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Oskarshamn site investigation

Hydrochemical logging in KLX20A

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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 author and do not necessarily coincide with those of the client.

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Abstract

Hydrochemical logging, also called tube sampling, has been performed in the core drilled borehole KLX20A. The method is a fast and simple sampling technique for obtaining information about the chemical composition of the water along an open borehole. The equipment consists of an approximately 450 m long polyamide tube divided into units of 50 m.

The water content in each tube unit constituted one sample. Every second sample, starting with the uppermost tube unit, was analysed according to SKB chemistry class 3 (isotope options excluded). Samples for isotope determination were collected at the time of sampling and stored in a freezer (tritium and carbon isotopes in a refrigerator); $\delta^{18}\text{O}$, deuterium ($\delta^2\text{H}$), tritium (^3H), ^{10}B , $\delta^{37}\text{Cl}$ and ^{87}Sr from odd-numbered tube units and $\delta^{34}\text{S}$ and carbon isotopes from even-numbered tube units. If any analyses of these samples will be performed, the results will be presented in a separate report.

The drill water content remaining in the borehole after drilling was low ($< 5\%$) in all five samples from the borehole. The relative charge balance error did not exceed the acceptable limit of $\pm 5\%$, except for one sample (6% in the tube unit from 100–150 m of borehole length) out of five. Based on general trends, there is no reason to discard the results from this sample despite the higher relative error of analysis.

Sammanfattning

Hydrokemisk loggning, även kallad slangprovtagning, har utförts i det kärnborrade borrhålet KLX20A. Metoden är snabb och enkel att använda för att erhålla information om den kemiska sammansättningen hos grundvattnet längs ett öppet borrhål. Utrustningen består av en cirka 450 m lång polyamidslang uppdelad i enheter om vardera 50 m.

Innehållet i en slangenhet utgör ett prov. Varannan slangenhet, med start från den översta, analyserades enligt SKB kemiklass 3 (exklusive alla tillval). Prover för bestämning av isotoptillvalen togs ut vid provtagningstillfället och sparades i frys (tritium och kolisotoper i kylskåp); $\delta^{18}\text{O}$, deuterium ($\delta^2\text{H}$), tritium (^3H), ^{10}B , $\delta^{37}\text{Cl}$ och ^{87}Sr ur udda enheter, $\delta^{34}\text{S}$ och kolisotoper ur jämna enheter. Om proven skickas för analys, kommer resultaten av dessa analyser att sammanfattas i en separat rapport.

Halten kvarvarande spolvatten i borrhålet efter avslutad borrning var låg ($< 5\%$) i alla de fem proverna från borrhålet. Det relativa felet i jonbalansen översteg inte den acceptabla nivån av $\pm 5\%$, utom i ett (6 % i slangenheten från 100–150 m borrhålslängd) av de fem analyserade. Baserat på generella trender finns ingen anledning att utesluta resultat från detta prov, trots det större relativa felet i jonbalans.

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1 Introduction

This document reports the performance and results from the hydrochemical logging in borehole KLX20A. The hydrochemical logging is one of the activities performed within the site investigation at Oskarshamn /1, 2/. The work was carried out in accordance with activity plan AP PS 400-06-064. In Table 1-1 controlling documents for performing this activity are listed. Both activity plan and method descriptions are SKB's internal controlling documents. The obtained data from the activity are reported to the database SICADA, where they are traceable by the activity plan number.

Borehole KLX20A is a 457.92 m long core drilled borehole, drilled within the site investigation in the Oskarshamn area. The percussion borehole HLX28 served as the source of flushing water for the drilling of KLX20A. The locations of KLX20A and HLX28 are shown in Figure 1-1.

The borehole KLX20A is not of the so called SKB chemical type; see method descriptions MD 620.003 (Method description for drilling cored boreholes) and 610.003 (Method description for percussion drilling). The cleaning procedures of all equipment used in the borehole, during and after drilling, were performed according to level 1 in the cleaning instructions in MD 600.004 (Instruktion för rengöring av borrhålsutrustning och viss markbaserad utrustning).

Table 1-1. SKB internal controlling documents for the performance of the activity.

| Activity plan | Number | Version |
|---|------------------|----------------|
| Hydrokemisk loggning i KLX20A | AP PS 400-06-064 | 1.0 |
| Method descriptions | Number | Version |
| Metodbeskrivning för hydrokemisk loggning | SKB MD 422.001 | 2.0 |
| Instruktion för rengöring av borrhålsutrustning och viss markbaserad utrustning | SKB MD 600.004 | 1.0 |

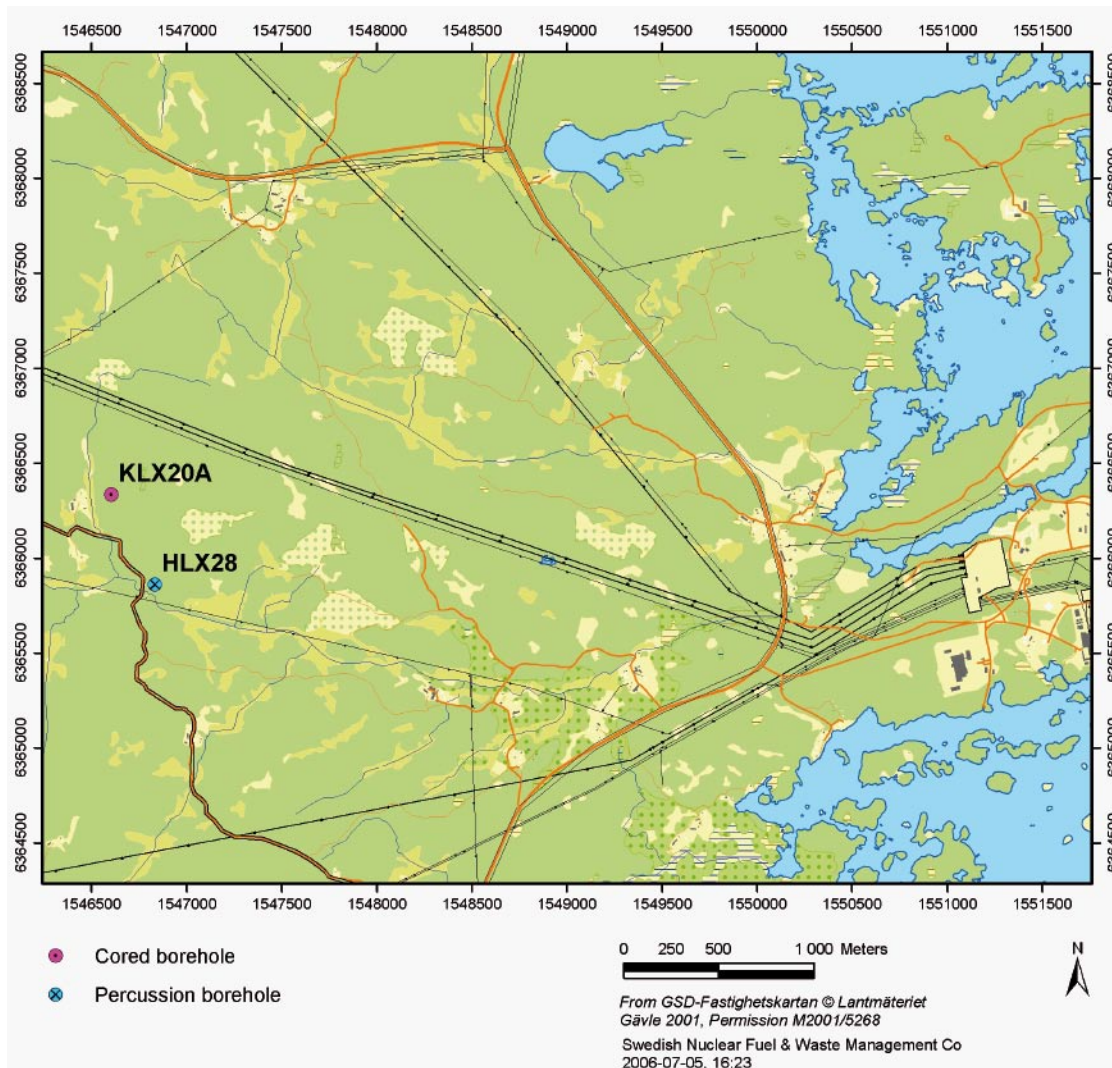


Figure 1-1. Location of the core drilled borehole KLX20A and the percussion borehole HLX28 within the site investigation in the Oskarshamn area.

2 Objective and scope

Hydrochemical logging was performed in order to obtain an overview of the chemical composition of the water along the open borehole KLX20A. The technique used for sampling is fast and simple, also for boreholes of considerable lengths.

The analysis program was carried out according to SKB chemistry class 3 except for optional isotopes. Sample portions intended for isotope analyses were also collected at the time of sampling. If these samples will be analysed, the results will be presented in a separate report.

3 Sampling equipment

For the hydrochemical logging an approximately 450 m long polyamide tube, divided into units of 50 m, was used. The equipment is described in the method description, see Table 1-1.

A schematic picture of the equipment used for the hydrochemical logging is shown in Figure 3-1. The tube units are connected using metal couplings and manual shut off valves. The external and internal diameters of the tube units are 10 and 8 mm, respectively. The first tube lowered down the borehole has a non-return valve at the bottom to prevent water outflow while lifting the tube units. At the lower end of the tube array, a weight is added in order to stretch the array and thereby prevent fastening.

The water content in each tube unit constitutes one sample, and the volume of each sample is approximately two and a half litres.

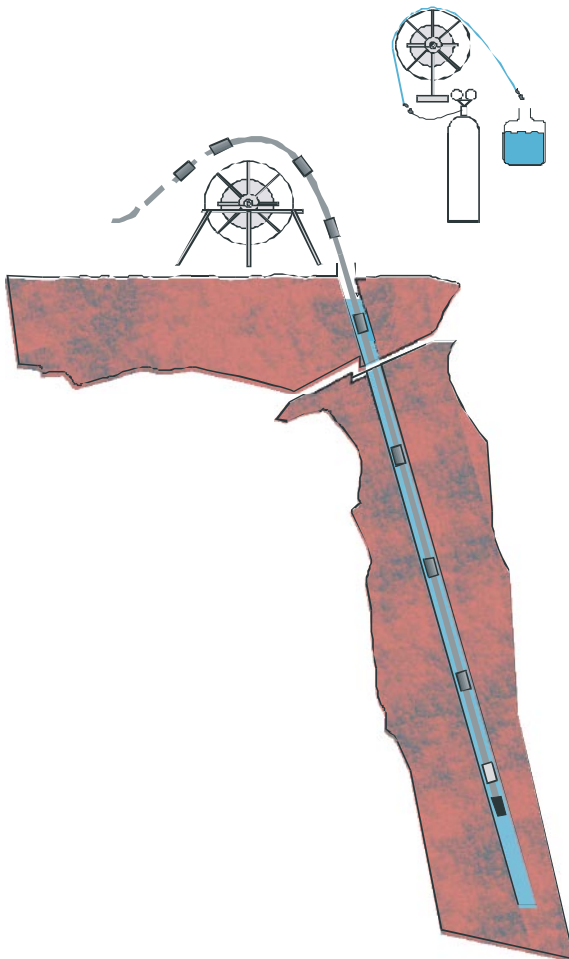


Figure 3-1. Equipment for hydrochemical logging in boreholes. At the lower end of the tube array there is a non-return valve and a weight connected. Each tube unit is 50 m long.

4 Performance

4.1 Hydrochemical logging

The hydrochemical logging in KLX20A was performed on June 14, 2006 according to the activity plan AP PS 400-06-064 and in compliance with the method description SKB MD 422.001 (cf. Table 1-1).

The equipment was lowered to a length of 450 m of borehole length, in order to avoid potential settled drilling debris at the bottom of the borehole, and thereby decrease the risk of fastening. The tubes were lowered down the borehole at a rate of about five m/minute. The lowering of the tube units started at 08:32 and the lifting of the tubes started at 10:36. The last tube unit was retrieved at 11:08. Pressurized nitrogen gas was used to empty the tube units and the water samples were portioned into sample bottles. Each tube unit represented one sample.

The ground water level measured before and after the hydrochemical logging was 18.50 and 19.08 m, respectively, below top of casing. As the ground water level was low, the sampling resulted in an uppermost not completely filled tube unit.

4.2 Sample treatment and chemical analysis

An overview of sample treatment and analysis routines of the activity is given in Appendix 1.

An overview showing the samples obtained at the logging occasion is given in Table 4-1. The analysis program was carried out according to SKB chemistry class 3 except for optional isotopes. Sample portions intended for isotope analyses were collected at the sampling occasion but not sent for analysis. These samples are stored in a freezer at SKB (except for the samples collected for tritium and carbon isotope determinations which are stored in a refrigerator). If these samples will be sent for analysis the results will be presented in a separate report. The data from the hydrochemical logging are stored in the database SICADA. The SKB sample numbers are 11161–11169.

The uppermost tube unit was not completely filled with sample water, see section 4.1. All other tube units seemed, by visual inspection, to be fully filled with sample water; only small bubbles of gas was observed during lifting. Due to the lack of water in tube unit number nine (0–50 m), see above, archive samples from tube unit number eight were not obtained. Water intended for archive samples from tube unit number eight was used to fill sample bottles for analyses of deuterium ($\delta^2\text{H}$), $\delta^{18}\text{O}$, $^{10}\text{B}/^{11}\text{B}$ and $^{87}\text{Sr}/^{86}\text{Sr}$ from tube unit number nine (0–50 m), and sampling of $\delta^{37}\text{Cl}$ was omitted.

Table 4-1. Overview of samples collected at the Hydrochemical logging in KLX20A. Filled cells represent collected samples. Striped (blue) filling represents samples sent for analyses, light (yellow) filling represents samples collected and stored in a freezer (tritium and carbon isotopes in a refrigerator) and dashed (purple) cells represent archive samples.

| Sample information | | | Collected sample portions | | | | | | | | | | | Archive |
|--------------------|------------|---------|---------------------------|-------------|----------|---------|----------------|---|------------------------|----------------------------------|------------------------------------|-----------------------|---|-------------------|
| Tube unit | Length [m] | SKB no. | Cond., pH, alk. | Major Comp. | Ura-nine | An-ions | ³ H | $\delta^{2}\text{H}$ $\delta^{18}\text{O}$ | $\delta^{37}\text{Cl}$ | ¹⁰ B/ ¹¹ B | ⁸⁷ Sr/ ⁸⁶ Sr | $\delta^{34}\text{S}$ | $\delta^{13}\text{C}$ and ^{14}C | Filtered 2x250 mL |
| 9 | 0-50 | 11161 | Striped | Striped | Striped | Striped | Yellow | ω | Yellow | Yellow | Yellow | Yellow | Yellow | |
| 8 | 100 | 11162 | White | White | White | White | White | White | White | White | White | White | Yellow | Yellow |
| 7 | 150 | 11163 | Striped | Striped | Striped | Striped | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | |
| 6 | 200 | 11164 | White | White | White | White | White | White | White | White | White | White | Yellow | Yellow |
| 5 | 250 | 11165 | Striped | Striped | Striped | Striped | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | |
| 4 | 300 | 11166 | White | White | White | White | White | White | White | White | White | White | Yellow | Yellow |
| 3 | 350 | 11167 | Striped | Striped | Striped | Striped | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | |
| 2 | 400 | 11168 | White | White | White | White | White | White | White | White | White | White | Yellow | Yellow |
| 1 | 450 | 11169 | Striped | Striped | Striped | Striped | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | |

ω Filled with sample

4.3 Data handling

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

All analytical results were 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 from *basic water analyses* are inserted into raw data tables for further evaluation. The evaluation results in a final 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. The analyses are repeated if a large disparity is noted (generally more than 10%).
- Calculation of charge balance errors. Relative errors within ± 5% are considered acceptable (in surface waters ± 10%).

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

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

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 the results considered most reliable.

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

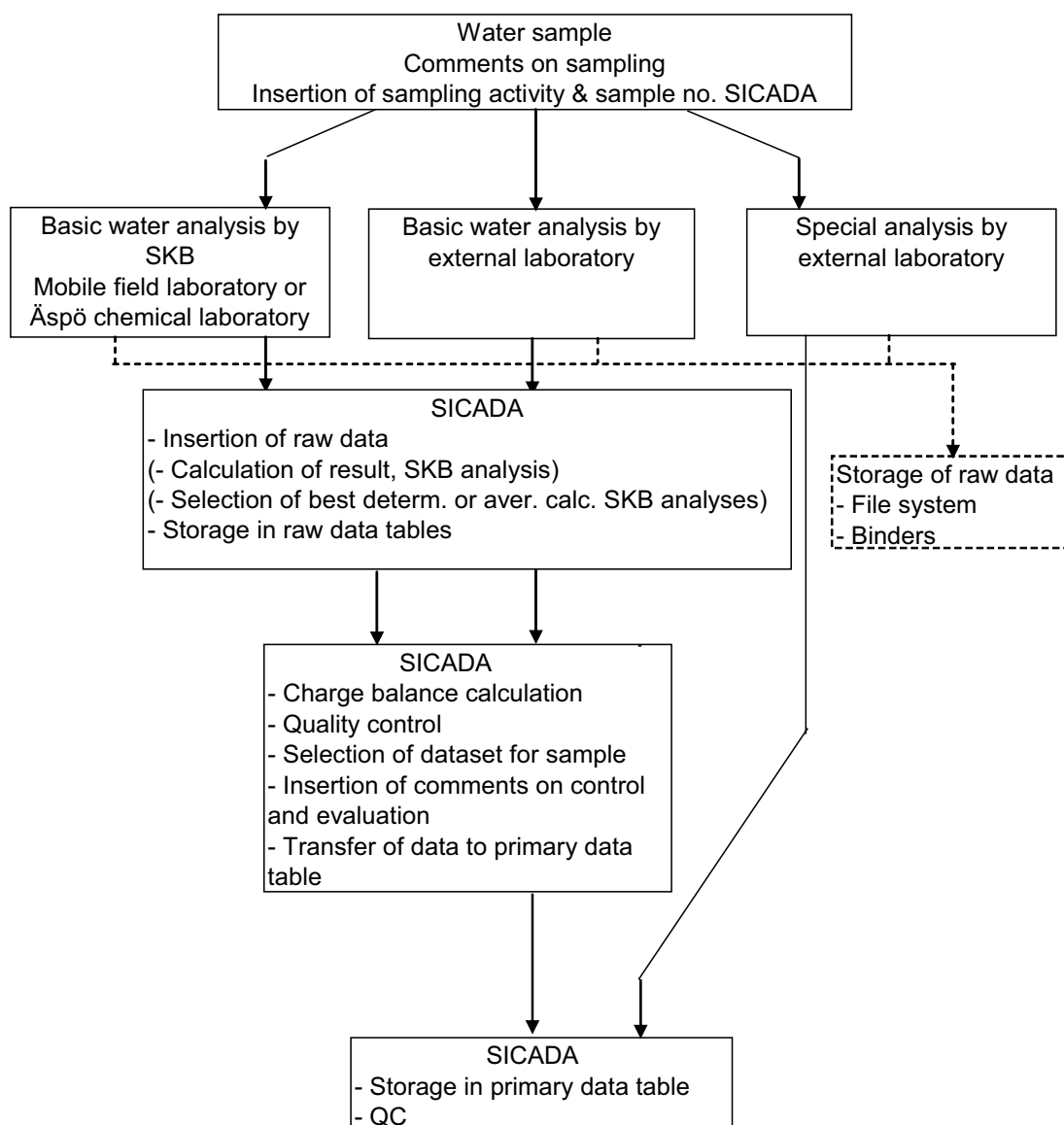


Figure 4-1. Overview of data management for hydrogeochemical data.

4.4 Nonconformities

The activity was performed without any deviations from the controlling documents for the activity that can affect the quality of data. Due to problems with lack of water in the uppermost sampling tube number nine (0–50 m), the bottles intended for archive samples from tube number eight were instead used to fill sample bottles for analysis of deuterium ($\delta^2\text{H}$), $\delta^{18}\text{O}$, $^{10}\text{B}/^{11}\text{B}$ and $^{87}\text{Sr}/^{86}\text{Sr}$ in the uppermost tube unit.

5 Results

5.1 Analytical results

The results from the chemical analyses are presented in Appendix 2. The original results are stored in the primary data base (SICADA), and the data in this data base will be used for further interpretation (modelling).

Diagrams showing the drill water content and the electric conductivity along the borehole, at the time of the Hydrochemical logging, are presented in Figures 5-1 and 5-2. Results from analyses of pH, HCO_3^- and some of the major constituents (Na^+ , Ca^+ and Cl^-) are shown in Figures 5-3 to 5-5, respectively. Sulphate (SO_4^{2-}) analysed by ion chromatography (IC) is compared with sulphate determined as total sulphur using inductively coupled plasma atomic emission spectrometry (ICP-AES) in Figure 5-6. Results are plotted for the mid-length of each tube unit.

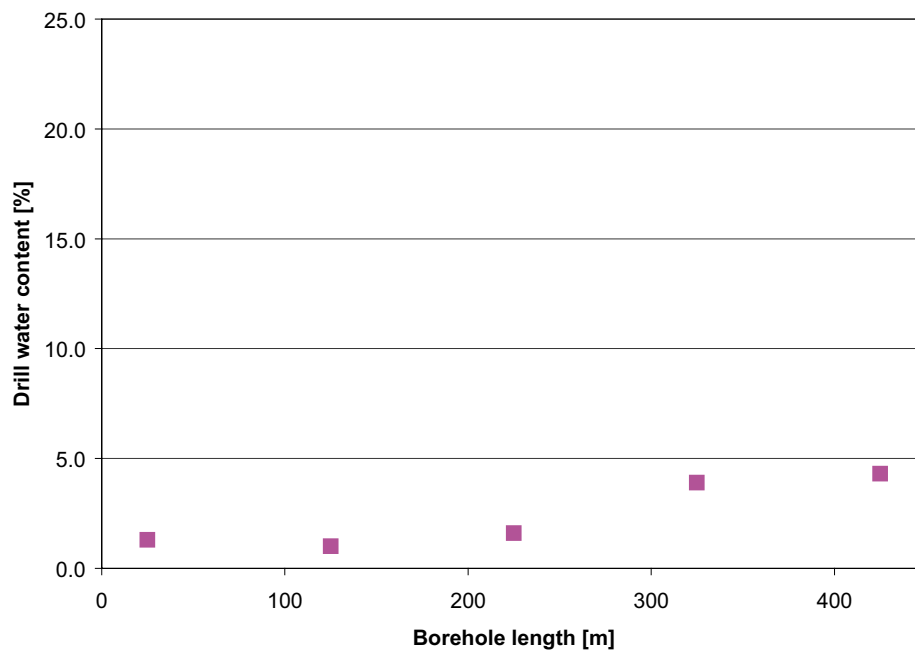


Figure 5-1. Drill water content remaining at different borehole lengths at the time of the Hydrochemical logging in KLX20A.

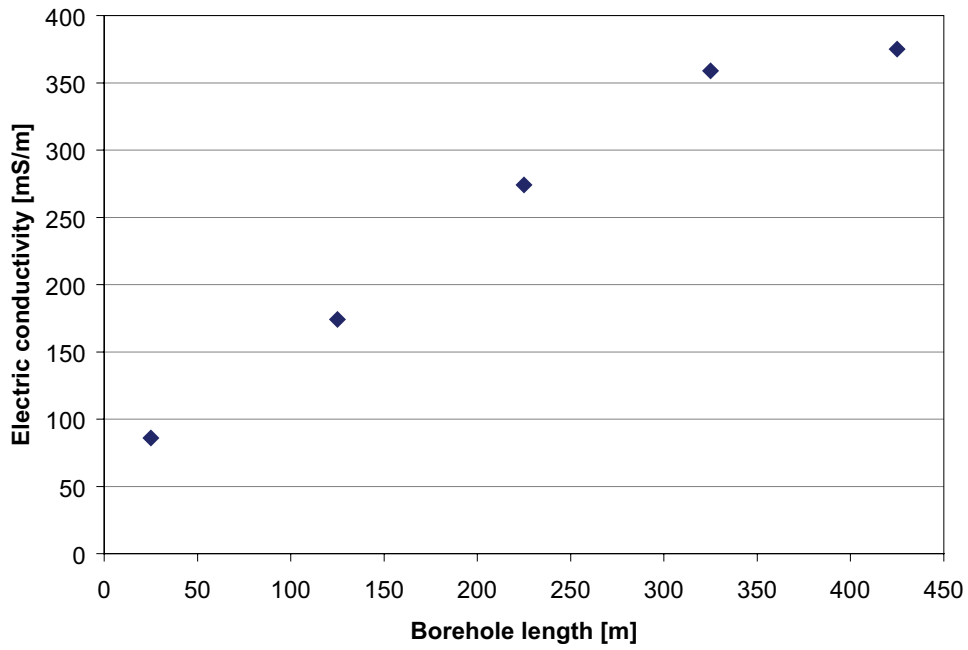


Figure 5-2. Electric conductivity values along the borehole KLX20A obtained from the Hydrochemical logging in KLX20A.

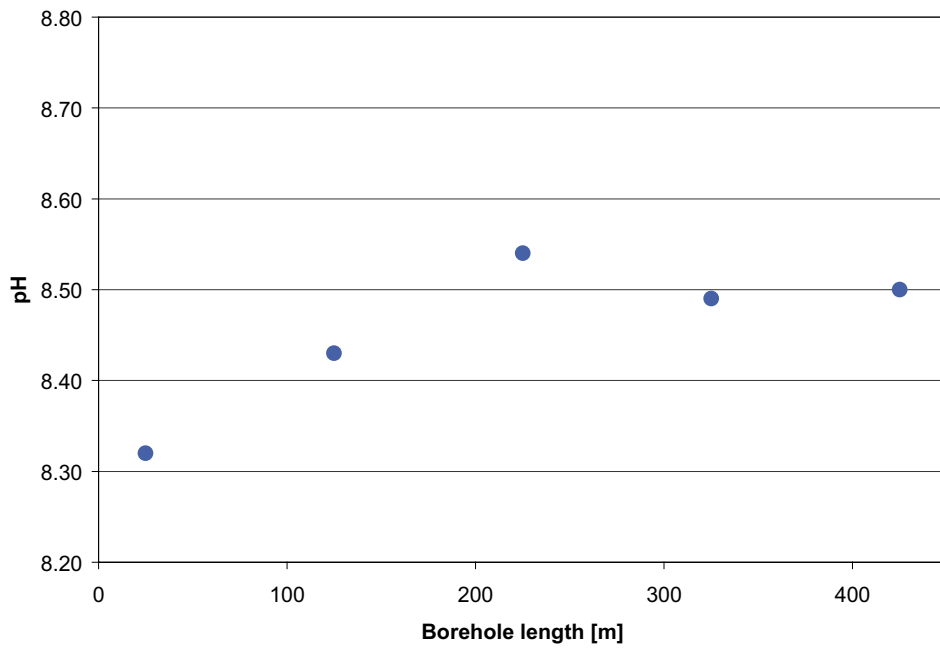


Figure 5-3. Results from pH measurements obtained from the Hydrochemical logging in KLX20A.

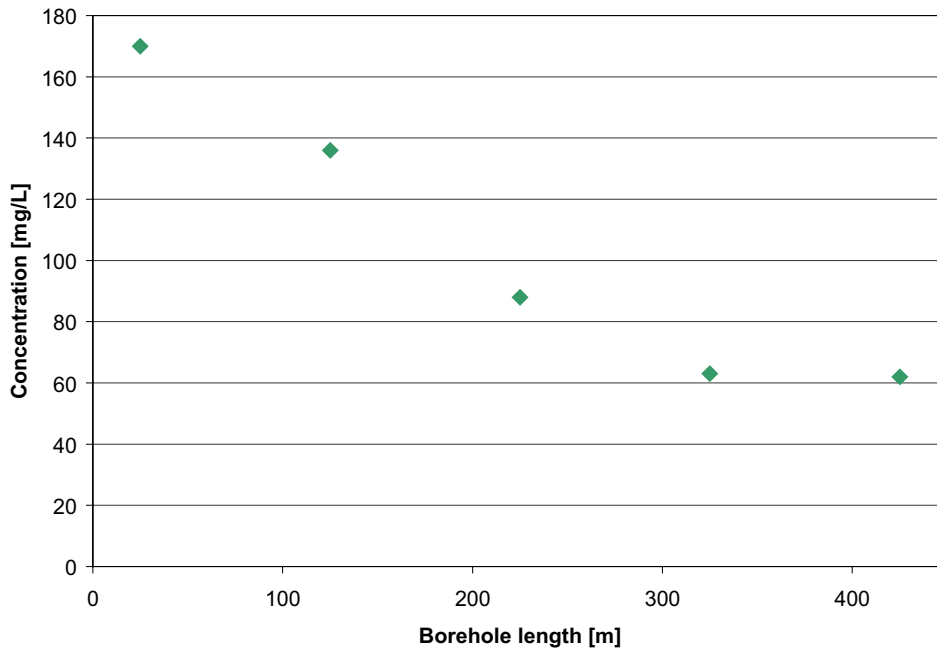


Figure 5-4. Results from analysis of hydrogen carbonate (HCO_3^-) in water samples obtained from the Hydrochemical logging in KLX20A.

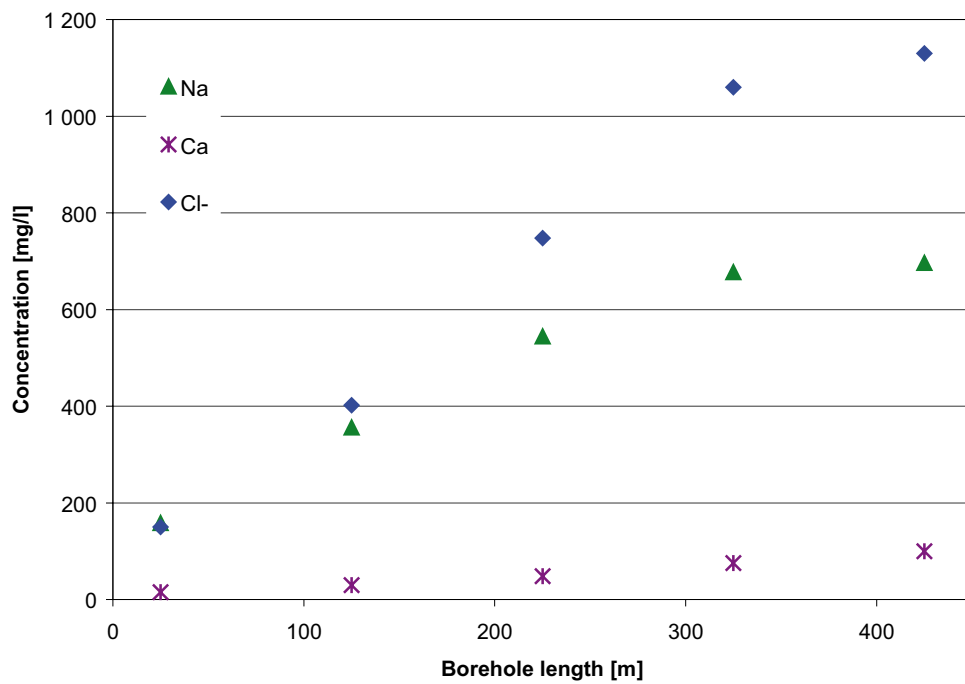


Figure 5-5. Results from analysis of the constituents Na^+ , Ca^{2+} and Cl^- in water samples obtained from the Hydrochemical logging in KLX20A.

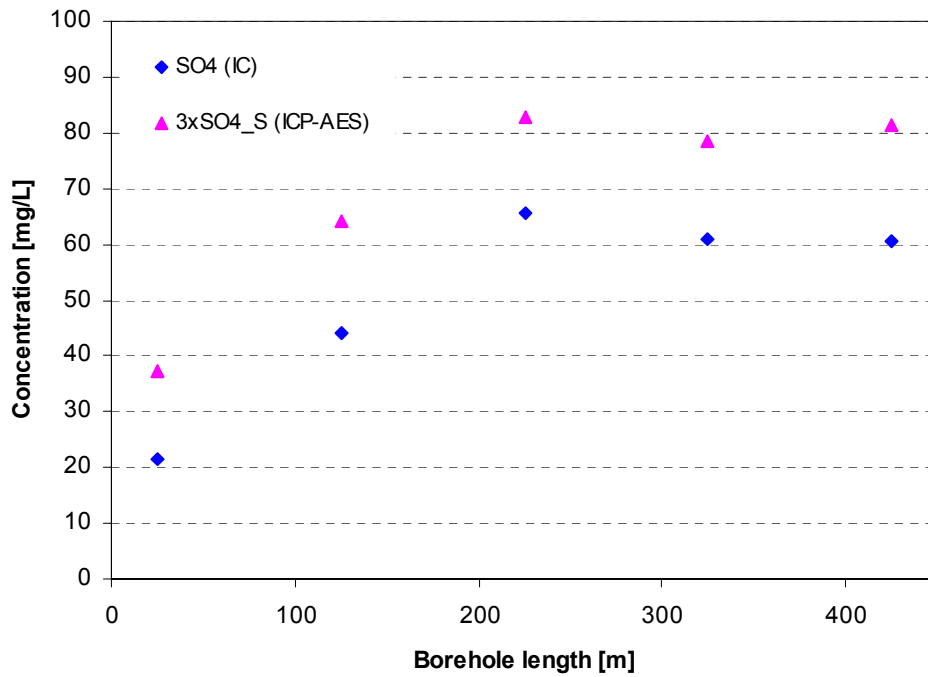


Figure 5-6. Sulphate (IC) compared to total sulphur (ICP-AES), results from the Hydrochemical logging in KLX20A.

5.2 Quality of the analyses

The charge balance errors give an indication of the quality and uncertainty of the analyses of major constituents. The relative charge balance errors were calculated for the selected sets of data, see Appendix 2. If the relative errors are within $\pm 5\%$ they are considered acceptable. The errors slightly exceed 5% in one out of five cases; the tube unit from 100–150 m of borehole length. Based on general trends, the results from this sample seem reliable enough, despite the higher relative error of analysis.

6 Conclusions

The Hydrochemical logging of KLX20A was conducted successfully. The main conclusions to be drawn from the Hydrochemical logging are:

- The amount of remaining drill water at the time of the Hydrochemical logging was below 5% all through the sampled borehole. Therefore the results can be considered as nearly representative for the water chemistry in the water-bearing fractures of the borehole.
- The electric conductivity and chloride concentration increased almost linearly with depth in 350 m in the borehole. From below 350 m the concentration decreased. The highest values were found in the tube unit from 400–450 m of borehole length; 375 mS/m and 1,130 mg/L, respectively. These values are much higher than in the samples at corresponding depth in the adjacent borehole KLX11A, where the conductivity and chloride concentrations were 52.1 mS/m and 35.4 mg/L, respectively. As the drill water content in the two compared tube units were both ca 4–5%, the results imply that the two boreholes are likely to intersect different water-bearing structures.
- The charge balance error, giving an indication of the quality and uncertainty of the analyses, did exceed 5% in one out of five cases; the tube unit from 100–150 m of borehole length (6%). No results were considered unconfident, based on general trends. The quality of the analyses seems to be nearly satisfying, and there is no obvious reason to discard the results from the sample of 100–150 m of borehole length. No sample was sent to a different laboratory due to lack of sample water.

7 References

- /1/ **SKB, 2001.** Generellt genomförande program för platsundersökningar. SKB R-01-10, Svensk Kärnbränslehantering AB.
- /2/ **SKB, 2005.** Platsundersökning Oskarshamn. Program för fortsatta undersökningar av berggrund, mark, vatten och miljö inom delområde Laxemar. SKB R-05-37, Svensk Kärnbränslehantering AB.

Sampling and analytical methods

Table A1-1. Sample handling routines and analytical methods.

| Component group | Component/element | Sample container (material) | Volume (mL) | Filtering | Preparation/Conservation* | Analysis method | Analysis within – or delivery time to lab |
|--|--|--|-------------|-----------------------------------|--|---|---|
| Anions 1 | HCO ₃ ⁻ pH (lab) cond (lab) | Plastic | 250 | No | No | Titration Pot. meas, Cond. meas | The same day – maximum 24 hours |
| Anions 2 | Cl ⁻ , SO ₄ ²⁻ , Br ⁻ , F ⁻ | Plastic | 100 | Yes (in connection with analysis) | No | Titration (Cl ⁻) IC (Cl ⁻ , SO ₄ ²⁻ , Br ⁻ , F ⁻) ISE (F ⁻) | Not critical (month) |
| Cations, Si and S according to SKB class 3 | Na, K, Ca, Mg, S(tot), Si(tot), Li, Sr | Plastic (at low conc. acid washed bottles) | 100 | Yes (not in the field) | Yes (not in the field, 1 mL HNO ₃) | ICP-AES ICP-MS | Not critical (month) |
| Environmental isotopes | δ ² H, δ ¹⁸ O | Plastic | 100 | No | – | MS | Not critical (month) |
| Tritium | ³ H (enhanced.) | Plastic (dry bottle) | 500 | No | – | LSC | |
| Chlorine-37 | δ ³⁷ Cl | Plastic | 500 | No | – | ICP MS | Not critical (month) |
| Carbon isotopes | δ ¹³ C, pmC (¹⁴ C) | Glass, dark | 100×2 | No | – | (A)MS | A few days |
| Sulphur isotopes | δ ³⁴ S | Plastic | 500–1,000 | No | – | Combustion, ICP MS | No limit |
| Strontium-isotopes | ⁸⁷ Sr/ ⁸⁶ Sr | Plastic | 100 | No | – | TIMS | Days or Week |
| Boron isotopes | ¹⁰ B/ ¹¹ B | Plastic | 100 | Yes | Yes (1 mL HNO ₃) | ICP-MS | No limit |
| Archive samples without acid | – | Plastic | 250×2 | Yes | No | – | Storage in freeze container |

* Suprapur acid is used for conservation of samples.

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 |
| MS | Mass Spectrometry |
| LSC | Liquid Scintillation Counting |
| (A)MS | (Accelerator) Mass Spectrometry |
| TIMS | Thermal Ionization Mass Spectrometry |

Table A1-2. Reporting limits and measurement uncertainties.

| Component | Method | Reporting limits or range | Unit | Measurement uncertainty ² | “Total” uncertainty ³ |
|------------------------------------|----------------------|---------------------------|-------------------------------|--------------------------------------|----------------------------------|
| HCO ₃ ⁻ | Alkalinity titration | 1 | mg/L | 4% | < 10% |
| pH | Pot. meas. | – | – | 5% | – |
| Cond. | Cond. meas. | 0.02 | mS/m | 4% | – |
| Cl ⁻ | Mohr-titration | > 70 | mg/L | 5% | < 10% |
| Cl ⁻ | IC | 1–100 | | 6% | 10% |
| SO ₄ ²⁻ | IC | 1 | mg/L | 10% | 15% |
| Br ⁻ | IC | 0.2 | mg/L | 9% | 20% |
| F ⁻ | IC | 0.1 | mg/L | 10% | 20% |
| F ⁻ | ISE | – | | – | – |
| 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 | 21% | 15% |
| Si(tot) | ICP | 0.03 | mg/L | 4% | 15% |
| Sr | ICP | 0.002 | mg/L | 4% | 15% |
| Li | ICP | 0.2 ¹ 2 | mg/L | 10% | 20% |
| Fe | ICP | 0.41 4 | mg/L | 6% | 10% |
| Mn | ICP | 0.031 0.1 | µg/L | 8% | 10% |
| δ ² H | MS | 2 | ‰ SMOW ⁴ | 1‰ | – |
| δ ¹⁸ O | MS | 0.1 | ‰ SMOW ⁴ | 0.2‰ | – |
| ³ H | LSC | 0.8 eller 0.1 | TU ⁵ | 0.8 eller 0.1 | Correct order of size |
| δ ³⁷ Cl | ICP MS | 0.2‰ (20 mg/L) | ‰ SMOC ⁶ | – | – |
| δ ¹³ C | A (MS) | – | ‰ PDB ⁷ | – | – |
| pmC (¹⁴ C) | A (MS) | – | pmC ⁸ | – | – |
| δ ³⁴ S | ICP MS | 0.2‰ | ‰ CDT ⁹ | 0.3‰ | – |
| ⁸⁷ Sr/ ⁸⁶ Sr | TIMS | – | No unit (ratio) ¹⁰ | – | – |
| ¹⁰ B/ ¹¹ B | ICP MS | – | No unit (ratio) ¹⁰ | – | – |

1. Reporting limits at salinity ≤ 0.4‰ (520 mS/m) and ≤ 3.5‰ (3,810 mS/m) respectively.
2. Measurement uncertainty reported by consulted laboratory, generally 95% confidence interval.
3. Estimated total uncertainty by experience (includes effects of sampling and sample handling).
4. Per mille deviation¹³ from SMOW (Standard Mean Oceanic Water).
5. TU=Tritium Units, where one TU corresponds to a Tritium/hydrogen ratio of 10⁻¹⁸ (1 Bq/L Tritium = 8.45 TU).
6. Per mille deviation¹³ from SMOC (Standard Mean Oceanic Chloride).
7. Per mille deviation¹³ from PDB (the standard PeeDee Belemnite).
8. The following relation is valid between pmC (percent modern carbon) and Carbon-14 age:

$$\text{pmC} = 100 \times e^{((1950-y-1.03t)/8274)}$$
 where y = the year of the C-14 measurement and t = C-14 age.
9. Per mille deviation¹³ from CDT (the standard Canyon Diablo Troilite).
10. Isotope ratio without unit.

Isotopes are often reported as per mill deviation from a standard. The deviation is calculated as:

$$\delta\text{‰} = 1000 \times (K_{\text{sample}} - K_{\text{standard}}) / K_{\text{standard}}$$
 where K= the isotope ratio and ‰ =²H, ¹⁸O, ³⁷Cl, ¹³C or ³⁴S etc.

Appendix 2

Water composition

Compilation August 2006

| Idcode | Secup m | Seclow m | Sample no. | 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 ⁻ mg/L | F ⁻ mg/L | Si mg/L | Fe mg/L | Mn mg/L |
|--------|------------|-------------|---------------|----------------|------------|-----------|------------|------------|---------------------------------------|-------------------------|---------------------------------------|----------------------------|-------------------------|------------------------|------------|------------|------------|
| KLX20A | 0 | 50 | 11161 | -0.83 | 158 | 2.47 | 15.3 | 2.2 | 170 | 150 | 21.4 | 12.4 | 0.7 | 4.2 | 6.23 | 0.205 | 0.022 |
| KLX20A | 50 | 100 | 11162 | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| KLX20A | 100 | 150 | 11163 | 6.49 | 356 | 2.75 | 29.7 | 3.0 | 136 | 402 | 44.1 | 21.4 | 2.0 | 4.9 | 5.92 | 0.107 | 0.026 |
| KLX20A | 150 | 200 | 11164 | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| KLX20A | 200 | 250 | 11165 | 3.73 | 544 | 3.11 | 48.1 | 3.8 | 88 | 748 | 65.6 | 27.6 | 3.5 | 5.1 | 5.41 | 0.079 | 0.030 |
| KLX20A | 250 | 300 | 11166 | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| KLX20A | 300 | 350 | 11167 | 1.31 | 677 | 3.97 | 75.1 | 4.8 | 63 | 1.060 | 61.0 | 26.2 | 5.2 | 4.3 | 5.01 | 0.102 | 0.048 |
| KLX20A | 350 | 400 | 11168 | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| KLX20A | 400 | 450 | 11169 | 1.34 | 696 | 4.09 | 100 | 4.8 | 62 | 1.130 | 60.7 | 27.1 | 5.4 | 4.0 | 4.74 | 0.391 | 0.058 |

- = Not analysed.

X = No result due to sampling problems.

XXX = Stored in freezer/refrigerator.

ChargeBal % = Relative charge balance error %.

Compilation August 2006, Continue.

| Idcode | Secup m | Seclow m | Sample no. | Li mg/L | Sr mg/L | pH | Drill_water % | EiCond mS/m | $\delta^{2}\text{H}$ dev SMOW | $\delta^{18}\text{O}$ dev SMOW | ^3H TU | $\delta^{37}\text{Cl}$ dev SMOC | $^{10}\text{B}/^{11}\text{B}$ no unit | $^{87}\text{Sr}/^{86}\text{Sr}$ no unit | $\delta^{34}\text{S}$ dev CDT | $\delta^{13}\text{C}$ dev PDB | ^{14}C pmC |
|--------|------------|-------------|---------------|------------|------------|------|------------------|----------------|----------------------------------|-----------------------------------|--------------------|------------------------------------|--|--|----------------------------------|----------------------------------|------------------------|
| KLX20A | 0 | 50 | 11161 | 0.018 | 0.154 | 8.32 | 1.3 | 86.2 | XXX | XXX | XXX | X | XXX | XXX | - | - | - |
| KLX20A | 50 | 100 | 11162 | - | - | - | - | - | - | - | - | - | - | - | XXX | XXX | XXX |
| KLX20A | 100 | 150 | 11163 | 0.037 | 0.430 | 8.43 | 1.0 | 174 | XXX | XXX | XXX | XXX | XXX | XXX | - | - | - |
| KLX20A | 150 | 200 | 11164 | - | - | - | - | - | - | - | - | - | - | - | XXX | XXX | XXX |
| KLX20A | 200 | 250 | 11165 | 0.056 | 0.768 | 8.54 | 1.6 | 274 | XXX | XXX | XXX | XXX | XXX | XXX | - | - | - |
| KLX20A | 250 | 300 | 11166 | - | - | - | - | - | - | - | - | - | - | - | XXX | XXX | XXX |
| KLX20A | 300 | 350 | 11167 | 0.067 | 1.26 | 8.49 | 3.9 | 359 | XXX | XXX | XXX | XXX | XXX | XXX | - | - | - |
| KLX20A | 350 | 400 | 11168 | - | - | - | - | - | - | - | - | - | - | - | XXX | XXX | XXX |
| KLX20A | 400 | 450 | 11169 | 0.067 | 1.85 | 8.50 | 4.3 | 375 | XXX | XXX | XXX | XXX | XXX | XXX | - | - | - |

- = Not analysed.

X = No result due to sampling problems.

XXX = Stored in freezer/refrigerator.

ChargeBal % = Relative charge balance error %.