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Laboratory measurements within the site investigation programme for the transport properties of the rock

Final report

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Abstract

This report presents data gained from laboratory investigations of diffusivity and sorption characteristics, which are part of the discipline-specific programme "Transport Properties of the Rock" within the SKB site investigations. The laboratory investigations started in 2003 and were terminated during 2007.

The cored boreholes concerned in the investigation are: KFM01A, KFM01B, KFM02A, KFM03A, KFM03B, KFM04A, KFM05A, KFM06A, KFM06B, KFM07A, KFM08A, KFM08C, KFM09A and KFM10A. Major and minor rock types, fracture types and some kinds of altered rock found in deformation zones at the Forsmark area are represented in the rock sample collection. Generally, the laboratory work has followed the method descriptions and activity plans with exception for a slight modification of the method description for batch sorption.

The parameters that are determined for the rock materials are: porosity, porosity distribution, effective diffusivity, specific surface area (BET), cation exchange capacity (CEC) and sorption coefficients. Some complementary investigations addressing experiments (BET surface area measurements and batch sorption experiments) using intact drill core have also been performed. No analyses or interpretations of the data results are included in this report.

Sammanfattning

Föreliggande rapport redovisar de resultat som erhållits från laboratoriemätningar av diffusions- och sorptionsegenskaper inom programmet för ”Bergets transportegenskaper” inom SKB:s platsundersökningar. Laboratoriemätningarna startade 2003 och avslutades 2007.

De borrhål som ingår i undersökningarna är: KFM01A, KFM01B, KFM02A, KFM03A, KFM03B, KFM04A, KFM05A, KFM06A, KFM06B, KFM07A, KFM08A, KFM08C, KFM09A och KFM10A. Provurvalet representerar såväl huvudbergarter som sekundära bergarter, varierande spricktyper och olika typer av omvandlingar vilka är förekommande i deformationszoner inom Forsmarks platsundersökningsområde. Laboratorieundersökningarna har i stort följt metodbeskrivningar och aktivitetsplaner, med undantag för en mindre modifiering av metodbeskrivningen för batchsorption.

De parametrar som bestämts är: porositet, porositetsfördelning, effektiv diffusivitet, specifik ytarea (BET), katjonbyteskapacitet (CEC) och sorptionskoefficienter. Några kompletterande försök (BET- och batchsorptionsmätningar) med hela borrkärnor har också genomförts. Inga analyser eller tolkningar av dataresultaten ingår i denna rapport.

Contents

1 Introduction

This report presents the results of the laboratory investigations of porosity, diffusivity and sorption characteristics within the discipline-specific programme “Transport Properties of the Rock”, which is one of the activities performed within the site investigation at Forsmark.

The work was carried out during the period from February 2003 to March 2007. In Table 1-1, controlling documents for performing this activity are listed. Both activity plans and method descriptions are SKB’s internal controlling documents.

The rock samples for the laboratory measurements are collected from the core drilled boreholes KFM01A, KFM01B, KFM02A, KFM03A, KFM03B, KFM04A, KFM05A, KFM06A, KFM06B, KFM07A, KFM08A, KFM08C, KFM09A and KFM10A by Eva Selnert (Gustavsson before 2007) and Henrik Widestrand, Geosigma AB. The locations of the boreholes are presented in Figure 1-1 below.

The present report is the final report from the laboratory measurements of transport properties of the rock and includes all data earlier reported. Consequently, SKB P-05-109 and SKB P-06-186, i.e. the data reports produced for data freeze 2.1 and 2.2, are subsets of this report. The laboratory data presented have been delivered to Sicada according to AP PF 400-03-058 and AP PF 400-06-007 and are traceable by the activity plan number.

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

Activity plans	Number	Version
Provtagning och analyser av borrkärna från kärnborrhål KFM01A–KFM07A för bestämning av bergets transportegenskaper	AP PF 400-03-058	1.0
Provtagning och analyser av borrkärnor under 2006 för bestämning av bergets transportegenskaper	AP PF 400-06-007	1.0
Method descriptions	**Number**	**Version**
Metodbeskrivning för instruktion och provtagning av borrkärna	SKB MD 143.007	3.0
Metodbeskrivning för bergartsanalyser	SKB MD 160.001	1.0
Metodbeskrivning för mätning av bergets petrofysiska egenskaper	SKB MD 230.001	2.0
Metodbeskrivning för genomdiffusionsmätning	SKB MD 540.001	1.0
Metodbeskrivning för batchsorptionsmätning	SKB MD 540.002	3.0
Metodbeskrivning för porositetsbestämning med PMMA	SKB MD 540.003	1.0

Figure 1-1. *Forsmark site investigation area, including the candidate area selected for more detailed investigations. The boreholes KFM01A–KFM010A are located at drill sites DS1–DS10, respectively.*

2 Objective and scope

2.1 Transport Properties of the Rock

The focus of the programme for the Transport Properties of the Rock is to furnish the data on the transport properties of the rock that are required for an assessment of the long term performance and radiological safety of the deep repository. The transport programme is divided into three parts: field measurements to obtain site-specific transport parameters, laboratory experiments on site-specific rock material and modelling of transport properties. An integrated analysis of these parts will form the main product of the transport programme; the Transport properties site descriptive model. Strategy and guidelines *for the modelling process* is presented in "Transport properties site descriptive model" /Berglund and Selroos 2003/, and in the associated "Strategy for the use of laboratory methods in the site investigations programme for the transport properties of the rock" /Byegård et al. 2003/. The site descriptive modelling of transport properties involves two main categories of parameters:

- *Parameters that characterise the retention properties of geologic materials.*
  These parameters quantify the diffusion and sorption properties of intact and altered rock, fracture coatings and fracture-filling materials, and are described within the framework of the 3D geometric models devised by the Geology programme.
- *Parameters that characterise solute transport along flow paths (flow-related transport parameters).*
  These parameters include the "*F*-parameter" and "water travel time", *t*w, and parameters that account for spatial variability in diffusion and sorption. The flow-related parameters are obtained by means of particle tracking simulations in groundwater flow models /Berglund and Selroos 2003/.

The main objectives of the laboratory measurements are to determine site-specific retardation parameters for solutes (sorbing and nonsorbing) and rock materials of importance for safety assessment of a deep repository, and furthermore, to obtain a geoscientific understanding of the retardation (porosity, diffusivity and sorption) properties of the Forsmark site, i.e. to understand how the different geologic processes and materials of a site affect the retardation properties.

The specific parameters determined for the different rock materials are:

- porosity (defined as open porosity in SS-EN 1936),
- porosity distribution,
- matrix diffusivity (equivalent to effective diffusivity),
- specific surface area, BET,
- cation exchange capacity, CEC,
- sorption coefficients for a number of combinations of rock materials, radionuclides and groundwater compositions.

The final product of the laboratory investigations is an interpreted retardation model, which is presented in a separate report. The retardation model is consequently a part of the Transport properties site descriptive model for Forsmark.

2.2 Selection of rock samples

2.2.1 Forsmark geology

As mentioned in Chapter 2.2, the basis for the laboratory investigations is the geological model, for the Forsmark site investigation area, briefly summarized below:

The Forsmark site is situated in the western part of the Fennoscandian Shield. This part of the shield is dominated by the geological unit referred to as the Svecokarelian (or Svecofennian) orogen. The bedrock in this orogen is dominated by Precambrian igneous rocks that were affected by complex ductile strain and metamorphism at predominantly mid-crustal levels /SKB 2007a/.

Outcrop mapping on the mainland and in the archipelago area indicates four major groups of rock types − Groups A to D, Table 2-1, distinguished on the basis of their relative age.

Both surface and borehole samples of analysed intrusive rocks (Groups B, C and D) show a distinctive gabbro-diorite-quartz diorite-granitoid igneous compositional trend. The medium-grained, biotite-bearing granite to granodiorite, metamorphic rock (rock code 101057) in Group B is the most dominant rock type and occupies about 84% of the candidate site volume. 10% consists of granodiorite, tonalite and granite (rock code 101051), belonging to Group C /SKB 2007a, Drake et al. 2006/.

Table 2-1. Major groups of rock types that form the basis for the division into rock units on the bedrock geological map. SKB rock codes are shown in brackets. The alteration code 104 for albitisation is also included /SKB 2007a/.

Groups of rock types	
All rocks are affected by brittle deformation. The fractures generally cut the boundaries between the different rock types. The boundaries are predominantly not fractured.	
Rocks in Group D are affected only partly by ductile deformation and metamorphism.	
Group D (c 1,851 million years)	• Fine- to medium-grained granite and aplite (111058). Pegmatitic granite and pegmatite (101061) Variable age relationships with respect to Group C. Occur as dykes and minor bodies that are commonly discordant and, locally, strongly discordant to ductile deformation in older rocks.
Rocks in Group C are affected by penetrative ductile deformation under lower amphibolite-facies metamorphic conditions.	
Group C (c 1,864 million years)	• Fine- to medium-grained granodiorite, tonalite and subordinate granite (101051). Occur as lenses and dykes in Groups A and B. Intruded after some ductile deformation in the rocks belonging to Groups A and B with weakly discordant contacts to ductile deformation in these older rocks.
Rocks in Groups A and B are affected by penetrative ductile deformation under amphibolite-facies metamorphic conditions.	
Group B (c 1,886–1,865 million years)	• Biotite-bearing granite (to granodiorite) (101057) and aplitic granite (101058), both with amphibolite (102017) as dykes and irregular inclusions. Local albitisation (104) of granitic rocks. • Tonalite to granodiorite (101054) with amphibolite (102017) enclaves. Granodiorite (101056). • Ultramafic rock (101004). Gabbro, diorite and quartz diorite (101033).
Group A (supracrustal rocks older than 1,885 million years)	• Sulphide mineralisation, possibly epigenetic (109010). • Volcanic rock (103076), calc-silicate rock (108019) and iron oxide mineralisation (109014). Subordinate sedimentary rocks (106001).

The frequency of transmissive factures is low and generally found in the uppermost 150 m of the rock. Consequently, most of the single fractures in the Forsmark area at depth larger than 100–150 m show low transmissivity, but still open and semi-open fractures are mapped throughout the entire drillcores /SKB 2007b/.

Fracture filling is used as a collective term for both coating and loose material in open fractures and for all material in sealed fractures. The most common fracture filling minerals in the area are calcite and chlorite, together with quartz, adularia, laumontite, prehnite, epidote, hematite, pyrite and clay minerals (mixed layer clays), represented in 6 different generations /Sandström and Tullborg 2005/.

2.2.2 The rock sample collection

In order to describe the heterogeneity of the rock material at the Forsmark site, features as major and minor rock types, different fracture types together with altered rock within deformation zones and adjacent to fractures, are represented in the total sample collection. The rock samples are also selected from different depths in the boreholes with purpose to reflect possible effects of stress relief.

As sorption and through-diffusion experiments are time-consuming, a part of the strategy has been to identify and collect rock material of importance in the initial phase of the site investigations. The rock sampling for the laboratory programme therefore started in February 2003 with the purpose to collect samples from three of the six planned boreholes, KFM01A–KFM06A. Since that time the number of cored boreholes has increased and the geological conceptual model has progressed. The improved knowledge of the site has later influenced the rock sampling. This means that additional boreholes have been included in the sampling and the total sample collection consists of about 300 rock samples from the cored boreholes KFM01A, KFM01B, KFM02A, KFM03A, KFM03B, KFM04A, KFM05A, KFM06A, KFM06B, KFM07A, KFM08A, KFM08C, KFM09A and KFM10A, although there is a predominance of rock samples from the early cored boreholes.

All the sampling work was performed according to /Byegård et al. 2003/ and with support from the Geology and Hydrogeology programmes within the Forsmark site investigations. Rock samples from fresh and altered rock types were selected with assistance from core mapping teams and data from the Boremap drill core mapping system. The selection of samples from open fractures were mainly controlled by the indications of water flow, as recorded in Posiva flow logs, but was also affected by the amounts of loose fracture filling material.

As mentioned above, the geological model has been developed during the site investigations and it has not, for logistical reasons, been possible to include rock core samples from the last stages of the geological and hydro-geological modelling work. Yet, the sample collection has been found representative for the target volume with respect to the major rock type (SKB code 101057), minor rock types, different fracture types together with important transmissive deformation zones.

2.3 This report

This report comprises a presentation of the laboratory investigations of the transport properties of the rock, i.e. description and evaluation of the performance of the measurements. In addition, data results from the laboratory investigations of porosity, through-diffusion, specific surface area (BET), cation exchange capacity (CEC) and batch sorption are reported. Data tables are presented in Appendices 1, 2, 3, 4, 5 and 6. The present report does not include interpretations and evaluations of the results. The analytical work is presented in the forthcoming Retardation model 2.3 for the Forsmark site investigation area.

3 Methods

3.1 Geological characterisation

Mineral contents, textures and occurrence of microcracks in the rock samples are properties that might have influences on the diffusivity and sorption capacity, and consequently on the retention capacity of the rock. Information about geological properties of the rock samples is a vital part for the further evaluation of the laboratory results, i.e. the Retardation model. For instance, occurrence of microfractures might be an explanation for a deviating porosity result, as well as the presence of clay within a fracture filling material might be a conceivable reason for high BET results. As a consequence of this, a geological characterisation of the rock samples involved was performed as a preparatory step of the laboratory measurements. The general characterisation included photography (Nikon Coolpix 4500) and study in stereo microscope (Nikon, SMZ645) with the purpose to determine mineralogy, texture, degree of alteration, as well as identifying microfractures (Figure 3-1).

For a minor amount of the rock samples, mainly samples intended for batch sorption experiments, thin sections were produced and analysed in transmissive light microscope. The purpose of these analyses was to confirm the rock mineralogy, as well as study microfractures and identify alteration within mineral grains. The geological characterisation was performed by Geosigma AB, apart from the analyses in transmissive light microscopic analyses which were performed by Isochrone Geoconsulting. Documentation of every single rock sample is not presented in this report but data are stored in the database Sicada.

Earlier investigations of Äspö diorite /Byegård et al. 1998/ have shown that there might be significant differences between coarse and fine-grained fractions due to different original grain sizes, but also differences in brittleness between minerals. Thus, in addition to the microscopic work described above, geochemical analyses on crushed rock material were performed. The main objective of these analyses was to confirm the mineralogical and chemical element distribution within different size fractions of the rock material used in batch sorption experiments. The analytical work focused on determination of main elements and trace elements. Main elements usually constitute the key components of rock (silica, aluminium, calcium etc) which occur together with oxygen in specific proportions (SiO2, Al_2O_3 etc). In typical silicate rock, the total of these main elements in oxide form plus the LOI (Loss On Ignition, usually reflecting the


Figure 3-1. *Pictures of rock samples selected for; a) electrical resistivity experiments (KFM02A 781.01 mbl (metres borehole length)), and b) batch sorption measurements (KFM06B 56.26 mbl).*

content of organic material), should equal 100%. Trace elements generally make a negligible contribution to the total content. Some of these are found in specific minerals which may be more or less poorly soluble. The geochemical analyses were performed according to SKB MD 160.001, SKB internal document, and were executed at the ALS Analytica laboratory group with the ICP-MS (Inductively Coupled Mass Spectrometry) and ICP-AES (Inductively Coupled Atomic Emission Spectrometry) methods.

3.2 Sample preparations

Before the onset of the laboratory experiments, some sample preparations were required; i.e. accurate sawing of the rock core samples into specific lengths in addition to crushing and sieving rock material into different size fractions. Milling of a minor amount of the rock samples was also made. The sample preparations were performed at the SP Technical Research Institute of Sweden (SP).

3.3 Porosity measurements

The total porosity in crystalline rock can briefly be summarized as the volume which is not occupied by mineral grains; i.e. the pore spaces between and within mineral grains. The total porosity can also be divided into a connected and an unconnected part, of which the connected porosity is the result of microfractures and grain boundary porosity, together with an intra-granular porosity. Porosity measurements on rock samples are performed in order to give information about available transport pathways of fluids in the rock and are the initial phase of the through-diffusion and the resistivity measurements. However, the pores available for water to soak into a core sample may deviate significantly from the pores available under e.g. diffusion measurements as well as under *in situ* conditions. The porosity was in this activity measured with two different methods, described below.

3.3.1 Water saturation method

There are several different ways to measure the porosity of a rock sample, but the most common method is the water saturation technique, in this investigation determined according to standard method SS EN 1936. Briefly summarized, this standard involves drying of the rock samples at 70° until constant mass is reached followed by water saturation in vacuum. SS EN 1936 is considered to be a rather non-destructive method which has been important as the majority of the rock samples measured are further investigated in diffusion and/or resistivity measurements. SS EN 1936 differs slightly from the recommended standard in MD 160.002, i.e. ISRM 1979, which is used for porosity measurements by e.g. the Geology programme.

The diameter of the measured core samples is c. 5.0 centimetres and the sample thickness varies from 0.5 to 5 centimetres, although the majority of the samples are 3 centimetres. Porosity measurements with water saturation technique were performed at the SP Technical Research Institute of Sweden (SP).

3.3.2 ^{14}C-PMMA method

Porosity investigations using the ^{14}C-PMMA technique have been performed at the Laboratory of Radiochemistry, University of Helsinki (HYRL). The C^{14}-PMMA method is used to measure microfracturing, as well as the two-dimensional distribution of porosity and can also be used to evaluate porosity gradients in e.g. altered and fractured rock materials. The method entails drying slices of drill cores and impregnating them with a ^{14}C-tagged polymethylmethacrylate monomer, whereby both the connected (matrix) porosity and its spatial distribution in the rock matrix are determined. This provides information for estimation of penetration depth for radionuclides. Comparable porosity determinations were made using conventional water gravimetric measurements at the University of Helsinki. The modified water gravimetry method used here was produced during the development of the PMMA technique and is not a standard method. More involved information of the method, results and the specific rocks samples are documented in a separate report /Penttinen et al. 2006/.

3.4 Diffusion measurements

3.4.1 Through-diffusion

The analyses were performed according to SKB MD 540.001, SKB internal document, in which it is described that the method is aimed to quantify the matrix porosity, ε_p (%), and the matrix diffusivity, D_e (m^2/s), i.e., the ability for a solute to diffuse through a rock disc. Matrix diffusivity and rock capacity factor are the primary parameters obtained in the evaluation procedure. In theory, the rock capacity factor is equivalent to the matrix porosity for a non-sorbing tracer. However, in order to avoid misinterpretation with matrix porosity determination by water saturation measurements (SKB MD 160.002 or SS-EN 1936) the term rock capacity factor, α (%), has been used in the reporting instead of the matrix porosity for the through-diffusion experiments.

Matrix diffusivity measurements are carried out by measuring how quickly an added substance diffuses through a piece of a drill core, so-called through-diffusion measurements /Ohlsson and Neretnieks 1995, Byegård et al. 1998/. The measurement is normally performed on a 1–5 cm thick sawn-out slice of a drill core placed in a measurement cell (Figure 3-2). One side of the core piece is in contact with a synthetic groundwater and the other is in contact with a synthetic groundwater tagged with the radionuclide to be studied (in this case tritiated water, H^3HO or HTO). Samples are then taken on the un-tagged side, and the effective diffusion coefficient, D_e, for the rock matrix can be calculated based on the concentration increase on the un-tagged side.

The effective diffusivity is related to the water diffusivity, D_w, through the formation factor F_f (–) as:

$$D_e = F_f \cdot D_w \tag{3-1}$$

The rock formation factor depends only on the properties of the rock and not on the tracer or solute properties. The formation factor includes properties such as the tortuous winding of pores (tortuosity), variations in cross-sectional area of pores (constrictivity) and the porosity of the backbone of the pores that are utilised for transport by diffusion in a certain direction (transport porosity). These properties are poorly known and cannot easily be separated from each other in measurements.

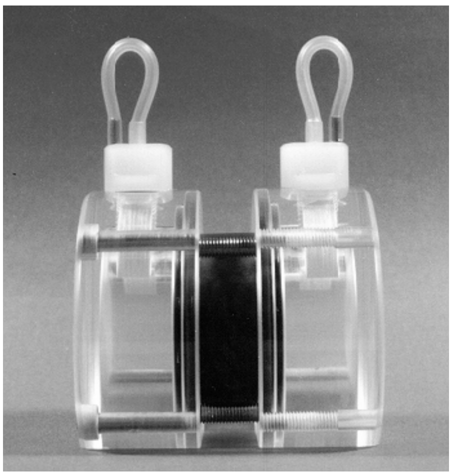


Figure 3-2. *Photograph of a rock sample assembled in a diffusion cell.*

The primary data are presented as a scaled accumulated amount of tracer in the target cell C_r (–) as a function of time. The effective diffusivity D_e and the rock capacity factor α were fitted to the experimental data using:

$$C_r = \frac{D_e t}{l^2} - \frac{\alpha}{6} - \frac{2\alpha}{\pi^2} \sum_{n=1}^{\infty} \frac{(-1)^n}{n^2} \exp\left\{ -\frac{D_e n^2 \pi^2 t}{l^2 \alpha} \right\} \tag{3-2}$$

where t is the experimental time after injection of tracer, l is the length of the rock sample and n is the summation factor. The capacity factor is defined as

$$\alpha = \varepsilon_p + K_d \rho \tag{3-3}$$

where ρ (kg/m³) is the rock bulk density and K_d (m³/kg) is the sorption coefficient. Consequently, for a truly non-sorbing tracer ($K_d = 0$) the matrix porosity is in theory equivalent to the rock capacity factor ($\alpha = \varepsilon_p$).

The latter part of the experimental data was also fitted to a simplified linear form of Equation 3-2, i.e.

$$C_r = \frac{D_e t}{l^2} - \frac{\alpha}{6} \tag{3-4}$$

Equation (3-4) was used for control of the results obtained in Equation (3-2) and also for estimation of the individual errors in D_e and α for a particular sample.

The through-diffusion experiments were carried out at the Chalmers University of Technology (CTH).

3.4.2 Electrical resistivity

Resistivity is a measure of the disability to conduct electric current in the form of ions in the pore space of a rock sample. Low resistivity will thus correspond to a high ability of conduction and vice versa. The resistivity of the water that the sample has been soaked in is often normalised with the resistivity of the sample. The resulting ratio is then referred to as the formation factor, F_f, which in turn is related to the effective diffusivity, D_e (see Section 3.4.1).

Resistivity along the sample axis is measured with an in-house two-electrode equipment at the frequencies of 0.1, 0.6 and 4.0 Hz, after the rock core samples have been saturated in 1.0 M NaCl-solution for ten weeks. The formation factor is then calculated as the ratio between the resistivity of the soaking water and the resistivity of the samples at 0.1 Hz:

$$Formation\_factor = \frac{\rho_{water}}{\rho_{sample}} \tag{3-5}$$

Resistivity measurements for obtaining the formation factor were performed by GeoVista AB, according to SKB MD 230.001, SKB internal document. Primarily the resistivity measurements are performed on 3 cm long rock core samples with plane-parallel end surfaces, but there are also a few 1 cm and 5 cm rock core samples. More detailed descriptions of the measurements and the results are presented in 4 separate reports /Thunehed 2005ab, Thunehed 2007ab/.

3.5 Batch sorption measurements

All activities done and described within the SKB MD 540.002 (Batch sorption experiment) are aimed to quantify the adsorptive properties of the rock material, i.e. the ability for the different radionuclides to adsorb on the rock surfaces. Three different methods are identified:

- Specific surface area measurements of the rock material, BET.
- Measurements of the cation exchange capacity, CEC.
- Actual measurement of the distribution of a radionuclide between the rock/groundwater phases, i.e. Batch sorption experiment.

3.5.1 BET

BET (Brunauer, Emmet, Teller, see /Brunauer et al. 1938/) is a method for measuring the specific surface area of a solid material by use of gas adsorption. BET measurements have been performed on site-specific materials from Forsmark according to the ISO 9277 standard method. BET measurements on crushed rock material were in this activity performed at the SP Technical Research Institute of Sweden (SP), whereas BET on whole rock core samples were executed at the Royal Institute of Technology (KTH).

The determination of the specific surface area does not produce parameters that are used in the safety assessment calculation to determine the retardation of radionuclides due to adsorption on to mineral surfaces. However, the BET surface areas, as well as the CEC, are good diagnostic parameters in order to give rough qualitative estimations of the sorption capacity of different geologic materials.

BET surface areas in this investigation were measured on the fractions 0.063–0.125 mm and 2–4 mm of crushed and sieved matrix rock samples. Quantified identification of "inner" and "outer" surfaces of the rock material has been done, using the assumption of spherical shape of the crushed rock particles, i.e.:

$$A_\mathrm{d} = A_\mathrm{i} + \frac{6n}{d_\mathrm{p}\rho} \qquad (3\text{-}6)$$

where A_d (m^2/g) is the measured BET surface area for the fraction having the d_p (m) average particle diameter, A_i (m^2/g) is the amount of inner BET surface area (representative for intact rock) and ρ (g/m^3) is the rock density. The term $6n/(d_\mathrm{p}\rho)$ (m^2/g) thus corresponds to the outer BET surface area of the crushed particles, i.e. the amount of surface areas obtained by the crushing process and thus not representative for the intact rock material. One can therefore identify the factor n as the microscopic roughness of the rock, i.e. the ratio of the BET surface area versus the geometric area. For a few number of rock types, BET surface area measurements have also been performed using intact drill core samples (50 mm diameter, 90 mm length). Ideally, the obtained values for these measurements should resemble the A_i obtained from the extrapolation.

For fracture fillings and altered rock material adjacent to fractures, the rock material was sampled by careful scraping of the rock. After sieving, only the < 0.125 mm fraction was used for the BET surface measurement. The general basis for this decision is that a loose material in an even smaller size fraction is lost during the drilling and the selection of the 0.125 mm fraction is still suspected to give an underestimation of the BET surface areas abundant in natural fractures.

3.5.2 CEC

The Cation Exchange Capacity (CEC) refers to the numbers of negatively charged sites of the rock material that can participate in a cation exchange. This parameter is closely related to BET and can be considered as a diagnostic parameter for a rough estimation of the sorption capacity of the rock material. Cation exchange is considered as the major sorption mechanism for several of the radionuclides involved in the batch sorption experiments, e.g. Cs^+, Sr^{2+} and Ra^{2+}.

The determination of potential cation exchange capacity, CEC, as well as exchangeable cations, involves that the negatively charged sorption sites of a geological material are saturated with one particular cation in a high concentration solution; in this specific case barium chloride ($BaCl_2$). A determination of sodium, potassium, calcium, magnesium, strontium and rubidium in the barium chloride extract of the rock material gives the sum of exchangeable cations.

Subsequently, the Ba saturated rock material is contacted with a $MgSO_4$ solution causing all adsorbed Ba^{2+} ions to be exchanged with Mg^{2+} ions. From this operation, the CEC is obtained by estimation of the total amount of Mg^{2+} ions that was, due to cation exchange with Ba^{2+}, lost from the original $MgSO_4$ solution.

The measurements of the CEC and exchangeable cations were performed according to ISO 13536 at the Swedish Geotechnical Institute (SGI). The host rock samples were measured on crushed and sieved rock core samples using the size fractions of 0.063–0.125 mm and 1–2 mm (corresponding to the smallest and largest size fractions used in the batch sorption experiment, cf. Section 3.5.3). Some fracture filling materials were also measured; in this case only the < 0.125 mm fraction was used. The basis for the selection of this size fraction was the same as described for the BET surface measurements, cf. Section 3.5.1.

3.5.3 Batch sorption

In batch sorption measurements, crushed rock is contacted with a groundwater spiked with radioactive tracers. The distribution of the radioactive tracers between the aqueous and the solid phase is measured /cf. e.g. Byegård et al. 1998/. Batch sorption measurements were performed at the Chalmers University of Technology (CTH) and at the Royal Institute of Technology (KTH).

Basically, two different methods were applied for the batch sorption experiments, one method used for the crushed matrix rock samples and one method used for non-consolidated rock material sampled in association with fractures:

Matrix rock

For the use of rock samples from the rock matrix, the material was crushed and sieved to different size fractions. The 0.063–0.125 mm, 0.25–0.5 mm and the 1–2 mm size fractions were used and the tracer distribution ratio (R_d) was measured for all of these size fractions. The results were thereafter interpreted from a model consisting of:

- Adsorption of the tracers on the outer surfaces of the rock material, determined by the surface sorption parameter, K_a (m). This interaction is considered to be caused by surfaces created during the crushing process and this adsorption is therefore not applicable in the process when the tracer penetrates into the rock matrix, i.e. matrix diffusion.
- Adsorption of the tracers on the inner surfaces of the rock material, determined by the volumetric sorption parameter, K_d (m^3/kg). These inner surfaces are representative to the intact rock and this amount of adsorption should thus be applied for the matrix diffusion process.

Using the assumption of spherical shape of the crushed rock material, the evaluation of the batch sorption experimental results to sorption parameters is thus done according to:

$$R_d = K_d + \frac{6K_a}{d_p \rho} \qquad (3\text{-}7)$$

where R_d (m^3/kg) is the measured tracer distribution between solid and liquid phases, d_p (m) is the average particle diameter, and ρ (kg/m^3) is the rock density. A graph of R_d versus $1/d_p$ gives an intercept corresponding to the K_d value, and a slope corresponding to $6K_a/\rho$, cf. Figure 3-3. The concept is thus analogous to the estimation of inner and outer surface area of the BET measurements, cf. Section 3.5.1.

Fracture filling materials

Similarly to the BET surface measurements, the adsorption on loose fracture filling materials as well as altered materials adjacent was for the same reasons studied using only the < 0.125 mm size fraction. In this case the measured tracer distribution ratio (R_d) was directly transferred and applied as the volumetric sorption parameter, K_d.

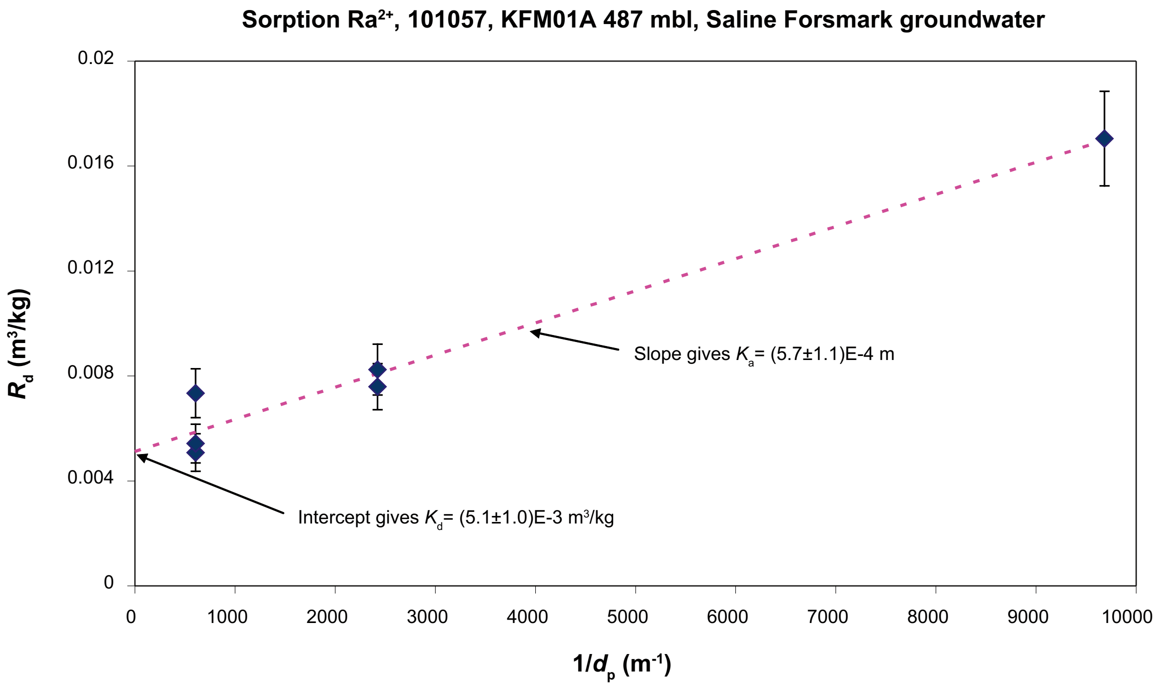


Figure 3-3. *Illustration of the evaluation method used for the batch sorption experiments on rock samples, exemplified by Ra^{2+} adsorption on rock material from KFM01A 487 mbl.*

Experimental conditions

Since it can be suspected that the R_d due to slow diffusion into the particles should be influenced by the contact time, sampling was performed at different contact times, i.e. 1, 7, 30, 90 and 180 days. A solid to liquid volume of 1 g to 4 ml was applied in the experiments and this ratio was allowed to decrease a total of < 10% due to the sampling during the experiment period. The batch sorption experiments were performed in glove-boxes with continuous nitrogen flow attempting to minimise the influence of oxygen during the sorption experiment. Synthetically produced groundwater (i.e. addition of salts to distilled water) having the same chemical composition as sampled groundwater was used in the experiments. The addition of redox-sensitive chemicals (e.g. salts of Fe(II), Mn(II) and S(-II)) together with potentially volatile chemicals (salts of HCO3-) were added inside the glove-box, after a thorough bubbling of water had been performed).

Four different groundwaters were selected for the batch experiments to represent a (I) fresh diluted Ca-HCO3 water, (II) groundwater with marine character, Na-(Ca)- Mg-Cl, 5,000 mg/L Cl, (III) saline groundwater of Na-Ca-Cl type, 5,400 mg/L Cl and (IV) Brine type water of very high salinity, Ca-Na-Cl type water with Cl content of 45,000 mg/L. The exact composition of the different groundwaters can be found in Appendix 6.

For the selection of tracers to be used in the batch experiments, it was decided to apply two different levels in the investigations:

- Level B, sorption studies using Cs+, Sr^{2+} and Am(III), (Am in some cases exchanged to its analogue Eu) as tracers.
- Level A, sorption studies using Cs+, Sr^{2+}, Ra^{2+}, Ni(II), Am(III), (Am in some cases exchanged to its analogue Eu), Th(IV), Np(V) and U(VI) as tracers.

The aim of this differentiation was that groundwater/rock mixtures which were foreseen to be very important in the performance assessment should be investigated using the A level. Consequently, less important groundwater/rock mixtures were only investigated using the B level.

4 Results

4.1 General

Original data from the reported activities are stored in the primary database Sicada, where they are traceable by the Activity Plan number (AP PF 400-03-058 and AP PF 400-06-007). 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.

Some results of the geological characterisation of the most important rock materials within the laboratory programme are given in the following sections. This summary should be considered as supporting information needed in the forthcoming interpretation of the result, i.e. the Retardation model, and is not a complete specification of the geological properties of the Forsmark site. Thus, it should be noted that the observations made are generally consistent with the work performed by the Geology programme. An entire documentation of the Forsmark geology can be found in /SKB 2007a/.

The results of the geochemical analyses have been used for simple calculations of the mineral content in different size fractions of crushed rock material used in batch sorption measurements. These calculations are based on the mineralogy of the whole rock sample, determined with point counting of thin sections, in addition to the already known composition of biotite and plagioclase /Sandström and Tullborg 2006/. General assumptions for granitic rock types, after the same concept as in previous investigations /Byegård et al. 1998/, are summarized below:

1. All Mg is hosted in the biotite.
2. All Na is hosted in the plagioclase.
3. All P is hosted in the apatite.
4. K is partitioned between the biotite and the K-feldspars.
5. Ti is partitioned between the biotite and the titanite.
6. Fe is partitioned between biotite, epidote, titanite and magnetite.
7. The SiO_2 in access, after subtracted for the amounts of the minerals above, is assumed to be quartz.

4.2 Geological characterisation

4.2.1 Rock types

Mineralogy and texture

The vast majority of the rock core samples are represented by granitic rock types, dominated by the major rock type at Forsmark site investigation area, i.e. a metamorphic granite to granodiorite rock (rock code 101057), belonging to the Group B (Table 4-1). In addition to this, a metamorphic granite, granodiorite and tonalite, (rock code 101051), is quite frequent in the sample collection as it commonly appears as dykes and lenses in the boreholes. These granitic rock samples comprise minerals as plagioclase, quartz, K-feldspar, biotite, ± amphibole, ± magnetite/hematite, ± titanite, ± pyrite. Altered varieties are often redstained due to small hematite grains, saussuritized and have often albitisized plagioclase. The rock samples are generally fine- to medium-grained or medium-grained, equigranular and weakly foliated with mineral fabric, i.e. mineral stretching lineation.

Tonalite to granodiorite (rock code 101054), pegmatite (rock code 101061), fine- to medium-grained granite (rock code 111058), aplitic granite (rock code 101058) and a felsic to intermediate volcanic rock (rock code 103076) are represented with a few or single samples. These rock types have an overall mineralogy as the granitic rock types described above. Amphibolite occurs as dykes and lenses in a great part of the boreholes and is therefore represented with several rock samples within the sample collection. The examined rock samples consist of plagioclase, amphibole, biotite, titanite and epidote. The grain-size is fine to medium.

The mineralogy of several of the rock types is also verified during analyses and point counting of thin sections in transmissive light microscope. Table 4-1 presents the mineralogical distribution in fresh rock core samples from the rock types described above according to these microscopic studies. As a reference, data from the Site Descriptive Model, Forsmark, are presented in the same table.

Additionally, microscopic observations of different size fractions of crushed rock material were made. These studies show that there are some differences between the fractions. Generally, for crushed material from rock types, the finer fractions (0.063–0.125 mm and 0.125–0.25 mm) consist of single mineral grains in contrast to the coarser (1–2 mm and 2–4 mm) which constitutes mineral aggregates. Still, the mineralogy is the same within all the size fractions. Similar observations have been made for crushed and sieved altered rock within deformation zones (Figure 4-3). Yet, for granitic rock samples with relatively high content of biotite the smaller fractions might to some extent contain more biotite than the larger fractions, which is also verified by calculations of geochemical data (Figure 4-4).

Table 4-1. Results from pointcounting of thin sections from rock types 101051 and 101057 involved in the laboratory measurements of the transport properties of the rock. Data from /Sandström and Tullborg, 2006/ in brackets. Mineralogical distributions are given in intervals as percent (vol %), + = < 0.2%.

	Granite to granodiorite, metamorphic, medium-grained, 101057 , n=6		Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained, 101051, n=2	
Quartz	26.1–39.0	(27.8–45.8)	30.0–39.6	(15.4–35.4)
K-feldspar	14.2–29.0	(0.2–36.0)	11.4–23.8	(0.0–38.0)
Plagioclase	27.0–41.0	(24.0–63.8)	35.0–38.6	(29.4–67.0)
Biotite	3.4–11.6	(0.8–8.2)	6.6–8.4	(1.8–19.4)
Muscovite	0.0–1.0		+	
Chlorite	0.0–0.4	(0.0–1.2)	0.0–0.4	
Amphibole	+		+	(0.0–25.2)**
Epidote	0.0–1.2	(0.1–3.2)	1.0–3.0	(0.4–1.8)
Allanite	+		–	
Prehnite	–		–	
Titanite	0.0–1.0	(0.0–1.0)	0.0–0.8	(0.0–1.8)
Calcite	+		–	
Apatite	+		+	
Zircon	0–0.2		+	
Opaque*	0.2–0.4	(0.0–0.8)	0.0–1.4	
Pyroxene	–		–	

* Mainly magnetite, more rarely pyrite or hematite.

** Hornblende.

Microfractures

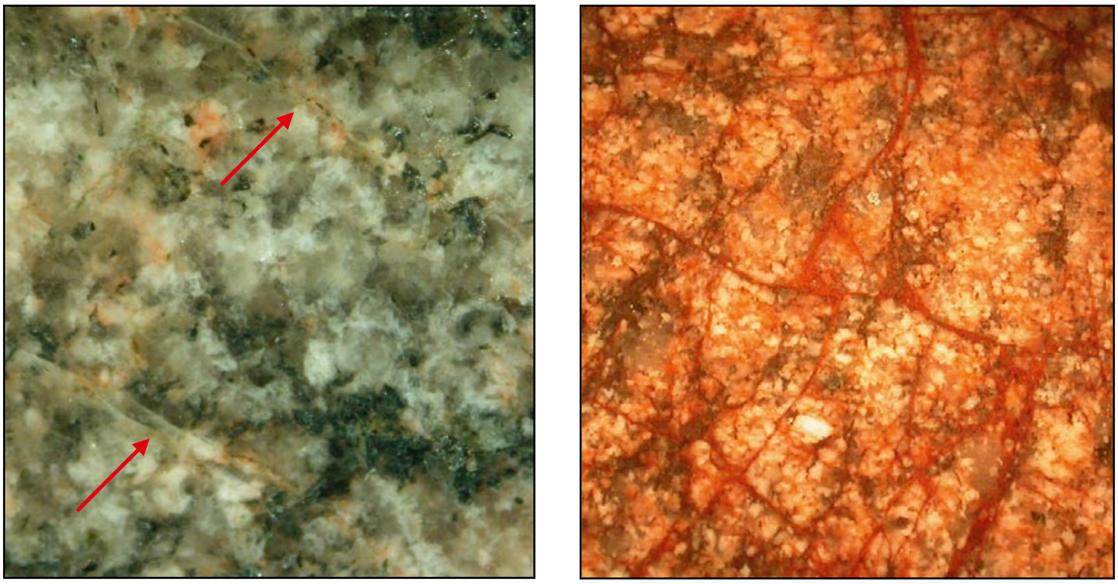
In this report the term microfracture refers to a short (1 mm to 25 mm) and thin (< 0.5 mm) open or sealed fracture (Figure 4-1). Microfractures usually cut right through mineral grains and are common in altered rock samples, but are visible in fresh rock samples as well. About 7% of the rock core samples have been documented with microfractures, which are suggested to be a minimum value because of the restricted area available for examination.

Calcite, hematite, prehnite, epidote and chlorite are minerals that have been recognized in sealed microfractures during the examination in stereomicroscope and transmissive light microscope.

4.2.2 Open fractures

Open fractures have, after macroscopic observations during the initial stage of the laboratory work, been divided into different groups with respect to their mineralogy and wall rock alteration. This work has been performed in cooperation with fracture mineralogical expertise and the mapping geologists at the Forsmark site.

In this report, fracture filling is used as a collective term for both fracture coating and loose material in open fractures. Only a few of the fracture types below have loose fracture fillings that could be scraped off and later be involved in the laboratory investigations. Consequently, the stereomicroscopic studies of different fracture fillings were performed on both core samples with thin fracture coating and loose fracture material, when possible (Figure 4-2). There are no thin sections with solely fracture filling minerals analyzed within the laboratory programme.



a) *b)*

Figure 4-1. *Illustration of a) partly open microfractures in rock sample KFM01A 400.01 mbl, and b) sealed microfractures in a network of small fractures filled with mainly hematite and chlorite (KFM08A 686.96 mbl). The scales of the pictures are 1.5 cm.*

a) *b)*

Figure 4-2. *Illustration of two types of fracture materials involved in the laboratory measurements; a) chlorite, hematite, ± calcite and b) chlorite, clay, ± epidote, ± prehnite, ± calcite.*

The mineralogy for the different fracture groups identified is:

A) *Chlorite,* ± calcite. Thin, ≤ 0.5 mm, fracture coating.

B) *Chlorite + clay* (mainly corrensite), ± epidote, ± prehnite, ± calcite. Usually loose fracture filling material, about 1 mm.

C) *Chlorite + hematite,* ± other. Thin fracture coating, < 0.5 mm.

D) *Chlorite* ± other. Thin fracture coating, < 0.5 mm.

E) *Laumontite* ± calcite, ± other. Occur as fracture coatings 0.1–2 mm, as well as more thick fracture fillings in sealed networks within deformation zones.

F) *Calcite* ± quartz, ± pyrite, ± other minerals. Thin coating with some large crystals of pyrite and/or calcite.

G) *Clay* ± other. Loose fracture filling, 1–5 mm.

Wall rock alteration is observed together with fracture types B, C, E and G. The observations above are roughly comparative with separate investigations of fracture mineralization and wall rock alteration /Sandström and Tullborg 2006/. Observations of microfractures are presented together with the rock types (Section 4.2.1).

Comparison between the mineralogy in different size fractions as performed on rock types (Section. 4.2.2), is not always possible on fracture fillings due to lack of material. Further on, the loose fracture filling material preferably seems to be placed in the smaller fractions (0.063– 0.125 mm and 0.125–0.250 mm); e.g. for fracture type B, only a small amount of chlorite is placed in the coarser fractions (1–2 mm or 2–4 mm). Fracture type E, which is common in both single fractures as well as sealed fracture networks, displays the same distribution as the rock types, i.e. single grains in the smaller fractions and mineral aggregate in the coarser fractions (Figure 4-3).

a)

b)

Figure 4-3. *Crushed and sieved material from a sealed fracture network in KFM05A, c. 611 mbl; a) 0.063-0.125 mm fraction showing single grains of laumontite, calcite, chlorite, some of them redstained due to small hematite grains, and b) 2-4 mm fraction displaying mineral aggregate of the same minerals.*

4.2.3 Deformation zones

At the initial phase of the laboratory investigations several kinds of rock alteration within deformation zones were identified and *grouped* in the same way as the fracture filling materials, i.e. after macroscopical observations. Originally three possible groups were estimated, but during the progressing work an additional group (4) has been added:

1. *Fault rock,* strongly altered (tectonised and partly incohesive) wall rock. Altered rock fragments with varied mineralogy dependent on host rock. Generally, chlorite, saussurite and clay are present.
2. *Oxidized rock*, mainly medium to strong degree of alteration. Hydrothermally altered host rock with red staining due to small hematite grains. Granitic rocks show K-feldspar, saussurite, plagioclase, quartz and chlorite.
3. *Sealed fracture network*, mainly with breccia and cataclasite. Different fracture fillings such as laumontite + calcite, epidote and chlorite are present.
4. *Quartz dissoluted rock, episyenite (vuggy rock).* Initially group 4 was considered as a possible rock type though its strong connection to deformation zones was not obvious. This hydrothermally altered variety of especially rock type 101057 /Möller et al. 2003/ has been given special attention because of its great contents of vugs, which subsequently is of importance for the transport properties. The stereo microscopic observation of the episyenitic rock samples shows plagioclase (mainly albite), K-feldspar, quartz, chlorite, and hematite. The rock samples display up to 13% vugs, i.e. pore space after dissolution of quartz. New formation of small grains of quartz, albite, calcite and hematite can be seen in these vugs.

4.2.4 Geochemical analyses

As was discussed in Section 3.1, earlier investigations /Byegård et al. 1998/ have shown that there might be mineralogical differences between coarse and fine-grained fractions which in turn could be of importance in the analysing process of the results from e.g. batch sorption measurements. The results from some of the calculations of geochemical analyses of three size fractions for the major rock type (SKB code 101057) are illustrated in Figures 4-4 and 4-5. In these two examples, a comparison of different size fractions of oligoclase (plagioclase variety with $An_{10–30}$), biotite and K-feldspar can be seen. Some variations are indicated, particularly for the oligoclase but also for biotite, which seems to increase in the smaller fractions in those rock samples where the total content of biotite exceeds 6 weight per cent.

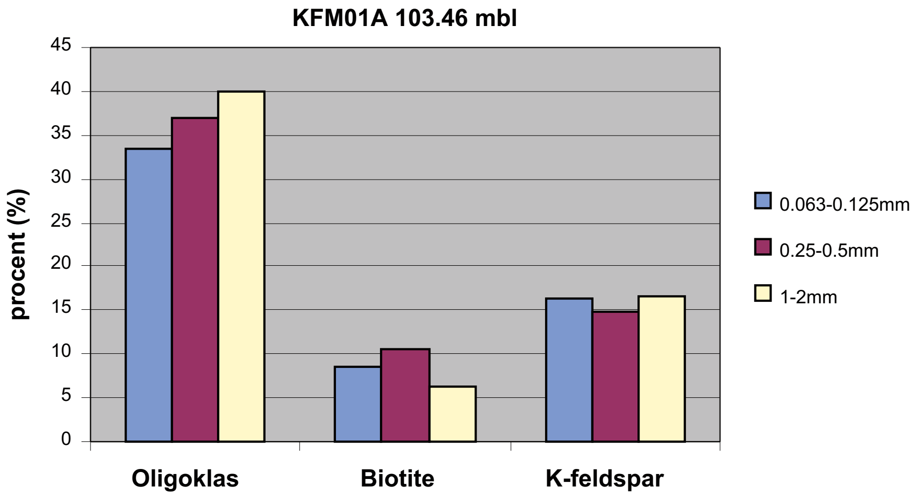


Figure 4-4. Mineralogical distribution in different fractions of rock sample KFM01A 103.46 mbl, calculated from geochemical analyses.

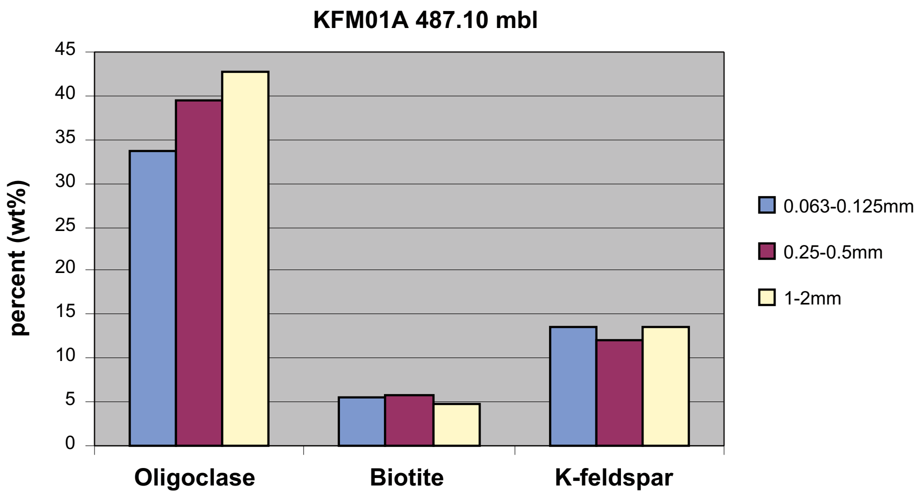


Figure 4-5. Mineralogical distribution in different fractions of rock sample KFM01A 487.10 mbl, calculated from geochemical analyses.

4.3 Porosity measurements

4.3.1 Water saturation

Data gained from the laboratory measurements using water saturation technique are presented in Appendix 1. The uncertainty of a single reported porosity value is 0.09%, given with a coverage factor of 2.

Porosity values for major and minor rock types are presented in Table 4-2 and display quite moderate variations between different rock types. It should be noted that the number of measured samples varies strongly between the different rock types dependent on the laboratory strategy, which focuses on the rock matrix and subsequently the major rock type. The relatively large range between minimum and maximum values are supposed to be an effect of the sampling strategy, i.e. to include both fresh and altered rock material. In addition, sampling each 20 mbl for porosity and resistivity measurements also include rock samples with fractures, both open microfractures, partly open and sealed fractures. Evaluation of the effects of alteration and/or microfractures is not included in this report but is considered to be included in the Retardation model.

Alteration as well as microfractures are assumed to affect the porosity. Figure 4-6 displays variations in porosities between fresh and altered and/or microfractured rock core samples, i.e. there is an increased porosity for altered and disturbed rock samples. The quartz dissoluted variant of rock type 101057, vuggy rock, is presented as a single *set* due to its extremely high porosities. The observation of increased porosity for altered rock is also verified during the porosity measurements with ^{14}C-PMMA (cf. Section 4.3.2).

Porosity is also measured on a few series of rock samples with different sample length; 0.5, 1, 3 and 5 cm. As can be seen in Figure 4-7, no clear relationship of the porosity and sample length is indicated. Thus, it is important to be aware of the restricted amount of rock samples with 0.5, 1 and 5 cm.

The porosity of a rock sample in laboratory is not obviously the same as the porosity *in situ*, which might be due to stress-release in connection with sampling. In Figure 4-8 the porosity versus depth, expressed as elevation (metres in height system RHB 70), is illustrated for the most prominent rock type, 101057. Both fresh and altered samples are included Further evaluation and division into fresh and altered groups of rock samples are supposed to be performed in the forthcoming Retardation model.

Table 4-2. Porosities (vol%) for different rock types at the Forsmark site investigation area, measured within the Transport programme. Data are presented as median with minimum and maximum values. Number of samples within parenthesis.

Rock name (rock code)	All rock samples (n)		
	median	min	max
Amphibolite (102017)	0.22 (7)	0.08	9.95
Felsic to intermediate volcanic rock, metamorphic (103076)	0.57 (2)	0.36	0.78
Granite. fine- to medium-grained (111058)	0.32 (2)	0.28	0.36
Granite. granodiorite and tonalite, metamorphic, fine- to medium-grained (101051)	0.23 (30)	0.10	1.60
Granite, metamorphic, aplitic (101058)	0.20 (3)	0.18	0.26
Granite to granodiorite, metamorphic, medium-grained (101057)	0.23 (158)	0.03	19.33
Granodiorite, metamorphic (101056)	0.34 (2)	0.19	0.48
Pegmatite, pegmatitic granite (101061)	0.27 (3)	0.24	0.32
Tonalite to granodiorite, metamorphic (101054)	0.16 (4)	0.11	0.19

* not evaluated

** no samples excluded.

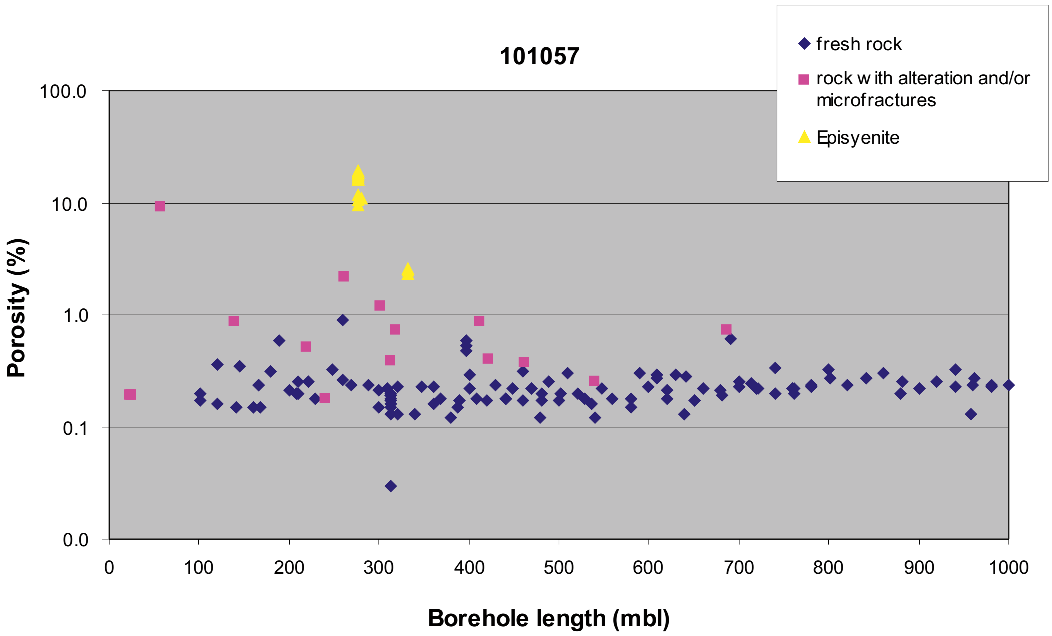


Figure 4-6. *Porosities for rock type 101057, granite to granodiorite, metamorphic. Distribution between fresh and altered/microfractured rock samples, in addition to the altered variety episyenite (vuggy rock), presented in log normal scale.*

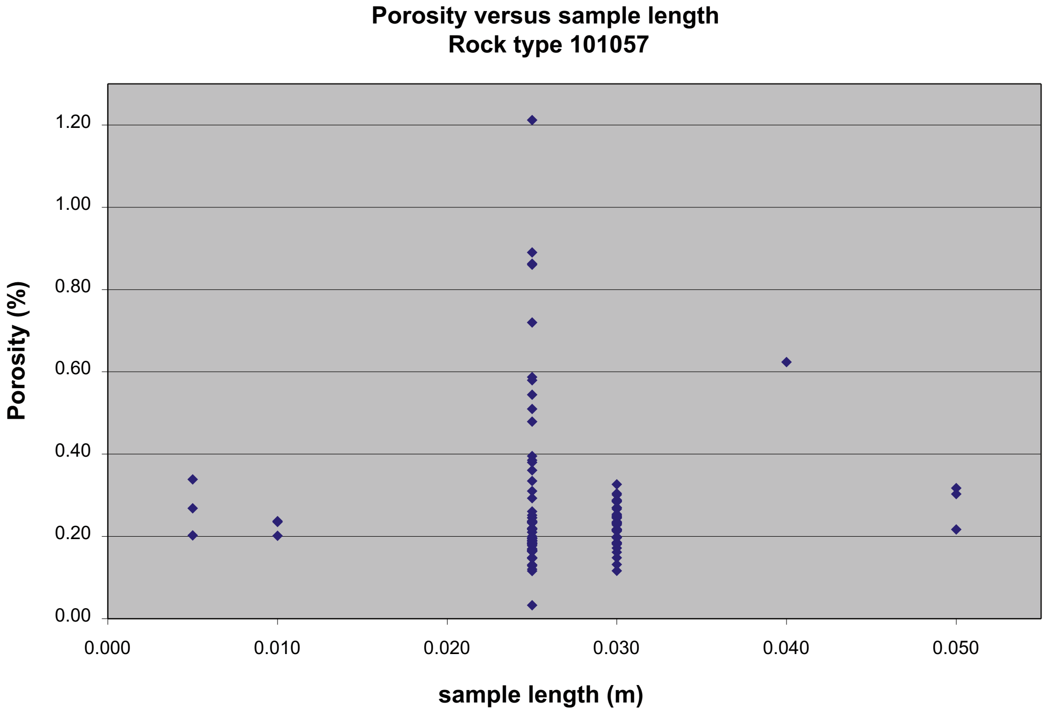


Figure 4-7. *Porosities versus sample length for all rock samples of rock type 101057, granite to granodiorite metamorphic, medium-grained.*

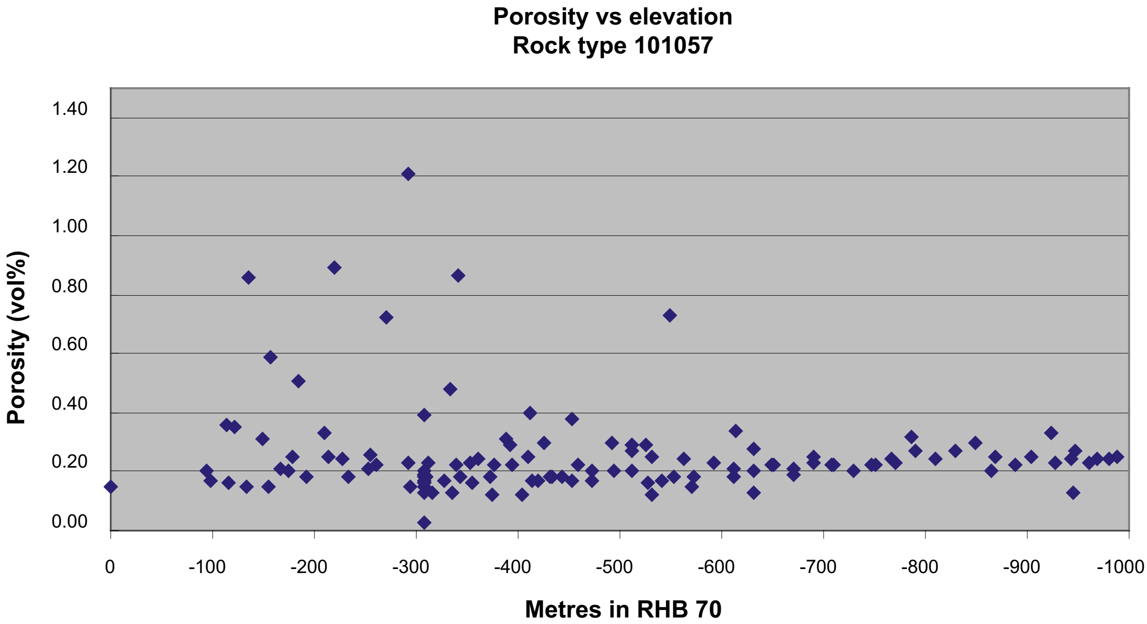


Figure 4-8. *Porosity versus elevation (m in RHB 70) for fresh and altered samples from rock type 101057. A few values above 1.4% are omitted.*

4.3.2 ^{14}C- PMMA

For the laboratory investigations of the transport properties of the rock, thirteen rock samples have been selected to be measured by the ^{14}C-PMMA method. As mentioned in Section 4.3.2 the data and results from the ^{14}C-PMMA measurements are presented in a separate report /Penttinen et al. 2006/ , and the following text is a summary from this report.

The porosities measured with the ^{14}C-PMMA method vary from c. 0.1% in tight and unaltered rock to c. 10% in highly altered rock samples. The average porosities of low porous rock are in the range from 0.1% to 0.5%. The grain boundary porosity is found to dominate in a few samples. However, in many cases the porosity pattern was not congruent with the mineral texture. The intragranular porosity dominated in samples having high porosities; 3%–16%. These samples also had very heterogeneous porosity patterns in cm scales. High porosity is also indicated in and around sealed microfractures (Figure 4-11).

Correlations between PMMA porosities and water gravimetry show that the PMMA porosity values in most of the cases are lower than the water gravimetry values. Relative to water gravimetry the PMMA method underestimates the porosity values by 10 to 40%. The porosity distribution is generally homogeneous in unaltered rock samples (Figure 4-9) while it generally is heterogeneous in strongly altered rock samples (Figure 4-10).

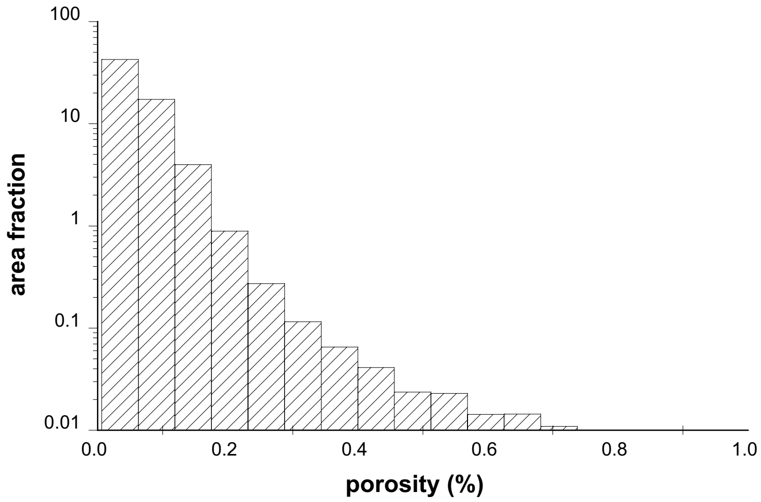


Figure 4-9. Homogeneous porosity distribution of fresh rock sample, KFM01A 486.90 mbl (rock type 101057). A total PMMA porosity of 0.1% was determined /Penttinen et al. 2006/.

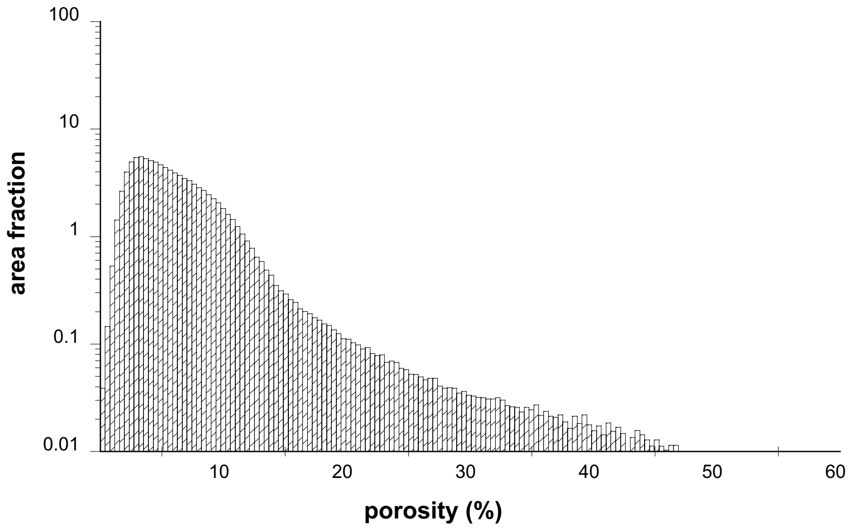
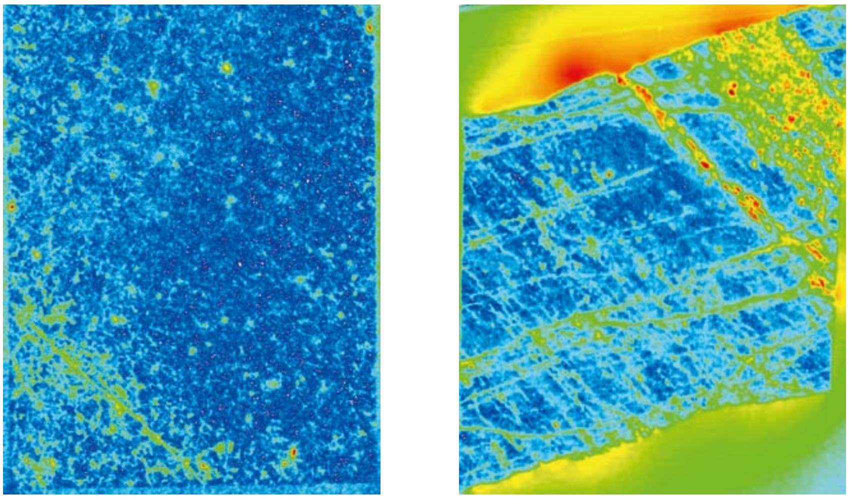


Figure 4-10. Heterogeneous porosity distribution in sample KFM04A 239.7 mbl, a strongly altered amphibolite with sealed network. A total PMMA porosity of about 7.5% was determined /Penttinen et al. 2006/.



a) *b)*

Figure 4-11. *Digital autoradiograph of two rock samples with increased porosity (green colour); a) in and around a sealed microfracture and b) parallel with the mineral texture in addition to sealed microfractures, cutting perpendicular to the foliation /Penttinen et al. 2006/.*

4.4 Diffusion experiments

4.4.1 Through-diffusion

The evaluated matrix diffusivities are presented in Table 4-3. A total number of 66 rock samples could be evaluated for matrix diffusivities that ranged over three orders of magnitude, from the lowest amphibolite (KFM02A 181.01 mbl) value of 4.9E–14 m^2/s to the episyenitic rock found in KFM02A at 276.05 mbl of 4.8E–11 m^2/s. It is interesting to note that these extreme values were found less than 100 m from each other in the same borehole!

A typical example of the results of an individual through-diffusion experiment is shown in Figure 4-12. The model has some inability to reproduce the early time data, but the steady state at late times is well fitted. The deviation at early times (the model is below the early data) has also been observed in earlier studies /e.g. Johansson et al. 2000, Valkiainen 1992/. The derivate plot shows how a steady state is reached at about 150 d. Some scatter in data is observed, most obviously in the derivative plot which is due to the relatively small concentration differences between successive measurements. The uncertainty in the parameter estimation for an individual rock sample is further discussed in the uncertainty analysis below.

The diffusivity histogram in Figure 4-13 displays the distribution of matrix diffusivities for all samples. The episyenites (vuggy rock) in KFM02A are clearly separated from the majority of samples, which to some extent resemble a normal or lognormal distribution.

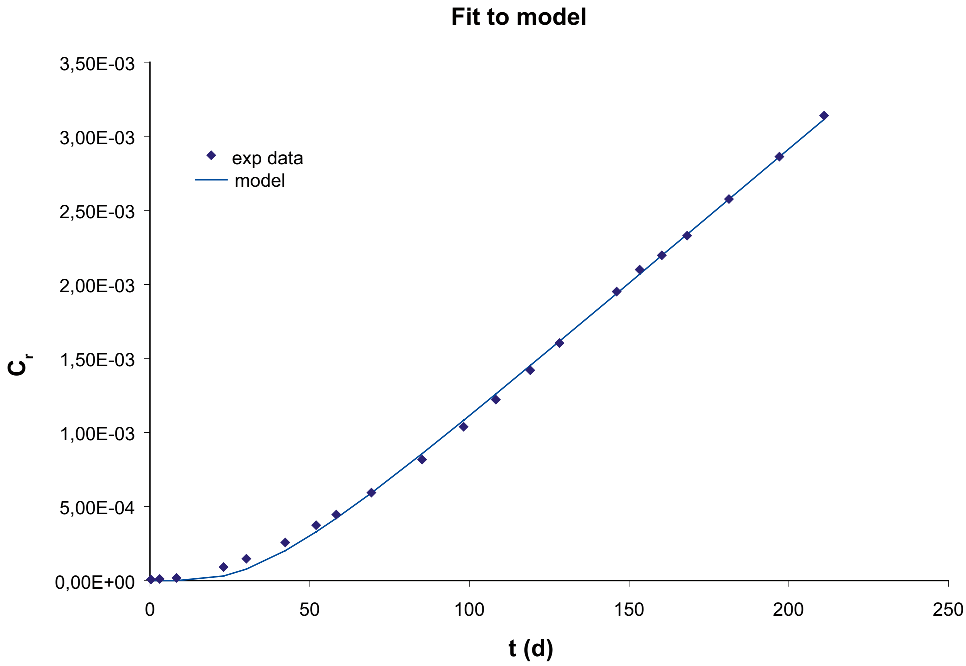
The high porosity of the episyenites in KFM02A, see e.g. Figure 4-13 and 4-14, results in very high matrix diffusivities for this group of samples, on the order of 5E–11 m^2/s. These high values influence the mean values for all samples which is clear from Table 4-3, where the mean calculated for all data (column 1) and with all episyenitic (vuggy rock) samples excluded (column 2) can be compared. Consequently, the median value of approximately 3E–13 m^2/s is a better representation of the typical matrix diffusivity of the 66 samples studied. In the same way, the episyenite affects the rock type "Granite to granodiorite, metamorphic, medium-grained", for which all data with and without episyenite samples can be compared in column 3 and 4.

There are no clear differences in matrix diffusivity between the rock types. However, the few (two) amphibolite measurements indicate that this rock type may have a lower diffusivity than the other rock types.

Table 4-3. Median value, maximum and minimum values in matrix diffusivity and median formation factor for the investigated rock types. A general method uncertainty of ± 25% (given with a coverage factor of 2 corresponding to a 95% confidence interval) should be applied for matrix diffusivity data from individual samples (see the method uncertainty analysis further below).

	All samples	**All samples excluding "episyenites" ***	**Granite to granodiorite, metamorphic, medium-grained**	**Granite to granodiorite, metamorphic, medium-grained, excluding "episyenites" ***	**Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained**	**Tonalite to granodiorite, metamorphic**	**Granite, meta-morphic, aplitic**	**Amphibolite**	**Felsic to intermediate volcanic rock, metamorphic**
D_e ,median value (m^2/s)	**3.1E–13**	**2.6E–13**	**3.2E–13**	**2.5E–13**	**3.2E–13**	**1.7E–13**	**3.8E–13**	**5.5E–14**	**1.2E–12**
$F_{f,HTO}$, median value (–)	1.5E–04	1.2E–04	1.5E–04	1.2E–04	1.5E–04	8.0E–05	1.8E–04	2.6E–05	5.6E–4
D_e ,maximum value (m^2/s)	4.8E–11	1.6E–12	4.8E–11	1.4E–12	1.6E–12	1.8E–13	6.3E–13	6.2E–14	–
D_e minimum value (m^2/s)	4.9E–14	4.9E–14	5.2E–14	5.2E–14	8.7E–14	1.5E–13	1.3E–13	4.9E–14	–
Number of samples	66	54	44	32	14	3	2	2	1

* The "episyenite" (vuggy rock) is represented by 9 samples in KFM02A 275.94–281.04 mbl and 3 samples in KFM06A 331.72–331.81 mbl.



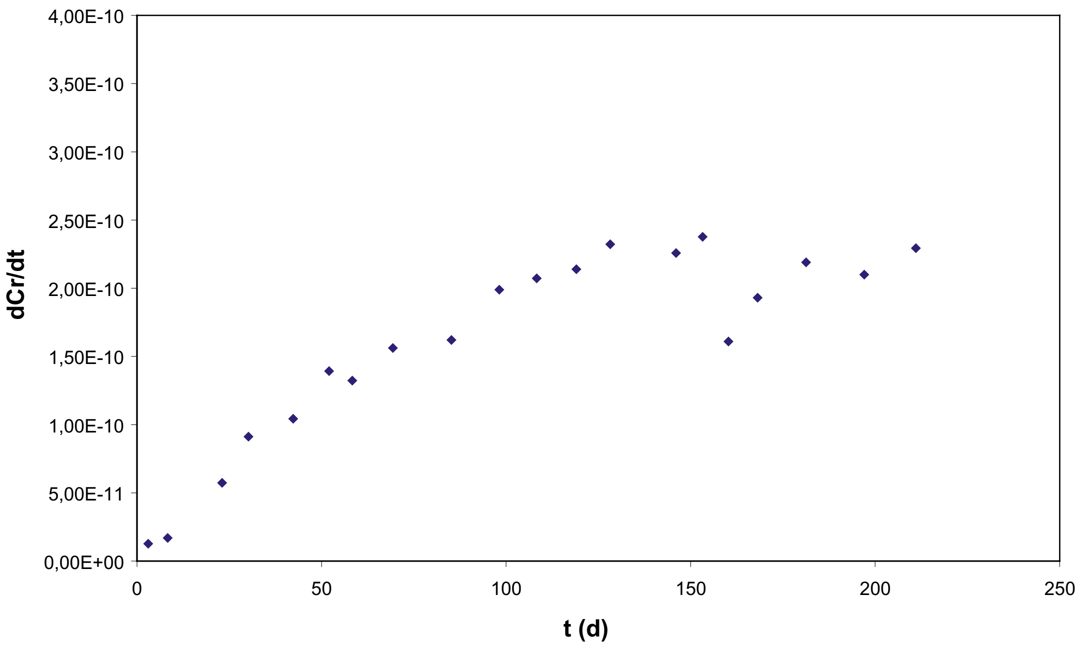


Figure 4-12. *Concentration versus time plot (top) and dCr/dt versus time for KFM03A 242.43–242.46 mbl (actual sample thickness 30 mm. De = 1.8E–13 m²/s ; capacity factor = 0.43%; water saturation porosity = 0.19%).*

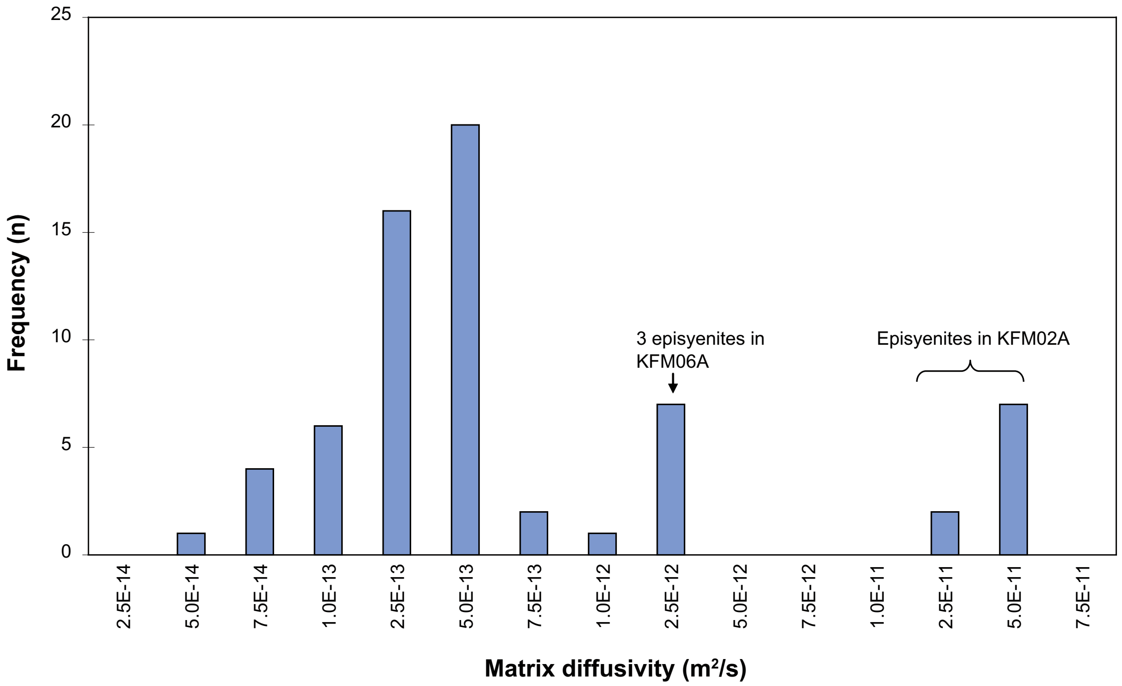


Figure 4-13. *Frequency distribution of matrix diffusivities for all samples. The staples show the number of samples in each interval (e.g. there are 20 samples in the interval 2.5E–13 to 5.0E–13 m²/s).*

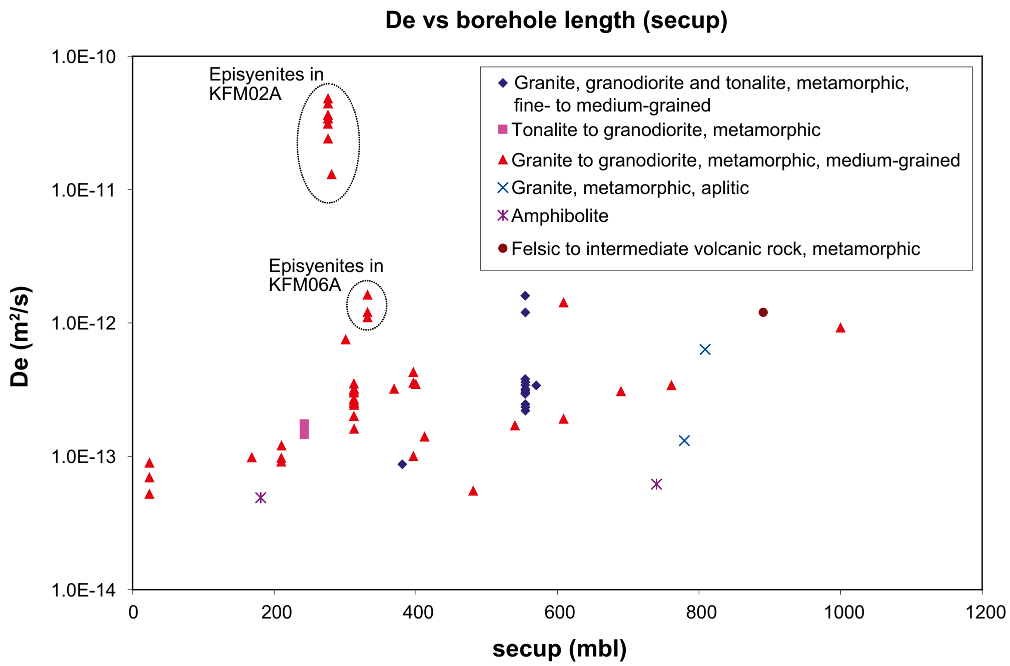


Figure 4-14. *Matrix diffusivity versus sample depth for different rock types.*

The variation of diffusivity with borehole length is shown in Figure 4-14. No correlation of diffusivity with depth can be verified with significance, although a very slight general diffusivity increase with increasing depth (if excluding episyenites) is indicated.

Diffusivity data for three rock samples, each cut into different sample thicknesses, are shown in Figure 4-15. No correlation of diffusivity with sample thickness can be verified.

Figures 4-16 and 4-17 present matrix diffusivity as a function of water saturation porosity and rock capacity factor respectively. A positive correlation with both porosity and capacity factor is observed when the whole range in porosity/capacity factor is regarded. However, the large scattering in data in the typical porosity range (< 0.5%) points to influence of other factors. Variation in pore structure such as foliation, pore connectivity or possible effects of the casting in epoxy resin may affect the correlation with porosity and capacity factor.

The epoxy resin has a very low diffusivity (< 5E–16 m^2/s) according to a separate measurement of an epoxy disc, i.e. the diffusion in the resin is about 100 times lower than that of the lowest measured values of the rock types (~ 5E–14 m^2/s). Consequently the diffusion in the resin is negligible compared to that in the rock samples studied. However, it can not be excluded that a diffusion accessible pore space is created by casting in the resin-rock interface which may affect the diffusivity. The effect of this method uncertainty on the quantification of matrix diffusivity is estimated in the uncertainty analysis below.

In Figure 4-18 the capacity factors and water saturation porosities are compared. Theoretically, the data are expected to be equal for each sample since non-sorbing HTO was used as tracer for which $\alpha=\varepsilon$. However, the mean capacity factor/porosity ratio is ~ 3 for all samples excluding the episyenites, while it is ~ 0.5 for the episyenites. It is apparent that the capacity factor is a poor estimate of the matrix porosity with consideration to the scattering in data.

10 of the 11 highest ratios of α/ε observed (ratio between 4 and 12, α between 1.4% and 2% and ε between 0.19% and 0.37%) were attributed to 5 and 10 mm thick samples which is a clear overrepresentation of short samples. The reason for this is not well understood and although the α/ε-ratios were high, the D_e values were normal for these samples (in the range from 2.2E–13 to 3.8E–13 m^2/s).

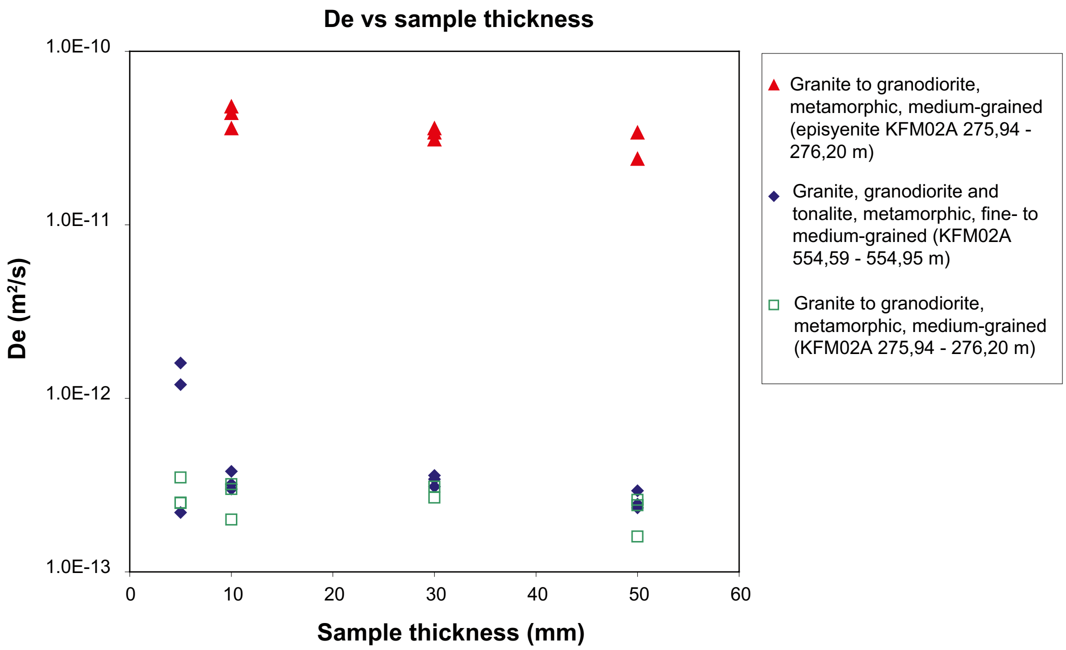


Figure 4-15. *Matrix diffusivity versus sample thickness for different rock types.*

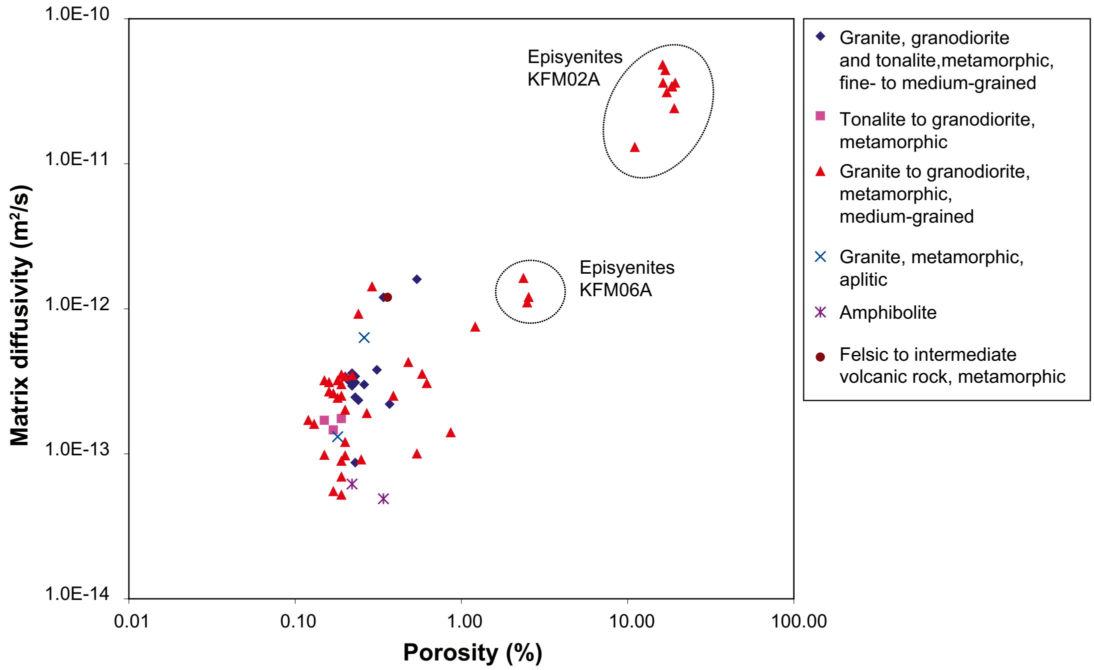


Figure 4-16. *Matrix diffusivity versus porosity for different rock types.*

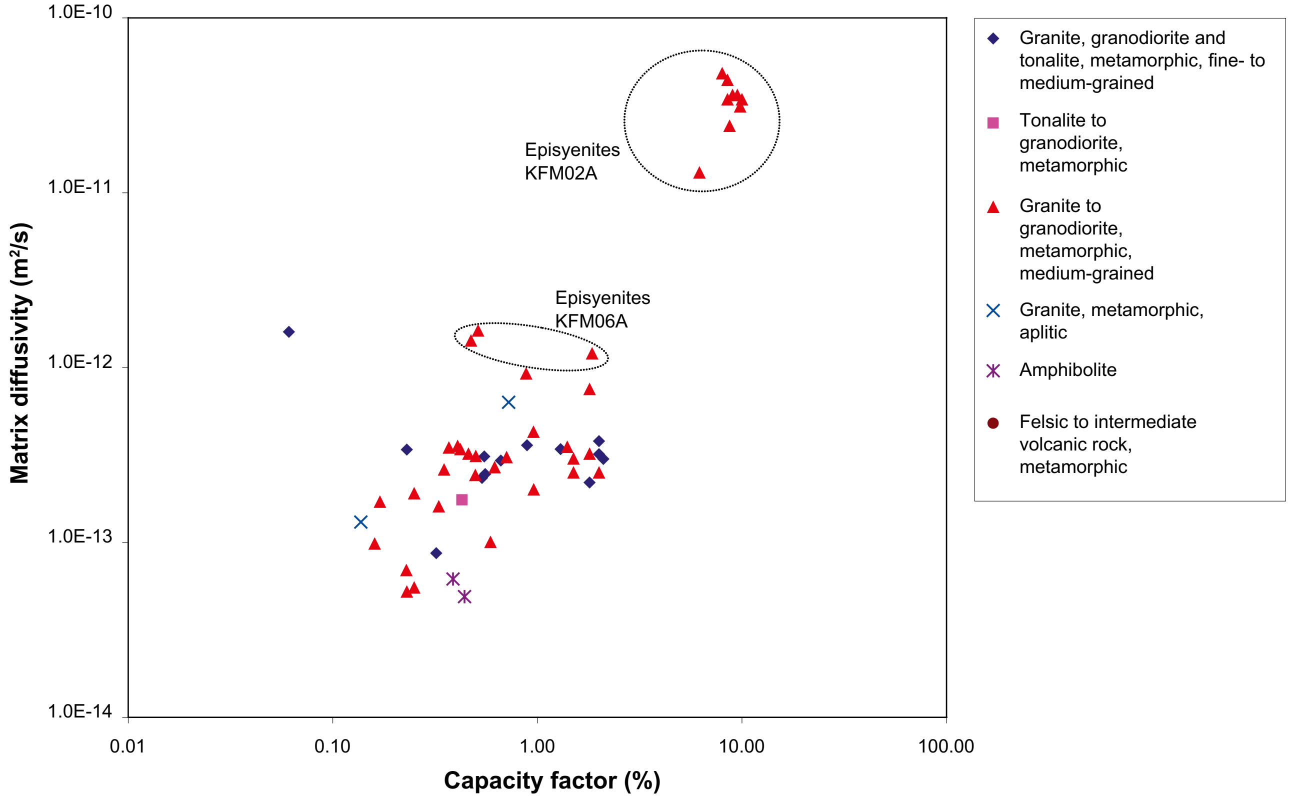


Figure 4-17. *Matrix diffusivity versus capacity factor for different rock types.*

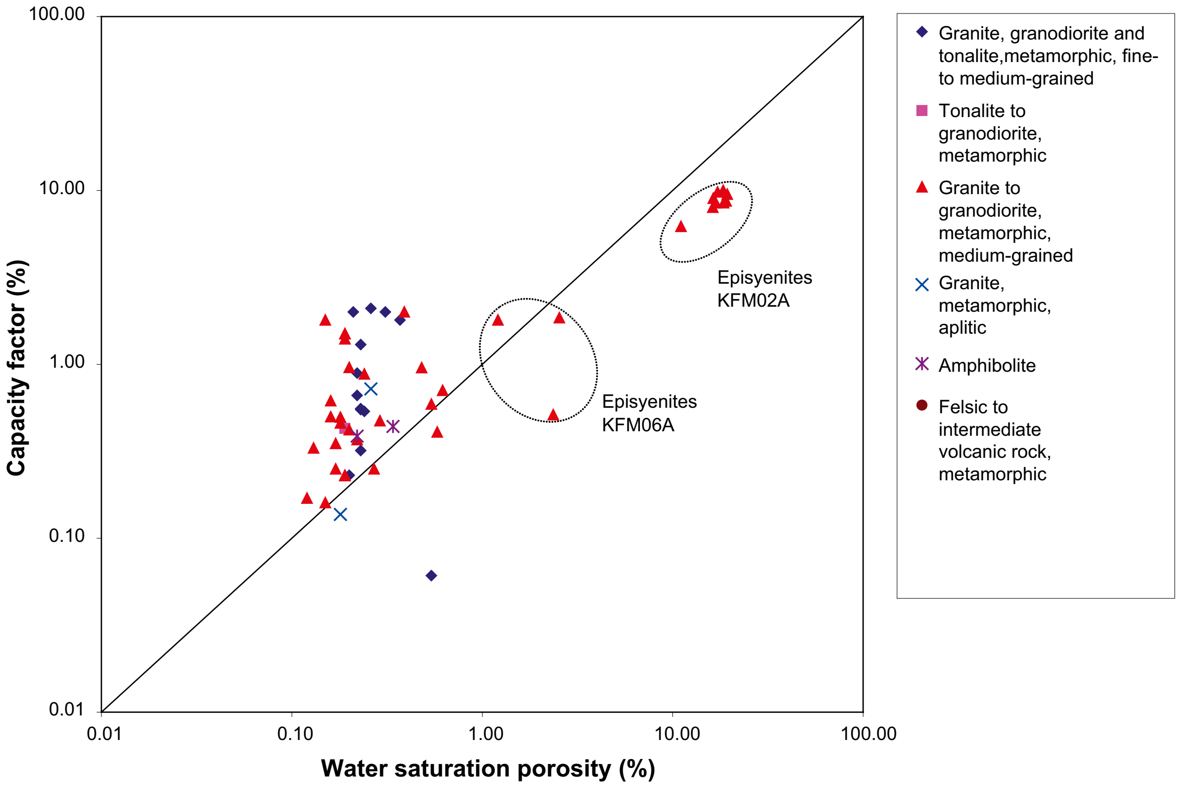


Figure 4-18. *Capacity factor versus porosity for different rock types. The relative uncertainty in individual capacity factors was on average ± 13% (Note that this is relative uncertainty!) for a 95% confidence interval. The absolute uncertainty in individual porosity data is ± 0.09% for a 95% confidence interval.*

Besides a possible influence of the casting as discussed above, it can be questioned if the considerably longer experimental time used in the diffusion experiment compared to that of the water saturation measurement may affect the results. On average 8 months were used for each diffusion experiment while the water saturation part of the porosity measurement lasts for approximately 4 days. It can not be excluded that mineral reactions may affect the porosity and that the water absorption continues to increase the accessible pore space during the longer time applied in the through-diffusion experiments. Such effects would result in an increased capacity factor.

Method uncertainty estimation

The through-diffusion experiments were terminated when a plateau was reached in the time derivative curves. Scatter in data could however have an influence on the decision of termination of an experiment which may cause an "*experiment time uncertainty*". The effect of the duration of a single through-diffusion experiment on the evaluated matrix diffusivity is analysed for one 30 mm sample and one 50 mm thick sample. In Figure 4-19 and 4-20, the matrix diffusivity is evaluated according to the method description and plotted for successively increasing time. The 30 mm sample in Figure 4-19 indicates a small continuous increase in matrix diffusivity (about 2% over the last 50 days of measurement) at the termination of the experiment, while the sample shown in Figure 4-20 indicates that a stable value is reached. Furthermore, the continuous increase in matrix diffusivity from early times show that the model has limitations in the ability to match the data (matrix diffusivity is independent of experiment time for an ideal porous medium). However, even though some samples may not have reached a true steady state at the termination of the experiment, the experiment time uncertainty is within a few % since the curve approaches a steady state.

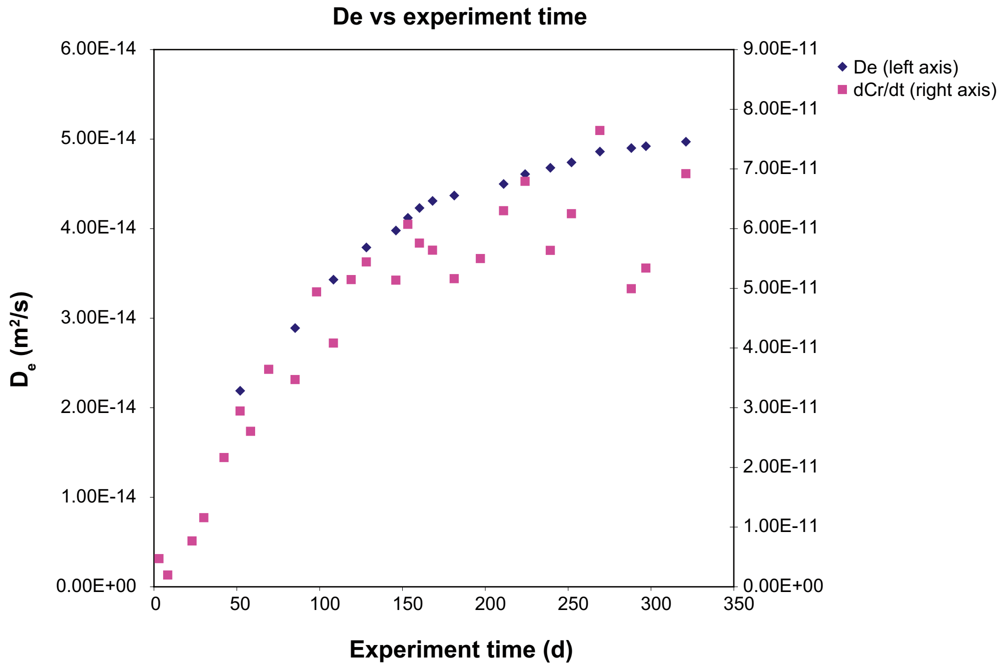


Figure 4-19. *Example of the evaluation of matrix diffusivity (left axis) for increasing experiment time for sample KFM01B 23.99–24.02 mbl (30 mm sample size). The time derivative of the concentration in the target cell is plotted on the right axis.*

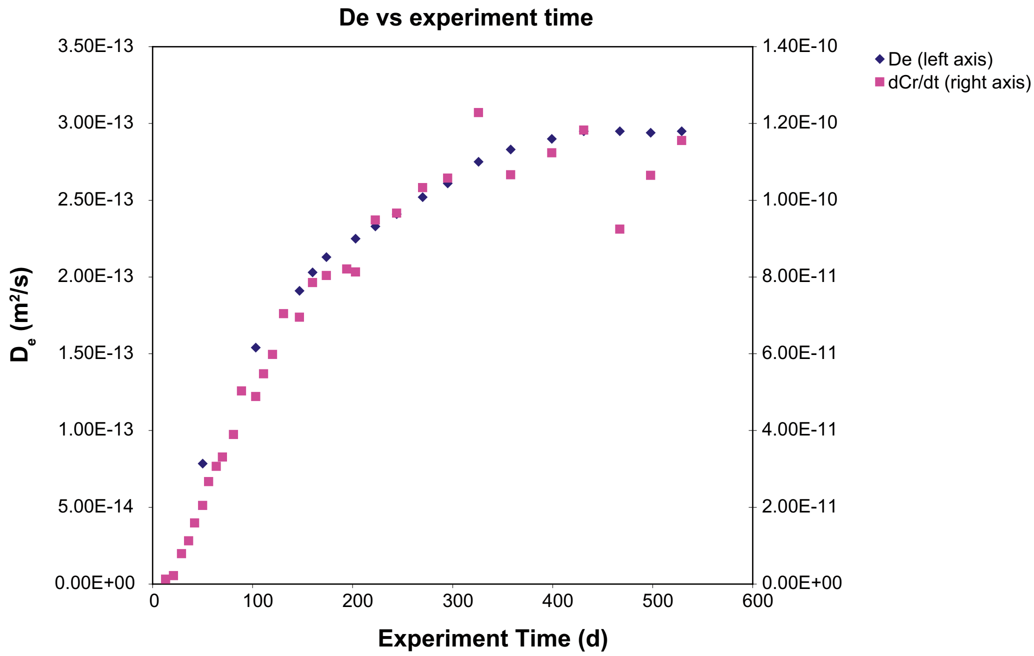


Figure 4-20. *Example of the evaluation of matrix diffusivity (left axis) for increasing experiment time for sample KFM02A 554.65–554.70 mbl (50 mm sample size). The time derivative of the concentration in the target cell is plotted on the right axis.*

The *parameter estimation uncertainty* in the modelling of a *particular* through-diffusion sample (at its final experiment time such as that shown in Figure 4-12) is on average only ±3% for the matrix diffusivity and ±13% for the capacity factor (both given with a coverage factor of 2, i.e. for a 95% confidence interval). However, the poor correlation between porosity and capacity factor causes a *general method uncertainty* since the evaluated matrix diffusivity differs somewhat between the following two cases:

A. Evaluation according to the method description with estimation of two parameters, D_e and α.

B. Alternative evaluation with estimation of one parameter, D_e, and setting a fixed capacity factor, α=ε, based on the water saturation porosity (considering that ideally α=ε).

Case A is defined in the method description which theoretically implies that the capacity factor is equivalent to the matrix porosity for HTO. Case B is a reasonable alternative evaluation method that results in a slightly changed D_e value for samples with $\alpha/\varepsilon \neq 1$.

The general method uncertainty was estimated in the following way:

1. The mean and standard deviation of the distribution of log (α/ε) was determined (see Figure 4-22).
2. D_e was calculated according to case A and B above for 4 samples at the –1s and 4 samples at the +1s level (the left and right arrows in Figure 4-22).
3. For each sample the relative difference (in %) between D_e from case A and B was calculated. An example is given in Figure 4-21.
4. The mean relative difference of the four samples at –1s and +1s, respectively, was calculated. The result was ±13% at both –1s and +1s.
5. The general method uncertainty at ±2s level can thus be approximated with 2 × ±13 ≈ ±25% (for a 95% confidence interval).

Since the general method uncertainty dominates over the parameter estimation uncertainty and experiment time uncertainty in matrix diffusivity, it is equivalent to a *general combined method uncertainty* that includes the parameter estimation uncertainty and experiment time uncertainty. The *general combined method uncertainty* in matrix diffusivity is on average approximately ±25% (coverage factor of 2) and should be applied for any particular matrix diffusivity table data.

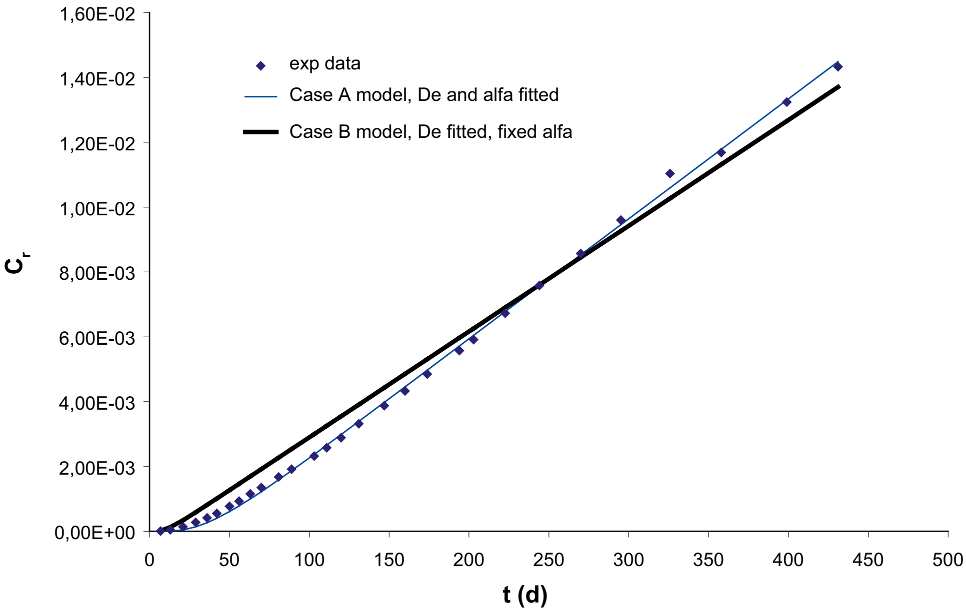


Figure 4-21. *Example of the evaluation for Case A and B for sample KFM02A 554.72–554.75 mbl, 30 mm thickness. Case A:* D_e *= 3.60E–13 m²/s, α=0.89%. Case B:* D_e *= 3.20E–13 m²/s, α=ε=0.22% (fixed). The relative difference,* $(D_{e,A}–D_{e,B})/D_{e,B}$*, was 13.8% for this sample.*

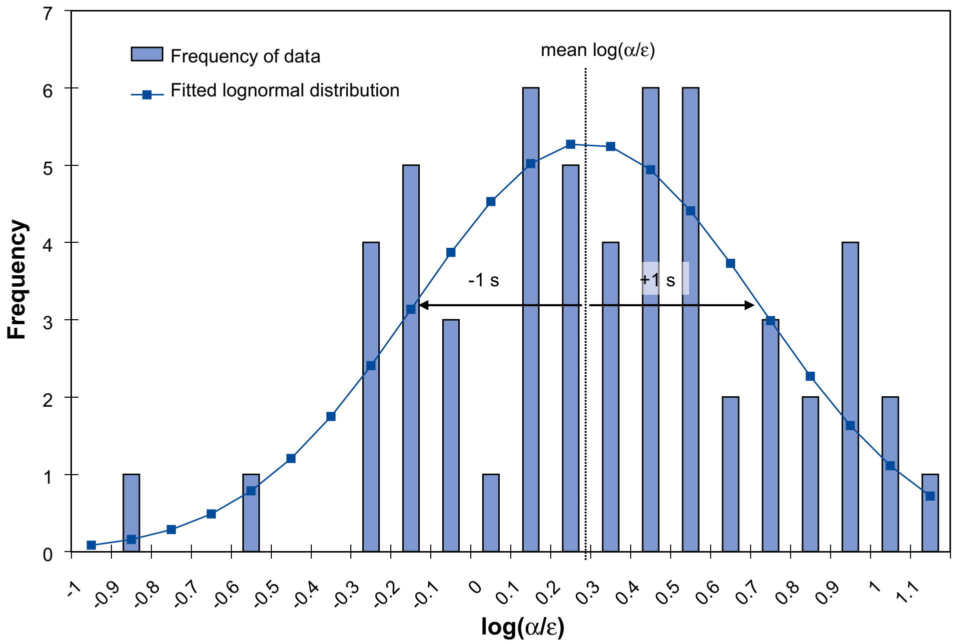


Figure 4-22. *Frequency of the logarithmic capacity factor-porosity ratio (log(α/ε)).*

4.4.2 Resistivity and formation factor

Resistivity data for calculation of the formation factor and effective diffusivity are reported in four separate reports (*see also* Section 3.4.2). However, a brief summary of the results is presented in Table 4-4 and in the text below. I should be noticed that data from the resistivity measurements are reported by one or several boreholes, not by rock types. Presentation of data for different rock types is a forthcoming assignment within the Retardation model.

Resistivity measurements have been conducted on 163 rock core samples in four campaigns. In the first campaign, samples were taken each 20 m throughout the whole core, 100–1,000 m borehole length, in boreholes KFM01A and KFM02A. The obtained resistivity values are fairly uniform, but a slight increase of the formation factor with depth can be seen for both KFM01A and KFM02A (Figure 4-23). The second campaign comprises samples mainly from KFM04A and KFM05A, taken each 20 m in sections of special interest in the boreholes. In addition to this, a few samples from KFM03A were involved. Formation factors from this set are comparable to KFM01A and KFM02A, but do not display any significant trends with respect to depth (Figure 4-24). A few samples from KFM04A display anomalous resistivity results, i.e. significantly lower resistivity and thus higher formation factor. These samples contain sealed fracture networks and originate from borehole sections that have been classified as possible deformation zones in the geological single-hole interpretation (SHI).

Rock samples, earlier involved within through-diffusion measurements, constitute the major part of the third set of resistivity measurements. Obtained data from these measurements are relatively uniform.

The fourth set includes rock samples required for complementary information of rock types, deformation zones, wall rock alteration etc. Resistivity values displayed a moderate spread and no outliers with significantly different formation factors were found.

Table 4-4. Summary of the data in P-reports, presenting median values from resistivity measurements on rock core samples.

SKB report	Boreholes	No of samples	Resistivity, (Ωm)	Formation factor (F_f)
P-05-26	KFM01A, KFM02A	79	452	2.86×10^{-4}
P-05-76	KFM03A, KFM04A, KFM05A	45	716	1.56×10^{-4}
P-07-51	KFM01A, KFM01B, KFM02A, KFM05A, KFM06A	31	460	2.32×10^{-4}
P-07-137	KFM01A, KFM02A, KFM06A, KFM08A, KFM08C	8	849	1.70×10^{-4}

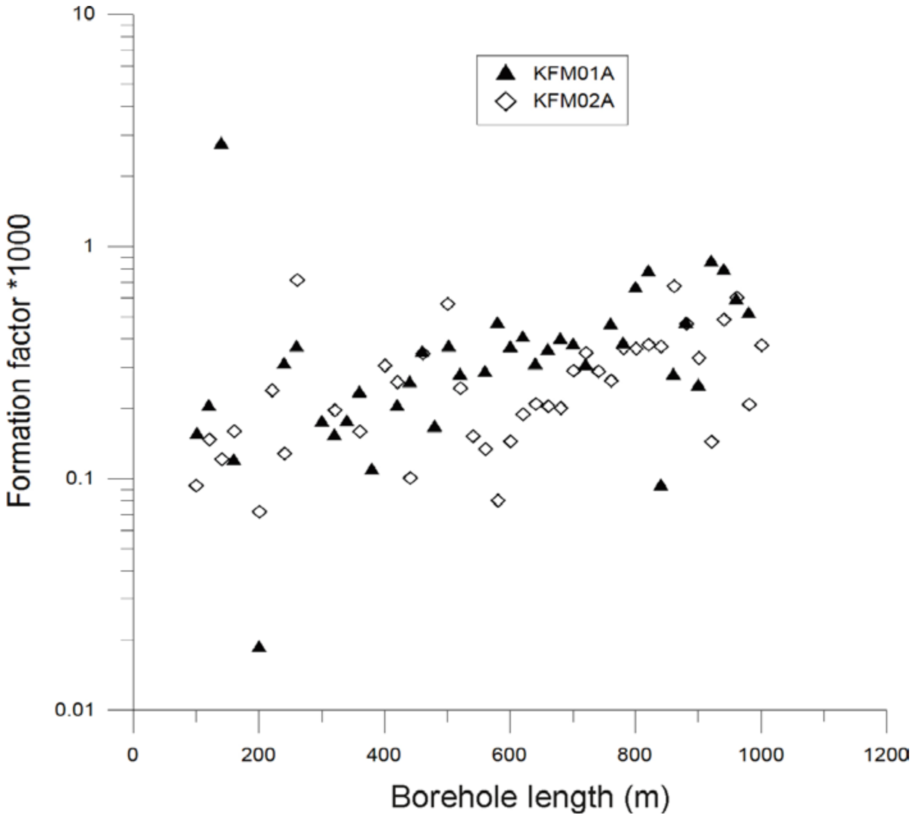


Figure 4-23. *Formation factor plotted as a function of borehole length along the cored boreholes in KFM01A and KFM02A /Thunehed 2005a/.*

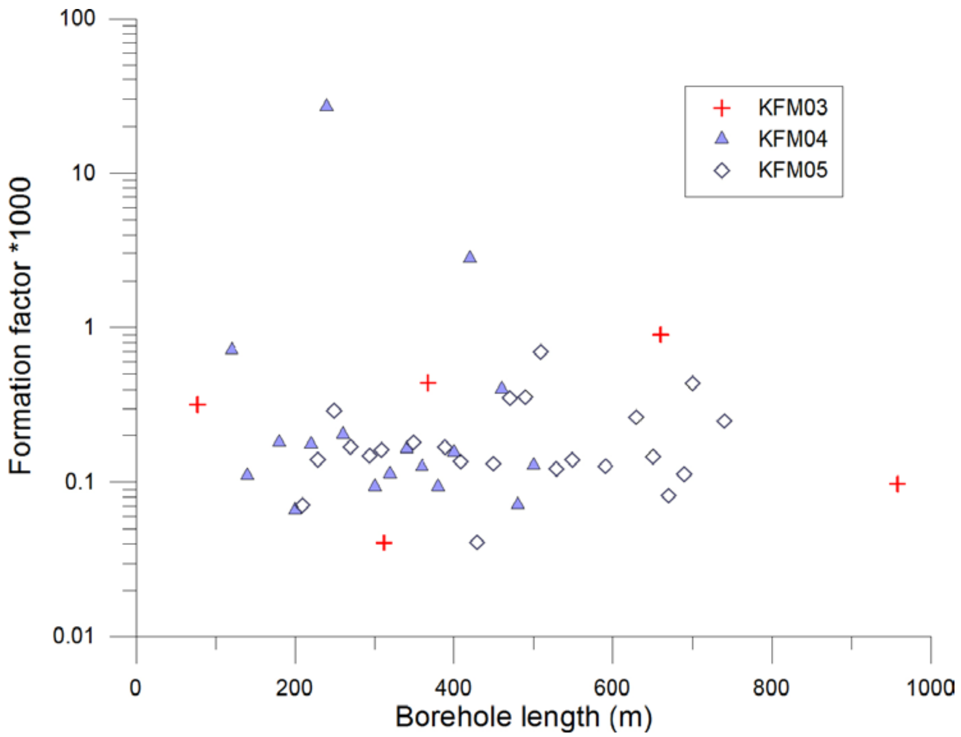


Figure 4-24. Formation factor plotted as a function of borehole length along the cores in KFM03A, KFM04A and KFM05A /Thunehed, 2005a/.

4.5 Sorption investigations

4.5.1 BET

A numerical representation of the complete results of the BET measurements is given in Appendix 3 and a summary of the results is given in Table 4-5. Some general observations can be made from the investigations:

- Samples from crushed fresh rock types show that values < 0.06 m^2/g are obtained for the 2–4 mm size fraction and < 0.35 m^2/g for the 0.063–0.125 mm size fraction. It is always observed that the BET surface area increased with decreasing particle size which supports the hypothesis that the crushing process creates surfaces not representative of intact rock. This hypothesis is also supported by the relatively few numbers of measurements of non-crushed drill cores (Figure 4-25) which give results in good agreement with their corresponding 2–4 mm size fraction.
- No significant difference between the different non-altered rock types can be observed. The crushed rock from the altered rock and particularly the vuggy rock samples, however, show a significant increase in BET surface area.
- A very large increase in BET surface is observed for the rock material sampled from the fractures (which opposite to the samples from the fresh rock types has not undergone any crushing process). Samples in the size fraction of 2–4 mm (Figure 4-26) mm show values in the range of 0.3–7 m^2/g and for the < 0.125 and 0.063–0.125 mm size fractions (Figure 4-26) corresponding values of 0.4–10.5 m^2/g are obtained. A summary and a comparison of the results from the smallest size fractions are presented in Figure 4-27.
- Extrapolations according to the outer/inner surface concept (Equation 3-6) yield inner BET surface area values close to the ones measured for the 2–4 mm size fraction. However, for some samples, large uncertainties are obtained in the extrapolation concept and no inner surface area can be verified (only a “lower than” value is given for these cases).

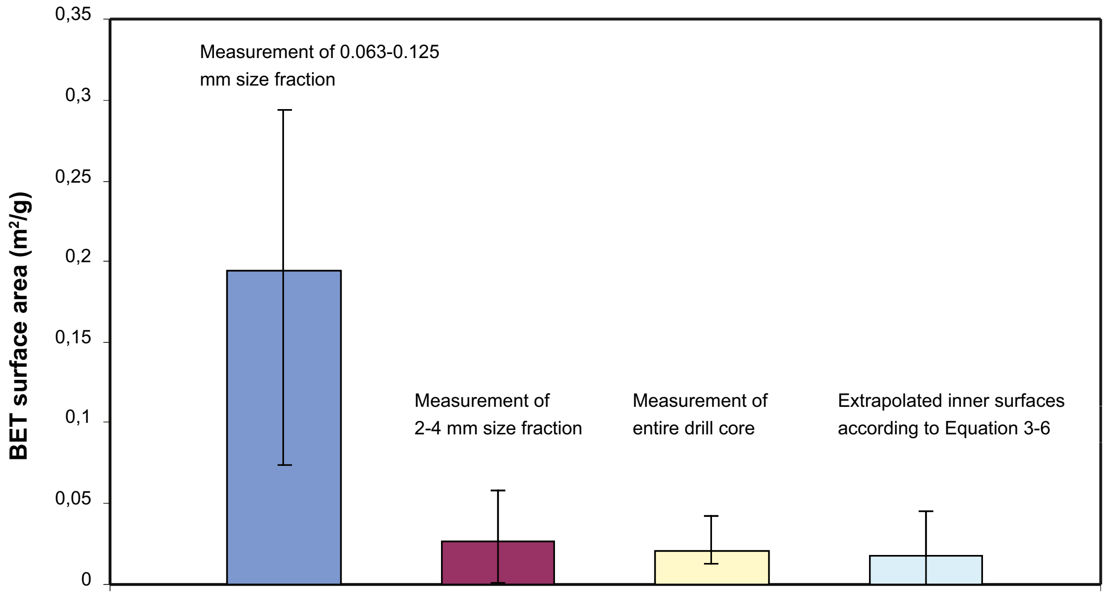


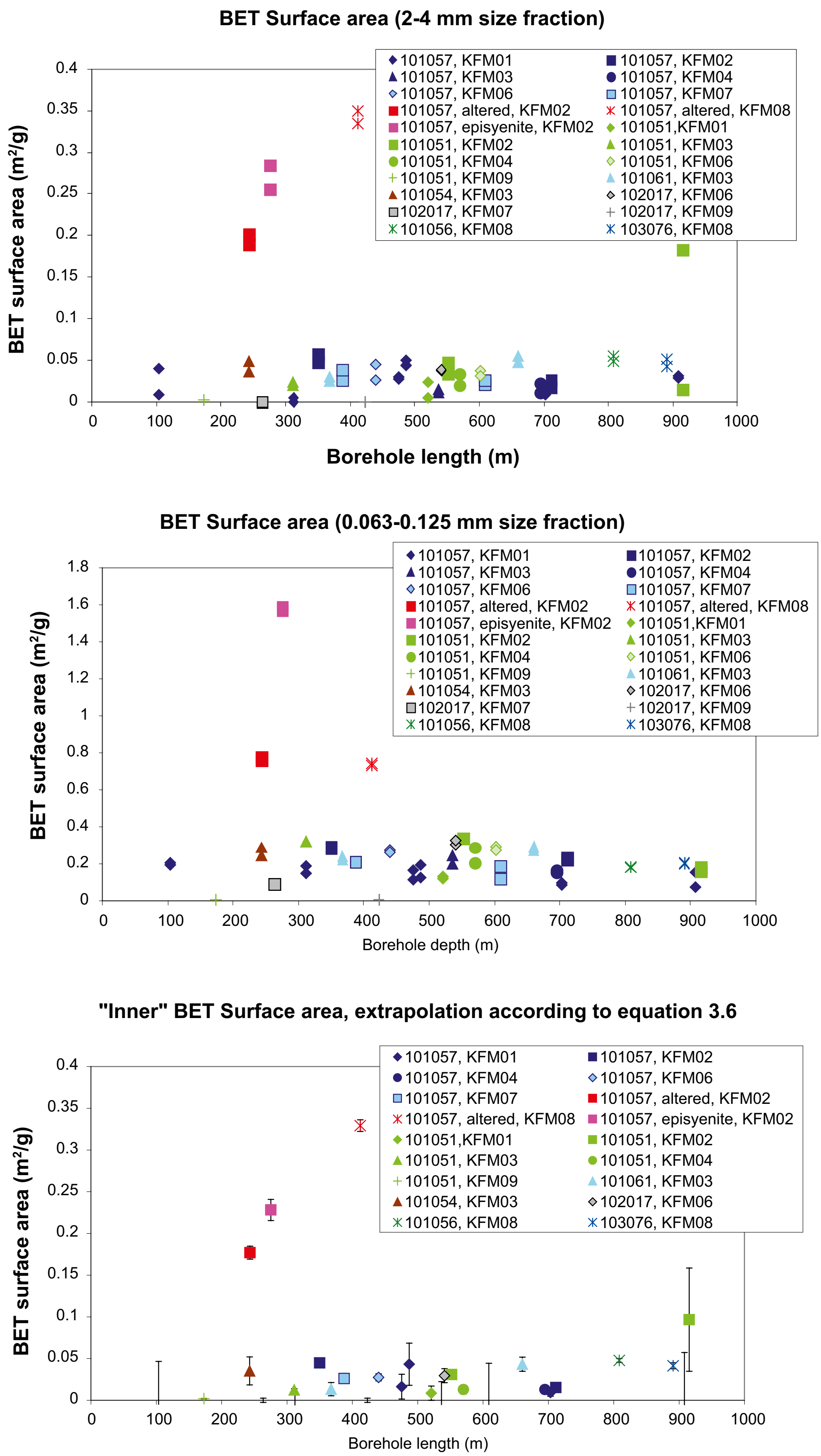
Figure 4-25. *Comparison between the results of BET surface area measurement of the 101057 rock type. The presented values refer to the median values and the error bars refer to the uncertainty represented by the minimum and maximum values obtained for all the measurements.*

Table 4-5. Results of the BET surface area measurements, mean values and standard deviation (1s) for the major rock types and the different measurement methods.

Rock type (SKB code)	0.063–0.125 mm size fraction (number of samples)	2–4 mm size fraction (number of samples)	Extrapolation according to Equation 4-1 (number of samples)	Entire drill core (number of samples)
101057	0.19 ± 0.06 (27)	0.025 ± 0.015 (27)	0.020 ± 0.015 (13)	0.024 ± 0.012
101051	0.17 ± 0.12 (14)	0.034 ± 0.045 (14)	0.028 ± 0.031 (7)	

The number of BET surface measurements is rather low and a meaningful mean value can only be given for the fresh and non-altered major rock types, i.e. granite to granodiorite, metamorphic, medium-grained (101057) and granite, granodiorite and tonalite, metamorphic, fine- to medium-grained (101051), cf. Table 4-5.

A relatively large spreading in the results for the crushed rock material can be observed. Given the results of the altered rock and the fracture material, a plausible explanation to the strong variation could be heterogeneous distribution of small amounts of altered material in the samples.



Figures 4-26. *Results for the BET surface are measurements for the crushed rock samples, large (top) and small (middle) size fraction combined with the results for the extrapolation (bottom).*

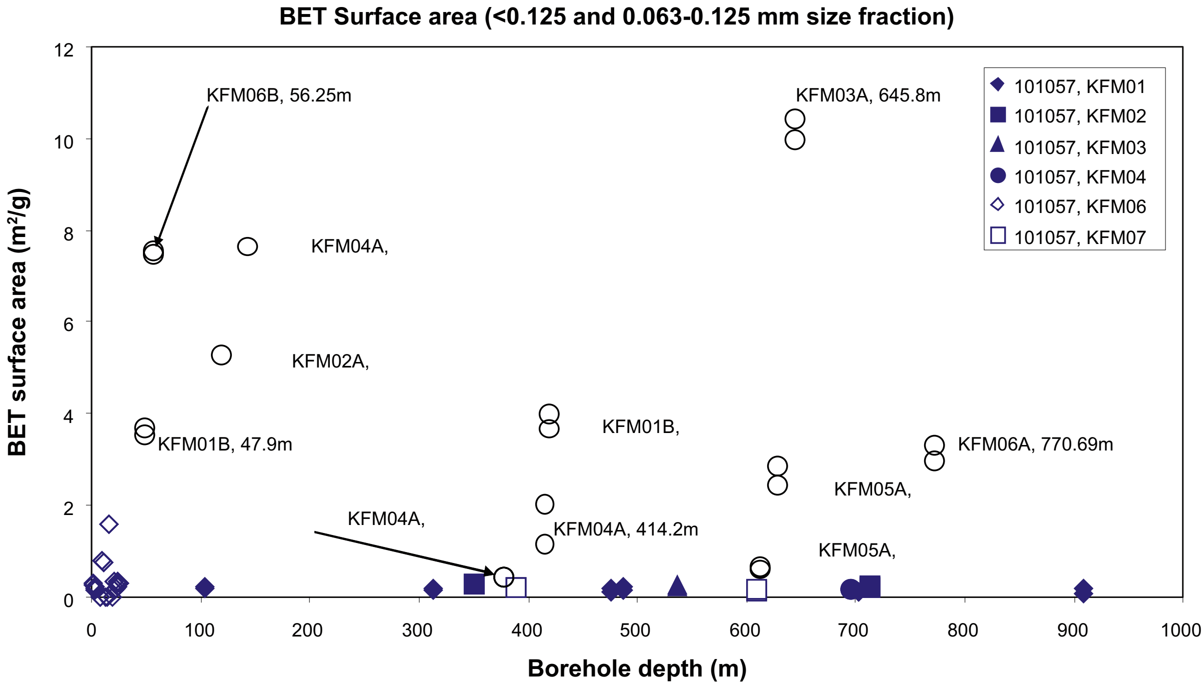


Figure 4-27. *Results of the BET Surface area measurement for the loose fracture material (circles) given in comparison to the non-altered 101057 rock type.*

4.5.2 CEC measurements

As a general comment to the results of the CEC measurements, it must be mentioned that method applied in this work (cf. Section 3.5.2) is comparatively insensitive for employment on the low CEC:s most often associated with crystalline rock. The implication of a low CEC is that a very low amount of the Mg^{2+} is lost from the aqueous solution and it becomes difficult to statistically verify such a small loss. It has been reported (Karin Lindholm, Analytica AB, pers. comm.) that the precision in the Mg^{2+} is 5% which causes the most results for the unaltered rock samples to be below the detection limit or associated with considerable uncertainty.

The fracture samples show higher CEC, but the results are, nevertheless, also associated with rather high uncertainty. The reason for this is that a general shortage of the availability of this material made it necessary in the CEC measurements to use less amount of material than the 10 g stipulated by the method.

Data from the CEC measurements are to be found in Appendix 4. Some preliminary conclusions can be made from the data (Table 4-6 and Figure 4-28):

- Cation Exchange Capacities (CEC) can be found in the range of 0.2–2.6 cmoles/kg for the crushed major rock types and in the range of 4.1–18.3 for the rock materials associated with the fractures.
- The agreement between the CEC and the amount of desorbed cations is rather bad which indicates difficulties of applying the method to this rock material of rather low CEC. Generally, the results give much lower CEC compared to the amount of extracted cations which could be an indication that mineral dissolution is taking place during the step of contact to the Ba solution.
- Comparisons of the BET surface are to the CEC (Figure 4-28) indicate some correlation, although far from perfect.

Table 4-6. Results from the CEC measurements.

		Borehole	Borehole length (m)	CEC (cmoles/kg)	Exchangeable cations (cmoles/kg) min	max	BET (m^2/g)
Unaltered rock							
Rock type	**Fraction**						
101057	0.063–0.0125 mm	KFM01A	103.46	0.9 ± 0.7	1.4	4.1	0.25
			487.10	0.7 ± 0.6	0.0	3.8	0.16
			908.36	< 0.6	0.0	3.8	0.12
	1–2 mm	KFM01A	103.46	< 1.0	0.3	3.7	0.04
			487.10	< 1.2	0.0	3.5	0.05
			908.18	< 0.8	0.0	3.5	0.03
		KFM02A	275.22	< 0.4	0.0	3.4	0.27
101051	0.063–0.0125 mm	KFM02A	552	2.6 ± 2.0	32.6	44.3	0.34
	1–2 mm	KFM02A	552	< 1.2	6.1	8.5	0.04
Altered rock and fracture material							
	Fraction						
	0.063–0.0125 mm	KFM01B	47.72	20 ± 5	11.5	11.5	3.62
	1–2 mm	KFM01B	47.72	9.0 ± 1.4	9.0	10.2	1.98
	0.063–0.0125 mm	KFM05A	611.68	5.4 ± 2.4	12.9	12.9	0.64
	1–2 mm	KFM05A	611.68	4.1 ± 1.8	6.9	10.5	0.78
	< 0.125	KFM07A	121	15 ± 10	15.7	36.1	
	< 0.125	KFM10A	144.51	18 ± 5	42.9	51.6	

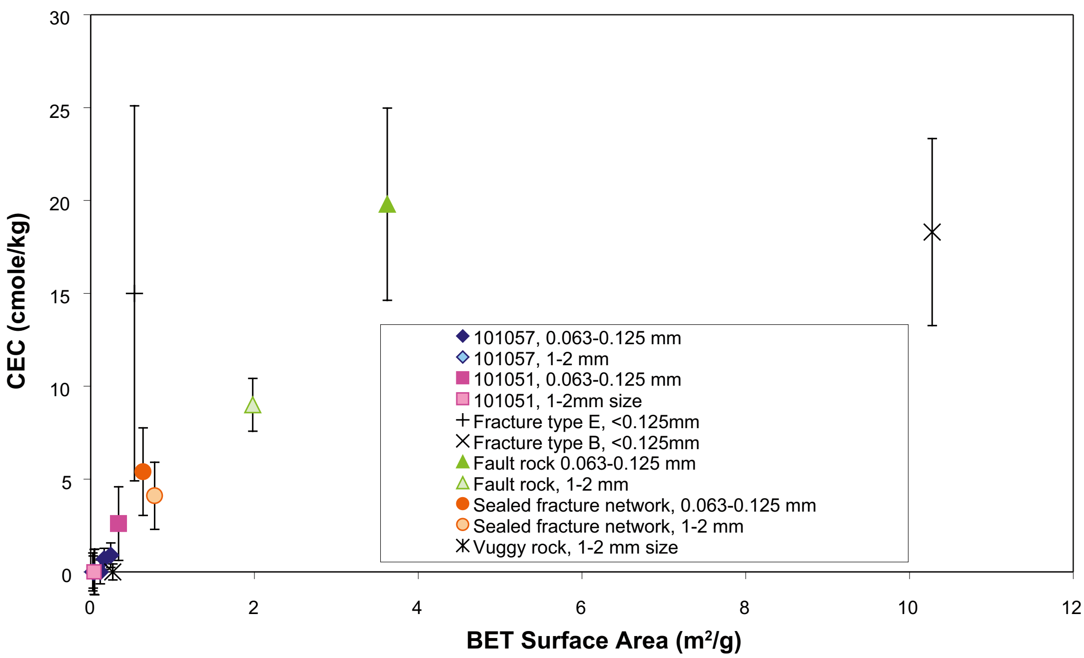


Figure 4-28. *Comparisons of the CEC versus the BET surface area.*

4.5.3 Batch sorption experiments

Some results from the batch sorption experiment are exemplified in this section (Figure 4-29 to 4-31). The major part of the results is found in Appendix 5. Some general observations can be made from the material:

- As expected, a strong increase of the sorption with decreasing ionic strength of the groundwater can be observed for the cations presumably dominated by a cation exchange sorption mechanism, i.e. Cs^+, Sr^{2+} and Ra^{2+}. Sr^{2+} is by far the weakest sorbing tracer and a concentration decrease in the water phase can only be statistically verified for the fresh groundwater. For all other types of groundwater, no sorption of Sr^{2+} can be verified and only detection limits for the sorption coefficients are reported. There is no or very little influence of the ionic strength on the adsorption of trivalent cations (i.e. Am(III) and Eu(III)) while Ni(II) seems to be an intermediate; i.e. some influence of the ionic strength but not as much as for Cs^+, Sr^{2+} and Ra^{2+}.
- The interpretation of the sorption results for crushed rock using the outer/inner surface model (cf. Section 3.5.1) results in varying agreement. Generally, the correlation coefficients are highest for the Cs tracer and lowest for the trivalent cations. Furthermore, for several interpretations the evaluation of the intercept yields no or even negative value; i.e. a negative K_d is obtained. It is obvious that the contribution of inner surfaces (according to conceptual model used, representative for the intact rock) in the adsorption is low compared to the contribution of the outer surfaces (obtained in the crushing process and thus non-representative for the intact rock).
- Concerning the potentially redox sensitive tracers (e.g. U and Np), it is indicated that a strong sorption is obtained in the 0.063–0.125 mm size fraction, an increased sorption that cannot be explained by the increased BET-surface for this size fraction. A possible explanation to this is that minerals possible to be involved in a reduction reaction of these tracers (e.g. $U(VI)O_2^{2+} \rightarrow U(IV)(OH)_x^{(4-x)+}$ and $Np(V)O_2^{+} \rightarrow Np(IV)(OH)_x^{(4-x)+}$) could be enriched in the smaller size fraction. These tetravalent species are known to be strongly sorbed and a faster reduction rate would thus lead to an increased sorption in the smaller size fraction.
- A significant loss of trivalent cations (Eu/Am) was observed already for the blank samples (i.e. samples with natural groundwater spiked with tracer, but without any solid phase). Actually, in most cases the loss of tracer in the blank samples is as high (and in some cases even higher) as in the samples with rock material. The method description stipulates that for the evaluation of the experiments, only the concentration decrease above the simultaneous loss in the blank samples should be attributed as the adsorption on the rock surfaces, whereas all other loss should be considered as adsorption on the test tube walls. Having high losses in the blank samples, very low adsorption is thus obtained and hence, very low adsorption coefficients are obtained.

  However, the method description for batch sorption experiments (SKB MD 540.002) also stipulates that a separate investigation should be performed in the case of more than 10% loss of the tracer in the water phase. In the investigation performed in this case, it was suggested during some preliminary discussions that the present evaluation probably gave a significant overestimation of the adsorption on the test tube walls. It was therefore decided to make alternative measurements for some samples where extraction of rock phase and the water phase was performed, followed by γ-spectrometric quantification of the tracer content for both phases separately. From the results of these measurements it became obvious that for the batches including rock material, the tracer content associated with the test tube walls was negligible compared to the tracer content of the rock surfaces. It was therefore decided in the evaluation of the sorption of the Am/Eu to instead use the tracer concentration in the acidified blank sample also included in the investigation.

- The time dependence of the sorption has been studied by performing samplings at different tracer contact times, i.e. 1 day, 1 week, 1 month, 3 months and 6 months. One should be aware of the fact that full diffusion equilibrium may not have been reached, especially not for the most strongly sorbing tracers. For different practical reasons, it has been considered unrealistic to ensure a full diffusion equilibrium. This can be illustrated by an approximate calculation; applying the numbers D_e= 5E–13 m^2/s, K_d=0.1 m^3/kg, ρ=2,700 kg/m^3, ε=0.002, the theoretically estimated time for obtaining a diffusion equilibrium of r=0.75E–3 m (average radius of the largest size fraction used) can be calculated according to:

$$t = \frac{r^2}{D_e / (\varepsilon + K_d \cdot \rho)} \tag{4-1}$$

This results in a necessary contact time of approximately 10 years, indeed a unrealistic time perspective fort a batch experiment. Furthermore, it has been argued that long contact time in the batch sorption experiments may result in degradation and weathering of the rock material, which also may give erroneous sorption coefficients.

From the discussion above it can therefore be concluded that the present sorption coefficients should more be regarded from a comparative perspective, i.e. identification of strongly and less strongly sorbing rock material/groundwater combinations. For the application of these values in e.g. performance assessment calculation, the limitations mentioned should be regarded.

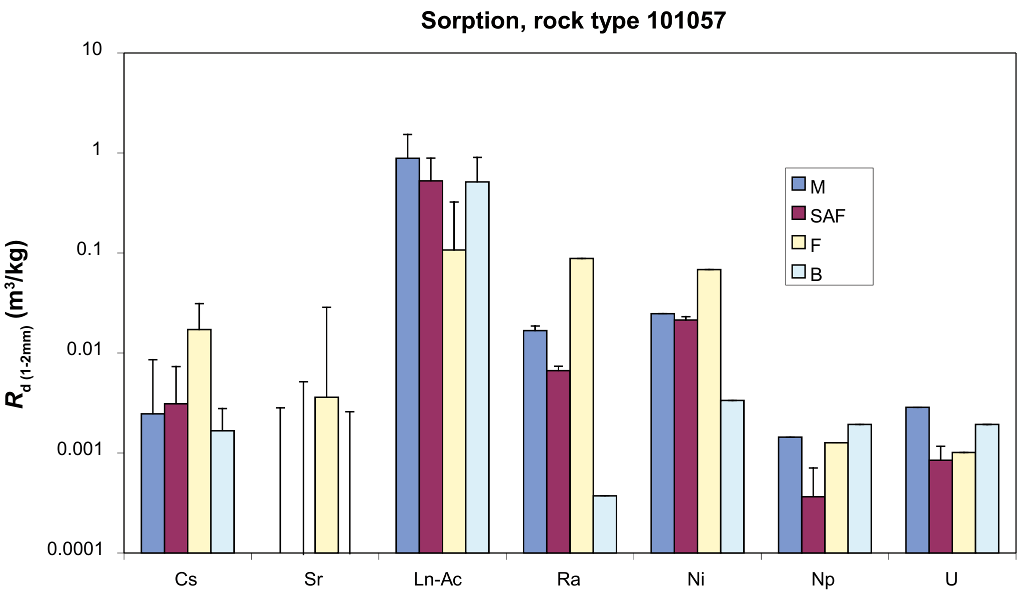
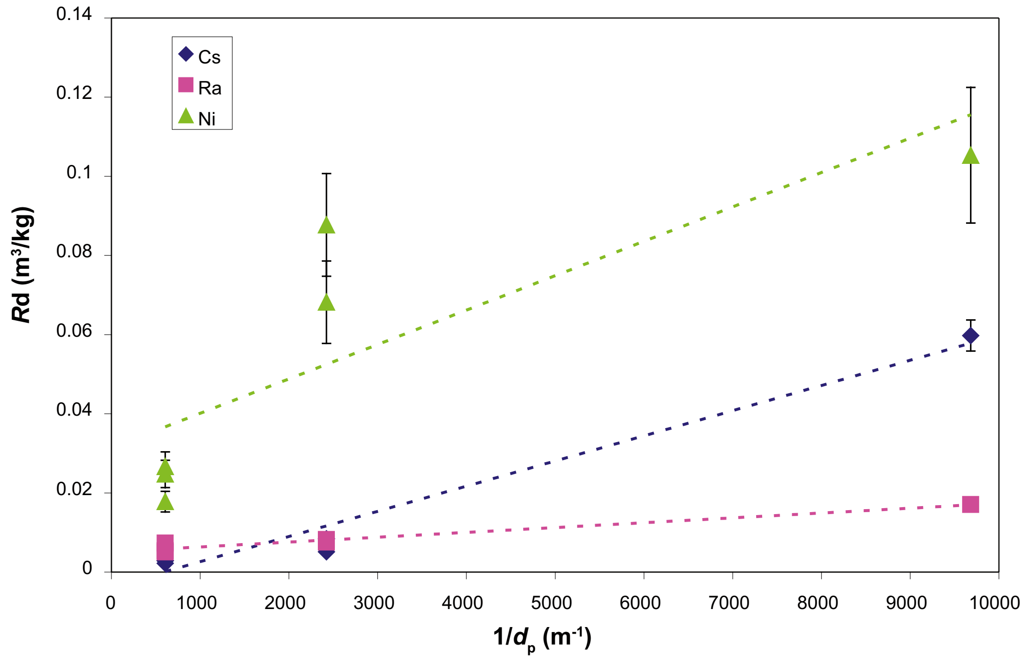


Figure 4-29. *Illustration of the sorption measured in the 1–2 mm size fraction of the 101057 rock type. The median values are given together with error bars representing the minimum and the maximum value measured. The different groundwater types used are marine groundwater (M), saline Forsmark groundwater (SaF), fresh groundwater (F) and brine groundwater (B). In cases when only one sample was measured, no error bars are given.*



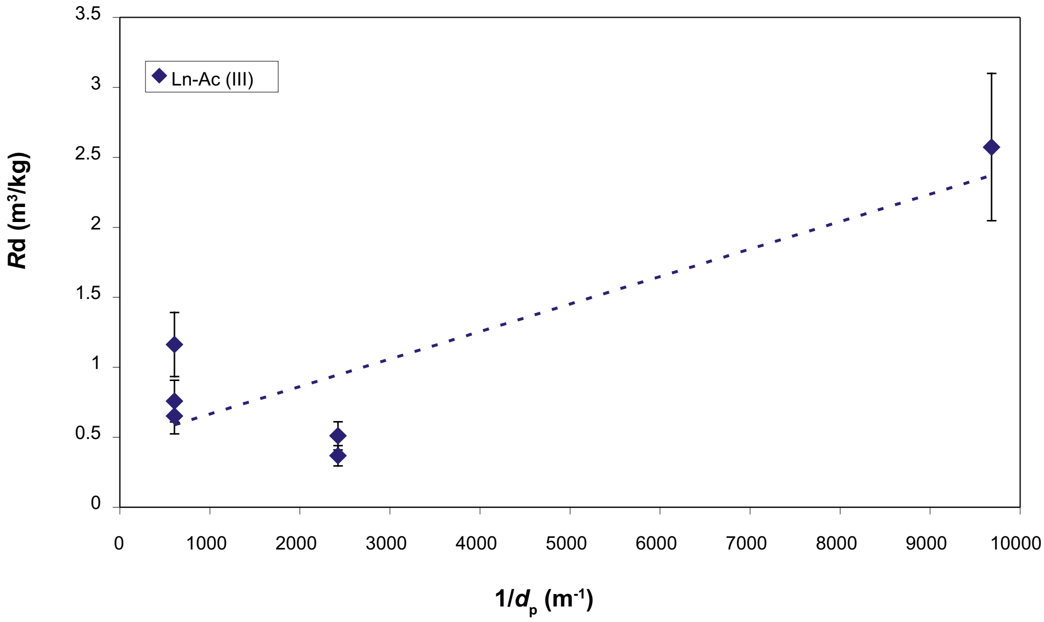


Figure 4-30. *Illustration of the results of the extrapolation according to the inner-outer surface model (Equation 3-7) for Cs, Ra and Ni (top) and Ln-Ac (III) (bottom) for the sorption studies using saline Forsmark groundwater and 101057 rock type from KFM01A 487 mbl.*

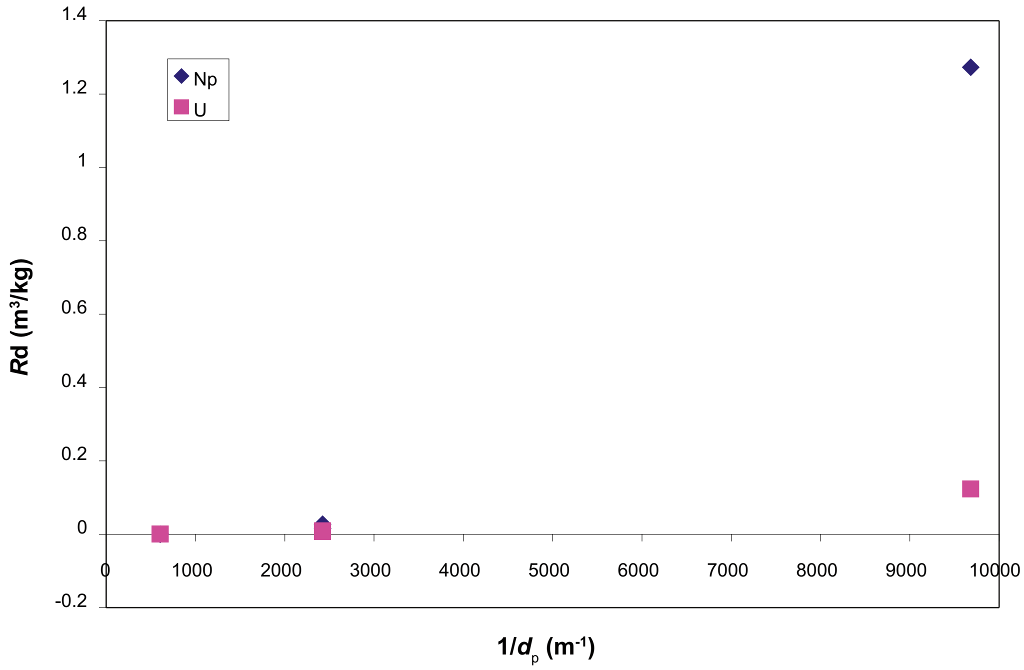


Figure 4-31. *Illustration of the results of sorption of the redox sensitive U and N, using saline Forsmark groundwater and 101057 rock type from KFM01A 487 mbl. It is obvious that the sorption in the smallest size fraction is far higher than what can be explained by increased amounts of surfaces due to the crushing process.*

4.6 Nonconformities

4.6.1 General

The outline for the laboratory work is clearly documented in the laboratory strategy /Byegård et al. 2003/. However it has not always been possible to perform the work as intended. Some deviations to the strategy are listed below:

- CEC measurements were originally /Byegård et al. 2003/ identified as a rather important method for obtaining a general sorption capacity of the rock material and therefore acting as a bridge between the batch sorption methods and a related method obtainable in a standardized form (ISO 13536). However, it was soon realized that the CEC methods were mainly aimed for soil investigations and therefore not likely to be sensitive enough for rock material with much lower CEC-values than soil. The CEC method was therefore instead decided to be used as a comparative method only applied on a very limited number of rock material.
- He-gas through-diffusion measurements, the suggested method for verifying pore connectivity, have not been performed. The main reason for this is that no clear indications of restricted pore connectivity have been seen in the porosity measurements of 5 mm to 50 mm rock samples (see Section 4.3.1).
- It has not been possible to involve all identified fracture fillings and altered rock types in the laboratory measurements, mainly due to restricted amount of available material but also because of problem with in-cohesive rock samples in e.g. porosity and through-diffusion measurements.

4.6.2 Through-diffusion

- Nonconformities with respect to method description SKB MD540.001 and Appendix 4.
  - According to the method description, matrix diffusivity and matrix porosity are the primary result parameters in the through-diffusion method. The term "rock capacity factor" was used for data delivery to Sicada instead of "matrix porosity" in order to distinguish matrix porosities determined by water saturation measurements from matrix porosity theoretically equivalent to the rock capacity factor.
  - The interruption criteria with 2% increase over 4 weeks for stop of the experiment given in Appendix B4.4 was difficult to use in reality due to data scattering of the derivative plot. Instead, enough experimental time was allowed to follow the derivative plot to a constant value over several months.
- Nonconformities in experimental boundary conditions.
  - Three samples containing microcracks broke during handling and could not be measured as planned.
  - Four samples were subject to contamination of HTO on the target side which made evaluation of the capacity factor impossible for those samples. D_e could still be evaluated.
  - Six samples were subject to contamination from earlier measurements. For these diffusion cells, tracer transport occurred into the target volume from another source than the injection volume. Three of these could not be evaluated at all and three could only be evaluated for maximum D_e. A reasonable explanation is that a cell container (mounted on each side of the rock sample to contain the water) previously used on the start side was re-used on the target side. A small absorption of high-concentration tracer containing water may have occurred on the start side. When re-used to the target side (with 50% probability) the container will act as a source of the now out-diffusing tracer that decreases in strength with time. Such a process is supported by the shape of the derivative curve in Figure 4-32 shown below.
  - Four samples displayed a clear jerk in the concentration-time curve at a time that co-incided with a change in sampling frequency. The reason for this behaviour is not well understood. Those samples were evaluated with a max-min range in matrix diffusivity.
  - The use of 5 mm samples can be questioned since A) these were difficult to handle in the laboratory, B) several of them were subject to jerks in the concentration-time curve and C) such thin samples are not of a size that represents the rock type well.

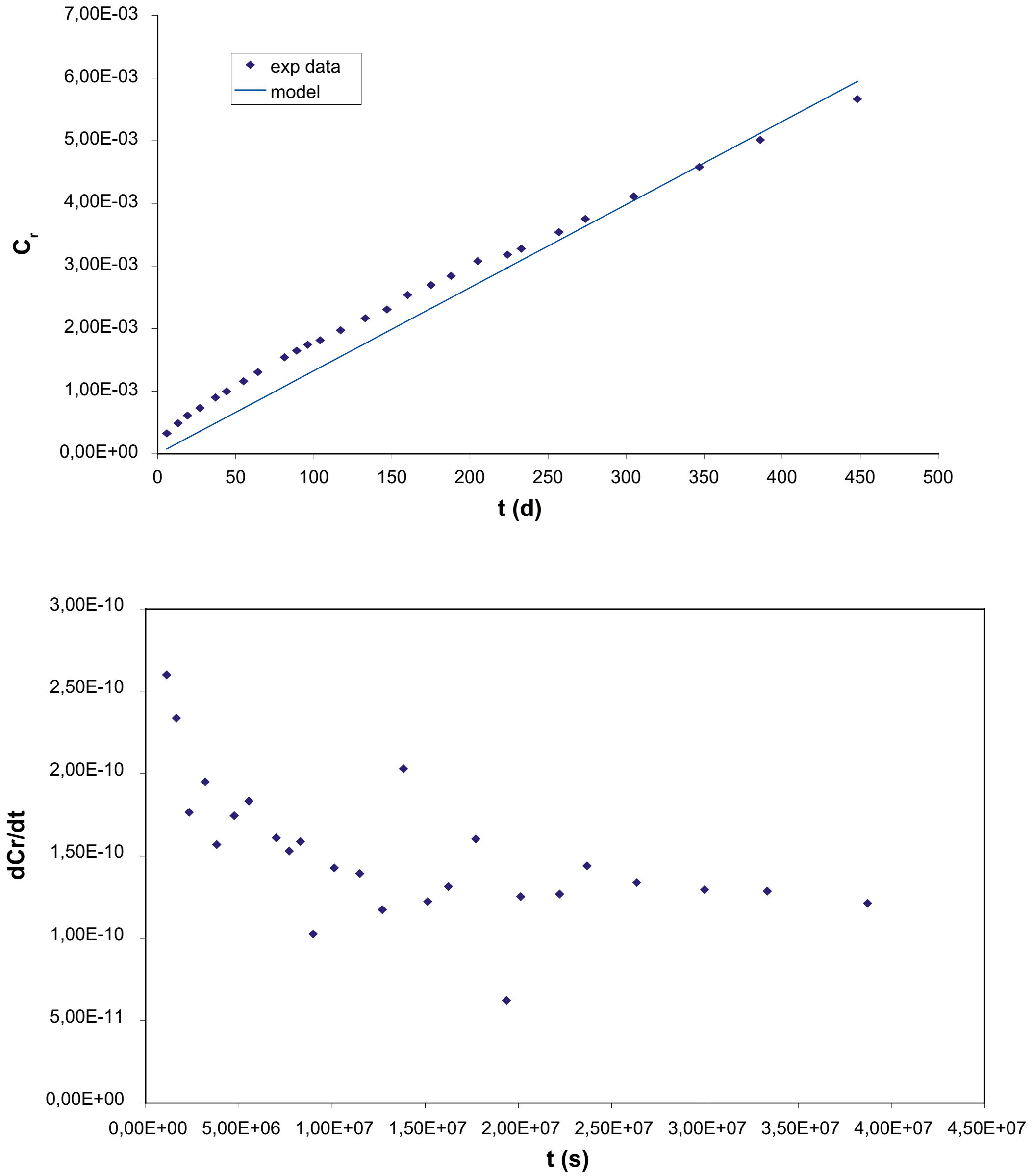


Figure 4-32. *Concentration versus time plot (top) and dCr/dt versus time for KFM06A 210.19–210.22 mbl (actual sample thickness 30 mm).*

5 Summary and conclusions

The laboratory measurements for the Transport properties of the rock in Forsmark were initiated already in 2003 and belong to the most time consuming activities in the entire investigation programme. Due to the long experimental time needed for several of the methods involved, it was necessary to begin at an early stage and an effect of this is that the majority of the rock samples originate from the first six drill sites (DS1 to DS6 in Figure 1-1). Supplementary rock sampling during the later stage of the site investigations for addition of new boreholes has been limited due to the long experiment time, accessibility in the laboratories as well as the prioritisation of resources. The representativeness of the samples regarding areal distribution might not be optimal for the Forsmark site in general and for the target area in particular. However, from a rock material point of view (rock types, fracture types etc) and the strategy document /Byegård et al. 2003/, the sample collection is considered to be adequate. Thus, it should be noted that the interpretation and analysis of the laboratory results are performed long time after the measurement has started, and together with the improved knowledge of the site this could possibly change the view of the rock samples representativeness.

About 300 rock core samples are included in the laboratory programme. Table 5-1 presents a summary of the total amount of different types of rock samples and their distribution in the various measurements. It should be noted that one rock sample can be involved in several measurements, e.g. BET-, CEC- and batch sorption measurements.

Table 5-1. Rock sample distribution for the different measurements within the laboratory programme and their division into fresh and altered rock types as well as fracture fillings.

Method	Tracer	Fresh rock samples	Altered rock samples*	Fracture fillings
Porosity (water saturation)		211	41	0
^{14}C-PMMA		5	8	**
Through-diffusion	HTO	47	22	0
Electrical resistivity		144	19	0
BET		33	5	12
CEC		4	3	2
Batchsorption		8	4	6
Level A***	Sr, Cs, Am, Ra, Ni, Th, Np and U	2	1	0
Level B***	Sr, Cs and Am or Eu	6	3	6

* Rock samples with medium to strong oxidation in addition to altered rock segments within deformation zones.

** One altered rock sample also gives information of fracture material; i.e. porosity for laumontite in a sealed breccia. In addition, several of the altered rock samples indicate an increased porosity in sealed fractures.

*** All combinations of tracers, size fractions and water types that every rock sample is in contact with are not taken into account in this table. A total presentation can be found in Appendix 5b.

Porosity results from the water saturation measurements show rather homogeneous median values, between 0.16 and 0.34%, for the different rock types. The large spread between minimum and maximum values is supposed to be an effect of the mixture of fresh and altered rock samples within the total sample collection and is further analysed in the forthcoming Retardation model. Porosity measured with ^{14}C-PMMA displays homogeneous porosity distribution for fresh rock samples but heterogeneous porosity distribution for the altered rock material. Generally, the PMMA method underestimates the water saturation porosity values by 10 to 40%.

Concerning the through-diffusion measurements, although there are some nonconformities regarding experimental boundary conditions, effective diffusivity (D_e) and formation factor (F_f) are obtained for almost all rock samples involved. The data results show no great differences between rock types. Deviating results, i.e. high D_e, were discovered from an altered episyenitic rock type (vuggy rock). Formation factors are also obtained by using electric resistivity measurements. The obtained resistivity values are fairly uniform, but a slight increase of the formation factor with depth can be seen for both KFM01A and KFM02A.

A slight modification has been made for the method description for batch sorption (cf. Section 4.6.3), i.e. for the strongly sorbing trivalent tracers Am and Eu, acidified blank samples are used as reference samples. Some complementary investigations addressing experiments (BET surface area measurements and batch sorption experiments) using intact drill core have also been performed.

The results from the sorption investigations indicate that rock material which is associated with fracture and/or alteration also shows increased sorption capacity (BET surface area, cation exchange capacity and sorption coefficients). Concerning the batch sorption experiments, one can, as expected, for the presumed cation exchange sorption sorbing tracers (e.g. Cs^{+}, Sr^{2+} and Ra^{2+}) observe a decreased sorption with increasing ionic strength. For the presumably surface complexation sorbing tracers (e.g. Ni(II), Am(III)/Eu(III)) there is not an obvious trend of influence of the ionic strength on the sorption. The redox sensitive tracers (e.g. Np and U) are sorbed to a comparatively low extent, indicating that reducing conditions have not been fully reached during the experiments.

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Appendix 1

Porosity

Appendix 1 contains matrix porosity data presented per drill-site. The uncertainty of a single reported porosity value is 0.09%, given with a coverage factor of 2.

Table A1-1. Porosity data for drill site 1.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Porosity
KFM01B	23.84	23.87	Granite to granodiorite, metamorphic, medium-grained	101057	0.19
KFM01B	23.87	23.90	Granite to granodiorite, metamorphic, medium-grained	101057	0.19
KFM01B	23.90	23.93	Granite to granodiorite, metamorphic, medium-grained	101057	0.19
KFM01A	101.49	101.52	Granite to granodiorite, metamorphic, medium-grained	101057	0.17
KFM01A	119.99	120.02	Granite to granodiorite, metamorphic, medium-grained	101057	0.16
KFM01A	140.01	140.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.86
KFM01A	159.81	159.84	Granite to granodiorite, metamorphic, medium-grained	101057	0.15
KFM01A	199.96	199.99	Amphibolite	102017	0.08
KFM01A	240.01	240.04	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.25
KFM01A	259.91	259.94	Granite to granodiorite, metamorphic, medium-grained	101057	0.26
KFM01A	300.01	300.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.15
KFM01A	312.53	312.54	Granite to granodiorite, metamorphic, medium-grained	101057	0.19
KFM01A	312.54	312.55	Granite to granodiorite, metamorphic, medium-grained	101057	0.20
KFM01A	312.56	312.59	Granite to granodiorite, metamorphic, medium-grained	101057	0.16
KFM01A	312.59	312.64	Granite to granodiorite, metamorphic, medium-grained	101057	0.17
KFM01A	312.65	312.66	Granite to granodiorite, metamorphic, medium-grained	101057	0.19
KFM01A	312.66	312.67	Granite to granodiorite, metamorphic, medium-grained	101057	0.19
KFM01A	312.68	312.71	Granite to granodiorite, metamorphic, medium-grained	101057	0.16
KFM01A	312.71	312.76	Granite to granodiorite, metamorphic, medium-grained	101057	0.18
KFM01A	312.76	312.77	Granite to granodiorite, metamorphic, medium-grained	101057	0.39
KFM01A	312.77	312.78	Granite to granodiorite, metamorphic, medium-grained	101057	0.15
KFM01A	312.78	312.81	Granite to granodiorite, metamorphic, medium-grained	101057	0.03
KFM01A	312.81	312.86	Granite to granodiorite, metamorphic, medium-grained	101057	0.13
KFM01A	340.01	340.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.13
KFM01A	360.01	360.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.16
KFM01A	380.01	380.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.12
KFM01A	420.01	420.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.17
KFM01A	440.01	440.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.18
KFM01A	460.01	460.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.17
KFM01A	480.01	480.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.20
KFM01A	501.73	501.76	Granite to granodiorite, metamorphic, medium-grained	101057	0.20
KFM01A	520.01	520.04	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.13
KFM01A	539.99	540.02	Granite to granodiorite, metamorphic, medium-grained	101057	0.12
KFM01A	560.01	560.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.18
KFM01A	580.01	580.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.18
KFM01A	600.01	600.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.23
KFM01A	620.01	620.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.18

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Porosity
KFM01A	640.06	640.09	Granite to granodiorite, metamorphic, medium-grained	101057	0.13
KFM01A	659.86	659.89	Granite to granodiorite, metamorphic, medium-grained	101057	0.22
KFM01A	680.01	680.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.21
KFM01A	699.96	699.99	Granite to granodiorite, metamorphic, medium-grained	101057	0.23
KFM01A	719.96	719.99	Granite to granodiorite, metamorphic, medium-grained	101057	0.22
KFM01A	740.01	740.04	Amphibolite	102017	0.22
KFM01A	760.01	760.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.22
KFM01A	778.83	778.86	Granite, fine- to medium-grained	111058	0.36
KFM01A	780.01	780.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.24
KFM01A	800.01	800.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.32
KFM01A	820.01	820.04	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.28
KFM01A	840.17	840.20	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.10
KFM01A	860.01	860.04	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.16
KFM01A	880.01	880.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.20
KFM01A	900.01	900.04	Pegmatite, pegmatitic granite	101061	0.27
KFM01A	920.01	920.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.25
KFM01A	940.06	940.09	Granite to granodiorite, metamorphic, medium-grained	101057	0.33
KFM01A	960.01	960.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.24
KFM01A	980.01	980.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.23
KFM01A	999.96	999.99	Granite to granodiorite, metamorphic, medium-grained	101057	0.24

Table A1-2. Porosity data for drill site 2.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Porosity
KFM02A	101.01	101.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.20
KFM02A	121.01	121.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.36
KFM02A	141.01	141.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.15
KFM02A	161.01	161.04	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.21
KFM02A	181.01	181.04	Amphibolite	102017	0.34
KFM02A	201.01	201.04	Amphibolite	102017	0.10
KFM02A	221.01	221.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.25
KFM02A	241.01	241.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.18
KFM02A	261.01	261.04	Granite to granodiorite, metamorphic, medium-grained	101057	2.18
KFM02A	275.93	275.94	Granite to granodiorite, metamorphic, medium-grained	101057	9.36
KFM02A	275.94	275.95	Granite to granodiorite, metamorphic, medium-grained	101057	16.32
KFM02A	275.95	275.98	Granite to granodiorite, metamorphic, medium-grained	101057	17.22
KFM02A	275.99	276.04	Granite to granodiorite, metamorphic, medium-grained	101057	17.94
KFM02A	276.04	276.05	Granite to granodiorite, metamorphic, medium-grained	101057	10.45
KFM02A	276.05	276.06	Granite to granodiorite, metamorphic, medium-grained	101057	16.25
KFM02A	276.06	276.09	Granite to granodiorite, metamorphic, medium-grained	101057	18.42
KFM02A	276.10	276.15	Granite to granodiorite, metamorphic, medium-grained	101057	18.52
KFM02A	276.15	276.16	Granite to granodiorite, metamorphic, medium-grained	101057	11.54
KFM02A	276.16	276.17	Granite to granodiorite, metamorphic, medium-grained	101057	16.84

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Porosity
KFM02A	276.17	276.20	Granite to granodiorite, metamorphic, medium-grained	101057	19.33
KFM02A	276.20	276.25	Granite to granodiorite, metamorphic, medium-grained	101057	19.09
KFM02A	281.01	281.04	Granite to granodiorite, metamorphic, medium-grained	101057	11.05
KFM02A	300.96	300.99	Granite to granodiorite, metamorphic, medium-grained	101057	1.21
KFM02A	321.01	321.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.23
KFM02A	350.27	350.30	Granite to granodiorite, metamorphic, medium-grained	101057	0.20
KFM02A	361.01	361.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.23
KFM02A	381.01	381.04	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.23
KFM02A	401.01	401.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.29
KFM02A	420.93	420.96	Granite to granodiorite, metamorphic, medium-grained	101057	0.40
KFM02A	440.96	440.99	Granite to granodiorite, metamorphic, medium-grained	101057	0.18
KFM02A	460.96	460.99	Granite to granodiorite, metamorphic, medium-grained	101057	0.38
KFM02A	481.01	481.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.17
KFM02A	500.68	500.71	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.42
KFM02A	521.01	521.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.20
KFM02A	541.01	541.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.25
KFM02A	552.33	552.36	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.23
KFM02A	554.59	554.60	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.54
KFM02A	554.60	554.61	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.31
KFM02A	554.61	554.64	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.23
KFM02A	554.65	554.70	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.22
KFM02A	554.70	554.71	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.34
KFM02A	554.71	554.72	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.21
KFM02A	554.72	554.75	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.22
KFM02A	554.76	554.81	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.23
KFM02A	554.81	554.82	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.37
KFM02A	554.84	554.85	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.26
KFM02A	554.86	554.89	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.23
KFM02A	554.90	554.95	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.24
KFM02A	561.01	561.04	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.19
KFM02A	580.89	580.92	Granite to granodiorite, metamorphic, medium-grained	101057	0.15
KFM02A	601.01	601.04	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.21
KFM02A	620.96	620.99	Granite to granodiorite, metamorphic, medium-grained	101057	0.21
KFM02A	641.01	641.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.28
KFM02A	661.01	661.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.22

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Porosity
KFM02A	681.01	681.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.19
KFM02A	701.01	701.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.25
KFM02A	711.85	711.88	Granite to granodiorite, metamorphic, medium-grained	101058	0.20
KFM02A	721.01	721.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.22
KFM02A	741.01	741.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.20
KFM02A	761.01	761.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.22
KFM02A	781.01	781.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.23
KFM02A	801.01	801.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.27
KFM02A	821.01	821.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.24
KFM02A	838.10	838.13	Granite, fine- to medium-grained	111058	0.28
KFM02A	841.01	841.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.27
KFM02A	861.01	861.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.30
KFM02A	881.01	881.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.25
KFM02A	901.01	901.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.22
KFM02A	921.01	921.04	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.15
KFM02A	941.01	941.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.23
KFM02A	961.01	961.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.27
KFM02A	981.04	981.07	Granite to granodiorite, metamorphic, medium-grained	101057	0.24
KFM02A	1001.01	1001.04	Granite to granodiorite, metamorphic, medium-grained	101057	0.25

Table A1-3. Porosity data for drill site 3.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Porosity
KFM03B	76.74	76.77	Pegmatite, pegmatitic granite	101061	0.24
KFM03A	242.43	242.46	Tonalite to granodiorite, metamorphic	101054	0.19
KFM03A	242.46	242.49	Tonalite to granodiorite, metamorphic	101054	0.15
KFM03A	242.49	242.52	Tonalite to granodiorite, metamorphic	101054	0.17
KFM03A	311.45	311.48	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.15
KFM03A	367.44	367.47	Pegmatite, pegmatitic granite	101061	0.32
KFM03A	536.67	536.70	Granite to granodiorite, metamorphic, medium-grained	101057	0.16
KFM03A	660.41	660.44	Pegmatite, pegmatitic granite	101061	0.68
KFM03A	957.67	957.70	Granite to granodiorite, metamorphic, medium-grained	101057	0.13

Table A1-4. Porosity data for drill site 4.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Porosity
KFM04A	120.04	120.07	Granodiorite, metamorphic	101056	0.48
KFM04A	140.03	140.06	Granodiorite, metamorphic	101056	0.19
KFM04A	180.02	180.05	Granite to granodiorite, metamorphic, medium-grained	101057	0.31
KFM04A	199.93	199.96	Granite to granodiorite, metamorphic, medium-grained	101057	0.21
KFM04A	220.00	220.03	Granite to granodiorite, metamorphic, medium-grained	101057	0.51
KFM04A	239.70	239.73	Amphibolite	102017	9.95
KFM04A	260.00	260.03	Granite to granodiorite, metamorphic, medium-grained	101057	0.89

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Porosity
KFM04A	300.04	300.07	Granite to granodiorite, metamorphic, medium-grained	101057	0.21
KFM04A	319.09	319.12	Granite to granodiorite, metamorphic, medium-grained	101057	0.72
KFM04A	339.83	339.86	Felsic to intermediate volcanic rock, metamorphic	103076	0.78
KFM04A	359.18	359.21	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.59
KFM04A	379.95	379.98	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.2
KFM04A	399.93	399.96	Granite to granodiorite, metamorphic, medium-grained	101057	0.22
KFM04A	420.19	420.22	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	1.6
KFM04A	459.93	459.96	Granite to granodiorite, metamorphic, medium-grained	101057	0.31
KFM04A	479.93	479.96	Granite to granodiorite, metamorphic, medium-grained	101057	0.12
KFM04A	499.91	499.94	Granite to granodiorite, metamorphic, medium-grained	101057	0.17

Table A1-5. Porosity data for drill site 5.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Porosity
KFM05A	168.34	168.37	Granite to granodiorite, metamorphic, medium-grained	101057	0.15
KFM05A	188.03	188.06	Granite to granodiorite, metamorphic, medium-grained	101057	0.59
KFM05A	208.82	208.85	Granite to granodiorite, metamorphic, medium-grained	101057	0.20
KFM05A	228.13	228.16	Granite to granodiorite, metamorphic, medium-grained	101057	0.18
KFM05A	249.03	249.06	Granite to granodiorite, metamorphic, medium-grained	101057	0.33
KFM05A	269.66	269.69	Granite to granodiorite, metamorphic, medium-grained	101057	0.24
KFM05A	288.85	288.88	Granite to granodiorite, metamorphic, medium-grained	101057	0.24
KFM05A	308.55	308.58	Granite to granodiorite, metamorphic, medium-grained	101057	0.22
KFM05A	348.25	348.28	Granite to granodiorite, metamorphic, medium-grained	101057	0.23
KFM05A	369.23	369.26	Granite to granodiorite, metamorphic, medium-grained	101057	0.18
KFM05A	388.93	388.96	Granite to granodiorite, metamorphic, medium-grained	101057	0.17
KFM05A	396.59	396.62	Granite to granodiorite, metamorphic, medium-grained	101057	0.48
KFM05A	396.62	396.65	Granite to granodiorite, metamorphic, medium-grained	101057	0.58
KFM05A	396.65	396.68	Granite to granodiorite, metamorphic, medium-grained	101057	0.54
KFM05A	408.75	408.78	Granite to granodiorite, metamorphic, medium-grained	101057	0.18
KFM05A	428.92	428.95	Granite to granodiorite, metamorphic, medium-grained	101057	0.24
KFM05A	449.35	449.38	Granite to granodiorite, metamorphic, medium-grained	101057	0.22
KFM05A	469.83	469.86	Granite to granodiorite, metamorphic, medium-grained	101057	0.22
KFM05A	489.36	489.39	Granite to granodiorite, metamorphic, medium-grained	101057	0.25
KFM05A	509.07	509.10	Granite to granodiorite, metamorphic, medium-grained	101057	0.30
KFM05A	528.72	528.75	Granite to granodiorite, metamorphic, medium-grained	101057	0.18
KFM05A	548.54	548.57	Granite to granodiorite, metamorphic, medium-grained	101057	0.22
KFM05A	570.04	570.07	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.20
KFM05A	590.05	590.08	Granite to granodiorite, metamorphic, medium-grained	101057	0.30
KFM05A	629.30	629.33	Granite to granodiorite, metamorphic, medium-grained	101057	0.29
KFM05A	650.42	650.45	Granite to granodiorite, metamorphic, medium-grained	101057	0.17
KFM05A	669.90	669.93	Amphibolite	102017	0.30
KFM05A	689.69	689.72	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.13
KFM05A	700.28	700.31	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.35
KFM05A	739.82	739.85	Granite to granodiorite, metamorphic, medium-grained	101057	0.34
KFM05A	761.07	761.10	Granite to granodiorite, metamorphic, medium-grained	101057	0.20

Table A1-6. Porosity data for drill site 6.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Matrix porosity
KFM06B	56.37	56.40	Granite to granodiorite, metamorphic, medium-grained	101057	9.13
KFM06B	56.40	56.43	Granite to granodiorite, metamorphic, medium-grained	101057	9.19
KFM06A	145.31	145.34	Granite to granodiorite, metamorphic, medium-grained	101057	0.35
KFM06A	210.13	210.16	Granite to granodiorite, metamorphic, medium-grained	101057	0.25
KFM06A	210.16	210.19	Granite to granodiorite, metamorphic, medium-grained	101057	0.20
KFM06A	210.19	210.22	Granite to granodiorite, metamorphic, medium-grained	101057	0.20
KFM06A	331.72	331.75	Granite to granodiorite, metamorphic, medium-grained	101057	2.36
KFM06A	331.75	331.78	Granite to granodiorite, metamorphic, medium-grained	101057	2.49
KFM06A	331.78	331.81	Granite to granodiorite, metamorphic, medium-grained	101057	2.54
KFM06A	440.06	440.09	Granite to granodiorite, metamorphic, medium-grained	101057	0.18
KFM06A	779.40	779.43	Granite, metamorphic, aplitic	101058	0.18

Table A1-7. Porosity data for drill site 7.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Porosity
KFM07A	387.47	387.50	Granite to granodiorite, metamorphic, medium-grained	101057	0.15
KFM07A	608.72	608.75	Granite to granodiorite, metamorphic, medium-grained	101057	0.27
KFM07A	608.75	608.78	Granite to granodiorite, metamorphic, medium-grained	101057	0.29
KFM07A	608.78	608.81	Granite to granodiorite, metamorphic, medium-grained	101057	0.29

Table A1-8. Porosity data for drill site 8.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Porosity
KFM08A	412.30	412.33	Granite to granodiorite, metamorphic, medium-grained	101057	0.86
KFM08A	686.92	686.95	Granite to granodiorite, metamorphic, medium-grained	111057	0.73
KFM08A	689.96	689.99	Granite to granodiorite, metamorphic, medium-grained	101057	0.62
KFM08A	808.70	808.73	Granite, metamorphic, aplitic	101058	0.26
KFM08A	890.80	890.83	Felsic to intermediate volcanic rock, metamorphic	103076	0.36
KFM08C	830.52	830.62	Granite to granodiorite, metamorphic, medium-grained	101057	0.24
KFM08C	830.63	830.90	Granite to granodiorite, metamorphic, medium-grained	101057	0.24

Table A1-9. Porosity data for drill site 9.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Porosity
KFM09A	173.39	173.42	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.19
KFM09A	423.43	423.46	Amphibolite	102017	0.08
KFM09A	713.68	713.71	Granite to granodiorite, metamorphic, medium-grained	101057	0.24
KFM09A	798.08	798.11	Tonalite to granodiorite, metamorphic	101054	0.11

Appendix 2

Through-diffusion

Appendix 2 contains results from through-diffusion experiments. Matrix diffusivity, D_e (also denoted effective diffusivity), and α, the rock capacity factor, was obtained from least square fits of experimental data to Equation 1 and Equation 2 (the linear form).

Table A2-1. Through-diffusion data for drill site 1.

Borehole	Secup (mbl)	Seclow (mbl)	Sample length (mm)	Rock type	Rock code	D_e from Equation 1 (m^2/s)	D_e from Equation 2 (m^2/s)	α from Equation 1	α from Equation 2
KFM01B	23.84	23.87	30	Granite to granodiorite, metamorphic, medium-grained	101057	6.92E–14	7.02E–14	2.29E–03	2.37E–03
KFM01B	23.87	23.90	30	Granite to granodiorite, metamorphic, medium-grained	101057	8.90E–14	8.80E–14	n.e 1)	n.e 1)
KFM01B	23.90	23.93	30	Granite to granodiorite, metamorphic, medium-grained	101057	5.20E–14	5.10E–14	2.30E–03	2.10E–03
KFM01A	312.53	312.54	5	Granite to granodiorite, metamorphic, medium-grained	101057	n.e 1)	(2.5±0.5)E–13	n.e 1)	(1.5±1.5)E–2
KFM01A	312.54	312.55	10	Granite to granodiorite, metamorphic, medium-grained	101057	2.00E–13	2.14E–13	9.60E–03	1.43E–02
KFM01A	312.56	312.59	30	Granite to granodiorite, metamorphic, medium-grained	101057	2.68E–13	2.80E–13	6.18E–03	7.85E–03
KFM01A	312.59	312.64	50	Granite to granodiorite, metamorphic, medium-grained	101057	2.60E–13	2.70E–13	3.50E–03	4.40E–03
KFM01A	312.65	312.66	5	Granite to granodiorite, metamorphic, medium-grained	101057	n.e 1)	(3.5±0.6)E–13	n.e 1)	(1.4±1.4)E–2
KFM01A	312.66	312.67	10	Granite to granodiorite, metamorphic, medium-grained	101057	3.00E–13	3.10E–13	1.50E–02	2.30E–02
KFM01A	312.68	312.71	30	Granite to granodiorite, metamorphic, medium-grained	101057	3.10E–13	3.10E–13	5.00E–03	5.10E–03
KFM01A	312.71	312.76	50	Granite to granodiorite, metamorphic, medium-grained	101057	2.42E–13	2.54E–13	4.97E–03	6.01E–03
KFM01A	312.76	312.77	5	Granite to granodiorite, metamorphic, medium-grained	101057	n.e 1)	(2.5±0.5)E–13	n.e 1)	(2.0±2.0)E–2
KFM01A	312.77	312.78	10	Granite to granodiorite, metamorphic, medium-grained	101057	3.20E–13	3.30E–13	1.80E–02	2.20E–02
KFM01A	312.81	312.86	50	Granite to granodiorite, metamorphic, medium-grained	101057	1.60E–13	1.67E–13	3.30E–03	3.30E–03
KFM01A	539.99	540.02	30	Granite to granodiorite, metamorphic, medium-grained	101057	1.70E–13	1.80E–13	1.70E–03	2.00E–03
KFM01A	740.01	740.04	30	Amphibolite	102017	6.19E–14	6.22E–14	3.87E–03	3.92E–03
KFM01A	999.96	999.99	30	Granite to granodiorite, metamorphic, medium-grained	101057	9.20E–13	9.30E–13	8.80E–03	9.40E–03

1) Not evaluated

Table A2-2. Through-diffusion data for drill site 2.

Borehole	Secup (mbl)	Seclow (mbl)	Sample length (mm)	Rock type	Rock code	D_e from Equation 1 (m^2/s)	D_e from Equation 2 (m^2/s)	α from Equation 1	α from Equation 2
KFM02A	181.01	181.04	30	Amphibolite	102017	4.90E–14	4.82E–14	4.40E–03	4.10E–03
KFM02A	275.94	275.95	10	Granite to granodiorite, metamorphic, medium-grained	101057	3.60E–11	3.50E–11	9.00E–02	8.40E–02
KFM02A	275.95	275.98	30	Granite to granodiorite, metamorphic, medium-grained	101057	3.10E–11	3.00E–11	9.80E–02	8.40E–02
KFM02A	276.05	276.06	10	Granite to granodiorite, metamorphic, medium-grained	101057	4.80E–11	4.80E–11	8.00E–02	8.00E–02
KFM02A	276.06	276.09	30	Granite to granodiorite, metamorphic, medium-grained	101057	3.40E–11	3.30E–11	1.00E–01	9.30E–02
KFM02A	276.10	276.15	50	Granite to granodiorite, metamorphic, medium-grained	101057	3.40E–11	3.20E–11	8.50E–02	6.60E–02
KFM02A	276.16	276.17	10	Granite to granodiorite, metamorphic, medium-grained	101057	4.40E–11	4.40E–11	8.50E–02	8.20E–02
KFM02A	276.17	276.20	30	Granite to granodiorite, metamorphic, medium-grained	101057	3.60E–11	3.50E–11	9.50E–02	8.50E–02
KFM02A	276.20	276.25	50	Granite to granodiorite, metamorphic, medium-grained	101057	2.40E–11	2.10E–11	8.70E–02	6.10E–02
KFM02A	281.01	281.04	30	Granite to granodiorite, metamorphic, medium-grained	101057	1.30E–11	1.25E–11	6.20E–02	5.81E–02
KFM02A	300.96	300.99	30	Granite to granodiorite, metamorphic, medium-grained	101057	7.50E–13	7.50E–13	1.80E–02	1.80E–02
KFM02A	381.01	381.04	30	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	8.70E–14	8.90E–14	3.20E–03	3.60E–03
KFM02A	481.01	481.04	30	Granite to granodiorite, metamorphic, medium-grained	101057	5.50E–14	5.80E–14	2.50E–03	3.00E–03
KFM02A	554.59	554.60	5	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	1.60E–12	n.e [1)]	6.10E–04	n.e [1)]
KFM02A	554.60	554.61	10	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	3.80E–13	3.80E–13	2.00E–02	2.10E–02
KFM02A	554.61	554.64	30	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	3.42E–13	3.60E–13	1.30E–02	1.50E–02
KFM02A	554.65	554.70	50	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	2.94E–13	2.96E–13	6.63E–03	6.68E–03
KFM02A	554.70	554.71	5	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	1.20E–12	n.e [1)]	n.e [1)]	n.e [1)]
KFM02A	554.71	554.72	10	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	3.20E–13	3.20E–13	2.00E–02	2.10E–02
KFM02A	554.72	554.75	30	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	3.60E–13	3.60E–13	8.90E–03	9.05E–03
KFM02A	554.76	554.81	50	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	2.46E–13	2.48E–13	5.56E–03	5.71E–03
KFM02A	554.81	554.82	5	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	n.e [1)]	(2.2±0.8)E–13	n.e [1)]	(1.8±1.8)E–2
KFM02A	554.84	554.85	10	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	3.00E–13	3.00E–13	2.10E–02	2.40E–02
KFM02A	554.86	554.89	30	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	3.10E–13	3.00E–13	5.50E–03	4.40E–03
KFM02A	554.90	554.95	50	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	2.34E–13	2.41E–13	5.36E–03	5.97E–03

Table A2-3. Through-diffusion data for drill site 3.

Borehole	Secup (mbl)	Seclow (mbl)	Sample length (mm)	Rock type	Rock code	D_e from Equation 1 (m^2/s)	D_e from Equation 2 (m^2/s)	α from Equation 1	α from Equation 2
KFM03A	242.43	242.46	30	Tonalite to granodiorite, metamorphic	101054	1.75E–13	1.76E–13	4.28E–03	4.36E–03
KFM03A	242.46	242.49	30	Tonalite to granodiorite, metamorphic	101054	1.70E–13	1.72E–13	n.e [1)]	n.e [1)]
KFM03A	242.49	242.52	30	Tonalite to granodiorite, metamorphic	101054	1.46E–13	1.52E–13	n.e [1)]	n.e [1)]

1) Capacity factor not evaluated

Table A2-4. Through-diffusion data for drill site 4.

Borehole	Secup (mbl)	Seclow (mbl)	Sample length (mm)	Rock type	Rock code	D_e from Equation 1 (m^2/s)	D_e from Equation 2 (m^2/s)	α from Equation 1	α from Equation 2
KFM04A	359.45	359.48	30	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	7.90E–12	7.20E–02	7.40E–12	5.90E–02
KFM04A	399.93	399.96	30	Granite to granodiorite, metamorphic, medium-grained	101057	3.47E–13	3.54E–13	3.69E–03	4.34E–03

Table A2-5. Through-diffusion data for drill site 5.

Borehole	Secup (mbl)	Seclow (mbl)	Sample length (mm)	Rock type	Rock code	D_e from Equation 1 (m^2/s)	D_e from Equation 2 (m^2/s)	α from Equation 1	α from Equation 2
KFM05A	168.34	168.37	30	Granite to granodiorite, metamorphic, medium-grained	101057	9.80E–14	1.00E–13	1.60E–03	2.20E–03
KFM05A	369.23	369.26	30	Granite to granodiorite, metamorphic, medium-grained	101057	3.20E–13	3.20E–13	4.60E–03	4.80E–03
KFM05A	396.59	396.62	30	Granite to granodiorite, metamorphic, medium-grained	101057	4.27E–13	4.18E–13	9.57E–03	8.58E–03
KFM05A	396.62	396.65	30	Granite to granodiorite, metamorphic, medium-grained	101057	3.54E–13	3.41E–13	4.08E–03	2.80E–03
KFM05A	396.65	396.68	30	Granite to granodiorite, metamorphic, medium-grained	101057	1.00E–13	1.00E–13	5.90E–03	5.30E–03
KFM05A	570.04	570.07	30	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	3.40E–13	3.70E–13	2.30E–03	4.00E–03
KFM05A	761.07	761.1	30	Granite to granodiorite, metamorphic, medium-grained	101057	3.40E–13	3.40E–13	4.20E–03	4.00E–03

Table A2-6. Through-diffusion data for drill site 6.

Borehole	Secup (mbl)	Seclow (mbl)	Sample length (mm)	Rock type	Rock code	D_e from Equation 1 (m^2/s)	D_e from Equation 2 (m^2/s)	α from Equation 1	α from Equation 2
KFM06A	210.13	210.16	30	Granite to granodiorite, metamorphic, medium-grained	101057	< 9.10E–14	n.e [1)]	n.e [1)]	n.e [1)]
KFM06A	210.16	210.19	30	Granite to granodiorite, metamorphic, medium-grained	101057	< 9.70E–14	n.e [1)]	n.e [1)]	n.e [1)]
KFM06A	210.19	210.22	30	Granite to granodiorite, metamorphic, medium-grained	101057	< 1.20E–13	n.e [1)]	n.e [1)]	n.e [1)]
KFM06A	331.72	331.75	30	Granite to granodiorite, metamorphic, medium-grained	101057	1.62E–12	1.61E–12	5.13E–03	4.52E–03
KFM06A	331.75	331.78	30	Granite to granodiorite, metamorphic, medium-grained	101057	< 1.10E–12	n.e [1)]	n.e [1)]	n.e [1)]
KFM06A	331.78	331.81	30	Granite to granodiorite, metamorphic, medium-grained	101057	1.20E–12	1.20E–12	1.85E–02	1.82E–02
KFM06A	779.40	779.43	30	Granite, metamorphic, aplitic	101058	1.31E–13	1.32E–13	1.37E–03	1.43E–03

1) Not evaluated

Table A2-7. Through-diffusion data for drill site 7.

Borehole	Secup (mbl)	Seclow (mbl)	Sample length (mm)	Rock type	Rock code	D_e from Equation 1 (m^2/s)	D_e from Equation 2 (m^2/s)	α from Equation 1	α from Equation 2
KFM07A	608.72	608.75	30	Granite to granodiorite, metamorphic, medium-grained	101057	1.90E–13		2.50E–03	
KFM07A	608.75	608.78	30	Granite to granodiorite, metamorphic, medium-grained	101057	1.42E–12	1.40E–12	4.74E–03	3.53E–03
KFM07A	608.78	608.81	30	Granite to granodiorite, metamorphic, medium-grained	101057	n.e [1)]	n.e [1)]	n.e [1)]	n.e [1)]

1) Not evaluated due to disturbed boundary conditions

Table A2-8. Through-diffusion data for drill site 8.

Borehole	Secup (mbl)	Seclow (mbl)	Sample length (mm)	Rock type	Rock code	D_e from Equation 1 (m^2/s)	D_e from Equation 2 (m^2/s)	α from Equation 1	α from Equation 2
KFM08A	412.30	412.33	30	Granite to granodiorite, metamorphic, medium-grained	101057	1.40E–13	n.e [1)]	n.e [1)]	n.e [1)]
KFM08A	689.96	689.99	30	Granite to granodiorite, metamorphic, medium-grained	101057	3.06E–13	3.00E–13	7.07E–03	6.57E–03
KFM08A	808.70	808.73	30	Granite, metamorphic, aplitic	101058	6.33E–13	6.27E–13	7.23E–03	6.85E–03
KFM08A	890.80	890.83	30	Felsic to intermediate volcanic rock, metamorphic	103076	1.20E–12	1.30E–12	n.e [1)]	n.e [1)]

1) Not evaluated

Specific surface area, BET

BET surface area is measured using double samples of the fractions 0.063–0.125 mm and 2–4 mm of crushed and sieved rock samples, or scraped fracture filling material, < 0.125 mm. A few whole core samples, with 90 mm length and 50 mm in diameter, are presented as well. Tables in Appendix 3 are presented per drill-site.

Table A3-1. Specific surface area, BET, for drill site 1.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	BET 2–4 mm (m^2/g)	BET 0.063–0.125 mm (m^2/g)	BET < 0.125 mm (m^2/g)
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057	0.009		
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057	0.040		
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057		0.194	
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057		0.209	
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057		0.279	
KFM01A	312.20	312.50	Granite to granodiorite, metamorphic, medium-grained	101057	< 0.001		
KFM01A	312.20	312.50	Granite to granodiorite, metamorphic, medium-grained	101057	0.005		
KFM01A	312.20	312.50	Granite to granodiorite, metamorphic, medium-grained	101057		0.153	
KFM01A	312.20	312.50	Granite to granodiorite, metamorphic, medium-grained	101057		0.188	
KFM01A	475.53	475.68	Granite to granodiorite, metamorphic, medium-grained	101057	0.027		
KFM01A	475.53	475.68	Granite to granodiorite, metamorphic, medium-grained	101057	0.004		
KFM01A	475.53	475.68	Granite to granodiorite, metamorphic, medium-grained	101057	0.030		
KFM01A	475.53	475.68	Granite to granodiorite, metamorphic, medium-grained	101057		0.116	
KFM01A	475.53	475.68	Granite to granodiorite, metamorphic, medium-grained	101057		0.170	
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	0.050		
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	0.044		
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057		0.198	
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057		0.129	
KFM01A	520.88	521.00	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.005		
KFM01A	520.88	521.00	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.023		
KFM01A	520.88	521.00	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051		0.120	
KFM01A	520.88	521.00	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051		0.135	
KFM01A	703.25	703.45	Granite to granodiorite, metamorphic, medium-grained	101057	0.015		
KFM01A	703.25	703.45	Granite to granodiorite, metamorphic, medium-grained	101057	0.009		

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	BET 2–4 mm (m^2/g)	BET 0.063–0.125 mm (m^2/g)	BET < 0.125 mm (m^2/g)
KFM01A	703.25	703.45	Granite to granodiorite, metamorphic, medium-grained	101057		0.09	
KFM01A	703.25	703.45	Granite to granodiorite, metamorphic, medium-grained	101057		0.101	
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057	0.029		
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057	0.031		
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057		0.156	
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057		0.074	
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	1.937		
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	2.020		
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057		3.550	
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057		3.695	
KFM01B	418.80	418.94	Granite to granodiorite, metamorphic, medium-grained	101057			3.683
KFM01B	418.80	418.94	Granite to granodiorite, metamorphic, medium-grained	101057			4.014

Table A3-2. Specific surface area, BET, for drill site 2.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	BET 2–4 mm (m^2/g)	BET 0.063–0.125 mm (m^2/g)	BET < 0.125 mm (m^2/g)	BET whole core
KFM02A	118.25	118.70	Granite to granodiorite, metamorphic, medium-grained	101057	1.678			
KFM02A	118.25	118.70	Granite to granodiorite, metamorphic, medium-grained	101057	1.657			
KFM02A	118.25	118.70	Granite to granodiorite, metamorphic, medium-grained	101057		5.302		
KFM02A	243.50	243.70	Granite to granodiorite, metamorphic, medium-grained	101057	0.189			
KFM02A	243.50	243.70	Granite to granodiorite, metamorphic, medium-grained	101057	0.202			
KFM02A	243.50	243.70	Granite to granodiorite, metamorphic, medium-grained	101057		0.78		
KFM02A	243.50	243.70	Granite to granodiorite, metamorphic, medium-grained	101057		0.763		
KFM02A	275.22	275.45	Granite to granodiorite, metamorphic, medium-grained	101057	0.256			
KFM02A	275.22	275.45	Granite to granodiorite, metamorphic, medium-grained	101057	0.285			
KFM02A	275.22	275.45	Granite to granodiorite, metamorphic, medium-grained	101057		1.573		
KFM02A	275.22	275.45	Granite to granodiorite, metamorphic, medium-grained	101057		1.592		
KFM02A	350.00	350.27	Granite to granodiorite, metamorphic, medium-grained	101057	0.058			
KFM02A	350.00	350.27	Granite to granodiorite, metamorphic, medium-grained	101057	0.047			
KFM02A	350.00	350.27	Granite to granodiorite, metamorphic, medium-grained	101057		0.294		
KFM02A	350.00	350.27	Granite to granodiorite, metamorphic, medium-grained	101057		0.286		
KFM02A	350.40	350.49	Granite to granodiorite, metamorphic, medium-grained	101057				0.019
KFM02A	552.00	552.23	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.033			
KFM02A	552.00	552.23	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.048			
KFM02A	552.00	552.23	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051		0.341		
KFM02A	552.00	552.23	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051		0.34		
KFM02A	711.48	711.73	Granite to granodiorite, metamorphic, medium-grained	101057	0.026			
KFM02A	711.48	711.73	Granite to granodiorite, metamorphic, medium-grained	101057	0.018			
KFM02A	711.48	711.73	Granite to granodiorite, metamorphic, medium-grained	101057		0.224		
KFM02A	711.48	711.73	Granite to granodiorite, metamorphic, medium-grained	101057		0.237		
KFM02A	711.75	711.84	Granite to granodiorite, metamorphic, medium-grained	101057				0.013
KFM02A	915.53	915.70	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.183			
KFM02A	915.53	915.70	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.015			
KFM02A	915.53	915.70	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051		0.183		
KFM02A	915.53	915.70	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051		0.162		

Table A3-3. Specific surface area, BET, for drill site 3.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	BET 2–4 mm (m^2/g)	BET 0.063–0.125 mm (m^2/g)	BET < 0.125 mm (m^2/g)
KFM03A	242.93	243.13	Tonalite to granodiorite, metamorphic	101054	0.049		
KFM03A	242.93	243.13	Tonalite to granodiorite, metamorphic	101054	0.036		
KFM03A	242.93	243.13	Tonalite to granodiorite, metamorphic	101054		0.290	
KFM03A	242.93	243.13	Tonalite to granodiorite, metamorphic	101054		0.246	
KFM03A	311.01	311.21	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.024		
KFM03A	311.01	311.21	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.02		
KFM03A	311.01	311.21	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051		0.321	
KFM03A	311.01	311.21	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051		0.320	
KFM03A	367.52	367.72	Pegmatite, pegmatitic granite	101061	0.025		
KFM03A	367.52	367.72	Pegmatite, pegmatitic granite	101061	0.03		
KFM03A	367.52	367.72	Pegmatite, pegmatitic granite	101061	0.005		
KFM03A	367.52	367.72	Pegmatite, pegmatitic granite	101061		0.227	
KFM03A	367.52	367.72	Pegmatite, pegmatitic granite	101061		0.239	
KFM03A	536.47	536.67	Granite to granodiorite, metamorphic, medium-grained	101057	0.015		
KFM03A	536.47	536.67	Granite to granodiorite, metamorphic, medium-grained	101057	0.011		
KFM03A	536.47	536.67	Granite to granodiorite, metamorphic, medium-grained	101057		0.204	
KFM03A	536.47	536.67	Granite to granodiorite, metamorphic, medium-grained	101057		0.248	
KFM03A	643.80	644.17	Granite to granodiorite, metamorphic, medium-grained	101057			10.550
KFM03A	643.80	644.17	Granite to granodiorite, metamorphic, medium-grained	101057			10.003
KFM03A	660.18	660.39	Pegmatite, pegmatitic granite	101061	0.055		
KFM03A	660.18	660.39	Pegmatite, pegmatitic granite	101061	0.048		
KFM03A	660.18	660.39	Pegmatite, pegmatitic granite	101061		0.318	
KFM03A	660.18	660.39	Pegmatite, pegmatitic granite	101061		0.296	

Table A3-4. Specific surface area, BET, for drill site 4.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	BET 2–4 mm (m^2/g)	BET 0.063–0.125 mm (m^2/g)	BET < 0.125 mm (m^2/g)
KFM04A	141.75	141.90	Granodiorite, metamorphic	101056			7.665
KFM04A	377.16	377.78	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051			0.425
KFM04A	377.16	377.78	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051			0.434
KFM04A	414.14	414.34	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051			2.041
KFM04A	414.20	414.40	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051			1.172
KFM04A	453.57	453.64	Granite to granodiorite, metamorphic, medium-grained	101057			0.425
KFM04A	453.57	453.64	Granite to granodiorite, metamorphic, medium-grained	101057			0.434
KFM04A	694.70	694.90	Granite to granodiorite, metamorphic, medium-grained	101057	0.012		
KFM04A	694.70	694.90	Granite to granodiorite, metamorphic, medium-grained	101057	0.023		
KFM04A	694.70	694.90	Granite to granodiorite, metamorphic, medium-grained	101057		0.158	
KFM04A	694.70	694.90	Granite to granodiorite, metamorphic, medium-grained	101057		0.167	

Table A3-5. Specific surface area, BET, for drill site 5.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	BET 2–4 mm (m^2/g)	BET 0.063–0.125 mm (m^2/g)	BET < 0.125 mm (m^2/g)
KFM05A	570.09	570.24	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.019		
KFM05A	570.09	570.24	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.034		
KFM05A	570.09	570.24	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051		0.290	
KFM05A	570.09	570.24	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051		0.209	
KFM05A	611.68	611.91	Granite to granodiorite, metamorphic, medium-grained	101057	0.687		
KFM05A	611.68	611.91	Granite to granodiorite, metamorphic, medium-grained	101057	0.876		
KFM05A	611.68	611.91	Granite to granodiorite, metamorphic, medium-grained	101057		0.667	
KFM05A	611.68	611.91	Granite to granodiorite, metamorphic, medium-grained	101057		0.613	
KFM05A	627.85	628.02	Granite to granodiorite, metamorphic, medium-grained	101057			2.867
KFM05A	627.85	628.02	Granite to granodiorite, metamorphic, medium-grained	101057			2.450

Table A3-6. Specific surface area, BET, for drill site 6.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	BET 2–4 mm (m^2/g)	BET 0.063–0.125 mm (m^2/g)	BET < 0.125 mm (m^2/g)	BET whole core
KFM06A	145.41	145.5	Granite to granodiorite, metamorphic, medium-grained	101057				0.042
KFM06A	357.87	357.96	Granite to granodiorite, metamorphic, medium-grained	101057			0.561	
KFM06A	357.87	357.96	Granite to granodiorite, metamorphic, medium-grained	101057			0.413	
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057	0.032			
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057	0.038			
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057		0.264		
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057		0.274		
KFM06A	541.08	541.43	Amphibolite	102017	0.039			
KFM06A	541.08	541.43	Amphibolite	102017	0.038			
KFM06A	541.08	541.43	Amphibolite	102017		0.304		
KFM06A	541.08	541.43	Amphibolite	102017		0.327		
KFM06A	601.86	602.26	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.045			
KFM06A	601.86	602.26	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.027			
KFM06A	601.86	602.26	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051		0.279		
KFM06A	601.86	602.26	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051		0.296		
KFM06A	770.69	770.79	Granite, metamorphic, aplitic	101058	2.979			
KFM06A	770.69	770.79	Granite, metamorphic, aplitic	101058			3.325	
KFM06B	56.25	56.32	Granite to granodiorite, metamorphic, medium-grained	101057			7.505	
KFM06B	56.25	56.32	Granite to granodiorite, metamorphic, medium-grained	101057			7.583	

Table A3-7. Specific surface area, BET, for drill site 7.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	BET 2–4 mm (m^2/g)	BET 0.063–0.125 mm (m^2/g)	BET < 0.125 mm (m^2/g)	BET whole core
KFM07A	263.53	263.65	Amphibolite	102017	< 0.001			
KFM07A	263.53	263.65	Amphibolite	102017	< 0.001			
KFM07A	263.53	263.65	Amphibolite	102017		0.095		
KFM07A	263.53	263.65	Amphibolite	102017		0.094		
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057				0.022
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	0.026			
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	0.038			
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057		0.212		
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057		0.215		
KFM07A	419.13	419.14	Granite to granodiorite, metamorphic, medium-grained	101057			1.721	
KFM07A	608.92	609.32	Granite to granodiorite, metamorphic, medium-grained	101057	0.027			
KFM07A	608.92	609.32	Granite to granodiorite, metamorphic, medium-grained	101057	0.021			
KFM07A	608.92	609.32	Granite to granodiorite, metamorphic, medium-grained	101057		0.122		
KFM07A	608.92	609.32	Granite to granodiorite, metamorphic, medium-grained	101057		0.189		
KFM07A	969.80	969.86	Granite to granodiorite, metamorphic, medium-grained	101057			3.267	

Table A3-8. Specific surface area, BET, for drill site 8.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	BET 2–4 mm (m^2/g)	BET 0.063–0.125 mm (m^2/g)	BET < 0.125 mm (m^2/g)
KFM08A	412.04	412.3	Granite to granodiorite. metamorphic. medium-grained	101057	0.335		
KFM08A	412.04	412.3	Granite to granodiorite. metamorphic. medium-grained	101057	0.349		
KFM08A	412.04	412.3	Granite to granodiorite. metamorphic. medium-grained	101057		0.745	
KFM08A	412.04	412.3	Granite to granodiorite. metamorphic. medium-grained	101057		0.732	
KFM08A	808.54	808.7	Granite. metamorphic. aplitic	101058	0.049		
KFM08A	808.54	808.7	Granite. metamorphic. aplitic	101058	0.055		
KFM08A	808.54	808.7	Granite. metamorphic. aplitic	101058		0.182	
KFM08A	808.54	808.7	Granite. metamorphic. aplitic	101058		0.184	
KFM08A	890.9	891.21	Felsic to intermediate volcanic rock. metamorphic	103076	0.051		
KFM08A	890.9	891.21	Felsic to intermediate volcanic rock. metamorphic	103076	0.042		
KFM08A	890.9	891.21	Felsic to intermediate volcanic rock. metamorphic	103076		0.203	
KFM08A	890.9	891.21	Felsic to intermediate volcanic rock. metamorphic	103076		0.207	

Table A3-9. Specific surface area, BET, for drill site 9.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	BET 2-4 mm (m^2/g)	BET 0.063-0.125 mm (m^2/g)	BET < 0.125 mm (m^2/g)
KFM09A	172.98	173.38	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.002		
KFM09A	172.98	173.38	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.002		
KFM09A	172.98	173.38	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051		0.009	
KFM09A	172.98	173.38	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051		0.009	
KFM09A	423.00	423.42	Amphibolite	102017	< 0.001		
KFM09A	423.00	423.42	Amphibolite	102017	< 0.001		
KFM09A	423.00	423.42	Amphibolite	102017		0.007	
KFM09A	423.00	423.42	Amphibolite	102017		0.010	

Appendix 4

Cation exchange capacity, CEC

Measured cation exchange capacity, CEC and sum of the exchangeble cations on the fractions 0.063–0.125 mm and 1–2 mm of crushed and sieved rock samples, or scraped fracture filling material, < 0.125 mm. Tables in Appendix 4 are presented per drill-site.

Table A4-1. Cation exchange capacity, CEC, for rock samples from drill site 1.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Fraction (mm)	CEC (cmol/kg)	Na (cmol/kg)	K (cmol/kg)	Mg (cmol/kg)	Ca (cmol/kg)	Cs (cmol/kg)	Rb (cmol/kg)	Sr (cmol/kg)
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057	0.063–0.125	9.00E–01	< 5.00E–01	< 1.40E+00	< 8.00E–01	1.08E+00	4.95E–06	9.10E–04	2.90E–01
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057	1–2	4.00E–01	< 4.00E–01	< 1.30E+00	< 7.00E–01	< 1.00E+00	3.91E–05	7.30E–04	2.60E–01
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	0.063–0.125	7.00E–01	< 5.00E–01	< 1.40E+00	< 8.00E–01	< 1.10E+00	8.41E–07	9.50E–04	2.60E–03
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	1–2	6.00E–01	< 4.00E–01	< 1.30E+00	< 8.00E–01	< 1.00E+00	1.06E–05	5.60E–04	2.10E–02
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057	0.063–0.125	2.00E–01	< 5.00E–01	< 1.40E+00	< 8.00E–01	< 1.10E+00	3.60E–03	9.60E–04	4.90E–03
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057	1–2	3.00E–01	< 4.00E–01	< 1.30E+00	< 8.00E–01	< 1.00E+00	3.49E–05	7.10E–04	6.90E–03
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	0.063–0.125	1.98E+01	9.70E–01	7.30E–01	2.64E+00	7.12E+00	6.70E–05	5.11E–03	*
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	1–2	9.00E+00	9.30E–01	< 1.20E+00	1.89E+00	6.18E+00	8.72E–05	2.40E–03	*

* Not evaluated

Table A4-2. Cation exchange capacity, CEC, for rock samples from drill site 2.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Fraction (mm)	CEC (cmol/kg)	Na (cmol/kg)	K (cmol/kg)	Mg (cmol/kg)	Ca (cmol/kg)	Cs (cmol/kg)	Rb (cmol/kg)	Sr (cmol/kg)
KFM02A	275.22	275.45	Granite to granodiorite, metamorphic, medium-grained	101057	1–2	2.00E–02	< 4.00E–01	< 1.30E+00	< 7.00E–01	< 1.00E+00	2.18E–05	1.00E–10	6.90E–03
KFM02A	552.00	552.23	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	0.063–0.125	2.60E+00	< 2.10E+00	< 6.10E+00	< 3.50E+00	3.26E+01	1.54E–04	3.40E–05	4.20E–07
KFM02A	552.00	552.23	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	1–2	6.00E–01	< 4.00E–01	< 1.30E+00	< 7.00E–01	6.10E+00	1.96E–05	9.90E–04	6.90E–03

Table A4-3. Cation exchange capacity, CEC, f for rock samples from drill site 5.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Fraction (mm)	CEC (cmol/kg)	Na (cmol/kg)	K (cmol/kg)	Mg (cmol/kg)	Ca (cmol/kg)	Cs (cmol/kg)	Rb (cmol/kg)	Sr (cmol/kg)
KFM05A	611.68	611.98	Granite to granodiorite, metamorphic, medium-grained	101057	0.063–0.125	5.40E+00	5.00E–02		1.00E–02	1.28E+01	3.92E–05	1.22E–04	
KFM05A	611.68	611.98	Granite to granodiorite, metamorphic, medium-grained	101057	1–2	4.10E+00	< 1.50E+00	< 1.80E+00	< 3.00E–01	6.88E+00		1.22E–04	

Table A4-4. Cation exchange capacity, CEC, for rock samples from drill site 7.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Fraction (mm)	CEC (cmol/kg)	Na (cmol/kg)	K (cmol/kg)	Mg (cmol/kg)	Ca (cmol/kg)	Cs (cmol/kg)	Rb (cmol/kg)	Sr (cmol/kg)
KFM07A	121.03	121.15	Granite to granodiorite, metamorphic, medium-grained	101057	< 0.125	1.50E+01	< 9.40E+00	< 1.10E–01	9.00E–02	1.53E+01	4.85E–04	3.12E–03	2.9E–01

Table A4-5. Cation exchange capacity, CEC, for rock samples from drill site 10.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Fraction (mm)	CEC (cmol/kg)	Na (cmol/kg)	K (cmol/kg)	Mg (cmol/kg)	Ca (cmol/kg)	Cs (cmol/kg)	Rb (cmol/kg)	Sr (cmol/kg)
KFM010A	144.51	144.66	Granite to granodiorite, metamorphic, medium-grained	101057	< 0.125	1.83E+01	< 4.00E+00	< 4.70E–00	8.00E–02	4.27E+01	1.11E–04	2.29E–03	8.39E–02

Batch sorption, K_d

Sorption coefficient, K_d, for a number of combinations of rock materials, radio nuclides and groundwater compositions, Table A5-1 to A5-7. The different groundwater types used are: fresh water (F), marine water (M), saline water Forsmark (SaF) and brine water (B).

Table A5-1. Sorption coefficients, K_d, for rock samples from drill site 1.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Tracer	Sorption coefficent K_d	Surface sorption coefficent K_a	Water composition
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	< 2.7E–02	2.0E–02	F
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 3.6E–03	5.4E–04	F
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057	Am	2.9E–02	6.5E–03	F
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	< 1.8E–03	3.8E–03	M
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 2.9E–04	< 1.6E–05	M
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057	Am	2.1E+00	–5.2E–02	M
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	< 3.9E–03	9.1E–03	SaF
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 1.1E–06	< 1.6E–05	SaF
KFM01A	103.46	103.65	Granite to granodiorite, metamorphic, medium-grained	101057	Am	9.0E–01	8.3E–02	SaF
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	< 6.2E–03	2.2E–03	M
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	2.8E–03	< 1.6E–04	M
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	Am	< 3.1E+00	< 3.4E–01	M
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	Ra	1.4E–02	1.2E–03	M
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	Ni	2.8E–02	5.2E–03	M
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	U	< 1.9E–02	4.0E–03	M
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	Th	3.0E–01	2.9E–02	M
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	< 9.4E–03	3.0E–03	SaF
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 6.8E–04	< 7.6E–05	SaF
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	Ra	5.1E–03	5.7E–04	SaF
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	Ni	3.1E–02	4.1E–03	SaF
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	Np	< 7.3E–02	2.0E–02	SaF
KFM01A	487.10	487.50	Granite to granodiorite, metamorphic, medium-grained	101057	U	< 2.1E–02	6.4E–03	SaF
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	6.3E–04	5.1E–04	M
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 3.5E–04	< 3.4E–05	M
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057	Am	6.7E–01	–7.9E–04	M

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Tracer	Sorption coefficent K_d	Surface sorption coefficent K_a	Water composition
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	< 1.2E–03	1.4E–03	SaF
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 3.8E–04	< 4.4E–05	SaF
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057	Am	4.2E–01	1.6E–02	SaF
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	1.1E–03	4.9E–04	B
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 1.5E–04	< 3.8E–06	B
KFM01A	908.18	908.36	Granite to granodiorite, metamorphic, medium-grained	101057	Am	2.6E–01	3.7E–02	B
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	3.0E–01	< 1.2E–02	F
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	5.8E–02	6.5E–03	F
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	Am	2.4E–01	< 2.3E–02	F
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	Ra	3.6E–01	< 4.3E–02	F
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	Np	< 1.1E–02	2.8E–03	F
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	U	1.1E–03	2.1E–05	F
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	4.3E–02	< 1.2E–03	SaF
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 5.4E–04	< 6.3E–05	SaF
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	Am	5.4E+00	< 3.7E–01	SaF
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	Ra	6.4E–02	< 1.3E–03	SaF
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	Ni	3.0E–01	< 1.7E–02	SaF
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	Np	< 8.5E–03	2.5E–03	SaF
KFM01B	47.72	47.82	Granite to granodiorite, metamorphic, medium-grained	101057	U	4.6E–02	< 8.9E–03	SaF
KFM01B	418.80	418.94	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	6.4E–02	n.a [1)]	F
KFM01B	418.80	418.94	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	3.7E–01	n.a [1)]	F
KFM01B	418.80	418.94	Granite to granodiorite, metamorphic, medium-grained	101057	Am	1.5E+00	n.a [1)]	F
KFM01B	418.80	418.94	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	4.1E–03	n.a [1)]	M
KFM01B	418.80	418.94	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 8.2E–04	n.a [1)]	M
KFM01B	418.80	418.94	Granite to granodiorite, metamorphic, medium-grained	101057	Am	2.4E+00	n.a [1)]	M
KFM01B	418.80	418.94	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	1.2E–03	n.a [1)]	B
KFM01B	418.80	418.94	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 1.9E–04	n.a [1)]	B
KFM01B	418.80	418.94	Granite to granodiorite, metamorphic, medium-grained	101057	Am	2.8E+00	n.a [1)]	B

Table A5-2. Sorption coefficients, K_d, for rock samples from drill site 2.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Tracer	Sorption coefficent K_d	Surface sorption coefficent K_a	Water composition
KFM02A	118.25	118.70	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	3.5E+00		F
KFM02A	118.25	118.70	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	9.5E–02		F
KFM02A	118.25	118.70	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	1.8E+00		F
KFM02A	118.25	118.70	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	6.1E–01		M
KFM02A	118.25	118.70	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	2.2E–03		M
KFM02A	118.25	118.70	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	1.6E+00		M
KFM02A	275.22	275.45	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	< 4.1E–03	5.0E–03	F
KFM02A	275.22	275.45	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	4.8E–03	2.1E–03	F
KFM02A	275.22	275.45	Granite to granodiorite, metamorphic, medium-grained	101057	Am	2.6E–01	3.8E–02	F
KFM02A	275.22	275.45	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	1.4E–03	5.3E–04	M
KFM02A	275.22	275.45	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 1.1E–03	< 9.2E–05	M
KFM02A	275.22	275.45	Granite to granodiorite, metamorphic, medium-grained	101057	Am	1.0E+00	1.5E–01	M
KFM02A	275.22	275.45	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	5.7E–04	1.7E–04	B
KFM02A	275.22	275.45	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 3.3E–04	< 5.7E–05	B
KFM02A	275.22	275.45	Granite to granodiorite, metamorphic, medium-grained	101057	Am	1.2E+00	1.2E–01	B
KFM02A	552.00	552.23	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Cs	< 3.8E–03	3.5E–03	F
KFM02A	552.00	552.23	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Sr	< 5.3E–03	1.6E–03	F
KFM02A	552.00	552.23	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Cs	1.3E–03	3.2E–04	M
KFM02A	552.00	552.23	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Cs	1.4E–03	7.6E–04	SaF
KFM02A	552.00	552.23	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Sr	4.1E–04	< –3.5E–06	SaF

Table A5-3. Sorption coefficients, K_d, for rock samples from drill site 3.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Tracer	Sorption coefficent K_d	Surface sorption coefficent K_a	Water composition
KFM03A	242.93	243.13	Tonalite to granodiorite, metamorphic	101054	Cs	2.0E–02	3.2E–03	F
KFM03A	242.93	243.13	Tonalite to granodiorite, metamorphic	101054	Sr	4.1E–03	5.2E–04	F
KFM03A	242.93	243.13	Tonalite to granodiorite, metamorphic	101054	Am	1.9E–01	4.3E–02	F
KFM03A	242.93	243.13	Tonalite to granodiorite, metamorphic	101054	Cs	1.0E–02	4.1E–04	M
KFM03A	242.93	243.13	Tonalite to granodiorite, metamorphic	101054	Sr	< 4.8E–04	3.3E–05	M
KFM03A	242.93	243.13	Tonalite to granodiorite, metamorphic	101054	Eu	2.5E–02	3.3E–03	M
KFM03A	242.93	243.13	Tonalite to granodiorite, metamorphic	101054	Cs	< 5.3E–03	6.7E–03	SaF
KFM03A	242.93	243.13	Tonalite to granodiorite, metamorphic	101054	Sr	< 2.0E–04	3.2E–04	SaF
KFM03A	242.93	243.13	Tonalite to granodiorite, metamorphic	101054	Eu	< 1.2E+00	2.2E–01	SaF
KFM03A	536.47	536.67	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	2.2E–02	4.8E–03	F
KFM03A	536.47	536.67	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	5.4E–03	2.5E–03	F
KFM03A	536.47	536.67	Granite to granodiorite, metamorphic, medium-grained	101057	Am	< 6.8E–02	3.1E–02	F
KFM03A	536.47	536.67	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	3.9E–03	1.1E–03	SaF
KFM03A	536.47	536.67	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	1.3E–03	< 2.4E–05	SaF
KFM03A	536.47	536.67	Granite to granodiorite, metamorphic, medium-grained	101057	Am	5.1E–01	5.6E–02	SaF
KFM03A	536.47	536.67	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	2.6E–03	3.5E–04	B
KFM03A	536.47	536.67	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 1.6E–03	< 5.0E–05	B
KFM03A	536.47	536.67	Granite to granodiorite, metamorphic, medium-grained	101057	Am	5.6E–01	5.4E–02	B
KFM03A	643.80	644.17	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	1.5E+00	n.a [1)]	F
KFM03A	643.80	644.17	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	2.0E–01	n.a [1)]	F
KFM03A	643.80	644.17	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	1.0E–01	n.a [1)]	F
KFM03A	643.80	644.17	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	4.8E–02	n.a [1)]	B
KFM03A	643.80	644.17	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 3.0E–04	n.a [1)]	B
KFM03A	643.80	644.17	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	8.6E–01	n.a [1)]	B
KFM03A	643.80	644.17	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	1.6E–01	n.a [1)]	SaF
KFM03A	643.80	644.17	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	7.5E–02	n.a [1)]	SaF

1) Not applicable. Loose fracture filling material, only one size fraction used (<0.125mm) and therefore only the Kd was evaluated (cf section 3.5.3 for details).

Table A5-4. Sorption coefficients, K_d, for rock samples from drill site 4.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Tracer	Sorption coefficent K_d	Surface sorption coefficent K_a	Water composition
KFM04A	377.16	377.78	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Cs	4.4E–01	n.a [1)]	F
KFM04A	377.16	377.78	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Sr	6.6E–02	n.a [1)]	F
KFM04A	377.16	377.78	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Am	1.5E+00	n.a [1)]	F
KFM04A	377.16	377.78	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Cs	1.8E–02	n.a [1)]	M
KFM04A	377.16	377.78	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Sr	< 5.1E–04	n.a [1)]	M
KFM04A	377.16	377.78	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Am	3.8E+00	n.a [1)]	M
KFM04A	377.16	377.78	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Cs	1.4E–02	n.a [1)]	SaF
KFM04A	377.16	377.78	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Sr	< 3.1E–04	n.a [1)]	SaF
KFM04A	377.16	377.78	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Am	1.3E+00	n.a [1)]	SaF
KFM04A	377.16	377.78	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Cs	4.1E–03	n.a [1)]	B
KFM04A	377.16	377.78	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Sr	< 5.4E–04	n.a [1)]	B
KFM04A	377.16	377.78	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Am	2.1E+00	n.a [1)]	B
KFM04A	414.14	414.34	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Cs	2.3E–01	n.a [1)]	F
KFM04A	414.14	414.34	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Sr	8.1E–02	n.a [1)]	F
KFM04A	414.14	414.34	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Eu	6.6E–02	n.a [1)]	F
KFM04A	414.14	414.34	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Cs	1.9E–02	n.a [1)]	M
KFM04A	414.14	414.34	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Sr	< 5.7E–04	n.a [1)]	M
KFM04A	414.14	414.34	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Eu	1.5E–01	n.a [1)]	M
KFM04A	414.14	414.34	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Cs	4.1E–02	n.a [1)]	SaF
KFM04A	414.14	414.34	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Sr	< 7.8E–04	n.a [1)]	SaF
KFM04A	414.14	414.34	Granite, granodiorite and tonalite, metamorphic, fine- to medium-grained	101051	Eu	1.5E–01	n.a [1)]	SaF

1) Not applicable. Loose fracture filling material, only one size fraction used (< 0.125mm) and therefore only the Kd was evaluated (cf section 3.5.3 for details).

Table A5-5. Sorption coefficients, K_d, for rock samples from drill site 5.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Tracer	Sorption coefficent K_d	Surface sorption coefficent K_a	Water composition
KFM05A	611.68	611.91	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	1.4E–02	n.a 1)	M
KFM05A	611.68	611.91	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	7.3E–02	n.a 1)	M
KFM05A	611.68	611.91	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	1.8E–02	n.a 1)	SaF
KFM05A	611.68	611.91	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 7.8E–04	n.a 1)	SaF
KFM05A	611.68	611.91	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	1.1E+00	n.a 1)	SaF
KFM05A	611.68	611.91	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	2.1E–01	n.a 1)	F
KFM05A	611.68	611.91	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	3.6E–02	n.a 1)	F
KFM05A	611.68	611.91	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	7.6E–01	n.a 1)	F

1) Not applicable. Loose fracture filling material, only one size fraction used (<0.125mm) and therefore only the Kd was evaluated (cf section 3.5.3 for details).

Table A5-6. Sorption coefficients, K_d, for rock samples from drill site 6.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Tracer	Sorption coefficent K_d	Surface sorption coefficent K_a	Water composition
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	6.0E–03	2.0E–03	F
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	2.5E–03	6.4E–04	F
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	2.3E–01	< 1.0E–03	F
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	< 2.1E–03	2.2E–04	M
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 5.5E–03	< 3.1E–04	M
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	4.4E–02	< 2.3E–03	M
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	1.5E–03	5.6E–04	SaF
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 3.2E–04	< 2.3E–05	SaF
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	9.1E–01	5.0E–02	SaF
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	1.4E–03	1.3E–04	B
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 1.7E–03	< 9.9E–05	B
KFM06A	440.13	440.60	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	< 8.1E–02	3.8E–02	B
KFM06A	770.69	770.79	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	1.3E–01	n.a [1)]	F
KFM06A	770.69	770.79	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 5.4E–01	n.a [1)]	F
KFM06A	770.69	770.79	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	< 6.2E–01	n.a [1)]	F
KFM06A	770.69	770.79	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	8.4E–03	n.a [1)]	M
KFM06A	770.69	770.79	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	2.3E–03	n.a [1)]	M
KFM06A	770.69	770.79	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	1.3E+00	n.a [1)]	M
KFM06A	770.69	770.79	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	9.7E–03	n.a [1)]	SaF
KFM06A	770.69	770.79	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	1.1E–03	n.a [1)]	SaF
KFM06A	770.69	770.79	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	2.1E+00	n.a [1)]	SaF
KFM06B	56.25	56.32	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	2.7E+00	n.a [1)]	F
KFM06B	56.25	56.32	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	1.4E–01	n.a [1)]	F
KFM06B	56.25	56.32	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	3.3E–01	n.a [1)]	SaF
KFM06B	56.25	56.32	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 1.6E–03	n.a [1)]	SaF
KFM06B	56.25	56.32	Granite to granodiorite, metamorphic, medium-grained	101057	Eu	1.0E+00	n.a [1)]	SaF

1) Not applicable. Loose fracture filling material, only one size fraction used (<0.125mm) and therefore only the Kd was evaluated (cf section 3.5.3 for details).

Table A5-7. Sorption coefficients, K_d, for rock samples from drill site 7.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type	Rock code	Tracer	Sorption coefficent K_d	Surface sorption coefficent K_a	Water composition
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	< 5.3E–02	9.9E–03	F
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 3.5E–02	< 9.2E–03	F
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Am	< 3.2E–01	3.3E–02	F
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Ra	< 2.3E–01	3.7E–02	F
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Np	< 1.2E+00	2.5E–01	F
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	U	< 3.9E–02	5.6E–03	F
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	< 7.6E–03	3.9E–03	SaF
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 1.2E–03	6.1E–05	SaF
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Ra	8.1E–03	8.1E–04	SaF
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Am	< 3.4E+00	3.1E–01	SaF
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Ni	4.0E–02	1.2E–02	SaF
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Np	< 1.2E+00	1.9E–01	SaF
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	U	< 3.8E–02	9.0E–03	SaF
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Cs	< 2.3E–03	1.1E–03	B
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Sr	< 3.4E–03	< 2.7E–04	B
KFM07A	387.47	387.80	Granite to granodiorite, metamorphic, medium-grained	101057	Am	4.0E–01	1.8E–01	B
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Ra	< 1.1E–03	2.5E–04	B
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Ni	< 3.6E–01	< 3.3E–02	B
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	Np	< 8.3E–01	1.2E–01	B
KFM07A	387.47	387.87	Granite to granodiorite, metamorphic, medium-grained	101057	U	< 4.8E–02	6.2E–03	B

Batch sorption, R_d

Tracer distribution ratio, R_d, for all combination of size fractions, water types and tracers at the different measurement times. Data are presented on single rock sample basis. The different groundwater types used are: fresh water (F), marine water (M), saline water Forsmark (SaF) and brine water (B).

Table A5-8. Tracer distribution ratio, *Rd,* for rock samples from drill site 1.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
KFM01A	103.46	103.65	101057	F	Cs	1	1	2	4.24E–03	3.38E–03	3.80E–03
							0.25	0.5	1.64E–02	1.48E–02	1.49E–02
							0.063	0.125	1.13E–01	1.15E–01	8.77E–02
						7	1	2	8.23E–03	7.45E–03	7.21E–03
							0.25	0.5	3.43E–02	3.18E–02	3.26E–02
							0.063	0.125	1.85E–01	2.21E–01	2.37E–01
						31	1	2	9.49E–03	1.10E–02	9.71E–03
							0.25	0.5	3.91E–02	4.40E–02	4.12E–02
							0.063	0.125	2.26E–01	2.29E–01	1.81E–01
						92	1	2	1.15E–02	1.07E–02	1.09E–02
							0.25	0.5	4.36E–02	5.25E–02	4.57E–02
							0.063	0.125	3.05E–01	2.67E–01	2.25E–01
						182	1	2	1.81E–02	1.72E–02	1.47E–02
							0.25	0.5	7.43E–02	7.18E–02	7.21E–02
							0.063	0.125	4.71E–01	3.06E–01	4.37E–01
					Sr	1	1	2	1.66E–03	1.17E–03	1.47E–03
							0.25	0.5	3.60E–03	2.78E–03	2.85E–03
							0.063	0.125	9.59E–03	1.12E–02	5.61E–03
						7	1	2	2.26E–03	2.10E–03	2.22E–03
							0.25	0.5	4.24E–03	3.79E–03	4.03E–03
							0.063	0.125	9.63E–03	1.30E–02	1.06E–02

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						31	1	2	1.84E–03	2.64E–03	2.56E–03
							0.25	0.5	3.48E–03	3.90E–03	4.49E–03
							0.063	0.125	9.28E–03	1.13E–02	7.54E–03
						92	1	2	2.15E–03	1.75E–03	1.91E–03
							0.25	0.5	3.36E–03	4.01E–03	3.52E–03
							0.063	0.125	1.25E–02	1.32E–02	9.81E–03
						182	1	2	3.24E–03	2.74E–03	2.31E–03
							0.25	0.5	4.00E–03	3.85E–03	4.12E–03
							0.063	0.125	1.27E–02	9.57E–03	1.66E–02
					Ln-Ac (III)	1	1	2	7.30E–03	6.52E–03	5.67E–03
							0.25	0.5	1.49E–02	1.04E–02	1.16E–02
							0.063	0.125	3.69E–02	2.99E–02	2.50E–02
						7	1	2	1.42E–02	1.22E–02	1.51E–02
							0.25	0.5	2.47E–02	2.44E–02	2.29E–02
							0.063	0.125	7.15E–02	6.54E–02	7.96E–02
						31	1	2	2.69E–02	2.57E–02	2.78E–02
							0.25	0.5	5.14E–02	5.47E–02	3.85E–02
							0.063	0.125	1.29E–01	1.46E–01	1.51E–01
						92	1	2	2.00E–02	2.06E–02	1.77E–02
							0.25	0.5	4.48E–02	4.44E–02	3.45E–02
							0.063	0.125	1.31E–01	1.36E–01	7.96E–02
						182	1	2	3.65E–02	3.29E–02	3.97E–02
							0.25	0.5	6.54E–02	6.70E–02	6.11E–02

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
							0.063	0.125	1.56E–01	1.65E–01	1.68E–01
				M	Cs	1	1	2	1.27E–03	1.12E–03	3.85E–04
							0.25	0.5	4.67E–03	3.19E–03	3.91E–03
							0.063	0.125	1.28E–02	1.21E–02	1.35E–02
						7	1	2	1.75E–03	1.15E–03	1.22E–03
							0.25	0.5	1.03E–02	6.43E–03	6.23E–03
							0.063	0.125	3.46E–02	4.33E–02	2.85E–02
						31	1	2	1.10E–03	7.93E–04	1.51E–03
							0.25	0.5	8.64E–03	4.53E–03	5.72E–03
							0.063	0.125	3.59E–02	3.79E–02	2.96E–02
						92	1	2	3.05E–03	2.75E–03	2.16E–03
							0.25	0.5	1.27E–02	9.25E–03	1.12E–02
							0.063	0.125	5.74E–02	5.24E–02	5.16E–02
						182	1	2	3.49E–03	2.39E–03	3.53E–03
							0.25	0.5	1.32E–02	1.03E–02	1.32E–02
							0.063	0.125	6.66E–02	8.65E–02	7.16E–02
					Sr	1	1	2	1.59E–04	1.09E–04	–6.15E–04
							0.25	0.5	2.54E–04	–3.99E–04	–1.69E–04
							0.063	0.125	–3.10E–05	–4.70E–04	–9.48E–04
						7	1	2	9.90E–06	–5.01E–04	–6.05E–04
							0.25	0.5	1.49E–03	1.70E–04	–1.44E–04
							0.063	0.125	–1.40E–04	5.96E–04	–8.73E–04
						31	1	2	–7.35E–04	–8.63E–04	–5.32E–04
							0.25	0.5	4.61E–04	–8.26E–04	–5.92E–04
							0.063	0.125	–5.26E–04	–6.95E–04	–7.00E–04
						92	1	2	3.41E–04	3.62E–04	–3.59E–04
							0.25	0.5	1.05E–03	2.23E–04	5.89E–04
							0.063	0.125	6.64E–03	9.80E–05	4.74E–04
						182	1	2	3.65E–04	–3.54E–04	–3.07E–05
							0.25	0.5	5.19E–05	–3.52E–04	3.48E–04
							0.063	0.125	–1.78E–04	2.75E–05	–1.69E–04

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
					Ln-Ac (III) (3)	1	1	2	2.75E–02	3.55E–02	2.41E–02
							0.25	0.5	4.79E–02	5.51E–02	6.44E–02
							0.063	0.125	3.20E–01	3.73E–01	4.06E–01
						7	1	2	1.06E–01	1.11E–01	1.05E–01
							0.25	0.5	1.81E–01	2.27E–01	2.45E–01
							0.063	0.125	8.89E–01	7.43E–01	1.09E+00
						31	1	2	5.14E–01	3.84E–01	4.90E–01
							0.25	0.5	7.83E–01	6.21E–01	6.92E–01
							0.063	0.125	2.90E+00	2.63E+00	1.61E+00
						92	1	2	1.28E–01	1.76E–01	1.72E–01
							0.25	0.5	2.23E–01	2.77E–01	2.23E–01
							0.063	0.125	9.69E–01	9.60E–02	2.14E–01
						182	1	2	1.65E+00	1.07E+00	1.69E+00
							0.25	0.5	2.06E+00	3.36E+00	2.20E+00
							0.063	0.125	5.16E–01	1.54E+00	5.76E–01
				SaF	Cs	1	1	2	2.03E–03	2.10E–03	1.66E–03
							0.25	0.5	8.67E–03	8.80E–03	6.39E–03
							0.063	0.125	2.64E–02	2.38E–02	3.79E–02
						7	1	2	2.99E–03	3.48E–03	2.07E–03
							0.25	0.5	1.51E–02	1.50E–02	1.39E–02
							0.063	0.125	7.00E–02	9.40E–02	4.31E–02
						31	1	2	3.82E–03	3.22E–03	2.43E–03
							0.25	0.5	1.64E–02	1.70E–02	1.44E–02
							0.063	0.125	1.02E–01	1.04E–01	1.04E–01
						92	1	2	4.07E–03	2.76E–03	4.46E–03
							0.25	0.5	1.96E–02	2.32E–02	2.23E–02
							0.063	0.125	1.12E–01	1.27E–01	1.01E–01
						182	1	2	5.17E–03	5.58E–03	5.69E–03
							0.25	0.5	2.89E–02	3.00E–02	3.50E–02
							0.063	0.125	1.82E–01	1.85E–01	1.68E–01

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
					Sr	1	1	2	4.17E–06	1.02E–04	–1.90E–04
							0.25	0.5	–2.44E–05	1.69E–04	–5.59E–04
							0.063	0.125	–5.64E–05	–7.10E–05	4.13E–04
						7	1	2	–1.79E–04	–8.96E–04	–6.06E–04
							0.25	0.5	–2.20E–04	1.78E–05	–3.38E–04
							0.063	0.125	–7.52E–04	7.59E–04	–2.22E–03
						31	1	2	3.31E–05	–3.05E–04	–6.13E–04
							0.25	0.5	–3.26E–04	–1.89E–04	–6.87E–04
							0.063	0.125	–6.44E–05	3.80E–04	6.56E–04
						92	1	2	–1.25E–04	–8.21E–04	5.40E–05
							0.25	0.5	–5.29E–04	4.13E–05	–1.39E–04
							0.063	0.125	–5.39E–04	2.05E–04	–5.70E–04
						182	1	2	–2.51E–04	–1.33E–04	9.16E–05
							0.25	0.5	–3.94E–04	–7.99E–05	–7.19E–05
							0.063	0.125	1.14E–05	–1.31E–04	–5.11E–05
					Ln-Ac (III)	1	1	2	2.60E–02	2.27E–02	2.51E–02
							0.25	0.5	7.06E–02	7.00E–02	7.70E–02
							0.063	0.125	2.96E–01	2.97E–01	4.56E–01
						7	1	2	1.09E–01	9.08E–02	9.97E–02
							0.25	0.5	2.46E–01	2.39E–01	2.85E–01
							0.063	0.125	7.40E–01	7.25E–01	1.27E+00
						31	1	2	3.75E–01	2.63E–01	3.03E–01
							0.25	0.5	9.95E–01	7.09E–01	1.10E+00
							0.063	0.125	2.18E+00	1.13E+00	3.30E+00
						92	1	2	4.94E–02	1.09E–01	1.27E–01
							0.25	0.5	1.57E–01	1.26E–01	1.94E–01
							0.063	0.125	1.69E–01	1.11E–01	2.23E–01
						182	1	2	5.84E–01	4.84E–01	5.14E–01
							0.25	0.5	1.17E+00	1.86E+00	2.74E+00
							0.063	0.125	1.49E+00	4.81E+00	1.20E+00
KFM01A	487.10	487.50	101057	M	Cs	1	1	2	4.83E–03	5.22E–03	2.67E–03
							0.25	0.5	5.10E–03	6.19E–03	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
							0.063	0.125	1.26E–02	1)	1)
						7	1	2	5.85E–03	5.03E–03	2.80E–03
							0.25	0.5	5.32E–03	7.20E–03	1)
							0.063	0.125	2.33E–02	1)	1)
						31	1	2	7.88E–03	6.10E–03	4.92E–03
							0.25	0.5	8.85E–03	9.71E–03	1)
							0.063	0.125	3.28E–02	1)	1)
						92	1	2	8.50E–03	7.37E–03	5.73E–03
							0.25	0.5	1.05E–02	1.18E–02	1)
							0.063	0.125	4.16E–02	1)	1)
						182	1	2	8.57E–03	7.96E–03	6.08E–03
							0.25	0.5	1.07E–02	1.16E–02	1)
							0.063	0.125	4.92E–02	1)	1)
					Sr	1	1	2	4.60E–03	5.23E–03	2.46E–03
							0.25	0.5	3.51E–03	4.98E–03	1)
							0.063	0.125	3.80E–03	1)	1)
						7	1	2	3.44E–03	2.64E–03	1.06E–03
							0.25	0.5	2.05E–03	2.89E–03	1)
							0.063	0.125	1.99E–03	1)	1)
						31	1	2	4.41E–03	3.14E–03	2.30E–03
							0.25	0.5	3.23E–03	3.92E–03	1)
							0.063	0.125	3.06E–03	1)	1)
						92	1	2	4.47E–03	3.96E–03	2.61E–03
							0.25	0.5	3.31E–03	4.67E–03	1)
							0.063	0.125	3.25E–03	1)	1)
						182	1	2	3.41E–03	3.04E–03	1.86E–03
							0.25	0.5	2.29E–03	3.19E–03	1)
							0.063	0.125	2.59E–03	1)	1)
					Ln-Ac (III) (2)	1	1	2	5.23E–02	4.31E–02	4.51E–02
							0.25	0.5	1.30E–01	3.44E–01	1)
							0.063	0.125	3.48E–01	1)	1)
						7	1	2	1.87E–01	1.60E–01	1.50E–01

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.25	0.5	7.54E–01	9.11E–01	1)
							0.063	0.125	1.43E+00	1)	1)
						31	1	2	1.44E+00	6.73E–01	1.00E+00
							0.25	0.5	1.66E+00	2.63E–01	1)
							0.063	0.125	3.43E+00	1)	1)
						92	1	2	1.87E+00	4.80E+00	2.44E+00
							0.25	0.5	3.20E+00	2.38E+00	1)
							0.063	0.125	6.51E+00	1)	1)
						182	1	2	3.16E+00	1.38E–01	1.30E+00
							0.25	0.5	4.68E–01	1.01E–01	1)
							0.063	0.125	3.61E+00	1)	1)
					Ra	1	1	2	4.94E–03	4.10E–03	3.94E–03
							0.25	0.5	3.84E–03	6.33E–03	1)
							0.063	0.125	1.15E–02	1)	1)
						7	1	2	1.14E–02	7.13E–03	7.75E–03
							0.25	0.5	1.11E–02	1.02E–02	1)
							0.063	0.125	2.14E–02	1)	1)
						31	1	2	1.35E–02	7.48E–03	7.42E–03
							0.25	0.5	1.16E–02	1.04E–02	1)
							0.063	0.125	3.08E–02	1)	1)
						92	1	2	2.00E–02	9.05E–03	9.39E–03
							0.25	0.5	1.31E–02	1.29E–02	1)
							0.063	0.125	3.49E–02	1)	1)
						182	1	2	2.74E–02	1.04E–02	1.25E–02
							0.25	0.5	1.68E–02	1.74E–02	1)
							0.063	0.125	4.03E–02	1)	1)
					Ni	1	1	2	3.07E–03	3.23E–03	2.88E–03
							0.25	0.5	1.76E–03	3.96E–03	3.46E–03
							0.063	0.125	4.73E–03	6.02E–03	1)
						7	1	2	4.46E–03	4.05E–03	4.09E–03
							0.25	0.5	4.82E–03	6.66E–03	6.03E–03
							0.063	0.125	1.59E–02	3.83E–02	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						31	1	2	7.27E–03	6.63E–03	1.68E–02
							0.25	0.5	1.65E–02	1.68E–02	1.66E–02
							0.063	0.125	1.52E–01	4.32E–01	1)
						92	1	2	1.34E–02	1.52E–02	1.27E–02
							0.25	0.5	2.76E–02	2.99E–02	2.81E–02
							0.063	0.125	2.47E–02	4.51E–02	1)
						182	1	2	2.70E–02	2.67E–02	2.06E–02
							0.25	0.5	6.68E–02	7.38E–02	6.42E–02
							0.063	0.125	8.96E–02	1.76E–01	1)
					Np	1	1	2	2.26E–03	2.36E–03	2.09E–03
							0.25	0.5	1.68E–03	1.77E–03	1)
							0.063	0.125	3.15E–03	1)	1)
						7	1	2	1.87E–03	2.93E–03	1.93E–03
							0.25	0.5	1.48E–03	1.62E–03	1)
							0.063	0.125	3.52E–02	1)	1)
						31	1	2	1.56E–03	3.22E–03	1.45E–03
							0.25	0.5	8.81E–04	1.33E–03	1)
							0.063	0.125	7.36E–01	1)	1)
						92	1	2	7.26E–04	2.86E–03	4.72E–04
							0.25	0.5	–3.05E–04	3.84E–05	1)
							0.063	0.125	1.51E–01	1)	1)
						182	1	2	5.98E–04	3.38E–03	3.34E–04
							0.25	0.5	–7.47E–04	–3.47E–04	1)
							0.063	0.125	4.08E–01	1)	1)
					U	1	1	2	2.39E–03	2.31E–03	2.22E–03
							0.25	0.5	1.80E–03	1.83E–03	1)
							0.063	0.125	1.93E–03	1)	1)
						7	1	2	2.96E–03	2.92E–03	2.77E–03
							0.25	0.5	2.42E–03	2.50E–03	1)
							0.063	0.125	1.16E–02	1)	1)
						31	1	2	3.05E–03	3.34E–03	2.97E–03

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
							0.25	0.5	2.63E–03	3.16E–03	1)
							0.063	0.125	1.30E–01	1)	1)
						92	1	2	3.07E–03	3.36E–03	2.86E–03
							0.25	0.5	2.78E–03	3.19E–03	1)
							0.063	0.125	7.02E–02	1)	1)
						182	1	2	2.72E–03	3.28E–03	2.58E–03
							0.25	0.5	2.61E–03	3.02E–03	1)
							0.063	0.125	7.99E–02	1)	1)
				SaF	Cs	1	1	2	6.32E–04	1.11E–03	–3.25E–05
							0.25	0.5	2.89E–03	2.41E–03	1)
							0.063	0.125	1.02E–02	1)	1)
						7	1	2	8.53E–04	1.08E–03	1.27E–03
							0.25	0.5	5.37E–03	4.20E–03	1)
							0.063	0.125	3.61E–02	1)	1)
						31	1	2	2.73E–03	2.98E–03	1.23E–03
							0.25	0.5	8.09E–03	4.44E–03	1)
							0.063	0.125	4.85E–02	1)	1)
						92	1	2	2.52E–03	3.12E–03	2.28E–03
							0.25	0.5	7.83E–03	4.85E–03	1)
							0.063	0.125	4.96E–02	1)	1)
						182	1	2	2.87E–03	2.92E–03	2.20E–03
							0.25	0.5	8.40E–03	5.14E–03	1)
							0.063	0.125	5.98E–02	1)	1)
					Sr	1	1	2	2.39E–04	6.78E–04	–4.78E–04
							0.25	0.5	7.31E–04	7.26E–04	1)
							0.063	0.125	9.69E–04	1)	1)
						7	1	2	–5.26E–04	–5.74E–04	–3.45E–04
							0.25	0.5	4.21E–04	6.03E–04	1)
							0.063	0.125	6.72E–04	1)	1)
						31	1	2	6.60E–05	2.04E–04	–8.65E–04

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.25	0.5	5.45E–04	–5.44E–04	1)
							0.063	0.125	9.89E–04	1)	1)
						92	1	2	–2.37E–04	–7.42E–05	–4.81E–04
							0.25	0.5	–1.57E–04	–6.29E–04	1)
							0.063	0.125	2.51E–04	1)	1)
						182	1	2	–1.87E–04	–4.17E–04	–6.19E–04
							0.25	0.5	9.84E–05	–6.95E–04	1)
							0.063	0.125	7.84E–05	1)	1)
					Ln-Ac (III) (2)	1	1	2	2.11E–02	1.72E–02	1.77E–02
							0.25	0.5	8.40E–02	7.03E–02	1)
							0.063	0.125	4.31E–01	1)	1)
						7	1	2	7.02E–02	7.51E–02	6.98E–02
							0.25	0.5	3.19E–01	1.97E–01	1)
							0.063	0.125	1.36E+00	1)	1)
						31	1	2	2.70E–01	1.22E–01	2.88E–01
							0.25	0.5	8.65E–01	4.80E–01	1)
							0.063	0.125	3.60E+00	1)	1)
						92	1	2	2.64E–01	3.94E–01	3.61E–01
							0.25	0.5	2.79E–01	4.54E–01	1)
							0.063	0.125	1.02E+01	1)	1)
						182	1	2	1.16E+00	6.52E–01	7.59E–01
							0.25	0.5	5.11E–01	3.68E–01	1)
							0.063	0.125	2.57E+00	1)	1)
					Ra	1	1	2	1.27E–03	1.45E–03	9.94E–04
							0.25	0.5	2.42E–03	2.51E–03	1)
							0.063	0.125	5.48E–03	1)	1)
						7	1	2	2.24E–03	3.32E–03	2.32E–03
							0.25	0.5	4.37E–03	4.92E–03	1)
							0.063	0.125	1.45E–02	1)	1)
						31	1	2	3.47E–03	4.75E–03	2.90E–03
							0.25	0.5	6.01E–03	8.03E–03	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.063	0.125	1.62E–02	1)	1)
						92	1	2	3.37E–03	5.11E–03	3.11E–03
							0.25	0.5	6.58E–03	5.17E–03	1)
							0.063	0.125	1.37E–02	1)	1)
						182	1	2	5.08E–03	7.34E–03	5.42E–03
							0.25	0.5	7.59E–03	8.24E–03	1)
							0.063	0.125	1.71E–02	1)	1)
					Ra	1	1	2	2.90E–04	1.94E–04	1.77E–04
							0.25	0.5	1.41E–03	5.53E–04	1)
							0.063	0.125	1.83E–03	1)	1)
						7	1	2	1.49E–03	1.23E–03	1.26E–03
							0.25	0.5	3.83E–03	2.22E–03	1)
							0.063	0.125	1.56E–02	1)	1)
						31	1	2	4.11E–03	4.70E–03	4.33E–03
							0.25	0.5	1.40E–02	1.15E–02	1)
							0.063	0.125	1.19E–01	1)	1)
						92	1	2	1.12E–02	1.35E–02	1.24E–02
							0.25	0.5	3.78E–02	3.65E–02	1)
							0.063	0.125	4.55E–02	1)	1)
						182	1	2	1.78E–02	2.67E–02	2.48E–02
							0.25	0.5	8.77E–02	6.82E–02	1)
							0.063	0.125	1.05E–01	1)	1)
					Np	1	1	2	–1.46E–04	–2.47E–04	–2.28E–04
							0.25	0.5	1.50E–04	–1.30E–04	1)
							0.063	0.125	1.13E–03	1)	1)
						7	1	2	1.59E–04	2.72E–05	4.78E–05
							0.25	0.5	1.68E–03	1.29E–03	1)
							0.063	0.125	2.39E–02	1)	1)
						31	1	2	1.21E–04	3.94E–05	2.78E–03
							0.25	0.5	6.76E–03	6.61E–03	1)
							0.063	0.125	5.32E–01	1)	1)
						92	1	2	4.13E–06	–1.10E–04	–8.46E–05

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.25	0.5	1.47E–02	1.86E–02	1)
							0.063	0.125	3.78E–01	1)	1)
						182	1	2	1.35E–04	–3.61E–05	–3.43E–05
							0.25	0.5	1.56E–02	2.76E–02	1)
							0.063	0.125	1.27E+00	1)	1)
					U	1	1	2	–7.05E–05	–1.55E–04	–1.63E–04
							0.25	0.5	1.42E–04	–4.86E–05	1)
							0.063	0.125	3.43E–04	1)	1)
						7	1	2	2.53E–04	1.27E–04	1.19E–04
							0.25	0.5	1.15E–03	8.73E–04	1)
							0.063	0.125	5.79E–03	1)	1)
						31	1	2	4.71E–04	3.84E–04	–4.12E–04
							0.25	0.5	3.47E–03	3.54E–03	1)
							0.063	0.125	4.84E–02	1)	1)
						92	1	2	4.75E–04	3.47E–04	3.74E–04
							0.25	0.5	6.04E–03	7.13E–03	1)
							0.063	0.125	7.85E–02	1)	1)
						182	1	2	6.04E–04	4.75E–04	5.05E–04
							0.25	0.5	7.00E–03	9.21E–03	1)
							0.063	0.125	1.23E–01	1)	1)
KFM01B	47.10	47.50		F	Cs	1	1	2	3.51E–02	4.93E–02	4.90E–02
							0.25	0.5	8.39E–02	1.30E–01	1.39E–01
							0.063	0.125	1.37E–01	1)	1)
						7	1	2	1.25E–01	1.25E–01	1.53E–01
							0.25	0.5	1.50E–01	1.87E–01	1.49E–01
							0.063	0.125	1.93E–01	1)	1)
						31	1	2	1.34E–01	1.47E–01	1.69E–01
							0.25	0.5	1.57E–01	2.44E–01	1.63E–01
							0.063	0.125	2.22E–01	1)	1)
						92	1	2	9.47E–02	2.03E–01	2.29E–01
							0.25	0.5	2.18E–01	2.80E–01	2.23E–01
							0.063	0.125	2.64E–01	1)	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						182	1	2	2.78E–01	3.18E–01	3.90E–01
							0.25	0.5	2.41E–01	3.01E–01	2.76E–01
							0.063	0.125	3.22E–01	1)	1)
					Sr	1	1	2	2.56E–02	4.03E–02	3.75E–02
							0.25	0.5	6.17E–02	8.47E–02	8.97E–02
							0.063	0.125	9.07E–02	1)	1)
						7	1	2	4.79E–02	5.50E–02	5.46E–02
							0.25	0.5	6.62E–02	9.01E–02	7.27E–02
							0.063	0.125	8.35E–02	1)	1)
						31	1	2	4.78E–02	6.23E–02	5.82E–02
							0.25	0.5	8.24E–02	1.02E–01	8.55E–02
							0.063	0.125	1.04E–01	1)	1)
						92	1	2	2.94E–02	6.32E–02	7.73E–02
							0.25	0.5	8.21E–02	9.86E–02	1.34E–01
							0.063	0.125	1.86E–01	1)	1)
						182	1	2	6.00E–02	8.67E–02	9.59E–02
							0.25	0.5	2.78E–01	1)	1)
							0.063	0.125	2)	2)	2)
					Ln-Ac (III)	1	1	2	2.75E–02	2.10E–02	3.14E–02
							0.25	0.5	6.39E–02	1.01E–01	1)
							0.063	0.125	1.08E–01	1)	1)
						7	1	2	8.19E–02	4.71E–02	1.05E–01
							0.25	0.5	1.33E–01	1.47E–01	1)
							0.063	0.125	1.56E–01	1)	1)
						31	1	2	1.46E–01	7.82E–02	1.23E–01
							0.25	0.5	2.02E–01	3.17E–01	1)
							0.063	0.125	2.45E–01	1)	1)
						92	1	2	1.84E–01	1.11E–01	1.77E–01
							0.25	0.5	4.02E–01	3.16E–01	1)
							0.063	0.125	3.88E–01	1)	1)
						182	1	2	2.22E–01	1.36E–01	2.21E–01
							0.25	0.5	4.01E–01	3.72E–01	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.063	0.125	3.65E–01	1)	1)
					Ra	1	1	2	6.82E–02	6.88E–02	8.69E–02
							0.25	0.5	2.19E–01	1.93E–01	1)
							0.063	0.125	2.18E–01	1)	1)
						7	1	2	2.52E–01	2.47E–01	1.57E–01
							0.25	0.5	3.74E–01	3.75E–01	1)
							0.063	0.125	3.34E–01	1)	1)
						31	1	2	2.67E–01	2.69E–01	2.76E–01
							0.25	0.5	3.64E–01	3.64E–01	1)
							0.063	0.125	3.94E–01	1)	1)
						92	1	2	2.67E–01	2.66E–01	2.83E–01
							0.25	0.5	3.74E–01	3.74E–01	1)
							0.063	0.125	3.32E–01	1)	1)
						182	1	2	1.85E–01	6.59E–01	2.45E–01
							0.25	0.5	3.36E–01	3.36E–01	1)
							0.063	0.125	2.97E–01	1)	1)
					Ni	1	1	2	2.48E–02	2.09E–02	2.13E–02
							0.25	0.5	5.31E–02	2.88E–02	1)
							0.063	0.125	6.88E–02	1)	1)
						7	1	2	7.69E–02	8.32E–02	4.10E–02
							0.25	0.5	1.66E–01	1.69E–01	1)
							0.063	0.125	2.07E–01	1)	1)
						31	1	2	1.82E–01	1.39E–01	1.67E–01
							0.25	0.5	2.03E–01	1.79E–01	1)
							0.063	0.125	3.36E–01	1)	1)
						92	1	2	3.62E–01	3.22E–01	2.85E–01
							0.25	0.5	5.90E–01	2.38E–01	1)
							0.063	0.125	5.91E–01	1)	1)
						182	1	2	4.13E–01	2.46E–01	2.42E–01
							0.25	0.5	4.77E–01	4.43E–01	1)
							0.063	0.125	4.90E–01	1)	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
					Np	1	1	2	7.27E–04	9.63E–04	1.07E–03
							0.25	0.5	1.63E–03	1.33E–03	1)
							0.25	0.5	1.46E–03	1)	1)
						7	1	2	1.40E–03	1.64E–03	1.65E–03
							0.25	0.5	2.68E–03	2.29E–03	1)
							0.25	0.5	2.23E–03	1)	1)
						31	1	2	2.08E–03	2.48E–03	2.46E–03
							0.25	0.5	3.96E–03	3.28E–03	1)
							0.25	0.5	3.30E–03	1)	1)
						92	1	2	2.96E–03	3.66E–03	3.62E–03
							0.25	0.5	5.91E–03	4.82E–03	1)
							0.25	0.5	4.90E–03	1)	1)
						182	1	2	3.86E–03	4.73E–03	4.64E–03
							0.25	0.5	7.05E–03	6.12E–03	1)
							0.25	0.5	5.86E–03	1)	1)
					U	1	1	2	3.24E–04	5.07E–04	6.21E–04
							0.25	0.5	8.05E–04	5.80E–04	1)
							0.25	0.5	6.67E–04	1)	1)
						7	1	2	6.62E–04	8.21E–04	8.41E–04
							0.25	0.5	1.24E–03	1.00E–03	1)
							0.25	0.5	9.60E–04	1)	1)
						31	1	2	9.85E–04	1.09E–03	1.18E–03
							0.25	0.5	1.46E–03	1.08E–03	1)
							0.25	0.5	1.17E–03	1)	1)
						92	1	2	9.06E–04	1.11E–03	1.14E–03
							0.25	0.5	1.47E–03	1.10E–03	1)
							0.25	0.5	1.31E–03	1)	1)
						182	1	2	8.57E–04	1.16E–03	1.13E–03
							0.25	0.5	1.40E–03	1.30E–03	1)
							0.25	0.5	1.11E–03	1)	1)
				SaF	Cs	1	1	2	6.48E–03	6.11E–03	6.66E–03
							0.25	0.5	1.57E–02	2.20E–02	1.57E–02

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.063	0.125	2.56E–02	1)	1)
						7	1	2	1.86E–02	1.40E–02	1.70E–02
							0.25	0.5	2.12E–02	2.96E–02	2.00E–02
							0.063	0.125	3.41E–02	1)	1)
						31	1	2	2.86E–02	2.42E–02	2.49E–02
							0.25	0.5	2.43E–02	2.92E–02	2.81E–02
							0.063	0.125	3.18E–02	1)	1)
						92	1	2	3.38E–02	2.97E–02	3.31E–02
							0.25	0.5	2.89E–02	3.38E–02	3.08E–02
							0.063	0.125	4.14E–02	1)	1)
						182	1	2	4.57E–02	4.29E–02	4.62E–02
							0.25	0.5	3.37E–02	4.71E–02	3.98E–02
							0.063	0.125	4.61E–02	1)	1)
					Sr	1	1	2	3.74E–04	1.06E–04	2.87E–04
							0.25	0.5	2.58E–04	1.98E–03	2.69E–04
							0.063	0.125	1.65E–03	1)	1)
						7	1	2	1.54E–04	–6.10E–04	4.60E–05
							0.25	0.5	–7.10E–04	8.20E–04	–6.41E–04
							0.063	0.125	2.77E–04	1)	1)
						31	1	2	3.98E–04	3.47E–04	1.55E–04
							0.25	0.5	–5.45E–04	4.96E–04	–6.26E–05
							0.063	0.125	–2.25E–04	1)	1)
						92	1	2	2.30E–04	4.93E–05	7.05E–05
							0.25	0.5	–4.94E–04	3.16E–04	–1.18E–04
							0.063	0.125	4.64E–05	1)	1)
						182	1	2	–2.98E–07	–1.14E–04	3.40E–04
							0.25	0.5	–4.03E–04	1.06E–04	4.09E–05
							0.063	0.125	4.26E–04	1)	1)
					Ln-Ac (III)	1	1	2	1.26E–01	1.29E–01	1.62E–01
							0.25	0.5	3.55E–01	3.99E–01	5.02E–01
							0.063	0.125	7.16E–01	1)	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						7	1	2	4.81E–01	8.86E–01	5.02E–01
							0.25	0.5	6.98E–01	4.92E–01	3.66E–01
							0.063	0.125	2.07E+00	1)	1)
						31	1	2	1.40E+00	8.68E–01	1.26E+00
							0.25	0.5	2.19E+00	1.10E+00	1.78E+00
							0.063	0.125	4.13E+00	1)	1)
						92	1	2	2.85E+00	8.22E+00	3.57E+00
							0.25	0.5	6.32E–01	7.14E+00	6.27E+00
							0.063	0.125	6.92E+00	1)	1)
						182	1	2	2.47E+00	5.18E+00	5.88E+00
							0.25	0.5	2.20E+00	1.31E+00	1.89E+00
							0.063	0.125	1.12E+01	1)	1)
					Ra	1	1	2	6.78E–03	7.69E–03	8.16E–03
							0.25	0.5	1.53E–02	3.06E–02	1.70E–02
							0.063	0.125	4.13E–02	1)	1)
						7	1	2	2.27E–02	2.38E–02	2.40E–02
							0.25	0.5	4.34E–02	4.56E–02	5.31E–02
							0.063	0.125	4.48E–02	1)	1)
						31	1	2	2.55E–02	4.46E–02	3.83E–02
							0.25	0.5	7.53E–02	5.22E–02	4.86E–02
							0.063	0.125	7.76E–02	1)	1)
						92	1	2	4.67E–02	5.54E–02	4.51E–02
							0.25	0.5	6.29E–02	6.76E–02	6.64E–02
							0.063	0.125	6.50E–02	1)	1)
						182	1	2	5.96E–02	6.35E–02	6.08E–02
							0.25	0.5	6.80E–02	7.54E–02	6.65E–02
							0.063	0.125	6.83E–02	1)	1)
					Ni	1	1	2	3.67E–03	2.65E–03	3.66E–03
							0.25	0.5	8.34E–03	1.00E–02	1.03E–02
							0.063	0.125	1.18E–02	1)	1)
						7	1	2	2.52E–02	2.32E–02	2.54E–02
							0.25	0.5	8.78E–02	8.43E–02	1.02E–01
							0.063	0.125	8.97E–02	1)	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						31	1	2	1.09E–01	1.04E–01	1.09E–01
							0.25	0.5	1.91E–01	2.13E–01	1.85E–01
							0.063	0.125	2.18E–01	[1)]	[1)]
						92	1	2	3.14E–01	2.79E–01	3.00E–01
							0.25	0.5	5.62E–01	3.98E–01	5.05E–01
							0.063	0.125	4.67E–01	[1)]	[1)]
						182	1	2	2.20E–01	3.30E–01	2.88E–01
							0.25	0.5	3.17E–01	4.15E–01	4.37E–01
							0.063	0.125	4.46E–01	[1)]	[1)]
					Np	1	1	2	8.83E–04	5.59E–04	6.13E–04
							0.25	0.5	8.80E–04	8.48E–04	2.44E–03
							0.063	0.125	1.44E–03	[1)]	[1)]
						7	1	2	1.50E–03	1.21E–03	1.23E–03
							0.25	0.5	1.67E–03	2.13E–03	3.43E–03
							0.063	0.125	5.85E–03	[1)]	[1)]
						31	1	2	1.86E–03	1.48E–03	1.52E–03
							0.25	0.5	2.22E–03	3.98E–03	3.98E–03
							0.063	0.125	3.80E–02	[1)]	[1)]
						92	1	2	2.15E–03	1.82E–03	1.80E–03
							0.25	0.5	2.91E–03	7.22E–03	4.58E–03
							0.063	0.125	5.04E–02	[1)]	[1)]
						182	1	2	2.42E–03	2.07E–03	1.97E–03
							0.25	0.5	3.26E–03	1.02E–02	5.11E–03
							0.063	0.125	1.05E–01	[1)]	[1)]
					U	1	1	2	2.20E–03	1.59E–03	1.65E–03
							0.25	0.5	5.56E–03	4.63E–03	7.98E–03
							0.063	0.125	3.96E–03	[1)]	[1)]
						7	1	2	4.51E–03	3.56E–03	3.66E–03
							0.25	0.5	1.34E–02	1.20E–02	1.87E–02
							0.063	0.125	9.69E–03	[1)]	[1)]
						31	1	2	1.02E–02	7.79E–03	7.69E–03

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
							0.25	0.5	2.85E–02	7.19E–02	7.03E–02
							0.063	0.125	2.19E–02	[1)]	[1)]
						92	1	2	1.87E–02	1.41E–02	1.44E–02
							0.25	0.5	7.11E–02	5.19E–02	6.91E–02
							0.063	0.125	4.74E–02	[1)]	[1)]
						182	1	2	2.54E–02	1.73E–02	1.88E–02
							0.25	0.5	1.07E–01	6.97E–02	9.22E–02
							0.063	0.125	6.38E–02	[1)]	[1)]
KFM01A	908.10	908.50	101057	M	Cs	1	1	2	1.44E–03	5.03E–04	5.22E–04
							0.25	0.5	1.61E–03	1.05E–03	1.24E–03
							0.063	0.125	8.12E–03	5.81E–03	8.24E–03
						7	1	2	1.79E–03	1.28E–03	1.34E–03
							0.25	0.5	2.20E–03	3.18E–03	2.33E–03
							0.063	0.125	1.57E–02	1.33E–02	1.23E–02
						31	1	2	1.77E–03	2.50E–03	2.64E–03
							0.25	0.5	4.99E–03	5.30E–03	5.00E–03
							0.063	0.125	1.72E–02	1.87E–02	1.90E–02
						92	1	2	2.63E–03	2.84E–03	2.20E–03
							0.25	0.5	4.10E–03	4.71E–03	5.57E–03
							0.063	0.125	1.99E–02	1.97E–02	1.92E–02
						182	1	2	3.11E–03	1.52E–03	2.58E–03
							0.25	0.5	6.85E–03	5.60E–03	7.57E–03
							0.063	0.125	3.14E–02	2.92E–02	2.83E–02
					Sr	1	1	2	2.05E–04	–5.38E–04	–4.71E–04
							0.25	0.5	–4.34E–04	–8.57E–04	–6.75E–04
							0.063	0.125	6.34E–04	–5.75E–04	2.50E–04
						7	1	2	–9.46E–07	–3.06E–04	–3.07E–04
							0.25	0.5	–7.02E–04	–1.72E–04	–7.13E–04
							0.063	0.125	8.66E–04	–1.42E–04	–3.88E–04
						31	1	2	–1.58E–04	3.84E–04	2.71E–04
							0.25	0.5	2.46E–04	4.03E–04	1.04E–04

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.063	0.125	–1.69E–04	–2.16E–04	1.06E–04
						92	1	2	–1.82E–05	3.77E–04	–2.45E–04
							0.25	0.5	–7.24E–04	–2.03E–04	6.44E–05
							0.063	0.125	2.34E–05	–2.88E–04	–3.34E–04
						182	1	2	3.41E–04	–7.96E–04	–3.77E–04
							0.25	0.5	2.67E–04	–6.74E–06	3.79E–04
							0.063	0.125	5.41E–04	–1.66E–04	–3.66E–04
					Ln-Ac (III)	1	1	2	1.26E–02	1.59E–02	1.36E–02
							0.25	0.5	3.12E–02	3.37E–02	3.79E–02
							0.063	0.125	2.57E–01	2.42E–01	1.84E–01
						7	1	2	6.14E–02	7.15E–02	5.73E–02
							0.25	0.5	1.48E–01	1.58E–01	1.77E–01
							0.063	0.125	1.05E+00	7.87E–01	6.75E–01
						31	1	2	2.38E–01	2.08E–01	1.79E–01
							0.25	0.5	2.60E–01	3.34E–01	2.77E–01
							0.063	0.125	4.75E–01	5.75E–01	8.69E–01
						92	1	2	4.00E–01	3.45E–01	3.60E–01
							0.25	0.5	3.97E–01	3.11E–01	3.28E–01
							0.063	0.125	1.03E+00	8.28E–01	6.03E–01
						182	1	2	5.21E–01	3.08E–01	1.33E–01
							0.25	0.5	4.05E–01	6.12E–01	9.42E–01
							0.063	0.125	1.03E+00	8.16E–01	3.30E–01
				M	Cs	1	1	2	1.44E–03	5.03E–04	5.22E–04
							0.25	0.5	1.61E–03	1.05E–03	1.24E–03
							0.063	0.125	8.12E–03	5.81E–03	8.24E–03
						7	1	2	1.79E–03	1.28E–03	1.34E–03
							0.25	0.5	2.20E–03	3.18E–03	2.33E–03
							0.063	0.125	1.57E–02	1.33E–02	1.23E–02
						31	1	2	1.77E–03	2.50E–03	2.64E–03
							0.25	0.5	4.99E–03	5.30E–03	5.00E–03
							0.063	0.125	1.72E–02	1.87E–02	1.90E–02
						92	1	2	2.63E–03	2.84E–03	2.20E–03
							0.25	0.5	4.10E–03	4.71E–03	5.57E–03
							0.063	0.125	1.99E–02	1.97E–02	1.92E–02

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
						182	1	2	3.11E–03	1.52E–03	2.58E–03
							0.25	0.5	6.85E–03	5.60E–03	7.57E–03
							0.063	0.125	3.14E–02	2.92E–02	2.83E–02
					Sr	1	1	2	2.05E–04	–5.38E–04	–4.71E–04
							0.25	0.5	–4.34E–04	–8.57E–04	–6.75E–04
							0.063	0.125	6.34E–04	–5.75E–04	2.50E–04
						7	1	2	–9.46E–07	–3.06E–04	–3.07E–04
							0.25	0.5	–7.02E–04	–1.72E–04	–7.13E–04
							0.063	0.125	8.66E–04	–1.42E–04	–3.88E–04
						31	1	2	–1.58E–04	3.84E–04	2.71E–04
							0.25	0.5	2.46E–04	4.03E–04	1.04E–04
							0.063	0.125	–1.69E–04	–2.16E–04	1.06E–04
						92	1	2	–1.82E–05	3.77E–04	–2.45E–04
							0.25	0.5	–7.24E–04	–2.03E–04	6.44E–05
							0.063	0.125	2.34E–05	–2.88E–04	–3.34E–04
						182	1	2	3.41E–04	–7.96E–04	–3.77E–04
							0.25	0.5	2.67E–04	–6.74E–06	3.79E–04
							0.063	0.125	5.41E–04	–1.66E–04	–3.66E–04
					Ln-Ac (III)	1	1	2	1.26E–02	1.59E–02	1.36E–02
							0.25	0.5	3.12E–02	3.37E–02	3.79E–02
							0.063	0.125	2.57E–01	2.42E–01	1.84E–01
						7	1	2	6.14E–02	7.15E–02	5.73E–02
							0.25	0.5	1.48E–01	1.58E–01	1.77E–01
							0.063	0.125	1.05E+00	7.87E–01	6.75E–01
						31	1	2	2.38E–01	2.08E–01	1.79E–01
							0.25	0.5	2.60E–01	3.34E–01	2.77E–01
							0.063	0.125	4.75E–01	5.75E–01	8.69E–01
						92	1	2	4.00E–01	3.45E–01	3.60E–01
							0.25	0.5	3.97E–01	3.11E–01	3.28E–01
							0.063	0.125	1.03E+00	8.28E–01	6.03E–01
						182	1	2	5.21E–01	3.08E–01	1.33E–01
							0.25	0.5	4.05E–01	6.12E–01	9.42E–01

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.063	0.125	1.03E+00	8.16E–01	3.30E–01
				B	Cs	1	1	2	1.74E–03	8.61E–04	1.22E–03
							0.25	0.5	1.44E–03	2.27E–03	1.33E–03
							0.063	0.125	3.81E–03	5.41E–03	3.59E–03
						7	1	2	1.73E–03	1.51E–03	6.67E–04
							0.25	0.5	2.48E–03	2.50E–03	1.45E–03
							0.063	0.125	5.30E–03	7.39E–03	7.24E–03
						31	1	2	7.98E–04	1.01E–03	1.14E–03
							0.25	0.5	2.21E–03	2.70E–03	1.69E–03
							0.063	0.125	7.57E–03	7.36E–03	7.40E–03
						92	1	2	2.42E–05	8.56E–04	4.05E–04
							0.25	0.5	1.88E–03	2.08E–03	2.49E–03
							0.063	0.125	8.07E–03	7.46E–03	8.84E–03
						182	1	2	1.48E–03	1.87E–03	1.67E–03
							0.25	0.5	3.74E–03	3.95E–03	3.57E–03
							0.063	0.125	1.19E–02	1.05E–02	1.13E–02
					Sr	1	1	2	1.22E–03	3.42E–04	5.76E–04
							0.25	0.5	3.22E–04	8.55E–04	1.34E–04
							0.063	0.125	4.56E–04	1.35E–03	2.45E–04
						7	1	2	8.49E–04	6.76E–04	–1.38E–04
							0.25	0.5	7.84E–04	5.85E–04	–1.17E–04
							0.063	0.125	4.84E–05	9.54E–04	1.05E–03
						31	1	2	–1.24E–04	–1.67E–04	2.02E–05
							0.25	0.5	–1.88E–04	9.67E–05	–3.80E–04
							0.063	0.125	1.18E–04	–1.02E–04	–5.44E–05
						92	1	2	–7.22E–04	–1.23E–04	–5.25E–04
							0.25	0.5	–2.93E–04	–2.60E–04	2.76E–05
							0.063	0.125	–4.07E–05	–1.17E–04	2.91E–04
						182	1	2	1.07E–05	2.47E–05	–2.08E–04
							0.25	0.5	–2.22E–04	1.68E–06	2.25E–05
							0.063	0.125	–1.78E–05	–5.63E–04	–1.75E–04
					Ln-Ac (III)	1	1	2	7.93E–03	7.27E–03	8.55E–03
							0.25	0.5	1.76E–02	1.69E–02	1.73E–02

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.063	0.125	4.84E–02	5.05E–02	5.38E–02
						7	1	2	2.35E–02	2.40E–02	2.70E–02
							0.25	0.5	6.30E–02	5.80E–02	5.92E–02
							0.063	0.125	2.56E–01	2.71E–01	2.84E–01
						31	1	2	5.38E–02	4.99E–02	5.27E–02
							0.25	0.5	1.18E–01	1.02E–01	1.22E–01
							0.063	0.125	–5.53E–01	4.63E–01	4.88E–01
						92	1	2	2.51E–01	2.01E–01	9.71E–02
							0.25	0.5	3.28E–01	2.90E–01	3.95E–01
							0.063	0.125	1.05E+00	1.16E+00	1.00E+00
						182	1	2	3.84E–01	3.86E–01	3.45E–01
							0.25	0.5	3.51E–01	4.28E–01	3.63E–01
							0.063	0.125	1.13E+00	8.81E–01	1.14E+00
KFM01B	418.80	418.94	fracture filling	F	Cs	1	0	0.25	1.90E–01	1)	1)
						7	0	0.25	5.67E–02	1)	1)
						35	0	0.25	5.39E–02	1)	1)
						97	0	0.25	6.81E–02	1)	1)
						181	0	0.25	6.35E–02	1)	1)
					Sr	1	0	0.25	1.90E–01	1)	1)
						7	0	0.25	3.70E–01	1)	1)
						35	0	0.25	2)	2)	2)
						97	0	0.25	2)	2)	2)
						181	0	0.25	2)	2)	2)
					Ln-Ac (III)	1	0	0.25	8.51E–01	1)	1)
						7	0	0.25	1.16E+00	1)	1)
						35	0	0.25	1.35E+00	1)	1)
						97	0	0.25	2.41E+00	1)	1)
						181	0	0.25	1.49E+00	1)	1)
				M	Cs	1	0	0.25	6.78E–04	1)	1)
						7	0	0.25	3.60E–03	1)	1)
						35	0	0.25	3.35E–03	1)	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
						97	0	0.25	4.45E–03	1)	1)
						181	0	0.25	4.09E–03	1)	1)
					Sr	1	0	0.25	6.78E–04	1)	1)
						7	0	0.25	1.02E–03	1)	1)
						35	0	0.25	6.21E–04	1)	1)
						97	0	0.25	1.42E–03	1)	1)
						181	0	0.25	3.73E–04	1)	1)
					Ln-Ac (III)	1	0	0.25	1.34E+00	1)	1)
						7	0	0.25	1.26E+00	1)	1)
						35	0	0.25	3.17E+00	1)	1)
						97	0	0.25	4.11E+00	1)	1)
						181	0	0.25	2.41E+00	1)	1)
				B	Cs	1	0	0.25	6.88E–04	1)	1)
						7	0	0.25	1.10E–03	1)	1)
						35	0	0.25	7.64E–04	1)	1)
						97	0	0.25	5.59E–04	1)	1)
						181	0	0.25	1.16E–03	1)	1)
					Sr	1	0	0.25	6.88E–04	1)	1)
						7	0	0.25	4.20E–04	1)	1)
						35	0	0.25	–3.42E–04	1)	1)
						97	0	0.25	–2.53E–04	1)	1)
						181	0	0.25	–3.00E–04	1)	1)
					Ln-Ac (III)	1	0	0.25	8.14E–01	1)	1)
						7	0	0.25	1.72E+00	1)	1)
						35	0	0.25	1.38E+00	1)	1)
						97	0	0.25	2.96E+00	1)	1)
						181	0	0.25	2.84E+00	1)	1)

1) No double and/or triple samples involved in the measurements due to limited amount of rock material.

2) No measurement data delivered due to low activity due to decay.

Table A5-9. Tracer distribution ratio, *Rd,* for rock samples from drill site 2.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
KFM02A	275.22	275.45	101057	F	Cs	1	1	2	4.47E–03	4.64E–03	4.17E–03
			Altered				0.25	0.5	9.22E–03	1.06E–02	1.16E–02
							0.063	0.125	4.08E–02	1)	1)
						7	1	2	6.83E–03	6.12E–03	6.04E–03
							0.25	0.5	1.43E–02	1.32E–02	1.64E–02
							0.063	0.125	6.57E–02	1)	1)
						31	1	2	8.14E–03	7.50E–03	7.37E–03
							0.25	0.5	1.86E–02	1.91E–02	1.43E–02
							0.063	0.125	8.18E–02	1)	1)
						92	1	2	8.24E–03	8.13E–03	9.55E–03
							0.25	0.5	2.24E–02	2.10E–02	2.26E–02
							0.063	0.125	9.77E–02	1)	1)
						182	1	2	1.06E–02	9.50E–03	8.06E–03
							0.25	0.5	2.04E–02	2.49E–02	2.17E–02
							0.063	0.125	1.06E–01	1)	1)
					Sr	1	1	2	4.33E–03	3.71E–03	4.00E–03
							0.25	0.5	8.79E–03	1.10E–02	1.50E–02
							0.063	0.125	3.09E–02	1)	1)
						7	1	2	5.77E–03	4.32E–03	5.69E–03
							0.25	0.5	1.53E–02	1.47E–02	2.01E–02
							0.063	0.125	3.92E–02	1)	1)
						31	1	2	5.84E–03	4.79E–03	5.39E–03
							0.25	0.5	2.00E–02	1.28E–02	1.23E–02
							0.063	0.125	4.85E–02	1)	1)
						92	1	2	5.21E–03	4.77E–03	6.67E–03
							0.25	0.5	1.90E–02	1.51E–02	2.11E–02
							0.063	0.125	4.74E–02	1)	1)
						182	1	2	7.68E–03	6.70E–03	6.52E–03
							0.25	0.5	9.99E–03	3.14E–02	1)
							0.063	0.125	3.20E–02	1)	1)
					Ln-Ac (III)	1	1	2	1.80E–02	1.60E–02	1.59E–02
							0.25	0.5	2.85E–02	3.30E–02	2.64E–02

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.063	0.125	7.73E–02	1)	1)
						7	1	2	9.78E–02	8.24E–02	1.04E–01
							0.25	0.5	2.10E–01	2.02E–01	1.96E–01
							0.063	0.125	5.23E–01	1)	1)
						31	1	2	2.68E–01	2.25E–01	2.58E–01
							0.25	0.5	8.12E–01	5.77E–01	5.88E–01
							0.063	0.125	1.59E+00	1)	1)
						92	1	2	3.00E–01	3.20E–01	3.27E–01
							0.25	0.5	5.88E–01	5.11E–01	5.46E–01
							0.063	0.125	1.56E+00	1)	1)
						182	1	2	3.35E–01	2.79E–01	1.94E–01
							0.25	0.5	5.21E–01	5.23E–01	4.99E–01
							0.063	0.125	1.03E+00	1)	1)
				M	Cs	1	1	2	1.22E–03	1.17E–03	8.43E–04
							0.25	0.5	2.33E–03	1.57E–03	3.14E–03
							0.063	0.125	5.93E–03	6.04E–03	1)
						7	1	2	1.72E–03	1.70E–03	1.70E–03
							0.25	0.5	3.78E–03	2.64E–03	3.97E–03
							0.063	0.125	9.01E–03	9.21E–03	1)
						31	1	2	1.24E–03	1.08E–03	1.64E–03
							0.25	0.5	2.05E–03	1.78E–03	3.41E–03
							0.063	0.125	9.19E–03	9.12E–03	1)
						92	1	2	2.21E–03	2.24E–03	2.04E–03
							0.25	0.5	4.42E–03	3.49E–03	4.55E–03
							0.063	0.125	1.26E–02	1.26E–02	1)
						182	1	2	2.12E–03	2.13E–03	1.76E–03
							0.25	0.5	4.03E–03	2.53E–03	6.33E–03
							0.063	0.125	1.19E–02	1.28E–02	1)
					Sr	1	1	2	4.78E–04	4.16E–04	4.36E–05
							0.25	0.5	5.42E–04	4.42E–04	7.34E–04
							0.063	0.125	6.81E–04	8.90E–04	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						7	1	2	6.87E–04	5.31E–04	5.76E–04
							0.25	0.5	1.16E–03	5.52E–04	9.73E–04
							0.063	0.125	1.19E–03	1.13E–03	1)
						31	1	2	6.17E–05	–8.76E–05	2.25E–04
							0.25	0.5	–3.73E–04	–1.14E–04	3.56E–04
							0.063	0.125	2.40E–04	4.53E–04	1)
						92	1	2	2.95E–04	7.80E–04	5.57E–04
							0.25	0.5	9.75E–04	5.05E–04	8.84E–04
							0.063	0.125	1.37E–03	9.98E–04	1)
						182	1	2	1.28E–05	9.01E–04	–8.17E–05
							0.25	0.5	5.08E–04	1.24E–03	1.16E–03
							0.063	0.125	3.64E–04	1.82E–03	1)
					Ln-Ac (III)	1	1	2	3.23E–02	3.92E–02	4.69E–02
							0.25	0.5	5.53E–02	7.67E–02	1.12E–01
							0.063	0.125	2.64E–01	3.50E–01	1)
						7	1	2	2.06E–01	1.46E–01	1.84E–01
							0.25	0.5	4.89E–01	3.39E–01	3.01E–01
							0.063	0.125	6.49E–01	1.23E+00	1)
						31	1	2	1.03E+00	8.54E–01	6.97E–01
							0.25	0.5	1.20E+00	1.74E+00	2.06E+00
							0.063	0.125	3.92E–01	3.16E+00	1)
						92	1	2	1.91E+00	1.04E+00	9.94E–01
							0.25	0.5	2.25E+00	1.66E–01	1.50E+00
							0.063	0.125	3.39E+00	3.68E+00	1)
						182	1	2	1.35E+00	2.23E+00	6.39E–01
							0.25	0.5	1.62E+00	9.14E–01	1.91E+00
							0.063	0.125	4.04E+00	4.17E+00	1)
				B	Cs	1	1	2	1.22E–03	7.36E–04	1.07E–03
							0.25	0.5	1.33E–03	1.77E–03	1.90E–03
							0.063	0.125	3.07E–03	2.71E–03	1)
						7	1	2	1.47E–03	1.51E–04	1.27E–03

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.25	0.5	2.18E–03	1.79E–03	2.29E–03
							0.063	0.125	2.01E–03	2.79E–03	1)
						31	1	2	4.43E–04	2.80E–04	6.46E–05
							0.25	0.5	1.21E–03	5.79E–04	1.53E–03
							0.063	0.125	1.98E–03	3.30E–03	1)
						92	1	2	2.98E–04	3.69E–04	1.08E–03
							0.25	0.5	1.46E–03	1.00E–03	1.54E–03
							0.063	0.125	4.20E–03	4.70E–03	1)
						182	1	2	5.80E–04	6.83E–04	6.68E–04
							0.25	0.5	1.58E–03	1.96E–03	1.42E–03
							0.063	0.125	4.06E–03	2.86E–03	1)
					Sr	1	1	2	7.83E–04	2.74E–04	7.40E–04
							0.25	0.5	6.47E–04	1.04E–03	7.91E–04
							0.063	0.125	1.02E–03	2.90E–04	1)
						7	1	2	9.45E–04	–3.39E–04	8.53E–04
							0.25	0.5	6.56E–04	6.89E–04	1.15E–03
							0.063	0.125	–6.04E–04	–1.89E–04	1)
						31	1	2	–2.49E–04	–3.31E–04	–4.30E–04
							0.25	0.5	–1.12E–04	–6.57E–04	4.14E–04
							0.063	0.125	–9.74E–04	–3.35E–04	1)
						92	1	2	–4.35E–04	–3.75E–05	7.70E–05
							0.25	0.5	3.07E–04	1.52E–04	–1.17E–04
							0.063	0.125	–7.89E–05	1.02E–04	1)
						182	1	2	–2.74E–04	–6.32E–04	–4.23E–04
							0.25	0.5	5.73E–04	2.48E–04	–3.06E–05
							0.063	0.125	–3.14E–04	–8.43E–04	1)
					Ln-Ac (III)	1	1	2	1.18E–02	8.40E–03	9.45E–03
							0.25	0.5	5.40E–02	6.83E–02	7.71E–02
							0.063	0.125	2.37E–01	2.49E–01	1)
						7	1	2	1.09E–01	8.00E–02	9.76E–02
							0.25	0.5	2.78E–01	3.99E–01	5.84E–01

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
							0.063	0.125	1.64E+00	1.49E+00	[1]
						31	1	2	4.88E–01	3.32E–01	3.60E–01
							0.25	0.5	1.02E+00	1.76E+00	1.69E+00
							0.063	0.125	2.71E+00	2.82E+00	[1]
						92	1	2	8.80E–01	4.25E–01	7.25E–01
							0.25	0.5	2.08E+00	2.36E+00	1.79E+00
							0.063	0.125	3.16E+00	3.27E+00	[1]
						182	1	2	1.24E+00	9.64E–01	5.09E–01
							0.25	0.5	2.01E+00	2.83E+00	2.56E+00
							0.063	0.125	3.39E+00	3.10E+00	[1]
KFM02A	552.00	552.23		F	Cs	1	1	2	1.68E–03	2.11E–03	1.82E–03
							0.25	0.5	[2]	3.72E–03	3.04E–03
							0.063	0.125	3.90E–02	4.04E–02	4.15E–02
						8	1	2	2.90E–03	3.41E–03	3.24E–03
							0.25	0.5	6.15E–03	4.91E–03	4.76E–03
							0.063	0.125	5.36E–02	5.43E–02	5.12E–02
						30	1	2	4.23E–03	4.99E–03	4.27E–03
							0.25	0.5	7.70E–03	6.88E–03	6.14E–03
							0.063	0.125	6.16E–02	5.51E–02	5.85E–02
						91	1	2	4.38E–03	5.01E–03	4.57E–03
							0.25	0.5	8.16E–03	8.48E–03	6.40E–03
							0.063	0.125	7.14E–02	6.49E–02	8.82E–02
						189	1	2	9.84E–03	7.36E–03	6.54E–03
							0.25	0.5	1.14E–02	9.87E–03	8.47E–03
							0.063	0.125	7.36E–02	6.97E–02	7.45E–02
					Sr	1	1	2	1.06E–03	1.42E–03	1.19E–03
							0.25	0.5	[2]	2.45E–03	1.79E–03
							0.063	0.125	2.31E–02	2.39E–02	2.53E–02
						8	1	2	1.60E–03	1.84E–03	2.01E–03
							0.25	0.5	3.66E–03	2.63E–03	2.25E–03
							0.063	0.125	1.74E–02	1.74E–02	1.66E–02
						30	1	2	2.33E–03	2.51E–03	2.41E–03

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.25	0.5	3.95E–03	3.34E–03	2.82E–03
							0.063	0.125	2.98E–02	2.71E–02	2.77E–02
						91	1	2	2.50E–03	2.33E–03	2.35E–03
							0.25	0.5	3.93E–03	4.28E–03	2.86E–03
							0.063	0.125	3.15E–02	2.91E–02	4.17E–02
						189	1	2	3.02E–03	2.75E–03	2.94E–03
							0.25	0.5	4.72E–03	4.42E–03	3.08E–03
							0.063	0.125	3.31E–02	2.43E–02	4.20E–02
					Ln-Ac (III)	1	1	2	1.97E–02	1.89E–02	1.82E–02
							0.25	0.5	2)	4.40E–02	4.37E–02
							0.063	0.125	5.25E–02	7.24E–02	3.31E–02
						8	1	2	4.69E–02	4.75E–02	4.00E–02
							0.25	0.5	9.67E–02	8.49E–02	8.36E–02
							0.063	0.125	1.35E–01	1.71E–01	1.32E–01
						30	1	2	6.67E–02	7.00E–02	6.22E–02
							0.25	0.5	1.40E–01	1.12E–01	1.12E–01
							0.063	0.125	1.49E–01	1.25E–01	9.71E–02
						91	1	2	9.42E–02	1.07E–01	8.36E–02
							0.25	0.5	1.70E–01	1.76E–01	1.47E–01
							0.063	0.125	2.16E–01	1.32E–01	1.74E–01
						189	1	2	1.11E–01	1.53E–01	1.12E–01
							0.25	0.5	2.10E–01	1.77E–01	1.82E–01
							0.063	0.125	1.13E–01	1.27E–01	2.06E–01
				M	Cs	1	1	2	1.02E–03	8.56E–04	9.55E–04
							0.25	0.5	1.52E–03	1.76E–03	1.43E–03
							0.063	0.125	1.13E–03	4.63E–03	3.85E–03
						8	1	2	1.08E–03	1.15E–03	1.35E–03
							0.25	0.5	9.77E–04	1.07E–03	1.17E–03
							0.063	0.125	3.71E–03	4.08E–03	4.06E–03
						30	1	2	1.76E–03	1.62E–03	1.92E–03
							0.25	0.5	1.72E–03	1.82E–03	1.99E–03

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.063	0.125	5.53E–03	5.48E–03	5.82E–03
						91	1	2	1.93E–03	1.93E–03	1.86E–03
							0.25	0.5	2.56E–03	2.51E–03	2.37E–03
							0.063	0.125	6.41E–03	6.09E–03	6.62E–03
						189	1	2	2.06E–03	1.99E–03	2.22E–03
							0.25	0.5	2.40E–03	2.57E–03	2.27E–03
							0.063	0.125	1.01E–02	7.06E–03	6.85E–03
					Sr	1	1	2	2)	2)	2)
							0.25	0.5	2)	2)	2)
							0.063	0.125	2)	2)	2)
						8	1	2	2)	2)	2)
							0.25	0.5	2)	2)	2)
							0.063	0.125	2)	2)	2)
						30	1	2	2)	2)	2)
							0.25	0.5	2)	2)	2)
							0.063	0.125	2)	2)	2)
						91	1	2	2)	2)	2)
							0.25	0.5	2)	2)	2)
							0.063	0.125	2)	2)	2)
						189	1	2	2)	2)	2)
							0.25	0.5	2)	2)	2)
							0.063	0.125	2)	2)	2)
					Ln-Ac (III)	1	1	2	3.69E–02	2.59E–02	2.82E–02
							0.25	0.5	5.21E–02	3.20E–02	3.34E–02
							0.063	0.125	9.70E–02	4.08E–02	5.37E–03
						8	1	2	–4.57E–04	–9.05E–04	–7.96E–04
							0.25	0.5	3.99E–02	5.33E–03	3.97E–02
							0.063	0.125	9.75E–02	8.36E–02	9.54E–02
						30	1	2	–7.92E–04	–3.13E–04	–1.19E–03
							0.25	0.5	2.12E–02	3.53E–02	1.21E–01
							0.063	0.125	4.65E–02	1.80E–02	4.64E–02
						91	1	2	3.60E–02	3.24E–02	2.99E–02
							0.25	0.5	7.21E–02	2.95E–01	5.53E–02
							0.063	0.125	5.02E–02	1.13E–01	5.27E–02

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						189	1	2	2.89E–02	2.49E–02	3.25E–02
							0.25	0.5	3.64E–02	5.58E–02	6.72E–02
							0.063	0.125	1.00E–02	7.39E–02	3.79E–02
				SaF	Cs	1	1	2	1.15E–03	1.50E–03	1.05E–03
							0.25	0.5	1.90E–03	3.20E–03	1.87E–03
							0.063	0.125	7.93E–03	8.68E–03	8.43E–03
						8	1	2	1.59E–03	1.75E–03	1.80E–03
							0.25	0.5	2.90E–03	–4.96E–04	2.51E–03
							0.063	0.125	1.02E–02	3.26E–03	1.06E–02
						30	1	2	1.96E–03	2.23E–03	2.40E–03
							0.25	0.5	3.39E–03	3.49E–03	3.34E–03
							0.063	0.125	1.35E–02	1.28E–02	1.40E–02
						91	1	2	2.69E–03	2.66E–03	2.63E–03
							0.25	0.5	3.47E–03	3.91E–03	3.80E–03
							0.063	0.125	1.33E–02	1.43E–02	1.46E–02
						189	1	2	2.60E–03	3.08E–03	3.07E–03
							0.25	0.5	4.94E–03	4.55E–03	4.34E–03
							0.063	0.125	1.66E–02	1.66E–02	1.86E–02
					Sr	1	1	2	–4.89E–04	2.64E–04	1.52E–04
							0.25	0.5	7.23E–06	1.57E–03	3.58E–05
							0.063	0.125	6.56E–04	6.54E–04	6.51E–04
						8	1	2	–2.96E–04	–8.72E–04	1.30E–04
							0.25	0.5	–8.69E–04	–2.44E–04	–1.23E–03
							0.063	0.125	–8.89E–04	–6.85E–04	–7.13E–04
						30	1	2	6.51E–04	2.39E–04	8.65E–05
							0.25	0.5	–1.61E–04	–1.49E–04	–4.91E–05
							0.063	0.125	6.11E–04	–1.57E–04	–1.18E–04
						91	1	2	1.53E–04	5.79E–04	–3.45E–05
							0.25	0.5	1.87E–04	1.10E–04	7.76E–05
							0.063	0.125	2.98E–04	3.35E–04	8.98E–04
						189	1	2	4.01E–04	3.00E–04	1.36E–04
							0.25	0.5	1.63E–04	4.80E–04	6.69E–04
							0.063	0.125	–5.41E–06	–6.70E–05	4.80E–05

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
					Ln-Ac (III)	1	1	2	1.69E–01	1.24E–01	1.34E–01
							0.25	0.5	2.29E–01	3.70E–01	2.10E–01
							0.063	0.125	3.81E–01	6.09E–01	3.73E–01
						8	1	2	6.27E–02	2.33E–01	2.52E–01
							0.25	0.5	5.46E–01	6.07E–01	5.48E–01
							0.063	0.125	7.21E–01	6.69E–01	7.13E–01
						30	1	2	4.09E–01	2.97E–01	4.20E–01
							0.25	0.5	7.55E–01	8.07E–01	6.36E–01
							0.063	0.125	1.32E+00	1.33E+00	1.00E+00
						91	1	2	4.40E–01	2.59E–01	4.34E–01
							0.25	0.5	8.47E–01	1.08E+00	6.37E–01
							0.063	0.125	1.40E+00	1.69E+00	1.21E+00
						189	1	2	4.54E–01	3.84E–01	3.44E–01
							0.25	0.5	9.21E–01	1.06E+00	9.07E–01
							0.063	0.125	1.70E+00	1.71E+00	1.82E+00
KFM02A	118.25		Fracture filling	F	Cs	1	0.063	0.125	2.02E+00	[1]	[1]
						7	0.063	0.125	3.64E+00	[1]	[1]
						41	0.063	0.125	2.38E+00	[1]	[1]
						91	0.063	0.125	3.51E+00	[1]	[1]
						188	0.063	0.125	5.83E+00	[1]	[1]
					Sr	1	0.063	0.125	[2]	[2]	[2]
						7	0.063	0.125	[2]	[2]	[2]
						41	0.063	0.125	[2]	[2]	[2]
						91	0.063	0.125	[2]	[2]	[2]
						188	0.063	0.125	9.45E–02	[1]	[1]
					Ln-Ac (III)	1	0.063	0.125	6.24E–01	[1]	[1]
						7	0.063	0.125	9.02E–01	[1]	[1]
						41	0.063	0.125	1.76E+00	[1]	[1]
						91	0.063	0.125	1.21E+00	[1]	[1]
						188	0.063	0.125	1.79E+00	[1]	[1]
				M	Cs	1	0.063	0.125	5.04E–01	5.32E–01	[1]
						7	0.063	0.125	5.63E–01	5.37E–01	[1]

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						41	0.063	0.125	5.86E–01	5.92E–01	1)
						91	0.063	0.125	6.13E–01	6.06E–01	1)
						188	0.063	0.125	6.07E–01	6.95E–01	1)
					Sr	1	0.063	0.125	2)	2)	2)
						7	0.063	0.125	2)	2)	2)
						41	0.063	0.125	2)	2)	2)
						91	0.063	0.125	2)	2)	2)
						188	0.063	0.125	1.92E–03	2.39E–03	1)
					Ln-Ac (III)	1	0.063	0.125	6.84E–01	7.72E–01	1)
						7	0.063	0.125	8.80E–01	9.19E–01	1)
						41	0.063	0.125	1.57E+00	1.46E+00	1)
						91	0.063	0.125	1.58E+00	1.52E+00	1)
						188	0.063	0.125	1.51E+00	1.65E+00	1)

1) No double and/or triple samples involved in the measurements due to limited amount of rock material.

2) No measurement data delivered due to low activity due to decay.

Table A5-10. Tracer distribution ratio, *Rd,* for rock samples from drill site 3.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
KFM03A	242.93	243.13	101054	F	Cs	1	1	2	3.46E–03	3.33E–03	3.85E–03
							0.25	0.5	1.25E–02	1.13E–02	1.18E–02
							0.063	0.125	3.09E–02	2.71E–02	2.80E–02
						7	1	2	6.78E–03	6.36E–03	6.77E–03
							0.25	0.5	1.99E–02	1.72E–02	1.87E–02
							0.063	0.125	4.41E–02	3.84E–02	4.03E–02
						41	1	2	1.00E–02	8.75E–03	1.05E–02
							0.25	0.5	2.71E–02	2.63E–02	2.64E–02
							0.063	0.125	6.10E–02	5.31E–02	5.67E–02
						91	1	2	1.30E–02	1.09E–02	1.35E–02
							0.25	0.5	2.14E–02	3.09E–02	3.24E–02
							0.063	0.125	7.55E–02	6.29E–02	6.39E–02
						188	1	2	1.86E–02	1.56E–02	1.93E–02
							0.25	0.5	4.53E–02	4.21E–02	4.51E–02
							0.063	0.125	8.89E–02	8.13E–02	8.56E–02
					Sr	1	1	2	1.79E–03	1.76E–03	2.03E–03
							0.25	0.5	4.87E–03	4.68E–03	4.82E–03
							0.063	0.125	9.30E–03	8.36E–03	8.92E–03
						7	1	2	2.58E–03	2.66E–03	2.45E–03
							0.25	0.5	5.65E–03	4.99E–03	5.40E–03
							0.063	0.125	1.01E–02	9.54E–03	9.40E–03
						41	1	2	3.01E–03	2.76E–03	3.20E–03
							0.25	0.5	6.39E–03	6.54E–03	6.20E–03
							0.063	0.125	1.18E–02	1.05E–02	1.12E–02
						91	1	2	3.53E–03	3.09E–03	4.04E–03
							0.25	0.5	3.19E–03	6.28E–03	6.72E–03
							0.063	0.125	1.33E–02	1.19E–02	1.23E–02
						188	1	2	4.10E–03	4.15E–03	4.19E–03
							0.25	0.5	7.90E–03	7.35E–03	7.72E–03
							0.063	0.125	1.40E–02	1.39E–02	1.66E–02

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
					Ln-Ac (III)	1	1	2	3.29E–02	2.94E–02	3.35E–02
							0.25	0.5	9.92E–02	9.32E–02	1.06E–01
							0.063	0.125	2.59E–01	2.32E–01	2.50E–01
						7	1	2	6.97E–02	6.82E–02	7.83E–02
							0.25	0.5	1.78E–01	2.19E–01	2.16E–01
							0.063	0.125	4.51E–01	4.15E–01	5.83E–01
						41	1	2	1.06E–01	9.74E–02	8.78E–02
							0.25	0.5	2.74E–01	2.80E–01	2.78E–01
							0.063	0.125	7.57E–01	7.63E–01	7.38E–01
						91	1	2	1.73E–01	1.44E–01	1.66E–01
							0.25	0.5	2.32E–01	3.72E–01	3.83E–01
							0.063	0.125	1.09E+00	8.25E–01	9.53E–01
						188	1	2	2.19E–01	1.76E–01	2.28E–01
							0.25	0.5	5.17E–01	4.20E–01	4.49E–01
							0.063	0.125	7.14E–01	1.16E+00	1.33E+00
				M	Cs	1	1	2	1.55E–03	1.53E–03	1.37E–03
							0.25	0.5	3.83E–03	4.07E–03	4.22E–03
							0.063	0.125	5.91E–03	7.14E–03	6.93E–03
						8	1	2	2.28E–03	2.37E–03	1.83E–03
							0.25	0.5	5.87E–03	5.76E–03	5.07E–03
							0.063	0.125	5.83E–03	7.29E–03	7.07E–03
						30	1	2	3.39E–03	3.69E–03	3.14E–03
							0.25	0.5	8.98E–03	8.95E–03	9.22E–03
							0.063	0.125	9.75E–03	1.11E–02	1.30E–02
						91	1	2	3.85E–03	4.57E–03	3.70E–03
							0.25	0.5	1.04E–02	1.05E–02	9.95E–03
							0.063	0.125	1.20E–02	1.39E–02	1.43E–02
						189	1	2	4.64E–03	5.58E–03	4.31E–03
							0.25	0.5	1.25E–02	1.33E–02	1.26E–02
							0.063	0.125	1.37E–02	1.49E–02	1.63E–02
					Sr	1	1	2	3.09E–04	5.23E–05	9.29E–05
							0.25	0.5	2.20E–04	3.39E–04	1.65E–04

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
							0.063	0.125	2.52E–04	1.29E–04	4.07E–04
						8	1	2	2)	2)	2)
							0.25	0.5	2)	2)	2)
							0.063	0.125	–2.57E–03	–2.49E–03	–3.00E–03
						30	1	2	4.83E–04	5.77E–04	3.92E–04
							0.25	0.5	4.23E–04	3.53E–04	5.14E–04
							0.063	0.125	7.43E–04	3.39E–02	4.00E–03
						91	1	2	2.16E–04	3.70E–04	3.51E–04
							0.25	0.5	4.32E–04	1.59E–04	2.32E–04
							0.063	0.125	1.42E–03	2.21E–02	3.40E–03
						189	1	2	3.54E–04	3.62E–04	2.95E–04
							0.25	0.5	3.69E–04	2.85E–04	3.62E–04
							0.063	0.125	6.08E–04	1.45E–03	7.52E–04
					Ln-Ac (III)	1	1	2	4.03E–02	3.20E–02	3.33E–02
							0.25	0.5	3.48E–02	3.52E–02	3.47E–02
							0.063	0.125	3.26E–02	1.01E–01	4.43E–02
						8	1	2	1.56E–01	2.29E–02	3.57E–02
							0.25	0.5	4.51E–02	1.25E–01	1.17E–01
							0.063	0.125	9.82E–02	1.10E–01	3.97E–02
						30	1	2	3.17E–02	3.50E–02	3.47E–02
							0.25	0.5	3.39E–02	3.41E–02	3.19E–02
							0.063	0.125	3.60E–02	5.03E–02	2.64E–02
						91	1	2	4.26E–02	3.57E–02	3.47E–02
							0.25	0.5	3.41E–02	3.48E–02	3.41E–02
							0.063	0.125	1.06E–01	8.50E–02	4.63E–02
						189	1	2	3.32E–02	3.67E–02	3.66E–02
							0.25	0.5	3.15E–02	3.30E–02	3.60E–02
							0.063	0.125	5.58E–02	1.18E–01	1.12E–01
				SaF	Cs	1	1	2	2.25E–03	1.97E–03	1.84E–03
							0.25	0.5	9.32E–03	9.83E–03	1.04E–02

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.063	0.125	5.38E–02	4.27E–02	5.90E–02
						8	1	2	3.79E–03	3.48E–03	3.46E–03
							0.25	0.5	1.61E–02	1.65E–02	1.73E–02
							0.063	0.125	6.65E–02	6.88E–02	7.73E–02
						30	1	2	5.33E–03	5.21E–03	5.31E–03
							0.25	0.5	2.09E–02	2.13E–02	2.25E–02
							0.063	0.125	9.07E–02	9.61E–02	1.09E–01
						91	1	2	7.10E–03	7.27E–03	6.30E–03
							0.25	0.5	2.55E–02	2.70E–02	2.92E–02
							0.063	0.125	9.29E–02	1.00E–01	1.14E–01
						189	1	2	8.60E–03	8.20E–03	8.36E–03
							0.25	0.5	3.16E–02	3.18E–02	3.65E–02
							0.063	0.125	1.28E–01	1.39E–01	1.51E–01
					Sr	1	1	2	–6.96E–04	–9.66E–04	–3.72E–04
							0.25	0.5	1.99E–04	–9.79E–04	–1.34E–04
							0.063	0.125	7.11E–03	4.76E–03	7.59E–03
						8	1	2	–6.68E–04	6.01E–04	–7.20E–04
							0.25	0.5	–5.28E–04	–4.63E–04	–1.75E–04
							0.063	0.125	3.76E–03	3.45E–03	4.37E–03
						30	1	2	–2.82E–04	2.86E–04	–2.28E–04
							0.25	0.5	3.16E–04	–2.42E–04	8.07E–04
							0.063	0.125	5.29E–03	5.98E–03	5.03E–03
						91	1	2	3.86E–04	9.39E–05	–4.45E–04
							0.25	0.5	3.55E–04	4.50E–05	5.11E–04
							0.063	0.125	5.82E–03	5.64E–03	5.85E–03
						189	1	2	–8.41E–05	2.66E–04	–1.44E–04
							0.25	0.5	5.82E–04	3.54E–04	3.37E–04
							0.063	0.125	6.74E–03	5.99E–03	5.22E–03
					Ln-Ac (III)	1	1	2	1.85E–01	2.22E–01	1.64E–01
							0.25	0.5	4.28E–01	3.89E–01	4.82E–01
							0.063	0.125	7.31E–01	5.39E–01	8.28E–01
						8	1	2	4.29E–01	4.07E–01	2.76E–01
							0.25	0.5	7.97E–01	8.46E–01	2.96E–01
							0.063	0.125	2.78E+00	1.93E+00	1.73E+00

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						30	1	2	8.14E–01	4.90E–01	7.97E–01
							0.25	0.5	9.47E–01	6.88E–01	1.57E+00
							0.063	0.125	4.80E–02	4.71E–02	5.10E–02
						91	1	2	6.39E–01	6.25E–01	6.10E–01
							0.25	0.5	9.24E–01	8.77E–01	1.31E+00
							0.063	0.125	3.42E+00	2.64E+00	4.14E+00
						189	1	2	8.36E–01	6.70E–01	9.46E–01
							0.25	0.5	1.18E+00	1.96E+00	3.41E–01
							0.063	0.125	6.45E+00	4.38E+00	3.69E+00
KFM03A	536.47	536.67	Fracture filling	F	Cs	1	1	2	5.85E–03	5.32E–03	5.09E–03
							0.25	0.5	1.28E–02	1.53E–02	1.33E–02
							0.063	0.125	4.14E–02	3.84E–02	5.71E–02
						7	1	2	1.10E–02	8.64E–03	9.77E–03
							0.25	0.5	2.51E–02	2.55E–02	2.44E–02
							0.063	0.125	6.69E–02	5.15E–02	1.01E–01
						31	1	2	1.73E–02	1.83E–02	1.58E–02
							0.25	0.5	3.48E–02	3.48E–02	3.25E–02
							0.063	0.125	8.41E–02	8.59E–02	9.81E–02
						92	1	2	2.46E–02	2.13E–02	2.30E–02
							0.25	0.5	3.70E–02	4.09E–02	3.55E–02
							0.063	0.125	9.17E–02	9.04E–02	1.12E–01
						182	1	2	3.12E–02	2.92E–02	2.53E–02
							0.25	0.5	4.67E–02	4.91E–02	4.32E–02
							0.063	0.125	1.18E–01	8.85E–02	1.59E–01
					Sr	1	1	2	4.08E–03	3.66E–03	3.80E–03
							0.25	0.5	5.68E–03	7.31E–03	6.40E–03
							0.063	0.125	1.55E–02	1.24E–02	1.87E–02
						7	1	2	5.16E–03	4.16E–03	4.25E–03
							0.25	0.5	7.46E–03	1.13E–02	7.72E–03
							0.063	0.125	1.47E–02	1.35E–02	2.23E–02
						31	1	2	8.91E–03	1.10E–02	5.81E–03

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.25	0.5	1.06E–02	1.19E–02	8.26E–03
							0.063	0.125	2.61E–02	1.91E–02	3.52E–02
						92	1	2	8.60E–03	1.21E–02	1.10E–02
							0.25	0.5	1.51E–02	1.67E–02	8.62E–03
							0.063	0.125	4.07E–02	2.13E–02	4.29E–02
						182	1	2	5.37E–03	9.28E–03	1.13E–02
							0.25	0.5	1.83E–02	1.65E–02	2.03E–02
							0.063	0.125	2)	2)	2)
					Ln-Ac (III)	1	1	2	1.38E–02	1.59E–02	1.35E–02
							0.25	0.5	2.51E–02	2.31E–02	2.83E–02
							0.063	0.125	7.53E–02	6.59E–02	7.79E–02
						7	1	2	3.61E–02	3.53E–02	3.27E–02
							0.25	0.5	8.17E–02	6.80E–02	7.85E–02
							0.063	0.125	3.26E–01	2.37E–01	3.09E–01
						31	1	2	6.79E–02	6.43E–02	6.17E–02
							0.25	0.5	1.29E–01	1.29E–01	1.29E–01
							0.063	0.125	9.37E–01	7.10E–01	8.57E–01
						92	1	2	7.95E–02	8.49E–02	7.32E–02
							0.25	0.5	1.81E–01	1.59E–01	1.58E–01
							0.063	0.125	9.61E–01	6.85E–01	1.08E+00
						182	1	2	7.55E–02	6.63E–02	5.10E–02
							0.25	0.5	1.94E–01	1.15E–01	9.83E–02
							0.063	0.125	7.57E–01	5.59E–01	6.13E–01
				SaF	Cs	1	1	2	2.63E–03	2.55E–03	1.41E–03
							0.25	0.5	3.90E–03	4.46E–03	4.32E–03
							0.063	0.125	1.12E–02	1.24E–02	9.90E–03
						7	1	2	3.27E–03	3.26E–03	1.79E–03
							0.25	0.5	6.96E–03	6.80E–03	5.74E–03
							0.063	0.125	1.51E–02	1.85E–02	1.90E–02
						29	1	2	4.18E–03	3.08E–03	2.65E–03
							0.25	0.5	6.32E–03	7.10E–03	1.06E–02
							0.063	0.125	1.79E–02	1.96E–02	2.26E–02

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						94	1	2	3.34E–03	5.28E–03	3.68E–03
							0.25	0.5	6.61E–03	7.69E–03	8.60E–03
							0.063	0.125	1.58E–02	2.49E–02	2.42E–02
						177	1	2	4.94E–03	5.44E–03	5.07E–03
							0.25	0.5	9.73E–03	9.65E–03	1.05E–02
							0.063	0.125	2.23E–02	2.90E–02	2.92E–02
					Sr	1	1	2	9.98E–04	8.52E–04	1.75E–05
							0.25	0.5	7.12E–05	4.70E–04	5.85E–04
							0.063	0.125	–1.57E–06	5.73E–04	–2.79E–04
						7	1	2	4.65E–04	7.52E–04	–3.73E–04
							0.25	0.5	3.64E–04	6.44E–04	2.09E–05
							0.063	0.125	–2.73E–04	–1.15E–04	5.11E–04
						29	1	2	7.04E–04	2.65E–04	–4.20E–04
							0.25	0.5	–4.92E–04	2.47E–04	8.12E–04
							0.063	0.125	–6.49E–04	–2.50E–04	4.57E–04
						94	1	2	–3.46E–04	3.89E–04	7.08E–05
							0.25	0.5	–6.55E–04	–1.89E–04	1.13E–04
							0.063	0.125	–9.53E–04	–1.23E–04	–5.55E–04
						177	1	2	1.23E–03	1.53E–03	1.99E–03
							0.25	0.5	1.30E–03	5.48E–04	6.76E–04
							0.063	0.125	1.36E–04	1.84E–03	6.16E–04
					Ln-Ac (III)	1	1	2	2.20E–02	2.45E–02	2.75E–02
							0.25	0.5	4.69E–02	5.57E–02	5.14E–02
							0.063	0.125	1.16E–01	1.96E–01	1.22E–01
						7	1	2	7.52E–02	7.68E–02	6.30E–02
							0.25	0.5	1.69E–01	1.64E–01	1.43E–01
							0.063	0.125	4.15E–01	8.40E–01	3.82E–01
						29	1	2	1.66E–01	1.78E–01	1.91E–01
							0.25	0.5	3.97E–01	4.41E–01	4.37E–01
							0.063	0.125	3.68E–01	1.50E–01	5.40E–01
						94	1	2	1.91E–01	2.28E–01	3.34E–01
							0.25	0.5	8.98E–01	1.02E+00	9.66E–01
							0.063	0.125	6.88E–01	1.26E+00	1.56E+00

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						177	1	2	3.99E–01	4.81E–01	2.77E–01
							0.25	0.5	1.03E+00	1.18E+00	9.41E–01
							0.063	0.125	7.11E–01	2.25E+00	1.91E+00
				B	Cs	1	1	2	7.19E–04	1.15E–03	1.59E–03
							0.25	0.5	2.78E–03	2.79E–03	2.45E–03
							0.063	0.125	3.02E–03	5.72E–03	4.18E–03
						7	1	2	1.77E–03	1.24E–03	2.28E–03
							0.25	0.5	3.90E–03	3.70E–03	3.66E–03
							0.063	0.125	4.62E–03	8.45E–03	7.38E–03
						31	1	2	2.48E–03	2.50E–03	2.67E–03
							0.25	0.5	4.76E–03	4.54E–03	5.04E–03
							0.063	0.125	5.26E–03	8.92E–03	7.89E–03
						92	1	2	1.04E–03	1.59E–03	2.20E–03
							0.25	0.5	3.77E–03	3.29E–03	3.68E–03
							0.063	0.125	6.86E–03	9.65E–03	6.85E–03
						182	1	2	2.78E–03	1.91E–03	2.71E–03
							0.25	0.5	5.30E–03	4.64E–03	5.21E–03
							0.063	0.125	6.96E–03	1.26E–02	9.33E–03
					Sr	1	1	2	3.72E–04	4.57E–04	6.78E–04
							0.25	0.5	4.85E–04	7.92E–04	1.84E–04
							0.063	0.125	–3.26E–04	1.07E–03	2.10E–04
						7	1	2	1.25E–03	6.39E–04	1.16E–03
							0.25	0.5	1.27E–03	1.05E–03	8.58E–04
							0.063	0.125	–2.08E–04	1.11E–03	7.48E–04
						31	1	2	1.28E–03	9.44E–04	1.57E–03
							0.25	0.5	1.38E–03	1.53E–03	1.43E–03
							0.063	0.125	4.36E–04	8.61E–04	2.07E–03
						92	1	2	9.59E–05	9.62E–05	4.18E–04
							0.25	0.5	–3.04E–05	–5.23E–04	4.65E–04
							0.063	0.125	–4.12E–04	1.41E–03	–1.22E–04
						182	1	2	2.06E–03	3.04E–04	1.58E–05
							0.25	0.5	8.63E–04	4.01E–04	1.81E–04

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.063	0.125	–8.32E–04	4.56E–04	1.42E–03
					Ln-Ac (III)	1	1	2	9.55E–03	1.04E–02	9.32E–03
							0.25	0.5	1.43E–02	1.39E–02	1.79E–02
							0.063	0.125	5.15E–02	1.03E–01	5.21E–02
						7	1	2	2.57E–02	3.08E–02	3.06E–02
							0.25	0.5	6.20E–02	4.80E–02	8.74E–02
							0.063	0.125	2.95E–01	3.92E–01	2.82E–01
						31	1	2	1.39E–01	1.35E–01	1.63E–01
							0.25	0.5	3.32E–01	2.22E–01	3.26E–01
							0.063	0.125	1.13E+00	1.21E+00	9.02E–01
						92	1	2	2.54E–01	4.07E–01	3.02E–01
							0.25	0.5	8.85E–01	6.47E–01	1.01E+00
							0.063	0.125	1.67E+00	2.16E+00	1.73E+00
						182	1	2	8.21E–01	4.90E–01	5.07E–01
							0.25	0.5	9.67E–01	5.61E–01	1.10E+00
							0.063	0.125	1.82E+00	2.00E+00	1.20E+00
KFM03A	643.80	644.17	Fracture filling	F	Cs	1	0	0.125	8.25E–01	1)	1)
						8	0	0.125	9.27E–01	1)	1)
						30	0	0.125	1.06E+00	1)	1)
						94	0	0.125	1.23E+00	1)	1)
						190	0	0.125	1.51E+00	1)	1)
					Sr	1	0	0.125	3.67E–01	1)	1)
						8	0	0.125	2.84E–01	1)	1)
						30	0	0.125	2.75E–01	1)	1)
						94	0	0.125	3.39E–01	1)	1)
						190	0	0.125	2.04E–01	1)	1)
					Ln-Ac (III)	1	0	0.125	4.34E–02	1)	1)
						8	0	0.125	1.06E–01	1)	1)
						30	0	0.125	4.65E–02	1)	1)
						94	0	0.125	7.40E–02	1)	1)
						190	0	0.125	1.04E–01	1)	1)
				SaF	Cs	1	0	0.125	9.13E–02	1)	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
						8	0	0.125	1.21E–01	1)	1)
						30	0	0.125	1.38E–01	1)	1)
						94	0	0.125	1.13E–01	1)	1)
						190	0	0.125	1.62E–01	1)	1)
					Sr	1	0	0.125	2)	2)	2)
						8	0	0.125	2)	2)	2)
						30	0	0.125	2)	2)	2)
						94	0	0.125	2)	2)	2)
						190	0	0.125	2)	2)	2)
					Ln-Ac (III)	0	0	0.125	6.95E–02	1)	1)
						8	0	0.125	5.44E–02	1)	1)
						30	0	0.125	1.51E–01	1)	1)
						94	0	0.125	1.01E–01	1)	1)
						190	0	0.125	7.55E–02	1)	1)
				B	Cs	1	0	0.125	3.32E–02	1)	1)
						8	0	0.125	2)	1)	1)
						30	0	0.125	4.22E–02	1)	1)
						94	0	0.125	4.91E–02	1)	1)
						190	0	0.125	4.82E–02	1)	1)
					Sr	1	0	0.125	1.94E–03	1)	1)
						8	0	0.125	2)	1)	1)
						30	0	0.125	3.09E–04	1)	1)
						94	0	0.125	6.51E–04	1)	1)
						190	0	0.125	–1.27E–03	1)	1)
					Ln-Ac (III)	0	0	0.125	9.50E–01	1)	1)
						8	0	0.125	2)	1)	1)
						30	0	0.125	7.30E–01	1)	1)
						94	0	0.125	7.90E–01	1)	1)
						190	0	0.125	8.57E–01	1)	1)

1) No double and/or triple samples involved in the measurements due to limited amount of rock material.

2) No measurement data delivered due to low activity due to decay.

Table A5-11. Tracer distribution ratio, *Rd,* for rock samples from drill site 4.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
KFM04A	377.16	377.48	Fracture filling	F	Cs	1	0	0.125	7.01E–02	1)	1)
						7	0	0.125	1.23E–01	1)	1)
						35	0	0.125	1.56E–01	1)	1)
						97	0	0.125	1.87E–01	1)	1)
						181	0	0.125	4.43E–01	1)	1)
					Sr	1	0	0.125	4.12E–02	1)	1)
						7	0	0.125	5.52E–02	1)	1)
						35	0	0.125	6.18E–02	1)	1)
						97	0	0.125	6.59E–02	1)	1)
						181	0	0.125		1)	1)
					Ln-Ac (III)	1	0	0.125	2.55E–01	1)	1)
						7	0	0.125	4.00E–01	1)	1)
						35	0	0.125	1.06E+00	1)	1)
						97	0	0.125	9.47E–01	1)	1)
						181	0	0.125	1.47E+00	1)	1)
				M	Cs	1	0	0.125	5.89E–03	1)	1)
						7	0	0.125	8.74E–03	1)	1)
						35	0	0.125	1.07E–02	1)	1)
						97	0	0.125	1.72E–02	1)	1)
						181	0	0.125	1.82E–02	1)	1)
					Sr	1	0	0.125	4.73E–04	1)	1)
						7	0	0.125	5.08E–04	1)	1)
						35	0	0.125	8.40E–05	1)	1)
						97	0	0.125	7.89E–04	1)	1)
						181	0	0.125	1.31E–04	1)	1)
					Ln-Ac (III)	1	0	0.125	4.49E–01	1)	1)
						7	0	0.125	7.49E–01	1)	1)
						35	0	0.125	2.34E+00	1)	1)
						97	0	0.125	1.22E+00	1)	1)
						181	0	0.125	3.77E+00	1)	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
				SaF	Cs	1	0	0.125	5.50E–03	1)	1)
						7	0	0.125	7.36E–03	1)	1)
						35	0	0.125	1.21E–02	1)	1)
						97	0	0.125	1.44E–02	1)	1)
						181	0	0.125	1.41E–02	1)	1)
					Sr	1	0	0.125	–1.53E–04	1)	1)
						7	0	0.125	–1.12E–04	1)	1)
						35	0	0.125	–2.27E–04	1)	1)
						97	0	0.125	–1.68E–05	1)	1)
						181	0	0.125	–2.67E–04	1)	1)
					Ln-Ac (III)	1	0	0.125	3.48E–01	1)	1)
						7	0	0.125	1.28E+00	1)	1)
						35	0	0.125	1.97E+00	1)	1)
						97	0	0.125	2.92E+00	1)	1)
						181	0	0.125	1.35E+00	1)	1)
				B	Cs	1	0	0.125	2.39E–03	1)	1)
						7	0	0.125	3.01E–03	1)	1)
						35	0	0.125	2.93E–03	1)	1)
						97	0	0.125	3.59E–03	1)	1)
						181	0	0.125	4.15E–03	1)	1)
					Sr	1	0	0.125	4.47E–04	1)	1)
						7	0	0.125	5.45E–04	1)	1)
						35	0	0.125	–3.82E–04	1)	1)
						97	0	0.125	–4.73E–04	1)	1)
						181	0	0.125	3.07E–05	1)	1)
					Ln-Ac (III)	1	0	0.125	1.13E–01	1)	1)
						7	0	0.125	4.39E–01	1)	1)
						35	0	0.125	1.23E+00	1)	1)
						97	0	0.125	1.82E+00	1)	1)
						181	0	0.125	2.13E+00	1)	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
KFM04A	414.20	414.40	fracture filling	F	Cs	1	0	0.125	1.15E–01	1.32E–01	1)
						8	0	0.125	1.46E–01	1.56E–01	1)
						30	0	0.125	1.63E–01	1.83E–01	1)
						94	0	0.125	1.91E–01	2.08E–01	1)
						190	0	0.125	2.04E–01	2.61E–01	1)
					Sr	1	0	0.125	5.31E–02	5.78E–02	1)
						8	0	0.125	4.50E–02	4.35E–02	1)
						30	0	0.125	6.68E–02	6.48E–02	1)
						94	0	0.125	6.84E–02	6.68E–02	1)
						190	0	0.125	6.88E–02	9.24E–02	1)
					Ln-Ac (III)	1	0	0.125	1.21E–02	4.02E–02	1)
						8	0	0.125	1.67E–01	7.69E–02	1)
						30	0	0.125	5.50E–02	4.34E–02	1)
						94	0	0.125	8.62E–02	8.11E–02	1)
						190	0	0.125	7.60E–02	5.51E–02	1)
				M	Cs	2	0	0.125	1.57E–02	1.13E–02	1)
						7	0	0.125	1.50E–02	9.90E–03	1)
						37	0	0.125	1.91E–02	1.37E–02	1)
						91	0	0.125	2.05E–02	1.53E–02	1)
						185	0	0.125	2.19E–02	1.56E–02	1)
					Sr	2	0	0.125	5.64E–04	1.20E–03	1)
						7	0	0.125	–6.98E–04	–7.56E–04	1)
						37	0	0.125	–1.78E–04	2.14E–04	1)
						91	0	0.125	2.33E–04	4.31E–04	1)
						185	0	0.125	–3.27E–04	4.18E–04	1)
					Ln-Ac (III)	2	0	0.125	3.88E–01	6.92E–01	1)
						7	0	0.125	7.02E–01	1.18E+00	1)
						37	0	0.125	6.53E–01	2.36E–01	1)
						91	0	0.125	8.24E–01	7.53E–01	1)
						185	0	0.125	1.04E–01	1.97E–01	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
				SaF	Cs	1	0	0.125	2.41E–02	2.44E–02	1)
						8	0	0.125	2.91E–02	2.98E–02	1)
						30	0	0.125	3.48E–02	3.32E–02	1)
						94	0	0.125	3.46E–02	3.61E–02	1)
						190	0	0.125	3.97E–02	4.33E–02	1)
					Sr	1	0	0.125	5.16E–04	1.07E–03	1)
						8	0	0.125	–6.91E–04	–5.79E–04	1)
						30	0	0.125	1.90E–04	1.26E–04	1)
						94	0	0.125	3.56E–04	3.27E–04	1)
						190	0	0.125	–1.51E–04	6.19E–04	1)
					Ln-Ac (III)	1	0	0.125	3.50E–01	6.44E–01	1)
						8	0	0.125	6.34E–01	1.19E+00	1)
						30	0	0.125	6.43E–01	2.23E–01	1)
						94	0	0.125	8.32E–01	7.68E–01	1)
						190	0	0.125	9.97E–02	2.01E–01	1)

1) No double and/or triple samples involved in the measurements due to limited amount of rock material.

2) No measurement data delivered due to low activity due to decay.

Table A5-12. Tracer distribution ratio, *Rd,* for rock samples from drill site 5.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
KFM05A	611.68	611.91	sealed fracture network	F	Cs	1	0	0.125	7.32E–02	7.40E–02	1)
						8	0	0.125	1.21E–01	1.09E–01	1)
						30	0	0.125	1.23E–01	1.24E–01	1)
						94	0	0.125	1.68E–01	1.84E–01	1)
						190	0	0.125	2.16E–01	1.96E–01	1)
					Sr	1	0	0.125	2)	2)	2)
						8	0	0.125	2)	2)	2)
						30	0	0.125	2)	2)	2)
						94	0	0.125	2)	2)	2)
						190	0	0.125	3.69E–02	3.55E–02	1)
					Ln-Ac (III)	1	0	0.125	2.47E–01	2.35E–01	1)
						8	0	0.125	6.09E–01	6.05E–01	1)
						30	0	0.125	9.26E–01	7.82E–01	1)
						94	0	0.125	7.45E–01	8.43E–01	1)
						190	0	0.125	7.54E–01	7.62E–01	1)
				M	Cs	1	0	0.125	6.36E–03	6.14E–03	1)
						8	0	0.125	5.16E–03	6.69E–03	1)
						30	0	0.125	1.03E–02	1.03E–02	1)
						94	0	0.125	1.31E–02	1.30E–02	1)
						190	0	0.125	1.42E–02	1.41E–02	1)
					Sr	1	0	0.125	2)	2)	2)
						8	0	0.125	2)	2)	2)
						30	0	0.125	2)	2)	2)
						94	0	0.125	2)	2)	2)
						190	0	0.125	2)	2)	2)
					Ln-Ac (III)	1	0	0.125	3.93E–02	2.43E–02	1)
						8	0	0.125	1.42E–01	2.60E–01	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						30	0	0.125	5.30E–02	1.87E–02	1)
						94	0	0.125	4.18E–02	1.10E–01	1)
						190	0	0.125	5.63E–02	8.87E–02	1)
				SaF	Cs	1	0	0.125	8.38E–03	1)	1)
						8	0	0.125	1.02E–02	1)	1)
						30	0	0.125	1.23E–02	1)	1)
						94	0	0.125	1.43E–02	1)	1)
						190	0	0.125	1.82E–02	1)	1)
					Sr	1	0	0.125	6.15E–04	1)	1)
						8	0	0.125	–1.08E–03	1)	1)
						30	0	0.125	–2.75E–04	1)	1)
						94	0	0.125	5.97E–04	1)	1)
						190	0	0.125	2.03E–04	1)	1)
					Ln-Ac (III)	1	0	0.125	5.16E–01	1)	1)
						8	0	0.125	1.45E+00	1)	1)
						30	0	0.125	1.04E+00	1)	1)
						94	0	0.125	1.87E+00	1)	1)
						190	0	0.125	1.13E+00	1)	1)

1) No double and/or triple samples involved in the measurements due to limited amount of rock material.

2) No measurement data delivered due to low activity due to decay.

Table A5-13. **Tracer distribution ratio, *Rd,* for rock samples from drill site 6.**

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
KFM06A	440.13	440.61	101057	F	Cs	1	1	2	3.59E–03	2.97E–03	2.81E–03
							0.25	0.5	6.06E–03	4.68E–03	5.50E–03
							0.063	0.125	1.88E–02	2.10E–02	[1)]
						8	1	2	7.87E–03	7.07E–03	5.86E–03
							0.25	0.5	7.71E–03	8.22E–03	8.61E–03
							0.063	0.125	2.88E–02	2.71E–02	[1)]
						30	1	2	9.93E–03	9.87E–03	7.65E–03
							0.25	0.5	8.67E–03	8.84E–03	1.06E–02
							0.063	0.125	3.23E–02	3.00E–02	[1)]
						94	1	2	1.12E–02	1.21E–02	9.13E–03
							0.25	0.5	1.00E–02	1.13E–02	1.16E–02
							0.063	0.125	4.40E–02	4.24E–02	[1)]
						190	1	2	1.32E–02	1.39E–02	1.16E–02
							0.25	0.5	1.03E–02	1.09E–02	1.12E–02
							0.063	0.125	4.84E–02	4.86E–02	[1)]
					Sr	1	1	2	1.80E–03	1.56E–03	1.51E–03
							0.25	0.5	3.25E–03	2.39E–03	2.97E–03
							0.063	0.125	7.69E–03	8.69E–03	[1)]
						8	1	2	2.65E–03	1.97E–03	2.05E–03
							0.25	0.5	1.25E–03	1.79E–03	1.78E–03
							0.063	0.125	5.81E–03	5.60E–03	[1)]
						30	1	2	2.55E–03	3.02E–03	2.59E–03
							0.25	0.5	3.36E–03	3.60E–03	4.73E–03
							0.063	0.125	9.28E–03	8.85E–03	[1)]
						94	1	2	3.64E–03	3.18E–03	2.30E–03
							0.25	0.5	3.61E–03	4.99E–03	4.63E–03
							0.063	0.125	1.33E–02	1.31E–02	[1)]
						190	1	2	4.67E–03	4.51E–03	3.78E–03

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.25	0.5	4.25E–03	5.28E–03	4.25E–03
							0.063	0.125	1.82E–02	1.42E–02	[1]
					Ln-Ac (III)	1	1	2	1.07E–01	5.68E–02	5.13E–02
							0.25	0.5	1.25E–02	6.57E–03	5.66E–03
							0.063	0.125	2.11E–02	1.54E–02	[1]
						8	1	2	7.84E–01	1.09E–01	1.55E–01
							0.25	0.5	2.83E–02	2.25E–02	2.65E–02
							0.063	0.125	7.05E–02	6.05E–02	[1]
						30	1	2	2.10E–01	1.68E–01	1.89E–01
							0.25	0.5	2.78E–02	1.15E–02	2.67E–02
							0.063	0.125	3.04E–02	4.58E–02	[1]
						94	1	2	3.38E–01	3.28E–01	2.75E–01
							0.25	0.5	5.27E–02	6.41E–02	4.57E–02
							0.063	0.125	7.57E–02	5.45E–02	[1]
						190	1	2	2.71E–01	3.81E–01	3.17E–01
							0.25	0.5	2.14E–02	4.20E–02	4.65E–02
							0.063	0.125	4.46E–02	4.65E–02	[1]
				M	Cs	1	1	2	1.33E–03	9.30E–04	1.02E–03
							0.25	0.5	1.39E–03	1.10E–03	1.30E–03
							0.063	0.125	3.51E–03	3.37E–03	[1]
						8	1	2	1.43E–03	1.37E–03	1.34E–03
							0.25	0.5	6.29E–04	9.82E–04	9.34E–04
							0.063	0.125	3.23E–03	3.26E–03	[1]
						30	1	2	2.17E–03	2.02E–03	1.99E–03
							0.25	0.5	6.77E–03	6.90E–03	7.20E–03
							0.063	0.125	2.12E–02	1.93E–02	[1]
						91	1	2	2.13E–03	2.01E–03	2.44E–03
							0.25	0.5	1.79E–03	–1.55E–04	2.15E–03
							0.063	0.125	5.22E–03	5.93E–03	[1]
						189	1	2	2.53E–03	2.24E–03	2.19E–03
							0.25	0.5	2.31E–03	2.32E–03	2.11E–03

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.063	0.125	6.19E–03	6.49E–03	1)
					Sr	1	1	2	4.25E–04	2.98E–04	1.35E–04
							0.25	0.5	–2.98E–04	–8.19E–04	1.58E–03
							0.063	0.125	3.72E–04	7.41E–05	1)
						8	1	2	1.64E–04	9.49E–05	–7.47E–05
							0.25	0.5	–2.51E–03	–2.67E–03	–2.50E–03
							0.063	0.125	–2.08E–03	–2.60E–03	1)
						30	1	2	4.77E–04	5.86E–04	4.32E–04
							0.25	0.5	3.25E–03	1.40E–03	7.61E–04
							0.063	0.125	2.98E–03	–5.43E–04	1)
						91	1	2	1.57E–04	3.18E–04	2.36E–04
							0.25	0.5	4.71E–03	–5.99E–04	3.31E–03
							0.063	0.125	–3.02E–04	9.06E–03	1)
						189	1	2	–1.08E–03	–1.18E–03	–1.28E–03
							0.25	0.5	1.32E–03	5.78E–03	8.12E–03
							0.063	0.125	–2.74E–04	–1.57E–04	1)
					Ln-Ac (III)	1	1	2	3.22E–02	3.21E–02	3.04E–02
							0.25	0.5	2.40E–02	4.76E–02	3.40E–02
							0.063	0.125	3.27E–02	5.72E–02	1)
						8	1	2	4.66E–02	5.03E–02	4.83E–02
							0.25	0.5	3.98E–02	8.60E–02	1.60E–02
							0.063	0.125	5.66E–02	2.58E–02	1)
						30	1	2	4.04E–02	3.84E–02	3.44E–02
							0.25	0.5	1.17E–01	2.04E–02	3.24E–02
							0.063	0.125	3.69E–02	9.72E–03	1)
						91	1	2	3.19E–02	2.45E–02	3.56E–02
							0.25	0.5	6.19E–02	1.44E–01	1.67E–02
							0.063	0.125	4.04E–02	6.88E–02	1)
						189	1	2	5.17E–02	3.71E–02	3.30E–02
							0.25	0.5	7.62E–02	4.17E–02	4.79E–02
							0.063	0.125	7.13E–02	5.73E–02	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
				SaF	Cs	1	1	2	9.93E–04	1.02E–03	9.20E–04
							0.25	0.5	1.97E–03	1.85E–03	1.63E–03
							0.063	0.125	6.08E–03	5.65E–03	[1]
						8	1	2	1.57E–03	1.82E–03	1.72E–03
							0.25	0.5	2.16E–03	2.32E–03	1.76E–03
							0.063	0.125	7.72E–03	7.70E–03	[1]
						30	1	2	2.34E–03	2.37E–03	1.94E–03
							0.25	0.5	2.43E–03	2.68E–03	2.25E–03
							0.063	0.125	9.86E–03	1.02E–02	[1]
						91	1	2	2.58E–03	2.88E–03	2.76E–03
							0.25	0.5	2.91E–03	3.44E–03	3.17E–03
							0.063	0.125	1.09E–02	[2]	[1]
						189	1	2	2.76E–03	3.11E–03	3.07E–03
							0.25	0.5	3.45E–03	3.91E–03	3.22E–03
							0.063	0.125	1.35E–02	1.33E–02	[1]
					Sr	1	1	2	–4.90E–04	–5.63E–04	–4.59E–04
							0.25	0.5	4.79E–04	6.46E–04	4.04E–04
							0.063	0.125	5.19E–04	1.64E–04	[1]
						8	1	2	9.24E–05	–1.19E–04	–2.65E–04
							0.25	0.5	–1.19E–03	–1.01E–03	–1.20E–03
							0.063	0.125	–6.30E–04	–6.81E–04	[1]
						30	1	2	2.07E–04	4.82E–04	–4.08E–04
							0.25	0.5	–5.86E–04	–5.16E–04	–1.01E–03
							0.063	0.125	–2.78E–04	–4.17E–04	[1]
						91	1	2	3.24E–04	4.63E–04	2.94E–04
							0.25	0.5	1.37E–05	–1.60E–05	4.09E–05
							0.063	0.125	–2.49E–04	[2]	[1]
						189	1	2	3.36E–04	2.26E–04	–3.58E–04
							0.25	0.5	–1.33E–04	–2.02E–04	1.35E–04
							0.063	0.125	–5.04E–04	–2.70E–04	[1]

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
					Ln-Ac (III)	1	1	2	9.48E–02	1.25E–01	1.13E–01
							0.25	0.5	3.74E–01	2.41E–01	3.01E–01
							0.063	0.125	5.51E–01	3.49E–01	[1]
						8	1	2	2.56E–01	2.45E–01	2.65E–01
							0.25	0.5	9.48E–01	6.57E–01	3.69E–01
							0.063	0.125	8.53E–01	9.60E–01	[1]
						30	1	2	4.64E–01	3.83E–01	4.28E–01
							0.25	0.5	1.10E+00	1.22E+00	5.25E–01
							0.063	0.125	1.37E+00	1.40E+00	[1]
						91	1	2	4.32E–01	3.56E–01	3.04E–01
							0.25	0.5	1.06E+00	1.13E+00	9.36E–01
							0.063	0.125	1.80E+00	[2]	[1]
						189	1	2	7.20E–01	4.99E–01	7.13E–01
							0.25	0.5	2.08E+00	1.44E+00	1.20E+00
							0.063	0.125	1.85E+00	1.79E+00	[1]
				B	Cs	1	1	2	5.48E–04	5.07E–04	2.88E–04
							0.25	0.5	6.67E–04	7.90E–04	1.03E–03
							0.063	0.125	2.62E–03	2.59E–03	[1]
						8	1	2	5.52E–04	9.50E–04	7.35E–04
							0.25	0.5	1.34E–03	1.96E–03	1.25E–03
							0.063	0.125	3.23E–03	3.08E–03	[1]
						30	1	2	9.79E–04	8.36E–04	7.14E–04
							0.25	0.5	1.56E–03	1.64E–03	1.52E–03
							0.063	0.125	3.55E–03	3.39E–03	[1]
						91	1	2	1.12E–03	1.34E–03	1.23E–03
							0.25	0.5	2.14E–03	1.97E–03	2.26E–03
							0.063	0.125	4.53E–03	4.64E–03	[1]
						189	1	2	1.42E–03	1.27E–03	1.23E–03
							0.25	0.5	2.60E–03	2.28E–03	2.34E–03
							0.063	0.125	3.57E–03	4.32E–03	[1]
					Sr	1	1	2	–1.11E–03	–9.04E–04	–1.06E–03
							0.25	0.5	–1.38E–03	–1.03E–03	–9.44E–04

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.063	0.125	–2.81E–04	1.69E–04	1)
						8	1	2	–5.56E–05	1.23E–03	–6.80E–05
							0.25	0.5	3.81E–05	–2.41E–04	–2.82E–05
							0.063	0.125	–7.10E–05	5.57E–03	1)
						30	1	2	2.60E–04	–1.13E–04	–3.58E–04
							0.25	0.5	–1.96E–04	–1.13E–04	–2.00E–04
							0.063	0.125	–1.24E–03	–2.35E–03	1)
						91	1	2	–2.06E–04	7.19E–04	–7.69E–05
							0.25	0.5	2.71E–04	–1.80E–04	2.12E–04
							0.063	0.125	9.07E–04	3.09E–03	1)
						189	1	2	1.11E–04	–2.21E–06	3.36E–04
							0.25	0.5	2.70E–04	2.50E–04	8.17E–04
							0.063	0.125	2.33E–05	1.78E–04	1)
					Ln-Ac (III)	1	1	2	6.51E–02	4.84E–02	4.42E–02
							0.25	0.5	8.98E–02	6.23E–02	9.49E–02
							0.063	0.125	2.14E–01	1.99E–01	1)
						8	1	2	6.55E–02	9.43E–02	5.13E–02
							0.25	0.5	9.21E–02	1.71E–01	6.70E–02
							0.063	0.125	3.38E–01	3.97E–01	1)
						30	1	2	5.18E–02	6.64E–02	8.83E–02
							0.25	0.5	6.37E–02	7.60E–02	8.32E–02
							0.063	0.125	7.07E–01	5.88E–01	1)
						91	1	2	1.36E–01	2.13E–01	2.16E–01
							0.25	0.5	1.62E–01	1.68E–01	1.45E–01
							0.063	0.125	4.20E+00	4.20E+00	1)
						189	1	2	1.32E–01	5.66E–02	1.26E–01
							0.25	0.5	1.01E–01	1.79E–01	1.19E–01
							0.063	0.125	8.77E–01	7.49E–01	1)
KFM06A	770.69	770.79	Fracture filling	M	Cs	1	0	0.125	8.62E–03	8.50E–03	8.68E–03
						7	0	0.125	7.84E–03	8.19E–03	7.99E–03
						41	0	0.125	8.65E–03	8.01E–03	8.71E–03
						91	0	0.125	7.97E–03	8.78E–03	8.33E–03

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						188	0	0.125	8.17E–03	8.97E–03	9.09E–03
					Sr	1	0	0.125	[2)]	[2)]	[2)]
						7	0	0.125	[2)]	[2)]	[2)]
						41	0	0.125	[2)]	[2)]	[2)]
						91	0	0.125	[2)]	[2)]	[2)]
						188	0	0.125	2.35E–03	2.18E–03	1.99E–03
					Ln-Ac (III)	1	0	0.125	1.89E–01	4.34E–01	2.30E–01
						7	0	0.125	3.94E–01	2.81E–01	2.24E–01
						41	0	0.125	3.16E–01	1.69E–01	1.38E–01
						91	0	0.125	1.01E–01	1.48E–01	8.48E–02
						188	0	0.125	1.42E+00	1.50E+00	1.05E+00
				SaF	Cs	1	0	0.125	8.73E–03	9.04E–03	7.65E–03
						7	0	0.125	9.15E–03	9.18E–03	9.44E–03
						41	0	0.125	9.66E–03	9.19E–03	9.67E–03
						91	0	0.125	9.16E–03	8.51E–03	9.15E–03
						188	0	0.125	9.27E–03	9.92E–03	1.00E–02
					Sr	1	0	0.125	4.95E–03	1.07E–02	3.19E–05
						7	0	0.125	1.21E–04	7.55E–04	–2.99E–04
						41	0	0.125	–6.17E–04	8.15E–05	4.16E–03
						91	0	0.125	7.46E–03	2.18E–04	4.88E–04
						188	0	0.125	9.53E–04	1.27E–03	1.01E–03
					Ln-Ac (III)	1	0	0.125	7.61E–01	9.61E–01	5.72E–01
						7	0	0.125	4.21E–01	3.35E–01	5.79E–01
						41	0	0.125	2.34E–01	1.15E+00	3.11E–01
						91	0	0.125	1.15E–01	2.86E–01	1.46E–01
						188	0	0.125	2.67E+00	1.50E+00	2.30E+00
KFM06B	56.25	56.33	altered bedrock (101057)	F	Cs	1	0	0.125	1.20E+00	9.64E–02	[1)]
			“fault rock”			8	0	0.125	1.30E+00	1.73E+00	[1)]
						30	0	0.125	1.52E+00	1.86E+00	[1)]
						91	0	0.125	2.35E+00	2.50E+00	[1)]

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						189	0	0.125	2.67E+00	2.76E+00	1)
					Sr	1	0	0.125	1.34E–01	1.31E–01	1)
						8	0	0.125	1.13E–01	1.05E–01	1)
						30	0	0.125	1.48E–01	3.54E–01	1)
						91	0	0.125	1.59E–01	1.09E–01	1)
						189	0	0.125	1.44E–01	1.18E–02	1)
					Ln-Ac (III)	1	0	0.125	7.43E–03	–2.08E–03	1)
						8	0	0.125	7.66E–01	1.85E–01	1)
						30	0	0.125	3.16E–01	5.03E–01	1)
						91	0	0.125	4.95E–01	3.18E–01	1)
						189	0	0.125	6.20E–01	1.90E–01	1)
				SaF	Cs	1	0	0.125	1.95E–01	2.23E–01	1)
						7	0	0.125	2.89E–01	2.75E–01	1)
						41	0	0.125	3.37E–01	2.82E–01	1)
						91	0	0.125	2.93E–01	2.74E–01	1)
						188	0	0.125	3.36E–01	3.19E–01	1)
					Sr	1	0	0.125	–1.35E–03	–1.44E–03	1)
						7	0	0.125	–2.27E–03	–2.99E–03	1)
						41	0	0.125	–1.16E–03	–2.00E–03	1)
						91	0	0.125	–9.65E–04	–1.92E–03	1)
						188	0	0.125	–1.06E–03	–2.08E–03	1)
					Ln-Ac (III)	1	0	0.125	4.76E–01	3.23E–01	1)
						7	0	0.125	1.41E+00	1.02E+00	1)
						41	0	0.125	4.00E–01	1.11E+00	1)
						91	0	0.125	4.81E–02	7.38E–02	1)
						188	0	0.125	1.24E+00	7.63E–01	1)

1) No double and/or triple samples involved in the measurements due to limited amount of rock material.

2) No measurement data delivered due to low activity due to decay.

Table A5-14. Tracer distribution ratio, *Rd,* for rock samples from drill site 7.

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
KFM07A	387.47	387.87	101057	F	Cs	1	1	2	1.26E–03	4.70E–03	1)
							0.25	0.5	1.25E–02	1.23E–02	1)
							0.063	0.125	3.37E–02	5.17E–02	1)
						8	1	2	5.01E–03	8.44E–03	1)
							0.25	0.5	2.76E–02	2.20E–02	1)
							0.063	0.125	8.10E–02	9.18E–02	1)
						35	1	2	7.03E–03	1.09E–02	1)
							0.25	0.5	3.73E–02	3.39E–02	1)
							0.063	0.125	8.09E–02	2.00E–01	1)
						99	1	2	1.03E–02	1.58E–02	1)
							0.25	0.5	4.46E–02	4.21E–02	1)
							0.063	0.125	1.49E–01	1.93E–01	1)
						178	1	2	1.28E–02	2.02E–02	1)
							0.25	0.5	4.61E–02	4.15E–02	1)
							0.063	0.125	1.75E–01	2.35E–01	1)
					Sr	1	1	2	–6.97E–04	1.65E–03	1)
							0.25	0.5	3.89E–03	3.22E–03	1)
							0.063	0.125	8.54E–03	9.17E–03	1)
						8	1	2	–1.49E–04	1.52E–03	1)
							0.25	0.5	4.06E–03	4.32E–03	1)
							0.063	0.125	1.28E–02	1.04E–02	1)
						35	1	2	–4.06E–05	1.83E–03	1)
							0.25	0.5	8.16E–03	5.52E–03	1)
							0.063	0.125	6.79E–03	2.12E–02	1)
						99	1	2	6.55E–04	1.92E–03	1)
							0.25	0.5	5.49E–03	1.04E–02	1)
							0.063	0.125	4.37E–02	2.18E–02	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
						178	1	2	6.98E–04	2.21E–03	[1]
							0.25	0.5	5.39E–03	2.33E–02	[1]
							0.063	0.125	[2]	[2]	[2]
					Ln-Ac (III)	0	1	2	7.72E–02	1.44E–02	1.53E–02
							0.25	0.5	3.80E–02	5.84E–02	3.90E–02
							0.063	0.125	7.19E–02	1.08E–01	[1]
						7	1	2	3.68E–02	2.90E–02	3.17E–02
							0.25	0.5	9.65E–02	9.21E–02	7.44E–02
							0.063	0.125	1.98E–01	2.65E–01	[1]
						34	1	2	7.72E–02	6.18E–02	5.55E–02
							0.25	0.5	1.72E–01	1.63E–01	1.15E–01
							0.063	0.125	3.50E–01	5.15E–01	[1]
						97	1	2	9.27E–02	6.60E–02	7.05E–02
							0.25	0.5	1.34E–01	1.84E–01	1.39E–01
							0.063	0.125	4.51E–01	5.62E–01	[1]
						183	1	2	1.02E–01	8.17E–02	8.18E–02
							0.25	0.5	1.75E–01	1.68E–01	6.81E–02
							0.063	0.125	4.39E–01	9.75E–01	[1]
					Ra	1	1	2	5.46E–02	2.75E–02	2.46E–02
							0.25	0.5	5.40E–02	5.78E–02	7.75E–02
							0.063	0.125	3.52E–01	3.55E–01	2.89E–01
						7	1	2	4.65E–02	5.02E–02	4.18E–02
							0.25	0.5	1.18E–01	1.07E–01	1.32E–01
							0.063	0.125	6.57E–01	3.85E–01	4.96E–01
						28	1	2	5.46E–02	5.06E–02	5.76E–02
							0.25	0.5	1.12E–01	1.07E–01	1.21E–01
							0.063	0.125	5.28E–01	5.32E–01	5.19E–01
						91	1	2	6.51E–02	7.11E–02	7.24E–02
							0.25	0.5	1.24E–01	9.51E–02	7.94E–02
							0.063	0.125	1.14E+00	4.92E–01	3.20E–01

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						168	1	2	7.76E–02	1.08E–01	7.95E–02
							0.25	0.5	2.95E–01	2.67E–01	3.27E–01
							0.063	0.125	9.77E–01	9.06E–01	5.91E–01
					Ni	1	1	2	2.87E–02	9.91E–03	9.64E–03
							0.25	0.5	7.57E–03	1.24E–02	1.05E–02
							0.063	0.125	3.04E–02	2.25E–02	3.18E–02
						7	1	2	1.61E–02	1.81E–02	2.10E–02
							0.25	0.5	1.56E–02	3.79E–02	2.22E–02
							0.063	0.125	5.47E–02	4.80E–02	5.95E–02
						28	1	2	2.87E–02	3.50E–02	4.50E–02
							0.25	0.5	5.27E–02	5.60E–02	3.54E–02
							0.063	0.125	7.34E–02	9.51E–02	1.05E–01
						91	1	2	5.51E–02	5.91E–02	7.13E–02
							0.25	0.5	7.59E–02	9.43E–02	4.35E–02
							0.063	0.125	2.65E–01	2.81E–01	6.91E–01
						168	1	2	5.90E–02	7.12E–02	7.46E–02
							0.25	0.5	1.02E–01	1.17E–01	4.93E–02
							0.063	0.125	3.68E–01	3.99E–01	1)
					Np	1	1	2	–2.79E–05	2.63E–04	1)
							0.25	0.5	1.22E–04	1.24E–03	1)
							0.063	0.125	1.61E–03	2.97E–03	1)
						8	1	2	2.73E–04	1.24E–03	1)
							0.25	0.5	1.80E–03	4.00E–03	1)
							0.063	0.125	2.47E–02	3.69E–02	1)
						35	1	2	3.23E–04	6.01E–04	1)
							0.25	0.5	4.06E–03	2.26E–02	1)
							0.063	0.125	4.41E+00	4.72E+00	1)
						99	1	2	1.00E–03	1.29E–03	1)
							0.25	0.5	7.52E–03	5.12E–01	1)
							0.063	0.125	2)	2)	2)
						178	1	2	1.11E–03	1.42E–03	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.25	0.5	7.88E–03	[2]	[1]
							0.063	0.125	[2]	[2]	[2]
					U	1	1	2	1.72E–04	4.50E–04	[1]
							0.25	0.5	1.61E–04	7.68E–04	[1]
							0.063	0.125	1.26E–04	8.96E–04	[1]
						8	1	2	4.32E–04	9.28E–04	[1]
							0.25	0.5	1.22E–03	2.05E–03	[1]
							0.063	0.125	5.86E–03	8.46E–03	[1]
						35	1	2	4.84E–04	8.21E–04	[1]
							0.25	0.5	1.27E–03	4.83E–03	[1]
							0.063	0.125	8.51E–02	1.21E–01	[1]
						99	1	2	8.16E–04	1.11E–03	[1]
							0.25	0.5	1.73E–03	8.92E–03	[1]
							0.063	0.125	[2]	[2]	[2]
						178	1	2	8.69E–04	1.16E–03	[1]
							0.25	0.5	1.63E–03	9.69E–03	[1]
							0.063	0.125	[2]	[2]	[2]
	KFM07A 387.47 – 387.87			B	Cs	1	1	2	1.32E–03	1.00E–03	[1]
							0.25	0.5	1.39E–03	3.13E–03	[1]
							0.063	0.125	6.85E–03	6.77E–03	[1]
						8	1	2	1.69E–03	6.41E–04	[1]
							0.25	0.5	4.25E–03	3.49E–03	[1]
							0.063	0.125	2.21E–02	1.34E–02	[1]
						35	1	2	2.80E–03	1.75E–03	[1]
							0.25	0.5	6.09E–03	6.99E–03	[1]
							0.063	0.125	2.52E–02	2.29E–02	[1]
						99	1	2	1.93E–03	8.38E–04	[1]
							0.25	0.5	6.10E–03	6.33E–03	[1]
							0.063	0.125	2.23E–02	1.98E–02	[1]

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
						178	1	2	2.05E–03	1.10E–03	1)
							0.25	0.5	6.94E–03	7.03E–03	1)
							0.063	0.125	2.34E–02	2.17E–02	1)
					Sr	1	1	2	9.70E–04	4.58E–04	1)
							0.25	0.5	–1.99E–04	1.54E–03	1)
							0.063	0.125	1.32E–03	9.28E–04	1)
						8	1	2	9.13E–04	–1.96E–04	1)
							0.25	0.5	6.59E–04	4.46E–04	1)
							0.063	0.125	1.48E–03	2.96E–04	1)
						35	1	2	1.66E–03	8.33E–04	1)
							0.25	0.5	7.45E–04	2.44E–03	1)
							0.063	0.125	8.95E–04	1.91E–03	1)
						99	1	2	6.20E–04	–1.03E–04	1)
							0.25	0.5	4.82E–04	9.45E–04	1)
							0.063	0.125	8.17E–04	1.49E–04	1)
						178	1	2	1.56E–04	–4.77E–04	1)
							0.25	0.5	1.83E–03	1.40E–03	1)
							0.063	0.125	2.42E–03	–6.59E–04	1)
					Ln-Ac (III)	0	1	2	1.08E–01	1.08E–02	1.17E–02
							0.25	0.5	4.64E–02	8.67E–02	6.39E–02
							0.063	0.125	3.16E–01	1.93E–01	1)
						7	1	2	3.20E–02	3.73E–02	4.19E–02
							0.25	0.5	2.94E–01	2.86E–01	4.41E–01
							0.063	0.125	9.63E–01	1.58E+00	1)
						34	1	2	1.08E–01	1.41E–01	9.65E–02
							0.25	0.5	8.55E–01	2.27E+00	8.63E–01
							0.063	0.125	2.83E+00	3.06E+00	1)
						97	1	2	1.33E–01	1.34E–01	1.16E–01
							0.25	0.5	1.10E+00	4.03E–01	2.97E+00
							0.063	0.125	2.11E+00	1.92E+00	1)
						183	1	2	4.39E–01	5.69E–01	5.31E–01
							0.25	0.5	1.31E+00	2.10E+00	1.14E+00

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m³/kg) sample no 1	Rd (m³/kg) sample no 2	Rd (m³/kg) sample no 3
							0.063	0.125	4.34E+00	3.91E+00	1)
					Ra	1	1	2	4.81E–04	2.41E–05	5.38E–04
							0.25	0.5	1.35E–03	2.72E–04	4.73E–04
							0.063	0.125	3.59E–03	2.41E–03	1)
						7	1	2	3.42E–04	3.86E–04	7.18E–04
							0.25	0.5	9.55E–04	1.30E–04	1.25E–03
							0.063	0.125	3.84E–03	3.56E–03	1)
						33	1	2	4.81E–04	1.12E–04	8.19E–04
							0.25	0.5	1.14E–03	7.03E–04	1.69E–03
							0.063	0.125	5.49E–03	4.13E–03	1)
						89	1	2	6.73E–04	3.93E–04	8.45E–04
							0.25	0.5	1.75E–03	1.30E–03	1.72E–03
							0.063	0.125	5.04E–03	4.67E–03	1)
						183	1	2	2.61E–04	1.58E–04	6.98E–04
							0.25	0.5	1.21E–03	9.94E–04	8.80E–04
							0.063	0.125	5.99E–03	4.29E–03	1)
					Ni	1	1	2	1.48E–03	1.04E–03	8.83E–04
							0.25	0.5	1.97E–03	1.19E–03	2.23E–03
							0.063	0.125	2.51E–03	4.25E–03	1)
						7	1	2	1.30E–03	1.50E–03	1.62E–03
							0.25	0.5	5.21E–03	3.89E–03	8.32E–03
							0.063	0.125	1.55E–02	1.47E–02	1)
						28	1	2	1.48E–03	1.68E–03	1.87E–03
							0.25	0.5	1.49E–02	1.39E–02	3.51E–02
							0.063	0.125	7.00E–02	7.06E–02	1)
						91	1	2	2.44E–03	2.36E–03	2.95E–03
							0.25	0.5	9.95E–02	8.76E–02	3.01E–01
							0.063	0.125	2.44E–01	2.05E–01	1)
						168	1	2	3.55E–03	3.12E–03	3.38E–03
							0.25	0.5	2.28E–01	1.81E–01	3.83E–01
							0.063	0.125	2.38E–01	2.15E–01	1)

Borehole	Secup (mbl)	Seclow (mbl)	Rock type (SKB code)/ Fracture filling	Water	Tracer	Contact time (days)	Size fraction (mm)		Rd (m^3/kg) sample no 1	Rd (m^3/kg) sample no 2	Rd (m^3/kg) sample no 3
					Np	1	1	2	–9.52E–04	–3.93E–04	1)
							0.25	0.5	8.37E–04	–1.22E–03	1)
							0.063	0.125	4.26E–03	3.33E–03	1)
						8	1	2	–5.60E–04	9.97E–05	1)
							0.25	0.5	2.90E–02	5.12E–04	1)
							0.063	0.125	1.80E–01	1.11E–01	1)
						35	1	2	–7.97E–04	–1.87E–04	1)
							0.25	0.5	1.76E–01	8.68E–03	1)
							0.063	0.125	2.68E+00	1.90E+00	1)
						99	1	2	–1.41E–03	–9.21E–04	1)
							0.25	0.5	2)	2)	2)
							0.063	0.125	2)	2)	2)
						178	1	2	–2.03E–03	–1.82E–03	1)
							0.25	0.5	2)	2)	2)
							0.063	0.125	2)	2)	2)
					U	1	1	2	–3.24E–04	3.04E–04	1)
							0.25	0.5	–3.41E–04	–5.39E–04	1)
							0.063	0.125	1.85E–03	1.77E–03	1)
						8	1	2	2.59E–06	7.79E–04	1)
							0.25	0.5	3.41E–03	5.97E–04	1)
							0.063	0.125	2.48E–02	2.56E–02	1)
						35	1	2	3.23E–04	1.10E–03	1)
							0.25	0.5	3.20E–02	6.30E–03	1)
							0.063	0.125	1.44E–01	9.45E–02	1)
						99	1	2	1.53E–03	2.47E–03	1)
							0.25	0.5	2)	7.67E–02	1)
							0.063	0.125	2)	2)	2)
						178	1	2	1.60E–03	2.27E–03	1)
							0.25	0.5	2)	2.57E–01	1)
							0.063	0.125	2)	2)	2)

1) No double and/or triple samples involved in the measurements due to limited amount of rock material.

2) No measurement data delivered due to low activity due to decay.

Appendix 6

Water compostitions

Groundwater compositions used in the laboratory measurements (methods described in /Byegård et al, 2003/), Forsmark; concentrations are given in mg/l. Specific sampling intervals in the boreholes in brackets. For diffusion experiments; only the major components (i.e. Ca^{2+}, Na+, Cl- and $SO^{2-}{}_4$) from water type II, were included.

Table 6-1.

	Type I (HSH02 0–200 m) Fresh water	Type II (KFM02A 509–516 m) Groundwater with marine character	Type III (KFM03 639–646 m) Saline groundwater	Type IV (KLX02 1,383–1,392 m) Brine type water of very high salinity
Li^+	1.60E–02	5.10E–02	2.80E–02	4.85E+00
Na^+	1.27E+02	2.12E+03	1.69E+03	7.45E+03
K^+	2.16E+00	3.33E+01	1.42E+01	3.26E+01
Rb^+	(2.52E–02)[A]	6.28E–02	3.93E–02	1.78E–01
Cs^+	(1.17E–03)[A]	1.79E–03	7.09E–04	1.86E–02
NH_4^+	(9.47E–02)[A]	4.00E–02	2.04E–01	5.60E–01
Mg^{2+}	1.43E+00	2.32E+02	5.27E+01	1.20E+00
Ca^{2+}	5.21E+00	9.34E+02	1.47E+03	1.48E+04
Sr^{2+}	6.95E–02	7.95E+00	1.69E+01	2.53E+02
Ba^{2+}	(1.29E+00)[A]	1.88E–01	9.07E–02	2.40E–02
Fe^{2+}	(3.64E–01)[C]	1.20E+00	2.33E–01	3.45E+00
Mn^{2+}	2.00E–02	2.12E+00	3.18E–01	1.11E+00
F^-	3.03E+00	9.00E–01	2.04E–01	(1.60E+00)[D]
Cl^-	2.15E+01	5.15E+03	5.19E+03	3.68E+04
Br^-	(2.00E–01)[B]	2.20E+01	3.89E+01	5.09E+02
SO_4^{2-}	8.56E+00	5.10E+02	1.95E+02	1.21E+03
Si(tot)	6.56E+00	5.20E+00	6.28E+00	2.60E+00
HCO_3^-	2.52E+02	1.24E+02	2.19E+01	4.20E+01
S^{2-}	(1.00E–02)[B]	5.00E–02	2.95E–02	5.00E–02
pH	8.58	7.1	7.55	6.8

A) No measurements available, data imported from KSH01 #5263.

B) Based on detection limit.

C) Based on the Fe-tot measurement.

D) No measurements available, data imported from KLX02 #2731.