P-10-06

Site investigation SFR

Geological single-hole interpretation of KFR105

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February 2010

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Abstract

This report presents the geological single-hole interpretations of the cored borehole KFR105, drilled from the lower construction tunnel in SFR. The interpretation combines the geological mapping, generalized geophysical logs, borehole radar measurements and subsequently hydrogeological logs to identify where rock units and possible deformation zones occur in the boreholes. A brief description of each rock unit and possible deformation zone is provided.

Borehole KFR105 has been divided into seven different rock units, RU1–RU7, of which RU1 occurs in three separate length intervals. The predominant rock type in RU2, RU3 and RU6 is fine- to medium-grained, moderately foliated metagranite-granodiorite (101057) with subordinate amounts of pegmatitic granite (101061), felsic to intermediate metavolcanic rock (103076), amphibolite (102017) and/or fine- to medium-grained granite (111058). Rock unit 5 also includes considerable amount of pegmatitic granite (101061), whereas RU1 and RU7 consist of pegmatitic granite (101061) with subordinate amounts of fine- to medium-grained granite (111058) and metagranite-granodiorite (101057). Rock unit 4 consists of felsic to intermediate metavolcanic rock (103076) with subordinate pegmatitic granite (101061).

Five possible deformation zones of brittle character have been interpreted in KFR105 (DZ1–DZ5), one with a medium degree of confidence and the other four with a high degree of confidence.

Sammanfattning

Denna rapport presenterar den geologiska enhålstolkningen från kärnborrhål KFR105, borrat från nedre byggtunneln i SFR. Tolkningen kombinerar den geologiska karteringen, generaliserade geofysiska loggar, data från borrhålsradar och därefter hydrogeologisk data för att identifiera litologiska enheter och möjliga deformationszoner i borrhålen. En översiktlig beskrivning av varje litologisk enhet och möjlig deformationszon presenteras.

Kärnborrhål KFR105 har delats upp i sju litologiska enheter, RU1–RU7, av vilka RU1 förekommer i tre separata längdintervall. Den dominerande bergarten i RU2, RU3 och RU6 är fin- till medelkornig, måttligt folierad metagranit-granodiorit (101057) med underordnade mängder pegmatitisk granit (101061), felsisk till intermediär metavulkanisk bergart (103076), amfibolit (102017) och/eller fin- till medelkornig granit (111058). RU5 inkluderar också betydande mängder pegmatitisk granit (101061), medan RU1 och RU7 uteslutande består av pegmatitisk granit (101061) med underordnade mängder fin- till medelkornig granit (111058) och metagranit-granodiorit (101057). RU4 består av felsisk till intermediär metavulkanisk bergart (103076) med mindre förekomster av pegmatitisk granit (101061).

Fem möjliga deformationszoner av spröd karaktär har tolkats i KFR105 (DZ1–DZ5), en med medelhög grad av tillförlitlighet och de andra fyra med en hög grad av tillförlitlighet.

Contents

1 Introduction

During 2008, SKB has initiated an investigation programme for the future expansion of the final repository for low and middle level radioactive operational waste, SFR. An essential part in this project is the drilling of four percussion and eight core drilled boreholes. Each borehole is thoroughly documented by means of geological mapping by the so-called Boremap system, as well as geophysical and radar borehole measurements. After import to the SKB database Sicada, the data is used as input for modelling in the 3D-CAD Rock Visualization System (RVS). This procedure follows SKB's established methodology of geological single-hole interpretation, which is based on an integrated series of different logs and accompanying descriptive documents. However, a difference in the methodology compared to that applied during the Forsmark site investigation programme (i.e. SKB MD 810.003) is the incorporation of hydrogeological borehole data in the interpretation process.

This document outlines the results of the geological single-hole interpretation of borehole KFR105. The horizontal projection of the borehole is shown in Figure 1-1.

The work was carried out in accordance with activity plan AP SFR-09-026. In Table 1-1 controlling documents for performing this activity are listed. Both activity plan and method descriptions are SKB's internal controlling documents.

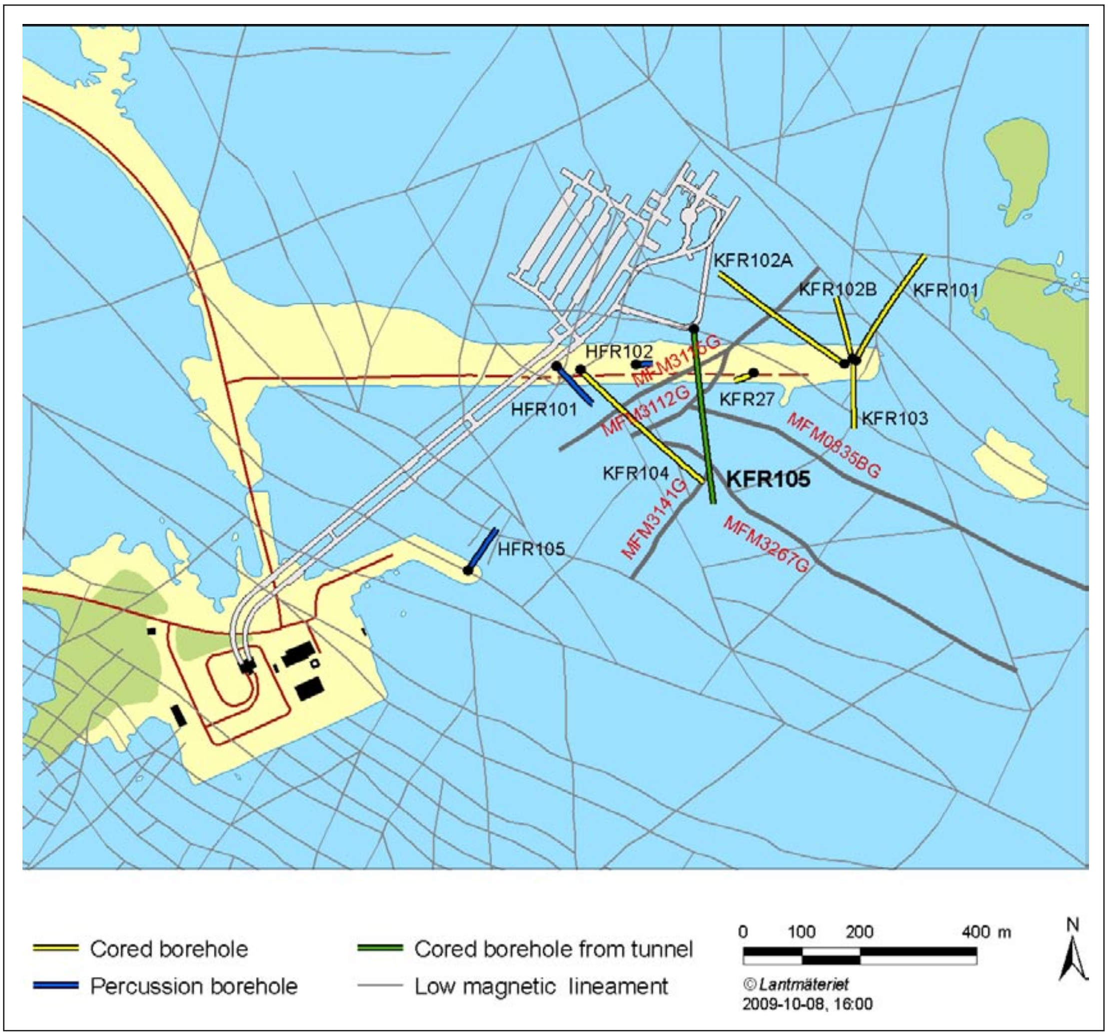

Figure 1-1. *Map showing position and horizontal projection of the cored borehole KFR105 relative to SFR and other boreholes in the drilling programme.Lineaments with low magnetic intensity, expected to be intersected by the borehole, are highlighted.*

Original data from the reported activity are stored in the primary database Sicada. Only data in SKB's databases are accepted for further interpretation and modelling. The data presented in this report are regarded as copies of the original data. Data in the databases may be revised, if needed. Such revisions will not necessarily result in a revision of the associated P-report, although the normal procedure is that major data revisions entail a revision of the P-report. Minor data revisions are normally presented as supplements, available at www.skb.se.

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

Activity plan	**Number**	**Version**
Geohydrologisk enhålstolkning av kärnborrhål KFR105, KFR106 samt hammarborrhål HFR106	AP SFR-09-026	1.0
Method descriptions	**Number**	**Version**
Metodbeskrivning för geologisk enhålstolkning	SKB MD 810.003	3.0

2 Objective and scope

A geological single-hole interpretation is carried out in order to identify and to describe the general characteristics of major rock units and possible deformation zones within a borehole. The work involves an integrated interpretation of data from the geological mapping of a drill core. Hydrogeological borehole data were used to identify flow anomalies and transmissive sections of the borehole.

The result from the geological single-hole interpretation is presented in a WellCAD plot. A detailed description of the technique is provided in the Method Description (SKB MD 810.003). The work reported here concerns stage 1 in the single-hole interpretation, as defined in the Method Description.

3 Data used for the geological single-hole interpretation

The following data have been used for the single-hole interpretation of the borehole KFR105:

- Boremap data (including BIPS-image and geological mapping /Winell 2009/).
- Generalized geophysical logs and their interpretation /Mattsson and Keisu 2009/.
- Radar data and their interpretation /Gustafsson and Gustafsson 2009/.
- Borehole flow logging data and their interpretation /Väisäsvaara 2009/.

The geological mapping of the borehole involves documentation of the drill core in combination with inspection of the oriented image of the borehole walls, obtained by a Borehole Image Processing System (BIPS).

The basis for the geological single-hole interpretation was a WellCAD plot consisting of parameters from the geological mapping, as well as geophysical, radar and hydrogeological data. Hydrogeological data were included after the geological single-hole interpretation was performed, i.e. the rock units and the possible deformation zones were defined first. An example of a WellCAD plot used during geological single-hole interpretation is shown in Figure 3-1. The plot consists of eight main columns and several subordinate columns. These include:

1: Length along the borehole

2: Rock type
- 2.1: Rock type
- 2.2: Rock type < 1 m
- 2.3: Rock type structure
- 2.4: Rock structure intensity
- 2.5: Rock type texture
- 2.6: Rock type grain size
- 2.7: Structure orientation
- 2.8: Rock alteration
- 2.9: Rock alteration intensity

3: Geophysics
- 3.1: Silicate density
- 3.2: Natural gamma radiation
- 3.3: Magnetic susceptibility
- 3.4: Estimated fracture frequency

4: Unbroken fractures
- 4.1: Primary mineral
- 4.2: Secondary mineral
- 4.3: Third mineral
- 4.4: Fourth mineral
- 4.5: Width
- 4.6: Alteration, dip direction

5: Broken fractures
- 5.1: Primary mineral
- 5.2: Secondary mineral
- 5.3: Third mineral
- 5.4: Fourth mineral
- 5.5: Width
- 5.6: Aperture
- 5.7: Roughness
- 5.8: Surface
- 5.9: Slickenside
- 5.10: Alteration, dip direction

6: Crush zones
   6.1: Piece (mm)
   6.2: Sealed network
   6.3: Core loss

7: Fracture frequency
   7.1: Open fractures
   7.2: Sealed fractures

8: Hydrogeology
   8.1: Transmissivity flow anomalies
   8.2: Transmissivity 5-m sections

The use of the geophysical, radar and hydrogeological parameters during the single-hole interpretation is as follows:

Silicate density: Indicates the density of the rock after subtraction of the magnetic component of the rock. It provides general information on the mineral composition of the rock and serves as a support for rock classification.

Natural gamma radiation: The rock has been classified into sections of low, medium and high natural gamma radiation. Low radiation may indicate mafic rock types and high radiation may indicate younger, fine-grained granite (111058) or pegmatitic granite (101061).

Magnetic susceptibility: The rock has been classified into sections of low, medium, high and very high magnetic susceptibility. The susceptibility measurement is strongly connected to the magnetite content of the rock.

Radar data: Inspection of the borehole radar data was carried out during the interpretation process, especially during the identification of possible deformation zones. The occurrence and orientation of radar anomalies within the possible deformation zones are commented upon in the text that describes these zones.

Transmissivity: The transmissivity from flow logging is related to the transmissivity of individual fractures and to the connectivity of the water-bearing fracture network.

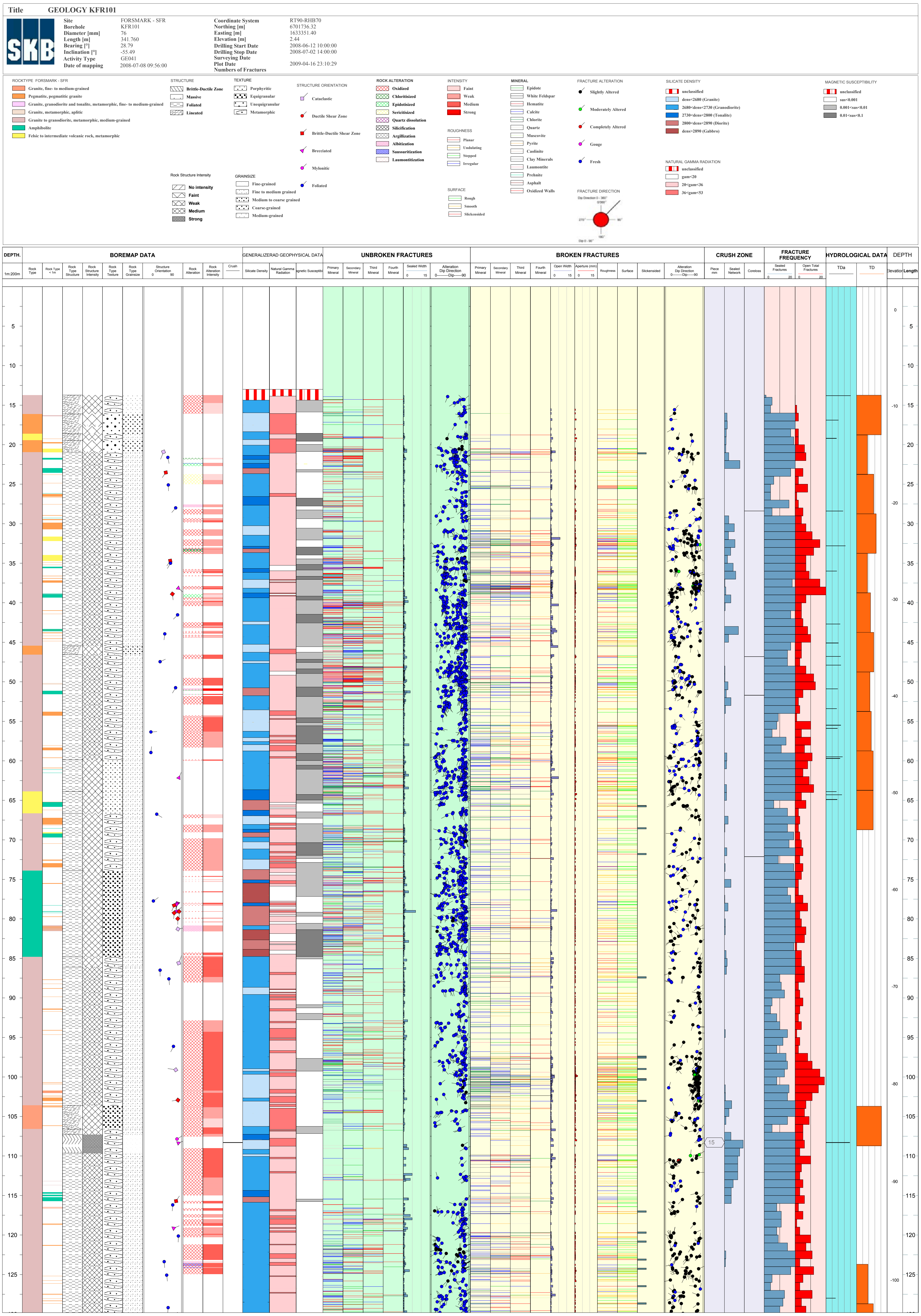

Figure 3-1. Example of WellCAD plot (from borehole KFR101) used as basis for the geological single-hole interpretation.

4 Execution

4.1 Geological single-hole interpretation

The geological single-hole interpretation has been carried out by a group of geoscientists, consisting of geologists, geophysicists and hydrogeologists. Several of them previously participated in the development of the source material. All data to be used (see Chapter 3) are presented side by side in a borehole document extracted from the software WellCAD. The working procedure is summarized in Figure 4-1 and in the text below.

The first step in the working procedure is to study all types of data related to the character of the rock type and to merge sections of similar rock types, or sections where one rock type is very dominant, into rock units. A minimum length of about 5 m was used for the single-hole interpretations during the site investigation. This minimum length was generally also used during this work, but not consistently, since the SFR model volume is considerably less. Each rock unit is defined in terms of the borehole length interval and provided with a brief description for inclusion in the WellCAD plot. The confidence in the interpretation of a rock unit is assigned according to three classes: 3 = high, 2 = medium and 1 = low. The use of low or medium degree of confidence is generally restricted to percussion drilled boreholes, where no drill core is available.

The second step in the working procedure is to identify possible deformation zones by visual inspection of the results of the geological mapping (fracture frequency, fracture mineral, alteration, etc.) in combination with available geophysical data. The section of each identified possible deformation zone is defined in terms of the borehole length interval and provided with a brief description for inclusion in the WellCAD plot. This includes a brief description of the rock types affected by the possible deformation zone. Mineral fillings registered in at least 10% of the open/sealed fractures in the interval or eight individual fractures are noted. The confidence in the interpretation of a possible deformation zone is assigned according to three classes: 3 = high, 2 = medium and 1 = low.

Inspection of BIPS images is carried out wherever it is judged necessary during the working procedure. Furthermore, following the definition of rock units and possible deformation zones, with their respective confidence estimates, the drill cores are inspected in order to check the selection of the boundaries between these geological entities. If judged necessary, the boundaries are adjusted.

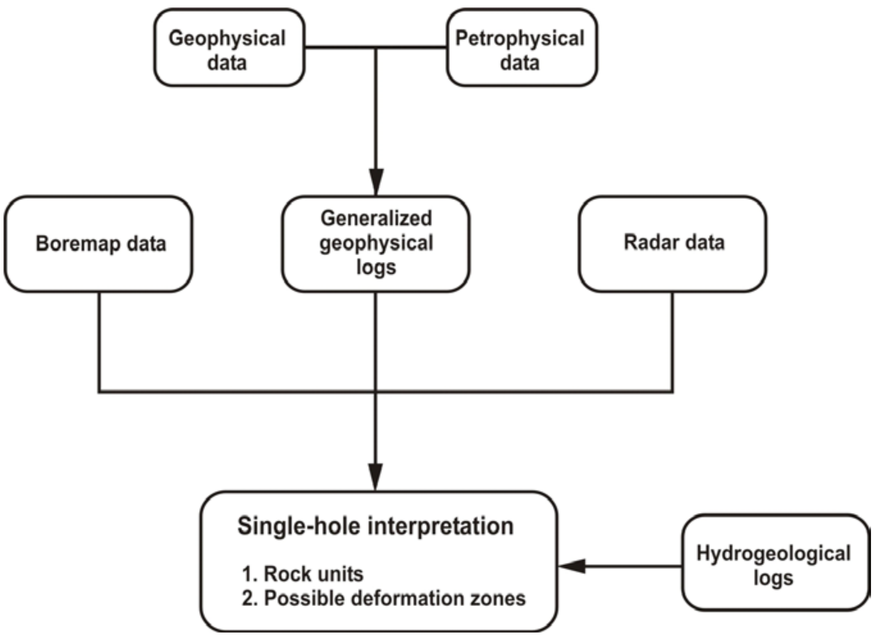

Figure 4-1. *Schematic chart showing the procedure for the development of a geological single-hole interpretation.*

Possible deformation zones that are brittle in character have been identified primarily on the basis of the frequency of fractures, according to the concept presented in /Munier et al. 2003/. Brittle deformation zones defined by an increased frequency of extensional fractures (joints) or shear fractures (faults) are not distinguished. Both the damage zone part, with a fracture frequency in the range 4–9 fractures/m, and the core zone part, with a fracture frequency > 9 fractures/m, have been included in each zone (Figure 4-2). The frequencies of open and sealed fractures have been assessed in the identification procedure, and the character of the zone has been described accordingly. Partly open fractures are included together with open fractures in the brief description of each zone. The presence of bedrock alteration, the occurrence and orientation of any radar reflectors, the resistivity, SPR, caliper and magnetic susceptibility logs have all assisted in the identification of the zones. The anomalies in these parameters that assist with the interpretation are presented in the short description.

Since the frequency of fractures is of key importance for the definition of the possible deformation zones, moving average plots for this parameter are shown for the cored borehole KFR105 (Figure 4-3). A 5 m window and 1 m step length have been used in the calculation procedure. The moving average for open fractures alone; the total number of open (including open, partly open and crush); the sealed fractures alone and the total number of sealed fractures (including sealed and sealed fracture networks) are shown in the diagram.

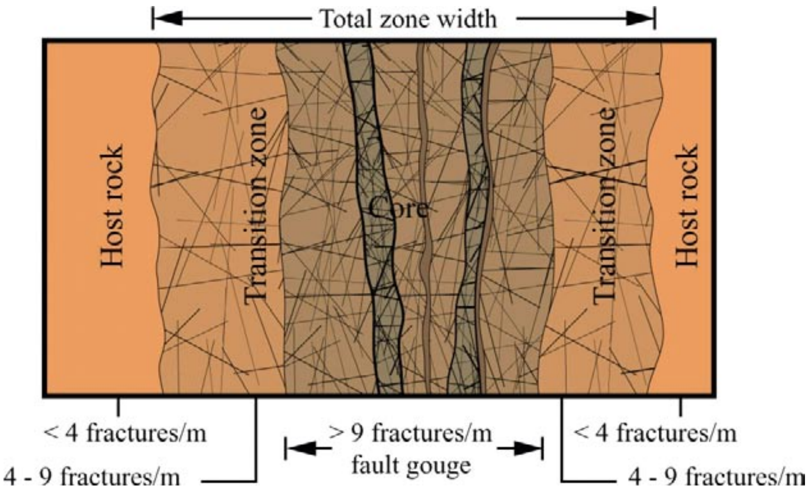

Figure 4-2. *Schematic illustration of the structure of a brittle deformation zone. After /Munier et al. 2003/. Note that the marked 'transition zone' corresponds to damage zone.*

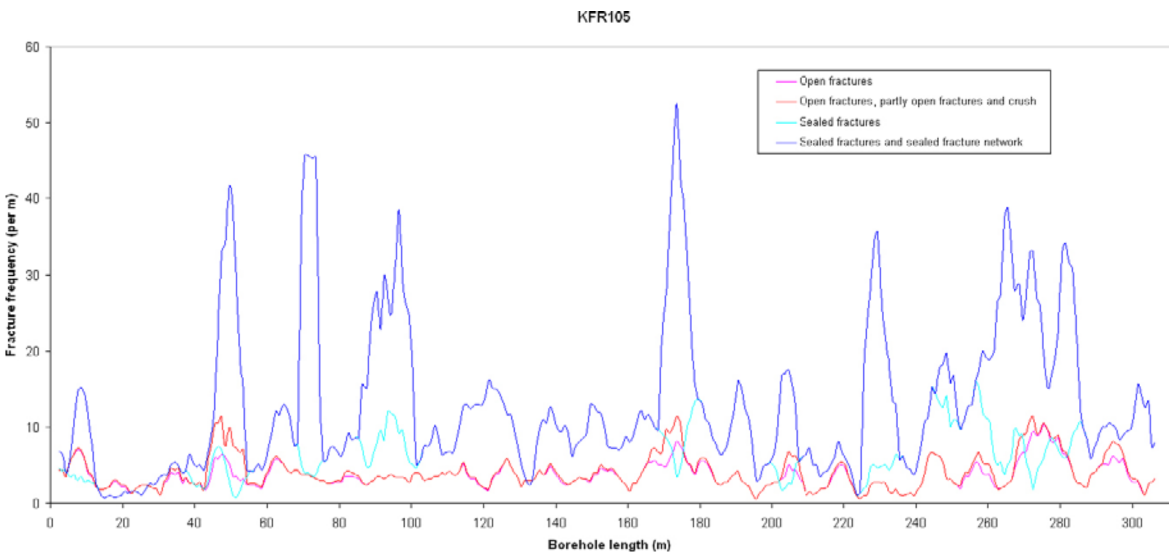

Figure 4-3. *Fracture frequency plot for KFR105. Moving average with a 5 m window and 1 m step length.*

The occurrence and orientation of radar anomalies within the possible deformation zones are used during the identification of these zones. Overview of the borehole radar measurements, based on 20 MHz dipole data, is presented in Figure 4-4. Along some intervals in the borehole, e.g. from 40 m to 50 m and from 165 m to 178 m the penetration is affected, probably due to relatively high electrical conductivity in the borehole fluid. Similarly, from approximately 245 m to the end of the borehole the penetration is very limited. The effect of attenuation varies between the different antenna frequencies (in this case 20 MHz dipole and 60 MHz directional antenna). In some cases, alternative orientations for oriented radar reflectors are presented, and a decision concerning which of the alternatives that represent the true orientation cannot be made. Orientations from the directional radar are presented as strike/dip using the right-hand-rule method.

4.2 Hydrogeological single-hole interpretation

The hydrogeological single-hole interpretation has been carried out by a hydrogeologist as a second step after, but in immediate connection to, the geological single-hole interpretation. All data to be used are presented side by side in the same borehole document as the geological and geophysical data. The hydrogeological columns were however not accessible at the geological interpretation stage.

In this particular case the single-hole interpretation concerned one cored borehole with differential flow logging data.

The methodology of the hydrogeological single-hole interpretation was to study the hydrogeological data for the identified possible deformation zones. The flow anomalies and hydraulic properties of each zone were then evaluated and described in comparison to the properties of the whole borehole.

4.3 Nonconformities

No BIPS images were available for the intervals 0.00–4.00 and 304.66–306.80 m of KFR105.

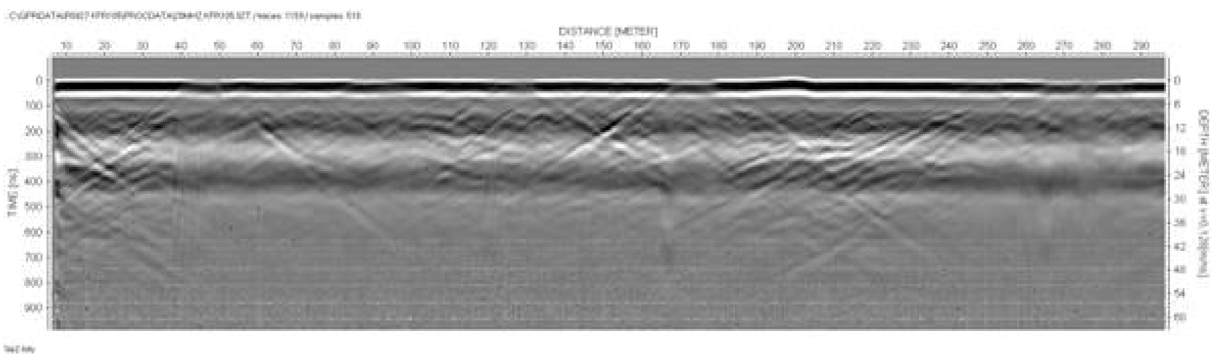

Figure 4-4. *An overview (20 MHz data) of the radar data for the borehole KFR105. The horizontal axis shows the borehole length and the vertical axis the distance from the borehole.*

5 Results

The results of the geological single-hole interpretation of KFR105 are presented as print-outs from the software WellCAD in Appendix 1.

5.1 KFR105

The coordinates at the reference point of KFR105 is 6701790 N, 1633073 E and the direction is 174.5°/–10.1° (RT 90 2.5 gon V 0:-15). The elevation is –106.8 m.a.s.l. (RHB70).

Rock Units

The borehole was divided into seven different rock units, RU1–RU7. Rock unit 1 occurs in three separate length intervals. All rock units have been interpreted with a high degree of confidence.

0.00–27.21 m

RU1a: Pegmatitic granite (101061) with one occurrence of fine- to medium-grained granite (111058) in the upper part. Confidence level = 3.

27.21–39.66 m

RU2: Fine to medium-grained metagranite-granodiorite (101057), locally veined by pegmatitic granite (101061). Confidence level = 3.

39.66–83.46 m

RU1b: Pegmatitic granite (101061) with subordinate occurrences of fine- to medium-grained granite (111058) and fine to medium-grained metagranite-granodiorite (101057). Confidence level = 3.

83.46–162.81 m

RU3: Fine to medium-grained metagranite-granodiorite (101057), with subordinate occurrences of pegmatitic granite (101061) and minor occurrences of fine- to medium-grained granite (111058), felsic to intermediate metavolcanic rock (103076) and amphibolite (102017). Confidence level = 3.

162.81–183.20 m

RU4: Felsic to intermediate metavolcanic rock (103076) with subordinate occurrences of pegmatitic granite (101061). Confidence level = 3.

183.20–221.18 m

RU5: Pegmatitic granite (101061) and fine- to medium-grained metagranite-granodiorite (101057) in approximately equal proportions. Confidence level = 3.

221.18–280.96 m

RU1c: Pegmatitic granite (101061) with subordinate occurrence of fine- to medium-grained granite (111058) and fine- to medium-grained metagranite-granodiorite (101057). One minor occurrence of amphibolite (102017). Confidence level = 3.

280.96–295.55 m

RU6: Fine- to medium-grained metagranite-granodiorite (101057) with occurrences of amphibolite (102017) and felsic to intermediate metavolcanic rock (103076) in the uppermost part. Confidence level = 3.

295.55–306.80 m

RU7: Pegmatitic granite (101061) with one minor occurrence of fine- to medium-grained metagranite-granodiorite (101057). Confidence level = 3.

Possible deformation zones

Five possible deformation zones of brittle character have been interpreted in KFR105, one with a medium degree of confidence and the other four with a high degree of confidence.

45–52 m

DZ1: Increased frequency of open and sealed fractures and sealed networks. Three minor crushes at 45.58–45.66, 47.97–48.01 and 51.67–51.73 m and one cataclasite at 45.59–45.75 m. Zone cores defined at 45.55–45.85 and 51.65–51.95 m. Fracture apertures in general up to 1mm, with one aperture at 5 mm. Predominant minerals in open fractures are clay minerals, calcite, chlorite and muscovite and in sealed fractures calcite, laumontite and clay minerals. Very local argillization at 45.52–45.75, 49.01–49.04 and 51.67–51.74 m. The entire interval is characterized by several low resistivity anomalies and decreased bulk resistivity (< 1,000 Ohm-m). One radar reflector at 47.6 m, oriented 062°/72° or 282°/54°. Pegmatitic granite (101061). Confidence level = 3.

Two low-transmissive flow anomalies at 45.8 m and 49.0 m ($T = 5 \cdot 10^{-9}$ and $1 \cdot 10^{-9}$ m^2/s, respectively). The total transmissivity of the section 43–53 m is about $1 \cdot 10^{-8}$ m^2/s.

88.5–96.5 m

DZ2: Increased frequency of sealed fractures and sealed networks. Fracture apertures in general up to 0.5 mm. Predominant fracture minerals are calcite, chlorite, adularia and oxidized walls. Generally weakly oxidized. A minor decrease in resistivity along the interval but no other indications in the geophysical logging data. Fine- to medium-grained metagranite-granodiorite (101057) and pegmatitic granite (101061). Confidence level = 3.

Three low-transmissive flow anomalies at 88.7, 94.9 and 95.7 m. The total transmissivity of the section is very low, about $2 \cdot 10^{-9}$ m^2/s.

170.8–176 m

DZ3: Increased frequency of sealed and open fractures and sealed networks. Zone core defined at 172.5–173.4 m. One minor crush at 172.82–172.86 m and one breccia at 173.11–173.19 m. Fracture apertures in general up to 0.5 mm. Predominant fracture minerals in open fractures are chlorite, oxidized walls, laumontite, calcite and clay minerals and in sealed fractures laumontite, calcite and oxidized walls. Local faint to moderate oxidation and chloritization. The section 172–176 m is characterized by significantly decreased bulk resistivity, < 1,000 Ohm-m in the zone core and a distinct anomaly in the fluid temperature data indicating a water bearing fracture. One distinct radar reflector at 173.6 m oriented 270°/38°. Felsic to intermediate metavolcanic rock (103076) and pegmatitic granite (101061). Confidence level = 3.

Increased frequency of flow anomalies, the two most significant at 172.7 and 173.0 m. The total transmissivity of the section is moderate, about $3 \cdot 10^{-7}$ m^2/s.

258–283 m

DZ4: Increased frequency of open fractures and especially sealed fractures along with sealed fracture networks. Two minor crushes at 259.80–259.82 and 270.31–270.38 m. Zone core defined at 279.7–281.0 m. Fracture apertures in general up to 0.5 mm. Very local moderate to strong oxidation and moderate laumontite alteration. Predominant fracture minerals in open fractures are laumontite, chlorite, calcite, oxidized walls, hematite and clay minerals and in sealed fractures laumontite, calcite and oxidized walls. Several significant low resistivity anomalies (< 2,000 Ohm-m), and two distinct anomalies in the fluid temperature data indicating water-bearing fractures. In the section 278–286 m there are significant caliper anomalies. Two radar reflectors without orientation at 271.0 and 277.9 m, and one radar reflector at 268.6 m oriented 316°/33° or 039°/45°. Pegmatitic granite (101061), fine- to medium-grained metagranite-granodiorite (101057) and felsic to intermediate metavolcanic rock (103076). Confidence level = 3.

Low transmissivity of the section ($T = 4 \cdot 10^{-8}$ m^2/s). The main flow anomaly is located at 267.3 m.

293.6–304 m

DZ5: Increased frequency of open and especially sealed fractures. One crush at 294.17–294.32 m. Fracture apertures in general up to 0.5 mm. No alteration. Predominant fracture minerals in open fractures are chlorite, calcite, muscovite and laumontite and in sealed fractures oxidized walls, laumontite, calcite and chlorite. The section is characterized by partly decreased resistivity. Pegmatitic granite (101061) and fine- to medium-grained metagranite-granodiorite (101057). Confidence level = 2.

Increased frequency of flow anomalies. The total transmissivity of the section is low, about $2 \cdot 10^{-8}$ m^2/s.

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WellCAD image

Title	SINGLE HOLE INTERPRETATION KFR105				
Site	FORSMARK - SFR	Inclination [°]	-10.14	Elevation [m.a.s.l.]	-106.82
Borehole	KFR105	Date of mapping	2009-06-23 09:42:00	Drilling Start Date	2009-04-21 00:00:00
Diameter [mm]	76	Coordinate System	RT90-RHB70	Drilling Stop Date	2009-06-02 00:00:00
Length [m]	306.810	Northing [m]	6701789.85	Surveying Date	
Bearing [°]	174.48	Easting [m]	1633072.96	Plot Date	2009-12-20 23:01:15

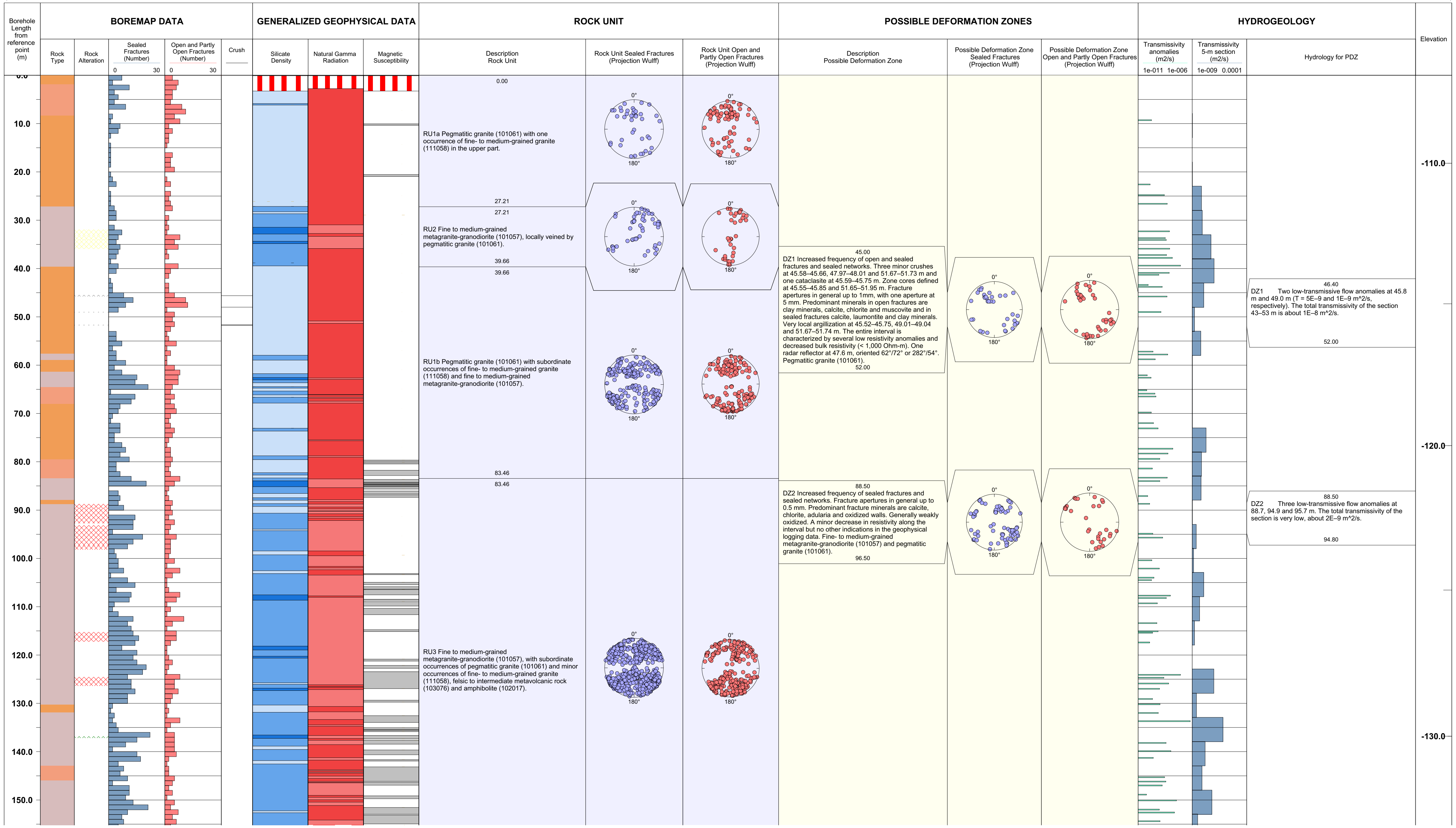
ROCKTYPE FORSMARK - SFR
- Granite, fine- to medium-grained
- Pegmatite, pegmatitic granite
- Granite to granodiorite, metamorphic, medium-grained
- Amphibolite
- Felsic to intermediate volcanic rock, metamorphic

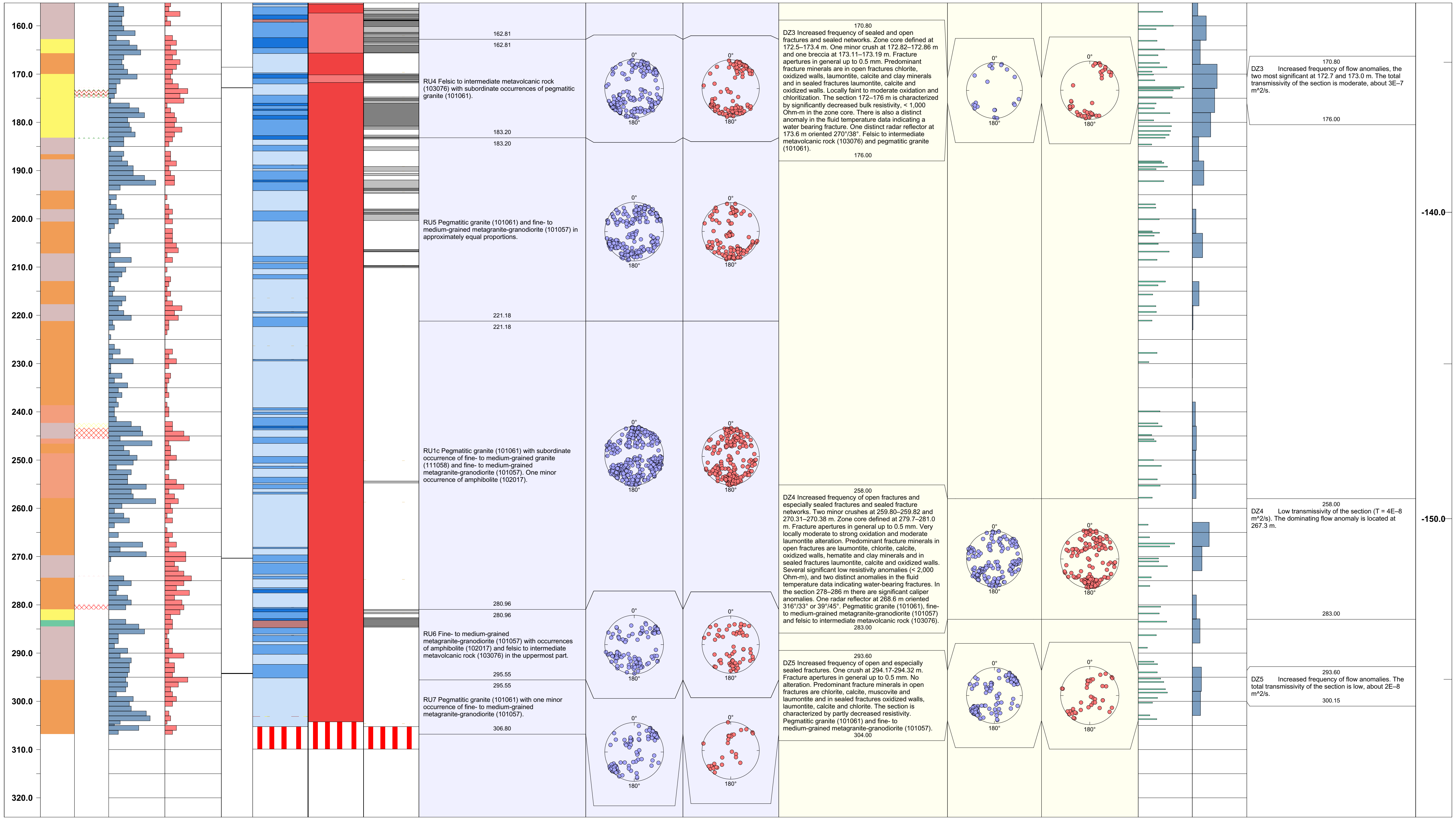
ROCK ALTERATION
- Oxidized
- Chloritisized
- Sericitisized
- Argillization
- Laumontitization

SILICATE DENSITY (kg/m³)
- unclassified
- dens<2680 (Granite)
- 2680<dens<2730 (Granodiorite)
- 2730<dens<2800 (Tonalite)
- 2800<dens<2890 (Diorite)

SUCEPTIBILITY (SI)
- unclassified
- sus<0.001
- 0.001<sus<0.01
- 0.01<sus<0.1
- sus>0.1

NATURAL GAMMA (µl)
- unclassified
- 36<gam<53
- 53<gam




160.0
170.0
180.0
190.0
200.0
210.0
220.0
230.0
240.0
250.0
260.0
270.0
280.0
290.0
300.0
310.0
320.0
162.81
162.81
RU4 Felsic to intermediate metavolcanic rock (103076) with subordinate occurrences of pegmatitic granite (101061).
183.20
183.20
RU5 Pegmatitic granite (101061) and fine- to medium-grained metagranite-granodiorite (101057) in approximately equal proportions.
221.18
221.18
RU1c Pegmatitic granite (101061) with subordinate occurrence of fine- to medium-grained granite (111058) and fine- to medium-grained metagranite-granodiorite (101057). One minor occurrence of amphibolite (102017).
280.96
280.96
RU6 Fine- to medium-grained metagranite-granodiorite (101057) with occurrences of amphibolite (102017) and felsic to intermediate metavolcanic rock (103076) in the uppermost part.
295.55
295.55
RU7 Pegmatitic granite (101061) with one minor occurrence of fine- to medium-grained metagranite-granodiorite (101057).
306.80
0°
180°
170.80
DZ3 Increased frequency of sealed and open fractures and sealed networks. Zone core defined at 172.5–173.4 m. One minor crush at 172.82–172.86 m and one breccia at 173.11–173.19 m. Fracture apertures in general up to 0.5 mm. Predominant fracture minerals are in open fractures chlorite, oxidized walls, laumontite, calcite and clay minerals and in sealed fractures laumontite, calcite and oxidized walls. Locally faint to moderate oxidation and chloritization. The section 172–176 m is characterized by significantly decreased bulk resistivity, < 1,000 Ohm-m in the zone core. There is also a distinct anomaly in the fluid temperature data indicating a water bearing fracture. One distinct radar reflector at 173.6 m oriented 270°/38°. Felsic to intermediate metavolcanic rock (103076) and pegmatitic granite (101061).
176.00
258.00
DZ4 Increased frequency of open fractures and especially sealed fractures and sealed fracture networks. Two minor crushes at 259.80–259.82 and 270.31–270.38 m. Zone core defined at 279.7–281.0 m. Fracture apertures in general up to 0.5 mm. Very locally moderate to strong oxidation and moderate laumontite alteration. Predominant fracture minerals in open fractures are laumontite, chlorite, calcite, oxidized walls, hematite and clay minerals and in sealed fractures laumontite, calcite and oxidized walls. Several significant low resistivity anomalies (< 2,000 Ohm-m), and two distinct anomalies in the fluid temperature data indicating water-bearing fractures. In the section 278–286 m there are significant caliper anomalies. One radar reflector at 268.6 m oriented 316°/33° or 39°/45°. Pegmatitic granite (101061), fine- to medium-grained metagranite-granodiorite (101057) and felsic to intermediate metavolcanic rock (103076).
283.00
293.60
DZ5 Increased frequency of open and especially sealed fractures. One crush at 294.17-294.32 m. Fracture apertures in general up to 0.5 mm. No alteration. Predominant fracture minerals in open fractures are chlorite, calcite, muscovite and laumontite and in sealed fractures oxidized walls, laumontite, calcite and chlorite. The section is characterized by partly decreased resistivity. Pegmatitic granite (101061) and fine- to medium-grained metagranite-granodiorite (101057).
304.00
170.80
DZ3 Increased frequency of flow anomalies, the two most significant at 172.7 and 173.0 m. The total transmissivity of the section is moderate, about 3E–7 m^2/s.
176.00
258.00
DZ4 Low transmissivity of the section (T = 4E–8 m^2/s). The dominating flow anomaly is located at 267.3 m.
283.00
293.60
DZ5 Increased frequency of flow anomalies. The total transmissivity of the section is low, about 2E–8 m^2/s.
300.15
-140.0
-150.0