P-07-107

Forsmark site investigation

Geological single-hole interpretation of KFM02B

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Hans Thunehed, GeoVista AB

October 2007

Svensk Kärnbränslehantering AB
Swedish Nuclear Fuel
and Waste Management Co
Box 5864
SE-102 40 Stockholm Sweden
Tel 08-459 84 00
+46 8 459 84 00
Fax 08-661 57 19
+46 8 661 57 19

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Keywords: Forsmark, Geophysics, Geology, Borehole, Bedrock, Fractures, AP PF 400-07-015.

Abstract

This report presents a geological single-hole interpretation of the cored borehole KFM02B at Forsmark. The interpretation combines the geological core mapping, generalized geophysical logs and borehole radar measurements to identify where rock units and possible deformation zones occur in the borehole. A brief description of the character of each rock unit and possible deformation zone is provided.

The geological single-hole interpretation shows that two rock units (RU1–RU2) occur in KFM02B. However, the borehole can be divided into three separate sections due to the repetition of RU1 (RU1a and RU1b). Medium-grained metagranite-granodiorite (101057) dominates the borehole. A large section in the central part of the borehole contains fine-to medium-grained granite (111058) and pegmatitic granite (101061). Subordinate rock type is amphibolite (102017). Six possible deformation zones of brittle character have been identified in KFM02B (DZ1–DZ6).

Sammanfattning

Denna rapport behandlar geologisk enhålstolkning av kärnborrhål KFM02B i Forsmark. Den geologiska enhålstolkningen syftar till att utifrån den geologiska karteringen, tolkade geofysiska loggar och borrhålsradarmätningar indikera olika litologiska enheters fördelning i borrhålet samt möjliga deformationszoners läge och utbredning. En kort beskrivning av varje bergenhet och möjlig deformationszon presenteras.

Denna undersökning visar att det i KFM02B finns två litologiska enheter (RU1–RU2). Baserat på repetition av enhet RU1 (RU1a och RU1b) kan borrhålet delas in i tre sektioner. Medelkorning metagranit-granodiorit (101057) dominerar borrhålet. En större sektion i mitten av borrhålet innehåller fin- till medelkorning granit (111058) och pegmatitisk granit (101061). I mindre omfattning förekommer amfibolit (102017). Sex möjliga deformationszoner som är spröda har identifierats i KFM02B (DZ1–DZ6).

Contents

1 Introduction

Much of the primary geological and geophysical borehole data stored in the SKB database SICADA need to be integrated and synthesized before they can be used for modelling in the 3D-CAD Rock Visualization System (RVS). The end result of this procedure is a geological single-hole interpretation, which consists of an integrated series of different logs and accompanying descriptive documents.

This document reports the geological single-hole interpretation of borehole KFM02B in the Forsmark area. The horizontal projection of the borehole is shown in Figure 1-1. The work was carried out in accordance with Activity Plan AP PF 400-07-015. The controlling documents for performing this activity are listed in Table 1-1. Both the activity plan and method description are SKB's internal controlling documents.

Original data from the reported activity are stored in the primary database Sicada, where they are traceable by the Activity Plan number (AP PF 400-07-015). 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 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**
Geologisk enhålstolkning av KFM02B, HFM33, HFM34 och HFM35	AP PF 400-07-015	1.0
Method description	**Number**	**Version**
Metodbeskrivning för geologisk enhålstolkning	SKB MD 810.003	3.0

Figure 1-1. *Map showing position and horizontal projection of the cored borehole KFM02B.*

2 Objective and scope

A geological single-hole interpretation is carried out in order to identify and to describe briefly the 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 the borehole (Boremap), different borehole geophysical logs and borehole radar data.

The geological mapping of the cored borehole involves a documentation of the character of the bedrock in the drill core. This work component is carried out in combination with an inspection of the oriented image of the borehole walls that is obtained with the help of the Borehole Image Processing System (BIPS). The interpretations of the borehole geophysical and radar logs are available when the single-hole interpretation is completed. The result from the geological single-hole interpretation is presented in a WellCad plot. A more detailed description of the technique is provided in the method description for geological single-hole interpretation (SKB MD 810.003, internal document). 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 and interpretations have been used for the single-hole interpretation of the borehole KFM02B:

- Boremap data (including BIPS and geological mapping data) /3/.
- Generalized geophysical logs and their interpretation /4/.
- Radar data and their interpretation /5/.

The material used as a basis for the geological single-hole interpretation was a WellCad plot consisting of parameters from the geological mapping in the Boremap system, geophysical logs and borehole radar. An example of a WellCad plot used during geological single-hole interpretation is shown in Figure 3-1. The plot consists of ten main columns and several subordinate columns. These include:

1: Length along the borehole

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

3: Unbroken fractures
   3.1: Primary mineral
   3.2: Secondary mineral
   3.3: Third mineral
   3.4: Fourth mineral
   3.5: Alteration, dip direction

4: Broken fractures
   4.1: Primary mineral
   4.2: Secondary mineral
   4.3: Third mineral
   4.4: Fourth mineral
   4.5: Aperture (mm)
   4.6: Roughness
   4.7: Surface
   4.8: Alteration, dip direction

5: Crush zones
   5.1: Primary mineral
   5.2: Secondary mineral
   5.3: Third mineral
   5.4: Fourth mineral
   5.5: Roughness
   5.6: Surface
   5.7: Crush alteration, dip direction
   5.8: Piece (mm)
   5.9: Sealed network
   5.10: Core loss

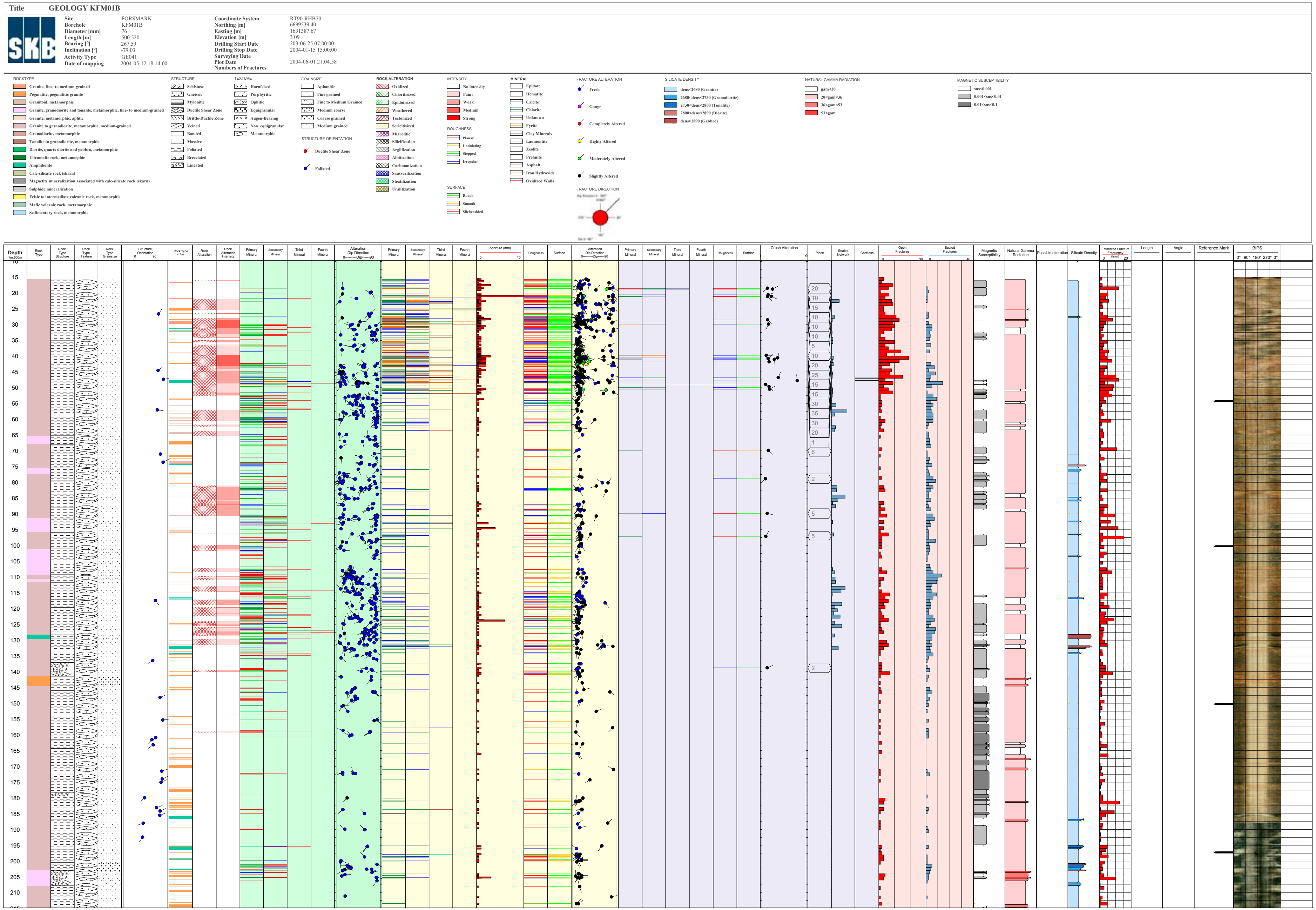

***Figure 3-1.** Example of WellCad plot (from borehole KFM01B) used as a basis for the single-hole interpretation.*

6: Fracture frequency
   6.1: Open fractures
   6.2: Sealed fractures

7: Geophysics
   7.1: Magnetic susceptibility
   7.2: Natural gamma radiation
   7.3: Possible alteration
   7.4: Silicate density
   7.5: Estimated fracture frequency

8: Radar
   8.1: Length
   8.2: Angle

9: Reference mark (not used for percussion-drilled boreholes)

10: BIPS

The geophysical logs are described below:

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 in the different rock types.

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 or pegmatite. The rocks with high natural gamma radiation have been included in the younger, Group D intrusive suite /1/.

Possible alteration: This parameter has not been used in the geological single-hole interpretation in the Forsmark area.

Silicate density: This parameter indicates the density of the rock after subtraction of the magnetic component in the rock. It provides general information on the mineral composition of the rock types, and serves as a support during classification of rock types.

Estimated fracture frequency: This parameter provides an estimate of the fracture frequency along 5 m sections, calculated from short and long normal resistivity, SPR, P-wave velocity as well as focused resistivity 140 and 300. The estimated fracture frequency is based on a statistical connection after a comparison has been made between the geophysical logs and the mapped fracture frequency. The log provides an indication of sections with low and high fracture frequencies.

Close 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.

4 Execution of the geological single-hole interpretation

4.1 General

The geological single-hole interpretation has been carried out by a group of geoscientists consisting of both geologists and geophysicists. Several of these geoscientists previously participated in the development of the source material for the single-hole interpretation. All data to be used (see Chapter 3) are visualized 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 (rock type, rock alteration, silicate density, natural gamma radiation, etc) 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 (minimum length of c. 5 m). 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 made on the following basis: 3 = high, 2 = medium and 1 = low.

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, aperture, alteration, etc) in combination with the geophysical logging and radar 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. The confidence in the interpretation of a possible deformation zone is made on the following basis: 3 = high, 2 = medium and 1 = low.

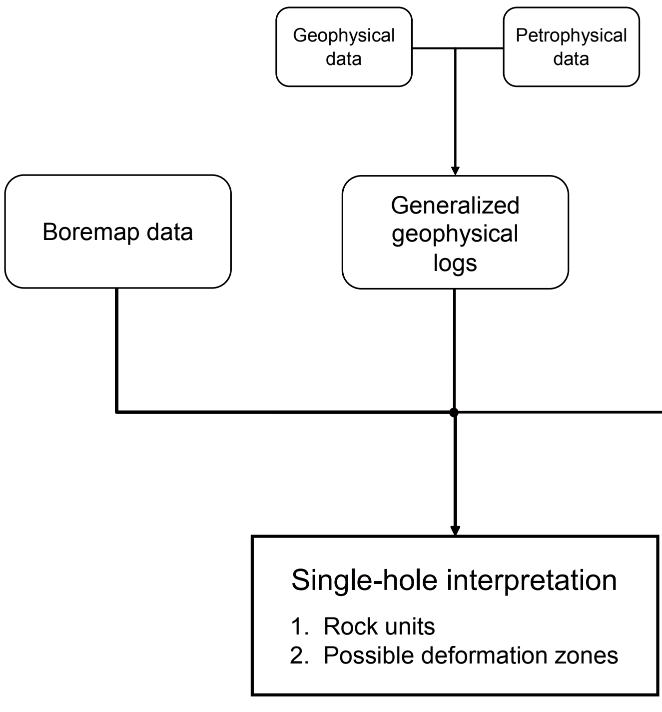

Figure 4-1. Schematic chart that shows the procedure for the development of a geological single-hole interpretation.

Inspection of BIPS images is carried out wherever it is judged necessary during the working procedure. Furthermore, following 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 location of these boundaries is adjusted.

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 /2/. Brittle deformation zones defined by an increased fracture frequency of extensional fractures (joints) or shear fractures (faults) are not distinguished. Both the transitional part, with a fracture frequency in the range 4–9 fractures/m, and the core 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, locally, inferred orientation of radar reflectors, the resistivity, SPR, P-wave velocity, caliper and magnetic susceptibility logs have all assisted in the identification of the zones. The anomalies in these parameters that assist with the identification 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 KFM02B (Figure 4-3). A 5 m window and 1 m steps have been used in the calculation procedure. The moving average for open fractures alone, the total number of open fractures (open, partly open and crush), the sealed fractures alone, and the total number of sealed fractures (sealed and sealed fracture network) are shown in each diagram.

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 measurement in KFM02B is shown in Figure 4-4. A conductive environment causes attenuation of the radar wave, which in turn decreases the penetration. The effect of attenuation can be observed in the borehole and is conspicuous in the parts at 100–170 m and 400–500 m in KFM02B (Figure 4-4). The effect of attenuation varies between the different antenna frequencies (20 MHz, 100 MHz, 250 MHz and 60 MHz directional antenna). In some cases, alternative orientations for oriented radar reflectors are presented. One of the alternatives is considered to be correct, but due to uncertainty in the interpretation of radar data, a decision concerning which of the alternatives that represent the true orientation cannot be made. Orientations from directional radar are presented as strike/dip using the right-hand-rule.

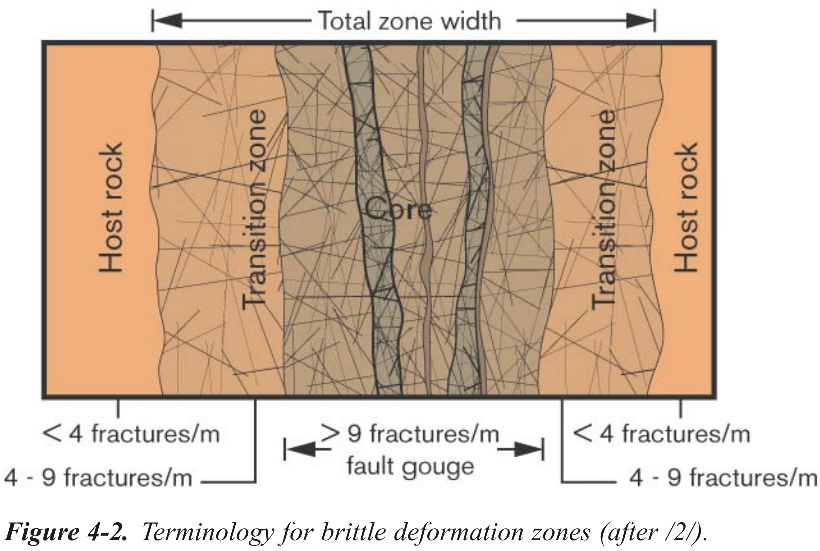

Figure 4-2. *Terminology for brittle deformation zones (after /2/).*

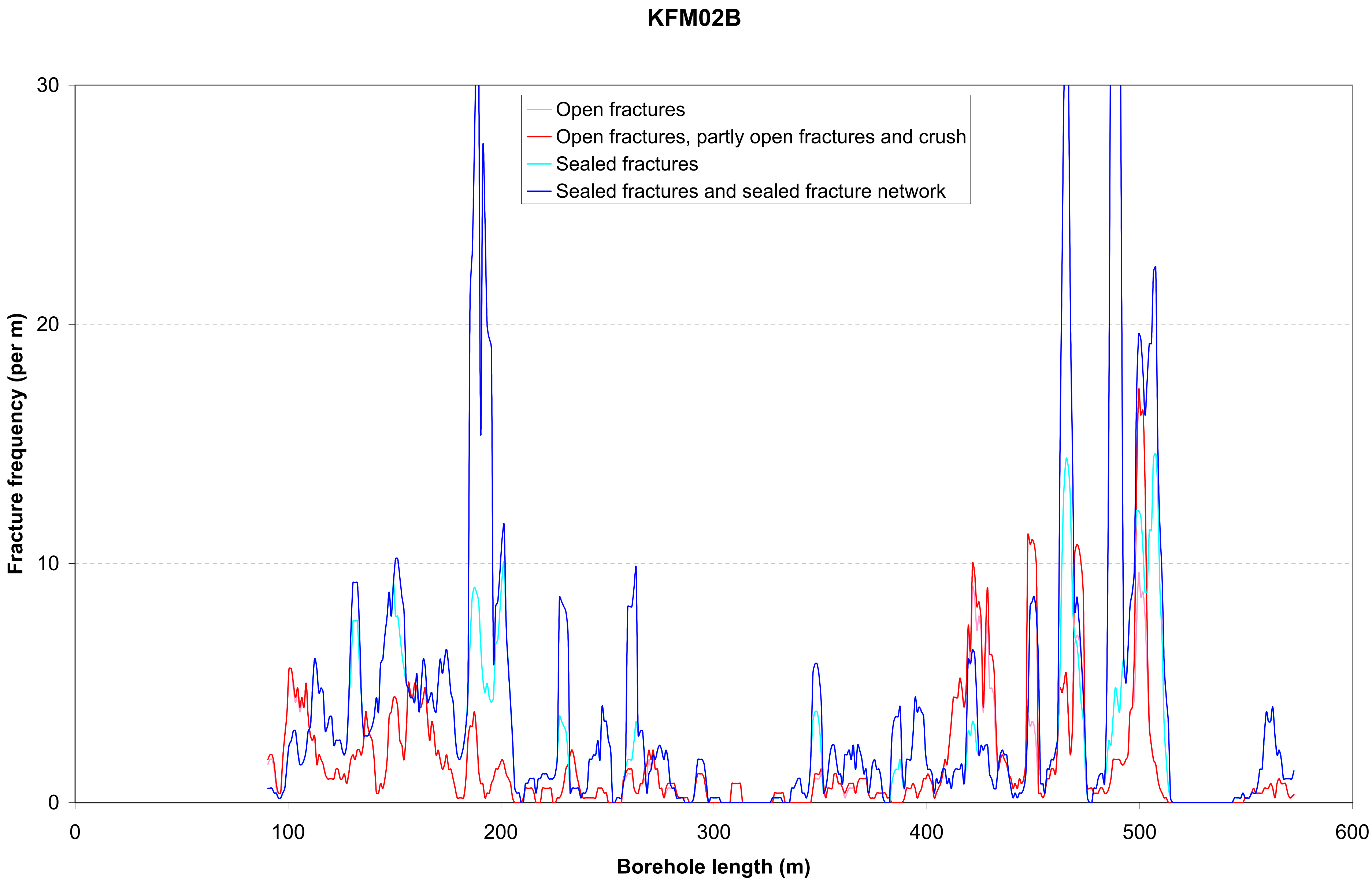

Figure 4-3. Fracture frequency plot for KFM02B. Moving average with a 5 m window and 1 m steps.

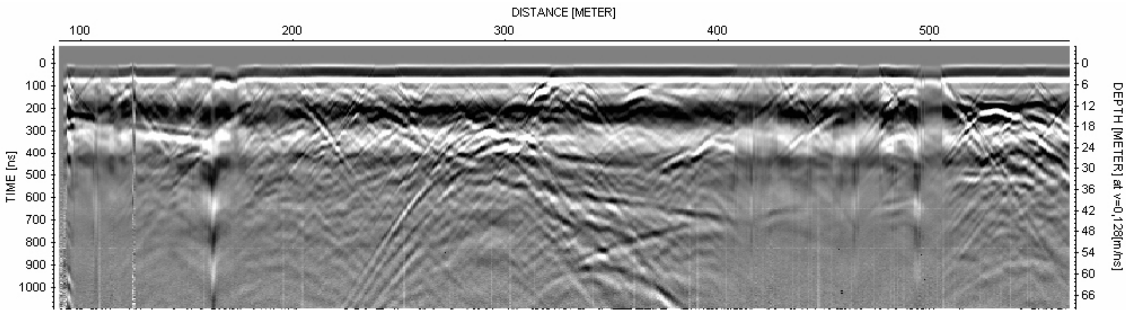

__Figure 4-4.__ Overview (20 MHz data) of the borehole radar measurements in KFM02B. Observe that the subparallel structure seen from 100 m to 400 m borehole length shows the location of KFM02A.

4.2 Nonconformities

The section 512.27–542.27 m adjusted length in KFM02B was mapped without access to drill core. Drill core was missing due to sampling for porosity investigation.

5 Results

The results of the geological single-hole interpretation are presented as print-outs from the software WellCad (Appendix 1 for KFM02B).

5.1 KFM02B

The borehole direction at the start is 313°/–80°.

Rock units

The borehole can be divided into two different rock units, RU1–RU2. Rock unit 1 occurs in two separate length intervals. The rock units have been recognized with a high degree of confidence.

88.55–323.38 m

RU1a: Medium-grained metagranite-granodiorite (101057), and subordinate occurrences of amphibolite (102017) and pegmatitic granite (101061). Fine- to medium-grained metagranitoid (101051) with a granodioritic composition and fine- to medium-grained granite (111058) are also present. Confidence level = 3.

323.38–428.67 m

RU2: Fine- to medium-grained granite (111058), which dominates above 393 m, and pegmatitic granite (101061), and subordinate occurrences of medium-grained metagranite-granodiorite (101057), fine- to medium-grained metagranitoid (101051) and amphibolite (102017). The natural gamma radiation increases with depth and the density decreases correspondingly in accordance with the change over from fine- to medium-grained granite to pegmatitic granite. Subparallel radar reflector identified along this borehole interval, approximately 30 m from the borehole. Confidence level = 3.

428.67–569.96 m

RU1b: Medium-grained metagranite-granodiorite(101057), and subordinate occurrences of amphibolite (102017) and pegmatitic granite (101061). One occurrence of medium-grained metadiorite-gabbro (101033) at 464–468 m. Subparallel radar reflector identified from 510–550 m, approximately 30 m from the borehole. Confidence level = 3.

Possible deformation zones

Six possible deformation zones of brittle character, of which all have been recognised with a high degree of confidence, are present in KFM02B.

98–115 m

DZ1: Increased frequency of open fractures throughout the possible deformation zone and sealed fractures in the lowermost part of the possible deformation zone. Variable orientations of both open and sealed fractures. Fracture apertures generally less than 1 mm, with one at 4 mm. Predominant fracture minerals are calcite and chlorite. The upper part is affected by faint to weak oxidation. Low resistivity, P-wave velocity and magnetic susceptibility. Seven radar reflectors with an intersection angle of 60–80º have been identified. Possible zone situated in medium-grained metagranite-granodiorite with subordinate amounts of amphibolite and pegmatitic granite. Confidence level = 3.

145–204 m

DZ2: Increased frequency of sealed and open fractures, with sealed networks concentrated in the lower part. Fractures strike approximately NE and dip variably to the SE. Higher frequency of gently dipping open fractures. Fracture apertures generally less than 1 mm, and one at 2 mm. Predominant fracture minerals are calcite, chlorite, adularia and hematite. Locally faint to weak oxidation. The entire interval shows several moderate resistivity anomalies with corresponding low magnetic susceptibility. Twenty-three radar reflectors of which two are oriented (172/12 and 297/83). An interval of vuggy granite with weak to medium quartz dissolution, strong oxidation and weak chloritization at 166.79–168.90 m. Between 165 and 171 m low resistivity, density, P-wave velocity and magnetic susceptibility. Possible zone situated in medium-grained metagranite-granodiorite with subordinate amounts of amphibolite and pegmatitic granite. Confidence level = 3.

411–431 m

DZ3: Increased frequency of open and sealed fractures. The fractures are gently dipping. Fracture apertures are generally 2 mm or less. Predominant fracture minerals are calcite and chlorite. Several fractures do not have a visible mineral coating or filling. The zone is affected by weak oxidation. Low resistivity, P-wave velocity and magnetic susceptibility. Eight radar reflectors with an intersection angle of 19–81º have been identified. Most of the possible zone occurs in pegmatitic granite, but continues downwards across the contact to the medium-grained metagranite-granodiorite. Confidence level = 3.

447–451 m

DZ4: Increased frequency of sealed fractures and a crush zone at 449.42–449.50 m. Variable orientations of both open and sealed fractures. Locally weak oxidation. Predominant fracture minerals are calcite and chlorite. Several fractures do not have a visible mineral coating or filling. Low resistivity, P-wave velocity and magnetic susceptibility. Two radar reflectors of which one is oriented (350/60). The possible zone occurs in medium-grained metagranite-granodiorite directly above the contact to amphibolite. Confidence level = 3.

462–473 m

DZ5: Increased frequency of open and sealed fractures particularly at both ends of the possible zone. Gently dipping fractures dominate. Steeply dipping sealed fractures that strike NNE and dip to the ESE are also present. Two crush zones at 471.46–471.49 m and 471.58–471.67 m. Fracture apertures are generally less than 1 mm, with a few ranging up to 5 mm. Predominant fracture minerals are calcite, prehnite, chlorite, clay minerals and epidote. Low resistivity, P-wave velocity and magnetic susceptibility. Two radar reflectors with intersection angles of 74 and 81º have been identified. The upper part of the possible zone occurs in amphibolite and continues downwards across the contact into medium-grained metagranite-granodiorite, with subordinate occurrences of pegmatitic granite. Confidence level = 3.

485–512 m

DZ6: Increased frequency of sealed, and in the central part, open fractures. Gently dipping fractures dominate. Three crush zones at 499.95–500.02 m, 500.64–500.71 m and 501.00–501.02 m. Fracture apertures are generally less than 1 mm, with a few ranging up to 5 mm. Locally weak to medium oxidation. Predominant fracture minerals are chlorite, calcite, prehnite, epidote and clay minerals. Low resistivity and in the central part low P-wave velocity and magnetic susceptibility. Four radar reflectors with an intersection angle of 58–80º have been identified. The uppermost part of the possible zone occurs in amphibolite and continues downwards across the contact into medium-grained metagranite-granodiorite, with subordinate occurrences of pegmatitic granite. Confidence level = 3.

6 Comments

The results of the geological single-hole interpretation of KFM02B are presented in a WellCad plot (Appendix 1). The WellCad plot consists of the following columns:

1: Depth (length along the borehole)

2: Rock type

3: Rock alteration

4: Sealed fractures

5: Open and partly open fractures

6: Crush zones

7: Silicate density

8: Magnetic susceptibility

9: Natural gamma radiation

10: Estimated fracture frequency

11: Description: Rock unit

12: Stereogram for sealed fractures in rock unit (blue symbols)

13: Stereogram for open and partly open fractures in rock unit (red symbols)

14: Description: Possible deformation zone

15: Stereogram for sealed fractures in possible deformation zone (blue symbols)

16: Stereogram for open and partly open fractures in possible deformation zone (red symbols)

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/2/ **Munier R, Stenberg L, Stanfors R, Milnes A G, Hermanson J, Triumf C-A, 2003.** Geological site descriptive model. A strategy for the model development during site investigations. SKB R-03-07, Svensk Kärnbränslehantering AB.

/3/ **Samuelsson E, 2007.** Forsmark site investigation. Boremap mapping of telescopic drilled borehole KFM02B. SKB P-07-102, Svensk Kärnbränslehantering AB.

/4/ **Mattsson H, Keisu M, 2007.** Forsmark site investigation. Interpretation of geophysical borehole measurements from KFM02B, KFM08D and KFM11A. SKB P-07-125, Svensk Kärnbränslehantering AB.

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Geological single-hole interpretation of KFM02B

Title	SINGLE HOLE INTERPRETATION KFM02B					
Site	FORSMARK	Inclination [°]	-80.26	Elevation [m.a.s.l.]	7.62	Signed data
Borehole	KFM02B	Date of mapping	2006-11-27 13:41:00	Drilling Start Date	2006-01-18 14:00:00	
Diameter [mm]	76	Coordinate System	RT90-RHB70	Drilling Stop Date	2007-02-13 00:00:00	
Length [m]	573.870	Northing [m]	6698719.19	Surveying Date		
Bearing [°]	313.06	Easting [m]	1633186.29	Plot Date	2007-10-09 22:03:00	

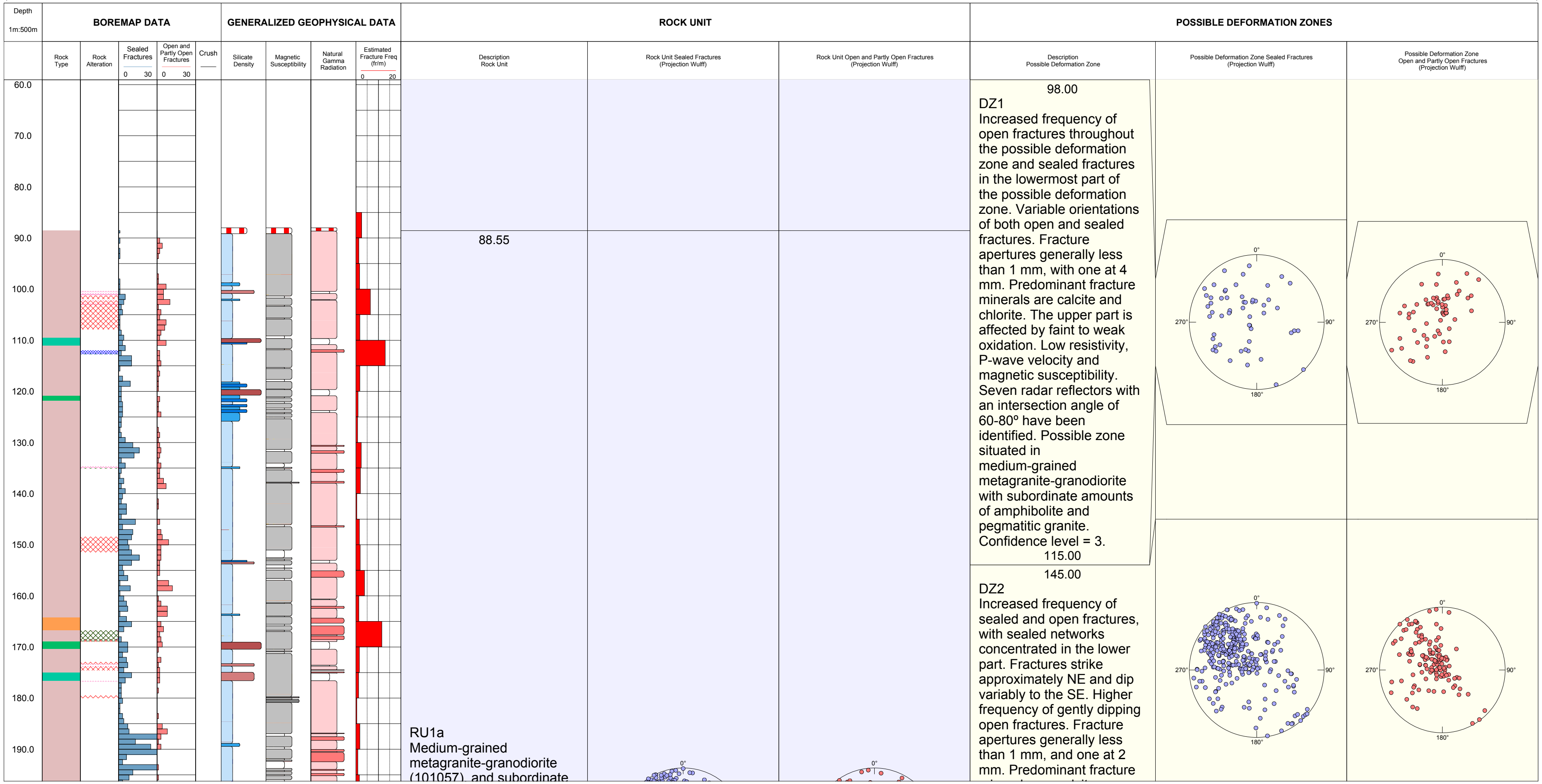
ROCKTYPE FORSMARK
- Granite, fine- to medium-grained
- Pegmatite, pegmatitic granite
- Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained
- Granite to granodiorite, metamorphic, medium-grained
- Diorite, quarts diorite and gabbro, metamorphic
- Amphibolite

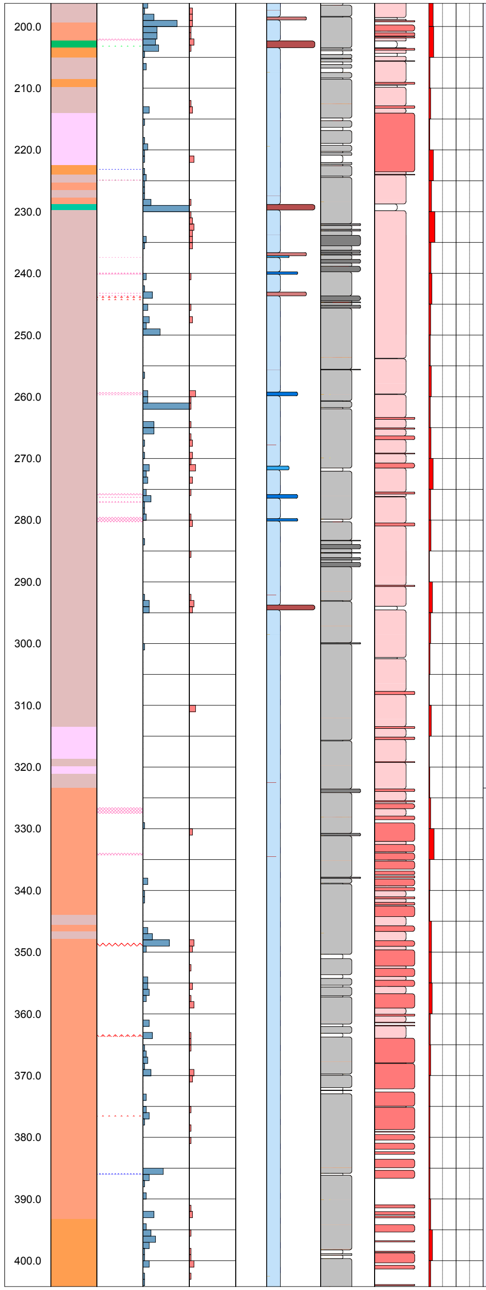
ROCK ALTERATION
- Oxidized
- Chloritisized
- Epidotisized
- Sericitisized
- Quartz dissolution
- Argillization
- Albitization
- Saussuritization

SILICATE DENSITY
- unclassified
- dens<2680 (Granite)
- 2680<dens<2730 (Granodiorite)
- 2730<dens<2800 (Tonalite)
- 2800<dens<2890 (Diorite)
- dens>2890 (Gabbro)

SUSCEPTIBILITET
- unclassified
- sus<0.001
- 0.001<sus<0.01
- 0.01<sus<0.1

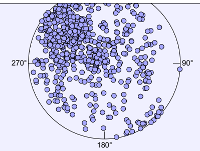
NATURAL GAMMA
- unclassified
- gam<20
- 20<gam<36
- 36<gam<53

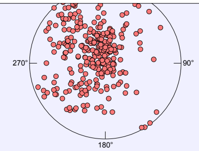




(101057), and subordinate occurrences of amphibolite (102017) and pegmatitic granite (101061). Fine- to medium-grained metagranitoid (101051) with a granodioritic composition and fine- to medium-grained granite (111058) are also present. Confidence level = 3.

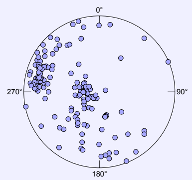
323.38

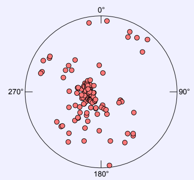




323.38

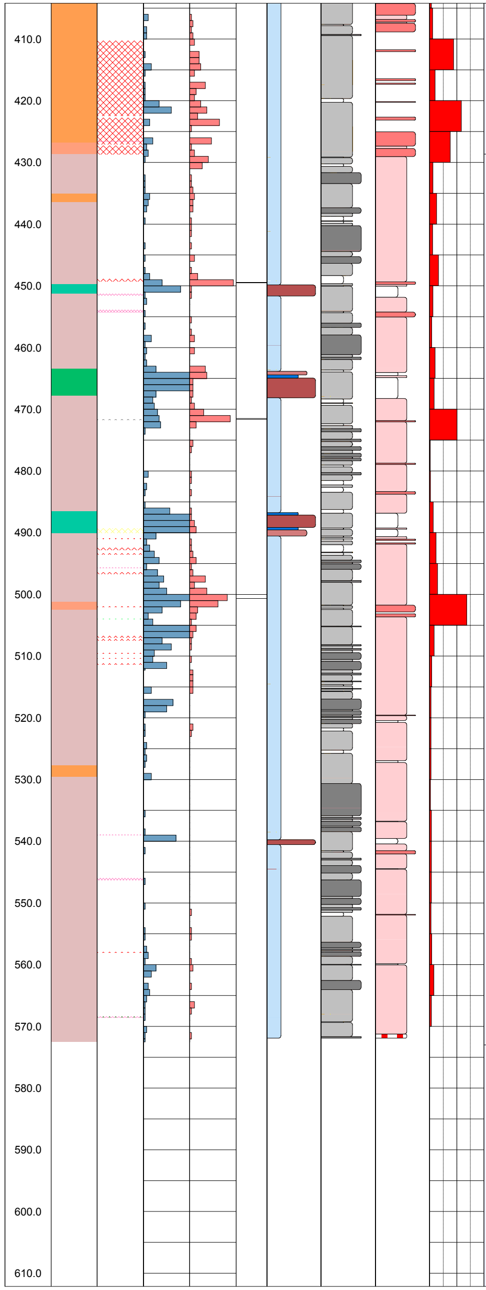
RU2
Fine- to medium-grained granite (111058), which dominates above 393 m, and pegmatitic granite (101061), and subordinate occurrences of medium-grained metagranite-granodiorite (101057), fine- to medium-grained metagranitoid (101051) and amphibolite (102017). The natural gamma radiation increases with depth and the density decreases correspondingly in accordance with the change over from fine- to medium-grained granite to pegmatitic granite. Subparallel radar reflector identified along this





minerals are calcite, chlorite, adularia and hematite. Locally faint to weak oxidation. The entire interval shows several moderate resistivity anomalies with corresponding low magnetic susceptibility. Twenty-three radar reflectors of which two are oriented (172/12 and 297/83). An interval of vuggy granite with weak to medium quartz dissolution, strong oxidation and weak chloritization at 166.79-168.90 m. Between 165 and 171 m low resistivity, density, P-wave velocity and magnetic susceptibility. Possible zone situated in medium-grained metagranite-granodiorite with subordinate amounts of amphibolite and pegmatitic granite. Confidence level = 3.
204.00

411.00
DZ3
Increased frequency of open and sealed fractures. The fractures are gently dipping. Fracture apertures are generally 2 mm or less. Predominant fracture minerals are



borehole interval, approximately 30 m from the borehole. Confidence level = 3.

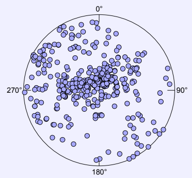
428.67

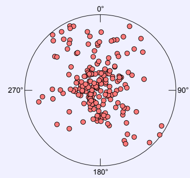
428.67

RU1b

Medium-grained metagranite-granodiorite(10· and subordinate occurrences of amphibolite (102017) and pegmatitic granite (101061). One occurrence of medium-grained metadiorite-gabbro (101033) at 464-468 m. Subparallel radar reflector identified from 510-550 m, approximately 30 m from the borehole. Confidence level = 3.

573.00





calcite and chlorite. Several fractures do not have a visible mineral coating or filling. The zone is affected by weak oxidation. Low resistivity, P-wave velocity and magnetic susceptibility. Eight radar reflectors with an intersection angle of 19-81° have been identified. Most of the possible zone occurs in pegmatitic granite, but continues downwards across the contact to the medium-grained metagranite-granodiorite. Confidence level = 3.

431.00

447.00

DZ4

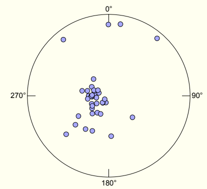
Increased frequency of sealed fractures and a crush zone at 449.42-449.50 m. Variable orientations of both open and sealed fractures. Locally weak oxidation. Predominant fracture minerals are calcite and chlorite. Several fractures do not have a visible mineral coating or filling. Low resistivity, P-wave velocity and magnetic susceptibility. Two radar reflectors of which one is oriented (350/60). The possible zone occurs in medium-grained metagranite-granodiorite directly above the contact to amphibolite. Confidence level = 3.

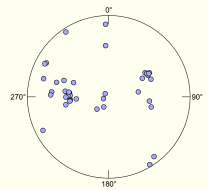
451.00

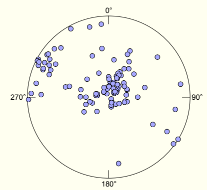
462.00

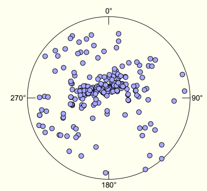
DZ5

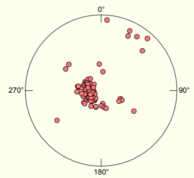
Increased frequency of open and sealed fractures particularly at both ends of the possible zone. Gently dipping fractures dominate. Steeply dipping sealed fractures that strike NNE and dip to the ESE are also present. Two crush zones at 471.46-471.49 m and 471.58-471.67 m. Fracture apertures are generally less than 1 mm, with a few ranging up to 5 mm. Predominant fracture minerals are calcite, prehnite, chlorite, clay minerals and epidote. Low resistivity, P-wave velocity and magnetic susceptibility. Two radar

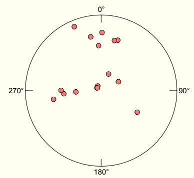


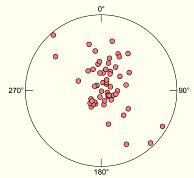


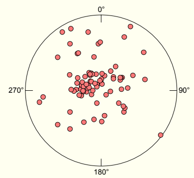












	reflectors with intersection angles of 74 and 81º have been identified. The upper part of the possible zone occurs in amphibolite and continues downwards across the contact into medium-grained metagranite-granodiorite, with subordinate occurrences of pegmatitic granite. Confidence level = 3. 473.00
620.0	
630.0	
640.0	
650.0	
	485.00 DZ6 Increased frequency of sealed, and in the central part, open fractures. Gently dipping fractures dominate. Three crush zones at 499.95-500.02 m, 500.64-500.71 m and 501.00-501.02 m. Fracture apertures are generally less than 1 mm, with a few ranging up to 5 mm. Locally weak to medium oxidation. Predominant fracture minerals are chlorite, calcite, prehnite, epidote and clay minerals. Low resistivity and in the central part low P-wave velocity and magnetic susceptibility. Four radar reflectors with an intersection angle of 58-80º have been identified. The uppermost part of the possible zone occurs in amphibolite and continues downwards across the contact into medium-grained metagranite-granodiorite, with subordinate occurrences of pegmatitic granite. Confidence level = 3. 512.00
660.0	
670.0	
680.0	
690.0	
700.0	
710.0	
720.0	
730.0	
740.0	
750.0	
760.0	