

Oskarshamn site investigation

Hydrochemical monitoring programme for core drilled boreholes, June–July 2006

Summary of analyses from summer water sampling and parts of winter sampling

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December 2006

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This report concerns a study which was conducted for SKB. The conclusions and viewpoints presented in the report are those of the authors and do not necessarily coincide with those of the client.

Data in SKB's database can be changed for different reasons. Minor changes in SKB's database will not necessarily result in a revised report. Data revisions may also be presented as supplements, available at www.skb.se.

A pdf version of this document can be downloaded from www.skb.se.

Abstract

This report summarises water sampling from eleven sections in permanently installed core-drilled boreholes; KAV01:3, KLX01:3, KLX02:2, KLX02:5, KLX06:3, KLX06:6, KLX07A:2, KSH01A:4, KSH01A:7, KSH02:1 and KSH02:4, within the site investigation programme at Oskarshamn. The water sampling performed in the monitoring programme is repeated twice every year and this report summarises results from the first sampling occasion 2006. The objective is to determine the groundwater composition in the sections instrumented for this purpose.

The results from this activity include groundwater chemistry data in accordance with SKB class 5 chemistry for all of the borehole sections above. The data were obtained during June and July 2006.

All analytical data from the activity are stored in the SICADA database.

(Some of the results from the second sampling occasion 2006 are presented in Appendix 2. A complete report is planned during 2007.)

Sammanfattning

Denna rapport sammanfattar vattenprovtagning från elva sektioner i de permanent installerade kärnborrhålen KAV01:3, KLX01:3, KLX02:2, KLX02:5, KLX06:3, KLX06:6, KLX07A:2, KSH01A:4, KSH01A:7, KSH02:1 and KSH02:4 inom platsundersökningen i Oskarshamn. Provtagningen utförs två gånger per år och denna rapport sammanfattar resultaten från den första omgången 2006. Syftet är att bestämma grundvattensammansättningen i samtliga för ändamålet instrumenterade borrhålssektioner.

Resultaten från denna aktivitet inkluderar vattenkemidata enligt SKB kemiklass 5 från alla sektioner ovan. Proverna är tagna under juni och juli 2006.

Alla resultat från vattenanalyserna finns i databasen SICADA.

(En del av resultaten från den andra provtagningsomgången 2006 finns med i Appendix 2. Fullständig rapport kommer under 2007.)

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1 Introduction

This document reports data collected within the Hydrochemical monitoring programme for core drilled boreholes 2006, which is one of the activities performed within the site investigation at Oskarshamn. The work was carried out in accordance with activity plan AP PS 400-06-060. Controlling documents for performing this activity are listed in Table 1-1. The activity plan and method description are SKB internal controlling documents. The field work was performed during June to July 2006 and is reported in the database SICADA, traceable using the activity plan number.

The activity includes water sampling from boreholes (Table 1-2) according to SKB chemistry class 5 including options of trace elements and the isotopes $\delta^{34}\text{S}$, $\delta^{37}\text{Cl}$, $^{87}\text{Sr}/^{86}\text{Sr}$, $^{10}\text{B}/^{11}\text{B}$, ^{14}C , $\delta^{13}\text{C}$, ^{226}Ra , ^{222}Rn , ^{238}U , ^{234}U and ^{230}Th . Determination of density and field measurements of pH and temperature were also performed. Archive samples were stored in a freezer. A map showing the investigation site at Oskarshamn is presented in Figure 1-1.

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

Activity plan	Number	Version
Hydrokemiskt monitoringsprogram för kärnborrhål 2006	AP PS 400-06-060	1.0
Method description	Number	Version
System för hydrologisk och meteorologisk datainsamling	SKB MD 368.010	1.0 (2004-05-26)

Table 1-2. Borehole, borehole section, borehole length and hydraulic transmissivity.

Borehole:Section	Borehole length (m)	Hydraulic transmissivity (m ² /s)
KAV01:3	391–434	1.8 E–5
KLX01:3	171–190	1.1 E–5
KLX02:2	1,145–1,164	3.2 E–7
KLX02:5	452–494	1.0 E–7
KLX03:1* (little water)	965–971	1.5 E–9 (value from recovery)
KLX03:4*	729–751	5.9 E–6
KLX04:2*	870–897	3.5 E–8
KLX04:5*	507–530	2.7 E–6
KLX05:3*	625–633	1.2 E–8
KLX05:7*	241–255	6.2 E–7
KLX06:3	554–570	1 E–5 (uncertain)
KLX06:6	256–275	> 5 E–5 (uncertain)
KLX07A:2	753–780	3.5 E–5
KSH01A:4	532–572	8.4 E–7
KSH01A:7	238–277	7.4 E–6
KSH02:1	955–963	6.8 E–8
KSH02:4	411–439	9.7 E–8

* Not in the first sampling occasion 2006.

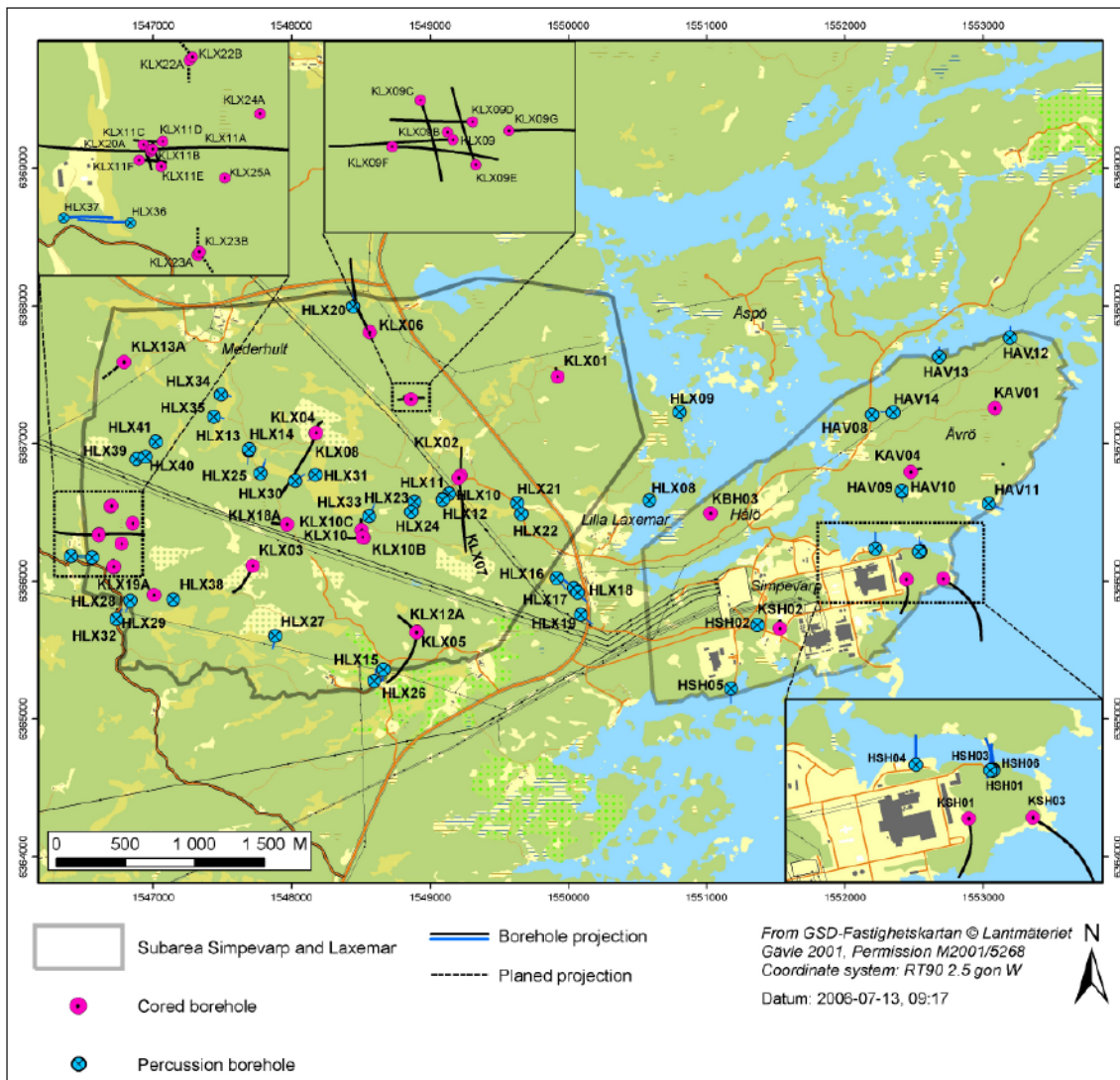


Figure 1-1. Overview of the Oskarshamn site investigation area, including the boreholes.

2 Objective and scope

This report summarises results from the water samples collected within the first sampling occasion of the Hydrochemical monitoring programme for core drilled boreholes 2006. According to the general programme for the site investigation area, the core drilled boreholes are monitored. The water sampling is performed in circulation sections that are sealed off using permanently installed packers. The monitoring programme will last at least until the decision about a future repository is made.

3 Equipment

3.1 Description of equipment

The water sampling is performed in borehole sections with permanently installed packers. The pump equipment used for the water sampling is schematically presented in Figure 3-1.

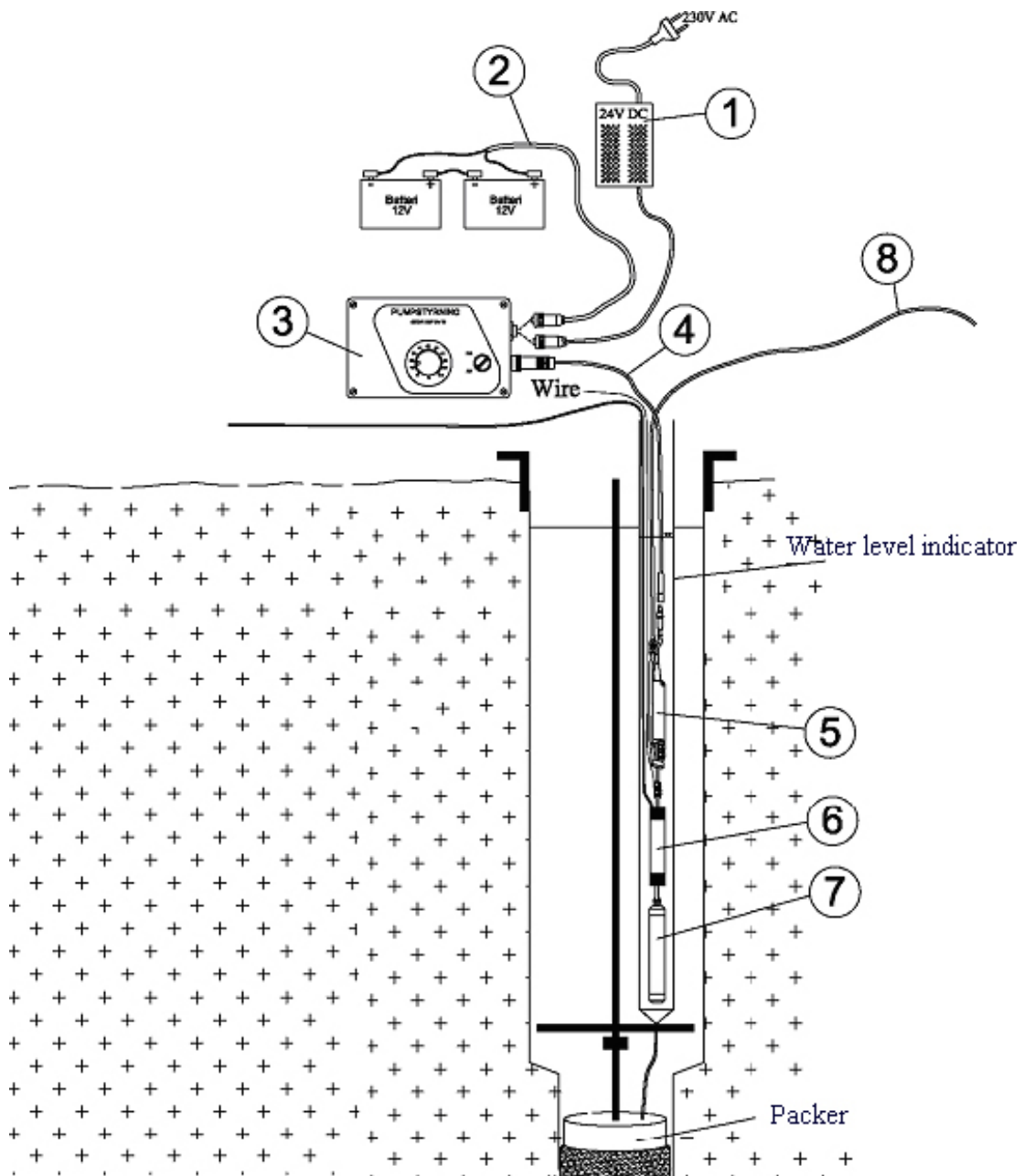


Figure 3-1. Schematic drawing of the equipment used for water sampling; 1. Battery eliminator 2. Battery cable 3. Pump control GEOPUMP UV 45 4. Pump Cable 5. GEOPUMP UV 45 6. Mini packer 7. Filter holder with filter 8. Pump tube, polyamide 8/6 mm.

4 Execution

4.1 General

The water sampling was performed using identical equipment set-ups, one in each borehole section, a schematic drawing is shown in Figure 3-1. The water volume in the pipe plus the volume in the section should preferably be converted five times, but at least three times before the water sample is taken (Table 4-1). The pumping volume is controlled by the down-hole pump. The drawdown is not allowed to exceed 20 m.

The water pumped up from the boreholes is collected in a tank and emptied onto the rinse plate at Simpevarp.

The activity was performed in accordance with the activity plan AP PS 400-06-060 and following the method description SKB MD 368.010 (System för hydrologisk och metrologisk datainsamling. Vattenprovtagning och utspädningsmätning i observationshål, SKB internal controlling document).

4.2 Preparations

The function of each pump was checked using a bucket. The tubes were cleaned or exchanged before installation in the borehole.

4.3 Execution of field work

The water sampling was performed in eleven sections listed in Table 4-1. The samples were collected after conversion of water at least three times in each section. For a detailed description see method description SKB MD 368.010 (System för hydrologisk och metrologisk datainsamling. Vattenprovtagning och utspädningsmätning i observationshål, SKB internal controlling document).

The water level in the borehole sections was logged in order to determine the maximal drawdown during the sampling period.

Table 4-1. Volume in tube and section and calculated pumping time.

Borehole	Borehole length (m)	Volume (tube + section) (L)	Volume x 3 (L)	Volume x 5 (L)	Calculated* pumping time (3 times the volume)	Calculated* pumping time (5 times the volume)
KAV01:3	391–434	38.27	114.81	191.35	3 h 50 min	6 h 23 min
KLX01:3	171–190	20.22	60.66	101.10	2 h 2 min	3 h 23 min
KLX02:2	1,145–1,164	75.30	225.90	376.50	7 h 32 min	12 h 33 min
KLX02:5	452–494	44.19	132.57	220.95	4 h 26 min	7 h 22 min
KLX06:3	554–570	40.48	121.44	202.40	4 h 3 min	6 h 45 min
KLX06:6	256–275	24.61	73.83	123.05	2 h 28 min	4 h 7 min
KLX07A:2	753–780	55.33	165.99	276.65	5 h 32 min	9 h 14 min
KSH01A:4	532–572	47.37	142.11	236.85	4 h 45 min	7 h 54 min
KSH01A:7	238–277	30.13	90.39	150.65	3 h 1 min	5 h 2 min
KSH02:1	955–963	60.74	182.22	303.70	6 h 5 min	10 h 8 min
KSH02:4	411–439	36.28	108.84	181.40	3 h 38 min	6 h 3 min

* When the water flow is 500 mL/min.

4.4 Handling of water analysis data

The following routines for quality control and data management are generally applied for hydrogeochemical analytical data, independently of sampling method or sampling object.

Some of the constituents are determined by more than one method and/or laboratory. All analytical results are stored in the SICADA database. The applied hierarchy path “Hydrochemistry/Hydrochemical investigation/Analyses/Water in the database” contains two types of tables, raw data tables and primary data tables (final data tables).

Data on **basic water analyses** are inserted into the raw data tables for further evaluation. The evaluation results in a final reduced data set for each sample. These data sets are compiled in a primary data table named “water composition”. The evaluation is based on:

- Comparison of the results from different laboratories and/or methods.
- Calculation of charge balance errors, equation (1). Relative errors within $\pm 5\%$ are considered acceptable.

$$\text{Relative error(\%)} = 100 \times \frac{\sum \text{cations(equivalents)} - \sum \text{anions(equivalents)}}{\sum \text{cations(equivalents)} + \sum \text{anions(equivalents)}} \quad (1)$$

- General judgement of plausibility based on earlier results and experience.

All results from **special analyses of trace metals and isotopes** are inserted directly into primary data tables. In cases where the analyses are repeated or performed by more than one laboratory, a “best choice” notation will indicate those results which are considered most reliable.

An overview of the data management is given in Figure 4-1.

4.5 Water sampling, sample treatment and analyses

The pumped water from the borehole section is conveyed from the pipe into the sample bottles. Filtration and conservation of the samples was performed on-line at the site. A water sample is defined as groundwater collected on one occasion and consists of several sample portions, labelled with the same sample number.

An overview of sample treatment and analysis methods is given in Appendix 1. The routines are applicable independently of sampling method or type of sampling object. Three samples (11145, 11186 and 11210) were sent for control analysis of main components and eight samples (11145, 11146, 11176, 11185, 11186, 11208, 11209 and 11210) were sent for control analysis of bromide to two other laboratories. The analytical results are not reported here, but are present in the database SICADA.

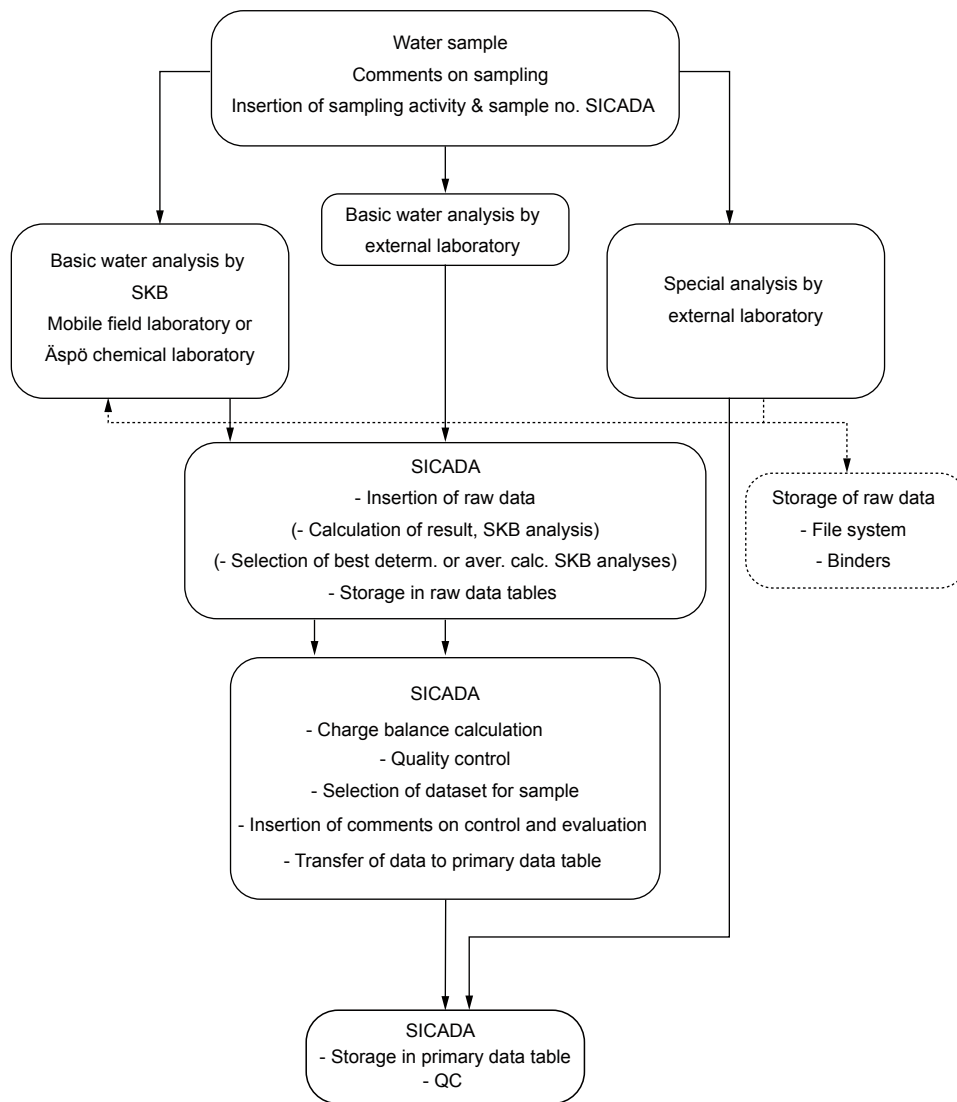


Figure 4-1. Overview of data management for hydrogeochemical data.

5 Results

The results obtained within this activity are water chemistry data from borehole sections KAV01:3, KLX01:3, KLX02:2, KLX02:5, KLX06:3, KLX06:6, KLX07A:2, KSH01A:4, KSH01A:7, KSH02:1 and KSH02:4. The results from the chemical analyses are presented below and in Appendix 2. The results are stored in the SICADA data base and are traceable by the activity plan number and sample number. It is the data in the data base that will be used for further interpretation (modelling).

(Some of the results from the second sampling occasion 2006 are presented in Appendix 2. A complete report is planned during 2007.)

5.1 Basic water analyses

The basic water analyses include Na, K, Ca, Mg, Si, Li, S, Sr, SO_4^{2-} , Cl^- , HCO_3^- , Br^- and F^- . Furthermore, measurements are made of pH, electrical conductivity, drill water content and density. The basic water analysis data and relative charge balance errors are compiled in Appendix 2, Table A2-1. The charge balance error gives an indication of the quality and uncertainty of the analyses of major constituents. The charge balance error exceeds the acceptable level of $\pm 5\%$ in one case, for KLX02:5. The error was most likely due to an unstable HCO_3^- value.

The drill water content in the samples collected during the pumping/measurement periods in the borehole sections are compiled in Appendix 2, Table A2-1.

Values of pH from laboratory and field analyses are compared in Figure 5-1.

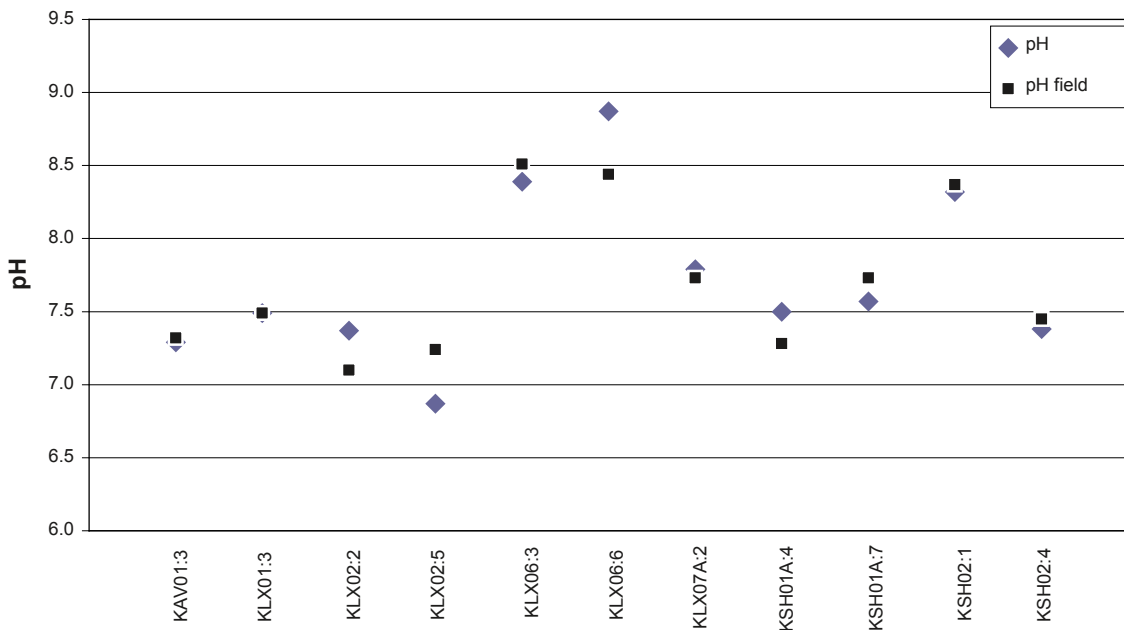


Figure 5-1. pH from laboratory and field analyses.

Sulphate (SO_4^{2-}) analysed using ion chromatography (IC) is compared with sulphate determined as total sulphur using inductively coupled plasma atomic emission spectrometry (ICP-AES) in Figure 5-2. In most samples, the sulphur content exists as sulphate species, but in i.e. KLX02:2 the hydrogen sulphide concentration was very high, resulting in a large discrepancy between the data points in Figure 5-2.

The chloride concentrations are plotted versus the corresponding electric conductivity values in Figure 5-3. The plot gives an approximate indication that the values are reasonable. The data from the borehole sections agree well with earlier data from the Äspö Hard Rock Laboratory.

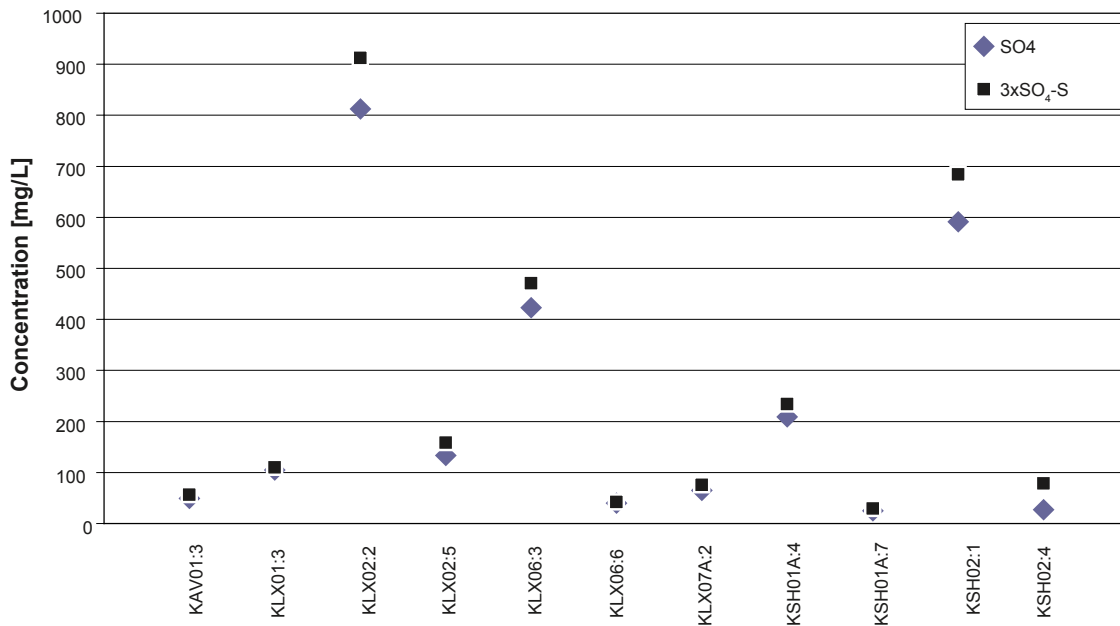


Figure 5-2. Sulphate (SO_4 by IC) data compared to sulphate calculated from total sulphur ($3 \times \text{SO}_4\text{-S}$ by ICP) data from samples collected in the investigated sections.

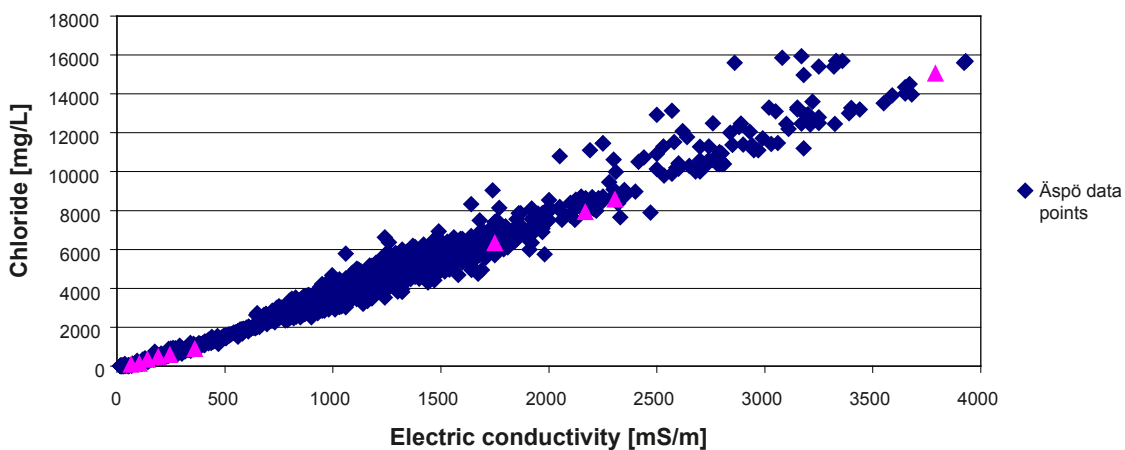


Figure 5-3. Chloride concentration versus electrical conductivity. Data points from this investigation are shown as pink triangles. Data from earlier investigations at the Äspö Hard Rock Laboratory are used to show the overall trend (blue rhombs).

5.2 Trace elements (rare earth metals and others)

The analyses of trace and rare earth metals include U, Th, As, Sc, Cd, Hg, V, Rb, Y, Zr, In, Cs, Ba, La, Hf, Tl, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu. Commonly occurring metals, such as Cu, Zn, Pb and Mo are not included in the analysis programme due to contamination considerations. The trace element data are compiled in Appendix 2, Table A2-2.

5.3 Stable and radioactive isotopes

The isotope determinations include the stable isotopes $\delta^2\text{H}$, $\delta^{18}\text{O}$, $\delta^{34}\text{S}$, $\delta^{37}\text{Cl}$, $^{87}\text{Sr}/^{86}\text{Sr}$, $^{10}\text{B}/^{11}\text{B}^*$, ^{14}C , $\delta^{13}\text{C}$ as well as the radioactive isotope ^3H (TU), ^{226}Ra , ^{222}Rn , ^{238}U , ^{234}U and ^{230}Th . The isotope data are compiled in Appendix 2, Table A2-3. The ^3H and $\delta^{18}\text{O}$ results from the investigated sections are presented in Figure 5-4. The ^3H content was below the detection limit (0.8 Tritium Units (TU)) in KLX06:3, KLX06:6, KSH01A:4, KSH01A:7 and KSH02:4.

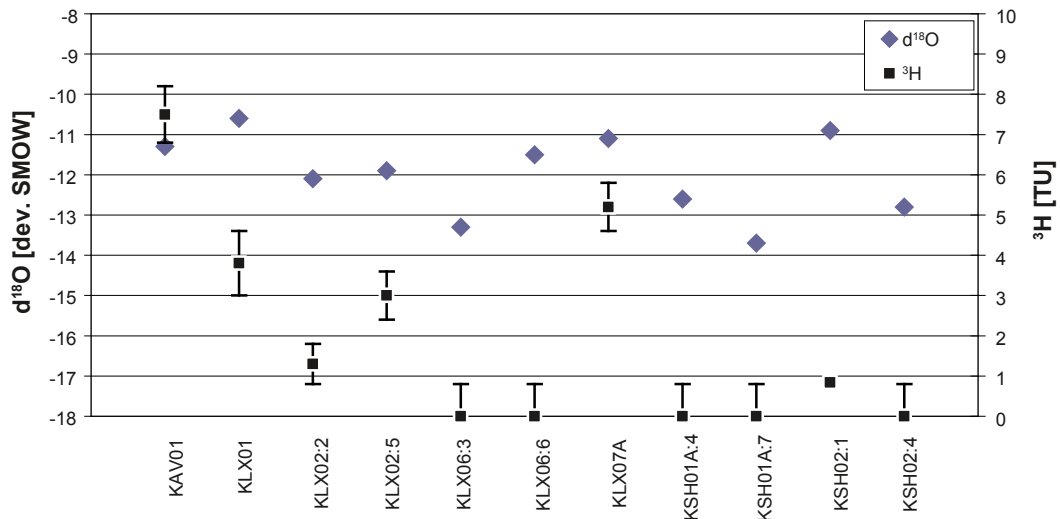


Figure 5-4. $\delta^{18}\text{O}$ and ^3H data from samples collected in the investigated sections.

* The B-isotope ratio is given as $^{10}\text{B}/^{11}\text{B}$ (the result reported from the consulting laboratory). If one wants to use the notation according to international standard for environmental isotopes, $^{11}\text{B}/^{10}\text{B}$, it is necessary to invert the $^{10}\text{B}/^{11}\text{B}$ value ($1/^{10}\text{B}/^{11}\text{B}$).

6 Summary

- Comparison of the results from different laboratories and/or methods showed agreement in most cases.
- The charge balance error exceeded the acceptable level of $\pm 5\%$ in one case, for KLX02:5.
- General judgement of plausibility based on earlier results and experience indicated reasonable values, in most cases.

Sampling and analysis methods

Table A1-1. Sample handling routines and analysis methods

Component group	Component/element	Sample container (material)	Volume (mL)	Filtering	Preparation/Conservation*	Analysis method	Analysis within - or delivery time to lab.	Included in SKB class
Drill water	Uranine	Glass (brown)	100	No	No	Spectrofluorometry	–	3,5
Anions	HCO ₃	Plastic	250	No	No	Titration	The same day – maximum 24 hours	3,5
	pH(lab) cond (lab)					Pot. meas, Cond. meas.		
	Cl ⁻ , SO ₄ ²⁻ , Br ⁻ , F ⁻	Plastic	250	Yes (in connection with analysis)	No	Titration (Cl ⁻) IC (Cl ⁻ , SO ₄ , Br ⁻ , F ⁻) ISE (F ⁻)	Not critical (month)	3,5
Cations, Si and S	Br ⁻ , I ⁻	Plastic	100	Yes	No	ICP MS	Not critical (month)	5
	Na, K, Ca, Mg, S(tot), Si(tot), Li, Sr	Plastic (acid washed)	100	Yes	Yes (1 mL HNO ₃ , suprapur)	ICP AES ICP MS	Not critical (month)	3,5
Cations	Fe, Mn	Plastic (acid washed)	100	Yes	Yes (1mL HNO ₃)	ICP AES ICP MS	Not critical (month)	5
Fe(II), Fe(tot)	Fe(II), Fe(tot)	Plastic-PEH (acid washed)	500	Yes	Yes (5 mL HCl)	Spectrophotometry Ferrozine method	As soon as possible the same day	5
Hydrogen sulphide	HS ⁻	Glass (Winkler)	About 120×2	Yes	Yes (1 mL 1 M NaOH+ 1 mL 1M ZnAc)	Spectrophotometry	Immediately or if conserved, a few days	5
Nutrient salts	NO ₂ , NO ₃ +NO ₂ , PO ₄	Plastic	250	Yes	Yes Frozen, transported in isolated bag	Spectrophotometry	Short transportation time	5
Environmental metals	NH ₄	Plastic cylinder	50	No	No	Spectrophotometry	Maximum 24 hours	5
	Al, As, Ba, B, Cd, Co, Cr, Cu, Hg, Mo, Ni, P, Pb, V, Zn, In	Plastic	100	Yes	Yes (1 mL HNO ₃ suprapur)	ICP AES ICP MS	Not critical (month)	5

Component group	Component/element	Sample container (material)	Volume (mL)	Filtering	Preparation/Conservation*	Analysis method	Analysis within - or delivery time to lab.	Included in SKB class
Lantanoids, U, Th and so on.	Sc, Rb, Y, Zr, I, Sb, Cs, La, Hf, Tl, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, U, Th	Plastic	100	Yes	Yes (1 mL HNO ₃ suprapur)	ICP AES ICP MS	Not critical (month)	5
Dissolved organic Carbon	DOC	Plastic	250	Yes	Yes Frozen, transported in isolated bag	UV oxidation, IR Carbon analyser Shimadzu TOC5000	Short transportation time	5
Total organic Carbon	TOC	Plastic	250	No	Yes Frozen, transported in isolated bag	UV oxidation, IR Carbon analyser Shimadzu TOC5000	Short transportation time	5
Environmental isotopes	$\delta^2\text{H}$, $\delta^{18}\text{O}$	Plastic	100	No	No	MS	Not critical (month)	3,5
Tritium,	^3H (enhanced.)	Plastic (dry bottle)	500	No	Flooded at least once.	LSC	Not critical (month)	3,5
Chlorine-37	$\delta^{37}\text{Cl}$	Plastic	500	No	No	ICP MS	Not critical (month)	5
Carbon isotopes	$\delta^{13}\text{C}$, pmC (^{14}C)	Glass (brown)	100×2	No	No	(A)MS	A few days	5
Sulphur isotopes	$\delta^{34}\text{S}$	Plastic	1,000	No	No	Combustion, ICP MS	No limit	5
Strontium-isotopes	$^{87}\text{Sr}/^{86}\text{Sr}$	Plastic	100	No	No	TIMS	Days or Week	5
Uranium and Thorium isotopes	^{234}U , ^{235}U , ^{238}U , ^{232}Th , ^{230}Th ,	Plastic (HDPE)	1,000	No	No	Chemical Separat. Alfa spectroscopy	No limit	5
Boron isotopes	$^{10}\text{B}/^{11}\text{B}^{**}$	Plastic	100	Yes	Yes (1 mL HNO ₃ suprapur)	ICP MS	No limit	5
Radon and Radium isotopes	^{222}Rn , ^{226}Ra	Plastic HDPE	1,000	No	No	LSS	Immediate transport	5

Component group	Component/ element	Sample container (material)	Volume (mL)	Filtering	Preparation/ Conservation*	Analysis method	Analysis within - or delivery time to lab.	Included in SKB class
Density	Density	Plastic	250	No	Yes	Pycnometer	–	5
Archive samples with acid	–	Plastic (washed in acid)	100×2 ***	Yes	Yes (1 mL HNO ₃)	–	Storage in freeze container	4,5
Archive samples without acid	–	Plastic	250×2 ***	Yes	No	–	Storage in freeze container	2,4,5

* Suprapur acid is used for conservation of samples.

** The B-isotope ratio is given as ¹⁰B/¹¹B (the result reported from the consulting laboratory). If one wants to use the notation according to international standard for environmental isotopes, ¹¹B/¹⁰B, it is necessary to invert the ¹⁰B/¹¹B value (1/¹⁰B/¹¹B).

*** Minimum number, the number of archive samples can vary depending on how many similar samples that are collected at the same occasion.

Abbreviations and definitions:

IC	Ion chromatograph
ISE	Ion selective electrode
ICP AES	Inductively Coupled Plasma Atomic Emission Spectrometry
ICP MS	Inductively Coupled Plasma Mass Spectrometry
INAA	Instrumental Neutron Activation Analysis
MS	Mass Spectrometry
LSC	Liquid Scintillation Counting
(A)MS	(Accelerator) Mass Spectrometry
TIMS	Thermal Ionization Mass Spectrometry
LSS	Liquid Scintillation Spectroscopy

Table A1-2. Reporting limits and measurement uncertainties.

Component	Method	Detection limit	Reporting limit or range	Unit	Measurement uncertainty ²	"Total" uncertainty ³
Uranine	Spectro-fluorometry	0.05		µg/L	15%	15%
pH	Pot. meas.	–	–	–	5%	–
Cond.	Cond. meas.	0.02	1	mS/m	4%	–
HCO ₃ ⁻	Alkalinity titration	0.2	1	mg/L	4%	< 10%
Cl ⁻	Mohr titration	5	70	mg/L	5%	< 10%
Cl ⁻	IC	0.2	0.5		6%	10%
SO ₄	IC	0.2	0.5	mg/L	6%	15%
Br ⁻	IC	0.2	0.7	mg/L	9%	20%
Br ⁻	ICP	–	0.001–0.010 ¹		15%	
F ⁻	IC	0.2	0.6	mg/L	10%	20%
F ⁻	Potentiometry	–	–		–	–
I ⁻	ICP	–	0.001–0.010 ¹	mg/L	15%	20%
Na	ICP	–	0.1	mg/L	4%	10%
K	ICP	–	0.4	mg/L	6%	15%
Ca	ICP	–	0.1	mg/L	4%	10%
Mg	ICP	–	0.09	mg/L	4%	10%
S(tot)	ICP	–	0.160	mg/L	10%	15%
Si(tot)	ICP	–	0.03	mg/L	4%	15%
Sr	ICP	–	0.002	mg/L	4%	15%
Li	ICP	–	0.2–2 ¹	µg/L	10%	20%
Fe	ICP	–	0.4–4 ¹	µg/L	6%	10%
Mn	ICP	–	0.03–0.1	µg/L	8%	10%
Al, Zn	ICP	–	0.2–0.7 ¹	µg/L	12%	–
Ba, Cr, Mo, Pb	ICP	–	0.01–0.3 ¹	µg/L	7–10%	–
Cd, Hg	ICP	–	0.002–0.5 ¹	µg/L	9 and 5% resp.	–
Co, V	ICP	–	0.005–0.05 ¹	µg/L	8 and 5% resp.	–
Cu	ICP	–	0.1–0.5 ¹	µg/L	8%	–
Ni	ICP	–	0.05–0.5 ¹	µg/L	8%	–
P	ICP	–	1–40 ¹	µg/L	6%	15%
As	ICP	–	0.01–0.5 ¹	µg/L	20%	Within the same size (low conc.)
La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y, Hf	ICP	–	0.005–0.05 ¹	µg/L	10%	Within the same size (low conc.)
Sc, In, Th	ICP	–	0.05–0.5 ¹	µg/L	10%	Within the same size (low conc.)
Rb, Zr, Sb, Cs, Tl	ICP	–	0.025–0.25 ¹	µg/L	10%	Within the same size (low conc.)
U	ICP	–	0.001–0.01 ¹	µg/L	12%	Within the same size (low conc.)
Fe(II), Fe(tot)	Spectro-photometry	5	20	µg/L	15% (> 30 µg/L)	20%
NH ₄ -N	Spectro-photometry	3	11–50 > 50	µg/L	10 µg/L 23%	–
NO ₂ -N	Spectro-photometry	–	0.1–20 > 20	µg/L	0.1 µg/L 2%	15%

Component	Method	Detection limit	Reporting limit or range	Unit	Measurement uncertainty ²	"Total" uncertainty ³
NO ₂ -N + NO ₃ -N	Spectrophotometry	–	0.2–20 > 20	µg/L	0.2 µg/L 2.5%	15%
PO ₄ -P	Spectrophotometry	–	0.5–20 > 20	µg/L	0.4 µg/L 2.2%	15%
HS ⁻	Spectrophotometry	2	30–200 200–500	µg/L	30 µg/L 18%	20%
DOC	See Table A9-1	–	0.5	mg/L	8%	30%
TOC	See Table A9-1	–	0.5	mg/L	10%	30%
δ ² H	MS	–	2	‰ SMOW ⁴	1.0‰	–
δ ¹⁸ O	MS	–	0.1	‰ SMOW ⁴	0.2‰	–
³ H	LSC	–	0.8 or 0.1	TU ⁵	0.8 or 0.1 TU	–
δ ³⁷ Cl	ICP MS	–	0.2‰ (20 mg/L)	‰ SMOC ⁶	–	–
δ ¹³ C	A (MS)	–	> 20 mg carbon	‰ PDB ⁷	–	–
pmC (¹⁴ C)	A (MS)	–	> 20 mg carbon	PmC ⁸	–	–
δ ³⁴ S	ICP MS	–	0.2‰	‰ CDT ⁹	0.2‰	–
⁸⁷ Sr/ ⁸⁶ Sr	MS	–	–	No unit (ratio) ¹⁰	0.000020	–
¹⁰ B/ ¹¹ B	ICP MS	–	–	No unit (ratio) ¹⁰	0.0020	–
²³⁴ U, ²³⁵ U, ²³⁸ U, ²³² Th, ²³⁰ Th ²²² Rn, ²²⁶ Rn	Alfa spectr. LSS	– –	0.05 0.1	Bq/L ¹¹ Bq/L	0.05 Bq/L 0.05 Bq/L	Right order of magnitude
Density	Pycnometer			g/mL	0.15%	Within the same size

- Reporting limits at salinity ≤ 0.4% (520 mS/m) and ≤ 3.5% (3,810 mS/m) respectively.
- Measurement uncertainty reported by consulted laboratory, generally 95% confidence interval.
- Estimated total uncertainty by experience (includes effects of sampling and sample handling).
- Per mill deviation¹¹ from SMOW (Standard Mean Oceanic Water).
- TU=Tritium Units, where one TU corresponds to a Tritium/hydrogen ratio of 10⁻¹⁸ (1 Bq/L Tritium = 8.45 TU).
- Per mill deviation¹¹ from SMOC (Standard Mean Oceanic Chloride).
- Per mill deviation¹¹ from PDB (the standard PeeDee Belemnite).
- The following relation is valid between pmC (percent modern carbon) and Carbon-14 age:
pmC = 100 × e^{((1.950 - y - 1.03t) / 8.274)} where y = the year of the C-14 measurement and t = C-14 age
- Per mill deviation¹² from CDT (the standard Canyon Diablo Troilite).
- Isotope ratio without unit.
- The following expressions are applicable to convert activity to concentration, for uranium-238 and thorium-232:
1 ppm U = 12.4 Bq/kg²³⁸U
1 ppm Th = 3.93 Bq/kg²³²Th
- Isotopes are often reported as per mill deviation from a standard. The deviation is calculated as:
δ‰ = 1,000 × (K_{sample} - K_{standard}) / K_{standard}, where K = the isotope ratio and ‰ = ²H, ¹⁸O, ³⁷Cl, ¹³C or ³⁴S etc.

Groundwater chemistry data

Compilation december 2006, results below the line refer to winter sampling

Table A2-1. Water compilation.

Idcode	Secup m	Seclow m	Sample no.	Sampling date and time	pH field	Temperature field °C	Charge Bal %	Na mg/L	K mg/L	Ca mg/L	Mg mg/L	HCO ₃ ⁻ mg/L	Cl ⁻ mg/L	SO ₄ ²⁻ mg/L	SO ₄ -S mg/L	Br (IC/ISE) mg/l	F ⁻ mg/L	Si mg/L
KAV01	391.00	434.00	11187	2006-06-28 07:30	7.32	12.1	0.88	212	4.54	151	14.3	197	473	49.4	18.7	2.48	1.53	7.54
KLX01	171.00	190.00	11209	2006-07-05 08:15	7.49	12.2	0.32	181	4.91	31.3	5.8	277	110	105	36.7	0.40	3.75	7.87
KLX02	1,145.00	1,164.00	11145	2006-06-21 07:55	7.10	14.8	0.66	3,680	16.5	5,730	8.3	17.3	15,000	813	304	117	1.60	11.7
KLX02	452.00	494.00	11144	2006-06-14 07:34	7.24	18.3	7.70	368	3.56	136	10.3	92.9	563	133	52.7	2.30	2.55	8.64
KLX06	554.00	570.00	11208	2006-07-04 08:19	8.51	13.9	0.40	569	8.66	203	13.0	71.7	878	423	157	4.40	3.55	6.66
KLX06	256.00	275.00	11210	2006-07-04 09:30	8.44	14.9	-0.79	134	2.61	8.7	1.4	227	57.7	39.8	14.1	0.24	6.12	7.35
KLX07A	753.00	780.00	11146	2006-06-20 15:50	7.73	14.6	0.76	218	4.35	60.3	8.0	146	318	65.1	25.1	1.70	2.91	8.45
KSH01A	532.00	572.00	11176	2006-06-20 07:30	7.28	13.3	0.43	3,180	12.6	2,140	39.7	18.5	8,560	209	77.9	62.7	1.62	5.92
KSH01A	238.00	277.00	11175	2006-06-20 07:30	7.73	15.2	0.20	2,610	11.9	1,220	62.5	19.9	6,320	25.3	9.68	35.4	1.13	5.33
KSH02	955.00	963.00	11185	2006-06-28 07:30	7.32	12.1	-0.63	4,920	15.8	5,510	5.7	6.63	17,100	592	228	127.0	1.43	5.58
KSH02	411.00	439.00	11186	2006-06-27 07:15	7.45	15.4	-0.42	3,100	10.4	1,770	13.4	97.5	7,910	26.9	26.1	58.4	1.41	10.6
KAV01	391.00	434.00	11483	2006-10-31 14:15	5.83	10.3	-1.20	242	4.92	174	15.3	202	546	53.1	38	3.00	1.45	7.17
KLX01	171.00	190.00	11484	2006-10-31 13:50	7.56	11.7	-1.49	192	4.99	30.5	5.4	278	122	112	41	0.44	4.15	7.38
KLX02	1,145.00	1,164.00	11485	2006-10-31 08:45	7.46	11.2	-1.18	3,450	17.2	5,640	10.2	21.6	15,000	809	334	119	1.75	11.0
KLX02	452.00	494.00	11486	2006-10-31 08:45	7.17	10.7	0.89	393	3.77	133	10.2	131	645	145	65.5	2.78	2.48	8.58
KLX03	729.00	751.00	11482	2006-11-28 12:35	5.50	9.6	A	A	A	A	A	124	1,660	107	A	10.9	2.40	A
KLX04	870.00	897.00	11509	2006-11-14 17:20	7.06	9.2	-2.18	1130	5.77	835	11.5	69.5	3,070	331	133	22.0	1.82	9.10
KLX04	507.00	530.00	11510	2006-11-14 15:53	7.26	9.0	-1.71	416	5.52	163	16.6	103	873	62.2	36.9	4.90	2.33	8.91
KLX05	625.00	633.00	11511	2006-12-06 07:50	7.84	12.3	A	A	A	A	A	A	A	A	A	A	A	A
KLX05	241.00	255.00	11463	2006-10-24 12:30	8.42	11.3	-1.33	449	4.31	55.3	7.3	180	626	126	45.6	2.53	3.25	5.06
KLX06	554.00	570.00	11461	2006-10-24 14:45	8.62	11.0	-0.08	514	8.27	169	10.6	86.3	778	376	135	4.45	3.18	6.43
KLX06	256.00	275.00	11464	2006-10-24 14:45	8.83	11.5	-1.95	130	2.58	8.4	1.3	224	58.7	40.6	13.5	0.24	6.24	7.04
KLX07	753.00	780.00	11462	2006-12-05 16:22	7.73	10.3	A	A	A	A	A	76.5	797	121	A	4.5	2.35	A
KLX10	689.00	710.00	11466	2006-10-27 11:02	7.66	9.5	-2.12	1,280	14.1	580	59.9	114	3,160	113	45.1	12.3	1.66	7.62
KLX10	351.00	368.00	11465	2006-10-27 11:02	6.67	9.3	-3.19	859	7.41	221	32.3	98.4	1,700	284	76.4	11.8	4.45	6.12
KLX12A	535.00	545.00	11487	2006-11-14 16:00	7.92	8.6	-1.23	1,100	6.89	345	13.6	91.8	2,220	168	60.9	11.3	2.05	7.63
KSH01A	532.00	572.00	11493	2006-11-08 07:30	7.89	10.6	-2.32	3,060	11.5	2,290	42.8	19.2	9,130	218	84.2	66.9	1.66	5.05
KSH01A	238.00	277.00	11494	2006-11-08 07:30	7.90	10.7	-4.12	2,430	10.0	1,200	68.7	20.1	6,570	24.5	9.6	37.5	1.22	4.69
KSH02	955.00	963.00	11495	2006-11-08 09:00	8.67	10.3	-0.18	4,850	17.3	5,730	5.8	7.4	17,200	566	244	103	1.45	5.32
KSH02	411.00	439.00	11496	2006-11-08 09:00	7.76	10.0	-2.60	2,930	10.3	1,850	13.9	95.8	8,090	36.8	50.8	55.5	1.37	9.71

Idcode	Secup m	Seclow m	Sample no.	Fe mg/L	Fe-tot mg/L	Fe(II) mg/L	Mn mg/L	Li mg/L	Sr mg/L	F ⁻ mg/L	pH	DOC mg/L	TOC mg/L	HS ⁻ mg/L	Drill_water %	EiCond mS/m	NH ₄ -N mg/L	NO ₂ -N mg/L
KAV01	391.00	434.00	11187	0.92	0.85	0.837	1.130	0.088	1.60	0.020	7.29	11	12	0.295	0.12	192	0.0607	< 0.0002
KLX01	171.00	190.00	11209	4.3	4.05	4.05	0.352	0.012	0.383	0.009	7.49	9.0	9.1	0.053	0.14	103	0.1530	< 0.0002
KLX02	1,145.00	1,164.00	11145	1.59	1.36	1.34	0.540	2.520	103	0.644	7.37	1.2	1.5	0.165	0.54	3,790	0.0975	0.0003
KLX02	452.00	494.00	11144	15.0	15.0	14.95	0.712	0.097	1.52	0.020	6.87	140	150	0.112	4.73	245	0.0185	< 0.0002
KLX06	554.00	570.00	11208	0.142	0.135	0.127	0.113	0.092	3.98	0.046	8.39	3.3	3.5	0.154	10.3	360	0.120	< 0.0002
KLX06	256.00	275.00	11210	0.0615	0.055	0.050	0.0145	0.020	0.235	0.004	8.87	3.4	3.5	0.143	3.56	65,7	0.0273	0.0003
KLX07A	753.00	780.00	11146	0.535	0.516	0.502	0.230	0.041	0.639	0.017	7.80	3.6	3.8	0.094	1.75	141	0.130	0.0002
KSH01A	532.00	572.00	11176	0.322	0.356	0.344	0.461	0.716	36.8	0.344	7.50	1.2	1.2	0.265	17.5	2,310	0.0375	0.0003
KSH01A	238.00	277.00	11175	0.611	0.604	0.584	0.626	0.477	21.3	0.191	7.57	1.0	1.0	0.135	6.61	1,750	0.0793	< 0.0002
KSH02	955.00	963.00	11185	0.0473	0.072	0.055	0.076	0.997	95.4	0.771	8.32	1	< 1.0	0.299	0.82	4,200	0.0051	< 0.0002
KSH02	411.00	439.00	11186	0.0312	0.055	0.044	0.160	0.439	28.5	0.393	7.38	240	240	> 2	17.5	2,170	0.0436	< 0.0002
KAV01	391.00	434.00	11483	0.897	-	-	1.28	0.083	2.01	-	7.21	-	-	-	0.09	201	-	-
KLX01	171.00	190.00	11484	3.69	-	-	0.306	0.012	0.388	-	7.46	-	-	-	0.10	105	-	-
KLX02	1,145.00	1,164.00	11485	1.78	1.89	1.89	0.683	2.32	100	0.551	7.24	A	A	0.171	0.87	3,700	0.156	< 0.0002
KLX02	452.00	494.00	11486	8.79	8.50	8.46	0.536	0.091	1.58	0.015	7.20	A	A	0.370	1.30	264	0.0481	< 0.0002
KLX03	729.00	751.00	11482	A	0.117	0.111	A	A	A	A	7.67	A	A	1.560	8.33	536	0.172	-
KLX04	870.00	897.00	11509	0.411	-	-	0.272	0.275	15.2	-	7.02	-	-	-	2.78	930	-	-
KLX04	507.00	530.00	11510	0.302	0.312	0.304	0.355	0.092	2.84	0.051	7.65	A	A	0.837	2.27	301	0.161	0,0002
KLX05	625.00	633.00	11511	A	-	-	A	A	A	A	A	-	-	-	A	A	-	-
KLX05	241.00	255.00	11463	0.709	-	-	0.101	0.050	1.05	0.025	8.39	A	A	0.080	0.99	253	0.0447	< 0.0002
KLX06	554.00	570.00	11461	0.0495	0.057	0.043	0.0648	0.087	3.32	0.048	8.49	A	A	0.509	9.31	327	0.120	< 0.0002
KLX06	256.00	275.00	11464	0.057	0.077	0.063	0.0122	0.021	0.232	0.003	8.85	A	A	0.186	3.62	65.5	0.0299	< 0.0002
KLX07	753.00	780.00	11462	A	-	-	A	A	A	A	7.69	-	-	-	4.01	287	-	-
KLX10	689.00	710.00	11466	0.190	-	-	0.302	0.169	9.68	-	7.50	-	-	-	11.8	944	-	-
KLX10	351.00	368.00	11465	0.195	-	-	0.186	0.093	3.48	-	7.98	-	-	-	35.2	477	-	-
KLX12A	535.00	545.00	11487	0.172	0.169	0.164	0.193	0.116	6.29	0.095	8.00	A	A	4.07	7.10	699	0.0142	< 0.0002
KSH01A	532.00	572.00	11493	0.219	-	-	0.461	0.728	34.0	-	7.61	-	-	-	9.27	2,370	-	-
KSH01A	238.00	277.00	11494	0.602	-	-	0.670	0.446	19.6	-	7.76	-	-	-	4.32	1,760	-	-
KSH02	955.00	963.00	11495	0.0408	-	-	0.086	1.07	94.1	-	8.36	-	-	-	0.59	4,200	-	-
KSH02	411.00	439.00	11496	0.0334	-	-	0.167	0.414	28.2	-	7.37	-	-	-	10.8	2,160	-	-

Idcode	Secup m	Seclow m	Sample no.	NO ₃ -N mg/L	NO ₂ -N+NO ₃ -N mg/L	PO ₄ -P mg/L	P (ICP) mg/L	Density g/mL
KAV01	391.00	434.00	11187	0.0014	0.0015	0.0006	0.0034	0.9978
KLX01	171.00	190.00	11209	0.0013	0.0013	0.0012	0.0225	0.9975
KLX02	1,145.00	1,164.00	11145	< 0.0003	0.0005	0.0050	< 0.04	1.0160
KLX02	452.00	494.00	11144	< 0.0003	< 0.0003	< 0.0005	0.00529	0.9980
KLX06	554.00	570.00	11208	0.0047	0.0047	0.0057	0.012	0.9987
KLX06	256.00	275.00	11210	0.0035	0.0038	0.0252	0.0242	0.9974
KLX07A	753.00	780.00	11146	0.0008	0.0010	0.0032	0.0117	0.9975
KSH01A	532.00	572.00	11176	0.0005	0.0007	0.0010	< 0.04	1.0074
KSH01A	238.00	277.00	11175	< 0.0003	< 0.0003	< 0.0005	0.133	1.0045
KSH02	955.00	963.00	11185	0.0006	0.0006	0.0005	< 0.010	1.0178
KSH02	411.00	439.00	11186	0.0004	0.0004	0.0011	< 0.010	1.0066
KAV01	391.00	434.00	11483	-	-	-	-	x
KLX01	171.00	190.00	11484	0.0007	0.0007	0.0007	< 0.04	x
KLX02	1,145.00	1,164.00	11485	0.0005	0.0005	< 0.0005	0.00442	0.9987
KLX02	452.00	494.00	11486	-	-	-	-	0.9992
KLX03	729.00	751.00	11482	-	-	-	-	1.0011
KLX04	870.00	897.00	11509	< 0.0003	0.0003	0.0015	0.00757	0.9982
KLX04	507.00	530.00	11510	-	-	-	-	A
KLX05	625.00	633.00	11511	< 0.0003	< 0.0003	0.0037	0.0129	x
KLX05	241.00	255.00	11463	< 0.0003	< 0.0003	0.0059	0.0136	0.9984
KLX06	554.00	570.00	11461	< 0.0003	< 0.0003	0.0225	0.0276	0.9972
KLX06	256.00	275.00	11464	-	-	-	-	A
KLX07	753.00	780.00	11462	-	-	-	-	1.0009
KLX10	689.00	710.00	11466	-	-	-	-	0.9992
KLX10	351.00	368.00	11465	0.0007	0.0008	0.0008	0.00864	1.0000
KLX12A	535.00	545.00	11487	-	-	-	-	1.0079
KSH01A	532.00	572.00	11493	-	-	-	-	x
KSH01A	238.00	277.00	11494	-	-	-	-	1.0191
KSH02	955.00	963.00	11495	-	-	-	-	1.0067
KSH02	411.00	439.00	11496	-	-	-	-	-

- = Not analysed

A = Results will be reported later

< "value" = Result less than detection limit

ChargeBal % = Rel. charge balance error %

Table A2-2. Trace elements.

Idcode	Secup m	Seclow m	Sample no.	Sampling date and time	U µg/L	Th µg/L	As µg/L	Sc µg/L	Cd µg/L	Hg µg/L	V µg/L	Y µg/L	Rb µg/L
KAV01	391.00	434.00	11187	2006-06-28 07:30	1.10	0.188	< 0.1	0.161	0.0239	< 0.002	2.63	4.05	5.88
KLX01	171.00	190.00	11209	2006-07-05 08:15	0.304	0.105	0.24	0.0799	< 0.002	< 0.002	2.66	1.30	5.32
KLX02	1,145.00	1,164.00	11145	2006-06-21 07:55	0.0714	< 0.2	< 10	1.69	< 0.05	0.0037	0.403	1.74	69.8
KLX02	452.00	494.00	11144	2006-06-14 07:34	0.0856	< 0.04	< 0.5	< 0.1	< 0.004	0.0102	0.469	0.290	7.03
KLX06	554.00	570.00	11208	2006-07-04 08:19	0.129	< 0.02	< 0.1	< 0.05	< 0.002	< 0.002	0.363	0.0752	23.7
KLX06	256.00	275.00	11210	2006-07-04 09:30	1.19	0.0205	0.28	< 0.05	< 0.005	0.0032	0.491	0.0361	5.45
KLX07A	753.00	780.00	11146	2006-06-20 15:50	0.561	< 0.02	0.379	< 0.05	< 0.002	< 0.002	0.673	0.162	7.41
KSH01A	532.00	572.00	11176	2006-06-20 07:30	0.102	< 0.2	< 5	< 0.5	< 0.05	< 0.002	0.121	0.578	31.1
KSH01A	238.00	277.00	11175	2006-06-20 07:30	0.074	< 0.2	< 5	< 0.5	< 0.05	< 0.002	0.426	0.422	26.4
KSH02	955.00	963.00	11185	2006-06-28 07:30	< 0.005	< 0.2	< 1	< 0.5	0.0263	0.0066	0.317	0.476	63.7
KSH02	411.00	439.00	11186	2006-06-27 07:15	0.0336	< 0.2	< 1	< 0.5	0.0252	0.0084	0.207	0.335	22.9
KLX02	1,145.00	1,164.00	11485	2006-10-31 08:45	0.171	< 0.2	< 1	2.67	0.0073	0.0023	0.37	1.63	70.1
KLX02	452.00	494.00	11486	2006-10-31 08:45	0.198	< 0.02	< 0.1	0.0526	0.0144	0.0027	0.527	0.244	7.73
KLX03	729.00	751.00	11482	2006-11-28 12:35	A	A	A	A	A	A	A	A	A
KLX04	507.00	530.00	11510	2006-11-14 15:53	0.741	< 0.02	0.15	< 0.05	< 0.002	< 0.002	0.375	0.137	12.8
KLX05	241.00	255.00	11463	2006-10-24 12:30	1.38	< 0.02	< 0.1	< 0.05	0.0515	0.0045	0.281	0.048	10.3
KLX06	554.00	570.00	11461	2006-10-24 14:45	0.206	< 0.02	0.22	0.057	0.031	< 0.002	0.317	0.0936	23.6
KLX06	256.00	275.00	11464	2006-10-24 14:45	1.66	< 0.02	0.408	< 0.05	0.0162	< 0.002	0.499	0.0369	5.9
KLX12A	535.00	545.00	11487	2006-11-14 16:00	0.249	< 0.2	< 0.5	< 0.4	< 0.02	0.0123	0.217	0.0777	18.3

Idcode	Secup m	Seclow m	Sample no.	Sampling date and time	Zr µg/L	In µg/L	Cs µg/L	Ba µg/L	La µg/L	Hf µg/L	Tl µg/L	Ce µg/L
KAV01	391.00	434.00	11187	2006-06-28 07:30	2.39	< 0.05	0.241	179	1.96	0.0354	< 0.005	4.12
KLX01	171.00	190.00	11209	2006-07-05 08:15	1.31	< 0.05	0.155	29	0.914	0.0183	< 0.005	1.56
KLX02	1,145.00	1,164.00	11145	2006-06-21 07:55	0.558	< 0.5	3.150	303	2.29	< 0.05	< 0.05	0.673
KLX02	452.00	494.00	11144	2006-06-14 07:34	0.0689	< 0.1	0.147	766	0.342	< 0.01	< 0.01	0.306
KLX06	554.00	570.00	11208	2006-07-04 08:19	0.0903	< 0.05	0.332	699	0.0797	< 0.005	< 0.005	0.0924
KLX06	256.00	275.00	11210	2006-07-04 09:30	0.178	< 0.05	0.125	24.5	0.140	< 0.005	< 0.005	0.196
KLX07A	753.00	780.00	11146	2006-06-20 15:50	0.0530	< 0.05	0.387	57.9	0.106	< 0.005	< 0.005	0.134
KSH01A	535.00	572.00	11176	2006-06-20 07:30	< 0.3	< 0.5	1.53	282	0.314	< 0.05	< 0.05	0.235
KSH01A	238.00	277.00	11175	2006-06-20 07:30	< 0.3	< 0.5	1.23	1440	0.137	< 0.05	< 0.05	0.0966
KSH02	955.00	963.00	11185	2006-06-28 07:30	< 0.3	< 0.5	5.19	143	0.457	< 0.05	< 0.05	0.139
KSH02	411.00	439.00	11186	2006-06-27 07:15	< 0.3	< 0.5	14.8	1,1600	0.683	< 0.05	< 0.05	0.617
KLX02	1,145.00	1,164.00	11485	2006-10-31 08:45	0.0321	< 0.5	3.06	385	1.84	< 0.05	< 0.05	0.607
KLX02	452.00	494.00	11486	2006-10-31 08:45	0.197	< 0.05	0.153	791	0.315	< 0.005	< 0.005	0.241
KLX03	729.00	751.00	11482	2006-11-28 12:35	A	A	A	A	A	A	A	A
KLX04	507.00	530.00	11510	2006-11-14 15:53	0.131	< 0.05	0.593	361	0.145	< 0.005	< 0.005	0.182
KLX05	241.00	255.00	11463	2006-10-24 12:30	0.14	< 0.05	0.137	50.2	0.0279	< 0.005	< 0.005	0.0347
KLX06	554.00	570.00	11461	2006-10-24 14:45	0.056	< 0.05	0.292	429	0.0736	< 0.005	< 0.005	0.0882
KLX06	256.00	275.00	11464	2006-10-24 14:45	0.122	< 0.05	0.142	27.2	0.146	< 0.005	< 0.005	0.191
KLX12A	535.00	545.00	11487	2006-11-14 16:00	0.634	< 0.2	0.231	121	0.0634	< 0.02	< 0.03	0.0731

Idcode	Secup m	Seclow m	Sample no.	Sampling date and time	Tm µg/L	Yb µg/L	Lu µg/L
KAV01	391.00	434.00	11187	2006-06-28 07:30	0.0457	0.372	0.0634
KLX01	171.00	190.00	11209	2006-07-05 08:15	0.0164	0.121	0.0209
KLX02	1,145.00	1,164.00	11145	2006-06-21 07:55	< 0.05	< 0.05	< 0.05
KLX02	452.00	494.00	11144	2006-06-14 07:34	< 0.01	0.0185	< 0.01
KLX06	554.00	570.00	11208	2006-07-04 08:19	< 0.005	0.0069	< 0.005
KLX06	256.00	275.00	11210	2006-07-04 09:30	< 0.005	< 0.005	< 0.005
KLX07A	753.00	780.00	11146	2006-06-20 15:50	< 0.005	0.0078	< 0.005
KSH01A	535.00	572.00	11176	2006-06-20 07:30	< 0.05	< 0.05	< 0.05
KSH01A	238.00	277.00	11175	2006-06-20 07:30	< 0.05	< 0.05	< 0.05
KSH02	955.00	963.00	11185	2006-06-28 07:30	< 0.05	0.130	< 0.05
KSH02	411.00	439.00	11186	2006-06-27 07:15	< 0.05	0.08	< 0.05
KLX02	1,145.00	1,164.00	11485	2006-10-31 08:45	< 0.05	< 0.05	< 0.005
KLX02	452.00	494.00	11486	2006-10-31 08:45	< 0.005	0.0235	0.0075
KLX03	729.00	751.00	11482	2006-11-28 12:35	A	A	A
KLX04	507.00	530.00	11510	2006-11-14 15:53	< 0.005	0.0094	< 0.005
KLX05	241.00	255.00	11463	2006-10-24 12:30	< 0.005	0.0053	< 0.005
KLX06	554.00	570.00	11461	2006-10-24 14:45	< 0.005	< 0.005	< 0.005
KLX06	256.00	275.00	11464	2006-10-24 14:45	< 0.005	< 0.005	< 0.005
KLX12A	535.00	545.00	11487	2006-11-14 16:00	< 0.02	< 0.02	< 0.02

< "value" = Result less than detection limit

A = Results will be reported later

Table A2-3. Isotopes I (H-, O-, B-, S-, Sr- C- and Cl-isotopes).

Idcode	Secup m	Seclow m	Sample no.	Sampling date and time	$\delta^2\text{H}$ dev SMOW	^3H TU	$\delta^{18}\text{O}$ dev SMOW	$^{10}\text{B}/^{11}\text{B}$ no unit	$\delta^{34}\text{S}$ dev CDT	$\delta^{13}\text{C}$ dev PDB	$^{87}\text{Sr}/^{86}\text{Sr}$ no unit	^{14}C pmC	AGE_BP years	$\delta^{37}\text{Cl}$ dev SMOC
KAV01	391.00	434.00	11187	2006-06-28 07:30	-79.9	7.5	-11.3	0.2359	23.7	xx	0.716595	A	A	A
KLX01	171.00	190.00	11209	2006-07-05 08:15	-78.3	3.8	-10.6	0.2364	28.3	-15.56	0.716951	A	A	0.19
KLX02	1,145.00	1,164.00	11145	2006-06-21 07:55	-83.7	1.3	-12.1	0.2370	11.4	A	0.720118	A	A	0.74
KLX02	452.00	494.00	11144	2006-06-14 07:34	-89.5	3.0	-11.9	0.2331	24.5	A	0.721514	A	A	0.03
KLX06	554.00	570.00	11208	2006-07-04 08:19	-98.8	< 0.8	-13.3	0.2375	12.9	-18.27	0.715811	A	A	0.26
KLX06	256.00	275.00	11210	2006-07-04 09:30	-83.9	< 0.8	-11.5	0.2371	32.9	-16.38	0.716043	A	A	0.23
KLX07A	753.00	780.00	11146	2006-06-20 15:50	-79.6	5.2	-11.1	0.2371	16.8	A	0.719466	A	A	0.41
KSH01A	532.00	572.00	11176	2006-06-20 07:30	-90.7	< 0.8	-12.6	0.2364	19.3	A	0.715614	A	A	0.32
KSH01A	238.00	277.00	11175	2006-06-20 07:30	-100.2	< 0.8	-13.7	0.2357	28.0	A	0.711495	A	A	0.19
KSH02	955.00	963.00	11185	2006-06-28 07:30	-73.5	0.84	-10.9	0.2386	13.3	x	0.715958	A	A	A
KSH02	411.00	439.00	11186	2006-06-27 07:15	-91.2	< 0.8	-12.8	0.2374	21.3	21.38	0.715390	x	x	A
KAV01	391.00	434.00	11483	2006-10-31 14:15	-74.1	A	-11.2	-	-	-	-	-	-	-
KLX01	171.00	190.00	11484	2006-10-31 13:50	-71.9	A	-10.6	-	-	-	-	-	-	-
KLX02	1,145.00	1,164.00	11485	2006-10-31 08:45	-75.4	A	-12.0	0.2375	12.5	A	0.717464	A	A	A
KLX02	452.00	494.00	11486	2006-10-31 08:45	-78.9	A	-11.9	0.2363	24.4	A	0.716214	A	A	A
KLX03	729.00	751.00	11482	2006-11-28 12:35	A	A	A	A	A	A	A	A	A	A
KLX04	870.00	897.00	11509	2006-11-14 17:20	A	A	A	-	-	-	-	-	-	-
KLX04	507.00	530.00	11510	2006-11-14 15:53	A	A	A	0.2370	A	A	A	A	A	A
KLX05	241.00	255.00	11463	2006-10-24 12:30	-81.4	A	-12.0	0.2352	27.0	A	0.715282	A	A	A
KLX06	554.00	570.00	11461	2006-10-24 14:45	-88.4	A	-13.0	0.2364	13.5	A	0.715787	A	A	A
KLX06	256.00	275.00	11464	2006-10-24 14:45	-75.4	A	-11.3	0.2357	30.9	A	0.715759	A	A	A
KLX10	689.00	710.00	11466	2006-10-27 11:02	-71.1	A	-10.1	-	-	-	-	-	-	-
KLX10	351.00	368.00	11465	2006-10-27 11:02	-73.8	A	-10.5	-	-	-	-	-	-	-
KLX12A	535.00	545.00	11487	2006-11-14 16:00	A	A	A	0.2358	A	A	A	A	A	A

- = Not analysed

< "value" = Result less than detection limit

A = Will be reported later

x = No result due to analytical problems

x = No result due to transportation problems

Table A2-4. Isotopes II. U– Th– Ra– and Rn isotopes.

Idcode	Secup m	Seclow m	Sample no.	Sampling date and time	²³⁸U mBq/L	²³⁴U mBq/L	²³⁰Th mBq/L	²²⁶Ra Bq/L	²²²Rn Bq/L
KAV01	391.00	434.00	11187	2006-06-28 07:30	A	A	A	0.072	100
KLX01	171.00	190.00	11209	2006-07-05 08:15	A	A	A	< 0.015	11
KLX02	1,145.00	1,164.00	11145	2006-06-21 07:55	1.2	2.3	0.31	< 0.015	56
KLX02	452.00	494.00	11144	2006-06-14 07:34	3.88	1.97	< 0.5	< 0.015	318
KLX06	554.00	570.00	11208	2006-07-04 08:19	A	A	A	< 0.015	174
KLX06	256.00	275.00	11210	2006-07-04 09:30	A	A	A	< 0.015	180
KLX07A	753.00	780.00	11146	2006-06-20 15:50	9.0	24.1	0.38	< 0.015	37
KSH01A	532.00	572.00	11176	2006-06-20 07:30	1.4	4.1	0.78	< 0.015	109
KSH01A	238.00	277.00	11175	2006-06-20 07:30	0.88	2.1	0.26	< 0.015	94
KSH02	955.00	963.00	11185	2006-06-28 07:30	0.10	0.34	0.13	0.0196	130
KSH02	411.00	439.00	11186	2006-06-27 07:15	1.30	3.2	0.29	3.31	217
KLX02	1,145.00	1,164.00	11485	2006-10-31 08:45	A	A	A	A	A
KLX02	452.00	494.00	11486	2006-10-31 08:45	A	A	A	A	A
KLX03	729.00	751.00	11482	2006-11-28 12:35	A	A	A	A	A
KLX04	507.00	530.00	11510	2006-11-14 15:53	A	A	A	A	A
KLX05	241.00	255.00	11463	2006-10-24 12:30	A	A	A	A	A
KLX06	554.00	570.00	11461	2006-10-24 14:45	A	A	A	A	A
KLX06	256.00	275.00	11464	2006-10-24 14:45	A	A	A	A	A
KLX12A	535.00	545.00	11487	2006-11-14 16:00	A	A	A	A	A

– = Not analysed

A = Results will be reported later

< "value" = Result less than detection limit