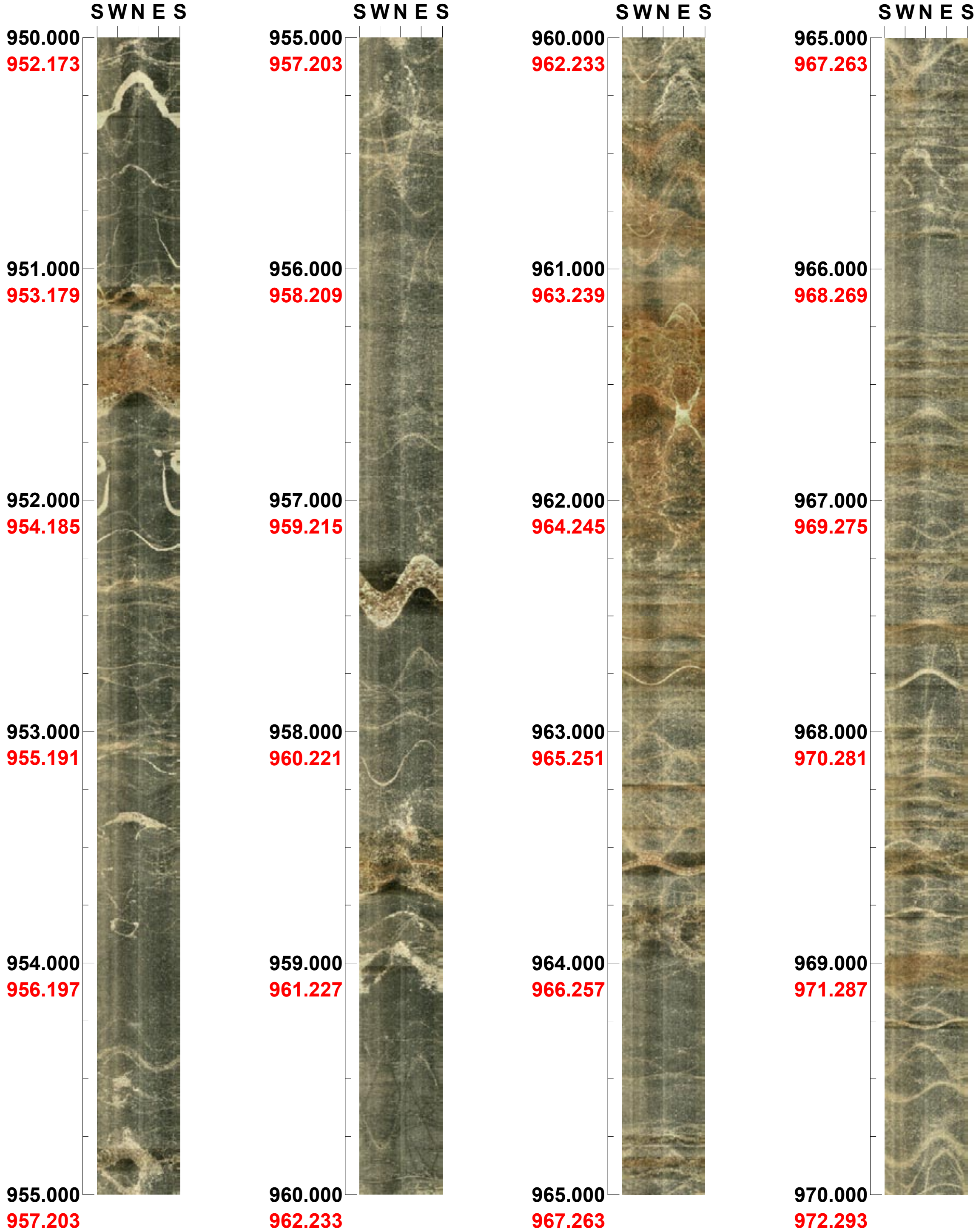
Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 930.000 - 950.000 m

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 950.000 - 970.000 m



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

Project name: Oskarshamn
Bore hole No.: KSH02

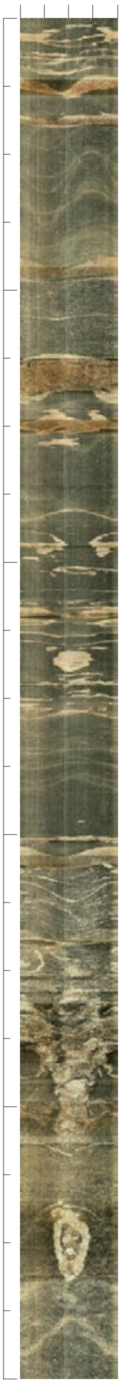
Depth range: 970.000 - 990.000 m

S W N E S

970.000 / 972.293
971.000 / 973.299
972.000 / 974.305
973.000 / 975.311
974.000 / 976.317
975.000 / 977.323

S W N E S

975.000 / 977.323
976.000 / 978.329
977.000 / 979.335
978.000 / 980.341
979.000 / 981.347
980.000 / 982.353



S W N E S

980.000 / 982.353
981.000 / 983.359
982.000 / 984.365
983.000 / 985.371
984.000 / 986.377
985.000 / 987.383

S W N E S

985.000 / 987.383
986.000 / 988.389
987.000 / 989.395
988.000 / 990.401
989.000 / 991.407
990.000 / 992.413

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

Project name: Oskarshamn
Bore hole No.: KSH02

Depth range: 990.000 - 998.031 m

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

Appendix 5

WellCad diagram of KSH02

Title LEGEND FOR SIMPEVARP KSH02

Site	SIMPEVARP
Borehole	KSH02
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
- Quartz
- Pyrite
- Laumontite
- Zeolite
- 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

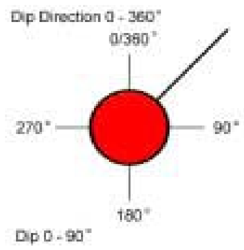
CRUSH ALTERATION

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

FRACTURE ALTERATION

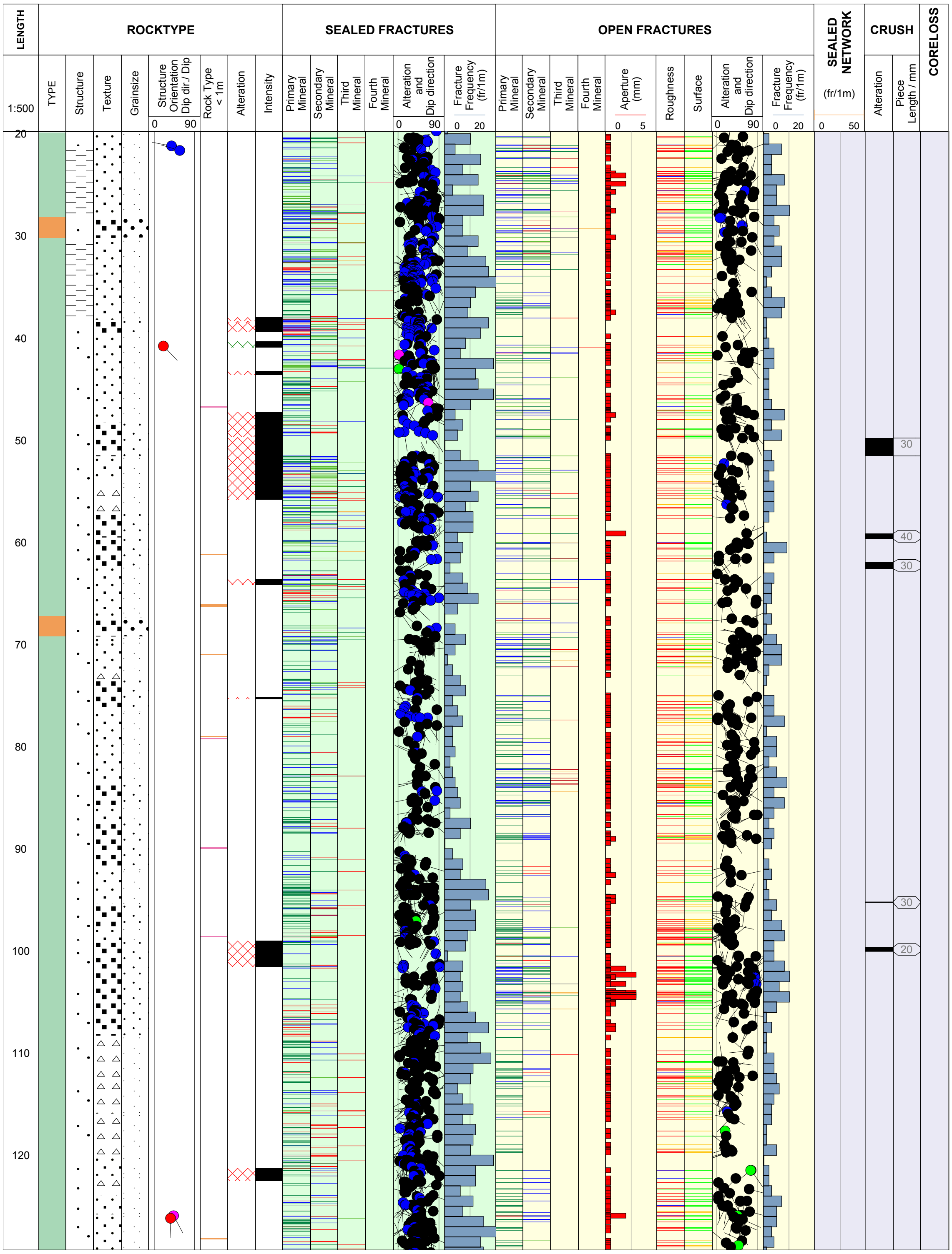
- Fresh
- Gouge
- Completely Altered
- Highly Altered
- Moderately Altered
- Slightly Altered

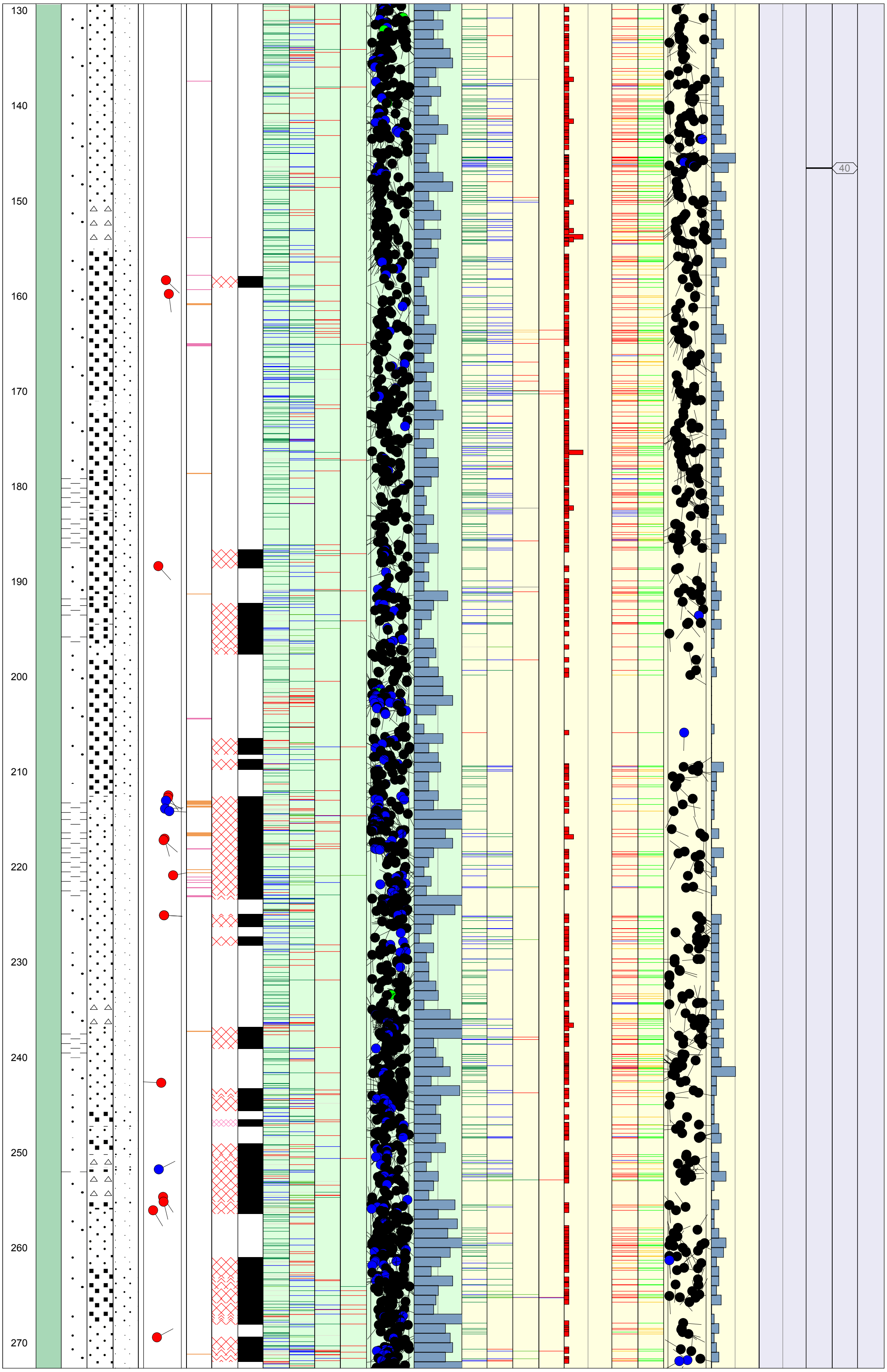
FRACTURE DIRECTION



Title

Site	SIMPEVARP	**Coordinate System**	RT90-RHB70
Borehole	KSH02	**Northing [m]**	6365658.33
Diameter [mm]	76	**Easting [m]**	1551528.93
Length [m]	1001.110	**Elevation [m.a.s.l.]**	5.48
Bearing [°]	330.68	**Drilling Start Date**	2003-01-22 07:00:00
Inclination [°]	-85.67	**Drilling Stop Date**	2003-06-11 15:10:00
Date of mapping	2004-03-15 09:53:00	**Plot Date**	2004-06-09 21:04:59
Rocktype data from	p_rock_XXXXX	**Fracture data from**	p_fract_core

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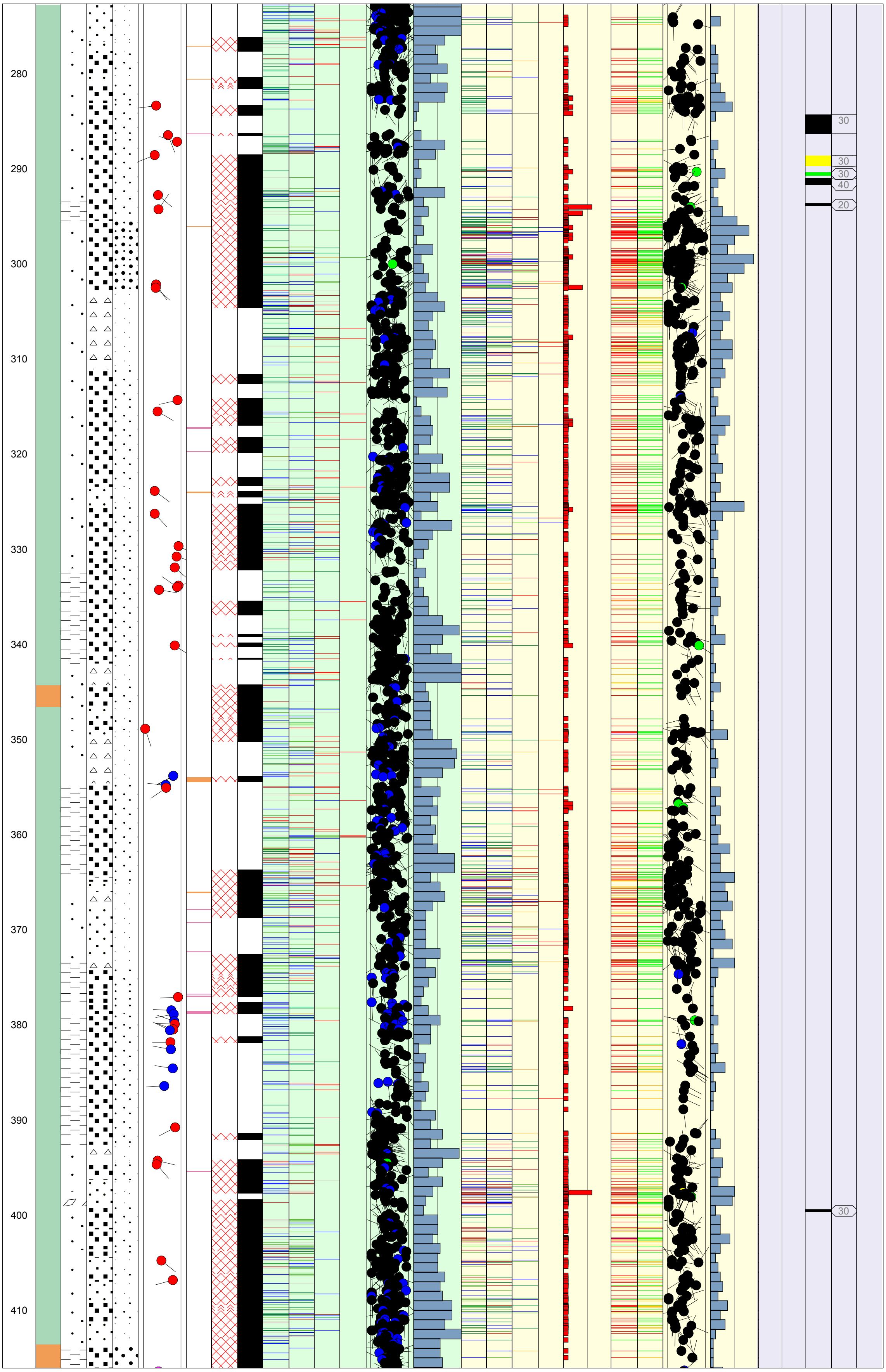
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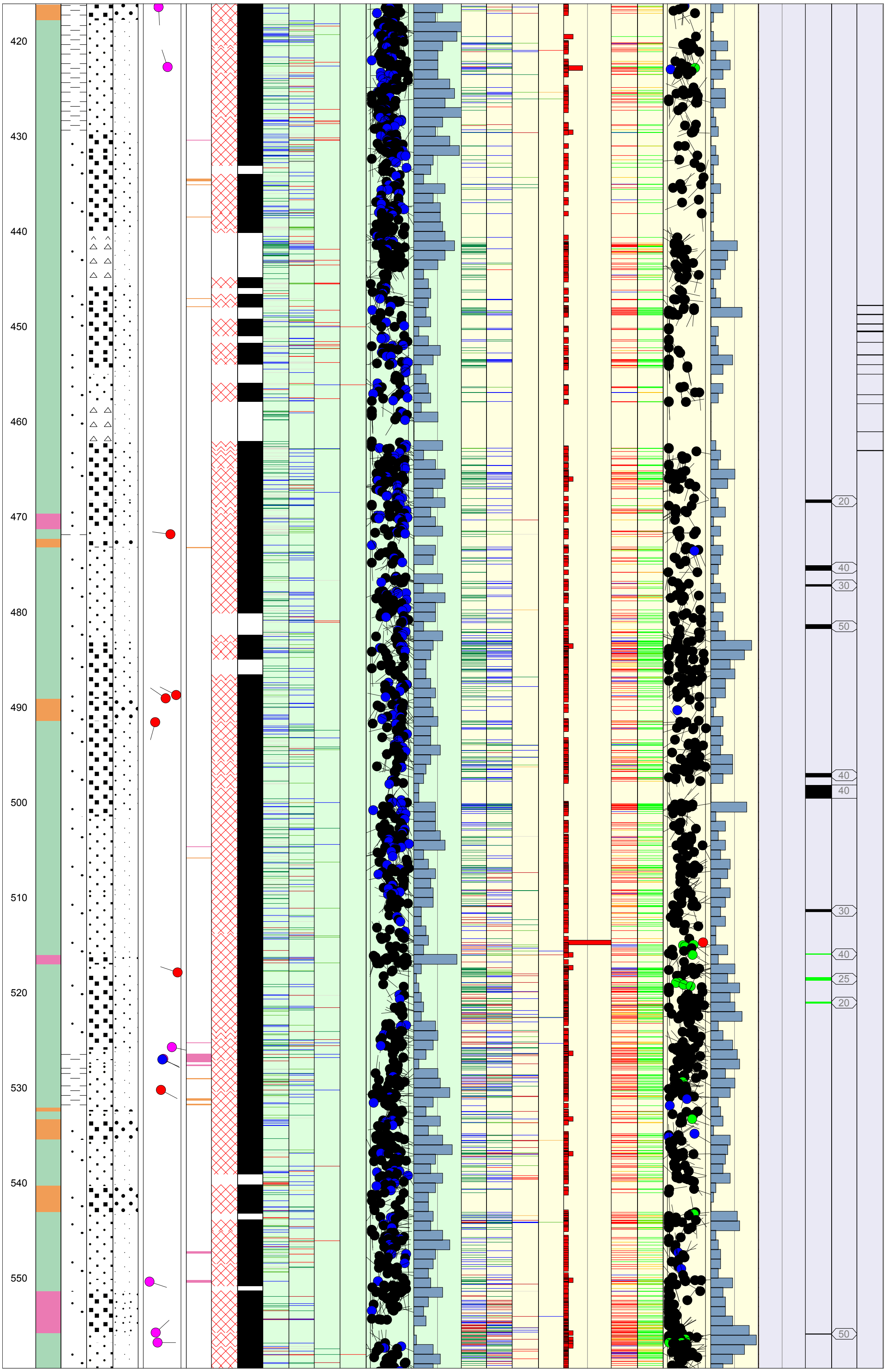
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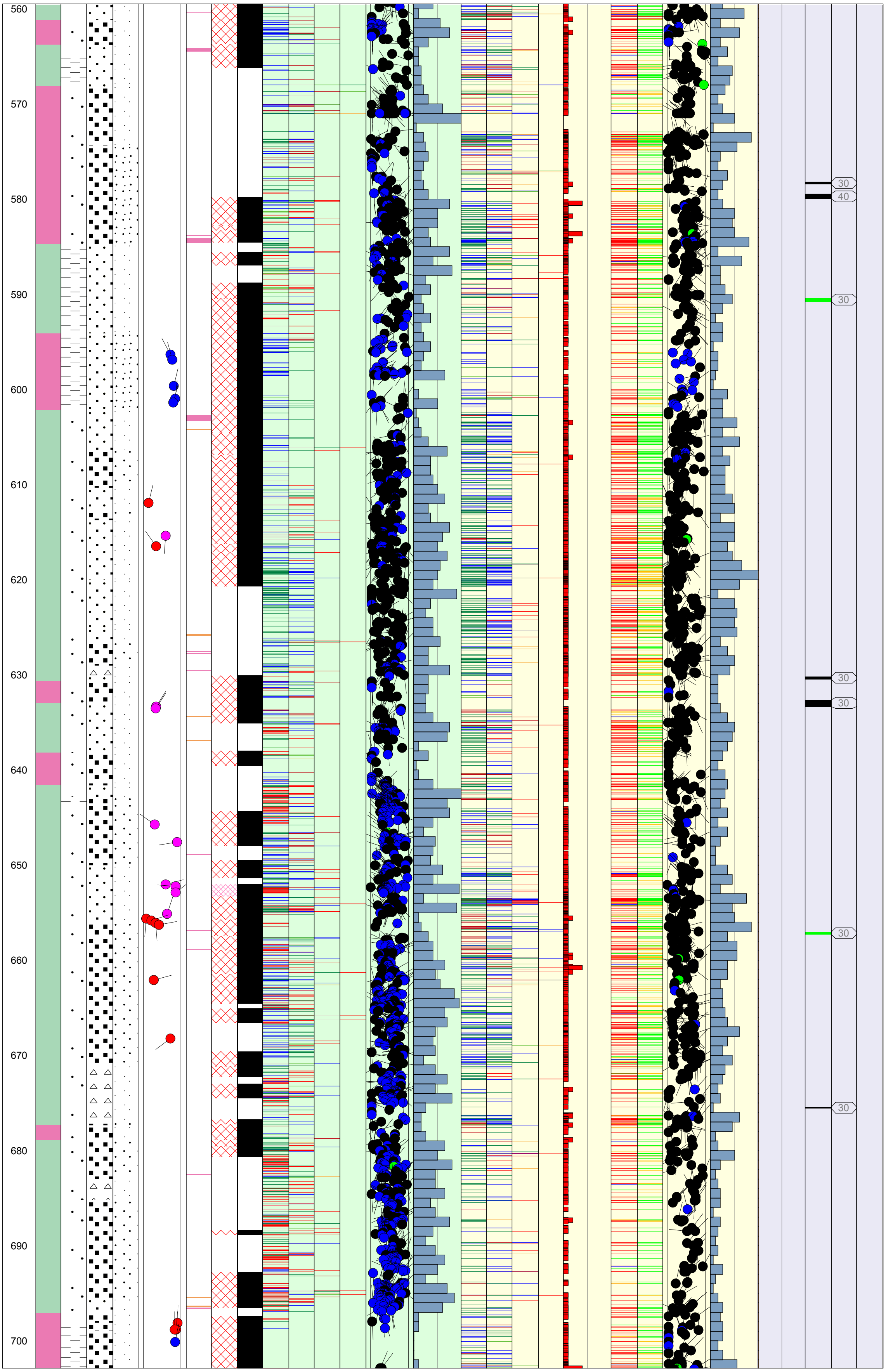
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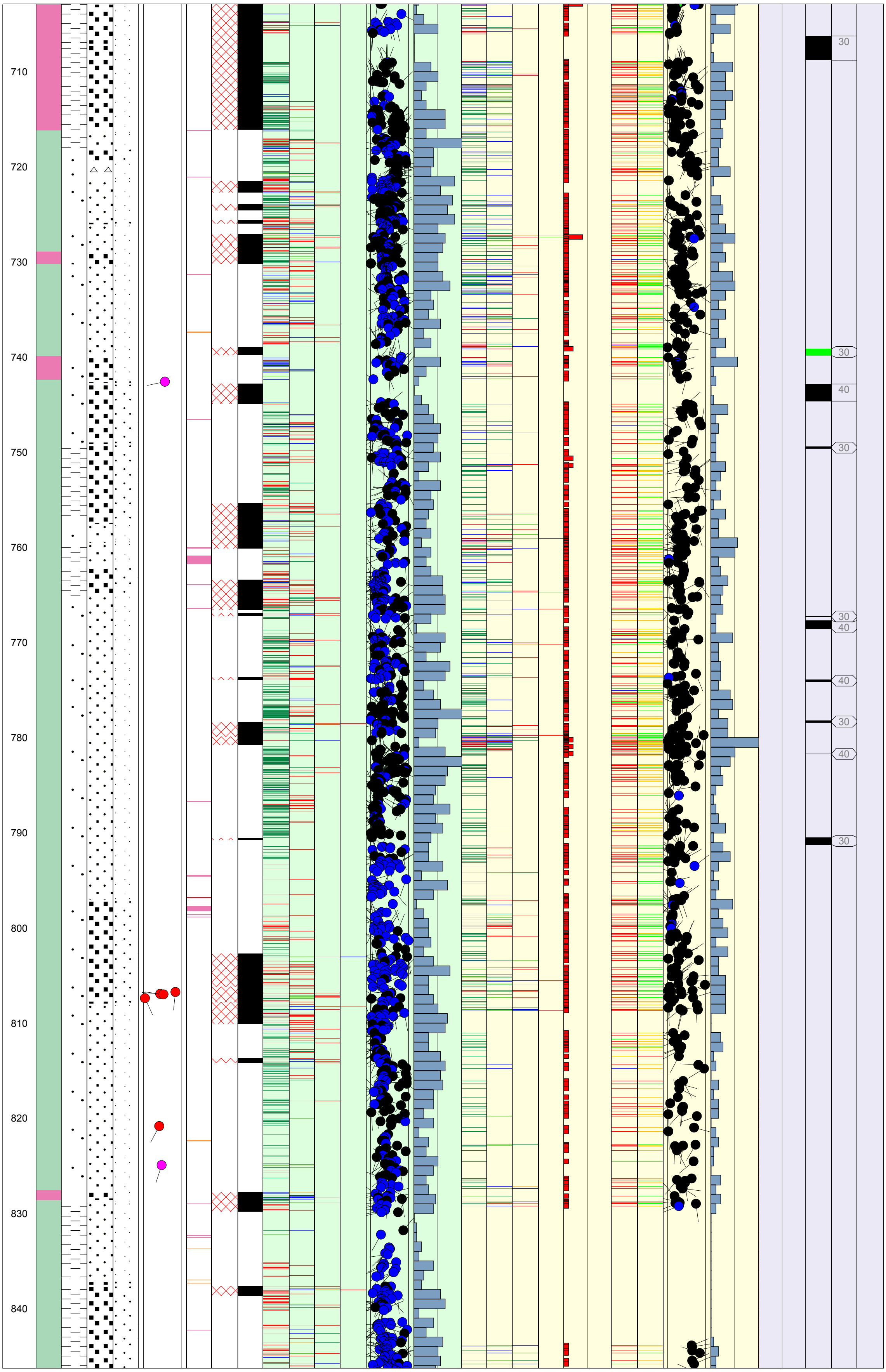

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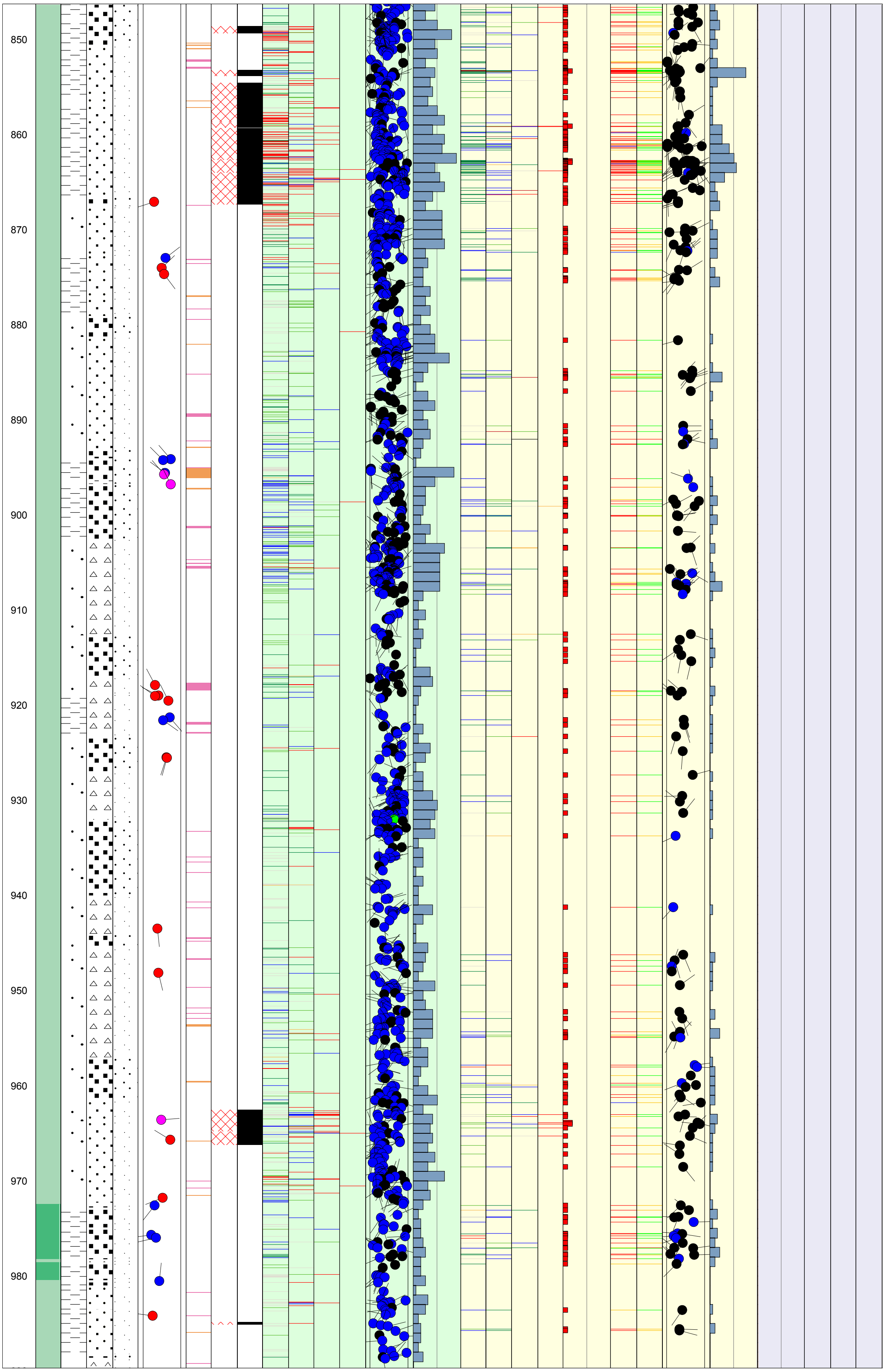
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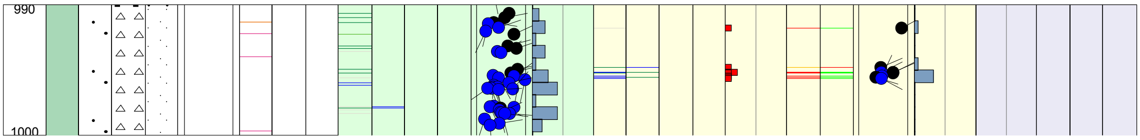
970
980


990
1000

In data: Borehole length and diameter for KSH02

Hole Diam T - Drilling: Borehole diameter

KSH02, 2003-01-28 07:00:00 - 2003-06-11 15:10:00 (65.850 - 1001.110 m)

Sub Secup (m)	Sub Seclow (m)	Hole Diam (m)	Comment
65.850	80.000	0.086	84/80 Rostfri casing!
80.000	1001.110	0.076	

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Appendix 7

In data: Deviation data for KSH02

Maxibor T - Borehole deviation: Maxibor

KSH02, 2003-05-29 08:00:00 - 2003-05-29 11:00:00 (0.000 - 996.000 m)

Length (m)	Northing (m)	Easting (m)	Elevation (m)	Coord System	Inclination (degrees)	Bearing (degrees)	Local A (m)	Local B (m)	Local C (m)	Extrapol Flag
-3.00	6365658.140	1551529.030	-8.490	RT90-RHB70	-85.8500	330.2500	0.0000	0.0000	0.0000	
0.00	6365658.328	1551528.922	-5.498	RT90-RHB70	-85.7500	329.9900	0.2170	0.0000	0.0000	
3.00	6365658.521	1551528.811	-2.506	RT90-RHB70	-85.6300	329.4600	0.4390	-0.0010	0.0050	
6.00	6365658.718	1551528.695	0.485	RT90-RHB70	-85.4900	329.1600	0.6680	-0.0040	0.0170	
9.00	6365658.920	1551528.574	3.476	RT90-RHB70	-85.4600	328.7500	0.9040	-0.0090	0.0350	
12.00	6365659.124	1551528.451	6.466	RT90-RHB70	-85.3500	327.7600	1.1410	-0.0150	0.0560	
15.00	6365659.329	1551528.321	9.457	RT90-RHB70	-85.2600	327.5000	1.3840	-0.0250	0.0820	
18.00	6365659.538	1551528.188	12.446	RT90-RHB70	-85.2200	327.9700	1.6320	-0.0370	0.1130	
21.00	6365659.750	1551528.055	15.436	RT90-RHB70	-85.2800	328.8900	1.8820	-0.0470	0.1450	
24.00	6365659.962	1551527.928	18.426	RT90-RHB70	-85.3400	329.1400	2.1290	-0.0530	0.1750	
27.00	6365660.171	1551527.802	21.416	RT90-RHB70	-85.3100	329.9700	2.3730	-0.0580	0.2020	
30.00	6365660.384	1551527.680	24.406	RT90-RHB70	-85.3100	330.2300	2.6180	-0.0590	0.2310	
33.00	6365660.597	1551527.558	27.396	RT90-RHB70	-85.3100	329.7500	2.8630	-0.0590	0.2590	
36.00	6365660.808	1551527.434	30.386	RT90-RHB70	-85.2900	329.4300	3.1080	-0.0610	0.2870	
39.00	6365661.020	1551527.309	33.376	RT90-RHB70	-85.3300	328.9300	3.3550	-0.0650	0.3160	
42.00	6365661.230	1551527.183	36.366	RT90-RHB70	-85.3400	328.5400	3.5990	-0.0700	0.3430	
45.00	6365661.437	1551527.056	39.356	RT90-RHB70	-85.3600	328.8800	3.8420	-0.0780	0.3700	
48.00	6365661.645	1551526.931	42.346	RT90-RHB70	-85.3800	330.3300	4.0850	-0.0840	0.3950	
51.00	6365661.855	1551526.811	45.336	RT90-RHB70	-85.3300	331.8100	4.3270	-0.0830	0.4200	
54.00	6365662.071	1551526.695	48.326	RT90-RHB70	-85.2300	331.7600	4.5710	-0.0770	0.4470	
57.00	6365662.290	1551526.577	51.316	RT90-RHB70	-85.1300	329.5600	4.8200	-0.0700	0.4800	
60.00	6365662.510	1551526.448	54.305	RT90-RHB70	-85.0500	326.4600	5.0750	-0.0730	0.5170	
63.00	6365662.726	1551526.305	57.294	RT90-RHB70	-85.1000	325.4500	5.3330	-0.0900	0.5590	
66.00	6365662.937	1551526.160	60.283	RT90-RHB70	-85.4600	324.9900	5.5880	-0.1120	0.5970	
69.00	6365663.131	1551526.024	63.273	RT90-RHB70	-86.1200	324.2500	5.8250	-0.1330	0.6160	
72.00	6365663.296	1551525.905	66.266	RT90-RHB70	-86.7000	323.8000	6.0270	-0.1540	0.6010	
75.00	6365663.435	1551525.803	69.261	RT90-RHB70	-86.8700	325.3800	6.1980	-0.1740	0.5550	
78.00	6365663.570	1551525.710	72.257	RT90-RHB70	-86.8700	326.6900	6.3620	-0.1880	0.5020	
81.00	6365663.707	1551525.620	75.253	RT90-RHB70	-86.8300	327.5300	6.5250	-0.1980	0.4480	
84.00	6365663.847	1551525.531	78.248	RT90-RHB70	-86.7900	327.4400	6.6910	-0.2060	0.3960	
87.00	6365663.988	1551525.441	81.243	RT90-RHB70	-86.7600	327.5300	6.8590	-0.2140	0.3470	
90.00	6365664.132	1551525.350	84.238	RT90-RHB70	-86.7600	327.6800	7.0280	-0.2220	0.2990	
93.00	6365664.275	1551525.259	87.234	RT90-RHB70	-86.7500	327.2700	7.1980	-0.2300	0.2520	
96.00	6365664.418	1551525.167	90.229	RT90-RHB70	-86.7600	327.1400	7.3680	-0.2390	0.2050	
99.00	6365664.561	1551525.075	93.224	RT90-RHB70	-86.7600	327.4600	7.5370	-0.2480	0.1570	
102.00	6365664.704	1551524.983	96.219	RT90-RHB70	-86.7700	327.7900	7.7070	-0.2560	0.1090	

105.00	6365664.847	1551524.893	99.214	RT90-RHB70	-86.7400	328.2400	7.8760	-0.2630	0.0610
108.00	6365664.992	1551524.803	102.210	RT90-RHB70	-86.7200	328.8200	8.0460	-0.2690	0.0140
111.00	6365665.139	1551524.714	105.205	RT90-RHB70	-86.6600	329.2300	8.2180	-0.2740	-0.0310
114.00	6365665.289	1551524.625	108.200	RT90-RHB70	-86.6700	329.7500	8.3930	-0.2770	-0.0740
117.00	6365665.440	1551524.537	111.194	RT90-RHB70	-86.6400	330.0500	8.5670	-0.2780	-0.1160
120.00	6365665.592	1551524.449	114.189	RT90-RHB70	-86.6200	330.6500	8.7430	-0.2790	-0.1580
123.00	6365665.746	1551524.363	117.184	RT90-RHB70	-86.6200	331.3700	8.9200	-0.2780	-0.1980
126.00	6365665.902	1551524.278	120.179	RT90-RHB70	-86.6400	331.9200	9.0970	-0.2740	-0.2390
129.00	6365666.057	1551524.195	123.174	RT90-RHB70	-86.6600	332.1800	9.2720	-0.2690	-0.2800
132.00	6365666.211	1551524.114	126.169	RT90-RHB70	-86.7000	332.4600	9.4470	-0.2630	-0.3230
135.00	6365666.365	1551524.034	129.164	RT90-RHB70	-86.7100	333.8200	9.6200	-0.2570	-0.3670
138.00	6365666.519	1551523.958	132.159	RT90-RHB70	-86.7500	334.2000	9.7910	-0.2460	-0.4130
141.00	6365666.672	1551523.884	135.154	RT90-RHB70	-86.7500	334.9600	9.9610	-0.2340	-0.4600
144.00	6365666.826	1551523.812	138.149	RT90-RHB70	-86.7900	335.3400	10.1310	-0.2200	-0.5080
147.00	6365666.979	1551523.742	141.144	RT90-RHB70	-86.7600	336.3000	10.2980	-0.2050	-0.5580
150.00	6365667.134	1551523.674	144.140	RT90-RHB70	-86.6900	337.0300	10.4670	-0.1870	-0.6060
153.00	6365667.294	1551523.606	147.135	RT90-RHB70	-86.6800	337.5200	10.6390	-0.1670	-0.6520
156.00	6365667.454	1551523.540	150.129	RT90-RHB70	-86.6900	337.7000	10.8110	-0.1450	-0.6960
159.00	6365667.614	1551523.474	153.124	RT90-RHB70	-86.6800	337.8200	10.9830	-0.1230	-0.7420
162.00	6365667.775	1551523.408	156.119	RT90-RHB70	-86.6900	338.0900	11.1550	-0.1000	-0.7870
165.00	6365667.936	1551523.344	159.114	RT90-RHB70	-86.7300	338.9300	11.3270	-0.0760	-0.8320
168.00	6365668.095	1551523.282	162.110	RT90-RHB70	-86.7800	339.1600	11.4950	-0.0500	-0.8810
171.00	6365668.253	1551523.222	165.105	RT90-RHB70	-86.7700	339.1300	11.6620	-0.0240	-0.9310
174.00	6365668.411	1551523.162	168.100	RT90-RHB70	-86.7800	339.3700	11.8290	0.0020	-0.9820
177.00	6365668.568	1551523.103	171.095	RT90-RHB70	-86.8000	339.8300	11.9950	0.0290	-1.0320
180.00	6365668.726	1551523.045	174.091	RT90-RHB70	-86.8100	339.7800	12.1610	0.0570	-1.0840
183.00	6365668.883	1551522.987	177.086	RT90-RHB70	-86.7800	339.8600	12.3250	0.0840	-1.1370
186.00	6365669.041	1551522.929	180.081	RT90-RHB70	-86.7200	340.2600	12.4910	0.1120	-1.1880
189.00	6365669.202	1551522.871	183.076	RT90-RHB70	-86.6800	340.8100	12.6610	0.1420	-1.2360
192.00	6365669.367	1551522.814	186.071	RT90-RHB70	-86.6500	341.1300	12.8310	0.1740	-1.2820
195.00	6365669.533	1551522.757	189.066	RT90-RHB70	-86.6200	341.5000	13.0040	0.2070	-1.3270
198.00	6365669.700	1551522.701	192.061	RT90-RHB70	-86.6100	342.6400	13.1770	0.2420	-1.3710
201.00	6365669.870	1551522.648	195.056	RT90-RHB70	-86.6300	343.7500	13.3510	0.2800	-1.4140
204.00	6365670.039	1551522.599	198.050	RT90-RHB70	-86.6300	343.8600	13.5220	0.3210	-1.4600
207.00	6365670.209	1551522.550	201.045	RT90-RHB70	-86.6100	344.0000	13.6940	0.3630	-1.5060
210.00	6365670.379	1551522.501	204.040	RT90-RHB70	-86.6000	344.6100	13.8660	0.4050	-1.5510
213.00	6365670.551	1551522.454	207.035	RT90-RHB70	-86.6100	345.2300	14.0380	0.4490	-1.5950
216.00	6365670.722	1551522.408	210.030	RT90-RHB70	-86.6100	346.1900	14.2100	0.4950	-1.6420
219.00	6365670.894	1551522.366	213.024	RT90-RHB70	-86.6200	346.4900	14.3800	0.5430	-1.6880
222.00	6365671.066	1551522.325	216.019	RT90-RHB70	-86.6000	346.8900	14.5500	0.5930	-1.7350
225.00	6365671.240	1551522.284	219.014	RT90-RHB70	-86.5800	347.4000	14.7210	0.6440	-1.7820
228.00	6365671.415	1551522.245	222.008	RT90-RHB70	-86.5900	348.0900	14.8920	0.6970	-1.8280
231.00	6365671.589	1551522.208	225.003	RT90-RHB70	-86.6200	348.2300	15.0620	0.7510	-1.8750

234.00	6365671.762	1551522.172	227.998	RT90-RHB70	-86.6000	348.4500	15.2300	0.8060	-1.9240
237.00	6365671.937	1551522.137	230.993	RT90-RHB70	-86.5700	348.7800	15.3990	0.8610	-1.9720
240.00	6365672.113	1551522.102	233.987	RT90-RHB70	-86.5500	348.9700	15.5690	0.9180	-2.0200
243.00	6365672.290	1551522.067	236.982	RT90-RHB70	-86.5200	348.8400	15.7400	0.9760	-2.0660
246.00	6365672.468	1551522.032	239.976	RT90-RHB70	-86.5000	349.3200	15.9120	1.0340	-2.1100
249.00	6365672.648	1551521.998	242.971	RT90-RHB70	-86.4800	349.8300	16.0860	1.0940	-2.1540
252.00	6365672.830	1551521.966	245.965	RT90-RHB70	-86.4800	350.2400	16.2590	1.1560	-2.1980
255.00	6365673.011	1551521.934	248.959	RT90-RHB70	-86.4800	350.1700	16.4320	1.2190	-2.2420
258.00	6365673.193	1551521.903	251.954	RT90-RHB70	-86.4700	349.7700	16.6050	1.2820	-2.2860
261.00	6365673.375	1551521.870	254.948	RT90-RHB70	-86.4500	349.7100	16.7800	1.3440	-2.3290
264.00	6365673.558	1551521.837	257.942	RT90-RHB70	-86.4300	349.9700	16.9550	1.4050	-2.3710
267.00	6365673.742	1551521.804	260.936	RT90-RHB70	-86.4000	350.1500	17.1310	1.4680	-2.4120
270.00	6365673.927	1551521.772	263.931	RT90-RHB70	-86.3900	350.1400	17.3080	1.5330	-2.4520
273.00	6365674.113	1551521.740	266.925	RT90-RHB70	-86.3900	350.2000	17.4850	1.5970	-2.4920
276.00	6365674.299	1551521.708	269.919	RT90-RHB70	-86.4000	350.5100	17.6630	1.6610	-2.5310
279.00	6365674.485	1551521.677	272.913	RT90-RHB70	-86.4100	351.2500	17.8390	1.7260	-2.5720
282.00	6365674.671	1551521.648	275.907	RT90-RHB70	-86.4100	351.7300	18.0150	1.7940	-2.6130
285.00	6365674.857	1551521.621	278.901	RT90-RHB70	-86.4400	352.2400	18.1900	1.8630	-2.6560
288.00	6365675.041	1551521.596	281.895	RT90-RHB70	-86.4800	352.5500	18.3630	1.9320	-2.7000
291.00	6365675.224	1551521.572	284.889	RT90-RHB70	-86.4700	352.6400	18.5330	2.0020	-2.7470
294.00	6365675.407	1551521.548	287.884	RT90-RHB70	-86.4600	352.7700	18.7040	2.0730	-2.7930
297.00	6365675.591	1551521.525	290.878	RT90-RHB70	-86.4500	352.9400	18.8750	2.1440	-2.8390
300.00	6365675.776	1551521.502	293.872	RT90-RHB70	-86.4400	352.8200	19.0470	2.2150	-2.8850
303.00	6365675.961	1551521.479	296.866	RT90-RHB70	-86.4300	352.7900	19.2190	2.2870	-2.9290
306.00	6365676.146	1551521.455	299.861	RT90-RHB70	-86.4100	353.2300	19.3910	2.3590	-2.9740
309.00	6365676.332	1551521.433	302.855	RT90-RHB70	-86.3900	353.2100	19.5640	2.4320	-3.0180
312.00	6365676.520	1551521.411	305.849	RT90-RHB70	-86.4000	353.0700	19.7380	2.5050	-3.0620
315.00	6365676.707	1551521.388	308.843	RT90-RHB70	-86.3800	353.3000	19.9120	2.5790	-3.1050
318.00	6365676.895	1551521.366	311.837	RT90-RHB70	-86.3700	353.6100	20.0860	2.6530	-3.1480
321.00	6365677.084	1551521.345	314.831	RT90-RHB70	-86.3700	353.9100	20.2610	2.7280	-3.1910
324.00	6365677.273	1551521.325	317.825	RT90-RHB70	-86.3700	354.0600	20.4340	2.8040	-3.2340
327.00	6365677.462	1551521.305	320.819	RT90-RHB70	-86.4000	353.9100	20.6080	2.8810	-3.2770
330.00	6365677.649	1551521.285	323.813	RT90-RHB70	-86.4300	353.9000	20.7810	2.9570	-3.3220
333.00	6365677.835	1551521.265	326.807	RT90-RHB70	-86.4500	354.3600	20.9520	3.0320	-3.3680
336.00	6365678.020	1551521.247	329.801	RT90-RHB70	-86.4800	354.4300	21.1220	3.1080	-3.4150
339.00	6365678.203	1551521.229	332.796	RT90-RHB70	-86.5000	354.4000	21.2900	3.1830	-3.4640
342.00	6365678.386	1551521.211	335.790	RT90-RHB70	-86.5000	354.1100	21.4570	3.2580	-3.5140
345.00	6365678.568	1551521.192	338.784	RT90-RHB70	-86.4900	353.6800	21.6250	3.3320	-3.5640
348.00	6365678.751	1551521.172	341.779	RT90-RHB70	-86.4700	353.7000	21.7930	3.4050	-3.6120
351.00	6365678.934	1551521.152	344.773	RT90-RHB70	-86.4600	354.2300	21.9630	3.4790	-3.6600
354.00	6365679.119	1551521.133	347.767	RT90-RHB70	-86.4600	354.4200	22.1320	3.5540	-3.7080
357.00	6365679.303	1551521.115	350.762	RT90-RHB70	-86.4800	353.9800	22.3010	3.6300	-3.7560
360.00	6365679.486	1551521.096	353.756	RT90-RHB70	-86.4800	354.7300	22.4690	3.7040	-3.8040

363.00	6365679.670	1551521.079	356.750	RT90-RHB70	-86.5100	355.7100	22.6370	3.7800	-3.8540
366.00	6365679.852	1551521.065	359.745	RT90-RHB70	-86.5500	356.1300	22.8020	3.8590	-3.9060
369.00	6365680.032	1551521.053	362.739	RT90-RHB70	-86.5900	356.4400	22.9650	3.9380	-3.9600
372.00	6365680.210	1551521.042	365.734	RT90-RHB70	-86.6100	356.8900	23.1250	4.0170	-4.0170
375.00	6365680.387	1551521.033	368.729	RT90-RHB70	-86.6600	357.3600	23.2840	4.0960	-4.0760
378.00	6365680.562	1551521.024	371.724	RT90-RHB70	-86.7100	358.1800	23.4390	4.1760	-4.1380
381.00	6365680.734	1551521.019	374.719	RT90-RHB70	-86.7100	358.9400	23.5910	4.2560	-4.2030
384.00	6365680.906	1551521.016	377.714	RT90-RHB70	-86.7300	359.8800	23.7420	4.3390	-4.2690
387.00	6365681.077	1551521.015	380.709	RT90-RHB70	-86.7500	359.8300	23.8910	4.4230	-4.3370
390.00	6365681.247	1551521.015	383.704	RT90-RHB70	-86.7400	359.0800	24.0380	4.5070	-4.4070
393.00	6365681.417	1551521.012	386.699	RT90-RHB70	-86.7200	358.8900	24.1880	4.5900	-4.4740
396.00	6365681.589	1551521.009	389.694	RT90-RHB70	-86.7000	358.7500	24.3390	4.6720	-4.5410
399.00	6365681.761	1551521.005	392.689	RT90-RHB70	-86.6600	359.0700	24.4900	4.7540	-4.6070
402.00	6365681.936	1551521.002	395.684	RT90-RHB70	-86.6200	359.5600	24.6430	4.8380	-4.6710
405.00	6365682.113	1551521.001	398.679	RT90-RHB70	-86.5900	0.0200	24.7970	4.9250	-4.7340
408.00	6365682.292	1551521.001	401.674	RT90-RHB70	-86.5700	0.1800	24.9530	5.0140	-4.7960
411.00	6365682.471	1551521.002	404.668	RT90-RHB70	-86.5500	0.5000	25.1080	5.1030	-4.8570
414.00	6365682.652	1551521.003	407.663	RT90-RHB70	-86.5500	0.8100	25.2640	5.1940	-4.9180
417.00	6365682.832	1551521.006	410.657	RT90-RHB70	-86.5100	0.9000	25.4200	5.2860	-4.9800
420.00	6365683.015	1551521.009	413.652	RT90-RHB70	-86.4700	1.9000	25.5770	5.3790	-5.0400
423.00	6365683.199	1551521.015	416.646	RT90-RHB70	-86.4500	2.4700	25.7340	5.4760	-5.1000
426.00	6365683.385	1551521.023	419.640	RT90-RHB70	-86.4700	2.1700	25.8910	5.5750	-5.1600
429.00	6365683.570	1551521.030	422.635	RT90-RHB70	-86.4900	3.0800	26.0480	5.6730	-5.2200
432.00	6365683.753	1551521.040	425.629	RT90-RHB70	-86.4500	3.6200	26.2020	5.7720	-5.2830
435.00	6365683.938	1551521.051	428.623	RT90-RHB70	-86.4800	4.4200	26.3570	5.8740	-5.3450
438.00	6365684.122	1551521.065	431.618	RT90-RHB70	-86.5200	5.0500	26.5100	5.9780	-5.4100
441.00	6365684.304	1551521.082	434.612	RT90-RHB70	-86.5800	5.2400	26.6590	6.0820	-5.4770
444.00	6365684.482	1551521.098	437.607	RT90-RHB70	-86.6500	5.5200	26.8060	6.1850	-5.5470
447.00	6365684.657	1551521.115	440.602	RT90-RHB70	-86.7200	5.8200	26.9490	6.2860	-5.6210
450.00	6365684.827	1551521.132	443.597	RT90-RHB70	-86.7500	6.3500	27.0890	6.3860	-5.6990
453.00	6365684.996	1551521.151	446.592	RT90-RHB70	-86.7700	6.4000	27.2260	6.4860	-5.7780
456.00	6365685.164	1551521.170	449.587	RT90-RHB70	-86.7900	6.2600	27.3630	6.5860	-5.8590
459.00	6365685.331	1551521.188	452.583	RT90-RHB70	-86.8000	6.7100	27.4980	6.6840	-5.9410
462.00	6365685.497	1551521.208	455.578	RT90-RHB70	-86.7900	7.0400	27.6330	6.7840	-6.0230
465.00	6365685.664	1551521.228	458.573	RT90-RHB70	-86.7700	7.5200	27.7680	6.8850	-6.1050
468.00	6365685.832	1551521.250	461.568	RT90-RHB70	-86.7600	7.4200	27.9020	6.9870	-6.1880
471.00	6365686.000	1551521.272	464.564	RT90-RHB70	-86.8000	7.5000	28.0370	7.0890	-6.2700
474.00	6365686.166	1551521.294	467.559	RT90-RHB70	-86.8000	7.8000	28.1710	7.1910	-6.3540
477.00	6365686.332	1551521.317	470.554	RT90-RHB70	-86.8100	8.1500	28.3040	7.2930	-6.4380
480.00	6365686.497	1551521.341	473.550	RT90-RHB70	-86.8100	8.9000	28.4350	7.3960	-6.5230
483.00	6365686.663	1551521.366	476.545	RT90-RHB70	-86.8100	9.5600	28.5660	7.5000	-6.6100
486.00	6365686.827	1551521.394	479.540	RT90-RHB70	-86.8300	9.8900	28.6950	7.6060	-6.6980
489.00	6365686.991	1551521.423	482.536	RT90-RHB70	-86.8100	10.2100	28.8230	7.7110	-6.7870

492.00	6365687.155	1551521.452	485.531	RT90-RHB70	-86.8100	11.0400	28.9510	7.8190	-6.8760
495.00	6365687.319	1551521.484	488.526	RT90-RHB70	-86.8100	11.3100	29.0770	7.9280	-6.9670
498.00	6365687.482	1551521.517	491.522	RT90-RHB70	-86.8000	11.9800	29.2030	8.0370	-7.0580
501.00	6365687.646	1551521.552	494.517	RT90-RHB70	-86.7700	12.6800	29.3280	8.1490	-7.1500
504.00	6365687.811	1551521.589	497.512	RT90-RHB70	-86.7300	13.2700	29.4530	8.2630	-7.2420
507.00	6365687.978	1551521.628	500.507	RT90-RHB70	-86.7000	13.0800	29.5780	8.3800	-7.3350
510.00	6365688.146	1551521.667	503.502	RT90-RHB70	-86.6800	12.9900	29.7050	8.4970	-7.4250
513.00	6365688.315	1551521.706	506.497	RT90-RHB70	-86.6500	12.2200	29.8320	8.6150	-7.5150
516.00	6365688.486	1551521.743	509.492	RT90-RHB70	-86.6100	11.0200	29.9630	8.7320	-7.6010
519.00	6365688.661	1551521.777	512.487	RT90-RHB70	-86.6100	10.9500	30.0970	8.8480	-7.6840
522.00	6365688.835	1551521.811	515.482	RT90-RHB70	-86.5700	11.1700	30.2320	8.9640	-7.7660
525.00	6365689.011	1551521.846	518.476	RT90-RHB70	-86.5400	11.1800	30.3670	9.0810	-7.8480
528.00	6365689.189	1551521.881	521.471	RT90-RHB70	-86.5200	11.7300	30.5040	9.2000	-7.9280
531.00	6365689.367	1551521.918	524.465	RT90-RHB70	-86.5200	11.8500	30.6400	9.3210	-8.0090
534.00	6365689.545	1551521.955	527.460	RT90-RHB70	-86.5500	11.8800	30.7760	9.4410	-8.0900
537.00	6365689.722	1551521.992	530.454	RT90-RHB70	-86.5400	12.5500	30.9110	9.5610	-8.1720
540.00	6365689.898	1551522.032	533.449	RT90-RHB70	-86.5600	12.7900	31.0450	9.6830	-8.2550
543.00	6365690.074	1551522.072	536.444	RT90-RHB70	-86.5400	13.0000	31.1780	9.8050	-8.3390
546.00	6365690.250	1551522.112	539.438	RT90-RHB70	-86.5200	12.9600	31.3110	9.9280	-8.4240
549.00	6365690.428	1551522.153	542.433	RT90-RHB70	-86.5000	12.8800	31.4450	10.0510	-8.5070
552.00	6365690.606	1551522.194	545.427	RT90-RHB70	-86.4900	12.6100	31.5790	10.1750	-8.5890
555.00	6365690.785	1551522.234	548.421	RT90-RHB70	-86.4500	12.5600	31.7150	10.2990	-8.6710
558.00	6365690.966	1551522.274	551.416	RT90-RHB70	-86.4200	12.2700	31.8520	10.4240	-8.7510
561.00	6365691.150	1551522.314	554.410	RT90-RHB70	-86.4000	12.1100	31.9920	10.5490	-8.8280
564.00	6365691.334	1551522.354	557.404	RT90-RHB70	-86.3900	11.4900	32.1320	10.6750	-8.9050
567.00	6365691.519	1551522.391	560.398	RT90-RHB70	-86.3600	10.9000	32.2740	10.8000	-8.9800
570.00	6365691.706	1551522.427	563.392	RT90-RHB70	-86.3800	10.7900	32.4180	10.9240	-9.0530
573.00	6365691.892	1551522.463	566.386	RT90-RHB70	-86.3900	10.5600	32.5620	11.0470	-9.1260
576.00	6365692.078	1551522.497	569.380	RT90-RHB70	-86.3900	10.3900	32.7060	11.1690	-9.1990
579.00	6365692.264	1551522.531	572.374	RT90-RHB70	-86.3800	10.2600	32.8510	11.2910	-9.2710
582.00	6365692.450	1551522.565	575.368	RT90-RHB70	-86.3800	10.2600	32.9960	11.4120	-9.3430
585.00	6365692.636	1551522.599	578.362	RT90-RHB70	-86.3800	10.4400	33.1410	11.5340	-9.4150
588.00	6365692.823	1551522.633	581.356	RT90-RHB70	-86.3800	10.8000	33.2850	11.6560	-9.4880
591.00	6365693.009	1551522.669	584.350	RT90-RHB70	-86.3800	10.5100	33.4290	11.7790	-9.5610
594.00	6365693.195	1551522.703	587.344	RT90-RHB70	-86.4000	10.5200	33.5740	11.9020	-9.6330
597.00	6365693.380	1551522.738	590.338	RT90-RHB70	-86.4300	10.9800	33.7170	12.0240	-9.7070
600.00	6365693.563	1551522.773	593.332	RT90-RHB70	-86.4500	11.2500	33.8590	12.1450	-9.7820
603.00	6365693.745	1551522.809	596.326	RT90-RHB70	-86.4800	11.3300	33.9990	12.2670	-9.8590
606.00	6365693.926	1551522.846	599.321	RT90-RHB70	-86.5000	11.4700	34.1380	12.3880	-9.9370
609.00	6365694.105	1551522.882	602.315	RT90-RHB70	-86.5000	11.4700	34.2760	12.5090	-10.0170
612.00	6365694.285	1551522.918	605.310	RT90-RHB70	-86.5300	11.5200	34.4140	12.6300	-10.0960
615.00	6365694.463	1551522.955	608.304	RT90-RHB70	-86.5200	12.2100	34.5500	12.7500	-10.1760
618.00	6365694.641	1551522.993	611.299	RT90-RHB70	-86.5300	11.9500	34.6860	12.8710	-10.2580

621.00	6365694.818	1551523.031	614.293	RT90-RHB70	-86.5300	12.0800	34.8210	12.9920	-10.3400
624.00	6365694.996	1551523.069	617.288	RT90-RHB70	-86.5400	12.2100	34.9560	13.1130	-10.4220
627.00	6365695.173	1551523.107	620.282	RT90-RHB70	-86.5400	12.5000	35.0910	13.2340	-10.5040
630.00	6365695.350	1551523.146	623.277	RT90-RHB70	-86.5500	12.6000	35.2250	13.3560	-10.5870
633.00	6365695.526	1551523.186	626.271	RT90-RHB70	-86.5500	12.6800	35.3580	13.4770	-10.6710
636.00	6365695.702	1551523.225	629.266	RT90-RHB70	-86.5500	12.5800	35.4910	13.5990	-10.7550
639.00	6365695.878	1551523.265	632.260	RT90-RHB70	-86.5600	12.3800	35.6250	13.7210	-10.8380
642.00	6365696.053	1551523.303	635.255	RT90-RHB70	-86.5800	12.5100	35.7580	13.8410	-10.9220
645.00	6365696.228	1551523.342	638.250	RT90-RHB70	-86.6100	13.1600	35.8910	13.9620	-11.0070
648.00	6365696.401	1551523.382	641.244	RT90-RHB70	-86.6200	12.9700	36.0210	14.0830	-11.0930
651.00	6365696.574	1551523.422	644.239	RT90-RHB70	-86.6300	13.0300	36.1510	14.2030	-11.1810
654.00	6365696.745	1551523.462	647.234	RT90-RHB70	-86.6500	12.9100	36.2800	14.3220	-11.2680
657.00	6365696.916	1551523.501	650.229	RT90-RHB70	-86.6500	13.7800	36.4090	14.4410	-11.3560
660.00	6365697.087	1551523.543	653.224	RT90-RHB70	-86.6700	14.1400	36.5360	14.5620	-11.4460
663.00	6365697.256	1551523.585	656.219	RT90-RHB70	-86.6800	13.9100	36.6620	14.6830	-11.5380
666.00	6365697.424	1551523.627	659.214	RT90-RHB70	-86.6800	13.4700	36.7880	14.8030	-11.6290
669.00	6365697.593	1551523.668	662.209	RT90-RHB70	-86.6800	13.5100	36.9140	14.9220	-11.7200
672.00	6365697.762	1551523.708	665.204	RT90-RHB70	-86.6900	13.8200	37.0410	15.0410	-11.8100
675.00	6365697.931	1551523.750	668.199	RT90-RHB70	-86.7100	13.9000	37.1670	15.1600	-11.9010
678.00	6365698.098	1551523.791	671.194	RT90-RHB70	-86.7000	13.8600	37.2910	15.2790	-11.9940
681.00	6365698.266	1551523.832	674.189	RT90-RHB70	-86.7100	14.2900	37.4160	15.3980	-12.0860
684.00	6365698.432	1551523.875	677.184	RT90-RHB70	-86.7000	14.6500	37.5400	15.5180	-12.1790
687.00	6365698.600	1551523.919	680.179	RT90-RHB70	-86.6700	15.1300	37.6630	15.6390	-12.2730
690.00	6365698.768	1551523.964	683.174	RT90-RHB70	-86.6900	14.5200	37.7870	15.7620	-12.3670
693.00	6365698.935	1551524.007	686.169	RT90-RHB70	-86.7100	13.8300	37.9110	15.8830	-12.4600
696.00	6365699.102	1551524.049	689.164	RT90-RHB70	-86.7000	14.5300	38.0350	16.0010	-12.5520
699.00	6365699.270	1551524.092	692.159	RT90-RHB70	-86.7100	15.0500	38.1590	16.1220	-12.6450
702.00	6365699.436	1551524.137	695.154	RT90-RHB70	-86.7300	14.6300	38.2810	16.2430	-12.7400
705.00	6365699.602	1551524.180	698.149	RT90-RHB70	-86.7800	14.1500	38.4040	16.3630	-12.8350
708.00	6365699.765	1551524.221	701.144	RT90-RHB70	-86.7900	14.4100	38.5250	16.4800	-12.9310
711.00	6365699.928	1551524.263	704.139	RT90-RHB70	-86.8200	15.1300	38.6460	16.5970	-13.0270
714.00	6365700.088	1551524.306	707.135	RT90-RHB70	-86.8500	15.5100	38.7640	16.7140	-13.1260
717.00	6365700.248	1551524.350	710.130	RT90-RHB70	-86.8400	15.3300	38.8800	16.8320	-13.2270
720.00	6365700.407	1551524.394	713.126	RT90-RHB70	-86.8000	15.0600	38.9970	16.9490	-13.3270
723.00	6365700.569	1551524.438	716.121	RT90-RHB70	-86.8000	15.3300	39.1150	17.0670	-13.4260
726.00	6365700.730	1551524.482	719.116	RT90-RHB70	-86.8100	15.2100	39.2340	17.1850	-13.5250
729.00	6365700.891	1551524.526	722.112	RT90-RHB70	-86.8200	14.8100	39.3520	17.3030	-13.6240
732.00	6365701.052	1551524.568	725.107	RT90-RHB70	-86.8100	15.0900	39.4700	17.4200	-13.7220
735.00	6365701.213	1551524.612	728.102	RT90-RHB70	-86.8300	15.6500	39.5880	17.5380	-13.8210
738.00	6365701.373	1551524.656	731.098	RT90-RHB70	-86.8500	15.6400	39.7050	17.6560	-13.9220
741.00	6365701.531	1551524.701	734.093	RT90-RHB70	-86.8400	15.7200	39.8200	17.7730	-14.0230
744.00	6365701.690	1551524.746	737.089	RT90-RHB70	-86.8100	16.3300	39.9360	17.8910	-14.1240
747.00	6365701.850	1551524.792	740.084	RT90-RHB70	-86.8200	16.8400	40.0520	18.0110	-14.2260

750.00	6365702.010	1551524.841	743.080	RT90-RHB70	-86.8500	16.3300	40.1660	18.1320	-14.3280
753.00	6365702.168	1551524.887	746.075	RT90-RHB70	-86.8500	16.1200	40.2810	18.2510	-14.4310
756.00	6365702.326	1551524.933	749.070	RT90-RHB70	-86.8500	16.0600	40.3960	18.3690	-14.5330
759.00	6365702.485	1551524.978	752.066	RT90-RHB70	-86.8400	16.1200	40.5110	18.4870	-14.6350
762.00	6365702.644	1551525.024	755.061	RT90-RHB70	-86.8500	16.3900	40.6260	18.6060	-14.7370
765.00	6365702.802	1551525.071	758.057	RT90-RHB70	-86.8500	16.5400	40.7400	18.7250	-14.8400
768.00	6365702.960	1551525.118	761.052	RT90-RHB70	-86.8400	17.0000	40.8540	18.8440	-14.9430
771.00	6365703.118	1551525.166	764.048	RT90-RHB70	-86.8300	17.8300	40.9670	18.9640	-15.0470
774.00	6365703.276	1551525.217	767.043	RT90-RHB70	-86.8400	18.4700	41.0790	19.0870	-15.1520
777.00	6365703.433	1551525.269	770.039	RT90-RHB70	-86.8400	18.6800	41.1890	19.2100	-15.2590
780.00	6365703.590	1551525.322	773.034	RT90-RHB70	-86.8200	18.8600	41.2990	19.3340	-15.3660
783.00	6365703.747	1551525.376	776.029	RT90-RHB70	-86.8400	19.1800	41.4090	19.4590	-15.4730
786.00	6365703.903	1551525.430	779.025	RT90-RHB70	-86.8700	19.4300	41.5180	19.5830	-15.5820
789.00	6365704.058	1551525.485	782.020	RT90-RHB70	-86.8600	19.4600	41.6250	19.7070	-15.6920
792.00	6365704.213	1551525.540	785.016	RT90-RHB70	-86.8700	19.5000	41.7320	19.8320	-15.8020
795.00	6365704.367	1551525.594	788.011	RT90-RHB70	-86.8800	19.2300	41.8390	19.9560	-15.9120
798.00	6365704.522	1551525.648	791.007	RT90-RHB70	-86.9000	19.1200	41.9460	20.0790	-16.0210
801.00	6365704.675	1551525.701	794.002	RT90-RHB70	-86.9200	19.5700	42.0530	20.2020	-16.1320
804.00	6365704.827	1551525.756	796.998	RT90-RHB70	-86.9100	20.1400	42.1590	20.3240	-16.2430
807.00	6365704.979	1551525.811	799.994	RT90-RHB70	-86.9000	20.4800	42.2630	20.4480	-16.3560
810.00	6365705.131	1551525.868	802.989	RT90-RHB70	-86.9000	21.0000	42.3670	20.5730	-16.4690
813.00	6365705.282	1551525.926	805.985	RT90-RHB70	-86.8900	21.7300	42.4690	20.6980	-16.5840
816.00	6365705.434	1551525.986	808.981	RT90-RHB70	-86.8700	22.4800	42.5710	20.8260	-16.7000
819.00	6365705.585	1551526.049	811.976	RT90-RHB70	-86.8900	22.7000	42.6710	20.9550	-16.8160
822.00	6365705.735	1551526.112	814.972	RT90-RHB70	-86.8900	22.9300	42.7700	21.0840	-16.9340
825.00	6365705.885	1551526.175	817.967	RT90-RHB70	-86.8800	23.2600	42.8690	21.2130	-17.0530
828.00	6365706.035	1551526.240	820.963	RT90-RHB70	-86.8900	23.5000	42.9670	21.3440	-17.1710
831.00	6365706.184	1551526.304	823.958	RT90-RHB70	-86.9300	23.6200	43.0640	21.4740	-17.2910
834.00	6365706.331	1551526.369	826.954	RT90-RHB70	-86.9400	23.9800	43.1600	21.6030	-17.4120
837.00	6365706.478	1551526.434	829.950	RT90-RHB70	-86.9200	24.4100	43.2550	21.7320	-17.5350
840.00	6365706.624	1551526.500	832.946	RT90-RHB70	-86.9100	24.6600	43.3490	21.8630	-17.6570
843.00	6365706.771	1551526.568	835.941	RT90-RHB70	-86.9200	25.1200	43.4430	21.9940	-17.7800
846.00	6365706.917	1551526.636	838.937	RT90-RHB70	-86.9200	25.4300	43.5360	22.1260	-17.9050
849.00	6365707.062	1551526.706	841.932	RT90-RHB70	-86.9200	25.4500	43.6280	22.2580	-18.0300
852.00	6365707.208	1551526.775	844.928	RT90-RHB70	-86.9400	26.1500	43.7200	22.3900	-18.1550
855.00	6365707.351	1551526.845	847.924	RT90-RHB70	-86.9500	26.1100	43.8090	22.5230	-18.2820
858.00	6365707.495	1551526.915	850.920	RT90-RHB70	-86.9600	25.8000	43.8990	22.6550	-18.4100
861.00	6365707.638	1551526.985	853.915	RT90-RHB70	-86.9500	26.4500	43.9890	22.7860	-18.5370
864.00	6365707.781	1551527.056	856.911	RT90-RHB70	-86.9600	26.8600	44.0780	22.9180	-18.6650
867.00	6365707.922	1551527.127	859.907	RT90-RHB70	-86.9600	27.4100	44.1650	23.0510	-18.7950
870.00	6365708.064	1551527.201	862.903	RT90-RHB70	-86.9500	28.4700	44.2520	23.1850	-18.9250
873.00	6365708.204	1551527.277	865.898	RT90-RHB70	-86.9600	28.8500	44.3360	23.3210	-19.0580
876.00	6365708.344	1551527.354	868.894	RT90-RHB70	-86.9600	29.2100	44.4180	23.4560	-19.1920

879.00	6365708.482	1551527.431	871.890	RT90-RHB70	-86.9400	29.6300	44.5010	23.5930	-19.3270
882.00	6365708.622	1551527.511	874.886	RT90-RHB70	-86.9200	29.8400	44.5820	23.7310	-19.4630
885.00	6365708.761	1551527.591	877.881	RT90-RHB70	-86.9500	30.2900	44.6640	23.8700	-19.5980
888.00	6365708.899	1551527.671	880.877	RT90-RHB70	-86.9500	30.9400	44.7430	24.0080	-19.7360
891.00	6365709.036	1551527.753	883.873	RT90-RHB70	-86.9400	31.1200	44.8210	24.1470	-19.8750
894.00	6365709.173	1551527.836	886.869	RT90-RHB70	-86.9200	31.2700	44.8990	24.2870	-20.0140
897.00	6365709.311	1551527.920	889.864	RT90-RHB70	-86.9200	32.1100	44.9780	24.4280	-20.1520
900.00	6365709.448	1551528.005	892.860	RT90-RHB70	-86.9500	32.4700	45.0540	24.5700	-20.2930
903.00	6365709.582	1551528.091	895.856	RT90-RHB70	-86.9500	32.2700	45.1280	24.7110	-20.4360
906.00	6365709.717	1551528.176	898.852	RT90-RHB70	-86.9500	32.8700	45.2030	24.8520	-20.5780
909.00	6365709.851	1551528.263	901.847	RT90-RHB70	-86.9400	33.2100	45.2760	24.9940	-20.7220
912.00	6365709.985	1551528.351	904.843	RT90-RHB70	-86.9400	32.9400	45.3490	25.1370	-20.8660
915.00	6365710.120	1551528.438	907.839	RT90-RHB70	-86.9300	33.1400	45.4230	25.2790	-21.0090
918.00	6365710.254	1551528.526	910.834	RT90-RHB70	-86.9200	34.0600	45.4960	25.4220	-21.1530
921.00	6365710.388	1551528.616	913.830	RT90-RHB70	-86.9500	34.5500	45.5670	25.5660	-21.2990
924.00	6365710.519	1551528.706	916.826	RT90-RHB70	-86.9600	34.3200	45.6360	25.7100	-21.4470
927.00	6365710.650	1551528.796	919.822	RT90-RHB70	-86.9500	34.6500	45.7060	25.8530	-21.5940
930.00	6365710.782	1551528.887	922.817	RT90-RHB70	-86.9600	35.1500	45.7750	25.9970	-21.7420
933.00	6365710.912	1551528.978	925.813	RT90-RHB70	-86.9400	35.1100	45.8420	26.1410	-21.8920
936.00	6365711.043	1551529.070	928.809	RT90-RHB70	-86.9300	35.3600	45.9100	26.2860	-22.0410
939.00	6365711.174	1551529.164	931.805	RT90-RHB70	-86.9200	35.7000	45.9780	26.4320	-22.1900
942.00	6365711.305	1551529.257	934.800	RT90-RHB70	-86.9400	36.1200	46.0450	26.5790	-22.3400
945.00	6365711.434	1551529.352	937.796	RT90-RHB70	-86.9300	36.5400	46.1100	26.7250	-22.4910
948.00	6365711.563	1551529.448	940.792	RT90-RHB70	-86.9200	37.0000	46.1750	26.8720	-22.6440
951.00	6365711.692	1551529.544	943.787	RT90-RHB70	-86.9100	37.2300	46.2380	27.0200	-22.7970
954.00	6365711.821	1551529.642	946.783	RT90-RHB70	-86.9000	37.8600	46.3020	27.1690	-22.9510
957.00	6365711.949	1551529.742	949.779	RT90-RHB70	-86.9100	38.5000	46.3630	27.3190	-23.1060
960.00	6365712.075	1551529.842	952.774	RT90-RHB70	-86.9000	38.4300	46.4230	27.4690	-23.2630
963.00	6365712.202	1551529.943	955.770	RT90-RHB70	-86.9000	38.9900	46.4840	27.6190	-23.4200
966.00	6365712.328	1551530.045	958.765	RT90-RHB70	-86.9200	40.3800	46.5420	27.7710	-23.5780
969.00	6365712.451	1551530.150	961.761	RT90-RHB70	-86.9100	40.0800	46.5970	27.9220	-23.7400
972.00	6365712.575	1551530.254	964.757	RT90-RHB70	-86.9200	40.0000	46.6530	28.0740	-23.9010
975.00	6365712.698	1551530.357	967.752	RT90-RHB70	-86.9100	40.9800	46.7090	28.2250	-24.0620
978.00	6365712.820	1551530.463	970.748	RT90-RHB70	-86.9000	42.0800	46.7620	28.3780	-24.2260
981.00	6365712.941	1551530.572	973.744	RT90-RHB70	-86.9000	42.8700	46.8130	28.5320	-24.3920
984.00	6365713.060	1551530.683	976.739	RT90-RHB70	-86.9100	43.5200	46.8610	28.6870	-24.5610
987.00	6365713.177	1551530.794	979.735	RT90-RHB70	-86.9000	43.9300	46.9080	28.8420	-24.7310
990.00	6365713.294	1551530.906	982.731	RT90-RHB70	-86.8900	44.0000	46.9530	28.9970	-24.9020
996.00	6365713.528	1551531.136	988.722	RT90-RHB70	-86.8500	44.7400	47.0420	29.3130	-25.2470

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In data: Reference marks for length adjustments for KSH02

Reference Mark T - Reference mark in drillhole

KSH02, 2003-06-02 10:30:00 - 2003-06-03 08:00:00 (105.000 - 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
105.00	400.00	220	1000	32.0	120	Yes		
153.00	400.00	220	1000	32.0	120	Yes		
203.00	400.00	220	1000	34.0	120	Yes		
256.00	400.00	220	1000	34.0	120	Yes		
317.00	400.00	220	1000	32.0	120	Yes		
362.00	400.00	300	1000	32.0	150	Yes		
415.00	400.00	320	1000	37.0	210	Yes		
468.00	400.00	280	1000	36.0	150	Yes		
519.00	400.00	300	1000	32.0	120	Yes		
571.00	400.00	300	1000	44.0	240	Yes		
624.00	400.00	300	1000	38.0	210	Yes		
674.00	400.00	300	1000	42.0	210	Yes		
727.00	400.00	220	1000	38.0	150	Yes		
780.00	400.00	380	1000	40.0	180	Yes		
830.00	400.00	240	1000	42.0	180	Yes		
852.00	400.00	240	1000	42.0	180	Yes		
900.00	400.00	300	1000	42.0	150	Yes		
950.00	400.00	240	1000	42.0	180	Yes		

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