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February 2004

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Summary

Siting studies for SKB's programme of deep geological disposal of nuclear fuel waste currently involves the investigation of two locations, Simpevarp and Forsmark, on the eastern coast of Sweden to determine their geological, hydrogeochemical and hydrogeological characteristics. Present work completed has resulted in model version 1.1 which represents the first evaluation of the available Simpevarp groundwater analytical data collected up to July 1st, 2003 (i.e. the first "data freeze" of the site). The HAG (Hydrochemical Analytical Group) group had access to a total of 535 water samples collected from the surface and sub-surface environment (e.g. soil pipes in the overburden, streams and lakes); only a few samples were collected from drilled boreholes. The deepest fracture groundwater samples with sufficient analytical data reflected depths down to 250 m. Furthermore, most of the waters sampled (79%) lacked crucial analytical information that restricted the evaluation. Consequently, model version 1.1 focussed on the processes taking place in the uppermost part of the bedrock rather than at repository levels.

The complex groundwater evolution and patterns at Simpevarp are a result of many factors such as: a) the flat topography and proximity to the Baltic Sea, b) changes in hydrogeology related to glaciation/deglaciation and land uplift, c) repeated marine/lake water regressions/transgressions, and d) organic or inorganic alteration of the groundwater composition caused by microbial processes or water/rock interactions. The sampled groundwaters reflect to various degrees of modern or ancient water/rock interactions and mixing processes. Higher topography to the west of Simpevarp has resulted in hydraulic gradients which have partially flushed out old water types.

Except for sea waters, most surface waters and some groundwaters from percussion boreholes are fresh, non-saline waters according to the classification used for Äspö groundwaters. The rest of the groundwaters are brackish (Cl < 5000 mg/L), except for three samples from KSH01A (at 253 m and 439 m depth) which are saline. Most surface waters are of Ca-HCO_3 or Na-Ca-HCO_3 type and naturally the sea water is of Na-Cl type. The deeper groundwaters are mainly of Na-Ca-Cl type.

The modelling indicated three water types, one dominated by meteoric water, the other affected by marine water and the third affected by glacial water. The surface meteoric type shows seasonal variations. Closer to the coast the influence of marine water is detected. With depth the saline groundwater has been affected by glacial melt water and meteoric water.

The present state of knowledge of the reactive system is that the main water-rock interaction processes that affect the chemistry in the fresh meteoric waters are: a) decomposition of organic matter, b) calcite, plagioclase, biotite and sulphide dissolution, c) Na-Ca ion exchange, and d) phyllosilicate precipitation probably extremely slow in the present low temperature environment. In contrast, for the brackish-saline groundwaterst the water/rock interaction processes seem to be less important although this has not been established because of a lack of data. At the moment, multiple end-member mixing between marine water, glacial meltwater and deeper saline water seem to play a significant role.

Based on presently available data, the groundwater sample at 250 m depth, although not representative of repository depths, met the groundwater criterion established by SKB concerning the measured Eh, pH, TDS and Ca+Mg values. The redox system at this depth is controlled by the presence of iron oxides/iron hydroxides or sulphide minerals.

In this evaluation the postglacial groundwater scenario model has been updated, the salinity distribution, mixing processes and the major reactions altering the groundwaters have been modelled down to a depth of 250 m and a new Hydrogeochemical Site Descriptive Model version 1.1 has been produced. A 3D groundwater description of the site was not produced at this stage due to a lack of observations reflecting spatial variations.

Contents

1 Introduction

1.1 Background

SKB is conducting thorough investigations at two candidate sites for the eventual disposal of spent nuclear fuel. These sites are located in the municipalities of Simpevarp and Forsmark and the main objective is aimed at providing detailed proposals of how a deep repository can be constructed and operated. The investigations at Simpevarp commenced in 2002 and will take between four and eight years to complete.

The site selection and investigation phases encompass a sufficiently large scale in terms of time, space and content to make a breakdown into different stages necessary. During the initial selection phase the site that is considered most suitable for a deep repository is chosen. A few boreholes are drilled as part of an Initial Site Investigation stage and the data they generate enables a decision to be made as to whether the site is still deemed suitable. The site and its immediate surroundings should cover an area of 5–10 km^2 in areal extent

Provided that the preconditions established are still good, a Complete Site Investigation stage follows. The main aim is to collect sufficient knowledge about the rock and its properties to enable SKB to produce both a site description and a construction plant description, and also to conduct a safety analysis.

The area's ecosystem is inventoried from ground surface surveys. A decision is also taken as to the major rock types present and the thickness of the soil layer above the bedrock. The surface/near-surface hydrological and groundwater chemistry studies include charting water courses, measuring the discharge and taking water samples. Drilling is the most extensive activity conducted, some 10–20 percussion boreholes will be made to a maximum depth of 200 m, and an equal number of cored boreholes to depths of 500–1000 m in depth. Most of the boreholes will be 76 mm in diameter. An extensive hydrochemistry programme together with other investigation programmes will be conducted during and after the drilling work.

1.2 Scope and Objectives

The aim of the site modelling is to develop a Hydrogeochemical Site Descriptive Model according to the Strategy for the Development of a Hydrogeochemical Site Descriptive Model /Smellie et al, 2002/. The first such model for Simpevarp was the "version 0" model /SKB, 2000/. For groundwater chemistry there were no samples available from the actual site so the conceptual model was based on data from nearby sites and interpretation of the post-glacial events.

The model presented in this report is model version 1.1 which represents the first evaluation of the available Simpevarp groundwater analytical data collected up to July 1st, 2003 (i.e. the so called "data freeze"). The Hydrochemical Analytical Group (HAG) had access to a total of 535 water samples collected from the surface and sub-surface environment (e.g. soil pipes in the overburden, streams and lakes); of these 116 samples were collected from drilled boreholes. The deepest samples reflected depths down to over 900 m. When modelled most of the waters (79%) still lacked important analytical information that restricted their evaluation. Consequently, model version 1.1 focussed on the processes taking place in the uppermost part of the bedrock and with a first evaluation of the conditions at half (250 m) repository levels.

The work presented here forms part of the Initial Site Investigation stage and the derived model represents the first model based on measured data from the site investigation programme. As the investigations progress over the next months and years, several updated models will be derived based on supplementary analytical data and groundwater samples from new boreholes and repeated sampling from existing boreholes.

1.3 Setting

The Simpevarp area is situated about 350 km south of Stockholm and is located within the confines of the Oskarshamn nuclear power plant facility. The candidate area selected for the site investigations is devided in the so called Simpevarp area (regional area) and Simpevarp sub area (local area). The Simpevarp sub area is shown in Figure 1-1 and Figure 2-2.

1.4 Methodology and organisation of work

1.4.1 Methodology

The main objectives of the Hydrogeochemical Site Descriptive Model for the Simpevarp area are to describe the chemistry and distribution of the groundwater in the bedrock and overburden and the processes involved in its origin and evolution. The SKB hydrogeochemistry programme /Smellie et al, 2002/ is intended to fulfill two basic requirements: 1) to provide representative and quality assured data for use as input parameter values in calculating long-term repository safety, and 2) to understand the present undisturbed hydrogeochemical conditions and how these conditions will change in the future. Parameter values for safety analysis include pH, Eh, S, SO_4, HCO_3, PO_4 and TDS (mainly cations), together with colloids, fulvic and humic acids, other organics, bacteria and dissolved gases. These values will be used to characterise the groundwater environment at, above and below repository depths. When the hydrogeochemical environment has been fully characterised, this knowledge, together with an understanding of the past and present groundwater evolution, should provide the basis for predicting future changes. The site investigations will therefore provide important source material for safety analyses and the environmental impact assessment of the Simpevarp area.

***Figure 1-1.** Overview of the Simpevarp sub area showing the area for detailed site investigation (dashed line).*

1.4.2 Organisation of work

This work forms part of the Initial Site Investigation stage of the hydrogeochemical evaluation carried out at the Simpevarp area leading to a Hydrogeochemical Site Descriptive Model (version 1.1). SKB's HAG consisting of independent consultants and university personnel, carried out the modelling during the period July 2003 to December 2003. Three separate groups within HAG were involved and the evaluation was conducted independently using different approaches ranging from expert knowledge to geochemical and mathematical modelling. During regular HAG meetings the results were presented and discussed. The lack of isotopic data in many samples restricted the modelling work. Despite different modelling approaches the similarities obtained gave added confidence to the modelling results presented in this report.

1.5 This report

Chapters 1–7 of this report summarise the hydrogeochemical results collated and interpreted by HAG. These results will serve as input for the final Site Descriptive Model report which will integrate collectively the results from all the geoscientific disciplines. The format and structure of this present report follows that established for the final report.

The main aim of this report is to attempt to integrate the different approaches of the three HAG groups to arrive at an overall interpretation of the presently available Simpevarp hydrogeochemical data. Chapter 2 presents an overview of available information prior to this Initial Site Investigation Stage. This information, presented as Hydrogeochemical Site Descriptive Model version 0, is an integrated result from the site selection studies. Chapter 3 describes the present updated ideas concerning the palaeoevolution of the Simpevarp region. Chapter 4 covers the integrated evaluation of the primary hydrogeochemical data and therefore constitutes the main conceptual descriptive input of the Simpevarp area. Chapter 5 focuses on the quantitative modelling use of the hydrogeochemical data covering the different modelling approaches attempted, the assumptions made, an evaluation of the uncertainties involved, and how such modelled results can best be visually presented. Chapter 6 summarises the hydrogeochemical description of the Simpevarp area and Chapter 7 presents the main conclusions.

The detailed contributions of the three HAG modelling groups are presented in Appendices 1–3. Appendix 4 lists all the groundwater analytical data available at the 'data freeze' point. Appendix 5 shows how the HAG modelling groups utilised the Simpevarp data.

2 Available investigations and other prerequisites for the modelling

2.1 Overview

The evaluation of the hydrogeochemical data has been carried out by considering not only the samples from the Simpevarp area, but in some cases also to the whole Fennoscandian hydrochemical dataset. For example, selecting the water end members describing other Fennoscandian sites in order to see how well they compare with the general Simpevarp trend and whether or not Simpevarp can be interpreted as part of the regional hydrogeochemical system. Consequently, information from hydrogeochemical model versions based on previously investigated sites in Sweden and elsewhere, and information from ongoing geological and hydrogeological modelling at Simpevarp, where included in the evaluation when possible.

2.2 Previous model versions

The first model of the Simpevarp area was the Site Descriptive Hydrogeochemical Model version 0 /SKB, 2002/. Although there were few data from the Simpevarp regional modelled area to support a detailed hydrogeochemical site descriptive model, postglacial events believed to have affected the groundwater evolution and chemistry at Simpevarp show similarities with other Fennoscandian sites. Hence, the major postglacial stages, all of which have been identified at the Äspö, Finnsjön, Gideå, Hästholmen and Olkiluoto sites, are considered relevant for the hydrogeochemical evolution of the Simpevarp area (Figure 2-1). The major stages were:

1. The continental ice melted and retreated and glacial melt water flushed the bedrock (> 13,000 BP). At great depths (> 800 m) glacial melt water was mixed with ancient brine groundwater in the bedrock. A saline groundwater with a glacial signature was formed at the interface and fresh glacial water was present in the upper part of the bedrock.

2. The flushing on the mainland started directly after the deglaciation commenced. However, since the sites were below the prevailing sea level, the postglacial marine transgression stages of the Baltic Sea and the Litorina Sea affected the groundwater composition. The continuous shoreline displacement has elevated the site to its present-day altitude above the sea level. The increasing hydraulic flushing has created a mixture of existing groundwater types, i.e. glacial, brine, marine and meteoric groundwaters.

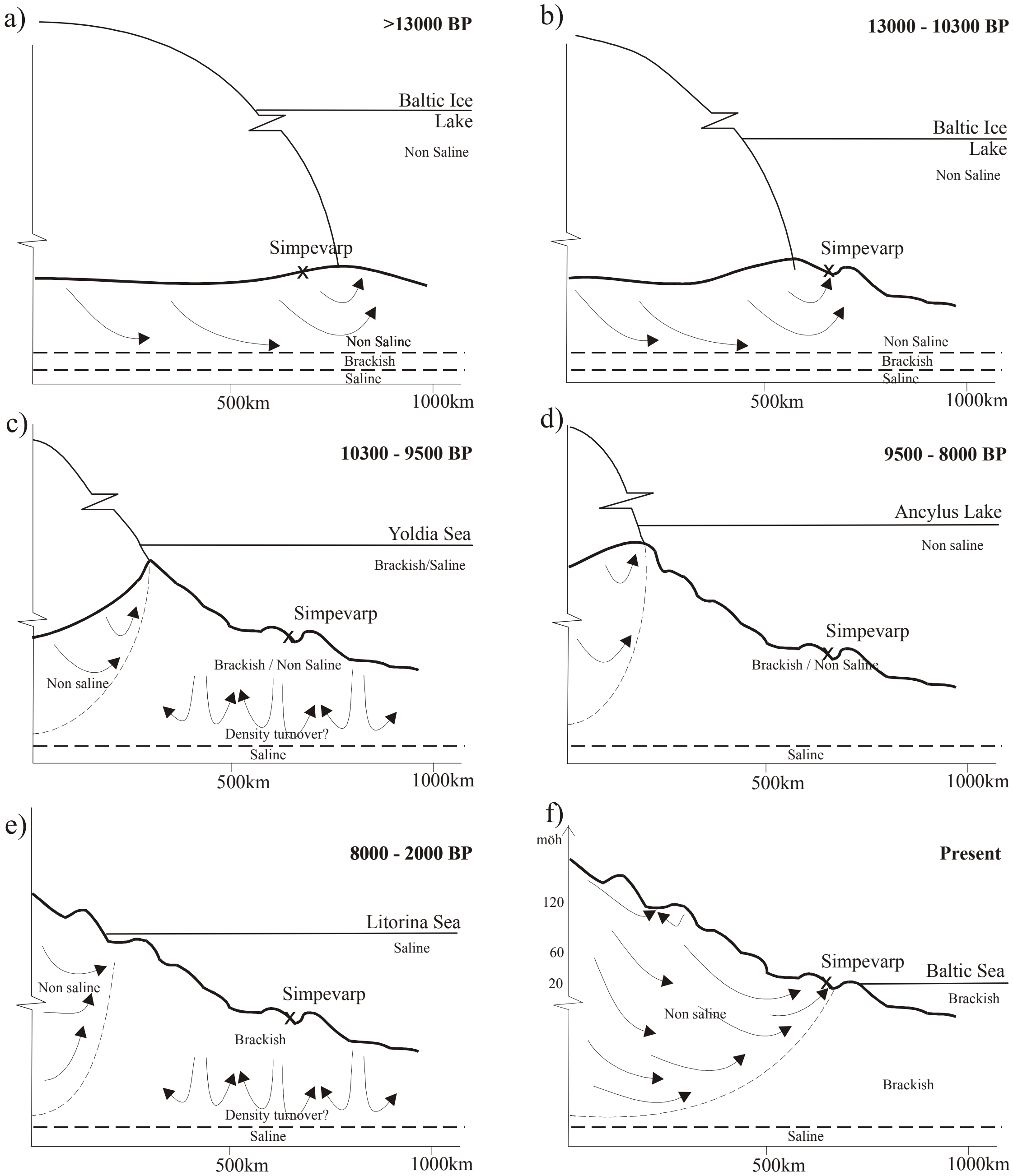

***Figure 2-1.** Postglacial scenario model for Simpevarp; this was used as the hydrochemical version 0 model for the site /SKB, 2002/.*

2.3 Geographical data

The co-ordinates used and made available for the data freeze are listed in Appendix 4. These data were used in the visualisation work.

2.4 Surface investigations

Available QA data describing the composition of the surface water sampled from lakes, streams, Baltic Sea and soil pipes are listed in Appendix 4.

2.5 Borehole investigations

Available QA data describing the composition of the groundwater sampled from percussion and core drilled boreholes are listed in Appendix 4.

2.6 Other data sources

Available QA data from the SICADA database describing the composition of the groundwater conditions at other Swedish sites and Finland /e.g. Pitkänen et al, 1999/ were used as background information in the modelling. Information from ongoing geological and hydrogeological investigations at Forsmark was also included in the evaluation.

2.7 Databases

The use of the data in the different modelling work is listed in Appendix 5.

2.8 Model volumes

2.8.1 Regional model volume

The Simpevarp area is located at the Baltic coast some 2–3 km SSE of Äspö island and 3–4 km ESE from Laxemar (Figure 2-2). The area forms part of the TransScandinavian Igneous Belt of Precambrian basement rocks dominated by granitoids which, at Simpevarp, comprise rocks ranging from granite to quartz monzodiorite. These rocks are usually medium grained but with some porphyritic varieties. Along the south-east part of the Simpevarp peninsula a variety of quartz monzodiorite occurs and a sub-volcanic origin has been proposed but not yet confirmed. Because of its close relationship with the quartz monzodiorite and similarity in composition, the term dioritoid has been suggested. Small amounts of aplitic (named fine-grained granite) and gabbroic rock-types also occur sporadically in smaller bodies. Structurally, Simpevarp is bounded to the west and east by large-scale regional deformation zones aligned sub-parallel to the coast, i.e. NE-SW. The site itself is contained within a structurally 'homogeneous' block bounded by these regional lineaments approximately orientated in NW-SE and NE-SW directions.

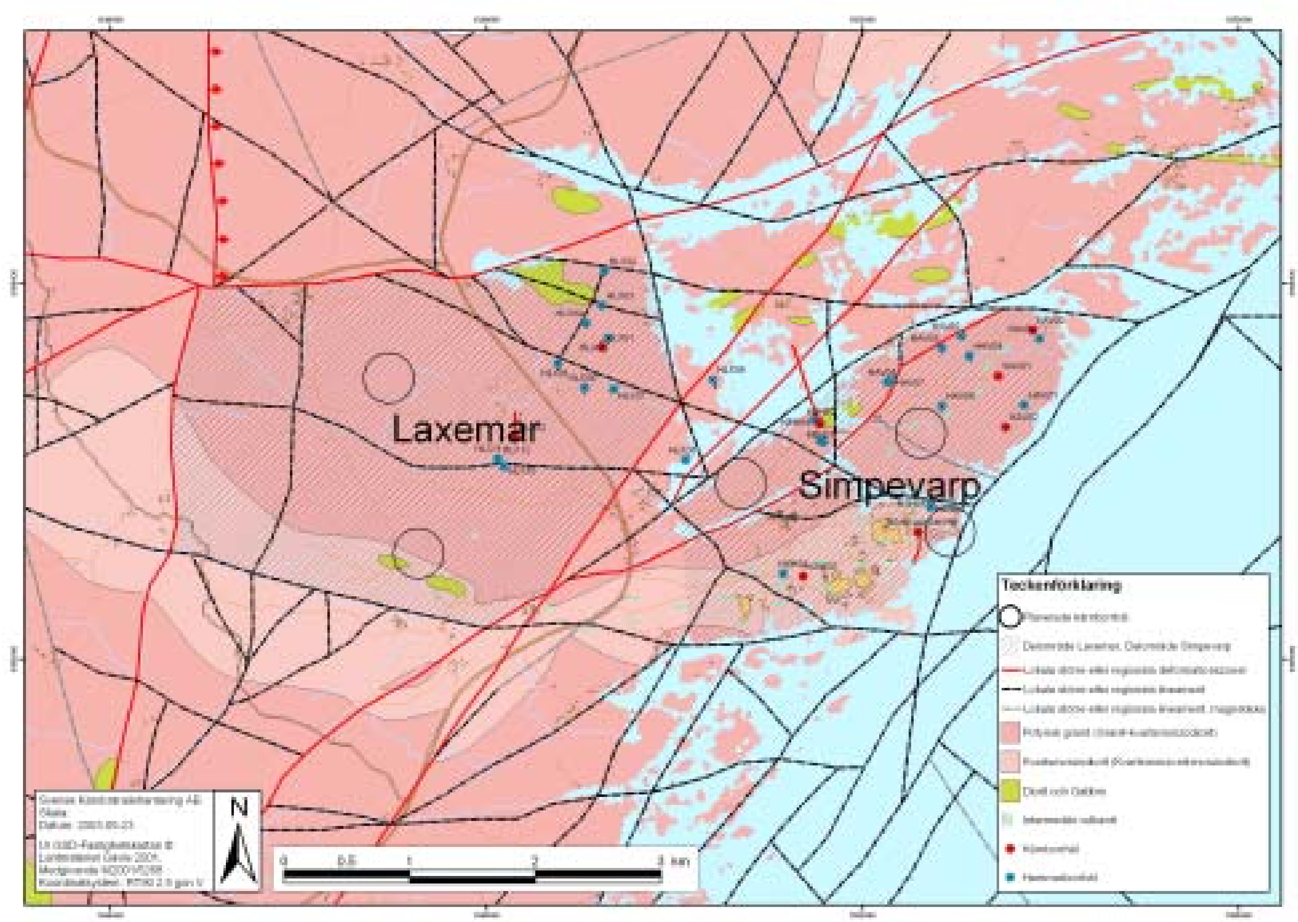

***Figure 2-2.** Geological setting at the Simpevarp area. The shaded area shows the Simpevarp sub-area where the most of the detailed studies are conducted.*

The borehole locations are also shown in Figure 2-2 but in more detail in Figure 4-2. With respect to the general hydrology, the immediate topography is relatively smooth with rapid run-off via stream flow; of 160 mm/year precipitation, approx 1 mm/year is expected to filter into the bedrock /I Rhén, pers comm, 2004/. The soil overburden is the main influence on the chemistry of the groundwater eventually penetrating the bedrock. The local groundwater circulation is controlled by small flow-lines to great depth (i.e. 1000 m) determined by more irregular and higher topography to the west. Based on hydrogeological modelling, regional large-scale groundwater circulation (hundreds of kilometres) is not expected to play an important role at Simpevarp.

2.8.2 Local model volume

The Simpevarp sub area is shown in Figure 2-2. The motivation for selection of the local model area is described by /Anderson et al, 2002/.

3 Evolutionary aspects of the Simpevarp area

3.1 Premises for surface and groundwater evolution

The first step in the groundwater evaluation is to construct a conceptual postglacial scenario model for the site (Figure 3-1) based largely on known palaeohydrogeological events from Quaternary geological investigations. This model can be helpful when evaluating data since it provides constraints on the possible groundwater types that may occur. Interpretation of the glacial/postglacial events that might have affected the Simpevarp area is based on information from various sources including /Fredén, 2002; T Påsse, pers comm, 2003; Westman et al, 1999; SKB, 2002/. This recent literature has resulted in some modification to Figure 2-1, for example, changes in the absolute ages of the different Baltic Sea evolution stages /Fredén, 2002/.

3.1.1 Development of permafrost and saline water

When the continental ice sheet was formed at about 100,000 BP permafrost formation ahead of the advancing ice sheet probably extended to depths of several hundred metres. According to /Bein and Arad, 1992/ the formation of permafrost in a brackish lake or sea environment (e.g. similar to the Baltic Sea) produced a layer of highly concentrated salinity ahead of the advancing freezing front. Since this saline water would be of high density, it would subsequently sink to lower depths and potentially penetrate into the bedrock where it would eventually mix with formational groundwaters of similar density. Where the bedrock was not covered by brackish lake or sea water similar freeze-out processes would occur on a smaller scale within the hydraulically active fractures and fracture zones, again resulting in formation of a higher density saline component which would gradually sink and eventually mix with existing saline groundwaters. Laboratory experiments at the University of Waterloo, Canada /S Frape, pers comm, 2003/, indicate that the volume of high salinity water produced from brackish waters by this freeze-out process would be much less than initially considered by Bein and Arads (op cit) and would tend to form restricted pockets of high density saline water rather than a continuous horizon of high salinity in the case of a lake or sea environment.

With continued evolution and movement of the ice sheet, areas previously subject to permafrost would be eventually covered by ice accompanied by a rise in temperature and a slow decay of the underlying permafrost layer. Hydrogeochemically, this decay may have resulted in distinctive signatures being imparted to the groundwater and fracture minerals.

3.1.2 Deglaciation and flushing by meltwater

During subsequent melting and retreat of the ice sheet the following sequences of events are thought to have influenced the Simpevarp area (see Figure 3-1):

- During the recession and melting of the continental ice sheet, glacial meltwater was hydraulically injected into the bedrock (> 14,000 BP) under considerable head pressure close to the ice margin. The exact penetration depth is still unknown, but depths exceeding several hundred metres are possible according to hydrodynamic modelling /e.g. Svensson, 1996/. Some of the permafrost decay groundwater signatures may have been disturbed or destroyed during this stage.

- Different non-saline and brackish lake/sea stages then transgressed the Simpevarp area during the period ca. 14,000–4000 BP. Of these, two periods with brackish water can be recognised; Yoldia Sea (11,500 to 10,800 BP) and Litorina Sea starting at 9500 and continuing to the present. The Yoldia period has probably resulted in only minor contributions to the subsurface groundwater since the water was very dilute to brackish from the large volumes of glacial meltwater it contained. Furthermore this period lasted only for 700 years. The Litorina Sea period in contrast had a maximum salinity of about twice the present Baltic Sea and this maximum prevailed at least from 6500 to 5000 BP; during the last 2000 years the salinity has remained almost equal to the present Baltic Sea values /Westman et al, 1999 and references therein/. Because of increased density, the Litorina Sea water was able to penetrate the bedrock resulting in a density turnover which affected the groundwater in the more conductive parts of the bedrock. The density of the intruding sea water in relation to the density of the groundwater determined the final penetration depth. As the Litorina Sea stage contained the most saline groundwater, it is assumed to have had the deepest penetration depth eventually mixing with the glacial/brine groundwater mixtures already present in the bedrock.

- When the Simpevarp region was subsequently raised above sea level 5000 to 4000 years ago, fresh meteoric recharge water formed a lens on top of the saline water because of its low density. However, local hydraulic gradients resulting from higher topography to the west of the Simpevarp area may have flushed out varying amounts of these older waters, at least to 100–150 m, with the freshwater lens mostly occupying these depths today depending on local hydraulic conditions.

Many of the natural events described above may be repeated several times during the lifespan of a repository (thousands to hundreds of thousands of years). As a result of these events, brine, glacial, marine and meteoric waters are expected to be mixed in a complex manner at various levels in the bedrock, depending on the hydraulic character of the fracture zones, groundwater density variations and borehole activities prior to groundwater sampling. For the modelling exercise which is based on the conceptual model of the site, groundwater end members reflecting, for example, Glacial meltwater and Litorina Sea water composition, were added to the data set (cf Appendix 3).

The uncertainty of the updated conceptual model increases with modelled time. The largest uncertainties are therefore associated with the stage showing the flushing of glacial melt water. The driving mechanism behind the flow lines in Figure 3-1 is the shore level displacement due to the land uplift.

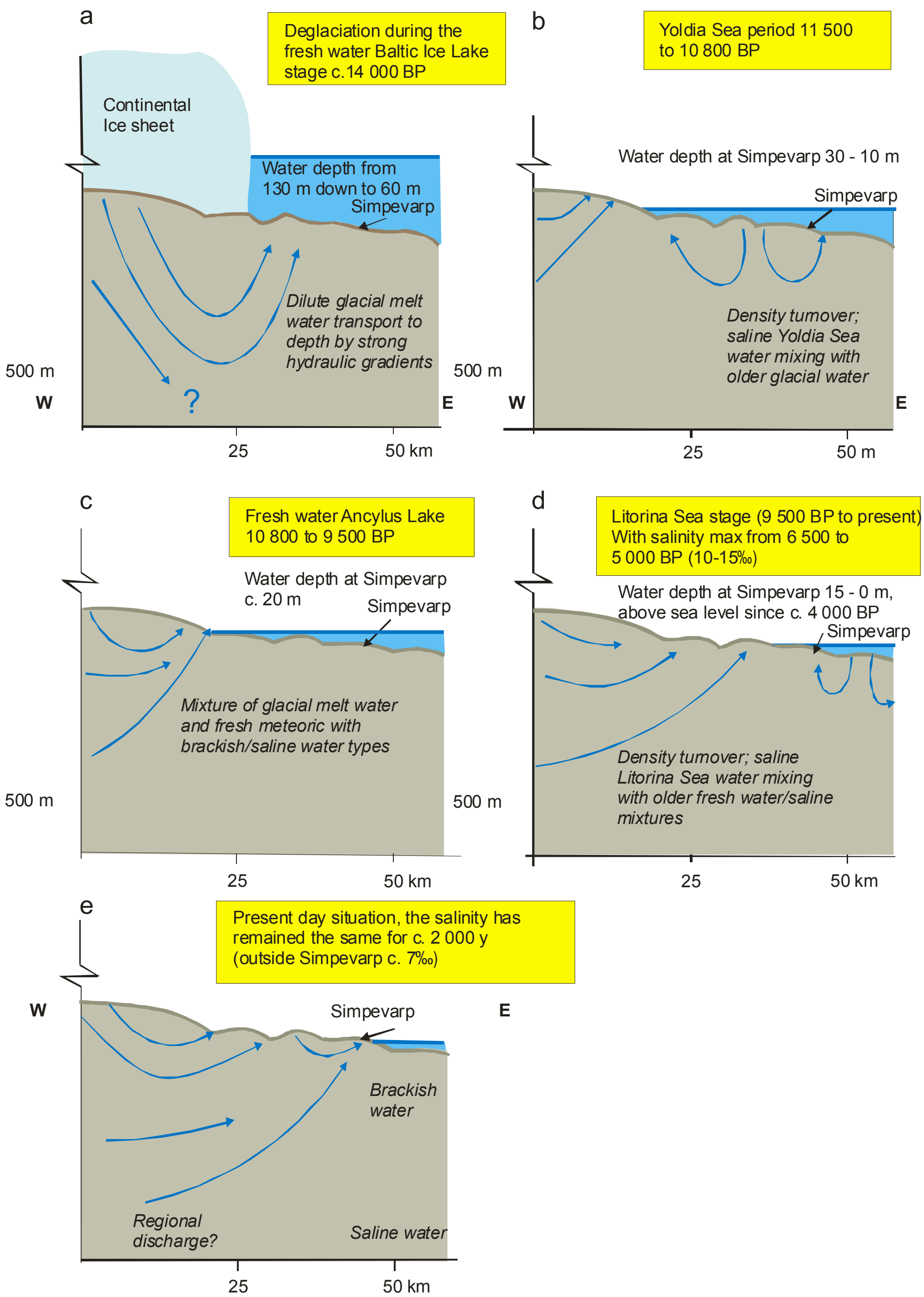

Figure 3-1. *An updated conceptual postglacial scenario model for the Simpevarp area. The figures show possible flow lines, density driven turnover events and non-saline, brackish and saline water interfaces. Possible relation to different known postglacial stages such as land uplift which may have affected the hydrochemical evolution of the site is shown: a) deglaciation of the continental ice, b) Yoldia Sea stage, c) Ancylus Lake stage, d) Litorina Sea stage, and e) present day Baltic Sea stage. From this conceptual model it is expected that glacial meltwater and deep and marine water of various salinities have affected the groundwater. Based on the shoreline displacement curve compiled by /T Påsse, pers comm, 2003/ and information from /Fredén, 2002; Westman et al, 1999; SKB, 2002/.*

4 Evaluation of primary data

This section describes the evaluation of the primary hydrogeochemical data. Most of these data are from waters sampled at various surface locations and in a few boreholes. The evaluation essentially aims at identifying representative datasets which are used for further analysis and providing a first conceptualisation of the origin and evolution of the Simpevarp groundwaters.

4.1 Hydrogeochemical data evaluation

The dataset available consists in total of 535 water samples (cf Appendix 4). Samples reflecting the surface/near-surface conditions (precipitation, streams, lakes, sea water and shallow soil pipe waters) comprise a total of 419 samples. Of the remainder, 11 samples are from percussion drilled boreholes and 105 samples from core drilled boreholes; some of these borehole samples represent repeated sampling from the same isolated location or sample of the water column in an open borehole (tube sampler). In conclusion, there is a heavy bias at this stage in the site characterisation of water samples from the surface and near-surface environments. Consequently, hydrochemical evaluation at greater depths is restricted to only a few borehole sampling points.

In the total dataset only 86 surface samples, 4 percussion borehole samples and 21 core-drilled samples were analysed for all the major elements, stable isotopes and tritium at the time of the "data freeze" analysed for all the major elements, stable isotopes and tritium. This means that 21% of the samples could be used for more detailed evaluation concerning the origin of the water. How the dataset was used in the different models is listed in Appendix 5.

4.1.1 Surface chemistry data

A total of 86 surface water samples were analysed sufficiently enough to be used in the detailed evaluation. Analysed data include: major cations and anions (Na, K, Ca, Mg, Si, Cl, HCO_3^-, SO_4^{2-}, S^{2-}), trace elements (Br, F, Fe, Mn, Li, Sr, DOC, N, PO_4^{3-}, U, Th, Sc, Rb, In, Cs, Ba, Tl, Y and REEs) and stable (^{18}O, ^{2}H, ^{13}C, ^{37}Cl, ^{34}S, ^{10}B) and radiogenic (^{3}H, ^{14}C, ^{226}Ra, ^{228}Ra, ^{222}Rn, ^{238}U, ^{235}U, ^{234}U, ^{232}Th, ^{230}Th and ^{228}Th) isotopes, but only for some samples. Additionally, for some samples there are nutrient and organic data including NH_4, NO_2, NO_3, N_{Tot}, P_{Tot}, PO_4, poP (particulate organic P), poN (particulate organic N), poC (particulate organic C), Chlorophyll A, Chlorophyll C, Pheopigment, TOC, DOC, DIC and O_2. Water temperature, pH, conductivity, salinity, turbidity and oxygen concentration values were determined at the nearby Äspö Laboratory shortly after sampling. There are no measured Eh and temperature values. The surface sampling locations are shown in Figure 4-1.

Figure 4-1. *Surface water sampling locations at the Simpevarp area.*

4.1.2 Chemistry data sampled in boreholes

Two cored boreholes have been sampled, KSH01 and KSH02. With respect to nomenclature in the report text, the first 100 m of each borehole (the initial percussion drilled portion) is referred to as 'B' (i.e. KSH01B and KSH02B) and from 100 m to the hole bottom (by core drilling) is referred to as 'A' (i.e. KSH01A and KSH02A). Since all hydrogeochemical data originate from the cored borehole length, all reference in the text is to KAS01A and KSH02A.

The borehole sampling locations at the Simpevarp area are shown in Figure 4-2 and the sampling and analytical data have been reported for the groundwaters by /Wacker, 2003/. In the data evaluation 116 groundwater samples have been used. The analytical programme include: major cations and anions (Na, K, Ca, Mg, Si, Cl, HCO_3^-, SO_4^{2-}, S^{2-}), trace elements (Br, F, Fe, Mn, Li, Sr, DOC, N, PO_4^{3-}, U, Th, Sc, Rb, In, Cs, Ba, Tl, Y and REEs) and stable (^{18}O, ^{2}H, ^{13}C, ^{37}Cl, ^{10}B, ^{34}S) and radioactive-radiogenic

(^{3}H, ^{226}Ra, ^{228}Ra, ^{222}Rn, ^{238}U, ^{235}U, ^{234}U, ^{232}Th, ^{230}Th and ^{228}Th) isotopes. Note: The samples were not analysed for all these elements at the time of the "data freeze" (cf Appendix 4).

The different analytical results obtained with contrasting analytical techniques for Fe and S have been confirmed with speciation-solubility calculations and checking their effects on the charge balance. The values selected for modelling were those obtained by ion chromatography (SO_4^{2-}) and spectrophotometry (Fe) assuming no colloidal contribution. The selected pH and Eh values correspond to available downhole data (cf Appendix 4).

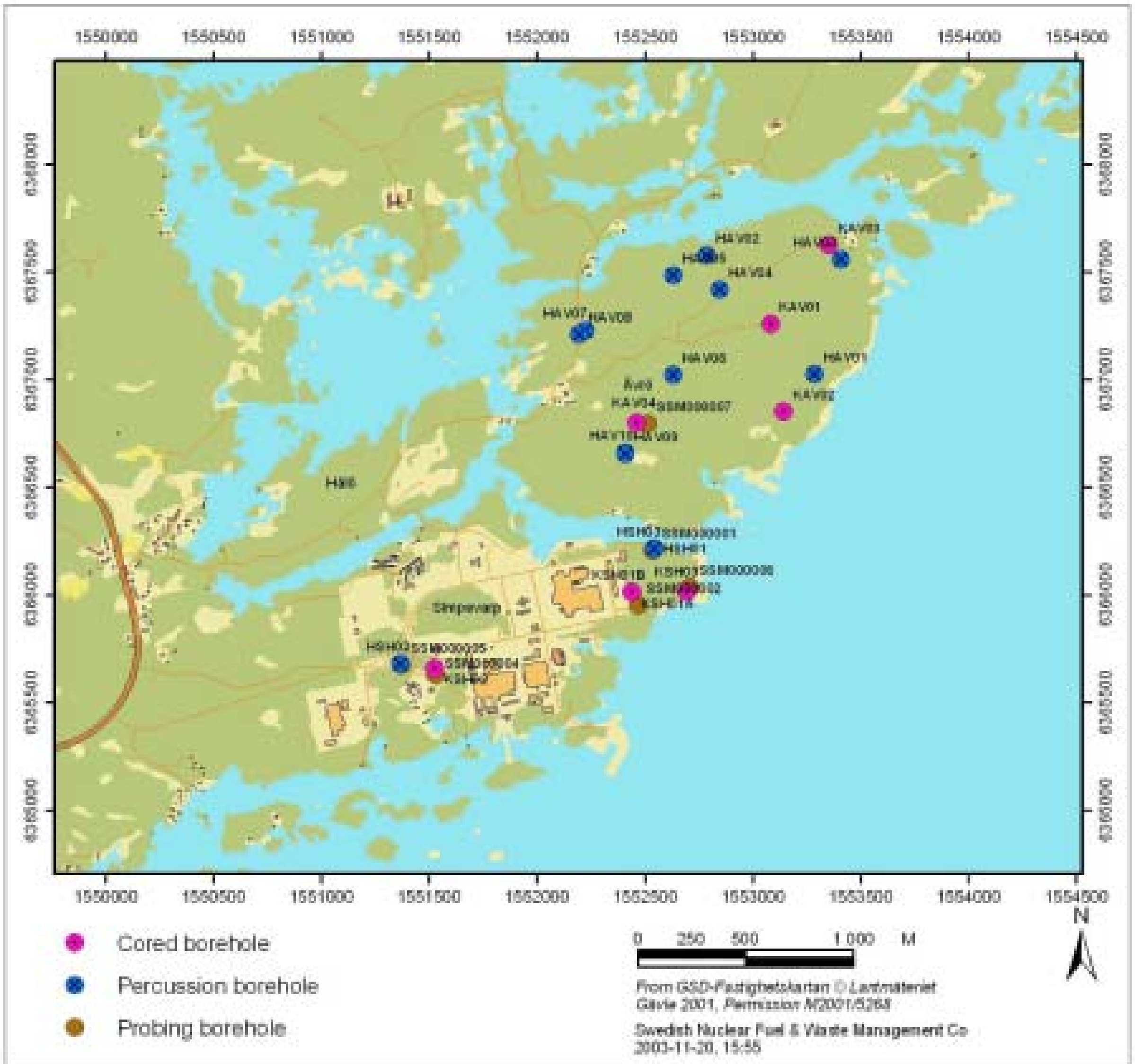

Figure 4-2. *The groundwater sampling locations at the Simpevarp sub area.*

4.1.3 Representativeness of the data

By definition, a high quality sample is considered to be that which best reflects the undisturbed hydrological and geochemical in situ conditions for the sampled section. A low quality sample may contain in situ, on-line, at-line, on-site or off-site errors such as contamination from tubes of varying compositions, air contamination, losses or uptake of CO_2, long storage times prior to analysis, analytical errors etc. The quality may also be influenced by the rationale in locating the borehole and selecting the sampling points. Some errors are easily avoided, others are difficult or impossible to avoid. Furthermore, chemical responses to these influences are sometimes, but not always, apparent.

A sampling and analytical protocol is established prior to a sampling campaign. This protocol is based on established sampling routines or special requirements associated with the sampling campaign. The sampling and analytical protocols used in the sampling campaigns at Simpevarp are described by /Wacker, 2003/. The analytical precision for the major components: Na, K, Ca, Mg, HCO_3, Cl and SO_4 was checked by ion-balance calculation, where the difference between the anions and cations was calculated. The charge balance calculated for 326 surface samples (made both manually and through speciation-solubility calculations with PHREEQC) indicates that half of the samples show percent errors within the range of ± 10%; only these samples were used in the detailed modelling. The calculated charge balance for the 25 groundwater samples with complete analytical data indicates that the error is almost always in the range ± 5%. Only samples 5177 and 5174 from borehole KSH01A fall outside this range, with errors of +8.46% and +16.91%, respectively.

The pre-sampling Chemac in situ monitoring data for O_2, Eh, electrical conductivity and temperature are available for borehole KSH01A but not for KSH02. Additional information requested and received included the actual sampling dates of the groundwaters tabulated in the database received for evaluation, and also included the range of data from which the tabulated values were selected. Only some on-line monitored in situ field pH values were measured; most recorded values are laboratory-derived and lie about 0.6 pH units under the in situ values.

Based on flushing water content, borehole activities and data evaluation a detailed evaluation of the representativeness of borehole data is presented in Appendix 1. As a general conclusion the open hole tube samples are not representative for the KSH01A borehole and should be discarded. The sections KSH01A:156.50–167.00 m and KSH01A:245.00–261.50 m were considered representative. The sections KSH02:6.65–100.50 m and 739.0–755.0 m were regarded not representative while the section KSH02:411.85–467.07 m can be considered as fairly representative.

The drilling event is considered to be the major source for contamination of the formation groundwater. During drilling large hydraulic pressure differences can occur due to uplifting/lowering of the equipment, pumping and injection of drilling fluids. These events can facilitate unwanted mixing and contamination of the groundwater in the fractures, or the cutting at the drilling head itself can change the hydraulic properties of the borehole fractures. It is therefore of major importance to analyse the drilling events in detail. From this information not only the uranine spiked drilling water can be traced, but also the major risk of contamination and disturbances from foreign water volumes can be directly identified. Too low or excessive extraction of water from a fracture zone prior to sampling can be calculated by applying the DIS (Drilling Impact Study) modelling /Gurban and Laaksoharju, 2002/.

Hydraulically active fracture zones in two isolated sections in borehole KSH01A were the subject of the DIS modelling (156.5–167 m and 245–261.5 m). The modelling carried out for these fracture zones was based on the DIFF (differential flow meter logging) measurements and the main aim was to model the amount of the contamination (Figure 4-3) for each fracture zone (cf Appendix 3).

For section KSH01A:156.5–167 m, the DIS calculations show that the section was contaminated with 21.22 m^3 of foreign water of which a maximum of 5% consisted of drilling water when penetrating this section. Later drilling activities could increase the amount of contamination, due to the relatively high hydraulic conductivity of the section. The results from the pumping and sampling show 3.7% remaining drilling water in the first sample at the start of pumping, and 2.39% remaining drilling water in the final sample pumped. The duration of the pumping was from 28.03.2003 to 30.04.2003, with an average flow rate 200 mL/min /Pia Wacker, pers comm, 2003/. The volume removed was calculated to be 7.2 m^3 of drilling water mixed with groundwater. This can be compared with the maximum 21.22 m^3 volume of foreign water that contaminated the fracture. The average amount of drilling water remaining in the fracture is therefore 14 m^3. The sampling shows an amount of 2.39% drilling water after 600 hours of pumping. The DIS calculations show that the pumping should have continued further in order to remove the remaining 14 m^3.

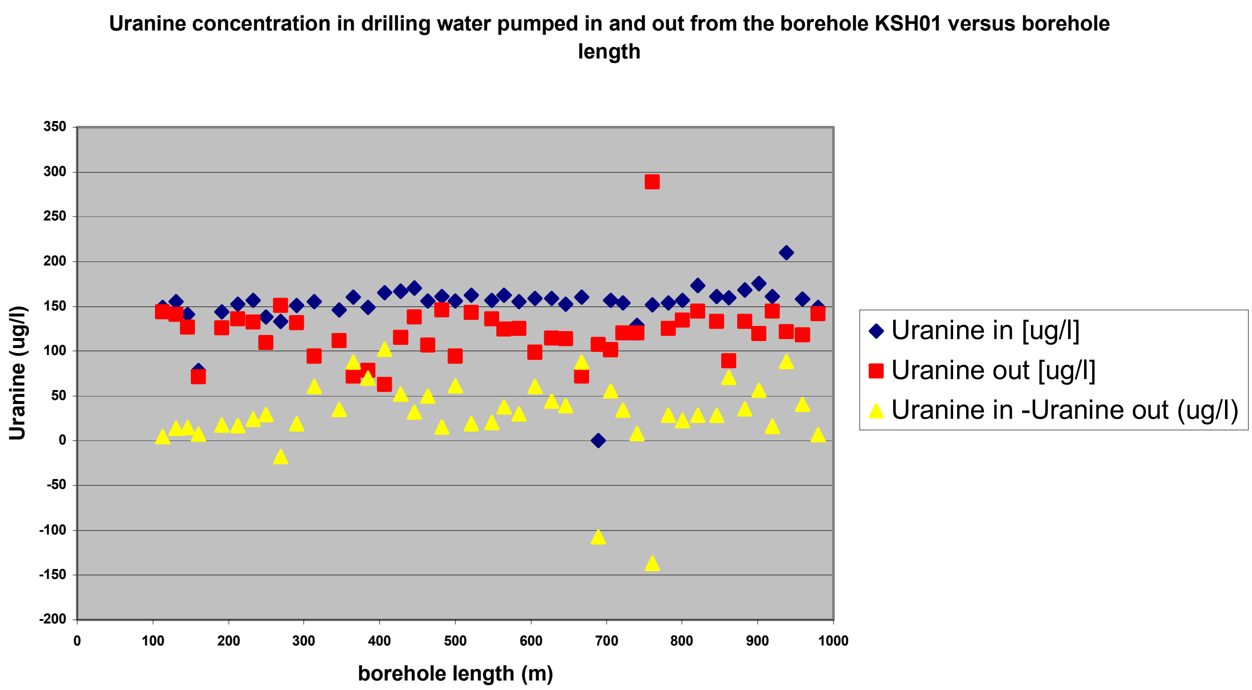

Figure 4-3. *Drilling water volume pumped in and out from borehole KSH01A during drilling.*

For section KSH01A:234–261.5 m, the calculations show that the section was contaminated during the drilling with 54.47 m^3 of foreign water of which maximum 18% consisted of drilling water. Later drilling activities could increase the amount of contamination, due to the relatively high hydraulic conductivity of the section. The results from the sampling show 8.02% drilling water in the last sample. The duration of the pumping was from 24.04.2003 to 20.5.2003, with an average flow rate of 200 ml/min. The volume removed was calculated to be, 10.9 m^3 of drilling water mixed with groundwater. This can be compared with the maximum volume of 54.47 m^3 foreign water that contaminated the fracture. The sampling shows an amount of 8.02% drilling water, sampled after 912 hours of pumping. The DIS calculations show that the pumping should have continued further in order to remove the remaining 43.5 m^3 In future the DIS calculations should be performed prior to sampling in order to support and guide the on-going sampling programme.

One fundamental question in modelling is whether the uncertainties lead to a risk of misunderstanding the information in the data. Generally the uncertainties from the analytical measurements are lower than the uncertainties caused by the modelling but the variability during sampling is generally higher than the model uncertainties.

4.1.4 Explorative analysis

A commonly used approach in groundwater modelling is to start the evaluation by explorative analysis of different groundwater variables and properties. The degree of mixing, the type of reactions and the origin and evolution of the groundwater can be indicated by applying such analyses. Also of major importance is to relate, as much as possible, the groundwaters sampled to the near-vicinity geology and hydrogeology. Because of incomplete data or below detection limits or suspect values at the time of the 'data freeze', evaluation of, for example the radiogenic isotopes, ^{87}Sr, ^{10}B and REEs and other trace elements, have not been included in this model version 1.1 stage.

Borehole properties

Borehole KSH01A penetrates different rock units. The main rock type in the upper part of the borehole (to 345 m) is the quartz monzodiorite with smaller volumes of dioritoid at 205–245 m and 325–340 m; larger amounts of dioritoid occur from 345–630 m. At greater depths to 1000 m are found granitic to granodioritic rocks (Ävrö granite) mixed with quartz monzodiorite. Smaller horizons of fine-grained granite occur at 360–365 m (mixed with pegmatite), 680–690 m and 720–730 m (mixed with mafic rocks) and 860–870 m. Large lengths of the drillcore show an increased fracture frequency accompanied by intense wall rock alteration/oxidation. This is most prominent in sections 250–285 m, 420–450 m and 590–630 m. Below 700 m the fracture frequency is significantly lower and only a slight alteration of the rock is observed. Figure 4-4 illustrates the major structures intercepted by borehole KSH01A and their hydraulic parameters, and indicates locations in red where groundwater samples have been taken. Drillcore mapping and available BIPS measurements show that both sub-vertical and subhorizontal fractures occur but the former structures are clearly dominant; this is partly due to the vertical orientation of the borehole.

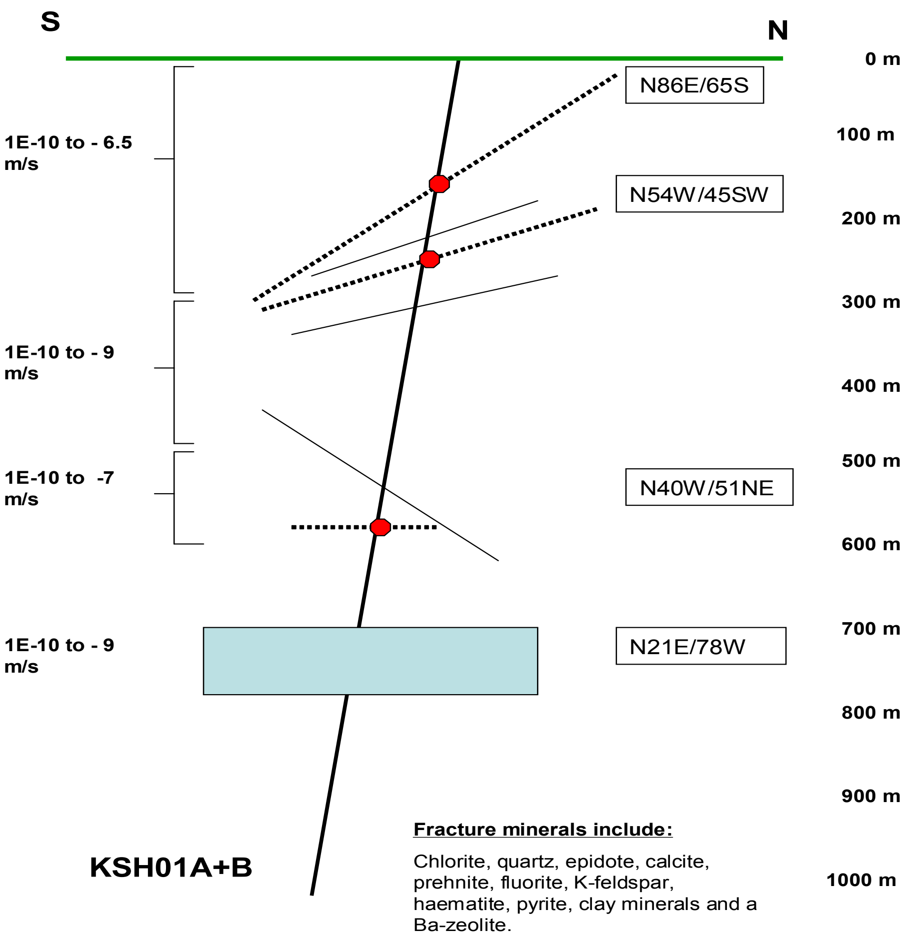

Figure 4-4. *Borehole KSH01A: Intercepted structures and their hydraulic parameters; groundwater sampling locations are indicated in red.*

Fractures are especially frequent in the upper 300 m of the borehole trending northwest and dipping mostly to the south and southwest. Lower intensity fracturing of similar trend but dipping to the northeast occurs between 550–600 m; at around 700 m a major isolated fracture trends northeast dipping to the west.

/Drake, Savolainen and Tullborg, written comm, 2003/ have identified several generations of mineralisations ranging from epidote facies (epidote, albite, quartz, calcite pyrite and muscovite) in combination with ductile deformation, over to brittle deformation in combination with oxidation and formation of haematite causing extensive red staining of the wall rock adjacent to the fractures. Subsequent breccia sealing by prehnite-fluorite, calcite and Fe-Mg chlorite has occurred followed by andularia haematite, harmontone (Ba-zeolite), Fe-chlorite (spherulite), calcite + REE-carbonates and clay minerals. The outermost coatings along the hydraulically conductive fractures consist mainly of clay minerals of mixed layer clay type (corrensite = chlorite/smectite) together with calcite and minor grains of pyrite.

Figure 4-5 shows downhole electrical conductivity (EC) measurements from borehole KSH02A under open hole conditions; the upper 100 m is not relevant as it relates to the cased borehole section. No log was available for KSH01A. Considering the more natural flow conditions without pumping (blue line), at 100 m the EC values are close to 0.1 Sm^{-1} and this is maintained to around 250 m. At this depth there is a rapid increase in EC eventually reaching 2.5 Sm^{-1} at 450 m; here it levels out until 830 m where there is a slight increase in salinity to 4 Sm^{-1} finally achieving 4.7 Sm^{-1} at the borehole bottom.

The low salinity recorded from 100–250 m probably corresponds to the equivalent level in borehole HSH02 which provided the source of the flushing water used during

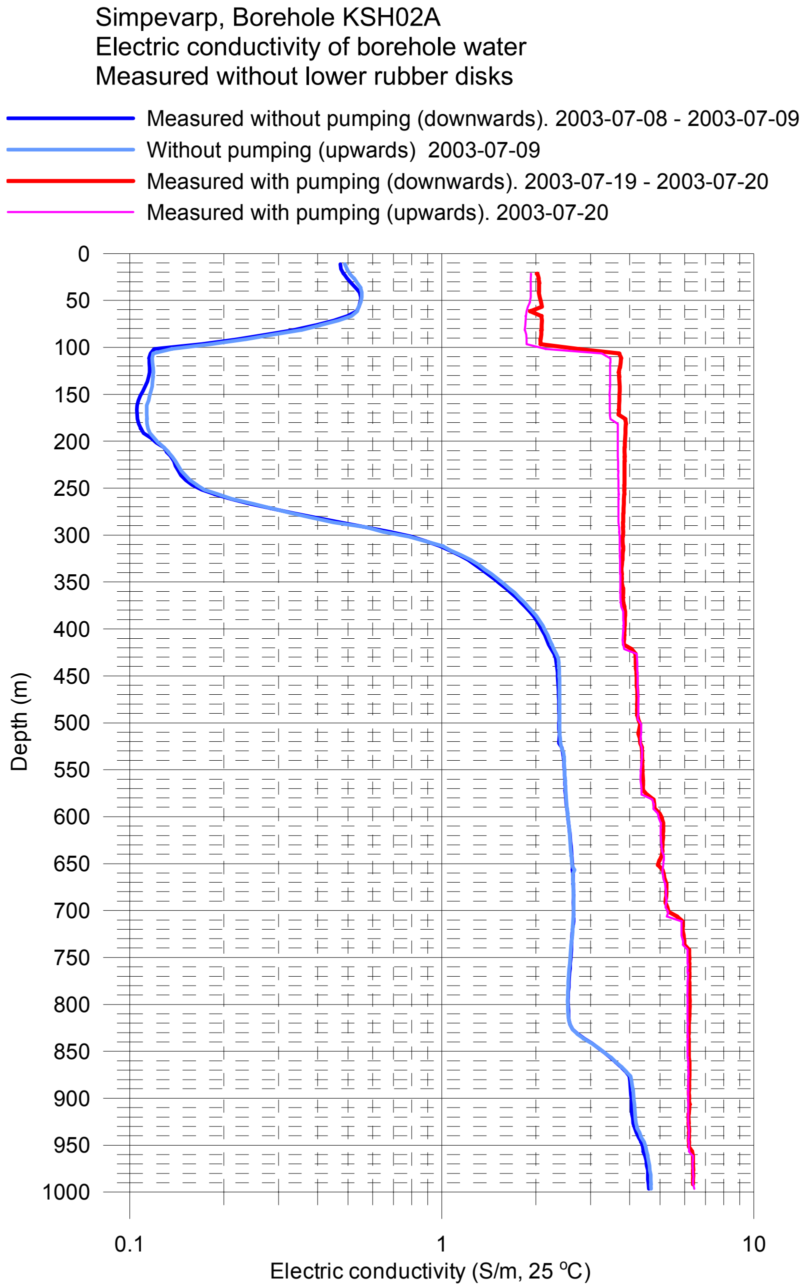

***Figure 4-5.** Electrical conductivity log for borehole KSH02A during open hole conditions.*

drilling, i.e. markedly fresh and dilute at approx 17 mg/L Cl. The increase in salinity with depth corresponds to the sampled level at 411.85–467.07 m where the chloride content lies around 6500 mg/L.

Although no log is available for KSH01A, the absence of dilute water from the sampled 100–250 m depth (chloride values average from 5000–6500 mg/L) probably reflects structural heterogeneities within the Simpevarp sub area. The absence of sufficient water in borehole HSH01 initially drilled as a source of flushing water may also reflect this situation.

Evaluation of scatter plots

The hydrochemical data have been expressed in several X-Y plots to derive trends that may facilitate interpretation. Since chloride is generally conservative in normal groundwater systems its use is appropriate to study hydrochemical evolution trends when coupled to ions, ranging from conservative and non-conservative, to provide information on mixing, dilution, sources/sinks etc. Many of the X-Y plots therefore involve chloride as one of the variables. The following is a preliminary evaluation of the various geochemical and isotopic trends apparent in the Simpevarp groundwaters. A more detailed evaluation of the major components and isotopes can be found in Appendix 1 and 2.

Evaluation of the hydrogeochemical data considers all sampled locations together in order to understand the overall large-scale dynamics and evolution of the groundwater systems. However, since the most quantitative hydrogeochemical data are from two borehole sections in KSH01A with Class 5 (a higher class of a sample indicates a more extensive analytical program, for details see /Smellie et al, 2002/) data located at 156.50–167.00 m and 245.00–261.50 m respectively, Class 3 data from one section at 197.00–313.42 m, and Class 3 data from one section in borehole KSH02A at 411.85–457.50 m, these data provide the main focus of the hydrogeochemical evaluation. Although considered unrepresentative, the open hole tube sampling data are also included for completeness but will be omitted in the next modelling phase. The following discussions therefore will relate only to groundwater samples obtained from predetermined packed off borehole sections.

General comparison of Cl vs depth with other sites

Considering samples from KSH01A (156.50–167.00 m and 245.00–261.00 m) and KSH02A (411.85–467.07 m), chloride increases from ~ 5500 to ~ 6400 mg/L over this depth range. At shallower levels chloride ranges from ~ 12 to ~ 55 mg/L which reflects the composition for the drilling waters extracted from open boreholes HSH03 and HSH02 respectively. Comparison with Forsmark, Laxemar and Olkiluoto (Finland) is shown in Figure 4-5. It may be argued that such a comparison should be treated with caution since Forsmark and Olkiluoto are geographically distant, have a somewhat differing palaeo-evolution and represent different hydrogeological regimes. Furthermore, Laxemar, although close by, represents more a mainland environment and involves greater depths. However, since the Fennoscandian basement hydrogeochemistry probably shares general similarities irrespective of geographic location, Figure 4-6 may serve a useful purpose particularly with respect to establishing whether a Litorina component is present in the Simpevarp groundwaters.

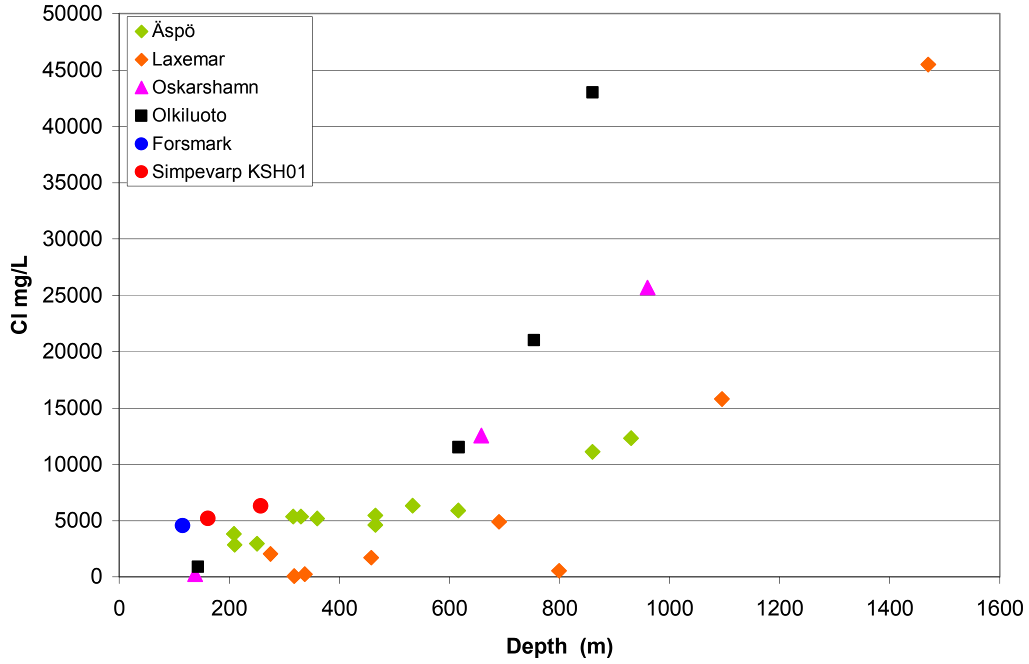

Figure 4-6. *Depth comparison of chloride between the Simpevarp (KSH01A), Forsmark, Laxemar, Olkiluoto and Oskarshamn localities.*

The Laxemar data show dilute groundwaters extending to approx 600 m and for KLX02 to around 1000 m before a rapid increase in salinity to maximum values of around 47 g/L Cl at 1700 m. Olkiluoto shows an initial sharp increase in chloride at around 150 m to a levelling off at 5 g/L Cl which continues to 450 m; here there is a relatively steady increase to maximum values of around 20 g/L Cl at 900 m depth (one maximum value of 44 g/L Cl was recorded). The available Forsmark data so far show a close similarity to the initial Olkiluoto trends, and the Simpevarp data, whilst also limited, also falls along the general plateau ranging from around 5.1–6.3 g/L Cl. It will be interesting to see if Simpevarp will follow the same rapid increase in salinity with increasing depth as at Olkiluoto and Laxemar. In common with the Forsmark data, an initial observation at this juncture is that the levelling out at 5 g/L Cl at Olkiluoto has been interpreted as possibly reflecting a Litorina Sea water component. Whether this may be also the situation at Simpevarp, as is the case for Forsmark, is further discussed below.

pH vs Cl for all Simpevarp data

Superficial fresh waters show a wide range of pH values as a consequence of their multiple origin (Figure 4-7). The lowest values are associated with waters with a marked influence of atmospheric and biogenic CO_2; the highest values are associated with the most diluted groundwater samples from percussion boreholes. Overall this gives a decreasing trend with chloride when the rest of the groundwater samples are taken into account. Nevertheless, this trend is partially defined by contaminated samples and affected by uncertainties of pH measurements in the laboratory.

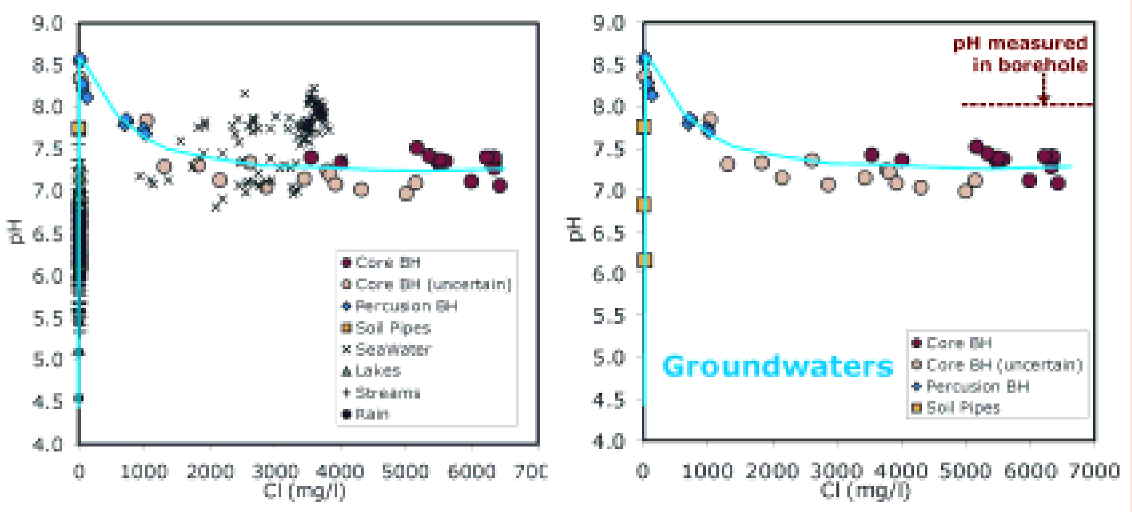

Figure 4-7. *pH vs chloride content (increasing with depth) in the Simpevarp waters.*

Appendix 2 presents an analysis of the uncertainties associated with pH values. Broadly speaking, the main features of the pH trend can be correlated with other Fennoscandian sites with similar waters (e.g. Äspö and Olkiluoto; /Laaksoharju and Wallin, 1997/ and /Pitkänen et al, 1999/ respectively), also affected by uncertainties in pH /e.g. Pitkänen et al, 1999/.

Alkalinity vs Cl for all Simpevarp data

Alkalinity (HCO_3^-) is, together with chloride and sulphate, the third major anion in the system, being the most abundant in the non-saline waters. Its concentration increases to equilibrium with calcite in the surface waters as a result of weathering up to equilibrium with calcite; then, it decreases dramatically with as a result of mixing and calcite precipitation depth (Figure 4-8). It is worth noting that the samples contaminated with flushing water (pale red circles dubbed “uncertain” in Figure 4-8a) again fit very well the trend defined by the rest of the samples. This alkalinity trend is similar to that observed in the nearby sites Äspö and Oskarshamn (borehole KOV01) (e.g. Figure 4-8b).

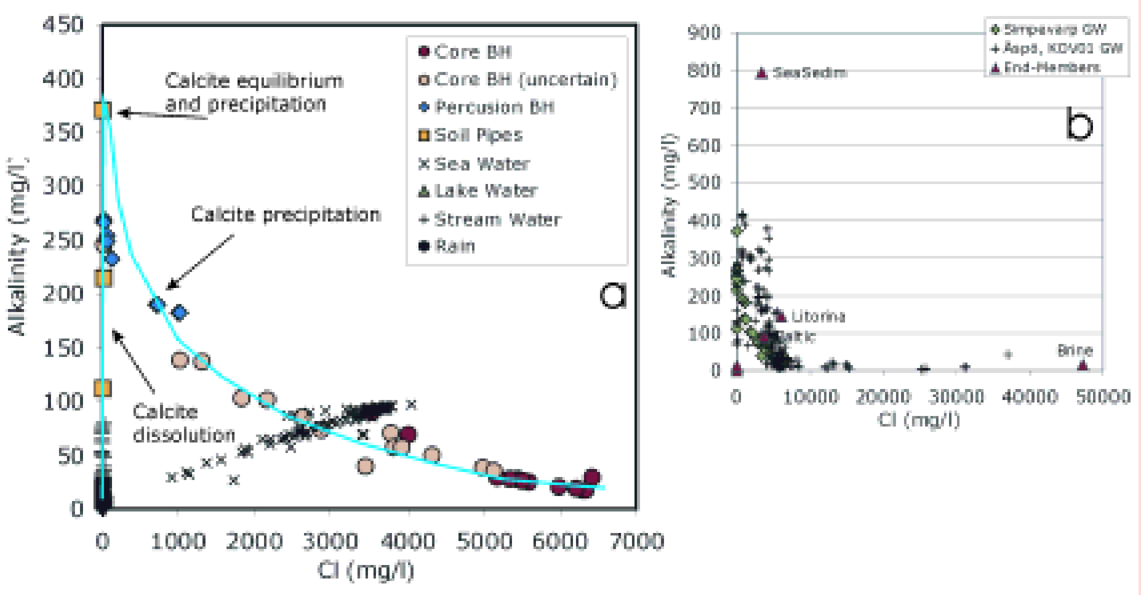

__Figure 4-8.__ Alkalinity vs Cl in water for all Simpevarp data (a) and comparison with Äspö and Oskarshamn (b). Figure (b) also indicates the main end members for the Simpevarp area, i.e. Sea Sediment, Brine, Litorina, Baltic and modern Meteoric (Lakes, Streams, Precipitation) unnamed at the xy axes intersection (cf Chaper 5).

SO_4 vs Cl for all Simpevarp data

Figure 4-9, showing SO_4 vs Cl, indicates an obvious modern Baltic Sea water dilution trend with the cored borehole samples possibly representing a separate saline dilution trend although there are inadequate data at this stage to be more specific. The reliable sulphate values for borehole KSH01A are generally low (32–51 mg/L) and show no correlation with Cl; Borehole KSH02A contains greater amounts of SO_4 (177 mg/L) but this may be a function of increasing sulphate with depth (in common with the Äspö data). The sulphur isotope data (cf Appendix 1) support a marine origin of the sulphate in the two sampled sections in borehole KSH01A. However, the SO_4/Cl ratio is much too low to be representative of a Litorina Sea water, and later modification caused by sulphate reducing bacteria is expected to have caused an increase in sulphur isotope ratios.

In general, these data for the representative cored borehole groundwaters lend support to an absence of a significant postglacial marine component, instead suggesting mixing with deeper, more saline waters of a non-marine origin.

Comparing all the Simpevarp SO_4 vs Cl data with the Forsmark site (Figure 4-10) further underlines the distinction between Forsmark, characterised by a strong marine (Baltic Sea plus Litorina Sea) signature, and Simpevarp which trends towards a non-marine or non-marine/marine signature.

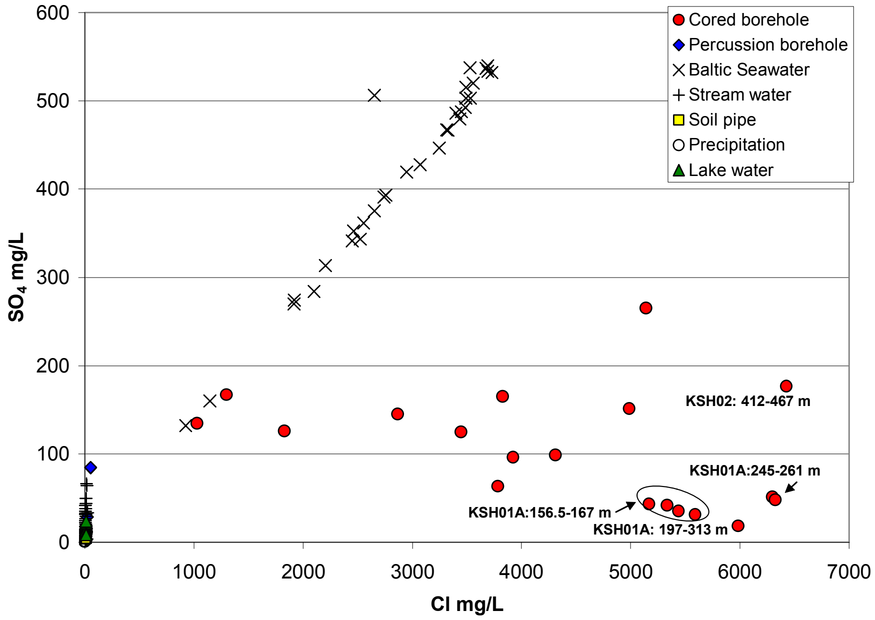

***Figure 4-9.** Plot of SO_4 vs Cl for all Simpevarp data. (Note: Cored borehole samples not labelled represent open hole mixing and should be ignored).*

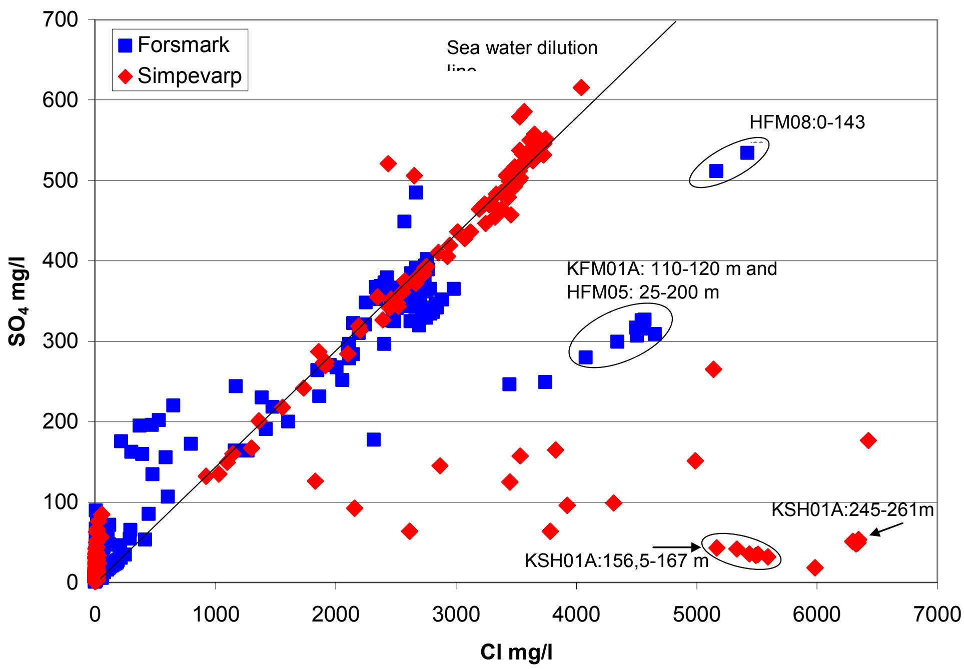

***Figure 4-10.** Plot comparing all Simpevarp SO_4 vs Cl data with the Forsmark site.*

Mg vs Cl for all Simpevarp data and comparison with other Swedish sites

Figure 4-11 shows, in common with Figure 4-10, two clear observations: a) an obvious modern Baltic Sea water dilution trend, and b) a clear borehole groundwater isolated group probably forming part of a different saline dilution trend that may become clearer with additional data in the future. Borehole KSH02 (411.85–457.07 m) has a significantly lower Mg content (10 mg/L at 6426 mg/L Cl) than the three KSH01A samples.

With respect to the modern Baltic Sea water dilution trend, the plotted data generally show a large spread to more dilute mixing compositions, and extreme examples exist where only small amounts of Cl are present. Because of this mixing there is no distinct clustering of the data that would indicate a representative Baltic Sea composition, although a small concentration in values occurs between 3300–3700 mg/L Cl.

According to /Ericsson and Engdahl, 2003/ two distinct environments have been sampled for 'Baltic Sea' water; that close to the open sea with only a few small islands surrounding them (locations PSM002060/61), and that situated close to the mainland, surrounded by large islands and more subject to dilution from seasonal run-off effects from the mainland (PSM002062/64). This would explain the nature of the Baltic Sea dilution line and also may explain the three anomalous samples around 2500 mg/L Cl (from localities PSM002060/61).

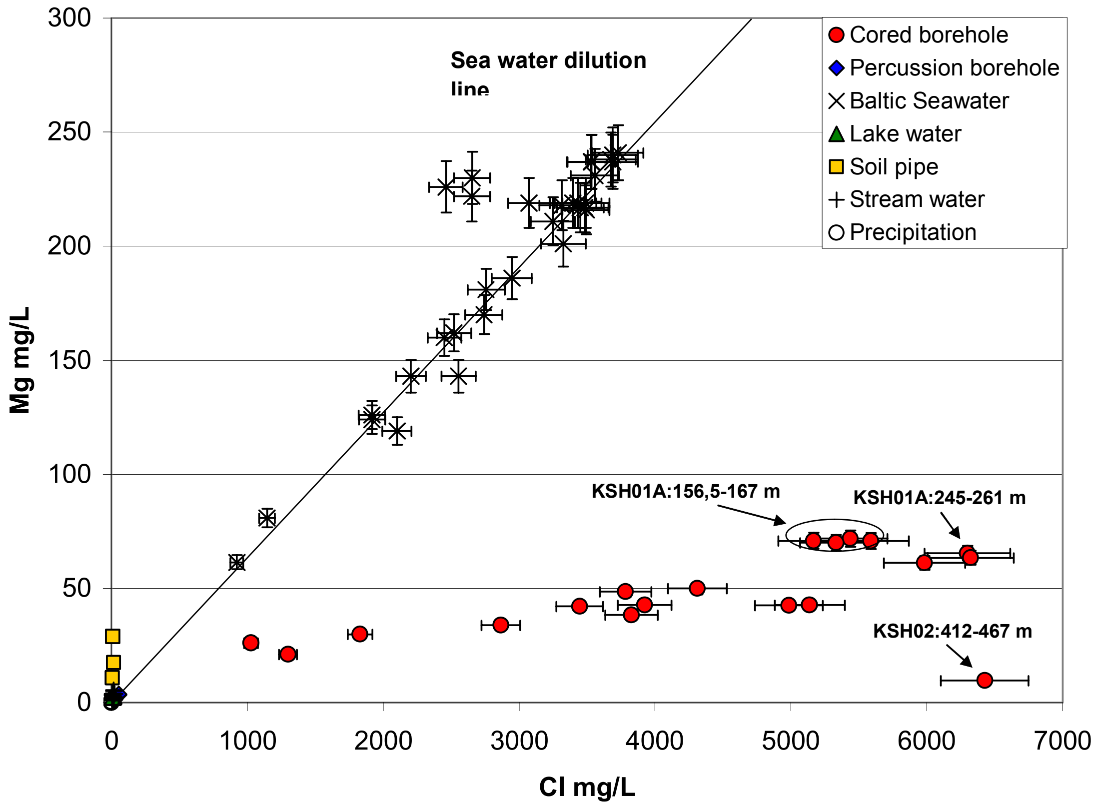

Figure 4-11. *Plot of Mg vs Cl for all Simpevarp data showing analytical error bars ± 5%. (Note: Cored borehole samples not labelled represent open hole mixing and should be ignored).*

A further observation from Figure 4-11 is the spread of Mg values at low Cl contents for the Soil Pipe samples (0.91–5.37 mg/L); this may reflect: a) contact with an older marine water followed by cation exchange reactions and later flushing out of chloride, or b) simply water-rock interaction of recharge with minerals in the soil.

There is no indication from these borehole data of a significant Litorina Sea component; for example the Mg values are too low (10–72 mg/L) compared to the estimated values for the Litorina Sea composition (Mg ~ 448 mg/L; Cl ~ 6500 mg/L) as derived by /Pitkänen et al, 1999/.

Ca/Mg vs Br/Cl comparing all Simpevarp data with other Fennoscandian sites

By plotting Ca/Mg vs Br/Cl, Figure 4-12 provides an opportunity to indicate those data of marine origin versus data with a non-marine or a non-marine/marine mixing origin. For comparison, the Simpevarp data have been grouped with other Fennoscandian sites (Finnsjön, SFR, Forsmark, Äspö, Laxemar, Olkiluoto and Stripa); the Yellowknife-Thompson data have been included since they represent highly evolved basement brines in Canada where a significant marine component is unlikely.

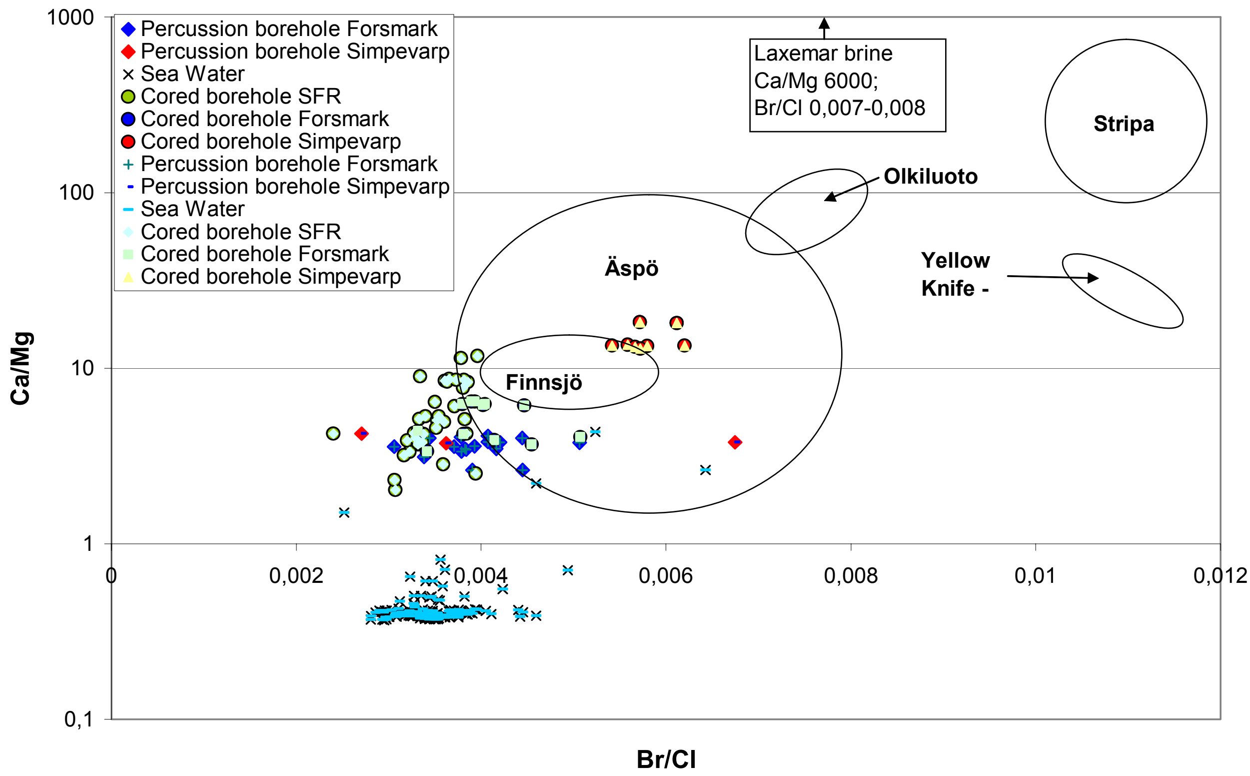

Figure 4-12. *Plot comparing all Simpevarp Ca/Mg vs Br/Cl data with other Fennoscandian sites and deep Canadian brines.*

The figure shows clearly the clustering of modern Baltic Sea water; these can be compared to the other extreme, the Stripa groundwaters, which are considered to be more representative of a non-marine origin since this area was not transgressed by the Litorina Sea or subsequent transgressions /Nordstrom et al, 1985/. Between these two extremes fall the range of Finnsjön and Äspö groundwaters considered to have a marine component of varying amounts /Smellie and Wikberg, 1991; Laaksoharju et al, 1999a/, and the Olkiluoto groundwaters which lean to a less marine component at greater depths /Pitkänen et al, 1999/. The Laxemar data, of deep basement origin, plot off the diagram further emphasising their non-marine character. Collectively the Forsmark borehole groundwaters cluster towards a dominant marine component, more similar to the SFR than the Finnsjön groundwaters, although the Forsmark cored borehole samples do extend towards a slightly less marine component.

The Simpevarp cored borehole groundwater data plot well within the range of the Äspö samples suggesting a more non-marine signature when compared with the Simpevarp percussion boreholes and the Forsmark waters which plot closer to the Baltic Sea/marine-related region of the figure. A more non-marine Simpevarp signature is supported by plotting Br vs Cl (cf Appendix 1).

Na vs Cl for all Simpevarp data

Sodium shows a positive and very good linear correlation with chloride concentration (Figure 4.13a), which reflects that mixing (and, in this case, contamination) is the main process controlling the Na content. The deviation of representative groundwater samples from the sea water dilution line can be interpreted as a small influence of the saline end member or as Na removal due to cation exchange reactions.

Sodium contents and the trend of the representative cored borehole samples fit fairly well with the less saline Äspö and KOV01 data set (Figure 4-13b) although they seem to be more Na enriched in Simpevarp.

Si vs Cl for all Simpevarp data

The content of dissolved SiO_2 in surface waters indicates a typical trend of weathering, while in groundwaters it has a narrow range of variation indicative of a steady state (Figure 4-14a). The general process evolves from an increase in dissolved SiO_2 by dissolution of silicates in surface waters and shallow groundwaters to a progressive decrease related to the participation of silica polymorphs and aluminosilicates which control dissolved silica as the residence time of the waters increases. Silica contents of the representative cored borehole samples and their trend fit fairly well with the less saline Äspö and Oskarshamn (KOV01) data set (Figure 4-14b).

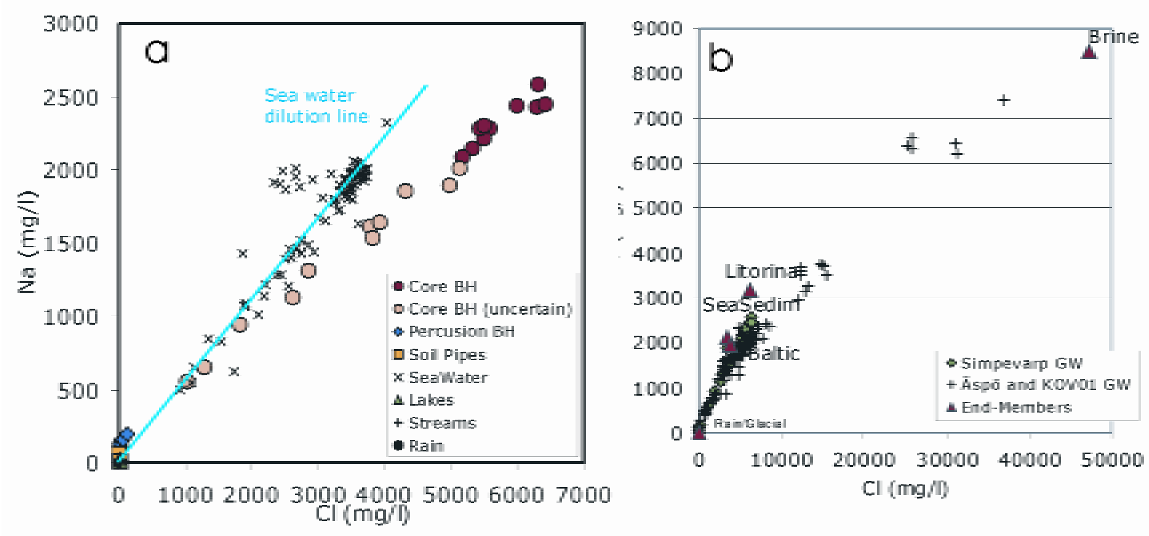

Figure 4-13. Plots of Na vs Cl for all Simpevarp data (a) and (b) comparison with the Äspö and Oskarshamn (KOV01) data.

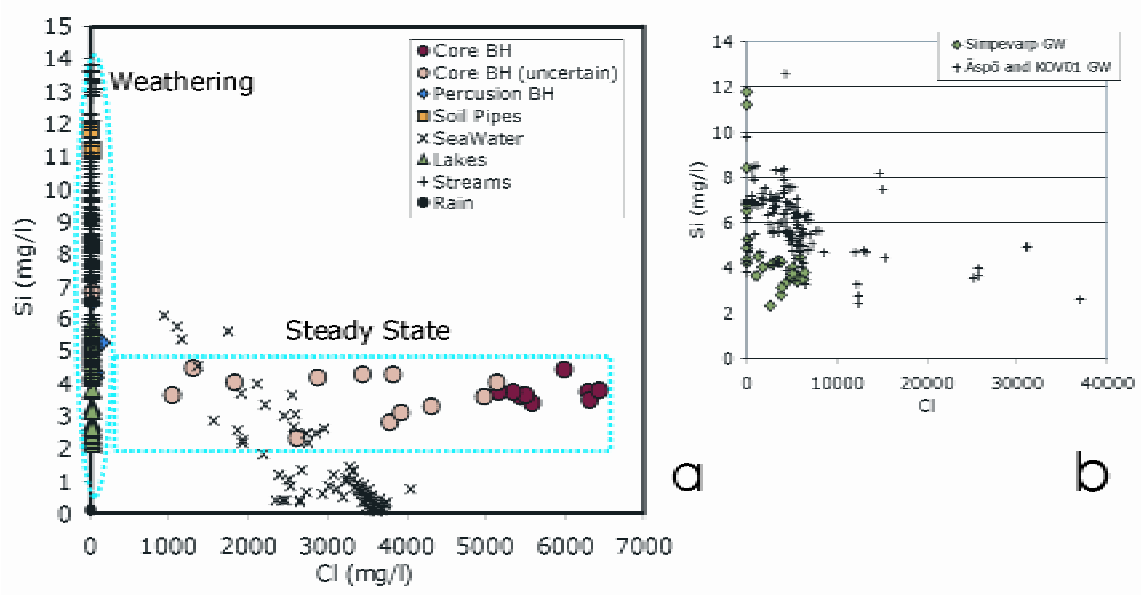

Figure 4-14. Plots of SiO_2 vs Cl for all Simpevarp data (a) and comparison with the Äspö and Oskarshamn sites (b).

δD vs $\delta^{18}O$ for all Simpevarp data and comparison with the Finnsjön and SFR sites

Figure 4-15 details the Simpevarp samples which plot on or close to the Global Meteoric Water Line (GMWL) indicating a meteoric origin. Three clear groups are indicated: a) Baltic Sea and Lake waters ($\delta^{18}O$ = –9.6 to –6.7‰ SMOW; δD = –72.7 to –54.1‰ SMOW), b) Stream Water ($\delta^{18}O$ = –11.7 to –9.7‰ SMOW; δD = –85.0 to –70.4‰ SMOW), and c) Cored Borehole waters ($\delta^{18}O$ = –14.1 to -12.6‰ SMOW; δD = –102.5 to –93.6‰ SMOW). The two precipitation $\delta^{18}O$ values represent a large spread ranging from –15.5 to –10.9‰ SMOW and δD from –116.9 to –80.6‰ SMOW. There is a clear indication of the Cored Borehole groundwaters representing cold recharge conditions, particularly from sections 245.0–261.5 m and 197.0–313.42 m in borehole KSH01A where recorded $\delta^{18}O$ and δD values are lightest (–14.1 to –13.4‰ SMOW and –102.5 to –100.0‰ SMOW respectively).

On closer inspection the Baltic Sea and Lake waters plot further from the GMWL in a trend (evaporation trend?) which intercepts the GMWL. There is no evidence of a mixing line towards the Baltic Sea samples as indicated in other regions /e.g. Olkiluoto; Pitkänen et al, 1999/. According to /Fritz and Fontes, 1980/ the deleted deuterium samples may be the result of surface evaporation which, at Simpevarp, would appear to be the case since the two sample groups (Baltic Sea and Lake waters) would be most subject to evaporation due to their large surface area exposure.

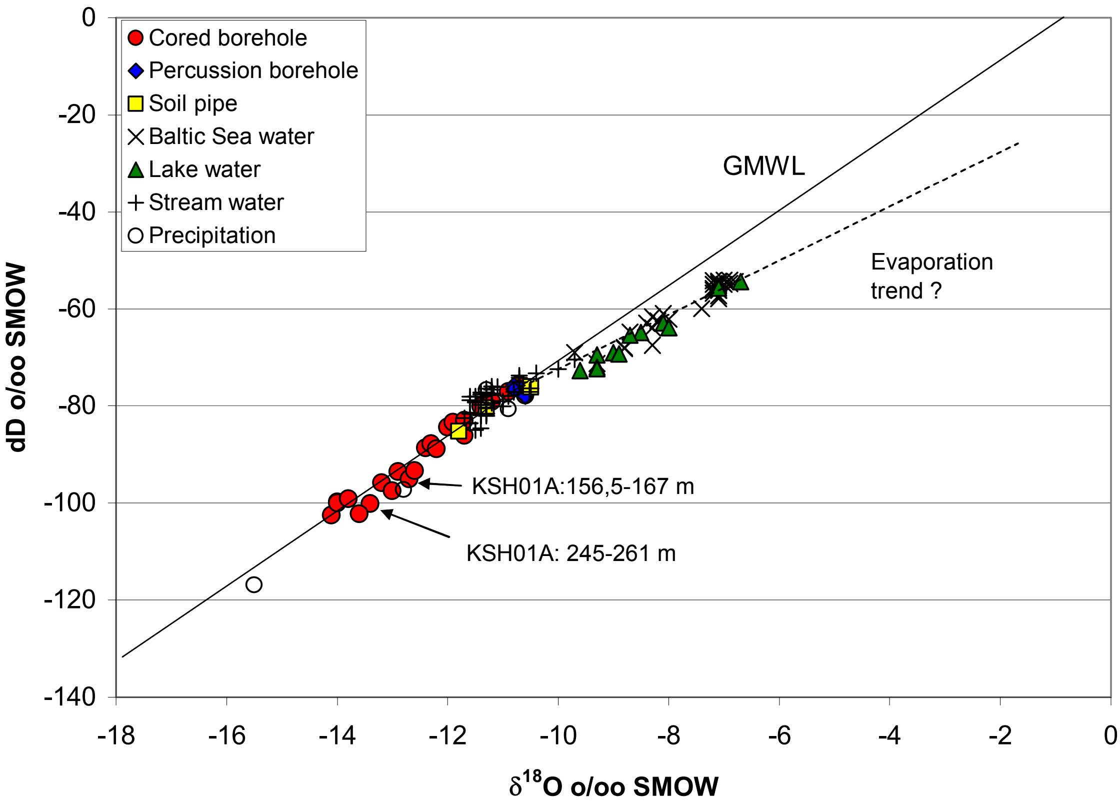

Figure 4-15. *Plot of δD vs δ18O for all Simpevarp data (GMWL = Global Meteoric Water Line). (Note: Cored borehole samples not labelled represent open hole mixing).*

$\delta^{18}O$ vs Cl for all Simpevarp data and comparison with the Finnsjön and SFR sites

The Lake and Stream waters from the Simpevarp areas (Figure 4-16) show a wide variation of $\delta^{18}O$ values (–11.7 to –6.7‰ SMOW) at low chloride contents; in turn there is a clear distinction between Lake Water (–6.7 to –9.6‰ SMOW) and Stream Water (–9.7 to –11.7‰ SMOW) with no major evidence of mixing. At higher chloride contents, and reflecting the above described plots, there is a clear Baltic Sea water dilution trend quite separate from the cored borehole group which may more obviously form part of a separate saline dilution trend when additional data become available. This conforms to the present hydrogeological interpretation that the near-surface and deep groundwater environments represent two distinct hydrogeological systems.

Figure 4-17, comparing Simpevarp with Forsmark, SFR and Finnsjön data, shows the Simpevarp KAH01A and KSH02A groundwaters plotting towards an increasing non-marine brine signature. Furthermore, the plotted areas for Baltic Sea, Lake and Stream waters correspond generally to that of Simpevarp. Of more significance is the absence of any of the Simpevarp samples plotting near or on the Litorina Sea dilution line. So far Simpevarp seems to lack a significant Litorina Sea component, even though it is reasonable to assume that Litorina Sea water entered the bedrock during the several thousand year long period when it covered the Simpevarp area (probably from 7000 BP to 4000 BP). However this water seems to have been subsequently removed (flushed out by meteoric recharge?). Less likely is the possibility that there never was a Litorina Sea component.

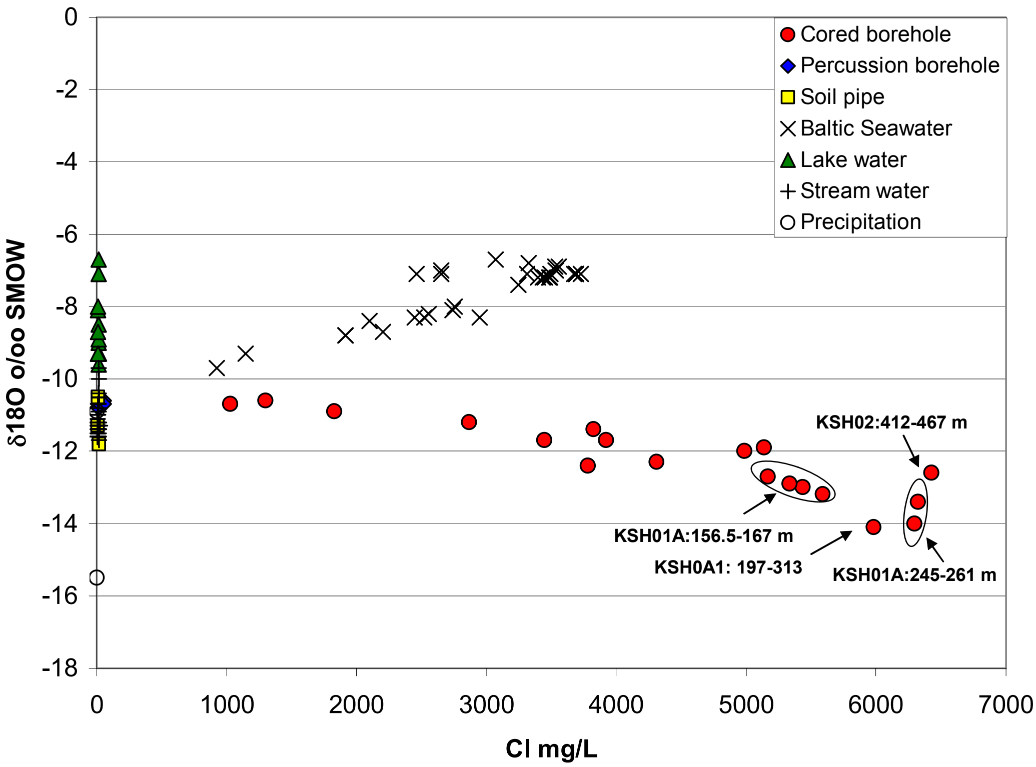

Figure 4-16. *Plot of $\delta^{18}O$ vs Cl for all Simpevarp data. (Note: Cored borehole samples not labelled represent open hole mixing and should be ignored).*

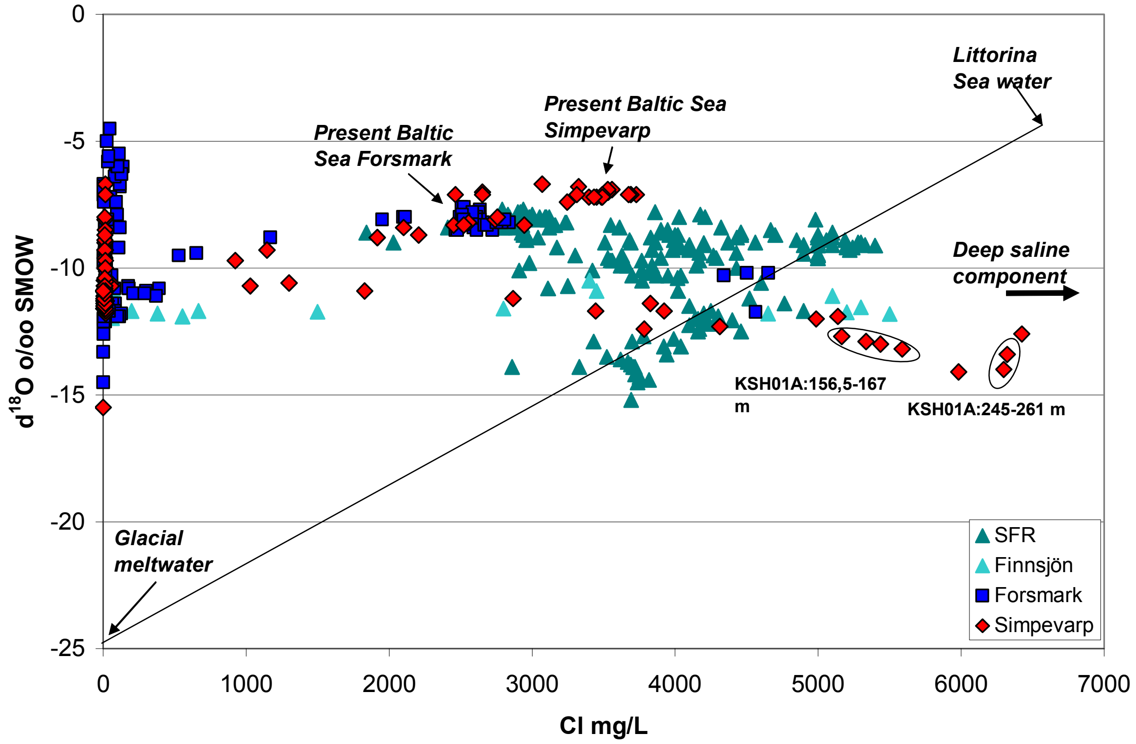

Figure 4-17. *Plot of $\delta^{18}O$ vs Cl comparing Simpevarp with Forsmark, SFR and Finnsjön.*

δ^{18}O vs tritium for all Simpevarp data

Figure 4-18 shows a wide range of δ^{18}O and tritium; the present-day average precipitation of 10–15 TU is associated with the Baltic Sea water and the Lake and Stream waters, as would be expected. The deepest samples from the cored borehole sections are tritium-free apart from one from the series taken from KSH01A (156.50–167.00 m) which registered 2.8TU; this probably represents some residual flushing water contamination from percussion borehole HSH03 (4.7–10 TU).

The range of δ^{18}O distinguishes very clearly between Baltic/Lake waters and Stream Water whereas tritium values differentiate between the Baltic Sea and Lake waters. This may be due to a large surface area evaporation for Lake and Baltic waters relative to a low surface area evaporation for Stream water. Alternatively, it may reflect longer residence times for these surface/sub-surface waters at shallow depths in the overburden where local recharge/discharge (plus some soil interaction) may have influenced their chemistry? More information is required on the near-surface/surface environment of the streams chosen for sampling.

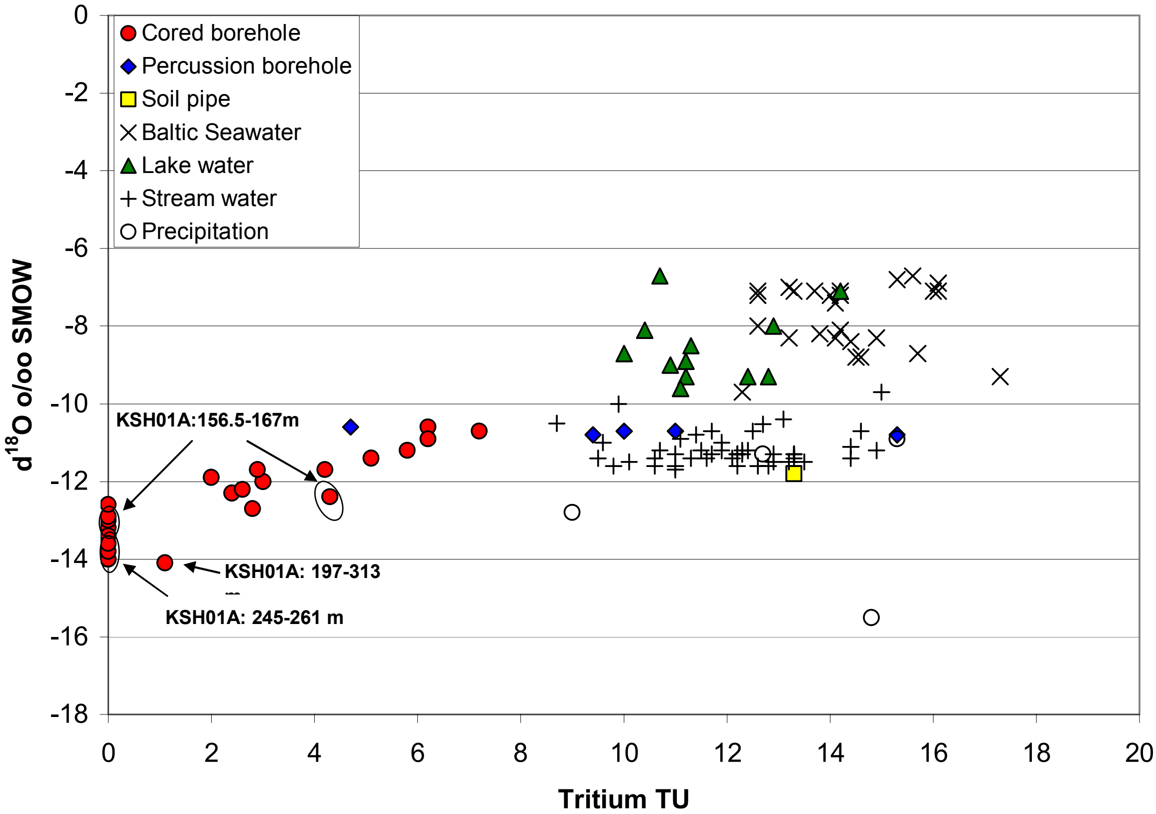

Figure 4-18. *Plot of $\delta^{18}O$ vs ^{3}H for Simpevarp data.*

The cored borehole groundwaters show diminishing tritium values with depth coupled with an increasing cold climate recharge $\delta^{18}O$ signature. The presence of tritium probably reflects some residual drilling water contamination. The percussion borehole data (with one exception) plot close to Stream Water compositions which might be an interesting observation.

Water classification

The aim of water classification is to simplify the groundwater information. First the data set was divided into different salinity classes. Except for sea waters, most surface waters and some groundwaters from percussion boreholes are fresh waters according to the classification used for Äspö groundwaters. The rest of the groundwaters are brackish (Cl < 5000 mg/L), except for three samples from KSH01A (at 253 m and 439 m depth) which are saline (> 5000 mg/L). Most surface waters are of Ca-HCO_3 or Na-Ca-HCO_3 type and naturally the sea water is of Na-Cl type. The deeper groundwaters are mainly of Na-Ca-Cl type. These water classes are illustrated by using different standard plots in Figure 4-19 and the results are listed for all samples in Appendix 3.

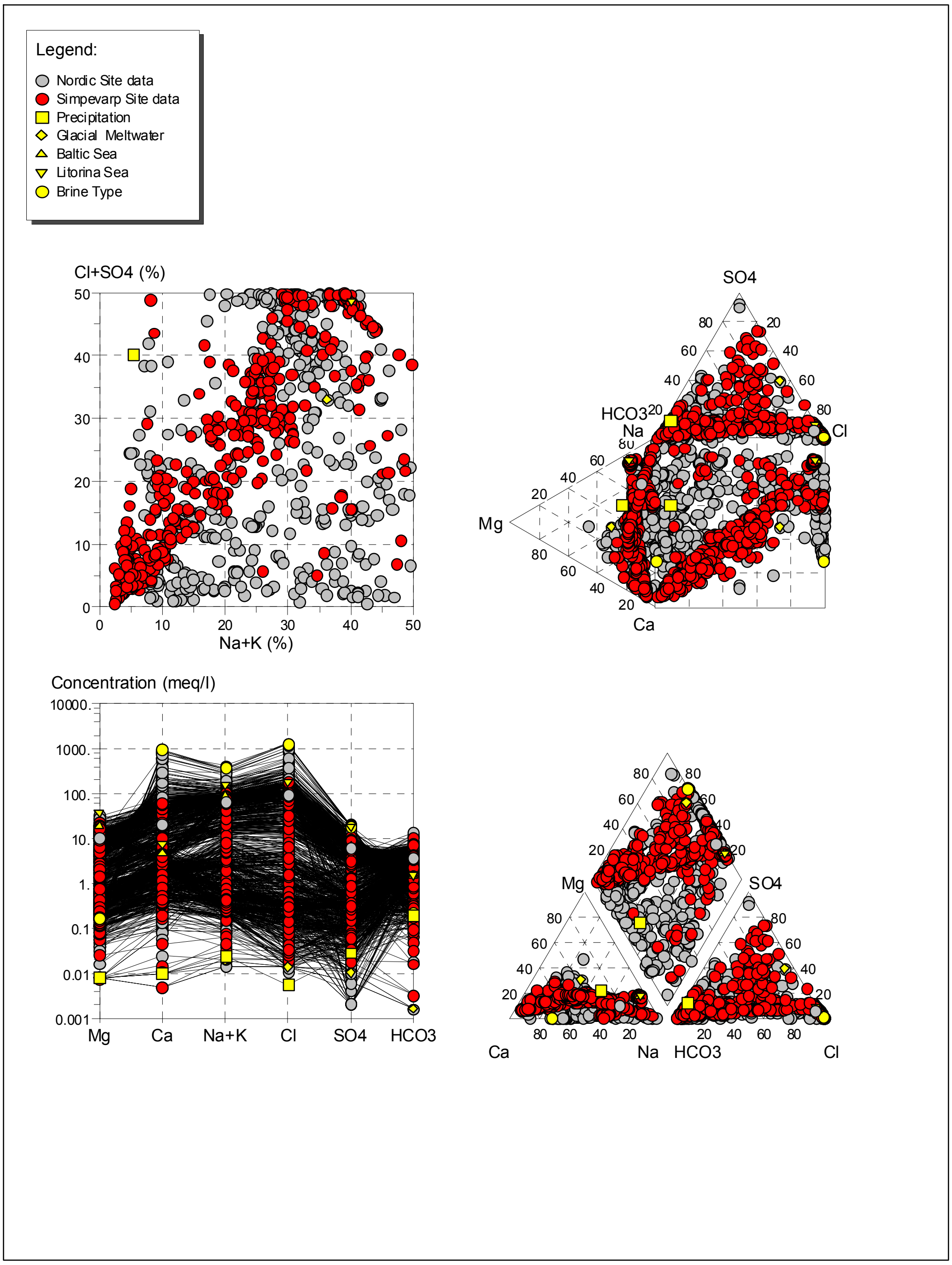

Figure 4-19. *Multicomponent plots used for classification of the groundwater data. Clockwise from the top left: Ludwig-Langelier plot, Durov plot, Piper plot and Shoeller plot applied on all Simpevarp data using AquaChem.*

5 Descriptive and quantitative modelling

5.1 Hydrogeochemical modelling

The data evaluation and modelling becomes a complex and time-consuming process when the information has to be decoded. Manual evaluation, expert judgment and mathematical modelling must normally be combined when evaluating groundwater information. A schematic presentation of how a site evaluation/modelling is performed and its components is shown in Figure 5-1. The methodology applied in this report is described in detail by /Smellie et al, 2002/.

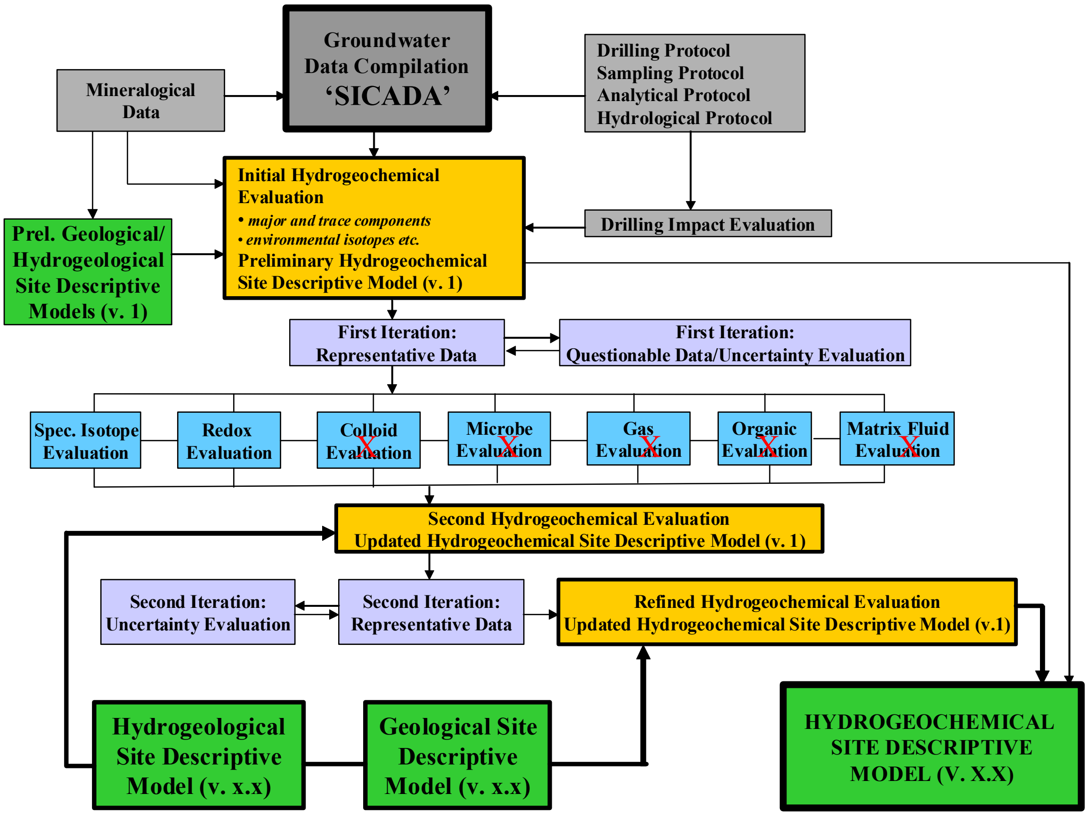

Figure 5-1. *The evaluation and modelling steps used in this report. The crossed over evaluation steps were not performed due to lack of data /after Smellie et al, 2002/.*

For the groundwater chemical calculations and simulations the following standard tools were used:

For evaluation and explorative analyses of the groundwater:

- AquaChem: Aqueous geochemical data analysis, plotting and modelling tool (Waterloo Hydrogeologic).

Mathematical simulation tools:

- PHREEQC with the database WATEQ4F: Chemical speciation and saturation index calculations, reaction path, advective-transport and inverse modelling /Parkhurst and Appelo, 1999/.
- M3: Mixing and Massbalance Modelling /Laaksoharju et al, 1999b/.

Visualisation/animation:

- TECPLOT: 2D/3D interpolation, visualisation and animation tool (Amtec Engineering Inc).

5.1.1 Modelling assumptions and input

Hydrogeochemical modelling involves the integration of different geoscientific disciplines such as geology and hydrogeology. This information is used as background information, supportive information or as independent information when models are constructed or compared. The following chapters describe how geological information can be used in the modelling and how speciation, mass-balance, coupled modelling and mixing modelling can be used.

Geological information is used in hydrogchemical modelling as direct input in mass-balance modelling but also to judge the feasibility of the results from, for example, saturation index modelling. For this particular modelling exercise geological data were summarised, the information was reviewed and the relevant rock types, fracture minerals and mineral alterations were identified (cf Appendix 1).

The underlying geostructural model provides important information of water-conducting fractures used for the understanding and modelling of the hydrodynamics. The cross section used for visualisation of groundwater properties is generally selected with respect to the geological model. The results from the modelling are generally presented by using 2D/3D visualisation tools. Unfortunately the lack of data from depth at Simpevarp precludes a 3D interpolation and production of a 2D cutting plane for this model version.

5.1.2 Conceptual model with potential alternatives

Because of the lack of data from depth (> 400 m) few alternative models were tested. Those tested included different reference waters and local and regional models (cf Appendix 3), and various modelling tools and approaches were applied on the data set.

5.1.3 Speciation, mass-balance and coupled modelling

Speciation modelling

Speciation-solubility modelling has been carried out with PHREEQC /Parkhurst and Appelo, 1999/ using the WATEQ4F thermodynamic database. In these types of calculations, starting from the concentration of a set of elements in a water sample and other relevant parameters (temperature, pH, Eh, total or carbonate alkalinity, and, in some cases, density), the concentration and activity of all the relevant species in the system and the saturation indices with respect to a predefined set of minerals is computed. It is a purely thermodynamic calculation where it is assumed that all dissolved species are in mutual homogeneous equilibrium. This approach defines the proximity of a solution to equilibrium with a relevant phase through a saturation index defined as:

$$SI = \log \frac{IAP}{K(T)}$$

where *IAP* is the ionic activity product and *K*(*T*) is the equilibrium constant of the dissolution-precipitation reaction of the relevant phase. A positive value indicates that thermodynamically a mineral can precipitate, and a negative value that it can dissolve. A value close to zero indicates that the mineral is at equilibrium and at saturation and, therefore, is not reacting. The saturation index indicates the potential for the process, not the rate, at which the process will proceed. From this information, conclusions concerning possible major reactions taking place of the system can be drawn.

The calculations are used to investigate the processes that control water composition at Simpevarp. This chapter is divided into two main sections, the first one concerning the state of non-redox elements and phases, and the second focussed on the redox state of the system.

The procedure only deals with plausible minerals in the system, i.e. those which can reach equilibrium with the groundwater. Therefore, clearly undersaturated mineral phases are not included in this description. In addition, only mineral phases actually identified from the Simpevarp area were considered. A more detailed description of the modelling performed can be found in Appendix 2.

Carbonate system

Calculated saturation states with respect to calcite in most groundwater samples indicate a generalized equilibrium state (considering the commonly accepted ± 0.5 uncertainty in the SI of this mineral when uncertainties in pH are evaluated) (Figure 5-2a). The valid groundwater samples plot below the Saturation Index (SI = 0) line because laboratory pH have been used for the calculations. The scatter in the values is mainly due to uncertainties in the pH of the samples (see detailed discussion of the pH uncertainties in Appendix 2). Surface and shallow subsurface waters are mostly undersaturated with respect to this mineral.

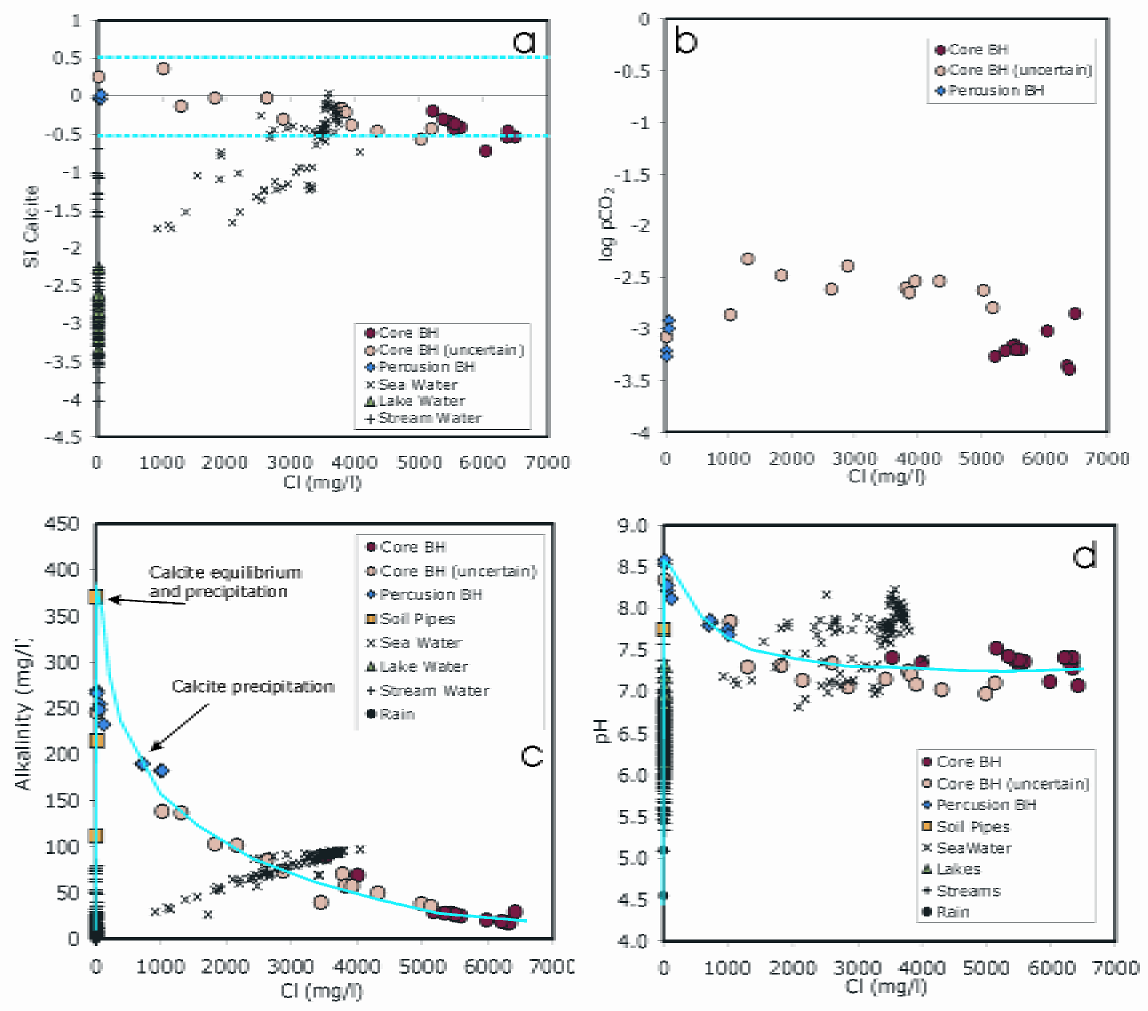

Figure 5-2. *Evolution of the carbonate system in the Simpevarp waters (a and b); Calculated calcite saturation indices and partial pressure of CO_2 against chloride (c); and (d) Alkalinity and pH against chloride. The dashed lines in Figure 5-2a represent the uncertainty associated with SI calculations.*

The computed P_{CO_2} values do not show any clear trend with chloride due to the problems with the non representative brackish samples (Figure 5-2b) sampled with the tube sampler in the open borehole. Basically trends of alkalinity, pH and the saturation state of calcite could be explained with a water-rock interaction model (dissolution-precipitation of fracture filling calcite and silicate hydrolysis) proposed by /Nordstrom et al, 1985/ for the Stripa groundwaters and verified at other Swedish and Finnish sites.

The initial steep rise in alkalinity (Figure 5-2c) and pH (Figure 5-2d) that affects superficial waters is related to weathering of the bedrock, causing calcite dissolution and the hydrolysis of silicates. Calcite reaches saturation (or oversaturation) at the alkalinity peak and the subsequent depletion in alkalinity can be attributed to calcite precipitation. This precipitation process is induced by calcium enrichment in groundwaters associated with mixing with a saline source.

The pH usually increases slightly beyond the alkalinity peak. As calcite precipitation produces a decrease in pH, it has been assumed that the pH increase is associated with the effect of silicate hydrolysis (i.e. consuming proton reactions) deep in the bedrock. The trend observed in Simpevarp groundwaters shows a pH decrease, apparently with minor or no silicate hydrolysis compensation.

Nevertheless, this pH decreasing trend pattern in Simpevarp can be magnified by the high pH peak developed in the more recent superficial waters (the existence of older recharge groundwaters with a less developed pH peak could modify the interpretation on the pH pattern) and mainly by the presence of the non-representative tube samples along the pattern.

Silica system

The weathering of rock-forming minerals is the main source of dissolved silica. Superficial waters have a variable degree of saturation with respect to silica phases (quartz and chalcedony), compatible with the weathering hypothesis.

Saline groundwaters are oversaturated in quartz and close to equilibrium with chalcedony (Figure 5-3). Saturation indices of these phases are relatively constant and independent of chloride content; this suggests that the groundwater has already reached a stationary state associated with the formation of aluminosilicates or secondary siliceous phases like chalcedony, which control the concentration of dissolved silica.

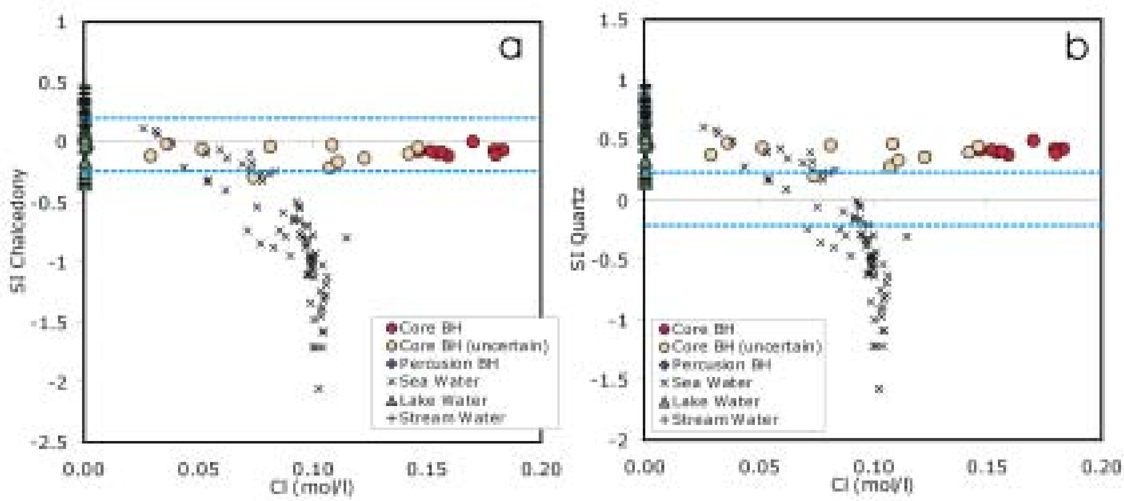

Figure 5-3. Saturation indices of chalcedony (a) and quartz (b) as a function of Cl in Simpevarp waters. The dashed lines represent the uncertainty associated with SI calculations /Deutsch et al, 1982/.

The lack of QA aluminium data for Simpevarp groundwaters precludes a speciation-solubility analysis of aluminosilicates. Therefore, activity diagrams were used to study the relationship between silicate minerals and their stability. The accuracy of these diagrams depends on pH and is therefore affected by the uncertainties in the pH measurements. Uncertainties in the equilibrium constants of the aluminosilicates (especially phillosilicates) also affect the conclusions drawn from these diagrams. This last source of uncertainty has been partially removed considering more than one equilibrium constant for some phases and different assumptions or mineralogical relations when constructing the diagrams. Nevertheless, the conclusions are preliminary because few representative groundwater samples are available.

Figure 5-4 shows several activity diagrams based on data from /Helgeson, 1969/ calculated at 7ºC (similar diagrams used in Olkilouto by /Pitkänen et al, 1999/). The diagrams plot clay minerals and, apart from the stability of kaolinite in superficial waters and in some groundwaters, they suggest an association of Ca and Mg to clay minerals in saline samples and samples from percussion boreholes, leading to the stabilisation of montmorillonite.

Figure 5-5 shows three additional stability diagrams for other mineral phases identified as fracture fillings in the KSH01A borehole: adularia, albite, prenhite, laumontite and chlorite. The diagrams are based on data calculated at 15ºC by /Grimaud et al, 1990/ for the Stripa groundwaters. These diagrams show that the most valid saline groundwaters and samples from percussion boreholes are near to or in the albite stability field and some of them near or in the chlorite stability field.

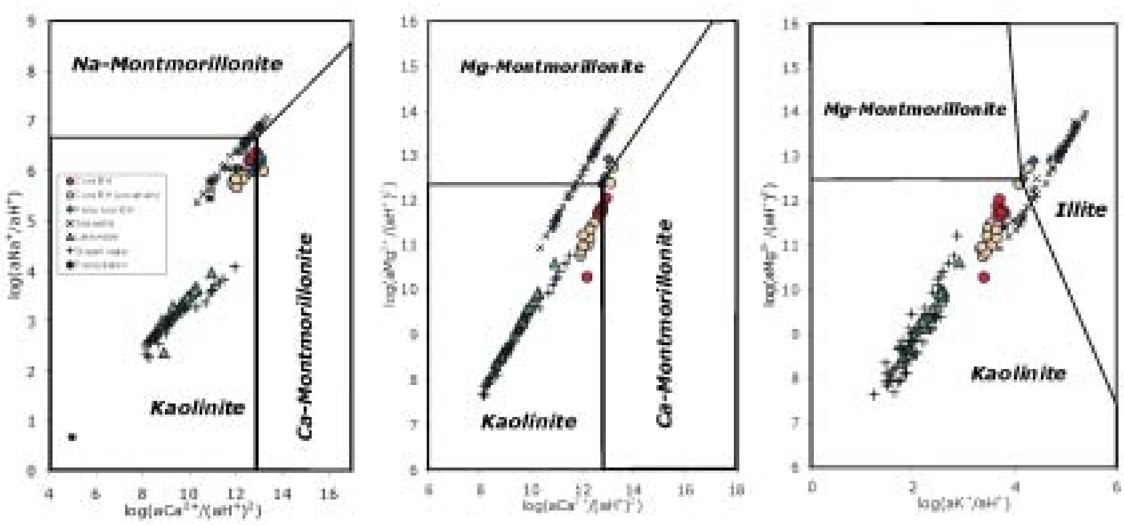

Figure 5-4. *Aqueous activity diagrams for some aluminosilicate minerals at 7ºC, 1 bar. The field boundaries were calculated with data from /Helgeson, 1969/ and a logarithmic silica activity of –4.*

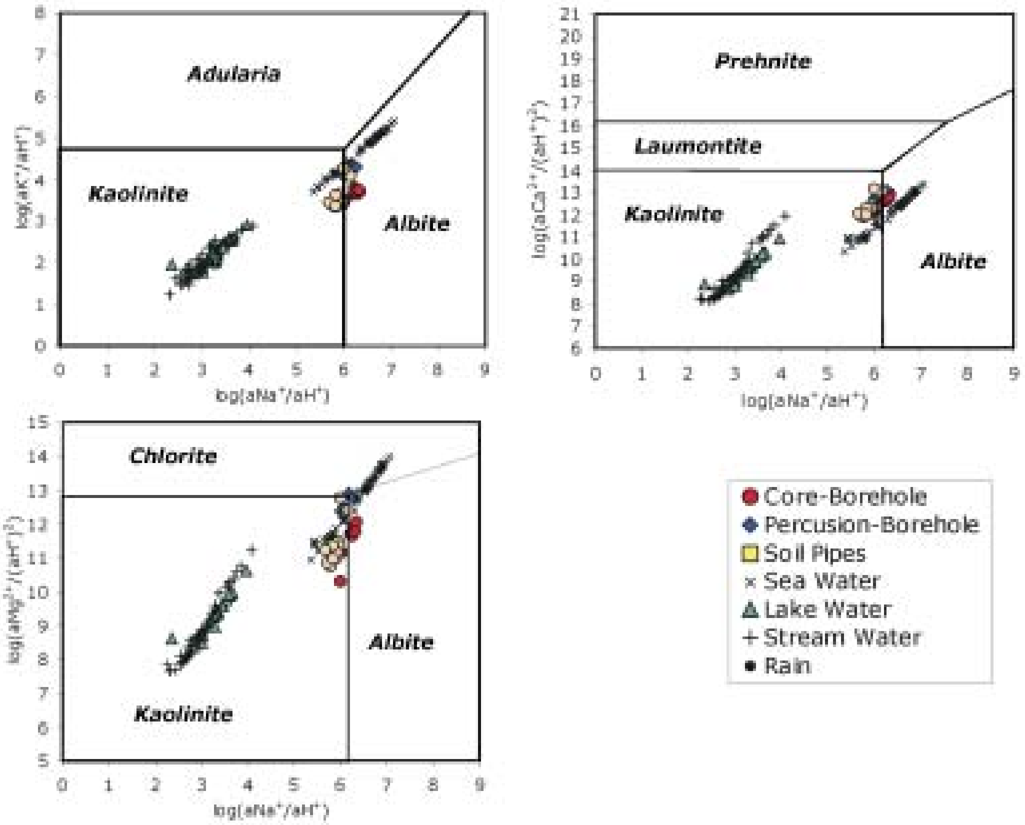

***Figure 5-5.** Aqueous activity diagrams for some aluminosilicate minerals at 15ºC, 1 bar. The field boundaries have been calculated from the data of /Grimaud et al, 1990/. The displacement from the model line for some of the tends in data could be due to incorrect pH values.*

Finally, Figure 5-6 plots stability diagrams that include illite. Diagram (a) was used in the Cigar Lake natural analogue study /Cramer and Smellie, 1994/, and is based on data from /Helgeson, 1969/ and /Helgeson et al, 1978/. Diagram (b) was constructed with data from /Garrels, 1984/. Both diagrams suggest that illite could play an important role in these groundwaters in agreement with the presence of this mineral in the studied fracture fillings.

Cation exchange processes are probably more important than clay mineral recrystallisation during short-term water-rock interaction at low temperature, but in waters with long residence times these exchange processes may cause irreversible changes in clay minerals as the solubility diagrams suggest /Pitkänen et al, 1999/.

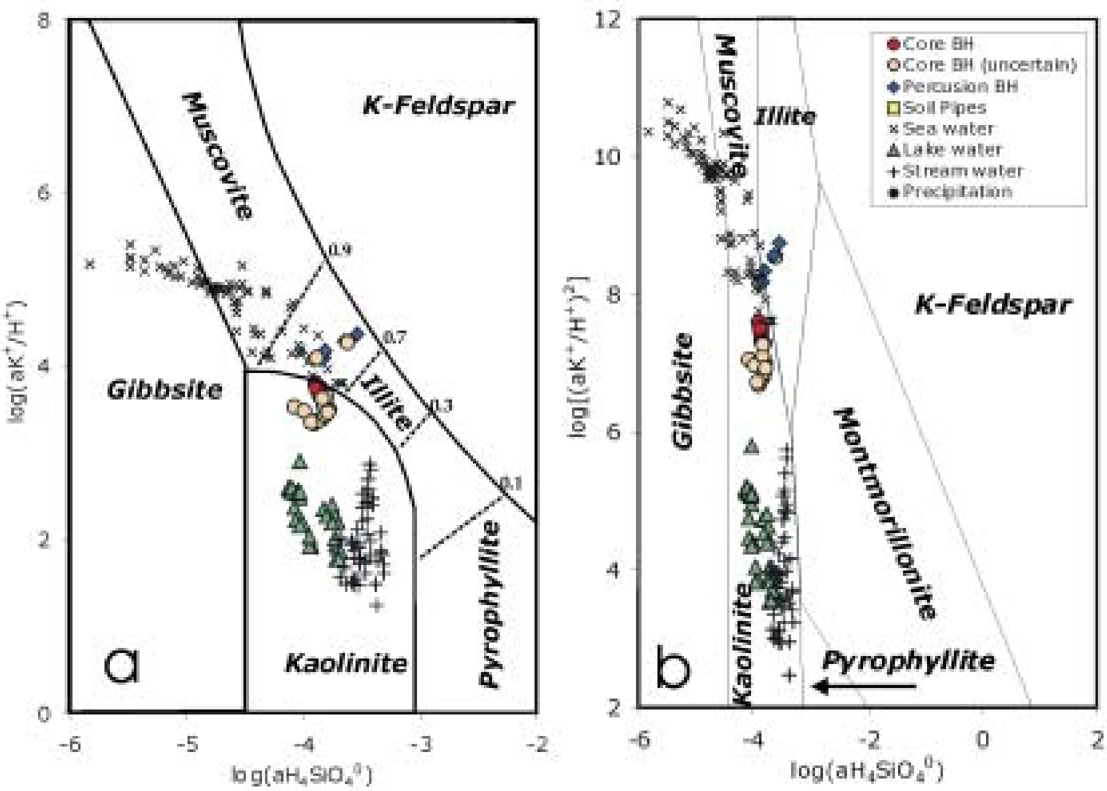

***Figure 5-6.** Aqueous activity diagrams for some aluminosilicate minerals at 25ºC, 1 bar, including illite. The field boundaries have been calculated using data from /Helgeson, 1969/ and /Helgeson et al, 1978/ in graph (a) and from /Garrels, 1984/ in graph (b). In graph (a) the illite field is contoured to show the stability of different illite fractios in I/S.*

Redox pairs calculations

The available analytical data (measured dissolved Fe^{2+}, total Fe, total sulphide and sulphate concentrations) allow a standard redox pair calculation only for samples at 161.75 m (samples 5257 and 5259 to 5263) and 253.25 m depth (samples 5266 and 5268) in KSHO1A borehole. For these two depths there is also a continuous Eh logging which gives a stable Eh reading of –220 mV at 161.75 m and –210 mV at 253.25 m (see Appendix 2). These data enable a comparison to be made between both approaches.

A temperature value is known only for the 161.77 m samples (7ºC). The temperature at 252.15 m has also been fixed at 7ºC for the speciation calculations. It is thought that this assumption does not affect negatively the final uncertainty, as it is smaller than the uncertainty associated with some redox pairs whose empirical calibration was carried out at 10ºC, Sweden's mean groundwater temperature, or even at 25ºC. Because redox calculations do depend on pH and there are significant differences between in situ and lab pH, they add an a priori extra uncertainty to the results of the redox pair calculations. To quantify this uncertainty, the following calculations have been performed at three different pH values: lab pH, in situ pH (8.1 at 161.75 m and 8.05 at 253.25 m; see Appendix A in Appendix 2), and computed pH assuming equilibrium with calcite.

Previous studies in "granitic" groundwaters from Sweden and Finland /Nordstrom and Puigdomenech, 1989; Smellie and Laaksoharju, 1992; Grenthe et al, 1992; Glynn and Voss, 1999; Bruno et al, 1999/ have found that various iron and sulphur redox pairs/buffers are the most reliable couples controlling the redox state of these groundwaters. Therefore, for the Simpervarp groundwaters the selected redox couples are the dissolved Fe^{3+}/Fe^{2+} and SO_4^{2-}/S^{2-} redox pairs and the heterogeneous $Fe(OH)_3$ /Fe^{2+}, pyrrhotite/SO_4^{2-} and pyrite/SO_4^{2-} couples. Also, results with the Fe^{3+}-clay/Fe^{2+}-clay redox pair proposed by /Banwart, 1999/ was tested (cf Appendix 2).

Several methods to model the obtained redox potential with the $Fe(OH)_{3(s)}$/ Fe^{2+} pair were employed. Results using the calibration from /Grenthe et al, 1992/ are very sensitive to pH uncertainties but always provide a more reducing redox potential than the electrochemically measured downhole values at both depths. This is especially true for the Eh values (from –390 to –400 mV) obtained using the measured downhole pH values.

The method based on the $Fe(OH)_{3(s)}$/ Fe^{2+} pair suggested by /Bruno et al, 1999/, using the thermodynamic data for two end members including crystalline and amorphous $Fe(OH)_3$, gave the best agreement with the measured values. The results obtained with this approach and using different pH values to assess the uncertainties, are shown in Figure 5-7. Obviously, without a detailed knowledge of the exact type of hydroxide involved and its crystallinity, this approach incorporates an additional uncertainty which, together with the pH uncertainty, broadens the Eh range from +30 to –240 mV. An excellent agreement between the redox potential obtained with the $Fe(OH)_3$ /Fe^{2+} pair and the in situ one is obtained if the amorphous hydroxide phase controls the pair at the pH measured in borehole KSH01A (Figure 5-7).

The redox potential deduced from the dissolved SO_4^{2-} pair shows less sensitivity to pH uncertainties with differences less than 50 mV for the pH interval examined. Furthermore, the Eh values provided by this redox pair (–210 to –230 mV) when using the in situ downhole pH measurements (or the calculated pH in equilibrium with calcite) are very similar.

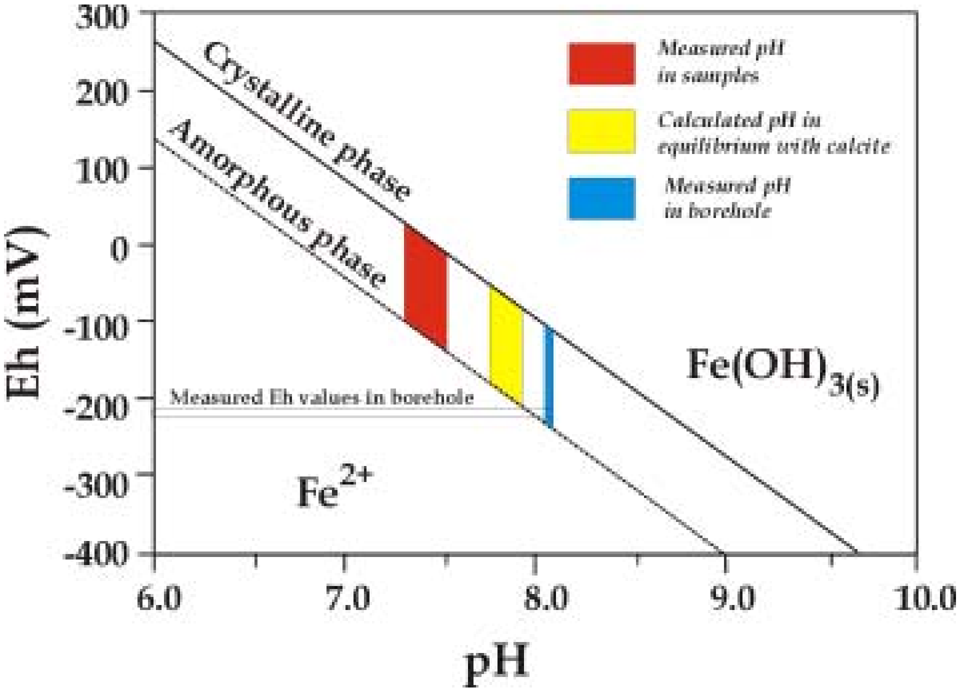

Figure 5-7. *Eh-pH diagram with $Fe(OH)_3(s)/ Fe^{2+}$ phase boundaries for crystalline (log K = 3) and amorphous (log K = 5) $Fe(OH)_3$ phases. The diagram has been drawn using data from the Palmottu natural analogue study /Bruno et al, 1999/ assuming a concentration of $Fe^{2+} = 3 \cdot 10^{-5}$ M. The coloured areas represent the pH ranges measured from the KSHO1A borehole in samples from the 161.75 and 253.5 m depth intervals (in situ, blue, and in the lab, red), and those calculated assuming equilibrium with calcite (yellow). The uncertainty associated with the crystallinity of the solid phase and the pH uncertainty, together give a maximum variation in Eh of +30 to –240 mV. The in situ measured Eh is consistent with a control using the amorphous hydroxide phase at the pH measured in the borehole (i.e. the intersection of the "Amorphous phase" line and the blue band).*

Results obtained with the pyrite/SO42- and pyrrhotite/SO42-buffers from /Bruno et al, 1999/ are presented in Figure 5-8. Overall, the Eh values calculated with these pairs range from –210 to –270 mV and are not very sensitive to pH. This range is in fairly good agreement with the measured Eh.

Finally, results with the Fe^{3+}-clay / Fe^{2+}-clay redox pair proposed by /Banwart, 1999/ provides Eh values close to the measured downhole in situ values (around –170 to –174 mV) when using the downhole in situ pH measurements (see Appendix 2).

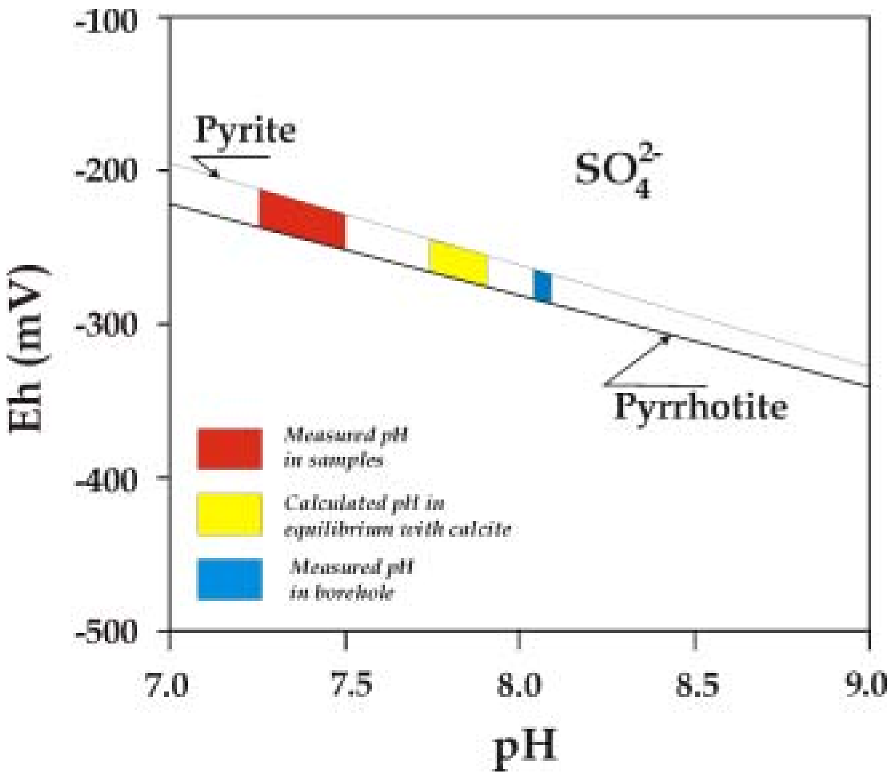

Figure 5-8. *Eh-pH diagram with SO_4^{2-}/pyrite and SO_4^{2-}/pyrrhotite phase boundaries for KSH01A saline groundwaters. Coloured areas show the pH ranges measured in situ at 161.75 and 253.5 m depth (blue), in the lab (red) and computed assuming equilibrium with calcite (yellow).*

The above results suggest that the redox state of the saline waters from the 161.57 m and 253.25 m depth intervals in borehole KFM01A are buffered by the presence of iron oxides and hydroxides and by redox reactions between phyllosilicates. Nevertheless, the good match between the electrochemical and sulphur redox-pair Eh values points to sulphide minerals as the main redox buffers for the groundwaters at both depths. These reducing conditions are also suggested by the low and similar U concentrations at both depths. The fracture coatings in the modelled sections contain chlorite and clay minerals (mainly corrensite and mixed-layer illite-smectite clays) and pigmentation/impregnation caused by haematite in the fracture zone at 245 to 300 m depth in borehole KSH01A; the presence of minor amounts of pyrite post-dating the haematite is indicated. In section 158 to 162 m coatings with chlorite, corrensite, calcite and pyrite are found.

The buffering of the sulphur system has also been identified in other Swedish and Finnish groundwaters /Nordstrom and Puigdomenech, 1989; Glynn and Voss, 1999; Bruno et al, 1999/ and, together with the presence of dissolved sulphides, suggest the development of an anoxic-sulphidic environment mediated by sulphate reducing bacterias (SRB). Microbial analysis data are not available for KFM01A groundwaters but other lines of reasoning support the presence of this bacterial process.

The precipitation of typical sulphide minerals associated with the sulphidic environment is suggested by the equilibrium between the waters and several sulphide phases, as deduced from speciation-solubility calculations for waters at 161.75 m depth. No reliable conclusion can be made from the 253.25 m depth downward due to lack of reliable samples. However, the concentration of dissolved Fe^{2+} at this depth is lower (1.27 to 1.34 mg/L) than at the shallower depth (1.4 to 1.74 mg/L), which is consistent with precipitation of these phases.

Finally, available $\delta^{34}S$ data for waters from both depths (between 20.2 and 22.8‰) show an enrichment with respect to values found in shallower bicarbonate waters (e.g. waters from borehole HSH02 with $\delta^{34}S$ values between 12.1–17.2‰ and have values similar to those in some Finnish sites, that have been related to bacterial sulphate reduction /Haveman et al, 1998; Snellman et al, 1998; Pitkänen et al, 1998, 1999/.

The absence of key analytical data (Fe, sulphide, methane, concentrations etc) for the rest of the samples in the area rules out a better characterisation of the sequence of redox conditions developed at depth.

Mass balance and mixing calculations with PHREEQC

The inverse approach via mass balance and mixing calculations for tracking the hydrogeochemical evolution of the groundwaters in the Simpevarp has been carried out on the few available samples that have a complete and free of contamination analytical data set, consisting of five samples of fresh and non-saline groundwaters and two samples of saline waters. As a consequence, the geochemical evolution path has only been calculated for two groundwater types with extreme hydrogeochemical characteristics and widely different apparent ages: 1) fresh, non-saline waters with a bicarbonate imprint, low residence times (tritium values above detection limit) and chloride concentrations from 12–132 mg/L (samples from HSH02 and HSH03 boreholes), and 2) saline waters with longer residence times (tritium values below detection limit) and chloride concentrations ranging from 5500–6300 mg/L (samples from borehole KSH01A at 156.5–167 and 245–261.5 m depth; see Appendix 2).

This limitation, together with the scarcity of detailed mineralogical data and the lack of a hydrogeological model, precludes the elaboration of a detailed evolutionary model for the groundwaters. Consequently, the results summarised in this section are to be understood as preliminary. They are mainly focussed in the analysis of saline waters, and based only on: 1) general premises regarding the type of waters and reactive phases involved, and 2) the inter-comparison with analogous systems (to select water end members). The code PHREEQC /Parkhurst and Appelo, 1999/ has been carried out for all mass balance and mixing calculations using the following chemical and isotopic data: Cl, HCO_3^-, SO_4^{2-}, SiO_2, Ca, Mg, Na, K, Fe, S^{2-}, $\delta^{18}O$ and δ^2H.

Model results for fresh, non-saline groundwaters

In common with Forsmark these groundwaters have an important a priori water-rock interaction component, with an added marine contribution in the high-Cl members /Laaksoharju et al, 2004/. Mass balance and mixing calculations carried out following the methodology developed in Forsmark /Laaksoharju et al, 2004/ confirm this hypothesis.

The evolution of the low Cl-waters from this group is dominated by the decomposition of organic matter, the dissolution of calcite, plagioclase, biotite and sulphides, and by Na-Ca exchange and precipitation of some phyllosilicates, all of them with very low mass transfers. High Cl-waters from this group could have, however, a small (< 10%) mixing contribution with a marine end member, but in general the reaction model is preserved. The lack of more detailed mineralogical data from the overburden and bedrock, and the lack of a hydrogeological model for the zone, preclude more specific conclusions to be drawn; in consequence, no more effort has been made to characterise these waters further.

Model results for saline groundwaters

As already pointed out, these waters have a longer residence time and their general character indicates that mixing between multiple end members is the principal mechanism controlling their chemistry as it has been seen in these type of saline groundwaters in other Swedish and Finnish sites /e.g. Laaksoharju and Wallin, 1997; Pitkänen et al, 1999; Puigdomenech, 2001/. To verify these general assumptions, the inverse modelling capabilities of PHREEQC to compute multiple end member mixing proportions and reactions have been used. The mixing proportions are computed with respect to end members of known composition and the reactions with respect to a predefined set of likely solid phases. Each solution given by PHREEQC is termed a model.

The chosen water end members, i.e. Rain 60, Litorina, Sea Sediment, Glacial Meltwater, and Brine, have been used elsewhere in the Fenoscandian Shield for modelling purposes. Additionally, the end member Lake Water, used in M3 calculations for Simpevarp, has also been included for comparative purposes. The selection of these general end members is useful to interpret the mixing processes under the general framework of all the Swedish sites.

Due to the lack of detailed bedrock mineralogical data, likely reacting solid phases include the most common phases used in similar systems elsewhere supported additionally by available information from observed fracture fillings at Simpevarp. The set of chosen phases and reactions is shown in Appendix 2.

From the end members used as initial waters, and from reactions with respect to a predefined set of solid phases, PHREEQC computes all the possible combinations of mixing and reaction that satisfy the chemistry of the final waters (the selected samples, see below). The reactions influence the mixing proportions and, besides, not all end members are used by PHREEQC in all the modes found (see Appendix 2 for detailed results). Therefore, the mixing proportions obtained by PHREEQC strongly depend on the number of end members considered in the model, and to a lesser degree on the set of selected reactions.

Brine and Glacial are the only end members that appear in *all* models, the former with a smaller variation range. The Glacial end member is generally the most abundant and shows up to a 20% variation in mixing proportion (30–50%) depending on the meteoric end member in the model.

Rain 60 and Lake Water do not appear together in a subset of the models, but they do appear together in the other subset. In this case, the total mixing proportion of meteoric water (Rain + Lake Water) ranges from 30% to 40%, similar to the individual mixing proportions of each meteoric end member in models where only one of the two appears.

Sea Sediment and Litorina behave in a similar way as Rain 60 + Lake Water. Here, one subset of the models includes only one of the two, and the other more minor subset includes both end members. The total contribution of both end members is low (13–17% for Sea Sediment and < 10% for Litorina). All the models have, at least, one of these marine end members.

The differences in mixing proportions between the two saline samples (with different Cl concentrations) selected for these calculations are small. At most, the high-Cl sample tends to show a somewhat larger contribution of the Glacial and Brine end members, but this difference can be considered as insignificant due to the uncertainties associated with the selection of the reacting phases.

The heterogeneous reactions identified during the mixing processes in these saline waters include: a) organic matter decomposition, b) dissolution of plagioclase, biotite and Fe-chlorite (or $Fe(OH)_3$), c) precipitation of calcite, illite and SiO_2 phases (or phyllosilicates), d) the possible occurrence of bacterial sulphate reduction processes with the simultaneous precipitation of iron sulphides, and finally, e) the ionic exchange between Na and Ca. Detailed description of the sets of phases and heterogenous reactions is shown in Appendix 2.

Discussion of the results

The chemistry of fresh, non-saline groundwaters is controlled only by water-rock interaction processes for the low-Cl members. The identified heterogeneous reactions are: organic matter decomposition, dissolution of calcite, plagioclase, biotite and gypsum (or sulphides), and Na-Ca exchange and precipitation of some phyllosilicates, all of them with very low mass transfers. The high-Cl members (132 mg/L) could show a small contribution from mixing with a marine end member.

The chemistry of saline groundwaters is mainly controlled by mixing of a saline end member (Brine) with several "dilute" end members. Among these dilute end members, Glacial Meltwater is always present, with a contribution of 30–50%, together with a meteoric end member with a similar contribution. The presence of a marine end member (Litorina or Sea Sediment) is uncertain because they always appear in low proportions (< 17%).

These results agree fairly well with the ones obtained by M3 (see below). The mixing proportions predicted by M3 and PHREEQC (only the models containing exactly the same end members as M3) for the two saline samples modelled are shown in Table 5-1.

Table 5-1. Variation ranges in the mixing proportions as computed by PRHEEQC and M3 for Simpevarp saline groundwaters.

	Sample 5260 at 161.75 m		Sample 5266 at 253.25 m	
	PHREEQC	M3	PHREEQC	M3
Brine	9.2–10.5	9.5	9.5–11.5	10.8
Glacial	34.0–42.1	46.02	36.4–44.8	51.7
Litorina	0–9.3	9.5	0.0–7.4	9.4
Sea Sediment	0–17.0	9.5	0.0–14.9	9.4
Rain 60	17.4–36.0	16.0	17.5–35.1	9.4
Lake water	5.3–13.6	9.5	4.5–14.2	9.4

M3 modelling

A further modelling approach which is useful in helping judge the origin, mixing and major reactions influencing groundwater samples is the M3 modelling concept (Multivariate Mixing and Mass-balance calculations) detailed in /Laaksoharju et al, 1995/ and /Laaksoharju et al, 1999b/.

Introduction and model description

M3 is a water classification model and the results describe a possible occurrence of different water types in the bedrock and how these water types relate to each other in terms of mixing and reactions. The results should not be misinterpreted as a flow modelling of the site but rather as a description of the similarities or differences between samples. M3 modelling uses a statistical method to analyse variations in groundwater compositions so that the mixing components, their proportions, and chemical reactions are revealed. The method estimates the contribution to hydrochemical variations by mixing of groundwater masses in a flow system by comparing groundwater compositions to identified reference waters. Subsequently, contributions to variations in non-conservative solutes from reactions can be calculated.

The M3 method consists of 4 steps where the first step is a standard principal component analysis (PCA), selection of reference waters, followed by calculations of mixing proportions, and finally mass balance calculations (for more details see /Laaksoharju et al, 1999b; Laaksoharju, 1999c/). The PCA applied to Simpevarp data and all Nordic Sites data (regional model) is illustrated in Figure 5-9 where 223 samples from Simpevarp area were used in the calculations. The numerical values are presented in Appendix 3 where also the M3 results using only Simpevarp data (local model) is presented. The regional model is discussed since it reflects the Simpevarp data in relation with other Nordic Site data such as Forsmark. In the future when more data is available from Simpevarp the local model will be used for site modelling and visualisation of the mixing proportions.

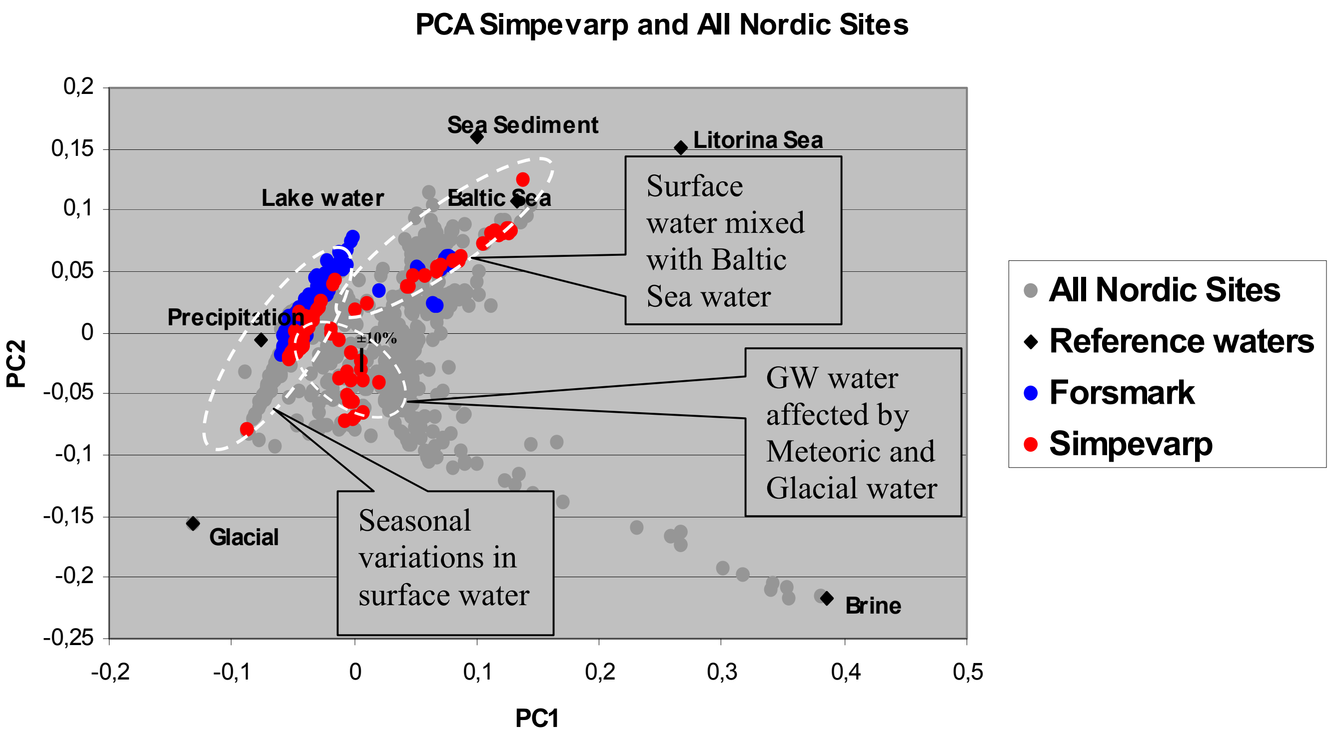

Figure 5-9. *This figure shows the principal components analysis and the location of the identified reference waters (Variance: First principal component: 0.42223, First and second principal components: 0.67221, First, second and third principal components: 0.77987). The figure shows the Nordic samples, the Simpevarp data (in red) and the Forsmark data (in blue). The Lake water (Forsmark), Sea sediment, Marine (Litorina), Brine, Glacial and Precipitation reference waters are used as end members for the modelling. The model uncertainty ± 10% is shown here as error bar (in black); the analytical uncertainty is ± 5% and represents therefore half of the error bar.*

The reference waters used in the regional M3 modelling have been identified from: a) previous site investigations (e.g. Äspö and Laxemar), b) the evaluation of the Simpevarp primary data set in Chapter 4 (for groundwater analytical data see Table 5-2), and c) selecting possible compositions of Meteoric (Precipitation and Lake water), Marine (Litorina Sea and Modified Sea), Glacial and Brine which according to the post glacial conceptual model (Figure 3-1) may have affected the site. The selected reference waters are more extreme than actually present at Simpevarp (e.g. Rain-60 or Litorina Sea). Their function is a) to be able to compare differences/similarities of the Simpevarp groundwaters with possible end-members, b) to be aible to describe all available Nordic data used in the regional model. For the local model local end-members are used (cf Appendix 3). The reference waters should not be regarded as point sources of flow but rather as possible contributors to the obtained water type.

- **Brine water:** Represents the sampled deep brine type (Cl = 47,000 mg/L) of water found in KLX02:1631–1681 m /Laaksoharju et al, 1995a/. An old age for the Brine is suggested by the measured ^{36}Cl values indicating a minimum residence time of 1.5 Ma for the Cl component /Laaksoharju and Wallin, 1997/. The sample contains some tritium (TU 4.2) which is believed to be contamination from borehole activities. In the modelling the measured values where used for this sample.

- **Glacial water:** Represents a possible melt-water composition from the last glaciation > 13,000BP. Modern sampled glacial melt water from Norway was used for the major elements and the $\delta^{18}O$ isotope value (–21‰ SMOW) was based on measured values of $\delta^{18}O$ in calcite surface deposits /Tullborg and Larson, 1984/. The $\delta^{2}H$ value (–158‰ SMOW) is a calculated value based on the equation ($\delta H = 8 \times \delta^{18}O + 10$) for the meteoric water line.

- **Litorina Sea:** Represents old marine water and its calculated composition has been based on /Pitkänen et al, 1999/. This water is used for modelling purposes to represent past Baltic Sea water composition.

- **Modified Sea water (Sea sediment):** Represents sea water affected by microbial sulphate reduction.

- **Precipitation:** Corresponds to infiltration of meteoric water (the origin can be rain or snow) from 1960. Sampled modern meteoric water with a modelled high tritium (2000 TU) content was used to represent precipitation from that period.

- **Lake water:** Corresponds to lake water affected by evaporation indicated by high $\delta^{18}O$ values and a slight evaporation modification of the deuterium value.

Table 5-2. Groundwater analytical or modelled data* used as reference waters in the M3 regional modelling for Simpevarp.

	Cl (mg/L)	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	HCO_3 (mg/L)	SO_4 (mg/L)	^{3}H (TU)	$\delta^{2}H$ ‰	$\delta^{18}O$ ‰
Brine	47200	8500	45.5	19300	2.12	14.1	906	4.2	–44.9	–8.9
Glacial	0.5	0.17	0.4	0.18	0.1	0.12	0.5	0	–158*	–21*
Litorina sea*	6500	3674	134	151	448	93	890	0	–38	–4.7
Sea Sediment	4920	2300	29	730	233	1200	36	14	–50.4	–7.3
Precipitation	0.23	0.4	0.29	0.24	0.1	12.2	1.4	2000*	–80	–10.5
Lake water	45.8	21	3.21	30.3	5.9	110	16.18	7.6	–44.3	–4.5

Based on past experience (e.g. Äspö and Laxemar sites), the following six reactions have been considered in the M3 modelling:

Organic decomposition: This reaction is detected in the unsaturated zone associated with Meteoric water. This process consumes oxygen and adds reducing capacity to the groundwater according to the reaction: $O_2 + CH_2O \rightarrow CO_2 + H_2O$. M3 reports a gain of HCO_3 as a result of this reaction.

Organic redox reactions: An important redox reaction is reduction of iron III minerals through oxidation of organic matter: $4Fe(III) + CH_2O + H_2O \rightarrow 4Fe^{2+} + 4H^+ + CO_2$. M3 reports a gain of Fe and HCO_3 as a result of this reaction. This reaction takes place in the shallow part of the bedrock associated with influx of Meteoric water.

Inorganic redox reaction: An example of an important inorganic redox reaction is sulphide oxidation in the soil and the fracture minerals containing pyrite according to the reaction: $HS^- + 2O_2 \rightarrow SO_4^{2-} + H^+$. M3 reports a gain of SO_4 as a result of this reaction. This reaction takes place in the shallow part of the bedrock associated with influx of Meteoric water.

Dissolution and precipitation of calcite: There is generally a dissolution of calcite in the upper part and precipitation in the lower part of the bedrock according to the reaction: $CO_2 + CaCO_3 \rightarrow Ca^{2+} + 2HCO_3^-$. M3 reports a gain or a loss of Ca and HCO_3 as a result of this reaction. This reaction can take place in any groundwater type.

Ion exchange: Cation exchange with Na/Ca is a common reaction in groundwater according to the reaction: $Na_2X_{(s)} + Ca^{2+} \rightarrow CaX_{(s)} + 2Na^+$, where X is a solid substrate such as a clay mineral. M3 reports a change in the Na/Ca ratios as a result of this reaction. This reaction can take place in any groundwater type.

Sulphate reduction: Microbes can reduce sulphate to sulphide using organic substances in natural groundwater as reducing agents according to the reaction: $SO_4^{2-} + 2(CH_2O) + OH^- \rightarrow HS^- + 2HCO_3^- + H_2O$. This reaction is of importance since it may cause corrosion of the copper capsules. Vigorous sulphate reduction is generally detected in association with marine sediments that provide the organic material and the favorable salinity interval for the microbes. M3 reports a loss of SO_4 and a gain of HCO_3 as a result of this reaction. This reaction modifies the seawater composition by increasing the HCO_3 content and decreasing the SO_4 content.

Model results

The M3 modelling indicated three water types (Figure 5-9), one dominated by meteoric water and the second affected by marine water and the third saline groundwater affected by glacial and meteoric water. The surface meteoric type shows seasonal variations. Closer to the coast the influence of marine water is detected for the shallow samples. With depth the glacial and meteoric waters have affected the saline groundwater.
The deviation calculations in the M3 mixing calculations show potential for organic decomposition/calcite dissolution in the shallow water. Indications of ion exchange and sulphate reduction have been modelled. These M3 results essentially support the initial evaluation of primary data in Chapter 4 and the PHREEQC results described in previous chapters.

Model uncertainties

The following factors can cause uncertainties in M3 calculations:

- Input hydrochemical data errors originating from sampling errors caused by the effects from drilling, borehole activities, extensive pumping, hydraulic short-circuiting of the borehole and uplifting of water which changes the in situ pH and Eh conditions of the sample, or as analytical errors.
- Conceptual errors such as wrong general assumptions, selecting wrong type/number of end-members and mixing samples that are not mixed.
- Methodological errors such as oversimplification, bias or non-linearity in the model, and the systematic uncertainty which is attributable to use of the centre point to create a solution for the mixing model.

An example of a conceptual error is assuming that the groundwater composition is a good tracer for the flow system. The water composition is not necessarily a tracer of mixing directly related to flow since there is not a point source as there is when labelled water is used in a tracer test.

Uncertainty in mixing calculations is smaller near the boundary of the PCA polygon and larger near the centre. The uncertainties have been handled in M3 by calculating an uncertainty of 0.1 mixing units (with a confidence interval of 90%) and stating that a mixing portion < 10% is under the detection limit of the method. The similarities with the PHREEQC mixing modelling, although the approaches are very different, do lend support to the performed modelling.

Visualisation of the groundwater properties

The 3D/2D visualisation of the Simpevarp Cl values was performed with the Tecplot code. Figure 5-10 shows the 3D and the 2D visualisation of Cl in the 118 sampling points (values used in M3 calculations) in Simpevarp. The few samples from depth did not allow any 3D interpolation of the Cl distribution or of the M3 mixing calculations.

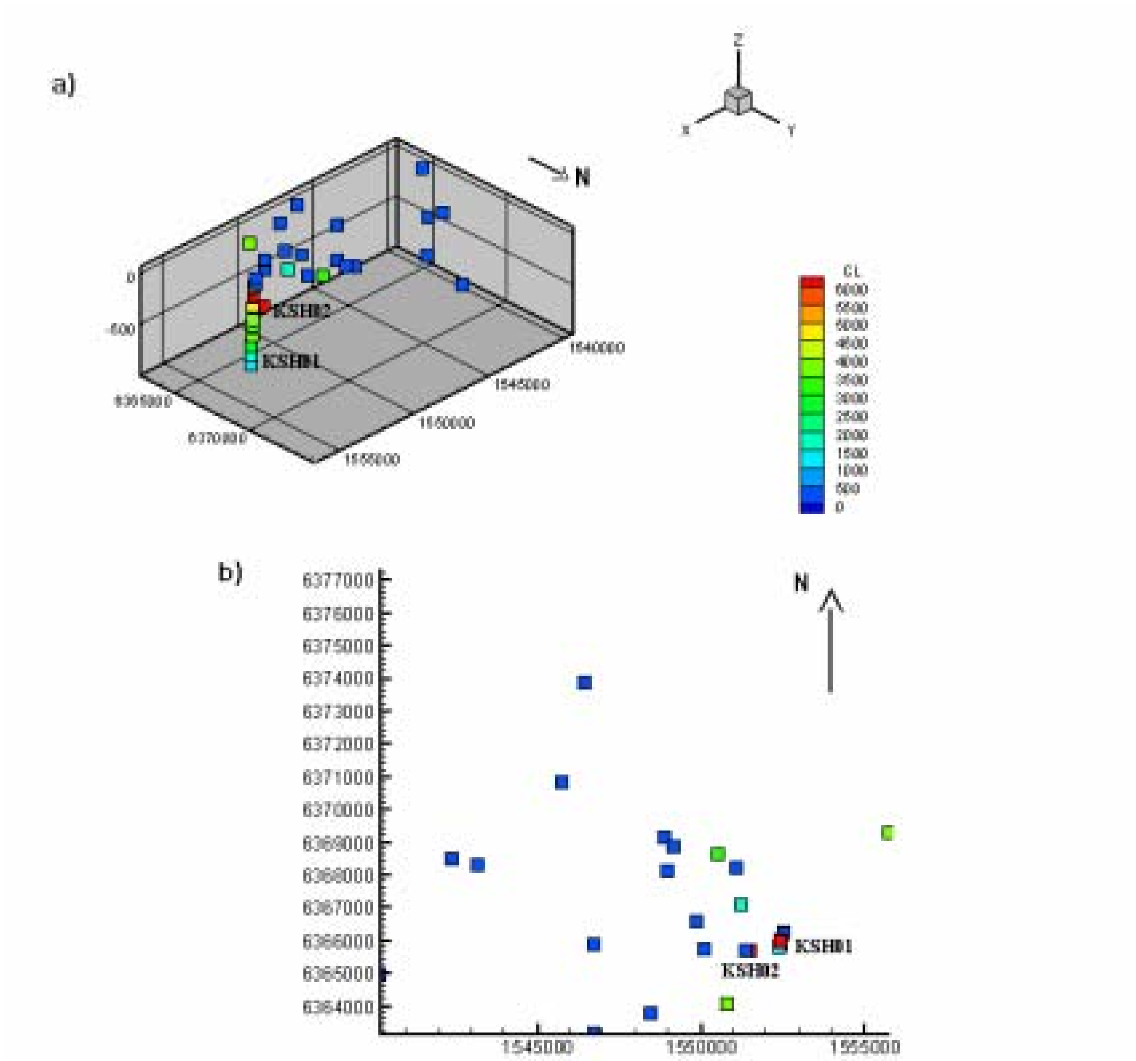

Figure 5-10. *3D (a) and 2D (b) visualisation of the Cl distribution and sampling points at Simpevarp. The x, y, z coordinates represent the Easting, Northing and elevation of the mid sampling section of the location of the sampling points, and are expressed in metres. The continuous sampling in KSH01A is from tube sampling and do not reflect the salinity in the fractured rock.*

5.1.4 Comparison between the hydrogeological and hydrogeochemical models

Since hydrogeology and hydrogeochemistry deal with the same geological and hydrodynamic media when describing the bedrock groundwater properties, these two disciplines should be able to complement each other when modelling the groundwater system in question. Testing such an integrated modelling approach was the focus of a SKB project (Task 5) based on the Äspö HRL /Wikberg 1998; Svensson et al, 2002; Rhén and Smellie, 2003/. The advantages with such an approach were identified as follows:

- Hydrogeological models will be constrained by a new data set. If, as an example, the model cannot produce any Meteoric water at a certain depth and the hydrogeochemical data indicates that there is a certain fraction of this water type at this depth, then the model has to be revised.

- Hydrogeochemical models generally focus on the effects from reactions on the obtained groundwater rather than on the effects from transport. An integrated modelling approach can describe flow directions and hence help to understand the origin of the groundwater, the turn over time of the groundwater system can indicate the age of the groundwater, and knowing the flow rate can be used to indicate the reaction rate. The obtained groundwater chemistry is a result of reactions and transport, therefore only an integrated description can be used to correctly describe the measurements.

- By comparing two independent modelling approaches a consistency check can be made. As a result greater confidence in active processes, geometrical description and material properties can be gained.

Major recent developments in hydrogeological modelling of the Simpevarp area /I Rhén, pers comm, 2004/ represents further progress since the TASK#5 exercise /Rhén and Smellie, 2003/. The present modelling should further facilitate future comparison and integration between hydrochemistry and hydrogeology. The hydrogeological model can provide predictions of the salinity in the connected rock matrix, in the flowing groundwater and for dynamic predictions over time for the different water types (meteoric, marine, glacial, and brine). Furthermore, the hydrodynamic model can, independently from chemistry, predict these salinity features at any point of the modelled rock volume, and the predictions can be checked by direct hydrochemical measurements or calculations. The mixing proportions from the hydrogeological model can in the future, for example, be directly compared with the mixing calculations from the hydrochemical modelling or, conversely, the hydrochemical model can be used to predict the chemistry which results from only transport and which, in turn, can be compared with that obtained from reactions. The modelling will increase the understanding of transport, mixing and reactions and will also provide a tool for predicting future chemical changes due to climate changes.

5.1.5 Evaluation of uncertainties

At every phase of the hydrogeochemical investigation programme – drilling, sampling, analysis, evaluation, modelling – uncertainties are introduced which have to be accounted for, addressed fully and clearly documented to provide confidence in the end result, whether it will be the site descriptive model or repository safety analysis and design /Smellie et al, 2002/. Handling the uncertainties involved in constructing a site descriptive model has been documented in detail by /Andersson et al, 2001, 2002/. The uncertainties can be conceptual uncertainties, data uncertainty, spatial variability of data, chosen scale, degree of confidence in the selected model, and error, precision, accuracy and bias in the predictions. Some of the identified uncertainties recognised during the Äspö HRL modelling exercise are discussed below.

The following data uncertainties have been estimated, calculated or modelled for the Simpevarp data; these are based on models used for the nearby Äspö Model Domain where similar uncertainties are believed to affect the present modelling:

- disturbances from drilling; may be ± 10–70%,
- effects from drilling during sampling; is < 5%,
- sampling; may be ± 10%,
- influence associated with the uplifting of water; may be ± 10%,
- sample handling and preparation; may be ± 5%,
- analytical error associated with laboratory measurements; is ± 5%,
- mean groundwater variability during groundwater sampling (first/last sample); is about 25%,
- the M3 model uncertainty; is ± 0.1units within 90% confidence interval.

Conceptual errors can occur in, for example, the palaeohydrogeological conceptual model. The influences and occurrences of old water end members in the bedrock can only be indicated by using certain element or isotopic signatures. The uncertainty is therefore generally increasing with the age of the end member. The relevance of an end member participating in the groundwater formation can be tested by introducing alternative end member compositions or by using hydrodynamic modelling to test if old water types can reside in the bedrock during prevailing hydrogeological conditions.

Uncertainties in the PHREEQC code depend on which PHREEQC code version is being used. Generally the analytical uncertainties and uncertainties concerning the thermodynamic data bases are of importance (in speciation-solubility calculations). Care also is required to select mineral phases which are realistic (even better if they have been positively identified) for the systems being modelled. The errors can be addressed by using sensitivity analyses, alternative models and descriptions. Such analysis was regarded to be outside the scope of this exercise due to lack of groundwater data.

The uncertainty due to 3D interpolation and visualisation depends on various issues, i.e. data quality, distribution, model uncertainties, assumptions and limitations introduced. The uncertainties are therefore often site specific and some of them can be tested such as the effect of 2D/3D interpolations. The site specific uncertainties can be tested by using quantified uncertainties, alternative models, and comparison with independent models such as hydrogeological simulations. Any test concerning Simpevarp was not possible because of the lack of groundwater data.

The discrepancies between different modelling approaches can be due to the differences in the boundary conditions used in the models or in the assumptions made. The discrepancies between models should be used as an important validation and confidence building opportunity to guide further modelling efforts.

6 Resulting description of the Simpevarp area

6.1 Bedrock – regional scale

6.1.1 Hydrogeochemical description

Groundwater composition

One of the objectives of the Initial Site Investigation stage is to produce a preliminary version of the hydrogeochemical descriptive model on a site scale /Smellie et al, 2002/. Visualisation should be based on modelled approaches and also on a manual approach where expert judgement is schematically illustrated. This latter model approach, based on presently available Simpevarp data, is presented in Figure 6-1. The figure is a conceptual visualisation based not only on measured salinity, but on all relevant hydrochemical and isotopic data (although still very limited), and general geological and hydrogeological considerations. The hydrogeochemical trends described and illustrated in Chapter 4, together with information from the postglacial scenario illustrated in Figure 3-1 and borehole KSH01A structures in Figure 4-4, have been used to make a first schematic attempt at integrating hydrochemistry with the general hydrogeostructural character of the Simpevarp area. The model will be updated when a more detailed local hydrogeological and geological models become available.

Figure 6-1, schematically representing a WNW-SSE profile selected to include the Laxemar site and the Simpevarp peninsula site areas, is oriented parallel to one set of regional structural faulting directions and perpendicular to another set of structural features trending NE-SW. These latter features, which may be of greater importance, are thought to be sub-vertical in orientation, but due to a lack of information their respective dip directions may in some cases be at variance with those shown in the figure. The major shear zone (double dashed lines) close to the coast has been intercepted and confirmed recently by borehole KSH03A. At greater depths the situation remains unclear but to date there is no evidence of interaction between borehole KSH01A and the shear zone. For example, borehole KSH01A generally shows low hydraulic responses below 300 m and more so below 600 m.

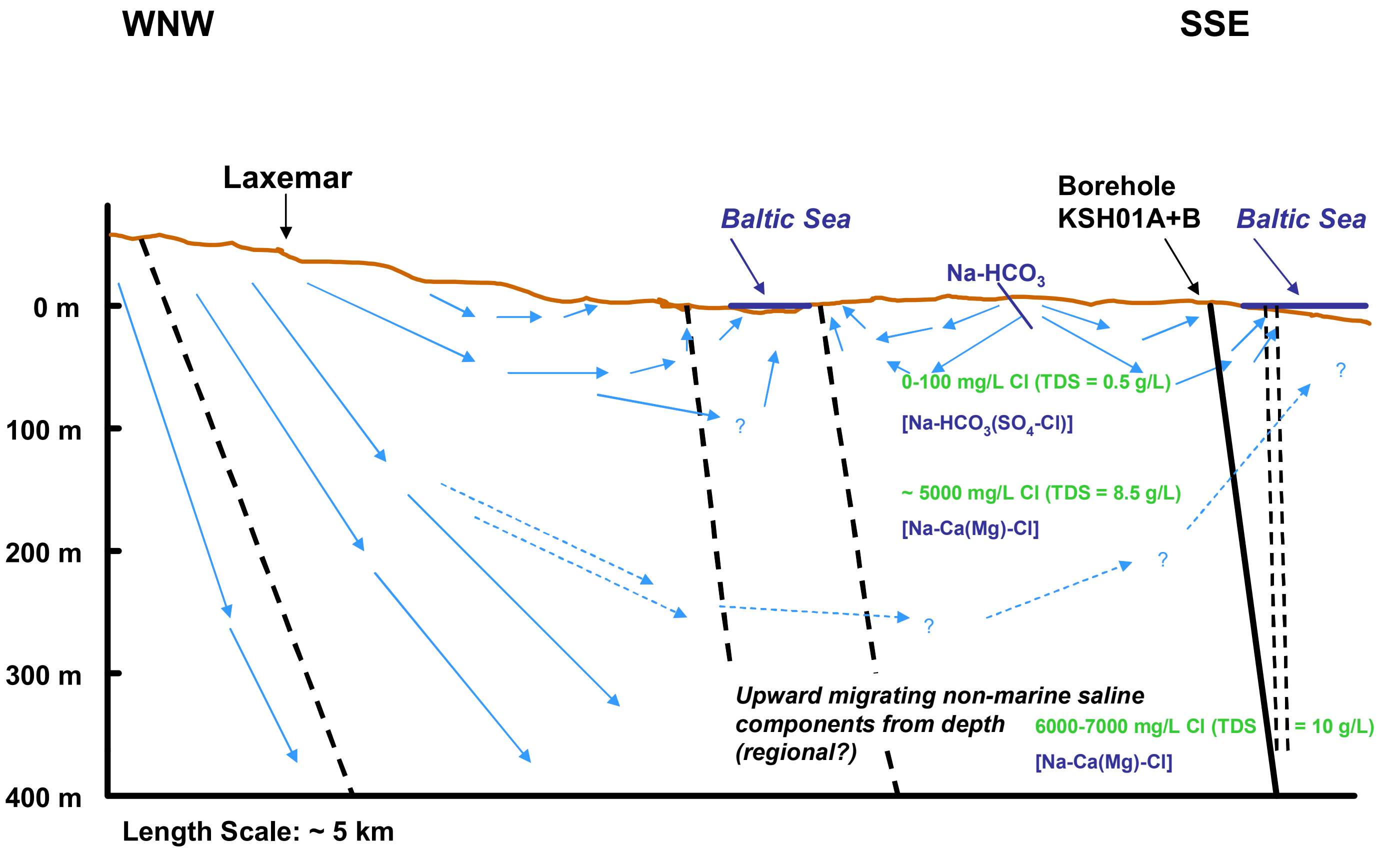

Figure 6-1. *Integrated conceptual visualisation of the Simpevarp area based partly on Figure 4-4, on other hydrochemical and isotopic criteria, and general geological and hydrogeological considerations. Note that the geological structures and groundwater flow directions are not based on measurement but are used only for illustration purposes to fit with present conceptual ideas (for example, when more information is available, the sub-vertical zones may have other dip orientations).*

Superimposed on this structural profile are possible groundwater flow directions, essentially representing fracture plane flow along the regional WNW-SSE trending structures. Since the intercepted structures are trending NE-SW and perpendicular, a series of hydraulic compartments may be formed, possibly with each compartment having distinct hydrodynamic properties which might affect both the groundwater distribution and chemistry. There is presently no information as to the hydraulic character (i.e. recharge/discharge) of these large-scale structures.

The solid blue arrows represent the possible directions of bedrock groundwater flow with the dashed variety indicating weaker, more uncertain flow directions. At Laxemar, with higher topography, meteoric groundwater recharge is shown in the figure to penetrate to at least 400 m, but probably to even greater depths as indicated by earlier studies (/Laaksoharju et al, 1995/; see also Figure 4-6). Furthermore, there may be a weak upward discharge towards the Baltic coastline as shown. Localised recharge/discharge groundwater circulation, independent of deeper flow pathways, is characteristic along the profile at shallow levels to around 100 m, with distinctive discharge towards the Baltic coastlines.

At still greater depths (> 1000 m), slow moving, larger scale regional flow systems are probably active with potentially some upward migration towards the coastline. This is suggested in the hydrogeochemical evaluation as saline waters of a non-marine origin or a non-marine/marine mixing origin.

Available groundwater compositions are shown in green in the near vicinity of borehole KSH01A. These indicate essentially fresh water (0–100 mg/L Cl; ~ 0.5 g/L TDS) to around 100 m with sharp increases to approx 5000 mg/L Cl (~ 8.5 g/L TDS) at around 150 m to 6000–7000 mg/L Cl (~ 10 g/L TDS) at around 400 m. This abrupt increase in salinity at around 150 m suggests the presence of two distinct hydrodynamic and hydrochemical regimes which is clearly reflected in the hydrogeochemical evaluation. In addition, this distinction may suggest the influence of some subhorizontal structural features at this interface or the opening of isolated 'pockets' of saline-glacial meltwater mixtures. Such a glacial meltwater component extends to at least 250 m depth and, in addition to being preserved in 'pockets', may also have its origin from the closely located NE-SW structures which have facilitated the deep recharge of glacial meltwater during glacial decay and retreat. A further possibility is from sources further inland.

The possibility of NE-SW trending structures forming a series of hydraulic compartments may be supported at Laxemar by salinities of around 5000 mg/L Cl being achieved only at 700 m /Laaksoharju et al, 1995/, compared to 150 m depth in the 'compartment' hosting borehole KSH01A.

The palaeoevolution of the Simpevarp area implies that a Litorina Sea component should be present in the groundwaters; this, however, has not been established by the hydrogeochemical evaluation to date. Either: a) no Litorina Sea component has been introduced, b) it has subsequently been flushed out, or c) it has not been seen yet because of the limited number of boreholes. A combination of (b) and (c) is probably the case. In the vicinity of KSH01A it would seem that any penetration of Litorina Sea water would be restricted hydrogeologically to the upper 100–150 m, and therefore easily flushed out during land uplift and emergence from the Baltic Sea. Limited penetration of Litorina Sea water to greater depths probably has occurred, especially along the sub-vertical fractures and evidence of existing pockets and/or lenses may still be discovered by subsequent investigations.

Processes and boundary conditions

The mixing processes, schematically visualised in Figure 6-1, are the result of: a) present-day meteoric recharge/discharge hydraulic gradients of local extent with potentially a more saline discharge contribution from depth, b) the forced introduction of glacial melt water to unknown depths during glacial retreat, c) density turnover influences from saline waters introduced during past marine transgressions (e.g. Litorina Sea) since the last glaciation, and d) possibly some limited recent introduction of brackish water when the Baltic Sea covered the Simpevarp area. The higher topography to the west of the Simpevarp area towards Laxemar has resulted in local hydrogeological gradients which have partially flushed out old water types (e.g. Litorina Sea component), at least in the upper 100–150 m of the bedrock in the vicinity of the KSH01A borehole location, and possibly at greater depths depending on local hydrodynamics. Greatest preservation of the more saline, denser Litorina Sea, Litorina Sea/glacial water and possibly some brackish Baltic Sea mixtures maybe be expected as pockets and lenses in the bedrock in association with those sub-vertical structures which are hydraulically active. Some preservation along sporadic subhorizontal hydraulic structures can not be ruled out.

The structural pattern of the area, i.e. apparently dominated by vertical and sub-vertical hydraulic fracture zones, may have produced a series of distinctive hydraulic (and therefore hydrochemical) 'compartments' further contributing to the heterogeneity of the hydrochemical systems.

6.2 Bedrock – local scale

6.2.1 Hydrogeochemical description

Groundwater composition

The detailed evaluation of the groundwater observations indicates the following features:

Descriptive observations

- Except for sea waters, most surface waters and some groundwaters from percussion boreholes are fresh, non-saline waters according to the classification used for Äspö groundwaters. The rest of the groundwaters are brackish (Cl < 5000 mg/L), except for three samples from KSH01A (at 253 m and 439 m depth) which are saline. Most surface waters are of Ca-HCO_3 or Na-Ca-HCO_3 type and naturally the sea water is of Na-Cl type. The deeper groundwaters are mainly of Na-Ca-Cl type.
- Dilute surface waters usually with very short residence times (high tritium and ^{14}C). However, the δ^{18}O values are relatively homogeneous when compared to that expected for surface waters, which may reflect a more evolved surface/subsurface water system down to the overburden/bedrock interface.
- Saline water with Cl contents around 3000–6500 mg/L and d^{18}O values between –11 and –14‰ indicate mixtures between cold climate meteoric water and saline water. Based on present data the marine signature (Litorina?) of the saline component is not significant in the Simpevarp samples in contrast to the Forsmark samples. The saline component in the Simpevarp groundwater is modified by water-rock interaction and shows similarities to an old, non-marine/marine saline water of brine type.
- δ^{36}Cl , δ^{37}Cl and ^{14}C analyses, when available, can add significant information concerning the origin of the Simpevarp (and Forsmark) saline waters.
- The presence of groundwater with major components of deep saline and glacial meltwater at relatively shallow depths (150 to 260 m) suggests either very stagnant conditions in general or the presence of isolated pockets of very old groundwater.
- Ion exchange reactions have modified the groundwaters (e.g. Mg, Na and Ca).
- Some evidence of decreased sulphate content coupled with higher δ^{34}S values suggest the activity of sulphate-reducing bacteria (based on very few analyses).

- The isotope ratios of the Lake Water and Stream Water show some puzzling values but probably indicate mixing of different sources (e.g. including surface water and near-surface water mixing).

Modelled observations

- **Fresh, non-saline groundwaters.** Their chemistry is manly controlled by water-rock interaction processes. The identified heterogeneous reactions are: a) organic matter decomposition, b) dissolution of calcite, plagioclase biotite and gypsum (or sulphides), and c) Na-Ca exchange and precipitation of some phyllosilicates, all of them with very low mass transfers. The Cl (132 mg/L) end members in this group show a small contribution from mixing with a marine end member.

- **Saline groundwaters.** Their chemistry is mainly controlled by the mixing of multiple end members. The mixing proportions obtained by PHREEQC indicate that the Glacial end member is generally the most abundant and shows up to a 20% variation in mixing proportion (30–50%) depending on the meteoric end member that the model includes. The use of two meteoric end members increases the variability of their mixing ratios, but the lumped contribution remains similar, in the order of 30–40%. A marine end member (Litorina or Sea Sediment) appears in all models, although always in low proportions, especially Litorina (< 10%). Taking into account all the uncertainties, the actual presence of a marine end member cannot be demonstrated. The mixing proportions obtained by M3 indicate that the saline waters are dominated by mixing with the Glacial end member (37–54%), a Meteoric water input of 9–22%, a smaller contribution from a Litorina Sea or Sea Sediment end member (9–11%) and a equally small proportion of Brine end member (around 9–11 %). The model uncertainty of the mixing models are generally ± 0.1 mixing units and the detection limit is 0.1 unit. This means that the occurrence of a water type with a calculated mixing proportion of ≤ 20% may still not be significant and the occurrence in the rock may still be uncertain. The interpretation is therefore that the saline water samples are affected by glacial and meteoric water but the input of e.g. Litorina Sea water is not significant. The model results generally agree, therefore, with what was obtained in the explorative analysis. This apparently complex mixing system agrees with the models presented by /Laaksoharju et al, 1999a; Piugdomenech, 2001/ and /Luukkonen, 2001/ for Äspö at similar depths.

- The heterogeneous reactions identified during mixing processes include organic matter decomposition, dissolution of plagioclase, biotite and Fe-chlorite (or $Fe(OH)_3$), precipitation of calcite, illite and SiO_2 phases (or phyllosilicates), the possible actuation of bacterial sulphate reduction processes with the simultaneous precipitation of iron sulphides, and, finally, the ionic exchange between Na and Ca.

Processes and boundary conditions

Based on measured salinity distributions and modelling results, the major processes affecting the local chemistry at Simpevarp are summarised in Figure 6-2.

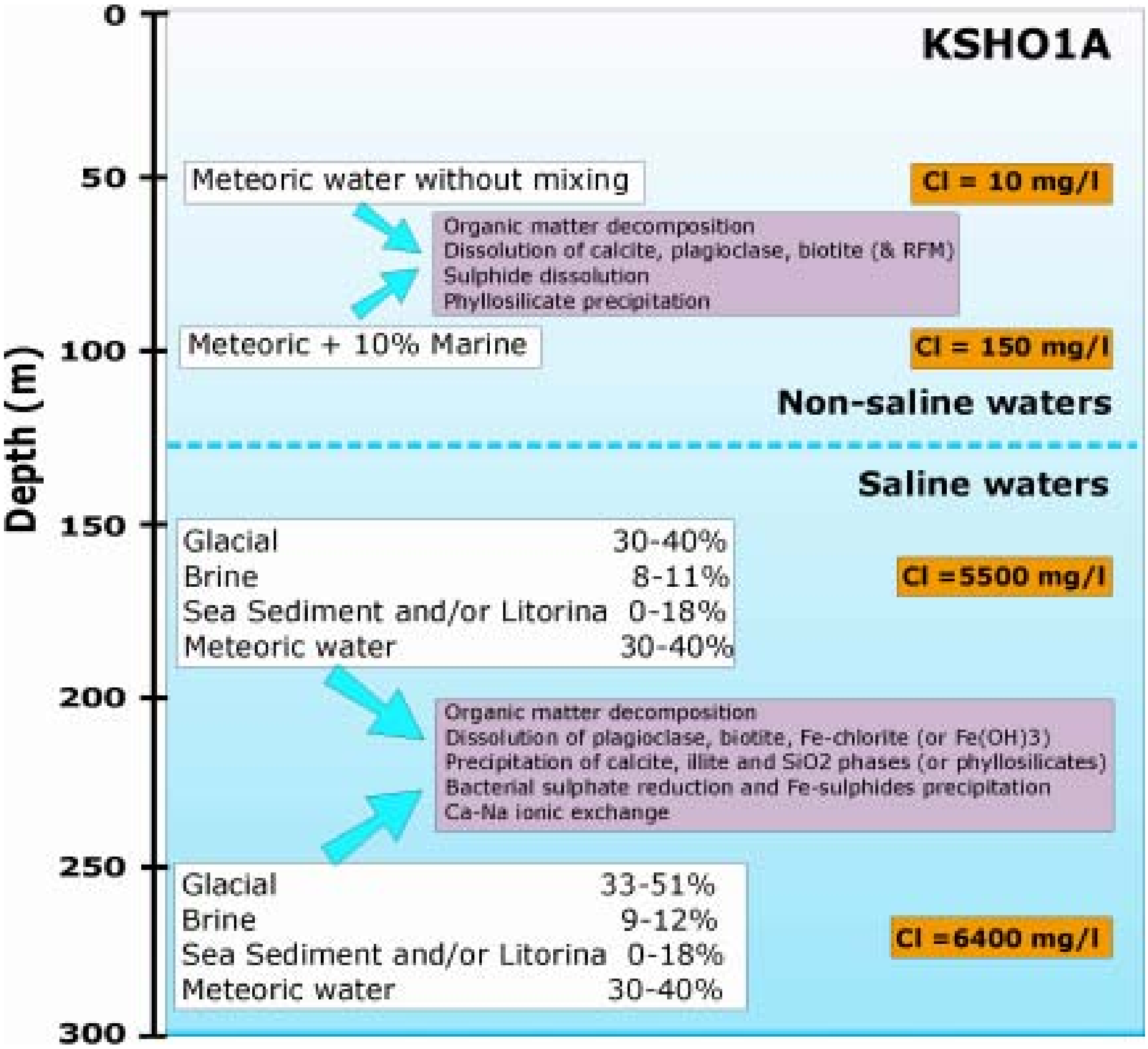

Figure 6-2. *Integrated conceptual visualisation of the local hydrochemistry at Simpevarp sub area is based on integration of: 1) Salinity distributions based on measured Cl concentrations 2) Modelled evaluation paths of the non-saline and saline groundwater. For each sample the mixing proportions and the main heterogeneous reaction processes are indicated. Mixing calculations are based on inverse modelling in PHREEQC but uses M3 mixing models and expert judgement for selecting appropriate end members. The mixing modelling results are significant only for water proportions > 20%.*

Figure 6-2 is based on modelled calculations integrating the inverse modelling in PHREEQC to explain the evolutionary reaction paths and mixing proportions of the Simpevarp groundwaters, with the M3 mixing modelling approach used to select appropriate groundwater end members. The modelling is preliminary and will be updated when more samples are available.

The present modelled state of hydrogeochemical knowledge of the Simpevarp groundwater water system is that the main water-rock interaction processes that affects the chemistry are: (i) decomposition of organic matter, (ii) calcite, plagioclase, biotite and sulphide dissolution, (iii) Na-Ca ion exchange, and (iv) phyllosilicate precipitation.

The generic reaction model in Figure 6-2 will be refined when more data concerning the mineralogy of the system and its hydrological functioning become available.

The intrepretation of the performed mixing modelling indicate that three water types dominate. The meteoric type of water at the surface shows typical seasonal variations. Closer to the coast the influence of marine water is detected. At greater depth the saline water has been affected by mainly glacial water.

The modelling indicated that water-rock interaction processes in the saline groundwaters is assumed to be much less important than in the fresh waters and secondary to the mixing process. The reason is: a) the modelling do not take into account the reactions forming the end-members, b) the groundwater at depth is generally in equlibrium with most of the minerals and c) the temperature of the groundwater is low. These circumstance allows the calculation of the mixing proportions even without a precise knowledge of the detailed mineralogy of the system. However, the influence of the sulphate-reduction processes on the final mixing proportions has not been evaluated rigorously enough and it is therefore likely that further detailed studies would produce a refinement of the generic reaction model used in the present calculations.

The results from the redox modelling suggest that the redox state of the brackish waters from the depth interval (centred at 161.7 m and 253.5 m) in the vicinity of borehole KSH01A could be buffered by the presence of iron oxides and hydroxides and by redox reactions among phyllosilicates which is possible from a mineralogical point of view. On the other hand, the good match between the sulphur redox-pair and measured Eh values points to sulphide minerals as redox buffers. This buffering action, together with the presence of dissolved sulphides, suggests the development of an anoxic-sulphidic state mediated by sulphate reducing bacteria (SRB). Typical precipitation of sulphide minerals associated with this environment is suggested by the equilibrium between the waters and several monosulphide phases, as deduced from speciation-solubility calculations: Pyrite is a relatively common fracture phase and is present in small amounts in the fracture systems sampled for groundwater.

The modelling indicates also that the groundwater composition at shallow depth, i.e. far from repository depth, is such that the representative sample from KSH01A:245–261.5 m can meet the SKB chemical stability criteria (Table 6-1) for Eh, pH, TDS and Ca+Mg /see Anderson et al, 2000/.

Table 6-1. The hydrochemical stability criteria defined by SKB are valid for the analysed values of the represenative sample KSH01A:245–261.5 m.

	Eh mV	pH (units)	TDS (g/L)	DOC (mg/L)	Colloids* (mg/L)	Ca+Mg (mg/L)
Criterion	< 0	6–10	< 100	< 20	< 0.5	> 4
KSH01A:245–261 m	–210	7.4	10.7	NA	NA	1223.5

NA = Not analysed.

In conclusion, the different first attempt approaches to construct a Hydrogeochemical Site Descriptive Model (version 1.1) have produced fairly good agreement with respect to addressing those issues in common. With additional hydrogeochemical, geological and hydrogeological data linked to model development there are good possibilities of further quantifying the groundwater system and meeting the required modelling objectives.

7 Conclusions

7.1 Overall changes since previous model version

The Hydrogeochemical Site Descriptive Model version 0 presented a conceptual postglacial scenario model for Simpevarp to indicate the possible origin of the groundwater. In this report the postglacial scenario model has been updated (Figure 3-1), the salinity distribution, mixing processes and the major reactions altering the groundwaters have been modelled in detail down to half repository depth and a new Hydrogeochemical Site Descriptive Model version 1.1 has been produced in regional (Figure 6-1) and local scale (Figure 6-2).

7.2 Implication for further modelling

A 3D hydrochemical description of the site was not produced at this stage due to lack of observations reflecting the spatial variations. Such data will be available for the next model version (version 1.2). Comparison and integration between geological and hydrogeological models was in this model version restricted to input concerning the fracture mineralogy, postglacial scenario models and preliminary salinity distributions and mixing proportion calculations.

For the future, the capacity for modelling the surface waters will be increased and coupled hydrogeological and hydrogeochemical modelling will be applied. The use of independent modelling approaches within the HAG group provided the possibility to compare the outcome of the different models and to use discrepancies between models to guide further modelling efforts. The many similarities in the HAG modelling results gave confidence in the obtained results.

The correct choice of groundwater end members is important for many of the modelling exercises reported. Whilst experience from Äspö and other Fennoscandian sites has contributed to a standard set of groundwater end members, individual sites (at different depths) may lack one or more of these standard end members. This possibility will have to be taken into account. With more groundwater data from the site local rather than regional mixing models can be constructed. A local model will reduce the uncertainty in the mixing modelling.

7.3 Overall understanding of the site

The overall understanding of the site is restricted to the processes taking place at the surface down to half the depth to expected repository levels. The confidence in this description is high since independent model approaches were utilised in the work. The origin and the postglacial evolution of the water is fairly well understood. The confidence concerning the spatial variation is low due to few observations at depth. The ongoing sampling programme will provide better spatial information and will increase this confidence.

7.4 Implications for the ongoing site investigation programme

From the HAG modelling work the following suggestions have been made for the ongoing site investigation programme (the response from the site is indicated in *italics*):

- All samples should have x, y, z coordinates in order to be useful in the visualisation work. The z coordinates were not available for the surface samples (sea, lake, streams, soil tubes). Therefore, the z coordinate was estimated from a grid-map with an error bar +/–10 m /Henrik Stridsman, pers comm, 2003/. A reference level should be used for future sampling so that the z-coordinate can be calculated in the field during the sampling. The tube sampling in boreholes with low hydrogeological conductivity are of limited use for accurately reflecting variations in the formation groundwaters. However, the information may be useful for reflecting the disturbances in the open borehole. *Answer: A more precise Z-coordinate determination will be available in the future by using high precision GPS.*

- For the Forsmark study emphasis was put on the need for more background information in order to evaluate sample representativeness. For example: a) at which stage during the Chemac monitoring of pH, Eh, O_2 and Temp. is it decided to take samples and why?, b) when there are time constraints and it is not possible to wait for chemical stability – sampling should be planned to cover the complete sampling period, rather than choosing just one time interval. This will give a spread of sampling which should also show up time variations which can be important, c) SICADA only indicates the 'Start' and 'Completion' dates of the sampling. It is necessary to know the actual day of sampling for proper evaluation, and d) information concerning drilling/sampling protocols (e.g. pump stops; other pauses etc) and the sequences of events carried out in the boreholes are needed. Information relating to these points generally was made available for the Simpevarp evaluation which greatly improved the potential for establishing the representativeness of the borehole groundwater samples. Additional information for point (d) would be appreciated in the future. *Answer: a) This will be better documented in the future Chemical Characterisation program. b) In the future the sampling will have a better distribution during the pumping period of each section regardless of flushing water content. c) This information is already in SICADA, and it is only a question of how the data are sorted. d) Every sub-activity (eg. Start and stop of pumping, calibrations, signal failure) of the borehole are documented in the Daily-Log, and this information is available in SICADA. If there is need for additional information the responsible personnel can record such information in separate tables.*

- The CHEMAC data are always very useful but the technology should be improved in order to avoid the many technical problems during field measurements. *Answer: Improvements have already been made during autumn 2003.*

- Analytical questions have been taken up with the site and moves are being made for improvement (e.g. Br data quality; U-series data). Also proper presentation of some data to the required precision (e.g. Sr isotope ratios; ^{11}B etc) have been improved in the SICADA data base.

- The flushing/drilling waters should be allocated Class 5 status which is useful to track contamination especially using trace elements and isotopic signatures which may be quite sensitive. Required would be: a) sampling at the point of removal from the source percussion borehole, and b) sampling prior to injection into the cored borehole. This should be checked on a monthly basis during the drilling period. *Answer: A change in the analytical quality for flushwater is a cost issue (three times the amount of samples and three times higher cost for each sample). There are no plans to change these routines but archived samples for Class 5 can be collected for later analysis.*

- Some data such as REEs are always below detection limits with the result that all granitic waters will show the same range of REE contents. Can other analytical techniques or laboratories be used so this information can be used in models? The same is valid for S^{2-}, for example, since it seems that the SO_4^{2-} / S^{2-} redox pair is crucial for the redox control of these systems, could the analysis of S^{2-} not be improved in order to obtain a greater amount of groundwater data? *Answer: This issue will be further investigated. New ICP-MS equipment with very high precision (detection limits in the area of 0.1 ppt for U and Th) is now available. This instrument can also be used for specific analyses requiring low detection limits and to be used for control analysis.*

- DIS (Drilling Impact Study) should be made during drilling in order to identify the degree of contamination and guide the sampling strategy. The drilling data should be available earlier concerning: a) the drilling water volume pumped in and out from the borehole, b) the uranine concentration in the drilling water pumped in and out from the borehole, and c) the water pressure and drawdown along the borehole. The equipment should be more reliable, for example: a) the water pressure during drilling could not be measured properly due to a sensor failure, and b) the quality is poor for the drilling water pumped into the borehole, showing plateaus with no inflow. During the "plateau period" drilling was still conducted and water was pumped into the borehole. The error is explained by a sensor problem. *Answer: Our general opinion is that it is difficult to use the data collected during drilling (DMS-data) for modelling or for sample guidance due to large uncertainties. If there is a need for a DIS-evaluation associated with the modelling of the data, a PM must be prepared in which it is stated exactly what information/data is needed and at what frequency.*

8 Acknowledgements

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Appendix 1

Explorative analysis, expert judgement and modelling

Contribution to the model version 1.1

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Conterra AB, Stockholm [1)]
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January 2004

Contents

Simpevarp Site: Hydrogeochemical Evaluation (Model 1.1 stage)

1. Geological and hydrogeological setting

The Simpevarp site is located at the Baltic coast some 2-3 kilometres SSE of Äspö island and 3-4 kilometres WSE from Laxemar (Fig. 1). The area forms part of the TransScandinavian Igneous Belt of Precambrian basement rocks dominated by granitoids which, at Simpevarp, comprise rocks ranging from granite to quartz monzodiorite. These rocks are usually medium grained but with some porphyritic varieties. Along the south-east part of the Simpevarp peninsula a variety of quartz monzodiorite occurs and a sub-volcanic origin has been proposed but not yet confirmed. Because of its close relationship with the quartz monzodiorite and similarity in composition, the term dioritoid has been suggested. Small amounts of aplitic (named fine-grained granite) and gabbroic rock-types also occur sporadically in smaller bodies. Structurally, Simpevarp is bounded to the west and east by large-scale regional deformation zones aligned sub-parallel to the coast, i.e. NE-SW. The site itself is contained within a structurally 'homogeneous' block bounded by these regional lineaments approximately orientated in NW-SE and NE-SW directions.

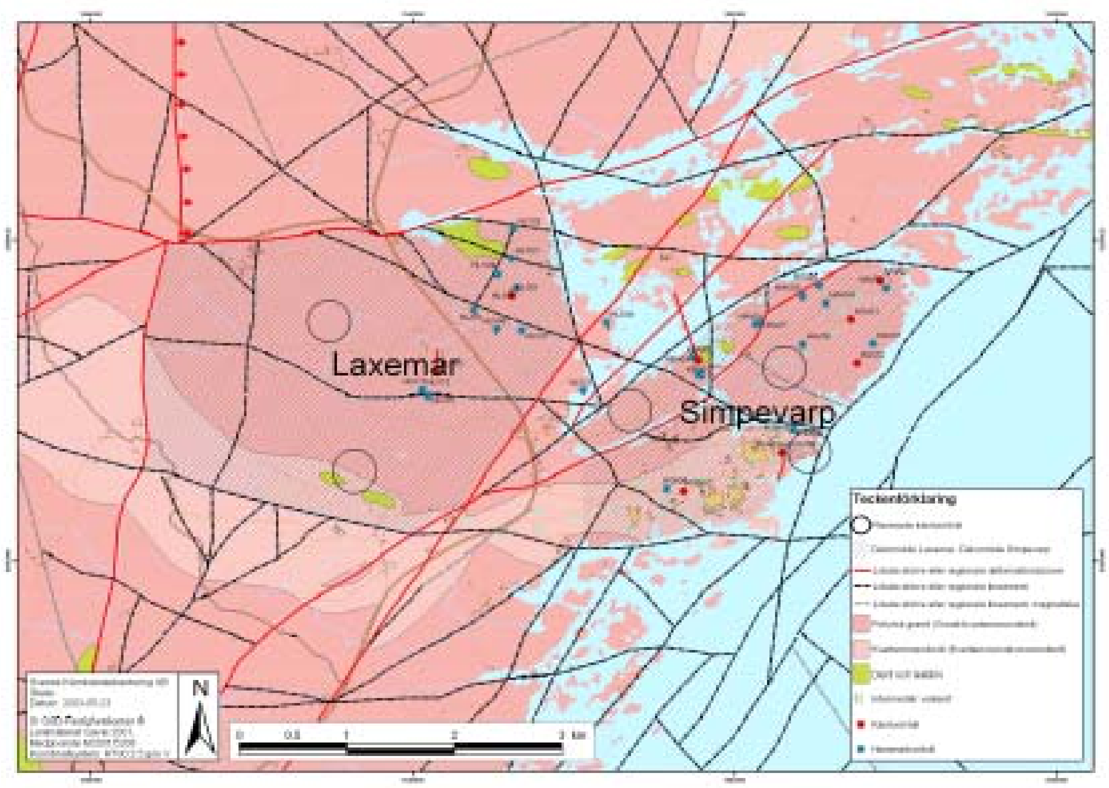

Figure 1-1: *Geological setting at the Simpevarp site*

The borehole locations are also shown in Figure 1-1 but in more detail in Figure 1-2. The main focus of this evaluation is borehole KSH01A located at the edge of the OKG Nuclear Power Facility to the east close to the Baltic Sea coast. The first attempt to obtain flushing water for drilling failed with percussion borehole HSH01 (insufficient capacity); a second attempt with percussion borehole HSH03 (0-201 m) was successful. Some provisional data are also available from one sampled section in borehole KSH02A located close to the western side of the OKG complex and slightly further from the Baltic Sea. Adequate flushing water for drilling was successfully accomplished with percussion borehole HSH02 (0-200 m).

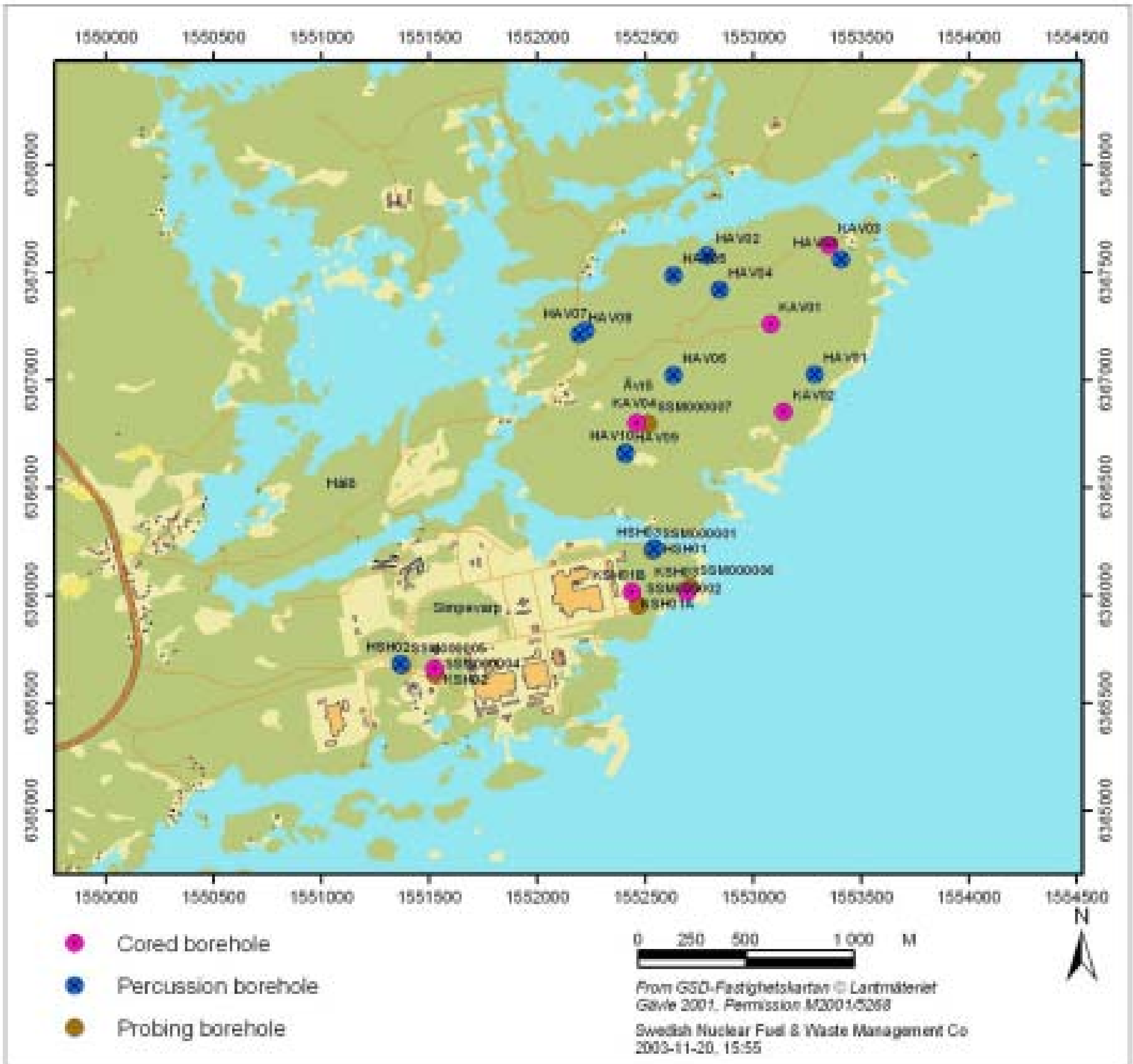

Figure 1-2: *Location of hydrogeochemically prioritised boreholes KSH01A and KSH02A together with the respective flushing water percussion boreholes HSH02 and HSH03.*

With respect to the general hydrology, the regional topography is relatively smooth with rapid run-off via stream flow; of 160 mL/year precipitation, approx. 1 mL/year is expected to filter into the bedrock (Ingvar Rhén, per. comm.. 2003). The soil cover is the main influence on the chemistry of the groundwater eventually penetrating the bedrock. The local groundwater circulation is controlled by small flow-lines to great depth (i.e. 1000 m) determined by the irregular topography. Regional large-scale groundwater circulation (hundreds of kilometres) is not expected to play an important role at Simpevarp.

2. Geological and hydrogeological character of borehole KSH01A

Borehole KSH01A penetrates different rock units. The main rock type in the upper part of the borehole (to 345 m) is the quartz monzodiorite with smaller volumes of dioritoid at 205-245 m and 325-340 m; larger amounts of dioritoid occur from 345-630 m. At greater depths to 1000 m are found granitic to granodioritic rocks (Ävtö granite) mixed with quartz monzodiorite. Smaller horizons of fine-grained granite occur at 360-365 m (mixed with pegmatite), 680-690 m and 720-730 m (mixed with mafic rocks) and 860-870 m. Large lengths of the drillcore show an increased fracture frequency accompanied by intense wall rock alteration/oxidation. This is most prominent in sections 250-285 m, 420-450 m and 590-630 m. Below 700 m the fracture frequency is significantly lower and only a slight alteration of the rock is observed.

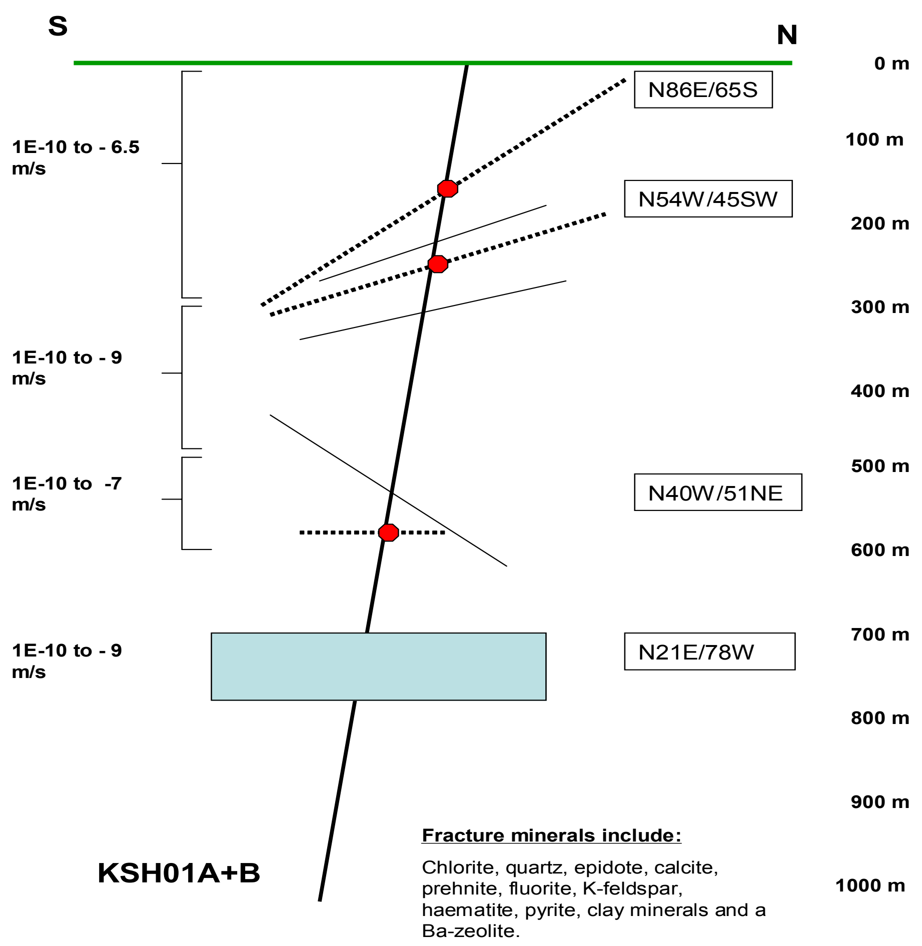

Figure 2-1: *Borehole KSH01A. Intercepted structures and their hydraulic parameters; groundwater sampling locations are indicated in red.*

Figure 2-1 represents a schematic representation of borehole KSH01A and the intercepted structures and their hydraulic parameters; groundwater sampling locations are indicated in red. Drillcore mapping and available BIPS measurements show that both sub-vertical and sub-horizontal fractures occur but the former structures are clearly dominant; this is partly due to the vertical orientation of the borehole.

Fractures are especially frequent in the upper 300 m of the borehole trending northwest and dipping mostly to the south and southwest. Lower intensity fracturing of similar trend but dipping to the northeast occurs between 550-600 m; at around 700 m a major isolated fracture trends northeast dipping to the west.

Drake, Savolainen and Tullborg (written comm., 2003) have identified several generations of mineralisations ranging from epidote facies (epidote, albite, quartz, calcite pyrite and muscovite) in combination with ductile deformation, over to brittle deformation in combination with oxidation and formation of haematite causing extensive red staining of the wallrock adjacent to the fractures. Subsequent breccia sealing by prehnite-fluorite, calcite and Fe-Mg chlorite has occurred followed by andularia haematite, harmontone (Ba-zeolite), Fe-chlorite (spherulite), calcite + REE-carbonates and clay minerals. The outermost coatings along the hydraulically conductive fractures consists mainly of clay minerals of mixed layer clay type (corrensite = chlorite/smectite) together with calcite and minor grains of pyrite.

Figure 2-2 shows the BIPS-images from KSH01A locating the major water-conducting fractures which probably have contributed most groundwater during sampling from borehole sections 156-50-167.00 m and 245.00-261.50 m. Striking is the amount of clay preserved in the fractures following triple-tube drilling; during normal core drilling this would otherwise have been flushed out and lost. Detailed mineralogical examination of these two zones revealed the following:

- One dominating fracture occurs at 159.50 m (section 156.50-167.00 m) with an orientation of N65E/65 S and with several millimetre thick fillings of chlorite and clay minerals of mixed layer clay type including layers of chlorite and smectite/vermiculite. The filling is rich in calcite and some equigranular calcite crystals were identified. Also minute pyrite crystals were found in the clay filling.
  One additional fracture at 161.3 m with an orientation of N86W/76N was also identified in the sampled section, this is however subordinate to the one at 159.50 m.

- The entire section (245-261.50 m) represents an altered and oxidised section of the bedrock and several open fractures were identified from the BIPS. There was also a several decimetre long zone at 251 m with intense chemical alteration and clay formation which is at the centre of the sampled fracture zone. It is difficult to exactly pinpoint the water-conducting parts from the flow log and very surprisingly the water flow seems to be low (because of the large clay content?). The minerals identified in the zone are chlorite, mixed layer clays with chlorite-smectite/vermiculite layers, adularia, haematite, quartz and calcite. The orientation of this structure can not be evaluated from the BIPS-images.

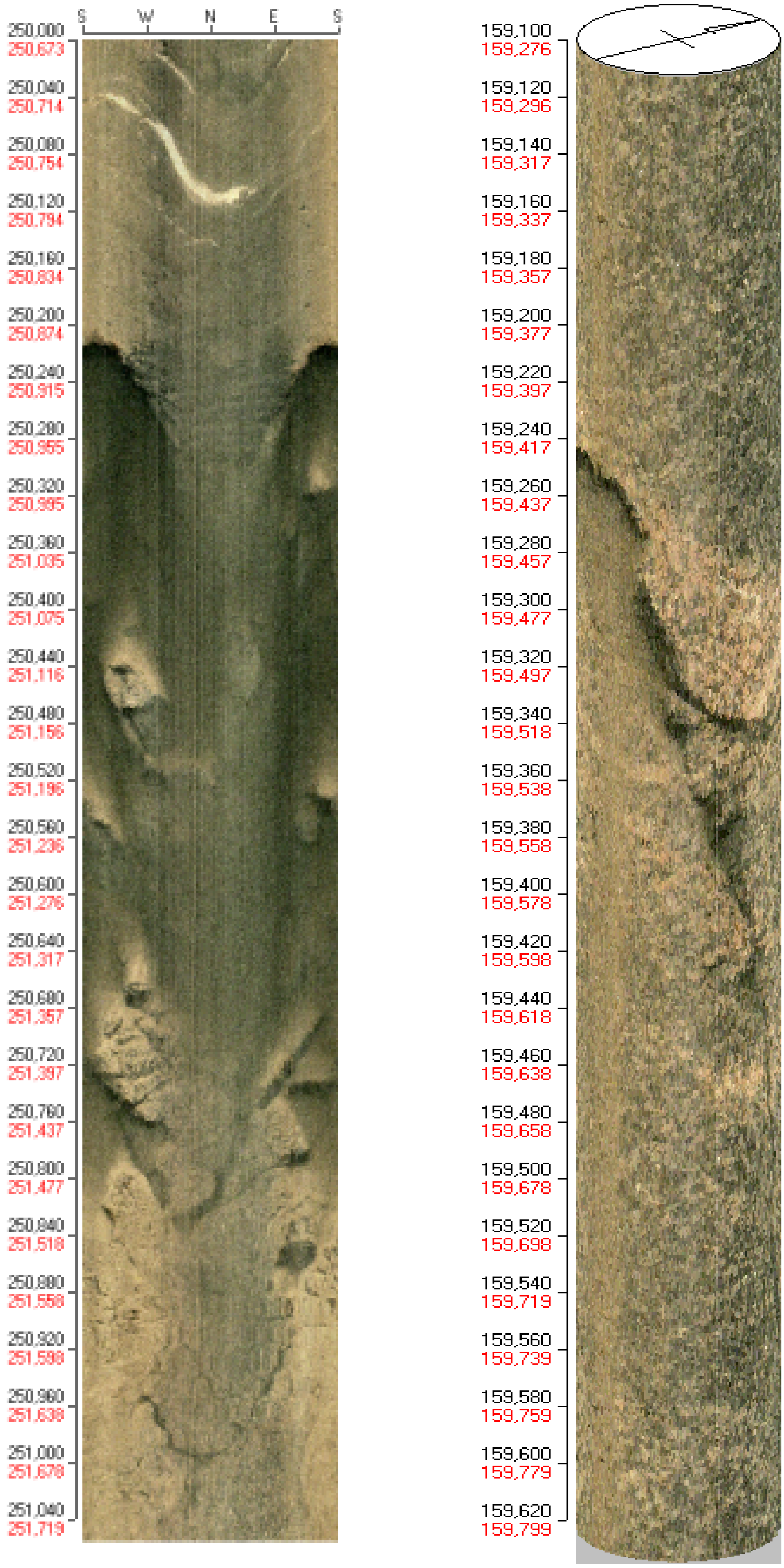

Figure 2-2: *BIPS-images from KSH01A showing the probable main water-conducting open fractures sampled from borehole sections 156-50-167.00 m and 245.00-261.50 m.*

Hydraulic conductivities (derived from Flow Meter logging; Fig. 2-3a) range from 10^{-10}-$10^{-6.5}$ ms^{-1} in the upper 300 m to 10^{-10}-10^{-9} ms^{-1} from 300-500 m and increasing to 10^{-10}-10^{-7} ms^{-1} from 500-600 m; at around 700 m values decrease again to 10^{-10}-10^{-9} ms^{-1}. From 725 m to the hole bottom at 1003 m no data are available indicating very low hydraulic conductivities and a hydraulically tight bedrock. Borehole KSH01A is cased to 100.24 m depth which excludes BIPS and Flow Meter data from this length.

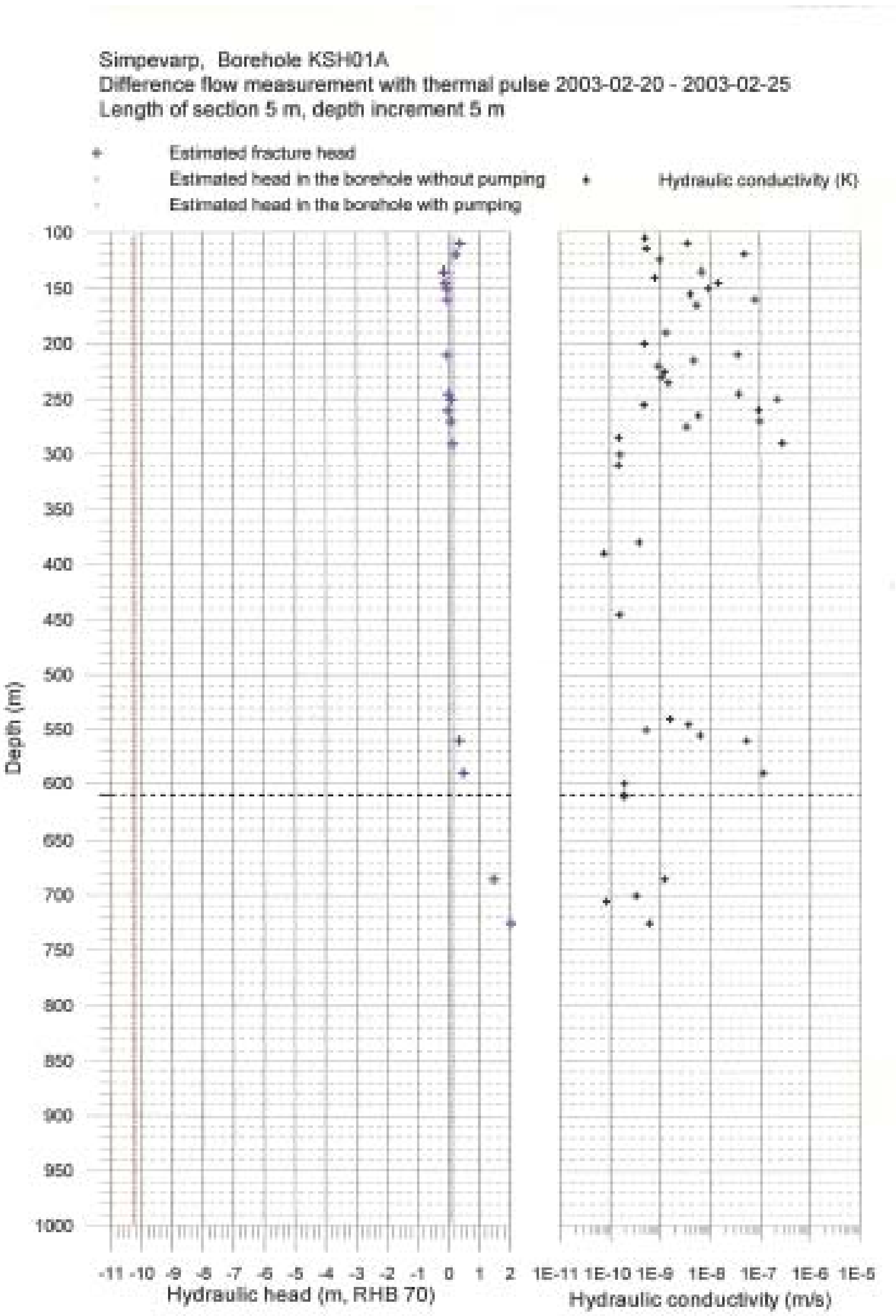

Figure 2-3a: *Flow meter measurements along borehole KSH01A (100.24 to 1003 m) of hydraulic head and conductivity.*

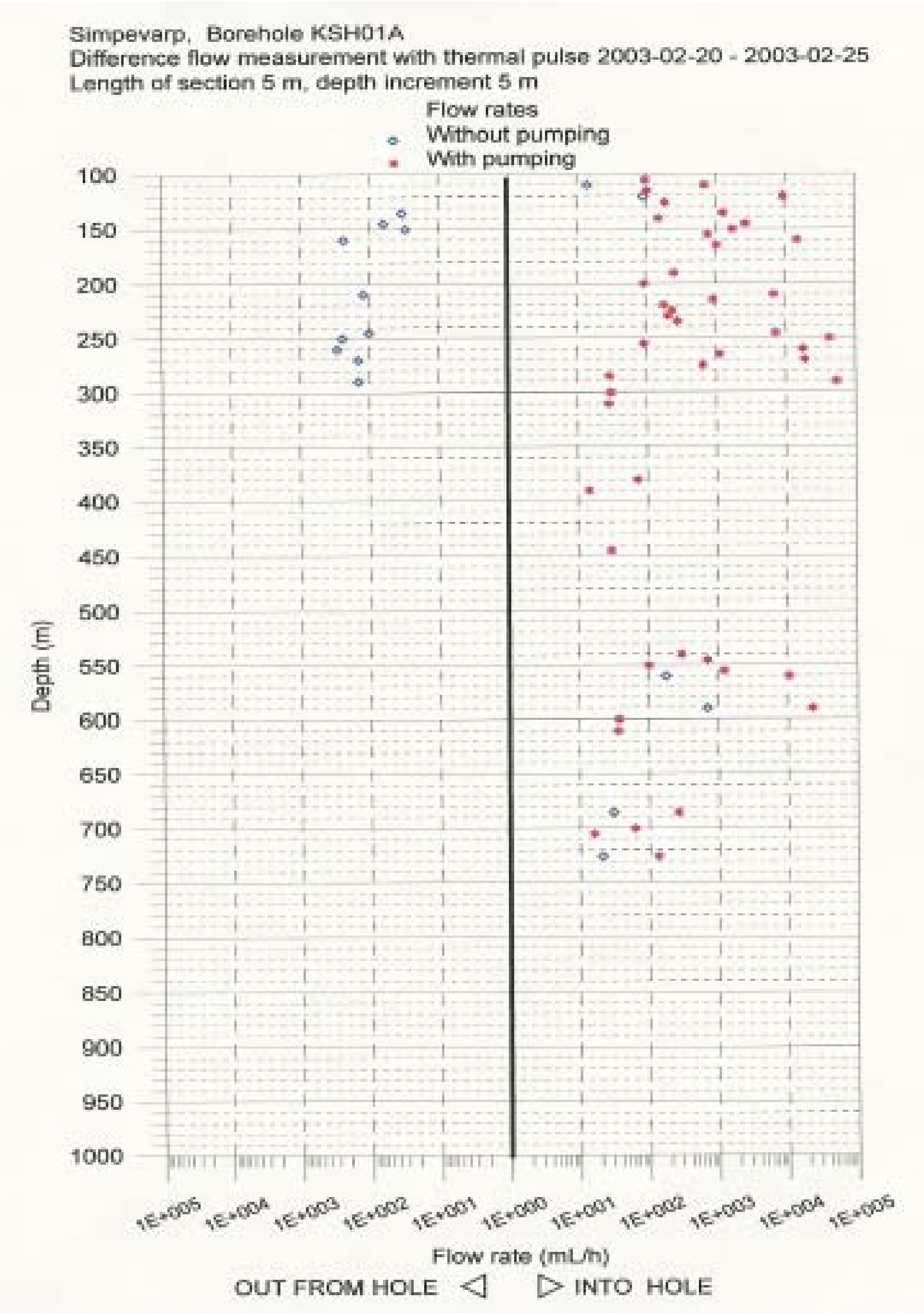

Figure 2-3b: *Flow meter measurements along borehole KSH01A (100.24 to 1003 m) of groundwater flow rate (mL/h) into and out of the borehole.*

The recorded rates of groundwater flow under 'natural' hydraulic conditions (i.e. no pumping) via fractures into the borehole from the surrounding bedrock, and conversely from the borehole into the bedrock, indicate that water movement is mostly out from the borehole to the surrounding bedrock in the upper 300 m and from the bedrock to the borehole from 300-750 m (Fig. 2-3b). From 750 m to the hole bottom the absence of data suggest a very tight, low transmissive bedrock. During pumping all movement of formational groundwater is into the borehole. Under open hole conditions, therefore, given strong hydraulic gradients, formation groundwater would be expected to leave the borehole at shallower depths where there is an increase in hydraulic conductivity coinciding with the location of the KSH01A sampling sections, and enter the borehole at the 550-600 m level where the hydraulic conductivity increases to around 10^{-7} ms^{-1}. Because of the very low hydraulic conductivities at depths greater than 600 m (<10^{-9} ms^{-1}) it is very doubtful that any open-hole circulation is active along this length and any drilling water would tend to be trapped (see section 3.1.3).

Figure 2-4: *Electrical conductivity log for borehole KSH02A during open hole conditions*

Figure 2-4 shows downhole electrical conductivity (EC) measurements from borehole KSH02A under open hole conditions; the upper 100 m is not relevant as it relates to the cased borehole section (KSH02B). No log was available for KSH01A. Considering the more natural flow conditions without pumping (blue line), at 100 m depth the EC values are close to 0.1 Sm^{-1} and this is maintained to around 250 m. At this depth there is a rapid increase eventually reaching 2.5 Sm^{-1} at 450 m; here it levels out until 830 m where there is a slight increase in salinity to 4 Sm^{-1} finally achieving 4.7 Sm^{-1} at the borehole bottom.

This low salinity recorded from 100-250 m probably corresponds to the equivalent level in borehole HSH02 which provided the source of the flushing water used during drilling, i.e. markedly fresh and dilute at approx. 17 mg/L Cl. The increase in salinity with depth corresponds to the sampled level at 411.85-467.07 m where the chloride content lies around 6500 mg/L.

Although no log is available for KSH01A, the absence of dilute water from the sampled 100-250 m depth (chloride values average from 5000-6500 mg/L) probably reflects structural heterogeneities within the Simpevarp site. The absence of sufficient water in borehole HSH01 initially drilled as a source of flushing water may also reflect this situation.

3. Groundwater quality and representativeness

The pre-sampling Chemac on-line monitoring data of O_2, Eh, electrical conductivity and temperature are available for borehole KSH01A but not for KSH02A. Additional information requested and received included the actual sampling dates of the groundwaters tabulated in the database received for evaluation, and also included the range of data from which the tabulated values were selected. Only some on-line monitored *in-situ* field pH values were measured; most recorded values are laboratory-derived and lie about 0.6 pH units under the *in-situ* values.

3.1 Borehole KSH01A

The flushing water used in drilling borehole KSH01A was from percussion borehole HSH03. The chemistry of this water shows it to be basically a fresh to slightly brackish Na(Ca)-$HCO_3(SO_4$-Cl) type with a chloride content of approx. 55 mg/L. Tritium varies from 4.7-10 TU.

3.1.1 Borehole activities

Pre-sampling borehole activities may have a significant influence on the quality of the sampled groundwaters eventually collected. According to available information (e.g. Stridsman, 2003), the following sequence of activities were carried out in borehole KSH01A:

- ***October/December, 2002:*** Drilling
- ***October/November, 2002:*** Class 3 sampling during drilling from three borehole sections was attempted (197.00-313.42 m, 585.00-593.00 m and 531.00-619.42 m)
- ***December, 2002.*** Following drilling, no nitrogen gas lift pumping was carried out to flush/clean the borehole
- ***January, 2003:*** Open hole tube sampling; Class 3 analysis

- ***February, 2003:*** Open hole differential flow meter logging
- ***March, 2003:*** Chemac monitoring (equipment failure noted) combined with Class 5 sampling of borehole section 156.50-167.00 m
- ***April, 2003:*** Chemac monitoring (equipment failure noted) combined with Class 5 sampling of borehole section 245.00-261.50 m
- ***May 2003:*** Attempt at resampling level 586-597 m; no indication if successful.

3.1.2 Borehole sections 197.00-313.42 m, 585.00-593.00 m and 531.00-619.42 m)

Sampling from these three sections was attempted during drilling. The decision to sample was based on a combination of factors: a) drilling expert judgement (e.g. fluctuations in drilling speed; changes in flushing water pressure etc.), b) variations in electrical conductivity of the flushing water that may indicate a sudden influx of brackish or saline waters etc., and c) evidence of potential water-conducting fractures from drillcore inspection. *(An evaluation is presently underway to try and establish a reliable methodology to locate potential water-conducting fractures during the drilling process).*

Consequently there is little information to go on, but the drilling water component from two borehole sections indicates 66.09% (section 585.00-593.00 m) and 34.98% (section 531.00-619.42 m) respectively. Corresponding tritium contents are 6.2 and 4.2 TU. No percentage drilling water was reported for section 197.0-313.42 m but 1.1 TU was recorded. The major ion chemistry reflects the dilution effect of the drilling water component in the former two sections; in contrast, section 197.00-313.42 m (in addition to low tritium) appears to be more acceptable recording representative major ion values expected at such bedrock depths (i.e. around 6000 mg/L Cl, 2440 mg/L Na, 1020 mg/L Ca; 18.5 mg/L SO_4 etc.) when compared to the later collected Class 5 samples (see below).

3.1.3 Open hole tube sampling

Open hole tube sampling was the next major borehole activity; this is discussed in some detail since such data can be very useful in evaluating borehole groundwater circulation pathways and groundwater budgets (e.g. water in and water out between the borehole and surrounding bedrock). Understanding these processes helps greatly in assessing water quality and representativeness.

Hydraulically, open boreholes usually establish groundwater circulation controlled by the piezometric head and the number and hydraulic properties of intersected water-conducting fractures or fracture zones. Groundwater may therefore either flow from the borehole into the bedrock or *vice-versa* and, in addition, groundwater flow systems in the bedrock may be short-circuited, i.e. it may be easier for formation water to flow into and along the borehole rather than through the bedrock. As described above, Figure 2-3b shows the groundwater flow directions into and out from borehole KSH01A during and in the absence of pumping. For this discussion it is the absence of pumping data that are relevant. These indicate that in the upper 300 m ‘natural’ groundwater flow is from the borehole into the surrounding bedrock, whilst between 550-750 m groundwater flow is into the borehole. This may give rise to some degree of open hole circulation of groundwater. However, because of the very low transmissivities, low flow rates and high salinities characterising the 600-750 m level (and certainly to the bottom of the borehole), groundwater circulation will be generally weak over the period of measurement and sampling. It is more likely, therefore, that the open hole groundwater chemistry will be influenced by residual flushing water at depth (since no high pressure nitrogen clearance was carried out) and any penetration downwards of formation water from the upper 300 m to depth will be determined by salinity differentials.

Tube sampling entails lowering an array of coupled tubes each of 50 m length to the borehole bottom; this is carried out with care to avoid excessive groundwater perturbation. When the tubes have been placed down the borehole, valves at each end of the tubes are opened allowing the groundwater to rise up and fill each tube. When this is considered complete, the valves are closed and the tube array is hoisted to the surface whereupon each tube is systematically emptied and the samples prepared for transport and analysis. One completely filled 50 m long tube would amount to 2.5 dm^3 of groundwater. However, the total water volume in each tube was less than expected (Wacker, 2003) and three tubes were discarded. Precipitation or suspended material was present in most of the collected samples.

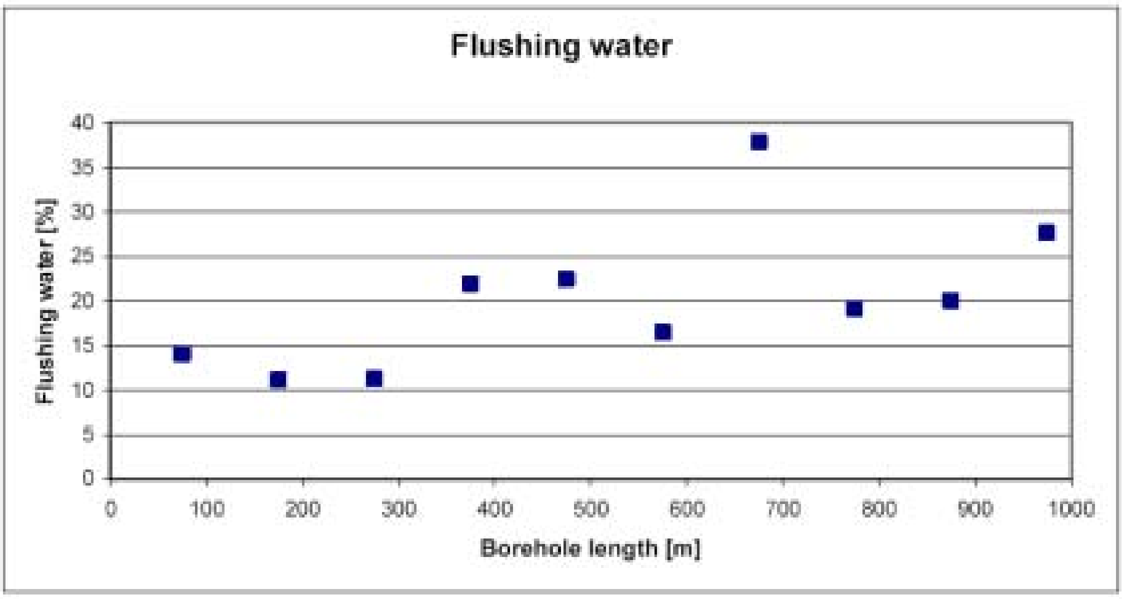

Figure 3-1: *Percentage of residual flushing water in borehole KSH01A under open hole conditions.*

Figure 3-1 shows the percentage of flushing water (i.e. from percussion borehole HSH03) present in borehole KSH01A under open hole conditions; lower values characterise the upper 300 m (10-15%) and higher values from 400 m downwards (15-30%). This is supported by the tritium contents introduced by the flushing water (4.7-10 TU) which along the borehole increase from 5.1 TU at the 500 m level to 7.2 TU at the borehole bottom. The increasing presence of more dilute flushing water with depth is reflected in most of the chemical plots in Wacker (2003). Examples of profiles along the borehole include HCO_3 (Fig. 3-2a), Na, Ca and Cl (Fig. 3-2b), Mg, Br, Sr and K (Fig. 3-2c) and δD vs $\delta^{18}O$ (Fig. 3-2d).

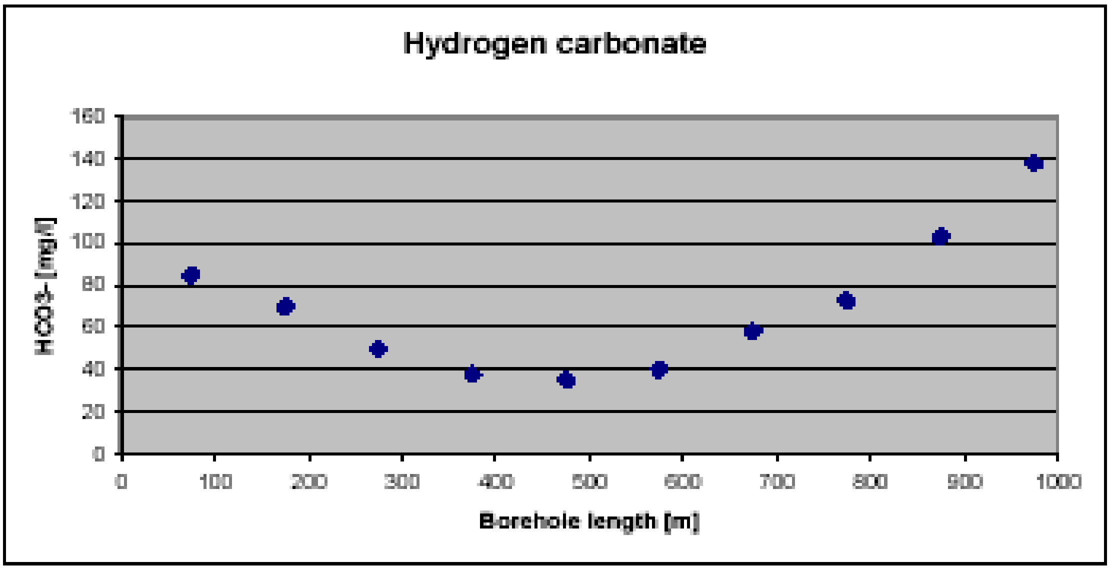

Figure 3-2a: *Distribution of alkalinity along open borehole KSH01A*

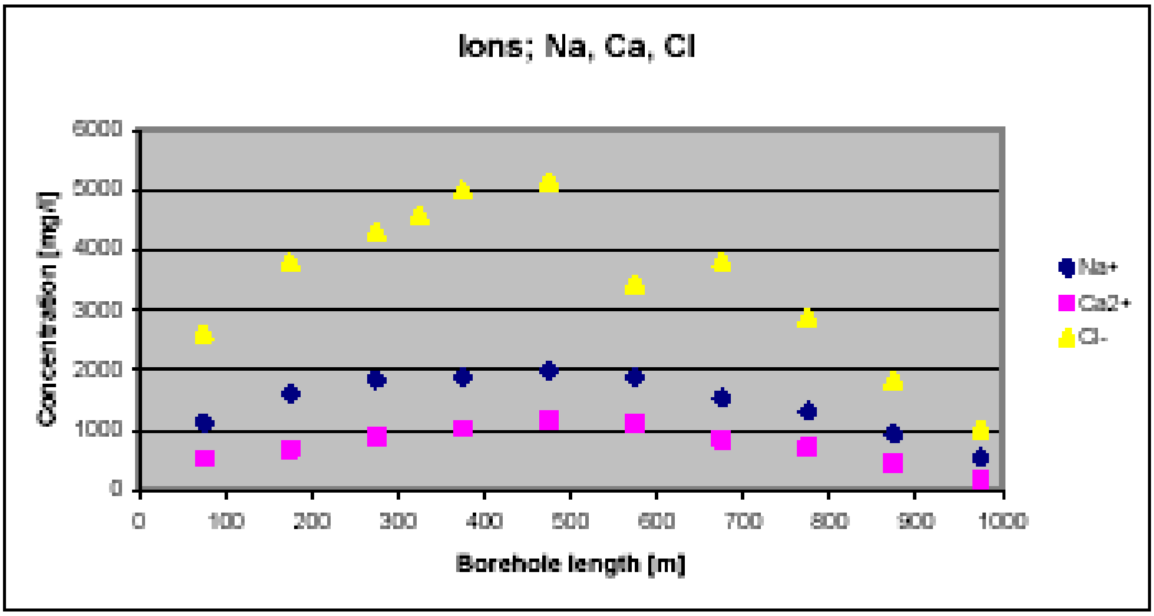

Figure 3-2b: *Distribution of Na, Ca and Cl along open borehole KSH01A*

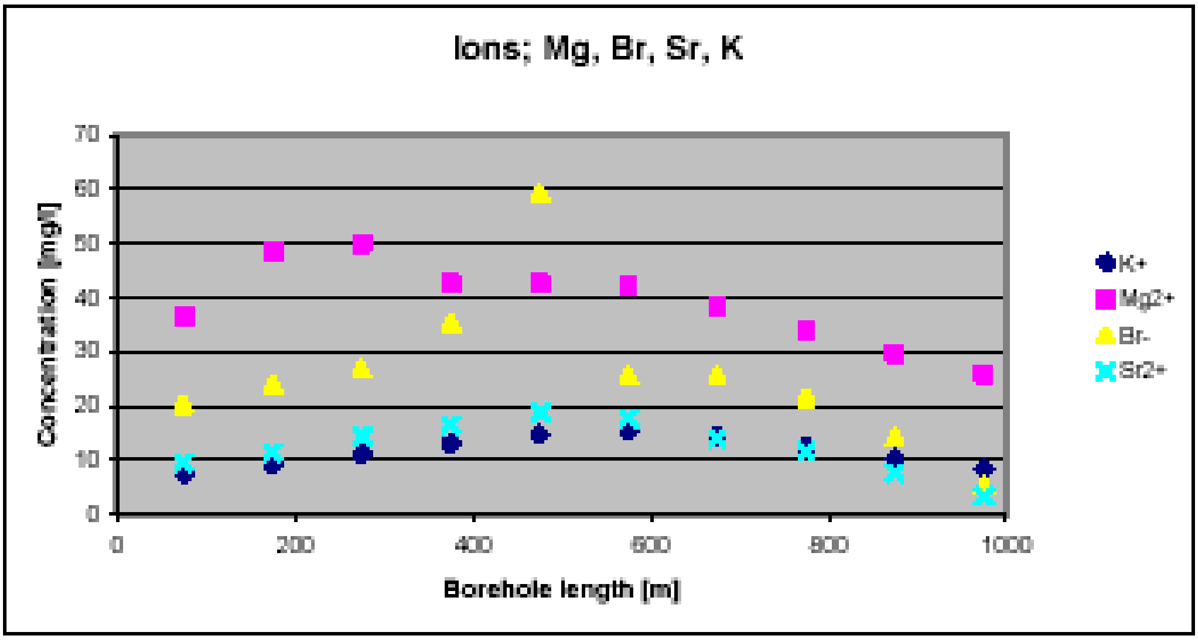

Figure 3-2c *Distribution of Mg, Br, Sr and K along open borehole KSH01A*

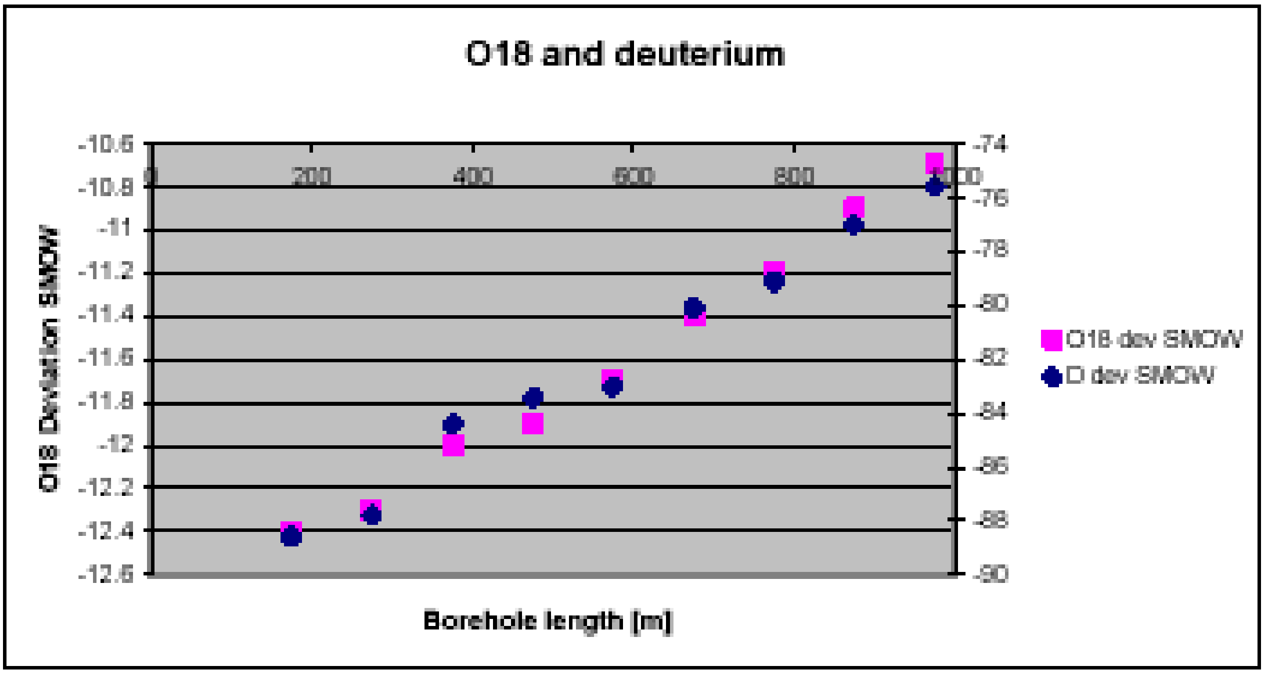

Figure 3-2d: *Distribution of* $\delta^{18}O$ *and* δD *in open borehole KSH01A*

Figures 3-2a-d show a clear increase in mixing of residual near-surface derived flushing water in Borehole KSH01A from about 500 m downwards:

- decreasing Na, Ca and Cl
- decreasing K, Mg, Br and Sr
- increasingly heavy δD and $\delta^{18}O$

The distribution of HCO_3, which shows a marked increase, may be influenced by its sensitivity to microbial reactions. Other bacteria-sensitive species, for example SO_4 and Fe(II), show a slight decrease (SO_4) and strong fluctuations, eventually decreasing with respect to Fe(II). The former may indicate the presence of sulphate-reducing bacteria. Because of some problems encountered during drilling, i.e. iron contamination from abrasion of the stainless steel drilling rods drilling crown, it is uncertain whether the observed Fe(II) fluctuations are artefacts of this contamination or represent geochemically reliable data.

Some of the chemical profiles from the upper approx. 400 m of the borehole may be explained also by flushing water contamination. However, the δD and $\delta^{18}O$ plot (Fig. 3-2d) shows only typical values for the flushing water (i.e. $\delta^{18}O$ = -10.60‰ and δD = -77‰ SMOW for HSH03) at the deepest part of the borehole. In the upper part of the borehole the values are generally closer to fracture groundwaters later sampled from the isolated borehole sections at 156.50-167.00 m and 245.00-261.50 m (see below). Since the groundwater is less contaminated by flushing water at these shallower depths, compositions more representative of the fracture groundwater would be expected.

As a general conclusion, these open hole tube samples are not representative for the KSH01A borehole and should be discarded.

3.1.4 Borehole section 156.50-167.00 m

Chemac monitoring commenced on 2003-03-27 and was completed in 2003-04-23; sampling commenced on 2003-03-31 and continued to 2003-04-23 with eventual selection of data taken from sampled groundwaters taken on the 2003-03-31, 2003-04-07, 2003-04-14 and 2003-04-16.

The Chemac monitoring protocol indicates, based on electrical conductivity and redox potential measurements, that 'stabilisation' of the extracted groundwater from the borehole section reflected electrical conductivity values of around 1540-1560 $mSm^{-1}$and redox potential measurements of around -265-275 mV; O_2 registered zero. In reality stabilisation was never really totally achieved during the monitoring period since both the electrical conductivity and redox potential continued to systematically change slowly throughout with increasing and decreasing values respectively. At one stage on 2003-04-03 there was a pause in monitoring and redox values in particular quickly increased (accompanied by O_2); it took some 5 days before the conductivity values returned to their pre-pause level.

These small monitoring trends are reflected in the chemistry of a selection of 18 groundwaters sampled and analysed through the sampling period, although not all analytical data are recorded. For example, chloride content increased only from 5166 to 5590 mg/L during the sampling period. In conclusion, since the fluctuations are small the values tabulated in the dataset can be considered representative. This supported by the low drilling water contents

(2.39-3.70%) and also tritium which was below detection for the first three samples and 2.8TU for the fourth sample provided in the dataset.

As indicated above, pH measurements are mostly laboratory-derived; only a few *in-situ* values are from the Chemac monitoring which indicated an average of 0.6 pH units lower than the laboratory values.

This sampled level can be considered representative.

3.1.5 Borehole section 245.00-261.50 m

Chemac monitoring commenced on 2003-04-25 and was completed in 2003-05-16; sampling of a series of six groundwaters was carried out during this time. The Chemac monitoring protocol indicates, based on electrical conductivity and redox potential measurements, that 'stabilisation' of the extracted groundwater from the borehole section reflected electrical conductivity values of around 1770-1790 $mSm^{-1}$and redox potential measurements of around -210-220 mV; (O_2 registered zero). In common with the shallower level discussed above there was an increase in electrical conductivity and decrease in redox potential with monitoring time, but this was very slight. This is reflected in the chemistry where all the major ions showed no significant variation. Moreover, drilling water was less than 1% and tritium was below detection.

As mentioned above, pH measurements are mostly laboratory-derived.

This sampled level can be considered representative.

3.2 Borehole KSH02A

. The chemistry of the flushing water used in drilling (borehole HSH02) is a fresh Na-HCO_3 type with a chloride content of 11.8-22.6 mg/L; tritium values ranged from 11-15 TU.

3.2.1 Borehole activities

According to available information (e.g. Stridsman, 2003), the following sequence of activities were carried out in borehole KSH02A:

- ***January/June, 2002:*** Drilling
- ***February/June, 2002:*** Borehole flushing/cleaning was carried on completion of drilling using high pressure nitrogen purging
- ***February, 2003:*** Open hole differential flow meter logging; no analyses available from section 6.65-100.50 m; 27 % drilling water
- ***April, 2003:*** Open hole differential flow meter logging; Class 3 analyses from section (412-467 m)
- ***May, 2003:*** Sampling from section 738-755 m; no analyses available, 52% drilling water
- ***June, 2003:*** Open hole tube sampling; Class 3 analyses, but not available.
- ***July 2003:*** Open hole electrical conductivity, temperature and pressure/water recovery measurements

No Chemac monitoring data or Class 5 data were available. The electrical conductivity log shown in Figure 2-4 indicates that the measured open hole salinities probably are a good reflection of the chemistry of the sampled groundwaters and shows that there is no major residual drilling water contamination following borehole flushing and cleaning. This is supported by Class 3 data from borehole section 411.85-467.07 m which records a drilling water content of 5.56% and tritium is below detection.

This section can be considered fairly representative.

3.2.2 Borehole sections 6.65-100.50 m and 739.0-755.0 m

Section 6-65-100.50 m records a drilling water content of 27%; no other analytical information is available.

Section 739.0-755.0 m records a drilling water content of 53%. Although no additional data are available, the high drilling water contamination would render these two sections as not being representative of the groundwaters at the levels of sampling and therefore unsuitable for evaluation.

3.2.3 Borehole section 411.85-467.07 m

As mentioned above, section 411.85-467.07 m records a drilling water content of 5.56%; tritium is below detection. Major ion chemistry indicates the highest chloride (6426 mg/L), Ca (1280 mg/L) and SO_4 (176.7 mg/L) and second highest Na (2450 mg/L), recorded at Simpevarp; Mg is correspondingly very low (9.7 mg/L). From Figure 2-4, this section is located following the increase and levelling off of salinity at 2.5 ms^{-1}.

This section can be considered fairly representative.

4. Available data

Two cored boreholes have been sampled, KSH01 and KSH02. With respect to nomenclature in the report text, the first 100 m of each borehole (the initial percussion drilled portion) is referred to as ‘B’ (i.e. KSH01B and KSH02B) and from 100 m to the hole bottom (by core drilling) is referred to as ‘A’ (i.e. KSH01A and KSH02A). Since all hydrogeochemical data originate from the cored borehole length, all reference in the text is to KAS01A and KSH02A.

Borehole KSH01A chemical data (Class 5) are available from isolated sections at 150.60-167.00 m and 245-261.50 m respectively. Additional Class 3 data are available from: a) borehole section 197.00-313.42 m which appears to be representative, b) two open percussion boreholes, HSH02 and HSH03, sampled down to depths of 200 m and 201 m respectively and provided flushing for drilling purposes, and c) open-hole sampling using the tube technique. Some limited data are also available from borehole KSH02A at sections 411.85-467.07 m. Surface water chemical data (Class 5) are available from sampled lakes, rivers and streams and Class 3 near-surface water data from shallow soil pipes. Due to contamination during sampling, only two precipitation rain water data are available.

5. Hydrogeochemical Evaluation

Evaluation of the hydrogeochemical data considers all sampled locations together in order to understand the overall large-scale dynamics and evolution of the groundwater systems. However, since the most quantitative hydrogeochemical data are from two borehole sections in KSH01A with Class 5 data located at 156.50-167.00 m and 245.00-261.50 m respectively, Class 3 data from one section at 197.00-313.42 m, and Class 3 data from one section in borehole KSH02A at 411.85-457.50 m, these data will provide the main focus of the hydrogeochemical evaluation.

The chemical data have been expressed in several X-Y plots to derive trends that may facilitate interpretation. The following is a preliminary evaluation of the various geochemical and isotopic trends. Although considered unrepresentative, the open hole tube sampling data are also included for completeness but will be omitted in the next modelling phase. The following discussions therefore will relate only to groundwater samples obtained from predetermined packed off borehole sections.

5.1 General comparison of Cl vs depth with other sites

Considering samples from KSH01A (156.50-167.00 m and 245.00-261.00 m) and KSH02A (411.85-467.07 m), chloride increases from ~5 500 to ~6 400 mg/L over this depth range. At shallower levels chloride ranges from ~12 to ~ 55 mg/L which reflects the composition for the drilling waters extracted from open boreholes HSH03 and HSH02 respectively. There is no indication as to what depth Comparison with Forsmark, Laxemar and Olkiluoto (Finland) is shown in Figure 5-1. It may be argued that such a comparison should be treated with caution since Forsmark and Olkiluoto are geographically distant, have a differing palaeo-evolution and represent different hydrogeological regimes. Furthermore, Laxemar, although close by, represents more a mainland environment and involves greater depths. However, since the Fennoscandian basement hydrogeochemistry probably shares general similarities irrespective of geographic location, Figure 5-1 may serve a useful purpose particularly with respect to establishing whether a Litorina component is present in the Simpevarp groundwaters.

The Laxemar data show dilute groundwaters extending to approx. 600 m and for KLX02 to around 1000 m before a rapid increase in salinity to maximum values of around 47 g/L Cl at 1700 m. Olkiluoto shows an initial sharp increase in chloride at around 150 m to a levelling off at 5 g/L Cl which continues to 450 m; here there is a relatively steady increase to maximum values of around 20 g/L Cl at 900 m depth (one maximum value of 44 g/L Cl was recorded). The available Forsmark data so far show a close similarity to the initial Olkiluoto trends, and the Simpevarp data, whilst also limited, also falls along the general plateau ranging from around 5.1-6.3 g/L Cl. It will be interesting to see if Simpevarp will follow the same rapid increase in salinity with increasing depth at Olkiluoto and Laxemar. In common with the Forsmark data, an initial observation at this juncture is that the levelling out at 5 g/L Cl at Olkiluoto has been interpreted as possibly reflecting a Litorina seawater component. Whether this may be also the situation at Simpevarp, as is the case for Forsmark, is further discussed below.

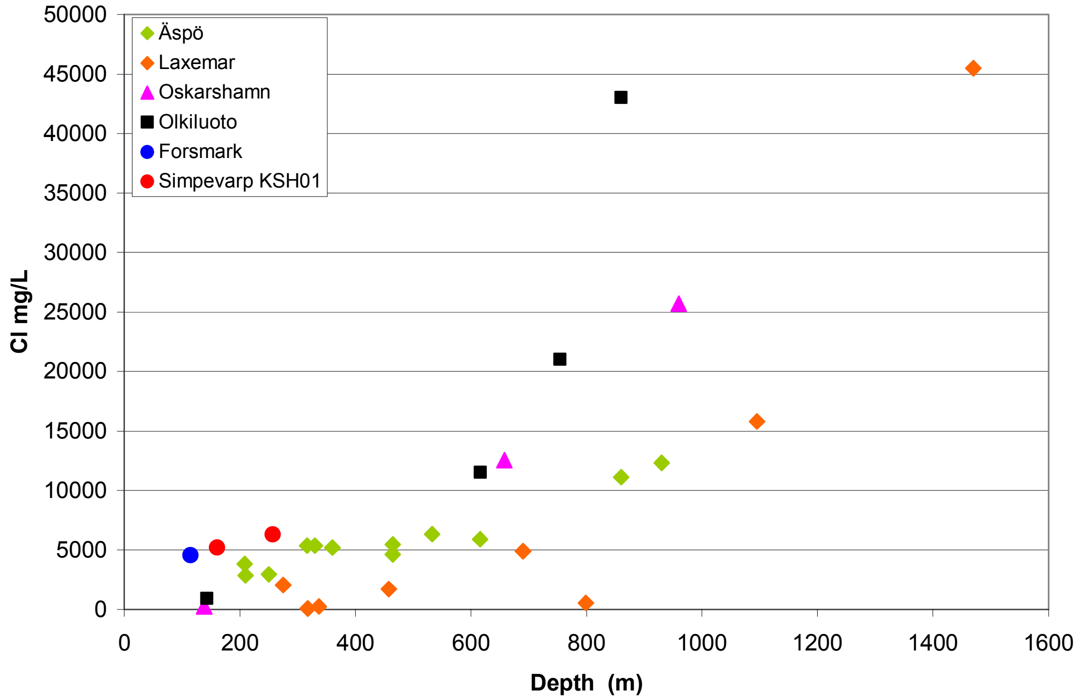

Figure 5-1: *Depth comparison of chloride between the Simpevarp, Forsmark, Laxemar and Olkiluoto localities.*

5.2 Plots of Mg vs Cl for all Simpevarp data and comparison with other Swedish sites

Figure 5-2 shows two clear observations: a) an obvious modern Baltic Seawater dilution trend, and b) borehole groundwaters forming an isolated group which may belong to a different saline dilution trend that may become clearer with additional data in the future. Borehole KSH02A (411.85-457.07 m) has a significantly lower Mg content (9.66 mg/L at 6426 mg/L Cl) than the three KSH01A samples.

With respect to the modern Baltic Seawater dilution trend, the plotted data generally show a large spread to more dilute mixing compositions, and extreme examples exist where only small amounts of Cl are present. Because of this mixing there is no distinct clustering of the data that would indicate a representative Baltic Sea composition, although a small concentration in values occurs between 3 300-3 700 mg/L Cl.

According to Ericsson and Engdahl (2003) two distinct environments have been sampled for 'Baltic Sea' water (Fig. 5-3); that close to the open sea with only a few small islands surrounding them (locations PSM002060/61), and that situated close to the mainland, surrounded by large islands and more subject to dilution from seasonal run-off effects from the mainland (PSM002062/64). This would explain the nature of the Baltic Sea dilution line and also may explain the three anomalous samples around 2 500 mg/L Cl (from localities PSM002060/61).

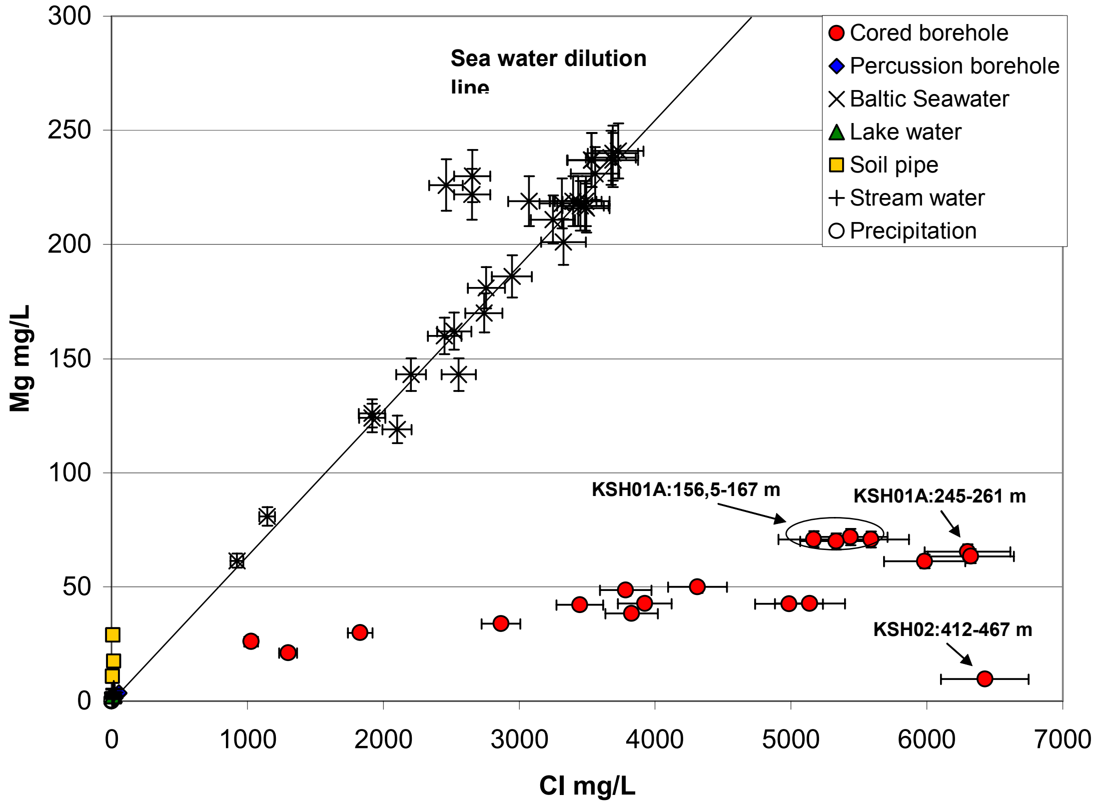

Figure 5-2: *Plot of Mg vs Cl for all Simpevarp data showing error bars ±5%. (Note: Cored borehole samples not labelled represent open hole mixing and should be ignored).*

A further observation from Figure 5-2 is the spread of Mg values at low Cl contents for the Soil Pipe samples (0.91-5.37 mg/L); this may reflect: a) contact with an older marine water followed by cation exchange reactions and later flushing out of chloride, or b) simply water-rock interaction of recharge with minerals in the soil.

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There is no indication from these borehole data of a significant Litorina Sea component; for example the Mg values are too low (9.66-71.80 mg/L) compared to the estimated values for the Litorina Sea composition (Mg ~448 mg/L; Cl ~6500 mg/L) as derived by Pitkänen et al (1999).

Figure 5-3: *Surface water sampling locations at Simpevarp.*

Figure 5-4, comparing the Simpevarp and Forsmark data shows a closer marine dependence for most of the Forsmark data, a dependence which is clearly lacking at Simpevarp where the salinity trend reflects an increasing, possibly non-marine older saline component, from depth. The four ringed Forsmark outliers (i.e. the deeper borehole samples collected) trending towards the Simpevarp borehole samples is also in accordance with an increasing, possibly non-marine saline component. There is no indication at this stage of a significant Litorina Sea component at Simpevarp as exemplified at Forsmark by borehole HMF08: 0-143m.

The other observation to note is the difference in average Baltic Sea compositions between Forsmark (~2 600 mg/L Cl) and Simpevarp (~3 500 mg/L).

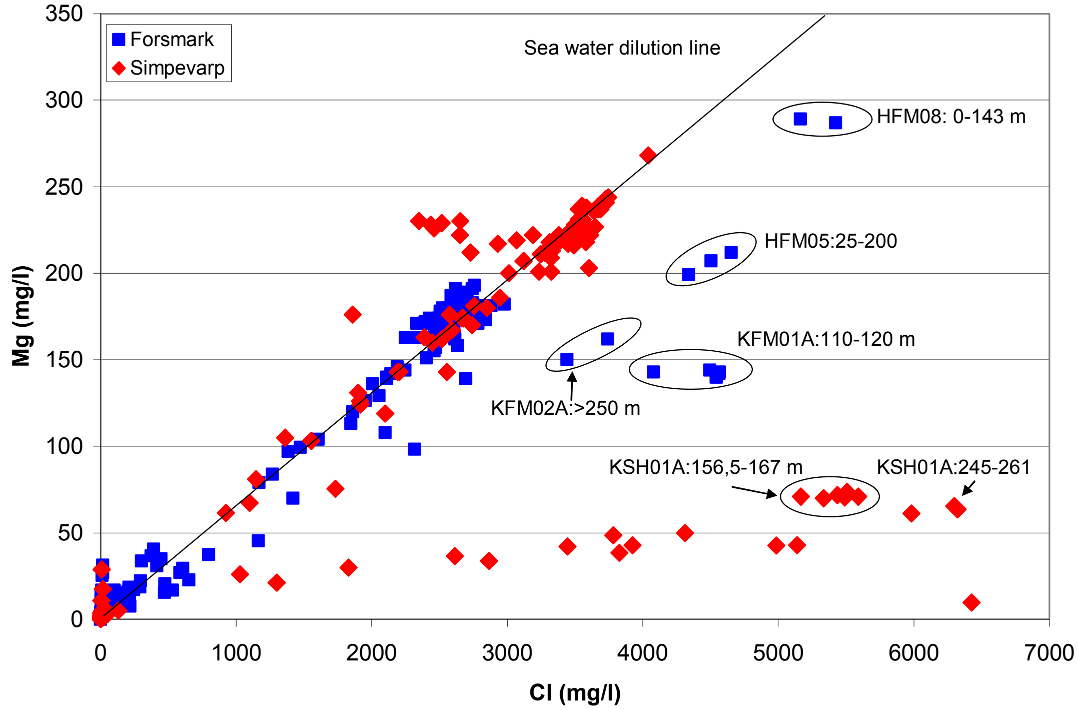

Figure 5-4: *Plot comparing all Simpevarp Mg vs Cl data with the Forsmark site*

5.3. Plot of Ca vs Cl for all Simpevarp data

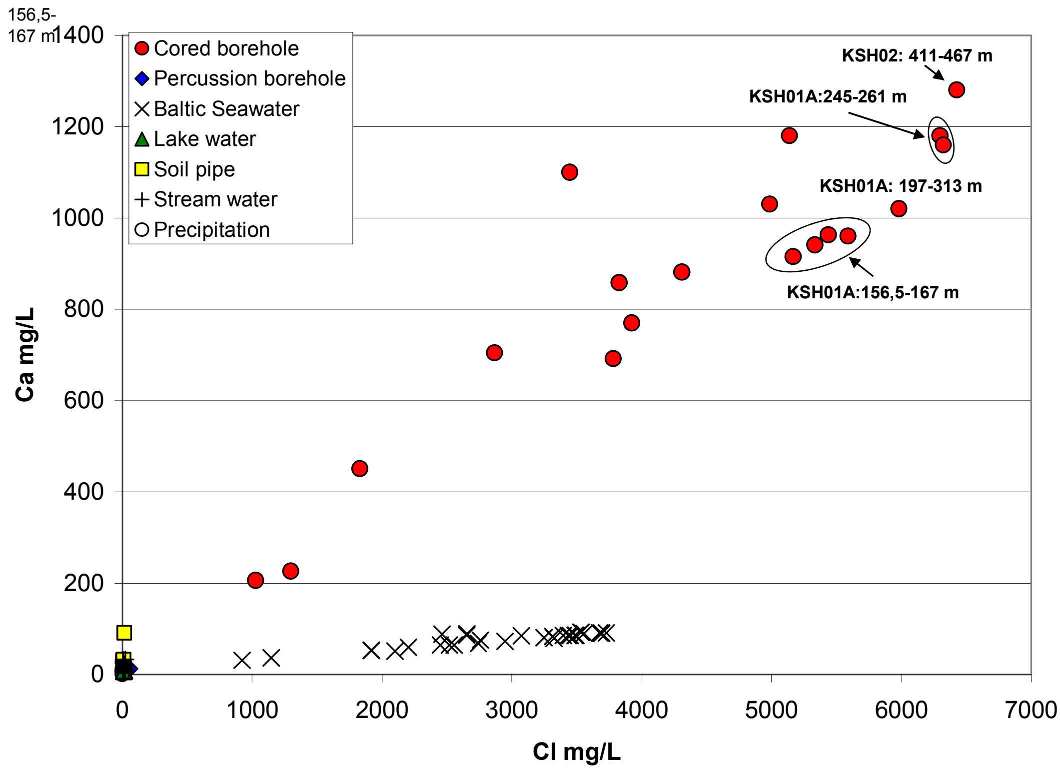

Figure 5-5: *Plot of Ca vs Cl for all Simpevarp data. (Note: Cored borehole samples not labelled represent open hole mixing and should be ignored).*

Figure 5-5 shows similar trends to those described in Figure 5-2 and similar to Ca vs Na and Ca vs Mg (not shown).

5.4 Plot of SO_4 vs Cl for all Simpevarp data

Figure 5-6, showing SO_4 vs Cl, indicates, in common with Figure 5-2, an obvious modern seawater dilution trend with the cored borehole samples possibly representing a separate saline dilution trend although there are inadequate data at this stage to be more specific. The reliable sulphate values for borehole KSH01A are generally low (31.71- 51.07 mg/L) and show no correlation with Cl; Borehole KSH02A contains greater amounts of SO_4 (176.69 mg/L) but this may be a function of increasing sulphate with depth (in common with the Äspö data). The sulphur isotope data (Fig 5-20) support a marine origin of the sulphate in the two sampled sections in borehole KSH01A. However, the SO4/Cl ratio is much to low to be representative of a Litorina sea water, and later modification caused by sulphate reducing bacteria is expected to have caused an increase in sulphur isotope ratios.

In general, these data lend support to an absence of a significant postglacial marine component, and suggests mixing with deeper, more saline waters of a non-marine origin or a non-marine/marine mixing origin.

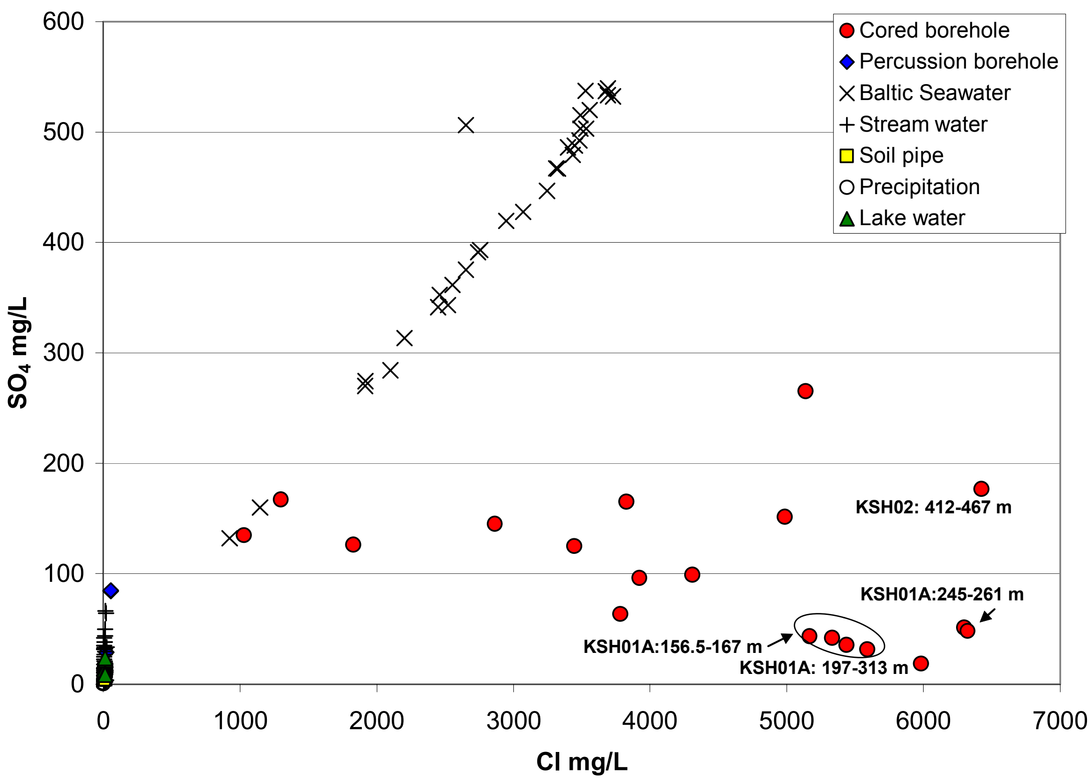

Figure 5-6: *Plot of SO_4 vs Cl for all Simpevarp data. (Note: Cored borehole samples not labelled represent open hole mixing and should be ignored).*

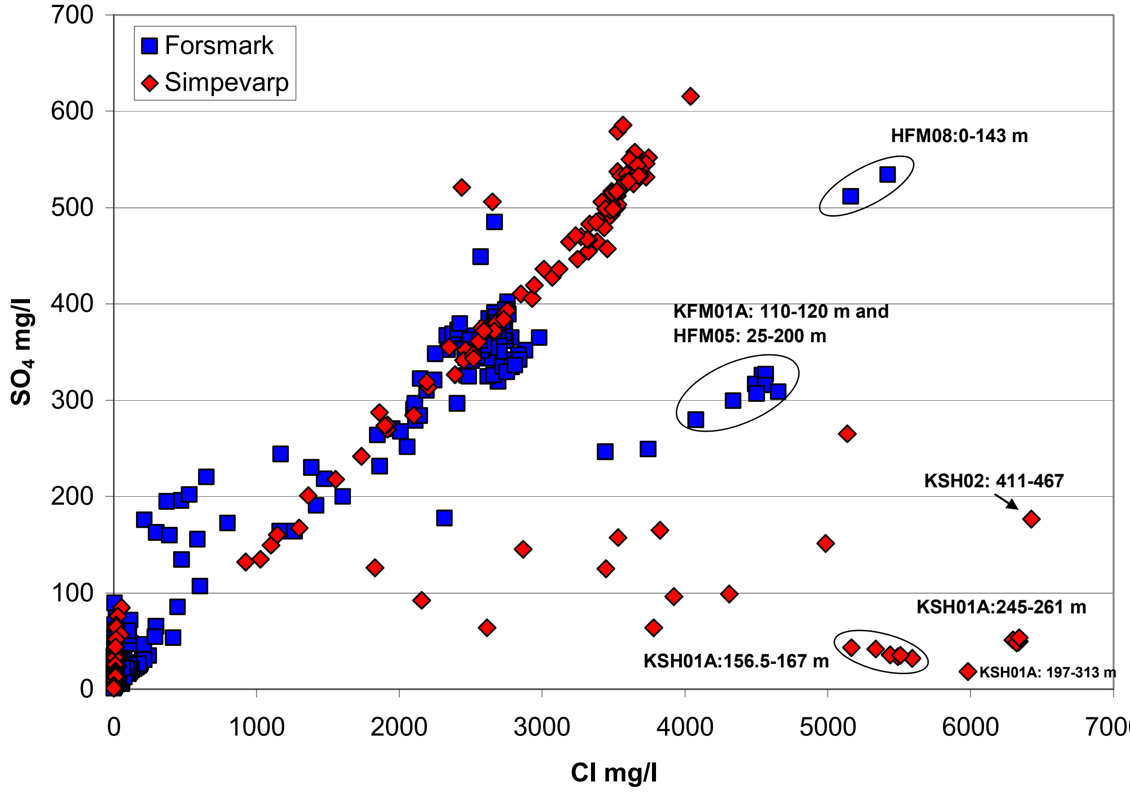

Figure 5-7: Plot comparing all Simpevarp SO_4 vs Cl data with the Forsmark site.

Comparing all the Simpevarp SO_4 vs Cl data with the Forsmark site (Fig. 5-7) further underlines the clear distinction between Forsmark characterised by a strong marine (Baltic Sea plus Litorina Sea) signature, and Simpevarp which trends towards a non-marine or non-marine/marine signature.

5.5 Plot of Br vs Cl for all Simpevarp data and comparison with Forsmark

Figure 5-8 reveals again the two distinct correlations: a) modern Baltic Seawater dilution trend, and b) a clear borehole groundwater isolated group. Bromine values for the Baltic Seawater (3.40-14.32 mg/L) are much lower than for borehole KSH01A (29.45-38.53 mg/L); Borehole KSH02A with higher salinity also records a higher bromine value (46.50 mg/L) and deviates significantly from borehole KSH01A in the plot. It is unlikely therefore that a marine component (including Litorina origin) has influenced these borehole groundwaters and the values obtained are more in line with deeper derived saline groundwaters from, for example, Äspö and Laxemar where water/rock interaction is prevalent.

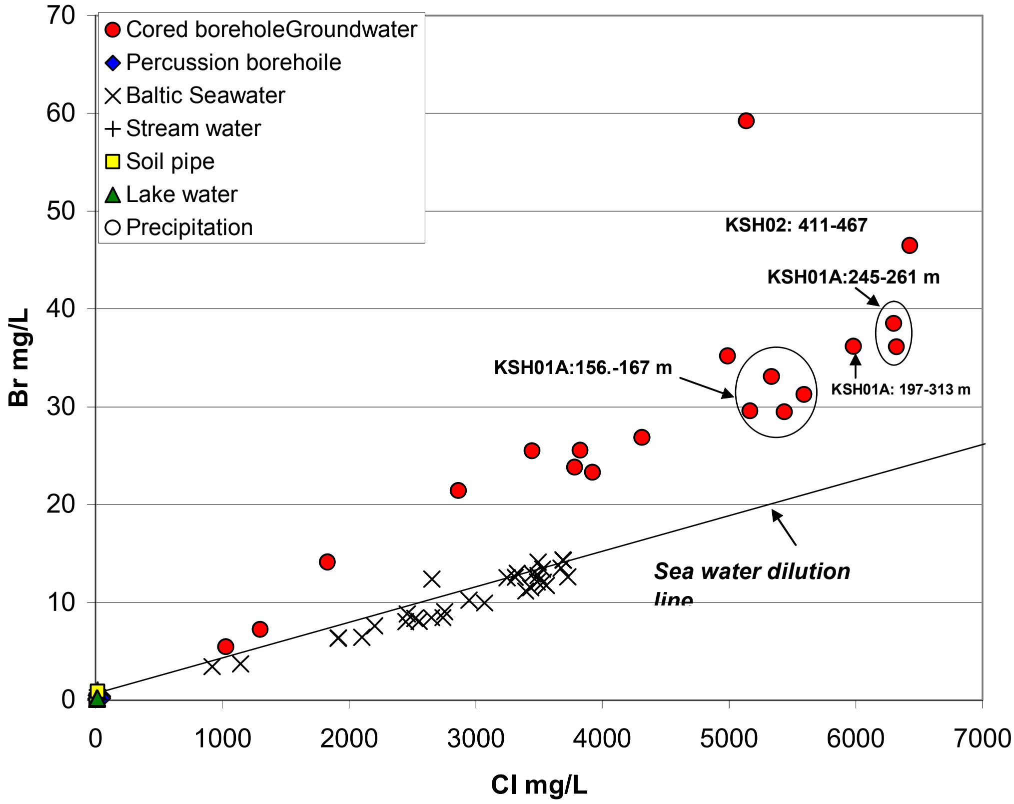

Figure 5-8: Plot of Br vs Cl for all Simpevarp data. (Note: Cored borehole samples not labelled represent open hole mixing and should be ignored).

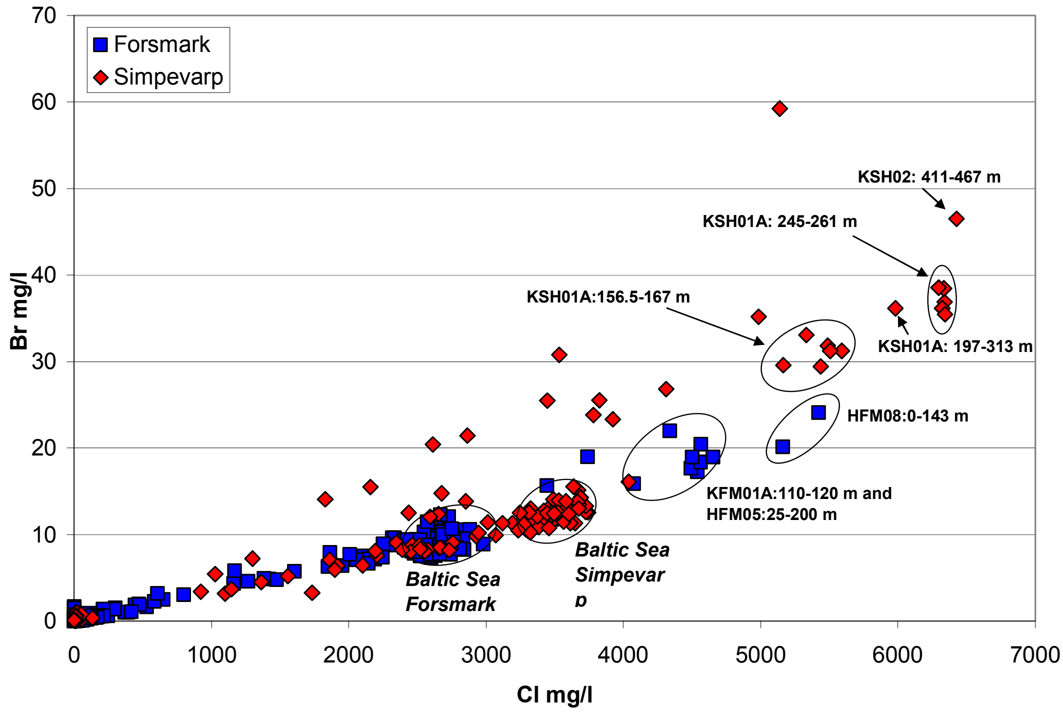

Figure 5-9: Plot comparing all Simpevarp Cl vs Br data with all Forsmark data.

Figure 5-9 compares Simpevarp with Forsmark and further emphasises the Simpevarp trend of higher bromide with increasing salinity and a distinct mixing trend away from the strongly marine influenced groundwater environment of Forsmark. Once again, the deeper Forsmark cored borehole groundwaters show an increasing affinity towards more non-marine or non-marine/marine saline signatures.

5.6 Plot of Mg vs Ca for all Simpevarp data

Figure 5-10 reflects the same relationships discussed for the preceding plots.

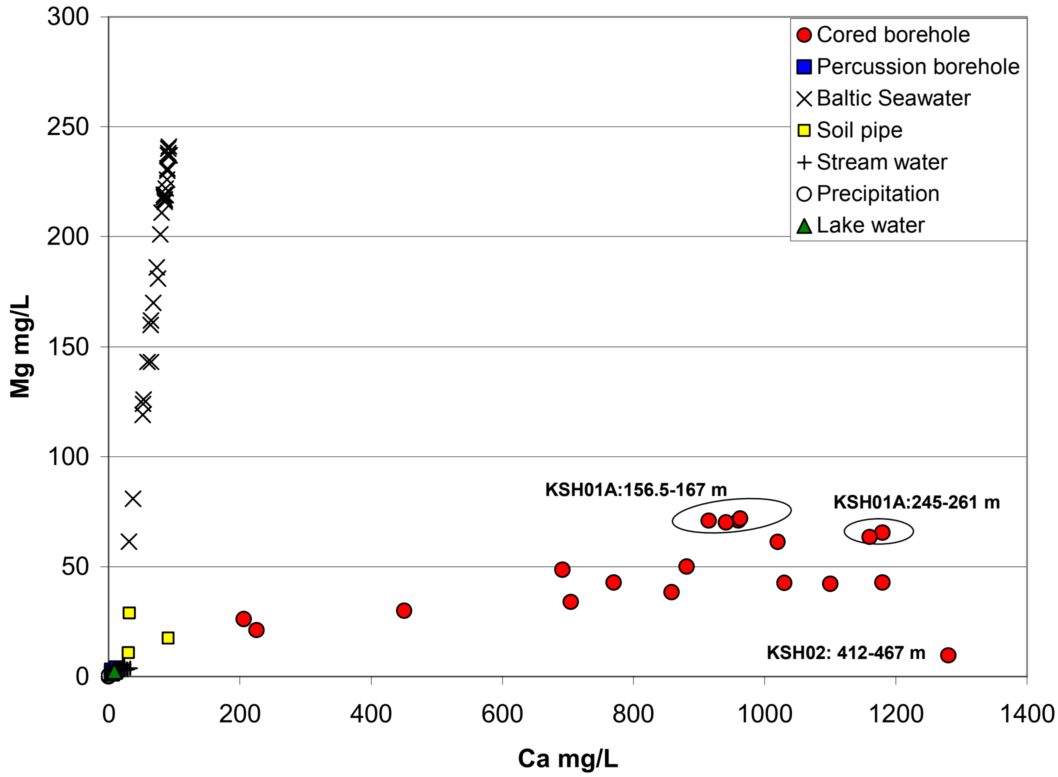

Figure 5-10: *Plot of Mg vs Ca for all Simpevarp data . (Note: Cored borehole samples not labelled represent open hole mixing and should be ignored).*

5.7 Plot Ca/Mg vs Br/Cl comparing all Simpevarp data with other Fennoscandian sites

By plotting Ca/Mg vs Br/Cl, Figure 5-11 provides an opportunity to indicate those data of marine origin versus data with a non-marine or a non-marine/marine mixing origin. For comparison, the Simpevarp data have been grouped with other Fennoscandian sites (Finnsjön, SFR, Forsmark, Äspö, Laxemar, Olkiluoto and Stripa); the Yellow Knife-Thompson data have been included since they represent highly evolved basement brines in Canada where a significant marine component is unlikely.

The figure shows clearly the clustering of modern Baltic Seawater; these can be compared to the other extreme, the Stripa groundwaters, which are considered to be more representative of a non-marine origin since this area was not transgressed by the Litorina Sea or subsequent transgressions (Nordstrom et al., 1985). Between these two extremes fall the range of Finnsjön and Äspö groundwaters considered to have a marine component of varying amounts (Smellie and Wikberg, 1991; Laaksoharju et al., 1999), and the Olkiluoto groundwaters which lean to a less marine component at greater depths (Pitkänen et al., 1999). The Laxemar data, of deep basement origin, plot off the diagram further emphasising their non-marine character. Collectively the Forsmark borehole groundwaters cluster towards a dominant marine component, more similar to the SFR than the Finnsjön groundwaters, although the Forsmark cored borehole samples do extend towards a slightly less marine component.

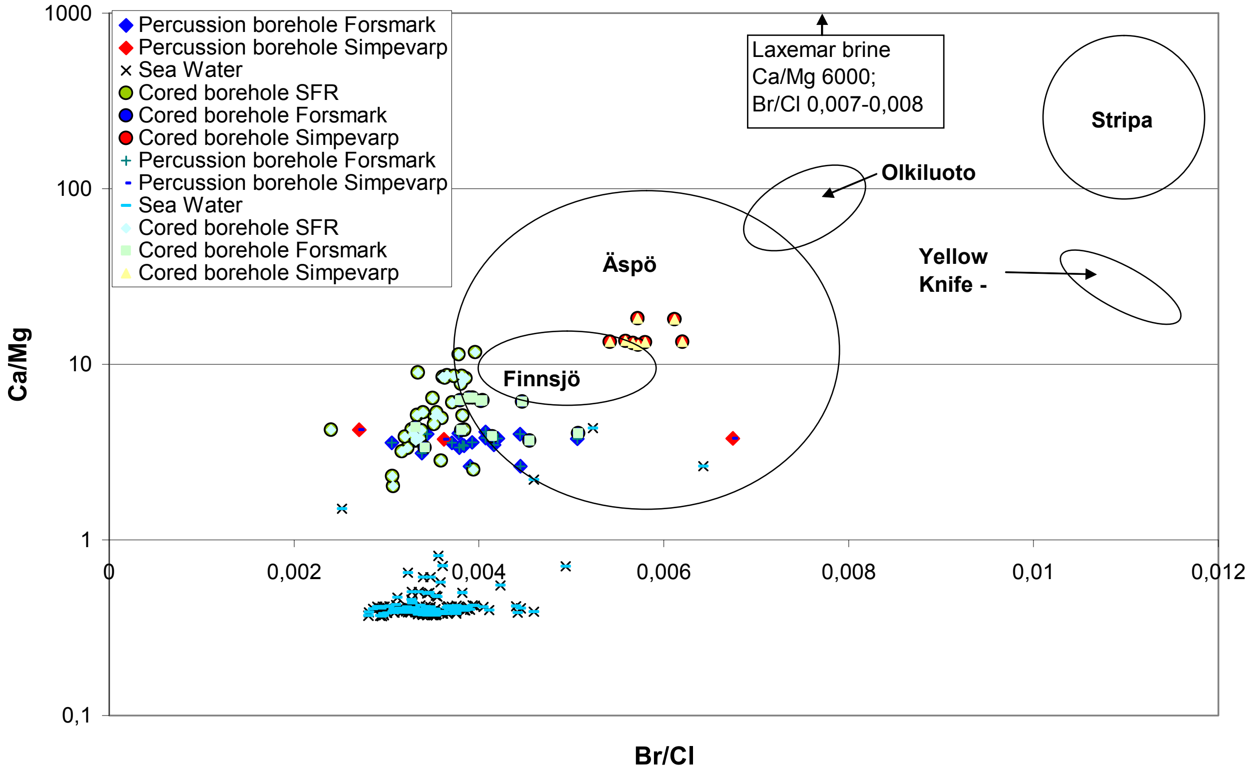

Figure 5-11: *Plot comparing all Forsmark Ca/Mg vs Br/Cl data with other Fennoscandian sites and deep Canadian brines.*

The Simpevarp cored borehole groundwater data plot well within the range of the Äspö samples suggesting a more non-marine signature when compared with the Simpevarp percussion boreholes and the Forsmark waters which plot closer to the Baltic Sea/marine-related region of the figure.

5.8 Plots of δD vs $\delta^{18}O$ for all Simpevarp data and comparison with the Finnsjön and SFR sites

Figure 5-12 details the Simpevarp samples which plot on or close to the Global Meteoric Water Line (GMWL) indicating a meteoric origin. Three clear groups are indicated: a) Baltic Sea and Lake waters (($\delta^{18}O$ = -9.6 to -6.7‰ SMOW; δD = -72.7 to -54.1‰ SMOW), b) Stream Water ($\delta^{18}O$ = -11.7 to -9.7‰ SMOW; δD = -85.0 to -70.4‰ SMOW), and c) Cored Borehole waters ($\delta^{18}O$ = -14.1 to -12.6‰ SMOW; δD = -102.5 to -93.6‰ SMOW). The two precipitation $\delta^{18}O$ values represent a large spread ranging from -15.5 to -10.9‰ SMOW and δD from -116.9 to -80.6‰ SMOW. There is a clear indication of the Cored Borehole groundwaters representing cold recharge conditions, particularly from sections 245.0-261.5 m and 197.0-313.42 m in borehole KSH01A where recorded $\delta^{18}O$ and δD values are lightest (-14.1 to -13.4‰ SMOW and -102.5 to -100.0‰ SMOW respectively).

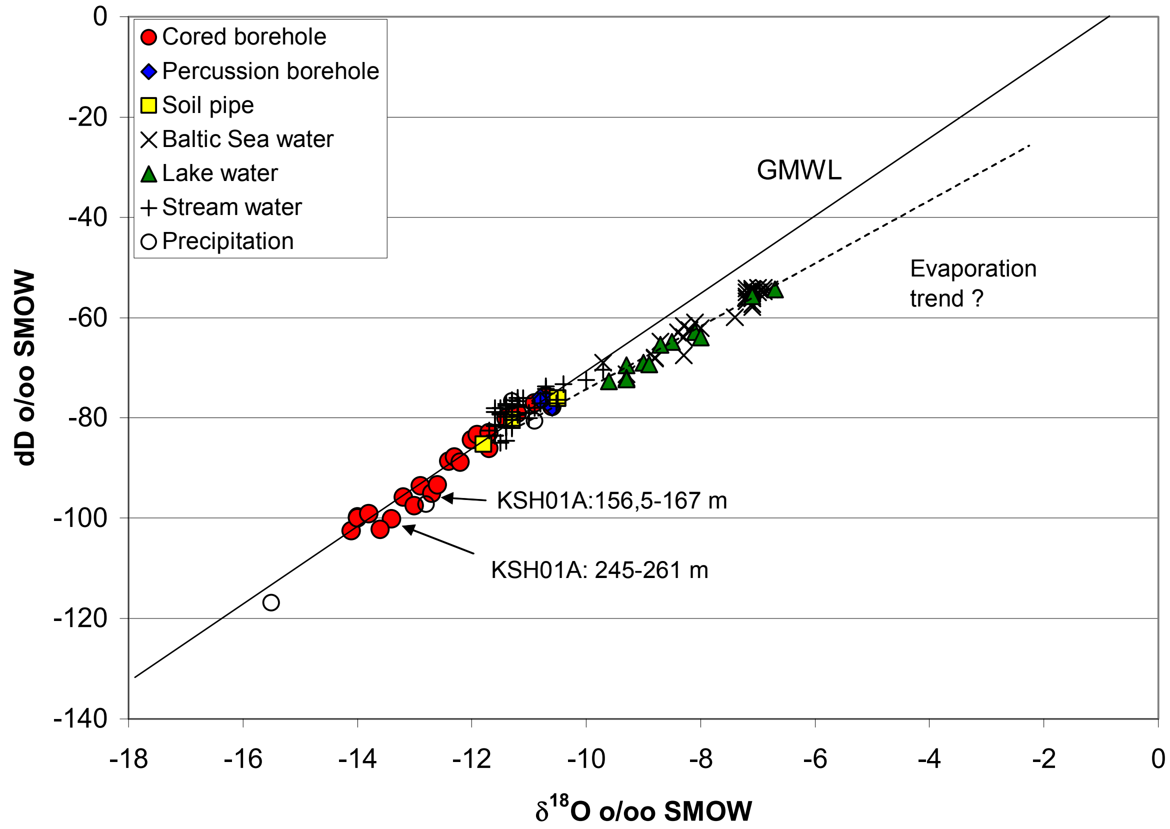

Figure 5-12: *Plot of δD vs $\delta^{18}O$ for all Simpevarp data (GMWL = Global Meteoric Water Line). (Note: Cored borehole samples not labelled represent open hole mixing).*

On closer inspection the Baltic Sea and Lake waters plot further from the GMWL in a trend (evaporation trend?) which intercepts the GWML. There is no evidence of a mixing line towards the Baltic Sea samples as indicated in other regions (e.g. Olkiluoto; Pitkänen et al., 1999). According to Fritz and Fontes (1980) the deleted deuterium samples may be the result of surface evaporation which, at Simpevarp, would appear to be the case since the two sample groups (Baltic Sea and Lake waters) would be most subject to evaporation due to their large surface area exposure.

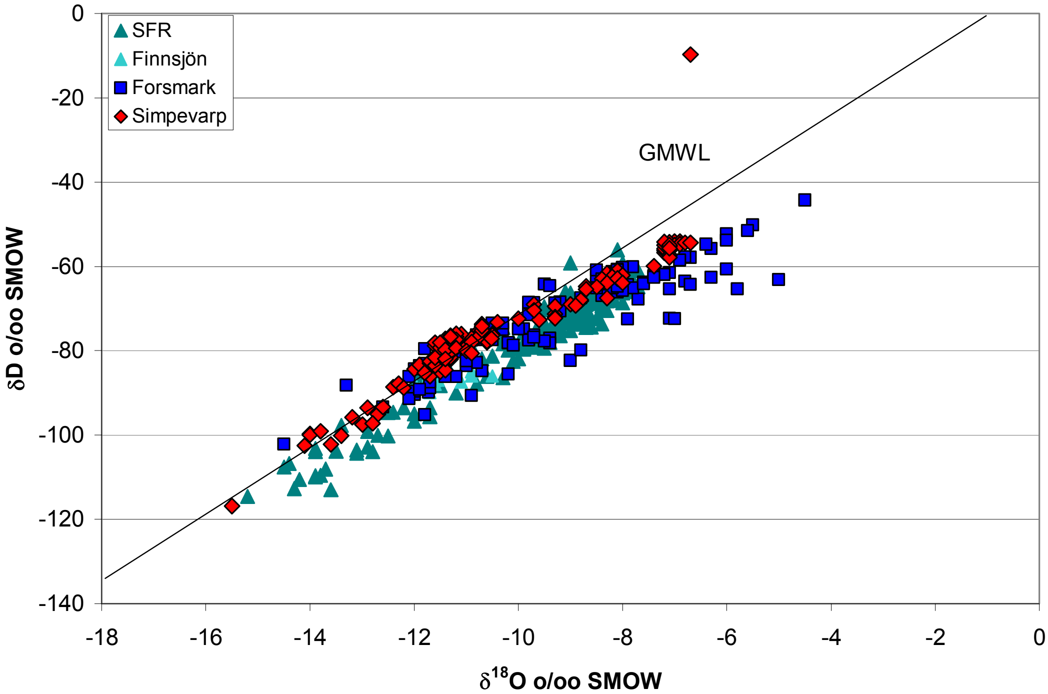

Figure 5-13: *Plot of δD vs $\delta^{18}O$ comparing Simpevarp, Forsmark, Finnsjön and SFR. (GMWL = Global Meteoric Water Line).*

In comparison with Forsmark, Finnsjön and SFR, the Simpevarp samples show similar general dispersion trends but plot closer to the GMWL than Forsmark and SFR, more in common with Finnsjön (Fig. 5-13). Forsmark also indicates an evaporation trend similar to that of Simpevarp.

5.9 Plots of $\delta^{18}O$ vs Cl for all Simpevarp data and comparison with the Finnsjön and SFR sites.

The Lake and Stream waters from the Simpevarp areas (Fig. 5-14) show a wide variation of $\delta^{18}O$ values (-11.7 to -6.7‰ SMOW) at low chloride contents; in turn there is a clear distinction between Lake Water (-6.7 to -9.6‰ SMOW) and Stream Water (-9.7 to -11.7‰ SMOW) with no major evidence of mixing. At higher chloride contents there is a clear Baltic Seawater dilution trend and an isolated cored borehole group as in previous plots. In reality, the Cored Borehole groundwater data (i.e. representative of the sampled isolated borehole sections) form an isolated group of high chloride and light $\delta^{18}O$ values totally divorced from the surface and near-surface data. This conforms to the present hydrogeological interpretation that the near-surface and deep groundwater environments represent two distinct hydrogeological systems.

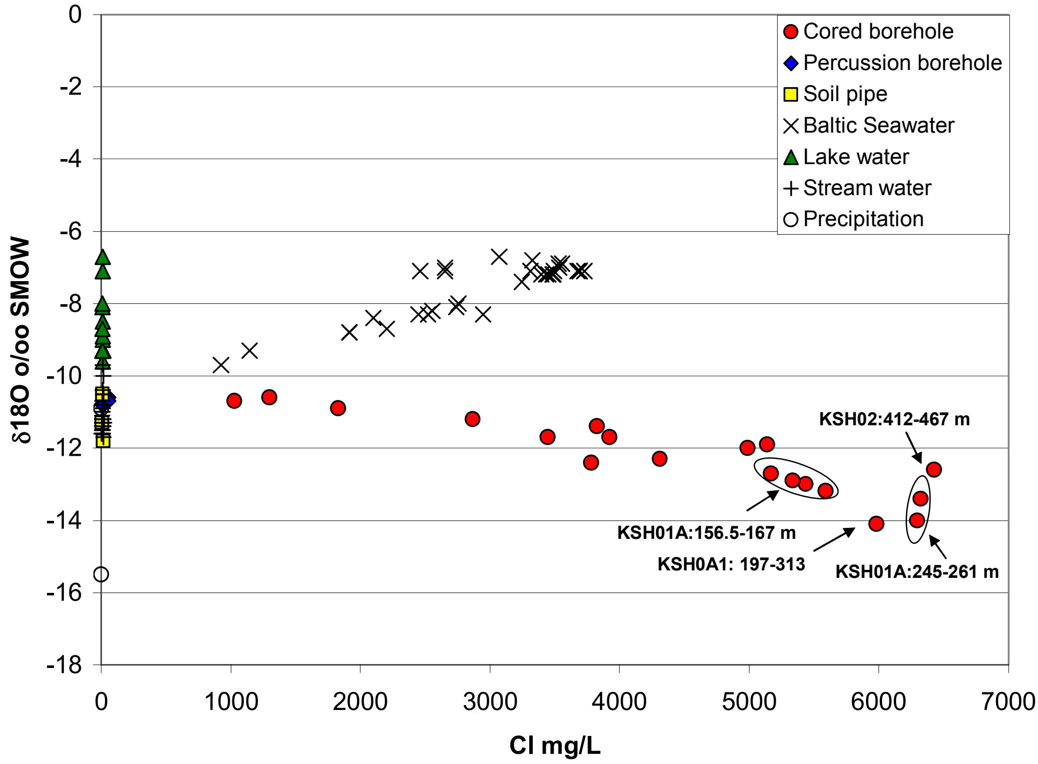

Figure 5-14: *Plot of $\delta^{18}O$ vs Cl for all Simpevarp data. (Note: Cored borehole samples not labelled represent open hole mixing and should be ignored).*

Figure 5-15 shows the similarity in Baltic Sea water and Lake/Stream water data at Simpevarp with the Forsmark region, but also the isolation of the Cored Borehole data, i.e. no evidence of mixing with a marine component (i.e. Baltic and/or Litorina) as evidenced at Forsmark. This plot further reinforces the similar evolution of the deeper cored borehole groundwater samples at Forsmark with those from the Simpevarp. Moreover, it also gives support for the mixing of cold climate meteoric/glacial meltwater with more saline water components in the deeper groundwaters.

As discussed in Figure 5-2, comparison of the Baltic Sea samples show a difference in chloride (Forsmark clustering at ~ 2500-3000 mg/L and Simpevarp ~ 3300-3700 mg/L) and also in the $\delta^{18}O$ signature (Forsmark ~ -9.0 to -7.0‰ SMOW and Simpevarp ~ -7.5 to -6.5‰ SMOW). This is not so surprising considering the enclosed Baltic Sea environment, i.e. the further north the more dilute the seawater becomes with respect to chloride (fresh water input from rivers and streams) and the lighter the stable isotope signatures become due to increasing cold climate seasonal recharge waters. The variation on Baltic Sea chloride content is important when choosing water reference or end-members for modelling purposes.

The Lake Waters, however, show less of a distinction since Forsmark appears to represent a much more heterogeneous surface water system and thus is characterised by a much greater spread of $\delta^{18}O$ values (-15 to -4‰ SMOW) than Simpevarp where $\delta^{18}O$ clusters between -10 to -7‰ SMOW. Similarly for the Stream samples where Forsmark represents a spread of $\delta^{18}O$ values (-13 to -5‰ SMOW) and at Simpevarp $\delta^{18}O$ values cluster between -10 to -4‰ SMOW.

Figure 5-15 emphasises again the trend of the Forsmark deeper Cored Borehole groundwaters towards a less marine signature.

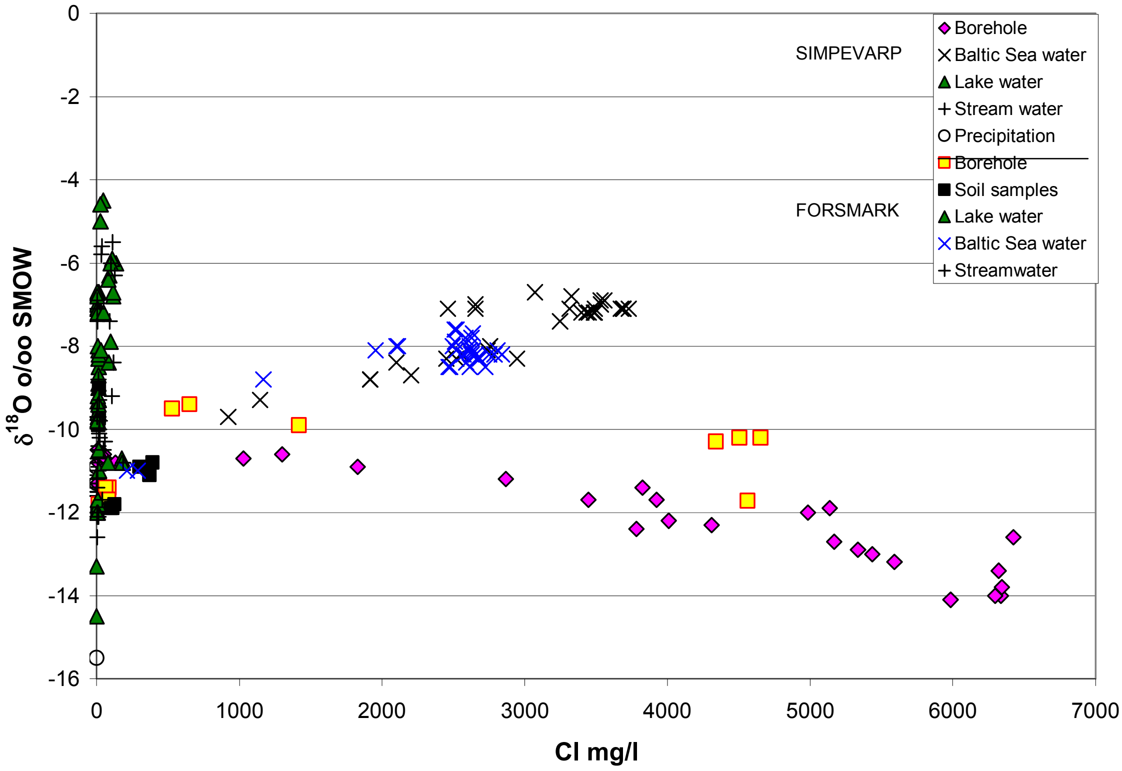

Figure 5-15: *Plot of $\delta^{18}O$ vs Cl comparing Simpevarp with Forsmark..*

Figure 5-16, comparing Simpevarp with Forsmark, SFR and Finnsjön data, shows the Simpevarp KAH01A and KSH02A groundwaters plotting towards an increasing non-marine brine signature. Furthermore, the plotted areas for Baltic Sea, Lake and Stream waters correspond generally to that of Simpevarp. Of more significance is the absence of any of the Simpevarp samples plotting near or on the Litorina dilution line. So far Simpevarp seems to lack a significant Litorina component, even though it is reasonable to assume that Litorina Sea water entered the bedrock during the several thousand year long period when the Litorina Sea covered the Simpevarp area (probably from 7000 BP to 4000 BP). However this water seems to have been subsequently removed (washed out by meteoric recharge?). Less likely is the possibility that there never was a Litorina component.

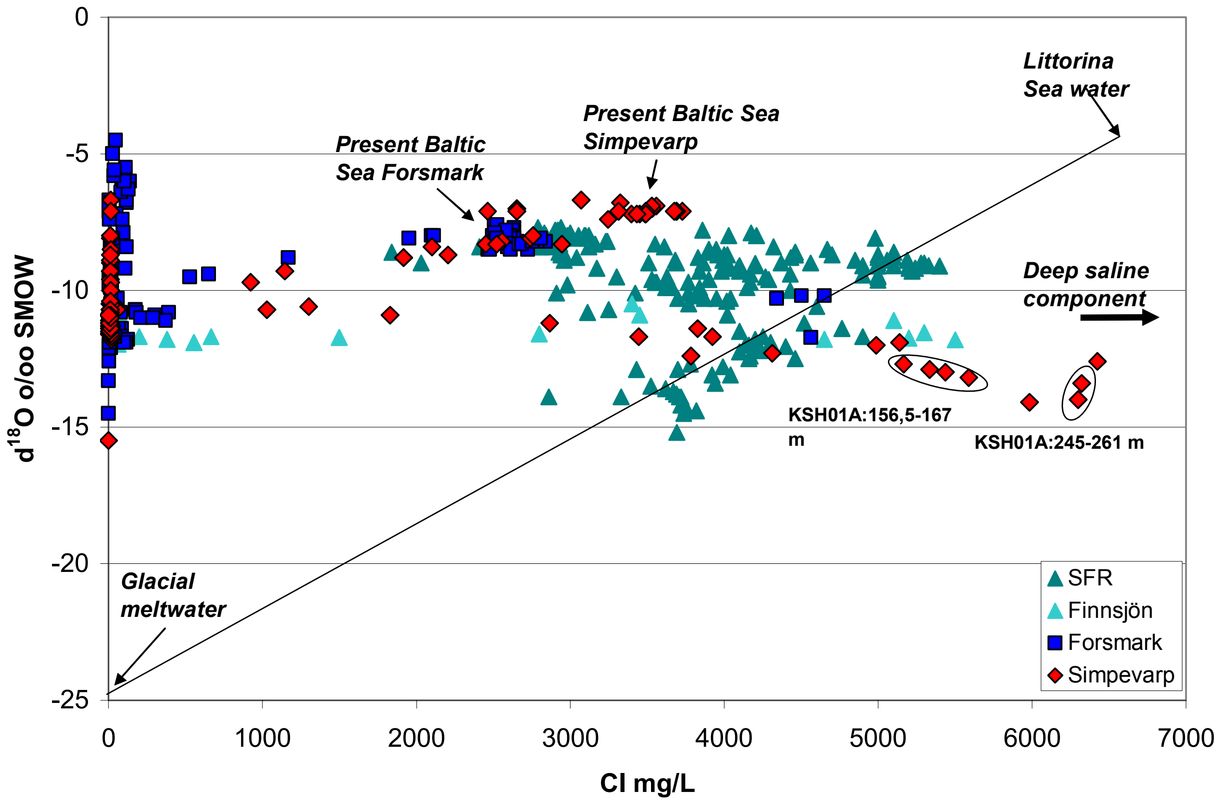

Figure 5-16: *Plot of $\delta^{18}O$ vs Cl comparing Simpevarp with Forsmark, SFR and Finnsjön.*

5.10 Plot of $\delta^{18}O$ vs tritium for all Simpevarp data.

Figure 5-17 shows a wide range of $\delta^{18}O$ and tritium; the present-day average precipitation of 10-15 TU (?) is associated with the Baltic Sea water and the Lake and Stream waters, as would be expected. The deepest samples from the Cored Borehole sections are tritium-free apart from one from the series taken from KSH01A (156.50-167.00 m) which registered 2.8TU; this probably represents some residual flushing water contamination from percussion borehole HSH03 (4.7-10 TU).

The range of $\delta^{18}O$ distinguishes very clearly between Baltic/Lake waters and Stream Water whereas tritium values differentiate between the Baltic Sea and Lake waters. This may be due to a large surface area evaporation for Lake and Baltic waters relative to a low surface area evaporation for Stream water. Alternatively, it may reflect longer residence times for these surface/sub-surface waters at shallow depths in the overburden where local recharge/discharge (plus some soil interaction) may have influenced their chemistry? More information is required on the near-surface/surface environment of the streams chosen for sampling.

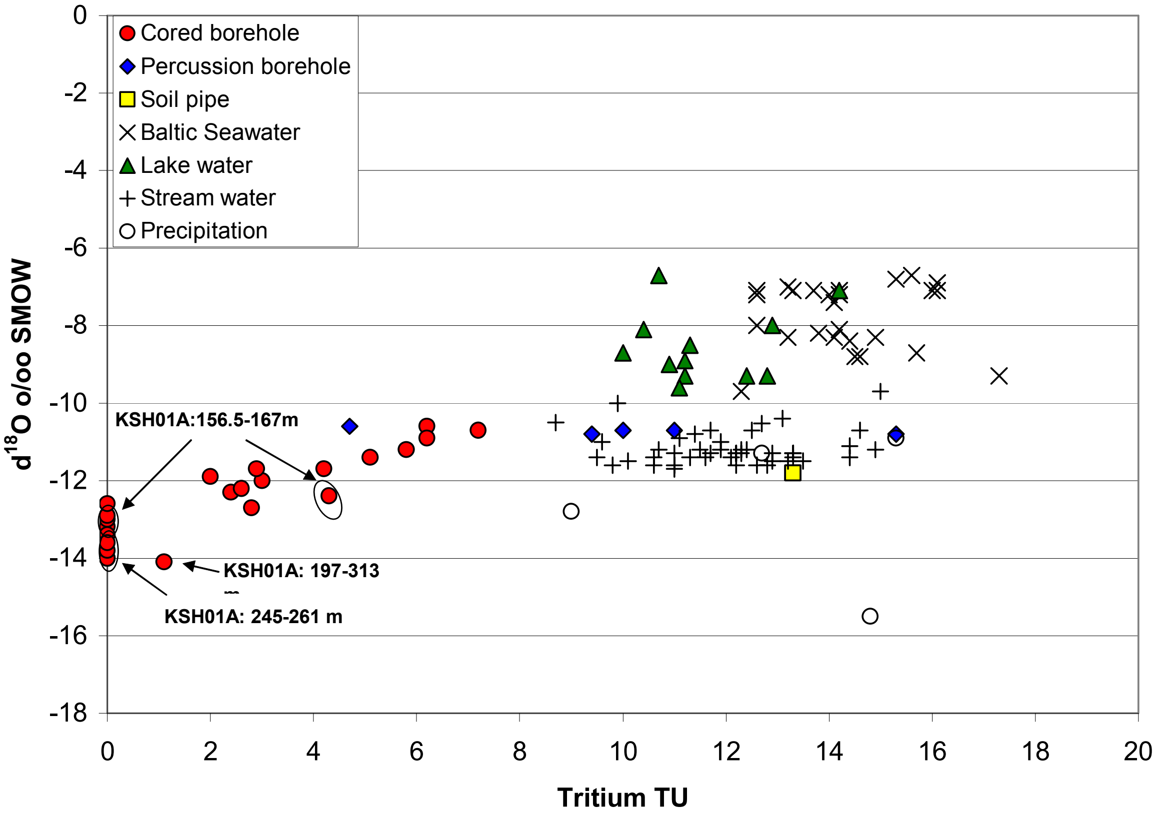

***Figure 5-17**: Plot of $\delta^{18}O$ vs ^{3}H for Simpevarp data.*

The Cored Borehole groundwaters show diminishing tritium values with depth coupled with an increasing cold climate recharge $\delta^{18}O$ signature. The presence of tritium probably reflects some residual drilling water contamination. The two percussion borehole data (with one exception) plot close to Stream Water compositions which might be an interesting observation.

5.11: Plot of pmC vs tritium for all Simpevarp data.

Figure 5-18 shows that almost all of the plotted data from the Baltic Sea Water and Lake Water fall between 70-110 pmC. The Baltic Sea, Lake and Stream water samples can be grouped individually with the Baltic Sea Water indicating slightly higher tritium and percentage modern carbon values (105-112 pmC) and the Lake Water lower percentage modern carbon (65-80 pmC) indicating the addition of dead carbon from dissolved calcite or from breakdown of organic material with significantly lower pmC than present. Stream Water shows a similar tritium range to the Lake Water (see also Fig. 5-17) but with higher percentage modern carbon values mostly between 85-105 pmC.

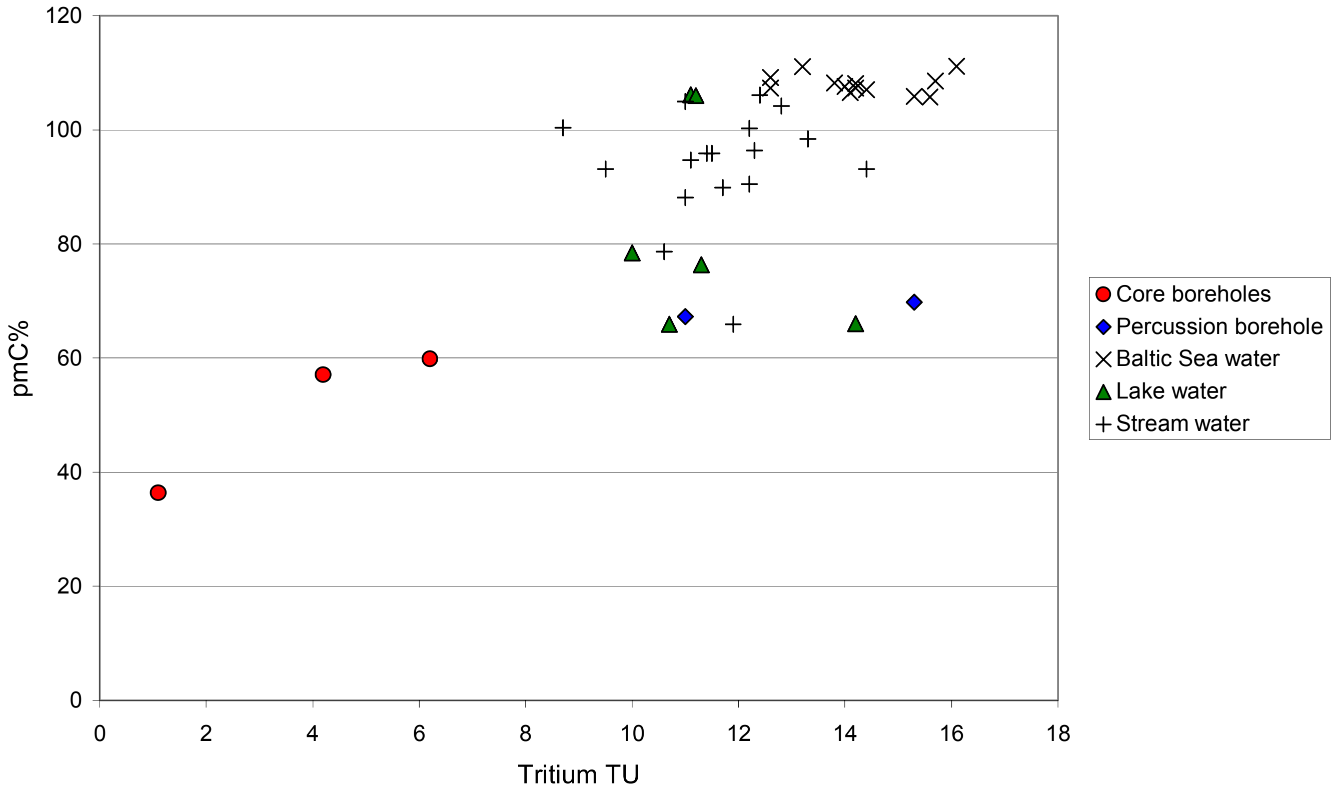

***Figure 5-18**: Plot of pmC vs tritium for all Simpevarp data.*

[Note: It is important not to read too much into these variations as pmC is notoriously complex, especially in a surface/near-surface water environment because of the number and variation of different sources of carbon that exist.]

Cored Borehole groundwater data are restricted to five samples, none of which formed part of the Class 5 Complete Characterisation Programme. The two from the HSH02 percussion borehole (flushing/drilling water source) show similar tritium and percentage modern carbon ranges to most of the Lake Water samples. The three levels in Borehole KSH01A sampled during drilling show, with increasing depth, a systematic decrease in tritium and percentage modern carbon**.** This suggests that if the Cored Borehole sections in the main characterisation programme had been sampled, the tritium-free groundwaters shown in Figure 5-18 would probably have been accompanied by low percentages of modern carbon (<40 pmC), all indicative of older deep groundwaters.

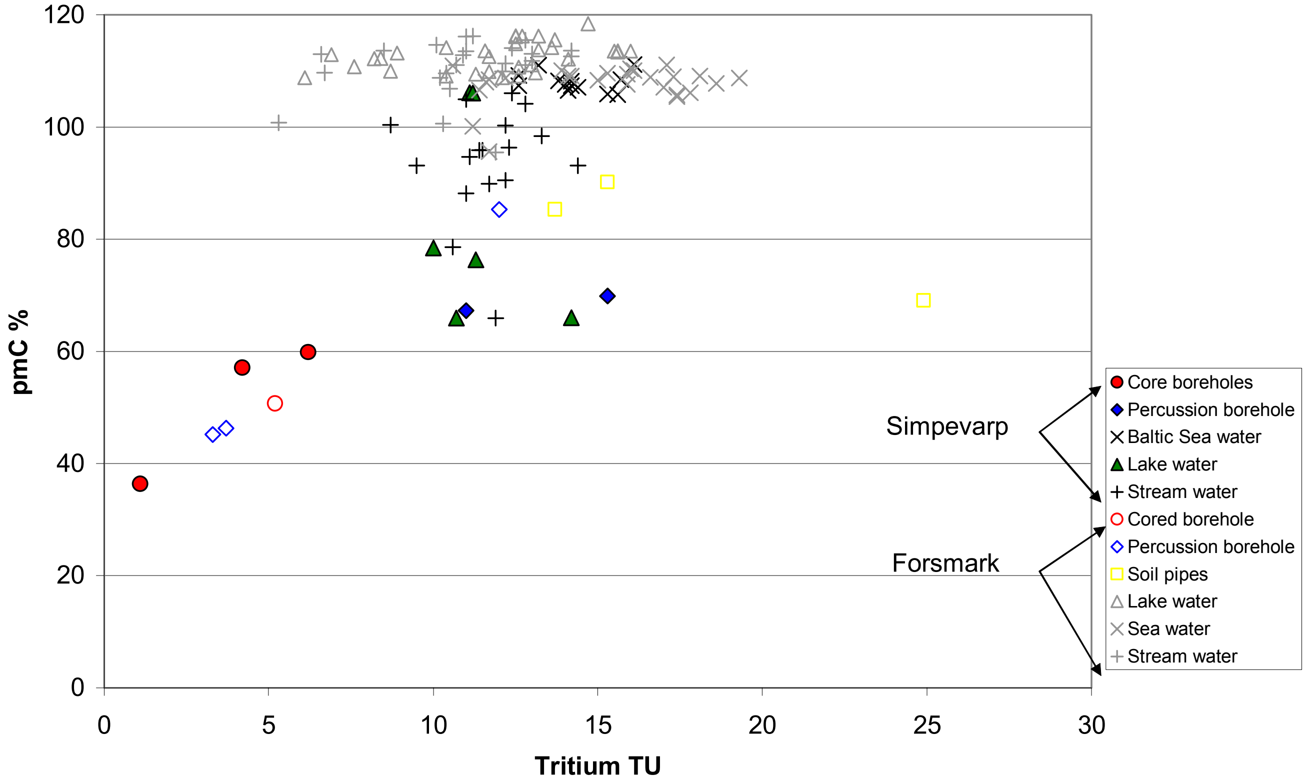

***Figure 5-19**: Plot of pmC vs tritium comparing all Simpevarp with Forsmark.*

Figure 5-19, comparing Simpevarp with Forsmark, shows the marked difference between the Lake and Stream waters based on pmC.

5.12 Plot of SO_4 vs. $\delta^{34}S$ for all Simpevarp data.

Figure 5-20 shows a clear distinction between Baltic Sea values (high SO_4 and $\delta^{34}S$) and Lake/Stream values (low SO_4 and $\delta^{34}S$). The Cored Borehole samples plot within the same range of $\delta^{34}S$ values as the Baltic Sea (15-25‰ CDT?) but at much lower sulphate values (30-180 mg/L). The main sampled Cored Borehole sections are much lower in sulphate (31-51 mg/L) than the early sampled boreholes during drilling (60-265 mg/L); these higher sulphate values suggest some mixing with Baltic Sea waters. Borehole KSK01A and KSH02A and percussion HSH02 (one value at 17.20‰ CDT) groundwaters show values typical for marine sulphate but may be also caused by microbial reduction of water originally with lower sulphate isotope ratios resulting in low sulphate and increased $\delta^{34}S$ (>20‰ CDT).

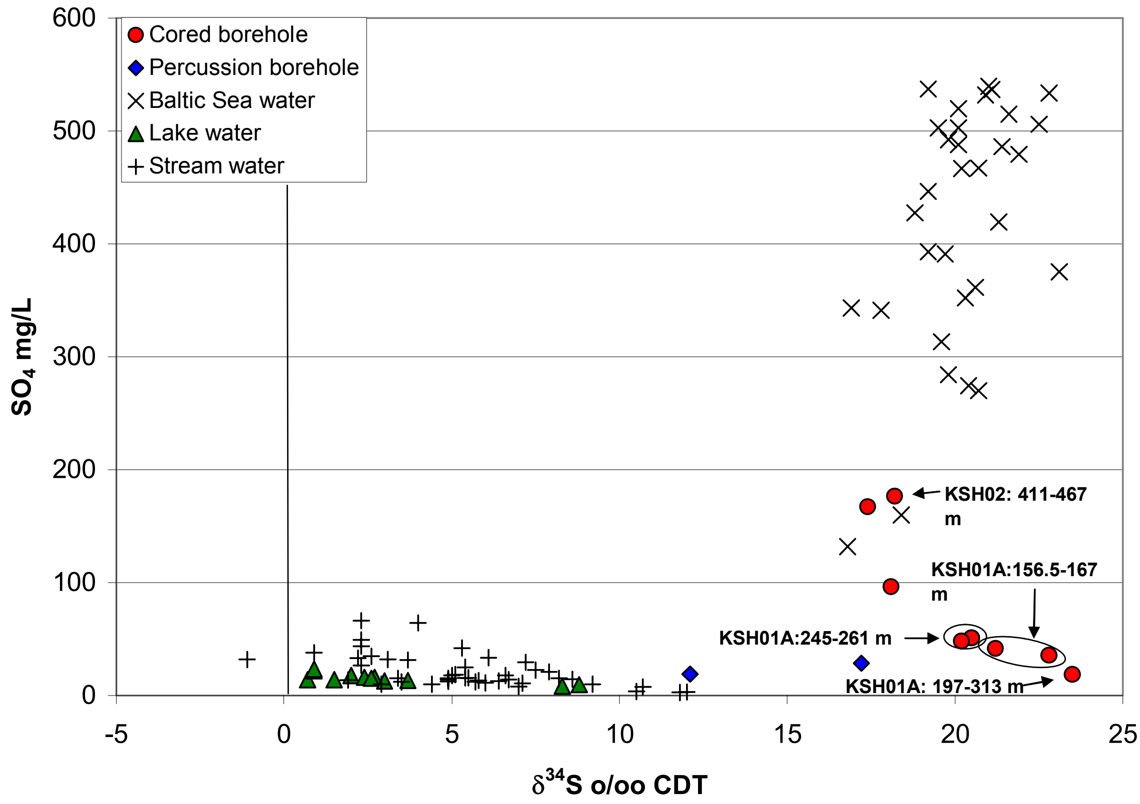

***Figure 5-20**: Plot of SO_4 vs. $\delta^{34}S$ for all Forsmark data.*

5.13 Plot of δ^{37}Cl vs Cl for all Simpevarp data.

Figure 5-21 plots δ^{37}Cl vs Cl for all Simpevarp and Forsmark data. According to Frape et al. (1966) modern Baltic and possibly palaeo-Baltic waters may be recognised by negative δ^{37}Cl signatures related to salt leachate from Palaeozoic salt deposits south of the Baltic sea; influence by water-rock interaction tends to result in positive δ^{37}Cl signatures. Taking into consideration the analytical uncertainty of around ±0.2 ‰, Figure 5-21 shows that the Simpevarp samples mostly lie within this uncertainty range.

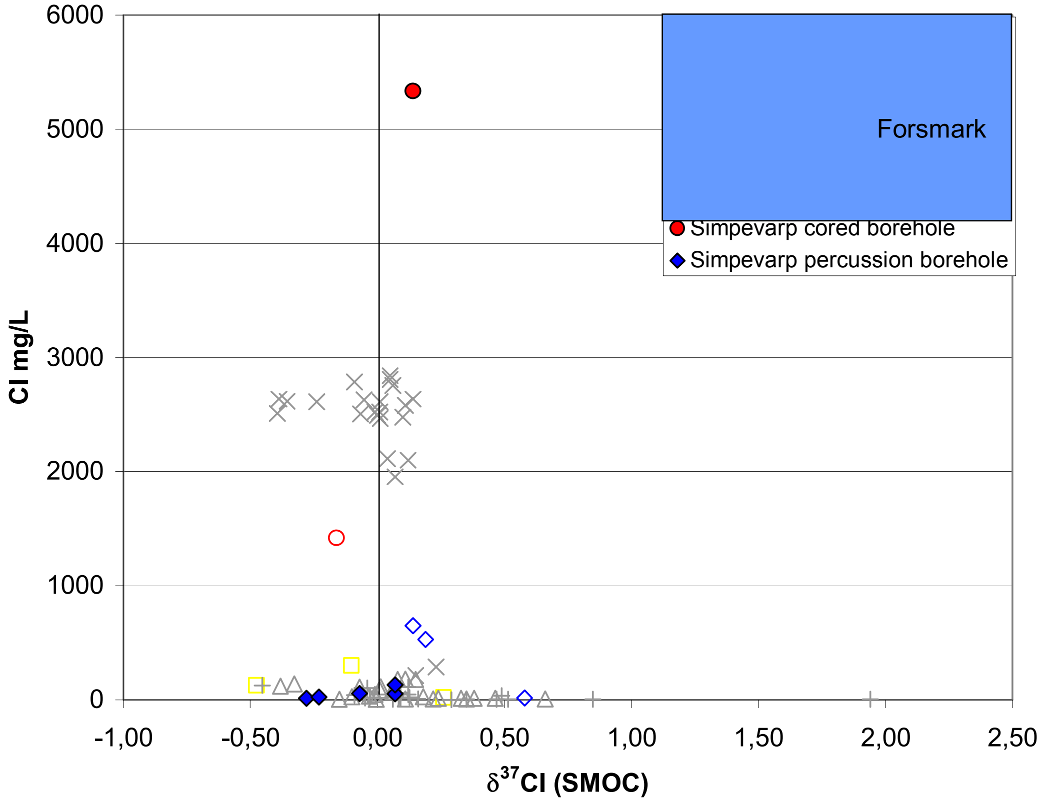

Figure 5-20: *Plot comparing Cl vs δ^{37}Cl for all Simpevarp data with Forsmark.*

5.14. Data related to radiogenic isotopes, ^{10}B, ^{87}Sr and trace elements

Because of either incomplete data or below detection or suspect values at the time of the 'data freeze', evaluation of, for example the radiogenic isotopes, ^{87}Sr, ^{10}B and REEs and other trace elements, have not been included in this Model v. 1.1 stage evaluation.

6. Conclusions

Preliminary observations from the Simpevarp area show the following:

- Except for sea waters, most surface waters and some groundwaters from percussion boreholes are fresh, non-saline waters according to the classification used for Äspö groundwaters. The rest of the groundwaters are brackish (Cl <5 000mg/L), except for three samples from KSH01A (at 253m and 439m depth) which are saline. Most surface waters are of Ca-HCO_3 or Na-Ca-HCO_3 type and naturally the sea water is of Na-Cl type. The deeper groundwaters are mainly of Na-Ca-Cl type.
- Dilute surface waters usually with very short residence times (high tritium and ^{14}C). However, the δ^{18}O values are relatively homogeneous when compared to that

expected for surface waters, which may reflect a more evolved surface/subsurface water system down to the overburden/bedrock interface.

- Saline water with Cl contents around 3 000-6 500 mg/L and $d^{18}O$ values between -11 and -14‰ indicate mixtures between cold climate meteoric water and saline water. Based on present data the marine signature (Litorina?) of the saline component is not significant in the Simpevarp samples in contrast to the Forsmark samples. The saline component in the Simpevarp groundwater is modified by water-rock interaction and shows similarities to an old, non-marine/marine saline water of brine type.
- $\delta^{36}Cl$, $\delta^{37}Cl$ and ^{14}C analyses, when available, can add significant information concerning the origin of the Simpevarp (and Forsmark) saline waters.
- The presence of groundwater with major components of deep saline and glacial meltwater at relatively shallow depths (150 to 260 m) suggests either very stagnant conditions in general or the presence of isolated pockets of very old groundwater.
- Ion exchange reactions have modified the groundwaters (e.g. Mg, Na and Ca).
- Some evidence of decreased sulphate content coupled to higher $\delta^{34}S$ values suggest the activity of sulphate-reducing bacteria (based on very few analyses).
- The isotope ratios of the Lake Water and Stream Water show some puzzling values but probably indicate mixing of different sources (e.g. including surface water and near-surface water mixing).

7. Visualisation of the Simpevarp data

One of the objectives of the Initial Site Investigation (ISI) stage is to produce a preliminary version of the hydrogeochemical descriptive model on a site scale (Smellie et al., 2002). Visualisation should be based on modelled approaches and also on a manual approach where expert judgement is schematically illustrated. This latter approach, based on available Simpevarp data, is presented in Figure 7-1.

Figure 7-1 is a conceptual visualisation based not only on measured salinity, but on all relevant hydrochemical and isotopic data (although still very limited), and general geological and hydrogeological considerations. The hydrogeochemical trends described and illustrated in Chapter 5, together with information from the postglacial scenario (SKB, 2002) and borehole KSH01A structures in Figure 2-1, have been used to make a first schematic attempt at integrating hydrochemistry with the general hydrogeostructural character of the Simpevarp area. The model will be updated when a more detailed local hydrogeological and geological models become available.

Figure 7-1, schematically representing a WNW-SSE profile selected to include the Laxemar site and the Simpevarp peninsula site areas, is oriented parallel to one set of regional structural faulting directions and perpendicular to another set of structural features trending NE-SW. These latter features, which may be of greater importance, are thought to be sub-vertical in orientation, but due to a lack of information their respective dip directions may in some cases be at variance with those shown in the figure. The major shear zone (double dashed lines) close to the coast has been intercepted and confirmed recently by borehole KSH03A. At greater depths the situation remains unclear but to date there is no evidence of interaction between borehole KSH01A and the shear zone. For example, borehole KSH01A generally shows low hydraulic responses below 300 m and more so below 600 m.

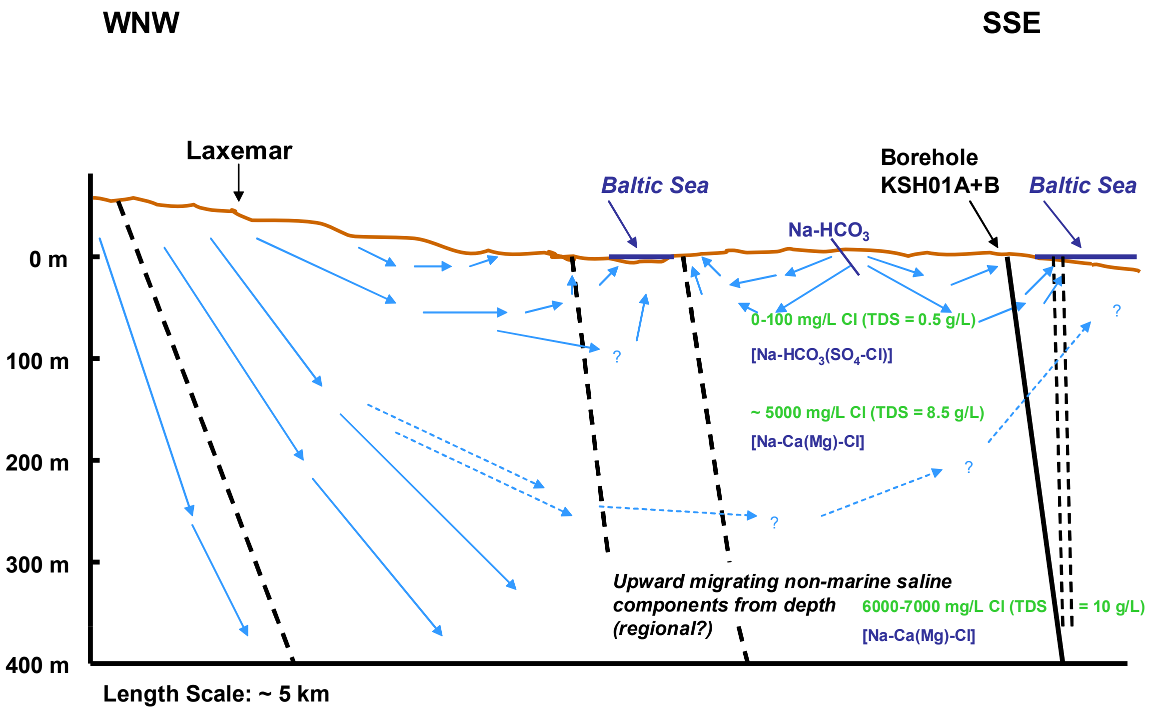

Figure 7-1: *Integrated conceptual visualisation of the Simpevarp site based partly on Figure 4-4, on other hydrochemical and isotopic criteria, and general geological and hydrogeological considerations. Note that the geological structures and groundwater flow directions are not based on measurement but are used only for illustration purposes to fit with present conceptual ideas (for example, when more information is available, the sub-vertical zones may have other dip orientations).*

Superimposed on this structural profile are possible groundwater flow directions, essentially representing fracture plane flow along the regional WNW-SSE trending structures. Since the intercepted structures are trending NE-SW and perpendicular, a series of hydraulic compartments may be formed, possibly with each compartment having distinct hydrodynamic properties which might affect both the groundwater distribution and chemistry. There is presently no information as to the hydraulic character (i.e. recharge/discharge) of these large-scale structures.

The solid blue arrows represent the possible directions of bedrock groundwater flow with the dashed variety indicating weaker, more uncertain flow directions. At Laxemar, with higher topography, meteoric groundwater recharge is shown in the figure to penetrate to at least 400 m, but probably to even greater depths as indicated by earlier studies (Laaksoharju et al., 1995). Furthermore, there may be a weak upward discharge towards the Baltic coastline as shown. Localised recharge/discharge groundwater circulation, independent of deeper flow pathways, is characteristic along the profile at shallow levels to around 100 m, with distinctive discharge towards the Baltic coastlines.

At still greater depths (> 1 000 m), slow moving, larger scale flow systems are probably active with potentially some upward migration towards the coastline. This is suggested in the hydrogeochemical evaluation as saline waters of a non-marine origin or a non-marine/marine mixing origin.

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Available groundwater compositions are shown in green in the near vicinity of borehole KSH01A. These indicate essentially fresh water (0-100 mg/L Cl; ~0.5 g/L TDS) to around 100 m with sharp increases to approx. 5 000 mg/L Cl (~8.5 g/L TDS) at around 150 m to 6 000-7 000 mg/L Cl (~10 g/L TDS) at around 400 m. This abrupt increase in salinity at around 150 m suggests the presence of two distinct hydrodynamic and hydrochemical regimes which is clearly reflected in the hydrogeochemical evaluation. In addition, this distinction may suggest the influence of some subhorizontal structural features at this interface or the opening of isolated 'pockets' of saline-glacial meltwater mixtures. Such a glacial meltwater component extends to at least 250 m depth and, in addition to being preserved in 'pockets', may also have its origin from the closely located NE-SW structures which have facilitated the deep recharge of glacial meltwater during glacial decay and retreat. A further possibility is from sources further inland.

The possibility of NE-SW trending structures forming a series of hydraulic compartments may be supported at Laxemar by salinities of around 5 000 mg/L Cl being achieved only at 700 m (Laaksoharju et al., 1995), compared to 150 m depth in the 'compartment' hosting borehole KSH01A.

The palaeoevolution of the Simpevarp area implies that a Litorina Sea component should be present in the groundwaters; this, however, has not been established by the hydrogeochemical evaluation to date. Either: a) no Litorina Sea component has been introduced, b) it has subsequently been flushed out, or c) it has not been seen yet because of the limited number of boreholes. A combination of (b) and (c) is probably the case. In the vicinity of KSH01A it would seem that any penetration of Litorina Sea water would be restricted hydrogeologically to the upper 100-150 m, and therefore easily flushed out during land uplift and emergence from the Baltic Sea. Limited penetration of Litorina Sea water to greater depths probably has occurred, especially along the sub-vertical fractures and evidence of existing pockets and/or lenses may still be discovered by subsequent investigations.

8. References

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Appendix 2

Explorative analysis and Mass balance modelling

Contribution to the model version 1.1

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January 2004

1 Hydrogeochemical data evaluation

1.1. Surface chemistry data

413 surface water samples were supplied by SICADA, but 17 of them had no data and were discarded from the evaluation, and 70 samples had incomplete data and were only used in ion-ion plots (not in modelling). Therefore, 396 samples have been used in this data evaluation including sea water, lakes, streams and precipitation samples[1]. The analytical results, sampling methods, analytical procedures and the evaluation of the representativity of the samples are discussed elsewhere.

Analyzed data include: major cations and anions (Na, K, Ca, Mg, Si, Cl, HCO_3^- SO_4^{2-}, S^{2-}), trace elements (Br, F, Fe, Mn, Li, Sr, NH_4, NO_2, NO_3, PO_4), and stable (^{18}O, ^{2}H, ^{13}C, ^{37}Cl, ^{34}S, ^{10}B) and radioactive and radiogenic isotopes (^{3}H, ^{14}C, ^{87}Sr), but not in all the samples.

The pH and conductivity values used in the following were the ones determined in the laboratory. There are no data for Eh and temperature.

1.2 Chemistry data sampled in boreholes

121 groundwater samples were supplied by SICADA, but 60 of them had no data and were discarded form the evaluation. Additionally, 23 samples had incomplete data and 13 more showed flushing water contamination and therefore, they were only used in ion-ion plots but not in modelling. In summary, 61 groundwater samples have been used in the data evaluation for this study[2]. The analytical results, sampling methods, analytical procedures and the evaluation of the representativity of the samples are discussed elsewhere.

The available data set comprises major cations and anions (Na, K, Ca, Mg, Si, Cl, HCO_3^- SO_4^{2-}, S^{2-}), trace elements (Br, F, Fe, Mn, Li, Sr, DOC, N, PO_4^{3-}, U, Th, Sc, Rb, In, Cs, Ba, Tl, Y and REE) and stable (^{18}O, ^{2}H, ^{13}C, ^{37}Cl, ^{34}S, ^{10}B) and radioactive and radiogenic isotopes (^{3}H, ^{14}C, ^{87}Sr, ^{226}Ra, ^{228}Ra, ^{222}Rn, ^{238}U, ^{235}U, ^{234}U, ^{232}Th, ^{230}Th and ^{228}Th). None of the samples has a complete data set and some elements or isotopes have been analysed only in a few samples (e.g. Fe^{2+}, U, Th, ^{14}C, etc).

The different analytical results obtained with different analytical techniques for Fe and S have been validated with speciation-solubility calculations, checking their effect on the electrical balance. The values selected for modelling were those obtained by ion chromatography (SO_4^{2-}) and spectrophotometry (Fe) assuming that they have no colloidal contribution (as it could be with ICP measurements).

pH values correspond to laboratory measurements. An analysis of the effect of CO_2 ingassing is discussed in section 1.4. comparing these laboratory data with the existing continuous logging measurements in KSH01A borehole. In this borehole there are some continuously logged Eh, pH and temperature data at two depths (161 and 250 m) and a discussion about their quality is presented in Appendix A. The selected Eh values are the stabilised measurements of the Pt and C-electrodes at surface (the only available data). A mean temperature value for all the groundwaters has been chosen from the 156.5-167 m depth interval, the only interval for which an *in situ* temperature value is avilable.

[1] Only 326 samples have a complete set of analytical data.

[2] But only 25 have a complete set of analytical data suitable for modelling calculations.

1.3 Representativity of the data

The charge balance has been carried out for the samples with a complete set of analytical data using PHREEEQC (Parkhurst y Appelo, 1999). The error in the charge balance is expressed in PHREEQC as

$$\% \; error = \left(\frac{\sum Cations\ (equivalents) - \sum Anions\ (equivalents)}{\sum Cations\ (equivalents) + \sum Anions\ (equivalents)} \right) x\, 100\,.$$

The calculated charge balance for the 25 groundwater samples with complete analytical data indicates that the error is almost always in the range ± 5%. Only samples 5177 and 5174 from borehole KSH01 fall outside this range, with errors of +8.46% and +16.91%, respectively.

The calculated charge balance for the 326 surface samples with complete analytical data (Sea water, Lake water and Stream water) have somewhat higher associated errors: half of them in the range ±10%, and the other half between 10 and 20%. Only those with errors < 10% have been used for modelling purposes.

Problems with flushing water contamination ***** John and EvaLena.

1.4 Explorative analysis

The evaluation of the hydrogeochemical data has been done both in isolation (i.e., considering only samples from Simpevarp) and taking into account the whole groundwater dataset from other sites in the area (Äspö and KOV01), in order to see how well they fit in the general trend and whether or not they can be interpreted as part of the whole hydrogeochemical system.

Main variables and components

Except for sea waters, all surface waters and most groundwaters from percussion boreholes (see *Table 1.4.a*) are fresh, non-saline waters according to the classification used for Äspö groundwaters[3]. Most of the groundwaters classified as brackish (Cl<5000mg/l) have been contaminated with drilling water. The rest of groundwaters are saline (*Figure 1.4.A*).

In terms of boreholes, samples from HSH02 and HSH03 between 50 and 100 m are fresh and non-saline; samples from KSH01A, are brackish except for two depths, 161.75 m and 255.21 m, where they display a more saline character. Finally, borehole KSH02 includes samples of the three main water types: non-saline (53.58 m), brackish (746-751 m) and saline (439.46 m).

[3] The Äspö groundwaters have been classified according to their site-specific chloride concentrations into three groups (Laaksoharju and Wallin, 1997; Laaksoharju *et al.,* 2000): non-saline groundwater (< 1000 mg/l), brackish groundwater (1000-5000 mg/l) and saline groundwater (> 5000 mg/l).

Table 4.1.4.a: *Classification of Simpevarp waters according to their chloride content. An asterisk after a sample number indicates that the sample is contaminated with drilling water.*

Chloride content	Water type	Borehole and Samples	
Cl<1000mg/l	Precipitation	all samples	
	Lake waters	all samples	
	Stream waters	all samples	
	Soil Pipes	all tubes and all samples	
	Groundwaters	HSH03	3759, 3760, 3761, 3898, 3900, 3897, 3896
		HSH02	3886
		KSH02	3888*
1000<Cl<5000	Sea waters	all samples	
	Groundwaters	HSH03	3899
		KSH01A	5179*, 3825*, 5177*, 5165*, 5176*, 5174*, 5167*, 5175*, 3831*, 5169*, 5170*, 5171*
		KSH02	3827*, 3833
Cl>5000	Groundwaters	KSH01A	5173*. 5257, 5259, 2561, 5260, 5263, 3824, 5264, 5268, 5266, 5267, 5269, 5265
		KSH02	3832

Chloride vs depth

Chloride is treated as a conservative component in mixing and reaction processes; moreover, in all Nordic sites it is generally an indicator of depth and, therefore, it has been used as the variable against which the rest of ion concentrations are plotted. In Sympevarp, deep water samples cover a wide depth range (up to 1000 m) but, after the initial data validation stage, it was observed that samples taken with the tube sampling had a high content of flushing water. Thus, samples below 500 m were not considered as representative.

As can be shown in Figure 1.4.A, most brackish waters (between 1000 and 5000 mg/l of chlorine) are contaminated samples (pale red circles). Only two samples are considered valid in this Cl range, but their chemical analysis are incomplete.

On the other hand, the contaminated samples define an artificial mixing line (as can be seen in the following ion-ion plots) superimposed onto a hydrogeochemical system in which other natural mixing processes are being taking place.

These sampling problems have limited the valid groundwater samples to two groups: fresh and saline samples (Figure 1.4.A). This state of affairs reduce drastically the interpretations that can be extracted from the ion-ion plots. Those that follow are based on interpolations carried out by the superposition of the few valid samples onto trends from other similar sites. Nevertheless, the authors suggest extreme caution when using them in the final report.

Obviously, this uncertainty finds its way into the modelling calculations, whose interpretation depends on the evaluation of compositional data (carbonate system and stability diagrams) and is aggravated by the additional uncertainty derived from the laboratory pH measurement (see “pH vs. Cl” section).

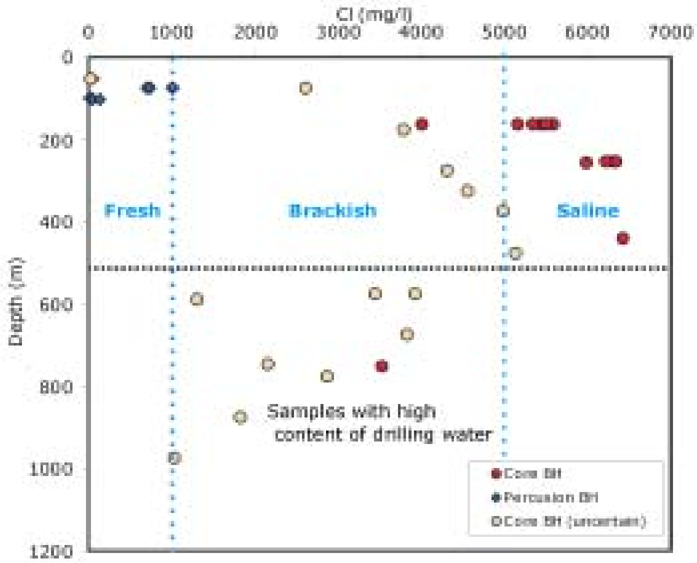

Figure 1.4.A: *Chloride contents in Simpevarp waters as a function of depth. Samples labelled " uncertain" have a high content of drilling water and are shown, in this figure and in the rest of the plots, with a pale red circle to differentiate them from the packered cored samples (dark red circles).*

pH vs. Chloride

Superficial fresh waters show a wide range of pH values as a consequence of their multiple origin (figure 1.4.B). The lowest values are associated with waters with a marked influence of atmospheric and biogenic CO_2.

The highest values of pH are associated to the most diluted groundwater samples from percussion boreholes. Overall this gives a decreasing trend with chloride when the rest of the groundwater samples are taken into account. Nevertheless, this trend is partially defined by contaminated samples and affected by uncertainties of pH mesaurements in the laboratory.

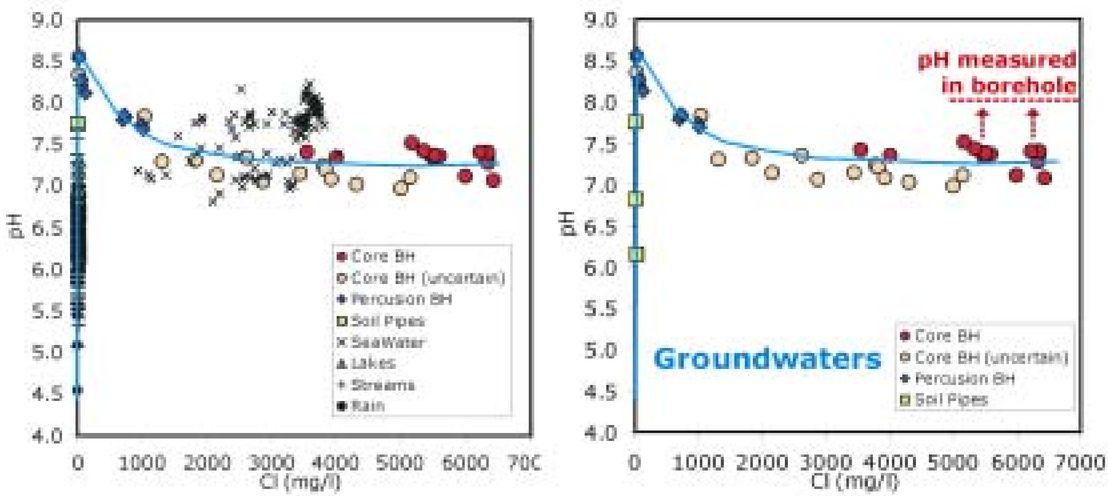

Figure 1.4.B: *pH vs. chloride content in mg/l (increasing with depth) in Simpevarp waters.*

There are only continuous logging pH measurements for two depths in borehole KSH01A (between 156.5 and 167 m; and between 245 and 261.5 m; see Appendix A), but most saline samples plotted in Figure 1.4.B came from these depth ranges. The logged pH at both depths is almost identical after stabilization (8.01 and 8.05, respectively; see Appendix A). The laboratory pH values for the 161.75 m depth interval range from 7.27 to 7.51 (between 7.34 and 7.51 if only samples with analytical data are considered), and between 7.27 and 7.41 for the 253.25 m depth interval (or between 7.34 and 7.40 if only samples with chemical analysis are considered). The laboratory pH is significantly lower than the *in situ* one (more than 0.6 pH units), suggesting variations in CO_2 during pH measurement.

Therefore, we have performed an analysis of pH values for the samples with continuous logging data from the 161.75m and 253.25 m depth intervals (samples inside the red rectangle in *Figure 1.4.C*). Assuming that the laboratory pH measurements have been affected by an exchange of CO_2 with the atmosphere, we have calculated the original pH of the samples compensating the effects of the exchange. For that purpose, we have computed with PRHEEQC the pH values in equilibrium with calcite changing only the CO_2 content of each sample (*Figure 1.4.C.a*). The assumption of an equilibrium with calcite seems reasonable for these waters because they have a marked saline character in spite of their relative shallowness (*Figure 1.4.C.b* shows the calcite saturation indices).

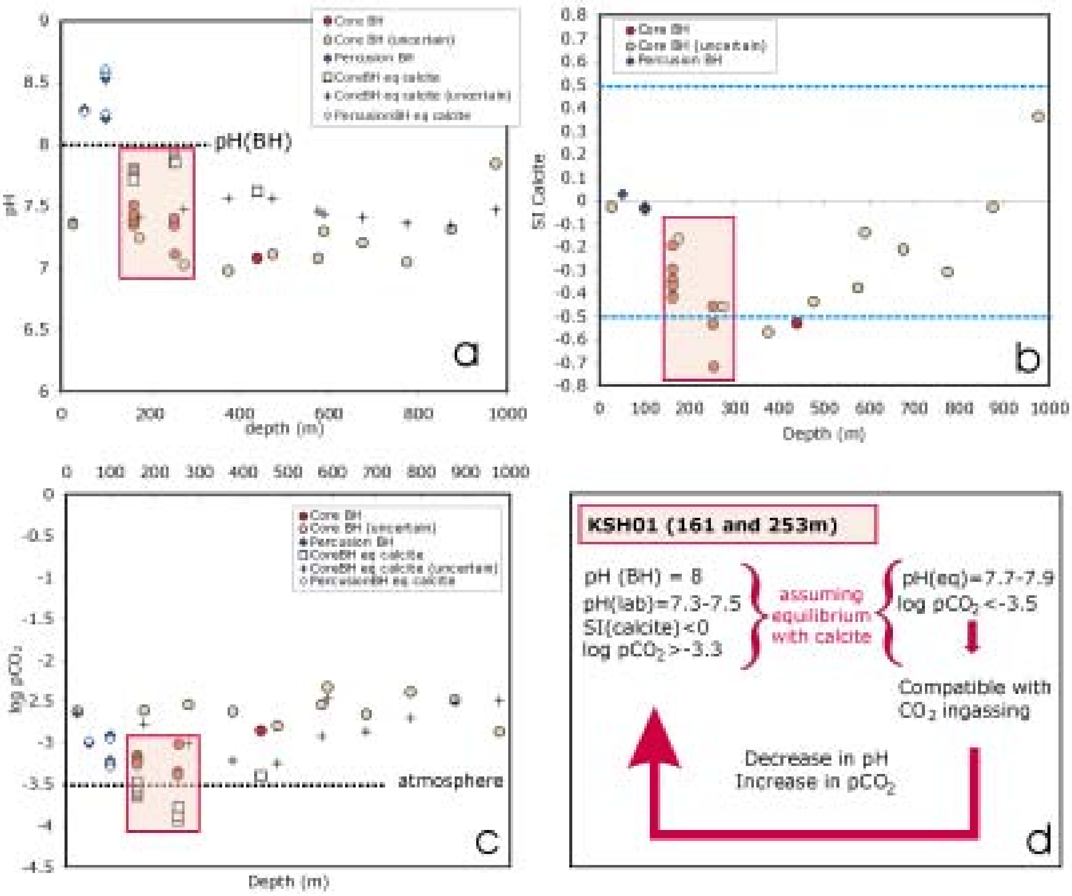

Figure 1.4.C: *pH values (a), calcite saturation indexes (b) and log pCO_2 values (c) with respect to depth in waters from Simpevarp. pH and log pCO_2 plots also show the results after equilibrium with calcite. Dashed blue lines in panel (b) represent the uncertainty associated with SI calculations. Panel (d) shows the measured and calculated values of pH, pCO2 and calcite saturation for the samples used in this sensitivity analysis, together with its interpretation. Samples inside the red rectangle belong to KSH01A borehole and come from depths for which in situ pH logging exists.*

The results of these calculations are shown in *Table 1.4.b*. The calculated pH values have less scatter than the measured ones and are closer to the *in situ* values (measured in borehole). For the samples from the 161.75 m depth interval the values range from 7.71 to 7.80 and for the 253.25 m depth interval they range between 7.87 and 7.90.

The P_{CO2} values calculated for samples from these two intervals with the assumption of equilibrium with calcite are lower than atmospheric (*Figure 1.4.C.c*). This result, together with a low alkalinity, indicates a very low pH buffering capacity of the waters at both depths, favouring changes in pH during laboratory measurement due to atmospheric CO_2 contamination.

This CO_2 ingassing causes an increase in P_{CO2} and total inorganic carbon (TIC), a decrease in pH and a subsaturation state with respect to calcite (*Figure 1.4.C.d*). All this effects are qualitatively consistent with what have been observed when comparing the calculations done in equilibrium with calcite with those performed using the laboratory-measured pH (*Table 1.4.b* and *Figure 1.4.C*).

As a result, the pH value for the more saline waters plotted in Figure 1.4.B should be higher than reported. This could change the trend shown in the figure for the groundwaters, especially if the rest of the samples, without pH *in situ* measurements, is affected by the same uncertainties.

Table 1.4.b: *pH values measured in the samples from KSH01A and computed values of total inorganic carbon (TIC), calcite saturation index (SI calcite) and CO_2 partial pressure (log pCO_2) using PHREEQC. These data can be compared with those obtained imposing equilibrium with calcite. See the text for further details.*

Borehole	Sample	Depth (m)	Measured pH				Calcite equilibrium		
			pH	TIC (mmol/kg)	SI calcite	log pCO_2	pH	TIC (mmol/kg)	log pCO_2
KSHO1A	5263	161.75	7.36	0.443	-0.42	-3.20	7.80	0.414	-3.65
	5262	161.75	7.34	0.466	-0.42	-3.16	7.78	0.434	-3.61
	5261	161.75	7.38	0.497	-0.34	-3.17	7.72	0.471	-3.52
	5260	161.75	7.38	0.462	-0.37	-3.20	7.75	0.436	-3.58
	5259	161.75	7.43	0.429	-0.30	-3.22	7.73	0.470	-3.53
	5257	161.75	7.51	0.521	-0.20	-3.27	7.71	0.506	-3.47
	5268	253.25	7.34	0.303	-0.54	-3.36	7.9	0.278	-3.93
	5266	253.25	7.40	0.317	-0.46	-3.39	7.87	0.297	-3.88

Silica vs Cl

The content of dissolved SiO_2 in surface waters indicates a typical trend of weathering, while in groundwaters it has a narrow range of variation indicative of a steady state (*Figure 1.4.D.a*). The general process evolves from an increase in dissolved SiO_2 by dissolution of silicates in surface waters and shallow groundwaters to a progressive decrease related to the participation of silica polimorphs and aluminosilicates in the control of dissolved silica as the residence time of the waters increases.

Silica contents of valid samples and trend fit fairly well with the less saline Äspö and KOV01 data set (*Figure 1.4.D.b.*)

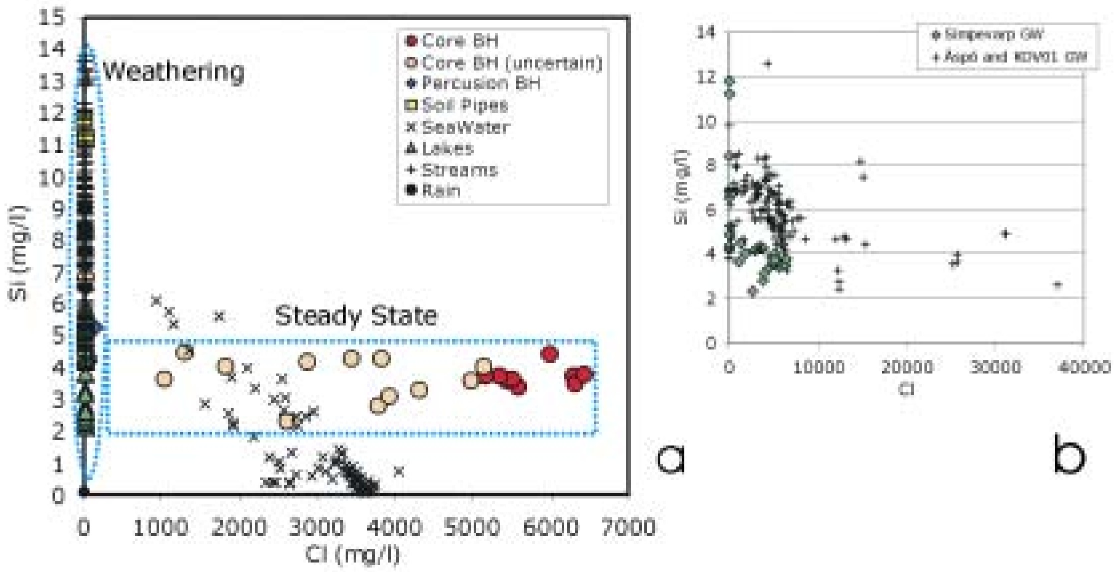

Figure 1.4.D: *a) SiO2 vs. chloride in Simpevarp. b) Si vs. chloride in groundwater samples from Simpevarp and other sites in the area (Äspö and KOV01).*

Sodium vs Cl

Sodium shows a positive and very good linear correlation with chloride concentration (*Figure 1.4.E.a*), which reflects that mixing (and, in this case, contamination) is the main process controlling Na content. The deviation of valid groundwater samples from the sea water dilution line can be interpreted as a small influence of the saline end-member or as a Na removal due to cation exchange reactions.

Sodium contents and trend of the valid samples fit fairly well with the less saline Äspö and KOV01 data set (*Figure 1.4.E.b.*) although they seem to be more Na enriched in Simpevarp.

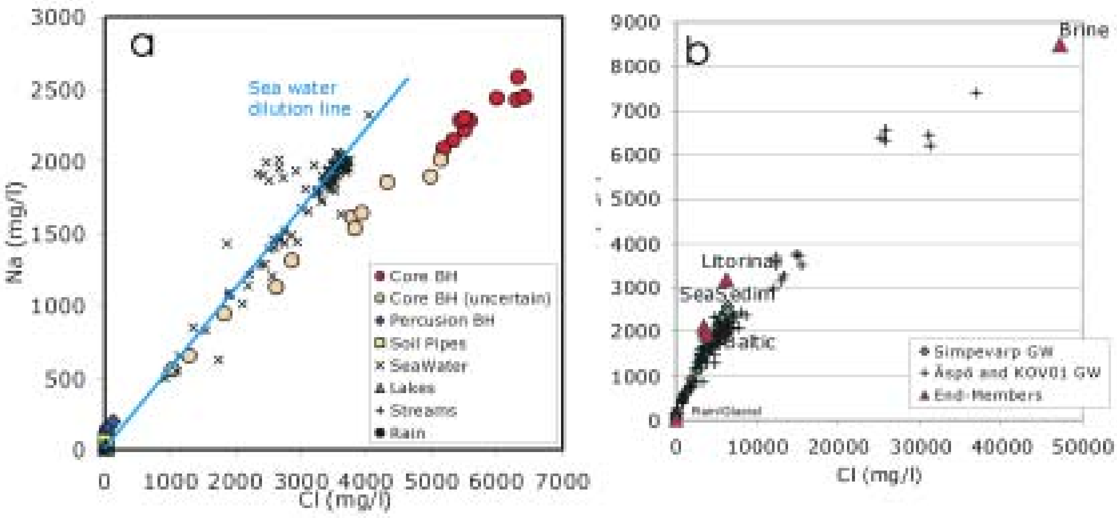

Figure 1.4.E: *(a) Sodium content in Simpevarp waters as a function of chloride. (b) Trend of Simpevarp waters compared with Äspö and KOV01 groundwaters.*

Calcium and strontium vs Cl

Ca and Sr (*Figures 1.4.F.a,c*) also show a good positive correlation with increasing chloride concentration. *Figures 1.4.F.b and d* show that Simpevarp valid data fit the trend followed by Äspö and KOV01 samples. Threfore, this linear behaviour suggests that mixing (natural and artifical) is the main process controlling Ca and Sr contents.

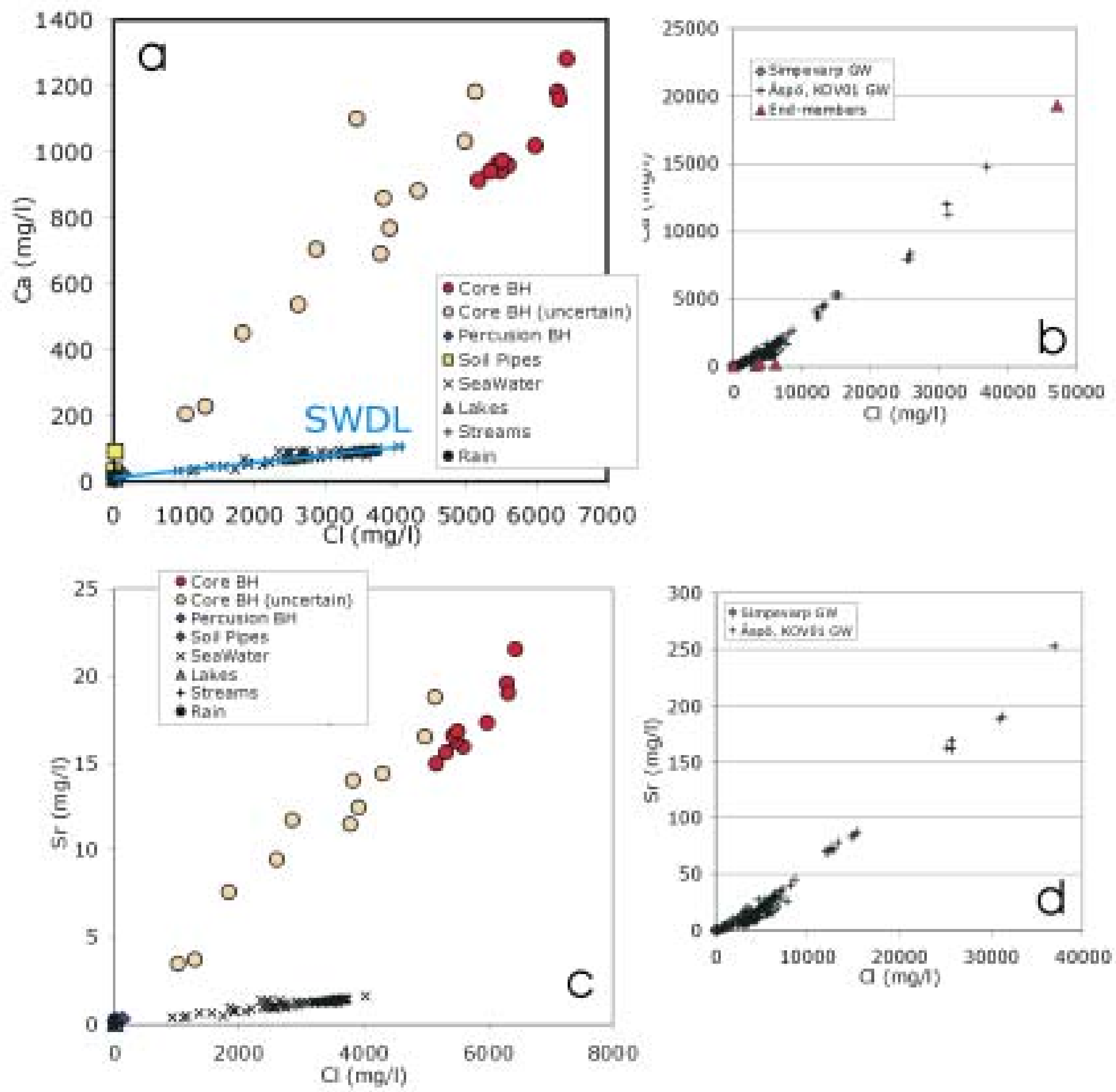

Figure 1.4.F: *Calcium and strontium vs. chloride in waters from Simpevarp (a and c). Ca and Sr in Simpevarp groundwaters compared with the contents in Äspö and KOV01 groundwaters (b and d).*

Potassium and Magnesium vs Cl

Potassium and magnesium behave differently to the other major cations, as *Figure 1.4.G* demonstrates. Potassium content (*panel a*) increases very slowly with depth, staying always below the sea water dilution line. This may reflect additional reaction processes controlling this element (precipitation of clay minerals, like illite in fracture fillings, or cation-exchange). Magnesium (*panel c*) shows a steeper increase with depth, but also below the sea water dilution line, suggesting a removal by reactions involving chlorite, montmorillonite, etc.

Potassium and magnesium contents of valid samples fit very well in the general trend of Äspö and KOV01 groundwaters (*panels b and d*).

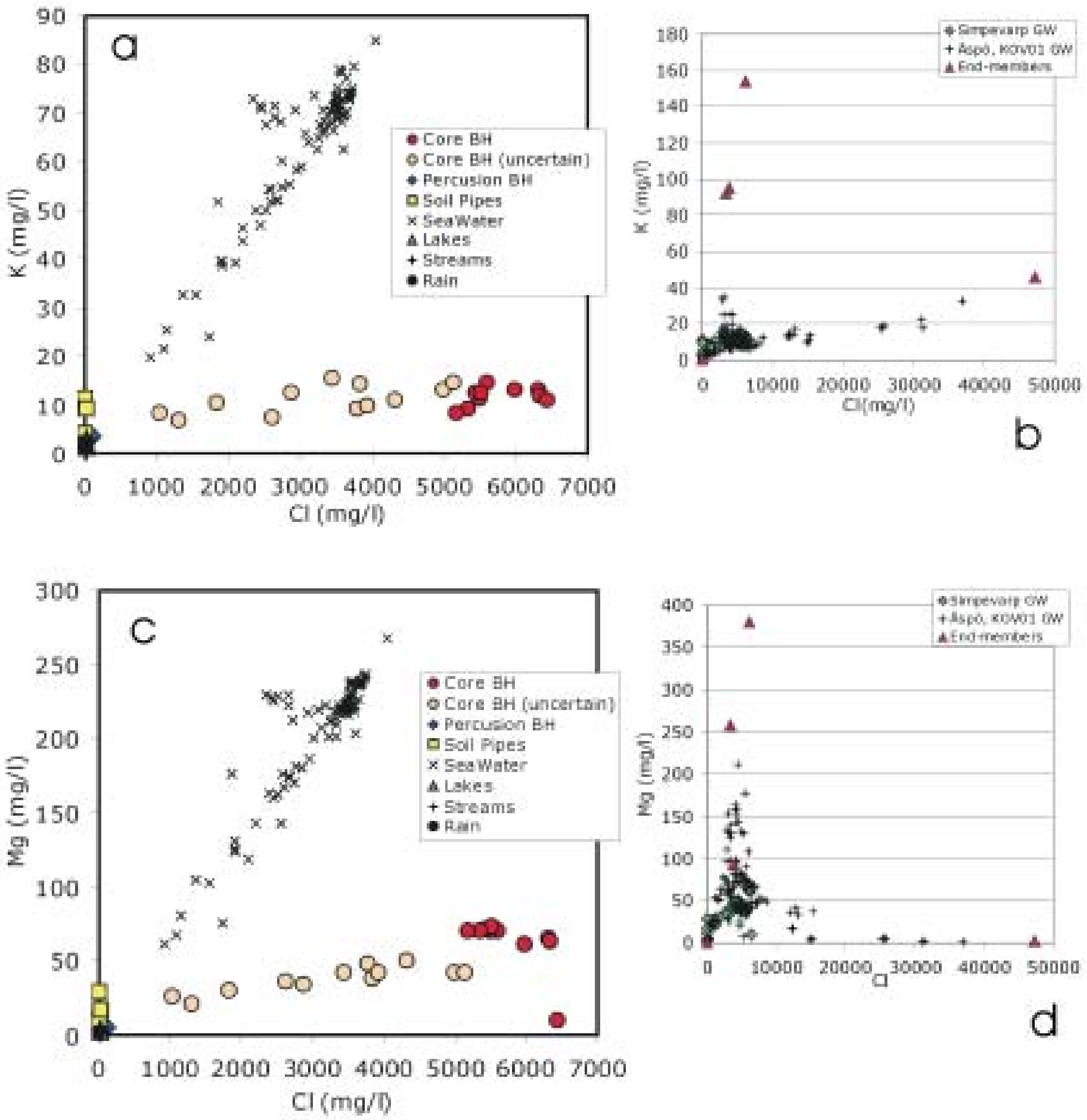

Figure 1.4.G: *Potassium and magnesium vs. chloride in water samples from Simpevarp (a and c). K and Mg contents in Simpevarp groundwaters compared with Äspö and KOV01 contents (b and d).*

Alkalinity vs Cl

Alkalinity (HCO_3^-) is, together with chloride and sulphate, the third major anion in the system, being the most abundant in the non-saline waters. Its concentration increases in the surface waters as a result of weathering up to equilibrium with calcite; then, it decreases dramatically with depth (*Figure 1.4.H*) as a result of mixing and calcite precipitation. It is worth noting that the samples contaminated with flushing water (pale red circles dubbed “uncertain” in *Figure 4.4.I.a*) again fit very well the trend defined by the rest of the samples.

This alkalinity trend is similar to that observed in other Scandinavian sites (e.g., Figure 1.4.H.b)

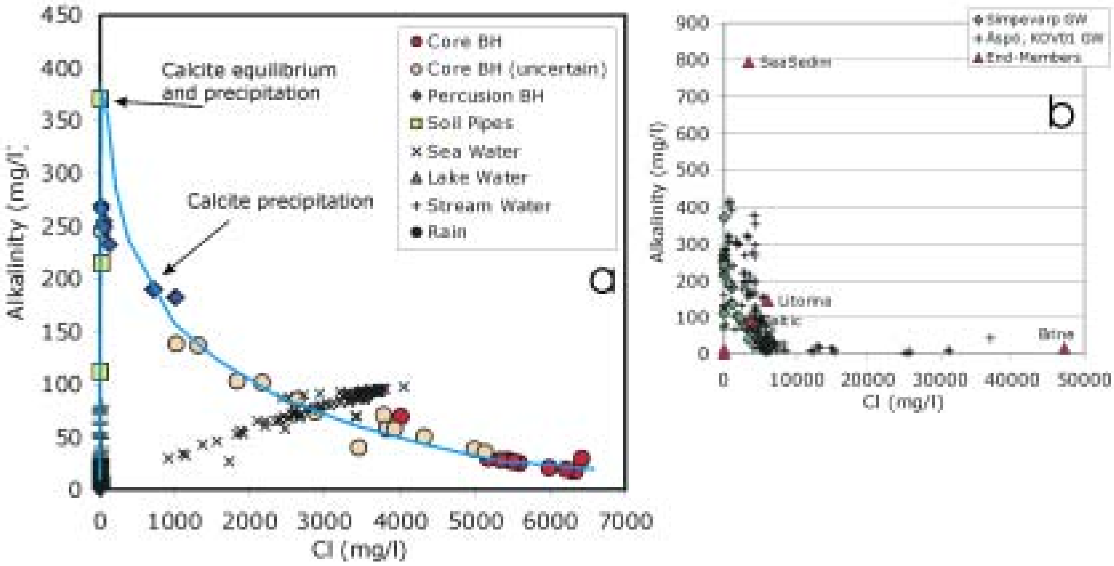

Figure 1.4.H: *(a) Alkalinity vs. chloride water samples from Simpevarp. (b) Comparison of alkalinity vs chloride trends for Simpevarp , Äspö and KOV01 groundwaters.*

Sulphate vs Cl

Sulphate (SO_4^{2-}) in valid groundwater samples shows a irregular decrease with chloride content (*Figure 1.4.I*) roughly similar to that observed in other sites (e.g., in KOV01; *Figure 1.4.I.b*). This can be interpreted as the result of microbially-catalysed sulphate reduction reactions, although the hypothesis should be tested when redox and microbial data become available (see below). In detail, the trend is not so clearly decreasing and the ratio Cl/SO_4 is rather variable. Some percussion borehole and soil pipe samples seems to reflect a superficial water imprint.

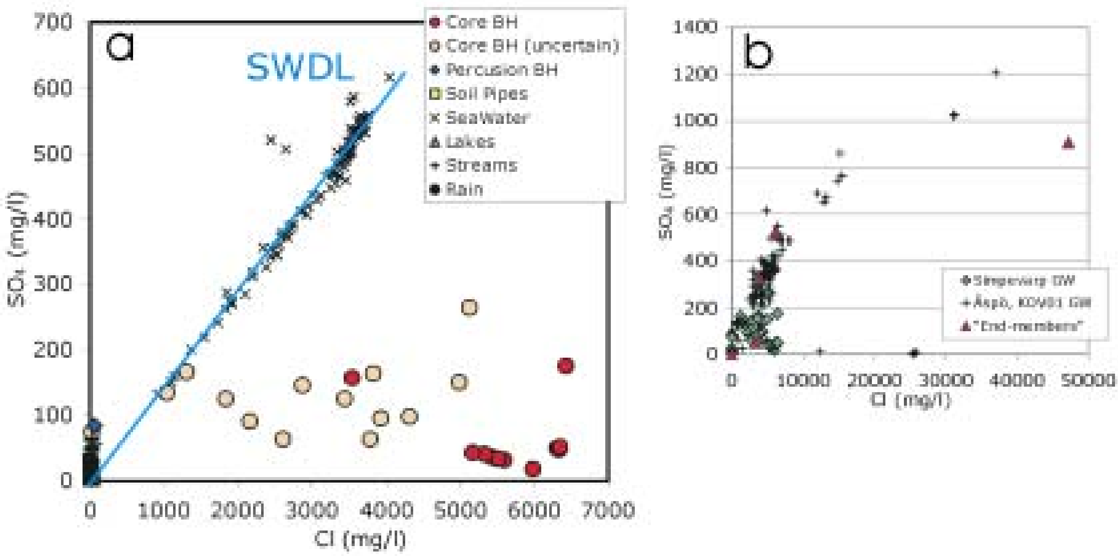

Figure 1.4.I: *Sulphate vs. chloride in waters from Simpevarp.*

Bromide and Lithium vs Cl

Bromide and lithium show a linear increase with chloride indicative of a common geochemical origin for both (*Figure 1.4.J*). Saline groundwaters have a higher bromide content than present Baltic, or estimated Litorina Sea waters. They have rather homogenous Br/Cl ratios (higher than sea water) supporting a non-marine origin for the saline groundwaters.

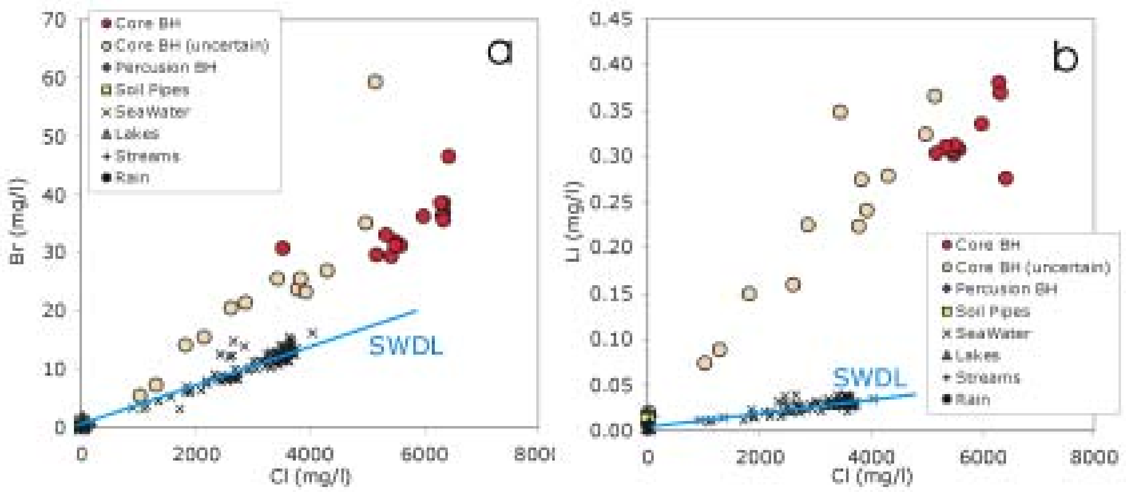

Figure 1.4.J: *Bromide and lithium vs. chloride in waters from Simpevarp.*

Fluoride vs. Chloride

Superimposed to the wide scatter in fluorine values, it appear to exist a general trend of decreasing fluoride with increasing Cl (*Figure 1.4.K*). High fluoride concentrations in non saline waters may be associated with the weathering of granite-forming minerals (biotite) or to the dissolution of fluorite, whereas low values at depth in saline waters enriched in Ca, may indicate that fluorite is controlling F concentrations.

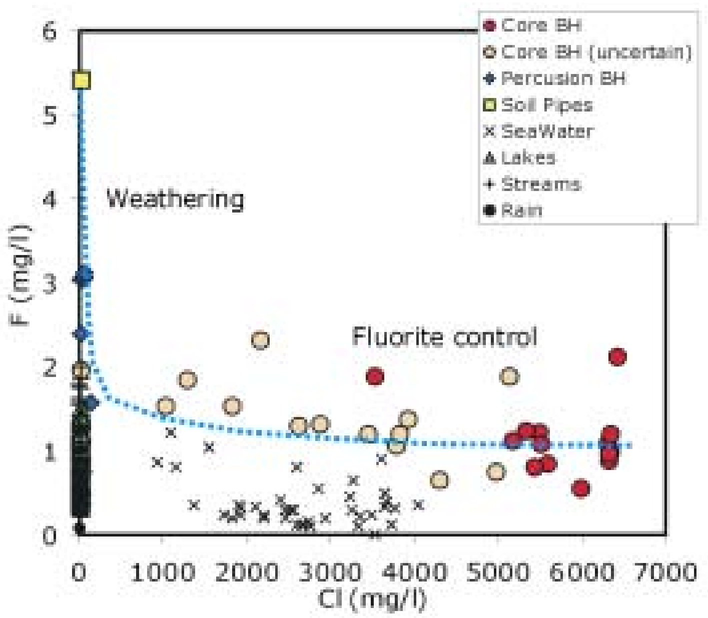

Figure 1.4.K: *Fluoride vs. chloride in waters from Simpevarp.*

Redox elements

There are not enough redox-active element data (iron, sulphide and uranium) to define any significant trend. Superficial waters have low contents of Fe_{Tot}, compatible with oxic conditions. Some soil pipe samples have the highest Fe_{Tot} concentrations, possibly associated to a local development of post-oxic reduced environments. Total iron against chloride shows an apparently decreasing trend for groundwaters but is defined mainly by contaminated samples (*Figure 1.4.L.a*). Concentrations of Fe^{2+} for the valid saline samples (*Figure 1.4.L.b*) show a decreasing trend that could indicate the presence of a sink of iron at depth, possibly related to sulphate reducing bacteria and the simultaneous precipitation of sulphides. Additional sulphide data could help to test this hypothesis. A more detailed analysis of the redox state of KSH01A waters is presented in Chapter 2.3.

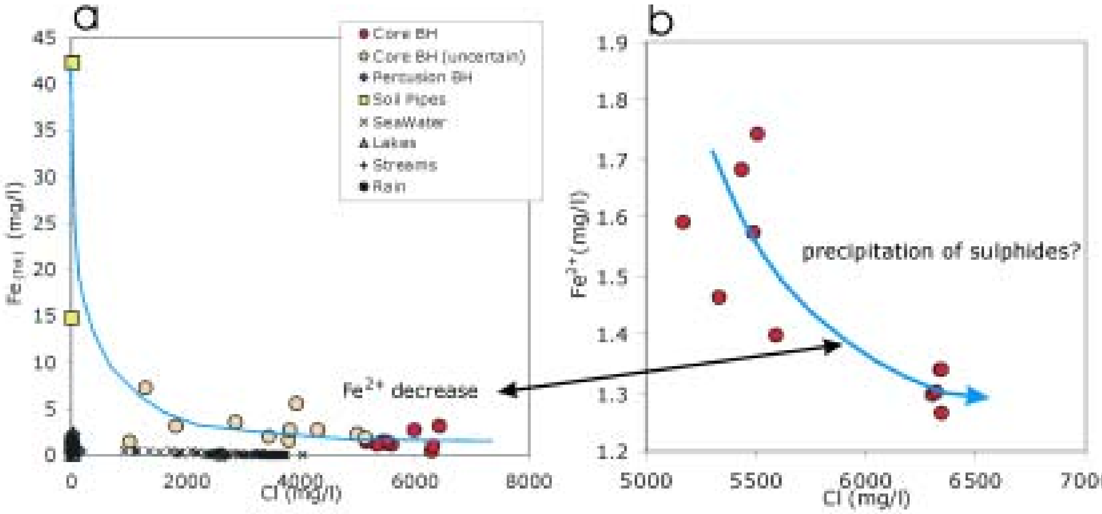

Figure 1.4.L: *Depth distribution of (a) total iron and (b)* Fe^{2+} *in Simpevarp samples.*

Stable isotopes

Figure 1.4.M shows the $\delta^{18}O$ y δD in Simpevarp waters. Most samples fall on or near the Global Meteoric Water Line (Craig, 1961), indicating a meteoric origin for all the waters. Below the GMWL, superficial waters and shallow groundwaters form a Local Meteoric Water Line (LMWL) with nearly the same slope as the GMWL, suggesting a mixing line towards the Baltic Sea samples.

Surface waters (lake, stream and sea waters) show considerably spread around the GMWL but always with depleted deuterium values, suggesting surface evaporation processes.

$\delta^{18}O$ vs Chloride contents are plotted in *Figure 1.4.M, panels c and d*. Wide variation of $\delta^{18}O$ values are observed at low chloride contents (fresh, superficial waters).This variation could reflect seasonal fluctuations and/or mixing of groundwater with lake and stream waters.

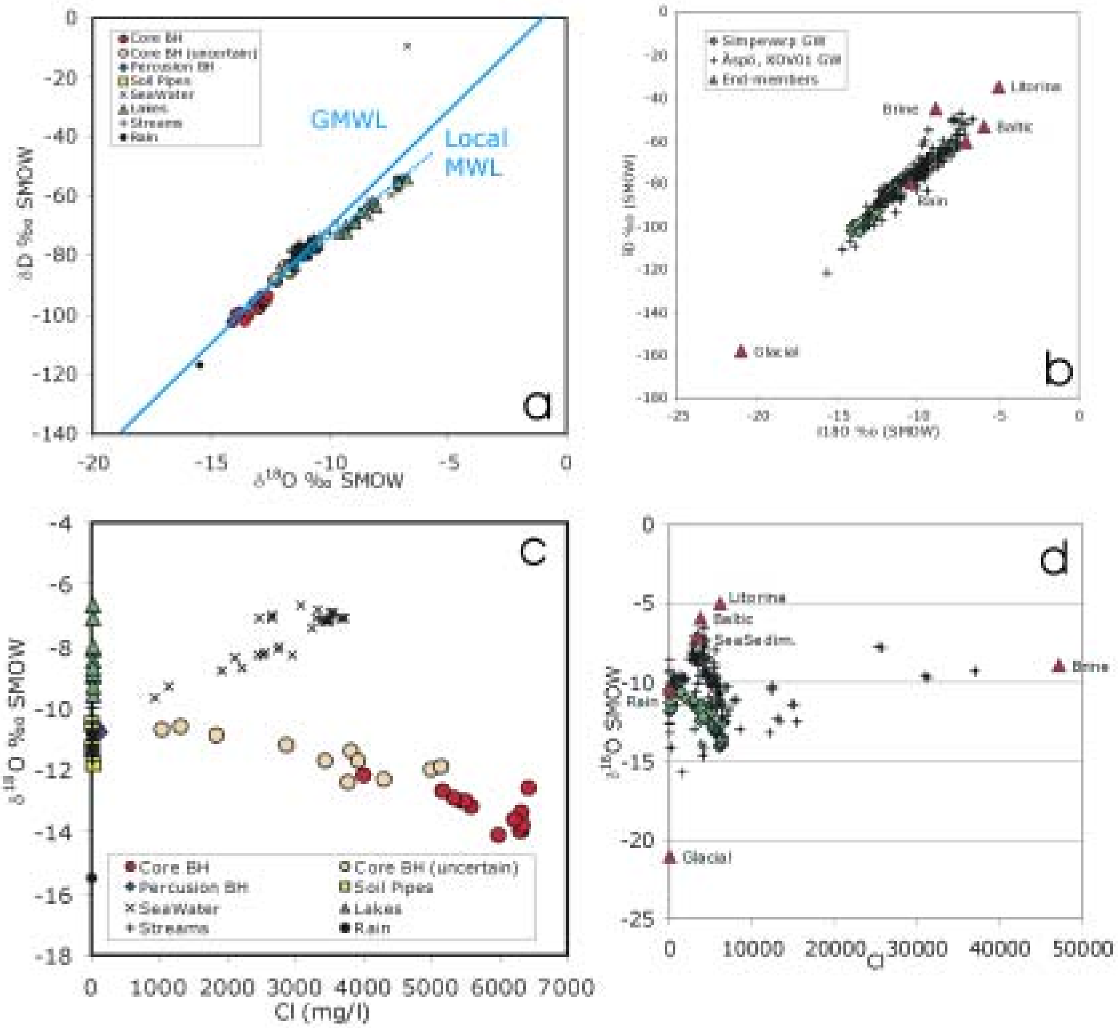

***Figure 1.4.M**. Isotopic plots for Simpevarp waters. Plot of δ^{18}O vs. Cl for all Simpevarp waters (a) and for Simpevarp, Äspö and KOV01 groundwater (b). Plot of δD vs. δ^{18}O for all Simpevarp waters (c) and for Simpevarp, Äspö and KOV01 groundwater (d).*

Soil waters tend to cluster at values between -11 and -12‰ SMOW, close to the annual mean precipitation values. Baltic Sea water samples show an important spread as a result of evaporation and mixing (dilution) with fresh superficial waters.

Some fresh non-saline groundwaters from percussion boreholes show δ^{18}O values similar to those of fresh superficial waters. The rest of valid δ^{18}O data for groundwaters are for the saline waters. The lighter δ^{18}O (and δD) isotopic composition of these groundwaters, indicates the existence of mixing with a cold melt-water component (Glacial end member).

Figure 1.4.N shows the important dispersion of δ^{18}O and tritium values. Fresh, superficial waters are modern waters of meteoric origin. Mixing with waters from different sources has promoted the observed scatter. Percussion borehole groundwaters show a variable mixing with younger waters. Lowest tritium contents are associated to saline waters from cored boreholes (KSH01A).

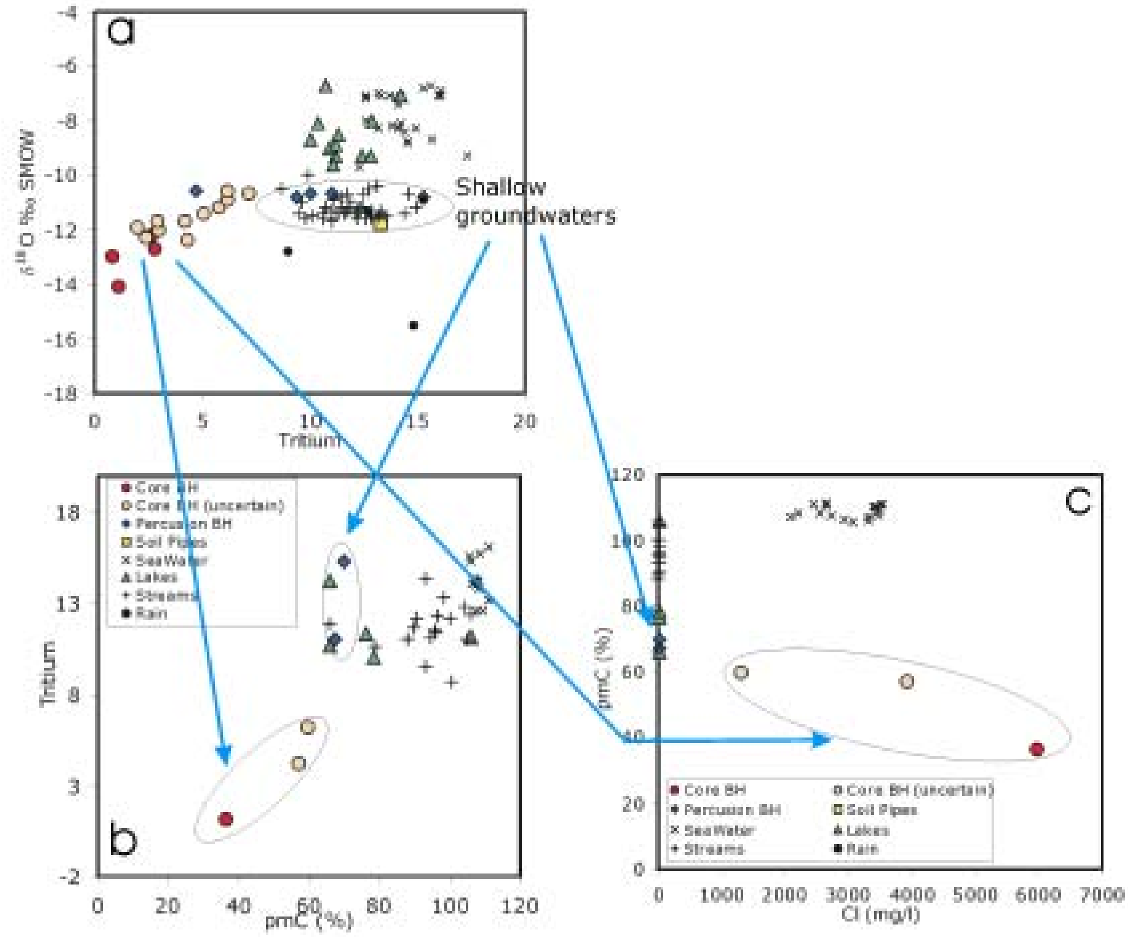

***Figure 1.4.N**. Isotopic plots for Simpevarp waters. a) Plot of $\delta^{18}O$ vs. tritium for all Simpevarp waters. b) Plot of tritium vs. percent of modern Carbon (pmc) for all Simpevarp waters. c) Plot of pmc vs. chloride for all Simpevarp waters.*

As expected, the lowest values of pmC are associated to the saline groundwaters from KSH01A borehole (*Figure 1.4.N.b and c*). Except for the marine members, the rest of superficial waters show a wide scatter in pmC values, which affects some groundwaters sampled in percussion boreholes (*Figure 1.4.N.b*), suggesting a mixing between different superficial waters and between these and the groundwaters.

Sulphate isotopes

Available data on $\delta^{34}S$ in waters can be used to evaluate the origin of sulphur and the actuation of redox processes (*Figure 1.4.O*). The $\delta^{34}S$ values of fresh superficial waters (below +12‰ CDT) diverges from the rest of the data indicating a different source for sulphate in these waters. Similar $\delta^{34}S$ values reported from Stripa and overburden waters at Olkilouto (around +6‰ CDT; *Figure 1.4.O.c*) have been interpreted as derived from the oxidation of rock-forming sulphides and meteoric fallout (Pitkanen *et al.*, 1999). The $\delta^{34}S$ values of some groundwaters from the HSH02 borehole appear to indicate a meteoric origin.

Although with dispersion, $\delta^{34}S$ values of marine seawater at chloride concentrations of 2500 mg/l are around 20‰ CDT. Some fresh non-saline waters from HSH02 approach this figure, suggesting a mixing between both water types.

Saline groundwater $\delta^{34}S$ data from KSH01A and KSH02 boreholes have an increasing trend with increasing chloride, with values close to those observed in Olkilouto and

Kivetty. These values have been interpreted as derived from the reduction of sulphate by sulphate-reducing bacteria. Input of marine sulphate would also increase $\delta^{34}S$ to the observed values but a mixing of KSH01A and KSH02 groundwaters with a seawater end member is not consistent with observed Br/Cl ratios (*Figure 4.1.4.J*).

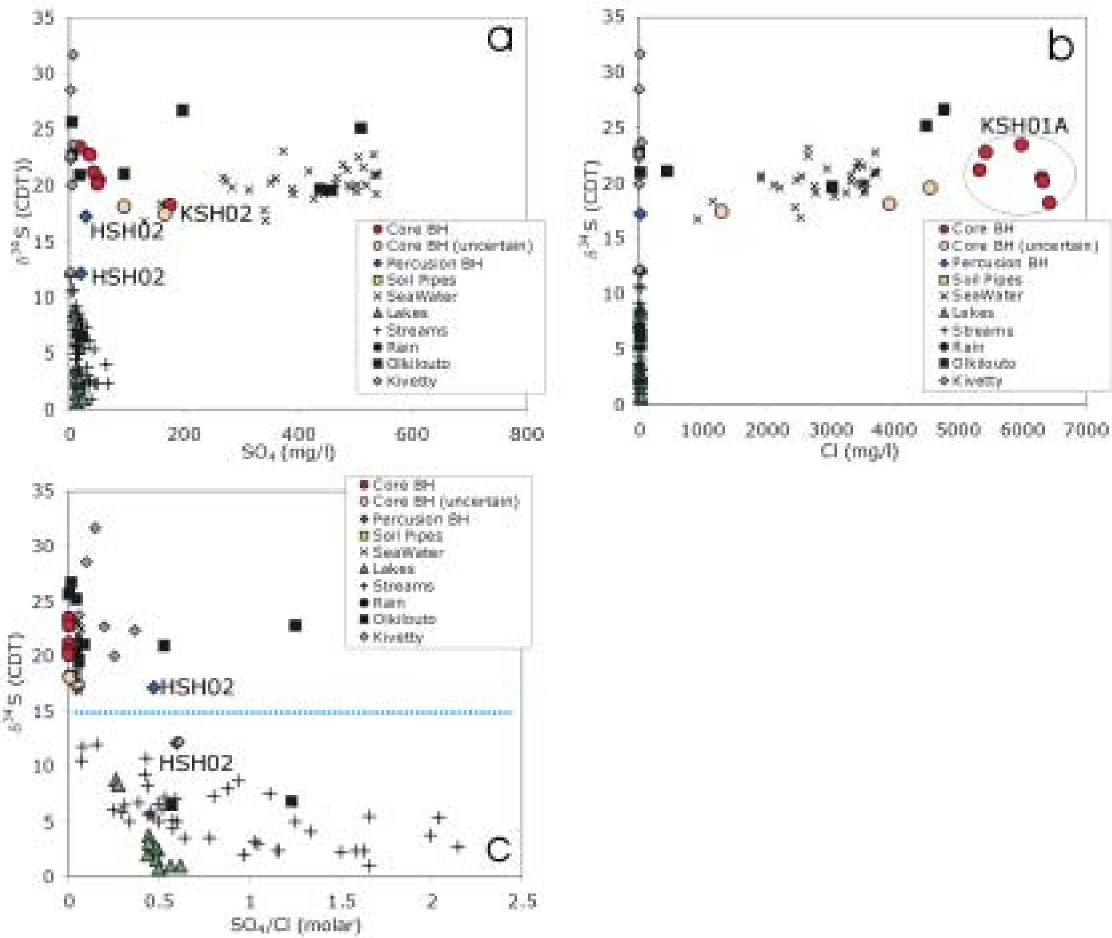

***Figure 1.4.O**. Sulphate isotopic plots for Simpevarp waters. a) Plot of $\delta^{24}S$ vs. sulphate content for all Simpevarp waters. b) Plot of $\delta^{24}S$ vs. chloride content for all Simpevarp waters. c) Plot of $\delta^{24}S$ vs. sulphate/chloride ratio for all Simpevarp waters.*

Stable chlorine isotope

$\delta^{37}Cl$ data may reveal information about the sources of dissolved chloride. According to Frape *et al*. (1996), modern Baltic and paleo-Baltic seas have a negative $\delta^{37}Cl$ signature related to salt leachate from Paleozoic salt deposits located south of the Baltic Sea ($\delta^{37}Cl$ ranging from -0.58 to 0‰ SMOC). Chlorine bound to rock minerals can show a heavy signature up to +4‰ (Pitkanen et al., 1999) that could be released by water-rock interactions and tend to result in positive $\delta^{37}Cl$ signatures.

The few available $\delta^{37}Cl$ data in Simpevarp groundwaters come from non-contaminated samples and have been plotted in *Figure 1.4.P* together with data from Olkiluoto and Forsmark (Pitkanen *et al.*, 1999; Laaksoharju *et al.*, 2003). As it is clear from the figure, Simpevarp groundwaters have a very low salinity and a very limited range in chlorine concentrations.

Taking into account the analytical uncertainty of ± 0.2‰, negative values of δ^{37}Cl for fresh non-saline groundwaters from HSH02 borehole could indicate some influence of modern Baltic or palaeo-Baltic waters. The observed enrichment in groundwaters from KSH01A borehole could be related to water-rock interaction processes.

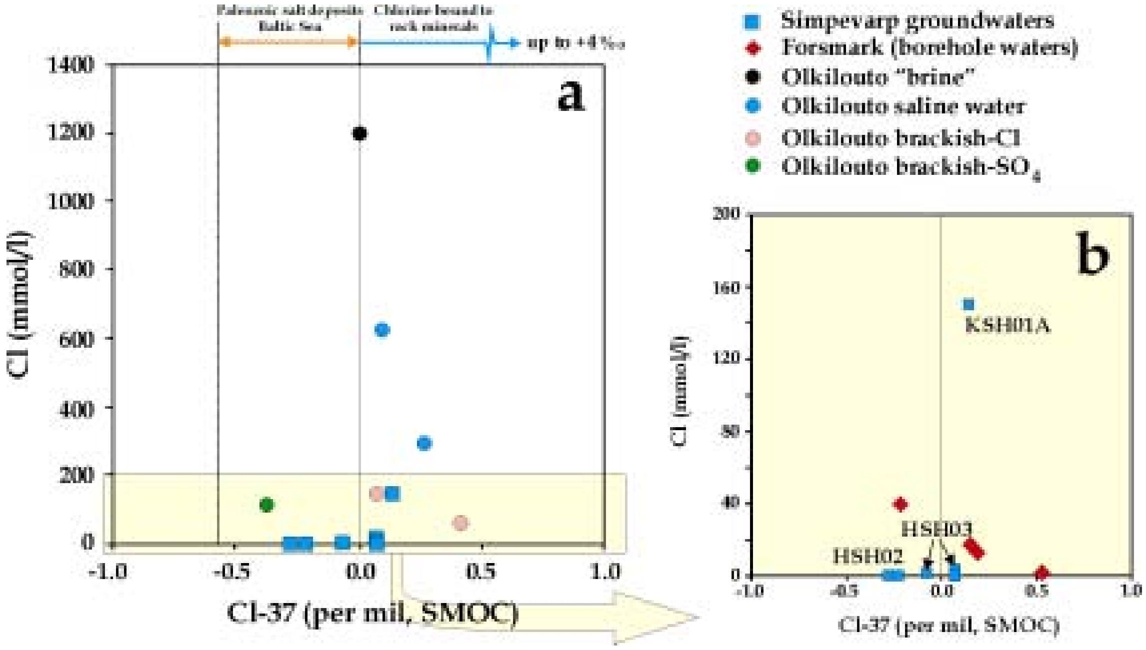

Figure 1.4.P: *Comparison of δ^{37}Cl values is Simpevarp groundwaters with values in other Scandinavian sites. a) Plot of δ^{37}Cl vs. Cl for Olkilouto and Simpevarp groundwaters. Plot of δ^{37}Cl vs. Cl for Forsmark and Simpevarp groundwaters.*

In any case, the interpretation of chloride isotope data must be considered as preliminary. More data and a better understanding of Cl fractionation are needed for a full analysis (Pitkänen *et al.*, 1999).

2. Hydrogeochemical modelling

2.1 Modelling assumptions and input from models

The geochemical modelling approach in this study has started with speciation solubility calculations (focused on the saturation indexes of the more relevant mineral phases in the system) and activity calculations for the construction of aluminosilicate stability diagrams and redox-pairs calculations. Then, in order to define the reaction models that can explain the changes in water chemistry (mixing and water-rock interaction processes), two kinds of inverse modelling simulations have been performed: simple mass balance calculations and more complex mixing and mass balance calculations. All these calculations have been carried out with PHREEQC (Parkhurst and Appelo, 1999) and the WATEQ4F database[4].

The main goal of the mass balance calculations is the evaluation of a set of hypothetical reactions that could affect a hydrochemical/hydrogeological system, without any input of thermodynamic data. Starting with the chemical composition of an initial point in the system (*initial water*), these calculations define the reaction model that better "explains" the chemistry of a *final water*.

Mixing and mass balance calculations have been performed to analyse the evolution of the two main water types: *fresh* and *brackish-saline*. For the *first water type*, which has an *a priori* important water-rock interaction component, simple mass balance calculations with no mixing (to assess the reaction processes occurred between two water samples joined by a hypothetical flow line) and binary mixing with mass balance (to asses the mixing proportions of two water samples and the reaction processes necessary to explain the chemistry of a third water sample) have been performed. For the analysis of the *second water type* (brackish-saline water), only multiple-mixing and mass balance calculations have been carried out. The goal of these calculations is to explain, using heterogeneous reactions between solid phases and the water, the chemistry of a water sample which is the product of the mixing of several (more than three) water end-members.

2.2 Conceptual model and potential alternatives

From the previous data evaluation analysis some ideas can be drawn to construct an initial conceptual model.

Based on their general geochemical character and apparent age, two water types have been identified in Simpevarp: fresh waters with a bicarbonate imprint and low residence times (tritium values above detection limit), and brackish-saline waters with Cl contents up to 6500 mg/l and longer residence times (tritium values below detection limit).

The chemistry of the first water type is mainly controlled by the recharge waters and, most important, by water-rock interaction processes. Locally, these waters can mix with marine solutions changing their chemical composition towards more saline members. Under these conditions the major water-rock interaction processes are organic matter decomposition, dissolution of the more soluble phases, such as calcite and sulphides (or gypsum and halite dispersed in the pedogenic zone), and the alteration of the granitic rock.

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[4] All these calculations have been made assuming the same temperature (7ºC) for all the samples. However, a sensitivity analysis considering temperatures up to 15ºC indicates that the maximum variation in the computed saturation indexes is not higher than ±0.2 units.

Primary and secondary silicates and aluminosilicates are related by incongruent reactions which seem to control silica and aluminium contents and participate in the loss or gain of elements like K, Mg and, to some extent, Na (through dissolution-precipitation or ionic-exchange processes).

Waters from the second type have a longer residence time and a higher mixing component with older waters from different origins. Heterogeneous reaction processes are less important and can be described by the same set of minerals as before, with the only difference that calcite is precipitating instead of dissolving. Also, in some of these waters microbially mediated reactions and dissolution-precipitation of Fe-mineral phases become important at controlling sulphate and iron contents, and the redox state of the system.

2.3 Speciation-solubility calculations

In this type of calculations, starting from the concentration of a set of elements in a water sample and other relevant parameters (temperature, pH, Eh, total or carbonate alkalinity, and, in some cases, density) the concentration and activity of all the relevant species in the system and the saturation indices with respect to a predefined set of minerals is computed. It is a purely thermodynamic calculation where it is assumed that all dissolved species are in mutual homogeneous equilibrium. No assumption about the heterogeneous processes affecting mineral phases are made as this approach define the proximity of a solution to equilibrium with a relevant phase through a saturation index defined as

$$SI = \log \frac{IAP}{K(T)},$$

where *IAP* is the ionic activity product and $K(T)$ is the equilibrium constant of the dissolution-precipitation reaction of the relevant phase.

These calculations are used to investigate the processes that control water composition at Simpevarp. This chapter is divided into two main sections, the first one concerning the state of non-redox elements and phases and the second focused on the redox state of the system.

The procedure only deals with plausible minerals in the system, i.e., those which can reach equilibrium with the groundwater. Therefore, clearly undersaturated mineral phases are not included in the following description.

Carbonate system

The pH sensitivity analysis performed with samples from KSH01A borehole at 161.77 m and 252.15 m depth (see discussion in Section 1.4, “Explorative analysis”) showed that laboratory pH values could have been affected by CO_2 ingassing. This hypothesis was confirmed with the pH data from continuous logging. This conclusion is valid for these groundwater samples. In the rest of the cases, the possible CO_2 exchange with atmosphere has not been assessed for lack of in situ pH values. Therefore the uncertainty in pH will propagate into the subsequent speciation-solubility calculations. On the other hand, all the available brackish groundwaters are contaminated (artificial mixing) and although included in calculations, the results are meaningless.

Calculated saturation states with respect to calcite in most groundwater samples indicate a generalized equilibrium state (considering the commonly accepted ± 0.5 uncertainty in the SI of this mineral when uncertainties in pH are evaluated; *Figure 2.3.A.a*). The valid groundwater samples plot below the IS=0 line because laboratory pH have been used for the calculations. The scatter in the values is mainly due to variations in the pH of the samples. Surface and shallow subsurface waters are mostly undersaturated with respect to this mineral.

The computed P_{CO2} values do not show any clear trend with chlorine due to the problems with the contaminated brackish samples (*Figure 2.3.A.b*).

Very roughly, trends of alkalinity, pH and the saturation state of calcite could be explain with a water-rock interaction model (dissolution-precipitation of fracture filling calcite and silicate hydrolysis) proposed by Nordstrom *et al* (1989) for Stripa groundwaters and verified in other Swedish and Finish sites.

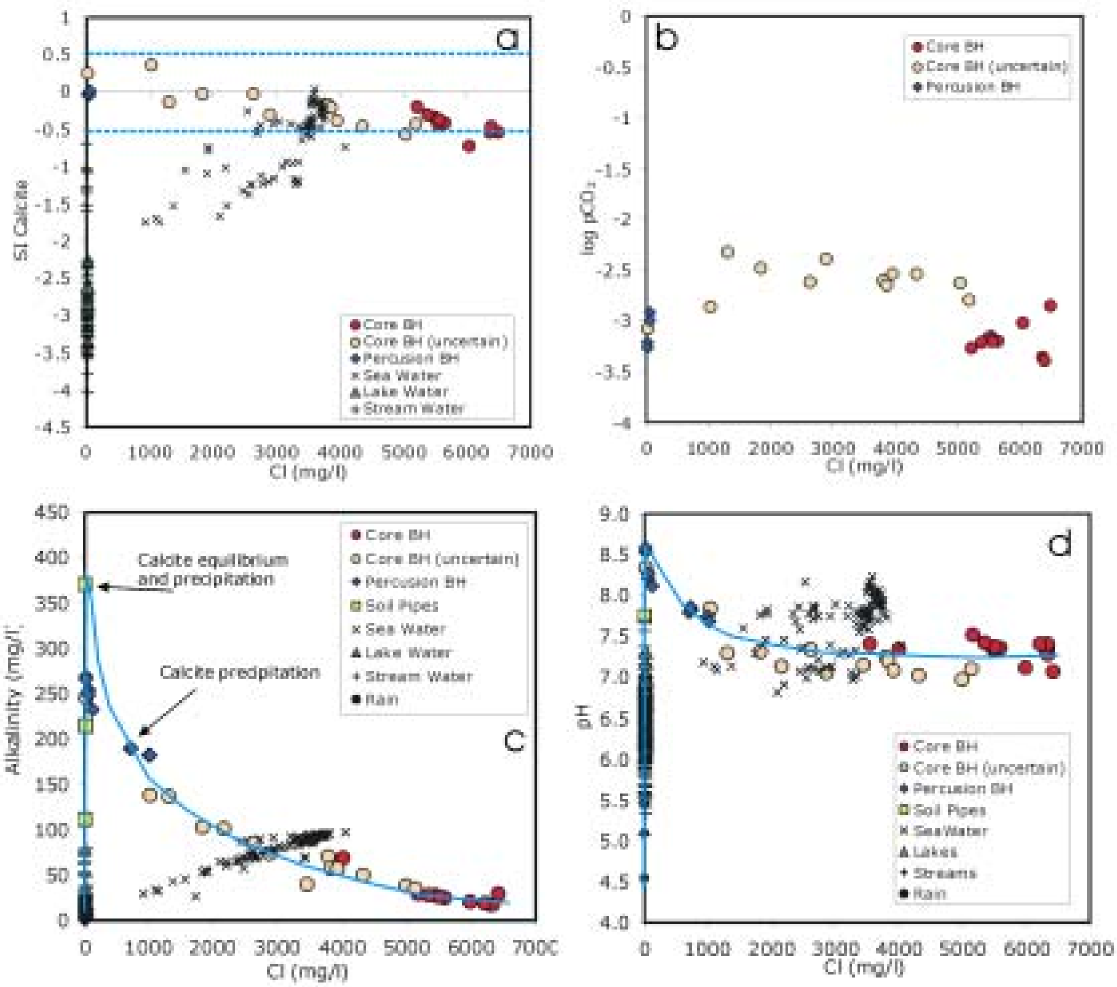

Figure 2.3.A: *Evolution of the carbonate system in Simpevarp waters. (a) and (b) Calculated calcite saturation indices and partial pressure of CO_2 against chloride. (c) and (d) Alkalinity and pH against chloride. The dashed lines in figure (a) represent the uncertainty associated with SI calculations.*

The initial steep rise in alkalinity (*Figure 2.3.A.c*) and pH (*Figure 2.3.A.d*) that affects superficial waters is related to weathering of the bedrock, causing calcite dissolution and the hydrolysis of silicates. Calcite reaches saturation (or oversaturation) at the alkalinity peak and the subsequent depletion in alkalinity can be attributed to calcite precipitation. This precipitation process is induced by calcium enrichment in groundwaters associated with mixing with a saline source.

The pH usually increases slightly beyond the alkalinity peak. As calcite precipitation produces a decrease in pH, it has been assumed that the pH increase is associated with the effect of silicate hydrolysis (i.e., consuming proton reactions) deep in the bedrock. The trend observed in Simpevarp groundwaters shows a pH decrease, apparently with minor or no silicate hydrolysis compensation.

Nevertheless, this pH decreasing pattern in Simpevarp can be magnified by the high pH peak developed in the more recent superficial waters (the existence of older recharge groundwaters with a less developed pH peak could modify the interpretation on the pH pattern) and mainly by the presence of the contaminated samples along the pattern.

Silica system

The weathering of rock-forming minerals is the main source of dissolved silica. Superficial waters have a variable degree of saturation with respect to silica phases (quartz and chalcedony), compatible with the weathering hypothesis.

Saline groundwaters are oversaturated in quartz and close to equilibrium with chalcedony (*Fig. 2.3.B*). Saturation indices of these phases are relatively constant independently of chlorine content; this suggests that the groundwater has already reached a stationary state associated with the formation of aluminosilicates or secondary siliceous phases like chalcedony, which control the concentration of dissolved silica.

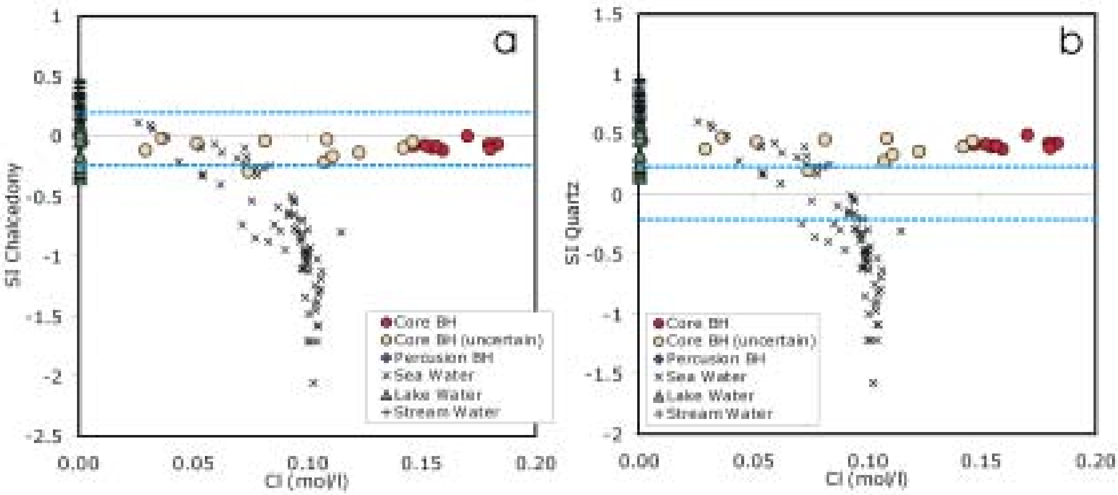

Figure 2.3.B: *Saturation indices of chalcedony (a) and quartz (b) as a function of Cl in Simpevarp waters. The dashed lines represent the uncertainty associated with SI calculations (Deutsch et al., 1982).*

The lack of dissolved aluminium data for Simpevarp groundwaters precludes an speciation-solubility analysis of aluminosilicates. Therefore, activity diagrams were used to study the relationship between silicate minerals and their stability. The accuracy of these diagrams depends on pH and are therefore affected by the uncertainties in the pH measurements. Uncertainties in the equilibrium constants of the aluminosilicates (especially phillosilicates) also affect the conclusions drawn from these diagrams. This last source of uncertainty has been partially removed considering more than one equilibrium constant for some phases and different assumptions or mineralogical relations when constructing the diagrams. Nevertheless, the conclusions are preliminary because few valid groundwater samples are available.

Figure 2.3.C. shows several activity diagrams based on data from Helgeson (1969) calculated at 7ºC (diagrams used in Olkilouto; Pitkänen *et al.* 1999). The diagrams plot clay minerals and, apart from the stability of kaolinite in surperficial waters and in some groundwaters, they suggest an association of Ca and Mg to clay minerals in saline samples and samples from percussion boreholes, leading to the stabilization of montmorillonite.

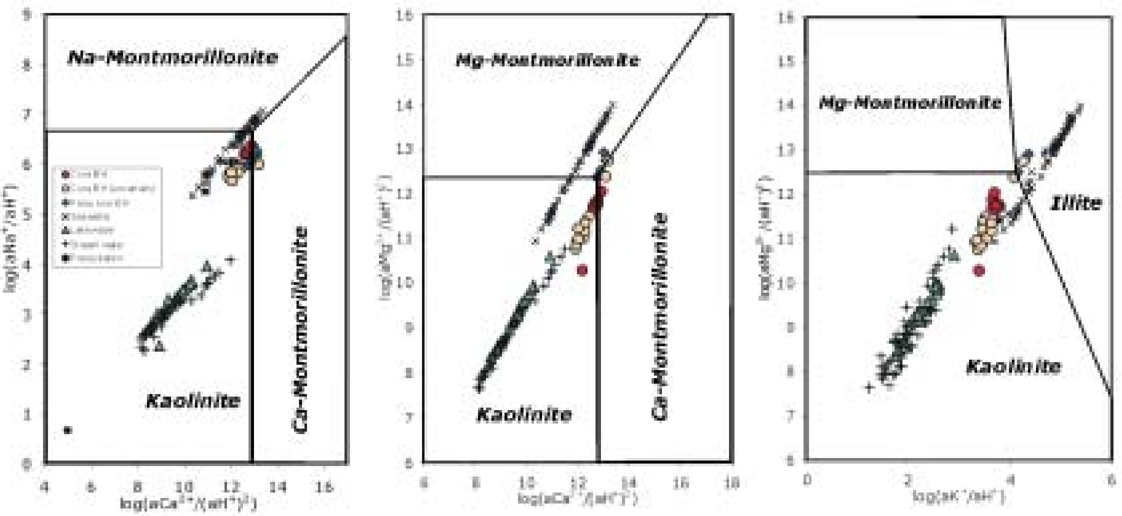

Figure 2.3.C: *Aqueous activity diagrams for some aluminosilicate minerals at 7ºC, 1 bar. The field boundaries were calculated with data from Helgeson (1969) and a logarithmic silica activity of –4.*

Figure 2.3.D. shows three additional stability diagrams for other mineral phases identified as fracture fillings in the KSH01A borehole: adularia, albite, prenhite, laumontite and chlorite. The diagrams are based on data calculated at 15ºC by Grimaud et al. (1990) for Stripa groundwaters. These diagrams show that most valid saline groundwaters and samples from percussion boreholes are near to or in the albite stability field and some of them near or in the chlorite stability field.

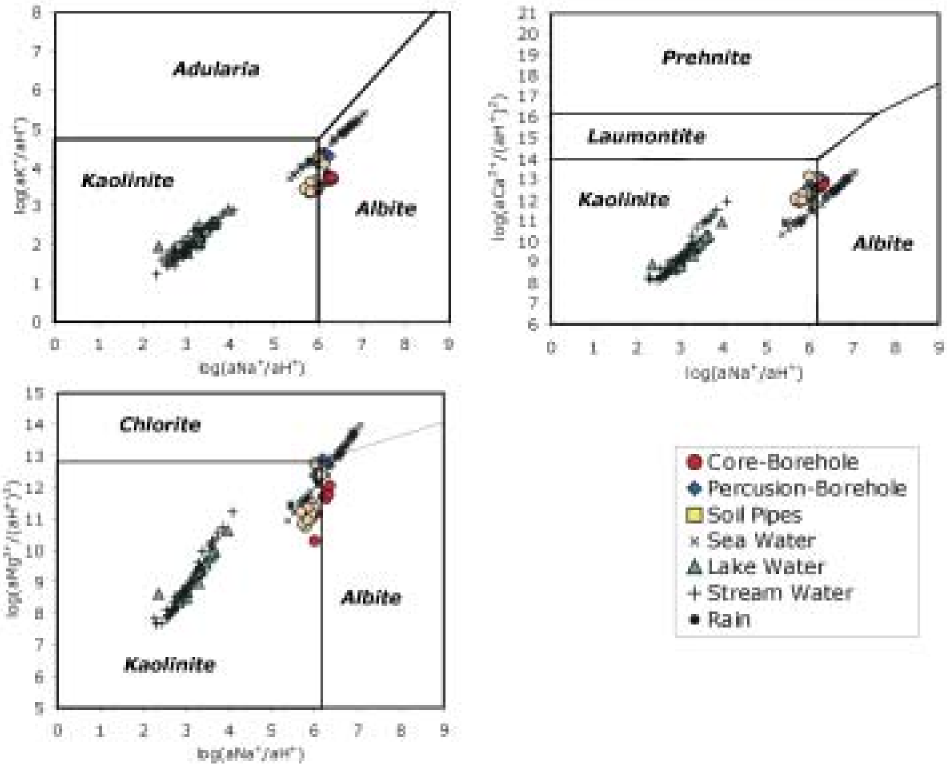

Figure 2.3.D: *Aqueous activity diagrams for some aluminosilicate minerals at 15ºC, 1 bar. The field boundaries have been calculated from the data of Grimaud et al. (1990).*

Finally, *Figure 2.3.E.* plot stability diagrams that include illite. Diagram (a) was used in the Cigar Lake natural analogue study (Cramer and Smellie, 1994), and is based on data from Helgeson (1969) and Helgeson *et al.* (1978). Diagram (b) was constructed with data from Garrels (1984). Both diagrams suggests that illite could play an important role in these groundwaters in agreement with the presence of this mineral in the studied fracture fillings.

Cation exchange processes are probably more important than clay mineral recrystallization during short-term water-rock interaction at low temperature, but in waters with long residence times these exchange processes may cause irreversible changes in clay minerals as the solubility diagrams suggest (Pitkänen et al., 1999).

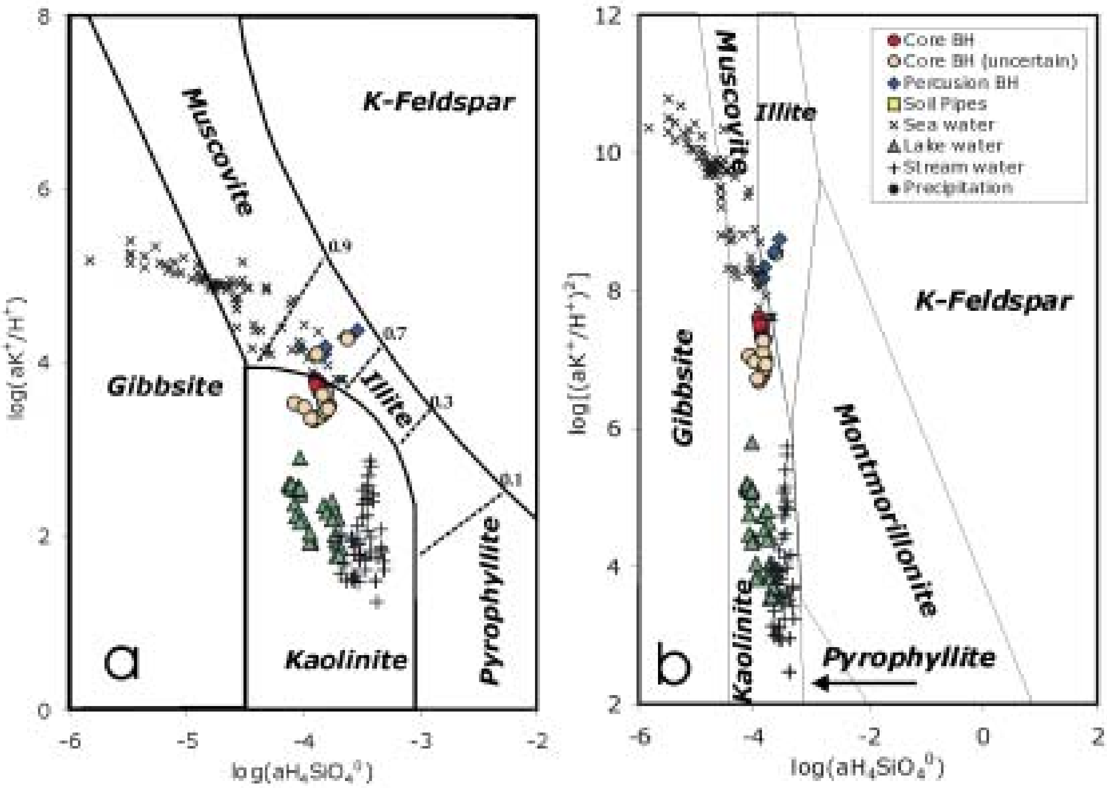

Figure 2.3.E: Aqueous activity diagrams for some aluminosilicate minerals at 25ºC, 1 bar, including illite. The field boundaries have been calculated with data from Helgeson (1969) and Helgeson et al. (1978) in graph (a) and from Garrels (1984) in graph (b). In graph (a) illite field is contoured to show the stability of different illite fractios in I/S.

Other minerals in the system

The SI evolution for fluorite indicates a trend towards equilibrium as chloride concentration increases. Apparently, fluorite reaches equilibrium in most groundwaters, justifying the control on F concentration in these waters (*Figure 2.3.F*).

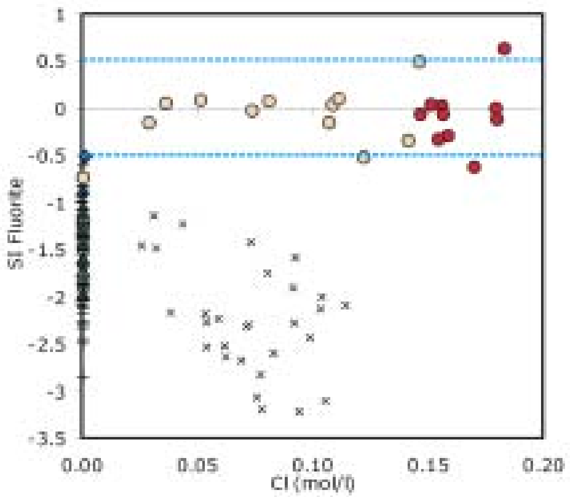

***Figure 2.3.F:** Saturation index of fluorite against Cl concentration. Fluorite seems to reach equilibrium in the most concentrated groundwaters. The dashed lines represent the uncertainty associated with SI calculations (Nordstrom & Jenne, 1977).*

Speciation-solubility calculations for the redox system

The available analytical data (measured dissolved Fe^{2+}, total Fe, total sulphide and sulphate concentrations) allow a standard redox pair calculation only for samples at 161.75 m (samples 5257 and 5259 to 5263) and 253.25 m depth (samples 5266 and 5268) in KSHO1A borehole. For these two depths there is also a continuous Eh logging which gives a stable Eh reading of –220 mV at 161.75 m and –210 mV at 253.25 m (see Appendix A). These data enable a comparison to be made between both approaches.

A temperature value is known only for the 161.77 m samples (7ºC). The temperature at 252.15 m has also been fixed at 7ºC for the speciation calculations. It is thought that this assumption does not affect negatively the final uncertainty, as it is smaller than the uncertainty associated with some redox pairs whose empirical calibration was carried out at 10ºC, Sweden's mean groundwater temperature, or even at 25ºC.

Because redox calculations do depend on pH and, as has been already indicated, there are significant differences between *in situ* and lab pH (see section 4.1.4, "Explorative Analysis"), they add an *a priori* extra uncertainty to the results of the redox pair calculations. To quantify this uncertainty, the following calculations have been performed at three different pH values: lab pH, *in situ* pH (8.1 at 161.75 m and 8.05 at 253.25 m; see Appendix A), and computed pH assuming equilibrium with calcite (see section 1.4).

Redox pairs calculations

Previous studies in "granitic" groundwaters from Sweden and Finland (Nordstrom and Puigdomenech, 1989; Smellie and Laaksoharju, 1992; Grenthe *et al.*, 1992; Glynn and Voss, 1999; Bruno *et al.*, 1999) have found that various iron and sulphur redox pairs/buffers are the most reliable couples controlling the redox state of these groundwaters. Therefore, for Simpervarp groundwaters the selected redox couples are the dissolved Fe^{3+}/Fe^{2+} and SO_4^{2-}/S^{2-} redox pairs and the heterogeneous $Fe(OH)_3$ /Fe^{2+}, pyrrhotite/SO_4^{2-} and pyrite/ SO_4^{2-} couples. Also, results with the Fe^{3+}-clay/Fe^{2+}-clay redox pair proposed by Banwart (1999) are tested.

Aqueous redox-active species in samples from KSH01A borehole at 161.75 m and 253.25 m depth are in sufficient concentrations for a successful Eh calculation. Total sulphide concentrations are low but above detection limit, with values between 4×10^{-8} to 3.4×10^{-7} mol/l (most of them $>10^{-7}$ mol/l); total iron concentration is between 2.3×10^{-5} and 3×10^{-5} mol/l, above the theoretical lower limit of iron concentration for a successful Eh measurement if iron pairs control the redox potential (10^{-6} mol /l, Grenthe *et al.*, 1992).

In these conditions, the dissolved Fe^{3+}/Fe^{2+} redox couple can in principle be used to estimate Eh numerical values (*Table 2.3.a*) but differences between total iron and Fe^{2+} concentrations are too small to obtain reliable figures. Calculated Eh values for all samples are always oxidizing and show an important sensibility to the pH value (*Table 2.3.a*).

Table 2.3.a*: Eh values obtained with different redox pairs/buffers for KSH01A at 161.75 m and 253.25 m depth (see the text for details).*

	pH	Fe^{2+}/Fe^{3+}	Fe^{3+}-clay/ Fe^{2+}-clay	$Fe(OH)_3/Fe^{2+}$ (total Fe^{2+} concentration)	$Fe(OH)_3/Fe^{2+}$ (calculated aFe^{2+})	SO_4/S^{2-}
161.75 m depth	Measured pH in laboratory (7.34-7.51)	181±18	-131 to 140.6	-284.9±10	-255±10	-188.6±3.5
	Calculated pH in equilibrium with calcite (7.7 –7.8)	130±11	-151.2 to -156.8	-343.6±5	-313.6±5	-210.9±3
	Measured pH in borehole (8.1)	73.9±11	-173.6	-404.2±2.3	-373.9±2.1	-232.7±1.5
253.25 m depth	Measured pH in laboratory (7.34-7.40)	195.9±4.1	-131 to 134.4	-275.3±5	-244.9±5	-184.3±4
	Calculated pH in equilibrium with calcite (7.8-7.9)	120.2±2.4	-166.7 to -162.4	-362.1±2.5	-332.1±2.5	-216.9±1.5
	Measured pH in borehole (8.05)	94.3±0.0	-170.8	-389.9±0.0	-359.9±0.0	-227.15±2

According to Grenthe *et al.* (1992), Eh values in Swedish groundwaters can be estimated with the $Fe(OH)_{3\,(s)}$/ Fe^{2+} heterogeneous redox couple,

$$Fe(OH)_{3\,(s)} + 3H^+ + e^- \leftrightarrow Fe^{2+} + 3H_2O,$$

by means of the equation

$$Eh = E_0^* - 2.303\, RT/F\, (3\, pH + \log\, [Fe^{2+}]), \qquad (1)$$

where E_0^* = 707 ± 59 mV at 10 ºC (the average Swedish groundwater temperature), F is Faraday constant (23.061 cal V^{-1} equivalent^{-1}), R is the gas constant (1.98717 cal deg^{-1} mol^{-1}) and T is the temperature (K). The E_0^* value determined by Grenthe *et al.* (1992) is based on a fit of equation (1) to Eh, pH and Fe^{2+} data from SKB groundwater studies at different sites. Equation (1) is usually employed to estimate Eh values from pH and Fe^{2+} concentration data (e.g. Smellie and Laaksoharju, 1992). For the fit, Grenthe *et al.* (1992) used Fe^{2+} concentration data corrected only for the $FeCO_3^0$ ion pair. But Fe^{2+} speciation is usually more complex than the simple correction made by these authors and, following Glynn and Voss (1999), in this study two sets of Eh values were calculated with equation (1), one considering Fe^{2+} analytical data and the other considering the Fe^{2+} species' activities obtained from the speciation-solubility calculations with WATEQ4F database.

Results with Fe^{2+} activities are around 30 mV higher than the Eh values obtained with Fe analytical data (*Table 2.3.a*; similar differences are obtained by Glynn and Voss, 1999 for Simpevarp groundwaters in SITE 94). The results obtained with this pair using the laboratory pH values are in close agreement with the *in situ* measured Eh values at both depths (-210 to -220 mV), more so if iron (II) activities are used (-245 to –255 mV; *Table 2.3.a*). But the pH sensitivity of this pair is very high, resulting in differences of around -100 mV between the previous calculations and those with the more reliable pH values, in equilibrium with calcite or the *in situ* pH value.

In summary, the Eh deduced from the $Fe(OH)_3/Fe^{2+}$ redox pair suggests more reducing conditions at both depths than the electrochemically measured in the borehole. These anomalous results can be related to the original calibration of the couple (from samples with Eh values below –200 mV) and with the natural variability of the $Fe(OH)_3$ (Fe^{3+} oxides and hydroxydes) involved in the process and/or changes in their crystallinity and its effects on the equilibrium constant.

An alternative approach to the computation of the redox potential with the $Fe(OH)_{3(s)}$/ Fe^{2+} pair is that of Bruno *et al.* (1999), using the thermodynamic data for two end members, crystalline and amorphous $Fe(OH)_3$. The results obtained with this approach, again using different pH values to asses the uncertainty, are shown in *Figure 2.3.G*. Obviously, without a detailed knowledge of the exact type of hydroxide involved and its crystallinity, this approach incorporates an additional uncertainty which, together with the pH uncertainty, broadens the Eh range from +30 to –240 mV. An excellent agreement between the redox potential obtained with the $Fe(OH)_3$ /Fe^{2+} pair and the *in situ* one is obtained if the amorphous hydroxide phase controls the pair at the pH measured in borehole (*Figure 2.3.G*).

The redox potential deduced from the SO_4/S^{2-} pair shows less sensitivity to pH variations, with differences smaller than 50 mV between approaches. Furthermore, the Eh values are very close to the in situ ones, especially when using also the *in situ* pH (or the calculated in equilibrium with calcite).

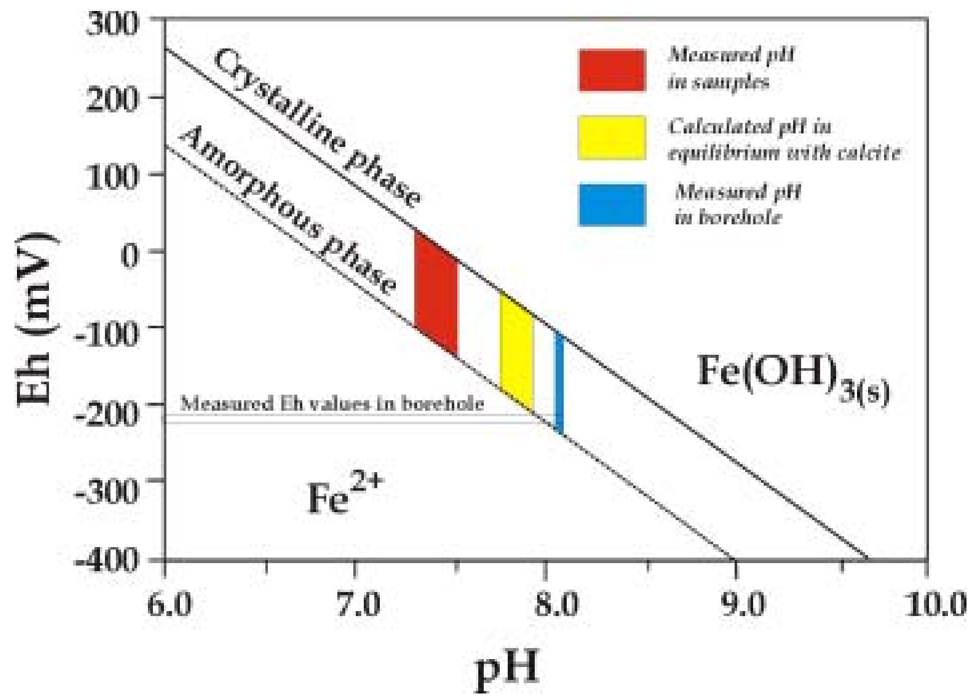

Figure 2.3.G: *Eh-pH diagram with $Fe(OH)_3(s)$/ Fe^{2+} phase boundaries for crystalline (log K=3) and amorphous (log K = 5) $Fe(OH)_3$ phases. The diagram has been drawn using data from the Palmottu natural analogue (Bruno et al., 1999) assuming a concentration of Fe^{2+} = 3·10-5 M. The coloured areas represent the pH ranges measured in KSHO1A borehole in samples from the 161.75 and 253.5 m depth intervals (both, in situ, blue, and in the lab, red), and those calculated assuming equilibrium with calcite (yellow). The uncertainty associated with the crystallinity of the solid phase and the pH uncertainty together give a maximum variation in the Eh of +30 to –240 mV. The in situ measured Eh is consistent with a control by the amorphous hydroxide phase at the pH measured in the borehole (i.e., the intersection of the "Amorphous phase" line and the blue band).*

Results obtained with the pyrite/SO_4^{2-} and pyrrhotite/SO_4^{2-} buffers from Bruno *et al.* (1999) are presented in *Figure 2.3.H*. Overall, the Eh values calculated with these pairs range from -210 to -270 mV and are not very sensitive to pH. This range is in fairly good agreement with the measured Eh.

Finally, results with the Fe^{3+}-clay/Fe^{2+}-clay redox pair proposed by Banwart (1999) have also been tested. This pair is based on the reversible one-electron transfer between oxidised and reduced smectites. For this reaction, the relation between conditional redox potential (Eh, V) and pH at 10ºC is defined by the equation

$$Eh = 0.280 - 0.056\ pH \quad (2)$$

The Eh values obtained with this pair (*Table 5.1.3.a*) are similar to the measures ones only when using the *in situ* measured pH values (or the pH values calculates assuming equilibrium with calcite), with a difference of only 50 mV.

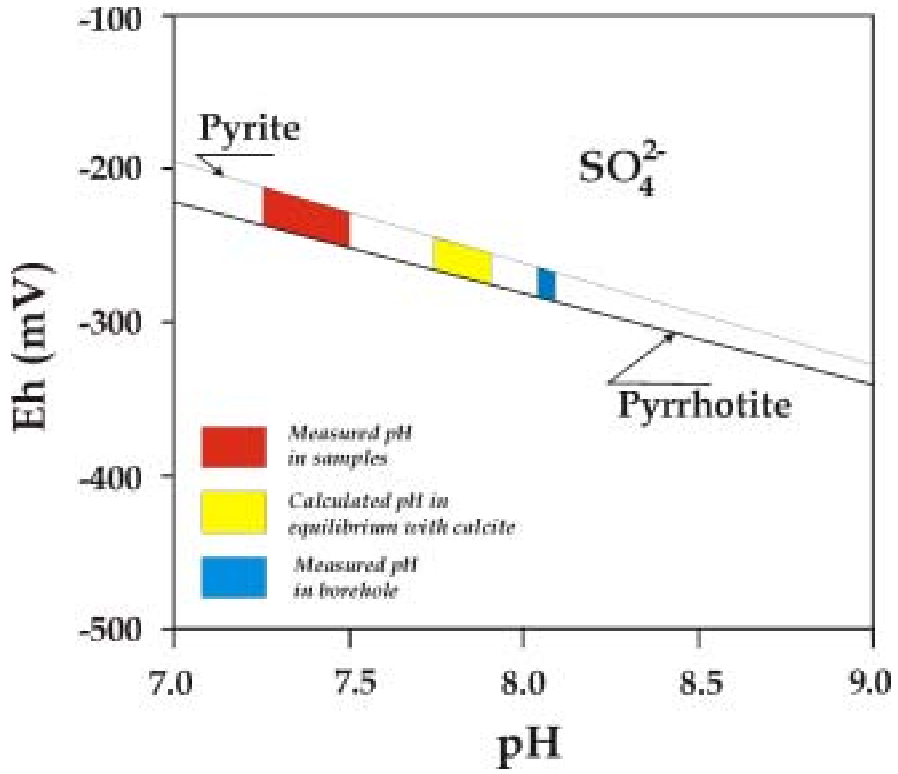

Figure 2.3.H: *Eh-pH diagram with SO_4^{2-}/pyrite and SO_4^{2-}/pyrrhotite phase boundaries for KSH01A saline groundwaters. Coloured areas show the pH ranges measured in situ at 161.75 and 253.5 m depth (blue), in the lab (red) and computed assuming equilibrium with calcite (yellow).*

This last result and the presence of several generations of Fe-rich chlorites and mixed-layer chlorite/smectite and chlorite/vermiculite clays as fracture fillings suggest the participation of ferrous clays in the control of the redox system. The verification of this hypothesis needs, however, more detailed geochemical studies and a more precise mineralogical characterization of the fracture fillings.

Solubility results for some iron (II) phases

Saturation states for different iron minerals were obtained for the KSHO1A waters at 161.75 and 253.25 m depths. The selected Eh values from electrochemical measurements (*Table 5.1.3.a*) are used in this speciation-solubility calculations. Saturation indexes for iron (II) minerals (such as siderite or iron sulphides) are insensitive to the Eh values as long as these values are below + 700 mV and as long as sulphide concentrations are specified (Glynn and Voss, 1999). Therefore, uncertainties in the electrochemical Eh values will not affect the saturation states of these minerals.

But, again, uncertainties in the pH value affect these solubility results. When considering the pH values measured in the lab the saturation indices of the important phases (siderite, rhodocrosite, sulphides and monosulphides) indicate a general subsaturation state with respect to all of them. When the calculations are repeated with the in situ pH values, the results change substantially, especially for the samples taken at 161.75 m depth.

For saline waters at 161.75 m, rodochrosite is always subsaturated and siderite is near equilibrium although this phase has not been identified in KSHO1A borehole. This equilibrium may be purely coincidental as the redox potential for the iron system is most likely buffered by suphides or iron-bearing oxides and oxyhydroxides. A similar situation has been reported by Banwart (1999) in the results of the Äspö Large-Scale Redox Experiment. Calculated amorphous FeS saturation indexes are in equilibrium for "FeS precipitate" using the WATEQ4F database, in agreement with the results obtained by Glynn and Voss (1999). Other monosulphides (mackinawite, pyrrothite) are slightly over or subsaturated and pyrite is always oversaturated.

For waters at 253.25 m depth only two samples with complete analytical data are available. Both samples show very similar Fe concentrations, but their sulphide concentrations are quite different (0.0063 y 0.0014 mg/l). This has its imprint in the saturation index of iron sulphides, which can be over or subsaturated. Only pyrite is oversaturated in both samples. Also, both samples are subsaturated with respect to rhodocrosite and siderite.

In summary, and taking into account the above commented uncertainties, these results emphasize the importance of sulfur redox pairs at these depths as sulphide minerals can buffer the redox state of the waters, specially at 161.75 m depth.

Speciation-Solubility results for uranium

Dissolved uranium data are available for samples at 161.75 m and 253.25 m depth. Uranium concentrations are similar at both depths, with values between 0.13 and 0.17 μg/l (except an anomalous value of 1.01 μg/l at 253.25 m depth).

Preliminary uranium speciation-solubility calculations have been performed for these samples using different thermodynamic databases: WATEQ4F, MINTEQ and LLNL (distributed with PHREEQC) and version 01/01 of NAGRA database (release 26-Aug-2002; Hummel *et al.*, 2002). The preferred electrochemically-measured Eh values at each depth are used for these calculations.

Calculations are performed with both lab and in situ pH values. The results suggest the the absolute value of each species change with pH but not so the distribution of species. Saturation indices of the most representative uranium minerals are also quite insensitive to pH variation (in the range considered here).

Uranium aqueous speciation for all the examined waters is dominated by U(IV) complex $U(OH)_4^0$. U(V) species (UO^{2+}) and U(VI) species (manly $UO_2(CO_3)_3^{4-}$ and $UO_2(CO_3)_2^{2-}$) have a secondary importance, with concentrations two or three orders of magnitude smaller than $U(OH)_4^0$.

Solubility results indicate that these waters are in equilibrium or near equilibrium with respect to different uranium minerals, depending on the chosen thermodynamic database.

UO_2 is near equilibrium with WATEQ4F and NAGRA databases while coffinite appears to be the controlling phase for LLNL and MINTEQ databases. There is no information on uranium minerals for KSHO1A borehole. However, the identified solubility-limiting phases are in good agreement with those obtained for Äspö groundwaters (Smellie and Laaksoharhu, 1992) and with the results of the Blind Prediction Modelling of the Palmottu system (Finland; Duro *et al.*, 1999).

Conclusions from redox calculations

The above results suggest that the redox state of the saline waters from the 161.57 and 253.25 m depth intervals in borehole KFM01A are buffered by the presence of iron oxides and hydroxides and by redox reactions between phyllosilicates. The lack of specific mineralogical data precludes a definitive confirmation of this conclusion. Nevertheless, the good match between the electrochemical and sulphur redox-pair Eh values points to sulphide minerals as the main redox buffers for the groundwaters at both depths, providing similar redox potential values. These reducing conditions are also suggested by the low and similar U concentrations at both depths.

The buffering of the sulphur system has also been identified in other Swedish and Finish groundwaters (Nordstrom and Puigdomenech, 1989; Glynn y Voss, 1999; Bruno *et al.*, 1999) and, together with the presence of dissolved sulphides, suggest the development of an anoxic-sulphidic environment mediated by sulphate reducing bacterias (SRB). Microbial analysis data are not available for KFM01A groundwaters but other lines of reasoning support the presence of this bacterial process.

The precipitation of typical sulphide minerals associated with the sulphidic environment is suggested by the equilibrium between the waters and several sulphide phases, as deduced from speciation-solubility calculations for waters at 161.75 m depth. No reliable conclusion can be forwarded about the 253.25 m depth interval due to the scarcity of samples. However, the concentration of dissolved Fe^{2+} at this depth is lower (1.27 to 1.34 mg/l) than at the shallower depth (1.4 to 1.74 mg/l; *Figure 1.4.L.b*), which is consistent with a process of precipitation of these phases.

Finally, available $\delta^{34}S$ data for waters from both depths (between 20.2 and 22.8 per thousand) show an enrichment with respect to values found in shallower bicarbonate waters (e.g. waters from borehole HSH02 with $\delta^{34}S$ values between 12.1-17.2 per thousand) and have values similar to those in some Finnish sites (*Figure 1.4.O*), that have been related to bacterial sulphate reduction (Haveman *et al.,* 1998; Snellman *et al*., 1998, Pitkanen *et al.,* 1998, 1999).

The absence of key analytical data (Fe, sulphide, methane, concentrations etc.) for the rest of the samples in the area rules out a better characterization of the sequence of redox conditions developed at depth.

2.4 Mass balance and mixing calculations

The inverse approach via mass balance and mixing calculations for tracking the hydrogeochemical evolution of the groundwaters in the Simpevarp has been carried out on the few available samples that have a complete and free of contamination analytical data set, consisting of five samples of fresh and non-saline groundwaters. As for saline waters, only samples from borehole KSH01A at 156.5-167 m and 245-261.5 m depth are available. No brackish water samples have been selected for the calculations.

As a consequence, the geochemical evolution path has only been calculated for two groundwater types with extreme hydrogeochemical characteristics and widely different apparent ages:(1) fresh, non-saline waters with a bicarbonate imprint, low residence times (tritium values above detection limit) and chloride concentrations from 11.8 to 131.8 mg/l (samples from HSH02 and HSH03 boreholes); and (2) saline waters with longer residence times (tritium values below detection limit) and chloride concentrations ranging from 5500 to 6300 mg/l (samples from KSH01A borehole).

This limitation, together with the scarcity of detailed mineralogical data and the lack of a hydrogeological model precludes the elaboration of a detailed evolutionary model for the groundwaters. Consequently, the results summarised in this section are to be understood as preliminary. They are mainly focussed in the analysis of saline waters, and based only on (i) general premises regarding the type of waters and reactive phases involved, and (ii) the inter-comparison with analogous systems (to select water end-members). The code PHREEQC (Parkhurst y Appelo, 1999) has been used for all mass balance and mixing calculations considering the following chemical and isotopic data: Cl, HCO_3^-, SO_4^{2-}, SiO_2, Ca, Mg, Na, K, Fe, S^{2-}, $\delta^{18}O$ and δ^2H.

Fresh non-saline groundwaters

These groundwaters have an important *a priori* water-rock interaction component, with an added marine contribution in the high-Cl members, as is the case in Forsmark (Laaksoharju *et al.*, in press). Mass balance and mixing calculations carried out following the methodology developed in Forsmark (Laaksoharju *et al.*, in press) confirm this hypothesis.

The evolution of the low-Cl waters from this group is dominated by the decomposition of organic matter, the dissolution of calcite, plagioclase, biotite and sulphides, and by Na-Ca exchange and precipitation of some phyllosilicates, all of them with very low mass transfers. High-Cl waters from this group could have, however, a small (< 10%) mixing contribution with a marine end member, but in general the reaction model is preserved. The lack of more detailed mineralogical data from the overburden and bedrock, and the lack of a hydrogeological model for the zone preclude more specific conclusions to be drawn; in consequence, no more efforts has been done to characterize these waters further.

Saline groundwaters

As already pointed out, these waters have a longer residence time and their general character indicates that mixing between multiple end-members is the principal mechanism controlling their chemistry. The role of water-rock interaction in these type of saline groundwaters in other Swedish and Finnish sites is much less important than the mixing process (e.g. Laaksoharju and Wallin, 1997; Pitkanen *et al*., 1999; Puigdomenech, 2001). To verify these general assumptions, the inverse modelling capabilities of PHREEQC to compute multiple end-member mixing proportions and reactions have been used. The mixing proportions are computed with respect to end-members of known composition and the reactions with respect to a predefined set of feasible solid phases. Each solution given by PHREEQC is term a model.

The chosen water end-members Rain 60, Litorina, Sea Sediment, Glacial Meltwater, and Brine, as have been used elsewhere in the Fenoscandian Shield. Additionally, the end-member Lake Water, used in M3 calculations for Simpevarp, has also been included for comparative purposes. The selection of this general end-members is useful to interpret the mixing processes under the general framework of all the Swedish sites.

Due to the lack of detailed bedrock mineralogical data, the feasible reacting solid phases include the most common phases used in similar systems elsewhere, supported additionally by the available information about fracture fillings.

Table 2.4.a shows the feasible phases separated into three reaction model sets. Also included in the table are additional minerals identified as fracture fillings that have been used to test their influence in the calculated mixing proportions. The detailed stoichiometry of phases like plagioclase, Fe-biotite and Fe-chlorite has been taken from similar systems in the Baltic Shield (e.g., Pitkanen *et al.,* 1999; Guimerá *et al.,* 1999), as no data are available for Simpevarp. As no aluminium data are available for the samples, nor SiO_2 data for the water end-members, the accuracy of the calculated mass transfers for aluminosilicate phases is limited. Exchange processes between Na, Ca, Mg and K have been modelled only in a general way.

Table 2.4.a: *Phases included in mixing and mass balance calculations for Simpevarp groundwaters.*

	Set 1	**Set 2**	**Set 3**
Main phases	Calcite, biotite (phlogopite end-member), plagioclase (An 0.38), illite, SiO_2, CH_2O, FeS, pyrite, $Fe(OH)_3$, Ca-Na-K exchange	Calcite, Fe-biotite, Fe-chlorite, plagioclase (An 0.38), illite, CH_2O, FeS, pyrite, $Fe(OH)_3$, Ca-Na-K exchange	Calcite, Fe-biotite, Fe-chlorite, plagioclase (An 0.38), illite, FeS, pyrite, $Fe(OH)_3$, Ca-Na-K exchange, bacterial sulphate reduction.
Additional minerals	Smectite, montmorillonite, laumontite, adularia, albite.		

From the end-members, used as initial waters, and from reactions with respect to a predefined set of solid phases, PHREEQC computes all the possible combinations of mixing and reaction that satisfy the chemistry of the final waters (the selected samples, see below). The reactions influence the mixing proportions and, besides, not all end-members are used by PHREEQC in all the solutions (models). Because the reactions influence the mixing proportions, with this approach one is forced to test a big number of feasible reactions in order to assess their control on the mixing proportions. The goal is to identify those end-members that appear in all the models, together with a measure of the variability in the mixing proportion from one model to the next.

Two saline samples from KSH01A borehole with different Cl concentrations have been selected for the calculations: sample number 5260 (156.5-167 m depth interval) with Cl = 5500 mg/l and sample number 5266 (245-261.5 m depth interval) with Cl = 6300 mg/l. As PHREEQC allows for analytical uncertainties, 5 to 10 % values are considered in calculations for all data except for $\delta^{18}O$ and δ^2H, with uncertainties of 0.1 and 1.0 units respectively.

Mixing proportions

As mentioned before, PHREEQC mass balance calculations find all the models (i.e., proportions of "initial" waters or end members) that match, by mixing and reaction, the chemical composition of the "final" water (selected sample). As a consequence, not all the models use all the predefined end members. This variability in the number of end-members affects the final mixing proportions and increases the range of mixing proportions for a particular sample. Reactions, even with the present uncertainties and with elevated mass transfers, appear to be of secondary importance in the results.

To simplify the presentation of results, these have been organized attending to the meteoric end-members that appear in each PHREEQC model (Rain, Lake Water, or both).

Sample 5260. For this less saline groundwater all the models found by PHREEQC include four or five end-members. Irrespective of the phases and reactions chosen, all the models include both the Glacial Meltwater and Brine end members. The Brine end member is common to all models and its proportion is very similar in all of them. These results do not depend on the number of end members or the set of phases and reactions chosen. Mixing proportions of the Glacial end member (which also appears in all the models) is more sensitive to the type of meteoric end member included in the model, ranging from 29 (with Rain) to 49 % (with Lake Water; see *Table 2.4.b*).

Most of the tabulated models do not have both Litorina *and* Sea Sediment as end members simultaneously. The very few models that do include *both* end members, have a sum (Litorina + Sea Sediment) that is of the same order as the individual contributions shown in *Table 2.4.b* for each separated end member. Litorina, when appearing as an end-member, has a mixing proportion below 10 %, whereas Sea Sediment can reach a 18% in models without Litorina.

Table 2.4.b: *Mixing proportions obtained by PHREEQC for sample 5260. The models have been separated into those with the two meteoric end members (Lake water y Rain 60), and those with only one of them (either Lake Water or Rain 60). The mixing proportions of Litorina and Sea Sediment are highlighted to stress that they do not appear together in the same model (see the text for details).*

	Models with Rain	**Models with Rain and Lakewater**	**Models with Lakewater**
Brine	7.6-10.2	9.2-10.5	7.5-10.6
Glacial	29.1-38.3	33.6-42.1	46.3-48.9
Litorina	***0.0-9.7***	***0.0-9.3***	***0.0-8.9***
Sea Sediment	***0.0-18.2***	***0.0-17.0***	***0.0-13.8***
Rain 60	36.0-54.0	17.4-36.6	0.0
Lake water	0.0	5.3-23.6	27.6-35.0

Table 2.4.b. shows the mixing proportions obtained in models with two meteoric end members, Lake Water and Rain 60, and in models that only include one of them (models with Rain 60 and models with Lake Water) in order to asses the importance of these end members in the mixing proportions. The total mixing proportion of the meteoric end-members (Rain 60 + Lake Water) in the model with both end-members ranges from 30 to 40%, similar to the values of Rain-60 and Lake Water in those model with only one of the two meteoric end-members.

Sample 5266. This is a more saline sample (Cl= 6300 mg/l). The results, similar to those of sample 5260, are shown in *Table 2.4.c*. Again, all the models found by PHREEQC include the end members Brine and Glacial, and *most* of them also include alternatively Litorina or Sea Sediment. Mixing proportions for Brine are very stable (between 9.5 and 11.8%), less so for the Glacial end member (between 33 and 51 %) due to the effects of the meteoric end member(s) included in the model. The total mixing proportion of the meteoric end-members (Rain 60 + Lake Water) ranges from 30 to 40% in the models with both end-members, again similar to the mixing proportion of each meteoric end-member in the model with only one of them.

Compared to previous sample, the mixing proportions of Brine and Glacial end-members tend to be higher, but with a broad overlap in their ranges. Considering the associated uncertainties, this difference in not significant.

Table 2.4.c: *Mixing proportions obtained by PHREEQC for sample 5266. The models have been separated into those with the two meteoric end members (Lake water y Rain 60), and those with only of them (either Lake Water or Rain 60). The mixing proportions of Litorina and Sea Sediment are highlighted to stress that they do not appear together in the same model (see the text for details).*

	Models with Rain	**Models with Rain and Lakewater**	**Models with Lakewater**
Brine	9.6-11.5	9.5-11.5	9.5-11.8
Litorina	***0.0-8.2***	***0.0-7.4***	***0.0-7.5***
Sea Sediment	***0.0-17.4***	***0.0-14.9***	***0.0-13.7***
Rain 60	28.7-49.5	17.5-35.1	---
Glacial	33.0-41.7	36.4-44.8	45.3-51.1
Lake water	---	4.6-14.2	20.8-32.4

Results of heterogeneous reactions

As a general comment, the results obtained with the selected phases and reactions can be considered as “reasonable” if we take into account the actual knowledge of the system and the scoping character of the calculations. Mass transfers for exchange reactions are usually high, as is the case for mass balance an mixing calculations when paths are poorly defined (e.g. Pitkannen *et al.*, 1999). Three sets of phases and reactions have been considered.

Set 1. For set 1, all the models point to the presence of organic matter decomposition; dissolution of plagioclase, biotite, and Fe $(OH)_3$; precipitation of calcite, illite, SiO_2 phases (or, alternatively, phyllosilicates) and iron sulphides; and ionic exchange (mainly Na-Ca).

Set 2. The addition of more Fe-bearing mineral phases in set 2 (Fe-chlorite and Fe-biotite) gives more variability to the models. Nevertheless, they generally predict decomposition of organic matter; dissolution of plagioclase, Fe-biotite, Fe-chlorite, and, in some cases, Fe $(OH)_3$; precipitation of calcite, illite and iron sulphides; and ionic exchange of Na and Ca. The precipitation of aluminosilicates occurs in some of the models.

<u>Set 3</u>. In this set bacterial sulphate reduction was explicitly included through the reaction

$$SO_4^{2-} + 2(CH_2O) + OH^- \Leftrightarrow HS^- + 2HCO_3^- + H_2O\,, \qquad (1)$$

The results are consistent with the actuation of this process. Furthermore, the addition of reaction (1) does not produce significant changes in the rest of predicted mass transfers which continue to be very similar to those in set 2. It is worth mentioning that, in spite of the mixing proportions, many of the models predict the precipitation of sulphides (pyrite or monosulphides), independently of other phases as sources or sinks of iron in the mass balance calculations ($Fe(OH)_3$, Fe-biotite or Fe-chlorite).

Discussion

The mixing proportions obtained by PHREEQC strongly depend on the number of end members entering the model, and to a lesser amount, on the set of selected reactions.

Brine and Glacial are the only end members that appear in *all* models, the former with a smaller variation range. The Glacial end member is generally the most abundant and shows up to a 20% variation in mixing proportion (30-50%) depending on the meteoric end-member in the model.

Rain 60 and Lake Water do not appear together in a subset of the models, but they do appear together in the other subset. In this case, the total mixing proportion of meteoric water (Rain + Lake Water) ranges from 30 to 40%, similar to the individual mixing proportion of each meteoric end-members in models where only one of the two appear.

Sea Sediment and Litorina behaves in a similar way as Rain 60 + Lake Water: One subset of the models includes only one of the two, and the other subset, minority, includes both end-members. The total contribution of both end-members is low (13-17% for Sea Sediment and <10% for Litorina). All the models have, at least, one of these marine end-members.

The mixing process seems to be a combination of a saline end-member (Brine) with several "dilute" end-members. Among these dilute end-members, Glacial Meltwater is always present, with a contribution of 30-50%, together with a meteoric end-member with a similar contribution. The presence of a marine end-members (Litorina or Sea Sediment) is not clear because they always appear in low proportion (< 17%).

Comparison with M3 results

The inverse geochemical modelling performed with PHREEQC and the multivariate approach of M3 can not be compared directly. M3 is a tool based on PCA analysis that quantifies mixing proportions without considering heterogeneous reactions (the contribution of reactions is deduced *after* mixing proportions have been calculated). M3 assigns to each sample a mixing ratio that depends on the number and type of end-members used during the PCA step. PHREEQC uses a classical inverse modelling approach where, apart from the mixing end members, a set of reacting mineral phases have to be defined in advance. Furthermore, not all the end members must contribute to the mixing budget of a sample.

Taking into account these differences, it is possible to compare M3 and PHREEQC results because the same mixing end members have been used. The mixing proportions predicted by M3 for sample 5260 from KSH01A borehole at 156.5-167 m depth and for sample 5266 (same borehole, but at 245-261.5 m depth) are shown in Table 2.4.d. These results are compared only with those PHREEQC models that include both Rain and Lakewater in order to put the results of both codes in the same footing.

Table 2.4.d: *Variation ranges in the mixing proportions as computed by PRHEEQC (for models with Rain and Lakewater) and M3 for Simpevarp saline groundwaters.*

	Sample 5260 at 161.75 m		Sample 5266 at 253.25 m	
	PHREEQC	M3	PHREEQC	M3
Brine	9.2-10.5	9.5	9.5-11.5	10.8
Glacial	34.0-42.1	46.02	36.4-44.8	51.7
Litorina	0-9.3	9.5	0.0-7-4	9.4
Sea Sediment	0-17.0	9.5	0.0-14.9	9.4
Rain 60	17.4-36.0	16.0	17.5-35.1	9.4
Lake water	5.3-13.6	9.5	4.5-14.2	9.4

As can be observed, M3 also identifies the Glacial end member as the dominant one, but with a value of mixing proportions somewhat higher. Rain-60 mixes in a proportion of 16%, a value somewhat smaller than the range predicted by PHREEQC. The mixing proportions calculated by M3 for the rest of the end members are low (<10%), below the detection limit of the method (e.g. Laaksoharju y Wallin, 1997). PHREEQC also predicts low contributions for these end-members.

Conclusions

Fresh, non-saline groundwaters. Their chemistry is controlled only by water-rock interaction processes for the low-Cl members. The identified heterogeneous reactions are: organic matter decomposition, dissolution of calcite, plagioclase biotite and gypsum (or sulphides), and Na-Ca exchange and precipitation of some phyllosilicates, all of them with very low mass transfers. The high-Cl members (131.8 mg/l) could show a small contribution from mixing with a marine end member.

Saline groundwaters. Their chemistry is mainly controlled by mixing with multiple end members. Brine and Glacial are the only end members that appear in *all* PHREEQC models, the former with a smaller variation range. The Glacial end member is generally the most abundant and shows up to a 20% variation in mixing proportion (30-50%) depending on the meteoric end-member that the model includes. The use of two meteoric end-members increases the variability of their mixing ratios, but the lumped contribution remains similar, of the order of 30-40%. A marine end member (Litorina or Sea Sediment) appears in all models, although always in low proportions, especially Litorina (< 10%). Taking into account all the uncertainties, the actual presence of a marine end-member cannot be demonstrated.

The differences in mixing proportions between the two saline samples (with different Cl concentrations) selected for these calculations are small. At most, the high-Cl sample tends to show a somewhat bigger contribution of the Glacial and Brine end members, but this difference can be considered as not significant due to the uncertainties associated with the selection of the reacting phases.

In summary, the mixing process seems to be a combination of a saline end-member (Brine) with several “dilute” end-members. Among these dilute end-members, Glacial Meltwater is always present, with a contribution of 30-50%, together with a meteoric end-member with a similar contribution. The presence of a marine end-members (Litorina or Sea Sediment) is not clear because they always appear in low proportion (< 17%).

These results appear to agree with the model presented by Luukkonen (2001) for Äspö groundwaters at similar depths (see also Figure 19 in Puigdomenech, 2001). In Luukkonen’s model, the Glacial end member shows a mean mixing proportion of 30% with a maximum contribution of around 50-60%. The corresponding contribution of Sea Sediment and Litorina are usually below 10% but can reach 20%. The meteoric contribution is of the order of 20-40% and the Brine contribution is between 10 and 15%. These similarities are significant, even surprising, taking into account that the reference waters and the methodology use by Luukkonen (2001) are different.

The heterogeneous reactions identified during the mixing processes include organic matter decomposition, dissolution of plagioclase, biotite and Fe-chlorite (or $Fe(OH)_3$), precipitation of calcite, illite and SiO_2 phases (or phyllosilicates), the possible actuation of bacterial sulphate reduction processes with the simultaneous precipitation of iron sulphides, and, finally, the ionic exchange between Na and Ca.

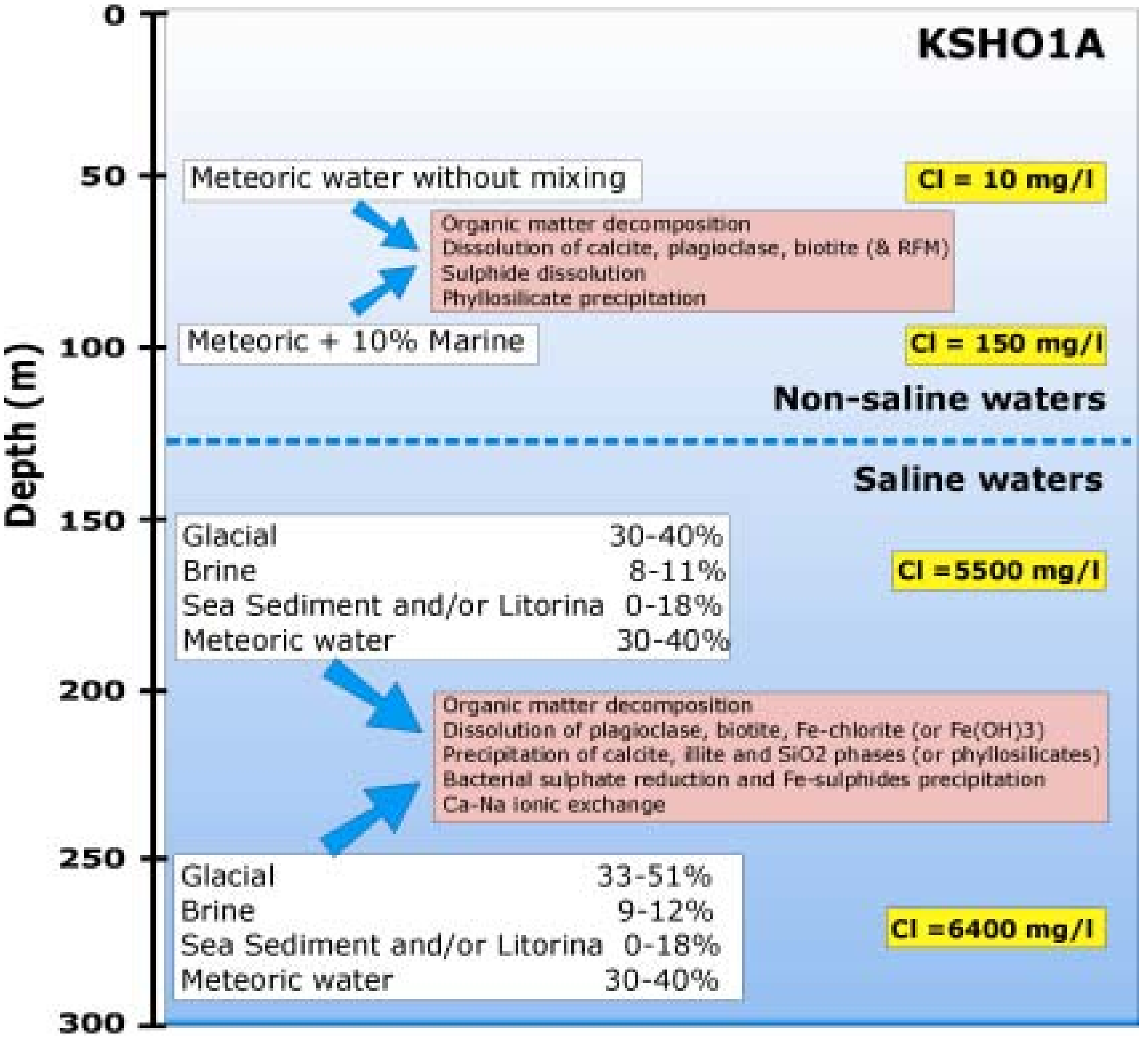

Figure 2.4.A. Summary of the mixing proportions and chemical reactions calculated with PHREEQC.

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Appendix A: Continuous logging of physicochemical parameters in borehole KSH01A and selection procedure of a representative Eh value at different depths

A.1 Introduction

For this work continuous logging of Eh (mV), pH, temperature (°C), conductivity (mS/m) and dissolved oxygen (mg/l) at two different depth ranges (156.5-167 m, thereafter the "shallow" depth interval, and 245-261.5 m, thereafter the "deep" depth interval) in borehole KSH01A have been used.

The Eh measurements where taken following in part SKB methodology. This methodology allows the continuous and simultaneous measurement of the Eh with three different electrodes (platinum, carbon and gold), both downhole and at the surface, for long periods of time (months). Due to technical problems during *in situ* logging only the *surface* Eh measurements taken with two of the three electrodes (Pt and C) at the two above-mentioned depth ranges are available, and the analysis presented here is based on this reduced data set. pH, conductivity and dissolved oxygen were also only measured at the surface and, for the dissolved oxygen, only at the shallow depth range. Temperature was measured *in situ*, but again only in the shallow depth interval.

All data have been extracted from SICADA database. The time columns from SICADA (year, month, day, hour, minutes and seconds) have been converted to a single time column expressed in hours, where t=0 corresponds to the starting time of the logging session. This simplifies the graphical representation of the data and facilitates the comparison of stabilization times.

In the following sections an analysis of the Eh and pH values for each depth is carried out, using the evolution of the remaining physicochemical parameters as background information. Temperature has not been included because (i) only data for the shallow depth are available (7ºC), and (ii) its value is constant throughout the logging period and therefore do not influences the evolution of Eh and pH.

A.2 Redox potential measurements

The evolution of the Eh values measured with the platinum (Eh_{Pt}) and the carbon (Eh_C) electrodes for each depth interval has been plotted in *Figures A.2.1* (shallow interval) and *A.2.2* (deep interval). Overall, Eh measurements tend quite fast to a stable value, reaching it after 200-300 hours of logging time.

The carbon electrode has a shorter stabilization time, specially in the deep interval (*Figure A2.2*). This is in contrast with laboratory data by Grenthe *et al.* (1992), where the platinum electrode has a shorter stabilization time.

Apart from this, the stabilized value registered by both electrodes is very similar, although some second order effects are present in the shallow depth interval, which would be discussed later.

Once both electrodes give a stabilized reading after 200-300 hours, it remains approximately constant until the end of the logging session (again with minor fluctuations in the case of the shallow depth interval). This stability suggest that the surface Eh measurements have not been contaminated with atmospheric oxygen.

A.2.1 Shallow depth interval (156.5-167 m)

At this depth the logging of all parameters was interrupted during 100 hours starting at 180 h (*Figure A.2.1*). Before this data gap, redox potential values were changing quite rapidly. If we compare the reading at *t*=180 h (just before the gap) and at *t*=280 h (just after the gap), we observe similar values, meaning that at *t*=180 h the electrodes were already reaching a stationary state. This behaviour is also displayed by pH (Figure A.3.1) and conductivity, with almost stable values when the data gap starts. Dissolved oxygen values stabilise very rapidly, and after 10 h of recording time they are already constant down to undetectable levels. In summary, after 300 hours all parameters have reached a stationary state.

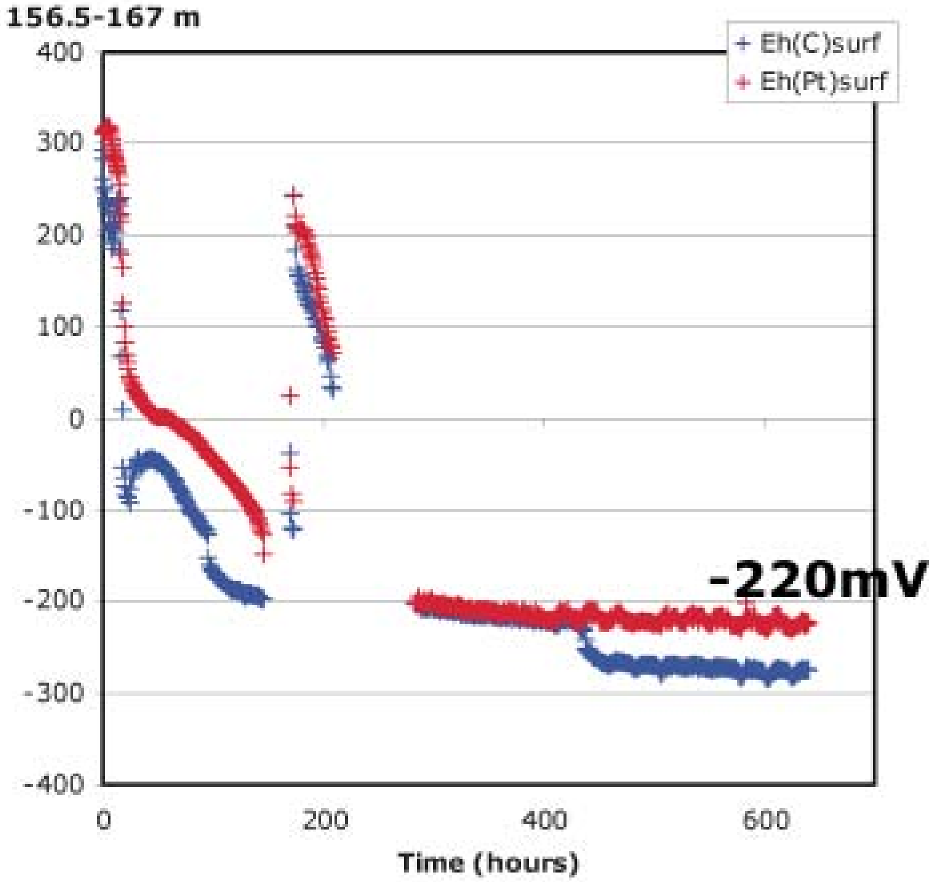

Figure A.2.1: *Redox potentials measured on surface with C and Pt-electrods as a function of time, in KSH01A at 156.5-167m depth.*

The stabilised Eh value registered by the Pt and C electrodes is almost identical (-200 mV to -220 mV) from *t*=300 h until *t*=450 h (*Figure A.2.1*). From this time on the Pt electrode continues to give a constant reading (-220 mV) but the C electrode Eh values suffer a fast decrease to around -280 mV, maintaining this reading until the end of the recording.

The Eh step measured by the C electrode is not correlated with a similar sudden change in any other parameter, making it difficult to ascertain the cause of the step. Because of this, it is safer to use the Eh reading of the Pt electrode (-220 mV) as the recommended stabilized Eh value at the shallow depth interval.

The redox couple potentials calculated for the water samples from this depth agree reasonably well with this stabilized value, in particular the SO_4^{2-}/S^{2-} couple (see section 2.3).

A.2.2. Deep depth interval (245-261.5 m)

This log also has a data gap, although smaller (between 400 and 450 h, *Figure A.2.2*), affecting all measured parameters. The interruption has taken place after the stabilization time and do not affect the readings recorded after the gap.

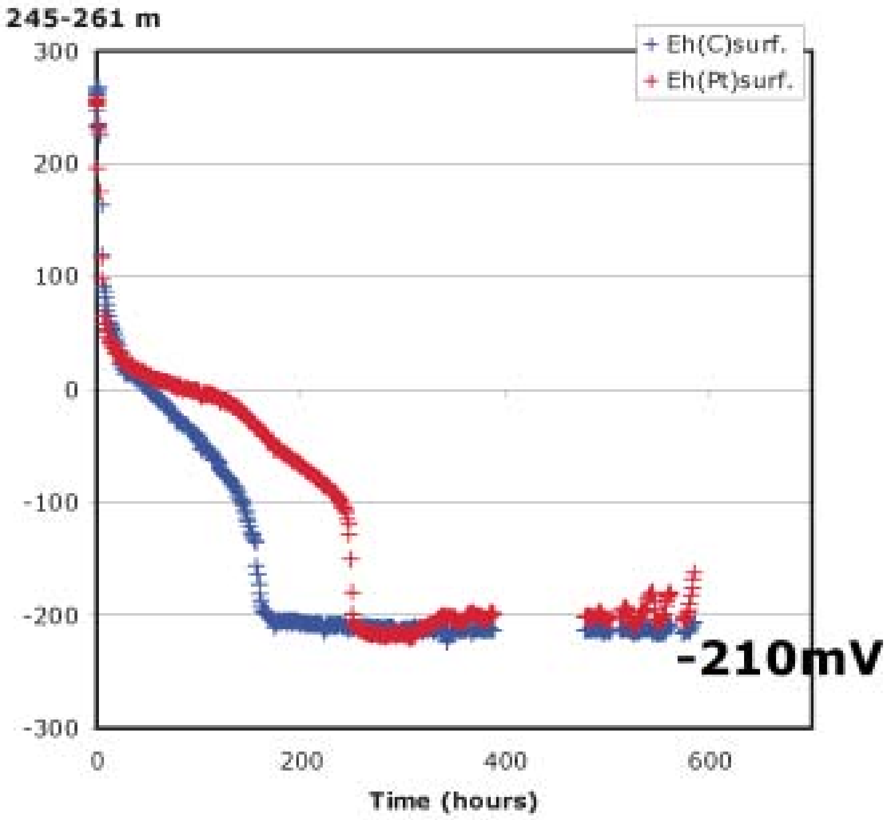

Figure A.2.2: *Redox potentials measured on surface with C and Pt-electrods as a function of time, in KSH01A at 245-261.5m depth.*

The Eh reading stabilises quite fast for both electrodes: after 170 h for the C electrode and after 250 h for the Pt electrode (*Figure A.2.2*). From this time on the readings are constant and coincident (around -210 mV). After the gap the Pt electrode reading is noisier, specially at the end of the recording time. Although these fluctuations in the Eh value recorded by the Pt electrode are small, we have selected the stabilised value given by the C electrode (-210 mV) as the representative Eh at this depth. Again, potential values calculated from redox couples (SO_4^{2-}/S^{2-}) agree with the potentiometric ones (see the discussion in section 2.3).

A.3 pH measurements

The pH readings at both depths reach a stable value before 100 hours and they are not affected by the logging gaps (*Figures A.3.1.a and A.3.1.b*). In the shallow depth interval the stable pH value fluctuates between 8.0 and 8.2 (average 8.1) and in the deep depth interval it fluctuates between 8.0 and 8.1 (average 8.05).

The *in situ* values differs significantly from the pH values measured in samples taken from both depths and analysed in the laboratory. Samples from the shallow interval have a pH between 7.34 and 7.51, which are at least 0.6 pH units lower than the *in situ* ones. The samples from the deep interval (#5266 and #5268) have pH values of 7.34 and 7.40 (7.27-7.41 if we include other not chemically analysed samples from this depth), again 0.6 pH units lower than the *in situ* values.

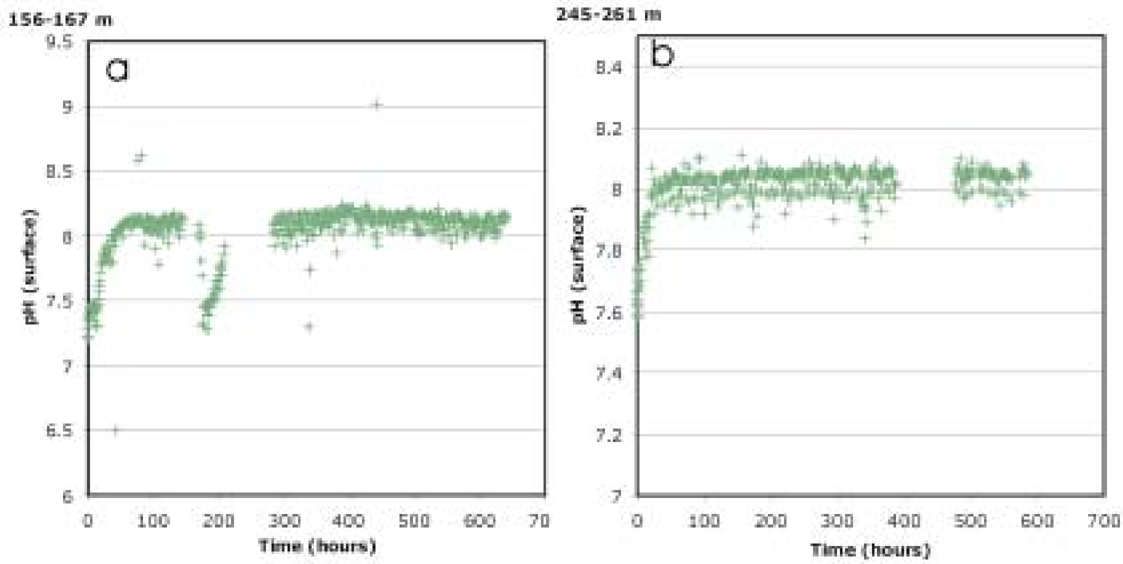

Figure A.3.1: *pH measured on surface with as a function of time, in KSH01A at 156.5-1670m depth (a) and 245-261.5m depth (b).*

Computed pH values assuming a CO_2 concentration in equilibrium with calcite (see section 1.4) are very similar to the *in situ* ones, giving values between 7.71 and 7.8 for the shallow samples and between 7.87 and 7.9 for the deep samples.

Differences bigger than 0.5 pH units between *in situ* and lab measurements suggest a faulty lab value (and not the opposite). The source of the discrepancy could be a CO_2 exchange with the atmosphere. This uncertainty will propagate into the speciation-solubility calculations (see section 2.3).

Appendix 3

Explorative analysis, M3 calculations and DIS modelling

Contribution to the model version 1.1

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Contents

1. Conceptual postglacial model of the Simpevarp site

The first step in the groundwater evaluation is to construct a conceptual postglacial scenario model for the site based on known paleogeological events. This model can be helpful when evaluating data since it gives constrains to the possible groundwater types that may occur. The glacial/post-glacial events that might have affected the Simpevarp site are described below (information compiled from Björck, 1995; Laaksoharju et al., 1999 c,d) and illustrated in Figure 1.

- When the continental ice was formed 100,000BP permafrost formation could take place at a depth of several hundred meters which concentrated the existing groundwater by freezing (Bein and Arad, 1992). The water formed had a higher density and could sink to the depth containing a water with the same salinity and density.
- When the continental ice melted and retreated, glacial meltwater was hydraulically injected under considerable head pressure into the bedrock (>13,000BP). The exact penetration depth is still unknown, but a depth exceeding several hundred metres is possible according to hydrogeological modelling (Svensson, 1996).
- Different non-saline and brackish lake/sea stages then covered the Simpevarp site (13,000BP – 4,000BP). Of these only a dense brackish sea water such as Yoldia (Yoldia represents a relative short time period and the effects may be difficult to trace) and Litorina Sea water could penetrate by density overturn and affect the groundwater in the more conductive parts of the bedrock. The density of the intruding sea water in relation to the density of the groundwater determined the final penetration depth of the sea water. The Litorina Sea stage (8,000 to 2,000BP) contained the most saline groundwater (twice the salinity of modern Baltic Sea water) and this water was supposed to have the deepest penetration depth. The result was that the glacial and brine groundwaters in the bedrock were affected by intruding brackish marine water.
- When Simpevarp site subsequently rose above sea level a freshwater pillow of meteoric recharge water developed on top of the saline water because of its low density. The continuous land rise increased the hydraulic driving force so that the groundwaters in the upper part of the bedrock were flushed out gradually. This flushing started directly after deglaciation and, since this part of the bedrock had already risen above sea level, the postglacial marine water at these locations did not affect the groundwater composition.

Many of the natural events described above are repeated during a repository lifespan of hundred of thousands of years. As a result of the described sequence of events, brine, glacial, marine and meteoric groundwaters are expected to be mixed in a complex manner at various levels in the bedrock, depending on the hydraulic character of the fracture zones, groundwater density variations and tunnel construction activities prior to groundwater sampling. For the modelling and based on the conceptual model of the site end-members reflecting e.g. glacial meltwater and Litorina Sea water composition were added to the data set (see Table 3-1).

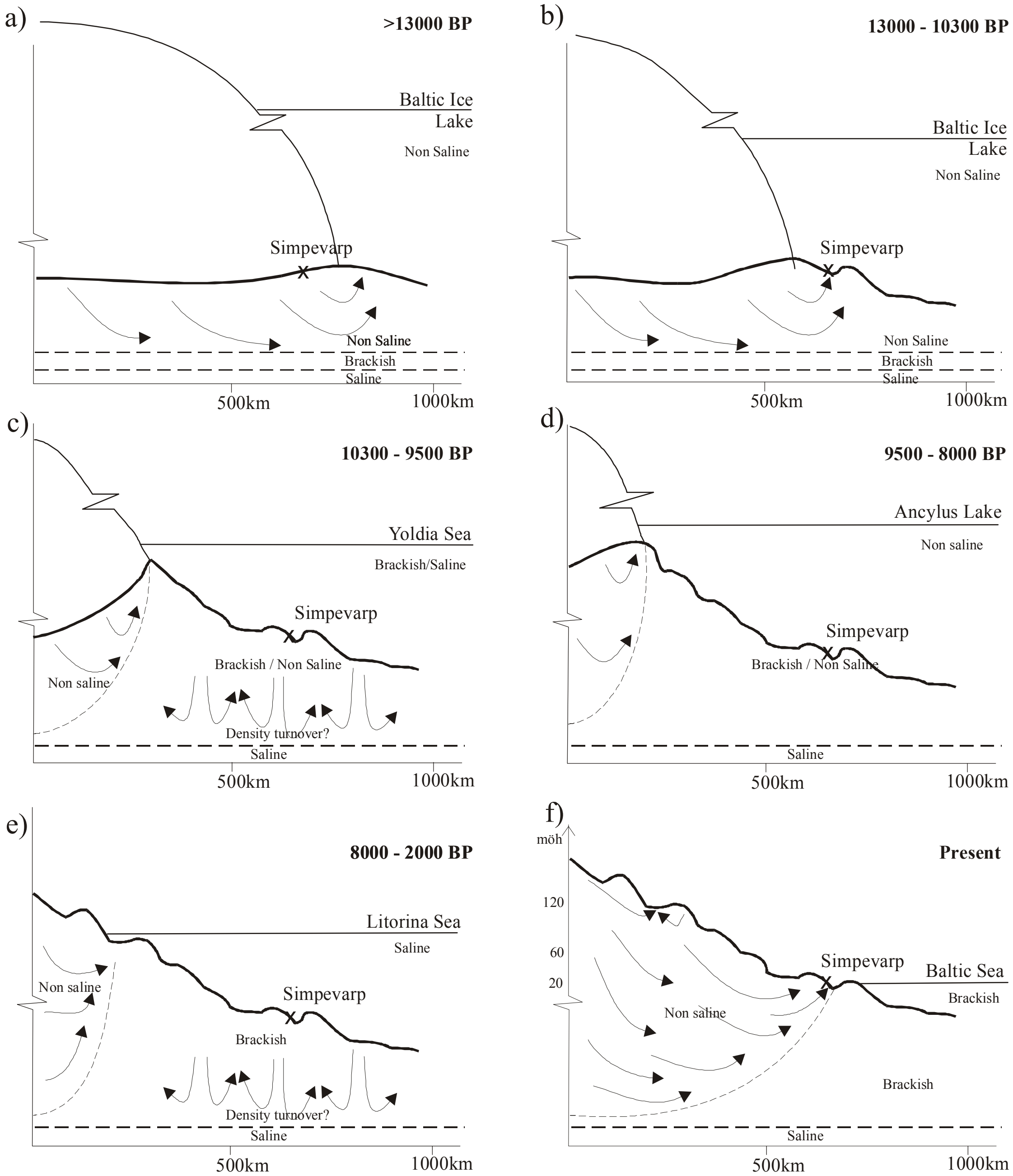

***Figure 1**: A conceptual postglacial scenario model for the Simpevarp site. Possible relation to different known post-glacial stages and land uplift which may have affected the hydrochemical evolution of the site is shown a) Glacial stage. b) Baltic Ice Lake stage, c) Yoldia Sea stage, d) Ancylus Lake stage, e) Litorina Sea stage and f) present day Baltic Sea stage, after Laaksoharju et al., 1999c. From this conceptual model it is expected that water affected by glacial meltwater and various Sea water stages such as Yoldia Sea, Litorina Sea and modern Baltic Sea water could affect the groundwater at the Simpevarp site.*

2. Explorative analysis

A commonly used approach in groundwater modelling is to start the evaluation by explorative analysis of different groundwater variables and properties. The next phase often includes a groundwater classification based on the salinity or major constituents of the groundwater. The effects from the major water rock interactions are modelled using some of the standard mass-balance codes.

2.1 AquaChem evaluation

This section gives examples of how classical geochemical evaluation and modelling can be applied on site data by using the computer code AquaChem. The starting point is scatter plots where the data set is examined see Figure 2 and Figure 3, followed by classification in Figure 4. Water type classification of the Simpevarp samples are shown in Appendix 1.

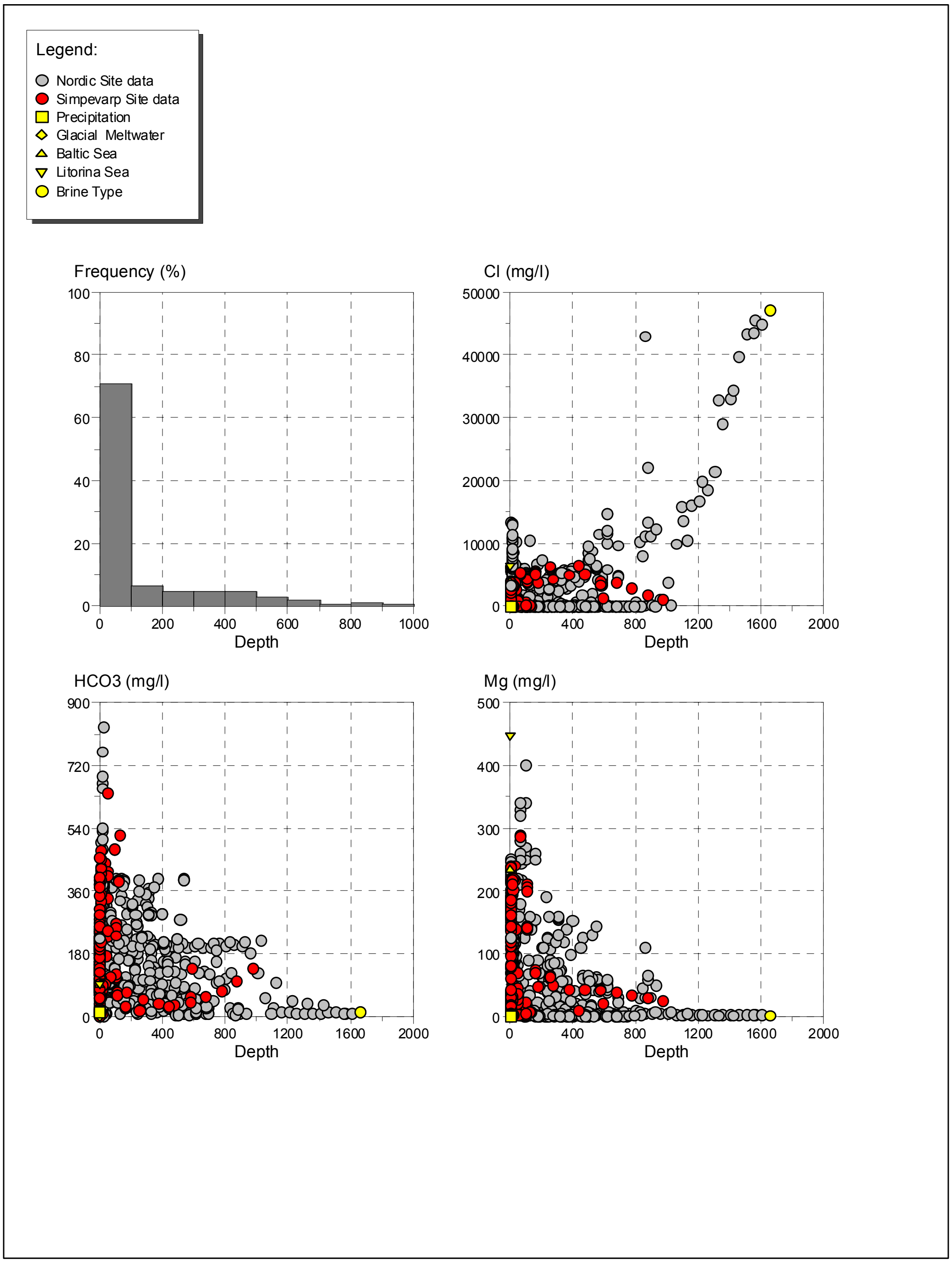

Figure 2: *The frequency of the Cl samples, Cl/depth, HCO_3/Depth and Mg/depth are plotted for the Simpevarp data using AquaChem.*

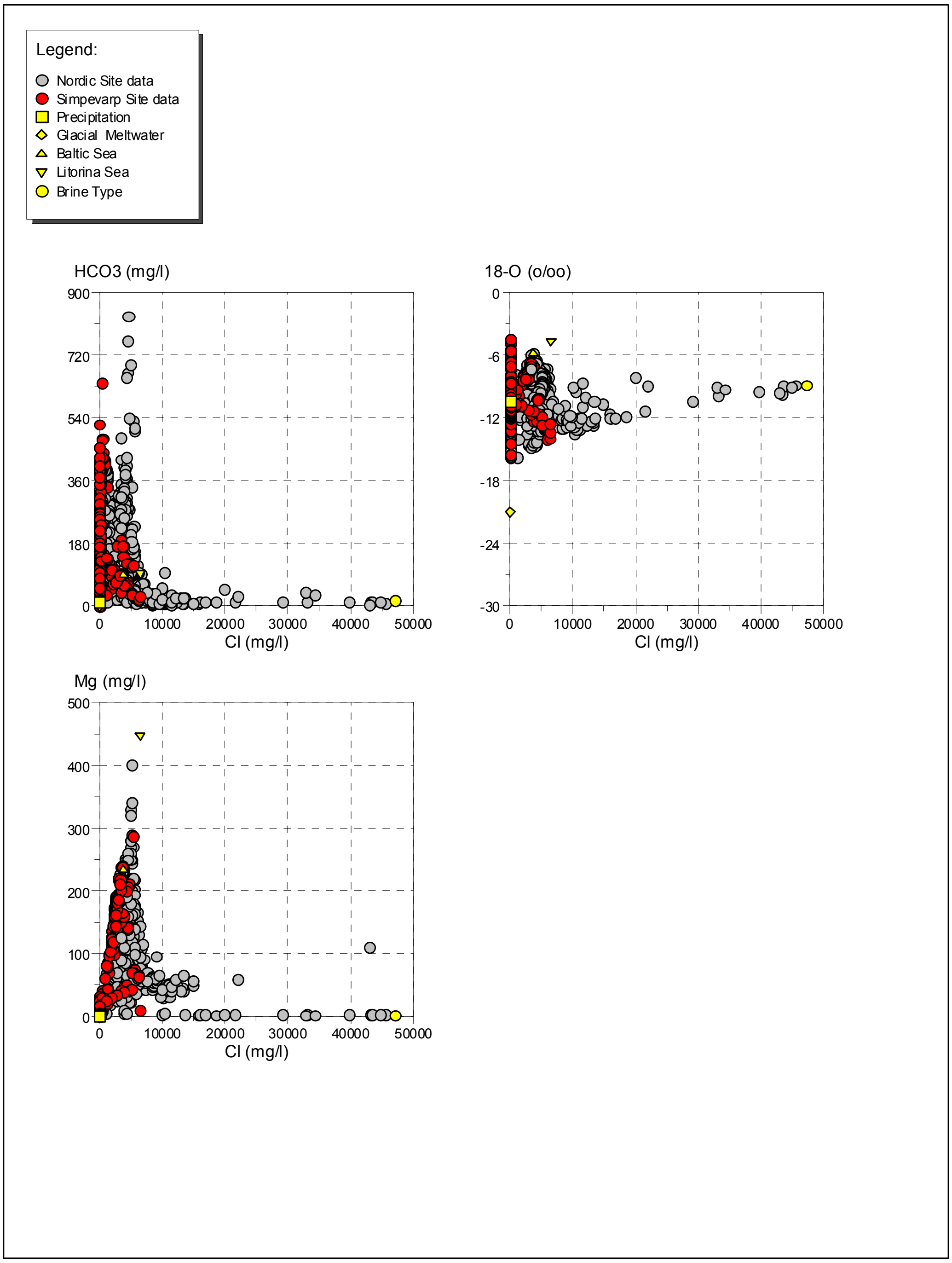

Figure 3*: The HCO_3/Cl, pH/Cl, Oxygen-18/Cl and Mg/Cl are plotted for all Simpevarp data using AquaChem.*

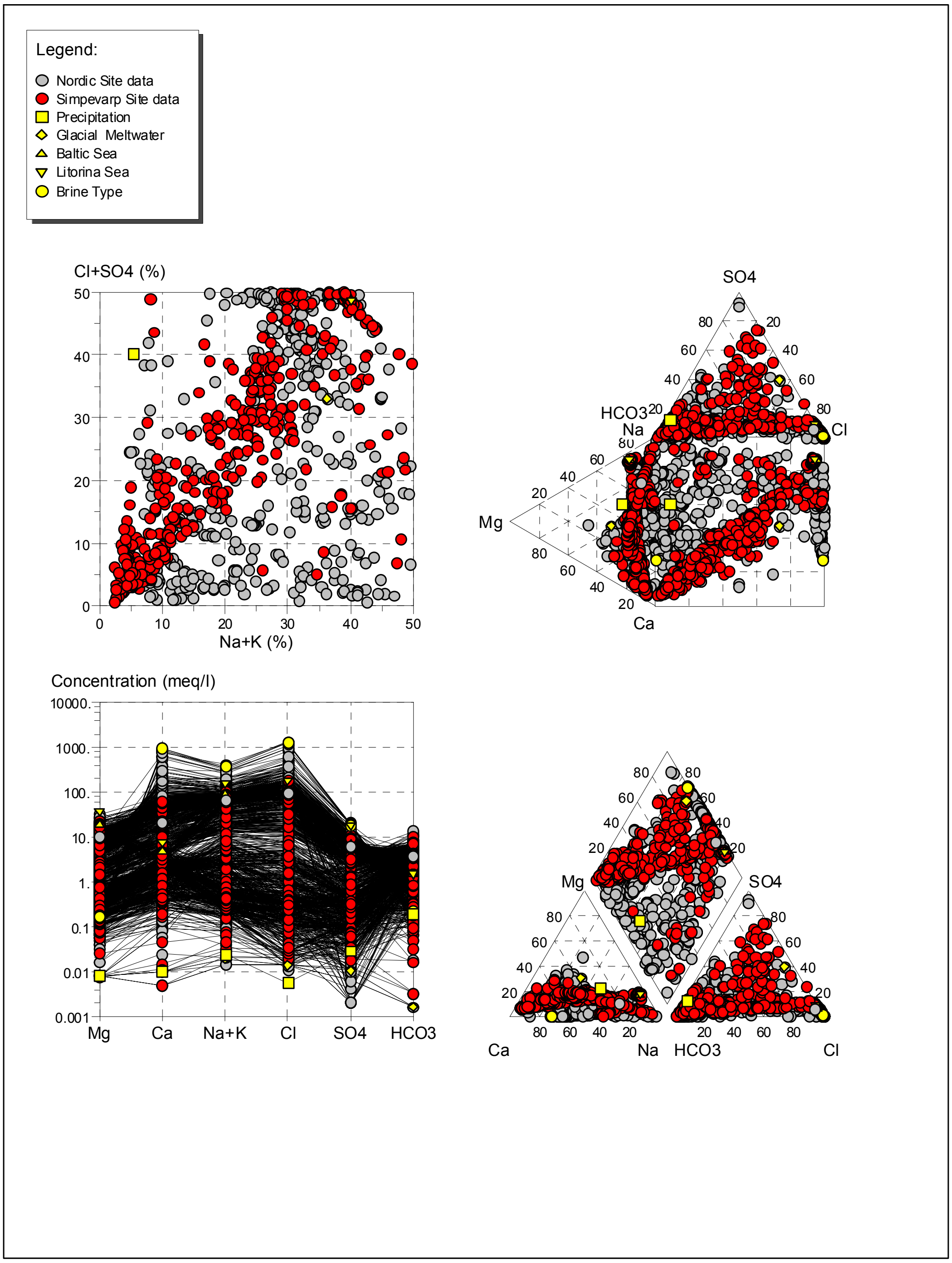

Figure 4: *Multicomponent plots used for classification of the data. From top left to top right to bottom left and bottom right: Ludwig-Langelier plot, Durov plot, Shoeller plot and Piper plot applied on all Simpevarp data using AquaChem.*

2. 2 Distribution of the Cl versus depth

The distribution of the Cl versus depth for Forsmark and Simpevarp is presented in Figure 5.

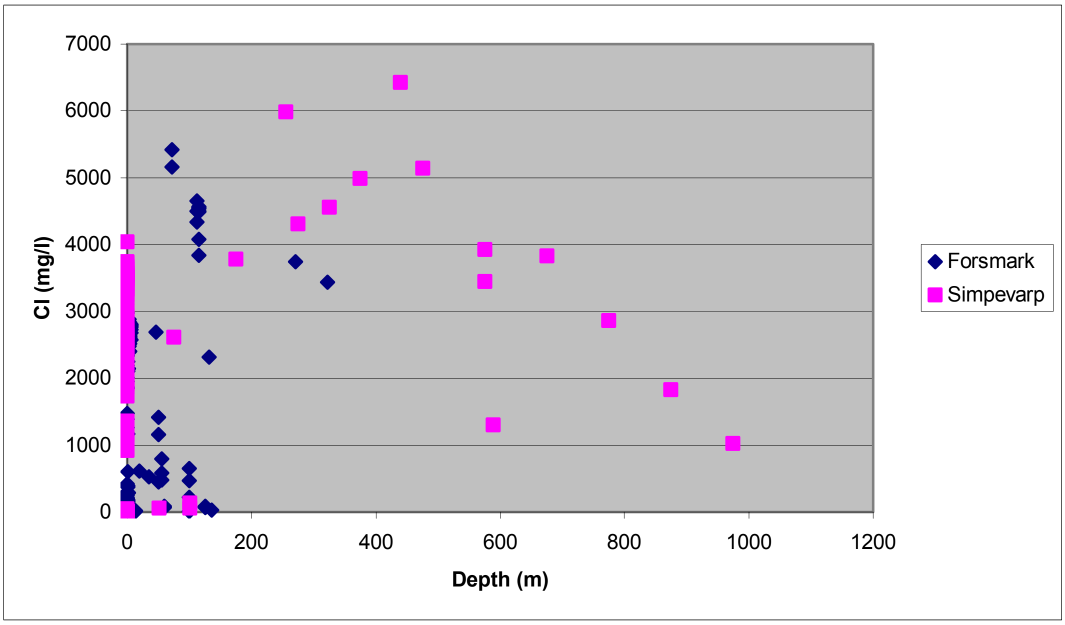

Figure 5. The distribution of the Cl (mg/l) with depth in Forsmark and Simpevarp (all data). The aim was to compare the 2 sites. *This first data set from Simpevarp site indicates samples from lager depths than in Forsmark (many of the samples are from open borehole sampling and not representative for downhole conditions).*

3. Descriptive and quantitative modelling by using M3 code

3.1 M3 modelling

A challenge in groundwater modelling is to reveal the origin, mixing and reactions altering the groundwater samples. The groundwater modelling concept M3 (Multivariate Mixing and Mass-balance calculations) Laaksoharju and Skårman, (1995c); Laaksoharju et al., (1999b,) can be used for making judgment on this.

3.1.1 Introduction and model description

In M3 modelling the assumption is that the groundwater is always a result of mixing and reactions. M3 modelling uses a statistical method to analyse variations in groundwater compositions so that the mixing components, their proportions, and chemical reactions are revealed. The method quantifies the contribution to hydrochemical variations by mixing of groundwater masses in a flow system by comparing groundwater compositions to identified reference waters. Subsequently, contributions to variations in non-conservative solutes from reactions are calculated.

The M3 method has been tested, evaluated, compared with standard methods and modified over several years within domestic and international research programmes supported by the SKB. The main test and application site for the model has been the Äspö HRL (Laaksoharju and Wallin (eds.) 1997; Laaksoharju et al., 1999c). Mixing seems to play an important role at many crystalline and sedimentary rock sites where M3 calculations have been applied such as in different Swedish sites (Laaksoharju et al., 1998), Canada (Smellie and Karlsson, 1996), Oklo in Gabon (Gurban et al., 1998) and Palmottu in Finland (Laaksoharju et al, 1999a).
The features of the M3 method are:

- It is a mathematical tool which can be used to evaluate groundwater field data, to help construct a conceptual model for the site and to support expert judgement for site characterisation.
- It uses the entire hydrochemical data set to construct a model of geochemical evolution, in contrast to a thermodynamic model that simulates reactions or predicts the reaction potential for a single water composition.
- The results of mixing calculations can be integrated with hydrodynamic models, either as a calibration tool or to define boundary conditions.
- Experience has shown that to construct a mixing model based on physical understanding can be complicated especially at site scale. M3 results can provide additional information of the major flow paths, flow directions and residence times of the different groundwater types which can be valuable in transport modelling.
- The numerical results of the modelling can be visualised and presented for non-expert use.

The M3 method consists of 4 steps where the first step is a standard principal component analysis (PCA), selection of reference waters, followed by calculations of mixing proportions, and finally mass balance calculations (for more details see Laaksoharju et al., 1999b; Laaksoharju, 1999d).

For Simpevarp, 2 models were built: at regional scale and at local scale. 113 samples from Simpevarp met the M3 criteria (data for major elements and isotopes) and were used in the M3 modelling. These samples were from boreholes (core and percussion), soil pipes, lake water, stream water and precipitation.

3.2 Regional model

The PCA applied to Simpevarp data and all Nordic Sites data is illustrated in Fig.7. 113 samples from Simpevarp site were used. Numerical values are listed in Appendix 2. Figure 7 shows a surface trend (winter – summer precipitation), a marine trend showing a Baltic Sea water influence, a glacial and deep groundwater trend.

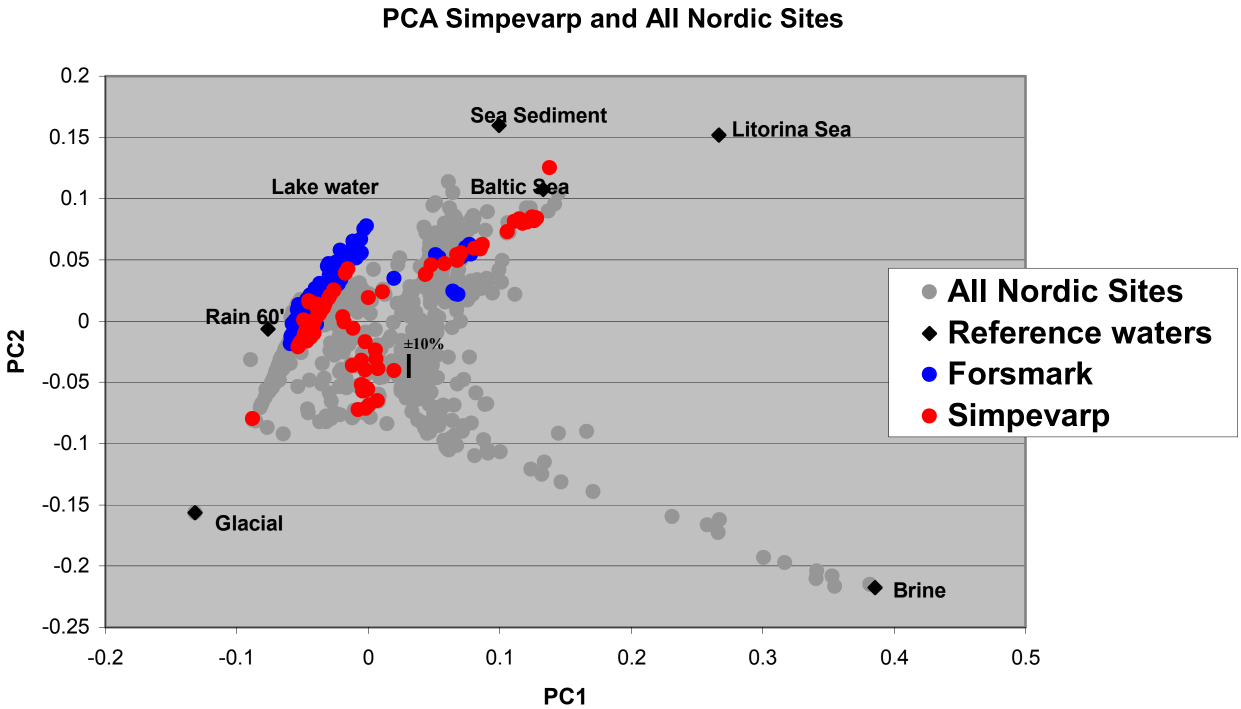

Figure 7. *The picture shows the principal components analysis and the identification of the reference waters. (Variance: First principal component: 0.42223, First and second principal components: 0.67221, First, second and third principal components: 0.77987). The figure shows the Nordic samples, the Simpevarp data (in red) and the Forsmark data (in blue). The Lake water (Forsmark), Sea sediment, Marine (Litorina), Brine, Glacial and Rain60' reference waters are used as end members for the modeling. The model uncertainty ±10% is shown here as error bar; the analytical uncertainty is ±5% and represents therefore half of the error bar.*

The reference waters used are:

- **Brine type of reference water:** Represents the sampled deep brine type (Cl = 47000 mg/L) of water found in KLX02: 1631-1681m (Laaksoharju et al., 1995a). An old age for the Brine is suggested by the measured ^{36}Cl values indicating a minimum residence time of 1.5Ma for the Cl component (Laaksoharju and Wallin (eds.), 1997).

- **Glacial reference water:** Represents a possible melt-water composition from the last glaciation >13000BP. Modern sampled glacial melt water from Norway was used for the major elements and the $\delta^{18}O$ isotope value (–21 ‰ SMOW) was based on measured values of $\delta^{18}O$ in calcite surface deposits (Tullborg, 1984). The $\delta^{2}H$ value (–158 ‰ SMOW) is a modelled value based on the equation ($\delta H = 8 \times \delta^{18}O + 10$) for the meteoric water line.

- **Litorina Water:** Represents modelled Litorina water (see table 3-1).

- **Modified Sea water (Sea sediment):** Represents Baltic Sea affected by microbial sulphate reduction.

- **Precipitation water:** Corresponds to infiltration of meteoric water (the origin can be rain or snow) from 1960. Sampled modern meteoric water with a modelled high tritium (100 TU) content was used to represent precipitation from that period.

- **Summer precipitation:** Corresponds to summer precipitation from a lake in Forsmark, with a high content of O^{18}. The water may have undergone evaporation.

For groundwater analytical data see Table 3-1.

Table 3-1: Groundwater analytical or modelled data* used as reference waters in the M3 regional modelling for Simpevarp.

	Cl (mg/L)	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	HCO_3 (mg/L)	SO_4 (mg/L)	^3H (TU)	δ^2H ‰	$\delta^{18}O$ ‰
Brine	47200	8500	45.5	19300	2.12	14.1	906	4.2	-44.9	-8.9
Glacial	0.5	0.17	0.4	0.18	0.1	0.12	0.5	0	-158*	-21*
Litorina sea*	6500	3674	134	151	448	93	890	0	-38	-4.7
Modified Sea	4920	2300	29	730	233	1200	36	14	-50.4	-7.3
Precipitation	0.23	0.4	0.29	0.24	0.1	12.2	1.4	2000	-80	-10.5
Summer precipitation	45.8	21	3.21	30.3	5.9	110	16.18	7.6	-44.3	-4.5

The reference waters chosen are identification rows in Appendix 2:

- Brine (identification row 119)
- Marine (identification row 117)
- Sea sediment (identification row 115)
- Rain’60 (identification row 116)
- Glacial (row 114)
- Summer precipitation (Forsmark lake water, row 174)

The following six reactions have been considered, with comments on the qualitative outcomes of mixing and mass balance modeling with M3:

1. *Organic decomposition:* This reaction is detected in the unsaturated zone associated with Meteoric water. This process consumes oxygen and adds reducing capacity to the groundwater according to the reaction: $O_2 + CH_2O \rightarrow CO_2 + H_2O$. M3 reports a gain of HCO_3 as a result of this reaction.
2. *Organic redox reactions:* An important redox reaction is reduction of iron III minerals through oxidation of organic matter: $4Fe(III) + CH_2O + H_2O \rightarrow 4Fe^{2+} + 4H^+ + CO_2$. M3 reports a gain of Fe and HCO_3 as a result of this reaction. This reaction takes place in the shallow part of the bedrock associated with influx of Meteoric water.
3. *Inorganic redox reaction:* An example of an important inorganic redox reaction is sulphide oxidation in the soil and the fracture minerals containing pyrite according to the reaction: $HS^- + 2O_2 \rightarrow SO_4^{2-} + H^+$. M3 reports a gain of SO_4 as a result of this

reaction. This reaction takes place in the shallow part of the bedrock associated with influx of Meteoric water.

4. *Dissolution and precipitation of calcite:* There is generally a dissolution of calcite in the upper part and precipitation in the lower part of the bedrock according to the reaction: $CO_2 + CaCO_3 \rightarrow Ca^{2+} + 2HCO_3^-$. M3 reports a gain or a loss of Ca and HCO_3 as a result of this reaction. This reaction can take place in any groundwater type.
5. *Ion exchange:* Cation exchange with Na/Ca is a common reaction in groundwater according to the reaction: $Na_2X_{(s)} + Ca^{2+} \rightarrow CaX_{(s)} + 2Na^+$, where X is a solid substrate such as a clay mineral. M3 reports a change in the Na/Ca ratios as a result of this reaction. This reaction can take place in any groundwater type.
6. *Sulphate reduction:* Microbes can reduce sulphate to sulphide using organic substances in natural groundwater as reducing agents according to the reaction: $SO_4^{2-} + 2(CH_2O) + OH^- \rightarrow HS^- + 2HCO_3^- + H_2O$. This reaction is of importance since it may cause corrosion of the copper capsules. Vigorous sulphate reduction is generally detected in association with marine sediments that provide the organic material and the favorable salinity interval for the microbes. M3 reports a loss of SO_4 and a gain of HCO_3 as a result of this reaction. This reaction modifies the seawater composition by increasing the HCO_3 content and decreasing the SO_4 content.

3.3 Local model

The local model was built with only data from the Simpevarp site. The PCA applied on Simpevarp data is illustrated in Fig.8. Figure 8 shows a similar trend as Figure 7 but with a higher resolution.

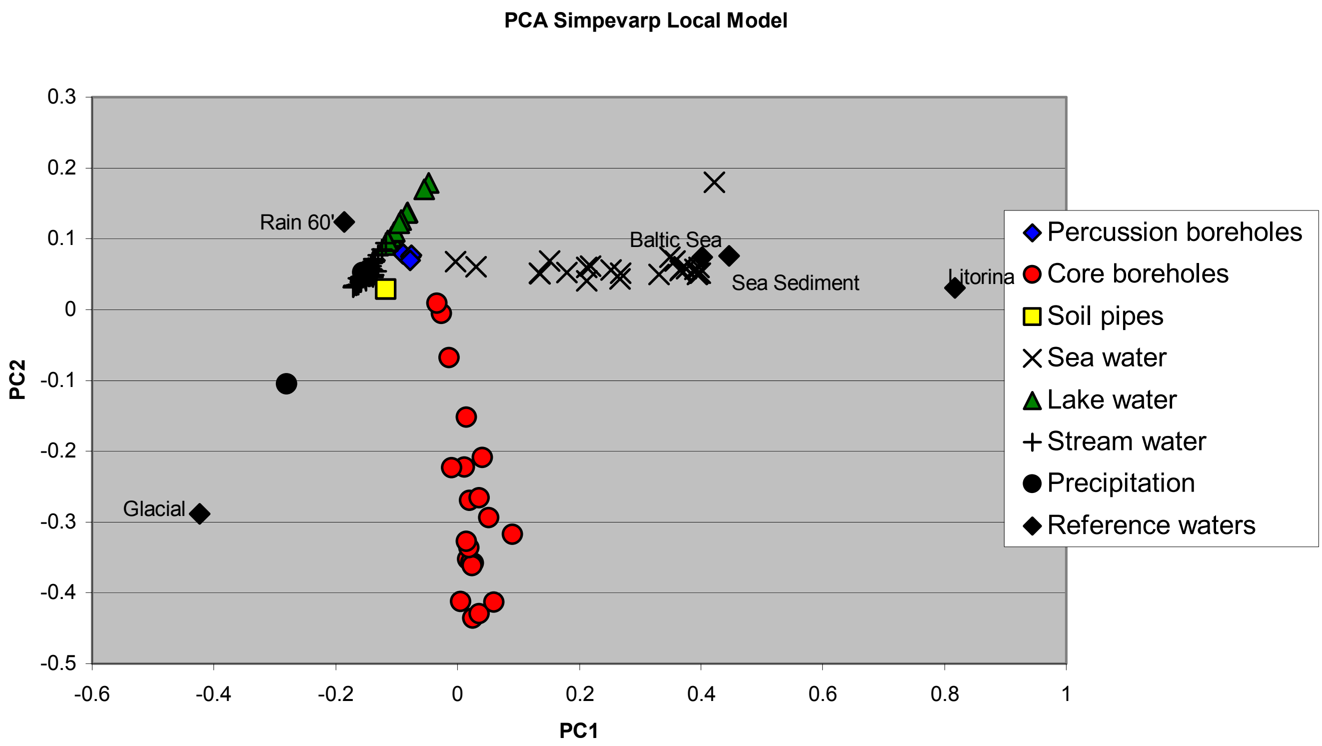

Figure 8. *The picture shows the PCA for the local model for Simpevarp. The picture shows the principal components analysis and the identification of the reference waters. (Variance: First principal component: 0.49907, First and second principal components: 0.75264, First, second and third principal components: 0.85248). The Lake water (Simpevarp), Sea water,*

Litorina, local Groundwater, Glacial and Rain60' are used as reference waters for the modelling.

The reference waters chosen are identification rows used in Appendix 3:

- Local Groundwater (identification row 24)
- Local Sea water (identification row 48)
- Litorina (identification row 117)
- Rain'60 (identification row 116)
- Glacial (row 114)
- Simpevarp lake water (row 63)

For groundwater analytical data see Table 3-2.

Table 3-2: Groundwater analytical or modelled data* used as reference waters in the M3 local modelling for Simpevarp.

	Cl (mg/L)	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	HCO_3 (mg/L)	SO_4 (mg/L)	^3H (TU)	δ^2H ‰	$\delta^{18}O$ ‰
Local Groundwater	6298.2	2430	13.2	1180	65.4	17	51.1	0	-100	-14
Glacial	0.5	0.17	0.4	0.18	0.1	0.12	0.5	0	-158*	-21*
Local Sea water	3071.7	1810	65.8	84.4	219	79	427.7	15.6	-9.7	-6.7
Litorina sea*	6500	3674	134	151	448	93	890	0	-38	-4.7
Precipitation	0.23	0.4	0.29	0.24	0.1	12.2	1.4	2000	-80	-10.5
Simpevarp Lake water	14.41	10.7	1.79	10.0	2.93	11.0	21.95	10.7	-54.4	-6.7

3.4 Alternative models

In order to try to achieve a better resolution, other chemical elements, like Fe, Si and TOC, were previously used together with the major elements and the isotopes. They seemed to be correlated to one or several major elements and/or isotopes and do not give any new information. In M3 calculations only independent elements could bring new information. The several tests performed show that the major elements and the isotopes together give the best resolution of the PCA.

4. DIS (Drilling Impact Study) calculations for Simpevarp

The Drilling Impact Study (DIS, Gurban I and Laaksoharju M, 2002) was used for evaluation of the borehole data for Simpevarp. The DIS evaluates the impact of the drilling on the hydrochemistry. We applied DIS on KSH01, the new-drilled borehole in Simpevarp. The main aim was to evaluate the contamination of the fracture zones, due to drilling activities. The results of the modelling were compared with the hydrochemical data sampled.

The successful implementation of DIS evaluation required the availability of drilling data stored in SICADA and the results from DIFF (Differential Flow measurements). The DIS evaluation involved the compilation, calculation and interpretation of drilling data and DIFF measurements. The following data are necessary for the DIS evaluation:

- Drilling water pumped in and out from the borehole during drilling operation;
- The drilled length versus time;
- Water pressure along the borehole during drilling;
- Drawdown during drilling;
- Uranine concentration in the drilling water pumped in and out from the borehole during drilling;
- The DIFF measurements performed in the borehole records the hydraulic conductivity along the borehole.

The data freeze at Simpevarp site provides groundwater data for the borehole KSH01. The two sections investigated were: 156.5-167 m and 245-261.6 m. The aim of the DIS calculations was to estimate the amount of the contamination for each fracture zone. As explained above, the drilling data was not available, only the DIFF measurements were provided. The DIFF measurements (Figure 9) show hydraulic conductivity K (m/s) around 10^{-7} m/s for the sections 156.5-167 m and 245-261.6 m in KSH01. These 2 sections are analyzed and modeled from a DIS evaluation perspective.

The evaluation work started by collecting data from the drilling and drilling related activities. The representativity of the drilling data and drilling activities were judged and the data used for the DIS calculations were selected. The DIFF measurements gave the hydraulic conductivity of the fractures zones to be modeled.

The data freeze determined the available drilling data and groundwater data for the borehole KSH01. The Figures 9 to 12 show for exemplification the results of the calculations of the methodology applied. Figure 9 shows the cumulated drilling water volume in and out from the borehole with time.

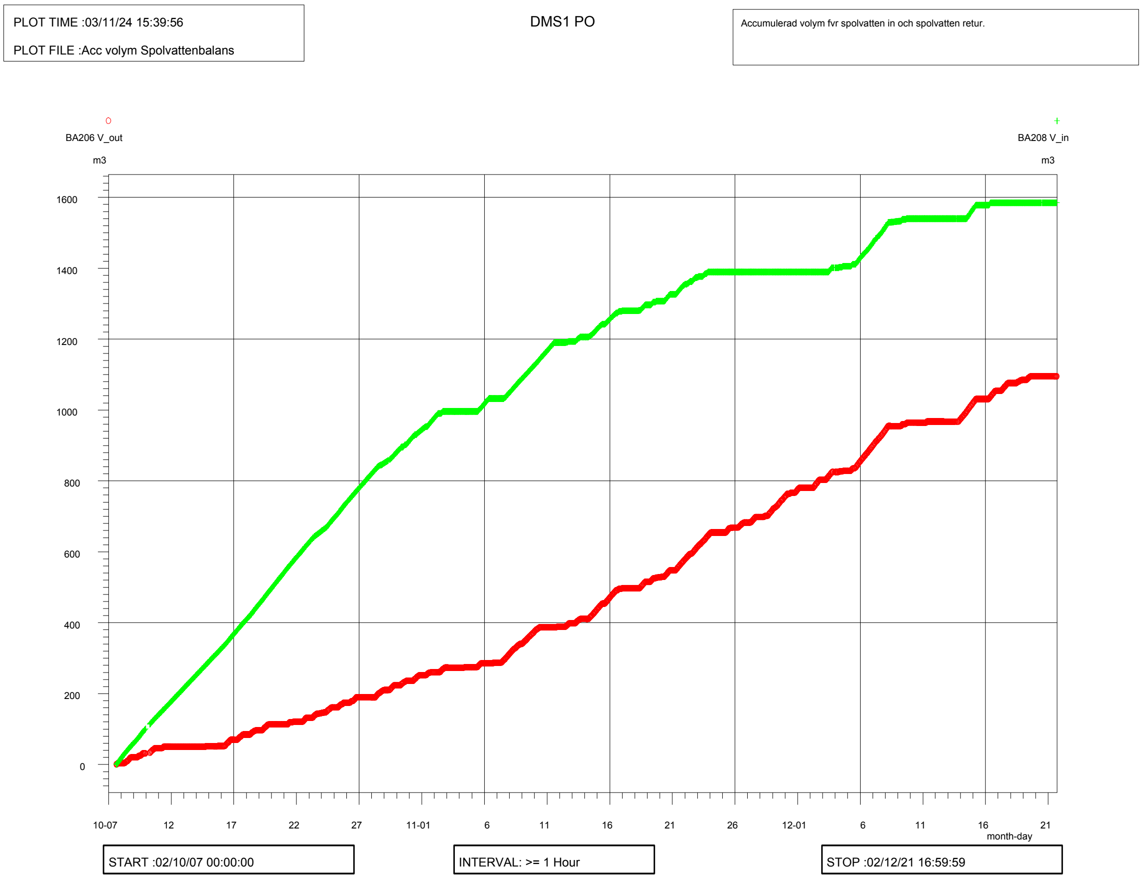

Figure 9: *Accummulated drilling water volume pumped in (in green) and drilling water volume pumped out (in red) in KSH01 with time. The quality is poor for the drilling water pumped into the borehole, showing 2 or 3 platoes with no inflow. During "platoe period" drilling was operated and water is pumped in. The error is explained by a sensor problem.*

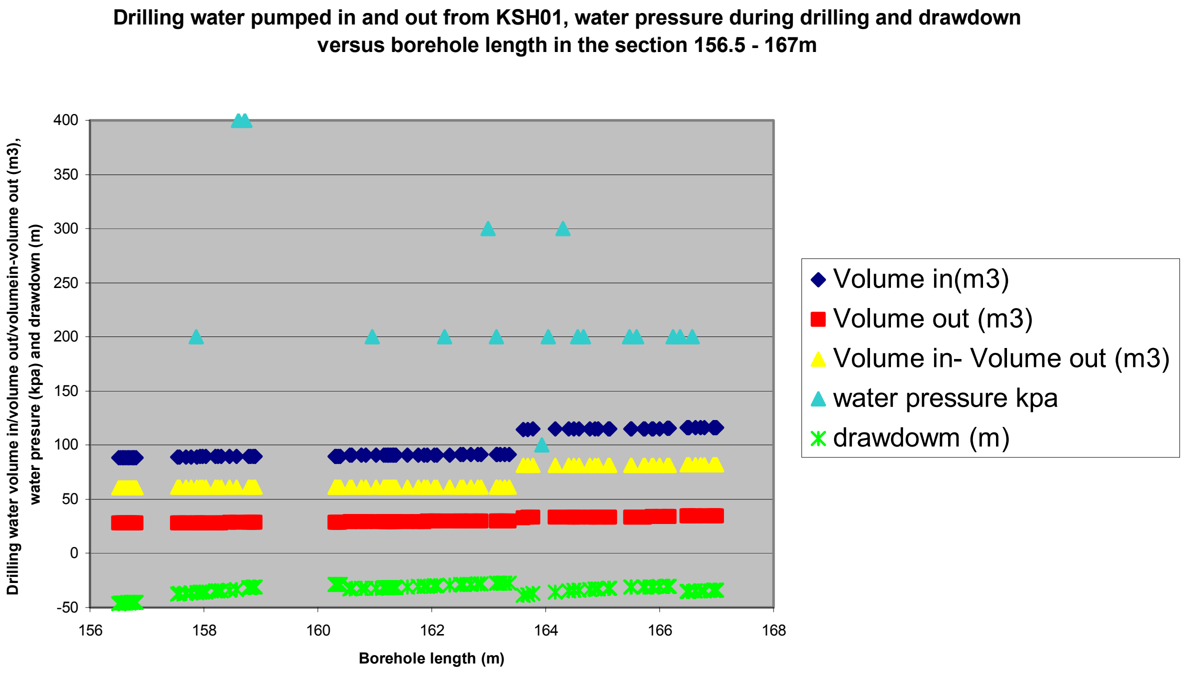

Figure 10: *Accumulated drilling water volume in and out from the borehole, corresponding to section 156.5-167m in KSH01. The difference between the drilling water pumped in and out from the borehole is represented in yellow. The water pressure along the borehole during drilling and the drawdown are represented in light blue and green respectively.*

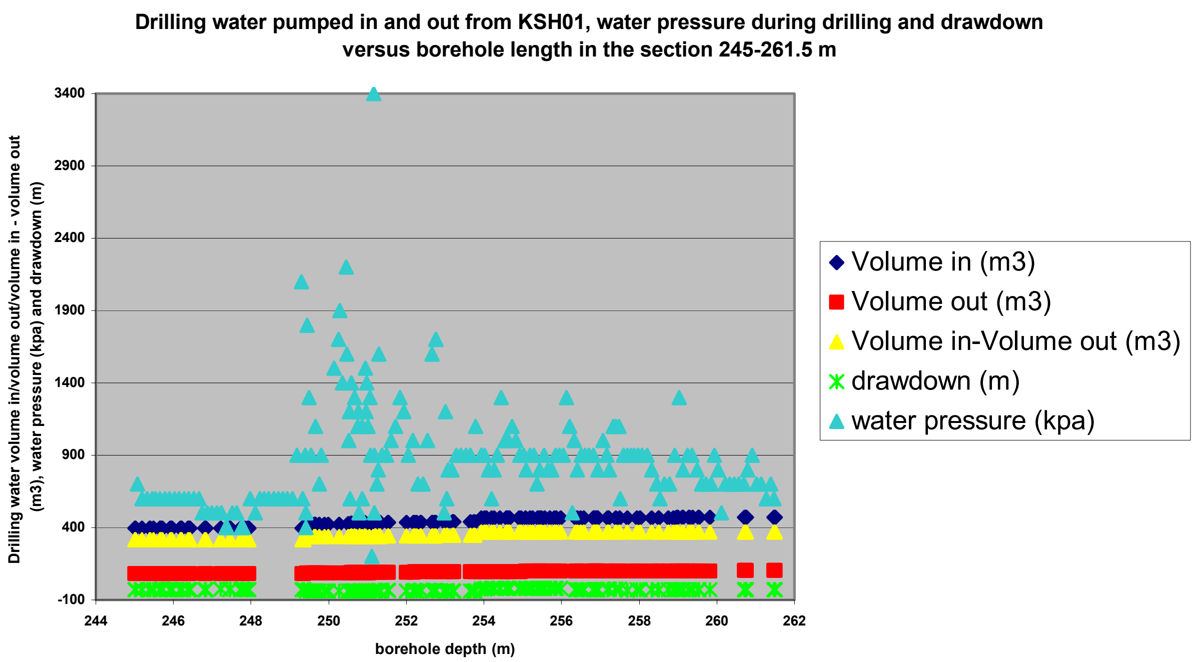

Figure 11: *Accumulated drilling water volume in and out from the KSH01 borehole, corresponding to section 245-261.5m. The difference between the drilling water pumped in and out from the borehole is represented in yellow. The water pressure along the borehole during drilling and the drawdown are represented in light blue and green respectively.*

Unfortunately, for the first section in Figure 10 the water pressure data is incomplete and biased, due to a sensor failure during drilling. Therefore the water pressure could not be used for the calculations of section 156.5-167m.

The uranine concentration in the drilling water was analyzed in Figure 12. The readings for uranine concentration in the drilling water pumped in and out from the borehole and the difference are presented in the Figure 12. The intention was to use 0.160mg/l uranine in the flushing water and this was used for the calculations, but in reality this value may vary.

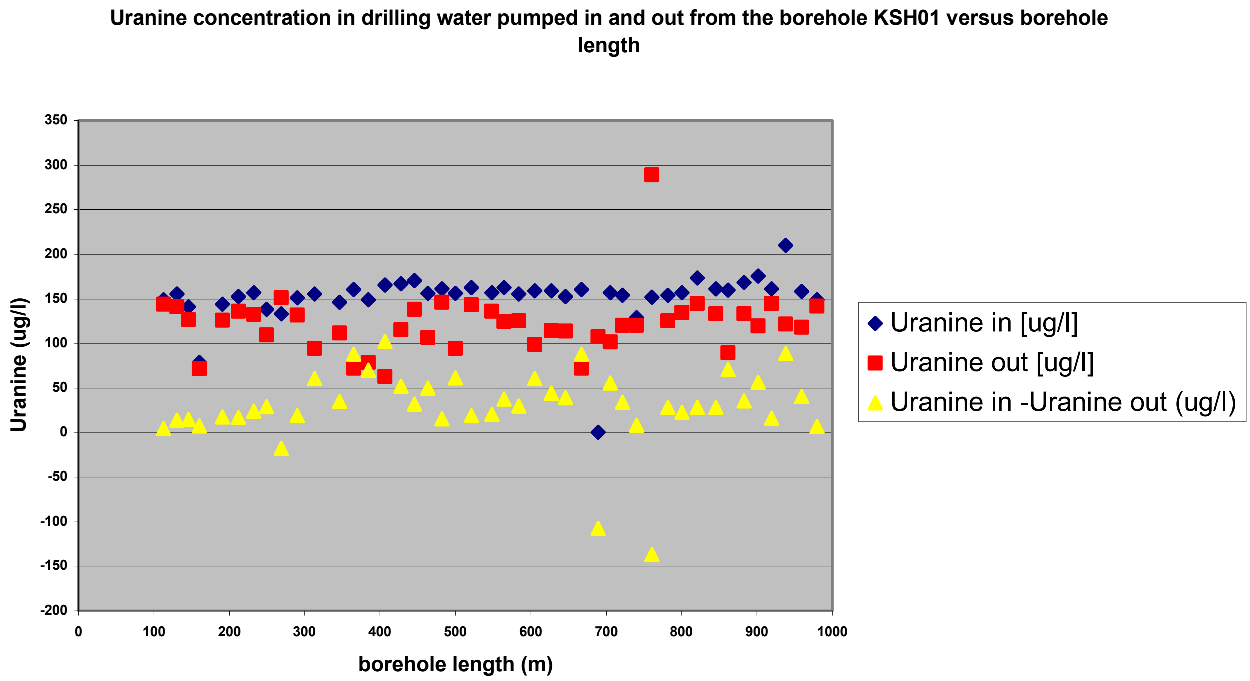

Figure 12: *Average uranine concentration in the drilling water volume pumped in and out and the difference from KFM01 with borehole length.*

4.1 Calculations of hydraulic permeability for individual fracture zone

The DIS calculations shown bellow are made according to the methodology proposed by Gurban and Laaksoharju (2002), as following:

This section explains how the hydraulic permeability for individual fracture zones can be calculated.

Calculations of hydraulic permeability for individual fracture zones by using data from KSH01 and comparison with the DIFF measurements:

- Calculation of the pressure:
    1. from the drill rig data: Δp maximum and Δp average
    2. by composing all the different pressures: h-drawdown+friction losses

- Calculation of the thickness of the section (Δe)

- Calculation of the effective drilling time

- Calculation of the flow in the fracture zone (considered the maximum flow which could penetrate the section)

$$Q = \Delta h \times K \times e$$

- Calculation of the drilling water volume lost in the fracture from the on-line measurements

$$V\ lost = Vol\ in - Vol\ out$$

- Calculation of amount of drilling water remained in the fracture

- Calculation of the hydraulic permeability in the fracture Δ e:
    1. $K = \Delta V / \Delta t / (\Delta h * e)$
    2. Comparison of $K_{calculated}$ with K_{DIFF}

Note: the friction losses along the borehole are very small (around 1 bar per 100m).

By analysing the records from drilling, drilling related activities and DIFF measurements (see figure 13) and by using the above methodology, the following results were obtained for the 2 sections investigated in KSH01:

<u>156.5-167m:</u>

Δpressure max = 300 kpa
Δpressure average= 230kpa
Drawdown average= -33.2m
Drawdown max= -27.2m

The drilling water volume maximum lost in the fracture is Vmax= 21.22m^3.
The time when the fracture was penetrated by the drilling was Δt= 61110s.
The real time (without stops in the drilling activities) was Δt= 4583s.
The uranine lost in the fracture is Δuranine= 0.0077mg/l
The thickness of the section is Δe= 10.5 m.
The hydraulic conductivity is K= $8*10^{-8}$m/s.
The error margin for the water pressure along borehole is +/-100 kPa.
The drawdown was measured in the borehole relative to the sea level. The sensor was not calibrated. The error margin is +/- 2m.

245-261.5m:

Δpressure max = 3200 kpa
Δpressure average= 230kpa
pressure mean= 12880kpa
Drawdown average= -29.86m
Drawdown max= -20.77m
The drilling water volume maximum lost in the fracture is Vmax= 54.47m^3.
The time when the fracture was penetrated by the drilling was Δt= 146744s.
The real time (without stops in the drilling activities) was Δt= 9910s.
The flow Qmax which penetrated the fracture during drilling is = $3.7*10^{-4}$ m^3/s.
The flow Qreal which penetrated the fracture during drilling is = $5.5*10^{-3}$ m^3/s.
The thickness of the section is Δe= 16.5 m.
The hydraulic conductivity is K= $2*10^{-7}$m/s.
The uranine lost in the fracture is Δuranine= 0.0289mg/l.
The error margin for the water pressure along borehole is +/-100 kPa.
The drawdown was measured in the borehole relative to the sea level. The sensor was not calibrated. The error margin is +/- 2m.

4.2 Calculations based on DIFF measurements

By using the hydraulic conductivity K from the DIFF measurements, water pressure during drilling and the drawdown and the fracture thickness the flow of the fracture can be calculated. This result can be compared with the flow calculated above, by using the drilling water volume and the time.

The pressures were calculated with three methods: 1) average of the water pressure during drilling and mean value, 2) the maximum pressure difference between maximum and minimum recorded values and 3) by composing the different pressures during drilling: hydraulic charge, drawdown and friction losses. Due to the lack of data or errors in the recordings the average values for the water pressure were used in the calculations. For example, the mean value for the water pressure was used in the bellow calculation:

Q = Δh * K * e = (water pressure-drawdown) * K * e = $4.15 * 10^{-3}m^3/s$.

As seen from the calculations above, the flow calculated directly from the drilling data (drilling water volume and time), and the flow calculated by using the pressure from the drilling and the K from the DIFF measurements give similar results. This shows that the drilling data could be used on line (during drilling) in order to measure the amount of contamination for each fracture zone. This could help for fast decisions concerning, for example, the sampling strategy of a fracture zone. These calculations can be repeated for all the individual fracture zones along the borehole.

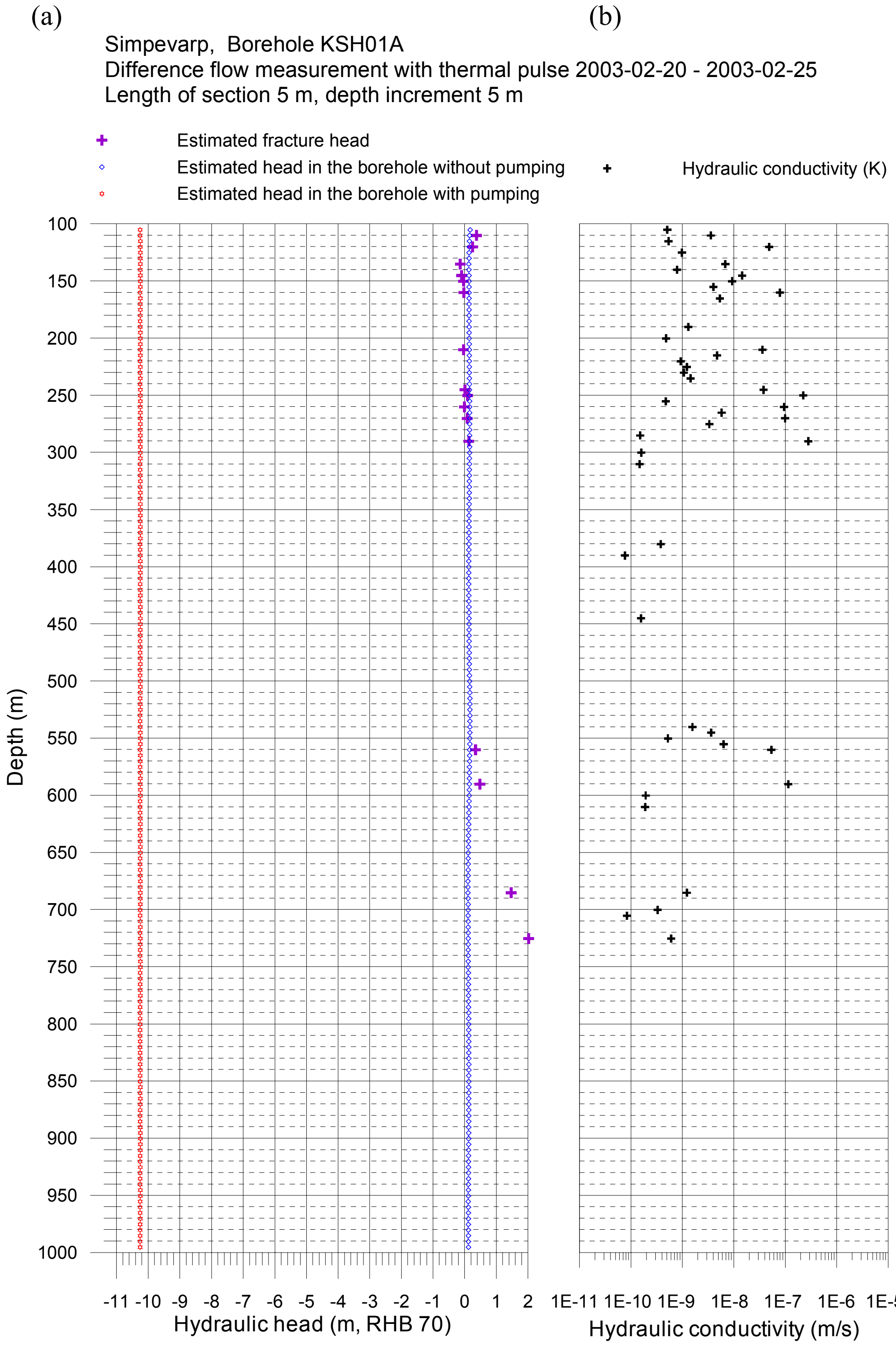

Figure 13. *DIFF measurements along borehole KSH01A (105 to 1000 m) of: a) groundwater flow rate (mL/h) into and out of the bedrock, and b) hydraulic head and conductivity.*

The above DIFF measurements (Figure 13) indicate that the hydraulic conductivity of the sections 156.5-167 m is $K_{DIFF} = 8*10^{-8}$m/s and 245-261.6 m is $K_{DIFF} = 2*10^{-7}$m/s.

Section 156.5-167m

By using the calculation scheme shown above, the DIS calculations show that the section was contaminated with maximum 21.22m^3 water of which maximum 5% consisted of drilling water, during the drilling of this section. Later drilling activities could increase the amount of contamination, due to the relative high hydraulic conductivity of the section. The results from the sampling show 3.7% remaining drilling water in the first sample, in the beginning of the pumping and 2.39% remaining drilling water in the last sample (see appendix 4). The duration of the pumping was from 28.03.2003 to 4.30.2003, with an average flow rate 200 ml/min (Pia Wacker, personal communication, 2003). The volume removed was calculated to be, 7.2 m^3. This was compared with the maximum 21.22 m^3 volume of water that contaminated the fracture. The average amount of drilling water remaining in the fracture is 14 m^3. The sampling shows an amount of 2.39% drilling water after 600 hours of pumping. The DIS calculations show that the pumping should have continued further in order to remove the additional 14m^3 m.

Section 245-261.5m

By using the calculation scheme shown above, the DIS calculations show that the section was contaminated during the drilling with maximum 54.47m^3 water of which maximum 18% consisted of drilling water. Later drilling activities could increase the amount of contamination, due to the relative high hydraulic conductivity of the section. The results from the sampling show 8.02% drilling water in the last sample (see appendix 4). The duration of the pumping was from 24.04.2003 to 20.5.2003, with an average flow rate of 200 ml/min. The volume removed was calculated to be, 10.9 m^3. This was compared with the maximum volume of 54.47m^3 water that contaminated the fracture. The sampling shows an amount of 8.02% drilling water, sampled after 912 hours of pumping. The DIS calculations show that the pumping should have continued further in order to remove the remaining 43.5 m^3. We recommend making DIS calculations during drilling and during sampling.

5. Site specific hydrogeochemical uncertainties

At every phase of the hydrogeochemical investigation programme – drilling, sampling, analysis, evaluation, modelling – uncertainties are introduced which have to be accounted for, addressed fully and clearly documented to provide confidence in the end result, whether it will be the site descriptive model or repository safety analysis and design (Smellie et al, 2002). Handling the uncertainties involved in constructing a site descriptive model has been documented in detail by Andersson et al. (2001). The uncertainties can be conceptual uncertainties, data uncertainty, spatial variability of data, chosen scale, degree of confidence in the selected model, and error, precision, accuracy and bias in the predictions. Some of the identified uncertainties recognized during the Simpevarp modelling exercise and during the DIS exercise are discussed below.

The following data uncertainties have been estimated, calculated or modelled:

- Drilling; may be ± 10-70%
- Effects from drilling during sampling; is <5%
- Sampling; may be ± 10%
- Influence associated with the uplifting of water; may be ± 10%

- Sample handling and preparation; may be ± 5%
- Analytical error associated with laboratory measurements; is ± 5%
- Mean groundwater variability at Simpevarp during groundwater sampling (first/last sample); is about 25%.
- The M3 model uncertainty; is ±0.1units within 90% confidence interval

Conceptual errors can occur from e.g. the paleohydrogeological conceptual model. The influences and occurrences of old water end-members in the bedrock can only be indicated by using certain element or isotopic signatures. The uncertainty is therefore generally increasing with the age of the end-member. The relevance of an end-member participating in the groundwater formation can be tested by introducing alternative end-member compositions or by using hydrodynamic modeling to test if old water types can resign in the bedrock during prevailing hydrogeological conditions.

5.1 Model uncertainties

The following factors can cause uncertainties in M3 calculations:

- Input hydrochemical data errors originating from sampling errors caused by the effects from drilling, borehole activities, extensive pumping, hydraulic short-circuiting of the borehole and uplifting of water which changes the in-situ pH and Eh conditions of the sample, or as analytical errors.

- Conceptual errors such as wrong general assumptions, selecting wrong type/number of end-members and mixing samples that are not mixed.

- Methodological errors such as oversimplification, bias or non-linearity in the model, and the systematic uncertainty, which is attributable to use of the centre point to create a solution for the mixing model.

An example of a conceptual error is assuming that the groundwater composition is a good tracer for the flow system. The water composition is not necessarily a tracer of mixing directly related to flow since there is not a point source as there is when labelled water is used in a tracer test.

Another source of uncertainty in the mixing model is the loss of information in using only the first two principal components. The third principal component gathers generally around 10% of the groundwater information compared with the first and second principal components, which contain around 70% of the information. A sample could appear to be closer to a reference water in the 2D surface than in a 3D volume involving the third principal component. In the latest version of M3 the calculations can also be performed in 3D.

Uncertainty in mixing calculations is smaller near the boundary of the PCA polygon and larger near the center. The uncertainties have been handled in M3 by calculating an uncertainty of 0.1 mixing units (with a confidence interval of 90%) and stating that a mixing portion <10% is under the detection limit of the method.

6. 3D Visualisation of the samples location and Cl distribution with Tecplot

The 3D/2D visualization of the Cl distribution in Simpevarp was performed with Tecplot. The x, y, z coordinates represent the Easting, Northing and elevation of the midpoint of the sampling section in meters. Figure 14 shows the 3D and the 2D visualisation of the 113 Cl values in Simpevarp. Figure 14.b shows the locations of the sampling points used for M3 modelling. The z coordinate was not available for the surface samples (sea, lake, streams, soil tubes). Therefore, the z coordinate was estimated from a grid-map and not measured in the field (Henrik Stridsman, personal communication). At the scale of the model, this represents an error smaller than 5%. The Figure 15 shows the map of the sampling points and boreholes in Simpevarp and the location of the modelling box used in Figure 14.

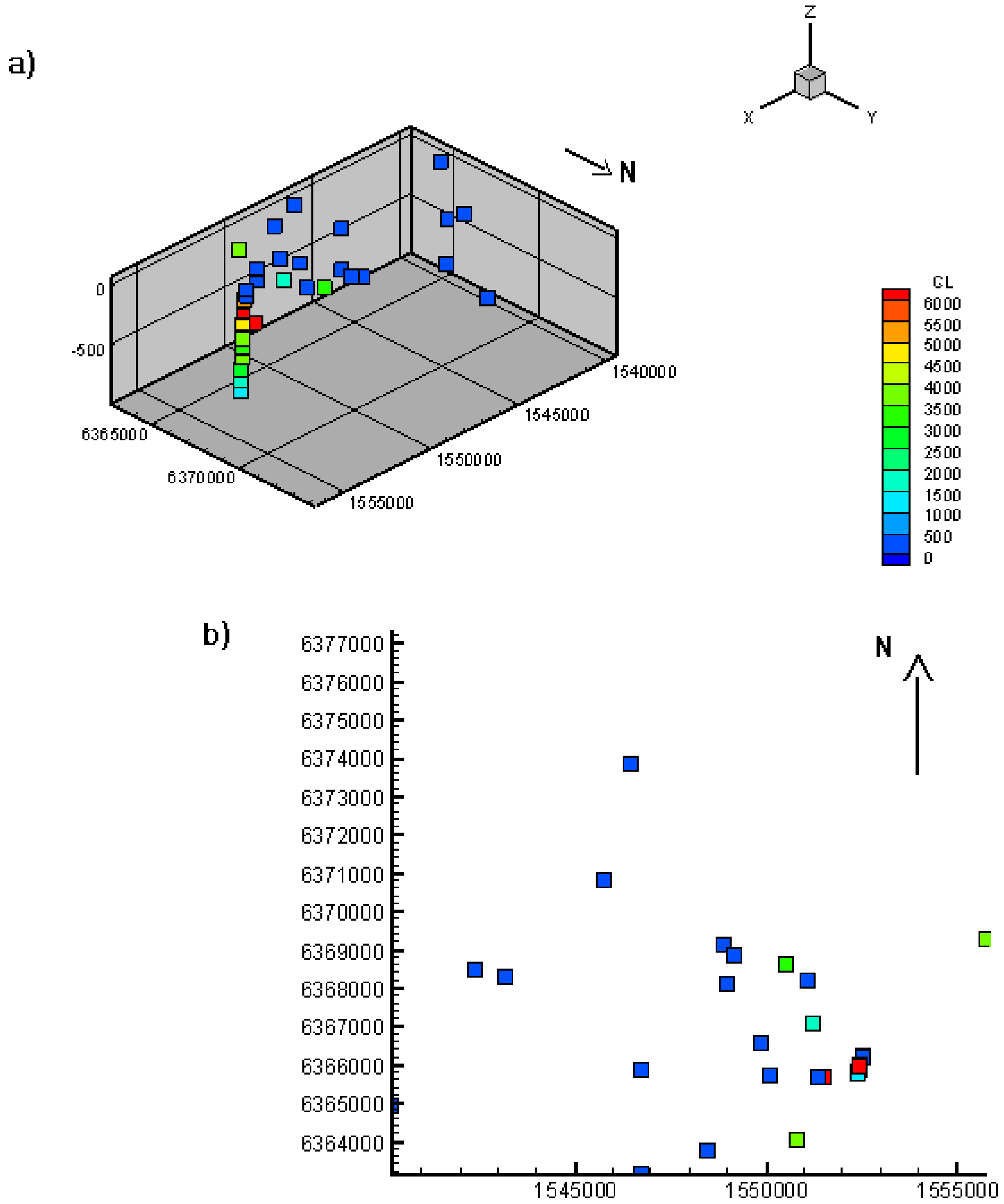

Figure 14: *3D/2D visualisation of the Cl sampling points in Simpevarp. The figure a) shows the 3D and the figure b) the 2D visualisation of the 113 Cl values in Simpevarp. Figure b) shows the locations of the sampling points used for M3 modelling. The depth scale is in meters.*

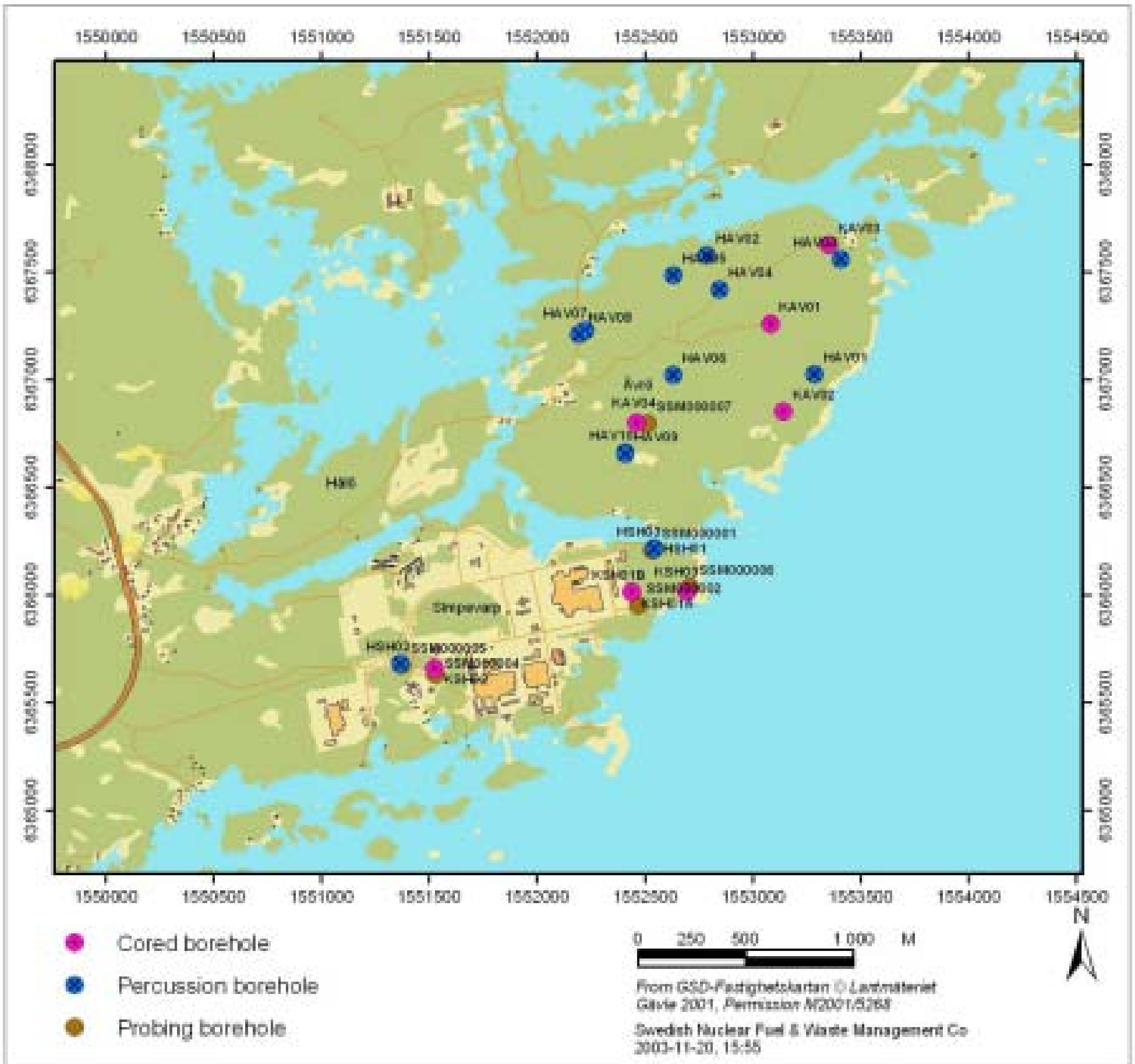

Figure 15: *The map showing the location of the sampling points and boreholes in Simpevarp.*

7. Concluding remarks

This work represents the phase 1 of the hydrochemical evaluation of the Simpevarp data. This comprises the explorative analyses (AquaChem, Cl distribution), M3 modelling, DIS (Drilling Impact Study) preliminary evaluation and 3D/2D visualisation of the data freeze for Simpevarp. M3 modelling helped to summarize and understand the data. DIS evaluation can help to judge the representativity of the drilling and sampled data when performed for the borehole KSH01. The two sections 156.5-167m and 245-261.5m in KSH01 were investigated and the results compared with the hydrochemical sampling data. The visualisation helps to understand the distribution of the data at the site.

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Appendix 1: Water type classification of the Simpevarp samples by using AquaChem

Borehole	Depth (m)	Cl (mg/l)	Water type
SSM000005	7	17.12	Ca-Mg-HCO3
SSM000005	6	17.12	Ca-Mg-HCO3
PSM002060	0.5	3484.68	Na-Cl
PSM002060	29	3449.22	Na-Cl
PSM002060	28.5	3727.53	Na-Cl
PSM002060	0.5	3689.24	Na-Cl
PSM002061	0.5	3532.54	Na-Cl
PSM002061	8	3529.23	Na-Cl
PSM002061	0.5	3491.77	Na-Cl
PSM002061	8	3491.23	Na-Cl
PSM002061	7.5	3690.3	Na-Cl
PSM002061	0.5	3673.99	Na-Cl
PSM002062	0.5	922.84	Na-Cl
PSM002062	3	2449.8	Na-Cl
PSM002062	0.5	2204.47	Na-Cl
PSM002062	3	2740.52	Na-Cl
PSM002062	0.5	2555.1	Na-Cl
PSM002062	2.5	2757.18	Na-Cl
PSM002062	2.5	1916.06	Na-Cl
PSM002062	0.5	1917.3	Na-Cl
PSM002064	0.5	1145.31	Na-Cl
PSM002064	17	3071.65	Na-Cl
PSM002064	0.5	2100.94	Na-Cl
PSM002064	17	3325.14	Na-Cl
PSM002064	0.5	2946.14	Na-Cl
PSM002064	15.5	3313.79	Na-Cl
PSM002064	0.5	2520.35	Na-Cl
PSM002064	15.5	3246.43	Na-Cl
PSM002065	0.5	10.8	Na-Ca-Mg-Cl-SO4
PSM002065	3	10.64	Na-Ca-Mg-Cl-SO4
PSM002065	0.5	15.31	Ca-Mg-Cl-SO4-HC
PSM002065	3	12.01	Ca-Mg-Cl-SO4-HC
PSM002065	0.5	12.65	Na-Ca-Mg-Cl-SO4
PSM002065	2.5	11.95	Na-Ca-Mg-Cl-SO4
PSM002065	0.5	10.94	Na-Ca-Mg-Cl-SO4
PSM002065	2.5	10.66	Na-Ca-Mg-Cl-SO4
PSM002066	1	14.41	Ca-Na-Mg-SO4-Cl
PSM002066	17	14.09	Ca-Na-Mg-SO4-Cl
PSM002067	1	14.2	Ca-Na-Mg-Cl-SO4
PSM002067	11	11.61	Ca-Na-Mg-Cl-HCO
PSM002071	0.1	13.5	Na-Ca-Cl-SO4
PSM002071	0.5	15.22	Ca-Na-Mg-Cl-SO4
PSM002071	0.5	15.14	Ca-Na-Mg-Cl-SO4
PSM002071	0.1	16.98	Na-Ca-Cl-SO4-HC
PSM002072	0.1	7.3	Na-Ca-Cl
PSM002072	0.5	12.47	Na-Ca-Cl
PSM002072	0.1	18.09	Na-Ca-Cl
PSM002072	0.1	14.06	Na-Ca-Cl
PSM002076	0.1	5.21	Ca-Na-SO4
PSM002076	0.1	7.48	Ca-Na-SO4-HCO3-

Borehole	Depth (m)	Cl (mg/l)	Water type
PSM002076	0.1	8.81	Ca-Na-SO4-HCO3-
PSM002076	0.1	5.82	Ca-Na-SO4-HCO3
PSM002079	0.1	8.73	Ca-Na-Mg-SO4-Cl
PSM002079	0.1	12.65	Ca-Na-Mg-Cl-SO4
PSM002079	0.1	12.98	Ca-Na-Mg-Cl-SO4
PSM002079	0.1	10.98	Ca-Na-Cl-SO4
PSM002082	0.1	5.08	Ca-Na-SO4-HCO3-
PSM002082	0.1	7.5	Ca-Na-HCO3-SO4-
PSM002082	0.5	8.91	Ca-Na-HCO3-Cl-S
PSM002082	0.1	6.53	Ca-Na-HCO3-Cl-S
PSM002083	0.74	3.57	Ca-Na-Mg-SO4
PSM002083	0.1	5.7	Ca-Na-SO4-Cl
PSM002083	0.1	13.29	Ca-Na-Cl-HCO3-S
PSM002083	0.5	13.53	Ca-Na-HCO3-Cl-S
PSM002083	0.1	6.62	Ca-Na-SO4-HCO3-
PSM002084	0.2	6.38	Ca-Na-Mg-SO4
PSM002084	0.1	8.49	Ca-Na-Mg-SO4
PSM002084	0.1	11.53	Ca-Na-SO4-HCO3
PSM002084	0.5	13.62	Ca-Na-HCO3-SO4-
PSM002084	0.1	8.53	Ca-Na-Mg-SO4-HC
PSM002085	0.2	6.01	Ca-SO4-HCO3
PSM002085	0.1	5.85	Ca-HCO3-SO4
PSM002085	0.1	7.58	Ca-HCO3-SO4
PSM002085	0.5	24.01	Ca-HCO3-SO4-Cl
PSM002085	0.1	5.57	Ca-HCO3-SO4
PSM002086	0.31	8.12	Ca-Na-Mg-SO4
PSM002086	0.1	11.21	Ca-Na-SO4-Cl
PSM002086	0.1	15.46	Ca-Na-SO4-Cl
PSM002086	0.1	17.74	Ca-Na-SO4-Cl
PSM002086	0.1	13.97	Ca-Na-SO4-Cl
PSM002087	0	5.29	Ca-Na-Mg-SO4-Cl
PSM002087	0.1	8.78	Ca-Na-Mg-SO4-Cl
PSM002087	0.1	12.02	Ca-Na-Mg-SO4-Cl
PSM002087	0.5	13.39	Ca-Na-Mg-Cl-SO4
PSM002087	0.1	11.22	Ca-Na-SO4-Cl
PSM002170	0	1.05	Ca-K-Mg-Na-SO4-
PSM002170	0	1.22	Na-Cl-SO4

Borehole	Depth (m)	Cl (mg/l)	Water type
HSH02	100	11.79	Na-HCO3
HSH02	100	22.58	Na-HCO3
HSH03	100	53.11	Na-HCO3-SO4
HSH03	51.5	55.13	Na-HCO3-SO4-Cl
HSH03	100	131.81	Na-HCO3-Cl
KSH01A	255	5982.27	Na-Ca-Cl
KSH01A	589	1298.64	Na-Ca-Cl
KSH01A	575	3922.87	Na-Ca-Cl
KSH01A	175	3781.95	Na-Ca-Cl
KSH01A	275	4311.08	Na-Ca-Cl
KSH01A	375	4986.46	Na-Ca-Cl
KSH01A	475	5138.03	Na-Ca-Cl
KSH01A	575	3445.32	Na-Ca-Cl
KSH01A	675	3826.27	Na-Ca-Cl
KSH01A	775	2865.67	Na-Ca-Cl
KSH01A	875	1830.08	Na-Ca-Cl
KSH01A	975	1028.14	Na-Ca-Cl
KSH01A	161	5590.05	Na-Ca-Cl
KSH01A	161	5489.9	Na-Ca-Cl
KSH01A	161	5436.72	Na-Ca-Cl
KSH01A	161	5507.62	Na-Ca-Cl
KSH01A	161	5333.9	Na-Ca-Cl
KSH01A	161	5166.39	Na-Ca-Cl
KSH01A	253	6298.23	Na-Ca-Cl
KSH01A	253	6322.16	Na-Ca-Cl
KSH02	439	6425.86	Na-Ca-Cl

Appendix 2: M3 mixing calculations for Simpevarp regional model

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
1	HSH02	Ground Water	6365666	1551367	-91,86		3883	110,0	3,0	5,4	2,5	269,0	11,8	19,1	-75,8	15,3	-10,8	0,01	0,01	0,01	0,01	0,68	0,28
2	HSH02	Ground Water	6365666	1551367	-91,86		3886	122,0	2,2	5,1	1,4	266,0	22,6	28,7	-76,3	11,0	-10,7	0,01	0,01	0,01	0,01	0,68	0,27
3	HSH03	Ground Water	6366200	1552533	-96,29		3759	152,0	3,3	13,0	3,4	255,0	53,1	84,3	-78,0	4,7	-10,6	0,02	0,02	0,02	0,02	0,68	0,24
4	HSH03	Ground Water	6366207	1552539	-48,11		3760	154,0	3,4	13,2	3,5	248,0	55,1	84,9	-76,1	10,0	-10,7	0,02	0,02	0,02	0,02	0,67	0,25
5	HSH03	Ground Water	6366200	1552533	-96,29		3761	192,0	3,6	21,1	5,0	233,0	131,8	81,6	-76,6	9,4	-10,8	0,02	0,02	0,02	0,02	0,69	0,22
6	KSH01A	Ground Water	6365958	1552452	-243,57		3824	2440,0	13,1	1020,0	61,2	21,0	5982,3	18,5	-102,5	1,1	-14,1	0,09	0,09	0,10	0,54	0,09	0,09
7	KSH01A	Ground Water	6365878	1552449	-567,34		3825	651,0	6,9	226,0	21,1	137,0	1298,6	167,3	-77,8	6,2	-10,6	0,06	0,06	0,06	0,06	0,69	0,09
8	KSH01A	Ground Water	6365881	1552449	-553,97		3831	1640,0	9,9	770,0	42,7	57,0	3922,9	96,2	-86,1	4,2	-11,7	0,08	0,08	0,08	0,28	0,39	0,08
9	KSH01A	Ground Water	6365977	1552449	-165,61		5167	1610,0	9,1	692,0	48,5	70,0	3781,9	63,5	-88,6	4,3	-12,4	0,08	0,08	0,08	0,30	0,39	0,08
10	KSH01A	Ground Water	6365954	1552452	-262,81		5169	1850,0	11,1	881,0	49,9	50,0	4311,1	98,9	-87,8	2,4	-12,3	0,09	0,09	0,09	0,34	0,31	0,09
11	KSH01A	Ground Water	6365930	1552454	-359,93		5171	1890,0	13,1	1030,0	42,6	38,0	4986,5	151,3	-84,4	3,0	-12,0	0,10	0,10	0,10	0,34	0,27	0,10
12	KSH01A	Ground Water	6365905	1552453	-456,83		5173	2010,0	14,8	1180,0	42,7	35,0	5138,0	265,1	-83,4	2,0	-11,9	0,11	0,11	0,11	0,37	0,19	0,11
13	KSH01A	Ground Water	6365881	1552449	-553,77		5174	1880,0	15,6	1100,0	42,2	40,0	3445,3	125,1	-83,0	2,9	-11,7	0,09	0,09	0,09	0,29	0,34	0,09
14	KSH01A	Ground Water	6365857	1552443	-650,69		5175	1530,0	14,4	858,0	38,4	58,0	3826,3	165,1	-80,1	5,1	-11,4	0,09	0,09	0,09	0,23	0,41	0,09
15	KSH01A	Ground Water	6365832	1552434	-747,19		5176	1310,0	12,5	705,0	33,9	73,0	2865,7	145,2	-79,1	5,8	-11,2	0,08	0,08	0,08	0,17	0,51	0,08
16	KSH01A	Ground Water	6365806	1552423	-842,99		5177	938,0	10,4	451,0	29,8	103,0	1830,1	126,1	-77,0	6,2	-10,9	0,07	0,07	0,07	0,08	0,66	0,07
17	KSH01A	Ground Water	6365777	1552407	-937,46		5179	558,0	8,5	206,0	26,0	138,0	1028,1	134,8	-75,6	7,2	-10,7	0,05	0,05	0,05	0,05	0,66	0,14
18	KSH01A	Ground Water	6365980	1552449	-152,74		5263	2280,0	14,7	960,0	70,8	25,0	5590,1	31,7	-95,9	0,8	-13,2	0,10	0,10	0,10	0,45	0,16	0,10
19	KSH01A	Ground Water	6365980	1552449	-152,74		5262	2210,0	11,3	939,0	70,4	26,0	5489,9	33,6	-97,8	0,8	-13,0	0,09	0,09	0,09	0,46	0,17	0,09
20	KSH01A	Ground Water	6365980	1552449	-152,74		5261	2280,0	12,6	963,0	71,8	28,0	5436,7	35,5	-97,5	0,8	-13,0	0,09	0,09	0,09	0,45	0,17	0,09
21	KSH01A	Ground Water	6365980	1552449	-152,74		5260	2300,0	12,7	975,0	73,7	26,0	5507,6	35,0	-98,0	0,8	-13,0	0,09	0,09	0,09	0,46	0,16	0,09
22	KSH01A	Ground Water	6365980	1552449	-152,74		5259	2150,0	9,1	941,0	70,0	28,0	5333,9	41,7	-93,6	0,8	-12,9	0,09	0,09	0,09	0,43	0,20	0,09
23	KSH01A	Ground Water	6365980	1552449	-152,74		5257	2090,0	8,4	915,0	70,9	30,0	5166,4	43,2	-95,1	2,8	-12,7	0,09	0,09	0,09	0,42	0,22	0,09
24	KSH01A	Ground Water	6365959	1552452	-241,67		5268	2430,0	13,2	1180,0	65,4	17,0	6298,2	51,1	-100,0	0,8	-14,0	0,09	0,09	0,11	0,53	0,09	0,09
25	KSH01A	Ground Water	6365959	1552452	-241,67		5266	2580,0	12,0	1160,0	63,5	18,0	6322,2	48,2	-100,2	0,8	-13,4	0,09	0,09	0,11	0,52	0,09	0,09
26	KSH02	Ground Water	6365684	1551521	-433,08		3832	2450,0	11,2	1280,0	9,7	29,0	6425,9	176,7	-93,4	0,8	-12,6	0,10	0,10	0,11	0,50	0,10	0,10
27	SSM000005	Ground Water	6365675	1551376	6,98		5404	10,1	9,3	91,2	17,5	215,0	17,1	4,5	-85,2	13,3	-11,8	0,02	0,02	0,02	0,02	0,81	0,10
28	SSM000005	Ground Water	6365675	1551377	5,59		5404	10,1	9,3	91,2	17,5	215,0	17,1	4,5	-85,2	13,3	-11,8	0,02	0,02	0,02	0,02	0,81	0,10
29	PSM002060	Sea Water	6369240	1555800		0,50	5120	1860,0	71,0	85,6	217,0	91,0	3484,7	492,4	-56,7	14,0	-7,2	0,45	0,22	0,08	0,08	0,08	0,08
30	PSM002060	Sea Water	6369240	1555800		29,00	5121	1870,0	71,5	85,7	217,0	92,0	3449,2	487,8	-56,2	14,2	-7,2	0,45	0,22	0,08	0,08	0,08	0,08
31	PSM002060	Sea Water	6369240	1555800		28,50	5371	1950,0	74,3	91,5	241,0	93,0	3727,5	532,0	-56,1	14,2	-7,1	0,41	0,27	0,08	0,08	0,08	0,08
32	PSM002060	Sea Water	6369240	1555800		0,50	5370	1950,0	72,6	91,2	240,0	93,0	3689,2	533,5	-56,2	16,1	-7,1	0,42	0,27	0,08	0,08	0,08	0,08

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
33	PSM002061	Sea Water	6364050	1550810		0,50	5065	1980,0	72,0	92,5	237,0	92,0	3532,5	503,0	-54,9	13,2	-7,0	0,44	0,25	0,08	0,08	0,08	0,08
34	PSM002061	Sea Water	6364050	1550810		8,00	5064	1980,0	71,4	92,9	237,0	92,0	3529,2	537,2	-54,8	16,1	-6,9	0,42	0,27	0,08	0,08	0,08	0,08
35	PSM002061	Sea Water	6364050	1550810		0,50	5142	1850,0	71,2	85,8	216,0	92,0	3491,8	502,9	-55,2	13,3	-7,1	0,45	0,23	0,08	0,08	0,08	0,08
36	PSM002061	Sea Water	6364050	1550810		8,00	5143	1880,0	72,2	86,8	219,0	94,0	3491,2	515,2	-55,8	12,6	-7,2	0,44	0,23	0,08	0,08	0,08	0,08
37	PSM002061	Sea Water	6364050	1550810		7,50	5373	1920,0	74,1	90,6	237,0	92,0	3690,3	539,8	-57,3	16,0	-7,1	0,41	0,27	0,08	0,08	0,08	0,08
38	PSM002061	Sea Water	6364050	1550810		0,50	5372	1930,0	73,7	90,7	238,0	94,0	3674,0	536,8	-57,9	13,7	-7,1	0,41	0,26	0,08	0,08	0,08	0,08
39	PSM002062	Sea Water	6367060	1551260		0,50	5049	494,0	19,7	30,9	61,5	30,0	922,8	132,2	-69,0	12,3	-9,7	0,06	0,06	0,06	0,06	0,45	0,33
40	PSM002062	Sea Water	6367060	1551260		3,00	5048	1280,0	46,8	64,2	160,0	69,0	2449,8	341,3	-61,6	14,9	-8,3	0,29	0,09	0,09	0,09	0,09	0,36
41	PSM002062	Sea Water	6367060	1551260		0,50	5114	1210,0	46,4	59,5	143,0	65,0	2204,5	313,5	-64,8	15,7	-8,7	0,20	0,09	0,09	0,09	0,09	0,45
42	PSM002062	Sea Water	6367060	1551260		3,00	5115	1430,0	54,6	68,3	170,0	76,0	2740,5	391,1	-61,0	14,2	-8,1	0,40	0,09	0,09	0,09	0,09	0,23
43	PSM002062	Sea Water	6367060	1551260		0,50	5202	1200,0	54,5	64,7	143,0	72,0	2555,1	361,3	-62,5	13,8	-8,2	0,32	0,09	0,09	0,09	0,09	0,33
44	PSM002062	Sea Water	6367060	1551260		2,50	5201	1510,0	60,1	75,4	181,0	76,0	2757,2	393,2	-62,1	12,6	-8,0	0,45	0,10	0,10	0,10	0,10	0,17
45	PSM002062	Sea Water	6367060	1551260		2,50	5375	1090,0	39,4	53,1	126,0	53,0	1916,1	270,0	-68,2	14,6	-8,8	0,08	0,08	0,08	0,08	0,09	0,57
46	PSM002062	Sea Water	6367060	1551260		0,50	5374	1070,0	38,6	52,4	124,0	53,0	1917,3	274,3	-68,0	14,5	-8,8	0,08	0,08	0,08	0,08	0,10	0,57
47	PSM002064	Sea Water	6368620	1550520		0,50	5051	653,0	25,3	37,2	80,9	33,0	1145,3	160,1	-71,3	17,3	-9,3	0,06	0,06	0,06	0,06	0,36	0,39
48	PSM002064	Sea Water	6368620	1550520		17,00	5050	1810,0	65,8	84,4	219,0	79,0	3071,6	427,7	-9,7	15,6	-6,7	0,59	0,27	0,03	0,03	0,03	0,03
49	PSM002064	Sea Water	6368620	1550520		0,50	5140	1010,0	39,2	51,6	119,0	64,0	2100,9	284,2	-63,0	14,4	-8,4	0,13	0,08	0,08	0,08	0,08	0,55
50	PSM002064	Sea Water	6368620	1550520		17,00	5141	1730,0	65,9	79,1	201,0	91,0	3325,1	466,6	-54,4	15,3	-6,8	0,50	0,18	0,08	0,08	0,08	0,08
51	PSM002064	Sea Water	6368620	1550520		0,50	5204	1440,0	58,2	73,1	186,0	80,0	2946,1	419,4	-63,9	14,1	-8,3	0,42	0,10	0,10	0,10	0,10	0,19
52	PSM002064	Sea Water	6368620	1550520		15,50	5203	1720,0	70,6	84,0	218,0	91,0	3313,8	467,1	-54,9	12,6	-7,1	0,48	0,20	0,08	0,08	0,08	0,08
53	PSM002064	Sea Water	6368620	1550520		0,50	5388	1390,0	49,9	64,4	162,0	68,0	2520,4	343,4	-67,5	13,2	-8,3	0,27	0,09	0,09	0,09	0,09	0,36
54	PSM002064	Sea Water	6368620	1550520		15,50	5389	1800,0	64,8	80,8	211,0	89,0	3246,4	446,7	-59,9	14,1	-7,4	0,48	0,16	0,09	0,09	0,09	0,09
55	PSM002065	Lake Water	6368100	1549010		0,50	5047	9,7	1,7	7,5	2,3	13,0	10,8	14,3	-62,9	10,4	-8,1	0,02	0,02	0,02	0,02	0,52	0,39
56	PSM002065	Lake Water	6368100	1549010		3,00	5046	9,9	1,7	7,6	2,4	11,0	10,6	14,3	-63,9	12,9	-8,0	0,02	0,02	0,02	0,02	0,53	0,38
57	PSM002065	Lake Water	6368100	1549010		0,50	5116	2,7	1,9	8,7	2,7	14,0	15,3	17,9	-69,5	11,2	-9,3	0,03	0,03	0,03	0,03	0,67	0,22
58	PSM002065	Lake Water	6368100	1549010		3,00	5117	2,5	1,7	8,2	2,5	14,0	12,0	16,1	-69,0	10,9	-9,0	0,03	0,03	0,03	0,03	0,65	0,25
59	PSM002065	Lake Water	6368100	1549010		0,50	5208	10,7	1,6	8,3	2,5	13,0	12,6	16,0	-72,7	11,1	-9,6	0,03	0,03	0,03	0,03	0,73	0,15
60	PSM002065	Lake Water	6368100	1549010		2,50	5207	10,6	1,6	8,6	2,9	14,0	12,0	15,4	-69,3	11,2	-8,9	0,03	0,03	0,03	0,03	0,64	0,25
61	PSM002065	Lake Water	6368100	1549010		0,50	5376	10,3	1,6	7,5	2,3	13,0	10,9	13,2	-72,0	12,4	-9,3	0,03	0,03	0,03	0,03	0,70	0,19
62	PSM002065	Lake Water	6368100	1549010		2,50	5377	10,1	1,5	7,4	2,3	13,0	10,7	12,8	-72,3	12,8	-9,3	0,03	0,03	0,03	0,03	0,70	0,18
63	PSM002066	Lake Water	6373820	1546460		1,00	5013	10,7	1,8	10,0	2,9	11,0	14,4	22,0	-54,4	10,7	-6,7	0,02	0,02	0,02	0,02	0,33	0,59
64	PSM002066	Lake Water	6373820	1546460		17,00	5014	10,3	1,8	10,1	2,9	11,0	14,1	23,6	-55,7	14,2	-7,1	0,02	0,02	0,02	0,02	0,38	0,55

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
65	PSM002067	Lake Water	6364900	1540190		1,00	5011	9,3	1,7	8,9	2,4	12,0	14,2	9,9	-64,9	11,3	-8,5	0,02	0,02	0,02	0,02	0,57	0,33
66	PSM002067	Lake Water	6364900	1540190		11,00	5012	8,8	1,6	8,7	2,3	15,0	11,6	8,7	-65,4	10,0	-8,7	0,02	0,02	0,02	0,02	0,59	0,31
67	PSM002071	Streaming Wat	6368450	1542380		0,10	5056	9,4	1,5	7,8	2,2	8,0	13,5	12,4	-70,4	15,0	-9,7	0,03	0,03	0,03	0,03	0,72	0,16
68	PSM002071	Streaming Wat	6368450	1542380		0,50	5128	10,6	1,4	9,4	2,6	15,0	15,2	12,2	-72,4	9,9	-10,0	0,03	0,03	0,03	0,03	0,75	0,12
69	PSM002071	Streaming Wat	6368450	1542380		0,50	5212	10,0	1,4	9,7	2,7	16,0	15,1	12,8	-76,4	8,7	-10,5	0,03	0,03	0,03	0,03	0,83	0,04
70	PSM002071	Streaming Wat	6368450	1542380		0,10	5386	12,0	1,4	8,6	2,3	13,0	17,0	11,2	-77,1	12,7	-10,5	0,03	0,03	0,03	0,04	0,83	0,03
71	PSM002072	Streaming Wat	6368290	1543190		0,10	5055	6,4	0,5	3,5	0,9	0,0	7,3	3,0	-78,8	12,6	-11,6	0,03	0,03	0,03	0,11	0,77	0,03
72	PSM002072	Streaming Wat	6368290	1543190		0,50	5127	10,4	0,0	5,5	1,3	6,0	12,5	3,7	-85,0	10,1	-11,5	0,03	0,03	0,03	0,13	0,75	0,03
73	PSM002072	Streaming Wat	6368290	1543190		0,10	5210	12,3	-0,4	5,6	1,4	4,0	18,1	3,5	-82,5	11,0	-11,7	0,03	0,03	0,03	0,13	0,75	0,03
74	PSM002072	Streaming Wat	6368290	1543190		0,10	5383	10,6	0,5	4,0	1,0	1,0	14,1	2,9	-83,5	10,6	-11,6	0,03	0,03	0,03	0,13	0,75	0,03
75	PSM002076	Streaming Wat	6363120	1546730		0,10	5058	4,9	1,0	11,4	1,9	10,0	5,2	17,6	-76,1	14,4	-11,1	0,03	0,03	0,03	0,06	0,81	0,03
76	PSM002076	Streaming Wat	6363120	1546730		0,10	5122	6,6	0,9	12,8	2,3	14,0	7,5	22,5	-77,2	12,9	-11,3	0,03	0,03	0,03	0,08	0,80	0,03
77	PSM002076	Streaming Wat	6363120	1546730		0,10	5214	7,6	0,9	13,2	2,5	16,0	8,8	20,9	-79,3	9,5	-11,4	0,03	0,03	0,03	0,09	0,78	0,03
78	PSM002076	Streaming Wat	6363120	1546730		0,10	5384	5,9	1,1	12,0	2,0	16,0	5,8	14,7	-81,8	12,1	-11,4	0,03	0,03	0,03	0,10	0,77	0,03
79	PSM002079	Streaming Wat	6365830	1546740		0,10	5071	7,2	1,5	7,7	1,9	5,0	8,7	14,2	-73,7	14,6	-10,7	0,03	0,03	0,03	0,03	0,83	0,04
80	PSM002079	Streaming Wat	6365830	1546740		0,10	5132	9,2	1,2	9,5	2,5	13,0	12,7	15,8	-73,3	13,1	-10,4	0,03	0,03	0,03	0,03	0,80	0,08
81	PSM002079	Streaming Wat	6365830	1546740		0,10	5228	9,4	1,3	9,9	2,6	14,0	13,0	15,3	-77,1	11,4	-10,8	0,03	0,03	0,03	0,05	0,82	0,03
82	PSM002079	Streaming Wat	6365830	1546740		0,10	5399	8,9	1,2	8,2	2,1	10,0	11,0	13,4	-79,0	9,6	-11,0	0,03	0,03	0,03	0,07	0,80	0,03
83	PSM002082	Streaming Wat	6370790	1545740		0,10	5074	4,8	1,1	8,2	1,4	9,0	5,1	8,1	-79,1	12,9	-11,5	0,03	0,03	0,03	0,10	0,78	0,03
84	PSM002082	Streaming Wat	6370790	1545740		0,10	5130	6,6	1,4	11,2	2,1	22,0	7,5	10,9	-84,6	13,3	-11,4	0,03	0,03	0,03	0,11	0,77	0,03
85	PSM002082	Streaming Wat	6370790	1545740		0,50	5233	7,4	1,4	11,8	2,2	24,0	8,9	10,1	-81,4	12,2	-11,6	0,03	0,03	0,03	0,10	0,78	0,03
86	PSM002082	Streaming Wat	6370790	1545740		0,10	5378	6,2	1,0	8,9	1,5	15,0	6,5	7,6	-83,5	9,8	-11,6	0,03	0,03	0,03	0,12	0,76	0,03
87	PSM002083	Streaming Wat	6369120	1548880		0,74	5003	4,4	1,7	7,0	1,5	3,0	3,6	10,1	-78,1	11,0	-11,6	0,03	0,03	0,03	0,10	0,78	0,03
88	PSM002083	Streaming Wat	6369120	1548880		0,10	5077	5,4	1,1	8,3	1,6	7,0	5,7	12,0	-79,3	13,2	-11,5	0,03	0,03	0,03	0,10	0,78	0,03
89	PSM002083	Streaming Wat	6369120	1548880		0,10	5137	10,8	1,2	11,9	2,5	22,0	13,3	16,0	-77,6	11,6	-11,4	0,03	0,03	0,03	0,08	0,80	0,03
90	PSM002083	Streaming Wat	6369120	1548880		0,50	5237	11,2	1,2	12,4	2,7	26,0	13,5	14,2	-81,7	12,8	-11,6	0,03	0,03	0,03	0,11	0,78	0,03
91	PSM002083	Streaming Wat	6369120	1548880		0,10	5396	6,5	1,0	8,3	1,7	12,0	6,6	10,3	-82,0	12,3	-11,3	0,03	0,03	0,03	0,10	0,78	0,03
92	PSM002084	Streaming Wat	6368840	1549190		0,20	5000	7,6	2,8	15,4	3,3	7,0	6,4	31,9	-77,2	10,6	-11,4	0,03	0,03	0,03	0,08	0,78	0,03
93	PSM002084	Streaming Wat	6368840	1549190		0,10	5076	7,7	2,3	16,9	3,4	13,0	8,5	38,1	-78,1	13,5	-11,5	0,03	0,03	0,03	0,09	0,77	0,03
94	PSM002084	Streaming Wat	6368840	1549190		0,10	5136	10,9	2,8	18,0	3,8	36,0	11,5	32,1	-77,6	12,3	-11,2	0,03	0,03	0,03	0,06	0,81	0,03
95	PSM002084	Streaming Wat	6368840	1549190		0,50	5236	11,5	3,0	18,7	4,0	39,0	13,6	29,5	-80,3	13,3	-11,3	0,03	0,03	0,03	0,07	0,80	0,03
96	PSM002084	Streaming Wat	6368840	1549190		0,10	5400	8,5	2,2	14,6	3,1	21,0	8,5	26,8	-81,6	12,2	-11,3	0,03	0,03	0,03	0,09	0,78	0,03

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
97	PSM002085	Streaming Wat	6366560	1549860		0,20	5001	5,8	1,6	27,8	3,6	20,0	6,0	35,0	-76,7	11,5	-11,2	0,03	0,03	0,03	0,06	0,80	0,03
98	PSM002085	Streaming Wat	6366560	1549860		0,10	5079	6,1	1,1	28,8	3,2	50,0	5,8	31,6	-77,8	14,9	-11,2	0,03	0,03	0,03	0,05	0,82	0,03
99	PSM002085	Streaming Wat	6366560	1549860		0,10	5145	8,1	1,3	32,3	3,9	64,0	7,6	41,9	-80,4	11,7	-11,3	0,03	0,03	0,03	0,06	0,81	0,03
100	PSM002085	Streaming Wat	6366560	1549860		0,50	5238	8,6	1,1	32,7	3,9	80,0	24,0	33,6	-79,8	12,2	-11,3	0,03	0,03	0,03	0,05	0,83	0,03
101	PSM002085	Streaming Wat	6366560	1549860		0,10	5398	6,8	1,0	24,9	3,0	53,0	5,6	25,0	-80,4	13,3	-11,3	0,03	0,03	0,03	0,07	0,81	0,03
102	PSM002086	Streaming Wat	6363730	1548480		0,31	5004	11,1	3,1	16,9	3,8	1,0	8,1	33,0	-76,0	11,9	-11,2	0,04	0,04	0,04	0,07	0,79	0,04
103	PSM002086	Streaming Wat	6363730	1548480		0,10	5070	11,2	3,3	17,2	3,8	3,0	11,2	49,5	-76,5	11,0	-11,3	0,04	0,04	0,04	0,08	0,78	0,04
104	PSM002086	Streaming Wat	6363730	1548480		0,10	5135	13,9	3,1	21,8	5,0	15,0	15,5	66,4	-77,4	10,7	-11,2	0,04	0,04	0,04	0,07	0,78	0,04
105	PSM002086	Streaming Wat	6363730	1548480		0,10	5216	15,3	3,5	23,3	5,4	20,0	17,7	64,3	-79,8	14,4	-11,4	0,04	0,04	0,04	0,09	0,76	0,04
106	PSM002086	Streaming Wat	6363730	1548480		0,10	5401	12,3	2,7	16,4	3,7	8,0	14,0	43,7	-81,9	11,3	-11,4	0,03	0,03	0,03	0,11	0,75	0,03
107	PSM002087	Streaming Wat	6365700	1550120			5002	5,9	1,5	7,7	2,0	2,0	5,3	13,9	-79,4	12,4	-11,2	0,03	0,03	0,03	0,09	0,78	0,03
108	PSM002087	Streaming Wat	6365700	1550120		0,10	5078	7,0	1,4	8,2	2,0	6,0	8,8	15,2	-75,1	11,7	-10,7	0,03	0,03	0,03	0,04	0,83	0,03
109	PSM002087	Streaming Wat	6365700	1550120		0,10	5144	8,7	1,4	10,1	2,6	14,0	12,0	18,7	-74,2	12,5	-10,7	0,03	0,03	0,03	0,03	0,82	0,04
110	PSM002087	Streaming Wat	6365700	1550120		0,50	5239	10,0	1,4	11,1	2,9	17,0	13,4	17,8	-78,0	11,1	-10,9	0,03	0,03	0,03	0,06	0,81	0,03
111	PSM002087	Streaming Wat	6365700	1550120		0,10	5397	9,0	1,3	9,1	2,3	11,0	11,2	15,2	-80,1	11,9	-11,0	0,03	0,03	0,03	0,08	0,80	0,03
112	PSM002170	Precipitation	6368189	1551082	6,17		3762	0,5	1,7	0,9	0,3	-0,2	1,0	1,7	-80,6	15,3	-10,9	0,03	0,03	0,03	0,08	0,80	0,03
113	PSM002170	Precipitation	6368189	1551082	6,17		6005	0,8	-0,4	0,2	-0,1	-0,2	1,2	0,9	-116,9	14,8	-15,5	0,02	0,02	0,02	0,51	0,43	0,02
114		Glacial						0,2	0,4	0,2	0,1	0,1	0,5	0,5	####	0,0	###	0,00	0,00	0,00	1,00	0,00	0,00
115		Sediment						2144,0	91,8	103,0	258,0	793,0	3383,0	53,1	-61,0	0,0	-7,0	1,00	0,00	0,00	0,00	0,00	0,00
116		Precipitation rain60'						0,4	0,3	0,2	0,1	12,2	0,2	1,4	-80,0	####	###	0,00	0,00	0,00	0,00	1,00	0,00
117		Sea Litorina new						3674,0	###	151,0	448,0	93,0	6500,0	890,0	-38,0	0,0	-4,7	0,00	1,00	0,00	0,00	0,00	0,00
118		Sea						1960,0	95,0	93,7	234,0	90,0	3760,0	325,0	-53,3	42,0	-5,9	0,52	0,27	0,05	0,05	0,05	0,05
119	127old	Laxemar						8500,0	45,5	####	2,1	14,1	####	906,0	-44,9	4,2	-8,9	0,00	0,00	1,00	0,00	0,00	0,00
120	KFM02A	Ground Water						168,0	6,5	34,2	7,8	378,0	84,4	53,9	-82,1	11,2	-11,4	0,01	0,01	0,01	0,01	0,68	0,28
121	KFM02A	Ground Water						148,0	8,4	30,8	7,3	381,0	63,0	48,1	-83,0	10,6	-11,4	0,01	0,01	0,01	0,01	0,68	0,29
122	HFM01	Ground Water						498,0	13,8	60,4	16,9	440,0	529,8	201,8	-64,2	3,7	-9,5	0,02	0,02	0,02	0,02	0,24	0,70
123	HFM01	Ground Water						556,0	15,2	79,1	22,8	480,0	651,1	220,1	-64,6	3,3	-9,4	0,02	0,02	0,02	0,02	0,19	0,75
124	HFM03	Ground Water						64,6	9,5	62,0	14,0	310,0	15,7	18,7	-79,6	12,0	-11,8	0,01	0,01	0,01	0,01	0,70	0,25
125	HFM05	Ground Water						1830,0	42,4	805,0	212,0	110,0	4652,5	308,7	-78,2	0,8	-10,2	0,14	0,12	0,12	0,12	0,12	0,37
126	HFM05	Ground Water						1800,0	42,2	781,0	207,0	115,0	4503,4	306,7	-78,1	0,8	-10,2	0,13	0,12	0,12	0,12	0,12	0,38
127	HFM05	Ground Water						1740,0	41,2	749,0	199,0	122,0	4340,3	299,2	-75,0	0,8	-10,3	0,13	0,12	0,12	0,12	0,12	0,40
128	SFM0001	Near Surface GW						242,0	15,9	103,0	33,7	420,0	300,6	162,6	-90,6	15,3	-10,9	0,02	0,02	0,02	0,02	0,58	0,34

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
129	SFM0001	Near Surface GW						321,0	18,9	91,7	40,6	476,0	392,4	159,8	-76,3	6,0	-10,8	0,01	0,01	0,01	0,01	0,36	0,58
130	SFM0001	Near Surface GW						254,0	16,9	89,1	36,5	427,0	371,1	195,1	-80,3	13,3	-11,1	0,02	0,02	0,02	0,02	0,47	0,44
131	SFM0002	Near Surface GW						40,7	6,2	187,0	11,8	330,0	126,2	19,6	-95,2	13,7	-11,8	0,02	0,02	0,02	0,02	0,87	0,06
132	SFM0002	Near Surface GW						43,1	5,4	129,0	9,5	390,0	113,1	18,0	-83,5	13,0	-11,9	0,01	0,01	0,01	0,01	0,74	0,24
133	SFM0002	Near Surface GW						46,7	6,1	131,0	9,7	351,0	100,3	46,9	-84,0	11,7	-11,9	0,01	0,01	0,01	0,01	0,76	0,19
134	SFM0003	Near Surface GW						33,4	15,8	143,0	31,2	410,0	18,6	81,4	-82,3	24,9	-9,0	0,00	0,00	0,00	0,00	0,38	0,60
135	SFM0003	Near Surface GW						33,5	13,7	97,3	27,0	453,0	17,9	75,3	-76,3	6,0	-9,7	-1.#IND	-1.#IND	-1.#IND	-1.#IND	-1.#IND	-1.#IND
136	SFM0003	Near Surface GW						31,1	13,6	93,0	25,2	426,0	12,7	60,8	-74,9	17,9	-9,9	-1.#IND	-1.#IND	-1.#IND	-1.#IND	-1.#IND	-1.#IND
137	SFM0005	Near Surface GW						5,8	1,9	85,6	5,4	260,0	7,4	13,6	-84,3	11,0	-12,0	0,02	0,02	0,02	0,02	0,86	0,07
138	PFM000074	Lake Water						6,7	1,6	69,1	3,2	210,0	6,2	3,7	-77,8	12,5	-9,6	0,01	0,01	0,01	0,01	0,66	0,29
139	PFM000074	Lake Water						6,9	1,6	71,3	3,6	240,0	6,1	2,8	-69,7	13,7	-9,8	0,01	0,01	0,01	0,01	0,58	0,39
140	PFM000074	Lake Water						10,5	1,8	66,1	4,0	222,0	10,3	3,4	-68,4	14,7	-9,2	0,01	0,01	0,01	0,01	0,53	0,44
141	PFM000074	Lake Water						9,0	2,6	84,0	4,4	245,0	12,2	27,3	-83,1	11,7	-11,8	0,02	0,02	0,02	0,02	0,84	0,09
142	PFM000087	Lake Water						8,8	2,7	63,2	3,9	190,0	9,5	8,3	-88,8	12,6	-11,7	0,02	0,02	0,02	0,04	0,87	0,02
143	PFM000087	Lake Water						8,7	2,8	64,1	4,0	190,0	9,4	8,3	-90,0	12,1	-12,0	0,02	0,02	0,02	0,06	0,86	0,02
144	PFM000087	Lake Water						12,0	2,2	64,9	4,4	190,0	12,0	6,4	-77,0	13,6	-9,4	0,01	0,01	0,01	0,01	0,64	0,30
145	PFM000087	Lake Water						12,0	2,3	66,3	4,5	200,0	12,5	6,2	-78,2	16,0	-9,4	0,01	0,01	0,01	0,01	0,65	0,30
146	PFM000087	Lake Water						9,8	2,3	65,4	4,5	220,0	10,3	5,3	-68,6	15,6	-9,7	0,01	0,01	0,01	0,01	0,56	0,40
147	PFM000087	Lake Water						9,8	2,5	66,2	4,6	230,0	10,4	5,4	-68,5	12,5	-9,8	0,01	0,01	0,01	0,01	0,56	0,40
148	PFM000087	Lake Water						12,1	2,1	52,5	5,2	180,0	11,2	5,6	-64,2	11,6	-8,3	0,01	0,01	0,01	0,01	0,44	0,53
149	PFM000087	Lake Water						11,9	2,2	54,5	5,1	189,0	14,6	5,6	-63,5	10,4	-8,2	0,01	0,01	0,01	0,01	0,42	0,55
150	PFM000087	Lake Water						11,5	3,9	93,9	6,2	309,0	14,9	33,4	-77,4	12,2	-10,5	0,01	0,01	0,01	0,01	0,64	0,33
151	PFM000087	Lake Water						12,2	3,9	99,0	6,3	309,0	17,8	33,4	-80,2	10,1	-11,0	0,01	0,01	0,01	0,01	0,70	0,26
152	PFM000097	Lake Water						89,2	4,9	44,2	12,3	110,0	176,7	25,2	-84,8	11,7	-10,7	0,03	0,03	0,03	0,03	0,83	0,05
153	PFM000097	Lake Water						75,5	4,3	42,7	10,7	120,0	136,2	22,0	-60,6	14,1	-6,0	0,01	0,01	0,01	0,01	0,25	0,71
154	PFM000097	Lake Water						57,9	3,5	39,5	8,9	120,0	108,9	19,5	-53,4	8,2	-5,9	0,01	0,01	0,01	0,01	0,18	0,79
155	PFM000097	Lake Water						51,4	4,3	58,6	9,4	190,0	95,9	22,3	-64,4	13,9	-7,9	0,01	0,01	0,01	0,01	0,38	0,58
156	PFM000107	Lake Water						91,6	4,8	46,6	12,5	120,0	182,0	26,1	-82,8	12,6	-10,8	0,03	0,03	0,03	0,03	0,81	0,07
157	PFM000107	Lake Water						89,8	4,9	46,9	12,4	110,0	178,8	25,7	-82,8	13,0	-10,8	0,03	0,03	0,03	0,03	0,82	0,06
158	PFM000107	Lake Water						65,0	4,0	42,9	9,5	120,0	116,5	19,4	-63,5	13,2	-6,8	0,01	0,01	0,01	0,01	0,34	0,61
159	PFM000107	Lake Water						64,9	3,9	42,8	9,4	120,0	116,1	19,4	-64,3	15,6	-6,7	0,01	0,01	0,01	0,01	0,34	0,61
160	PFM000107	Lake Water						48,8	3,3	42,0	8,2	130,0	88,9	17,5	-55,8	8,4	-6,3	0,01	0,01	0,01	0,01	0,23	0,74

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
161	PFM000107	Lake Water						47,7	3,4	42,2	7,8	130,0	83,2	16,9	-54,8	11,7	-6,4	0,01	0,01	0,01	0,01	0,23	0,75
162	PFM000107	Lake Water						57,1	4,1	44,4	9,3	144,0	98,1	17,6	-52,3	10,4	-6,0	0,00	0,00	0,00	0,00	0,16	0,83
163	PFM000107	Lake Water						40,0	4,4	41,0	6,5	157,0	78,8	18,1	-77,4	11,5	-10,8	0,02	0,02	0,02	0,02	0,75	0,16
164	PFM000107	Lake Water						43,6	3,8	52,0	8,1	171,0	84,2	20,0	-66,9	9,8	-8,4	0,01	0,01	0,01	0,01	0,46	0,49
165	PFM000117	Lake Water						5,4	1,9	53,3	2,6	160,0	5,1	4,4	-77,3	12,5	-9,8	0,02	0,02	0,02	0,02	0,70	0,23
166	PFM000117	Lake Water						5,6	1,9	53,3	2,5	160,0	3,9	4,2	-77,5	13,2	-9,8	0,02	0,02	0,02	0,02	0,70	0,23
167	PFM000117	Lake Water						5,8	1,9	38,2	2,7	110,0	4,1	4,5	-72,3	15,5	-7,1	0,01	0,01	0,01	0,01	0,48	0,47
168	PFM000117	Lake Water						5,9	1,9	39,2	2,7	110,0	4,2	4,5	-72,4	12,7	-7,0	0,01	0,01	0,01	0,01	0,48	0,48
169	PFM000117	Lake Water						5,4	1,7	36,6	2,7	120,0	4,3	4,5	-57,9	6,9	-6,7	0,01	0,01	0,01	0,01	0,31	0,67
170	PFM000117	Lake Water						7,4	2,5	52,3	3,5	170,0	5,5	5,7	-61,5	12,7	-7,1	0,00	0,00	0,00	0,00	0,33	0,65
171	PFM000117	Lake Water						6,8	2,3	53,5	3,3	185,0	9,3	6,9	-61,8	13,5	-7,2	0,00	0,00	0,00	0,00	0,34	0,65
172	PFM000127	Lake Water						21,5	3,4	29,6	5,6	97,0	26,6	14,5	-63,2	8,7	-5,0	0,01	0,01	0,01	0,01	0,23	0,74
173	PFM000127	Lake Water						21,4	3,3	30,2	5,8	97,0	29,9	14,9	-62,4	13,1	-8,1	0,02	0,02	0,02	0,02	0,45	0,49
174	PFM000127	Lake Water						21,0	3,2	30,3	5,9	110,0	45,8	16,2	-44,3	7,6	-4,5	0,00	0,00	0,00	0,00	0,00	1,00
175	PFM000127	Lake Water						21,0	3,0	30,6	5,7	110,0	27,8	14,1	-46,3	6,1	-4,6	0,00	0,00	0,00	0,00	0,03	0,97
176	PFM000135	Lake Water						33,7	5,4	72,2	9,0	281,0	49,3	22,8	-61,9	11,6	-7,2	-1.#IND	-1.#IND	-1.#IND	-1.#IND	-1.#IND	-1.#IND
177	PFM000062	Sea Water						1455,0	56,0	71,7	184,0	71,0	2615,6	362,9	-66,1	10,6	-8,1	0,38	0,09	0,09	0,09	0,09	0,25
178	PFM000062	Sea Water						1430,0	51,6	66,6	165,0	70,0	2464,7	343,9	-64,1	15,9	-8,5	0,30	0,09	0,09	0,09	0,09	0,33
179	PFM000062	Sea Water						1410,0	50,1	66,6	164,0	70,0	2476,4	348,8	-62,4	11,7	-8,5	0,31	0,09	0,09	0,09	0,09	0,32
180	PFM000062	Sea Water						1490,0	51,0	68,3	180,0	74,0	2627,6	363,7	-61,3	15,6	-8,2	0,37	0,09	0,09	0,09	0,09	0,26
181	PFM000062	Sea Water						1490,0	51,3	68,7	181,0	83,0	2656,8	368,6	-61,6	15,3	-8,2	0,38	0,09	0,09	0,09	0,09	0,25
182	PFM000063	Sea Water						1450,0	55,1	72,2	184,0	72,0	2627,4	365,7	-65,1	17,4	-7,8	0,40	0,09	0,09	0,09	0,09	0,23
183	PFM000063	Sea Water						1460,0	56,0	72,8	186,0	72,0	2612,9	370,2	-65,7	17,4	-8,0	0,39	0,09	0,09	0,09	0,09	0,23
184	PFM000063	Sea Water						1473,3	52,7	68,5	169,7	74,0	2573,1	363,6	-61,6	18,6	-8,2	0,36	0,09	0,09	0,09	0,09	0,27
185	PFM000063	Sea Water						1513,3	54,0	70,2	174,3	77,0	2591,5	367,5	-62,6	18,1	-8,4	0,36	0,09	0,09	0,09	0,09	0,26
186	PFM000063	Sea Water						1460,0	50,4	67,7	178,0	71,0	2636,0	366,0	-61,8	16,0	-8,1	0,37	0,09	0,09	0,09	0,09	0,26
187	PFM000063	Sea Water						1500,0	51,2	68,9	181,0	70,0	2610,2	359,7	-61,6	17,1	-8,1	0,38	0,09	0,09	0,09	0,09	0,25
188	PFM000063	Sea Water						1410,0	53,0	71,3	173,0	79,0	2613,2	374,5	-60,9	13,9	-8,5	0,36	0,09	0,09	0,09	0,09	0,27
189	PFM000063	Sea Water						1450,0	55,2	72,2	179,0	82,0	2723,5	381,3	-65,1	17,5	-8,5	0,36	0,10	0,10	0,10	0,10	0,26
190	PFM000064	Sea Water						1385,0	53,3	73,4	176,0	79,0	2507,5	347,0	-63,7	11,6	-7,6	0,39	0,09	0,09	0,09	0,09	0,26
191	PFM000064	Sea Water						1385,0	53,4	72,9	175,5	77,0	2522,8	348,4	-64,1	12,2	-7,6	0,39	0,09	0,09	0,09	0,09	0,26
192	PFM000064	Sea Water						1203,3	43,5	66,2	107,9	90,0	2098,5	290,4	-61,5	17,0	-8,0	0,20	0,08	0,08	0,08	0,08	0,49

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
193	PFM000064	Sea Water						1430,0	49,0	69,9	175,0	77,0	2582,4	352,4	-60,1	15,0	-7,8	0,38	0,09	0,09	0,09	0,09	0,27
194	PFM000064	Sea Water						1410,0	48,6	69,5	172,0	80,0	2494,6	345,2	-60,2	14,2	-8,0	0,36	0,09	0,09	0,09	0,09	0,29
195	PFM000065	Sea Water						1375,0	53,3	71,8	175,5	76,0	2509,5	349,3	-72,5	14,1	-7,9	0,30	0,09	0,09	0,09	0,09	0,33
196	PFM000065	Sea Water						1090,0	40,3	63,8	126,3	93,0	1952,9	270,3	-60,7	11,4	-8,1	0,20	0,07	0,07	0,07	0,07	0,51
197	PFM000065	Sea Water						1430,0	49,3	68,6	174,0	74,0	2520,9	350,2	-60,9	16,6	-8,1	0,35	0,09	0,09	0,09	0,09	0,29
198	PFM000065	Sea Water						652,0	25,9	55,8	78,9	99,0	1170,0	244,2	-67,5	12,2	-8,8	0,06	0,06	0,06	0,06	0,23	0,52
199	PFM000082	Sea Water						1420,0	53,1	72,1	173,0	76,0	2840,7	341,9	-64,5	15,9	-8,2	0,34	0,09	0,09	0,09	0,09	0,29
200	PFM000082	Sea Water						1400,0	52,7	71,7	171,0	75,0	2786,8	334,4	-65,1	19,3	-8,2	0,33	0,09	0,09	0,09	0,09	0,31
201	PFM000082	Sea Water						1430,0	54,1	70,3	176,0	75,0	2667,1	373,9	-64,1	12,6	-8,3	0,36	0,09	0,09	0,09	0,09	0,26
202	PFM000082	Sea Water						1450,0	54,0	70,2	177,0	80,0	2685,6	380,3	-64,1	16,6	-8,3	0,36	0,09	0,09	0,09	0,09	0,26
203	PFM000083	Sea Water						1430,0	53,5	72,8	175,0	74,0	2751,9	329,5	-65,1	16,1	-8,2	0,34	0,09	0,09	0,09	0,09	0,30
204	PFM000083	Sea Water						1430,0	53,8	72,9	175,0	74,0	2808,5	336,6	-64,8	13,9	-8,1	0,35	0,09	0,09	0,09	0,09	0,28
205	PFM000084	Sea Water						133,0	6,7	48,5	18,4	110,0	211,6	46,4	-83,5	11,2	-11,0	0,03	0,03	0,03	0,03	0,81	0,05
206	PFM000084	Sea Water						136,0	6,9	49,2	18,7	110,0	289,4	54,5	-82,4	11,7	-11,0	0,04	0,04	0,04	0,04	0,80	0,06
207	PFM000066	Streaming Water						3,7	2,2	60,4	2,6	180,0	3,5	9,0	-89,7	10,5	-12,0	0,02	0,02	0,02	0,07	0,85	0,02
208	PFM000066	Streaming Water						5,0	1,5	67,3	3,2	200,0	3,1	4,2	-77,7	13,0	-9,5	0,01	0,01	0,01	0,01	0,66	0,29
209	PFM000066	Streaming Water						4,8	1,5	66,6	3,2	210,0	3,1	3,7	-67,9	14,2	-9,7	0,01	0,01	0,01	0,01	0,57	0,39
210	PFM000066	Streaming Water						7,9	3,2	84,6	4,2	245,0	6,0	27,5	-78,3	11,8	-11,0	0,01	0,01	0,01	0,01	0,73	0,21
211	PFM000067	Streaming Water						92,8	5,1	46,5	12,8	110,0	184,8	26,1	-82,9	13,0	-10,8	0,03	0,03	0,03	0,03	0,82	0,06
212	PFM000067	Streaming Water						72,2	4,3	43,1	10,3	120,0	127,2	21,1	-62,6	12,2	-6,3	0,01	0,01	0,01	0,01	0,29	0,67
213	PFM000067	Streaming Water						53,8	3,5	41,7	8,5	130,0	101,6	18,5	-53,8	6,7	-6,0	0,01	0,01	0,01	0,01	0,18	0,79
214	PFM000067	Streaming Water						62,9	4,4	45,4	10,4	124,0	111,7	25,3	-50,1	14,2	-5,5	0,01	0,01	0,01	0,01	0,10	0,87
215	PFM000067	Streaming Water						54,1	5,0	60,9	9,8	191,0	90,8	20,8	-62,2	13,7	-7,4	0,01	0,01	0,01	0,01	0,32	0,65
216	PFM000068	Streaming Water						7,0	2,1	50,2	3,0	150,0	7,0	5,0	-86,2	10,7	-11,2	0,02	0,02	0,02	0,03	0,88	0,02
217	PFM000068	Streaming Water						12,3	1,5	55,8	4,2	160,0	13,5	5,8	-79,9	11,0	-8,8	0,01	0,01	0,01	0,01	0,65	0,29
218	PFM000068	Streaming Water						12,7	1,5	58,6	4,4	190,0	17,0	5,2	-68,7	8,5	-9,3	0,01	0,01	0,01	0,01	0,56	0,40
219	PFM000068	Streaming Water						27,1	2,3	73,0	7,9	226,0	47,5	9,0	-73,4	12,8	-10,5	0,01	0,01	0,01	0,01	0,66	0,29
220	PFM000068	Streaming Water						15,9	3,0	66,2	5,1	202,0	19,2	14,8	-74,9	13,6	-10,0	0,01	0,01	0,01	0,01	0,65	0,29
221	PFM000069	Streaming Water						8,7	2,2	49,5	3,3	140,0	13,2	6,8	-91,4	10,9	-12,1	0,02	0,02	0,02	0,11	0,80	0,02
222	PFM000069	Streaming Water						15,9	1,3	61,3	4,9	180,0	20,5	8,1	-85,5	11,0	-10,2	0,02	0,02	0,02	0,02	0,80	0,13
223	PFM000069	Streaming Water						14,6	1,3	62,0	4,8	190,0	20,4	6,3	-71,5	10,1	-9,8	0,01	0,01	0,01	0,01	0,62	0,32
224	PFM000069	Streaming Water						26,7	1,6	70,4	7,6	222,0	59,3	9,3	-73,4	11,2	-10,3	0,01	0,01	0,01	0,01	0,65	0,30

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
225	PFM000069	Streaming Water						27,3	3,7	85,5	7,2	256,0	40,6	17,5	-87,4	13,9	-11,7	0,02	0,02	0,02	0,02	0,86	0,07
226	PFM000070	Streaming Water						5,8	1,8	40,2	2,7	120,0	4,2	3,9	-65,3	12,4	-7,1	0,01	0,01	0,01	0,01	0,41	0,55
227	PFM000070	Streaming Water						5,5	1,4	39,9	2,6	130,0	4,1	3,4	-58,5	6,6	-6,9	0,01	0,01	0,01	0,01	0,32	0,65
228	PFM000070	Streaming Water						9,7	3,1	52,8	3,4	168,0	5,4	6,5	-62,6	15,4	-7,4	0,01	0,01	0,01	0,01	0,36	0,61
229	PFM000071	Streaming Water						3,7	2,1	82,0	3,7	250,0	2,3	2,7	-86,2	11,9	-11,4	0,01	0,01	0,01	0,01	0,85	0,09
230	PFM000071	Streaming Water						3,6	2,1	83,9	3,8	280,0	1,5	1,1	-78,5	5,3	-11,2	0,01	0,01	0,01	0,01	0,74	0,22
231	PFM000071	Streaming Water						5,6	2,6	86,3	4,1	268,0	3,2	9,2	-86,2	13,3	-12,1	0,02	0,02	0,02	0,02	0,88	0,05
232	PFM000072	Streaming Water						14,0	3,0	47,1	4,8	140,0	17,7	11,8	-78,7	10,2	-10,1	0,02	0,02	0,02	0,02	0,73	0,18
233	PFM000072	Streaming Water						28,9	1,6	36,1	6,4	130,0	34,1	7,4	-65,3	12,8	-5,8	0,01	0,01	0,01	0,01	0,30	0,68
234	PFM000072	Streaming Water						28,0	1,4	36,4	6,5	140,0	37,7	6,9	-51,5	10,4	-5,6	0,00	0,00	0,00	0,00	0,15	0,85
235	PFM000072	Streaming Water						72,8	4,7	49,1	11,8	128,0	117,8	71,7	-63,0	12,1	-8,4	0,02	0,02	0,02	0,02	0,43	0,49
236	PFM000072	Streaming Water						70,4	4,9	63,6	15,3	201,0	107,7	55,2	-70,6	13,8	-9,2	0,02	0,02	0,02	0,02	0,51	0,42
237	PFM000073	Streaming Water						10,0	6,4	122,0	13,3	390,0	5,9	48,4	-89,2	10,3	-11,9	0,01	0,01	0,01	0,01	0,77	0,19
238	HA0982B	Äspö						1557,1	21,0	427,9	125,2	225,0	3403,5	299,0	-54,5	22,8	-7,4	0,24	0,07	0,07	0,07	0,07	0,47
239	HA1327B	Äspö						1850,0	12,0	778,0	158,0	277,0	4770,0	198,0	-59,2	8,0	-7,5	0,19	0,07	0,07	0,07	0,07	0,51
240	HA1327B	Äspö						1860,0	11,0	746,0	155,0	280,0	4600,0	208,0	-57,5	18,0	-7,6	0,19	0,07	0,07	0,07	0,07	0,51
241	HA1327B	Äspö						1790,0	12,3	674,0	153,0	265,0	4350,0	241,0	-54,5	13,0	-7,4	0,24	0,07	0,07	0,07	0,07	0,47
242	HA1327B	Äspö						1760,0	13,7	684,0	157,0	259,0	4310,0	255,0	-50,6	18,0	-7,5	0,28	0,07	0,07	0,07	0,07	0,43
243	HA1749A	Äspö						1260,0	13,0	726,5	65,9	116,0	3450,0	284,6	-69,3	4,2	-10,9	0,09	0,09	0,09	0,09	0,52	0,10
244	HAS02	Äspö						2320,0	26,0	818,0	217,0	227,0	5470,0	162,0	-57,6	1,0	-7,5	0,38	0,09	0,09	0,09	0,09	0,27
245	HAS02	Äspö						2250,0	28,0	741,0	244,0	219,0	5160,0	155,0	-63,7	1,0	-7,8	0,36	0,09	0,09	0,09	0,09	0,29
246	HAS03	Äspö						335,0	14,0	80,0	36,0	235,0	574,0	98,0	-76,4	33,0	-10,8	0,03	0,03	0,03	0,03	0,56	0,31
247	HAS03	Äspö						336,0	12,0	87,0	39,0	235,0	608,0	104,0	-80,5	35,0	-10,9	0,03	0,03	0,03	0,03	0,62	0,25
248	HAS05	Äspö						228,0	4,0	27,0	4,0	373,0	123,0	118,0	-68,7	1,0	-9,8	0,01	0,01	0,01	0,01	0,45	0,52
249	HAS05	Äspö						237,0	4,0	25,0	6,0	370,0	119,0	118,0	-73,8	2,0	-9,9	0,01	0,01	0,01	0,01	0,50	0,46
250	HAS06	Äspö						254,0	3,0	44,0	11,0	271,0	280,0	96,0	-73,3	24,0	-10,2	0,02	0,02	0,02	0,02	0,58	0,34
251	HAS06	Äspö						900,0	12,0	297,0	56,0	155,0	1760,0	283,0	-66,6	11,0	-9,4	0,07	0,07	0,07	0,07	0,37	0,37
252	HAS07	Äspö						669,0	5,0	347,0	48,0	102,0	1650,0	122,0	-81,2	1,0	-11,2	0,06	0,06	0,06	0,10	0,67	0,06
253	HAS07	Äspö						656,0	5,0	361,0	55,0	106,0	1740,0	116,0	-83,4	1,0	-11,4	0,06	0,06	0,06	0,11	0,66	0,06
254	HAS13	Äspö						1880,0	32,8	1040,0	219,0	132,0	5070,0	136,0	-69,3	1,2	-7,2	0,29	0,10	0,10	0,10	0,10	0,33
255	HBH01	Äspö						8,6	2,3	41,3	4,0	137,0	11,3	24,5	-67,3	34,0	-8,8	0,01	0,01	0,01	0,01	0,53	0,41
256	HBH01	Äspö						487,0	6,7	257,0	37,6	222,0	1200,0	130,0	-74,7	34,0	-10,0	0,04	0,04	0,04	0,04	0,54	0,30

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
257	HBH01	Äspö						494,0	5,9	224,0	34,8	237,0	1080,0	131,8	-74,7	42,0	-10,1	0,04	0,04	0,04	0,04	0,55	0,30
258	HBH01	Äspö						482,0	5,8	211,0	34,3	243,0	1056,0	126,0	-75,8	34,0	-10,3	0,04	0,04	0,04	0,04	0,58	0,28
259	HBH01	Äspö						441,0	5,0	180,0	30,2	260,0	932,0	130,0	-79,3	17,0	-10,7	0,03	0,03	0,03	0,03	0,64	0,22
260	HBH01	Äspö						426,0	4,8	166,0	26,1	270,0	869,0	132,7	-78,3	17,0	-10,3	0,03	0,03	0,03	0,03	0,60	0,27
261	HBH01	Äspö						434,0	6,4	169,0	26,8	280,0	843,0	142,0	-77,8	25,0	-10,2	0,03	0,03	0,03	0,03	0,57	0,30
262	HBH01	Äspö						420,0	7,1	163,0	26,5	280,0	833,0	137,5	-78,1	17,0	-9,7	0,03	0,03	0,03	0,03	0,53	0,35
263	HBH01	Äspö						421,0	5,7	162,0	27,0	286,0	812,0	134,0	-76,9	17,0	-9,8	0,03	0,03	0,03	0,03	0,53	0,35
264	HBH01	Äspö						391,0	5,6	144,0	23,7	288,0	737,0	136,0	-76,7	25,0	-9,6	0,03	0,03	0,03	0,03	0,52	0,37
265	HBH01	Äspö						390,0	5,7	144,0	22,8	291,0	739,0	138,0	-73,8	9,3	-9,7	0,03	0,03	0,03	0,03	0,50	0,40
266	HBH01	Äspö						369,0	5,0	130,0	21,4	294,0	654,0	140,0	-72,4	9,3	-9,7	0,02	0,02	0,02	0,02	0,49	0,41
267	HBH01	Äspö						361,0	3,7	120,0	19,9	291,0	610,0	128,0	-70,1	15,0	-9,9	0,02	0,02	0,02	0,02	0,50	0,41
268	HBH01	Äspö						356,0	5,5	118,0	19,7	292,0	598,0	128,5	-68,0	14,0	-10,0	0,02	0,02	0,02	0,02	0,47	0,44
269	HBH01	Äspö						321,0	4,3	108,0	21,3	299,0	519,0	129,0	-71,0	22,0	-9,9	0,02	0,02	0,02	0,02	0,49	0,42
270	HBH01	Äspö						304,0	4,0	94,3	15,8	305,0	476,0	123,0	-75,1	25,0	-9,9	0,02	0,02	0,02	0,02	0,54	0,38
271	HBH01	Äspö						312,0	5,0	98,2	16,8	311,0	484,0	125,0	-71,4	14,0	-9,8	0,02	0,02	0,02	0,02	0,48	0,44
272	HBH01	Äspö						349,0	5,1	115,0	19,1	309,0	461,0	104,7	-71,8	22,0	-9,7	0,02	0,02	0,02	0,02	0,48	0,44
273	HBH01	Äspö						346,0	5,0	113,0	20,2	310,0	515,0	124,6	-73,2	16,0	-9,5	0,02	0,02	0,02	0,02	0,48	0,44
274	HBH01	Äspö						348,0	5,0	115,0	20,5	311,0	529,0	125,8	-63,9	26,0	-9,5	0,02	0,02	0,02	0,02	0,38	0,54
275	HBH01	Äspö						305,0	4,6	97,6	17,8	315,0	450,0	114,2	-67,8	25,0	-9,5	0,02	0,02	0,02	0,02	0,43	0,51
276	HBH01	Äspö						260,5	3,3	82,1	14,3	311,0	352,0	105,0	-68,5	14,4	-9,8	0,02	0,02	0,02	0,02	0,47	0,46
277	HBH01	Äspö						262,9	3,2	81,0	14,3	319,0	348,0	104,2	-68,6	14,4	-9,8	0,01	0,01	0,01	0,01	0,47	0,47
278	HBH02	Äspö						11,5	2,3	15,4	1,9	63,0	5,0	13,2	-77,1	59,0	-10,2	0,03	0,03	0,03	0,03	0,78	0,11
279	HBH02	Äspö						11,9	2,6	45,0	3,6	142,0	19,1	19,9	-72,9	42,0	-9,7	0,02	0,02	0,02	0,02	0,65	0,28
280	HBH02	Äspö						21,1	1,7	34,5	3,2	137,0	13,5	24,3	-71,7	42,0	-10,0	0,02	0,02	0,02	0,02	0,67	0,25
281	HBH02	Äspö						5,3	1,7	16,7	2,4	40,0	8,3	17,5	-61,6	25,0	-8,5	0,02	0,02	0,02	0,02	0,52	0,39
282	HBH02	Äspö						6,2	1,3	20,8	3,4	70,0	10,4	18,4	-63,6	17,0	-7,9	0,02	0,02	0,02	0,02	0,48	0,45
283	HBH02	Äspö						5,3	1,0	16,7	4,0	65,0	9,6	15,4	-70,8	25,0	-8,9	0,02	0,02	0,02	0,02	0,63	0,28
284	HBH02	Äspö						5,5	1,0	17,1	3,1	53,0	10,6	16,2	-64,9	20,0	-8,0	0,02	0,02	0,02	0,02	0,51	0,41
285	HBH02	Äspö						5,6	1,0	17,9	5,6	65,0	9,2	15,1	-65,6	12,0	-9,1	0,02	0,02	0,02	0,02	0,59	0,33
286	HBH02	Äspö						5,4	1,1	16,3	2,2	64,0	10,3	15,2	-62,6	23,0	-9,9	0,02	0,02	0,02	0,02	0,62	0,28
287	HBH02	Äspö						5,4	1,2	20,9	3,7	63,0	12,4	15,7	-62,5	16,0	-9,5	0,02	0,02	0,02	0,02	0,59	0,32
288	HBH02	Äspö						6,2	1,4	25,9	3,2	74,0	12,8	20,9	-71,7	18,0	-9,4	0,02	0,02	0,02	0,02	0,67	0,24

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
289	HBH02	Äspö						6,4	1,4	25,1	3,3	70,0	9,9	20,6	-66,0	29,0	-9,2	0,02	0,02	0,02	0,02	0,60	0,31
290	HBH02	Äspö						6,7	1,4	27,5	3,3	77,0	7,8	18,7	-64,8	20,0	-8,6	0,02	0,02	0,02	0,02	0,54	0,39
291	HBH02	Äspö						8,0	1,3	28,4	4,9	79,0	17,7	18,2	-65,7	24,0	-8,5	0,02	0,02	0,02	0,02	0,54	0,39
292	HBH02	Äspö						6,4	1,2	21,4	2,8	55,0	12,1	17,8	-63,3	37,0	-9,1	0,02	0,02	0,02	0,02	0,58	0,34
293	HBH02	Äspö						10,3	1,7	42,5	3,3	114,0	6,0	19,2	-72,9	42,0	-9,7	0,02	0,02	0,02	0,02	0,68	0,24
294	HBH05	Äspö						15,4	2,6	38,4	4,0	137,0	11,2	23,0	-75,3	25,0	-9,6	0,02	0,02	0,02	0,02	0,67	0,25
295	HBH05	Äspö						16,6	2,5	39,2	4,3	143,0	11,7	22,3	-75,8	34,0	-9,5	0,02	0,02	0,02	0,02	0,66	0,26
296	HBH05	Äspö						19,2	3,0	38,5	3,8	162,0	12,0	21,5	-68,4	22,0	-9,9	0,02	0,02	0,02	0,02	0,61	0,33
297	HBH05	Äspö						19,4	2,7	40,4	4,5	165,0	19,9	16,6	-65,1	22,0	-8,8	0,01	0,01	0,01	0,01	0,49	0,46
298	HBH05	Äspö						25,4	2,6	42,6	8,8	172,0	27,6	36,6	-64,7	24,0	-9,4	0,01	0,01	0,01	0,01	0,52	0,42
299	KA0483A	Äspö						1480,0	9,1	1250,0	132,0	42,0	4890,0	60,0	-85,9	8,0	-11,3	0,09	0,09	0,09	0,23	0,39	0,09
300	KA1639A	Äspö						2005,0	6,8	1711,0	66,7	22,0	6290,0	434,4	-89,8	5,1	-12,1	0,11	0,11	0,15	0,43	0,11	0,11
301	KA1639A	Äspö						1995,0	6,8	1723,0	67,6	25,0	6390,0	437,4	-91,2	8,4	-12,1	0,11	0,11	0,15	0,43	0,11	0,11
302	KA1639A	Äspö						2113,0	6,8	1900,0	68,3	23,0	6950,0	485,0	-90,2	4,2	-12,4	0,10	0,10	0,16	0,43	0,10	0,10
303	KA1639A	Äspö						2218,0	8,2	1967,0	68,3	23,0	6960,0	479,4	-89,1	4,2	-12,4	0,10	0,10	0,17	0,42	0,10	0,10
304	KA1639A	Äspö						1670,0	6,3	773,0	38,8	15,0	4260,0	123,1	-107,6	12,0	-14,6	0,08	0,08	0,08	0,59	0,10	0,08
305	KA1639A	Äspö						1626,0	6,0	733,0	41,0	17,0	4060,0	114,5	-110,9	7,6	-14,7	0,07	0,07	0,07	0,60	0,10	0,07
306	KA1639A	Äspö						1620,0	6,0	774,0	45,9	19,0	4230,0	130,0	-107,1	4,2	-14,2	0,08	0,08	0,08	0,56	0,13	0,08
307	KA1750A	Äspö						1907,0	7,4	1540,0	76,4	37,0	6310,0	431,5	-89,6	4,2	-11,5	0,11	0,11	0,14	0,41	0,11	0,11
308	KA1750A	Äspö						1986,0	6,9	1607,0	70,7	33,0	6030,0	434,4	-86,2	5,1	-11,4	0,12	0,12	0,14	0,40	0,12	0,12
309	KA1750A	Äspö						2003,0	7,0	1630,0	69,0	31,0	6320,0	449,4	-80,0	8,4	-11,6	0,12	0,12	0,14	0,38	0,12	0,12
310	KA1750A	Äspö						2062,0	7,8	1684,0	71,2	33,0	6230,0	461,4	-83,5	4,2	-11,4	0,12	0,12	0,14	0,38	0,12	0,12
311	KA1755A	Äspö						2682,1	9,3	3400,3	40,7	9,0	10407,2	640,3	-91,9	8,5	-13,1	0,08	0,08	0,26	0,44	0,08	0,08
312	KA2162B	Äspö						2200,0	15,0	1260,0	166,0	102,0	5940,0	311,6	-60,2	4,2	-8,7	0,14	0,13	0,13	0,13	0,13	0,35
313	KA2162B	Äspö						2150,0	13,0	1330,0	153,0	116,0	5990,0	314,6	-61,5	4,2	-8,9	0,13	0,13	0,13	0,13	0,16	0,34
314	KA2162B	Äspö						2130,0	12,0	1420,0	126,0	96,0	6070,0	329,6	-73,5	4,2	-9,6	0,13	0,13	0,13	0,16	0,31	0,13
315	KA2512A	Äspö						1877,0	10,0	903,0	117,0	196,0	4750,7	302,0	-63,8	11,0	-8,1	0,10	0,10	0,10	0,10	0,15	0,46
316	KA2858A	Äspö						2630,0	9,7	3360,0	49,7	9,0	10300,0	577,0	-96,6	8,5	-13,1	0,07	0,07	0,25	0,46	0,07	0,07
317	KA2862A	Äspö						3230,0	13,6	4720,0	41,4	8,0	13300,0	666,0	-90,8	8,5	-12,7	0,07	0,07	0,32	0,40	0,07	0,07
318	KA2862A	Äspö						3160,0	13,6	4600,0	46,5	8,0	13200,0	667,0	-91,3	8,5	-12,5	0,07	0,07	0,32	0,40	0,07	0,07
319	KA3005A	Äspö						1730,0	12,5	1160,0	84,9	81,0	4870,0	288,0	-76,0	15,2	-9,7	0,11	0,11	0,11	0,16	0,40	0,11
320	KA3005A	Äspö						1740,0	12,7	1310,0	85,6	57,0	5400,0	305,0	-80,5	8,5	-10,0	0,12	0,12	0,12	0,23	0,30	0,12

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
321	KA3005A	Äspö						1730,0	13,6	1191,4	82,5	93,0	4878,3	350,6	-75,5	30,0	-10,0	0,12	0,12	0,12	0,17	0,36	0,12
322	KA3010A	Äspö						1820,0	15,5	1530,0	90,5	56,0	5770,0	315,0	-80,3	8,5	-10,5	0,12	0,12	0,12	0,27	0,24	0,12
323	KA3010A	Äspö						1890,0	15,1	1820,0	82,2	43,0	6600,0	336,0	-87,9	8,5	-11,3	0,12	0,12	0,13	0,38	0,12	0,12
324	KA3067A	Äspö						1720,0	11,8	1510,0	85,9	53,0	5650,0	307,0	-81,2	8,5	-10,6	0,12	0,12	0,12	0,28	0,25	0,12
325	KA3067A	Äspö						2374,3	12,7	2705,6	49,3	10,0	8584,9	426,3	-95,2	14,0	-13,0	0,09	0,09	0,20	0,46	0,09	0,09
326	KA3067A	Äspö						1880,0	11,2	1950,0	66,6	26,0	6560,0	350,0	-91,1	8,5	-11,7	0,11	0,11	0,14	0,42	0,11	0,11
327	KA3105A	Äspö						1400,0	9,5	856,0	97,6	102,0	3960,0	243,0	-72,4	22,0	-9,4	0,09	0,09	0,09	0,09	0,43	0,19
328	KA3105A	Äspö						1260,0	8,0	754,0	101,0	125,0	3520,0	217,0	-73,5	8,5	-8,7	0,08	0,08	0,08	0,08	0,38	0,29
329	KA3110A	Äspö						1590,0	26,0	585,0	131,0	164,0	3820,0	273,0	-60,7	27,0	-7,7	0,19	0,08	0,08	0,08	0,08	0,47
330	KA3110A	Äspö						1600,0	20,0	656,0	133,0	161,0	3940,0	286,0	-64,3	11,8	-9,2	0,09	0,09	0,09	0,09	0,16	0,47
331	KA3191F	Äspö						2128,5	9,5	1722,5	90,0	61,0	6691,8	368,0	-76,7	12,7	-10,4	0,13	0,13	0,13	0,31	0,16	0,13
332	KA3191F	Äspö						2225,3	8,6	2093,1	64,3	29,0	7409,7	444,7	-81,6	8,4	-11,2	0,12	0,12	0,16	0,37	0,12	0,12
333	KA3385A	Äspö						2080,0	8,5	1861,0	60,5	10,0	6650,0	443,0	-79,3	9,3	-10,4	0,12	0,12	0,15	0,35	0,12	0,12
334	KA3385A	Äspö						2090,0	8,4	1860,0	63,1	10,0	6710,0	450,0	-81,8	8,5	-10,5	0,12	0,12	0,15	0,36	0,12	0,12
335	KAS02	Äspö						1300,0	6,6	990,0	65,0	71,0	3820,0	106,0	-108,9	0,3	-13,9	0,07	0,07	0,07	0,49	0,22	0,07
336	KAS02	Äspö						1710,0	8,8	1480,0	75,0	33,0	5360,0	291,0	-99,8	8,0	-12,7	0,10	0,10	0,11	0,48	0,10	0,10
337	KAS02	Äspö						1150,0	7,5	671,0	48,5	138,0	3250,0	200,0	-94,9	8,0	-13,3	0,07	0,07	0,07	0,33	0,38	0,07
338	KAS02	Äspö						1700,0	9,0	1540,0	72,0	27,0	5340,0	270,0	-100,6	8,0	-12,3	0,10	0,10	0,11	0,48	0,10	0,10
339	KAS02	Äspö						1800,0	8,1	1580,0	66,0	25,0	5440,0	290,0	-99,9	8,0	-12,8	0,10	0,10	0,12	0,49	0,10	0,10
340	KAS02	Äspö						2100,0	8,1	1890,0	42,0	10,0	6410,0	560,0	-97,2	8,0	-12,3	0,09	0,09	0,17	0,46	0,09	0,09
341	KAS02	Äspö						2850,0	13,7	3310,0	30,1	25,0	10200,0	668,2	-99,7	8,0	-13,6	0,07	0,07	0,27	0,46	0,07	0,07
342	KAS02	Äspö						2850,0	11,5	3690,0	31,0	7,0	11100,0	522,0	-96,8	8,0	-13,0	0,07	0,07	0,26	0,46	0,07	0,07
343	KAS02	Äspö						3000,0	10,9	3830,0	31,0	11,0	11100,0	519,0	-96,8	0,2	-13,1	0,07	0,07	0,27	0,47	0,07	0,07
344	KAS03	Äspö						613,0	2,4	162,0	21,0	61,0	1220,0	31,1	-124,8	0,1	-15,8	0,03	0,03	0,03	0,58	0,30	0,03
345	KAS03	Äspö						1200,0	6,3	472,0	61,0	54,0	2850,0	31,9	-115,3	8,0	-14,6	0,06	0,06	0,06	0,51	0,27	0,06
346	KAS03	Äspö						1290,0	6,5	490,0	58,0	53,0	2950,0	39,0	-118,1	8,0	-14,5	0,06	0,06	0,06	0,53	0,24	0,06
347	KAS03	Äspö						1770,0	5,9	1400,0	40,0	12,0	5180,0	370,0	-104,9	8,0	-13,3	0,08	0,08	0,12	0,54	0,08	0,08
348	KAS03	Äspö						1550,0	6,2	1190,0	40,0	27,0	4600,0	300,0	-109,6	8,0	-13,6	0,08	0,08	0,10	0,57	0,08	0,08
349	KAS03	Äspö						1340,0	5,8	659,0	47,8	48,0	3360,0	167,4	-116,0	8,0	-14,9	0,07	0,07	0,07	0,60	0,13	0,07
350	KAS03	Äspö						1340,0	5,8	800,0	42,8	49,0	3530,0	175,9	-111,2	5,1	-14,6	0,07	0,07	0,07	0,57	0,14	0,07
351	KAS03	Äspö						1370,0	5,5	872,0	45,7	42,0	3840,0	198,0	-108,3	4,2	-14,4	0,08	0,08	0,08	0,56	0,13	0,08
352	KAS03	Äspö						1626,8	7,1	1263,8	44,3	33,0	4701,1	274,8	-105,8	5,0	-13,9	0,09	0,09	0,10	0,56	0,09	0,09

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
353	KAS03	Äspö						1450,0	6,9	964,0	48,4	38,0	4230,0	212,4	-108,5	4,0	-14,3	0,08	0,08	0,08	0,57	0,10	0,08
354	KAS03	Äspö						1564,0	6,7	1162,0	48,4	38,0	4637,0	270,0	-106,3	6,8	-13,6	0,09	0,09	0,09	0,55	0,09	0,09
355	KAS03	Äspö						1920,0	6,2	1740,0	38,0	11,0	5880,0	470,0	-103,4	8,0	-13,3	0,08	0,08	0,15	0,52	0,08	0,08
356	KAS03	Äspö						2130,0	6,6	2670,0	45,0	11,0	8080,0	680,0	-99,7	8,0	-13,0	0,08	0,08	0,22	0,47	0,08	0,08
357	KAS03	Äspö						3020,0	7,3	4380,0	49,5	11,0	12300,0	709,0	-96,4	0,4	-12,7	0,06	0,06	0,31	0,43	0,06	0,06
358	KAS04	Äspö						382,0	2,4	91,0	6,2	222,0	508,0	180,0	-84,8	4,3	-11,0	0,04	0,04	0,04	0,04	0,78	0,06
359	KAS04	Äspö						1060,0	8,0	597,0	24,9	69,0	2760,0	207,0	-103,4	8,0	-13,6	0,07	0,07	0,07	0,44	0,29	0,07
360	KAS04	Äspö						1180,0	6,1	740,0	30,0	69,0	3030,0	220,0	-99,6	0,5	-13,0	0,07	0,07	0,07	0,41	0,29	0,07
361	KAS04	Äspö						1890,0	7,8	1660,0	61,0	21,0	5840,0	407,0	-92,3	0,0	-11,9	0,11	0,11	0,13	0,44	0,11	0,11
362	KAS05	Äspö						1490,0	8,6	1070,0	53,5	97,0	4500,0	116,0	-100,3	8,0	-13,3	0,08	0,08	0,08	0,43	0,26	0,08
363	KAS05	Äspö						2270,0	7,7	2020,0	42,7	12,0	7290,0	576,0	-95,6	8,0	-12,9	0,09	0,09	0,19	0,46	0,09	0,09
364	KAS05	Äspö						2450,0	10,0	2560,0	42,1	5,0	8402,0	534,0	-96,8	8,4	-13,0	0,08	0,08	0,21	0,47	0,08	0,08
365	KAS06	Äspö						945,0	5,5	484,0	48,8	135,0	2450,0	117,0	-94,0	8,0	-12,0	0,06	0,06	0,06	0,22	0,54	0,06
366	KAS06	Äspö						1230,0	7,4	893,0	82,0	89,0	3630,0	150,0	-94,3	3,8	-10,9	0,08	0,08	0,08	0,24	0,44	0,08
367	KAS06	Äspö						1820,0	9,1	1490,0	119,0	49,0	5680,0	283,0	-77,8	0,3	-9,2	0,12	0,12	0,12	0,18	0,33	0,12
368	KAS06	Äspö						2070,0	11,7	1410,0	153,0	64,0	5970,0	362,0	-69,2	0,6	-7,4	0,13	0,13	0,13	0,13	0,16	0,31
369	KAS06	Äspö						2000,0	11,0	1280,0	126,0	52,0	5670,0	357,0	-77,7	8,0	-9,2	0,13	0,13	0,13	0,18	0,30	0,13
370	KAS06	Äspö						2200,0	11,1	1570,0	130,0	50,0	6150,0	459,0	-70,8	3,5	-8,2	0,15	0,15	0,15	0,15	0,26	0,15
371	KAS07	Äspö						971,0	8,1	522,0	39,3	167,0	2460,0	205,0	-87,1	8,0	-11,2	0,07	0,07	0,07	0,14	0,58	0,07
372	KAS07	Äspö						1540,0	11,0	655,0	126,0	182,0	3810,0	347,6	-65,3	24,0	-8,1	0,09	0,09	0,09	0,09	0,14	0,50
373	KAS07	Äspö						1479,0	10,8	559,0	125,0	335,0	3743,8	74,4	-65,4	22,0	-8,0	0,05	0,05	0,05	0,05	0,08	0,71
374	KAS07	Äspö						1940,0	9,8	1650,0	50,1	18,0	6060,0	486,0	-94,2	25,0	-12,1	0,10	0,10	0,15	0,44	0,10	0,10
375	KAS07	Äspö						1980,0	10,2	1600,0	51,2	52,0	6120,0	452,4	-89,1	9,0	-11,3	0,12	0,12	0,14	0,40	0,12	0,12
376	KAS07	Äspö						1890,0	9,5	1610,0	59,6	13,0	5960,0	446,0	-80,4	12,7	-11,2	0,12	0,12	0,14	0,38	0,12	0,12
377	KAS08	Äspö						450,0	4,0	164,0	18,9	237,0	918,0	87,0	-89,4	8,0	-11,5	0,04	0,04	0,04	0,05	0,80	0,04
378	KAS08	Äspö						2000,0	8,3	1670,0	64,3	27,0	6300,0	413,0	-84,3	8,0	-10,8	0,12	0,12	0,14	0,38	0,12	0,12
379	KAS08	Äspö						2180,0	13,3	1522,0	144,8	63,0	6452,0	391,0	-73,8	13,0	-9,2	0,14	0,14	0,14	0,18	0,25	0,14
380	KAS09	Äspö						1790,0	33,2	403,0	152,0	396,0	3820,0	228,0	-61,9	25,0	-7,4	0,35	0,06	0,06	0,06	0,06	0,43
381	KAS09	Äspö						1770,0	40,0	291,0	148,0	264,0	3541,8	352,0	-56,2	35,0	-7,1	0,43	0,07	0,07	0,07	0,07	0,27
382	KAS09	Äspö						1700,0	42,5	268,0	150,0	240,0	3390,0	362,5	-55,8	10,0	-6,7	0,47	0,07	0,07	0,07	0,07	0,23
383	KAS09	Äspö						1628,0	38,0	219,0	144,8	206,0	3162,0	363,0	-58,8	30,0	-7,1	0,37	0,08	0,08	0,08	0,08	0,32
384	KAS09	Äspö						1490,0	39,5	191,0	141,0	192,0	2930,0	364,0	-51,5	38,0	-6,9	0,43	0,07	0,07	0,07	0,07	0,28

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
385	KAS09	Äspö						1465,1	33,9	198,9	139,7	175,0	2804,3	298,3	-56,7	33,8	-7,0	0,32	0,07	0,07	0,07	0,07	0,40
386	KAS12	Äspö						1440,0	11,3	891,0	91,5	76,0	4220,0	171,0	-90,7	8,0	-11,4	0,09	0,09	0,09	0,26	0,38	0,09
387	KAS12	Äspö						1460,0	12,0	880,0	84,4	103,0	4158,6	168,0	-86,1	5,1	-11,2	0,09	0,09	0,09	0,20	0,44	0,09
388	KAS12	Äspö						1650,0	12,5	1070,0	107,0	61,0	4860,0	232,5	-82,0	4,0	-10,5	0,11	0,11	0,11	0,20	0,37	0,11
389	KAS13	Äspö						350,0	4,6	83,0	11,4	294,0	543,0	112,0	-83,4	17,0	-11,1	0,03	0,03	0,03	0,03	0,72	0,17
390	KAS13	Äspö						894,0	10,9	408,0	44,2	188,0	2160,0	190,0	-92,2	8,0	-11,9	0,06	0,06	0,06	0,16	0,58	0,06
391	KAS14	Äspö						1775,0	46,8	265,0	156,2	349,0	3403,5	350,0	-57,8	29,0	-6,8	0,52	0,06	0,06	0,06	0,06	0,22
392	KAS14	Äspö						1766,0	47,4	271,0	154,8	328,0	3399,9	361,0	-56,6	29,0	-7,1	0,51	0,07	0,07	0,07	0,07	0,22
393	KBH02	Äspö						1870,0	20,5	692,0	154,0	366,0	4320,0	212,7	-58,1	14,0	-7,2	0,30	0,06	0,06	0,06	0,06	0,45
394	KBH02	Äspö						1850,0	19,4	647,0	158,0	354,0	4350,0	210,0	-52,0	4,0	-7,3	0,34	0,06	0,06	0,06	0,06	0,42
395	KBH02	Äspö						1800,0	21,0	638,0	160,0	340,0	4210,0	227,4	-52,4	10,0	-7,3	0,35	0,06	0,06	0,06	0,06	0,41
396	KR0012B	Äspö						352,0	2,0	143,0	15,4	198,0	695,0	70,0	-82,1	34,0	-11,4	0,03	0,03	0,03	0,03	0,81	0,05
397	KR0012B	Äspö						410,0	2,0	200,0	22,0	185,0	915,0	62,0	-83,2	25,0	-11,5	0,04	0,04	0,04	0,05	0,80	0,04
398	KR0012B	Äspö						629,0	5,0	280,0	37,8	243,0	1360,0	133,6	-76,4	25,0	-10,2	0,04	0,04	0,04	0,04	0,57	0,26
399	KR0012B	Äspö						604,0	4,9	268,0	37,7	245,0	1330,0	134,2	-77,3	25,0	-10,2	0,04	0,04	0,04	0,04	0,58	0,26
400	KR0012B	Äspö						597,0	5,1	255,0	36,9	248,0	1290,0	131,2	-80,5	34,0	-9,9	0,04	0,04	0,04	0,04	0,59	0,25
401	KR0012B	Äspö						591,0	5,2	252,0	37,2	250,0	1300,0	138,7	-77,6	51,0	-10,3	0,04	0,04	0,04	0,04	0,59	0,25
402	KR0012B	Äspö						572,0	4,9	235,0	34,9	250,0	1270,0	125,0	-76,8	34,0	-11,0	0,04	0,04	0,04	0,04	0,64	0,20
403	KR0012B	Äspö						540,0	4,7	213,0	31,9	260,0	1130,0	147,0	-77,5	25,0	-10,2	0,04	0,04	0,04	0,04	0,58	0,27
404	KR0012B	Äspö						539,0	4,9	206,0	31,1	260,0	1110,0	140,0	-81,1	17,0	-10,3	0,04	0,04	0,04	0,04	0,63	0,22
405	KR0012B	Äspö						527,0	4,6	206,0	31,1	270,0	1130,0	139,0	-79,7	17,0	-10,4	0,04	0,04	0,04	0,04	0,62	0,24
406	KR0012B	Äspö						526,0	4,5	200,0	29,5	280,0	1070,0	141,0	-80,2	8,0	-10,4	0,04	0,04	0,04	0,04	0,62	0,24
407	KR0012B	Äspö						522,0	4,5	196,0	29,6	280,0	1040,0	147,0	-80,5	17,0	-10,4	0,04	0,04	0,04	0,04	0,62	0,24
408	KR0012B	Äspö						516,0	5,5	195,0	28,5	280,0	1080,0	143,0	-78,3	17,0	-10,3	0,03	0,03	0,03	0,03	0,59	0,28
409	KR0012B	Äspö						513,0	5,5	191,0	29,1	280,0	1000,0	132,0	-80,3	17,0	-9,8	0,03	0,03	0,03	0,03	0,57	0,30
410	KR0012B	Äspö						510,0	7,0	187,0	28,0	280,0	1020,0	148,0	-79,4	17,0	-9,9	0,03	0,03	0,03	0,03	0,56	0,31
411	KR0012B	Äspö						503,0	5,5	187,0	28,3	292,0	1010,0	133,0	-81,1	17,0	-9,8	0,03	0,03	0,03	0,03	0,57	0,30
412	KR0012B	Äspö						497,0	5,0	186,0	27,9	292,0	970,0	176,0	-79,9	17,0	-9,9	0,03	0,03	0,03	0,03	0,56	0,30
413	KR0012B	Äspö						486,0	4,8	178,0	27,1	296,0	934,0	140,0	-78,5	25,0	-9,7	0,03	0,03	0,03	0,03	0,54	0,34
414	KR0012B	Äspö						478,0	5,3	171,0	25,7	301,0	918,0	141,4	-78,7	17,0	-9,8	0,03	0,03	0,03	0,03	0,54	0,34
415	KR0012B	Äspö						475,0	5,0	168,0	22,9	299,0	932,0	150,0	-72,4	10,0	-9,8	0,03	0,03	0,03	0,03	0,49	0,40
416	KR0012B	Äspö						471,0	5,0	159,0	21,7	302,0	888,0	148,0	-72,3	4,2	-9,1	0,03	0,03	0,03	0,03	0,44	0,46

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sedim ent	Litorina	Brine	Glacial	Rain 60'	Lake water Forsm ark
417	KR0012B	Äspö						468,0	4,3	163,0	24,7	307,0	876,0	137,0	-72,4	18,0	-9,7	0,03	0,03	0,03	0,03	0,48	0,41
418	KR0012B	Äspö						452,0	5,2	155,0	23,8	306,0	823,0	127,0	-72,9	9,3	-9,8	0,03	0,03	0,03	0,03	0,49	0,41
419	KR0012B	Äspö						452,0	4,2	153,0	23,3	304,0	835,0	157,0	-72,9	20,0	-9,8	0,03	0,03	0,03	0,03	0,49	0,39
420	KR0012B	Äspö						461,0	4,5	156,0	23,7	311,0	840,0	142,0	-71,9	11,0	-9,8	0,03	0,03	0,03	0,03	0,48	0,42
421	KR0012B	Äspö						453,0	5,0	144,0	22,3	306,0	780,0	124,0	-68,1	12,0	-9,9	0,02	0,02	0,02	0,02	0,45	0,45
422	KR0012B	Äspö						445,0	5,1	146,0	22,7	306,0	789,0	128,0	-69,2	15,0	-9,7	0,02	0,02	0,02	0,02	0,45	0,46
423	KR0012B	Äspö						424,0	4,3	136,0	25,1	315,0	710,0	142,0	-72,0	17,0	-9,9	0,02	0,02	0,02	0,02	0,48	0,42
424	KR0012B	Äspö						406,0	4,5	118,0	18,6	307,0	662,0	143,0	-75,1	18,0	-9,9	0,03	0,03	0,03	0,03	0,53	0,37
425	KR0012B	Äspö						403,0	4,8	120,0	19,1	316,0	645,0	130,0	-74,1	27,0	-9,9	0,02	0,02	0,02	0,02	0,51	0,40
426	KR0012B	Äspö						411,0	4,5	126,0	20,1	317,0	665,0	137,0	-74,1	21,0	-9,6	0,02	0,02	0,02	0,02	0,49	0,42
427	KR0012B	Äspö						387,0	4,3	118,0	20,4	324,0	619,0	134,5	-69,6	34,0	-9,6	0,02	0,02	0,02	0,02	0,44	0,48
428	KR0012B	Äspö						346,6	3,4	100,1	17,4	325,0	500,0	125,6	-68,1	25,3	-9,8	0,02	0,02	0,02	0,02	0,45	0,48
429	KR0012B	Äspö						343,9	3,5	100,2	17,9	326,0	531,8	128,7	-67,9	30,4	-9,6	0,02	0,02	0,02	0,02	0,44	0,50
430	KR0012B	Äspö						381,3	4,5	109,5	21,7	308,0	608,4	129,8	-68,8	16,9	-9,4	0,02	0,02	0,02	0,02	0,43	0,49
431	KR0012B	Äspö						375,3	4,5	115,9	23,2	295,0	642,4	119,6	-66,7	42,0	-9,5	0,02	0,02	0,02	0,02	0,42	0,50
432	KR0013B	Äspö						876,0	4,8	571,0	63,7	133,0	2500,0	83,0	-93,3	17,0	-11,4	0,06	0,06	0,06	0,18	0,59	0,06
433	KR0013B	Äspö						986,0	4,7	535,0	71,5	237,0	2460,0	148,6	-78,5	25,0	-10,3	0,06	0,06	0,06	0,06	0,56	0,21
434	KR0013B	Äspö						964,0	5,1	540,0	75,5	243,0	2450,0	146,8	-81,4	17,0	-10,4	0,06	0,06	0,06	0,06	0,58	0,19
435	KR0013B	Äspö						926,0	4,5	502,0	70,3	245,0	2340,0	142,6	-77,8	34,0	-10,1	0,05	0,05	0,05	0,05	0,53	0,25
436	KR0013B	Äspö						913,0	6,3	490,0	71,3	250,0	2340,0	148,6	-77,2	34,0	-10,1	0,05	0,05	0,05	0,05	0,51	0,27
437	KR0013B	Äspö						888,0	6,4	466,0	65,7	260,0	2290,0	140,0	-78,9	34,0	-10,5	0,05	0,05	0,05	0,05	0,56	0,23
438	KR0013B	Äspö						851,0	4,1	440,0	64,0	260,0	2150,0	136,0	-80,1	25,0	-10,4	0,05	0,05	0,05	0,05	0,58	0,21
439	KR0013B	Äspö						848,0	4,0	433,0	61,9	270,0	2130,0	148,0	-80,0	8,0	-10,4	0,05	0,05	0,05	0,05	0,58	0,22
440	KR0013B	Äspö						836,0	4,1	424,0	61,0	270,0	2110,0	149,0	-79,8	8,0	-10,3	0,05	0,05	0,05	0,05	0,57	0,23
441	KR0013B	Äspö						821,0	4,0	413,0	58,2	280,0	2040,0	150,0	-80,6	17,0	-10,3	0,05	0,05	0,05	0,05	0,57	0,23
442	KR0013B	Äspö						831,0	4,0	413,0	58,8	280,0	2020,0	153,0	-80,0	17,0	-10,3	0,05	0,05	0,05	0,05	0,57	0,24
443	KR0013B	Äspö						806,0	6,3	405,0	57,7	290,0	1990,0	148,0	-81,3	17,0	-10,4	0,05	0,05	0,05	0,05	0,57	0,24
444	KR0013B	Äspö						802,0	4,9	398,0	59,1	290,0	1920,0	146,0	-81,1	8,0	-9,9	0,05	0,05	0,05	0,05	0,54	0,28
445	KR0013B	Äspö						795,0	5,8	386,0	55,3	290,0	1900,0	146,0	-80,0	17,0	-10,0	0,05	0,05	0,05	0,05	0,53	0,29
446	KR0013B	Äspö						776,0	4,7	378,0	55,0	299,0	1880,0	135,0	-81,9	8,0	-9,9	0,04	0,04	0,04	0,04	0,55	0,28
447	KR0013B	Äspö						764,0	4,4	378,0	54,7	300,0	1840,0	148,0	-80,2	17,0	-9,9	0,04	0,04	0,04	0,04	0,53	0,30
448	KR0013B	Äspö						749,0	4,0	365,0	52,7	299,0	1800,0	147,0	-80,1	25,0	-9,8	0,04	0,04	0,04	0,04	0,53	0,30

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
449	KR0013B	Äspö						742,0	3,9	359,0	50,9	305,0	1750,0	145,0	-80,0	25,0	-9,7	0,04	0,04	0,04	0,04	0,52	0,32
450	KR0013B	Äspö						793,0	4,6	384,0	51,9	293,0	1920,0	145,0	-75,7	4,2	-9,9	0,04	0,04	0,04	0,04	0,49	0,33
451	KR0013B	Äspö						745,0	4,5	360,0	48,0	307,0	1740,0	143,0	-74,6	14,0	-9,9	0,04	0,04	0,04	0,04	0,48	0,36
452	KR0013B	Äspö						740,0	4,7	353,0	51,1	308,0	1740,0	137,0	-73,2	5,9	-9,9	0,04	0,04	0,04	0,04	0,46	0,38
453	KR0013B	Äspö						734,0	4,6	343,0	50,6	309,0	1690,0	127,0	-74,6	14,0	-9,9	0,04	0,04	0,04	0,04	0,48	0,37
454	KR0013B	Äspö						736,0	3,7	342,0	49,5	313,0	1680,0	146,0	-74,6	14,0	-9,9	0,04	0,04	0,04	0,04	0,48	0,37
455	KR0013B	Äspö						743,0	4,0	347,0	50,5	310,0	1790,0	128,0	-72,7	26,0	-9,9	0,04	0,04	0,04	0,04	0,46	0,39
456	KR0013B	Äspö						721,0	4,5	330,0	47,7	315,0	1650,0	123,0	-70,8	9,3	-10,0	0,04	0,04	0,04	0,04	0,45	0,41
457	KR0013B	Äspö						751,0	4,7	351,0	51,6	305,0	1690,0	126,0	-67,9	10,0	-9,9	0,04	0,04	0,04	0,04	0,41	0,44
458	KR0013B	Äspö						740,0	4,0	343,0	53,5	311,0	1690,0	134,0	-72,8	19,0	-9,9	0,04	0,04	0,04	0,04	0,46	0,39
459	KR0013B	Äspö						735,0	4,2	328,8	49,8	307,0	1710,0	144,0	-75,9	15,0	-10,0	0,04	0,04	0,04	0,04	0,50	0,34
460	KR0013B	Äspö						769,0	4,7	346,0	52,2	307,0	1720,0	148,0	-72,2	47,0	-9,8	0,04	0,04	0,04	0,04	0,44	0,40
461	KR0013B	Äspö						830,6	4,5	384,0	57,0	297,0	1870,0	147,4	-75,8	19,0	-9,7	0,04	0,04	0,04	0,04	0,47	0,36
462	KR0013B	Äspö						860,0	4,8	403,0	64,0	298,0	2010,0	153,4	-70,7	24,0	-9,8	0,04	0,04	0,04	0,04	0,41	0,41
463	KR0013B	Äspö						784,8	4,1	339,3	56,5	289,0	1790,0	147,2	-68,7	27,0	-9,7	0,04	0,04	0,04	0,04	0,41	0,43
464	KR0013B	Äspö						737,0	4,1	324,2	54,5	291,0	1737,2	148,0	-68,3	21,1	-9,4	0,04	0,04	0,04	0,04	0,38	0,46
465	KR0013B	Äspö						715,7	4,2	308,5	52,2	273,0	1520,9	142,7	-69,8	17,7	-9,3	0,04	0,04	0,04	0,04	0,41	0,44
466	KR0013B	Äspö						619,5	4,0	269,9	47,1	267,0	1458,9	125,5	-70,6	71,0	-9,5	0,03	0,03	0,03	0,03	0,45	0,42
467	KR0015B	Äspö						1060,0	5,0	679,0	74,2	122,0	3050,0	89,0	-86,8	17,0	-11,6	0,07	0,07	0,07	0,17	0,56	0,07
468	KR0015B	Äspö						578,0	3,2	247,0	30,6	342,0	1150,0	129,1	-81,9	25,0	-10,7	0,03	0,03	0,03	0,03	0,63	0,25
469	KR0015B	Äspö						720,0	4,0	345,0	48,6	320,0	1500,0	146,8	-80,7	25,0	-10,6	0,04	0,04	0,04	0,04	0,59	0,25
470	KR0015B	Äspö						641,0	3,7	296,0	40,4	327,0	1480,0	133,3	-81,1	25,0	-10,4	0,04	0,04	0,04	0,04	0,59	0,27
471	KR0015B	Äspö						531,0	3,3	228,0	30,4	348,0	1140,0	129,4	-83,6	42,0	-10,5	0,03	0,03	0,03	0,03	0,63	0,26
472	KR0015B	Äspö						504,0	3,1	207,0	26,5	360,0	1020,0	133,0	-78,9	34,0	-10,5	0,03	0,03	0,03	0,03	0,58	0,32
473	KR0015B	Äspö						553,0	3,1	233,0	31,5	360,0	1120,0	138,0	-82,2	17,0	-10,6	0,03	0,03	0,03	0,03	0,61	0,27
474	KR0015B	Äspö						558,0	3,5	238,0	32,4	370,0	1120,0	140,0	-82,4	17,0	-10,7	0,03	0,03	0,03	0,03	0,61	0,28
475	KR0015B	Äspö						635,0	3,7	279,0	38,5	360,0	1300,0	144,0	-80,1	17,0	-10,8	0,03	0,03	0,03	0,03	0,59	0,28
476	KR0015B	Äspö						562,0	3,2	235,0	31,8	370,0	1130,0	141,0	-81,3	17,0	-10,9	0,03	0,03	0,03	0,03	0,62	0,27
477	KR0015B	Äspö						562,0	3,2	229,0	31,1	370,0	1250,0	145,0	-82,3	17,0	-10,6	0,03	0,03	0,03	0,03	0,60	0,28
478	KR0015B	Äspö						552,0	4,0	229,0	30,8	380,0	1120,0	146,0	-82,6	25,0	-10,7	0,03	0,03	0,03	0,03	0,60	0,28
479	KR0015B	Äspö						589,0	4,1	245,0	35,2	380,0	1170,0	162,0	-80,6	17,0	-10,2	0,03	0,03	0,03	0,03	0,54	0,35
480	KR0015B	Äspö						527,0	4,6	210,0	28,2	390,0	1040,0	145,0	-81,9	17,0	-10,2	0,02	0,02	0,02	0,02	0,55	0,35

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
481	KR0015B	Äspö						520,0	3,7	205,0	27,9	393,0	1040,0	147,0	-68,2	8,0	-7,9	0,01	0,01	0,01	0,01	0,25	0,69
482	KR0015B	Äspö						477,0	3,3	186,0	25,1	396,0	876,0	140,0	-82,3	25,0	-10,1	0,02	0,02	0,02	0,02	0,56	0,35
483	KR0015B	Äspö						491,0	3,1	190,0	26,0	400,0	924,0	148,0	-81,0	17,0	-10,3	0,02	0,02	0,02	0,02	0,56	0,35
484	KR0015B	Äspö						490,0	3,3	185,0	25,1	404,0	895,0	137,0	-81,4	25,0	-10,7	0,02	0,02	0,02	0,02	0,59	0,32
485	KR0015B	Äspö						602,0	4,0	254,0	36,9	376,0	1270,0	145,0	-76,3	8,4	-10,1	0,03	0,03	0,03	0,03	0,49	0,40
486	KR0015B	Äspö						487,0	3,5	190,0	23,2	400,0	895,0	139,0	-76,4	11,0	-10,1	0,02	0,02	0,02	0,02	0,50	0,42
487	KR0015B	Äspö						488,0	3,8	185,0	25,7	403,0	895,0	165,0	-75,8	15,0	-10,1	0,02	0,02	0,02	0,02	0,48	0,43
488	KR0015B	Äspö						499,0	3,8	189,0	26,4	404,0	901,0	142,0	-75,2	14,0	-10,1	0,02	0,02	0,02	0,02	0,48	0,44
489	KR0015B	Äspö						496,0	3,0	187,0	26,8	408,0	878,0	126,0	-76,7	21,0	-10,2	0,02	0,02	0,02	0,02	0,51	0,42
490	KR0015B	Äspö						455,0	3,0	169,0	22,6	415,0	792,0	122,0	-69,6	17,0	-10,1	0,01	0,01	0,01	0,01	0,43	0,51
491	KR0015B	Äspö						458,0	3,5	168,0	22,6	415,0	760,0	120,0	-72,9	8,4	-10,1	0,01	0,01	0,01	0,01	0,46	0,48
492	KR0015B	Äspö						481,0	3,7	179,0	25,1	417,0	755,0	131,8	-71,4	13,0	-10,2	0,02	0,02	0,02	0,02	0,44	0,49
493	KR0015B	Äspö						404,0	2,8	146,0	23,1	427,0	646,0	120,0	-73,9	7,6	-9,9	0,01	0,01	0,01	0,01	0,45	0,50
494	KR0015B	Äspö						511,0	3,8	189,0	27,3	415,0	805,0	134,0	-77,6	19,0	-10,1	0,02	0,02	0,02	0,02	0,50	0,43
495	KR0015B	Äspö						403,4	3,2	141,0	19,1	409,0	729,0	129,0	-73,7	19,0	-10,1	0,01	0,01	0,01	0,01	0,48	0,46
496	KR0015B	Äspö						566,0	3,9	210,0	32,9	389,0	1080,0	148,3	-71,7	28,0	-9,8	0,02	0,02	0,02	0,02	0,42	0,49
497	KR0015B	Äspö						481,7	3,0	176,7	27,7	389,0	851,0	132,2	-69,7	32,1	-9,8	0,02	0,02	0,02	0,02	0,42	0,51
498	KR0015B	Äspö						357,7	2,5	123,5	19,0	422,0	534,6	97,0	-69,2	28,7	-9,7	0,01	0,01	0,01	0,01	0,41	0,57
499	KR0015B	Äspö						578,5	3,6	207,1	36,8	346,0	977,1	140,3	-70,8	8,5	-9,6	0,03	0,03	0,03	0,03	0,42	0,48
500	KR0015B	Äspö						452,5	3,2	159,0	29,2	309,0	889,9	121,4	-71,8	61,7	-9,7	0,02	0,02	0,02	0,02	0,48	0,43
501	KXTT1	Äspö						1768,9	14,1	1285,5	81,4	91,0	5084,0	343,3	-76,9	16,0	-10,2	0,12	0,12	0,12	0,20	0,33	0,12
502	KXTT2	Äspö						1632,2	11,6	963,7	79,7	124,0	4389,1	326,9	-68,4	39,0	-9,3	0,11	0,11	0,11	0,11	0,37	0,20
503	KXTT2	Äspö						1754,3	13,8	1263,3	80,8	91,0	5119,4	357,7	-78,4	22,0	-10,2	0,12	0,12	0,12	0,21	0,32	0,12
504	KXTT3	Äspö						1621,3	12,1	947,3	79,9	130,0	4296,9	295,1	-73,4	20,0	-9,3	0,10	0,10	0,10	0,10	0,42	0,17
505	KXTT3	Äspö						1775,9	14,3	1301,1	82,3	92,0	5091,1	347,0	-78,4	24,0	-10,2	0,12	0,12	0,12	0,21	0,32	0,12
506	KXTT4	Äspö						1763,7	14,2	1253,8	81,5	98,0	5013,1	343,0	-78,6	18,0	-10,1	0,12	0,12	0,12	0,20	0,34	0,12
507	KXTT4	Äspö						1731,7	14,1	1191,8	83,2	106,0	4920,9	329,8	-77,0	25,0	-9,9	0,11	0,11	0,11	0,16	0,38	0,11
508	SA0158A	Äspö						852,8	15,5	239,9	104,2	245,0	1942,8	253,0	-63,1	22,8	-8,8	0,05	0,05	0,05	0,05	0,14	0,65
509	SA0205A	Äspö						1475,8	16,4	511,8	135,0	197,0	3376,9	388,0	-57,3	35,5	-7,6	0,20	0,08	0,08	0,08	0,08	0,46
510	SA0237B	Äspö						1417,7	16,8	418,6	129,5	160,0	3173,0	356,0	-60,5	30,4	-8,2	0,11	0,09	0,09	0,09	0,09	0,54
511	SA0311A	Äspö						1031,3	6,5	508,0	85,1	221,0	2655,4	200,0	-67,8	10,1	-9,3	0,06	0,06	0,06	0,06	0,34	0,41
512	SA0327B	Äspö						1226,8	5,9	724,2	83,1	96,0	3453,1	177,0	-81,6	8,4	-10,0	0,08	0,08	0,08	0,11	0,55	0,08

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
513	SA0435A	Äspö						1094,6	4,0	509,9	71,2	220,0	2712,2	163,0	-71,4	14,4	-9,7	0,06	0,06	0,06	0,06	0,46	0,30
514	SA0452A	Äspö						1464,0	4,8	770,1	107,3	134,0	3882,1	227,0	-68,5	16,9	-8,9	0,09	0,09	0,09	0,09	0,35	0,30
515	SA0468A	Äspö						1543,1	6,0	782,7	118,7	129,0	4098,4	240,0	-66,8	15,2	-9,0	0,09	0,09	0,09	0,09	0,32	0,32
516	SA0813B	Äspö						1700,0	21,0	364,0	123,0	481,0	3450,0	194,0	-59,8	6,8	-7,5	0,25	0,04	0,04	0,04	0,04	0,59
517	SA0813B	Äspö						1670,0	19,0	317,0	124,0	420,0	3360,0	226,8	-58,2	14,0	-7,5	0,24	0,05	0,05	0,05	0,05	0,57
518	SA0813B	Äspö						1660,0	20,0	325,0	127,0	326,0	3300,0	276,0	-57,6	19,0	-7,0	0,27	0,06	0,06	0,06	0,06	0,50
519	SA0813B	Äspö						1640,0	19,1	310,0	124,0	317,0	3350,0	261,0	-50,4	14,0	-7,3	0,29	0,06	0,06	0,06	0,06	0,49
520	SA0813B	Äspö						1578,0	11,9	322,1	121,1	302,0	3272,3	282,0	-53,7	22,8	-7,2	0,21	0,06	0,06	0,06	0,06	0,55
521	SA0813B	Äspö						1572,7	20,3	318,1	120,8	292,0	3112,8	298,0	-53,7	30,4	-7,2	0,27	0,06	0,06	0,06	0,06	0,49
522	SA0813B	Äspö						1551,0	17,5	282,3	124,3	311,0	3080,9	273,3	-53,2	19,4	-6,8	0,28	0,05	0,05	0,05	0,05	0,51
523	SA0813B	Äspö						1470,9	16,2	279,8	114,8	318,0	2979,8	582,1	-58,9	18,6	-7,5	0,26	0,08	0,08	0,08	0,08	0,41
524	SA0850B	Äspö						1920,0	18,0	1210,0	141,0	170,0	5440,0	90,5	-67,2	6,8	-8,3	0,09	0,09	0,09	0,09	0,16	0,46
525	SA0923A	Äspö						1850,0	31,0	746,0	172,0	669,0	4500,0	90,0	-63,4	4,2	-7,9	0,38	0,03	0,03	0,03	0,03	0,51
526	SA0923A	Äspö						1800,0	30,0	678,0	162,0	655,0	4310,0	127,6	-59,7	8,4	-7,7	0,40	0,03	0,03	0,03	0,03	0,49
527	SA0958B	Äspö						1829,2	22,4	595,2	137,2	371,0	4087,9	243,0	-56,0	8,4	-7,5	0,30	0,06	0,06	0,06	0,06	0,46
528	SA0958B	Äspö						1803,1	21,5	697,7	139,6	311,0	4310,0	225,3	-61,9	14,0	-7,7	0,21	0,07	0,07	0,07	0,07	0,50
529	SA0958B	Äspö						1810,0	19,6	657,0	144,0	296,0	4260,0	241,0	-57,5	14,0	-7,4	0,26	0,07	0,07	0,07	0,07	0,46
530	SA0958B	Äspö						1634,1	21,4	477,8	125,1	274,0	3641,0	303,0	-55,6	22,8	-7,2	0,27	0,07	0,07	0,07	0,07	0,46
531	SA0976B	Äspö						2170,0	20,6	993,0	203,0	500,0	5590,0	58,7	-60,4	14,0	-7,4	0,36	0,05	0,05	0,05	0,05	0,43
532	SA1009B	Äspö						1847,1	26,3	535,3	163,6	300,0	4125,6	250,0	-84,8	5,1	-11,1	0,09	0,09	0,09	0,09	0,32	0,30
533	SA1009B	Äspö						1769,8	26,6	506,1	153,1	292,0	3984,1	250,0	-58,1	15,0	-7,3	0,31	0,07	0,07	0,07	0,07	0,41
534	SA1009B	Äspö						1740,0	25,8	514,0	164,0	276,0	4080,0	252,0	-47,3	8,0	-7,3	0,41	0,07	0,07	0,07	0,07	0,33
535	SA1009B	Äspö						1682,1	23,6	440,5	144,5	242,0	3672,9	304,0	-54,2	12,7	-7,3	0,31	0,07	0,07	0,07	0,07	0,40
536	SA1009B	Äspö						1590,0	27,1	371,7	137,9	234,0	3390,0	313,0	-53,1	36,3	-7,3	0,32	0,07	0,07	0,07	0,07	0,40
537	SA1009B	Äspö						1568,0	31,2	275,2	151,8	228,0	3385,8	352,4	-54,3	20,3	-6,7	0,40	0,07	0,07	0,07	0,07	0,32
538	SA1009B	Äspö						1526,0	30,3	240,0	145,5	234,0	3045,4	330,3	-57,4	24,5	-7,0	0,34	0,07	0,07	0,07	0,07	0,39
539	SA1062B	Äspö						2230,0	23,5	770,0	220,0	531,0	5320,0	100,7	-58,0	8,0	-7,7	0,43	0,05	0,05	0,05	0,05	0,37
540	SA1062B	Äspö						1930,0	34,0	545,0	177,0	403,0	4350,0	187,0	-57,6	9,3	-7,3	0,43	0,06	0,06	0,06	0,06	0,35
541	SA1077A	Äspö						2180,0	32,6	650,0	200,0	690,0	4890,0	127,3	-58,7	17,0	-7,5	0,52	0,03	0,03	0,03	0,03	0,36
542	SA1094A	Äspö						2140,0	35,1	504,0	195,0	760,0	4490,0	111,5	-60,3	17,0	-7,3	0,55	0,02	0,02	0,02	0,02	0,39
543	SA1111B	Äspö						2160,0	18,7	736,0	200,0	340,0	5130,0	110,9	-60,3	25,0	-7,7	0,29	0,07	0,07	0,07	0,07	0,44
544	SA1210A	Äspö						1980,0	30,5	572,0	208,0	540,0	4620,0	129,1	-61,5	17,0	-7,4	0,45	0,04	0,04	0,04	0,04	0,39

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
545	SA1210A	Äspö						1770,3	45,1	255,7	152,4	309,0	3369,7	328,0	-55,4	27,0	-6,9	0,50	0,07	0,07	0,07	0,07	0,24
546	SA1210A	Äspö						1728,0	45,4	272,4	150,2	278,0	3450,0	327,8	-53,9	30,0	-6,9	0,50	0,07	0,07	0,07	0,07	0,23
547	SA1210A	Äspö						1760,0	47,3	246,0	171,0	256,0	3450,0	368,5	-49,6	23,0	-6,6	0,60	0,07	0,07	0,07	0,07	0,12
548	SA1210A	Äspö						1661,0	27,0	226,7	147,6	264,0	3254,6	325,0	-52,4	30,4	-6,9	0,38	0,06	0,06	0,06	0,06	0,36
549	SA1229A	Äspö						2170,0	11,2	1060,0	194,0	510,0	5590,0	101,0	-63,6	17,0	-8,1	0,24	0,06	0,06	0,06	0,06	0,53
550	SA1229A	Äspö						1847,9	24,5	598,5	156,1	426,0	4210,9	208,3	-60,0	16,0	-7,3	0,33	0,05	0,05	0,05	0,05	0,45
551	SA1229A	Äspö						1810,4	27,0	579,6	151,4	388,0	4105,5	209,7	-58,1	14,0	-7,4	0,33	0,06	0,06	0,06	0,06	0,44
552	SA1229A	Äspö						1820,0	24,7	549,0	159,0	378,0	4140,0	216,0	-50,1	14,0	-6,6	0,44	0,05	0,05	0,05	0,05	0,36
553	SA1229A	Äspö						1735,4	26,1	512,1	151,7	336,0	3928,2	243,0	-52,8	16,9	-7,0	0,38	0,06	0,06	0,06	0,06	0,39
554	SA1229A	Äspö						1707,7	25,9	525,8	147,7	325,0	3687,1	242,0	-49,7	27,0	-7,1	0,38	0,06	0,06	0,06	0,06	0,39
555	SA1229A	Äspö						1732,0	27,4	456,0	145,0	330,0	3871,5	224,0	-51,7	16,9	-7,1	0,37	0,06	0,06	0,06	0,06	0,40
556	SA1229A	Äspö						1628,5	24,1	466,9	146,7	310,0	3674,7	247,6	-46,3	15,2	-6,5	0,43	0,05	0,05	0,05	0,05	0,36
557	SA1229A	Äspö						1620,6	24,4	440,4	136,3	314,0	3481,5	224,4	-54,7	23,7	-7,3	0,29	0,06	0,06	0,06	0,06	0,48
558	SA1327B	Äspö						1610,0	9,4	648,0	128,0	252,0	3920,0	225,0	-65,3	17,0	-7,4	0,08	0,07	0,07	0,07	0,07	0,63
559	SA1342B	Äspö						1680,0	11,0	950,0	152,0	170,0	4730,0	148,3	-61,9	5,9	-8,7	0,09	0,09	0,09	0,09	0,15	0,50
560	SA1420A	Äspö						1650,0	7,6	981,0	117,0	830,0	4610,0	200,0	-86,6	4,2	-11,2	0,04	0,04	0,04	0,04	0,25	0,60
561	SA1420A	Äspö						1540,0	10,2	715,0	123,0	170,0	3930,0	225,9	-72,0	17,0	-8,7	0,09	0,09	0,09	0,09	0,29	0,37
562	SA1420A	Äspö						1610,0	11,0	760,0	126,0	202,0	4140,0	225,0	-68,8	10,0	-8,5	0,08	0,08	0,08	0,08	0,21	0,45
563	SA1420A	Äspö						1550,0	14,0	482,0	129,0	226,0	3450,0	335,6	-55,5	32,0	-7,2	0,22	0,07	0,07	0,07	0,07	0,49
564	SA1420A	Äspö						1484,2	9,7	487,9	124,5	215,0	3419,9	307,0	-59,0	31,0	-7,5	0,12	0,07	0,07	0,07	0,07	0,58
565	SA1420A	Äspö						1539,0	15,8	485,0	127,4	212,0	3434,5	308,8	-57,6	27,0	-7,2	0,19	0,07	0,07	0,07	0,07	0,51
566	SA1420A	Äspö						1600,0	13,7	480,0	139,0	214,0	3530,0	335,0	-52,5	22,0	-7,0	0,26	0,07	0,07	0,07	0,07	0,44
567	SA1420A	Äspö						1426,5	15,7	395,8	116,8	206,0	3052,5	303,0	-57,0	28,7	-7,5	0,16	0,07	0,07	0,07	0,07	0,56
568	SA1420A	Äspö						1441,8	18,2	368,7	125,2	199,0	2949,7	304,5	-50,5	32,1	-7,1	0,26	0,07	0,07	0,07	0,07	0,48
569	SA1420A	Äspö						1347,5	20,5	284,4	135,8	199,0	2900,1	301,4	-60,3	23,7	-7,1	0,20	0,07	0,07	0,07	0,07	0,52
570	SA1420A	Äspö						1334,4	20,3	247,4	129,4	204,0	2721,0	267,4	-58,4	33,0	-7,3	0,19	0,06	0,06	0,06	0,06	0,56
571	SA1614B	Äspö						1570,0	8,3	1250,0	80,2	37,0	5160,0	308,0	-103,1	8,0	-13,1	0,10	0,10	0,11	0,50	0,10	0,10
572	SA1614B	Äspö						1953,7	5,2	1710,4	65,9	32,0	6207,3	424,0	-85,5	4,2	-11,5	0,11	0,11	0,14	0,41	0,11	0,11
573	SA1614B	Äspö						1944,3	7,5	1516,2	84,5	67,0	5815,5	339,0	-78,3	4,0	-10,5	0,12	0,12	0,12	0,29	0,23	0,12
574	SA1614B	Äspö						1880,0	6,7	1390,0	90,8	81,0	5650,0	350,0	-77,6	4,0	-10,4	0,12	0,12	0,12	0,26	0,27	0,12
575	SA1614B	Äspö						1831,3	7,4	1207,0	98,3	109,0	5176,1	333,0	-71,9	8,4	-9,7	0,12	0,12	0,12	0,14	0,39	0,12
576	SA1680A	Äspö						606,0	5,9	171,0	26,9	237,0	1160,0	166,0	-77,4	7,6	-10,4	0,04	0,04	0,04	0,04	0,60	0,22

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
577	SA1680B	Äspö						657,0	4,9	217,0	30,6	224,0	1560,0	178,0	-85,5	17,0	-10,7	0,05	0,05	0,05	0,05	0,72	0,08
578	SA1680B	Äspö						1100,0	10,0	583,0	63,3	137,0	2790,0	194,0	-83,8	5,1	-10,8	0,08	0,08	0,08	0,12	0,58	0,08
579	SA1693F	Äspö						941,0	5,4	489,0	38,9	160,0	2400,0	219,0	-90,3	4,2	-12,0	0,07	0,07	0,07	0,21	0,53	0,07
580	SA1696B	Äspö						693,0	5,8	285,0	33,3	213,0	1560,0	169,0	-84,0	5,1	-11,0	0,05	0,05	0,05	0,05	0,72	0,07
581	SA1696B	Äspö						1330,0	9,4	916,0	74,3	102,0	3910,0	266,0	-93,2	8,0	-11,5	0,09	0,09	0,09	0,29	0,35	0,09
582	SA1696B	Äspö						1653,4	6,3	1195,8	73,3	68,0	4828,0	365,0	-85,6	8,4	-11,2	0,11	0,11	0,11	0,33	0,24	0,11
583	SA1696B	Äspö						1817,0	8,9	1400,6	72,3	54,0	5498,8	419,0	-82,8	4,2	-11,1	0,12	0,12	0,12	0,35	0,16	0,12
584	SA1696B	Äspö						1880,0	8,0	1450,0	76,2	57,0	5690,0	428,0	-81,0	7,0	-11,1	0,12	0,12	0,12	0,35	0,15	0,12
585	SA1696B	Äspö						1932,5	9,1	1740,4	71,4	89,0	6275,2	459,0	-81,3	8,4	-11,2	0,13	0,13	0,13	0,36	0,13	0,13
586	SA1713A	Äspö						960,0	14,0	602,0	26,4	25,0	2730,0	192,0	-90,2	4,2	-12,0	0,08	0,08	0,08	0,29	0,41	0,08
587	SA1730A	Äspö						1740,0	10,0	1420,0	64,8	39,0	5470,0	464,0	-91,6	4,2	-12,4	0,11	0,11	0,13	0,43	0,11	0,11
588	SA1730A	Äspö						1944,4	6,1	1709,4	61,8	39,0	6062,5	459,0	-89,2	12,0	-11,9	0,11	0,11	0,14	0,42	0,11	0,11
589	SA1730A	Äspö						2001,9	8,1	1860,8	59,0	40,0	6064,5	470,8	-87,2	4,0	-11,7	0,11	0,11	0,15	0,41	0,11	0,11
590	SA1730A	Äspö						2060,0	7,6	1830,0	65,4	32,0	6890,0	513,0	-81,7	4,0	-12,1	0,11	0,11	0,16	0,39	0,11	0,11
591	SA1730A	Äspö						2149,1	8,2	2160,0	54,2	45,0	7329,9	512,0	-86,4	8,4	-12,2	0,10	0,10	0,17	0,41	0,10	0,10
592	SA1730A	Äspö						2430,5	9,4	2793,3	48,6	31,0	8499,9	549,0	-85,1	8,4	-12,4	0,10	0,10	0,21	0,41	0,10	0,10
593	SA1730A	Äspö						2440,3	8,2	2755,1	53,5	32,0	8671,8	539,3	-90,2	8,5	-12,0	0,10	0,10	0,21	0,41	0,10	0,10
594	SA1730A	Äspö						2384,2	8,2	2616,5	56,4	36,0	8650,5	530,5	-88,8	16,0	-12,1	0,10	0,10	0,20	0,41	0,10	0,10
595	SA1742A	Äspö						1300,0	8,4	968,0	41,5	71,0	3800,0	286,0	-98,3	4,2	-12,8	0,09	0,09	0,09	0,42	0,23	0,09
596	SA1828B	Äspö						1700,0	8,5	1290,0	92,2	43,0	5200,0	302,6	-84,4	4,2	-10,8	0,11	0,11	0,11	0,30	0,25	0,11
597	SA1828B	Äspö						1860,0	9,6	1250,0	118,0	72,0	5540,0	340,0	-71,1	32,0	-9,3	0,12	0,12	0,12	0,13	0,37	0,12
598	SA1828B	Äspö						1909,2	8,0	1392,4	113,9	48,0	5849,7	387,0	-75,9	4,2	-10,3	0,13	0,13	0,13	0,26	0,23	0,13
599	SA1828B	Äspö						1933,1	11,6	1493,5	107,8	49,0	6550,0	363,0	-80,1	4,0	-10,3	0,13	0,13	0,13	0,29	0,19	0,13
600	SA1828B	Äspö						1930,0	10,0	1450,0	108,0	48,0	6010,0	376,0	-71,4	4,0	-10,3	0,13	0,13	0,13	0,23	0,24	0,13
601	SA1828B	Äspö						1861,5	11,7	1063,9	138,8	111,0	5123,0	251,0	-67,8	8,4	-8,9	0,11	0,11	0,11	0,11	0,26	0,30
602	SA1844B	Äspö						1810,0	9,5	1220,0	113,0	62,0	5250,0	330,0	-75,8	4,2	-9,5	0,12	0,12	0,12	0,17	0,35	0,12
603	SA1861A	Äspö						1720,0	11,0	1050,0	112,0	79,0	4940,0	302,0	-73,9	4,2	-9,2	0,11	0,11	0,11	0,11	0,40	0,14
604	SA2074A	Äspö						1959,4	8,6	992,6	172,0	47,0	5282,5	305,0	-65,2	5,9	-8,5	0,12	0,12	0,12	0,12	0,20	0,32
605	SA2074A	Äspö						1730,0	11,0	764,0	144,0	79,0	4670,0	277,0	-60,0	7,0	-8,4	0,10	0,10	0,10	0,10	0,15	0,43
606	SA2074A	Äspö						1701,7	10,2	723,2	141,5	94,0	4275,6	275,0	-63,3	8,4	-8,5	0,10	0,10	0,10	0,10	0,19	0,41
607	SA2074A	Äspö						1521,7	10,3	627,0	126,4	103,0	3967,2	263,0	-61,3	8,4	-8,4	0,09	0,09	0,09	0,09	0,18	0,45
608	SA2074A	Äspö						1454,0	9,3	560,4	119,3	128,0	3414,1	261,9	-66,3	8,5	-8,7	0,09	0,09	0,09	0,09	0,26	0,40

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
609	SA2074A	Äspö						1425,0	9,1	510,1	111,8	140,0	3238,6	251,3	-65,1	33,0	-8,4	0,08	0,08	0,08	0,08	0,23	0,45
610	SA2109B	Äspö						1730,0	17,0	884,0	107,0	67,0	4480,0	302,6	-64,5	5,9	-8,2	0,11	0,11	0,11	0,11	0,21	0,36
611	SA2142A	Äspö						1720,0	25,0	581,0	128,0	127,0	3880,0	367,3	-56,2	21,0	-7,2	0,26	0,09	0,09	0,09	0,09	0,36
612	SA2175B	Äspö						2030,0	17,1	1100,0	172,0	94,0	5650,0	276,0	-61,1	14,0	-8,3	0,16	0,12	0,12	0,12	0,12	0,38
613	SA2175B	Äspö						1959,5	15,3	1037,1	161,6	127,0	5442,0	267,0	-62,0	8,4	-8,2	0,14	0,11	0,11	0,11	0,11	0,43
614	SA2240B	Äspö						2150,0	17,1	1040,0	177,0	158,0	5560,0	258,0	-60,7	4,0	-8,0	0,21	0,11	0,11	0,11	0,11	0,36
615	SA2240B	Äspö						2110,0	17,5	1010,0	180,0	171,0	5460,0	253,5	-57,3	5,9	-8,1	0,24	0,10	0,10	0,10	0,10	0,35
616	SA2273A	Äspö						2070,0	13,4	1110,0	172,0	146,0	5570,0	252,9	-61,1	4,2	-8,4	0,14	0,11	0,11	0,11	0,11	0,42
617	SA2273A	Äspö						1932,0	13,4	900,5	166,0	201,0	4998,9	218,0	-60,5	8,4	-7,8	0,17	0,09	0,09	0,09	0,09	0,47
618	SA2273A	Äspö						1911,1	14,4	848,6	165,3	205,0	4920,9	203,0	-56,7	12,7	-7,9	0,20	0,09	0,09	0,09	0,09	0,46
619	SA2273A	Äspö						1866,0	12,4	852,2	151,1	182,0	4787,9	241,0	-64,0	8,5	-7,8	0,11	0,09	0,09	0,09	0,09	0,51
620	SA2273A	Äspö						1778,6	13,2	795,9	140,3	180,0	4346,5	241,7	-62,8	20,3	-8,1	0,09	0,09	0,09	0,09	0,09	0,54
621	SA2273B	Äspö						1830,0	8,0	1280,0	136,0	104,0	5460,0	231,3	-75,8	5,9	-9,4	0,11	0,11	0,11	0,11	0,42	0,12
622	SA2273B	Äspö						1761,7	7,8	1135,1	127,5	117,0	5105,2	196,0	-71,3	8,4	-9,5	0,10	0,10	0,10	0,10	0,39	0,19
623	SA2289B	Äspö						2040,0	12,0	1160,0	164,0	138,0	5570,0	252,0	-66,6	10,0	-8,4	0,11	0,11	0,11	0,11	0,16	0,39
624	SA2289B	Äspö						1952,7	12,2	968,6	162,1	178,0	5167,3	219,0	-60,8	8,4	-8,0	0,14	0,10	0,10	0,10	0,10	0,48
625	SA2322A	Äspö						2170,0	8,6	1070,0	129,0	152,0	5340,0	227,0	-66,0	4,0	-8,8	0,11	0,11	0,11	0,11	0,25	0,31
626	SA2322A	Äspö						1910,0	9,8	998,0	139,0	165,0	5070,0	231,6	-62,9	7,6	-8,5	0,10	0,10	0,10	0,10	0,17	0,43
627	SA2322A	Äspö						1924,0	11,6	1024,0	140,0	169,0	5353,0	223,0	-68,0	8,4	-8,6	0,10	0,10	0,10	0,10	0,21	0,38
628	SA2322A	Äspö						1908,3	9,4	977,4	142,5	184,0	5034,3	213,0	-63,4	8,4	-8,1	0,09	0,09	0,09	0,09	0,13	0,49
629	SA2355B	Äspö						1959,0	8,4	1634,0	68,7	23,0	6240,0	443,0	-83,1	5,9	-10,6	0,12	0,12	0,14	0,37	0,12	0,12
630	SA2583A	Äspö						2099,0	8,3	1870,0	56,9	13,0	6647,0	508,0	-85,9	4,2	-10,7	0,12	0,12	0,16	0,38	0,12	0,12
631	SA2583A	Äspö						2170,0	8,5	1859,6	73,9	44,0	6895,6	492,0	-83,5	5,9	-11,1	0,12	0,12	0,16	0,36	0,12	0,12
632	SA2600A	Äspö						2398,0	9,9	2541,0	52,0	17,0	8349,0	560,0	-93,7	9,3	-12,2	0,09	0,09	0,21	0,43	0,09	0,09
633	SA2600A	Äspö						2171,1	7,6	1825,4	72,2	92,0	6718,3	498,0	-80,4	4,2	-10,8	0,13	0,13	0,15	0,34	0,13	0,13
634	SA2600A	Äspö						2260,0	9,1	2180,0	65,0	37,0	7734,7	470,0	-77,9	8,4	-11,2	0,12	0,12	0,17	0,35	0,12	0,12
635	SA2600A	Äspö						2094,0	7,6	1499,0	90,7	90,0	6023,5	407,3	-70,4	11,0	-9,4	0,13	0,13	0,13	0,20	0,28	0,13
636	SA2600A	Äspö						2140,2	7,6	1542,4	89,3	95,0	6183,0	382,1	-75,5	11,0	-9,8	0,13	0,13	0,13	0,24	0,24	0,13
637	SA2600B	Äspö						2453,0	9,9	2681,0	49,0	13,0	8597,0	575,0	-94,3	5,9	-12,4	0,09	0,09	0,22	0,43	0,09	0,09
638	SA2634B	Äspö						2273,0	10,2	1986,0	91,4	64,0	7197,0	414,0	-86,2	18,0	-11,3	0,12	0,12	0,15	0,37	0,12	0,12
639	SA2649A	Äspö						2123,0	8,3	1715,0	76,1	39,0	6523,0	501,0	-82,7	14,0	-10,9	0,12	0,12	0,15	0,36	0,12	0,12
640	SA2663B	Äspö						2447,0	10,0	2639,0	53,4	20,0	8686,0	589,0	-92,8	4,2	-12,2	0,09	0,09	0,22	0,42	0,09	0,09

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1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
641	SA2664A	Äspö						2124,0	8,2	1753,0	75,1	39,0	6701,0	515,0	-83,4	11,0	-10,9	0,12	0,12	0,16	0,36	0,12	0,12
642	SA2681A	Äspö						2139,0	8,1	1675,0	77,8	41,0	6523,0	486,0	-82,1	15,0	-10,7	0,13	0,13	0,15	0,35	0,13	0,13
643	SA2681B	Äspö						2187,0	10,6	1772,0	114,0	64,0	6842,0	406,0	-80,4	9,3	-10,4	0,14	0,14	0,14	0,31	0,14	0,14
644	SA2703A	Äspö						2694,0	11,0	3285,0	43,2	12,0	10140,0	659,0	-93,2	10,0	-12,8	0,08	0,08	0,26	0,43	0,08	0,08
645	SA2703A	Äspö						2824,0	7,8	3581,3	40,3	12,0	10591,6	683,0	-93,7	4,2	-13,1	0,07	0,07	0,27	0,44	0,07	0,07
646	SA2718A	Äspö						2707,2	7,9	3360,3	41,9	15,0	10148,4	648,0	-93,8	4,2	-12,9	0,08	0,08	0,26	0,44	0,08	0,08
647	SA2734B	Äspö						2071,0	8,5	1726,0	94,5	37,0	6490,0	436,0	-83,6	10,0	-10,7	0,13	0,13	0,14	0,35	0,13	0,13
648	SA2768A	Äspö						2459,0	9,4	2904,0	55,1	11,0	9058,0	580,0	-92,6	4,2	-12,9	0,08	0,08	0,23	0,44	0,08	0,08
649	SA2768B	Äspö						2190,0	7,9	2226,0	70,3	14,0	7640,0	490,0	-84,2	4,2	-11,8	0,11	0,11	0,18	0,39	0,11	0,11
650	SA2783A	Äspö						2258,0	8,4	2363,0	59,6	14,0	8030,0	508,0	-88,3	4,2	-12,2	0,10	0,10	0,19	0,42	0,10	0,10
651	SA2783A	Äspö						2347,6	9,1	2532,4	62,5	20,0	8411,2	523,0	-90,5	9,3	-12,1	0,10	0,10	0,20	0,41	0,10	0,10
652	SA2783A	Äspö						2448,4	9,6	2813,0	57,9	18,0	9022,8	513,0	-83,2	8,4	-12,2	0,10	0,10	0,21	0,39	0,10	0,10
653	SA2783A	Äspö						2811,3	10,3	3661,9	53,3	14,0	10944,3	584,0	-88,6	8,5	-12,0	0,09	0,09	0,26	0,40	0,09	0,09
654	SA2783A	Äspö						2839,8	11,7	3712,7	50,1	18,0	10910,7	599,5	-90,0	22,0	-12,5	0,08	0,08	0,26	0,41	0,08	0,08
655	SA2834B	Äspö						2522,0	10,7	2734,0	95,9	15,0	9094,0	571,0	-86,8	4,2	-12,3	0,10	0,10	0,22	0,38	0,10	0,10
656	SA2880A	Äspö						3156,4	13,6	4378,1	41,1	22,0	12956,3	625,3	-87,7	17,0	-12,3	0,08	0,08	0,30	0,39	0,08	0,08
657	SA2880A	Äspö						2846,8	12,1	3812,5	46,4	30,0	11371,5	609,4	-84,5	21,0	-12,1	0,09	0,09	0,27	0,38	0,09	0,09
658	HAV04	Ävrö						215,0	4,0	14,0	3,0	300,0	108,0	76,0	-73,5	8,0	-10,1	0,01	0,01	0,01	0,01	0,57	0,38
659	HAV04	Ävrö						202,0	4,0	13,0	3,0	290,0	106,0	71,0	-79,7	1,0	-9,9	0,01	0,01	0,01	0,01	0,62	0,32
660	HAV05	Ävrö						117,0	3,0	14,0	3,0	265,0	14,0	62,0	-71,8	11,0	-9,8	0,01	0,01	0,01	0,01	0,56	0,39
661	HAV05	Ävrö						144,0	3,0	12,0	2,0	271,0	15,0	97,0	-67,1	1,0	-9,8	0,01	0,01	0,01	0,01	0,51	0,44
662	HAV06	Ävrö						107,0	2,6	9,7	1,0	231,0	22,0	45,0	-73,4	1,0	-10,0	0,01	0,01	0,01	0,01	0,62	0,32
663	HAV06	Ävrö						127,0	1,6	11,0	1,4	228,0	36,0	71,0	-70,1	1,0	-10,2	0,02	0,02	0,02	0,02	0,61	0,33
664	HAV07	Ävrö						135,0	2,0	18,0	2,0	258,0	63,0	68,0	-71,2	1,0	-9,9	0,01	0,01	0,01	0,01	0,57	0,37
665	HAV07	Ävrö						139,0	2,0	21,0	2,0	257,0	73,0	69,0	-73,3	2,0	-10,2	0,02	0,02	0,02	0,02	0,62	0,32
666	KAV01	Ävrö						255,0	4,7	156,0	21,0	186,0	575,0	43,0	-78,6	19,0	-10,6	0,03	0,03	0,03	0,03	0,70	0,18
667	KAV01	Ävrö						750,0	7,4	440,0	42,0	81,0	1970,0	118,0	-80,3	13,0	-10,9	0,06	0,06	0,06	0,10	0,65	0,06
668	KAV01	Ävrö						1500,0	6,0	1100,0	60,0	42,0	4300,0	220,0	-86,2	8,0	-11,7	0,09	0,09	0,09	0,33	0,30	0,09
669	KAV01	Ävrö						3100,0	8,0	2900,0	31,0	9,0	9700,0	400,0	-92,6	3,0	-12,8	0,08	0,08	0,22	0,46	0,08	0,08
670	HLX01	Laxemar						32,5	2,2	37,8	4,9	115,0	18,1	47,8	-81,0	34,0	-10,9	0,03	0,03	0,03	0,03	0,83	0,05
671	HLX01	Laxemar						137,0	2,9	10,7	2,1	232,0	42,3	59,1	-79,0	25,0	-10,8	0,02	0,02	0,02	0,02	0,73	0,19
672	HLX01	Laxemar						141,0	3,0	11,5	1,9	233,0	40,9	63,8	-79,0	17,0	-10,9	0,02	0,02	0,02	0,02	0,73	0,19

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
673	HLX03	Laxemar						76,0	5,1	15,0	3,9	210,0	11,0	21,0	-80,0	25,0	-10,8	0,02	0,02	0,02	0,02	0,74	0,19
674	HLX03	Laxemar						67,0	5,0	17,0	4,3	204,0	5,8	21,5	-80,0	34,0	-10,9	0,02	0,02	0,02	0,02	0,75	0,17
675	HLX06	Laxemar						56,1	2,8	24,5	4,9	219,0	5,7	8,7	-77,0	17,0	-10,6	0,01	0,01	0,01	0,01	0,71	0,24
676	HLX06	Laxemar						92,0	2,0	12,3	2,3	249,0	12,1	23,5	-77,0	17,0	-10,6	0,01	0,01	0,01	0,01	0,70	0,25
677	HLX07	Laxemar						170,0	5,2	27,5	6,1	151,0	215,0	72,0	-76,0	25,0	-10,5	0,03	0,03	0,03	0,03	0,70	0,18
678	HLX07	Laxemar						430,0	5,6	42,0	9,2	200,0	440,0	260,0	-78,0	8,4	-10,8	0,05	0,05	0,05	0,05	0,67	0,14
679	KLX01	Laxemar						1040,0	6,2	243,0	28,0	83,0	2050,0	48,0	-89,9	8,0	-11,5	0,06	0,06	0,06	0,19	0,59	0,06
680	KLX01	Laxemar						860,0	6,1	223,0	18,0	78,0	1700,0	106,0	-94,5	8,0	-12,2	0,05	0,05	0,05	0,26	0,53	0,05
681	KLX01	Laxemar						1680,0	7,1	1400,0	23,0	24,0	4870,0	351,0	-102,1	8,0	-13,3	0,09	0,09	0,11	0,54	0,09	0,09
682	KLX01	Laxemar						1610,0	7,3	1330,0	24,0	24,0	4680,0	390,0	-98,8	8,0	-11,8	0,10	0,10	0,11	0,49	0,10	0,10
683	KLX02	Laxemar						137,0	3,9	54,1	4,4	220,0	149,0	61,1	-74,4	8,4	-9,9	0,02	0,02	0,02	0,02	0,61	0,31
684	KLX02	Laxemar						134,0	3,9	45,7	4,3	202,0	146,0	58,1	-75,1	5,9	-10,5	0,02	0,02	0,02	0,02	0,68	0,24
685	KLX02	Laxemar						130,0	3,8	43,4	4,3	200,0	140,0	56,6	-74,6	4,2	-10,7	0,02	0,02	0,02	0,02	0,69	0,22
686	KLX02	Laxemar						120,0	3,7	39,3	4,3	200,0	123,0	52,4	-76,3	11,8	-10,3	0,02	0,02	0,02	0,02	0,68	0,24
687	KLX02	Laxemar						110,0	4,3	38,6	4,3	202,0	109,0	48,8	-76,1	15,2	-10,4	0,02	0,02	0,02	0,02	0,68	0,24
688	KLX02	Laxemar						97,4	3,5	33,8	4,3	202,0	82,5	43,7	-76,3	12,7	-10,5	0,02	0,02	0,02	0,02	0,69	0,23
689	KLX02	Laxemar						87,0	3,5	31,5	4,3	205,0	63,8	40,1	-75,9	5,1	-10,5	0,02	0,02	0,02	0,02	0,69	0,24
690	KLX02	Laxemar						111,0	3,1	24,0	4,6	223,0	73,0	43,0	-73,4	5,9	-10,3	0,02	0,02	0,02	0,02	0,64	0,29
691	KLX02	Laxemar						77,0	3,5	29,1	4,3	205,0	45,0	36,6	-75,4	7,6	-10,7	0,02	0,02	0,02	0,02	0,70	0,23
692	KLX02	Laxemar						206,0	3,1	36,0	5,9	201,0	235,0	84,0	-75,7	13,0	-10,6	0,03	0,03	0,03	0,03	0,69	0,21
693	KLX02	Laxemar						72,9	3,4	27,4	4,5	205,0	34,5	33,6	-76,4	7,6	-10,7	0,02	0,02	0,02	0,02	0,71	0,22
694	KLX02	Laxemar						69,5	3,4	26,2	4,6	204,0	28,0	32,1	-75,5	8,4	-10,6	0,02	0,02	0,02	0,02	0,69	0,23
695	KLX02	Laxemar						67,7	3,5	25,6	4,7	202,0	26,5	31,2	-76,2	12,7	-10,6	0,02	0,02	0,02	0,02	0,70	0,23
696	KLX02	Laxemar						67,3	3,5	25,3	4,7	198,0	26,2	30,6	-75,3	16,1	-10,6	0,02	0,02	0,02	0,02	0,70	0,23
697	KLX02	Laxemar						67,6	3,4	25,5	4,5	201,0	25,5	29,8	-76,5	8,4	-10,4	0,02	0,02	0,02	0,02	0,69	0,24
698	KLX02	Laxemar						67,4	3,4	25,3	4,5	200,0	28,0	29,8	-75,5	8,4	-10,4	0,02	0,02	0,02	0,02	0,68	0,25
699	KLX02	Laxemar						68,2	3,5	25,5	4,5	200,0	28,3	29,8	-76,0	17,7	-10,4	0,02	0,02	0,02	0,02	0,69	0,24
700	KLX02	Laxemar						67,6	3,4	25,9	4,5	209,0	28,0	30,0	-76,6	19,4	-10,5	0,02	0,02	0,02	0,02	0,70	0,24
701	KLX02	Laxemar						68,8	3,4	28,3	4,5	202,0	34,0	31,2	-75,5	15,2	-10,5	0,02	0,02	0,02	0,02	0,69	0,24
702	KLX02	Laxemar						288,0	4,5	123,0	10,6	111,0	548,0	105,0	-78,7	8,4	-10,9	0,04	0,04	0,04	0,04	0,78	0,05
703	KLX02	Laxemar						73,4	3,4	38,9	4,3	205,0	60,0	35,4	-75,1	12,7	-10,7	0,02	0,02	0,02	0,02	0,70	0,23
704	KLX02	Laxemar						103,0	3,4	82,6	4,5	202,0	175,0	48,2	-76,1	11,0	-10,4	0,02	0,02	0,02	0,02	0,69	0,23

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
705	KLX02	Laxemar						327,0	3,7	397,0	4,6	181,0	1080,0	125,5	-77,8	13,5	-10,7	0,04	0,04	0,04	0,04	0,73	0,10
706	KLX02	Laxemar						1000,0	5,1	1340,0	4,7	126,0	3780,0	302,6	-81,5	11,0	-11,3	0,08	0,08	0,08	0,26	0,40	0,08
707	KLX02	Laxemar						2460,0	8,5	3590,0	4,0	53,0	9910,0	644,2	-84,5	10,1	-11,9	0,09	0,09	0,24	0,41	0,09	0,09
708	KLX02	Laxemar						3300,0	11,3	4820,0	3,2	24,0	13600,0	806,0	-85,2	4,2	-12,1	0,07	0,07	0,34	0,38	0,07	0,07
709	KLX02	Laxemar						3800,0	10,4	5620,0	2,1	8,0	15800,0	1010,0	-78,6	7,6	-11,7	0,07	0,07	0,41	0,33	0,07	0,07
710	KLX02	Laxemar						3780,0	10,5	5720,0	2,5	13,0	16000,0	898,9	-83,7	0,2	-12,0	0,06	0,06	0,40	0,36	0,06	0,06
711	KLX02	Laxemar						3930,0	10,2	6110,0	2,2	12,0	16800,0	928,8	-82,3	4,2	-12,0	0,06	0,06	0,42	0,35	0,06	0,06
712	KLX02	Laxemar						4190,0	12,0	6810,0	2,1	11,0	18500,0	949,8	-80,7	0,2	-11,9	0,05	0,05	0,46	0,33	0,05	0,05
713	KLX02	Laxemar						4640,0	14,2	8000,0	2,6	11,0	21500,0	943,8	-77,1	4,2	-11,4	0,05	0,05	0,51	0,30	0,05	0,05
714	KLX02	Laxemar						5750,0	18,2	11000,0	2,2	10,0	29100,0	949,8	-66,0	0,2	-10,4	0,04	0,04	0,65	0,21	0,04	0,04
715	KLX02	Laxemar						6520,0	20,5	12700,0	2,3	11,0	33100,0	955,8	-60,2	4,2	-9,9	0,03	0,03	0,73	0,16	0,03	0,03
716	KLX02	Laxemar						8030,0	29,0	18600,0	2,7	9,0	45500,0	832,0	-47,4	26,0	-8,9	-1.#IND	-1.#IND	-1.#IND	-1.#IND	-1.#IND	-1.#IND
717	KLX02	Laxemar						7330,0	25,6	15800,0	2,6	12,0	39700,0	946,8	-53,2	0,2	-9,5	0,01	0,01	0,85	0,10	0,01	0,01
718	KLX02	Laxemar						7740,0	30,6	17100,0	3,1	12,0	43300,0	925,8	-49,4	4,2	-9,8	0,00	0,00	0,91	0,08	0,00	0,00
719	KLX02	Laxemar						7690,0	30,0	16900,0	2,9	11,0	43500,0	913,8	-49,8	0,2	-9,0	0,01	0,01	0,90	0,07	0,01	0,01
720	KLX02	Laxemar						7860,0	34,2	17500,0	2,9	10,0	44800,0	913,8	-48,1	4,2	-9,1	0,00	0,00	0,93	0,05	0,00	0,00
721	KLX02	Laxemar						8200,0	45,5	19200,0	2,1	14,0	47200,0	904,9	-44,9	0,2	-8,9	0,00	0,00	0,99	0,00	0,00	0,00
722	KLX02	Laxemar						61,0	4,1	29,2	5,9	0,0	150,0	6,0	-76,5	38,0	-9,5	0,03	0,03	0,03	0,03	0,75	0,12
723	KLX02	Laxemar						62,6	3,8	33,6	6,0	51,0	120,0	6,6	-77,4	24,0	-9,7	0,03	0,03	0,03	0,03	0,74	0,14
724	KLX02	Laxemar						58,0	3,8	32,1	6,5	139,0	66,0	8,1	-77,0	25,0	-9,9	0,02	0,02	0,02	0,02	0,70	0,22
725	KLX02	Laxemar						53,6	3,3	34,4	6,9	182,0	46,0	10,5	-77,4	30,0	-10,0	0,02	0,02	0,02	0,02	0,68	0,25
726	KLX02	Laxemar						50,8	4,9	37,2	7,4	205,0	36,1	12,6	-77,7	26,0	-10,0	0,02	0,02	0,02	0,02	0,66	0,28
727	KLX02	Laxemar						52,0	3,1	39,6	7,7	209,0	35,4	13,5	-77,8	26,0	-10,0	0,01	0,01	0,01	0,01	0,67	0,27
728	KLX02	Laxemar						51,2	4,3	39,4	7,6	212,0	35,4	13,7	-78,1	32,0	-10,0	0,01	0,01	0,01	0,01	0,66	0,28
729	KLX02	Laxemar						51,6	3,1	40,1	7,8	212,0	35,4	13,8	-81,2	32,0	-10,1	0,02	0,02	0,02	0,02	0,71	0,23
730	KLX02	Laxemar						50,4	4,8	39,1	7,6	213,0	34,7	13,8	-79,3	32,0	-10,0	0,01	0,01	0,01	0,01	0,67	0,27
731	KLX02	Laxemar						50,3	3,2	38,1	7,4	215,0	35,4	13,3	-82,2	27,0	-10,0	0,01	0,01	0,01	0,01	0,71	0,23
732	KLX02	Laxemar						57,5	3,2	53,4	7,4	217,0	83,4	14,8	-79,3	28,0	-10,0	0,01	0,01	0,01	0,01	0,68	0,26
733	KLX02	Laxemar						2277,0	9,2	3929,0	4,4	97,0	10387,0	489,0	-76,2	30,0	-9,5	0,12	0,12	0,20	0,33	0,12	0,12
734	KLX02	Laxemar						4286,0	18,0	7733,0	2,4	47,0	19908,0	707,0	-66,0	25,0	-8,2	0,09	0,09	0,43	0,20	0,09	0,09
735	KLX02	Laxemar						6762,0	28,0	12550,0	2,0	38,0	32882,0	862,0	-63,4	19,0	-9,1	0,04	0,04	0,71	0,14	0,04	0,04
736	KLX02	Laxemar						6941,0	26,0	12800,0	2,1	32,0	34341,0	646,0	-62,8	25,0	-9,3	0,03	0,03	0,70	0,17	0,03	0,03

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
737	BFI01	Finnsjön						24,0	3,2	76,0	6,3	220,0	61,0	8,3	-88,2	36,0	-12,0	0,02	0,02	0,02	0,03	0,89	0,02
738	BFI01	Finnsjön						420,0	6,1	170,0	24,0	250,0	830,0	102,0	-85,2	5,0	-11,6	0,04	0,04	0,04	0,04	0,77	0,08
739	BFI01	Finnsjön						650,0	8,7	320,0	41,0	260,0	1500,0	140,0	-85,7	3,0	-11,7	0,05	0,05	0,05	0,05	0,73	0,07
740	BFI01	Finnsjön						1700,0	14,0	1500,0	120,0	59,0	5200,0	370,0	-89,0	3,0	-11,8	0,12	0,12	0,12	0,35	0,16	0,12
741	BFI01	Finnsjön						1700,0	16,0	1500,0	140,0	61,0	5500,0	390,0	-86,9	3,0	-11,5	0,13	0,13	0,13	0,32	0,17	0,13
742	BFI01	Finnsjön						1700,0	13,0	1650,0	110,0	47,0	5500,0	370,0	-88,7	3,0	-11,8	0,12	0,12	0,12	0,38	0,13	0,12
743	KFI01	Finnsjön						44,0	2,5	59,0	7,5	314,0	10,0	1,0	-87,0	38,0	-11,6	0,01	0,01	0,01	0,01	0,82	0,14
744	KFI01	Finnsjön						45,0	2,5	61,0	7,0	320,0	11,0	1,0	-88,0	40,0	-11,6	0,01	0,01	0,01	0,01	0,83	0,13
745	KFI01	Finnsjön						50,0	2,7	60,0	7,0	322,0	13,0	1,0	-90,0	50,0	-11,6	0,01	0,01	0,01	0,01	0,85	0,12
746	KFI01	Finnsjön						56,0	2,9	59,0	7,5	325,0	18,0	1,0	-88,0	46,0	-11,6	0,01	0,01	0,01	0,01	0,82	0,14
747	KFI01	Finnsjön						88,0	2,8	50,0	6,5	350,0	37,0	1,0	-87,0	40,0	-11,6	0,01	0,01	0,01	0,01	0,80	0,17
748	KFI04	Finnsjön						225,0	3,0	25,0	4,0	386,0	127,0	44,0	-80,4	6,0	-11,3	0,01	0,01	0,01	0,01	0,68	0,29
749	KFI04	Finnsjön						225,0	3,1	24,0	5,5	390,0	133,0	48,0	-80,4	7,0	-11,3	0,01	0,01	0,01	0,01	0,68	0,29
750	KFI04	Finnsjön						210,0	3,1	23,0	9,5	389,0	124,0	46,0	-83,0	6,0	-11,3	0,01	0,01	0,01	0,01	0,70	0,27
751	KFI04	Finnsjön						215,0	3,0	40,0	7,0	360,0	200,0	40,0	-83,6	10,0	-11,7	0,01	0,01	0,01	0,01	0,76	0,20
752	KFI04	Finnsjön						170,0	2,8	24,0	4,0	390,0	74,0	30,0	-81,0	11,0	-11,5	0,01	0,01	0,01	0,01	0,71	0,27
753	KFI04	Finnsjön						165,0	2,8	22,0	4,0	397,0	72,0	25,0	-85,0	13,0	-11,4	0,00	0,00	0,00	0,00	0,73	0,25
754	KFI04	Finnsjön						165,0	2,7	22,0	4,0	395,0	72,0	29,0	-85,0	14,0	-10,9	0,00	0,00	0,00	0,00	0,70	0,29
755	KFI04	Finnsjön						165,0	2,9	22,0	4,0	395,0	75,0	29,0	-85,0	13,0	-11,3	0,01	0,01	0,01	0,01	0,73	0,25
756	KFI04	Finnsjön						170,0	2,8	22,0	4,0	393,0	75,0	29,0	-85,0	14,0	-11,5	0,01	0,01	0,01	0,01	0,74	0,23
757	KFI04	Finnsjön						170,0	2,8	22,0	4,0	393,0	75,0	19,0	-85,0	10,0	-11,4	0,00	0,00	0,00	0,00	0,74	0,24
758	KFI04	Finnsjön						170,0	2,7	22,0	4,0	393,0	75,0	19,0	-85,0	13,0	-11,6	0,01	0,01	0,01	0,01	0,75	0,23
759	KFI05	Finnsjön						1100,0	10,0	875,0	110,0	85,0	3400,0	325,0	-86,0	7,0	-10,5	0,10	0,10	0,10	0,17	0,44	0,10
760	KFI05	Finnsjön						1100,0	9,4	900,0	110,0	83,0	3450,0	325,0	-86,0	7,0	-10,9	0,10	0,10	0,10	0,19	0,42	0,10
761	KFI05	Finnsjön						1380,0	7,2	1500,0	70,0	39,0	4650,0	300,0	-88,0	5,0	-11,8	0,10	0,10	0,10	0,37	0,22	0,10
762	KFI05	Finnsjön						1500,0	8,3	1790,0	100,0	44,0	5650,0	324,0	-88,0	3,0	-12,2	0,11	0,11	0,11	0,41	0,13	0,11
763	KFI07	Finnsjön						94,0	1,4	36,0	5,5	333,0	23,0	7,0	-87,0	13,0	-11,6	0,01	0,01	0,01	0,01	0,82	0,15
764	KFI07	Finnsjön						164,0	1,6	57,0	7,5	314,0	173,0	18,0	-87,0	10,0	-11,8	0,01	0,01	0,01	0,01	0,84	0,10
765	KFI07	Finnsjön						390,0	2,9	114,0	18,0	233,0	665,0	71,0	-90,0	3,0	-11,7	0,03	0,03	0,03	0,06	0,81	0,03
766	KFI07	Finnsjön						195,0	1,7	96,0	13,0	300,0	320,0	32,0	-88,0	11,0	-11,8	0,02	0,02	0,02	0,02	0,85	0,08
767	KFI07	Finnsjön						224,0	1,8	107,0	16,0	292,0	380,0	35,0	-88,0	11,0	-11,8	0,02	0,02	0,02	0,02	0,84	0,07
768	KFI07	Finnsjön						280,0	2,2	145,0	18,0	278,0	545,0	51,0	-89,0	10,0	-12,0	0,03	0,03	0,03	0,03	0,86	0,03

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
769	KFI07	Finnsjön						275,0	2,1	149,0	14,0	277,0	555,0	47,0	-89,0	11,0	-11,9	0,03	0,03	0,03	0,03	0,87	0,03
770	KFI07	Finnsjön						275,0	2,0	142,0	17,0	278,0	555,0	49,0	-89,0	8,0	-11,9	0,03	0,03	0,03	0,03	0,87	0,03
771	KFI09	Finnsjön						950,0	7,0	370,0	49,0	162,0	2800,0	210,0	-84,0	3,0	-11,6	0,07	0,07	0,07	0,14	0,58	0,07
772	KFI09	Finnsjön						1600,0	8,0	1000,0	57,0	34,0	5100,0	320,0	-89,9	3,0	-11,9	0,10	0,10	0,10	0,40	0,19	0,10
773	KFI09	Finnsjön						1400,0	8,0	1000,0	57,0	33,0	5100,0	300,0	-87,4	3,0	-11,1	0,10	0,10	0,10	0,33	0,27	0,10
774	KGI02	Gideå						50,0	2,3	10,0	2,6	161,0	4,8	1,0	-90,9	3,0	-12,6	0,02	0,02	0,02	0,11	0,81	0,02
775	KGI02	Gideå						48,0	2,2	10,0	2,7	161,0	4,1	0,6	-90,4	3,0	-12,6	0,02	0,02	0,02	0,11	0,81	0,02
776	KGI02	Gideå						49,0	2,2	9,5	2,4	163,0	4,7	0,5	-90,1	3,0	-12,6	0,02	0,02	0,02	0,11	0,81	0,02
777	KGI02	Gideå						53,0	2,0	10,0	2,4	160,0	5,4	0,4	-91,4	3,0	-12,7	0,02	0,02	0,02	0,12	0,80	0,02
778	KGI02	Gideå						51,0	2,2	9,5	2,3	160,0	5,0	0,1	-89,5	3,0	-12,4	0,02	0,02	0,02	0,10	0,82	0,02
779	KGI02	Gideå						50,0	2,2	11,0	1,9	158,0	4,6	0,1	-92,7	3,0	-12,7	0,02	0,02	0,02	0,13	0,79	0,02
780	KGI04	Gideå						11,0	2,5	33,0	4,4	141,0	1,5	3,9	-93,4	36,0	-12,9	0,02	0,02	0,02	0,15	0,77	0,02
781	KGI04	Gideå						49,0	0,9	9,0	1,0	133,0	7,9	0,3	-89,7	5,0	-12,6	0,02	0,02	0,02	0,13	0,79	0,02
782	KGI04	Gideå						105,0	1,9	21,0	1,1	18,0	178,0	0,1	-99,4	8,0	-13,6	0,02	0,02	0,02	0,31	0,59	0,02
783	KGI04	Gideå						5,0	2,7	30,0	4,3	121,0	2,2	8,0	-94,1	49,0	-12,9	0,02	0,02	0,02	0,17	0,75	0,02
784	KGI04	Gideå						145,0	3,0	58,0	1,5	50,0	260,0	0,1	-100,8	10,0	-13,8	0,02	0,02	0,02	0,31	0,59	0,02
785	KFJ02	Fjällved						26,0	2,3	19,0	3,3	144,0	8,0	10,0	-80,5	19,0	-11,3	0,02	0,02	0,02	0,02	0,85	0,06
786	KFJ02	Fjällved						33,0	2,6	21,0	3,4	170,0	8,0	0,2	-80,8	3,0	-11,4	0,02	0,02	0,02	0,02	0,83	0,08
787	KFJ02	Fjällved						130,0	1,0	12,0	0,8	83,0	170,0	0,2	-102,9	3,0	-14,1	0,02	0,02	0,02	0,32	0,60	0,02
788	KFJ04	Fjällved						65,0	3,0	15,0	2,2	218,0	6,0	7,0	-81,8	9,0	-11,5	0,02	0,02	0,02	0,02	0,82	0,10
789	KFJ04	Fjällved						38,0	2,7	28,0	3,9	196,0	9,0	7,0	-82,6	21,0	-11,5	0,02	0,02	0,02	0,02	0,85	0,07
790	KFJ04	Fjällved						54,0	2,4	17,0	2,3	195,0	5,0	3,6	-81,6	12,0	-11,5	0,02	0,02	0,02	0,02	0,84	0,09
791	KFJ04	Fjällved						62,0	2,0	14,0	2,0	198,0	8,0	3,9	-84,7	6,0	-11,7	0,02	0,02	0,02	0,02	0,89	0,03
792	KFJ07	Fjällved						55,0	3,8	11,0	2,1	160,0	4,0	0,5	-80,4	3,0	-11,3	0,02	0,02	0,02	0,02	0,82	0,09
793	KFJ07	Fjällved						48,0	3,9	11,0	2,1	160,0	3,0	0,5	-80,3	3,0	-11,3	0,02	0,02	0,02	0,02	0,83	0,08
794	KFJ07	Fjällved						37,0	3,3	11,0	2,0	160,0	1,0	0,5	-80,7	3,0	-11,3	0,02	0,02	0,02	0,02	0,84	0,08
795	KFJ07	Fjällved						37,0	3,1	11,0	2,0	160,0	3,0	1,1	-80,2	3,0	-11,2	0,02	0,02	0,02	0,02	0,82	0,09
796	KFJ07	Fjällved						47,0	3,1	11,0	2,1	150,0	1,0	0,5	-80,1	3,0	-11,2	0,02	0,02	0,02	0,02	0,83	0,08
797	KFJ07	Fjällved						46,0	3,6	10,0	2,0	150,0	3,0	0,5	-81,4	3,0	-11,4	0,02	0,02	0,02	0,02	0,85	0,06
798	KFJ07	Fjällved						53,0	3,6	11,0	2,1	150,0	3,0	0,8	-81,2	3,0	-11,4	0,02	0,02	0,02	0,02	0,85	0,06
799	KFJ07	Fjällved						54,0	3,2	11,0	2,1	160,0	4,0	0,5	-80,3	3,0	-11,4	0,02	0,02	0,02	0,02	0,83	0,08
800	KFJ07	Fjällved						52,0	3,0	11,0	2,0	190,0	4,0	0,5	-80,6	3,0	-11,4	0,02	0,02	0,02	0,02	0,82	0,10

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
801	KFJ08	Fjällved						13,0	3,2	25,0	4,6	130,0	4,0	6,5	-79,3	8,0	-11,2	0,02	0,02	0,02	0,02	0,83	0,07
802	KFJ08	Fjällved						14,0	2,9	26,0	4,0	130,0	4,0	5,0	-77,8	10,0	-10,9	0,02	0,02	0,02	0,02	0,80	0,11
803	KFR01	Forsmark						1900,0	8,6	940,0	170,0	69,0	4100,0	300,0	-88,1	3,0	-12,3	0,11	0,11	0,11	0,29	0,26	0,11
804	KFR01	Forsmark						1700,0	9,3	1200,0	180,0	71,0	4400,0	300,0	-86,4	3,0	-12,1	0,11	0,11	0,11	0,27	0,27	0,11
805	KFR01	Forsmark						1700,0	8,8	1200,0	210,0	73,0	4100,0	340,0	-88,3	3,0	-11,5	0,12	0,12	0,12	0,23	0,29	0,12
806	KFR01	Forsmark						800,0	9,7	490,0	65,0	74,0	4300,0	320,0	-86,0	3,0	-11,9	0,09	0,09	0,09	0,25	0,40	0,09
807	KFR01	Forsmark						1500,0	16,0	1600,0	170,0	77,0	4200,0	490,0	-88,2	3,0	-12,0	0,13	0,13	0,13	0,31	0,17	0,13
808	KFR01	Forsmark						1500,0	7,1	970,0	160,0	83,0	4200,0	350,0	-88,0	3,0	-11,8	0,11	0,11	0,11	0,26	0,30	0,11
809	KFR10	Forsmark						1200,0	20,0	1650,0	400,0	80,0	5100,0	450,0	-62,8	3,0	-9,1	0,37	0,17	0,12	0,12	0,12	0,12
810	KFR10	Forsmark						1800,0	19,0	1000,0	270,0	90,0	5400,0	400,0	-63,0	3,0	-9,1	0,28	0,12	0,12	0,12	0,12	0,22
811	KFR10	Forsmark						1800,0	20,0	1500,0	250,0	88,0	5000,0	400,0	-62,9	3,0	-9,1	0,26	0,13	0,13	0,13	0,13	0,23
812	KFR10	Forsmark						2000,0	21,0	1200,0	340,0	89,0	5100,0	440,0	-66,1	3,0	-8,6	0,34	0,16	0,12	0,12	0,12	0,12
813	KFR10	Forsmark						1800,0	18,0	970,0	260,0	92,0	5000,0	430,0	-69,0	3,0	-8,7	0,24	0,13	0,13	0,13	0,13	0,26
814	KFR10	Forsmark						1600,0	19,0	1400,0	250,0	98,0	5200,0	670,0	-67,2	3,0	-9,1	0,26	0,16	0,14	0,14	0,14	0,14
815	KFR10	Forsmark						1500,0	16,0	1100,0	270,0	105,0	5000,0	450,0	-67,3	3,0	-8,8	0,25	0,12	0,12	0,12	0,12	0,26
816	KFR7A	Forsmark						1800,0	21,0	1250,0	330,0	87,0	5000,0	440,0	-67,0	3,0	-9,6	0,33	0,13	0,13	0,13	0,13	0,14
817	KFR7A	Forsmark						2300,0	20,0	930,0	260,0	94,0	4900,0	440,0	-65,5	3,1	-9,4	0,26	0,13	0,13	0,13	0,13	0,20
818	KFR7A	Forsmark						1900,0	20,0	1200,0	320,0	98,0	5000,0	420,0	-65,6	3,0	-9,5	0,33	0,13	0,13	0,13	0,13	0,15
819	KFR7A	Forsmark						2100,0	19,0	880,0	280,0	92,0	4900,0	480,0	-67,7	3,1	-9,1	0,29	0,13	0,13	0,13	0,13	0,17
820	KFR7A	Forsmark						2600,0	20,0	1200,0	340,0	98,0	5200,0	430,0	-69,1	2,9	-9,2	0,27	0,19	0,13	0,13	0,13	0,13
821	KFR7A	Forsmark						1100,0	44,0	760,0	180,0	96,0	5000,0	480,0	-69,6	3,0	-9,5	0,23	0,12	0,12	0,12	0,12	0,29
822	KFR7A	Forsmark						2500,0	28,0	1500,0	280,0	120,0	5000,0	670,0	-70,2	3,0	-9,5	0,16	0,26	0,14	0,14	0,14	0,14
823	KFR7A	Forsmark						1800,0	15,0	970,0	250,0	110,0	5000,0	460,0	-70,0	3,0	-9,0	0,20	0,13	0,13	0,13	0,13	0,29
824	KKA03	Kamlunge						17,0	2,9	130,0	12,0	272,0	19,0	170,0	-59,6	103,0	-8,7	0,01	0,01	0,01	0,01	0,33	0,62
825	KKA03	Kamlunge						19,0	2,8	129,0	7,5	271,0	21,0	160,0	-59,6	99,0	-8,7	0,01	0,01	0,01	0,01	0,34	0,61
826	KKA03	Kamlunge						17,0	2,7	127,0	9,5	265,0	20,0	160,0	-59,0	77,0	-8,8	0,01	0,01	0,01	0,01	0,34	0,61
827	KKA04	Kamlunge						53,0	3,1	75,0	18,0	293,0	37,0	118,0	-69,0	58,0	-10,0	0,01	0,01	0,01	0,01	0,50	0,45
828	KKA04	Kamlunge						55,0	3,3	86,0	17,0	295,0	38,0	110,0	-67,6	41,0	-9,7	0,01	0,01	0,01	0,01	0,47	0,49
829	KKA04	Kamlunge						55,0	3,2	85,0	15,0	290,0	37,0	110,0	-71,0	48,0	-9,5	0,01	0,01	0,01	0,01	0,49	0,46
830	KKA04	Kamlunge						54,0	3,2	85,0	15,0	296,0	36,0	110,0	-71,0	60,0	-9,8	0,01	0,01	0,01	0,01	0,51	0,44
831	KKA04	Kamlunge						53,0	3,2	85,0	16,0	293,0	36,0	110,0	-70,0	61,0	-10,0	0,01	0,01	0,01	0,01	0,52	0,43
832	KKA04	Kamlunge						57,0	3,3	78,0	17,0	295,0	37,0	110,0	-71,0	60,0	-9,9	0,01	0,01	0,01	0,01	0,51	0,44

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
833	KKA04	Kamlunge						58,0	3,2	80,0	17,0	295,0	41,0	112,0	-71,0	59,0	-9,9	0,01	0,01	0,01	0,01	0,51	0,43
834	KKA04	Kamlunge						58,0	3,2	80,0	17,0	295,0	41,0	112,0	-71,0	58,0	-9,9	0,01	0,01	0,01	0,01	0,51	0,43
835	KKA04	Kamlunge						58,0	3,2	80,0	17,0	295,0	41,0	112,0	-71,0	60,0	-9,9	0,01	0,01	0,01	0,01	0,51	0,43
836	HKM20	Karlsham						8,7	1,6	11,0	2,4	59,0	11,0	2,0	-99,1	28,0	-13,6	0,02	0,02	0,02	0,28	0,64	0,02
837	HKM20	Karlsham						8,1	1,7	11,0	2,6	81,0	9,0	3,0	-99,8	22,0	-13,7	0,02	0,02	0,02	0,27	0,65	0,02
838	KKM03	Karlsham						5,7	1,2	13,0	2,8	65,0	2,5	4,0	-99,3	49,0	-13,7	0,02	0,02	0,02	0,27	0,65	0,02
839	KKM03	Karlsham						6,1	1,3	13,0	2,7	65,0	2,5	4,0	-100,1	39,0	-13,8	0,02	0,02	0,02	0,28	0,64	0,02
840	KKM03	Karlsham						4,8	1,8	13,0	3,1	62,0	3,0	6,0	-100,2	56,0	-13,8	0,02	0,02	0,02	0,29	0,63	0,02
841	KKM03	Karlsham						5,0	1,8	13,0	3,2	66,0	2,5	6,0	-100,1	56,0	-13,8	0,02	0,02	0,02	0,28	0,64	0,02
842	KKM08	Karlsham						0,8	0,2	2,0	0,6	8,0	0,5	5,0	-106,6	30,0	-14,6	0,02	0,02	0,02	0,40	0,52	0,02
843	KKM13	Karlsham						18,0	1,6	106,0	0,6	13,0	6,0	240,0	-99,8	9,0	-13,7	0,04	0,04	0,04	0,37	0,47	0,04
844	KKM13	Karlsham						19,0	5,8	145,0	3,9	23,0	11,0	300,0	-97,9	28,0	-13,5	0,05	0,05	0,05	0,34	0,47	0,05
845	KKM13	Karlsham						1,9	1,0	5,4	0,8	31,0	2,0	7,0	-98,9	37,0	-13,6	0,02	0,02	0,02	0,29	0,62	0,02
846	KKM13	Karlsham						1,4	0,8	3,5	0,7	8,0	5,0	5,0	-109,2	39,0	-14,9	0,02	0,02	0,02	0,43	0,50	0,02
847	KKM13	Karlsham						1,0	0,7	3,0	0,5	9,0	0,5	6,0	-110,3	25,0	-15,0	0,02	0,02	0,02	0,44	0,49	0,02
848	KKL01	Klipperå						48,0	0,9	14,4	2,3	80,0	48,0	1,3	-85,2	6,5	-11,9	0,03	0,03	0,03	0,11	0,79	0,03
849	KKL02	Klipperå						27,0	1,1	30,0	1,0	134,0	18,0	0,1	-88,8	3,0	-12,4	0,02	0,02	0,02	0,11	0,80	0,02
850	KKL02	Klipperå						41,0	1,5	16,0	1,0	99,0	25,0	0,1	-80,5	13,0	-11,3	0,03	0,03	0,03	0,04	0,86	0,03
851	KKL09	Klipperå						16,0	1,0	30,0	2,0	121,0	5,5	4,0	-85,4	2,1	-11,9	0,02	0,02	0,02	0,08	0,82	0,02
852	KKR01	Kråkemål						39,0	3,2	40,0	8,0	223,0	15,0	4,2	-78,0	3,0	-10,3	0,01	0,01	0,01	0,01	0,69	0,26
853	KKR01	Kråkemål						40,0	3,1	40,0	8,0	224,0	15,0	4,2	-78,0	3,0	-10,3	0,01	0,01	0,01	0,01	0,69	0,26
854	KKR01	Kråkemål						39,0	3,2	40,0	8,0	224,0	15,0	3,6	-78,0	3,0	-10,3	0,01	0,01	0,01	0,01	0,68	0,26
855	KKR01	Kråkemål						40,0	3,1	40,0	9,0	224,0	15,0	3,6	-78,0	3,0	-10,3	0,01	0,01	0,01	0,01	0,68	0,26
856	KKR01	Kråkemål						57,0	3,3	30,0	8,0	231,0	25,0	2,7	-77,0	3,0	-10,4	0,01	0,01	0,01	0,01	0,68	0,27
857	KKR01	Kråkemål						57,0	3,1	28,0	8,5	231,0	25,0	2,7	-77,0	3,0	-10,4	0,01	0,01	0,01	0,01	0,68	0,27
858	KKR01	Kråkemål						58,0	3,1	27,0	9,0	231,0	25,0	3,6	-77,0	3,0	-10,4	0,01	0,01	0,01	0,01	0,68	0,27
859	KKR01	Kråkemål						57,0	3,3	28,0	9,5	227,0	23,0	1,5	-77,0	3,0	-10,4	0,01	0,01	0,01	0,01	0,68	0,27
860	KKR01	Kråkemål						235,0	3,2	25,0	8,5	210,0	260,0	36,0	-79,0	3,0	-10,7	0,02	0,02	0,02	0,02	0,73	0,18
861	KKR01	Kråkemål						250,0	3,3	29,0	8,5	215,0	280,0	40,0	-79,0	3,0	-10,7	0,02	0,02	0,02	0,02	0,72	0,19
862	KKR01	Kråkemål						250,0	3,3	29,0	8,0	215,0	280,0	39,0	-79,0	3,0	-10,7	0,02	0,02	0,02	0,02	0,72	0,19
863	KKR01	Kråkemål						250,0	3,2	29,0	7,5	215,0	280,0	38,0	-79,0	3,0	-10,7	0,02	0,02	0,02	0,02	0,72	0,19
864	KKR01	Kråkemål						80,0	3,7	22,0	6,5	222,0	44,0	9,6	-83,0	3,0	-10,4	0,02	0,02	0,02	0,02	0,74	0,20

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
865	KKR01	Kråkemål						80,0	3,3	22,0	7,0	222,0	44,0	7,2	-83,0	3,0	-10,4	0,02	0,02	0,02	0,02	0,74	0,20
866	KKR01	Kråkemål						82,0	3,4	22,0	6,5	223,0	45,0	8,1	-83,0	3,0	-10,4	0,02	0,02	0,02	0,02	0,74	0,20
867	KKR01	Kråkemål						82,0	3,5	21,0	7,0	222,0	47,0	8,1	-83,0	3,0	-10,4	0,02	0,02	0,02	0,02	0,74	0,20
868	KLJ01	Lansfjär						11,3	1,5	7,7	1,2	44,0	0,8	4,4	-109,3	8,0	-13,8	0,02	0,02	0,02	0,35	0,57	0,02
869	KSV04	Svartbob						24,0	1,7	25,0	3,2	138,0	2,3	1,9	-90,0	5,0	-12,5	0,02	0,02	0,02	0,12	0,79	0,02
870	KSV04	Svartbob						40,0	0,8	13,0	1,7	127,0	9,0	0,8	-95,3	3,0	-13,2	0,02	0,02	0,02	0,19	0,73	0,02
871	KSV04	Svartbob						35,0	0,9	17,0	2,0	130,0	8,0	1,2	-95,0	3,0	-13,0	0,02	0,02	0,02	0,18	0,74	0,02
872	KSV04	Svartbob						35,0	0,7	17,0	1,9	126,0	7,0	0,8	-95,4	3,0	-13,1	0,02	0,02	0,02	0,19	0,73	0,02
873	KSV05	Svartbob						20,0	1,1	19,0	1,2	114,0	2,4	3,0	-92,2	33,0	-12,8	0,02	0,02	0,02	0,16	0,75	0,02
874	KSV05	Svartbob						3,0	0,6	8,0	1,9	28,0	7,0	4,7	-90,8	36,0	-12,6	0,02	0,02	0,02	0,20	0,70	0,02
875	KSV05	Svartbob						3,0	0,6	8,0	1,3	50,0	7,0	4,8	-86,8	37,0	-12,1	0,03	0,03	0,03	0,14	0,76	0,03
876	KSV05	Svartbob						3,0	0,5	9,0	1,6	47,0	10,0	5,5	-86,0	36,0	-12,0	0,03	0,03	0,03	0,13	0,76	0,03
877	KTA01	Taavinun						3,9	1,0	6,2	1,4	32,0	2,0	6,9	-97,4	145,0	-13,6	0,02	0,02	0,02	0,28	0,64	0,02
878	KTA01	Taavinun						4,5	1,0	6,7	1,4	33,0	1,0	7,6	-101,2	120,0	-13,9	0,02	0,02	0,02	0,32	0,60	0,02
879	KTA01	Taavinun						3,9	0,9	6,7	1,4	32,0	1,0	6,2	-97,6	123,0	-13,7	0,02	0,02	0,02	0,29	0,63	0,02
880	KTA01	Taavinun						3,7	0,9	5,4	1,4	26,0	1,0	4,8	-98,7	123,0	-13,6	0,02	0,02	0,02	0,29	0,62	0,02
881	KTA01	Taavinun						3,7	1,0	5,3	1,4	30,0	1,0	5,2	-97,8	160,0	-13,6	0,02	0,02	0,02	0,28	0,63	0,02
882	KTA01	Taavinun						4,3	1,0	5,3	1,4	28,0	1,0	5,3	-97,5	162,0	-13,7	0,02	0,02	0,02	0,29	0,63	0,02
883	KTA01	Taavinun						4,5	1,0	5,6	1,4	31,0	1,0	5,3	-98,5	121,0	-13,8	0,02	0,02	0,02	0,30	0,62	0,02
884	KTA01	Taavinun						4,0	1,0	6,2	1,4	32,0	1,0	6,3	-98,7	155,0	-13,8	0,02	0,02	0,02	0,30	0,63	0,02
885	KTA01	Taavinun						4,3	1,0	6,4	1,3	32,0	1,0	6,4	-97,9	99,0	-13,8	0,02	0,02	0,02	0,29	0,62	0,02
886	KTA01	Taavinun						4,1	0,9	6,5	1,4	32,0	1,0	6,5	-98,6	121,0	-13,6	0,02	0,02	0,02	0,29	0,63	0,02
887	KTA01	Taavinun						4,1	0,9	6,4	1,4	31,0	1,0	7,0	-98,6	158,0	-13,8	0,02	0,02	0,02	0,30	0,62	0,02
888	KTA01	Taavinun						4,0	0,9	5,9	1,3	31,0	1,0	6,7	-98,0	153,0	-13,8	0,02	0,02	0,02	0,29	0,63	0,02
889	KTA01	Taavinun						4,8	1,3	7,9	1,1	25,0	1,0	5,8	-97,4	129,0	-13,7	0,02	0,02	0,02	0,29	0,63	0,02
890	KTA01	Taavinun						4,5	1,3	6,9	1,2	30,0	1,0	5,8	-97,1	115,0	-13,6	0,02	0,02	0,02	0,28	0,63	0,02
891	Rain old	Precipitation						0,4	0,3	0,2	0,1	12,2	0,2	1,4	-80,0	0,0	-10,5	0,03	0,03	0,03	0,05	0,82	0,03
892	Rain	Precipitation						0,4	0,3	0,2	0,1	12,2	0,2	1,4	-80,0	22,0	-10,5	0,03	0,03	0,03	0,05	0,83	0,03
893	Rain old, north	Precipitation						0,4	0,3	0,2	0,1	12,2	0,2	1,4	-80,0	0,0	-14,0	0,03	0,03	0,03	0,22	0,68	0,03
894	Rain, north	Precipitation						0,4	0,3	0,2	0,1	12,2	0,2	1,4	-80,0	22,0	-14,0	0,03	0,03	0,03	0,22	0,68	0,03
895	Rain'60, north	Precipitation						0,4	0,3	0,2	0,1	12,2	0,2	1,4	-80,0	2000,0	-14,0	-1.#IND	-1.#IND	-1.#IND	-1.#IND	-1.#IND	-1.#IND
896	Glacial	Glacial						0,2	0,4	0,2	0,1	0,1	0,5	0,5	-158,0	0,0	-21,0	0,00	0,00	0,00	1,00	0,00	0,00

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
897	1569_1	Äspö-1						1190,0	5,8	297,0	37,1	111,8	2318,0	62,6	-125,7	0,1	-16,6	0,04	0,04	0,04	0,63	0,19	0,04
898	1569_2	Äspö-2						110,0	1,8	33,8	3,5	12,4	219,0	10,4	-120,6	0,1	-15,5	0,02	0,02	0,02	0,53	0,40	0,02
899	PROV 1b	Norway g						0,1	0,4	0,1	0,1	0,1	0,5	0,3	-102,0	0,0	-14,0	0,02	0,02	0,02	0,35	0,56	0,02
900	PROV 2b	Norway g						0,2	0,4	0,2	0,1	0,1	0,5	0,5	-116,4	0,0	-15,8	0,02	0,02	0,02	0,52	0,42	0,02
901	PROV 3b	Norway g						0,1	0,4	0,1	0,1	0,1	0,5	0,3	-99,6	0,0	-13,7	0,02	0,02	0,02	0,32	0,59	0,02
902	PROV 4b	Norway g						0,1	0,4	0,2	0,1	0,2	0,5	0,6	-115,6	0,0	-15,7	0,02	0,02	0,02	0,51	0,43	0,02
903	PROV 5b	Norway g						0,3	0,3	0,5	0,1	1,1	0,7	0,9	-110,8	0,0	-15,1	0,02	0,02	0,02	0,45	0,47	0,02
904	PROV 6b	Norway g						713,2	26,3	26,3	85,6	11,0	1290,0	176,4	-102,8	0,0	-14,1	0,07	0,07	0,07	0,32	0,40	0,07
905	PASSEA01	Sea						1960,0	95,0	93,7	234,0	90,0	3760,0	503,4	-53,3	42,0	-5,9	0,43	0,34	0,06	0,06	0,06	0,06
906	PASSEA01	Sea						1380,0	58,0	67,7	168,0	61,0	2670,0	383,5	-54,6	26,0	-7,0	0,52	0,09	0,09	0,09	0,09	0,14
907	PASSEA01	Sea						1810,0	69,0	88,8	215,0	84,0	3380,0	501,0	-50,7	36,0	-6,0	0,49	0,23	0,07	0,07	0,07	0,07
908	PASSEA02	Sea						1640,0	66,0	76,1	197,0	73,0	3160,0	434,4	-54,5	38,0	-6,9	0,52	0,15	0,08	0,08	0,08	0,08
909	PASSEA02	Sea						1810,0	69,0	88,0	212,0	83,0	3320,0	461,4	-50,8	33,0	-6,0	0,51	0,22	0,07	0,07	0,07	0,07
910	PASSEA03	Sea						1820,0	75,0	82,6	223,0	80,0	3540,0	491,4	-54,8	29,0	-6,9	0,45	0,24	0,08	0,08	0,08	0,08
911	PASSEA03	Sea						1920,0	64,0	91,0	227,0	84,0	3620,0	514,0	-52,3	36,0	-6,5	0,46	0,23	0,08	0,08	0,08	0,08
912	PASSEA04	Sea						2050,0	83,0	93,0	251,0	94,0	4030,0	548,3	-53,0	40,0	-6,5	0,40	0,34	0,07	0,07	0,07	0,07
913	PASSEA04	Sea						1990,0	66,0	94,0	234,0	89,0	3680,0	535,0	-53,6	58,0	-6,7	0,43	0,25	0,08	0,08	0,08	0,08
914	PASSEA05	Sea						2030,0	81,0	91,8	246,0	91,0	4100,0	536,3	-54,8	30,0	-6,8	0,40	0,32	0,07	0,07	0,07	0,07
915	PASSEA05	Sea						1935,0	73,0	90,0	231,0	84,0	3610,0	516,0	-54,1	34,0	-7,0	0,43	0,26	0,08	0,08	0,08	0,08
916	Varvinnokka	Olkiluoto						28,8	6,6	25,0	5,2	98,8	6,6	62,4	-86,6	21,3	-10,4	0,03	0,03	0,03	0,03	0,82	0,04
917	Varvinnokka*	Olkiluoto						9,7	3,6	44,0	5,0	152,5	4,7	15,0	-81,6	12,7	-10,6	0,02	0,02	0,02	0,02	0,79	0,13
918	Helmiranta*	Olkiluoto						76,0	2,4	19,0	3,4	201,4	15,0	23,0	-84,1	10,5	-11,3	0,02	0,02	0,02	0,02	0,84	0,07
919	PVP1	Olkiluoto						7,2	2,4	13,0	4,8	26,8	7,3	28,0	-72,9	55,0	-9,9	0,03	0,03	0,03	0,03	0,73	0,15
920	PVP2	Olkiluoto						3,1	1,7	4,7	1,4	9,2	4,8	5,9	-75,6	47,0	-10,0	0,03	0,03	0,03	0,03	0,79	0,09
921	PR1	Olkiluoto						3,3	1,8	4,6	2,3	20,1	1,3	5,0	-84,4	15,0	-11,1	0,03	0,03	0,03	0,10	0,79	0,03
922	PR4	Olkiluoto						31,0	4,0	15,0	5,5	122,0	4,5	25,0	-81,3	35,0	-10,2	0,02	0,02	0,02	0,02	0,77	0,13
923	PR2	Olkiluoto						79,0	4,3	19,0	5,7	213,6	12,0	17,0	-83,5	13,5	-10,7	0,02	0,02	0,02	0,02	0,77	0,16
924	PR3	Olkiluoto						210,0	4,7	9,6	3,7	414,9	30,0	110,0	-85,9	42,0	-10,7	0,01	0,01	0,01	0,01	0,65	0,31
925	2/T7	Olkiluoto						270,0	4,9	19,0	7,3	292,9	210,0	80,0	-79,7	10,7	-10,8	0,02	0,02	0,02	0,02	0,67	0,25
926	1/T6	Olkiluoto						270,0	4,9	32,0	11,0	375,3	250,0	110,0	-79,3	5,8	-10,8	0,01	0,01	0,01	0,01	0,61	0,34
927	1/T5	Olkiluoto						290,0	4,8	38,0	12,0	372,2	275,0	109,0	-77,7	5,5	-10,9	0,02	0,02	0,02	0,02	0,60	0,34
928	1/T7	Olkiluoto						324,0	6,8	78,0	25,0	391,0	413,0	101,0	-78,4	6,2	-11,1	0,02	0,02	0,02	0,02	0,58	0,36

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
929	1/T7	Olkiluoto						330,0	7,9	83,0	27,0	396,6	430,0	96,0	-79,2	5,6	-10,9	0,01	0,01	0,01	0,01	0,56	0,38
930	5/T7	Olkiluoto						500,0	5,4	147,0	32,0	274,6	910,0	190,0	-77,2	1,7	-10,7	0,04	0,04	0,04	0,04	0,59	0,25
931	4/T6	Olkiluoto						760,0	18,0	172,0	67,0	212,1	1140,0	200,0	-76,0	1,3	-10,0	0,05	0,05	0,05	0,05	0,42	0,37
932	2/T6	Olkiluoto						760,0	5,0	160,0	35,0	165,0	1500,0	160,0	-89,2	2,2	-11,9	0,05	0,05	0,05	0,15	0,64	0,05
933	4/T4	Olkiluoto						1010,0	11,0	530,0	86,0	145,6	2330,0	150,0	-76,4	3,2	-10,6	0,07	0,07	0,07	0,07	0,54	0,18
934	2/T4	Olkiluoto						1900,0	16,0	750,0	160,0	51,3	4600,0	523,0	-69,7	0,8	-9,2	0,14	0,14	0,14	0,14	0,22	0,24
935	4/T5	Olkiluoto						1870,0	20,0	700,0	260,0	80,4	4500,0	510,0	-72,4	0,8	-9,5	0,20	0,13	0,13	0,13	0,13	0,26
936	4/T5	Olkiluoto						1900,0	21,0	700,0	250,0	86,0	4500,0	500,0	-73,5	0,8	-10,0	0,16	0,14	0,14	0,14	0,14	0,30
937	8/P1	Olkiluoto						2030,0	7,0	1020,0	130,0	38,6	4770,0	470,0	-79,7	12,0	-9,6	0,13	0,13	0,13	0,23	0,25	0,13
938	5/T6	Olkiluoto						1600,0	15,0	595,0	160,0	69,3	3800,0	463,0	-74,0	0,8	-10,0	0,12	0,12	0,12	0,12	0,32	0,19
939	5/T5	Olkiluoto						1670,0	16,0	700,0	190,0	74,9	4300,0	440,0	-77,3	1,1	-10,3	0,13	0,13	0,13	0,13	0,32	0,17
940	2/T5	Olkiluoto						1770,0	10,0	520,0	110,0	47,7	3870,0	400,0	-80,9	0,8	-10,8	0,11	0,11	0,11	0,22	0,33	0,11
941	5/T4	Olkiluoto						1900,0	12,0	570,0	86,0	48,5	4000,0	320,0	-89,1	1,2	-11,6	0,11	0,11	0,11	0,31	0,26	0,11
942	3/T7	Olkiluoto						1680,0	11,0	340,0	90,0	42,1	3420,0	280,0	-92,1	0,9	-12,4	0,09	0,09	0,09	0,33	0,29	0,09
943	2/T3	Olkiluoto						1950,0	6,6	730,0	33,0	25,0	4300,0	225,0	-81,2	1,3	-11,1	0,10	0,10	0,10	0,31	0,30	0,10
944	3/T6	Olkiluoto						1400,0	6,0	350,0	70,0	36,0	2800,0	218,0	-92,1	0,8	-12,1	0,08	0,08	0,08	0,31	0,37	0,08
945	3/T5	Olkiluoto						1460,0	4,7	270,0	26,0	30,5	2700,0	2,5	-94,9	0,8	-12,8	0,06	0,06	0,06	0,35	0,42	0,06
946	3/P1	Olkiluoto						1445,0	5,0	279,0	25,0	17,1	2760,0	1,4	-98,7	0,8	-12,8	0,06	0,06	0,06	0,38	0,39	0,06
947	3/T3	Olkiluoto						1600,0	8,8	404,0	25,0	28,7	3400,0	26,0	-90,6	0,8	-12,1	0,07	0,07	0,07	0,31	0,41	0,07
948	3/T2	Olkiluoto						2100,0	9,6	380,0	9,9	24,4	3900,0	16,0	-91,5	0,8	-12,2	0,08	0,08	0,08	0,37	0,33	0,08
949	2/T2	Olkiluoto						1990,0	4,7	720,0	5,3	9,8	4200,0	6,9	-90,8	0,8	-12,4	0,08	0,08	0,08	0,41	0,29	0,08
950	5/T2	Olkiluoto						2230,0	8,4	960,0	41,0	36,6	4700,0	75,0	-84,4	0,8	-11,3	0,09	0,09	0,09	0,32	0,31	0,09
951	10/P1	Olkiluoto						1930,0	8,6	1240,0	57,0	15,3	5400,0	8,3	-89,3	0,8	-11,7	0,09	0,09	0,09	0,36	0,27	0,09
952	3/T1	Olkiluoto						2690,0	12,0	890,0	37,0	6,1	5865,0	31,2	-86,9	0,9	-11,7	0,10	0,10	0,10	0,40	0,19	0,10
953	5/T1	Olkiluoto						3020,0	15,0	1940,0	61,0	6,1	8400,0	4,2	-80,4	2,7	-11,1	0,12	0,12	0,13	0,39	0,12	0,12
954	5/T1	Olkiluoto						3050,0	13,0	1940,0	61,0	12,5	8500,0	4,5	-81,2	1,3	-11,2	0,12	0,12	0,13	0,40	0,12	0,12
955	1/T4	Olkiluoto						3300,0	15,0	2100,0	62,0	34,7	8800,0	20,6	-75,8	2,1	-10,9	0,12	0,12	0,14	0,36	0,12	0,12
956	5/P1	Olkiluoto						3325,0	14,0	2255,0	65,0	6,6	9500,0	3,1	-89,3	0,8	-11,8	0,10	0,10	0,16	0,43	0,10	0,10
957	9/P1	Olkiluoto						4200,0	14,0	3250,0	40,0	4,1	11480,0	1,3	-82,2	23,0	-11,0	0,10	0,10	0,21	0,39	0,10	0,10
958	1/T3	Olkiluoto						4800,0	21,0	3900,0	50,0	8,7	14800,0	4,4	-73,3	3,0	-10,7	0,10	0,10	0,26	0,32	0,10	0,10
959	1/T3	Olkiluoto						4800,0	21,0	4000,0	56,0	9,0	14800,0	0,8	-72,9	2,8	-10,7	0,10	0,10	0,26	0,32	0,10	0,10
960	4/P1	Olkiluoto						9750,0	22,0	15700,0	110,0	5,1	43000,0	1,0	-56,6	0,8	-9,6	0,01	0,01	0,82	0,13	0,01	0,01

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
961	1/S2	Olkiluoto						3500,0	19,0	2700,0	43,9	20,7	10000,0	0,1	-69,5	11,0	-9,1	0,14	0,14	0,16	0,30	0,14	0,14
962	1/S2	Olkiluoto						3890,0	19,8	3100,0	48,1	12,8	11500,0	0,1	-64,4	8,0	-8,7	0,14	0,14	0,19	0,26	0,14	0,14
963	1/S2	Olkiluoto						4100,0	19,0	3300,0	59,3	24,4	12000,0	0,1	-73,0	8,0	-10,0	0,12	0,12	0,21	0,31	0,12	0,12
964	1/S1	Olkiluoto						6622,0	15,6	6214,0	59,8	26,8	22000,0	0,1	-70,3	8,0	-9,0	0,09	0,09	0,40	0,25	0,09	0,09
965	1/S1	Olkiluoto						4621,0	17,4	3575,0	65,5	22,0	13400,0	0,1	-73,3	8,5	-10,4	0,11	0,11	0,24	0,32	0,11	0,11
966	5/S1	Olkiluoto						2795,0	13,9	1654,0	57,0	40,5	7580,0	10,9	-81,2	17,0	-11,1	0,12	0,12	0,12	0,37	0,17	0,12
967	Puskakari	Olkiluoto						1730,0	61,4	91,0	227,0	99,5	3250,0	501,0	-62,8	39,8	-7,2	0,47	0,17	0,09	0,09	0,09	0,09
968	Puskakari*	Olkiluoto						1780,0	66,0	80,0	218,0	79,3	3030,0	440,0	-60,7	16,3	-7,6	0,48	0,15	0,09	0,09	0,09	0,09
969	Eteläriutta*	Olkiluoto						1740,0	65,0	84,0	219,0	78,1	3020,0	460,0	-60,9	14,4	-7,5	0,47	0,16	0,09	0,09	0,09	0,09
970	Vuorimäki	Kivetty						2,5	0,9	3,2	0,8	11,0	1,2	2,8	-94,6	13,0	-12,5	0,02	0,02	0,02	0,23	0,67	0,02
971	Ylimm.Vuorijän	Kivetty						1,5	0,5	2,4	0,8	7,3	5,2	1,3	-84,4	18,8	-10,3	0,03	0,03	0,03	0,07	0,81	0,03
972	Kulmala	Kivetty						5,8	0,7	8,3	3,8	27,5	7,2	3,8	-98,4	12,3	-12,9	0,02	0,02	0,02	0,26	0,65	0,02
973	1/T6	Kivetty						14,0	1,5	24,0	4,6	128,1	3,5	2,8	-95,3	0,8	-12,7	0,02	0,02	0,02	0,17	0,75	0,02
974	1/T5	Kivetty						40,0	0,9	10,0	1,6	81,8	22,2	6,8	-100,0	0,8	-13,7	0,02	0,02	0,02	0,27	0,64	0,02
975	1/T4	Kivetty						18,0	0,8	12,7	0,7	86,0	2,1	1,2	-90,4	0,8	-12,6	0,02	0,02	0,02	0,16	0,75	0,02
976	1/T3	Kivetty						33,0	0,7	15,0	1,9	103,1	9,7	2,5	-94,9	0,8	-13,2	0,02	0,02	0,02	0,21	0,71	0,02
977	1/T2	Kivetty						27,0	1,4	15,0	2,8	125,1	4,5	0,9	-93,2	0,8	-12,4	0,02	0,02	0,02	0,14	0,77	0,02
978	2/T7	Kivetty						4,6	0,5	6,3	2,1	42,7	0,5	0,2	-94,8	17,0	-12,7	0,02	0,02	0,02	0,22	0,69	0,02
979	2/T6	Kivetty						5,2	0,6	7,0	2,3	42,1	0,5	1,4	-96,2	1,8	-13,3	0,02	0,02	0,02	0,26	0,65	0,02
980	2/T5	Kivetty						17,0	0,7	13,0	1,4	76,9	7,8	2,7	-99,3	0,8	-13,6	0,02	0,02	0,02	0,27	0,65	0,02
981	3/T7	Kivetty						4,7	1,9	18,0	3,9	74,4	1,2	3,9	-93,9	13,5	-12,8	0,02	0,02	0,02	0,20	0,71	0,02
982	3/T7	Kivetty						4,6	1,5	15,0	3,4	72,0	1,5	4,9	-97,2	10,8	-12,8	0,02	0,02	0,02	0,22	0,69	0,02
983	3/T6	Kivetty						5,4	1,1	19,0	3,4	80,5	0,9	3,9	-96,4	8,5	-12,9	0,02	0,02	0,02	0,21	0,70	0,02
984	3/T3	Kivetty						18,0	0,6	16,0	1,7	84,8	6,2	4,3	-99,3	4,7	-13,6	0,02	0,02	0,02	0,26	0,66	0,02
985	4/T7	Kivetty						9,1	1,4	21,0	5,3	105,6	1,1	1,0	-93,3	0,8	-12,7	0,02	0,02	0,02	0,17	0,75	0,02
986	4/T6	Kivetty						7,5	1,2	13,0	4,4	81,8	1,4	1,5	-92,4	0,8	-12,8	0,02	0,02	0,02	0,18	0,73	0,02
987	4/T3	Kivetty						8,6	1,3	19,0	4,1	94,0	1,1	0,6	-95,8	0,8	-12,8	0,02	0,02	0,02	0,20	0,72	0,02
988	4/T2	Kivetty						21,0	1,0	10,0	2,0	83,6	2,1	1,9	-95,0	1,2	-13,0	0,02	0,02	0,02	0,21	0,70	0,02
989	4/T1	Kivetty						9,6	1,0	16,0	4,4	90,9	1,4	2,3	-96,5	4,6	-12,7	0,02	0,02	0,02	0,20	0,72	0,02
990	5/T7	Kivetty						7,3	1,2	12,6	3,8	73,2	1,7	1,5	-91,3	8,8	-12,8	0,02	0,02	0,02	0,18	0,73	0,02
991	5/T6	Kivetty						8,2	1,7	13,5	4,2	81,8	3,5	2,4	-92,2	2,4	-12,4	0,02	0,02	0,02	0,16	0,74	0,02
992	5/T5	Kivetty						10,0	1,5	13,0	3,2	81,2	2,1	1,3	-94,3	8,8	-13,1	0,02	0,02	0,02	0,21	0,70	0,02

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
993	5/T4	Kivetty						20,0	2,0	13,8	1,6	79,3	13,8	5,6	-108,0	8,1	-14,5	0,02	0,02	0,02	0,36	0,57	0,02
994	5/T3	Kivetty						11,0	1,1	10,0	3,7	70,2	4,7	2,8	-94,9	14,0	-13,0	0,02	0,02	0,02	0,22	0,70	0,02
995	5/T2	Kivetty						12,0	1,4	17,0	3,7	89,1	4,3	1,6	-94,4	11,8	-12,7	0,02	0,02	0,02	0,19	0,73	0,02
996	5/T1	Kivetty						12,0	1,2	10,0	3,5	80,5	2,1	1,2	-90,6	8,1	-12,6	0,02	0,02	0,02	0,16	0,74	0,02
997	KR5	Kivetty						35,0	3,0	22,0	2,1	79,3	48,0	6,9	-101,5	1,7	-13,9	0,02	0,02	0,02	0,29	0,63	0,02
998	Patvikonmaa	Kivetty						1,7	1,1	5,6	0,9	22,6	0,7	2,4	-88,6	32,5	-11,7	0,03	0,03	0,03	0,15	0,74	0,03
999	Toimisto	Kivetty						12,3	4,0	18,6	4,1	45,2	22,0	12,0	-100,3	44,1	-12,8	0,02	0,02	0,02	0,25	0,66	0,02
1000	Piilola	Kivetty						2,0	1,0	9,9	0,9	10,4	15,8	3,7	-102,6	35,0	-13,2	0,02	0,02	0,02	0,31	0,60	0,02
1001	Harakkamäki	Kivetty						2,1	1,2	2,4	0,7	12,8	0,8	2,8	-93,7	31,9	-12,2	0,03	0,03	0,03	0,21	0,69	0,03
1002	Lemetyinen	Kivetty						2,1	0,6	3,6	0,8	12,2	0,9	5,7	-95,9	34,1	-12,2	0,02	0,02	0,02	0,22	0,68	0,02
1003	P-Ahvenainen	Kivetty						1,5	0,6	1,9	0,5	10,4	0,6	1,5	-95,5	18,5	-12,7	0,02	0,02	0,02	0,25	0,66	0,02
1004	Iso-Paskol.	Kivetty						1,4	0,7	1,9	0,7	9,2	0,4	2,9	-95,9	21,0	-12,3	0,02	0,02	0,02	0,23	0,67	0,02
1005	Liimatainen	Kivetty						5,8	2,8	11,4	5,8	79,9	1,9	2,0	-96,9	3,2	-12,6	0,02	0,02	0,02	0,20	0,71	0,02
1006	KA1	Kivetty						3,6	2,5	11,6	4,0	66,5	2,2	1,8	-94,9	31,9	-12,4	0,02	0,02	0,02	0,18	0,72	0,02
1007	KA1	Kivetty						3,6	2,5	12,5	4,7	68,3	2,2	1,8	-94,0	27,1	-12,4	0,02	0,02	0,02	0,18	0,73	0,02
1008	KA2	Kivetty						6,2	1,5	14,1	3,2	70,2	2,2	2,0	-94,1	5,5	-12,8	0,02	0,02	0,02	0,20	0,71	0,02
1009	TAP	Kivetty						22,7	2,9	9,8	3,6	80,5	8,2	9,9	-94,6	37,0	-12,4	0,02	0,02	0,02	0,18	0,73	0,02
1010	KA2	Kivetty						6,0	1,3	9,2	3,1	58,6	1,8	0,7	-96,4	6,0	-12,6	0,02	0,02	0,02	0,21	0,70	0,02
1011	KA2	Kivetty						6,0	1,4	11,3	3,1	61,0	1,8	1,8	-97,9	6,0	-12,7	0,02	0,02	0,02	0,22	0,69	0,02
1012	KR1	Kivetty						9,3	2,3	28,3	7,3	152,5	1,5	0,7	-96,0	6,1	-12,4	0,02	0,02	0,02	0,14	0,79	0,02
1013	KR1	Kivetty						9,3	2,4	22,5	5,5	115,9	1,5	0,1	-96,0	6,1	-12,5	0,02	0,02	0,02	0,16	0,75	0,02
1014	KR1	Kivetty						9,5	2,4	22,2	5,4	122,0	1,5	0,1	-92,7	6,1	-12,4	0,02	0,02	0,02	0,14	0,78	0,02
1015	Takkikangas	Romuvaara						1,6	0,6	4,3	0,5	8,4	5,8	1,4	-105,8	15,5	-14,0	0,02	0,02	0,02	0,37	0,55	0,02
1016	Hirvelä	Romuvaara						3,0	0,8	5,7	1,9	13,2	3,1	7,8	-104,5	11,9	-13,8	0,02	0,02	0,02	0,35	0,57	0,02
1017	Haapanoro	Romuvaara						13,0	17,0	16,0	5,5	43,3	10,0	20,0	-94,8	17,2	-12,6	0,03	0,03	0,03	0,17	0,69	0,03
1018	Kotikumpu	Romuvaara						7,8	4,2	10,0	4,1	15,9	11,0	21,0	-93,1	15,6	-12,8	0,03	0,03	0,03	0,23	0,66	0,03
1019	2/T6	Romuvaara						27,0	0,5	6,3	0,2	80,5	8,2	2,0	-93,1	0,8	-12,9	0,02	0,02	0,02	0,20	0,71	0,02
1020	2/T5	Romuvaara						15,0	1,5	18,0	1,6	100,1	1,7	2,2	-94,9	1,7	-13,0	0,02	0,02	0,02	0,20	0,72	0,02
1021	2/T4	Romuvaara						23,0	0,9	12,0	0,9	65,9	17,8	9,0	-96,0	3,8	-12,9	0,02	0,02	0,02	0,22	0,68	0,02
1022	2/T3	Romuvaara						31,0	0,9	8,6	0,4	62,2	24,1	8,6	-94,9	5,4	-13,2	0,02	0,02	0,02	0,24	0,67	0,02
1023	2/T2	Romuvaara						3,5	2,4	25,0	2,3	94,0	4,5	3,0	-96,1	25,4	-13,1	0,02	0,02	0,02	0,21	0,71	0,02
1024	3/T6	Romuvaara						4,8	1,8	16,0	4,0	89,7	0,7	1,3	-96,5	8,0	-12,9	0,02	0,02	0,02	0,20	0,71	0,02

1	2	3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	IDCODE	WATER TYPE	Northing sec_mid	Easting sec_mid	Elevation sec_mid	Sampl depth	Sample no	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Sea Sediment	Litorina	Brine	Glacial	Rain 60'	Lake water Forsmark
1025	3/T4	Romuvaara						5,5	1,8	19,0	5,0	106,8	0,8	1,2	-96,6	2,0	-13,1	0,02	0,02	0,02	0,20	0,72	0,02
1026	3/T1	Romuvaara						45,0	2,6	35,6	1,4	61,0	109,0	1,2	-99,6	1,4	-13,0	0,02	0,02	0,02	0,25	0,66	0,02
1027	4/T6	Romuvaara						38,0	0,7	2,6	0,2	88,5	7,4	1,5	-94,2	0,8	-13,3	0,02	0,02	0,02	0,22	0,70	0,02
1028	4/T6	Romuvaara						39,0	0,6	1,7	0,1	87,9	7,6	2,0	-99,3	1,1	-12,8	0,02	0,02	0,02	0,23	0,69	0,02
1029	4/T5	Romuvaara						22,0	1,2	15,0	2,1	107,4	3,3	0,3	-99,4	17,6	-13,1	0,02	0,02	0,02	0,22	0,70	0,02
1030	4/T3	Romuvaara						36,0	0,8	4,2	0,9	67,1	23,0	1,6	-97,5	10,5	-13,2	0,02	0,02	0,02	0,25	0,67	0,02
1031	5/T7	Romuvaara						3,7	2,1	10,9	1,8	51,3	0,8	4,9	-100,7	24,5	-13,7	0,02	0,02	0,02	0,29	0,62	0,02
1032	5/T6	Romuvaara						39,0	0,5	1,7	0,1	87,3	2,0	0,5	-97,9	4,5	-13,1	0,02	0,02	0,02	0,23	0,69	0,02
1033	5/T4	Romuvaara						65,0	0,4	1,2	0,0	103,7	29,0	2,6	-97,4	2,3	-13,0	0,02	0,02	0,02	0,22	0,70	0,02
1034	5/T1	Romuvaara						37,0	0,7	2,7	0,1	97,0	6,0	5,1	-99,9	3,2	-13,4	0,02	0,02	0,02	0,25	0,67	0,02
1035	KA2	Romuvaara						2,7	1,3	13,5	1,8	60,4	0,8	2,0	-102,1	20,6	-13,2	0,02	0,02	0,02	0,27	0,65	0,02
1036	KA2	Romuvaara						2,9	1,1	11,1	1,9	54,9	0,7	2,2	-102,8	16,6	-13,5	0,02	0,02	0,02	0,29	0,63	0,02
1037	KA2	Romuvaara						1,7	0,8	6,1	0,8	25,6	0,7	2,4	-102,2	36,7	-13,5	0,02	0,02	0,02	0,31	0,61	0,02
1038	KA3	Romuvaara						3,0	1,5	7,5	1,4	38,4	0,6	3,2	-104,9	46,5	-13,7	0,02	0,02	0,02	0,32	0,60	0,02
1039	KA3	Romuvaara						3,2	1,7	5,9	1,5	34,2	0,5	2,3	-106,2	40,4	-13,7	0,02	0,02	0,02	0,33	0,59	0,02
1040	KA3	Romuvaara						2,8	1,5	4,9	2,3	29,9	0,5	1,8	-105,4	36,4	-13,4	0,02	0,02	0,02	0,32	0,60	0,02

Appendix 3: M3 mixing calculations for Simpevarp local model

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	IDCODE	WATER TYPE	Sample no	Sampling depth	Northing sec mid	Easting sec mid	Elevation sec mid	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Rain	Lake water	Sea water	Marine	Ground water	Glacial
1	HSH02	Ground Water	3883		6365666	1551367	-91,86	110,0	3,0	5,4	2,5	269,0	11,8	19,1	-75,8	15,3	-10,8	0,68	0,12	0,05	0,05	0,05	0,05
2	HSH02	Ground Water	3886		6365666	1551367	-91,86	122,0	2,2	5,1	1,4	266,0	22,6	28,7	-76,3	11,0	-10,7	0,68	0,12	0,05	0,05	0,05	0,05
3	HSH03	Ground Water	3759		6366200	1552533	-96,29	152,0	3,3	13,0	3,4	255,0	53,1	84,3	-78,0	4,7	-10,6	0,63	0,14	0,06	0,06	0,06	0,06
4	HSH03	Ground Water	3760		6366207	1552539	-48,11	154,0	3,4	13,2	3,5	248,0	55,1	84,9	-76,1	10,0	-10,7	0,61	0,16	0,06	0,06	0,06	0,06
5	HSH03	Ground Water	3761		6366200	1552533	-96,29	192,0	3,6	21,1	5,0	233,0	131,8	81,6	-76,6	9,4	-10,8	0,66	0,10	0,06	0,06	0,06	0,06
6	KSH01A	Ground Water	3824		6365958	1552452	-243,57	2440,0	13,1	1020,0	61,2	21,0	5982,3	18,5	-102,5	1,1	-14,1	0,01	0,01	0,01	0,01	0,92	0,06
7	KSH01A	Ground Water	3825		6365878	1552449	-567,34	651,0	6,9	226,0	21,1	137,0	1298,6	167,3	-77,8	6,2	-10,6	0,41	0,10	0,10	0,10	0,10	0,18
8	KSH01A	Ground Water	3831		6365881	1552449	-553,97	1640,0	9,9	770,0	42,7	57,0	3922,9	96,2	-86,1	4,2	-11,7	0,08	0,08	0,08	0,08	0,48	0,19
9	KSH01A	Ground Water	5167		6365977	1552449	-165,61	1610,0	9,1	692,0	48,5	70,0	3781,9	63,5	-88,6	4,3	-12,4	0,08	0,08	0,08	0,08	0,45	0,24
10	KSH01A	Ground Water	5169		6365954	1552452	-262,81	1850,0	11,1	881,0	49,9	50,0	4311,1	98,9	-87,8	2,4	-12,3	0,06	0,06	0,06	0,06	0,60	0,14
11	KSH01A	Ground Water	5171		6365930	1552454	-359,93	1890,0	13,1	1030,0	42,6	38,0	4986,5	151,3	-84,4	3,0	-12,0	0,06	0,06	0,06	0,06	0,70	0,06
12	KSH01A	Ground Water	5173		6365905	1552453	-456,83	2010,0	14,8	1180,0	42,7	35,0	5138,0	265,1	-83,4	2,0	-11,9	0,04	0,04	0,04	0,10	0,75	0,04
13	KSH01A	Ground Water	5174		6365881	1552449	-553,77	1880,0	15,6	1100,0	42,2	40,0	3445,3	125,1	-83,0	2,9	-11,7	0,07	0,07	0,07	0,07	0,61	0,11
14	KSH01A	Ground Water	5175		6365857	1552443	-650,69	1530,0	14,4	858,0	38,4	58,0	3826,3	165,1	-80,1	5,1	-11,4	0,09	0,09	0,09	0,09	0,49	0,15
15	KSH01A	Ground Water	5176		6365832	1552434	-747,19	1310,0	12,5	705,0	33,9	73,0	2865,7	145,2	-79,1	5,8	-11,2	0,11	0,11	0,11	0,11	0,32	0,24
16	KSH01A	Ground Water	5177		6365806	1552423	-842,99	938,0	10,4	451,0	29,8	103,0	1830,1	126,1	-77,0	6,2	-10,9	0,20	0,12	0,12	0,12	0,12	0,30
17	KSH01A	Ground Water	5179		6365777	1552407	-937,46	558,0	8,5	206,0	26,0	138,0	1028,1	134,8	-75,6	7,2	-10,7	0,47	0,10	0,10	0,10	0,10	0,15
18	KSH01A	Ground Water	5263		6365980	1552449	-152,74	2280,0	14,7	960,0	70,8	25,0	5590,1	31,7	-95,9	0,8	-13,2	0,03	0,03	0,03	0,03	0,82	0,06
19	KSH01A	Ground Water	5262		6365980	1552449	-152,74	2210,0	11,3	939,0	70,4	26,0	5489,9	33,6	-97,8	0,8	-13,0	0,03	0,03	0,03	0,03	0,79	0,08
20	KSH01A	Ground Water	5261		6365980	1552449	-152,74	2280,0	12,6	963,0	71,8	28,0	5436,7	35,5	-97,5	0,8	-13,0	0,03	0,03	0,03	0,03	0,81	0,07
21	KSH01A	Ground Water	5260		6365980	1552449	-152,74	2300,0	12,7	975,0	73,7	26,0	5507,6	35,0	-98,0	0,8	-13,0	0,03	0,03	0,03	0,03	0,82	0,06
22	KSH01A	Ground Water	5259		6365980	1552449	-152,74	2150,0	9,1	941,0	70,0	28,0	5333,9	41,7	-93,6	0,8	-12,9	0,04	0,04	0,04	0,04	0,76	0,09
23	KSH01A	Ground Water	5257		6365980	1552449	-152,74	2090,0	8,4	915,0	70,9	30,0	5166,4	43,2	-95,1	2,8	-12,7	0,04	0,04	0,04	0,04	0,73	0,11
24	KSH01A	Ground Water	5268		6365959	1552452	-241,67	2430,0	13,2	1180,0	65,4	17,0	6298,2	51,1	-100,0	0,8	-14,0	0,00	0,00	0,00	0,00	1,00	0,00
25	KSH01A	Ground Water	5266		6365959	1552452	-241,67	2580,0	12,0	1160,0	63,5	18,0	6322,2	48,2	-100,2	0,8	-13,4	0,00	0,00	0,00	0,01	0,99	0,00
26	KSH02	Ground Water	3832		6365684	1551521	-433,08	2450,0	11,2	1280,0	9,7	29,0	6425,9	176,7	-93,4	0,8	-12,6	0,00	0,00	0,00	0,04	0,95	0,00
27	SSM000005	Ground Water	5404		6365675	1551376	6,98	10,1	9,3	91,2	17,5	215,0	17,1	4,5	-85,2	13,3	-11,8	0,63	0,05	0,05	0,05	0,05	0,16
28	SSM000005	Ground Water	5404		6365675	1551377	5,59	10,1	9,3	91,2	17,5	215,0	17,1	4,5	-85,2	13,3	-11,8	0,63	0,05	0,05	0,05	0,05	0,16
29	PSM002060	Sea Water	5120	0,5	6369240	1555800	0,30	1860,0	71,0	85,6	217,0	91,0	3484,7	492,4	-56,7	14,0	-7,2	0,07	0,07	0,43	0,28	0,07	0,07
30	PSM002060	Sea Water	5121	29,0	6369240	1555800	0,30	1870,0	71,5	85,7	217,0	92,0	3449,2	487,8	-56,2	14,2	-7,2	0,07	0,07	0,44	0,28	0,07	0,07
31	PSM002060	Sea Water	5371	28,5	6369240	1555800	0,30	1950,0	74,3	91,5	241,0	93,0	3727,5	532,0	-56,1	14,2	-7,1	0,07	0,07	0,39	0,34	0,07	0,07
32	PSM002060	Sea Water	5370	0,5	6369240	1555800	0,30	1950,0	72,6	91,2	240,0	93,0	3689,2	533,5	-56,2	16,1	-7,1	0,07	0,07	0,39	0,33	0,07	0,07
33	PSM002061	Sea Water	5065	0,5	6364050	1550810	0,30	1980,0	72,0	92,5	237,0	92,0	3532,5	503,0	-54,9	13,2	-7,0	0,07	0,07	0,42	0,31	0,07	0,07
34	PSM002061	Sea Water	5064	8,0	6364050	1550810	0,30	1980,0	71,4	92,9	237,0	92,0	3529,2	537,2	-54,8	16,1	-6,9	0,06	0,06	0,43	0,31	0,06	0,06

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	IDCODE	WATER TYPE	Sample no	Sampling depth	Northing sec mid	Easting sec mid	Elevation sec mid	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Rain	Lake water	Sea water	Marine	Ground water	Glacial
35	PSM002061	Sea Water	5142	0,5	6364050	1550810	0,30	1850,0	71,2	85,8	216,0	92,0	3491,8	502,9	-55,2	13,3	-7,1	0,07	0,07	0,45	0,27	0,07	0,07
36	PSM002061	Sea Water	5143	8,0	6364050	1550810	0,30	1880,0	72,2	86,8	219,0	94,0	3491,2	515,2	-55,8	12,6	-7,2	0,07	0,07	0,43	0,29	0,07	0,07
37	PSM002061	Sea Water	5373	7,5	6364050	1550810	0,30	1920,0	74,1	90,6	237,0	92,0	3690,3	539,8	-57,3	16,0	-7,1	0,07	0,07	0,39	0,34	0,07	0,07
38	PSM002061	Sea Water	5372	0,5	6364050	1550810	0,30	1930,0	73,7	90,7	238,0	94,0	3674,0	536,8	-57,9	13,7	-7,1	0,07	0,07	0,38	0,34	0,07	0,07
39	PSM002062	Sea Water	5049	0,5	6367060	1551260	0,30	494,0	19,7	30,9	61,5	30,0	922,8	132,2	-69,0	12,3	-9,7	0,27	0,42	0,08	0,08	0,08	0,08
40	PSM002062	Sea Water	5048	3,0	6367060	1551260	0,30	1280,0	46,8	64,2	160,0	69,0	2449,8	341,3	-61,6	14,9	-8,3	0,09	0,16	0,47	0,09	0,09	0,09
41	PSM002062	Sea Water	5114	0,5	6367060	1551260	0,30	1210,0	46,4	59,5	143,0	65,0	2204,5	313,5	-64,8	15,7	-8,7	0,10	0,21	0,40	0,10	0,10	0,10
42	PSM002062	Sea Water	5115	3,0	6367060	1551260	0,30	1430,0	54,6	68,3	170,0	76,0	2740,5	391,1	-61,0	14,2	-8,1	0,09	0,09	0,51	0,12	0,09	0,09
43	PSM002062	Sea Water	5202	0,5	6367060	1551260	0,30	1200,0	54,5	64,7	143,0	72,0	2555,1	361,3	-62,5	13,8	-8,2	0,09	0,15	0,48	0,09	0,09	0,09
44	PSM002062	Sea Water	5201	2,5	6367060	1551260	0,30	1510,0	60,1	75,4	181,0	76,0	2757,2	393,2	-62,1	12,6	-8,0	0,09	0,09	0,48	0,15	0,09	0,09
45	PSM002062	Sea Water	5375	2,5	6367060	1551260	0,30	1090,0	39,4	53,1	126,0	53,0	1916,1	270,0	-68,2	14,6	-8,8	0,10	0,30	0,30	0,10	0,10	0,10
46	PSM002062	Sea Water	5374	0,5	6367060	1551260	0,30	1070,0	38,6	52,4	124,0	53,0	1917,3	274,3	-68,0	14,5	-8,8	0,10	0,31	0,30	0,10	0,10	0,10
47	PSM002064	Sea Water	5051	0,5	6368620	1550520	0,50	653,0	25,3	37,2	80,9	33,0	1145,3	160,1	-71,3	17,3	-9,3	0,12	0,52	0,09	0,09	0,09	0,09
48	PSM002064	Sea Water	5050	17,0	6368620	1550520	0,50	1810,0	65,8	84,4	219,0	79,0	3071,6	427,7	-9,7	15,6	-6,7	0,00	0,00	1,00	0,00	0,00	0,00
49	PSM002064	Sea Water	5140	0,5	6368620	1550520	0,50	1010,0	39,2	51,6	119,0	64,0	2100,9	284,2	-63,0	14,4	-8,4	0,09	0,31	0,34	0,09	0,09	0,09
50	PSM002064	Sea Water	5141	17,0	6368620	1550520	0,50	1730,0	65,9	79,1	201,0	91,0	3325,1	466,6	-54,4	15,3	-6,8	0,07	0,07	0,53	0,20	0,07	0,07
51	PSM002064	Sea Water	5204	0,5	6368620	1550520	0,50	1440,0	58,2	73,1	186,0	80,0	2946,1	419,4	-63,9	14,1	-8,3	0,10	0,10	0,44	0,18	0,10	0,10
52	PSM002064	Sea Water	5203	15,5	6368620	1550520	0,50	1720,0	70,6	84,0	218,0	91,0	3313,8	467,1	-54,9	12,6	-7,1	0,07	0,07	0,50	0,23	0,07	0,07
53	PSM002064	Sea Water	5388	0,5	6368620	1550520	0,50	1390,0	49,9	64,4	162,0	68,0	2520,4	343,4	-67,5	13,2	-8,3	0,11	0,11	0,46	0,11	0,11	0,11
54	PSM002064	Sea Water	5389	15,5	6368620	1550520	0,50	1800,0	64,8	80,8	211,0	89,0	3246,4	446,7	-59,9	14,1	-7,4	0,08	0,08	0,42	0,25	0,08	0,08
55	PSM002065	Lake Water	5047	0,5	6368100	1549010	2,32	9,7	1,7	7,5	2,3	13,0	10,8	14,3	-62,9	10,4	-8,1	0,38	0,55	0,02	0,02	0,02	0,02
56	PSM002065	Lake Water	5046	3,0	6368100	1549010	2,32	9,9	1,7	7,6	2,4	11,0	10,6	14,3	-63,9	12,9	-8,0	0,39	0,55	0,02	0,02	0,02	0,02
57	PSM002065	Lake Water	5116	0,5	6368100	1549010	2,32	2,7	1,9	8,7	2,7	14,0	15,3	17,9	-69,5	11,2	-9,3	0,67	0,20	0,03	0,03	0,03	0,03
58	PSM002065	Lake Water	5117	3,0	6368100	1549010	2,32	2,5	1,7	8,2	2,5	14,0	12,0	16,1	-69,0	10,9	-9,0	0,62	0,26	0,03	0,03	0,03	0,03
59	PSM002065	Lake Water	5208	0,5	6368100	1549010	2,32	10,7	1,6	8,3	2,5	13,0	12,6	16,0	-72,7	11,1	-9,6	0,79	0,07	0,04	0,04	0,04	0,04
60	PSM002065	Lake Water	5207	2,5	6368100	1549010	2,32	10,6	1,6	8,6	2,9	14,0	12,0	15,4	-69,3	11,2	-8,9	0,62	0,27	0,03	0,03	0,03	0,03
61	PSM002065	Lake Water	5376	0,5	6368100	1549010	2,32	10,3	1,6	7,5	2,3	13,0	10,9	13,2	-72,0	12,4	-9,3	0,73	0,13	0,03	0,03	0,03	0,03
62	PSM002065	Lake Water	5377	2,5	6368100	1549010	2,32	10,1	1,5	7,4	2,3	13,0	10,7	12,8	-72,3	12,8	-9,3	0,74	0,13	0,03	0,03	0,03	0,03
63	PSM002066	Lake Water	5013	1,0	6373820	1546460	1,18	10,7	1,8	10,0	2,9	11,0	14,4	22,0	-54,4	10,7	-6,7	0,00	1,00	0,00	0,00	0,00	0,00
64	PSM002066	Lake Water	5014	17,0	6373820	1546460	1,18	10,3	1,8	10,1	2,9	11,0	14,1	23,6	-55,7	14,2	-7,1	0,08	0,90	0,00	0,00	0,00	0,00
65	PSM002067	Lake Water	5011	1,0	6364900	1540190	25,02	9,3	1,7	8,9	2,4	12,0	14,2	9,9	-64,9	11,3	-8,5	0,48	0,43	0,02	0,02	0,02	0,02
66	PSM002067	Lake Water	5012	11,0	6364900	1540190	25,02	8,8	1,6	8,7	2,3	15,0	11,6	8,7	-65,4	10,0	-8,7	0,52	0,39	0,02	0,02	0,02	0,02
67	PSM002071	Streaming Wate	5056	0,1	6368450	1542380	12,23	9,4	1,5	7,8	2,2	8,0	13,5	12,4	-70,4	15,0	-9,7	0,77	0,10	0,03	0,03	0,03	0,03
68	PSM002071	Streaming Wate	5128	0,5	6368450	1542380	12,23	10,6	1,4	9,4	2,6	15,0	15,2	12,2	-72,4	9,9	-10,0	0,81	0,04	0,04	0,04	0,04	0,05

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	IDCODE	WATER TYPE	Sample no	Sampling depth	Northing sec mid	Easting sec mid	Elevation sec mid	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Rain	Lake water	Sea water	Marine	Ground water	Glacial
69	PSM002071	Streaming Wate	5212	0,5	6368450	1542380	12,23	10,0	1,4	9,7	2,7	16,0	15,1	12,8	-76,4	8,7	-10,5	0,77	0,04	0,04	0,04	0,04	0,09
70	PSM002071	Streaming Wate	5386	0,1	6368450	1542380	12,23	12,0	1,4	8,6	2,3	13,0	17,0	11,2	-77,1	12,7	-10,5	0,76	0,04	0,04	0,04	0,04	0,09
71	PSM002072	Streaming Wate	5055	0,1	6368290	1543190	10,71	6,4	0,5	3,5	0,9	0,0	7,3	3,0	-78,8	12,6	-11,6	0,73	0,03	0,03	0,03	0,03	0,15
72	PSM002072	Streaming Wate	5127	0,5	6368290	1543190	10,71	10,4	0,0	5,5	1,3	6,0	12,5	3,7	-85,0	10,1	-11,5	0,70	0,03	0,03	0,03	0,03	0,19
73	PSM002072	Streaming Wate	5210	0,1	6368290	1543190	10,71	12,3	-0,4	5,6	1,4	4,0	18,1	3,5	-82,5	11,0	-11,7	0,70	0,03	0,03	0,03	0,03	0,18
74	PSM002072	Streaming Wate	5383	0,1	6368290	1543190	10,71	10,6	0,5	4,0	1,0	1,0	14,1	2,9	-83,5	10,6	-11,6	0,70	0,03	0,03	0,03	0,03	0,18
75	PSM002076	Streaming Wate	5058	0,1	6363120	1546730	9,20	4,9	1,0	11,4	1,9	10,0	5,2	17,6	-76,1	14,4	-11,1	0,75	0,03	0,03	0,03	0,03	0,11
76	PSM002076	Streaming Wate	5122	0,1	6363120	1546730	9,20	6,6	0,9	12,8	2,3	14,0	7,5	22,5	-77,2	12,9	-11,3	0,74	0,03	0,03	0,03	0,03	0,13
77	PSM002076	Streaming Wate	5214	0,1	6363120	1546730	9,20	7,6	0,9	13,2	2,5	16,0	8,8	20,9	-79,3	9,5	-11,4	0,72	0,03	0,03	0,03	0,03	0,14
78	PSM002076	Streaming Wate	5384	0,1	6363120	1546730	9,20	5,9	1,1	12,0	2,0	16,0	5,8	14,7	-81,8	12,1	-11,4	0,71	0,03	0,03	0,03	0,03	0,16
79	PSM002079	Streaming Wate	5071	0,1	6365830	1546740	8,76	7,2	1,5	7,7	1,9	5,0	8,7	14,2	-73,7	14,6	-10,7	0,78	0,03	0,03	0,03	0,03	0,08
80	PSM002079	Streaming Wate	5132	0,1	6365830	1546740	8,76	9,2	1,2	9,5	2,5	13,0	12,7	15,8	-73,3	13,1	-10,4	0,79	0,04	0,04	0,04	0,04	0,07
81	PSM002079	Streaming Wate	5228	0,1	6365830	1546740	8,76	9,4	1,3	9,9	2,6	14,0	13,0	15,3	-77,1	11,4	-10,8	0,75	0,03	0,03	0,03	0,03	0,11
82	PSM002079	Streaming Wate	5399	0,1	6365830	1546740	8,76	8,9	1,2	8,2	2,1	10,0	11,0	13,4	-79,0	9,6	-11,0	0,74	0,03	0,03	0,03	0,03	0,13
83	PSM002082	Streaming Wate	5074	0,1	6370790	1545740	5,54	4,8	1,1	8,2	1,4	9,0	5,1	8,1	-79,1	12,9	-11,5	0,73	0,03	0,03	0,03	0,03	0,15
84	PSM002082	Streaming Wate	5130	0,1	6370790	1545740	5,54	6,6	1,4	11,2	2,1	22,0	7,5	10,9	-84,6	13,3	-11,4	0,70	0,03	0,03	0,03	0,03	0,17
85	PSM002082	Streaming Wate	5233	0,5	6370790	1545740	5,54	7,4	1,4	11,8	2,2	24,0	8,9	10,1	-81,4	12,2	-11,6	0,71	0,03	0,03	0,03	0,03	0,16
86	PSM002082	Streaming Wate	5378	0,1	6370790	1545740	5,54	6,2	1,0	8,9	1,5	15,0	6,5	7,6	-83,5	9,8	-11,6	0,70	0,03	0,03	0,03	0,03	0,18
87	PSM002083	Streaming Wate	5003	0,7	6369120	1548880	4,72	4,4	1,7	7,0	1,5	3,0	3,6	10,1	-78,1	11,0	-11,6	0,73	0,03	0,03	0,03	0,03	0,15
88	PSM002083	Streaming Wate	5077	0,1	6369120	1548880	4,72	5,4	1,1	8,3	1,6	7,0	5,7	12,0	-79,3	13,2	-11,5	0,72	0,03	0,03	0,03	0,03	0,15
89	PSM002083	Streaming Wate	5137	0,1	6369120	1548880	4,72	10,8	1,2	11,9	2,5	22,0	13,3	16,0	-77,6	11,6	-11,4	0,73	0,03	0,03	0,03	0,03	0,13
90	PSM002083	Streaming Wate	5237	0,5	6369120	1548880	4,72	11,2	1,2	12,4	2,7	26,0	13,5	14,2	-81,7	12,8	-11,6	0,70	0,03	0,03	0,03	0,03	0,16
91	PSM002083	Streaming Wate	5396	0,1	6369120	1548880	4,72	6,5	1,0	8,3	1,7	12,0	6,6	10,3	-82,0	12,3	-11,3	0,72	0,03	0,03	0,03	0,03	0,16
92	PSM002084	Streaming Wate	5000	0,2	6368840	1549190	6,28	7,6	2,8	15,4	3,3	7,0	6,4	31,9	-77,2	10,6	-11,4	0,73	0,04	0,04	0,04	0,04	0,13
93	PSM002084	Streaming Wate	5076	0,1	6368840	1549190	6,28	7,7	2,3	16,9	3,4	13,0	8,5	38,1	-78,1	13,5	-11,5	0,72	0,04	0,04	0,04	0,04	0,14
94	PSM002084	Streaming Wate	5136	0,1	6368840	1549190	6,28	10,9	2,8	18,0	3,8	36,0	11,5	32,1	-77,6	12,3	-11,2	0,73	0,04	0,04	0,04	0,04	0,12
95	PSM002084	Streaming Wate	5236	0,5	6368840	1549190	6,28	11,5	3,0	18,7	4,0	39,0	13,6	29,5	-80,3	13,3	-11,3	0,71	0,04	0,04	0,04	0,04	0,14
96	PSM002084	Streaming Wate	5400	0,1	6368840	1549190	6,28	8,5	2,2	14,6	3,1	21,0	8,5	26,8	-81,6	12,2	-11,3	0,71	0,04	0,04	0,04	0,04	0,15
97	PSM002085	Streaming Wate	5001	0,2	6366560	1549860	4,84	5,8	1,6	27,8	3,6	20,0	6,0	35,0	-76,7	11,5	-11,2	0,73	0,04	0,04	0,04	0,04	0,12
98	PSM002085	Streaming Wate	5079	0,1	6366560	1549860	4,84	6,1	1,1	28,8	3,2	50,0	5,8	31,6	-77,8	14,9	-11,2	0,73	0,04	0,04	0,04	0,04	0,12
99	PSM002085	Streaming Wate	5145	0,1	6366560	1549860	4,84	8,1	1,3	32,3	3,9	64,0	7,6	41,9	-80,4	11,7	-11,3	0,71	0,04	0,04	0,04	0,04	0,13
100	PSM002085	Streaming Wate	5238	0,5	6366560	1549860	4,84	8,6	1,1	32,7	3,9	80,0	24,0	33,6	-79,8	12,2	-11,3	0,71	0,04	0,04	0,04	0,04	0,13
101	PSM002085	Streaming Wate	5398	0,1	6366560	1549860	4,84	6,8	1,0	24,9	3,0	53,0	5,6	25,0	-80,4	13,3	-11,3	0,71	0,04	0,04	0,04	0,04	0,14
102	PSM002086	Streaming Wate	5004	0,3	6363730	1548480	3,86	11,1	3,1	16,9	3,8	1,0	8,1	33,0	-76,0	11,9	-11,2	0,74	0,04	0,04	0,04	0,04	0,11

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	IDCODE	WATER TYPE	Sample no	Sampling depth	Northing sec mid	Easting sec mid	Elevation sec mid	NA	K	CA	MG	HCO3	CL	SO4	D	TR	O18	Rain	Lake water	Sea water	Marine	Ground water	Glacial
103	PSM002086	Streaming Wate	5070	0,1	6363730	1548480	3,86	11,2	3,3	17,2	3,8	3,0	11,2	49,5	-76,5	11,0	-11,3	0,73	0,04	0,04	0,04	0,04	0,12
104	PSM002086	Streaming Wate	5135	0,1	6363730	1548480	3,86	13,9	3,1	21,8	5,0	15,0	15,5	66,4	-77,4	10,7	-11,2	0,72	0,04	0,04	0,04	0,04	0,11
105	PSM002086	Streaming Wate	5216	0,1	6363730	1548480	3,86	15,3	3,5	23,3	5,4	20,0	17,7	64,3	-79,8	14,4	-11,4	0,70	0,04	0,04	0,04	0,04	0,14
106	PSM002086	Streaming Wate	5401	0,1	6363730	1548480	3,86	12,3	2,7	16,4	3,7	8,0	14,0	43,7	-81,9	11,3	-11,4	0,70	0,04	0,04	0,04	0,04	0,15
107	PSM002087	Streaming Wate	5002		6365700	1550120	1,84	5,9	1,5	7,7	2,0	2,0	5,3	13,9	-79,4	12,4	-11,2	0,73	0,03	0,03	0,03	0,03	0,14
108	PSM002087	Streaming Wate	5078	0,1	6365700	1550120	1,84	7,0	1,4	8,2	2,0	6,0	8,8	15,2	-75,1	11,7	-10,7	0,77	0,03	0,03	0,03	0,03	0,09
109	PSM002087	Streaming Wate	5144	0,1	6365700	1550120	1,84	8,7	1,4	10,1	2,6	14,0	12,0	18,7	-74,2	12,5	-10,7	0,77	0,04	0,04	0,04	0,04	0,08
110	PSM002087	Streaming Wate	5239	0,5	6365700	1550120	1,84	10,0	1,4	11,1	2,9	17,0	13,4	17,8	-78,0	11,1	-10,9	0,75	0,04	0,04	0,04	0,04	0,11
111	PSM002087	Streaming Wate	5397	0,1	6365700	1550120	1,84	9,0	1,3	9,1	2,3	11,0	11,2	15,2	-80,1	11,9	-11,0	0,73	0,03	0,03	0,03	0,03	0,13
112	PSM002170	Precipitation	3762		6368189	1551082	6,17	0,5	1,7	0,9	0,3	0,2	1,0	1,7	-80,6	15,3	-10,9	0,74	0,03	0,03	0,03	0,03	0,13
113	PSM002170	Precipitation	6005		6368189	1551082	6,17	0,8	0,4	0,2	0,1	0,2	1,2	0,9	-116,9	14,8	-15,5	0,40	0,02	0,02	0,02	0,02	0,53
114		Glacial						0,2	0,4	0,2	0,1	0,1	0,5	0,5	-158,0	0,0	-21,0	0,00	0,00	0,00	0,00	0,00	1,00
115		Sediment						####	91,8	103,0	258,0	793,0	3383,0	53,1	-61,0	0,0	-7,0	0,05	0,05	0,47	0,34	0,05	0,05
116		Precipitation rain60'						0,4	0,3	0,2	0,1	12,2	0,2	1,4	-80,0	2000,0	-10,5	1,00	0,00	0,00	0,00	0,00	0,00
117		Sea Litorina new						####	134,0	151,0	448,0	93,0	6500,0	890,0	-38,0	0,0	-4,7	0,00	0,00	0,00	1,00	0,00	0,00
118		Sea						####	95,0	93,7	234,0	90,0	3760,0	325,0	-53,3	42,0	-5,9	0,06	0,06	0,50	0,28	0,06	0,06
	in red: estimated elevation values from grid-map																						

Appendix 4: Sampling performed in the sections 156.5-167m and 245-261.5m in KSH01

IDCODE	Start_Date	Stop_Date	SECUP	SECLOW	Section	Sample	Drill water (%)	sampling date	Pump time(h)	Volume pumped (m3)
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5416				
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5415				
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5414				
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5412				
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5411				
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5410				
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5408				
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5407		22.04.03		
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5263	2.39	22.04.03	600	7.2
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5262	2.51	16.04.03	456	5.5
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5261	2.61	14.04.03	408	4.9
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5260	3.17	10.04.03	312	3.7
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5259	3.34	7.04.03	240	2.9
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5258		3.04.03	144	1.7
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5257	3.70	31.03.03	72	8.6
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5256	3.28			
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5413				
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5417				
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5409				
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5421				
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5422		10.04.03		
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5420				
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5419				
KSH01A	3/28/03 10:00	4/30/03 15:30	156.50	167.00	1	5418				
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5428				
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5430				
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5429				
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5427				
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5426				
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5425				
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5423				
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5269	8.22			
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5268	8.02	12.05.03	912	10.9
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5267	7.48			
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5267	7.48	8.05.03	816	9.8
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5266	7.54	2.05.03	672	8.1
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5268	8.02	12.05.03	912	10.9
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5424				
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5266	7.54	2.05.03	672	8.1
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5265	8.19	29.04.03	600	7.2
KSH01A	4/24/03 7:50	5/20/03 12:30	245.00	261.50	2	5264	3.60	25.04.03	504	6.1

Appendix 4

Groundwater data from Simpevarp

Observation #	ACTIVITY_ID	ACTIVITY_TYPE	SITE	IDCODE	START_DATE	STOP_DATE	SECUP	SECLOW	SECTION_NO
1	12960702	WC080	SIMPEVARP	HSH02	2003-01-31 10:09	2003-01-31 10:09	0,00	200,00	
2	12960701	WC080	SIMPEVARP	HSH02	2003-01-31 10:17	2003-01-31 10:17	0,00	200,00	
3	12960700	WC080	SIMPEVARP	HSH02	2003-01-31 10:50	2003-01-31 10:50	0,00	200,00	
4	12960703	WC080	SIMPEVARP	HSH02	2003-02-03 13:00	2003-02-03 13:00	0,00	200,00	
5	12946762	WC080	SIMPEVARP	HSH03	2002-08-21 16:30	2002-08-21 16:30	0,00	201,00	
6	12946763	WC080	SIMPEVARP	HSH03	2002-08-22 18:00	2002-08-22 18:00	0,00	103,00	
7	12946764	WC080	SIMPEVARP	HSH03	2002-09-05 15:55	2002-09-05 15:55	0,00	201,00	
8	12960730	WC070	SIMPEVARP	HSH03	2003-03-04 13:46	2003-03-04 13:46	0,00	150,00	
9	12960731	WC070	SIMPEVARP	HSH03	2003-03-04 14:20	2003-03-04 14:20	0,00	150,00	
10	12960732	WC070	SIMPEVARP	HSH03	2003-03-04 14:30	2003-03-04 14:30	0,00	150,00	
11	12960733	WC070	SIMPEVARP	HSH03	2003-03-04 15:40	2003-03-04 15:40	0,00	150,00	
12	12960734	WC070	SIMPEVARP	HSH03	2003-03-04 15:50	2003-03-04 15:50	0,00	150,00	
13	12946782	WC080	SIMPEVARP	KSH01A	2002-10-24 09:30	2002-10-24 10:22	197,00	313,42	
14	12948514	WC080	SIMPEVARP	KSH01A	2002-11-16 21:40	2002-11-16 22:35	585,00	593,00	
15	12948533	WC080	SIMPEVARP	KSH01A	2002-11-20 08:30	2002-11-20 08:45	531,00	619,42	
16	12958852	WC080	SIMPEVARP	KSH01A	2003-01-29 13:40	2003-01-29 14:00	1,00	50,00	
17	12958853	WC080	SIMPEVARP	KSH01A	2003-01-29 14:00	2003-01-29 14:15	50,00	100,00	
18	12958854	WC080	SIMPEVARP	KSH01A	2003-01-29 14:15	2003-01-29 14:26	100,00	150,00	
19	12958855	WC080	SIMPEVARP	KSH01A	2003-01-29 14:26	2003-01-29 14:43	150,00	200,00	
20	12958869	WC080	SIMPEVARP	KSH01A	2003-01-29 14:49	2003-01-29 14:56	200,00	250,00	
21	12958870	WC080	SIMPEVARP	KSH01A	2003-01-29 14:58	2003-01-29 15:08	250,00	300,00	
22	12958871	WC080	SIMPEVARP	KSH01A	2003-01-29 15:12	2003-01-29 15:20	300,00	350,00	
23	12958872	WC080	SIMPEVARP	KSH01A	2003-01-29 15:22	2003-01-29 15:29	350,00	400,00	
24	12958873	WC080	SIMPEVARP	KSH01A	2003-01-29 15:29	2003-01-29 15:42	400,00	450,00	
25	12958874	WC080	SIMPEVARP	KSH01A	2003-01-29 15:52	2003-01-29 15:59	450,00	500,00	
26	12958875	WC080	SIMPEVARP	KSH01A	2003-01-29 16:08	2003-01-29 16:15	550,00	600,00	
27	12958876	WC080	SIMPEVARP	KSH01A	2003-01-29 16:24	2003-01-29 16:30	650,00	700,00	
28	12958877	WC080	SIMPEVARP	KSH01A	2003-01-29 16:38	2003-01-29 16:44	750,00	800,00	
29	12958878	WC080	SIMPEVARP	KSH01A	2003-01-29 16:50	2003-01-29 16:57	850,00	900,00	
30	12958879	WC080	SIMPEVARP	KSH01A	2003-01-29 17:00	2003-01-29 17:05	900,00	950,00	
31	12958880	WC080	SIMPEVARP	KSH01A	2003-01-29 17:05	2003-01-29 17:15	950,00	1000,00	
32	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
33	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
34	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
35	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
36	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
37	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
38	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
39	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
40	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
41	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
42	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
43	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
44	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
45	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
46	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
47	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
48	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
49	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
50	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
51	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
52	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1

Observation #	ACTIVITY_ID	ACTIVITY_TYPE	SITE	IDCODE	START_DATE	STOP_DATE	SECUP	SECLOW	SECTION_NO
53	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
54	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
55	12969978	WC120	SIMPEVARP	KSH01A	2003-03-28 10:00	2003-04-30 15:30	156,50	167,00	1
56	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
57	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
58	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
59	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
60	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
61	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
62	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
63	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
64	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
65	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
66	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
67	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
68	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
69	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
70	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
71	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
72	12969979	WC120	SIMPEVARP	KSH01A	2003-04-24 07:50	2003-05-20 12:30	245,00	261,50	2
73	12970585	WC120	SIMPEVARP	KSH01A	2003-05-26 08:40		586,00	597,00	
74	12959633	WC080	SIMPEVARP	KSH02	2003-02-10 17:30	2003-02-10 17:30	6,65	100,50	
75	12964514	WC080	SIMPEVARP	KSH02	2003-04-09 09:05	2003-04-09 09:20	411,85	467,07	
76	12969242	WC100	SIMPEVARP	KSH02	2003-04-24 10:30	2003-04-24 12:30	588,70	588,94	
77	12969241	WC100	SIMPEVARP	KSH02	2003-04-24 10:30	2003-04-24 12:30	588,14	588,44	
78	12969244	WC100	SIMPEVARP	KSH02	2003-04-28 15:00	2003-04-28 17:00	637,27	637,45	
79	12969243	WC100	SIMPEVARP	KSH02	2003-04-28 15:00	2003-04-28 17:00	636,50	636,72	
80	12969829	WC100	SIMPEVARP	KSH02	2003-05-07 15:20	2003-05-07 17:00	752,25	752,45	
81	12969828	WC100	SIMPEVARP	KSH02	2003-05-07 15:20	2003-05-07 17:00	751,65	751,96	
82	12969435	WC080	SIMPEVARP	KSH02	2003-05-08 10:10	2003-05-08 10:20	738,00	755,17	
83	12969831	WC100	SIMPEVARP	KSH02	2003-05-12 11:10	2003-05-12 12:20	785,52	785,68	
84	12969830	WC100	SIMPEVARP	KSH02	2003-05-12 11:10	2003-05-12 12:20	785,30	785,52	
85	12969703	WC080	SIMPEVARP	KSH02	2003-05-14 08:10	2003-05-14 08:25	699,00	803,15	
86	12969981	WC100	SIMPEVARP	KSH02	2003-05-15 10:30	2003-05-15 12:10	832,30	832,49	
87	12969980	WC100	SIMPEVARP	KSH02	2003-05-15 10:30	2003-05-15 12:10	831,15	831,40	
88	12969983	WC100	SIMPEVARP	KSH02	2003-05-19 09:30	2003-05-19 11:10	879,28	879,53	
89	12969982	WC100	SIMPEVARP	KSH02	2003-05-19 09:30	2003-05-19 11:10	879,15	879,28	
90	12970587	WC100	SIMPEVARP	KSH02	2003-05-23 09:40	2003-05-23 10:50	928,68	928,87	
91	12970586	WC100	SIMPEVARP	KSH02	2003-05-23 09:40	2003-05-23 10:50	928,52	928,68	
92	12970589	WC100	SIMPEVARP	KSH02	2003-05-26 11:00	2003-05-26 12:20	967,50	967,74	
93	12970588	WC100	SIMPEVARP	KSH02	2003-05-26 11:00	2003-05-26 12:20	966,58	966,86	
94	12970747	WC100	SIMPEVARP	KSH02	2003-05-28 12:30	2003-05-28 13:30	997,26	997,46	
95	12970746	WC100	SIMPEVARP	KSH02	2003-05-28 12:30	2003-05-28 13:30	997,01	997,26	
96	12973141	WC080	SIMPEVARP	KSH02	2003-06-18 13:47	2003-06-18 13:50	0,00	41,00	
97	12973142	WC080	SIMPEVARP	KSH02	2003-06-18 13:55	2003-06-18 13:58	41,00	91,00	
98	12973143	WC080	SIMPEVARP	KSH02	2003-06-18 14:00	2003-06-18 14:03	91,00	141,00	
99	12973144	WC080	SIMPEVARP	KSH02	2003-06-18 14:05	2003-06-18 14:08	141,00	191,00	
100	12973145	WC080	SIMPEVARP	KSH02	2003-06-18 14:11	2003-06-18 14:14	191,00	241,00	
101	12973146	WC080	SIMPEVARP	KSH02	2003-06-18 14:18	2003-06-18 14:22	241,00	291,00	
102	12973147	WC080	SIMPEVARP	KSH02	2003-06-18 14:24	2003-06-18 14:28	291,00	341,00	
103	12973148	WC080	SIMPEVARP	KSH02	2003-06-18 14:30	2003-06-18 14:33	341,00	391,00	
104	12973149	WC080	SIMPEVARP	KSH02	2003-06-18 14:38	2003-06-18 14:39	391,00	441,00	

Observation #	ACTIVITY_ID	ACTIVITY_TYPE	SITE	IDCODE	START_DATE	STOP_DATE	SECUP	SECLOW	SECTION_NO
105	12973150	WC080	SIMPEVARP	KSH02	2003-06-18 14:41	2003-06-18 14:45	441,00	491,00	
106	12973151	WC080	SIMPEVARP	KSH02	2003-06-18 14:46	2003-06-18 14:49	491,00	541,00	
107	12973152	WC080	SIMPEVARP	KSH02	2003-06-18 14:51	2003-06-18 14:54	541,00	591,00	
108	12973153	WC080	SIMPEVARP	KSH02	2003-06-18 14:55	2003-06-18 14:59	591,00	641,00	
109	12973154	WC080	SIMPEVARP	KSH02	2003-06-18 15:00	2003-06-18 15:04	641,00	691,00	
110	12973155	WC080	SIMPEVARP	KSH02	2003-06-18 15:06	2003-06-18 15:09	691,00	741,00	
111	12973156	WC080	SIMPEVARP	KSH02	2003-06-18 15:11	2003-06-18 15:14	741,00	791,00	
112	12973157	WC080	SIMPEVARP	KSH02	2003-06-18 15:15	2003-06-18 15:18	791,00	841,00	
113	12973158	WC080	SIMPEVARP	KSH02	2003-06-18 15:20	2003-06-18 15:24	841,00	891,00	
114	12973159	WC080	SIMPEVARP	KSH02	2003-06-18 15:25	2003-06-18 15:28	891,00	941,00	
115	12973160	WC080	SIMPEVARP	KSH02	2003-06-18 15:30	2003-06-18 15:34	941,00	991,00	
116	12968887	WC080	SIMPEVARP	SSM000001	2003-04-22 09:45	2003-04-22 09:55			
117	12968887	WC080	SIMPEVARP	SSM000001	2003-04-22 09:45	2003-04-22 09:55			
118	12968889	WC080	SIMPEVARP	SSM000002	2003-04-22 09:58	2003-04-22 10:05			
119	12968889	WC080	SIMPEVARP	SSM000002	2003-04-22 09:58	2003-04-22 10:05			
120	12968890	WC080	SIMPEVARP	SSM000005	2003-04-22 10:52	2003-04-22 11:00			
121	12968890	WC080	SIMPEVARP	SSM000005	2003-04-22 10:52	2003-04-22 11:00			
122									
123	12947290	WC085	SIMPEVARP	PSM002060	2002-10-30 10:00	2002-10-30 10:30			16
124	12947291	WC085	SIMPEVARP	PSM002060	2002-10-30 10:30	2002-10-30 11:15			1
125	12948692	WC085	SIMPEVARP	PSM002060	2002-11-18 10:50	2002-11-18 11:20			30
126	12948693	WC085	SIMPEVARP	PSM002060	2002-11-18 11:20	2002-11-18 11:50			1
127	12956550	WC085	SIMPEVARP	PSM002060	2002-12-17 09:50	2002-12-17 10:20			1
128	12956551	WC085	SIMPEVARP	PSM002060	2002-12-17 10:20	2002-12-17 10:50			30
129	12958290	WC085	SIMPEVARP	PSM002060	2003-01-15 09:10	2003-01-15 09:40			30
130	12958291	WC085	SIMPEVARP	PSM002060	2003-01-15 09:40	2003-01-15 10:10			1
131	12959666	WC085	SIMPEVARP	PSM002060	2003-02-11 08:40	2003-02-11 09:10			29
132	12959667	WC085	SIMPEVARP	PSM002060	2003-02-11 09:10	2003-02-11 09:40			1
133	12962314	WC085	SIMPEVARP	PSM002060	2003-03-26 09:20	2003-03-26 09:45			
134	12962315	WC085	SIMPEVARP	PSM002060	2003-03-26 09:45	2003-03-26 10:20			
135	12965553	WC085	SIMPEVARP	PSM002060	2003-04-08 10:35	2003-04-08 11:15			
136	12969389	WC085	SIMPEVARP	PSM002060	2003-04-28 09:00	2003-04-28 10:05			
137	12969388	WC085	SIMPEVARP	PSM002060	2003-04-28 09:00	2003-04-28 10:05			
138	12969970	WC085	SIMPEVARP	PSM002060	2003-05-13 10:30	2003-05-13 11:25			
139	12969971	WC085	SIMPEVARP	PSM002060	2003-05-13 10:30	2003-05-13 11:25			
140	12970641	WC085	SIMPEVARP	PSM002060	2003-05-26 09:45	2003-05-26 11:00			
141	12970642	WC085	SIMPEVARP	PSM002060	2003-05-26 09:45	2003-05-26 11:00			
142	12971300	WC085	SIMPEVARP	PSM002060	2003-06-10 09:25	2003-06-10 10:45			
143	12971299	WC085	SIMPEVARP	PSM002060	2003-06-10 09:25	2003-06-10 10:45			
144	12973107	WC105	SIMPEVARP	PSM002060	2003-06-23 09:35	2003-06-23 11:05			
145	12973108	WC105	SIMPEVARP	PSM002060	2003-06-23 09:35	2003-06-23 11:05			
146	12947292	WC085	SIMPEVARP	PSM002061	2002-10-30 12:00	2002-10-30 12:20			9
147	12947293	WC085	SIMPEVARP	PSM002061	2002-10-30 12:20	2002-10-30 12:55			1
148	12948702	WC085	SIMPEVARP	PSM002061	2002-11-19 11:00	2002-11-19 11:20			8
149	12948703	WC085	SIMPEVARP	PSM002061	2002-11-19 11:20	2002-11-19 11:40			1
150	12948718	WC085	SIMPEVARP	PSM002061	2002-12-03 09:45	2002-12-03 10:00			9
151	12948719	WC085	SIMPEVARP	PSM002061	2002-12-03 10:00	2002-12-03 10:20			1
152	12956577	WC085	SIMPEVARP	PSM002061	2002-12-17 12:25	2002-12-17 12:45			1
153	12956578	WC085	SIMPEVARP	PSM002061	2002-12-17 12:45	2002-12-17 13:05			9
154	12958292	WC085	SIMPEVARP	PSM002061	2003-01-15 10:55	2003-01-15 11:15			9
155	12958293	WC085	SIMPEVARP	PSM002061	2003-01-15 11:15	2003-01-15 11:30			1
156	12962316	WC085	SIMPEVARP	PSM002061	2003-03-26 10:45	2003-03-26 11:05			

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157	12962317	WC085	SIMPEVARP	PSM002061	2003-03-26 11:05	2003-03-26 11:30			
158	12965560	WC085	SIMPEVARP	PSM002061	2003-04-08 14:10	2003-04-08 14:30			
159	12965561	WC085	SIMPEVARP	PSM002061	2003-04-08 14:30	2003-04-08 14:55			
160	12969392	WC085	SIMPEVARP	PSM002061	2003-04-28 10:35	2003-04-28 11:35			
161	12969391	WC085	SIMPEVARP	PSM002061	2003-04-28 10:35	2003-04-28 11:35			
162	12969974	WC085	SIMPEVARP	PSM002061	2003-05-13 11:45	2003-05-13 12:20			
163	12969973	WC085	SIMPEVARP	PSM002061	2003-05-13 11:45	2003-05-13 12:20			
164	12970645	WC085	SIMPEVARP	PSM002061	2003-05-26 11:40	2003-05-26 12:20			
165	12970646	WC085	SIMPEVARP	PSM002061	2003-05-26 11:40	2003-05-26 12:20			
166	12971304	WC085	SIMPEVARP	PSM002061	2003-06-10 11:10	2003-06-10 11:45			
167	12971303	WC085	SIMPEVARP	PSM002061	2003-06-10 11:10	2003-06-10 11:45			
168	12973105	WC105	SIMPEVARP	PSM002061	2003-06-23 11:20	2003-06-23 12:20			
169	12948694	WC085	SIMPEVARP	PSM002062	2002-11-18 13:30	2002-11-18 14:00			5
170	12948697	WC085	SIMPEVARP	PSM002062	2002-11-18 14:00	2002-11-18 14:45			1
171	12948716	WC085	SIMPEVARP	PSM002062	2002-12-02 14:40	2002-12-02 15:05			5
172	12948717	WC085	SIMPEVARP	PSM002062	2002-12-02 15:05	2002-12-02 15:25			1
173	12956581	WC085	SIMPEVARP	PSM002062	2002-12-17 15:10	2002-12-17 15:25			1
174	12956582	WC085	SIMPEVARP	PSM002062	2002-12-17 15:25	2002-12-17 15:54			4
175	12958283	WC085	SIMPEVARP	PSM002062	2003-01-14 09:35	2003-01-14 10:05			4
176	12958284	WC085	SIMPEVARP	PSM002062	2003-01-14 10:05	2003-01-14 10:45			1
177	12959660	WC085	SIMPEVARP	PSM002062	2003-02-10 09:30	2003-02-10 10:05			4
178	12959661	WC085	SIMPEVARP	PSM002062	2003-02-10 10:05	2003-02-10 10:45			1
179	12960792	WC085	SIMPEVARP	PSM002062	2003-03-03 11:40	2003-03-03 12:20			
180	12960793	WC085	SIMPEVARP	PSM002062	2003-03-03 12:20	2003-03-03 13:05			
181	12965556	WC085	SIMPEVARP	PSM002062	2003-04-08 12:30	2003-04-08 12:50			
182	12965557	WC085	SIMPEVARP	PSM002062	2003-04-08 12:50	2003-04-08 13:15			
183	12969395	WC085	SIMPEVARP	PSM002062	2003-04-28 12:40	2003-04-28 13:30			
184	12969394	WC085	SIMPEVARP	PSM002062	2003-04-28 12:40	2003-04-28 13:30			
185	12969926	WC085	SIMPEVARP	PSM002062	2003-05-14 08:30	2003-05-14 09:10			
186	12969927	WC085	SIMPEVARP	PSM002062	2003-05-14 08:30	2003-05-14 09:10			
187	12970629	WC085	SIMPEVARP	PSM002062	2003-05-27 08:30	2003-05-27 09:15			
188	12970630	WC085	SIMPEVARP	PSM002062	2003-05-27 08:30	2003-05-27 09:15			
189	12971287	WC085	SIMPEVARP	PSM002062	2003-06-11 08:45	2003-06-11 09:20			
190	12971288	WC085	SIMPEVARP	PSM002062	2003-06-11 08:45	2003-06-11 09:20			
191	12973096	WC105	SIMPEVARP	PSM002062	2003-06-24 10:30	2003-06-24 11:20			
192	12947294	WC085	SIMPEVARP	PSM002063	2002-10-30 14:00	2002-10-30 14:35			6
193	12947295	WC085	SIMPEVARP	PSM002063	2002-10-30 14:35	2002-10-30 15:15			1
194	12948700	WC085	SIMPEVARP	PSM002063	2002-11-19 13:00	2002-11-19 13:30			6
195	12948701	WC085	SIMPEVARP	PSM002063	2002-11-19 13:30	2002-11-19 14:05			1
196	12948720	WC085	SIMPEVARP	PSM002063	2002-12-03 11:20	2002-12-03 11:35			6
197	12948721	WC085	SIMPEVARP	PSM002063	2002-12-03 11:35	2002-12-03 11:50			1
198	12956579	WC085	SIMPEVARP	PSM002063	2002-12-17 13:40	2002-12-17 13:55			1
199	12956580	WC085	SIMPEVARP	PSM002063	2002-12-17 13:55	2002-12-17 14:10			6
200	12959668	WC085	SIMPEVARP	PSM002063	2003-02-11 11:55	2003-02-11 12:30			5
201	12959669	WC085	SIMPEVARP	PSM002063	2003-02-11 12:30	2003-02-11 13:00			1
202	12960800	WC085	SIMPEVARP	PSM002063	2003-03-05 08:30	2003-03-05 08:55			
203	12960801	WC085	SIMPEVARP	PSM002063	2003-03-05 08:55	2003-03-05 09:20			
204	12965577	WC085	SIMPEVARP	PSM002063	2003-04-09 14:45	2003-04-09 15:05			
205	12965578	WC085	SIMPEVARP	PSM002063	2003-04-09 15:05	2003-04-09 15:25			
206	12969375	WC085	SIMPEVARP	PSM002063	2003-04-29 14:10	2003-04-29 14:50			
207	12969385	WC085	SIMPEVARP	PSM002063	2003-04-29 14:10	2003-04-29 14:50			
208	12969934	WC085	SIMPEVARP	PSM002063	2003-05-14 11:45	2003-05-14 12:20			

Observation #	ACTIVITY_ID	ACTIVITY_TYPE	SITE	IDCODE	START_DATE	STOP_DATE	SECUP	SECLOW	SECTION_NO
209	12969935	WC085	SIMPEVARP	PSM002063	2003-05-14 11:45	2003-05-14 12:20			
210	12970638	WC085	SIMPEVARP	PSM002063	2003-05-27 13:55	2003-05-27 14:35			
211	12970639	WC085	SIMPEVARP	PSM002063	2003-05-27 13:55	2003-05-27 14:35			
212	12971296	WC085	SIMPEVARP	PSM002063	2003-06-11 13:50	2003-06-11 14:30			
213	12971297	WC085	SIMPEVARP	PSM002063	2003-06-11 13:50	2003-06-11 14:30			
214	12973080	WC105	SIMPEVARP	PSM002063	2003-06-25 12:05	2003-06-25 12:35			
215	12948704	WC085	SIMPEVARP	PSM002064	2002-11-19 09:20	2002-11-19 09:50			18
216	12948705	WC085	SIMPEVARP	PSM002064	2002-11-19 09:50	2002-11-19 10:15			1
217	12948712	WC085	SIMPEVARP	PSM002064	2002-12-02 11:30	2002-12-02 11:55			18
218	12948713	WC085	SIMPEVARP	PSM002064	2002-12-02 11:55	2002-12-02 12:20			1
219	12956540	WC085	SIMPEVARP	PSM002064	2002-12-18 09:05	2002-12-18 09:35			1
220	12956541	WC085	SIMPEVARP	PSM002064	2002-12-18 09:35	2002-12-18 10:05			19
221	12958294	WC085	SIMPEVARP	PSM002064	2003-01-15 13:30	2003-01-15 14:00			18
222	12958295	WC085	SIMPEVARP	PSM002064	2003-01-15 14:00	2003-01-15 14:30			1
223	12959662	WC085	SIMPEVARP	PSM002064	2003-02-10 11:50	2003-02-10 12:25			17
224	12959663	WC085	SIMPEVARP	PSM002064	2003-02-10 12:25	2003-02-10 13:05			1
225	12960794	WC085	SIMPEVARP	PSM002064	2003-03-03 14:10	2003-03-03 14:45			
226	12960795	WC085	SIMPEVARP	PSM002064	2003-03-03 14:45	2003-03-03 15:20			
227	12965565	WC085	SIMPEVARP	PSM002064	2003-04-09 08:35	2003-04-09 09:00			
228	12965566	WC085	SIMPEVARP	PSM002064	2003-04-09 09:00	2003-04-09 09:35			
229	12969372	WC085	SIMPEVARP	PSM002064	2003-04-29 12:15	2003-04-29 13:30			
230	12969373	WC085	SIMPEVARP	PSM002064	2003-04-29 12:15	2003-04-29 13:30			
231	12969929	WC085	SIMPEVARP	PSM002064	2003-05-14 09:45	2003-05-14 10:45			
232	12969930	WC085	SIMPEVARP	PSM002064	2003-05-14 09:45	2003-05-14 10:45			
233	12970632	WC085	SIMPEVARP	PSM002064	2003-05-27 10:00	2003-05-27 11:00			
234	12970633	WC085	SIMPEVARP	PSM002064	2003-05-27 10:00	2003-05-27 11:00			
235	12971290	WC085	SIMPEVARP	PSM002064	2003-06-11 10:05	2003-06-11 10:55			
236	12971291	WC085	SIMPEVARP	PSM002064	2003-06-11 10:05	2003-06-11 10:55			
237	12973099	WC105	SIMPEVARP	PSM002064	2003-06-24 08:50	2003-06-24 09:50			
238	12948708	WC085	SIMPEVARP	PSM002065	2002-11-20 11:20	2002-11-20 11:40			4
239	12948709	WC085	SIMPEVARP	PSM002065	2002-11-20 11:40	2002-11-20 12:00			1
240	12948714	WC085	SIMPEVARP	PSM002065	2002-12-02 13:25	2002-12-02 13:45			4
241	12948715	WC085	SIMPEVARP	PSM002065	2002-12-02 13:45	2002-12-02 14:05			1
242	12956542	WC085	SIMPEVARP	PSM002065	2002-12-18 12:45	2002-12-18 13:00			1
243	12956544	WC085	SIMPEVARP	PSM002065	2002-12-18 13:00	2002-12-18 13:10			4
244	12958285	WC085	SIMPEVARP	PSM002065	2003-01-14 11:35	2003-01-14 12:00			4
245	12958286	WC085	SIMPEVARP	PSM002065	2003-01-14 12:00	2003-01-14 12:25			1
246	12959672	WC085	SIMPEVARP	PSM002065	2003-02-12 08:50	2003-02-12 09:20			4
247	12959673	WC085	SIMPEVARP	PSM002065	2003-02-12 09:20	2003-02-12 09:55			1
248	12960798	WC085	SIMPEVARP	PSM002065	2003-03-04 13:30	2003-03-04 14:15			
249	12960799	WC085	SIMPEVARP	PSM002065	2003-03-04 14:15	2003-03-04 15:05			
250	12962310	WC085	SIMPEVARP	PSM002065	2003-03-25 09:50	2003-03-25 10:10			
251	12962311	WC085	SIMPEVARP	PSM002065	2003-03-25 10:10	2003-03-25 10:30			
252	12965582	WC085	SIMPEVARP	PSM002065	2003-04-10 10:15	2003-04-10 10:30			
253	12965583	WC085	SIMPEVARP	PSM002065	2003-04-10 10:30	2003-04-10 10:50			
254	12969397	WC085	SIMPEVARP	PSM002065	2003-04-28 14:10	2003-04-28 15:05			
255	12969398	WC085	SIMPEVARP	PSM002065	2003-04-28 14:10	2003-04-28 15:05			
256	12969924	WC085	SIMPEVARP	PSM002065	2003-05-15 08:15	2003-05-15 08:55			
257	12969923	WC085	SIMPEVARP	PSM002065	2003-05-15 08:15	2003-05-15 08:55			
258	12970652	WC085	SIMPEVARP	PSM002065	2003-05-26 15:25	2003-05-26 16:00			
259	12970651	WC085	SIMPEVARP	PSM002065	2003-05-26 15:25	2003-05-26 16:00			
260	12971310	WC085	SIMPEVARP	PSM002065	2003-06-10 15:05	2003-06-10 15:45			

Observation #	ACTIVITY_ID	ACTIVITY_TYPE	SITE	IDCODE	START_DATE	STOP_DATE	SECUP	SECLOW	SECTION_NO
261	12971309	WC085	SIMPEVARP	PSM002065	2003-06-10 15:05	2003-06-10 15:45			
262	12973102	WC105	SIMPEVARP	PSM002065	2003-06-23 13:15	2003-06-23 14:05			
263	12947298	WC085	SIMPEVARP	PSM002066	2002-10-31 12:00	2002-10-31 12:30			18
264	12947299	WC085	SIMPEVARP	PSM002066	2002-10-31 12:30	2002-10-31 13:00			1
265	12948706	WC085	SIMPEVARP	PSM002066	2002-11-20 09:05	2002-11-20 09:40			17
266	12948707	WC085	SIMPEVARP	PSM002066	2002-11-20 09:40	2002-11-20 10:15			1
267	12948691	WC085	SIMPEVARP	PSM002066	2002-12-02 10:00	2002-12-02 10:20			18
268	12948711	WC085	SIMPEVARP	PSM002066	2002-12-02 10:20	2002-12-02 10:45			1
269	12958287	WC085	SIMPEVARP	PSM002066	2003-01-14 13:30	2003-01-14 14:00			18
270	12958288	WC085	SIMPEVARP	PSM002066	2003-01-14 14:00	2003-01-14 14:30			1
271	12959664	WC085	SIMPEVARP	PSM002066	2003-02-10 14:00	2003-02-10 14:30			17
272	12959665	WC085	SIMPEVARP	PSM002066	2003-02-10 14:30	2003-02-10 15:05			1
273	12960796	WC085	SIMPEVARP	PSM002066	2003-03-04 10:55	2003-03-04 11:40			
274	12960797	WC085	SIMPEVARP	PSM002066	2003-03-04 11:40	2003-03-04 12:30			
275	12962312	WC085	SIMPEVARP	PSM002066	2003-03-25 12:00	2003-03-25 12:25			
276	12962313	WC085	SIMPEVARP	PSM002066	2003-03-25 12:25	2003-03-25 13:00			
277	12965570	WC085	SIMPEVARP	PSM002066	2003-04-09 10:40	2003-04-09 11:05			
278	12965571	WC085	SIMPEVARP	PSM002066	2003-04-09 11:05	2003-04-09 11:40			
279	12969369	WC085	SIMPEVARP	PSM002066	2003-04-29 10:05	2003-04-29 11:00			
280	12969368	WC085	SIMPEVARP	PSM002066	2003-04-29 10:05	2003-04-29 11:00			
281	12969977	WC085	SIMPEVARP	PSM002066	2003-05-13 13:50	2003-05-13 14:25			
282	12969975	WC085	SIMPEVARP	PSM002066	2003-05-13 13:50	2003-05-13 14:25			
283	12970649	WC085	SIMPEVARP	PSM002066	2003-05-26 13:45	2003-05-26 14:30			
284	12970648	WC085	SIMPEVARP	PSM002066	2003-05-26 13:45	2003-05-26 14:30			
285	12971306	WC085	SIMPEVARP	PSM002066	2003-06-10 13:10	2003-06-10 14:00			
286	12971307	WC085	SIMPEVARP	PSM002066	2003-06-10 13:10	2003-06-10 14:00			
287	12973074	WC105	SIMPEVARP	PSM002066	2003-06-25 09:10	2003-06-25 09:50			
288	12947296	WC085	SIMPEVARP	PSM002067	2002-10-31 10:00	2002-10-31 10:30			12
289	12947297	WC085	SIMPEVARP	PSM002067	2002-10-31 10:30	2002-10-31 11:00			1
290	12948698	WC085	SIMPEVARP	PSM002067	2002-11-19 14:30	2002-11-19 15:05			11
291	12948699	WC085	SIMPEVARP	PSM002067	2002-11-19 15:05	2002-11-19 15:35			1
292	12948722	WC085	SIMPEVARP	PSM002067	2002-12-03 12:45	2002-12-03 13:05			12
293	12948723	WC085	SIMPEVARP	PSM002067	2002-12-03 13:05	2002-12-03 13:25			1
294	12956545	WC085	SIMPEVARP	PSM002067	2002-12-18 13:50	2002-12-18 14:15			1
295	12956546	WC085	SIMPEVARP	PSM002067	2002-12-18 14:15	2002-12-18 14:40			12
296	12958299	WC085	SIMPEVARP	PSM002067	2003-01-16 08:45	2003-01-16 09:15			11
297	12958300	WC085	SIMPEVARP	PSM002067	2003-01-16 09:15	2003-01-16 09:45			1
298	12959670	WC085	SIMPEVARP	PSM002067	2003-02-11 13:50	2003-02-11 14:20			12
299	12959671	WC085	SIMPEVARP	PSM002067	2003-02-11 14:20	2003-02-11 14:50			1
300	12960810	WC085	SIMPEVARP	PSM002067	2003-03-05 09:55	2003-03-05 10:20			
301	12960811	WC085	SIMPEVARP	PSM002067	2003-03-05 10:20	2003-03-05 10:50			
302	12965574	WC085	SIMPEVARP	PSM002067	2003-04-09 13:10	2003-04-09 13:35			
303	12965576	WC085	SIMPEVARP	PSM002067	2003-04-09 13:35	2003-04-09 14:00			
304	12969366	WC085	SIMPEVARP	PSM002067	2003-04-29 08:30	2003-04-29 09:20			
305	12969365	WC085	SIMPEVARP	PSM002067	2003-04-29 08:30	2003-04-29 09:20			
306	12969938	WC085	SIMPEVARP	PSM002067	2003-05-14 13:00	2003-05-14 13:45			
307	12969937	WC085	SIMPEVARP	PSM002067	2003-05-14 13:00	2003-05-14 13:45			
308	12970636	WC085	SIMPEVARP	PSM002067	2003-05-27 12:15	2003-05-27 13:00			
309	12970635	WC085	SIMPEVARP	PSM002067	2003-05-27 12:15	2003-05-27 13:00			
310	12971294	WC085	SIMPEVARP	PSM002067	2003-06-11 12:05	2003-06-11 12:50			
311	12971293	WC085	SIMPEVARP	PSM002067	2003-06-11 12:05	2003-06-11 12:50			
312	12973077	WC105	SIMPEVARP	PSM002067	2003-06-25 10:40	2003-06-25 11:20			

Observation #	ACTIVITY_ID	ACTIVITY_TYPE	SITE	IDCODE	START_DATE	STOP_DATE	SECUP	SECLOW	SECTION_NO
313	12948640	WC085	SIMPEVARP	PSM002068	2002-11-20 09:45	2002-11-20 10:25			1
314	12948727	WC085	SIMPEVARP	PSM002068	2002-12-02 11:05	2002-12-02 12:30			1
315	12956586	WC085	SIMPEVARP	PSM002068	2002-12-17 12:05	2002-12-17 12:20			1
316	12958270	WC085	SIMPEVARP	PSM002068	2003-01-13 12:05	2003-01-13 12:35			1
317	12959645	WC085	SIMPEVARP	PSM002068	2003-02-10 11:50	2003-02-10 12:10			1
318	12960785	WC085	SIMPEVARP	PSM002068	2003-03-03 15:00	2003-03-03 15:25			
319	12962292	WC085	SIMPEVARP	PSM002068	2003-03-25 11:50	2003-03-25 12:15			
320	12965558	WC085	SIMPEVARP	PSM002068	2003-04-08 13:20	2003-04-08 13:45			
321	12969348	WC085	SIMPEVARP	PSM002068	2003-04-28 11:15	2003-04-28 11:40			
322	12969960	WC085	SIMPEVARP	PSM002068	2003-05-13 11:05	2003-05-13 11:25			
323	12970661	WC085	SIMPEVARP	PSM002068	2003-05-26 11:40	2003-05-26 12:10			
324	12971257	WC085	SIMPEVARP	PSM002068	2003-06-10 11:30	2003-06-10 11:50			
325	12948639	WC085	SIMPEVARP	PSM002069	2002-11-20 09:10	2002-11-20 09:40			1
326	12948728	WC085	SIMPEVARP	PSM002069	2002-12-02 12:40	2002-12-02 13:10			1
327	12956587	WC085	SIMPEVARP	PSM002069	2002-12-17 12:35	2002-12-17 13:00			1
328	12958271	WC085	SIMPEVARP	PSM002069	2003-01-13 13:00	2003-01-13 13:30			1
329	12959646	WC085	SIMPEVARP	PSM002069	2003-02-10 12:35	2003-02-10 13:05			1
330	12960786	WC085	SIMPEVARP	PSM002069	2003-03-03 15:30	2003-03-03 15:50			
331	12962293	WC085	SIMPEVARP	PSM002069	2003-03-25 12:30	2003-03-25 13:00			
332	12965559	WC085	SIMPEVARP	PSM002069	2003-04-08 14:00	2003-04-08 14:25			
333	12969346	WC085	SIMPEVARP	PSM002069	2003-04-28 12:00	2003-04-28 12:30			
334	12969962	WC085	SIMPEVARP	PSM002069	2003-05-13 12:00	2003-05-13 12:20			
335	12970663	WC085	SIMPEVARP	PSM002069	2003-05-26 12:15	2003-05-26 12:40			
336	12971259	WC085	SIMPEVARP	PSM002069	2003-06-10 12:05	2003-06-10 12:30			
337	12948726	WC085	SIMPEVARP	PSM002070	2002-12-02 11:30	2002-12-02 11:55			1
338	12956585	WC085	SIMPEVARP	PSM002070	2002-12-17 11:30	2002-12-17 11:45			1
339	12958269	WC085	SIMPEVARP	PSM002070	2003-01-13 11:10	2003-01-13 11:40			1
340	12959644	WC085	SIMPEVARP	PSM002070	2003-02-10 11:10	2003-02-10 11:30			1
341	12960784	WC085	SIMPEVARP	PSM002070	2003-03-03 14:15	2003-03-03 14:40			
342	12962291	WC085	SIMPEVARP	PSM002070	2003-03-25 11:00	2003-03-25 11:30			
343	12965555	WC085	SIMPEVARP	PSM002070	2003-04-08 12:10	2003-04-08 12:35			
344	12969350	WC085	SIMPEVARP	PSM002070	2003-04-28 10:25	2003-04-28 11:50			
345	12969958	WC085	SIMPEVARP	PSM002070	2003-05-13 10:30	2003-05-13 10:50			
346	12970659	WC085	SIMPEVARP	PSM002070	2003-05-26 10:30	2003-05-26 11:00			
347	12971255	WC085	SIMPEVARP	PSM002070	2003-06-10 10:30	2003-06-10 10:55			
348	12948730	WC085	SIMPEVARP	PSM002071	2002-12-02 14:00	2002-12-02 14:30			1
349	12956589	WC085	SIMPEVARP	PSM002071	2002-12-17 13:40	2002-12-17 13:55			1
350	12958273	WC085	SIMPEVARP	PSM002071	2003-01-13 14:25	2003-01-13 14:45			1
351	12959648	WC085	SIMPEVARP	PSM002071	2003-02-10 14:05	2003-02-10 14:25			1
352	12960802	WC085	SIMPEVARP	PSM002071	2003-03-04 12:45	2003-03-04 13:30			
353	12962295	WC085	SIMPEVARP	PSM002071	2003-03-25 13:55	2003-03-25 14:20			
354	12965563	WC085	SIMPEVARP	PSM002071	2003-04-08 15:10	2003-04-08 15:30			
355	12969342	WC085	SIMPEVARP	PSM002071	2003-04-28 13:15	2003-04-28 13:45			
356	12969966	WC085	SIMPEVARP	PSM002071	2003-05-13 12:55	2003-05-13 13:15			
357	12970667	WC085	SIMPEVARP	PSM002071	2003-05-26 13:20	2003-05-26 13:40			
358	12971261	WC085	SIMPEVARP	PSM002071	2003-06-10 12:50	2003-06-10 13:15			
359	12948729	WC085	SIMPEVARP	PSM002072	2002-12-02 13:40	2002-12-02 14:00			1
360	12956588	WC085	SIMPEVARP	PSM002072	2002-12-17 13:10	2002-12-17 13:25			1
361	12958272	WC085	SIMPEVARP	PSM002072	2003-01-13 13:45	2003-01-13 14:10			1
362	12959647	WC085	SIMPEVARP	PSM002072	2003-02-10 13:25	2003-02-10 13:50			1
363	12960791	WC085	SIMPEVARP	PSM002072	2003-03-04 11:40	2003-03-04 12:30			
364	12962294	WC085	SIMPEVARP	PSM002072	2003-03-25 13:10	2003-03-25 13:40			

Observation #	ACTIVITY_ID	ACTIVITY_TYPE	SITE	IDCODE	START_DATE	STOP_DATE	SECUP	SECLOW	SECTION_NO
365	12965562	WC085	SIMPEVARP	PSM002072	2003-04-08 14:35	2003-04-08 15:00			
366	12969344	WC085	SIMPEVARP	PSM002072	2003-04-28 12:45	2003-04-28 13:10			
367	12969964	WC085	SIMPEVARP	PSM002072	2003-05-13 12:30	2003-05-13 12:50			
368	12970665	WC085	SIMPEVARP	PSM002072	2003-05-26 12:50	2003-05-26 13:15			
369	12971263	WC085	SIMPEVARP	PSM002072	2003-06-10 13:25	2003-06-10 13:45			
370	12948630	WC085	SIMPEVARP	PSM002075	2002-11-18 10:25	2002-11-18 11:30			1
371	12948725	WC085	SIMPEVARP	PSM002075	2002-12-02 10:40	2002-12-02 11:05			1
372	12956584	WC085	SIMPEVARP	PSM002075	2002-12-17 10:50	2002-12-17 11:05			1
373	12958268	WC085	SIMPEVARP	PSM002075	2003-01-13 09:55	2003-01-13 10:20			1
374	12959643	WC085	SIMPEVARP	PSM002075	2003-02-10 10:00	2003-02-10 10:25			1
375	12960781	WC085	SIMPEVARP	PSM002075	2003-03-03 12:50	2003-03-03 13:40			
376	12962289	WC085	SIMPEVARP	PSM002075	2003-03-25 10:00	2003-03-25 10:30			
377	12965554	WC085	SIMPEVARP	PSM002075	2003-04-08 10:55	2003-04-08 11:25			
378	12969352	WC085	SIMPEVARP	PSM002075	2003-04-28 09:25	2003-04-28 09:50			
379	12969956	WC085	SIMPEVARP	PSM002075	2003-05-13 09:40	2003-05-13 10:00			
380	12970657	WC085	SIMPEVARP	PSM002075	2003-05-26 09:40	2003-05-26 10:00			
381	12971253	WC085	SIMPEVARP	PSM002075	2003-06-10 09:40	2003-06-10 10:05			
382	12948724	WC085	SIMPEVARP	PSM002076	2002-12-02 09:40	2002-12-02 10:10			1
383	12956583	WC085	SIMPEVARP	PSM002076	2002-12-17 10:00	2002-12-17 10:20			1
384	12958267	WC085	SIMPEVARP	PSM002076	2003-01-13 08:50	2003-01-13 09:30			1
385	12959642	WC085	SIMPEVARP	PSM002076	2003-02-10 09:10	2003-02-10 09:40			1
386	12960778	WC085	SIMPEVARP	PSM002076	2003-03-03 11:45	2003-03-03 12:25			
387	12962288	WC085	SIMPEVARP	PSM002076	2003-03-25 09:05	2003-03-25 09:35			
388	12965552	WC085	SIMPEVARP	PSM002076	2003-04-08 10:10	2003-04-08 10:35			
389	12969363	WC085	SIMPEVARP	PSM002076	2003-04-28 08:30	2003-04-28 09:05			
390	12969954	WC085	SIMPEVARP	PSM002076	2003-05-13 08:40	2003-05-13 09:20			
391	12970654	WC085	SIMPEVARP	PSM002076	2003-05-26 08:20	2003-05-26 09:00			
392	12971251	WC085	SIMPEVARP	PSM002076	2003-06-10 08:55	2003-06-10 09:25			
393	12948633	WC085	SIMPEVARP	PSM002077	2002-11-18 13:45	2002-11-18 14:40			1
394	12948736	WC085	SIMPEVARP	PSM002077	2002-12-03 10:30	2002-12-03 10:50			1
395	12956594	WC085	SIMPEVARP	PSM002077	2002-12-18 10:20	2002-12-18 10:40			1
396	12958278	WC085	SIMPEVARP	PSM002077	2003-01-14 11:20	2003-01-14 11:40			1
397	12959653	WC085	SIMPEVARP	PSM002077	2003-02-11 10:20	2003-02-11 10:45			1
398	12960790	WC085	SIMPEVARP	PSM002077	2003-03-04 10:45	2003-03-04 11:05			
399	12962300	WC085	SIMPEVARP	PSM002077	2003-03-26 10:00	2003-03-26 10:30			
400	12965569	WC085	SIMPEVARP	PSM002077	2003-04-09 10:35	2003-04-09 11:00			
401	12969325	WC085	SIMPEVARP	PSM002077	2003-04-29 11:00	2003-04-29 11:25			
402	12969944	WC085	SIMPEVARP	PSM002077	2003-05-14 10:00	2003-05-14 10:25			
403	12970610	WC085	SIMPEVARP	PSM002077	2003-05-27 10:20	2003-05-27 10:40			
404	12971275	WC085	SIMPEVARP	PSM002077	2003-06-11 10:45	2003-06-11 11:10			
405	12948631	WC085	SIMPEVARP	PSM002078	2002-11-18 11:45	2002-11-18 12:45			1
406	12948734	WC085	SIMPEVARP	PSM002078	2002-12-03 09:20	2002-12-03 09:35			1
407	12956592	WC085	SIMPEVARP	PSM002078	2002-12-18 09:20	2002-12-18 09:35			1
408	12958276	WC085	SIMPEVARP	PSM002078	2003-01-14 09:35	2003-01-14 10:00			1
409	12959651	WC085	SIMPEVARP	PSM002078	2003-02-11 09:00	2003-02-11 09:25			1
410	12960788	WC085	SIMPEVARP	PSM002078	2003-03-04 09:20	2003-03-04 09:40			
411	12962298	WC085	SIMPEVARP	PSM002078	2003-03-26 08:45	2003-03-26 09:05			
412	12965567	WC085	SIMPEVARP	PSM002078	2003-04-09 09:10	2003-04-09 09:45			
413	12969329	WC085	SIMPEVARP	PSM002078	2003-04-29 09:35	2003-04-29 10:05			
414	12969948	WC085	SIMPEVARP	PSM002078	2003-05-14 08:40	2003-05-14 09:05			
415	12970606	WC085	SIMPEVARP	PSM002078	2003-05-27 09:00	2003-05-27 09:30			
416	12971271	WC085	SIMPEVARP	PSM002078	2003-06-11 09:25	2003-06-11 09:50			

Observation #	ACTIVITY_ID	ACTIVITY_TYPE	SITE	IDCODE	START_DATE	STOP_DATE	SECUP	SECLOW	SECTION_NO
417	12948632	WC085	SIMPEVARP	PSM002079	2002-11-18 12:50	2002-11-18 13:40			1
418	12948735	WC085	SIMPEVARP	PSM002079	2002-12-03 09:55	2002-12-03 10:20			1
419	12956593	WC085	SIMPEVARP	PSM002079	2002-12-18 09:50	2002-12-18 10:10			1
420	12958277	WC085	SIMPEVARP	PSM002079	2003-01-14 10:35	2003-01-14 11:05			1
421	12959652	WC085	SIMPEVARP	PSM002079	2003-02-11 09:40	2003-02-11 10:05			1
422	12960789	WC085	SIMPEVARP	PSM002079	2003-03-04 10:00	2003-03-04 10:30			
423	12962299	WC085	SIMPEVARP	PSM002079	2003-03-26 09:30	2003-03-26 09:50			
424	12965568	WC085	SIMPEVARP	PSM002079	2003-04-09 10:00	2003-04-09 10:25			
425	12969327	WC085	SIMPEVARP	PSM002079	2003-04-29 10:20	2003-04-29 10:45			
426	12969950	WC085	SIMPEVARP	PSM002079	2003-05-14 09:20	2003-05-14 09:50			
427	12970608	WC085	SIMPEVARP	PSM002079	2003-05-27 09:45	2003-05-27 10:10			
428	12971273	WC085	SIMPEVARP	PSM002079	2003-06-11 10:10	2003-06-11 10:35			
429	12948732	WC085	SIMPEVARP	PSM002080	2002-12-02 14:50	2002-12-02 15:15			1
430	12956590	WC085	SIMPEVARP	PSM002080	2002-12-17 14:05	2002-12-17 14:20			1
431	12958274	WC085	SIMPEVARP	PSM002080	2003-01-13 15:10	2003-01-13 15:30			1
432	12959649	WC085	SIMPEVARP	PSM002080	2003-02-10 14:45	2003-02-10 15:05			1
433	12960803	WC085	SIMPEVARP	PSM002080	2003-03-04 13:50	2003-03-04 14:10			
434	12962296	WC085	SIMPEVARP	PSM002080	2003-03-25 14:30	2003-03-25 15:00			
435	12965572	WC085	SIMPEVARP	PSM002080	2003-04-09 11:30	2003-04-09 12:00			
436	12969340	WC085	SIMPEVARP	PSM002080	2003-04-28 13:55	2003-04-28 14:20			
437	12969968	WC085	SIMPEVARP	PSM002080	2003-05-13 13:25	2003-05-13 13:40			
438	12970615	WC085	SIMPEVARP	PSM002080	2003-05-27 11:00	2003-05-27 11:25			
439	12971277	WC085	SIMPEVARP	PSM002080	2003-06-11 11:45	2003-06-11 12:10			
440	12948636	WC085	SIMPEVARP	PSM002081	2002-11-19 10:15	2002-11-19 11:25			1
441	12948737	WC085	SIMPEVARP	PSM002081	2002-12-03 11:40	2002-12-03 12:05			1
442	12956595	WC085	SIMPEVARP	PSM002081	2002-12-18 11:10	2002-12-18 11:30			1
443	12958279	WC085	SIMPEVARP	PSM002081	2003-01-14 11:45	2003-01-14 12:05			1
444	12959654	WC085	SIMPEVARP	PSM002081	2003-02-11 11:20	2003-02-11 11:45			1
445	12960804	WC085	SIMPEVARP	PSM002081	2003-03-04 14:25	2003-03-04 14:45			
446	12962302	WC085	SIMPEVARP	PSM002081	2003-03-26 11:00	2003-03-26 11:30			
447	12965579	WC085	SIMPEVARP	PSM002081	2003-04-10 08:20	2003-04-10 08:40			
448	12969336	WC085	SIMPEVARP	PSM002081	2003-04-28 15:05	2003-04-28 15:30			
449	12969952	WC085	SIMPEVARP	PSM002081	2003-05-14 10:55	2003-05-14 11:25			
450	12970669	WC085	SIMPEVARP	PSM002081	2003-05-26 14:10	2003-05-26 14:50			
451	12971267	WC085	SIMPEVARP	PSM002081	2003-06-10 14:50	2003-06-10 15:15			
452	12948635	WC085	SIMPEVARP	PSM002082	2002-11-19 09:15	2002-11-19 10:05			1
453	12948738	WC085	SIMPEVARP	PSM002082	2002-12-03 12:20	2002-12-03 12:50			1
454	12956596	WC085	SIMPEVARP	PSM002082	2002-12-18 11:40	2002-12-18 12:05			1
455	12958280	WC085	SIMPEVARP	PSM002082	2003-01-14 13:20	2003-01-14 13:50			1
456	12959655	WC085	SIMPEVARP	PSM002082	2003-02-11 12:15	2003-02-11 12:35			1
457	12960805	WC085	SIMPEVARP	PSM002082	2003-03-04 14:55	2003-03-04 15:20			
458	12962303	WC085	SIMPEVARP	PSM002082	2003-03-26 11:50	2003-03-26 12:10			
459	12965580	WC085	SIMPEVARP	PSM002082	2003-04-10 08:55	2003-04-10 09:15			
460	12969338	WC085	SIMPEVARP	PSM002082	2003-04-28 14:30	2003-04-28 15:00			
461	12969940	WC085	SIMPEVARP	PSM002082	2003-05-14 11:45	2003-05-14 12:05			
462	12970672	WC085	SIMPEVARP	PSM002082	2003-05-26 14:55	2003-05-26 15:20			
463	12971265	WC085	SIMPEVARP	PSM002082	2003-06-10 14:00	2003-06-10 14:25			
464	12947287	WC085	SIMPEVARP	PSM002083	2002-10-29 11:30	2002-10-29 12:15			1
465	12948638	WC085	SIMPEVARP	PSM002083	2002-11-19 12:50	2002-11-19 13:30			1
466	12948741	WC085	SIMPEVARP	PSM002083	2002-12-03 13:50	2002-12-03 14:15			1
467	12956598	WC085	SIMPEVARP	PSM002083	2002-12-18 12:50	2002-12-18 13:05			1
468	12958282	WC085	SIMPEVARP	PSM002083	2003-01-14 14:50	2003-01-14 15:20			1

Observation #	ACTIVITY_ID	ACTIVITY_TYPE	SITE	IDCODE	START_DATE	STOP_DATE	SECUP	SECLOW	SECTION_NO
469	12959656	WC085	SIMPEVARP	PSM002083	2003-02-11 12:50	2003-02-11 13:10			1
470	12960806	WC085	SIMPEVARP	PSM002083	2003-03-05 07:45	2003-03-05 08:20			
471	12962305	WC085	SIMPEVARP	PSM002083	2003-03-26 13:25	2003-03-26 13:40			
472	12965573	WC085	SIMPEVARP	PSM002083	2003-04-09 12:45	2003-04-09 13:15			
473	12969322	WC085	SIMPEVARP	PSM002083	2003-04-29 12:20	2003-04-29 12:45			
474	12969921	WC085	SIMPEVARP	PSM002083	2003-05-15 07:35	2003-05-15 08:00			
475	12970618	WC085	SIMPEVARP	PSM002083	2003-05-27 12:40	2003-05-27 13:05			
476	12971281	WC085	SIMPEVARP	PSM002083	2003-06-11 13:00	2003-06-11 13:25			
477	12973116	WC105	SIMPEVARP	PSM002083	2003-06-23 08:55	2003-06-23 09:40			
478	12947286	WC085	SIMPEVARP	PSM002084	2002-10-29 10:50	2002-10-29 11:30			1
479	12948637	WC085	SIMPEVARP	PSM002084	2002-11-19 12:00	2002-11-19 12:45			1
480	12948740	WC085	SIMPEVARP	PSM002084	2002-12-03 13:15	2002-12-03 13:40			1
481	12956597	WC085	SIMPEVARP	PSM002084	2002-12-18 12:25	2002-12-18 12:40			1
482	12958281	WC085	SIMPEVARP	PSM002084	2003-01-14 14:15	2003-01-14 14:40			1
483	12959657	WC085	SIMPEVARP	PSM002084	2003-02-11 13:15	2003-02-11 13:35			1
484	12960807	WC085	SIMPEVARP	PSM002084	2003-03-05 08:40	2003-03-05 09:05			
485	12962304	WC085	SIMPEVARP	PSM002084	2003-03-26 12:30	2003-03-26 12:55			
486	12965575	WC085	SIMPEVARP	PSM002084	2003-04-09 13:20	2003-04-09 13:45			
487	12969320	WC085	SIMPEVARP	PSM002084	2003-04-29 12:50	2003-04-29 13:20			
488	12969946	WC085	SIMPEVARP	PSM002084	2003-05-14 12:25	2003-05-14 12:50			
489	12970622	WC085	SIMPEVARP	PSM002084	2003-05-27 13:10	2003-05-27 13:35			
490	12971279	WC085	SIMPEVARP	PSM002084	2003-06-11 12:30	2003-06-11 12:50			
491	12973114	WC105	SIMPEVARP	PSM002084	2003-06-23 10:00	2003-06-23 10:35			
492	12947285	WC085	SIMPEVARP	PSM002085	2002-10-29 09:15	2002-10-29 10:40			1
493	12948642	WC085	SIMPEVARP	PSM002085	2002-11-20 11:35	2002-11-20 12:30			1
494	12948742	WC085	SIMPEVARP	PSM002085	2002-12-04 08:20	2002-12-04 09:25			1
495	12956599	WC085	SIMPEVARP	PSM002085	2002-12-18 13:50	2002-12-18 14:10			1
496	12958296	WC085	SIMPEVARP	PSM002085	2003-01-15 08:45	2003-01-15 09:10			1
497	12959658	WC085	SIMPEVARP	PSM002085	2003-02-12 07:50	2003-02-12 08:10			1
498	12960808	WC085	SIMPEVARP	PSM002085	2003-03-05 09:15	2003-03-05 10:20			
499	12962306	WC085	SIMPEVARP	PSM002085	2003-03-26 13:45	2003-03-26 14:05			
500	12965581	WC085	SIMPEVARP	PSM002085	2003-04-10 10:10	2003-04-10 10:30			
501	12969293	WC085	SIMPEVARP	PSM002085	2003-04-29 13:45	2003-04-29 14:15			
502	12969919	WC085	SIMPEVARP	PSM002085	2003-05-15 08:10	2003-05-15 08:35			
503	12970624	WC085	SIMPEVARP	PSM002085	2003-05-27 13:45	2003-05-27 14:05			
504	12971283	WC085	SIMPEVARP	PSM002085	2003-06-11 13:40	2003-06-11 14:05			
505	12973112	WC105	SIMPEVARP	PSM002085	2003-06-23 10:50	2003-06-23 11:21			
506	12947289	WC085	SIMPEVARP	PSM002086	2002-10-29 13:50	2002-10-29 14:35			1
507	12948634	WC085	SIMPEVARP	PSM002086	2002-11-18 14:50	2002-11-18 15:35			1
508	12948733	WC085	SIMPEVARP	PSM002086	2002-12-03 08:30	2002-12-03 09:00			1
509	12956591	WC085	SIMPEVARP	PSM002086	2002-12-18 08:40	2002-12-18 09:00			1
510	12958275	WC085	SIMPEVARP	PSM002086	2003-01-14 08:15	2003-01-14 08:50			1
511	12959650	WC085	SIMPEVARP	PSM002086	2003-02-11 08:00	2003-02-11 08:25			1
512	12960787	WC085	SIMPEVARP	PSM002086	2003-03-04 07:45	2003-03-04 09:00			
513	12962297	WC085	SIMPEVARP	PSM002086	2003-03-26 07:50	2003-03-26 08:20			
514	12965564	WC085	SIMPEVARP	PSM002086	2003-04-09 08:05	2003-04-09 08:45			
515	12969332	WC085	SIMPEVARP	PSM002086	2003-04-29 08:45	2003-04-29 09:15			
516	12969942	WC085	SIMPEVARP	PSM002086	2003-05-14 07:55	2003-05-14 08:20			
517	12970604	WC085	SIMPEVARP	PSM002086	2003-05-27 08:10	2003-05-27 08:30			
518	12971269	WC085	SIMPEVARP	PSM002086	2003-06-11 08:15	2003-06-11 08:40			
519	12947288	WC085	SIMPEVARP	PSM002087	2002-10-29 13:00	2002-10-29 13:45			1
520	12948641	WC085	SIMPEVARP	PSM002087	2002-11-20 10:55	2002-11-20 11:30			1

Observation #	ACTIVITY_ID	ACTIVITY_TYPE	SITE	IDCODE	START_DATE	STOP_DATE	SECUP	SECLOW	SECTION_NO
521	12948743	WC085	SIMPEVARP	PSM002087	2002-12-04 08:55	2002-12-04 09:25			1
522	12956600	WC085	SIMPEVARP	PSM002087	2002-12-18 14:15	2002-12-18 14:35			1
523	12958297	WC085	SIMPEVARP	PSM002087	2003-01-15 09:20	2003-01-15 09:55			1
524	12959659	WC085	SIMPEVARP	PSM002087	2003-02-12 08:20	2003-02-12 08:45			1
525	12960809	WC085	SIMPEVARP	PSM002087	2003-03-05 10:35	2003-03-05 11:00			
526	12962307	WC085	SIMPEVARP	PSM002087	2003-03-26 14:10	2003-03-26 14:30			
527	12965584	WC085	SIMPEVARP	PSM002087	2003-04-10 10:40	2003-04-10 11:05			
528	12969334	WC085	SIMPEVARP	PSM002087	2003-04-29 07:55	2003-04-29 08:25			
529	12969917	WC085	SIMPEVARP	PSM002087	2003-05-15 08:40	2003-05-15 09:00			
530	12970626	WC085	SIMPEVARP	PSM002087	2003-05-27 14:15	2003-05-27 14:35			
531	12971285	WC085	SIMPEVARP	PSM002087	2003-06-11 14:15	2003-06-11 14:35			
532	12973110	WC105	SIMPEVARP	PSM002087	2003-06-23 11:35	2003-06-23 12:10			
533	12969431	WC080	SIMPEVARP	PSM002170	2002-09-09 09:00	2002-09-09 10:15			
534	12969432	WC080	SIMPEVARP	PSM002170	2002-12-18 08:30	2002-12-18 09:30			
535	12969433	WC080	SIMPEVARP	PSM002170	2003-02-24 10:00	2003-02-24 11:00			
536	12969434	WC080	SIMPEVARP	PSM002170	2003-04-14 09:00	2003-04-14 10:05			

Observation #	SAMPLE_NO	CLASS_NO	WATER_TYPE	SAMPLING_DEPTH	SEC_MID	NORTHING_SECUP	EASTING_SECUP	ELEVATION_SECUP	NORTHING_SEC_MI
1	3885	3	Ground Water		100,00	6365682,896	1551368,337	6,649	6365665,779
2	3884	3	Ground Water		100,00	6365682,896	1551368,337	6,649	6365665,779
3	3883	3	Ground Water		100,00	6365682,896	1551368,337	6,649	6365665,779
4	3886	3	Ground Water		100,00	6365682,896	1551368,337	6,649	6365665,779
5	3759	3	Ground Water		100,50	6366213,946	1552544,526	2,523	6366199,692
6	3760	3	Ground Water		51,50	6366213,946	1552544,526	2,523	6366206,642
7	3761	3	Ground Water		100,50	6366213,946	1552544,526	2,523	6366199,692
8	3896	2	Ground Water		75,00	6366213,946	1552544,526	2,523	6366203,309
9	3899	2	Ground Water		75,00	6366213,946	1552544,526	2,523	6366203,309
10	3897	2	Ground Water		75,00	6366213,946	1552544,526	2,523	6366203,309
11	3898	2	Ground Water		75,00	6366213,946	1552544,526	2,523	6366203,309
12	3900	2	Ground Water		75,00	6366213,946	1552544,526	2,523	6366203,309
13	3824	3	Ground Water		255,21	6365971,717	1552450,063	-186,990	6365958,161
14	3825	3	Ground Water		589,00	6365878,480	1552448,870	-563,460	6365877,523
15	3831	3	Ground Water		575,21	6365891,450	1552451,290	-511,100	6365880,842
16	5164	3	Ground Water		25,50	6366013,310	1552443,010	4,330	6366009,235
17	5165	3	Ground Water		75,00	6366004,837	1552443,760	-43,927	6365999,830
18	5166	3	Ground Water		125,00	6365994,320	1552445,613	-92,770	6365988,473
19	5167	3	Ground Water		175,00	6365982,650	1552448,140	-141,320	6365976,857
20	5168	3	Ground Water		225,00	6365971,013	1552450,167	-189,907	6365965,190
21	5169	3	Ground Water		275,00	6365959,377	1552451,730	-238,503	6365953,533
22	5170	3	Ground Water		325,00	6365947,690	1552453,150	-287,100	6365941,753
23	5171	3	Ground Water		375,00	6365935,830	1552454,050	-335,667	6365929,810
24	5172	3	Ground Water		425,00	6365923,673	1552454,173	-384,160	6365917,487
25	5173	3	Ground Water		475,00	6365911,320	1552453,670	-432,610	6365905,133
26	5174	3	Ground Water		575,00	6365886,880	1552450,517	-529,520	6365880,893
27	5175	3	Ground Water		675,00	6365862,977	1552445,007	-626,463	6365857,060
28	5176	3	Ground Water		775,00	6365838,690	1552436,840	-723,120	6365832,363
29	5177	3	Ground Water		875,00	6365813,003	1552425,913	-819,137	6365806,253
30	5178	3	Ground Water		925,00	6365799,330	1552419,160	-866,760	6365792,200
31	5179	3	Ground Water		975,00	6365784,857	1552411,333	-913,970	6365777,380
32	5416	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
33	5415	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
34	5414	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
35	5412	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
36	5411	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
37	5410	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
38	5408	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
39	5407	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
40	5263	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
41	5262	4	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
42	5261	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
43	5260	4	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
44	5259	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
45	5258	2	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
46	5257	4	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
47	5256	2	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
48	5413	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
49	5417	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
50	5409	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
51	5421	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
52	5422	3	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928

Observation #	SAMPLE_NO	CLASS_NO	WATER_TYPE	SAMPLING_DEPTH	SEC_MID	NORTHING_SECUP	EASTING_SECUP	ELEVATION_SECUP	NORTHING_SEC_MID
53	5420	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
54	5419	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
55	5418	5	Ground Water		161,75	6365981,143	1552448,433	-147,635	6365979,928
56	5428	5	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
57	5430	5	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
58	5429	5	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
59	5427	5	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
60	5426	5	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
61	5425	5	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
62	5423	3	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
63	5269	4	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
64	5268	5	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
65	5267	4	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
66	5267	4	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
67	5266	5	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
68	5268	5	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
69	5424	5	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
70	5266	5	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
71	5265	4	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
72	5264	2	Ground Water		253,25	6365960,543	1552451,583	-233,647	6365958,618
73	5270	2	Ground Water		591,50	6365878,240	1552448,817	-564,430	6365876,930
74	3888	3	Ground Water		53,58	6365658,762	1551528,669	-1,133	6365662,040
75	3832	3	Ground Water		439,46	6365682,522	1551521,002	-405,517	6365684,211
76	5332	5	Ground Water		588,82	6365692,866	1551522,641	-582,055	6365692,874
77	5331	5	Ground Water		588,29	6365692,832	1551522,635	-581,496	6365692,841
78	5334	5	Ground Water		637,36	6365695,777	1551523,242	-630,533	6365695,782
79	5333	5	Ground Water		636,61	6365695,731	1551523,232	-629,765	6365695,738
80	5336	5	Ground Water		752,35	6365702,128	1551524,876	-745,326	6365702,134
81	5335	5	Ground Water		751,81	6365702,097	1551524,866	-744,727	6365702,105
82	3827	3	Ground Water		746,59	6365701,373	1551524,656	-731,098	6365701,828
83	5338	5	Ground Water		785,60	6365703,878	1551525,421	-778,546	6365703,882
84	5337	5	Ground Water		785,41	6365703,867	1551525,417	-778,326	6365703,872
85	3833	3	Ground Water		751,08	6365699,270	1551524,092	-692,159	6365702,067
86	5340	5	Ground Water		832,40	6365706,248	1551526,332	-825,256	6365706,252
87	5339	5	Ground Water		831,28	6365706,191	1551526,307	-824,108	6365706,197
88	5342	5	Ground Water		879,41	6365708,495	1551527,438	-872,170	6365708,501
89	5341	5	Ground Water		879,22	6365708,489	1551527,435	-872,040	6365708,492
90	5344	5	Ground Water		928,78	6365710,724	1551528,847	-921,499	6365710,728
91	5343	5	Ground Water		928,60	6365710,717	1551528,842	-921,339	6365710,720
92	5346	5	Ground Water		967,62	6365712,389	1551530,097	-960,263	6365712,394
93	5345	5	Ground Water		966,72	6365712,352	1551530,065	-959,344	6365712,358
94	5348	5	Ground Water		997,36	6365713,577	1551531,184	-989,980	6365713,581
95	5347	5	Ground Water		997,14	6365713,567	1551531,175	-989,730	6365713,572
96	5651	3	Ground Water		20,50	6365658,328	1551528,922	5,498	6365659,715
97	5652	3	Ground Water		66,00	6365661,160	1551527,225	-35,369	6365662,937
98	5653	3	Ground Water		116,00	6365664,180	1551525,320	-85,237	6365665,390
99	5654	3	Ground Water		166,00	6365666,672	1551523,884	-135,154	6365667,989
100	5655	3	Ground Water		216,00	6365669,312	1551522,833	-185,073	6365670,722
101	5656	3	Ground Water		266,00	6365672,172	1551522,090	-234,985	6365673,681
102	5657	3	Ground Water		316,00	6365675,224	1551521,572	-284,889	6365676,770
103	5658	3	Ground Water		366,00	6365678,325	1551521,217	-334,792	6365679,852
104	5659	3	Ground Water		416,00	6365681,304	1551521,014	-384,702	6365682,772

Observation #	SAMPLE_NO	CLASS_NO	WATER_TYPE	SAMPLING_DEPTH	SEC_MID	NORTHING_SECUP	EASTING_SECUP	ELEVATION_SECUP	NORTHING_SEC_MID
105	5660	3	Ground Water		466,00	6365684,304	1551521,082	-434,612	6365685,720
106	5661	3	Ground Water		516,00	6365687,100	1551521,442	-484,533	6365688,486
107	5662	3	Ground Water		566,00	6365689,957	1551522,045	-534,447	6365691,457
108	5663	3	Ground Water		616,00	6365693,009	1551522,669	-584,350	6365694,522
109	5664	3	Ground Water		666,00	6365695,995	1551523,290	-634,257	6365697,424
110	5665	3	Ground Water		716,00	6365698,824	1551523,978	-684,172	6365700,195
111	5666	3	Ground Water		766,00	6365701,531	1551524,701	-734,093	6365702,855
112	5667	3	Ground Water		816,00	6365704,161	1551525,522	-784,017	6365705,434
113	5668	3	Ground Water		866,00	6365706,673	1551526,523	-833,944	6365707,875
114	5669	3	Ground Water		916,00	6365709,036	1551527,753	-883,873	6365710,165
115	5670	3	Ground Water		966,00	6365711,261	1551529,226	-933,802	6365712,328
116	5405	3	Ground Water						6366207,69
117	5405	3	Ground Water						6366207,62
118	5406	3	Ground Water						6365951,94
119	5406	3	Ground Water						6365951,93
120	5404	3	Ground Water						6365674,54
121	5404	3	Ground Water						6365675,01
122									
123	5007	3	Sea Water	1,00					6369240
124	5008	3	Sea Water	30,00					6369240
125	5015	3	Sea Water	0,50					6369240
126	5016	3	Sea Water	28,00					6369240
127	5086	3	Sea Water	28,50					6369240
128	5087	3	Sea Water	0,50					6369240
129	5120	3	Sea Water	0,50					6369240
130	5121	3	Sea Water	29,00					6369240
131	5150	3	Sea Water	0,50					6369240
132	5151	3	Sea Water	30,00					6369240
133	5312	3	Sea Water	0,50					6369240
134	5313	3	Sea Water	28,50					6369240
135	5316	3	Sea Water	0,50					6369240
136	5371	3	Sea Water	28,50					6369240
137	5370	3	Sea Water	0,50					6369240
138	5500	3	Sea Water	0,50					6369240
139	5501	3	Sea Water	28,50					6369240
140	5538	3	Sea Water	0,50					6369240
141	5539	3	Sea Water	28,50					6369240
142	5574	3	Sea Water	0,50					6369240
143	5573	3	Sea Water	28,50					6369240
144	5606	5	Sea Water	0,50					6369240
145	5605	5	Sea Water	28,50					6369240
146	5009	3	Sea Water	1,00					6364050
147	5010	3	Sea Water	8,00					6364050
148	5029	3	Sea Water	0,50					6364050
149	5030	3	Sea Water	7,00					6364050
150	5065	3	Sea Water	0,50					6364050
151	5064	3	Sea Water	8,00					6364050
152	5084	3	Sea Water	7,50					6364050
153	5085	3	Sea Water	0,50					6364050
154	5142	3	Sea Water	0,50					6364050
155	5143	3	Sea Water	8,00					6364050
156	5242	3	Sea Water	0,50					6364050

Observation #	SAMPLE_NO	CLASS_NO	WATER_TYPE	SAMPLING_DEPTH	SEC_MID	NORTHING_SECUP	EASTING_SECUP	ELEVATION_SECUP	NORTHING_SEC_MID
157	5243	3	Sea Water	7,50					6364050
158	5314	3	Sea Water	0,50					6364050
159	5315	3	Sea Water	7,50					6364050
160	5373	3	Sea Water	7,50					6364050
161	5372	3	Sea Water	0,50					6364050
162	5503	3	Sea Water	7,50					6364050
163	5502	3	Sea Water	0,50					6364050
164	5536	3	Sea Water	0,50					6364050
165	5537	3	Sea Water	7,50					6364050
166	5570	3	Sea Water	0,50					6364050
167	5569	3	Sea Water	7,50					6364050
168	5607	5	Sea Water	7,50					6364050
169	5017	3	Sea Water	0,50					6367060
170	5018	3	Sea Water	3,30					6367060
171	5049	3	Sea Water	0,50					6367060
172	5048	3	Sea Water	3,00					6367060
173	5081	3	Sea Water	2,50					6367060
174	5080	3	Sea Water	0,50					6367060
175	5114	3	Sea Water	0,50					6367060
176	5115	3	Sea Water	3,00					6367060
177	5152	1	Sea Water	0,50					6367060
178	5153	3	Sea Water	3,00					6367060
179	5202	3	Sea Water	0,50					6367060
180	5201	3	Sea Water	2,50					6367060
181	5318	3	Sea Water	0,50					6367060
182	5319	3	Sea Water	2,50					6367060
183	5375	3	Sea Water	2,50					6367060
184	5374	3	Sea Water	0,50					6367060
185	5506	3	Sea Water	0,50					6367060
186	5507	3	Sea Water	2,50					6367060
187	5556	3	Sea Water	0,50					6367060
188	5557	3	Sea Water	2,50					6367060
189	5596	3	Sea Water	0,50					6367060
190	5595	3	Sea Water	2,50					6367060
191	5621	5	Sea Water	2,50					6367060
192	5005	3	Sea Water	1,00					6360970
193	5006	3	Sea Water	5,00					6360970
194	5027	3	Sea Water	1,00					6360970
195	5028	3	Sea Water	5,00					6360970
196	5069	3	Sea Water	0,50					6360970
197	5068	3	Sea Water	5,00					6360970
198	5082	3	Sea Water	4,50					6360970
199	5083	3	Sea Water	0,50					6360970
200	5182	3	Sea Water	0,50					6360970
201	5183	3	Sea Water	5,50					6360970
202	5226	3	Sea Water	0,50					6360970
203	5225	3	Sea Water	5,00					6360970
204	5240	3	Sea Water	0,50					6360970
205	5241	3	Sea Water	5,00					6360970
206	5394	3	Sea Water	0,50					6360970
207	5395	3	Sea Water	5,00					6360970
208	5530	3	Sea Water	0,50					6360970

Observation #	SAMPLE_NO	CLASS_NO	WATER_TYPE	SAMPLING_DEPTH	SEC_MID	NORTHING_SECUP	EASTING_SECUP	ELEVATION_SECUP	NORTHING_SEC_MID
209	5531	3	Sea Water	5,00					6360970
210	5552	3	Sea Water	0,50					6360970
211	5553	3	Sea Water	5,00					6360970
212	5601	3	Sea Water	5,00					6360970
213	5602	3	Sea Water	0,50					6360970
214	5627	5	Sea Water	5,00					6360970
215	5019	3	Sea Water	0,50					6368620
216	5020	3	Sea Water	17,00					6368620
217	5051	3	Sea Water	0,50					6368620
218	5050	3	Sea Water	17,00					6368620
219	5096	3	Sea Water	17,50					6368620
220	5097	3	Sea Water	0,05					6368620
221	5140	3	Sea Water	0,50					6368620
222	5141	3	Sea Water	17,00					6368620
223	5148	3	Sea Water	0,50					6368620
224	5149	3	Sea Water	16,00					6368620
225	5204	3	Sea Water	0,50					6368620
226	5203	3	Sea Water	15,50					6368620
227	5320	3	Sea Water	0,50					6368620
228	5321	3	Sea Water	15,50					6368620
229	5388	3	Sea Water	0,50					6368620
230	5389	3	Sea Water	15,50					6368620
231	5528	3	Sea Water	0,50					6368620
232	5529	3	Sea Water	15,50					6368620
233	5558	3	Sea Water	0,50					6368620
234	5559	3	Sea Water	15,50					6368620
235	5598	3	Sea Water	0,50					6368620
236	5597	3	Sea Water	15,50					6368620
237	5619	5	Sea Water	15,50					6368620
238	5040	3	Lake Water	0,50					6368100
239	5041	3	Lake Water	3,00					6368100
240	5047	3	Lake Water	0,50					6368100
241	5046	3	Lake Water	3,00					6368100
242	5098	3	Lake Water	2,50					6368100
243	5099	3	Lake Water	0,50					6368100
244	5116	3	Lake Water	0,50					6368100
245	5117	3	Lake Water	3,00					6368100
246	5184	3	Lake Water	0,50					6368100
247	5185	3	Lake Water	3,00					6368100
248	5208	3	Lake Water	0,50					6368100
249	5207	3	Lake Water	2,50					6368100
250	5246	3	Lake Water	0,50					6368100
251	5247	3	Lake Water	2,50					6368100
252	5358	3	Lake Water	0,50					6368100
253	5357	3	Lake Water	2,50					6368100
254	5376	3	Lake Water	0,50					6368100
255	5377	3	Lake Water	2,50					6368100
256	5533	3	Lake Water	2,50					6368100
257	5532	3	Lake Water	0,50					6368100
258	5535	3	Lake Water	2,50					6368100
259	5534	3	Lake Water	0,50					6368100
260	5572	3	Lake Water	0,50					6368100

Observation #	SAMPLE_NO	CLASS_NO	WATER_TYPE	SAMPLING_DEPTH	SEC_MID	NORTHING_SECUP	EASTING_SECUP	ELEVATION_SECUP	NORTHING_SEC_MID
261	5571	3	Lake Water	2,50					6368100
262	5603	5	Lake Water	2,50					6368100
263	5013	3	Lake Water	1,00					6373820
264	5014	3	Lake Water	17,00					6373820
265	5038	3	Lake Water	0,50					6373820
266	5039	3	Lake Water	16,00					6373820
267	5052	3	Lake Water	0,50					6373820
268	5053	3	Lake Water	17,00					6373820
269	5118	3	Lake Water	0,50					6373820
270	5119	3	Lake Water	17,00					6373820
271	5154	3	Lake Water	0,50					6373820
272	5155	3	Lake Water	16,00					6373820
273	5234	3	Lake Water	0,50					6373820
274	5235	3	Lake Water	15,50					6373820
275	5244	3	Lake Water	0,50					6373820
276	5245	3	Lake Water	15,50					6373820
277	5360	3	Lake Water	0,50					6373820
278	5359	3	Lake Water	15,50					6373820
279	5393	3	Lake Water	15,50					6373820
280	5392	3	Lake Water	0,50					6373820
281	5505	3	Lake Water	15,50					6373820
282	5504	3	Lake Water	0,50					6373820
283	5541	3	Lake Water	15,50					6373820
284	5540	3	Lake Water	0,50					6373820
285	5575	3	Lake Water	15,50					6373820
286	5576	3	Lake Water	0,50					6373820
287	5623	5	Lake Water	15,50					6373820
288	5011	3	Lake Water	1,00					6364900
289	5012	3	Lake Water	11,00					6364900
290	5033	3	Lake Water	1,00					6364900
291	5034	3	Lake Water	9,00					6364900
292	5067	3	Lake Water	0,50					6364900
293	5066	3	Lake Water	11,00					6364900
294	5100	3	Lake Water	10,50					6364900
295	5101	3	Lake Water	0,50					6364900
296	5146	3	Lake Water	1,00					6364900
297	5147	3	Lake Water	10,00					6364900
298	5180	3	Lake Water	0,50					6364900
299	5181	3	Lake Water	11,00					6364900
300	5230	3	Lake Water	0,50					6364900
301	5231	3	Lake Water	10,50					6364900
302	5356	3	Lake Water	0,50					6364900
303	5317	3	Lake Water	10,50					6364900
304	5391	3	Lake Water	10,50					6364900
305	5390	3	Lake Water	0,50					6364900
306	5527	3	Lake Water	10,50					6364900
307	5526	3	Lake Water	0,50					6364900
308	5555	3	Lake Water	10,50					6364900
309	5554	3	Lake Water	0,50					6364900
310	5600	3	Lake Water	0,50					6364900
311	5599	3	Lake Water	10,50					6364900
312	5625	5	Lake Water	10,50					6364900

Observation #	SAMPLE_NO	CLASS_NO	WATER_TYPE	SAMPLING_DEPTH	SEC_MID	NORTHING_SECUP	EASTING_SECUP	ELEVATION_SECUP	NORTHING_SEC_MID
313	5045	3	Streaming Water	0,10					6364160
314	5061	3	Streaming Water	0,10					6364160
315	5093	3	Streaming Water	0,10					6364160
316	5125	3	Streaming Water	0,50					6364160
317	5159	3	Streaming Water	0,10					6364160
318	5211	3	Streaming Water	0,10					6364160
319	5249	3	Streaming Water	0,50					6364160
320	5325	3	Streaming Water	0,50					6364160
321	5381	3	Streaming Water	0,10					6364160
322	5511	3	Streaming Water	0,10					6364160
323	5549	3	Streaming Water	0,10					6364160
324	5584	3	Streaming Water	0,10					6364160
325	5044	3	Streaming Water	0,10					6365310
326	5054	3	Streaming Water	0,10					6365310
327	5088	3	Streaming Water	0,10					6365310
328	5126	3	Streaming Water	0,50					6365310
329	5161	3	Streaming Water	0,10					6365310
330	5206	3	Streaming Water	0,10					6365310
331	5253	3	Streaming Water	0,50					6365310
332	5324	3	Streaming Water	0,50					6365310
333	5385	3	Streaming Water	0,10					6365310
334	5514	3	Streaming Water	0,10					6365310
335	5546	3	Streaming Water	0,10					6365310
336	5585	3	Streaming Water	0,10					6365310
337	5060	3	Streaming Water	0,10					6363620
338	5092	3	Streaming Water	0,10					6363620
339	5124	3	Streaming Water	0,50					6363620
340	5158	3	Streaming Water	0,10					6363620
341	5209	3	Streaming Water	0,10					6363620
342	5248	3	Streaming Water	0,50					6363620
343	5326	3	Streaming Water	0,50					6363620
344	5380	3	Streaming Water	0,10					6363620
345	5515	3	Streaming Water	0,10					6363620
346	5543	3	Streaming Water	0,10					6363620
347	5583	3	Streaming Water	0,10					6363620
348	5056	3	Streaming Water	0,10					6368450
349	5094	3	Streaming Water	0,10					6368450
350	5128	3	Streaming Water	0,50					6368450
351	5156	3	Streaming Water	0,10					6368450
352	5212	3	Streaming Water	0,50					6368450
353	5254	3	Streaming Water	0,50					6368450
354	5323	3	Streaming Water	0,50					6368450
355	5386	3	Streaming Water	0,10					6368450
356	5517	3	Streaming Water	0,10					6368450
357	5542	3	Streaming Water	0,10					6368450
358	5577	3	Streaming Water	0,10					6368450
359	5055	3	Streaming Water	0,10					6368290
360	5089	3	Streaming Water	0,10					6368290
361	5127	3	Streaming Water	0,50					6368290
362	5160	3	Streaming Water	0,10					6368290
363	5210	3	Streaming Water	0,10					6368290
364	5252	3	Streaming Water	0,50					6368290

Observation #	SAMPLE_NO	CLASS_NO	WATER_TYPE	SAMPLING_DEPTH	SEC_MID	NORTHING_SECUP	EASTING_SECUP	ELEVATION_SECUP	NORTHING_SEC_MID
365	5322	3	Streaming Water	0,50					6368290
366	5383	3	Streaming Water	0,10					6368290
367	5512	3	Streaming Water	0,10					6368290
368	5544	3	Streaming Water	0,10					6368290
369	5580	3	Streaming Water	0,10					6368290
370	5025	3	Streaming Water	0,10					6361170
371	5059	3	Streaming Water	0,10					6361170
372	5091	3	Streaming Water	0,10					6361170
373	5123	3	Streaming Water	0,50					6361170
374	5162	3	Streaming Water	0,10					6361170
375	5215	3	Streaming Water	0,10					6361170
376	5251	3	Streaming Water	0,50					6361170
377	5327	3	Streaming Water	0,50					6361170
378	5382	3	Streaming Water	0,10					6361170
379	5510	3	Streaming Water	0,10					6361170
380	5547	3	Streaming Water	0,10					6361170
381	5578	3	Streaming Water	0,10					6361170
382	5058	3	Streaming Water	0,10					6363120
383	5090	3	Streaming Water	0,10					6363120
384	5122	3	Streaming Water	0,10					6363120
385	5163	3	Streaming Water	0,50					6363120
386	5214	3	Streaming Water	0,10					6363120
387	5250	3	Streaming Water	0,50					6363120
388	5330	3	Streaming Water	0,50					6363120
389	5384	3	Streaming Water	0,10					6363120
390	5516	3	Streaming Water	0,10					6363120
391	5551	3	Streaming Water	0,10					6363120
392	5579	3	Streaming Water	0,10					6363120
393	5024	3	Streaming Water	0,10					6365990
394	5072	3	Streaming Water	0,10					6365990
395	5107	3	Streaming Water	0,10					6365990
396	5134	3	Streaming Water	0,10					6365990
397	5191	3	Streaming Water	0,10					6365990
398	5229	3	Streaming Water	0,10					6365990
399	5309	3	Streaming Water	0,50					6365990
400	5361	3	Streaming Water	0,50					6365990
401	5403	3	Streaming Water	0,10					6365990
402	5518	3	Streaming Water	0,10					6365990
403	5566	3	Streaming Water	0,10					6365990
404	5587	3	Streaming Water	0,10					6365990
405	5023	3	Streaming Water	0,10					6365750
406	5073	3	Streaming Water	0,10					6365750
407	5108	3	Streaming Water	0,10					6365750
408	5133	3	Streaming Water	0,10					6365750
409	5190	3	Streaming Water	0,10					6365750
410	5227	3	Streaming Water	0,10					6365750
411	5311	3	Streaming Water	0,50					6365750
412	5363	3	Streaming Water	0,50					6365750
413	5402	3	Streaming Water	0,50					6365750
414	5520	3	Streaming Water	0,10					6365750
415	5550	3	Streaming Water	0,10					6365750
416	5588	3	Streaming Water	0,10					6365750

Observation #	SAMPLE_NO	CLASS_NO	WATER_TYPE	SAMPLING_DEPTH	SEC_MID	NORTHING_SECUP	EASTING_SECUP	ELEVATION_SECUP	NORTHING_SEC_MID
417	5026	3	Streaming Water	0,10					6365830
418	5071	3	Streaming Water	0,10					6365830
419	5109	3	Streaming Water	0,10					6365830
420	5132	3	Streaming Water	0,10					6365830
421	5189	3	Streaming Water	0,10					6365830
422	5228	3	Streaming Water	0,10					6365830
423	5308	3	Streaming Water	0,50					6365830
424	5362	3	Streaming Water	0,50					6365830
425	5399	3	Streaming Water	0,10					6365830
426	5521	3	Streaming Water	0,10					6365830
427	5562	3	Streaming Water	0,10					6365830
428	5591	3	Streaming Water	0,10					6365830
429	5057	3	Streaming Water	0,10					6370930
430	5095	3	Streaming Water	0,10					6370930
431	5129	3	Streaming Water	0,50					6370930
432	5157	3	Streaming Water	0,10					6370930
433	5213	3	Streaming Water	0,50					6370930
434	5255	3	Streaming Water	0,50					6370930
435	5329	3	Streaming Water	0,50					6370930
436	5379	3	Streaming Water	0,10					6370930
437	5513	3	Streaming Water	0,10					6370930
438	5567	3	Streaming Water	0,10					6370930
439	5586	3	Streaming Water	0,10					6370930
440	5022	3	Streaming Water	0,10					6370460
441	5075	3	Streaming Water	0,10					6370460
442	5110	3	Streaming Water	0,10					6370460
443	5131	3	Streaming Water	0,10					6370460
444	5195	3	Streaming Water	0,10					6370460
445	5232	3	Streaming Water	0,50					6370460
446	5304	3	Streaming Water	0,50					6370460
447	5367	3	Streaming Water	0,50					6370460
448	5387	3	Streaming Water	0,10					6370460
449	5523	3	Streaming Water	0,10					6370460
450	5545	3	Streaming Water	0,10					6370460
451	5582	3	Streaming Water	0,10					6370460
452	5031	3	Streaming Water	0,10					6370790
453	5074	3	Streaming Water	0,10					6370790
454	5111	3	Streaming Water	0,10					6370790
455	5130	3	Streaming Water	0,10					6370790
456	5194	3	Streaming Water	0,10					6370790
457	5233	3	Streaming Water	0,50					6370790
458	5305	3	Streaming Water	0,50					6370790
459	5369	3	Streaming Water	0,50					6370790
460	5378	3	Streaming Water	0,10					6370790
461	5508	3	Streaming Water	0,10					6370790
462	5548	3	Streaming Water	0,10					6370790
463	5581	3	Streaming Water	0,10					6370790
464	5003	3	Streaming Water	0,74					6369120
465	5035	3	Streaming Water	0,10					6369120
466	5077	3	Streaming Water	0,10					6369120
467	5105	3	Streaming Water	0,10					6369120
468	5137	3	Streaming Water	0,10					6369120

Observation #	SAMPLE_NO	CLASS_NO	WATER_TYPE	SAMPLING_DEPTH	SEC_MID	NORTHING_SECUP	EASTING_SECUP	ELEVATION_SECUP	NORTHING_SEC_MID
469	5192	3	Streaming Water	0,10					6369120
470	5237	3	Streaming Water	0,50					6369120
471	5307	3	Streaming Water	0,50					6369120
472	5328	3	Streaming Water	0,50					6369120
473	5396	3	Streaming Water	0,10					6369120
474	5524	3	Streaming Water	0,10					6369120
475	5560	3	Streaming Water	0,10					6369120
476	5593	3	Streaming Water	0,10					6369120
477	5611	5	Streaming Water	0,10					6369120
478	5000	3	Streaming Water	0,20					6368840
479	5032	3	Streaming Water	0,10					6368840
480	5076	3	Streaming Water	0,10					6368840
481	5104	3	Streaming Water	0,10					6368840
482	5136	3	Streaming Water	0,10					6368840
483	5193	3	Streaming Water	0,10					6368840
484	5236	3	Streaming Water	0,50					6368840
485	5306	3	Streaming Water	0,50					6368840
486	5368	3	Streaming Water	0,50					6368840
487	5400	3	Streaming Water	0,10					6368840
488	5519	3	Streaming Water	0,10					6368840
489	5565	3	Streaming Water	0,10					6368840
490	5589	3	Streaming Water	0,10					6368840
491	5610	5	Streaming Water	0,10					6368840
492	5001	3	Streaming Water	0,20					6366560
493	5043	3	Streaming Water	0,10					6366560
494	5079	3	Streaming Water	0,10					6366560
495	5113	3	Streaming Water	0,10					6366560
496	5145	3	Streaming Water	0,10					6366560
497	5186	3	Streaming Water	0,10					6366560
498	5238	3	Streaming Water	0,50					6366560
499	5302	3	Streaming Water	0,50					6366560
500	5365	3	Streaming Water	0,50					6366560
501	5398	3	Streaming Water	0,10					6366560
502	5522	3	Streaming Water	0,10					6366560
503	5564	3	Streaming Water	0,10					6366560
504	5592	3	Streaming Water	0,10					6366560
505	5609	5	Streaming Water	0,10					6366560
506	5004	3	Streaming Water	0,31					6363730
507	5021	3	Streaming Water	0,10					6363730
508	5070	3	Streaming Water	0,10					6363730
509	5106	3	Streaming Water	0,10					6363730
510	5135	3	Streaming Water	0,10					6363730
511	5188	3	Streaming Water	0,10					6363730
512	5216	3	Streaming Water	0,10					6363730
513	5310	3	Streaming Water	0,50					6363730
514	5364	3	Streaming Water	0,50					6363730
515	5401	3	Streaming Water	0,10					6363730
516	5509	3	Streaming Water	0,10					6363730
517	5563	3	Streaming Water	0,10					6363730
518	5590	3	Streaming Water	0,10					6363730
519	5002	3	Streaming Water						6365700
520	5042	3	Streaming Water	0,10					6365700

Observation #	SAMPLE_NO	CLASS_NO	WATER_TYPE	SAMPLING_DEPTH	SEC_MID	NORTHING_SECUP	EASTING_SECUP	ELEVATION_SECUP	NORTHING_SEC_MID
521	5078	3	Streaming Water	0,10					6365700
522	5112	3	Streaming Water	0,10					6365700
523	5144	3	Streaming Water	0,10					6365700
524	5187	3	Streaming Water	0,10					6365700
525	5239	3	Streaming Water	0,50					6365700
526	5303	3	Streaming Water	0,50					6365700
527	5366	3	Streaming Water	0,50					6365700
528	5397	3	Streaming Water	0,10					6365700
529	5525	3	Streaming Water	0,10					6365700
530	5561	3	Streaming Water	0,10					6365700
531	5594	3	Streaming Water	0,10					6365700
532	5612	5	Streaming Water	0,10					6365700
533	3762	3	Precipitation						6368188,887
534	3881	3	Precipitation						6368188,887
535	3894	3	Precipitation						6368188,887
536	6005	3	Precipitation						6368188,887

Observation #	EASTING_SEC_MID	ELEVATION_SEC_MI	NORTHING_SECLOW	EASTING_SECLOW	ELEVATION_SECLOW	COORD_SYSTEM	pH (pH units)	COND (mS/m)	Na (mg/l)
1	1551366,507	-91,858	6365648,663	1551364,677	-190,365	RT90-RHB70	8,34	53,70	
2	1551366,507	-91,858	6365648,663	1551364,677	-190,365	RT90-RHB70	8,54	57,00	
3	1551366,507	-91,858	6365648,663	1551364,677	-190,365	RT90-RHB70	8,53	52,70	110,00
4	1551366,507	-91,858	6365648,663	1551364,677	-190,365	RT90-RHB70	8,58	63,60	122,00
5	1552533,007	-96,292	6366185,439	1552521,489	-195,107	RT90-RHB70	8,21	76,80	152,00
6	1552538,623	-48,114	6366199,338	1552532,721	-98,750	RT90-RHB70	8,28	77,30	154,00
7	1552533,007	-96,292	6366185,439	1552521,489	-195,107	RT90-RHB70	8,12	111,00	192,00
8	1552535,930	-71,220	6366192,672	1552527,334	-144,962	RT90-RHB70	7,74	345,80	
9	1552535,930	-71,220	6366192,672	1552527,334	-144,962	RT90-RHB70	7,69	350,10	
10	1552535,930	-71,220	6366192,672	1552527,334	-144,962	RT90-RHB70	7,82	280,10	
11	1552535,930	-71,220	6366192,672	1552527,334	-144,962	RT90-RHB70	7,79	261,70	
12	1552535,930	-71,220	6366192,672	1552527,334	-144,962	RT90-RHB70	7,85	270,00	
13	1552451,876	-243,574	6365944,504	1552453,458	-300,132	RT90-RHB70	7,11	1661,00	2440,00
14	1552448,660	-567,340	6365876,570	1552448,453	-571,220	RT90-RHB70	7,30	451,00	651,00
15	1552449,347	-553,974	6365870,239	1552446,975	-596,827	RT90-RHB70	7,08	1160,00	1640,00
16	1552443,390	-19,830	6366004,837	1552443,760	-43,927	RT90-RHB70	6,98	1049,00	
17	1552444,480	-68,410	6365994,320	1552445,613	-92,770	RT90-RHB70	7,35	861,00	1130,00
18	1552446,937	-117,037	6365982,650	1552448,140	-141,320	RT90-RHB70	7,40	1247,00	
19	1552449,233	-165,613	6365971,013	1552450,167	-189,907	RT90-RHB70	7,24	1079,00	1610,00
20	1552450,970	-214,200	6365959,377	1552451,730	-238,503	RT90-RHB70			
21	1552452,460	-262,807	6365947,690	1552453,150	-287,100	RT90-RHB70	7,02	1295,00	1850,00
22	1552453,700	-311,380	6365935,830	1552454,050	-335,667	RT90-RHB70			
23	1552454,190	-359,930	6365923,673	1552454,173	-384,160	RT90-RHB70	6,98	1416,00	1890,00
24	1552453,980	-408,383	6365911,320	1552453,670	-432,610	RT90-RHB70			
25	1552453,167	-456,827	6365898,993	1552452,423	-481,050	RT90-RHB70	7,11	1465,00	2010,00
26	1552449,357	-553,770	6365874,900	1552448,080	-578,000	RT90-RHB70	7,15	1411,00	1880,00
27	1552443,230	-650,690	6365851,027	1552441,280	-674,867	RT90-RHB70	7,20	1150,00	1530,00
28	1552434,430	-747,190	6365826,003	1552431,840	-771,227	RT90-RHB70	7,05	991,00	1310,00
29	1552422,667	-842,990	6365799,330	1552419,160	-866,760	RT90-RHB70	7,31	722,00	938,00
30	1552415,353	-890,413	6365784,857	1552411,333	-913,970	RT90-RHB70			
31	1552407,170	-937,460	6365769,843	1552402,803	-960,889	RT90-RHB70	7,84	376,80	558,00
32	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			2430,00
33	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			2400,00
34	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			2190,00
35	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			0,26
36	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			2270,00
37	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			2210,00
38	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			0,35
39	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			-0,10
40	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70	7,36	1539,00	2280,00
41	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70	7,34	1491,00	2210,00
42	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70	7,38	1484,00	2280,00
43	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70	7,38	1527,00	2300,00
44	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70	7,43	1498,00	2150,00
45	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70	7,27	1513,00	
46	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70	7,51	1476,00	2090,00
47	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70	7,34	1181,00	
48	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			2260,00
49	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			
50	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			2330,00
51	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			
52	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			

Observation #	EASTING_SEC_MID	ELEVATION_SEC_MI	NORTHING_SECLOW	EASTING_SECLOW	ELEVATION_SECLOW	COORD_SYSTEM	pH (pH units)	COND (mS/m)	Na (mg/l)
53	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			
54	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			
55	1552448,669	-152,737	6365978,710	1552448,900	-157,840	RT90-RHB70			
56	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70			
57	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70			
58	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70			
59	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70			
60	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70			
61	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70			
62	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70			
63	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70	7,36	1722,00	
64	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70	7,34	1718,00	2430,00
65	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70	7,27	1707,00	
66	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70	7,27	1707,00	
67	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70	7,40	1730,00	2580,00
68	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70	7,34	1718,00	2430,00
69	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70			
70	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70	7,40	1730,00	2580,00
71	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70	7,40	1739,00	
72	1552451,823	-241,667	6365956,693	1552452,065	-249,685	RT90-RHB70	7,41	1673,00	
73	1552448,533	-569,765	6365875,620	1552448,240	-575,100	RT90-RHB70			
74	1551526,711	-47,902	6365664,633	1551525,029	-94,721	RT90-RHB70	8,35	64,50	112,00
75	1551521,073	-433,075	6365685,780	1551521,243	-460,640	RT90-RHB70	7,08	1709,00	2450,00
76	1551522,643	-582,174	6365692,881	1551522,644	-582,294	RT90-RHB70			
77	1551522,636	-581,645	6365692,850	1551522,638	-581,795	RT90-RHB70			
78	1551523,243	-630,623	6365695,787	1551523,244	-630,713	RT90-RHB70			
79	1551523,233	-629,875	6365695,744	1551523,235	-629,985	RT90-RHB70			
80	1551524,877	-745,426	6365702,139	1551524,879	-745,526	RT90-RHB70			
81	1551524,869	-744,882	6365702,113	1551524,871	-745,037	RT90-RHB70			
82	1551524,786	-739,670	6365702,282	1551524,920	-748,241	RT90-RHB70	7,14	677,00	
83	1551525,423	-778,626	6365703,886	1551525,424	-778,705	RT90-RHB70			
84	1551525,419	-778,436	6365703,878	1551525,421	-778,546	RT90-RHB70			
85	1551524,857	-744,153	6365704,784	1551525,740	-796,149	RT90-RHB70	7,41	1035,00	
86	1551526,334	-825,351	6365706,257	1551526,336	-825,446	RT90-RHB70			
87	1551526,310	-824,233	6365706,204	1551526,313	-824,357	RT90-RHB70			
88	1551527,442	-872,294	6365708,507	1551527,445	-872,419	RT90-RHB70			
89	1551527,437	-872,105	6365708,495	1551527,438	-872,170	RT90-RHB70			
90	1551528,850	-921,594	6365710,732	1551528,853	-921,689	RT90-RHB70			
91	1551528,845	-921,419	6365710,724	1551528,847	-921,499	RT90-RHB70			
92	1551530,102	-960,383	6365712,399	1551530,106	-960,503	RT90-RHB70			
93	1551530,070	-959,484	6365712,363	1551530,075	-959,624	RT90-RHB70			
94	1551531,188	-990,080	6365713,585	1551531,192	-990,180	RT90-RHB70			
95	1551531,180	-989,855	6365713,577	1551531,184	-989,980	RT90-RHB70			
96	1551528,077	-14,938	6365661,160	1551527,225	-35,369	RT90-RHB70			
97	1551526,160	-60,283	6365664,180	1551525,320	-85,237	RT90-RHB70			
98	1551524,566	-110,196	6365666,672	1551523,884	-135,154	RT90-RHB70			
99	1551523,323	-160,113	6365669,312	1551522,833	-185,073	RT90-RHB70			
100	1551522,408	-210,030	6365672,172	1551522,090	-234,985	RT90-RHB70			
101	1551521,815	-259,938	6365675,224	1551521,572	-284,889	RT90-RHB70			
102	1551521,381	-309,841	6365678,325	1551521,217	-334,792	RT90-RHB70			
103	1551521,065	-359,745	6365681,304	1551521,014	-384,702	RT90-RHB70			
104	1551521,005	-409,659	6365684,304	1551521,082	-434,612	RT90-RHB70			

Observation #	EASTING_SEC_MID	ELEVATION_SEC_MI	NORTHING_SECLOW	EASTING_SECLOW	ELEVATION_SECLOW	COORD_SYSTEM	pH (pH units)	COND (mS/m)	Na (mg/l)
105	1551521,235	-459,571	6365687,100	1551521,442	-484,533	RT90-RHB70			
106	1551521,743	-509,492	6365689,957	1551522,045	-534,447	RT90-RHB70			
107	1551522,379	-559,400	6365693,009	1551522,669	-584,350	RT90-RHB70			
108	1551522,968	-609,302	6365695,995	1551523,290	-634,257	RT90-RHB70			
109	1551523,627	-659,214	6365698,824	1551523,978	-684,172	RT90-RHB70			
110	1551524,335	-709,132	6365701,531	1551524,701	-734,093	RT90-RHB70			
111	1551525,087	-759,055	6365704,161	1551525,522	-784,017	RT90-RHB70			
112	1551525,986	-808,981	6365706,673	1551526,523	-833,944	RT90-RHB70			
113	1551527,103	-858,908	6365709,036	1551527,753	-883,873	RT90-RHB70			
114	1551528,467	-908,837	6365711,261	1551529,226	-933,802	RT90-RHB70			
115	1551530,045	-958,765	6365713,333	1551530,944	-983,730	RT90-RHB70			
116	1552539,79	2,79				RT90-RHB70	6,81	23,69	10,50
117	1552539,90	0,59				RT90-RHB70	6,81	23,69	10,50
118	1552470,83	2,40				RT90-RHB70	7,75	61,90	58,60
119	1552470,72	0,30				RT90-RHB70	7,75	61,90	58,60
120	1551376,39	6,98				RT90-RHB70	6,15	52,60	10,10
121	1551376,72	5,59				RT90-RHB70	6,15	52,60	10,10
122									
123	1555800					RT90-RHB70	7,87	868,00	2010,00
124	1555800					RT90-RHB70	7,89	1129,00	2020,00
125	1555800					RT90-RHB70	7,59	1117,00	1900,00
126	1555800					RT90-RHB70	7,78	835,00	1910,00
127	1555800					RT90-RHB70	7,82	1085,00	1960,00
128	1555800					RT90-RHB70	7,82	1103,00	1970,00
129	1555800					RT90-RHB70	7,85	1092,00	1860,00
130	1555800					RT90-RHB70	7,79	1091,00	1870,00
131	1555800					RT90-RHB70	7,70	1134,00	2050,00
132	1555800					RT90-RHB70	7,40	1247,00	2320,00
133	1555800					RT90-RHB70	8,04	1121,00	2040,00
134	1555800					RT90-RHB70	7,94	1155,00	2010,00
135	1555800					RT90-RHB70	7,99	1129,00	1970,00
136	1555800					RT90-RHB70	7,87	1159,00	1950,00
137	1555800					RT90-RHB70	7,89	1163,00	1950,00
138	1555800					RT90-RHB70	7,92	1150,00	2000,00
139	1555800					RT90-RHB70	7,81	1154,00	2000,00
140	1555800					RT90-RHB70	7,95	1159,00	
141	1555800					RT90-RHB70	7,78	1183,00	
142	1555800					RT90-RHB70	7,89	1176,00	
143	1555800					RT90-RHB70	7,74	1200,00	
144	1555800					RT90-RHB70			
145	1555800					RT90-RHB70			
146	1550810					RT90-RHB70	7,72	864,00	1950,00
147	1550810					RT90-RHB70	7,34	808,00	1990,00
148	1550810					RT90-RHB70	7,77	1111,00	1980,00
149	1550810					RT90-RHB70	7,78	1077,00	1990,00
150	1550810					RT90-RHB70	7,76	1099,00	1980,00
151	1550810					RT90-RHB70	7,77	1105,00	1980,00
152	1550810					RT90-RHB70	7,75	1048,00	1970,00
153	1550810					RT90-RHB70	7,74	1092,00	1970,00
154	1550810					RT90-RHB70	7,76	1098,00	1850,00
155	1550810					RT90-RHB70	7,70	1106,00	1880,00
156	1550810					RT90-RHB70	8,22	1160,00	2050,00

Observation #	EASTING_SEC_MID	ELEVATION_SEC_MI	NORTHING_SECLOW	EASTING_SECLOW	ELEVATION_SECLOW	COORD_SYSTEM	pH (pH units)	COND (mS/m)	Na (mg/l)
157	1550810					RT90-RHB70	8,16	1128,00	2060,00
158	1550810					RT90-RHB70	8,04	1117,00	1980,00
159	1550810					RT90-RHB70	8,05	1114,00	1980,00
160	1550810					RT90-RHB70	7,94	1154,00	1920,00
161	1550810					RT90-RHB70	8,00	1135,00	1930,00
162	1550810					RT90-RHB70	7,99	1137,00	1950,00
163	1550810					RT90-RHB70	8,07	1109,00	1950,00
164	1550810					RT90-RHB70	8,01	1150,00	
165	1550810					RT90-RHB70	7,88	1133,00	
166	1550810					RT90-RHB70	8,02	1177,00	
167	1550810					RT90-RHB70	7,91	1117,00	
168	1550810					RT90-RHB70			
169	1551260					RT90-RHB70	7,29	303,30	623,00
170	1551260					RT90-RHB70	7,39	687,00	1430,00
171	1551260					RT90-RHB70	7,18	315,60	494,00
172	1551260					RT90-RHB70	7,07	795,00	1280,00
173	1551260					RT90-RHB70	7,14	338,10	547,00
174	1551260					RT90-RHB70			
175	1551260					RT90-RHB70	6,91	730,00	1210,00
176	1551260					RT90-RHB70	7,21	870,00	1430,00
177	1551260					RT90-RHB70	7,12	832,00	1460,00
178	1551260					RT90-RHB70	7,12	907,00	1490,00
179	1551260					RT90-RHB70	6,99	833,00	1200,00
180	1551260					RT90-RHB70	7,07	910,00	1510,00
181	1551260					RT90-RHB70	7,86	855,00	1470,00
182	1551260					RT90-RHB70	7,82	853,00	1460,00
183	1551260					RT90-RHB70	7,78	645,00	1090,00
184	1551260					RT90-RHB70	7,83	633,00	1070,00
185	1551260					RT90-RHB70	7,61	521,00	828,00
186	1551260					RT90-RHB70	7,46	729,00	1140,00
187	1551260					RT90-RHB70	7,76	618,00	
188	1551260					RT90-RHB70	7,10	874,00	
189	1551260					RT90-RHB70	7,85	798,00	
190	1551260					RT90-RHB70	7,39	939,00	
191	1551260					RT90-RHB70			
192	1546150					RT90-RHB70	7,80	879,00	1930,00
193	1546150					RT90-RHB70	7,83	877,00	1920,00
194	1546150					RT90-RHB70	7,79	1083,00	1890,00
195	1546150					RT90-RHB70	7,71	1091,00	1940,00
196	1546150					RT90-RHB70	7,74	1027,00	1820,00
197	1546150					RT90-RHB70	7,77	1014,00	1810,00
198	1546150					RT90-RHB70	7,75	1062,00	1930,00
199	1546150					RT90-RHB70	7,75	1053,00	1880,00
200	1546150					RT90-RHB70	7,55	1052,00	1850,00
201	1546150					RT90-RHB70	7,61	1077,00	1910,00
202	1546150					RT90-RHB70	7,59	1105,00	1800,00
203	1546150					RT90-RHB70	7,70	1110,00	1890,00
204	1546150					RT90-RHB70	8,08	1124,00	1950,00
205	1546150					RT90-RHB70	8,11	1112,00	1950,00
206	1546150					RT90-RHB70	8,12	1093,00	1950,00
207	1546150					RT90-RHB70	8,12	1099,00	1940,00
208	1546150					RT90-RHB70	8,03	1106,00	1870,00

Observation #	EASTING_SEC_MID	ELEVATION_SEC_MI	NORTHING_SECLOW	EASTING_SECLOW	ELEVATION_SECLOW	COORD_SYSTEM	pH (pH units)	COND (mS/m)	Na (mg/l)
209	1546150					RT90-RHB70	7,96	1143,00	1630,00
210	1546150					RT90-RHB70	8,06	1108,00	
211	1546150					RT90-RHB70	8,00	1124,00	
212	1546150					RT90-RHB70	7,88	1155,00	
213	1546150					RT90-RHB70	8,04	1160,00	
214	1546150					RT90-RHB70			
215	1550520					RT90-RHB70	7,45	683,00	1070,00
216	1550520					RT90-RHB70	7,32	1041,00	1850,00
217	1550520					RT90-RHB70	7,08	377,00	653,00
218	1550520					RT90-RHB70	7,27	971,00	1810,00
219	1550520					RT90-RHB70	7,36	1042,00	1860,00
220	1550520					RT90-RHB70	7,13	460,00	849,00
221	1550520					RT90-RHB70	6,81	695,00	1010,00
222	1550520					RT90-RHB70	7,01	1032,00	1730,00
223	1550520					RT90-RHB70	7,10	847,00	1400,00
224	1550520					RT90-RHB70	6,98	1049,00	1800,00
225	1550520					RT90-RHB70	7,14	943,00	1440,00
226	1550520					RT90-RHB70	7,02	1060,00	1720,00
227	1550520					RT90-RHB70	7,89	977,00	1670,00
228	1550520					RT90-RHB70	7,28	1041,00	1780,00
229	1550520					RT90-RHB70	8,17	801,00	1390,00
230	1550520					RT90-RHB70	7,06	1019,00	1800,00
231	1550520					RT90-RHB70	7,68	798,00	1280,00
232	1550520					RT90-RHB70	7,31	1000,00	1650,00
233	1550520					RT90-RHB70	7,78	843,00	
234	1550520					RT90-RHB70	7,66	1057,00	
235	1550520					RT90-RHB70	7,87	1034,00	
236	1550520					RT90-RHB70	7,63	1110,00	
237	1550520					RT90-RHB70			
238	1549010					RT90-RHB70	6,71	11,45	10,60
239	1549010					RT90-RHB70	6,68	12,10	10,60
240	1549010					RT90-RHB70	6,75	12,89	9,66
241	1549010					RT90-RHB70	6,68	12,81	9,85
242	1549010					RT90-RHB70	6,45	15,29	11,60
243	1549010					RT90-RHB70	6,85	12,40	11,10
244	1549010					RT90-RHB70	6,43	15,27	2,74
245	1549010					RT90-RHB70	6,33	13,66	2,54
246	1549010					RT90-RHB70	6,15	13,62	10,60
247	1549010					RT90-RHB70	6,30	13,11	10,80
248	1549010					RT90-RHB70	6,25	13,57	10,70
249	1549010					RT90-RHB70	6,18	13,63	10,60
250	1549010					RT90-RHB70	6,72	13,11	9,59
251	1549010					RT90-RHB70	6,56	12,99	10,40
252	1549010					RT90-RHB70	6,76	12,42	9,10
253	1549010					RT90-RHB70	6,75	18,33	9,20
254	1549010					RT90-RHB70	6,95	12,35	10,30
255	1549010					RT90-RHB70	6,84	12,22	10,10
256	1549010					RT90-RHB70	6,82	12,02	9,51
257	1549010					RT90-RHB70	6,95	12,05	9,46
258	1549010					RT90-RHB70	6,65	12,08	
259	1549010					RT90-RHB70	6,78	14,70	
260	1549010					RT90-RHB70	6,94	12,35	

Observation #	EASTING_SEC_MID	ELEVATION_SEC_MI	NORTHING_SECLOW	EASTING_SECLOW	ELEVATION_SECLOW	COORD_SYSTEM	pH (pH units)	COND (mS/m)	Na (mg/l)
261	1549010					RT90-RHB70	6,88	12,48	
262	1549010					RT90-RHB70			
263	1546460					RT90-RHB70	6,94	15,61	10,70
264	1546460					RT90-RHB70	6,83	14,93	10,30
265	1546460					RT90-RHB70	6,99	15,41	11,40
266	1546460					RT90-RHB70	6,95	14,76	10,90
267	1546460					RT90-RHB70	6,89	14,72	10,70
268	1546460					RT90-RHB70	6,95	14,77	10,70
269	1546460					RT90-RHB70	6,79	15,42	11,30
270	1546460					RT90-RHB70	6,36	17,97	10,60
271	1546460					RT90-RHB70	6,62	15,50	10,70
272	1546460					RT90-RHB70	6,33	15,90	11,50
273	1546460					RT90-RHB70	6,67	15,41	10,70
274	1546460					RT90-RHB70	6,25	15,97	11,10
275	1546460					RT90-RHB70	6,68	18,50	10,20
276	1546460					RT90-RHB70	6,53	16,34	11,10
277	1546460					RT90-RHB70	6,99	14,97	10,20
278	1546460					RT90-RHB70	7,00	15,44	10,20
279	1546460					RT90-RHB70	7,00	14,92	11,00
280	1546460					RT90-RHB70	7,00	14,92	11,10
281	1546460					RT90-RHB70	6,96	14,66	10,30
282	1546460					RT90-RHB70	7,31	14,68	10,60
283	1546460					RT90-RHB70	6,82	14,78	
284	1546460					RT90-RHB70	7,18	14,54	
285	1546460					RT90-RHB70	6,66	15,13	
286	1546460					RT90-RHB70	7,10	14,80	
287	1546460					RT90-RHB70			
288	1540190					RT90-RHB70	6,75	10,72	9,32
289	1540190					RT90-RHB70	6,72	12,17	8,77
290	1540190					RT90-RHB70	6,69	12,97	9,42
291	1540190					RT90-RHB70	6,72	12,10	9,29
292	1540190					RT90-RHB70	6,72	13,10	8,39
293	1540190					RT90-RHB70	6,62	12,13	9,00
294	1540190					RT90-RHB70	6,47	11,88	11,00
295	1540190					RT90-RHB70	6,55	49,30	8,70
296	1540190					RT90-RHB70	6,49	11,57	8,18
297	1540190					RT90-RHB70	6,49	17,61	15,30
298	1540190					RT90-RHB70	6,41	12,62	7,93
299	1540190					RT90-RHB70	6,26	16,50	14,30
300	1540190					RT90-RHB70	6,42	12,70	8,10
301	1540190					RT90-RHB70	6,23	17,86	14,60
302	1540190					RT90-RHB70	6,70	12,15	8,76
303	1540190					RT90-RHB70	6,73	12,59	8,74
304	1540190					RT90-RHB70	6,58	12,05	9,38
305	1540190					RT90-RHB70	6,87	12,59	9,21
306	1540190					RT90-RHB70	6,53	15,73	8,72
307	1540190					RT90-RHB70	6,83	11,97	8,25
308	1540190					RT90-RHB70	6,39	12,06	
309	1540190					RT90-RHB70	7,07	11,32	
310	1540190					RT90-RHB70	7,02	11,83	
311	1540190					RT90-RHB70	6,36	12,61	
312	1540190					RT90-RHB70			

Observation #	EASTING_SEC_MID	ELEVATION_SEC_MI	NORTHING_SECLOW	EASTING_SECLOW	ELEVATION_SECLOW	COORD_SYSTEM	pH (pH units)	COND (mS/m)	Na (mg/l)
313	1540020					RT90-RHB70	5,97	7,00	3,75
314	1540020					RT90-RHB70	6,07	6,85	3,71
315	1540020					RT90-RHB70	6,07	7,45	5,26
316	1540020					RT90-RHB70	6,12	9,28	5,01
317	1540020					RT90-RHB70	6,01	8,34	4,51
318	1540020					RT90-RHB70	6,19	9,80	4,91
319	1540020					RT90-RHB70	6,35	6,42	3,22
320	1540020					RT90-RHB70	6,37	7,40	3,88
321	1540020					RT90-RHB70	6,35	8,28	4,58
322	1540020					RT90-RHB70	6,34	7,56	4,17
323	1540020					RT90-RHB70	6,46	8,24	
324	1540020					RT90-RHB70	6,83	13,66	
325	1540660					RT90-RHB70	6,62	10,10	9,34
326	1540660					RT90-RHB70	6,59	11,58	8,43
327	1540660					RT90-RHB70	6,66	14,53	10,90
328	1540660					RT90-RHB70	6,36	13,81	7,97
329	1540660					RT90-RHB70	6,19	9,87	6,80
330	1540660					RT90-RHB70	6,13	11,07	6,74
331	1540660					RT90-RHB70	6,17	9,64	6,48
332	1540660					RT90-RHB70	6,62	12,06	8,86
333	1540660					RT90-RHB70	6,85	11,78	9,43
334	1540660					RT90-RHB70	6,70	11,42	8,47
335	1540660					RT90-RHB70	7,01	11,43	
336	1540660					RT90-RHB70	7,11	11,84	
337	1542290					RT90-RHB70	6,33	11,77	7,64
338	1542290					RT90-RHB70	6,41	14,19	11,50
339	1542290					RT90-RHB70	6,15	18,25	12,10
340	1542290					RT90-RHB70	6,22	13,26	8,56
341	1542290					RT90-RHB70	6,42	15,60	9,33
342	1542290					RT90-RHB70	6,75	13,68	8,79
343	1542290					RT90-RHB70	6,60	14,61	11,00
344	1542290					RT90-RHB70	6,74	12,75	9,88
345	1542290					RT90-RHB70	6,71	13,01	9,29
346	1542290					RT90-RHB70	6,77	13,56	
347	1542290					RT90-RHB70	6,91	16,45	
348	1542380					RT90-RHB70	6,23	12,00	9,39
349	1542380					RT90-RHB70	6,23	16,98	10,90
350	1542380					RT90-RHB70	6,04	14,19	10,60
351	1542380					RT90-RHB70	6,00	11,87	9,12
352	1542380					RT90-RHB70	6,14	14,04	9,98
353	1542380					RT90-RHB70	6,46	12,84	9,78
354	1542380					RT90-RHB70	6,45	14,32	11,10
355	1542380					RT90-RHB70	6,39	13,90	12,00
356	1542380					RT90-RHB70	6,45	12,80	9,92
357	1542380					RT90-RHB70	6,52	14,02	
358	1542380					RT90-RHB70	6,60	15,42	
359	1543190					RT90-RHB70	5,07	6,63	6,40
360	1543190					RT90-RHB70			
361	1543190					RT90-RHB70	5,71	9,66	10,40
362	1543190					RT90-RHB70	5,34	10,10	11,70
363	1543190					RT90-RHB70	5,84	10,96	12,30
364	1543190					RT90-RHB70	5,66	8,82	9,60

Observation #	EASTING_SEC_MID	ELEVATION_SEC_MI	NORTHING_SECLOW	EASTING_SECLOW	ELEVATION_SECLOW	COORD_SYSTEM	pH (pH units)	COND (mS/m)	Na (mg/l)
365	1543190					RT90-RHB70	5,57	10,85	9,19
366	1543190					RT90-RHB70	5,51	8,97	10,60
367	1543190					RT90-RHB70	5,41	8,82	10,00
368	1543190					RT90-RHB70	5,56	9,18	
369	1543190					RT90-RHB70	5,52	11,99	
370	1544730					RT90-RHB70	6,24	10,21	6,68
371	1544730					RT90-RHB70	6,41	12,11	8,03
372	1544730					RT90-RHB70	6,49	13,02	10,80
373	1544730					RT90-RHB70	6,33	16,19	10,50
374	1544730					RT90-RHB70	6,23	12,84	8,46
375	1544730					RT90-RHB70	6,33	14,67	9,14
376	1544730					RT90-RHB70	6,20	12,43	8,18
377	1544730					RT90-RHB70			
378	1544730					RT90-RHB70	6,55	11,83	8,80
379	1544730					RT90-RHB70	6,68	12,18	8,73
380	1544730					RT90-RHB70	6,83	13,53	
381	1544730					RT90-RHB70	6,64	16,04	
382	1546730					RT90-RHB70	5,96	10,86	4,91
383	1546730					RT90-RHB70	5,98	11,67	7,08
384	1546730					RT90-RHB70	5,88	13,69	6,55
385	1546730					RT90-RHB70	5,89	11,94	6,32
386	1546730					RT90-RHB70	5,95	13,82	7,57
387	1546730					RT90-RHB70	6,20	12,43	5,91
388	1546730					RT90-RHB70	6,12	13,23	6,43
389	1546730					RT90-RHB70	6,24	11,50	5,88
390	1546730					RT90-RHB70	6,25	11,25	5,78
391	1546730					RT90-RHB70	6,31	12,40	
392	1546730					RT90-RHB70	6,39	19,05	
393	1545960					RT90-RHB70	6,01	9,00	6,26
394	1545960					RT90-RHB70	6,08	10,50	7,26
395	1545960					RT90-RHB70	6,02	11,84	9,17
396	1545960					RT90-RHB70	5,95	13,55	9,61
397	1545960					RT90-RHB70	5,91	11,43	8,34
398	1545960					RT90-RHB70	6,00	13,77	9,51
399	1545960					RT90-RHB70	6,57	12,34	8,69
400	1545960					RT90-RHB70	6,37	13,31	9,22
401	1545960					RT90-RHB70	6,16	12,12	9,25
402	1545960					RT90-RHB70	6,32	12,00	8,65
403	1545960					RT90-RHB70	6,42	13,12	
404	1545960					RT90-RHB70	6,71	16,06	
405	1546420					RT90-RHB70	5,53	5,94	3,97
406	1546420					RT90-RHB70	5,68	7,25	3,90
407	1546420					RT90-RHB70	5,46	7,80	4,64
408	1546420					RT90-RHB70	5,58	8,17	4,31
409	1546420					RT90-RHB70	5,70	7,75	4,09
410	1546420					RT90-RHB70	5,58	8,59	4,25
411	1546420					RT90-RHB70	6,06	8,91	3,84
412	1546420					RT90-RHB70	5,84	8,08	3,84
413	1546420					RT90-RHB70	5,80	7,28	3,99
414	1546420					RT90-RHB70	5,92	7,22	3,75
415	1546420					RT90-RHB70	5,88	7,24	
416	1546420					RT90-RHB70	5,90	9,29	

Observation #	EASTING_SEC_MID	ELEVATION_SEC_MI	NORTHING_SECLOW	EASTING_SECLOW	ELEVATION_SECLOW	COORD_SYSTEM	pH (pH units)	COND (mS/m)	Na (mg/l)
417	1546740					RT90-RHB70	5,85	8,65	5,64
418	1546740					RT90-RHB70	6,10	10,45	7,20
419	1546740					RT90-RHB70	6,03	13,55	8,74
420	1546740					RT90-RHB70	6,00	13,30	9,24
421	1546740					RT90-RHB70	5,91	11,54	8,08
422	1546740					RT90-RHB70	6,06	13,81	9,35
423	1546740					RT90-RHB70	6,38	12,10	8,34
424	1546740					RT90-RHB70	6,40	13,01	8,89
425	1546740					RT90-RHB70	6,25	11,60	8,87
426	1546740					RT90-RHB70	6,35	11,78	8,45
427	1546740					RT90-RHB70	6,49	12,91	
428	1546740					RT90-RHB70	6,72	15,97	
429	1544720					RT90-RHB70	5,89	7,57	5,97
430	1544720					RT90-RHB70	5,91	8,76	7,20
431	1544720					RT90-RHB70	5,83	11,02	7,54
432	1544720					RT90-RHB70	5,86	9,58	7,86
433	1544720					RT90-RHB70	5,97	11,83	8,55
434	1544720					RT90-RHB70	6,34	9,37	7,61
435	1544720					RT90-RHB70	6,19	11,40	8,77
436	1544720					RT90-RHB70	6,41	9,29	8,08
437	1544720					RT90-RHB70	6,19	9,42	7,48
438	1544720					RT90-RHB70	6,33	10,52	
439	1544720					RT90-RHB70	6,64	13,01	
440	1545350					RT90-RHB70	6,35	6,90	3,76
441	1545350					RT90-RHB70	6,35	8,89	3,87
442	1545350					RT90-RHB70	6,29	9,61	4,89
443	1545350					RT90-RHB70	6,34	11,14	5,08
444	1545350					RT90-RHB70	6,33	9,62	4,48
445	1545350					RT90-RHB70	6,31	11,21	5,13
446	1545350					RT90-RHB70	6,57	9,43	4,18
447	1545350					RT90-RHB70	6,70	9,70	4,15
448	1545350					RT90-RHB70	6,69	9,16	4,35
449	1545350					RT90-RHB70	6,55	9,25	4,18
450	1545350					RT90-RHB70	6,58	9,79	
451	1545350					RT90-RHB70	6,63	12,15	
452	1545740					RT90-RHB70	6,08	5,98	4,70
453	1545740					RT90-RHB70	6,14	8,29	4,79
454	1545740					RT90-RHB70	6,32	9,76	6,21
455	1545740					RT90-RHB70	6,13	11,98	6,61
456	1545740					RT90-RHB70	6,12	9,89	6,20
457	1545740					RT90-RHB70	6,27	12,77	7,44
458	1545740					RT90-RHB70	6,43	10,08	5,96
459	1545740					RT90-RHB70	6,56	10,43	6,47
460	1545740					RT90-RHB70	6,44	12,85	6,17
461	1545740					RT90-RHB70	6,48	9,71	6,79
462	1545740					RT90-RHB70	6,50	10,28	
463	1545740					RT90-RHB70	6,28	14,05	
464	1548880					RT90-RHB70	5,85	6,53	4,41
465	1548880					RT90-RHB70	5,99	8,10	4,62
466	1548880					RT90-RHB70	6,11	9,10	5,44
467	1548880					RT90-RHB70	6,14	10,87	7,59
468	1548880					RT90-RHB70	6,14	15,37	10,80

Observation #	EASTING_SEC_MID	ELEVATION_SEC_MI	NORTHING_SECLOW	EASTING_SECLOW	ELEVATION_SECLOW	COORD_SYSTEM	pH (pH units)	COND (mS/m)	Na (mg/l)
469	1548880					RT90-RHB70	6,07	11,80	8,14
470	1548880					RT90-RHB70	6,34	15,49	11,20
471	1548880					RT90-RHB70	6,41	11,78	7,95
472	1548880					RT90-RHB70	6,46	12,09	7,79
473	1548880					RT90-RHB70	6,28	10,28	6,50
474	1548880					RT90-RHB70	6,62	22,12	9,36
475	1548880					RT90-RHB70	6,45	12,27	
476	1548880					RT90-RHB70	6,84	17,39	
477	1548880					RT90-RHB70			
478	1549190					RT90-RHB70	6,12	14,22	7,59
479	1549190					RT90-RHB70	5,97	13,07	7,46
480	1549190					RT90-RHB70	6,25	17,05	7,74
481	1549190					RT90-RHB70	6,55	17,74	10,10
482	1549190					RT90-RHB70	6,37	19,92	10,90
483	1549190					RT90-RHB70	6,27	17,33	9,80
484	1549190					RT90-RHB70	6,50	20,40	11,50
485	1549190					RT90-RHB70	6,65	18,39	9,76
486	1549190					RT90-RHB70	6,63	18,96	9,56
487	1549190					RT90-RHB70	6,47	15,94	8,52
488	1549190					RT90-RHB70	6,67	17,74	9,70
489	1549190					RT90-RHB70	6,84	17,53	
490	1549190					RT90-RHB70	6,91	19,59	
491	1549190					RT90-RHB70			
492	1549860					RT90-RHB70	6,59	15,64	5,83
493	1549860					RT90-RHB70	6,85	16,80	5,88
494	1549860					RT90-RHB70	6,97	20,21	6,14
495	1549860					RT90-RHB70	7,03	24,28	7,81
496	1549860					RT90-RHB70	6,76	24,54	8,06
497	1549860					RT90-RHB70	7,10	21,40	7,42
498	1549860					RT90-RHB70	7,17	24,31	8,58
499	1549860					RT90-RHB70	7,58	27,56	7,64
500	1549860					RT90-RHB70	7,28	23,05	7,29
501	1549860					RT90-RHB70	7,16	19,12	6,79
502	1549860					RT90-RHB70	7,37	21,01	7,15
503	1549860					RT90-RHB70	7,69	21,90	
504	1549860					RT90-RHB70	7,74	20,86	
505	1549860					RT90-RHB70			
506	1548480					RT90-RHB70	5,61	14,39	11,10
507	1548480					RT90-RHB70	5,59	13,96	11,60
508	1548480					RT90-RHB70	5,67	19,60	11,20
509	1548480					RT90-RHB70	5,77	21,89	11,80
510	1548480					RT90-RHB70	5,97	25,03	13,90
511	1548480					RT90-RHB70	5,90	21,68	11,60
512	1548480					RT90-RHB70	6,16	26,50	15,30
513	1548480					RT90-RHB70	6,25	21,52	12,00
514	1548480					RT90-RHB70	6,00	22,40	12,10
515	1548480					RT90-RHB70	5,94	20,44	12,30
516	1548480					RT90-RHB70	6,01	20,67	11,10
517	1548480					RT90-RHB70	6,24	22,16	
518	1548480					RT90-RHB70	6,29	30,12	
519	1550120					RT90-RHB70	5,96	8,26	5,87
520	1550120					RT90-RHB70	5,95	9,97	6,24

Observation #	EASTING_SEC_MID	ELEVATION_SEC_MI	NORTHING_SECLOW	EASTING_SECLOW	ELEVATION_SECLOW	COORD_SYSTEM	pH (pH units)	COND (mS/m)	Na (mg/l)
521	1550120					RT90-RHB70	6,12	10,68	6,98
522	1550120					RT90-RHB70	6,12	12,11	8,88
523	1550120					RT90-RHB70	6,24	14,08	8,69
524	1550120					RT90-RHB70	6,15	12,27	8,32
525	1550120					RT90-RHB70	6,41	15,00	9,97
526	1550120					RT90-RHB70	6,62	12,23	8,79
527	1550120					RT90-RHB70	6,57	13,63	8,92
528	1550120					RT90-RHB70	6,45	12,76	9,00
529	1550120					RT90-RHB70	6,47	14,04	8,60
530	1550120					RT90-RHB70	6,60	13,27	
531	1550120					RT90-RHB70	7,06	17,66	
532	1550120					RT90-RHB70			
533	1551081,634	6,165				RT90-RHB70	5,45	2,19	0,55
534	1551081,634	6,165				RT90-RHB70	4,55	3,55	1,91
535	1551081,634	6,165				RT90-RHB70			0,45
536	1551081,634	6,165				RT90-RHB70	5,10	2,97	0,85

Observation #	K (mg/l)	Ca (mg/l)	Mg (mg/l)	HCO3 (Alkalinity) (mg/l)	Cl (mg/l)	SO4 (mg/l)	SO4_S (mg/l) (total sulphur by ICP-AES)	Br (mg/l)	F (mg/l)
1				279,00					
2				277,00					
3	2,97	5,35	2,54	269,00	11,79	19,10	5,41	-0,20	2,39
4	2,15	5,09	1,43	266,00	22,58	28,70	8,55	-0,20	3,04
5	3,31	13,00	3,44	255,00	53,11	84,29	27,10	0,36	3,07
6	3,37	13,20	3,52	248,00	55,13	84,95	27,20	0,20	3,11
7	3,56	21,10	4,97	233,00	131,81		27,20	0,36	1,57
8				183,00	998,53				
9				182,00	1018,56				
10				190,00	737,25				
11				189,00	703,03				
12				189,00	721,65				
13	13,10	1020,00	61,20	21,00	5982,27	18,50	5,43	36,16	0,56
14	6,87	226,00	21,10	137,00	1298,64	167,34	42,40	7,24	1,84
15	9,91	770,00	42,70	57,00	3922,87	96,21	35,40	23,30	1,37
16									
17	7,56	535,00	36,50	85,00	2613,95	63,78	88,90	20,41	1,29
18									
19	9,13	692,00	48,50	70,00	3781,95	63,50	74,50	23,82	1,06
20									
21	11,10	881,00	49,90	50,00	4311,08	98,94	55,70	26,83	0,64
22					4559,26				
23	13,10	1030,00	42,60	38,00	4986,46	151,26	60,60	35,20	0,75
24									
25	14,80	1180,00	42,70	35,00	5138,03	265,12	70,20	59,23	1,88
26	15,60	1100,00	42,20	40,00	3445,32	125,08	68,90	25,47	1,20
27	14,40	858,00	38,40	58,00	3826,27	165,10	64,40	25,52	1,20
28	12,50	705,00	33,90	73,00	2865,67	145,19	62,10	21,43	1,32
29	10,40	451,00	29,80	103,00	1830,08	126,11	56,00	14,09	1,53
30									
31	8,50	206,00	26,00	138,00	1028,14	134,80	53,40	5,43	1,52
32	14,40	1000,00	69,40				11,40		
33	12,70	979,00	68,20				11,20		
34	12,70	879,00	64,40				10,60		
35	-0,50	-0,20	-0,09				-0,20		
36	13,40	928,00	68,50				11,70		
37	13,20	885,00	64,90				10,70		
38	-0,50	-0,20	-0,09				-0,20		
39	-0,50	-0,20	-0,09				-0,20		
40	14,70	960,00	70,80	25,00	5590,05	31,71	12,00	31,24	0,84
41	11,30	939,00	70,40	26,00	5489,90	33,58	12,30	31,82	1,22
42	12,60	963,00	71,80	28,00	5436,72	35,54	12,80	29,45	0,80
43	12,70	975,00	73,70	26,00	5507,62	34,98	13,30	31,22	1,08
44	9,13	941,00	70,00	28,00	5333,90	41,68	12,80	33,07	1,23
45				28,00					
46	8,44	915,00	70,90	30,00	5166,39	43,18	14,80	29,56	1,11
47				69,00	4007,08				
48	13,00	929,00	68,90				12,00		
49									
50	13,80	942,00	69,20				11,60		
51									
52									

Observation #	K (mg/l)	Ca (mg/l)	Mg (mg/l)	HCO3 (Alkalinity) (mg/l)	Cl (mg/l)	SO4 (mg/l)	SO4_S (mg/l) (total sulphur by ICP-AES)	Br (mg/l)	F (mg/l)
53									
54									
55									
56									
57									
58									
59									
60									
61									
62									
63				17,00	6340,77	49,81		36,88	0,97
64	13,20	1180,00	65,40	17,00	6298,23	51,07	18,30	38,53	1,09
65				17,00	6335,45	48,56		38,43	0,89
66				17,00	6335,45	48,56		38,43	0,89
67	12,00	1160,00	63,50	18,00	6322,16	48,16	18,10	36,14	0,96
68	13,20	1180,00	65,40	17,00	6298,23	51,07	18,30	38,53	1,09
69									
70	12,00	1160,00	63,50	18,00	6322,16	48,16	18,10	36,14	0,96
71				18,00	6342,54	53,19		35,48	1,20
72				19,00	6217,57				
73									
74	3,58	18,70	4,21	245,00	27,37	75,78	22,70	0,58	1,96
75	11,20	1280,00	9,66	29,00	6425,86	176,69	59,70	46,50	2,11
76									
77									
78									
79									
80									
81									
82				101,00	2157,49	92,32		15,49	2,31
83									
84									
85				89,00	3532,89	157,60		30,77	1,88
86									
87									
88									
89									
90									
91									
92									
93									
94									
95									
96									
97									
98									
99									
100									
101									
102									
103									
104									

Observation #	K (mg/l)	Ca (mg/l)	Mg (mg/l)	HCO3 (Alkalinity) (mg/l)	Cl (mg/l)	SO4 (mg/l)	SO4_S (mg/l) (total sulphur by ICP-AES)	Br (mg/l)	F (mg/l)
105									
106									
107									
108									
109									
110									
111									
112									
113									
114									
115									
116	4,16	30,20	10,80	112,00	7,08	4,13	2,23	-0,20	0,48
117	4,16	30,20	10,80	112,00	7,08	4,13	2,23	-0,20	0,48
118	11,50	31,80	28,80	371,00	8,47	12,66	4,97	0,00	1,06
119	11,50	31,80	28,80	371,00	8,47	12,66	4,97	0,00	1,06
120	9,31	91,20	17,50	215,00	17,12	4,48	0,78	0,91	5,41
121	9,31	91,20	17,50	215,00	17,12	4,48	0,78	0,91	5,41
122									
123	71,40	89,30	230,00	68,00	2653,14	506,02	158,00	12,36	-0,20
124	71,80	89,80	231,00	91,00	3557,49	519,99	158,00	11,69	-0,20
125	71,50	90,10	228,00	87,00	2436,47	520,80	157,00	12,50	-0,20
126	73,10	90,60	230,00	64,00	2347,59	355,07	157,00	9,06	-0,20
127	73,40	93,00	222,00	92,00	3520,48	514,00	160,00	12,07	0,00
128	74,00	93,30	224,00	92,00	3525,80	511,94	160,00	11,82	-0,20
129	71,00	85,60	217,00	91,00	3484,68	492,39	146,00	12,10	0,24
130	71,50	85,70	217,00	92,00	3449,22	487,80	146,00	12,90	-0,20
131	73,90	94,10	237,00	93,00	3671,16	545,38	165,00	15,15	-0,20
132	84,80	104,00	268,00	97,00	4040,22	615,61	186,00	16,10	0,35
133	77,20	95,10	236,00	94,00	3638,90	524,92	176,00	15,54	-0,20
134	79,60	98,00	244,00	93,00	3745,25	552,03	181,00	12,56	-0,20
135	70,40	91,40	227,00	93,00	3649,53	557,49	167,00	11,29	0,34
136	74,30	91,50	241,00	93,00	3727,53	532,01	168,00	12,61	-0,20
137	72,60	91,20	240,00	93,00	3689,24	533,52	167,00	14,32	-0,20
138	73,00	93,30	239,00	93,00	3684,98	533,35	171,00	13,17	-0,20
139	75,10	94,40	243,00	94,00	3728,24	546,03	174,00	13,31	0,11
140				93,00	3685,69	554,16		12,84	-0,20
141				95,00	3771,14	559,63		13,74	0,30
142				94,00	3724,34				
143				95,00	3806,59				
144									
145									
146	69,10	86,90	222,00	67,00	2652,40	375,39	155,00	8,43	0,12
147	70,90	88,60	226,00	58,00	2461,51	352,32	156,00	8,79	0,29
148	71,70	88,90	224,00	89,00	3486,92	516,83	154,00	12,55	-0,20
149	71,90	89,10	225,00	86,00	3522,86	499,82	155,00	12,24	-0,20
150	72,00	92,50	237,00	92,00	3532,54	503,02	158,00	12,03	-0,20
151	71,40	92,90	237,00	92,00	3529,23	537,20	159,00	13,38	-0,20
152	73,20	93,60	223,00	93,00	3475,81	497,39	160,00	11,36	-0,20
153	73,50	93,60	222,00	93,00	3191,83	464,37	160,00	11,32	-0,20
154	71,20	85,80	216,00	92,00	3491,77	502,92	146,00	12,75	-0,20
155	72,20	86,80	219,00	94,00	3491,23	515,17	148,00	14,10	-0,20
156	78,30	96,00	238,00	95,00	3584,65	531,11	177,00	12,40	-0,20

Observation #	K (mg/l)	Ca (mg/l)	Mg (mg/l)	HCO3 (Alkalinity) (mg/l)	Cl (mg/l)	SO4 (mg/l)	SO4_S (mg/l) (total sulphur by ICP-AES)	Br (mg/l)	F (mg/l)
157	78,80	96,60	239,00	91,00	3550,26	532,99	178,00	12,20	-0,20
158	69,30	89,60	221,00	92,00	3592,45	534,54	164,00	13,24	-0,20
159	69,60	89,50	222,00	92,00	3614,08	550,16	164,00	11,29	-0,20
160	74,10	90,60	237,00	92,00	3690,30	539,81	166,00	14,27	-0,20
161	73,70	90,70	238,00	94,00	3673,99	536,77	166,00	13,49	-0,20
162	74,10	92,70	237,00	93,00	3666,19	544,03	170,00	13,81	0,39
163	74,00	93,10	239,00	93,00	3676,48	533,27	171,00	13,00	-0,20
164				93,00	3654,14	537,84		14,42	0,48
165				93,00	3663,36	542,21		12,72	-0,20
166				95,00	3725,40				
167				95,00	3736,04				
168									
169	23,90	35,00	75,40	27,00	1733,98	241,62	54,10	3,26	0,23
170	51,60	66,90	176,00	56,00	1859,56	287,31	113,00	7,08	-0,20
171	19,70	30,90	61,50	30,00	922,84	132,18	45,30	3,40	0,86
172	46,80	64,20	160,00	69,00	2449,80	341,33	107,00	8,02	0,19
173	21,60	33,90	67,20	34,00	1099,75	149,38	49,80	3,18	1,22
174									
175	46,40	59,50	143,00	65,00	2204,47	313,51	97,00	7,59	0,20
176	54,60	68,30	170,00	76,00	2740,52	391,07	113,00	8,42	0,16
177	54,00	71,30	176,00	70,00	2574,95	375,08	121,00	8,27	-0,20
178	55,40	72,70	180,00	77,00	2851,84	410,57	124,00	13,86	0,54
179	54,50	64,70	143,00	72,00	2555,10	361,34	103,00	8,05	0,29
180	60,10	75,40	181,00	76,00	2757,18	393,20	133,00	9,06	0,10
181	51,90	69,00	174,00	72,00	2677,06	379,99	124,00	14,77	0,12
182	52,10	69,10	174,00	71,00	2664,65	372,19	123,00	8,53	-0,20
183	39,40	53,10	126,00	53,00	1916,06	270,02	91,50	6,32	0,31
184	38,60	52,40	124,00	53,00	1917,30	274,34	89,90	6,39	0,23
185	32,60	45,80	103,00	45,00	1555,68	217,86	77,10	5,18	1,04
186	43,60	58,80	143,00	60,00	2192,06	318,97	103,00	8,09	0,23
187				53,00	1830,79	262,92		6,14	0,20
188				71,00	2681,66	390,86		9,97	-0,20
189				66,00	2417,89				
190				75,00	2923,10				
191									
192	67,30	85,70	219,00	69,00	3396,78	486,14	151,00	11,13	-0,20
193	67,80	85,50	219,00	69,00	3434,21	479,34	151,00	11,48	-0,20
194	68,10	85,10	213,00	86,00	3332,48	483,12	147,00	11,43	-0,20
195	70,30	87,40	220,00	87,00	3419,11	506,06	152,00	12,75	-0,20
196	67,60	86,90	222,00	87,00	3382,22	464,62	147,00	10,84	-0,20
197	66,30	86,30	220,00	86,00	3456,67	457,24	146,00	10,74	-0,20
198	70,50	91,40	217,00	91,00	2929,84	405,88	156,00	9,81	0,19
199	68,30	89,20	212,00	89,00	2730,59	384,33	152,00	8,18	-0,20
200	69,70	88,80	219,00	91,00	3375,48	484,72	153,00	12,08	-0,20
201	70,30	90,70	223,00	93,00	3444,61	499,10	156,00	12,45	-0,20
202	75,00	90,20	231,00	93,00	3526,86	578,98	161,00	12,22	-0,20
203	78,50	93,00	229,00	93,00	3566,22	585,78	167,00	11,48	-0,20
204	68,70	88,30	220,00	91,00	3528,99	515,69	161,00	13,95	-0,20
205	68,30	88,50	218,00	91,00	3581,64	526,51	161,00	13,83	-0,20
206	69,70	86,40	227,00	92,00	3523,67	515,59	157,00	12,45	-0,20
207	70,30	86,80	228,00	91,00	3523,32	516,58	158,00	12,55	-0,20
208	71,20	89,60	228,00	89,00	3497,08	498,29	163,00	12,43	-0,20

Observation #	K (mg/l)	Ca (mg/l)	Mg (mg/l)	HCO3 (Alkalinity) (mg/l)	Cl (mg/l)	SO4 (mg/l)	SO4_S (mg/l) (total sulphur by ICP-AES)	Br (mg/l)	F (mg/l)
209	62,60	78,40	203,00	91,00	3603,09	527,23	143,00	12,36	0,90
210				90,00	3551,68	535,20		12,04	-0,20
211				92,00	3648,11	533,65		12,52	-0,20
212				92,00	3637,48				
213				92,00	3633,58				
214									
215	39,40	52,50	131,00	54,00	1898,88	273,81	87,10	5,95	0,35
216	66,60	82,40	209,00	82,00	3322,72	454,34	144,00	10,27	-0,20
217	25,30	37,20	80,90	33,00	1145,31	160,11	57,30	3,70	0,81
218	65,80	84,40	219,00	79,00	3071,65	427,73	145,00	9,92	-0,20
219	67,50	87,20	229,00	87,00	2514,68	347,25	148,00	8,74	-0,20
220	32,60	46,90	105,00	42,00	1361,93	201,05	73,70	4,50	0,35
221	39,20	51,60	119,00	64,00	2100,94	284,20	81,80	6,43	0,33
222	65,90	79,10	201,00	91,00	3325,14	466,63	135,00	12,99	0,10
223	51,70	68,70	167,00	73,00	2591,97	372,11	116,00	12,03	0,80
224	67,60	84,60	212,00	91,00	3274,44	469,98	146,00	11,20	0,64
225	58,20	73,10	186,00	80,00	2946,14	419,43	127,00	10,21	-0,20
226	70,60	84,00	218,00	91,00	3313,79	467,10	150,00	12,56	-0,20
227	58,90	77,20	200,00	81,00	3012,80	436,22	139,00	11,41	-0,20
228	62,50	81,10	201,00	88,00	3235,44	470,67	147,00	10,51	0,45
229	49,90	64,40	162,00	68,00	2520,35	343,42	114,00	8,34	0,29
230	64,80	80,80	211,00	89,00	3246,43	446,71	146,00	12,52	0,29
231	49,80	65,20	163,00	66,00	2390,60	326,46	115,00	8,22	0,40
232	64,00	81,00	207,00	83,00	3119,51	436,11	146,00	11,32	-0,20
233				71,00	2598,70	378,39		8,81	0,12
234				87,00	3344,28	502,45		12,74	0,21
235				83,00	3204,95				
236				90,00	3442,49				
237									
238	1,68	7,27	2,36	11,00	11,19	14,14	4,99	-0,20	1,11
239	1,66	7,24	2,36	12,00	11,00	14,15	4,94	0,17	0,93
240	1,66	7,48	2,34	13,00	10,80	14,27	5,22	0,06	0,84
241	1,72	7,58	2,35	11,00	10,64	14,32	5,19	0,07	0,65
242	2,16	7,89	2,49	12,00	12,79	11,47	5,46	0,00	0,58
243	1,87	8,07	2,48	12,00	8,29	10,86	5,55	0,07	0,69
244	1,87	8,66	2,74	14,00	15,31	17,93	5,95	0,11	0,96
245	1,73	8,16	2,54	14,00	12,01	16,06	5,64	0,10	0,93
246	1,67	8,12	2,55	12,00	11,22	15,07	5,61	0,10	0,97
247	1,66	8,34	2,65	16,00	11,88	14,69	5,69	0,08	0,89
248	1,62	8,26	2,54	13,00	12,65	16,02	5,61	-0,20	0,79
249	1,58	8,55	2,87	14,00	11,95	15,41	5,53	0,17	1,03
250	1,25	7,73	2,34	12,00	11,31	14,46	5,66	0,28	0,75
251	1,44	8,45	2,78	15,00	11,62	14,57	5,91	0,13	0,78
252	1,47	7,29	2,29	14,00	10,30	12,56	4,83	-0,20	0,75
253	1,48	7,34	2,31	14,00	10,82	12,84	4,85	0,08	0,82
254	1,57	7,46	2,34	13,00	10,94	13,17	4,85	-0,20	0,70
255	1,52	7,35	2,32	13,00	10,66	12,84	4,91	0,17	1,01
256	1,55	7,45	2,39	12,00	10,90	13,29	5,03	0,11	0,93
257	1,59	7,44	2,38	11,00	10,46	12,78	4,99	0,09	0,71
258				12,00	10,53	13,05		0,04	0,84
259				10,00	10,47	13,05		0,08	0,85
260				12,00					

Observation #	K (mg/l)	Ca (mg/l)	Mg (mg/l)	HCO3 (Alkalinity) (mg/l)	Cl (mg/l)	SO4 (mg/l)	SO4_S (mg/l) (total sulphur by ICP-AES)	Br (mg/l)	F (mg/l)
261				12,00					
262									
263	1,79	10,00	2,93	11,00	14,41	21,95	7,70	-0,20	1,31
264	1,82	10,10	2,89	11,00	14,09	23,62	7,71	0,20	1,18
265	1,66	9,95	2,93	11,00	14,08	21,90	8,20	-0,20	1,45
266	1,59	9,88	2,86	11,00	13,72	22,14	7,45	-0,20	1,44
267	1,89	10,10	2,86	11,00	14,08	22,26	7,54	-0,20	1,37
268	1,82	10,20	2,88	11,00	13,82	22,26	7,68	-0,20	1,38
269	1,59	10,30	3,02	12,00	15,02	23,07	7,61	-0,20	1,50
270	1,54	10,30	2,93	13,00	13,76	22,85	7,54	0,09	1,11
271	1,56	10,40	3,00	11,00	21,24	23,67	7,79	0,21	1,35
272	1,57	11,10	3,20	15,00	16,86	23,47	8,04	0,38	1,23
273	1,49	10,20	3,04	11,00	14,43	22,13	7,93	-0,20	1,02
274	1,53	11,00	3,24	15,00	14,72	22,82	8,01	0,15	1,42
275	1,26	10,20	2,96	11,00	13,38	21,67	8,36	-0,20	1,13
276	1,28	11,00	3,21	16,00	15,09	22,33	8,56	0,08	1,26
277	1,43	9,63	2,79	11,00	22,08	23,01	7,61	0,11	1,21
278	1,46	9,64	2,78	11,00	28,78	24,05	7,62	0,18	1,36
279	1,49	9,56	2,79	11,00	13,58	21,39	7,49	-0,20	1,32
280	1,49	9,58	2,80	11,00	13,63	21,63	7,52	-0,20	1,23
281	1,58	9,91	2,92	11,00	13,90	21,85	7,65	-0,20	1,22
282	1,60	10,20	2,97	11,00	14,51	21,92	7,76	-0,20	1,39
283				10,00	13,09	21,58		-0,20	1,15
284				10,00	13,22	21,18		0,14	1,20
285				10,00					
286				10,00					
287									
288	1,69	8,92	2,39	12,00	14,20	9,90	3,68	0,20	0,61
289	1,62	8,68	2,32	15,00	11,61	8,69	3,73	-0,20	0,57
290	1,47	8,59	2,30	14,00	13,81	9,97	3,62	-0,20	0,49
291	1,45	8,59	2,32	15,00	12,39	9,61	3,60	-0,20	0,48
292	1,57	8,54	2,22	13,00	11,24	9,49	3,54	-0,20	0,46
293	1,81	8,61	2,27	13,00	23,26	11,08	3,66	-0,20	0,65
294	1,56	9,30	2,38	14,00	10,58	8,11	3,95	-0,20	0,39
295	1,47	8,85	2,26	12,00	7,63	6,92	3,83	-0,20	0,44
296	1,27	8,33	2,25	13,00	11,03	11,11	3,64	0,00	0,49
297	1,40	10,80	2,92	19,00	24,34	11,69	4,26	-0,20	0,63
298	1,30	8,58	2,29	13,00	11,27	9,78	3,85	-0,20	0,83
299	1,44	10,70	2,86	19,00	21,55	11,19	4,24	-0,20	0,47
300	1,24	8,61	2,35	13,00	11,98	9,82	3,80	-0,20	0,71
301	1,46	11,30	3,14	19,00	24,25	12,11	4,49	-0,20	0,52
302	1,26	8,41	2,23	14,00	15,30	9,90	3,72	-0,20	0,58
303	1,26	8,44	2,23	14,00	12,65	9,40	3,66	-0,20	0,58
304	1,33	8,33	2,22	14,00	12,23	9,50	3,69	-0,20	0,45
305	1,28	8,17	2,19	13,00	12,04	9,38	3,57	-0,20	0,44
306	1,30	8,48	2,30	13,00	12,36	10,03	3,92	-0,20	0,59
307	1,36	8,34	2,28	13,00	11,43	9,16	3,65	-0,20	0,49
308				13,00	11,82	10,30		1,58	0,55
309				13,00	11,09	8,91		-0,20	0,57
310				13,00					
311				13,00					
312									

Observation #	K (mg/l)	Ca (mg/l)	Mg (mg/l)	HCO3 (Alkalinity) (mg/l)	Cl (mg/l)	SO4 (mg/l)	SO4_S (mg/l) (total sulphur by ICP-AES)	Br (mg/l)	F (mg/l)
313	0,75	6,27	1,67	5,00	3,52	8,69	3,33	-0,20	0,54
314	1,03	6,11	1,56	6,00	3,61	7,60	2,92	-0,20	0,46
315	1,06	7,18	1,77	8,00	3,36	7,20	3,43	-0,20	0,49
316	0,85	8,51	2,12	15,00	5,09	9,79	3,64	-0,20	0,54
317	0,77	7,84	1,96	13,00	4,44	8,80	3,46	-0,20	0,72
318	0,77	8,88	2,21	16,00	5,24	10,35	3,92	-0,20	0,59
319	0,41	5,71	1,43	9,00	3,35	5,83	2,74	-0,20	0,60
320	0,76	6,60	1,62	11,00	3,98	7,32	2,75	-0,20	0,49
321	0,82	7,02	1,69	10,00	3,79	6,86	2,81	-0,20	0,53
322	0,87	7,32	1,81	12,00	3,83	6,25	2,61	-0,20	
323				15,00	4,09	5,93		-0,20	0,69
324				33,00					
325	1,48	8,81	2,37	12,00	13,63	9,73	3,60	-0,20	0,62
326	1,47	8,60	2,22	13,00	11,84	9,73	3,58	-0,20	0,53
327	2,49	8,91	2,34	14,00	9,53	8,46	3,88	-0,20	0,46
328	1,25	8,37	2,24	13,00	10,36	9,69	3,66	-0,20	0,60
329	1,13	8,13	2,17	12,00	8,39	9,47	3,72	-0,20	0,56
330	0,99	8,31	2,24	13,00	8,64	9,85	3,75	-0,20	0,67
331	0,79	7,10	1,89	11,00	8,91	7,70	3,44	-0,20	0,47
332	1,30	8,46	2,24	14,00	13,25	9,96	3,73	0,26	0,52
333	1,29	8,27	2,21	13,00	12,29	9,21	3,62	-0,20	0,46
334	1,42	8,45	2,29	13,00	12,32	9,38	3,62	-0,20	0,49
335				13,00	11,47	8,95		-0,20	0,58
336				14,00					
337	1,28	10,50	2,31	15,00	10,32	11,17	4,19	-0,20	0,98
338	1,74	12,50	2,76	23,00	10,24	7,12	3,97	-0,20	0,40
339	1,01	16,30	3,71	48,00	18,35	7,70	3,19	-0,20	0,63
340	0,72	12,40	2,75	28,00	11,25	9,20	3,55	-0,20	0,58
341	0,95	14,00	3,24	35,00	14,37	10,66	3,98	0,35	0,95
342	0,67	11,70	2,66	25,00	13,18	9,19	3,69	-0,20	0,71
343	0,87	10,90	2,55	26,00	17,77	7,12	2,82	-0,20	0,59
344	0,95	9,51	2,17	17,00	13,34	8,30	3,31	-0,20	0,67
345	1,13	10,80	2,44	23,00	13,34	7,26	3,09	-0,20	0,76
346				25,00	14,79	6,06		-0,20	0,84
347				43,00					
348	1,49	7,82	2,15	8,00	13,50	12,39	4,42	-0,20	0,44
349	1,63	8,89	2,36	11,00	12,28	11,03	4,86	-0,20	0,55
350	1,38	9,40	2,59	15,00	15,22	12,22	4,56	-0,20	0,47
351	1,26	8,71	2,36	13,00	13,07	12,57	4,49	-0,20	0,49
352	1,39	9,68	2,67	16,00	15,14	12,80	4,79	-0,20	0,44
353	1,14	9,09	2,44	15,00	13,79	10,42	4,70	0,10	0,60
354	1,53	9,30	2,51	16,00	17,78	12,43	4,64	-0,20	0,48
355	1,42	8,62	2,34	13,00	16,98	11,16	4,30	-0,20	0,42
356	1,42	8,88	2,42	15,00	15,03	10,08	3,94	-0,20	0,54
357				18,00	15,57	9,98		-0,20	0,68
358				24,00					
359	0,50	3,46	0,91	0,00	7,30	3,05	1,38	-0,20	0,23
360									
361	-0,01	5,46	1,28	6,00	12,47	3,67	1,62	-0,20	0,24
362	-0,40	4,77	1,20	0,00	16,96	3,33	1,60	-0,20	0,31
363	-0,40	5,63	1,36	4,00	18,09	3,50	1,54	-0,20	0,27
364	-0,40	4,19	1,02	0,90	14,14	3,24	1,74	-0,20	0,38

Observation #	K (mg/l)	Ca (mg/l)	Mg (mg/l)	HCO3 (Alkalinity) (mg/l)	Cl (mg/l)	SO4 (mg/l)	SO4_S (mg/l) (total sulphur by ICP-AES)	Br (mg/l)	F (mg/l)
365	0,40	3,99	0,99	0,00	13,49	3,47	1,53	0,16	0,25
366	0,52	3,99	1,01	1,00	14,06	2,92	1,38	-0,20	0,21
367	0,47	4,23	1,02	3,00	13,51	2,02	1,19	-0,20	0,24
368				1,00	13,68	1,64		-0,20	0,21
369				2,00					
370	1,68	8,30	2,15	7,00	6,71	13,99	5,13	-0,20	0,52
371	1,28	9,81	2,35	12,00	10,38	12,80	4,89	-0,20	0,67
372	1,65	11,20	2,63	17,00	9,26	9,36	4,81	0,10	0,44
373	1,09	13,30	3,27	30,00	13,96	14,19	5,07	-0,20	0,55
374	0,99	11,10	2,76	22,00	10,56	11,74	4,56	0,08	0,60
375	1,03	12,60	3,19	27,00	17,32	16,26	5,62	-0,20	0,89
376	0,75	10,90	2,70	21,00	11,39	11,74	5,01	-0,20	0,57
377									
378	0,75	9,41	2,19	15,00	10,42	10,81	4,18	-0,20	0,77
379	1,17	10,40	2,49	20,00	10,40	9,17	3,85	-0,20	0,56
380				23,00	12,35	8,48		-0,20	0,68
381				36,00					
382	0,99	11,40	1,90	10,00	5,21	17,63	6,66	-0,20	0,61
383	1,43	12,70	2,10	12,00	4,33	14,47	7,39	0,10	0,33
384	0,93	12,80	2,28	14,00	7,48	22,48	8,05	0,15	0,42
385	0,88	12,10	2,13	14,00	6,69	17,84	6,77	0,26	0,36
386	0,86	13,20	2,45	16,00	8,81	20,94	7,88	-0,20	0,58
387	0,66	13,20	2,16	18,00	6,37	17,15	7,37	0,11	0,57
388	0,93	13,50	2,20	20,00	7,61	19,56	7,19	0,69	0,43
389	1,05	12,00	1,95	16,00	5,82	14,70	5,87	0,17	0,64
390	1,03	12,20	2,03	17,00	6,23	13,04	5,44	-0,20	0,47
391				20,00	6,42	12,72		-0,20	0,53
392				39,00					
393	1,50	6,36	1,61	4,00	6,85	11,88	4,23	-0,20	0,46
394	1,39	7,69	1,92	6,00	9,22	13,82	4,84	-0,20	0,39
395	1,39	8,92	2,27	9,00	11,26	14,75	5,47	-0,20	0,57
396	1,45	9,47	2,55	14,00	13,53	15,22	5,28	-0,20	0,37
397	1,13	8,56	2,21	11,00	10,08	13,05	5,00	-0,20	0,38
398	1,42	9,60	2,62	15,00	13,32	14,80	5,46	-0,20	0,30
399	1,05	9,05	2,34	13,00	14,27	13,82	5,53	0,06	0,52
400	1,28	8,96	2,30	13,00	13,46	14,51	5,24	-0,20	0,33
401	1,18	8,42	2,15	10,00	11,70	14,05	5,14	-0,20	0,45
402	1,34	8,72	2,26	12,00	11,41	10,90	4,40	-0,20	0,30
403				15,00	12,78	10,96		-0,20	0,54
404				26,00					
405	0,79	5,13	1,37	1,00	2,96	8,47	4,00	-0,20	0,25
406	0,78	6,33	1,44	2,00	4,06	12,64	4,68	-0,20	0,32
407	0,66	7,11	1,58	3,00	4,18	13,76	5,34	-0,20	0,32
408	-0,01	6,65	1,66	3,00	4,75	15,68	5,45	0,15	0,29
409	0,50	6,38	1,52	4,00	4,08	13,29	4,82	-0,20	0,27
410	-0,40	6,80	1,71	3,00	4,19	15,56	5,92	-0,20	0,29
411	-0,40	6,36	1,49	5,00	12,88	14,35	5,29	0,28	0,24
412	0,56	6,38	1,49	4,00	3,60	12,76	5,05	-0,20	0,42
413	0,60	5,85	1,39	3,00	3,43	11,71	4,42	-0,20	0,25
414	0,65	6,18	1,39	4,00	3,23	10,20	4,15	0,10	0,34
415				4,00	3,25	10,39		-0,20	0,37
416				2,00					

Observation #	K (mg/l)	Ca (mg/l)	Mg (mg/l)	HCO3 (Alkalinity) (mg/l)	Cl (mg/l)	SO4 (mg/l)	SO4_S (mg/l) (total sulphur by ICP-AES)	Br (mg/l)	F (mg/l)
417	1,38	6,36	1,60	3,00	6,30	12,17	4,35	-0,20	0,25
418	1,53	7,74	1,90	5,00	8,73	14,17	5,03	-0,20	0,33
419	1,30	8,96	2,25	8,00	10,77	15,13	5,72	-0,20	0,38
420	1,23	9,50	2,51	13,00	12,65	15,81	5,56	-0,20	0,39
421	1,10	8,65	2,21	11,00	9,97	13,66	5,19	-0,20	0,36
422	1,27	9,85	2,63	14,00	12,98	15,27	5,67	-0,20	0,51
423	1,05	9,03	2,30	12,00	15,75	14,66	5,65	0,47	0,41
424	1,26	8,98	2,28	13,00	12,51	14,51	5,45	-0,20	0,44
425	1,18	8,23	2,07	10,00	10,98	13,43	4,94	-0,20	0,39
426	1,25	8,83	2,25	12,00	10,79	11,87	4,56	-0,20	0,42
427				15,00	12,21	11,23		-0,20	0,43
428				28,00					
429	1,86	6,30	1,15	5,00	6,14	6,86	2,62	-0,20	0,26
430	1,00	7,52	1,35	8,00	7,20	8,01	3,32	-0,20	0,27
431	0,88	9,18	1,78	16,00	8,98	9,97	3,87	-0,20	0,30
432	0,69	7,37	1,43	10,00	9,88	7,87	3,10	-0,20	0,28
433	0,97	9,51	1,89	16,00	11,64	9,21	3,71	0,21	0,29
434	0,50	7,16	1,35	10,00	9,89	6,88	3,29	0,11	0,24
435	0,77	7,94	1,44	12,00	12,46	7,83	3,22	-0,20	0,23
436	0,78	7,04	1,25	10,00	9,34	6,42	2,67	-0,20	0,30
437	0,84	7,58	1,37	12,00	9,04	5,77	2,60	-0,20	0,41
438				14,00	10,36	5,21		-0,20	0,31
439				27,00					
440	1,12	7,69	1,30	10,00	3,18	6,60	2,86	-0,20	0,30
441	1,01	10,30	1,49	16,00	3,98	8,69	3,41	-0,20	0,42
442	1,01	12,20	1,73	22,00	4,26	8,85	3,66	-0,20	0,40
443	0,82	12,30	1,94	26,00	5,23	10,59	4,04	-0,20	0,44
444	0,70	11,50	1,70	25,00	4,26	8,48	3,55	-0,20	0,41
445	0,78	12,60	2,02	27,00	5,16	9,64	4,02	-0,20	0,60
446	0,57	11,20	1,66	23,00	4,09	8,13	3,69	0,13	0,36
447	0,83	10,70	1,56	22,00	4,58	8,02	3,35	-0,20	0,38
448	0,97	10,40	1,50	19,00	4,19	7,13	3,03	-0,20	0,34
449	0,90	11,50	1,60	22,00	3,78	5,26	2,53	-0,20	0,38
450				26,00	3,92	5,12		-0,20	0,44
451				41,00					
452	1,05	6,33	1,20	5,00	3,85	5,48	2,76	-0,20	0,24
453	1,09	8,23	1,39	9,00	5,08	8,14	3,21	-0,20	0,24
454	1,12	10,10	1,69	15,00	6,05	9,40	3,70	-0,20	0,38
455	1,38	11,20	2,05	22,00	7,50	10,90	4,08	-0,20	0,36
456	1,02	9,45	1,68	16,00	6,58	8,35	3,50	-0,20	0,45
457	1,44	11,80	2,20	24,00	8,91	10,13	4,09	-0,20	0,52
458	0,87	9,74	1,70	17,00	7,01	8,59	3,79	0,62	0,42
459	1,01	9,22	1,60	17,00	7,98	8,12	3,37	-0,20	0,35
460	0,99	8,89	1,48	15,00	6,53	7,56	3,04	-0,20	0,34
461	1,06	8,46	1,63	18,00	6,17	6,27	2,61	-0,20	0,50
462				21,00	6,87	5,83		-0,20	0,35
463				43,00					
464	1,74	7,01	1,52	3,00	3,57	10,12	5,06	-0,20	0,49
465	1,06	6,48	1,35	5,00	4,91	9,75	3,58	-0,20	0,88
466	1,10	8,29	1,62	7,00	5,70	12,04	4,50	-0,20	0,74
467	1,16	10,10	1,96	12,00	7,51	13,59	5,18	-0,20	1,18
468	1,22	11,90	2,51	22,00	13,29	15,99	5,79	0,14	1,29

Observation #	K (mg/l)	Ca (mg/l)	Mg (mg/l)	HCO3 (Alkalinity) (mg/l)	Cl (mg/l)	SO4 (mg/l)	SO4_S (mg/l) (total sulphur by ICP-AES)	Br (mg/l)	F (mg/l)
469	1,03	10,10	2,10	17,00	8,69	12,18	4,79	-0,20	1,07
470	1,23	12,40	2,72	26,00	13,53	14,18	5,43	0,18	1,27
471	0,85	9,94	2,01	19,00	9,26	10,47	4,56	0,45	0,76
472	1,15	9,49	1,91	18,00	9,19	11,15	4,34	-0,20	0,80
473	1,04	8,29	1,65	12,00	6,62	10,27	4,01	-0,20	0,87
474	0,99	9,10	1,82	14,00	6,99	9,00	3,92	0,11	0,78
475				17,00	8,67	9,22		-0,20	1,10
476				25,00					
477									
478	2,84	15,40	3,34	7,00	6,38	31,89	12,80	0,07	1,24
479	2,23	14,40	3,06	6,00	5,64	26,07	11,10	-0,20	1,04
480	2,26	16,90	3,39	13,00	8,49	38,08	12,70	0,13	1,77
481	2,69	17,60	3,60	24,00	9,81	32,10	11,30	-0,20	1,81
482	2,81	18,00	3,78	36,00	11,53	32,08	10,40	-0,20	1,86
483	2,57	16,20	3,48	26,00	9,36	26,06	9,94	-0,20	1,62
484	3,04	18,70	3,99	39,00	13,62	29,54	10,20	0,12	2,00
485	2,41	18,10	3,76	30,00	10,18	29,45	11,50	0,10	1,42
486	2,65	17,10	3,61	27,00	9,91	31,42	11,20	0,07	1,59
487	2,21	14,60	3,12	21,00	8,53	26,76	9,41	0,11	1,55
488	3,05	16,10	3,44	29,00	10,23	24,13	8,80	-0,20	1,75
489				32,00	10,01	23,82		-0,20	1,86
490				40,00					
491									
492	1,59	27,80	3,56	20,00	6,01	34,95	11,90	0,16	0,81
493	1,14	27,30	3,32	30,00	5,57	32,40	11,00	-0,20	0,90
494	1,14	28,80	3,21	50,00	5,85	31,56	10,70	-0,20	0,71
495	1,17	33,50	3,65	64,00	6,86	35,92	12,30	-0,20	1,17
496	1,25	32,30	3,90	64,00	7,58	41,92	13,70	0,07	0,91
497	0,98	30,10	3,45	62,00	6,19	29,71	10,40	-0,20	1,01
498	1,07	32,70	3,86	80,00	24,01	33,63	10,60	0,10	1,21
499	0,81	33,40	3,66	74,00	6,07	30,65	11,80	0,41	0,98
500	1,09	30,40	3,41	71,00	6,28	29,92	10,60	-0,20	1,10
501	0,98	24,90	2,98	53,00	5,57	24,99	8,66	-0,20	0,93
502	1,13	28,60	3,28	65,00	5,61	23,31	8,57	-0,20	1,09
503				77,00	6,07	21,97		-0,20	1,33
504				79,00					
505									
506	3,11	16,90	3,83	1,00	8,12	33,02	15,30	0,47	0,69
507	2,88	14,10	3,08	2,00	8,79	25,26	12,20	0,32	0,53
508	3,33	17,20	3,79	3,00	11,21	49,54	16,20	0,63	0,57
509	2,94	21,20	4,62	6,00	11,45	62,65	20,60	0,79	0,69
510	3,12	21,80	4,98	15,00	15,46	66,38	20,00	1,01	0,72
511	2,68	18,50	4,22	9,00	14,16	52,15	17,20	0,68	0,92
512	3,46	23,30	5,37	20,00	17,74	64,29	20,80	1,03	1,01
513	2,59	18,80	4,29	12,00	51,17	56,50	18,20	0,77	0,75
514	2,79	18,00	4,13	10,00	14,46	52,01	17,40	0,64	0,79
515	2,71	16,40	3,74	8,00	13,97	43,69	14,50	0,59	0,76
516	2,95	17,50	4,01	9,00	12,44	43,81	15,50	0,52	0,86
517				14,00	14,24	48,23		0,69	0,80
518				59,00					
519	1,45	7,69	1,95	2,00	5,29	13,93	6,09	-0,20	0,25
520	1,34	7,50	1,92	3,00	7,05	14,54	5,57	-0,20	0,33

Observation #	K (mg/l)	Ca (mg/l)	Mg (mg/l)	HCO3 (Alkalinity) (mg/l)	Cl (mg/l)	SO4 (mg/l)	SO4_S (mg/l) (total sulphur by ICP-AES)	Br (mg/l)	F (mg/l)
521	1,43	8,22	2,02	6,00	8,78	15,19	5,44	0,00	0,40
522	1,42	9,72	2,42	8,00	10,82	17,35	6,45	-0,20	0,56
523	1,42	10,10	2,62	14,00	12,02	18,68	6,29	0,03	0,38
524	1,29	9,54	2,44	11,00	10,25	16,10	6,00	-0,20	0,43
525	1,44	11,10	2,90	17,00	13,39	17,83	6,55	-0,20	0,51
526	1,18	10,10	2,55	14,00	11,41	15,27	6,47	-0,20	0,34
527	1,41	9,76	2,46	14,00	12,30	16,60	6,00	0,08	0,44
528	1,30	9,05	2,27	11,00	11,22	15,22	5,57	-0,20	0,38
529	1,47	9,58	2,44	13,00	11,59	13,09	5,22	-0,20	0,50
530				17,00	12,25	13,19		-0,20	0,44
531				30,00					
532									
533	1,65	0,91	0,31	-0,20	1,05	1,70	0,73	0,09	0,08
534	-0,40	1,03	0,19		1,28	3,63	1,29	-0,20	0,53
535	-0,40	0,58	-0,09				0,51		
536	-0,40	0,23	-0,09	-0,20	1,22	0,87	0,35	-0,20	

Observation #	Si (mg/l) (as Si)	Fe (mg/l) Fetot (ICP-AES)	FeTot (mg/l) (Spectrophotometry)	Fe2+ (mg/l) (spectophotometry)	Mn (mg/l)	Li (mg/l)	Sr (mg/l)	TOC (mg/l)	DOC (mg/l)
1									
2									
3	8,41	2,30			0,06	0,02	0,07	7,10	
4	6,51	0,36			0,02	0,02	0,07	6,30	
5	4,19	0,04			0,03	0,02	0,19	4,50	
6	4,35	0,05			0,03	0,02	0,20	4,40	
7	5,27	0,40			0,05		0,32	5,00	
8									
9									
10									
11									
12									
13	4,43	2,76			0,53	0,34	17,30		
14	4,48	7,26			0,55	0,09	3,72		
15	3,11	5,50			0,74	0,24	12,50		
16									
17	2,32	0,07			0,81	0,16	9,50		
18									
19	2,79	1,60			0,72	0,22	11,50		
20									
21	3,29	2,69			0,66	0,28	14,40		
22									
23	3,58	2,30			0,59	0,32	16,50		
24									
25	4,01	1,87			0,63	0,37	18,80		
26	4,29	1,96			0,65	0,35	17,60		
27	4,27	2,65			0,64	0,28	14,00		
28	4,18	3,58			0,62	0,23	11,70		
29	4,03	3,12			0,58	0,15	7,58		
30									
31	3,62	1,36			0,51	0,07	3,46		
32	4,23	1,84			0,60	0,33	17,00		
33	3,69	0,82			0,56	0,33	16,50		
34	3,47	0,54			0,51	0,30	14,80		-1,00
35	-0,04	-0,02			-0,01	-0,01	-0,01		-1,00
36	3,70	0,78			0,54	0,31	15,60		1,30
37	3,53	0,77			0,51	0,30	14,90		1,00
38	-0,04	-0,02			-0,01	-0,01	-0,01		-1,00
39	-0,04	-0,02			-0,01	-0,01	-0,01		-1,00
40	3,39	1,15	1,41	1,40	0,54	0,31	15,90	0,90	0,90
41	3,65	1,31	1,60	1,57	0,54	0,30	16,30		
42	3,60	1,38	1,70	1,68	0,54	0,31	16,60	1,10	1,00
43	3,66	1,44	1,77	1,74	0,55	0,31	16,80		1,20
44	3,73	1,15	1,47	1,46	0,56	0,31	15,60	1,20	1,20
45									
46	3,76	1,38	1,60	1,59	0,58	0,30	15,00		1,50
47									
48	3,71	0,52			0,54	0,31	15,60		1,30
49									
50	3,77	1,13			0,54	0,32	15,80		1,00
51									
52									

Observation #	Si (mg/l) (as Si)	Fe (mg/l) Fetot (ICP-AES)	FeTot (mg/l) (Spectrophotometry)	Fe2+ (mg/l) (spectophotometry)	Mn (mg/l)	Li (mg/l)	Sr (mg/l)	TOC (mg/l)	DOC (mg/l)
53									
54									
55									
56									
57									
58									
59									
60									
61									
62									
63			1,28	1,27					
64	3,76	0,36	1,32	1,30	0,66	0,38	19,60		
65			1,37	1,34					
66			1,37	1,34					
67	3,48	1,03	1,32	1,30	0,55	0,37	19,00		
68	3,76	0,36	1,32	1,30	0,66	0,38	19,60		
69									
70	3,48	1,03	1,32	1,30	0,55	0,37	19,00		
71			1,32	1,34					
72									
73									
74	6,83	1,10			0,06	0,02	0,25		
75	3,78	3,07			0,19	0,28	21,50		
76									
77									
78									
79									
80									
81									
82									
83									
84									
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102									
103									
104									

Observation #	Si (mg/l) (as Si)	Fe (mg/l) Fetot (ICP-AES)	FeTot (mg/l) (Spectrophotometry)	Fe2+ (mg/l) (spectophotometry)	Mn (mg/l)	Li (mg/l)	Sr (mg/l)	TOC (mg/l)	DOC (mg/l)
105									
106									
107									
108									
109									
110									
111									
112									
113									
114									
115									
116	11,80	14,80			0,80	0,01	0,08		
117	11,80	14,80			0,80	0,01	0,08		
118	4,88	0,99			0,34	0,01	0,27		
119	4,88	0,99			0,34	0,01	0,27		
120	11,20	42,30			6,05	0,00	0,26		
121	11,20	42,30			6,05	0,00	0,26		
122									
123	0,34	0,01			0,00	0,04	1,38		
124	0,34	0,01			0,00	0,04	1,38		
125	0,40	-0,02			0,00	0,03	1,38		
126	0,37	-0,02			0,00	0,03	1,39		
127	0,41	-0,02			0,00	0,03	1,31		
128	0,39	-0,02			0,00	0,03	1,31		
129	0,36	-0,02			-0,01	0,03	1,29		
130	0,36	-0,02			-0,01	0,03	1,29		
131	0,43	-0,02			-0,01	0,03	1,43		
132	0,72	-0,02			-0,01	0,04	1,60		
133	0,26	-0,02			-0,01	0,03	1,41		
134	0,34	-0,02			-0,01	0,03	1,46		
135	0,18	0,02			-0,01	0,04	1,45		
136	0,24	-0,02			-0,01	0,03	1,43		
137	0,22	-0,02			-0,01	0,03	1,43		
138	0,19	-0,02			-0,01	0,03	1,46		
139	0,30	-0,02			-0,01	0,03	1,48		
140									
141									
142									
143									
144									
145									
146	0,40	0,02			0,00	0,04	1,34		
147	0,41	0,01			0,00	0,04	1,36		
148	0,47	-0,02			0,00	0,03	1,36		
149	0,46	-0,02			0,00	0,03	1,37		
150	0,49	-0,02			0,00	0,03	1,38		
151	0,50	-0,02			0,00	0,03	1,38		
152	0,51					0,03	1,31		
153	0,51	-0,02			0,00	0,03	1,31		
154	0,43	-0,02			-0,01	0,03	1,28		
155	0,49	-0,02			-0,01	0,03	1,30		
156	0,09	-0,02			-0,01	0,03	1,42		

Observation #	Si (mg/l) (as Si)	Fe (mg/l) Fetot (ICP-AES)	FeTot (mg/l) (Spectrophotometry)	Fe2+ (mg/l) (spectophotometry)	Mn (mg/l)	Li (mg/l)	Sr (mg/l)	TOC (mg/l)	DOC (mg/l)
157	0,15	-0,02			-0,01	0,03	1,43		
158	-0,04	-0,02			-0,01	0,04	1,43		
159	0,04	-0,02			-0,01	0,04	1,42		
160	0,12	-0,02			-0,01	0,03	1,41		
161	0,09	-0,02			-0,01	0,03	1,42		
162	0,16	-0,02			-0,01	0,03	1,45		
163	0,12	-0,02			-0,01	0,03	1,46		
164									
165									
166									
167									
168									
169	5,62	0,39			0,04	0,01	0,48		
170	2,58	0,18			0,04	0,02	1,00		
171	6,08	0,45			0,04	0,01	0,40		
172	3,01	0,21			0,04	0,02	0,94		
173	5,75	0,44			0,03	0,01	0,41		
174									
175	3,33	0,26			0,04	0,02	0,86		
176	2,48	0,17			0,02	0,02	1,00		
177	2,64	0,15			0,02	0,02	1,04		
178	2,47	0,13			0,02	0,02	1,07		
179	3,66	0,27			0,03	0,02	0,94		
180	2,18	0,12			0,02	0,02	1,17		
181	1,31	0,07			-0,01	0,03	1,07		
182	1,31	0,07			-0,01	0,03	1,07		
183	2,15	0,10			0,01	0,02	0,78		
184	2,26	0,12			0,01	0,02	0,77		
185	2,84	0,23			0,01	-0,01	0,66		
186	1,82	0,13			0,01	0,02	0,88		
187									
188									
189									
190									
191									
192	0,68	0,03			0,00	0,04	1,31		
193	0,64	0,02			0,00	0,04	1,32		
194	0,77	-0,02			0,00	0,03	1,30		
195	0,60	-0,02			0,03	0,03	1,34		
196	0,92	0,02			0,00	0,03	1,28		
197	0,91	0,03			0,00	0,03	1,28		
198	0,60	-0,02			0,00	0,03	1,28		
199	0,65	-0,02			0,00	0,03	1,25		
200	0,74	-0,02			-0,01	0,03	1,32		
201	0,70	-0,02			-0,01	0,03	1,35		
202	0,75	-0,02			0,00	0,03	1,41		
203	0,54	-0,02			0,00	0,03	1,46		
204	-0,04	-0,02			-0,01	0,04	1,40		
205	-0,04	-0,02			-0,01	0,04	1,40		
206	0,09	-0,02			-0,01	0,03	1,35		
207	0,09	-0,02			-0,01	0,03	1,36		
208	0,21	-0,02			-0,01	0,03	1,39		

Observation #	Si (mg/l) (as Si)	Fe (mg/l) Fetot (ICP-AES)	FeTot (mg/l) (Spectrophotometry)	Fe2+ (mg/l) (spectophotometry)	Mn (mg/l)	Li (mg/l)	Sr (mg/l)	TOC (mg/l)	DOC (mg/l)
209	0,16	-0,02			-0,01	0,02	1,22		
210									
211									
212									
213									
214									
215	3,69	0,28			0,02	0,02	0,77		
216	1,02	0,05			0,01	0,03	1,27		
217	5,37	0,46			0,02	0,01	0,51		
218	1,17	0,07			0,01	0,03	1,27		
219	1,01	0,09			0,02	0,03	1,23		
220	4,53	0,36			0,02	0,01	0,61		
221	3,99	0,42			0,05	0,02	0,74		
222	1,29	0,10			0,02	0,03	1,19		
223	3,07	0,20			0,02	0,02	1,01		
224	1,43	0,10			0,02	0,03	1,27		
225	2,60	0,17			0,02	0,02	1,12		
226	1,33	0,18			0,02	0,03	1,32		
227	0,83	0,05			-0,01	0,03	1,22		
228	1,06	0,10			0,01	0,03	1,29		
229	0,84	0,04			-0,01	0,02	0,98		
230	0,99	0,05			0,01	0,03	1,26		
231	1,16	0,09			-0,01	0,02	0,98		
232	0,74	0,03			0,02	0,02	1,24		
233									
234									
235									
236									
237									
238	3,81	0,72			0,04	0,00	0,04		
239	3,84	0,72			0,04	0,00	0,04		
240	4,20	0,71			0,04	0,00	0,04		
241	4,24	0,71			0,05	0,00	0,04		
242	4,42	0,74			0,05	0,00	0,04		
243	4,38	0,70			0,04	0,00	0,04		
244	5,37	0,78			0,05	0,00	0,04		
245	5,32	0,76			0,05	0,00	0,04		
246	5,75	0,76			0,05	0,00	0,04		
247	5,51	0,82			0,06	0,00	0,04		
248	5,92	0,68			0,05	0,00	0,04		
249	5,40	1,09			0,13	0,00	0,05		
250	5,51	0,66			0,06	0,00	0,04		
251	5,45	1,13			0,13	0,00	0,04		
252	5,11	0,76			0,09	0,00	0,04		
253	5,16	0,78			0,09	0,00	0,04		
254	5,25	0,76			0,07	0,00	0,04		
255	5,26	0,77			0,07	0,00	0,04		
256	4,96	0,70			0,05	0,00	0,04		
257	4,94	0,68			0,05	0,00	0,04		
258									
259									
260									

Observation #	Si (mg/l) (as Si)	Fe (mg/l) Fetot (ICP-AES)	FeTot (mg/l) (Spectrophotometry)	Fe2+ (mg/l) (spectophotometry)	Mn (mg/l)	Li (mg/l)	Sr (mg/l)	TOC (mg/l)	DOC (mg/l)
261									
262									
263	2,15	0,04			0,03	0,00	0,06		
264	2,61	0,07			0,04	0,00	0,06		
265	2,10	0,05			0,03	0,00	0,06		
266	2,42	0,07			0,03	0,00	0,05		
267	2,23	0,06			0,03	0,00	0,06		
268	2,24	0,06			0,03	0,00	0,06		
269	2,35	0,06			0,03	0,00	0,06		
270	3,28	0,21			0,11	0,00	0,05		
271	2,79	0,07			0,02	0,00	0,06		
272	3,17	0,23			0,21	0,00	0,06		
273	2,39	0,05			0,02	0,00	0,06		
274	3,30	0,28			0,32	0,00	0,06		
275	2,65	0,08			0,05	0,00	0,05		
276	3,17	0,26			0,34	0,00	0,06		
277	2,54	0,08			0,06	0,00	0,06		
278	2,56	0,08			0,06	0,00	0,06		
279	2,57	0,09			0,05	0,00	0,05		
280	2,56	0,09			0,04	0,00	0,05		
281	2,65	0,11			0,05	0,00	0,05		
282	2,61	0,09			0,03	0,00	0,06		
283									
284									
285									
286									
287									
288	4,27	1,74			0,14	0,00	0,05		
289	4,41	1,63			0,13	0,00	0,05		
290	4,27	1,57			0,12	0,00	0,05		
291	4,26	1,58			0,12	0,00	0,05		
292	4,43	1,45			0,10	0,00	0,04		
293	4,43	1,47			0,11	0,00	0,04		
294	4,44	1,44			0,13	0,00	0,04		
295	4,63	1,41			0,09	0,00	0,04		
296	4,75	1,35			0,09	0,00	0,04		
297	5,28	1,34			0,16	0,00	0,05		
298	5,24	1,36			0,09	0,00	0,04		
299	5,63	1,34			0,16	0,00	0,05		
300	4,93	1,27			0,09	0,00	0,05		
301	5,65	1,64			0,21	0,00	0,06		
302	4,98	1,12			0,15	0,00	0,05		
303	4,99	1,14			0,15	0,00	0,05		
304	4,96	1,23			0,14	0,00	0,04		
305	4,93	1,11			0,12	0,00	0,04		
306	5,17	1,33			0,16	0,00	0,04		
307	4,98	1,02			0,08	0,00	0,04		
308									
309									
310									
311									
312									

Observation #	Si (mg/l) (as Si)	Fe (mg/l) Fetot (ICP-AES)	FeTot (mg/l) (Spectrophotometry)	Fe2+ (mg/l) (spectophotometry)	Mn (mg/l)	Li (mg/l)	Sr (mg/l)	TOC (mg/l)	DOC (mg/l)
313	5,36	1,36			0,04	0,00	0,04		
314	5,37	1,36			0,04	0,00	0,03		
315	5,74	1,37			0,03	0,00	0,04		
316	6,47	1,35			0,09	0,00	0,05		
317	6,56	1,34			0,07	0,00	0,04		
318	6,77	1,27			0,09	0,00	0,05		
319	4,83	1,00			0,06	0,00	0,03		
320	5,65	1,66			0,09	0,00	0,04		
321	5,24	1,30			0,07	0,00	0,04		
322	5,29	1,39			0,10	0,00	0,04		
323									
324									
325	4,30	1,57			0,12	0,00	0,05		
326	4,40	1,46			0,10	0,00	0,04		
327	4,57	1,42			0,09	0,00	0,04		
328	4,95	1,42			0,09	0,00	0,04		
329	5,59	1,23			0,08	0,00	0,04		
330	5,52	1,30			0,09	0,00	0,05		
331	4,09	1,00			0,10	0,00	0,04		
332	4,97	1,02			0,12	0,00	0,05		
333	4,88	1,12			0,10	0,00	0,04		
334	4,92	1,05			0,09	0,00	0,04		
335									
336									
337	7,59	0,86			0,03	0,00	0,06		
338	8,03	1,05			0,09	0,00	0,06		
339	9,19	2,12			0,31	0,00	0,08		
340	8,57	1,21			0,14	0,00	0,07		
341	8,59	1,04			0,13	0,00	0,08		
342	7,41	0,71			0,09	0,00	0,06		
343	7,21	0,43			0,09	0,00	0,06		
344	6,66	0,56			0,05	0,00	0,05		
345	7,12	0,76			0,10	0,00	0,06		
346									
347									
348	5,57	1,20			0,03	0,00	0,04		
349	5,67	1,26			0,03	0,00	0,04		
350	5,92	1,45			0,06	0,00	0,05		
351	6,45	1,28			0,04	0,00	0,05		
352	6,41	1,26			0,05	0,00	0,05		
353	5,59	1,15			0,04	0,00	0,05		
354	6,02	1,00			0,06	0,00	0,05		
355	5,89	1,30			0,06	0,00	0,05		
356	5,58	1,17			0,07	0,00	0,05		
357									
358									
359	4,96	1,03			0,05	0,00	0,02		
360									
361	6,63	1,67			0,10	0,00	0,03		
362	6,08	1,24			0,06	0,00	0,03		
363	6,64	1,40			0,06	0,00	0,03		
364	5,21	0,70			0,04	0,00	0,02		

Observation #	Si (mg/l) (as Si)	Fe (mg/l) Fetot (ICP-AES)	FeTot (mg/l) (Spectrophotometry)	Fe2+ (mg/l) (spectophotometry)	Mn (mg/l)	Li (mg/l)	Sr (mg/l)	TOC (mg/l)	DOC (mg/l)
365	4,99	0,63			0,04	0,00	0,02		
366	4,60	0,84			0,04	0,00	0,02		
367	4,20	1,45			0,05	0,00	0,03		
368									
369									
370	8,04	0,61			0,02	0,00	0,05		
371	8,25	0,75			0,01	0,00	0,05		
372	8,48	0,88			0,02	0,00	0,05		
373	9,63	1,04			0,03	0,00	0,07		
374	9,33	0,83			0,04	0,00	0,06		
375	9,58	0,83			0,04	0,00	0,07		
376	8,35	0,73			0,06	0,00	0,06		
377									
378	7,70	0,68			0,06	0,00	0,05		
379	8,13	0,95			0,11	0,00	0,05		
380									
381									
382	10,80	1,12			0,04	0,00	0,05		
383	11,30	1,29			0,05	0,00	0,05		
384	11,90	1,52			0,08	0,00	0,06		
385	11,90	1,40			0,07	0,00	0,05		
386	12,10	1,71			0,10	0,00	0,06		
387	11,30	1,38			0,07	0,00	0,05		
388	11,80	1,27			0,08	0,00	0,06		
389	10,60	1,44			0,07	0,00	0,05		
390	10,60	2,05			0,10	0,00	0,05		
391									
392									
393	7,52	0,70			0,04	0,00	0,03		
394	7,66	1,09			0,04	0,00	0,04		
395	7,44	1,27			0,04	0,00	0,04		
396	7,25	1,51			0,06	0,01	0,05		
397	7,91	1,20			0,05	0,00	0,04		
398	7,52	1,34			0,05	0,01	0,05		
399	7,30	1,05			0,04	0,00	0,05		
400	7,70	0,89			0,05	0,00	0,05		
401	7,62	1,08			0,05	0,00	0,05		
402	7,00	1,27			0,06	0,00	0,05		
403									
404									
405	8,50	0,60			0,04	0,00	0,03		
406	10,40	0,81			0,04	0,00	0,03		
407	11,00	0,84			0,04	0,00	0,03		
408	12,00	0,83			0,05	0,00	0,03		
409	11,30	0,76			0,04	0,00	0,03		
410	12,30	0,70			0,04	0,00	0,03		
411	10,90	0,58			0,04	0,00	0,03		
412	11,10	0,58			0,04	0,00	0,03		
413	9,95	0,66			0,03	0,00	0,03		
414	10,10	0,89			0,04	0,00	0,03		
415									
416									

Observation #	Si (mg/l) (as Si)	Fe (mg/l) Fetot (ICP-AES)	FeTot (mg/l) (Spectrophotometry)	Fe2+ (mg/l) (spectophotometry)	Mn (mg/l)	Li (mg/l)	Sr (mg/l)	TOC (mg/l)	DOC (mg/l)
417	7,84	0,68			0,04	0,00	0,03		
418	8,01	1,06			0,04	0,00	0,04		
419	7,78	1,24			0,04	0,00	0,04		
420	7,76	1,45			0,06	0,00	0,05		
421	8,33	1,18			0,05	0,00	0,04		
422	8,01	1,34			0,06	0,00	0,05		
423	7,67	1,02			0,04	0,00	0,05		
424	8,08	0,88			0,05	0,00	0,05		
425	7,78	1,05			0,05	0,00	0,04		
426	7,34	1,24			0,05	0,00	0,05		
427									
428									
429	7,16	0,89			0,03	0,00	0,03		
430	7,90	0,94			0,03	0,00	0,03		
431	9,09	1,67			0,05	0,00	0,04		
432	8,30	1,02			0,05	0,00	0,03		
433	8,85	1,44			0,06	0,00	0,04		
434	6,81	0,54			0,03	0,00	0,03		
435	7,29	0,48			0,03	0,00	0,03		
436	5,90	0,64			0,03	0,00	0,03		
437	5,98	0,90			0,04	0,00	0,03		
438									
439									
440	7,22	0,63			0,02	0,00	0,03		
441	8,38	0,84			0,02	0,00	0,03		
442	9,13	0,95			0,03	0,00	0,04		
443	9,67	1,46			0,06	0,00	0,04		
444	9,46	0,99			0,04	0,00	0,04		
445	9,99	1,28			0,07	0,00	0,04		
446	8,20	0,74			0,04	0,00	0,04		
447	8,07	0,70			0,05	0,00	0,04		
448	7,64	0,84			0,05	0,00	0,03		
449	7,82	1,53			0,09	0,00	0,04		
450									
451									
452	7,14	0,69			0,03	0,00	0,03		
453	8,12	0,91			0,03	0,00	0,03		
454	8,76	1,04			0,04	0,00	0,04		
455	9,24	1,15			0,07	0,00	0,04		
456	9,11	1,00			0,05	0,00	0,04		
457	9,41	1,08			0,07	0,00	0,05		
458	8,03	0,75			0,05	0,00	0,04		
459	8,03	0,81			0,06	0,00	0,04		
460	7,33	0,80			0,05	0,00	0,03		
461	6,59	1,16			0,06	0,00	0,03		
462									
463									
464	8,40	0,95			0,04	0,00	0,03		
465	7,69	0,90			0,03	0,00	0,03		
466	8,93	1,22			0,03	0,00	0,04		
467	9,62	1,21			0,04	0,00	0,04		
468	9,74	1,78			0,13	0,00	0,06		

Observation #	Si (mg/l) (as Si)	Fe (mg/l) Fetot (ICP-AES)	FeTot (mg/l) (Spectrophotometry)	Fe2+ (mg/l) (spectophotometry)	Mn (mg/l)	Li (mg/l)	Sr (mg/l)	TOC (mg/l)	DOC (mg/l)
469	10,10	1,36			0,09	0,00	0,05		
470	10,50	1,86			0,10	0,00	0,06		
471	8,50	0,98			0,07	0,00	0,04		
472	8,46	1,02			0,06	0,00	0,04		
473	7,51	0,94			0,03	0,00	0,04		
474	8,10	1,41			0,03	0,00	0,04		
475									
476									
477									
478	10,70	0,61			0,10	0,00	0,07		
479	10,10	0,86			0,08	0,00	0,06		
480	10,80	0,98			0,10	0,00	0,07		
481	9,75	0,98			0,11	0,00	0,07		
482	9,07	1,07			0,14	0,00	0,07		
483	9,94	0,90			0,13	0,00	0,06		
484	9,02	1,11			0,13	0,00	0,07		
485	9,76	1,03			0,11	0,00	0,07		
486	10,00	0,85			0,12	0,00	0,07		
487	9,13	0,82			0,10	0,00	0,06		
488	9,18	1,17			0,08	0,00	0,06		
489									
490									
491									
492	11,40	0,23			0,03	0,00	0,09		
493	11,10	0,36			0,04	0,01	0,08		
494	11,10	0,42			0,04	0,00	0,08		
495	10,90	0,46			0,06	0,00	0,09		
496	9,90	0,59			0,10	0,00	0,09		
497	10,90	0,43			0,07	0,00	0,08		
498	10,20	0,55			0,09	0,00	0,09		
499	10,40	0,43			0,07	0,00	0,09		
500	10,10	0,43			0,15	0,00	0,08		
501	9,57	0,49			0,09	0,00	0,07		
502	10,80	0,77			0,09	0,00	0,08		
503									
504									
505									
506	13,60	0,50			0,11	0,01	0,08		
507	11,60	0,71			0,08	0,00	0,06		
508	13,40	0,82			0,10	0,00	0,07		
509	13,80	0,67			0,12	0,01	0,08		
510	13,00	0,71			0,14	0,01	0,09		
511	13,60	0,73			0,12	0,01	0,07		
512	12,90	0,67			0,14	0,01	0,09		
513	13,10	0,67			0,12	0,01	0,07		
514	13,30	0,61			0,12	0,00	0,07		
515	12,10	0,73			0,11	0,00	0,07		
516	13,10	1,05			0,12	0,00	0,07		
517									
518									
519	8,88	0,54			0,06	0,00	0,04		
520	8,59	0,75			0,05	0,00	0,04		

Observation #	Si (mg/l) (as Si)	Fe (mg/l) Fetot (ICP-AES)	FeTot (mg/l) (Spectrophotometry)	Fe2+ (mg/l) (spectophotometry)	Mn (mg/l)	Li (mg/l)	Sr (mg/l)	TOC (mg/l)	DOC (mg/l)
521	8,40	1,01			0,03	0,00	0,04		
522	8,32	1,17			0,04	0,00	0,05		
523	8,31	1,32			0,07	0,00	0,05		
524	8,77	1,15			0,05	0,00	0,05		
525	8,33	1,22			0,06	0,00	0,06		
526	8,11	1,01			0,05	0,00	0,05		
527	8,23	0,96			0,05	0,00	0,05		
528	8,17	1,01			0,05	0,00	0,05		
529	7,78	1,27			0,06	0,00	0,05		
530									
531									
532									
533	0,10	0,01			0,05	0,00	0,00		13,00
534	-0,03	0,02			0,01	0,00	0,01		
535	0,04	0,02			0,01	0,00	0,01		
536	-0,03					0,00	0,00		

Observation #	S2 (mg/l) (hydrogen sulphide analysed	I (mg/l)	No2n (mg/l)	No3n (mg/l)	No3 N No2 N (mg/l)	NH4_N (mg/l) (Ammonium as Nitrogen)	Po4 P (mg/l)	U (µg/l)	Th (µg/l)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34							-0,04		
35									
36							-0,04		
37							-0,04		
38							-0,04		
39							0,00		
40	0,00	0,13	0,00	0,00	0,00	0,10	0,00	0,14	-0,20
41	0,01	0,14	0,00	0,00	0,00	0,10	0,00		
42	0,00	0,13	0,00	0,00	0,00	0,08	0,00	0,13	-0,20
43	0,00	0,14	0,00	0,00	0,00	0,02	0,00		
44	0,00	0,12	0,00	0,00	0,00	0,08	0,00	0,14	-0,20
45									
46	0,01	0,12		0,00	0,00	0,08	0,00		
47									
48							-0,04		
49									
50							-0,04		
51									
52									

Observation #	S2 (mg/l) (hydrogen sulphide analysed	I (mg/l)	No2n (mg/l)	No3n (mg/l)	No3 N No2 N (mg/l)	NH4_N (mg/l) (Ammonium as Nitrogen)	Po4 P (mg/l)	U (μg/l)	Th (μg/l)
53									
54									
55									
56									
57									
58									
59									
60									
61									
62									
63	0,01		0,00	0,00	0,00	0,08	0,00		
64	0,00	0,19	0,00	0,00	0,00	0,08	0,00	0,17	-0,02
65	0,01		0,00	0,00	0,00	0,08	0,00		
66	0,01		0,00	0,00	0,00	0,08	0,00		
67	0,01	0,19	0,00	0,00	0,00	0,08	0,00	0,16	-0,20
68	0,00	0,19	0,00	0,00	0,00	0,08	0,00	0,17	-0,02
69									
70	0,01	0,19	0,00	0,00	0,00	0,08	0,00	0,16	-0,20
71	0,01		0,00	0,00	0,00	0,10	0,00	1,01	-0,20
72									
73									
74									
75									
76									
77									
78									
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102									
103									
104									

Observation #	S2 (mg/l) (hydrogen sulphide analysed	I (mg/l)	No2n (mg/l)	No3n (mg/l)	No3 N No2 N (mg/l)	NH4_N (mg/l) (Ammonium as Nitrogen)	Po4 P (mg/l)	U (µg/l)	Th (µg/l)
105									
106									
107									
108									
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129									
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131									
132									
133									
134									
135									
136		0,01							
137		0,01							
138									
139									
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143									
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146									
147									
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151									
152									
153									
154									
155									
156									

Observation #	S2 (mg/l) (hydrogen sulphide analysed	I (mg/l)	No2n (mg/l)	No3n (mg/l)	No3 N No2 N (mg/l)	NH4_N (mg/l) (Ammonium as Nitrogen)	Po4 P (mg/l)	U (µg/l)	Th (µg/l)
157									
158									
159									
160		0,01							
161		0,01							
162									
163									
164									
165									
166									
167									
168									
169									
170									
171									
172									
173									
174									
175									
176									
177									
178									
179					0,20	0,08	-0,01		
180					0,20	0,05	0,01		
181									
182									
183		0,01							
184		0,01							
185									
186									
187									
188									
189									
190									
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195									
196									
197									
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199									
200									
201									
202									
203									
204									
205									
206		0,01							
207		0,01							
208									

Observation #	S2 (mg/l) (hydrogen sulphide analysed	I (mg/l)	No2n (mg/l)	No3n (mg/l)	No3 N No2 N (mg/l)	NH4_N (mg/l) (Ammonium as Nitrogen)	Po4 P (mg/l)	U (µg/l)	Th (µg/l)
209									
210									
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219									
220									
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222									
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224									
225									
226									
227									
228									
229		0,01							
230		0,02							
231									
232									
233									
234									
235									
236									
237									
238									
239									
240									
241									
242									
243									
244									
245									
246									
247									
248					0,40	0,10	-0,01		
249					0,38	0,26	-0,01		
250									
251									
252									
253									
254		0,03							
255		0,03							
256									
257									
258									
259									
260									

Observation #	S2 (mg/l) (hydrogen sulphide analysed	I (mg/l)	No2n (mg/l)	No3n (mg/l)	No3 N No2 N (mg/l)	NH4_N (mg/l) (Ammonium as Nitrogen)	Po4 P (mg/l)	U (µg/l)	Th (µg/l)
261									
262									
263									
264									
265									
266									
267									
268									
269									
270									
271									
272									
273					0,20	0,02	-0,01		
274					0,33	0,03	-0,01		
275									
276									
277									
278									
279		0,01							
280		0,02							
281									
282									
283									
284									
285									
286									
287									
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292									
293									
294									
295									
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297									
298									
299									
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301									
302									
303									
304		0,00							
305		0,00							
306									
307									
308									
309									
310									
311									
312									

Observation #	S2 (mg/l) (hydrogen sulphide analysed	I (mg/l)	No2n (mg/l)	No3n (mg/l)	No3 N No2 N (mg/l)	NH4_N (mg/l) (Ammonium as Nitrogen)	Po4 P (mg/l)	U (µg/l)	Th (µg/l)
313									
314									
315									
316									
317									
318									
319									
320									
321		0,00							
322									
323									
324									
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328									
329									
330									
331									
332									
333		0,00							
334									
335									
336									
337									
338									
339									
340									
341									
342									
343									
344		0,00							
345									
346									
347									
348									
349									
350									
351									
352					0,32	0,08	-0,01		
353									
354									
355		0,00							
356									
357									
358									
359									
360									
361									
362									
363					0,12	0,09	-0,01		
364									

Observation #	S2 (mg/l) (hydrogen sulphide analysed	I (mg/l)	No2n (mg/l)	No3n (mg/l)	No3 N No2 N (mg/l)	NH4_N (mg/l) (Ammonium as Nitrogen)	Po4 P (mg/l)	U (µg/l)	Th (µg/l)
365									
366		0,00							
367									
368									
369									
370									
371									
372									
373									
374									
375					0,21	0,12	0,01		
376									
377									
378		0,00							
379									
380									
381									
382									
383									
384									
385									
386									
387									
388									
389		0,02							
390									
391									
392									
393									
394									
395									
396									
397									
398									
399									
400									
401		0,00							
402									
403									
404									
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407									
408									
409									
410									
411									
412									
413		0,01							
414									
415									
416									

Observation #	S2 (mg/l) (hydrogen sulphide analysed	I (mg/l)	No2n (mg/l)	No3n (mg/l)	No3 N No2 N (mg/l)	NH4_N (mg/l) (Ammonium as Nitrogen)	Po4 P (mg/l)	U (µg/l)	Th (µg/l)
417									
418									
419									
420									
421									
422									
423									
424									
425		0,00							
426									
427									
428									
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430									
431									
432									
433									
434									
435									
436		0,00							
437									
438									
439									
440									
441									
442									
443									
444									
445									
446									
447									
448		0,01							
449									
450									
451									
452									
453									
454									
455									
456									
457									
458									
459									
460		0,00							
461									
462									
463									
464									
465									
466									
467									
468									

Observation #	S2 (mg/l) (hydrogen sulphide analysed	I (mg/l)	No2n (mg/l)	No3n (mg/l)	No3 N No2 N (mg/l)	NH4_N (mg/l) (Ammonium as Nitrogen)	Po4 P (mg/l)	U (µg/l)	Th (µg/l)
469									
470									
471									
472									
473		0,01							
474									
475									
476									
477									
478									
479									
480									
481									
482									
483									
484									
485									
486									
487		0,01							
488									
489									
490									
491									
492									
493									
494									
495									
496									
497									
498					0,51	0,22	0,01		
499									
500									
501		0,01							
502									
503									
504									
505									
506									
507									
508									
509									
510									
511									
512					0,64	0,11	0,01		
513									
514									
515		0,04							
516									
517									
518									
519									
520									

Observation #	S2 (mg/l) (hydrogen sulphide analysed	I (mg/l)	No2n (mg/l)	No3n (mg/l)	No3 N No2 N (mg/l)	NH4_N (mg/l) (Ammonium as Nitrogen)	Po4 P (mg/l)	U (µg/l)	Th (µg/l)
521									
522									
523									
524									
525									
526									
527									
528		0,01							
529									
530									
531									
532									
533									
534									
535									
536									

Observation #	Al (µg/l)	ARS	Sc (µg/l)	Cd	Cr (µg/l)	Cu	Co (µg/l)	Hg	Ni (µg/l)
1									
2									
3									
4									
5									
6									
7									
8									
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31									
32									
33									
34	-0,70			-0,05	-0,10	0,58	0,15	0,00	1,32
35	-0,70			-0,05	-0,10	-0,50	-0,05	0,00	-0,50
36	-0,70			-0,05	0,17	-0,50	0,18	0,00	2,26
37	-0,70			-0,05	0,13	-0,50	0,18	0,00	2,36
38	-0,70			-0,05	-0,10	-0,50	-0,05	0,00	-0,50
39	0,36			0,00	0,02	-0,10	0,04	0,00	-0,05
40	22,50	-1,00	-0,50	-0,05	0,33	0,75	0,17	0,00	1,59
41									
42	5,80		-0,50	-0,02	1,15	-1,00	0,17	0,00	2,48
43									
44	5,60	-1,00	-0,50	-0,02	0,57	1,18	0,17	0,00	1,97
45									
46									
47									
48	-0,70			-0,05	0,14	-0,50	0,18	0,00	1,54
49									
50	-0,70			-0,05	0,20	-0,50	0,19	0,00	1,27
51									
52									

Observation #	Al (μg/l)	ARS	Sc (μg/l)	Cd	Cr (μg/l)	Cu	Co (μg/l)	Hg	Ni (μg/l)
53									
54									
55									
56									
57									
58									
59									
60									
61	421,00			0,45	17,20	21,50	1,70	-0,02	66,50
62									
63									
64	4,10	-1,00	0,03	0,03	0,47	-1,00	0,13	0,00	1,27
65									
66									
67	-0,70	-1,00	-0,50	-0,05	0,22	-0,50	0,17	0,00	1,19
68	4,10	-1,00	0,03	0,03	0,47	-1,00	0,13	0,00	1,27
69	4,12			0,17	0,62	3,78	0,49	0,00	44,40
70	-0,70	-1,00	-0,50	-0,05	0,22	-0,50	0,17	0,00	1,19
71	-0,70	-1,00	-0,50	-0,05	0,66	-0,50	0,25	0,00	1,75
72									
73									
74									
75									
76									
77									
78									
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102									
103									
104									

Observation #	Al (μg/l)	ARS	Sc (μg/l)	Cd	Cr (μg/l)	Cu	Co (μg/l)	Hg	Ni (μg/l)
105									
106									
107									
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156									

Observation #	Al (µg/l)	ARS	Sc (µg/l)	Cd	Cr (µg/l)	Cu	Co (µg/l)	Hg	Ni (µg/l)
157									
158									
159									
160									
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208									

Observation #	Al (µg/l)	ARS	Sc (µg/l)	Cd	Cr (µg/l)	Cu	Co (µg/l)	Hg	Ni (µg/l)
209									
210									
211									
212									
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260									

Observation #	Al (μg/l)	ARS	Sc (μg/l)	Cd	Cr (μg/l)	Cu	Co (μg/l)	Hg	Ni (μg/l)
261									
262									
263									
264									
265									
266									
267									
268									
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312									

Observation #	Al (μg/l)	ARS	Sc (μg/l)	Cd	Cr (μg/l)	Cu	Co (μg/l)	Hg	Ni (μg/l)
313									
314									
315									
316									
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364									

Observation #	Al (µg/l)	ARS	Sc (µg/l)	Cd	Cr (µg/l)	Cu	Co (µg/l)	Hg	Ni (µg/l)
365									
366									
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413									
414									
415									
416									

Observation #	Al (μg/l)	ARS	Sc (μg/l)	Cd	Cr (μg/l)	Cu	Co (μg/l)	Hg	Ni (μg/l)
417									
418									
419									
420									
421									
422									
423									
424									
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466									
467									
468									

Observation #	Al (μg/l)	ARS	Sc (μg/l)	Cd	Cr (μg/l)	Cu	Co (μg/l)	Hg	Ni (μg/l)
469									
470									
471									
472									
473									
474									
475									
476									
477									
478									
479									
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518									
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520									

Observation #	Al (μg/l)	ARS	Sc (μg/l)	Cd	Cr (μg/l)	Cu	Co (μg/l)	Hg	Ni (μg/l)
521									
522									
523									
524									
525									
526									
527									
528									
529									
530									
531									
532									
533									
534									
535									
536									

Observation #	Zn (µg/l)	Pb	V	Rb (µg/l)	Y (µg/l)	Zr (µg/l)	Mo (µg/l)	Indium (µg/l)	Sb (µg/l)
1									
2									
3									
4									
5									
6									
7									
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26									
27									
28									
29									
30									
31									
32									
33									
34	72,50	-0,30	-0,05				8,50		
35	-2,00	-0,30	-0,05				-0,10		
36	83,80	-0,30	-0,05				9,18		
37	74,80	-0,30	-0,05				8,63		
38	-2,00	-0,30	-0,05				-0,10		
39	-0,20	-0,01	0,02				-0,05		
40	82,90	-0,30	0,32	25,30	0,30	2,35	9,57	-0,50	0,14
41									
42	85,10	0,19	0,35	23,30	1,51	0,26	8,59		0,11
43									
44	79,70	0,24	0,29	23,10	1,56	-0,30	8,38	-0,50	0,16
45									
46									
47									
48	82,50	-0,30	-0,05				9,48		
49									
50	77,10	-0,30	-0,05				9,36		
51									
52									

Observation #	Zn (µg/l)	Pb	V	Rb (µg/l)	Y (µg/l)	Zr (µg/l)	Mo (µg/l)	Indium (µg/l)	Sb (µg/l)
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61	680,00	2,60	2,76				31,10		
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64	50,40	0,13	-0,05	28,00	0,12	0,28	9,72	-0,50	0,53
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66									
67	63,20	-0,30	0,37	30,50	0,31	2,36	10,10	-0,50	0,13
68	50,40	0,13	-0,05	28,00	0,12	0,28	9,72	-0,50	0,53
69	290,00	-0,30	-0,05				19,60		
70	63,20	-0,30	0,37	30,50	0,31	2,36	10,10	-0,50	0,13
71	66,10	-0,30	0,39	29,30	0,31	3,40	10,80	-0,50	0,21
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Observation #	Zn (μg/l)	Pb	V	Rb (μg/l)	Y (μg/l)	Zr (μg/l)	Mo (μg/l)	Indium (μg/l)	Sb (μg/l)
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Observation #	Zn (µg/l)	Pb	V	Rb (µg/l)	Y (µg/l)	Zr (µg/l)	Mo (µg/l)	Indium (µg/l)	Sb (µg/l)
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Observation #	Zn (μg/l)	Pb	V	Rb (μg/l)	Y (μg/l)	Zr (μg/l)	Mo (μg/l)	Indium (μg/l)	Sb (μg/l)
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Observation #	Zn (μg/l)	Pb	V	Rb (μg/l)	Y (μg/l)	Zr (μg/l)	Mo (μg/l)	Indium (μg/l)	Sb (μg/l)
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Observation #	Zn (μg/l)	Pb	V	Rb (μg/l)	Y (μg/l)	Zr (μg/l)	Mo (μg/l)	Indium (μg/l)	Sb (μg/l)
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Observation #	Zn (μg/l)	Pb	V	Rb (μg/l)	Y (μg/l)	Zr (μg/l)	Mo (μg/l)	Indium (μg/l)	Sb (μg/l)
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Observation #	Zn (μg/l)	Pb	V	Rb (μg/l)	Y (μg/l)	Zr (μg/l)	Mo (μg/l)	Indium (μg/l)	Sb (μg/l)
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Observation #	Zn (μg/l)	Pb	V	Rb (μg/l)	Y (μg/l)	Zr (μg/l)	Mo (μg/l)	Indium (μg/l)	Sb (μg/l)
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Observation #	Zn (μg/l)	Pb	V	Rb (μg/l)	Y (μg/l)	Zr (μg/l)	Mo (μg/l)	Indium (μg/l)	Sb (μg/l)
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Observation #	Cs (µg/l)	Ba (µg/l)	La (µg/l)	Hf (µg/l)	Tl (µg/l)	Ce (µg/l)	Pr (µg/l)	Nd (µg/l)	Sm (µg/l)
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34		1210,00							
35		1,59							
36		1270,00							
37		1220,00							
38		0,73							
39		-0,01							
40	1,21	1300,00	0,51	0,50	-0,30	0,91	0,13	0,54	0,08
41									
42	1,16	1310,00	0,23	-0,05	-0,30	0,08	-0,05	0,77	0,06
43									
44	1,13	1280,00	0,24	-0,05	-0,30	0,08	-0,05	1,12	0,05
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48		1270,00							
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50		1300,00							
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Observation #	Cs (µg/l)	Ba (µg/l)	La (µg/l)	Hf (µg/l)	Tl (µg/l)	Ce (µg/l)	Pr (µg/l)	Nd (µg/l)	Sm (µg/l)
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61		2030,00							
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64	1,24	1530,00	0,02	0,09	0,00	0,01	0,00	0,07	0,01
65									
66									
67	1,34	1420,00	0,49	0,45	-0,30	0,87	0,12	0,49	0,07
68	1,24	1530,00	0,02	0,09	0,00	0,01	0,00	0,07	0,01
69		2110,00							
70	1,34	1420,00	0,49	0,45	-0,30	0,87	0,12	0,49	0,07
71	1,36	1380,00	0,51	0,78	-0,30	0,92	0,13	0,54	0,07
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Observation #	Cs (μg/l)	Ba (μg/l)	La (μg/l)	Hf (μg/l)	Tl (μg/l)	Ce (μg/l)	Pr (μg/l)	Nd (μg/l)	Sm (μg/l)
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Observation #	Cs (µg/l)	Ba (µg/l)	La (µg/l)	Hf (µg/l)	Tl (µg/l)	Ce (µg/l)	Pr (µg/l)	Nd (µg/l)	Sm (µg/l)
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Observation #	Cs (μg/l)	Ba (μg/l)	La (μg/l)	Hf (μg/l)	Tl (μg/l)	Ce (μg/l)	Pr (μg/l)	Nd (μg/l)	Sm (μg/l)
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Observation #	Cs (μg/l)	Ba (μg/l)	La (μg/l)	Hf (μg/l)	Tl (μg/l)	Ce (μg/l)	Pr (μg/l)	Nd (μg/l)	Sm (μg/l)
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Observation #	Cs (µg/l)	Ba (µg/l)	La (µg/l)	Hf (µg/l)	Tl (µg/l)	Ce (µg/l)	Pr (µg/l)	Nd (µg/l)	Sm (µg/l)
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Observation #	Cs (μg/l)	Ba (μg/l)	La (μg/l)	Hf (μg/l)	Tl (μg/l)	Ce (μg/l)	Pr (μg/l)	Nd (μg/l)	Sm (μg/l)
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Observation #	Cs (μg/l)	Ba (μg/l)	La (μg/l)	Hf (μg/l)	Tl (μg/l)	Ce (μg/l)	Pr (μg/l)	Nd (μg/l)	Sm (μg/l)
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Observation #	Cs (μg/l)	Ba (μg/l)	La (μg/l)	Hf (μg/l)	Tl (μg/l)	Ce (μg/l)	Pr (μg/l)	Nd (μg/l)	Sm (μg/l)
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Observation #	Cs (μg/l)	Ba (μg/l)	La (μg/l)	Hf (μg/l)	Tl (μg/l)	Ce (μg/l)	Pr (μg/l)	Nd (μg/l)	Sm (μg/l)
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Observation #	Eu (µg/l)	Gd (µg/l)	Tb (µg/l)	Dy (µg/l)	Ho (µg/l)	Er (µg/l)	Tm (µg/l)	Yb (µg/l)	Lu (µg/l)
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40	0,12	0,07	-0,05	-0,05	-0,05	0,07	-0,05	-0,05	-0,05
41									
42	1,43	-0,05	-0,50	-0,05	-0,05	-0,05	-0,05	-0,05	-0,05
43									
44	1,46	-0,05	-0,50	-0,05	-0,05	-0,05	-0,05	-0,05	-0,05
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Observation #	Eu (μg/l)	Gd (μg/l)	Tb (μg/l)	Dy (μg/l)	Ho (μg/l)	Er (μg/l)	Tm (μg/l)	Yb (μg/l)	Lu (μg/l)
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64	0,11	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,01
65									
66									
67	0,12	0,06	-0,05	-0,05	-0,05	-0,05	-0,05	-0,05	-0,05
68	0,11	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,01
69									
70	0,12	0,06	-0,05	-0,05	-0,05	-0,05	-0,05	-0,05	-0,05
71	0,12	0,07	-0,05	-0,05	-0,05	-0,05	-0,05	-0,05	-0,05
72									
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Observation #	Eu (μg/l)	Gd (μg/l)	Tb (μg/l)	Dy (μg/l)	Ho (μg/l)	Er (μg/l)	Tm (μg/l)	Yb (μg/l)	Lu (μg/l)
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Observation #	Eu (µg/l)	Gd (µg/l)	Tb (µg/l)	Dy (µg/l)	Ho (µg/l)	Er (µg/l)	Tm (µg/l)	Yb (µg/l)	Lu (µg/l)
157									
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Observation #	Eu (μg/l)	Gd (μg/l)	Tb (μg/l)	Dy (μg/l)	Ho (μg/l)	Er (μg/l)	Tm (μg/l)	Yb (μg/l)	Lu (μg/l)
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Observation #	Eu (μg/l)	Gd (μg/l)	Tb (μg/l)	Dy (μg/l)	Ho (μg/l)	Er (μg/l)	Tm (μg/l)	Yb (μg/l)	Lu (μg/l)
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Observation #	Eu (μg/l)	Gd (μg/l)	Tb (μg/l)	Dy (μg/l)	Ho (μg/l)	Er (μg/l)	Tm (μg/l)	Yb (μg/l)	Lu (μg/l)
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Observation #	Eu (μg/l)	Gd (μg/l)	Tb (μg/l)	Dy (μg/l)	Ho (μg/l)	Er (μg/l)	Tm (μg/l)	Yb (μg/l)	Lu (μg/l)
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Observation #	Eu (μg/l)	Gd (μg/l)	Tb (μg/l)	Dy (μg/l)	Ho (μg/l)	Er (μg/l)	Tm (μg/l)	Yb (μg/l)	Lu (μg/l)
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Observation #	Eu (μg/l)	Gd (μg/l)	Tb (μg/l)	Dy (μg/l)	Ho (μg/l)	Er (μg/l)	Tm (μg/l)	Yb (μg/l)	Lu (μg/l)
469									
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Observation #	Eu (µg/l)	Gd (µg/l)	Tb (µg/l)	Dy (µg/l)	Ho (µg/l)	Er (µg/l)	Tm (µg/l)	Yb (µg/l)	Lu (µg/l)
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Observation #	PMC (pmc)	C13 (permil)	AGE_BP (years)	D (dev, SMOW)	Tr (TU)	O18 (dev, SMOW)	Ra226 (bq/l)	RA226DEV	Ra228 (bq/l)
1									
2									
3	69,84	-17,30	2832	-75,80	15,30	-10,80			
4	67,28	-16,90	3132	-76,30	11,00	-10,70			
5				-78,00	4,70	-10,60			
6				-76,10	10,00	-10,70			
7				-76,60	9,40	-10,80			
8									
9									
10									
11									
12									
13	36,35	-21,42	8078	-102,50	1,10	-14,10			
14	59,81	-16,30	4077	-77,80	6,20	-10,60			
15	57,08	-15,70	4453	-86,10	4,20	-11,70			
16									
17									
18									
19		-19,29		-88,60	4,30	-12,40			
20									
21		-15,59		-87,80	2,40	-12,30			
22									
23		-17,75		-84,40	3,00	-12,00			
24									
25		-17,41		-83,40	2,00	-11,90			
26		-17,68		-83,00	2,90	-11,70			
27		-17,47		-80,10	5,10	-11,40			
28		-11,84		-79,10	5,80	-11,20			
29		-17,79		-77,00	6,20	-10,90			
30									
31		-16,46		-75,60	7,20	-10,70			
32									
33									
34									
35									
36									
37									
38									
39									
40				-95,86	-0,80	-13,19			
41				-97,80	-0,80	-13,00			
42				-97,50	-0,80	-13,00	1,40E+00		
43				-98,00	0,80	-13,00			
44				-93,60	-0,80	-12,90	4,00E-01		
45									
46				-95,10	2,80	-12,70			
47				-88,80	2,60	-12,20			
48									
49									
50									
51									
52									

Observation #	PMC (pmc)	C13 (permil)	AGE_BP (years)	D (dev, SMOW)	Tr (TU)	O18 (dev, SMOW)	Ra226 (bq/l)	RA226DEV	Ra228 (bq/l)
53									
54									
55									
56									
57									
58									
59									
60									
61									
62									
63									
64					-0,80		8,00E-01		
65					-0,80				
66				-99,80	-0,80	-14,00			
67					-0,80		6,00E-01		
68				-100,00	-0,80	-14,00	8,00E-01		
69									
70				-100,20	-0,80	-13,40	6,00E-01		
71				-99,10	-0,80	-13,80			
72				-102,20	-0,80	-13,60			
73									
74									
75				-93,40	-0,80	-12,60			
76									
77									
78									
79									
80									
81									
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103									
104									

Observation #	PMC (pmc)	C13 (permil)	AGE_BP (years)	D (dev, SMOW)	Tr (TU)	O18 (dev, SMOW)	Ra226 (bq/l)	RA226DEV	Ra228 (bq/l)
105									
106									
107									
108									
109									
110									
111									
112									
113									
114									
115									
116				-80,40		-11,30			
117				-80,40		-11,30			
118				-76,10		-10,50			
119				-76,10		-10,50			
120				-85,20	13,30	-11,80			
121				-85,20	13,30	-11,80			
122									
123	111,36	-0,35	-916	-54,10		-7,00			
124				-54,10		-6,90			
125									
126									
127									
128									
129	107,60	-0,93	-640	-56,70	14,00	-7,20			
130	108,16	-1,19	-681	-56,20	14,20	-7,20			
131									
132									
133									
134									
135									
136				-56,10	14,20	-7,10			
137				-56,20	16,10	-7,10			
138									
139									
140									
141									
142									
143									
144									
145									
146	110,65	-1,09	-865	-54,60		-7,10			
147	110,98	-1,10	-888	-54,30		-7,10			
148									
149									
150	111,03	-1,16	-892	-54,90	13,20	-7,00			
151	111,14	-1,02	-900	-54,80	16,10	-6,90			
152									
153									
154		-0,67		-55,20	13,30	-7,10			
155	109,18	-0,66	-757	-55,80	12,60	-7,20			
156									

Observation #	PMC (pmc)	C13 (permil)	AGE_BP (years)	D (dev, SMOW)	Tr (TU)	O18 (dev, SMOW)	Ra226 (bq/l)	RA226DEV	Ra228 (bq/l)
157									
158									
159									
160				-57,30	16,00	-7,10			
161				-57,90	13,70	-7,10			
162									
163									
164									
165									
166									
167									
168									
169									
170									
171				-69,00	12,30	-9,70			
172				-61,60	14,90	-8,30			
173									
174									
175	108,50	-5,62	-707	-64,80	15,70	-8,70			
176	107,38	-3,23	-624	-61,00	14,20	-8,10			
177									
178									
179	108,26	-5,01	-689	-62,50	13,80	-8,20			
180		-4,36		-62,10	12,60	-8,00			
181									
182									
183				-68,20	14,60	-8,80			
184				-68,00	14,50	-8,80			
185									
186									
187									
188									
189									
190									
191									
192	110,17	-1,27	-830	-54,90		-7,20			
193	110,40	-1,04	-846	-54,20		-7,20			
194									
195									
196									
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208									

Observation #	PMC (pmc)	C13 (permil)	AGE_BP (years)	D (dev, SMOW)	Tr (TU)	O18 (dev, SMOW)	Ra226 (bq/l)	RA226DEV	Ra228 (bq/l)
209									
210									
211									
212									
213									
214									
215									
216									
217				-71,30	17,30	-9,30			
218	105,78	-6,69	-503	-9,70	15,60	-6,70			
219									
220									
221	107,06	-5,26	-599	-63,00	14,40	-8,40			
222	105,88	-6,41	-510	-54,40	15,30	-6,80			
223									
224									
225	106,53	-6,99	-560	-63,90	14,10	-8,30			
226	107,37	-6,16	-623	-54,90	12,60	-7,10			
227									
228									
229				-67,50	13,20	-8,30			
230				-59,90	14,10	-7,40			
231									
232									
233									
234									
235									
236									
237									
238									
239									
240				-62,90	10,40	-8,10			
241				-63,90	12,90	-8,00			
242									
243									
244				-69,50	11,20	-9,30			
245				-69,00	10,90	-9,00			
246									
247									
248	106,14	-18,79	-530	-72,70	11,10	-9,60			
249	106,01	-19,54	-521	-69,30	11,20	-8,90			
250									
251									
252									
253									
254				-72,00	12,40	-9,30			
255				-72,30	12,80	-9,30			
256									
257									
258									
259									
260									

Observation #	PMC (pmc)	C13 (permil)	AGE_BP (years)	D (dev, SMOW)	Tr (TU)	O18 (dev, SMOW)	Ra226 (bq/l)	RA226DEV	Ra228 (bq/l)
261									
262									
263	65,92	-12,90	3297	-54,40	10,70	-6,70			
264	66,01	-15,65	3285	-55,70	14,20	-7,10			
265									
266									
267									
268									
269									
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272									
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284									
285									
286									
287									
288	76,35	-18,49	2116	-64,90	11,30	-8,50			
289	78,42	-21,08	1901	-65,40	10,00	-8,70			
290									
291									
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311									
312									

Observation #	PMC (pmc)	C13 (permil)	AGE_BP (years)	D (dev, SMOW)	Tr (TU)	O18 (dev, SMOW)	Ra226 (bq/l)	RA226DEV	Ra228 (bq/l)
313									
314									
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343									
344									
345									
346									
347									
348				-9,70	15,00	-70,40			
349									
350				-72,40	9,90	-10,00			
351									
352	100,36	-20,34	-80	-76,40	8,70	-10,50			
353									
354									
355				-77,10	12,70	-10,52			
356									
357									
358									
359				-78,80	12,60	-11,60			
360									
361				-85,00	10,10	-11,50			
362									
363	104,98	-20,98	-442	-82,50	11,00	-11,70			
364									

Observation #	PMC (pmc)	C13 (permil)	AGE_BP (years)	D (dev, SMOW)	Tr (TU)	O18 (dev, SMOW)	Ra226 (bq/l)	RA226DEV	Ra228 (bq/l)
365									
366				-83,50	10,60	-11,60			
367									
368									
369									
370									
371									
372									
373									
374									
375									
376									
377									
378									
379									
380									
381									
382				-11,10	14,40	-76,10			
383									
384				-77,20	12,90	-11,30			
385									
386	93,15	-19,83	519	-79,30	9,50	-11,40			
387									
388									
389				-81,80	12,10	-11,40			
390									
391									
392									
393									
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416									

Observation #	PMC (pmc)	C13 (permil)	AGE_BP (years)	D (dev, SMOW)	Tr (TU)	O18 (dev, SMOW)	Ra226 (bq/l)	RA226DEV	Ra228 (bq/l)
417									
418				-73,70	14,60	-10,70			
419									
420				-73,30	13,10	-10,40			
421									
422	95,91	-19,88	284	-77,10	11,40	-10,80			
423									
424									
425				-79,00	9,60	-11,00			
426									
427									
428									
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448									
449									
450									
451									
452									
453				-79,10	12,90	-11,50			
454									
455				-84,60	13,30	-11,40			
456									
457	100,26	-18,89	-72	-81,40	12,20	-11,60			
458									
459									
460				-83,50	9,80	-11,60			
461									
462									
463									
464	88,13	-23,76	964	-78,10	11,00	-11,60			
465									
466				-79,30	13,20	-11,50			
467									
468				-77,60	11,60	-11,40			

Observation #	PMC (pmc)	C13 (permil)	AGE_BP (years)	D (dev, SMOW)	Tr (TU)	O18 (dev, SMOW)	Ra226 (bq/l)	RA226DEV	Ra228 (bq/l)
469									
470	104,16	-16,68	-379	-81,70	12,80	-11,60			
471									
472									
473				-82,00	12,30	-11,30			
474									
475									
476									
477									
478	78,62	-20,90	1881	-77,20	10,60	-11,40			
479									
480				-78,10	13,50	-11,50			
481									
482	96,35	-16,95	247	-77,60	12,30	-11,20			
483									
484	98,38	-17,32	79	-80,30	13,30	-11,30			
485									
486									
487				-81,60	12,20	-11,30			
488									
489									
490									
491									
492	95,85	-15,54	289	-76,70	11,50	-11,20			
493									
494				-77,80	14,90	-11,20			
495									
496	89,85	-14,90	808	-80,40	11,70	-11,30			
497									
498	90,55	-13,60	746	-79,80	12,20	-11,30			
499									
500									
501				-80,40	13,30	-11,30			
502									
503									
504									
505									
506	65,95	-23,06	3292	-76,00	11,90	-11,20			
507									
508				-76,50	11,00	-11,30			
509									
510				-77,40	10,70	-11,20			
511									
512	93,12	-17,90	521	-79,80	14,40	-11,40			
513									
514									
515				-81,90	11,30	-11,40			
516									
517									
518									
519	106,06	-21,14	-524	-79,40	12,40	-11,20			
520									

Observation #	PMC (pmc)	C13 (permil)	AGE_BP (years)	D (dev, SMOW)	Tr (TU)	O18 (dev, SMOW)	Ra226 (bq/l)	RA226DEV	Ra228 (bq/l)
521				-75,10	11,70	-10,70			
522									
523				-74,20	12,50	-10,70			
524									
525	94,72	-18,03	384	-78,00	11,10	-10,90			
526									
527									
528				-80,10	11,90	-11,00			
529									
530									
531									
532									
533				-80,60	15,30	-10,90			
534				-76,70	12,70	-11,30			
535				-97,20	9,00	-12,80			
536				-116,90	14,80	-15,50			

Observation #	RA228DEV	Rn222 (bq/l)	RNDEV	U238 (mbq/kg)	U235 (mbq/kg)	U234 (mbq/kg)	Th232 (mbq/kg)	Th230 (mbq/kg)	Th228 (mbq/kg)
1									
2									
3									
4									
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6									
7									
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32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42		2,14E+01		1,10E+02	-5,00E+01	1,10E+02	-5,00E+01	1,10E+02	
43									
44		4,48E+01		5,94E+03	2,40E+02	5,94E+03	-5,00E+01	1,10E+02	
45									
46									
47									
48									
49									
50									
51									
52									

Observation #	RA228DEV	Rn222 (bq/l)	RNDEV	U238 (mbq/kg)	U235 (mbq/kg)	U234 (mbq/kg)	Th232 (mbq/kg)	Th230 (mbq/kg)	Th228 (mbq/kg)
53									
54									
55									
56									
57									
58									
59									
60									
61									
62									
63									
64		7,34E+01		-5,00E+01	-5,00E+01	-5,00E+01	-5,00E+01	-5,00E+01	
65									
66									
67		6,69E+01			-5,00E+01	-5,00E+01	-5,00E+01	-5,00E+01	
68		7,34E+01		-5,00E+01	-5,00E+01	-5,00E+01	-5,00E+01	-5,00E+01	
69									
70		6,69E+01			-5,00E+01	-5,00E+01	-5,00E+01	-5,00E+01	
71									
72									
73									
74									
75									
76									
77									
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101									
102									
103									
104									

Observation #	RA228DEV	Rn222 (bq/l)	RNDEV	U238 (mbq/kg)	U235 (mbq/kg)	U234 (mbq/kg)	Th232 (mbq/kg)	Th230 (mbq/kg)	Th228 (mbq/kg)
105									
106									
107									
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155									
156									

Observation #	RA228DEV	Rn222 (bq/l)	RNDEV	U238 (mbq/kg)	U235 (mbq/kg)	U234 (mbq/kg)	Th232 (mbq/kg)	Th230 (mbq/kg)	Th228 (mbq/kg)
157									
158									
159									
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Observation #	RA228DEV	Rn222 (bq/l)	RNDEV	U238 (mbq/kg)	U235 (mbq/kg)	U234 (mbq/kg)	Th232 (mbq/kg)	Th230 (mbq/kg)	Th228 (mbq/kg)
209									
210									
211									
212									
213									
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215									
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218									
219									
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255									
256									
257									
258									
259									
260									

Observation #	RA228DEV	Rn222 (bq/l)	RNDEV	U238 (mbq/kg)	U235 (mbq/kg)	U234 (mbq/kg)	Th232 (mbq/kg)	Th230 (mbq/kg)	Th228 (mbq/kg)
261									
262									
263									
264									
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267									
268									
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309									
310									
311									
312									

Observation #	RA228DEV	Rn222 (bq/l)	RNDEV	U238 (mbq/kg)	U235 (mbq/kg)	U234 (mbq/kg)	Th232 (mbq/kg)	Th230 (mbq/kg)	Th228 (mbq/kg)
313									
314									
315									
316									
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364									

Observation #	RA228DEV	Rn222 (bq/l)	RNDEV	U238 (mbq/kg)	U235 (mbq/kg)	U234 (mbq/kg)	Th232 (mbq/kg)	Th230 (mbq/kg)	Th228 (mbq/kg)
365									
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413									
414									
415									
416									

Observation #	RA228DEV	Rn222 (bq/l)	RNDEV	U238 (mbq/kg)	U235 (mbq/kg)	U234 (mbq/kg)	Th232 (mbq/kg)	Th230 (mbq/kg)	Th228 (mbq/kg)
417									
418									
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466									
467									
468									

Observation #	RA228DEV	Rn222 (bq/l)	RNDEV	U238 (mbq/kg)	U235 (mbq/kg)	U234 (mbq/kg)	Th232 (mbq/kg)	Th230 (mbq/kg)	Th228 (mbq/kg)
469									
470									
471									
472									
473									
474									
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520									

Observation #	RA228DEV	Rn222 (bq/l)	RNDEV	U238 (mbq/kg)	U235 (mbq/kg)	U234 (mbq/kg)	Th232 (mbq/kg)	Th230 (mbq/kg)	Th228 (mbq/kg)
521									
522									
523									
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532									
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534									
535									
536									

Observation #	B10	S34 (dev, SMOW)	Cl37	Sr87	DRILL_WATER	C_LAB_ID	H_LAB_ID	B_LAB_ID	T_LAB_ID
1						-1	0	-1	-1
2						-1	0	-1	-1
3	0,24	12,10	-0,28	0,72		36	34	34	-1
4	0,24	17,20	-0,23	0,72		36	34	34	-1
5			0,07			-1	34	36	-1
6			-0,07			-1	34	36	-1
7			0,07			-1	34	36	-1
8					0,04	-1	0	-1	-1
9					0,04	-1	0	-1	-1
10					0,25	-1	0	-1	-1
11					0,05	-1	0	-1	-1
12					0,04	-1	0	-1	-1
13		23,50		0,72		36	34	11	-1
14		17,40		0,72	66,09	36	34	11	-1
15		18,10		0,72	34,98	36	34	11	-1
16		20,80				-1	0	11	-1
17	0,24				14,09	-1	0	27	-1
18		20,90				-1	0	11	-1
19	0,24			0,72	11,19	36	34	34	-1
20		21,10				-1	0	11	-1
21	0,24			0,72	11,24	36	34	34	-1
22		19,60				-1	0	11	-1
23	0,24			0,72	21,96	36	34	34	-1
24		19,50				-1	0	11	-1
25	0,24			0,72	22,52	36	34	34	-1
26	0,24			0,72	16,47	36	34	34	-1
27	0,24			0,72	37,86	36	34	34	-1
28	0,24			0,72	19,12	36	34	34	-1
29	0,24			0,72	20,04	36	34	34	-1
30		21,20				-1	0	11	-1
31	0,24			0,72	27,66	36	34	34	-1
32						-1	0	-1	-1
33						-1	0	-1	-1
34						-1	0	-1	27
35						-1	0	-1	27
36						-1	0	-1	27
37						-1	0	-1	27
38						-1	0	-1	27
39						-1	0	-1	27
40	0,24				2,39	-1	36	27	27
41					2,51	-1	34	-1	-1
42		22,80		0,71	2,61	-1	34	11	27
43					3,17	-1	34	-1	-1
44	0,24	21,20	0,14	0,71	3,34	-1	34	34	27
45						-1	0	-1	-1
46					3,70	-1	34	-1	-1
47					3,28	-1	34	-1	-1
48						-1	0	-1	27
49						-1	0	-1	-1
50						-1	0	-1	27
51						-1	0	-1	-1
52						-1	0	-1	-1

Observation #	B10	S34 (dev, SMOW)	Cl37	Sr87	DRILL_WATER	C_LAB_ID	H_LAB_ID	B_LAB_ID	T_LAB_ID
53						-1	0	-1	-1
54						-1	0	-1	-1
55						-1	0	-1	-1
56						-1	0	-1	-1
57						-1	0	-1	-1
58						-1	0	-1	-1
59						-1	0	-1	-1
60						-1	0	-1	-1
61						-1	0	-1	27
62						-1	0	-1	-1
63					8,22	-1	0	-1	-1
64	0,24	20,50		0,71	8,02	-1	36	34	27
65					7,48	-1	36	-1	-1
66					7,48	-1	34	-1	-1
67	0,24	20,20		0,71	7,54	-1	36	34	27
68	0,24	20,50		0,71	8,02	-1	34	34	27
69						-1	0	-1	27
70	0,24	20,20		0,71	7,54	-1	34	34	27
71	0,24				8,19	-1	34	27	27
72					3,60	-1	34	-1	-1
73						-1	0	-1	-1
74	0,24				26,64	-1	0	27	-1
75	0,24	18,20		0,72	5,56	-1	34	34	-1
76						-1	0	-1	-1
77						-1	0	-1	-1
78						-1	0	-1	-1
79						-1	0	-1	-1
80						-1	0	-1	-1
81						-1	0	-1	-1
82					52,41	-1	0	-1	-1
83						-1	0	-1	-1
84						-1	0	-1	-1
85					52,99	-1	0	-1	-1
86						-1	0	-1	-1
87						-1	0	-1	-1
88						-1	0	-1	-1
89						-1	0	-1	-1
90						-1	0	-1	-1
91						-1	0	-1	-1
92						-1	0	-1	-1
93						-1	0	-1	-1
94						-1	0	-1	-1
95						-1	0	-1	-1
96						-1	0	-1	-1
97						-1	0	-1	-1
98						-1	0	-1	-1
99						-1	0	-1	-1
100						-1	0	-1	-1
101						-1	0	-1	-1
102						-1	0	-1	-1
103						-1	0	-1	-1
104						-1	0	-1	-1

Observation #	B10	S34 (dev, SMOW)	Cl37	Sr87	DRILL_WATER	C_LAB_ID	H_LAB_ID	B_LAB_ID	T_LAB_ID
105						-1	0	-1	-1
106						-1	0	-1	-1
107						-1	0	-1	-1
108						-1	0	-1	-1
109						-1	0	-1	-1
110						-1	0	-1	-1
111						-1	0	-1	-1
112						-1	0	-1	-1
113						-1	0	-1	-1
114						-1	0	-1	-1
115						-1	0	-1	-1
116	0,24					-1	11	27	-1
117	0,24					-1	11	27	-1
118	0,24			0,71		-1	11	34	-1
119	0,24			0,71		-1	11	34	-1
120	0,25			0,73		-1	34	34	-1
121	0,25			0,73		-1	34	34	-1
122									
123	0,24	22,50		0,71		36	11	34	-1
124	0,24	20,10		0,71		-1	11	34	-1
125	0,23					-1	0	27	-1
126	0,24					-1	0	27	-1
127	0,23					-1	0	27	-1
128	0,23					-1	0	27	-1
129	0,24	19,80		0,71		36	34	34	-1
130	0,24	20,10		0,71		36	34	34	-1
131	0,24					-1	0	27	-1
132	0,24					-1	0	27	-1
133	0,24					-1	0	27	-1
134	0,24					-1	0	27	-1
135	0,24					-1	0	27	-1
136	0,24	20,90		0,71		-1	34	34	-1
137	0,24	22,80		0,71		-1	34	34	-1
138	0,24					-1	0	27	-1
139	0,24					-1	0	27	-1
140						-1	0	-1	-1
141						-1	0	-1	-1
142						-1	0	-1	-1
143						-1	0	-1	-1
144						-1	0	-1	-1
145						-1	0	-1	-1
146	0,24	23,10		0,71		36	11	34	-1
147	0,24	20,30		0,71		36	11	34	-1
148	0,24					-1	0	27	-1
149	0,23					-1	0	27	-1
150	0,24	19,50		0,71		36	34	34	-1
151	0,24	19,20		0,71		36	34	34	-1
152	0,23					-1	0	27	-1
153	0,23					-1	0	27	-1
154	0,24	20,10		0,71		36	34	34	-1
155	0,24	21,60		0,71		36	34	34	-1
156	0,24					-1	0	27	-1

Observation #	B10	S34 (dev, SMOW)	Cl37	Sr87	DRILL_WATER	C_LAB_ID	H_LAB_ID	B_LAB_ID	T_LAB_ID
157	0,24					-1	0	27	-1
158	0,24					-1	0	27	-1
159	0,24					-1	0	27	-1
160	0,24	21,00		0,71		-1	34	34	-1
161	0,24	21,10		0,71		-1	34	34	-1
162	0,24					-1	0	27	-1
163	0,24					-1	0	27	-1
164						-1	0	-1	-1
165						-1	0	-1	-1
166						-1	0	-1	-1
167						-1	0	-1	-1
168						-1	0	-1	-1
169	0,24					-1	0	27	-1
170	0,23					-1	0	27	-1
171	0,24	16,80		0,71		-1	34	34	-1
172	0,24	17,80		0,71		-1	34	34	-1
173	0,23					-1	0	27	-1
174	0,24					-1	0	27	-1
175	0,24	19,60		0,71		36	34	34	-1
176	0,24	19,70		0,71		36	34	34	-1
177	0,24					-1	0	27	-1
178	0,24					-1	0	27	-1
179	0,23	20,60		0,71		36	34	34	-1
180	0,23	19,20		0,71		36	34	34	-1
181	0,24					-1	0	27	-1
182	0,24					-1	0	27	-1
183	0,24	20,70		0,71		-1	34	34	-1
184	0,24	20,40		0,71		-1	34	34	-1
185	0,24					-1	0	27	-1
186	0,24					-1	0	27	-1
187						-1	0	-1	-1
188						-1	0	-1	-1
189						-1	0	-1	-1
190						-1	0	-1	-1
191						-1	0	-1	-1
192	0,24	21,40		0,71		36	11	34	-1
193	0,24	21,90		0,71		36	11	34	-1
194	0,24					-1	0	27	-1
195	0,24					-1	0	27	-1
196	0,24					-1	0	27	-1
197	0,24					-1	0	27	-1
198	0,23					-1	0	27	-1
199	0,23					-1	0	27	-1
200	0,24					-1	0	27	-1
201	0,24					-1	0	27	-1
202	0,24					-1	0	27	-1
203	0,24					-1	0	27	-1
204	0,24					-1	0	27	-1
205	0,24					-1	0	27	-1
206	0,24					-1	0	27	-1
207	0,24					-1	0	27	-1
208	0,24					-1	0	27	-1

Observation #	B10	S34 (dev, SMOW)	Cl37	Sr87	DRILL_WATER	C_LAB_ID	H_LAB_ID	B_LAB_ID	T_LAB_ID
209	0,24					-1	0	27	-1
210						-1	0	-1	-1
211						-1	0	-1	-1
212						-1	0	-1	-1
213						-1	0	-1	-1
214						-1	0	-1	-1
215	0,24					-1	0	27	-1
216	0,24					-1	0	27	-1
217	0,24	18,40		0,71		-1	34	34	-1
218	0,24	18,80		0,71		36	34	34	-1
219	0,23					-1	0	27	-1
220	0,23					-1	0	27	-1
221	0,24	19,80		0,71		36	34	34	-1
222	0,24	20,20		0,71		36	34	34	-1
223	0,24					-1	0	27	-1
224	0,24					-1	0	27	-1
225	0,23	21,30		0,71		36	34	34	-1
226	0,23	20,70		0,71		36	34	34	-1
227	0,24					-1	0	27	-1
228	0,24					-1	0	27	-1
229	0,24	16,90		0,71		-1	34	34	-1
230	0,24	19,20		0,71		-1	34	34	-1
231	0,24					-1	0	27	-1
232	0,24					-1	0	27	-1
233						-1	0	-1	-1
234						-1	0	-1	-1
235						-1	0	-1	-1
236						-1	0	-1	-1
237						-1	0	-1	-1
238	0,24					-1	0	27	-1
239	0,24					-1	0	27	-1
240	0,24	1,50		0,72		-1	34	34	-1
241	0,25	0,70		0,72		36	34	34	-1
242	0,24					-1	0	27	-1
243	0,24					-1	0	27	-1
244	0,24	2,00		0,72		36	34	34	-1
245	0,24	2,40		0,72		36	34	34	-1
246	0,24					-1	0	27	-1
247	0,24					-1	0	27	-1
248	0,24	2,70		0,72		36	34	34	-1
249	0,23	2,60		0,72		36	34	34	-1
250	0,24					-1	0	27	-1
251	0,24					-1	0	27	-1
252	0,24					-1	0	27	-1
253	0,24					-1	0	27	-1
254	0,24	3,70		0,72		-1	34	34	-1
255	0,24	3,00		0,72		-1	34	34	-1
256	0,24					-1	0	27	-1
257	0,24					-1	0	27	-1
258						-1	0	-1	-1
259						-1	0	-1	-1
260						-1	0	-1	-1

Observation #	B10	S34 (dev, SMOW)	Cl37	Sr87	DRILL_WATER	C_LAB_ID	H_LAB_ID	B_LAB_ID	T_LAB_ID
261						-1	0	-1	-1
262						-1	0	-1	-1
263	0,24	0,90		0,72		36	34	34	-1
264	0,24	0,90		0,72		36	34	34	-1
265	0,25					-1	0	27	-1
266	0,24					-1	0	27	-1
267	0,24					-1	0	27	-1
268	0,24					-1	0	27	-1
269	0,25					-1	0	27	-1
270	0,24					-1	0	27	-1
271	0,24					-1	0	27	-1
272	0,24					-1	0	27	-1
273	0,24					-1	0	27	-1
274	0,24					-1	0	27	-1
275	0,24					-1	0	27	-1
276	0,24					-1	0	27	-1
277	0,24					-1	0	27	-1
278	0,24					-1	0	27	-1
279	0,24					-1	0	27	-1
280	0,24					-1	0	27	-1
281	0,24					-1	0	27	-1
282	0,24					-1	0	27	-1
283						-1	0	-1	-1
284						-1	0	-1	-1
285						-1	0	-1	-1
286						-1	0	-1	-1
287						-1	0	-1	-1
288	0,24	8,80		0,73		36	34	34	-1
289	0,24	8,30		0,73		36	34	34	-1
290	0,25					-1	0	27	-1
291	0,25					-1	0	27	-1
292	0,24					-1	0	27	-1
293	0,24					-1	0	27	-1
294	0,24					-1	0	27	-1
295	0,23					-1	0	27	-1
296	0,27					-1	0	27	-1
297	0,27					-1	0	27	-1
298	0,24					-1	0	27	-1
299	0,24					-1	0	27	-1
300	0,23					-1	0	27	-1
301	0,23					-1	0	27	-1
302	0,24					-1	0	27	-1
303	0,24					-1	0	27	-1
304	0,24					-1	0	27	-1
305	0,24					-1	0	27	-1
306	0,24					-1	0	27	-1
307	0,24					-1	0	27	-1
308						-1	0	-1	-1
309						-1	0	-1	-1
310						-1	0	-1	-1
311						-1	0	-1	-1
312						-1	0	-1	-1

Observation #	B10	S34 (dev, SMOW)	Cl37	Sr87	DRILL_WATER	C_LAB_ID	H_LAB_ID	B_LAB_ID	T_LAB_ID
313	0,25					-1	0	27	-1
314	0,24					-1	0	27	-1
315	0,24					-1	0	27	-1
316	0,27					-1	0	27	-1
317	0,24					-1	0	27	-1
318	0,23					-1	0	27	-1
319	0,24					-1	0	27	-1
320	0,24					-1	0	27	-1
321	0,23					-1	0	27	-1
322	0,24					-1	0	27	-1
323						-1	0	-1	-1
324						-1	0	-1	-1
325	0,25					-1	0	27	-1
326	0,24					-1	0	27	-1
327	0,23					-1	0	27	-1
328	0,28					-1	0	27	-1
329	0,24					-1	0	27	-1
330	0,23					-1	0	27	-1
331	0,24					-1	0	27	-1
332	0,24					-1	0	27	-1
333	0,23					-1	0	27	-1
334	0,24					-1	0	27	-1
335						-1	0	-1	-1
336						-1	0	-1	-1
337	0,24					-1	0	27	-1
338	0,25					-1	0	27	-1
339	0,27					-1	0	27	-1
340	0,24					-1	0	27	-1
341	0,24					-1	0	27	-1
342	0,24					-1	0	27	-1
343	0,24					-1	0	27	-1
344	0,24					-1	0	27	-1
345	0,24					-1	0	27	-1
346						-1	0	-1	-1
347						-1	0	-1	-1
348	0,24	4,90		0,73		36	34	34	-1
349	0,24					-1	0	27	-1
350	0,27	5,70		0,73		36	34	34	-1
351	0,24					-1	0	27	-1
352	0,25	6,40		0,73		36	34	34	-1
353	0,24					-1	0	27	-1
354	0,24					-1	0	27	-1
355	0,24	6,00		0,73		-1	34	34	-1
356	0,24					-1	0	27	-1
357						-1	0	-1	-1
358						-1	0	-1	-1
359	0,24	12,00		0,72		36	34	34	-1
360	0,24					-1	0	27	-1
361	0,26			0,72		36	34	34	-1
362	0,24					-1	0	27	-1
363	0,24	10,50		0,72		36	34	34	-1
364	0,24					-1	0	27	-1

Observation #	B10	S34 (dev, SMOW)	Cl37	Sr87	DRILL_WATER	C_LAB_ID	H_LAB_ID	B_LAB_ID	T_LAB_ID
365	0,24					-1	0	27	-1
366	0,23	11,80		0,72		-1	34	34	-1
367	0,24					-1	0	27	-1
368						-1	0	-1	-1
369						-1	0	-1	-1
370	0,25					-1	0	27	-1
371	0,24					-1	0	27	-1
372	0,24					-1	0	27	-1
373	0,25					-1	0	27	-1
374	0,24					-1	0	27	-1
375	0,24					-1	0	27	-1
376	0,24					-1	0	27	-1
377	0,24					-1	0	27	-1
378	0,24					-1	0	27	-1
379	0,24					-1	0	27	-1
380						-1	0	-1	-1
381						-1	0	-1	-1
382	0,24	5,00		0,72		36	34	34	-1
383	0,24					-1	0	27	-1
384	0,24	7,50		0,72		36	34	34	-1
385	0,25					-1	0	27	-1
386	0,24	7,90		0,72		36	34	34	-1
387	0,24					-1	0	27	-1
388	0,24					-1	0	27	-1
389	0,24	8,60		0,72		-1	34	34	-1
390	0,24					-1	0	27	-1
391						-1	0	-1	-1
392						-1	0	-1	-1
393	0,25					-1	0	27	-1
394	0,24					-1	0	27	-1
395	0,24					-1	0	27	-1
396	0,24					-1	0	27	-1
397	0,24					-1	0	27	-1
398	0,25					-1	0	27	-1
399	0,24					-1	0	27	-1
400	0,24					-1	0	27	-1
401	0,24					-1	0	27	-1
402	0,24					-1	0	27	-1
403						-1	0	-1	-1
404						-1	0	-1	-1
405	0,26					-1	0	27	-1
406	0,25					-1	0	27	-1
407	0,24					-1	0	27	-1
408	0,26					-1	0	27	-1
409	0,24					-1	0	27	-1
410	0,24					-1	0	27	-1
411	0,24					-1	0	27	-1
412	0,24					-1	0	27	-1
413	0,25					-1	0	27	-1
414	0,24					-1	0	27	-1
415						-1	0	-1	-1
416						-1	0	-1	-1

Observation #	B10	S34 (dev, SMOW)	Cl37	Sr87	DRILL_WATER	C_LAB_ID	H_LAB_ID	B_LAB_ID	T_LAB_ID
417	0,24					-1	0	27	-1
418	0,24	4,90		0,72		36	34	34	-1
419	0,24					-1	0	27	-1
420	0,24	5,40		0,72		36	34	34	-1
421	0,24					-1	0	27	-1
422	0,24	8,20		0,72		36	34	34	-1
423	0,24					-1	0	27	-1
424	0,24					-1	0	27	-1
425	0,24	5,80		0,72		-1	34	34	-1
426	0,24					-1	0	27	-1
427						-1	0	-1	-1
428						-1	0	-1	-1
429	0,24					-1	0	27	-1
430	0,24					-1	0	27	-1
431	0,27					-1	0	27	-1
432	0,24					-1	0	27	-1
433	0,24					-1	0	27	-1
434	0,24					-1	0	27	-1
435	0,24					-1	0	27	-1
436	0,24					-1	0	27	-1
437	0,24					-1	0	27	-1
438						-1	0	-1	-1
439						-1	0	-1	-1
440	0,25					-1	0	27	-1
441	0,24					-1	0	27	-1
442	0,24					-1	0	27	-1
443	0,27					-1	0	27	-1
444	0,24					-1	0	27	-1
445	0,25					-1	0	27	-1
446	0,24					-1	0	27	-1
447	0,24					-1	0	27	-1
448	0,24					-1	0	27	-1
449	0,24					-1	0	27	-1
450						-1	0	-1	-1
451						-1	0	-1	-1
452	0,25					-1	0	27	-1
453	0,24	7,00		0,72		36	34	34	-1
454	0,24					-1	0	27	-1
455	0,27	7,10		0,72		36	34	34	-1
456	0,24					-1	0	27	-1
457	0,25	9,20		0,72		36	34	34	-1
458	0,24					-1	0	27	-1
459	0,24					-1	0	27	-1
460	0,24	10,70		0,72		-1	34	34	-1
461	0,24					-1	0	27	-1
462						-1	0	-1	-1
463						-1	0	-1	-1
464	0,25	2,90		0,72		36	34	34	-1
465	0,25					-1	0	27	-1
466	0,25	3,50		0,72		36	34	34	-1
467	0,24					-1	0	27	-1
468	0,24	5,50		0,72		36	34	34	-1

Observation #	B10	S34 (dev, SMOW)	Cl37	Sr87	DRILL_WATER	C_LAB_ID	H_LAB_ID	B_LAB_ID	T_LAB_ID
469	0,24					-1	0	27	-1
470	0,26	6,70		0,72		36	34	34	-1
471	0,24					-1	0	27	-1
472	0,24					-1	0	27	-1
473	0,24	4,40		0,72		-1	34	34	-1
474	0,24					-1	0	27	-1
475						-1	0	-1	-1
476						-1	0	-1	-1
477						-1	0	-1	-1
478	0,25	-1,10		0,72		36	34	34	-1
479	0,24					-1	0	27	-1
480	0,25	0,90		0,72		36	34	34	-1
481	0,24					-1	0	27	-1
482	0,25	3,10		0,72		36	34	34	-1
483	0,25					-1	0	27	-1
484	0,25	7,20		0,72		36	34	34	-1
485	0,24					-1	0	27	-1
486	0,24					-1	0	27	-1
487	0,25	2,30		0,72		-1	34	34	-1
488	0,25					-1	0	27	-1
489						-1	0	-1	-1
490						-1	0	-1	-1
491						-1	0	-1	-1
492	0,25	2,60		0,72		36	34	34	-1
493	0,24					-1	0	27	-1
494	0,25	3,70		0,72		-1	34	34	-1
495	0,25					-1	0	27	-1
496	0,25	5,30		0,72		36	34	34	-1
497	0,25					-1	0	27	-1
498	0,24	6,10		0,72		36	34	34	-1
499	0,24					-1	0	27	-1
500	0,24					-1	0	27	-1
501	0,25	5,40		0,72		-1	34	34	-1
502	0,25					-1	0	27	-1
503						-1	0	-1	-1
504						-1	0	-1	-1
505						-1	0	-1	-1
506	0,25	2,20		0,72		36	34	34	-1
507	0,25					-1	0	27	-1
508	0,25	2,30		0,72		36	34	34	-1
509	0,25					-1	0	27	-1
510	0,25	2,30		0,72		36	34	34	-1
511	0,25					-1	0	27	-1
512	0,25	4,00		0,72		36	34	34	-1
513	0,24					-1	0	27	-1
514	0,25					-1	0	27	-1
515	0,25	2,30		0,72		-1	34	34	-1
516	0,25					-1	0	27	-1
517						-1	0	-1	-1
518						-1	0	-1	-1
519	0,24	1,90		0,72		36	34	34	-1
520	0,26					-1	0	27	-1

Observation #	B10	S34 (dev, SMOW)	Cl37	Sr87	DRILL_WATER	C_LAB_ID	H_LAB_ID	B_LAB_ID	T_LAB_ID
521	0,25	3,40		0,72		-1	34	34	-1
522	0,25					-1	0	27	-1
523	0,25	5,10		0,72		36	34	34	-1
524	0,24					-1	0	27	-1
525	0,24	6,60		0,72		36	34	34	-1
526	0,24					-1	0	27	-1
527	0,24					-1	0	27	-1
528	0,24	4,90		0,72		-1	34	34	-1
529	0,24					-1	0	27	-1
530						-1	0	-1	-1
531						-1	0	-1	-1
532						-1	0	-1	-1
533						-1	34	-1	-1
534			0,07			-1	34	36	-1
535						-1	34	-1	-1
536						-1	34	-1	-1

Observation #	R_LAB_ID	R_D_NO	U_LAB_ID	T_D_NO
1	-1	-1	-1	-1
2	-1	-1	-1	-1
3	-1	-1	-1	-1
4	-1	-1	-1	-1
5	-1	-1	-1	-1
6	-1	-1	-1	-1
7	-1	-1	-1	-1
8	-1	-1	-1	-1
9	-1	-1	-1	-1
10	-1	-1	-1	-1
11	-1	-1	-1	-1
12	-1	-1	-1	-1
13	-1	-1	-1	-1
14	-1	-1	-1	-1
15	-1	-1	-1	-1
16	-1	-1	-1	-1
17	-1	-1	-1	-1
18	-1	-1	-1	-1
19	-1	-1	-1	-1
20	-1	-1	-1	-1
21	-1	-1	-1	-1
22	-1	-1	-1	-1
23	-1	-1	-1	-1
24	-1	-1	-1	-1
25	-1	-1	-1	-1
26	-1	-1	-1	-1
27	-1	-1	-1	-1
28	-1	-1	-1	-1
29	-1	-1	-1	-1
30	-1	-1	-1	-1
31	-1	-1	-1	-1
32	-1	-1	-1	-1
33	-1	-1	-1	-1
34	-1	-1	-1	1
35	-1	-1	-1	1
36	-1	-1	-1	1
37	-1	-1	-1	1
38	-1	-1	-1	1
39	-1	-1	-1	1
40	-1	-1	-1	1
41	-1	-1	-1	-1
42	11	1	11	1
43	-1	-1	-1	-1
44	11	1	11	1
45	-1	-1	-1	-1
46	-1	-1	-1	-1
47	-1	-1	-1	-1
48	-1	-1	-1	1
49	-1	-1	-1	-1
50	-1	-1	-1	1
51	-1	-1	-1	-1
52	-1	-1	-1	-1

Observation #	R_LAB_ID	R_D_NO	U_LAB_ID	T_D_NO
53	-1	-1	-1	-1
54	-1	-1	-1	-1
55	-1	-1	-1	-1
56	-1	-1	-1	-1
57	-1	-1	-1	-1
58	-1	-1	-1	-1
59	-1	-1	-1	-1
60	-1	-1	-1	-1
61	-1	-1	-1	1
62	-1	-1	-1	-1
63	-1	-1	-1	-1
64	11	1	11	1
65	-1	-1	-1	-1
66	-1	-1	-1	-1
67	11	1	11	1
68	11	1	11	1
69	-1	-1	-1	1
70	11	1	11	1
71	-1	-1	-1	1
72	-1	-1	-1	-1
73	-1	-1	-1	-1
74	-1	-1	-1	-1
75	-1	-1	-1	-1
76	-1	-1	-1	-1
77	-1	-1	-1	-1
78	-1	-1	-1	-1
79	-1	-1	-1	-1
80	-1	-1	-1	-1
81	-1	-1	-1	-1
82	-1	-1	-1	-1
83	-1	-1	-1	-1
84	-1	-1	-1	-1
85	-1	-1	-1	-1
86	-1	-1	-1	-1
87	-1	-1	-1	-1
88	-1	-1	-1	-1
89	-1	-1	-1	-1
90	-1	-1	-1	-1
91	-1	-1	-1	-1
92	-1	-1	-1	-1
93	-1	-1	-1	-1
94	-1	-1	-1	-1
95	-1	-1	-1	-1
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Appendix 5

The use of the data in the modelling work

How the data was used in the modelling presented in Appendix 1:

Available site data		Utilised in model version 1.1		Not utilised in model version 1.1
Data specification	**Reference**	**Analysis/Modelling**	**c.f. section**	**Motivation**
Cored borehole data				
Complete chemical characterisation Borehole name: KSH01A		All hydrochemical modelling and visualisation. Groundwater quality and representativeness.	.	
Class 3 analyses. Open-hole tube sampling. Borehole name: KSH01A		Groundwater quality and representativeness		Will not be used for modelling purposes due to excessive flushing water contamination.
Hydrochemical logging. Class 3 analyses. Borehole name: KSH02A		All hydrochemical modelling and visualisation. Groundwater quality and representativeness.		Borehole sections 6.65-100.50 m and 739.0-755.0 m will not be used for modelling purposes because of excess flushing water contamination.
Uranine analyses during core drilling Borehole name: KSH01A		DIS (Drilling impact study) Groundwater quality and representativeness.		
Uranine analyses during core drilling Borehole name: KSH02A		DIS (Drilling impact study) Groundwater quality and representativeness.		

Percussion hole data				
Samples from: Borehole name: KFM01A, percus. drilled part HSH02 HSH03		All hydrochemical modelling and visualisation. Groundwater quality and representativeness.		
Surface based data				
Precipitation		All hydrochemical modelling and visualisation. Groundwater quality and representativeness.		
Surface sampling		All hydrochemical modelling and visualisation. Groundwater quality and representativeness.		

How the data was used in the modelling presented in Appendix 2:

Available site data		Utilized in model version 1.1		Not utilized in model version 1.1
Data specification	**Reference**	**Analysis/Modelling**	**c.f. section**	**Motivation**
Cored borehole data				
KSH01A Complete chemical characterization	All samples	Ion-ion plots	4.1.4	
	5263,5262,5261,5260,5259,5257,5268, 5266	- pH sensitivity analysis	4.1.4	Samples contaminated with flushing water
		- Speciation-solubility calculations - Redox pairs calculations	5.1.3	
	5260, 5266	Mass balance and Mixing modelling	5.1.4	
KSH02 Complete chemical characterization only for four depths	Four samples (3888, 3827, 3832, 3833)	Ion-ion plots	3.8	Samples in SICADA table without data
	3832	Speciation-solubility calculations	5.1.3	Samples contaminated with flushing water

Percussion hole data				
HSH02 Complete chemical characterization	All samples (3885,3884,3883,3886)	Ion-ion plots	4.1.4	
	3883, 3886	Speciation-solubility calculations	5.1.3	
HSH03 Complete chemical characterization	All samples (3759,3760,3761,3896,3899,3897,3898 ,3900)	Ion-ion plots	4.1.4	
	3759, 3760	Speciation-solubility calculations	5.1.3	
Other borehole data				
Soil Pipes Complete chemical characterization	SFM0001, 0002, 0005	Ion-ion plots	4.1.4	
Surface based data				
Rain Complete chemical characterization for three samples	All the samples (3762,3881,3894,6005)	Ion-ion plots	4.1.4	
	6005	Speciation-solubility calculations	5.1.3	Samples with charge balance errors greater than 10%
Lake Water Complete chemical characterization	All the samples	Ion-ion plots	4.1.4	Samples in SICADA table without data.
	5047,5117,5185,5208,5207,5246,5358, 5357,5533,5013,5014,5038,5039,5052, 5053,5118,5119,5154,5155,5234,5244, 5245,5360,5393,5392,5505,5504,5066, 5147,5231,5356	Speciation-solubility calculations	5.1.3	Samples with charge balance errors greater than 10%
Stream Water Complete chemical characterization	All the samples	Ion-ion plots	3.8	Samples in SICADA table without data.
	5209,5248,5326,5128,5156,5212,5323, 5517,5123,5215,5251,5122,5330,5134, 5229,5309,5361,5311,5132,5228,5308, 5137,5237,5307,5328,5076,5104,5136, 5193,5236,5306,5368,5519,5079,5113, 5145,5186,5238,5302,5365,5398,5522, 5106,5135,5188,5216,5364,5401,5509, 5144,5239,5366	Speciation-solubility calculations	5.1.3	Samples with charge balance errors greater than 10%

Sea Water Complete chemical characterization	All the samples	Ion-ion plots	3.8	Samples in SICADA table without data.
	5008,5086,5087,5120,5121,5150,5151,5312,5313,5316,5371,5370,5500,5501,5029,5030,5065,5064,5084,5085,5142,5143,5242,5243,5314,5315,5373,5372,5503,5502,5049,5048,5081,5114,5115,5152,5153,5202,5201,5318,5319,5375,5374,5506,5507,5005,5006,5027,5028,5069,5068,5082,5083,5182,5183,5226,5225,5240,5241,5394,5395,5530,5019,5020,5051,5050,5097,5140,5141,5148,5149,5204,5203,5320,5321,5388,5389,5529		5.1.3	Samples with charge balance errors greater than 10%

How the data was used in the modelling presented in Appendix 3:

Available site data		Utilized in model version 1.1		Not utilized in model version 1.1
Data specification	**Reference**	**Analysis/Modelling**	**c.f. section**	**Motivation**
Cored borehole data				
KSH01	3824, 3825, 3831, 5167, 5169, 5171, 5173, 5174, 5175, 5176, 5177, 5179, 5263, 5262, 5261, 5260, 5259, 5257, 5268, 5266,	Drilling data: drilling water volume in/out, uranine concentration in drilling water volume in/out, water pressure during drilling, drawdown Explorative analyses, Tecplot visualisation M3, AquaChem modelling	§ 2, 3, 4, 5, 6	
KSH02	3832	Explorative analyses, Tecplot visualisation M3, AquaChem modelling	§ 2, 3, 5, 6	

Percussion hole data				
HSH02	3883, 3886, 3759, 3760, 3761	Explorative analyses, Tecplot visualisation M3, AquaChem modelling	§ 2, 3, 5, 6	
Precipitation				
PSM002170	3762, 6005			
Other borehole data				
Soil Pipes: SSM000005	5404	Explorative analyses, Tecplot visualisation M3, AquaChem modelling	§ 2, 3, 5, 6	
Surface based data				
Lake Water: PSM002065, PSM002066, PSM002067	5047, 5046, 5116, 5117, 5208, 5207, 5376, 5377, 5013, 5014, 5011, 5012	Explorative analyses, Tecplot visualization M3, AquaChem modeling	§ 2, 3, 5, 6	
Stream Water: PSM002071, PSM002072, PSM00202076, PSM002079, PSM002082, PSM002083, PSM002084, PSM002085, PSM002086, PSM002087	5056, 5128, 5212, 5386, 5055, 5127, 5210, 5383, 5058, 5122, 5214, 5384, 5071, 5132, 5228, 5399, 5074, 5130, 5233, 5378, 5003, 5077, 5137, 5237, 5396, 5000, 5076, 5136, 5236, 5400, 5001, 5079, 5145, 5238, 5398, 5004, 5070, 5135, 5216, 5401, 5002, 5078, 5144, 5239, 5397	Explorative analyses, Tecplot visualization M3, AquaChem modeling	§ 2, 3, 5, 6	
Sea Water: PSM002060, PSM002061, PSM002062, PSM002064	5120, 5121, 5371, 5370, 5065, 5064, 5142, 5143, 5373, 5372, 5049, 5048, 5114, 5115, 5202, 5201, 5375, 5374, 5051, 5050, 5140, 5141, 5204, 5203, 5388, 5389	Explorative analyses, Tecplot visualization M3, AquaChem modeling	§ 2, 3, 5, 6	

<u>Note:</u> Only the samples with major elements and isotopes analyzed can be used in the M3 modeling. Therefore, the samples, which are not listed in this table, didn't meet these criteria and could not be used for the hydrochemical evaluation, modeling and visualization.