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Oskarshamn site investigation

Monitoring of shallow groundwater chemistry 2008

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October 2009

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Abstract

In 2008 sampling of shallow ground water in water wells in soil has been performed at 10 sites within the site investigation area at Oskarshamn. The purpose of the activity is to monitor (long term observation) and characterise the shallow ground water in the site investigation area.

Some physical and chemical parameters were measured directly in the field but most parameters were analysed at different laboratories. The ground water sampling activity consisted of one program, chemical programme class 5 (reduced).

The large number of sites and parameters analysed have generated a large amount of data, which will later be used for advanced analysis and modelling. In this report the evaluation aims to give a simple overview of the results and to describe the quality of the data sampled 2008.

No major nonconformity occurred during 2008.

The results showed a quite large variation between the different wells. The ion concentrations and conductivity ranged from what can be termed as low to high or very high values. The concentration of HCO_3 also varied extensively throughout the investigation area. But since the concentrations were above 60 mg/l in most wells the results indicate a good ground water quality with respect to acidification in the investigation area.

The concentration of environmental metals and trace elements varied quite much between the wells. High concentration of lead in some of the wells indicated pollution but since the concentration of lead in the wells had a similar relation to aluminium as most other elements it was argued that the high concentration of lead probably can be explained by the natural composition of minerals within the site investigation area.

With the exception of one site (SSM000241) the ratio of $\delta^{18}\text{O}$ showed a good relationship with the conductivity. This result might indicate occurrence of relict seawater at the site.

The activity of tritium (^3H) was markedly lower in three of the wells. This might be an indication of older groundwater in these wells. The average hydrogen isotope ratio of deuterium ($\delta^2\text{H}$) varied with similar values in most wells. The $\delta^2\text{H}$ ratio correlates reasonably well with the $\delta^{18}\text{O}$ ratio but the linear relation differ markedly from the "Global Meteoric Line" ($\delta^2\text{H} = 8 \times \delta^{18}\text{O} + 10$) which is based on precipitation data.

The concentration of nitrate varied to some extent between the wells but according to the Swedish Environmental Quality Criteria the concentration of nitrate was very low in all the wells. The concentration of $\text{NH}_4\text{-N}$ and $\text{PO}_4\text{-P}$ varied with markedly higher values in some of the ground water wells. The site SSM000241 and SSM000242 differed even more with extremely high values of $\text{NH}_4\text{-N}$ and $\text{PO}_4\text{-P}$. The concentration of carbon (TOC and DOC) varied with low to moderately high concentrations in most wells. Again the wells SSM000241 and SSM000242 differed markedly with very high concentrations.

Sammanfattning

Provtagning av ytligt grundvatten i jordrör har under 2008 skett vid 10 platser inom platsundersökningsområdet i Oskarshamn. Målsättningen med aktiviteten är att monitera (långtidsövervaka) och karakterisera det ytliga grundvattnet i området.

Några fysiska och kemiska parametrar har mätts direkt i fält men merparten av de insamlade parametrarna är resultatet av laboratorieanalyser. Aktiviteten bestod av ett program, klass 5 (reducerat).

Det stora antalet platser och analyserade parametrar har genererat en stor mängd data som senare kommer att användas för avancerad analys och modellering. I denna rapport har utvärderingen syftat till att ge en enkel översikt över resultaten och att beskriva kvaliteten av de data som samlats in 2008.

Resultaten av undersökningarna visade på en stor variation mellan de olika grundvattenrören i området. Halterna av joner och vattnets och konduktivitet varierade från vad som kan betecknas som låga till väldigt höga värden. Även halten av HCO_3 varierade mycket mellan provplatserna. På de flesta platserna var dock halterna över 60 mg/l vilket visar på en god vattenkvalitet med avseende på försurning.

Koncentrationerna av miljömetaller och spårelement varierade också ganska mycket mellan de olika provplatserna. En hög koncentration av bly vid några av platserna indikerade någon sorts förorening. Eftersom relationen mellan koncentrationen av bly och aluminium liknade den som flertalet andra metaller och spårelement hade med aluminium drogs dock slutsatsen att de höga blyhalterna kan förklaras med mineralets naturliga sammansättning i området.

Med undantag av ett jordrör, SSM000241, visade isotopen $\delta^{18}\text{O}$ en god relation med konduktiviteten i vattnet. Detta resultat kan indikera förekomst av relik havsvatten vid provplatsen.

Medelvärde för aktiviteten av tritium (^3H) var märkbart lägre i tre av jordrören vilket kan vara en indikation på att grundvattnet är äldre i dessa jordrör. Kvoterna av deuterium ($\delta^2\text{H}$) varierade med liknande värden i de flesta grundvattenrören. Kvoterna av $\delta^2\text{H}$ var relativt väl korrelerade med kvoterna av $\delta^{18}\text{O}$ men det linjära sambandet skiljde sig märkbart från "the Global Meteoric Line" vilken baseras på data från nederbörd.

Koncentrationen av nitrat varierade i viss grad men enligt Naturvårdsverkets kriterier var halterna mycket låga i samtliga grundvattenrör. Koncentrationen av $\text{NH}_4\text{-N}$ och $\text{PO}_4\text{-P}$ varierade med märkbart högre halter i några av jordrören. Resultaten från jordrören SSM000241 och SSM000242 visade på vad som kan klassas som extremt höga halter av $\text{NH}_4\text{-N}$ och $\text{PO}_4\text{-P}$. Koncentrationen av kol (TOC och DOC) varierade med värden som kan betecknas som låga till måttligt höga i de flesta jordrören. Jordrören SSM000241 och SSM000242 avvek med betydligt högre halter.

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1 Introduction

This document reports the data gained by sampling of shallow ground water 2008, which is one of the activities performed within the site investigation programme at Oskarshamn. The work was carried out in accordance with the activity plan AP PS 400-08-010. In Table 1-1 controlling documents for performing this activity are listed. The activity plan is one of SKB's internal controlling document.

Within the site investigation area water has been sampled from shallow ground water wells in soil. During 2008 sampling was performed at 10 sites at four occasions (Figure 1.1). The water was analysed for a large number of parameters. All original results have been stored in the primary database SICADA. The results are traceable by the activity plan number. The data in the database will later be used for further interpretation (modelling).

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

Activity plan	Number	Version
Hydrokemisk jordrörsmonitoring 2008	AP PS 400-08-010	1.0

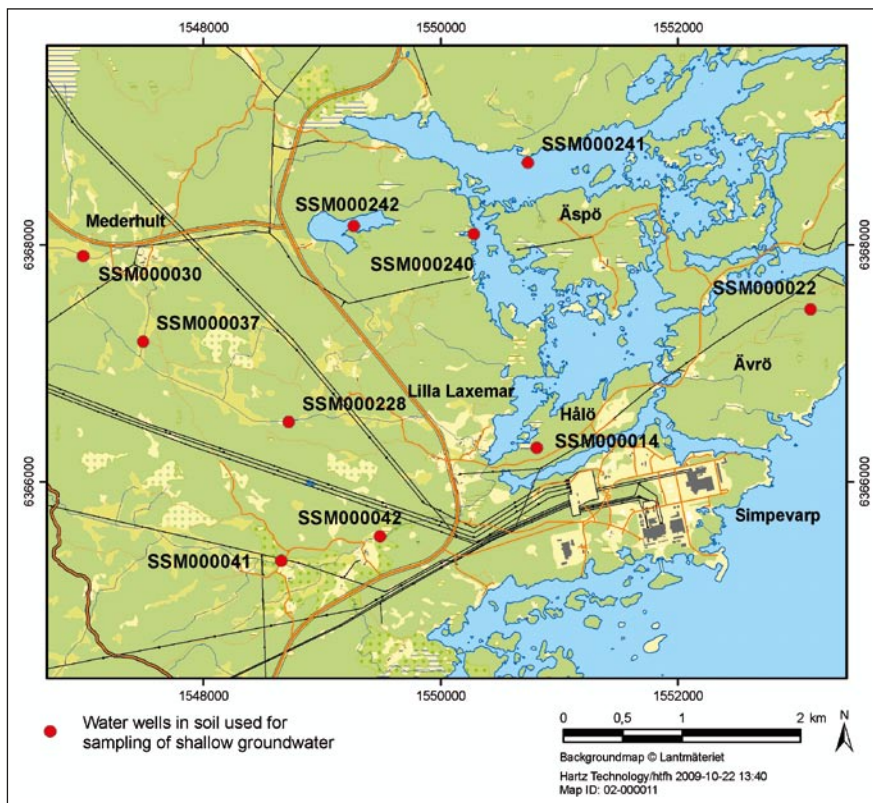


Figure 1-1. The site investigation area and the location of the water wells in soil used for sampling of shallow ground water in 2008.

2 Objective and scope

The purpose of the activity was to monitor and characterise the shallow ground water in the site investigation area. According to the activity plan sampling was planned to be performed at 10 different ground water wells, at one or more occasions during 2008. Two of these water wells are situated in the Ävrö, Hålö and Simpevarp peninsula area, and the rest in the Laxemar area. After the first sampling period the sampling finished at the water well SSM000037. Instead the well SSM000242 was sampled. Due to shortage of water it was later decided that sampling in the well SSM000242 was to end. Instead it was decided that the well SSM000014 was to be included in the program. Here sampling began from the fourth sampling period in November.

Some physical and chemical parameters were measured in the field and water samples for analysis of further parameters were sent to different analyzing laboratories for analysis.

In general the ground water sampling activity was done according to the programme chemical class 5 (reduced). Analysed parameters are presented in Table 2-1. If it was not possible to get a sufficient amount of water for analysis of all components a priority order was set up (Table 2-1). A time schedule for the sampling in 2008 is presented in appendix 2.

The large number of sites and parameters analysed have generated a large amount of data, which will later be used for advanced analysis and modelling. In this report the evaluation aims to give a simple overview of the results and to describe the quality of the data sampled during 2008.

Table 2-1. Analysed components and priority order when sampling ground water wells 2008.

Components	Priority	Components	Priority
Alkalinity, pH, Conductivity	2	Fe ²⁺ , Fe-tot	7
Anions (F ⁻ , Cl ⁻ , Br ⁻ , SO ₄ ²⁻)	3	HS ⁻	8
Standard elements	1	NH ₄ , NO ₃ , NO ₂ , NO ₂ +NO ₃ , PO ₄	9
Environmental metals	1	Tot-N and Tot-P	10
Lantanoides	1	DOC	11
Trace elements	1	TOC	12
δ ² H, δ ¹⁸ O	4	POP, PON and POC	13
³ H	5	Archive (acid rinsed)	14
Cl-37	6	Archive	14

3 Equipment

3.1 Equipment used in the field

Underwater pump (type 12 V Avimex) and 12 V vacuum pump. Used in the field for pumping up water from the ground water wells.

Two litres plastic cans, used in field as collecting vessels for archive samples. Acid rinsed 500 ml plastic vessels were used when sampling for analysis of Fe (II) + Fe (tot), standard elements, trace elements, lantanoides, and environmental metals. Archive samples were also taken from the acid rinsed vessels.

Samples for analysis of NH₄-N, NO₂-N, NO₃-N, NO₂/NO₃-N, PO₄-P and DOC were filtered with disposable filters 0.45 µm.

Sounding apparatus, pH-meter and thermometer were used for field measurements.

Field notes.

3.2 Equipment used at the laboratory

Tube pump. Used in the laboratory to filter sampled water.

0.45 µm filter (PALL). Capsule filter used together with the tube pump.

0.45 µm membrane filter. Used together with the tube pump.

4 Execution

4.1 Sites and sampling frequency

The total number of sampled sites was 10 (Appendix 1). The sampling frequency of the ground water wells sampled in 2008 is presented in appendix 2.

4.2 Execution of sampling and treatment of samples

To avoid contamination all sampling was conducted with protective rubber gloves and great care was taken not to contaminate containers or equipment. The day before sampling, each ground water well was visited and water was pumped out, if possible, for at least 15 minutes. On the sampling day, the ground water level was sounded and noted. Field measurements of pH were then performed, before the collecting vessels were filled with water. The samples for analysis of NH₄-N, NO₂-N, NO₃-N, NO₂/NO₃-N, PO₄-P and DOC were filtered in field with a syringe and 0.45 µm filters.

Bottles for most analysis were filled and treated in the field (Table 4-1). Water for archive samples, Fe (II) + Fe (tot), standard elements, trace elements, lantanoides, and environmental metals were transported in collecting vessels to a preparation room where the samples were divided into smaller bottles and treatments were made (Table 4-1). All work was conducted with protective rubber gloves to minimise the risk of contamination.

Routines for storing and delivery of samples to the different analysing laboratories are presented in Table 4-2. Some of the samples were sent immediately at the end of each day and some were stored in a refrigerator till the end of the week, when they were sent to the laboratory.

Table 4-1. Field and indoor treatments of samples. Samples which are treated indoor are marked grey.

Bottle	Number	SKB-label	Components	Filling instructions	Preparation
250 ml	1	green	Alkalinity, pH, Conductivity	Fill up	–
250 ml	1	green	Anions (F ⁻ , Cl ⁻ , Br ⁻ , SO ₄ ²⁻)	Fill up	–
500 ml acid rinsed PEH bottle	1	red	Fe (II) + Fe (tot)	Fill up	Filter with membrane filter, add 5 ml concentrated HCl
Winkler bottle	2		S ²⁻	Flow over three times	Add 0.5 ml 1M ZnAc and 0.5 ml 1M NaOH
125 ml	1	red	Standard elements, B-10, environment metals, lantanoides, trace elements	Fill up	Filter with membrane filter, add 1 ml concentrated HNO ₃
Test tubes	4	green	NO ₃ ⁻ , NO ₂ ⁻ , (NO ₂ ⁻ +NO ₃ ⁻), PO ₄ ³⁻	Fill 80%	Filter with disposable filter, 0.45 µm in field, heat 60° for 1 hour
100 ml	1	green	Tot-N and Tot-P	Fill up	–
1,000 ml	1	green	POP, POC and PON	Fill up	–
20 ml scint. vessel	1	green	DOC	Fill 80%	Filter with disposable filter, 0.45 µm in field, add 1 drop of 1 M HCl
20 ml scint. vessel	1	green	TOC	Fill 80%	Add 2 drops of 2 M HCl
100 ml quadrangular	1	green	δ ² H, δ ¹⁸ O	Fill 80%	–
500 ml dried	1	green	³ H	Flow over	–
250 ml	2	green	Archive	Fill 80%	Filter with "Pallfilter" 0.45 µm
100 ml	2	red	Archive	Fill 80%	Filter with membrane filter, add 1 ml concentrated HNO ₃

4.3 Documentation

All activities were continuously documented. Notes were taken on field conditions, time of sampling, markings of samples and so forth. Any deviations from the normal routines were also noted and commented in a special report. Delivery notes with instructions on which components to analyse were always sent with the samples to the different laboratories.

After analysis data has continuously been reported from the laboratories. As a routine a first preliminary quality control of the data was performed before storing them in the database SICADA.

Table 4-2. Treatments of samples when storing and delivering to analysing laboratories (Systemekologen is a laboratory at the University of Stockholm).

Bottle	Number	SKB-label	Components	Storing	Analysing laboratory	Way of delivery
250 ml	1	green	Alkalinity, pH, Conductivity	Refrigerator	Äspö laboratory	Directly
250 ml	1	green	Anions (F ⁻ , Cl ⁻ , Br ⁻ , SO ₄ ²⁻)	Refrigerator	Äspö laboratory	Directly
500 ml acid rinsed PEH bottle	1	red	Fe (II) + Fe (tot)	Refrigerator	Äspö laboratory	Directly
Winkler bottle	2		S ₂ ⁻	Refrigerator	Äspö laboratory	Directly
125 ml	1	red	Standard elements, B-10, environment metals, lantanoides, trace elements	Refrigerator	ALS	Parcel post
Test tubes	4	green	NO ₃ ⁻ , NO ₂ ⁻ , (NO ₂ ⁻ +NO ₃ ⁻), PO ₄ ³⁻	Refrigerator	Systemekologen	Parcel post
100 ml	1	green	Tot-N and Tot-P	Refrigerator	Systemekologen	Parcel post
1,000 ml	1	green	POP, POC and PON	Refrigerator	Systemekologen	Parcel post
20 ml scint. vessel	1	green	DOC	Refrigerator	Systemekologen	Parcel post
20 ml scint. vessel	1	green	TOC	Refrigerator	Systemekologen	Parcel post
100 ml quadrangular	1	green	δ ² H, δ ¹⁸ O	Refrigerator	IFE, Norway	Parcel post
1,000 ml dried	1	green	³ H	Refrigerator	EIL; Canada	Parcel post
250 ml	2	green	Archive	Freezer	–	–
100 ml	2	red	Archive	Freezer	–	–

5 Nonconformities

No major nonconformities occurred during 2008.

6 Results and discussion

6.1 Primary results

All primary results from the laboratory analysis and from the field measurements are presented in appendix 3 and 4.

6.2 Dissolved ions and conductivity

The concentrations of ions and the conductivity varied much between the sites (Table 6-1). The sites with the highest concentrations of ions are situated close to the coast or under the seabed. The site SSM000042 which is situated quite far from the coast also had comparably high concentrations of ions.

According to the Swedish Environmental Quality Criteria /Swedish Environment Protection Agency 1999/ the concentrations of chloride ranged from low to very high at different wells, with concentrations above 100 mg/l termed as high and above 300 mg/l termed as very high.

As a quality control the charge balance has been calculated for the samples. In one of the samples there was a positive deviation of more than 10 percent (Table 6-2). This could indicate analytical problems or significant concentrations of negative ions which were not included in the calculation of the charge balance. The sample with high positive deviation had a comparatively low conductivity which might be an indication of ions not included in the calculation instead of analytical errors (Figure 6-1). One possible example is organic anions which has not been included. In three cases (Table 6-2) there were negative deviations of more than ten percent. Likewise this could indicate ether analytical problems or significant concentrations of positive ions not included in the calculation.

Table 6-1. Average concentration of major ions and conductivity in shallow ground water wells 2008.

Site number	Fe (II) (mg/l)	Fe (tot) (mg/l)	Na (mg/l)	K (mg/l)	Ca (mg/l)	Mg (mg/l)	Li (mg/l)
SSM000014	5.63	6.42	12.2	5.26	18.7	10.0	0.0274
SSM000022	0.117	0.135	221	5.64	22.5	6.72	0.0258
SSM000030	1.76	1.88	27.5	2.38	65.1	7.92	0.0094
SSM000037	4.30	4.35	29.7	3.21	53.3	7.13	0.0121
SSM000041	7.91	8.44	9.05	4.60	47.9	8.45	0.0071
SSM000042	10.7	11.3	51.4	3.68	50.4	11.2	0.0058
SSM000228	6.57	6.60	14.5	2.06	40.7	5.86	0.0099
SSM000240	0.867	0.912	472	18.2	126	64.6	0.0251
SSM000241	1.13	1.14	2,705	125	320	427	0.1498
SSM000242	5.81	2.00	2,030	78.6	259	313	0.0888

Site number	HCO ₃ (mg/l)	Cl (mg/l)	SO ₄ (mg/l)	SO ₄ -S (mg/l)	F (mg/l)	Sr (mg/l)	Conductivity (mS/m)
SSM000014	52.1	13.3	46.3	15.9	2.37	0.081	25.1
SSM000022	258	151	133	52.9	3.93	0.287	137
SSM000030	249	12.4	31.0	11.6	2.18	0.270	50.1
SSM000037	207	22.3	34.3	12.6	1.79	0.209	47.9
SSM000041	109	37.2	30.4	12.0	0.783	0.138	39.9
SSM000042	147	59.2	77.0	27.5	1.21	0.135	59.0
SSM000228	121	21.6	36.7	11.1	2.05	0.094	33.5
SSM000240	291	957	71.9	29.7	1.14	0.909	373
SSM000241	5,135	4,788	6.47	12.9	0.755	4.97	1,970
SSM000242	3,530	3,470	1.81	10.1	0.510	3.35	1,400

Table 6-2. Samples with a charge balance which deviates more than 10 percent. Sampling in shallow ground water wells 2008.

Site number	Sampling date	Sample number	Charge balance (%)
SSM000041	2008-08-19	15637	13.26
SSM000241	2008-03-13	15388	-13.71
SSM000241	2008-05-22	15556	-15.42
SSM000241	2008-11-19	15771	-12.79

Charge balance (%)

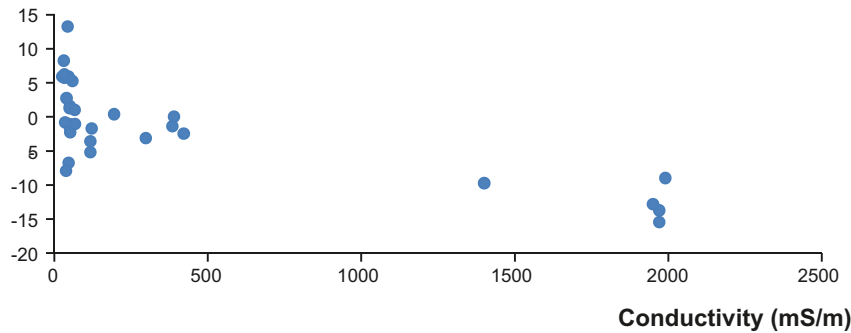


Figure 6-1. Relation of charge balance and conductivity in samples from all ground water wells 2008.

6.3 Acidification

As with other ions the concentration of HCO_3 varied extensively throughout the investigation area (Table 6-3). In most of the wells the average concentration of HCO_3 was higher than 60 mg/l which is termed as a high or very high concentration according to the Swedish Environmental Quality Criteria /Swedish Environment Protection Agency 1999/. These results indicate a good ground water quality with respect to acidification at the investigated sites. The well SSM000014 differed with a concentration of HCO_3 below 60 mg/l. This might indicate problem with acidification at that site.

The field measurements of pH had a poor relation with the measurements in the laboratory (Figure 6-2). Likewise the field measurements of pH were poorly correlated to HCO_3 (Figure 6-3).

Table 6-3. Average concentration of HCO_3 , calculated alkalinity (HCO_3) and pH in shallow ground water wells 2008.

Site number	HCO_3 (mg/l)	Alkalinity (meq/l)	pH-lab	pH-field
SSM000014	52.1	0.854	5.96	7.94
SSM000022	258	4.23	7.92	7.36
SSM000030	249	4.09	7.19	6.62
SSM000037	207	3.39	6.92	6.01
SSM000041	109	1.79	6.44	6.68
SSM000042	147	2.41	6.76	6.72
SSM000228	121	1.99	6.62	6.86
SSM000240	291	4.77	7.33	6.34
SSM000241	5,135	84.2	6.85	6.72
SSM000242	3,530	57.9	7.33	-

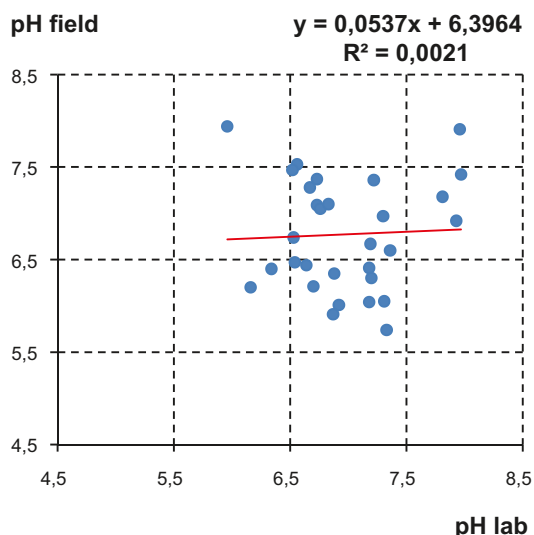


Figure 6-2. Relation of pH measured in the laboratory and in the field in ground water wells 2008.

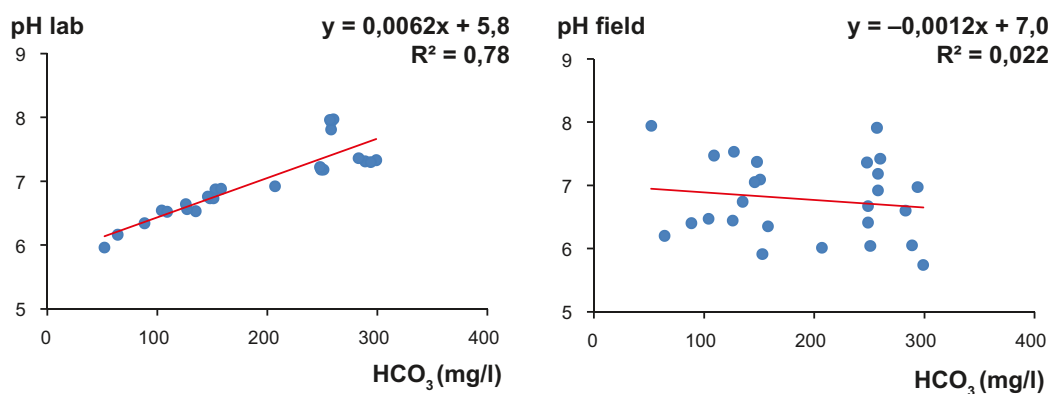


Figure 6-3. Relation of pH measured in the laboratory and HCO₃ and relation of pH measured in the field and HCO₃ in ground water wells 2008. Data from the wells SSM000241 and SSM000242 are not included.

6.4 Environmental metals and trace elements

The concentrations of environmental metals and trace elements are presented as averages in Tables 6-4 and 6-5. The results varied quite much between the wells but most elements had a strong relation with aluminium, examples are shown in Figure 6-4. This indicates a good quality of the analysis performed. However, in one case an apparent outlier exists, indicating pollution, contamination or analytical errors. The case is Zn (SSM000022, sample number 15552) (Figure 6-5). Similar outliers exists for some elements at site SSM00241 and SSM000242 (Figure 6-6). This ground water well seems to have a different type of water and therefore the poor relation with aluminium is probably not an indication of pollution, contamination or analytical errors.

Some of the environmental metals can be classified according to the Swedish Environmental Quality Criteria's /Swedish Environment Protection Agency 1999/. According to these criteria's the concentration of Cd and Zn was low to moderately high in the different wells. These results are what to be expected in an unpolluted area. However, the average concentration of Pb was very high ($> 10 \mu\text{g/l}$) in one well (SSM000014) (Table 6-4 and Figure 6-7). This could be an indication of some kind of pollution. However, since the relation to aluminium is similar to most other elements the high concentration of Pb in this well can probably be explained as a natural composition of the mineral at the site.

Table 6-4. Average concentration of environmental metals in shallow ground water wells 2008. Figures in italic indicate that some or all individual values in the calculation were below the detection limit of the analysis.

Site number	Al (µg/l)	Ba (µg/l)	Cd (µg/l)	Cr (µg/l)	Cu (µg/l)	Co (µg/l)	Hg (µg/l)
SSM000014	3,870	60.1	0.0521	6.36	17.2	3.59	0.0027
SSM000022	52.3	30.0	0.0026	0.184	0.310	0.0698	0.0020
SSM000030	112	36.5	0.0027	0.591	0.264	0.109	0.0020
SSM000037	146	33.9	0.0020	0.501	0.295	0.0983	0.0020
SSM000041	1,106	37.7	0.0251	2.76	2.70	1.7475	0.0020
SSM000042	660	76.3	0.0125	2.22	3.87	0.774	0.0020
SSM000228	408	28.4	0.0037	1.53	0.528	0.823	0.0020
SSM000240	12.0	159	0.0025	0.629	0.140	0.0540	0.0020
SSM000241	15.8	813	0.0500	8.59	0.695	5.26	0.0078
SSM000242	23.5	539	0.0489	3.64	2.01	5.45	0.0020

Site number	Mo (µg/l)	Ni (µg/l)	Pb (µg/l)	Se (µg/l)	V (µg/l)	Zn (µg/l)
SSM000014	0.510	9.27	17.6		11.6	21.9
SSM000022	12.9	0.428	0.103		0.932	48.6
SSM000030	0.8225	0.534	0.205	0.069	4.55	2.44
SSM000037	2.10	0.629	0.166		1.69	2.46
SSM000041	0.482	6.29	1.22	0.100	4.65	11.4
SSM000042	1.55	1.58	1.25	0.072	5.50	6.62
SSM000228	0.563	1.09	0.586	0.097	8.37	3.63
SSM000240	0.403	0.155	0.044	0.069	4.97	1.17
SSM000241	0.500	3.89	0.391		16.4	7.41
SSM000242	0.633	3.32	1.94		5.07	46.5

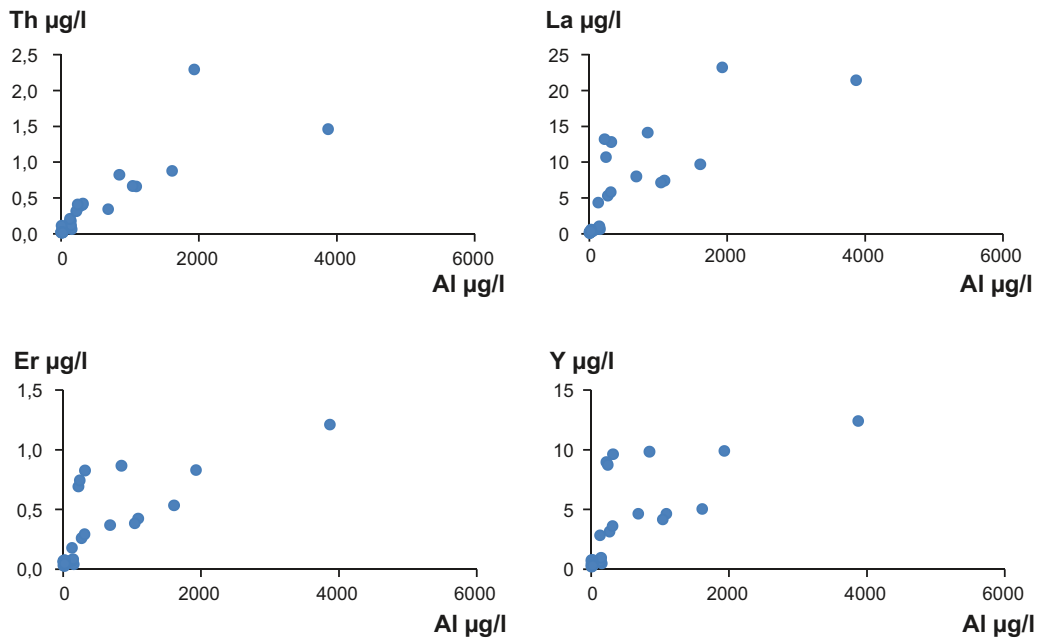


Figure 6-4. Relations between concentrations of Al and some other elements in ground water wells 2008.

Table 6-5. Average concentration of trace elements in shallow ground water wells 2008. Figures in italic indicate that some individual values in the calculation were below the detection limit of the analysis.

Site number	U (µg/l)	Th (µg/l)	Sc (µg/l)	Rb (µg/l)	Y (µg/l)	Zr (µg/l)	Sb (µg/l)	Cs (µg/l)
SSM000014	9.08	1.46	0.681	12.2	12.4	4.91	0.116	0.734
SSM000022	2.21	0.039	0.050	2.42	0.440	0.865	0.066	0.219
SSM000030	0.144	0.144	0.054	4.86	0.659	2.53	0.023	0.346
SSM000037	0.790	0.118	0.050	3.23	0.975	0.921	0.028	0.066
SSM000041	0.629	0.638	0.344	7.36	4.63	2.82	0.044	0.253
SSM000042	0.952	0.821	0.309	5.57	4.89	2.71	0.030	0.387
SSM000228	1.17	0.493	0.374	2.56	9.29	3.92	0.108	0.099
SSM000240	0.350	0.059	0.050	12.4	0.714	2.56	0.151	0.983
SSM000241	0.063	0.020	0.500	63.2	0.288	18.7	0.588	2.443
SSM000242	0.098	0.020	0.400	33.0	0.318	5.03	1.53	0.420

Site number	La (µg/l)	Hf (µg/l)	Tl (µg/l)	Ce (µg/l)	Pr (µg/l)	Nd (µg/l)	Sm (µg/l)	Eu (µg/l)
SSM000014	21.4	0.121	0.076	38.6	5.37	22.0	3.69	0.641
SSM000022	0.396	0.039	0.010	0.647	0.085	0.358	0.062	0.006
SSM000030	0.661	0.106	0.010	1.38	0.157	0.638	0.118	0.014
SSM000037	1.03	0.035	0.010	1.83	0.216	0.923	0.168	0.020
SSM000041	8.06	0.063	0.025	17.0	2.07	8.45	1.41	0.192
SSM000042	9.67	0.063	0.018	17.1	1.95	8.44	1.29	0.178
SSM000228	12.7	0.099	0.011	25.1	2.80	11.9	1.92	0.335
SSM000240	0.201	0.038	0.010	0.402	0.052	0.257	0.059	0.005
SSM000241	0.284	0.105	0.100	0.350	0.064	0.176	0.054	0.005
SSM000242	0.366	0.037	0.050	0.575	0.072	0.314	0.057	0.020

Site number	Gd (µg/l)	Tb (µg/l)	Dy (µg/l)	Ho (µg/l)	Er (µg/l)	Tm (µg/l)	Yb (µg/l)	Lu (µg/l)
SSM000014	2.84	0.336	2.09	0.404	1.21	0.162	1.09	0.174
SSM000022	0.059	0.007	0.049	0.011	0.034	0.005	0.032	0.006
SSM000030	0.114	0.015	0.096	0.022	0.072	0.012	0.077	0.015
SSM000037	0.151	0.019	0.129	0.027	0.084	0.012	0.081	0.014
SSM000041	1.08	0.117	0.713	0.155	0.428	0.063	0.412	0.074
SSM000042	1.12	0.118	0.697	0.153	0.391	0.057	0.335	0.058
SSM000228	1.82	0.192	1.20	0.273	0.782	0.112	0.722	0.131
SSM000240	0.077	0.010	0.073	0.019	0.068	0.011	0.081	0.017
SSM000241	0.052	0.050	0.050	0.050	0.065	0.050	0.050	0.050
SSM000242	0.048	0.020	0.044	0.020	0.048	0.020	0.036	0.020

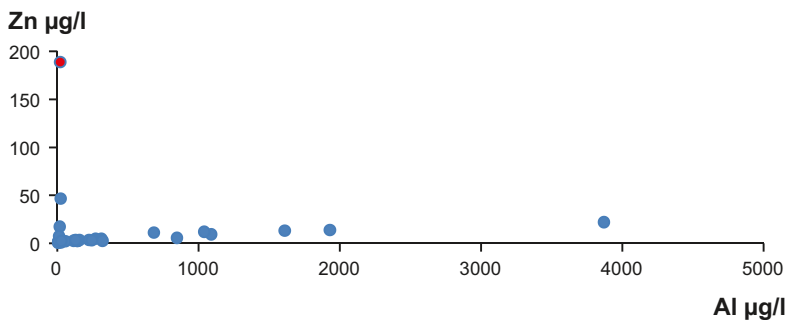


Figure 6-5. Relations between concentrations of Al and Zn in ground water wells 2008. Apparent outlier is marked red.

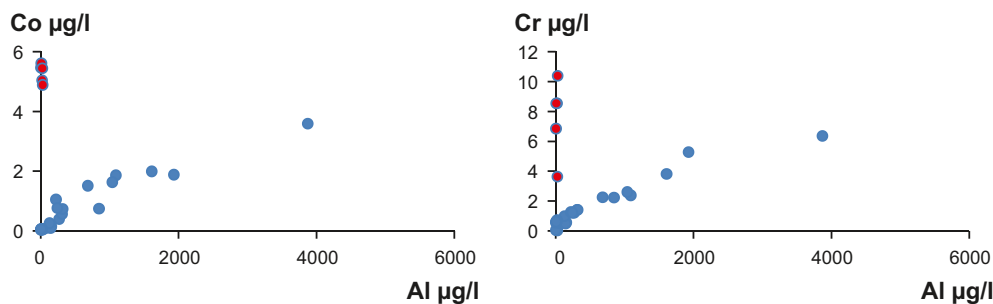


Figure 6-6. Relations between concentrations of Al and Co and Al and Cr in ground water wells 2008. Results from SSM00241 are marked red.

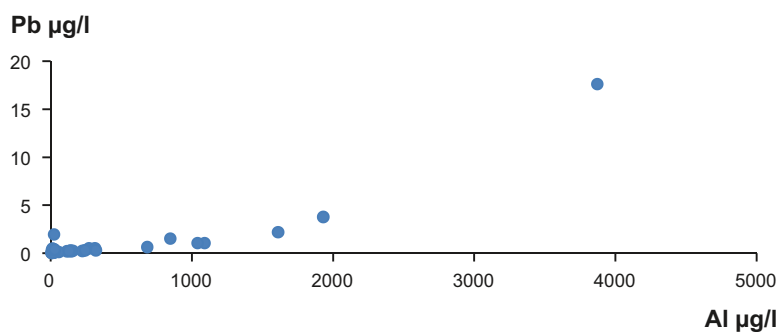


Figure 6-7. Relations between concentrations of Al and Pb in ground water wells 2008.

6.5 Isotopes

The results of the measurements of isotopes are presented in Table 6-6. With the exception of one site (SSM000241) the ratio of $\delta^{18}\text{O}$ showed a good relationship with the conductivity (Figure 6-8). This result might indicate occurrence of relict seawater at the site SSM000241.

The activity of tritium (^3H) was markedly lower in the wells SSM000022, SSM000241 and SSM000242. This might be an indication of older groundwater in these wells. The average hydrogen isotope ratio of deuterium ($\delta^2\text{H}$) varied with similar values in most wells. The $\delta^2\text{H}$ ratio correlates reasonable well with the $\delta^{18}\text{O}$ ratio but the linear relation differ from the “Global Meteoric Line” ($\delta^2\text{H} = 8 \times \delta^{18}\text{O} + 10$) which is based on precipitation data (Figure 6-9).

Table 6-6. Average ratio of $\delta^{18}\text{O}$ and deuterium and average activity of tritium in shallow ground water wells 2008.

Site number	$\delta^{18}\text{O}$ (‰ VSMOW)	$\delta^2\text{H}$ (‰ VSMOW)	^3H (TU)
SSM000014	-10.0	-67.8	11
SSM000022	-10.65	-76.375	1.725
SSM000030	-10.95	-77.525	8.4
SSM000037	-10.9	-81.9	8.0
SSM000041	-10.775	-75.625	8.8
SSM000042	-10.85	-79.875	8.325
SSM000228	-10.65	-75.875	10.275
SSM000240	-9.975	-72.6	7.825
SSM000241	-8.75	-63.75	0.425
SSM000242	-8.2	-65.8	1.6

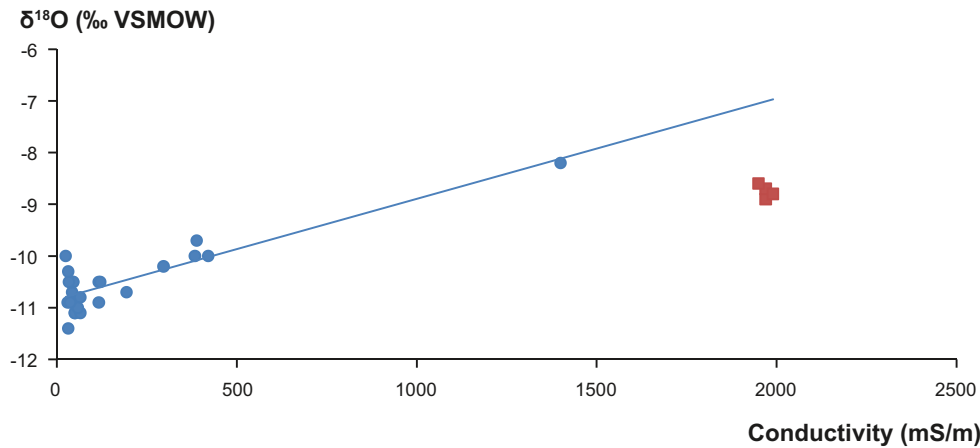


Figure 6-8. The relationship between the conductivity and the ratio of $\delta^{18}O$ in ground water wells 2008. Red dots show the site SSM000241 which had a different relationship between conductivity and the ratio of $\delta^{18}O$.

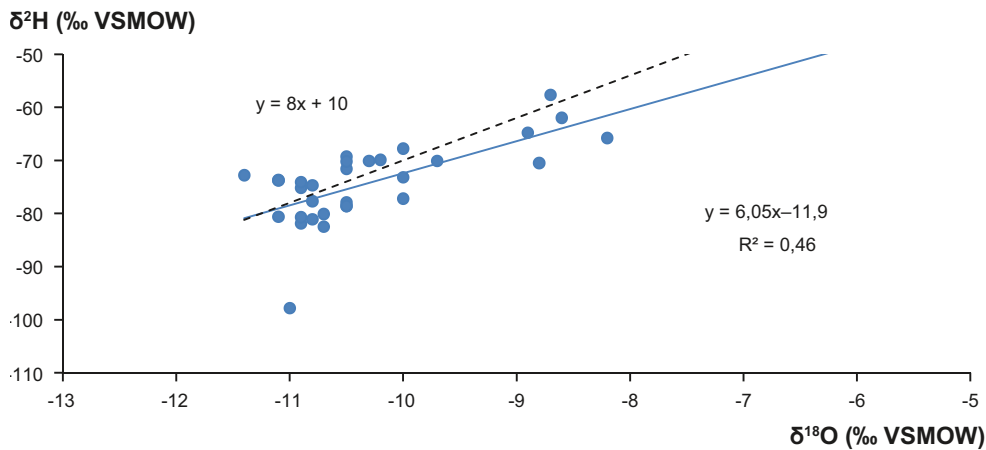


Figure 6-9. The local relationship between the ratios of δ^2H and $\delta^{18}O$ in ground water wells 2008. The dotted line shows "Global Meteoric Line" ($\delta^2H = 8 \times \delta^{18}O + 10$).

6.6 Nutrients and carbon

The concentration of nitrate varied to some extent between the wells (Table 6-7), but according to the Swedish Environmental Quality Criteria /Swedish Environment Protection Agency 1999/ the concentration of nitrate was very low in all the wells. The concentration of NH_4-N and PO_4-P varied with markedly higher values in some of the ground water wells. The sites SSM000241 and SSM000242 differed even more with extremely high values of NH_4-N and PO_4-P . The concentration of carbon (TOC and DOC) varied with results between 5 and 15 mg/l in most wells (Table 6-7). Again the wells SSM000241 and SSM000242 differed markedly with values around 75 mg/l.

Table 6-7. Average concentration of nitrogen and phosphorus compounds and carbon in shallow ground water wells 2008. Figures in *italic* indicate that some individual values in the calculation were below the detection limit of the analysis.

Site number	NO ₂ -N (mg/l)	NO ₃ -N (mg/l)	NO ₂ /NO ₃ -N (mg/l)	NH ₄ -N (mg/l)	PON (mg/l)	N-tot (mg/l)
SSM000014	0.0004	0.0125	0.0129	0.266	0.124	0.555
SSM000022	0.0004	0.0009	0.0012	0.701	0.011	0.815
SSM000030	0.0008	0.0060	0.0068	1.61	0.038	1.83
SSM000037	0.0002	0.0045	0.0045	0.270	0.019	0.393
SSM000041	0.0015	0.0705	0.0721	0.230	0.064	0.620
SSM000042	0.0012	0.0149	0.0160	0.285	0.057	0.626
SSM000228	0.0006	0.0013	0.0017	0.117	0.010	0.451
SSM000240	0.0008	0.0006	0.0013	2.10	0.008	2.30
SSM000241	0.0004	0.0015	0.0017	625	0.134	627
SSM000242	0.0012	0.0174	0.0186	264	0.631	278

Site number	PO ₄ -P (mg/l)	POP (mg/l)	P-tot (mg/l)	TOC (mg/l)	DOC (mg/l)	POC (mg/l)
SSM000014	0.013	0.103	0.175	16.0	15.1	2.72
SSM000022	0.012	0.001	0.015	5.03	5.03	0.225
SSM000030	0.082	0.012	0.206	8.55	8.50	0.404
SSM000037	0.003	0.002	0.021	5.90	6.10	0.237
SSM000041	0.009	0.052	0.132	10.1	9.18	1.10
SSM000042	0.001	0.030	0.068	5.93	6.65	1.38
SSM000228	0.007	0.004	0.021	14.0	14.0	0.274
SSM000240	0.242	0.001	0.278	10.1	10.2	0.202
SSM000241	27.5	0.043	26.8	74.5	75.1	1.15
SSM000242	19.2	1.15	52.5	75.3	72.8	7.18

References

Swedish Environment Protection Agency, 1999. Bedömningsgrunder för miljö kvalitet. Grundvatten. Naturvårdsverket, rapport 4915.

Sites, co-ordinates and sampling depths**Sites, sample depths and location co-ordinates 2008.**

ID-code	Co-ordinate (X)	Co-ordinate (Y)	Sampling depth (m)
SSM000014	6366286	1550813	2-3
SSM000022	6367458	1553120	5-7
SSM000030	6367908	1546986	4-5
SSM000037	6367186	1547490	3-4
SSM000041	6365332	1548655	2-4
SSM000042	6365541	1549488	3-5
SSM000228	6366504	1548718	6-7
SSM000240	6368093	1550283	5-6
SSM000241	6368695	1550739	32-33
SSM000242	6368160	1549267	17-18

Schedule. Sampling of shallow ground water 2008

ID-code	March	May	August	November
	Week number 10–11, 15	Week number 20–21	Week number 34–35	Week number 46–47
SSM000014				x
SSM000022	x	x	x	x
SSM000030	x	x	x	x
SSM000037	x			
SSM000041	x	x	x	x
SSM000042	x	x	x	x
SSM000228	x	x	x	x
SSM000240	x	x	x	x
SSM000241	x	x	x	x
SSM000242	x			

Primary results. Laboratory analysis

(Figures in *italic* indicate that the results were below the detection limit of the analysis).

Site number	Date	Sample number	Na (mg/l)	K (mg/l)	Ca (mg/l)	Mg (mg/l)	HCO ₃ (mg/l)	Cl (mg/l)	SO ₄ (mg/l)	SO ₄ -S (mg/l)
SSM000014	2008-11-19	15769	12.2	5.26	18.7	9.96	52.1	13.3	46.3	15.9
SSM000022	2008-03-11	15386	204	5.13	21.2	6.12	258	147	145.0	50.1
SSM000022	2008-05-13	15552	208	5.24	20.3	6.17	258	141	144.0	49.5
SSM000022	2008-08-21	15640	240	6.37	25.6	7.65	260	155	94.8	58.1
SSM000022	2008-11-11	15764	231	5.82	23.0	6.92	257	161	149.0	53.8
SSM000030	2008-03-04	15381	27.8	2.32	63.4	7.83	251	12.7	31.8	11.7
SSM000030	2008-05-13	15550	26.9	2.31	63.1	7.68	249	13.9	33.6	11.8
SSM000030	2008-08-21	15641	26.4	2.42	67.9	8.12	249	11.4	27.0	11.3
SSM000030	2008-11-13	15767	28.9	2.48	66.0	8.03	248	11.7	31.4	11.4
SSM000037	2008-03-04	15382	29.7	3.21	53.3	7.13	207	22.3	34.3	12.6
SSM000041	2008-03-04	15384	8.40	3.96	45.7	8.20	88.5	42.7	38.7	13.7
SSM000041	2008-05-14	15553	7.90	3.80	38.0	7.14	64.1	38.8	32.9	11.6
SSM000041	2008-08-19	15637	9.90	5.12	63.0	9.84	135.0	26.9	18.6	10.8
SSM000041	2008-11-11	15765	10.0	5.50	45.0	8.62	148.0	40.2	31.5	11.8
SSM000042	2008-03-11	15385	54.5	3.26	53.0	11.1	153.0	63.4	80.2	29.6
SSM000042	2008-05-14	15554	54.6	3.16	52.2	10.8	158.0	67.8	85.7	29.8
SSM000042	2008-08-19	15638	60.3	4.32	55.1	11.9	151.0	77.4	88.2	29.1
SSM000042	2008-11-11	15766	36.0	3.99	41.4	11.1	127.0	28.2	54.0	21.3
SSM000228	2008-03-04	15383	13.9	1.88	38.6	5.42	126.0	14.7	32.2	11.7
SSM000228	2008-05-13	15551	16.2	1.94	41.1	5.82	104.0	16.4	31.9	11.5
SSM000228	2008-08-19	15639	15.0	2.18	44.8	6.41	146.0	43.5	54.2	10.6
SSM000228	2008-11-13	15768	13.0	2.24	38.3	5.77	109.0	11.8	28.4	10.6
SSM000240	2008-03-12	15387	440	16.6	122	60.4	289.0	909	75.1	28.1
SSM000240	2008-05-21	15555	386	15.1	104	51.3	283.0	789	65.0	22.1
SSM000240	2008-08-27	15642	514	20.3	138	73.1	299.0	1,060	56.7	31.8
SSM000240	2008-11-18	15770	547	20.7	140	73.6	294.0	1,070	90.8	36.6
SSM000241	2008-03-13	15388	2,690	119.0	312	411	5,100	4,850	6.45	12.8
SSM000241	2008-05-22	15556	2,570	120.0	305	405	5,170	4,820	3.60	12.7
SSM000241	2008-08-28	15643	2,860	129.0	339	452	5,020	4,690	9.60	12.7
SSM000241	2008-11-19	15771	2,700	132.0	324	438	5,250	4,790	6.23	13.3
SSM000242	2008-04-08	15494	2,030	78.6	259	313	3,530	3,470	1.81	10.1

Site number	Date	Sample number	Br (mg/l)	F (mg/l)	Si (mg/l)	Fe (mg/l)	Fe-tot (mg/l)	Fe (II) (mg/l)	Mn (mg/l)	Li (mg/l)
SSM000014	2008-11-19	15769	0.200	2.37	16.8	9.47	6.42	5.63	0.482	0.0274
SSM000022	2008-03-11	15386	0.435	4.30	5.04	0.135	0.143	0.126	0.074	0.0221
SSM000022	2008-05-13	15552	0.200	4.11	5.05	0.135	0.137	0.110	0.077	0.0247
SSM000022	2008-08-21	15640	0.500	3.10	5.74	0.097	0.092	0.068	0.075	0.0298
SSM000022	2008-11-11	15764	0.552	4.19	6.13	0.330	0.166	0.164	0.080	0.0266
SSM000030	2008-03-04	15381	0.200	2.38	8.31	2.00	1.87	1.70	0.559	0.0094
SSM000030	2008-05-13	15550	0.200	2.37	8.29	2.12	2.04	1.75	0.554	0.0087
SSM000030	2008-08-21	15641	0.500	1.55	8.35	1.97	1.86	1.75	0.531	0.0095
SSM000030	2008-11-13	15767	0.200	2.41	8.81	2.14	1.75	1.82	0.575	0.0101
SSM000037	2008-03-04	15382	0.200	1.79	9.71	4.48	4.35	4.30	0.618	0.0121
SSM000041	2008-03-04	15384	0.200	0.78	13.7	10.5	9.15	8.57	0.562	0.0057
SSM000041	2008-05-14	15553	0.200	0.81	13.1	9.96	9.48	9.00	0.464	0.0055
SSM000041	2008-08-19	15637	0.209	0.55	13.8	9.47	7.56	7.17	0.630	0.0085
SSM000041	2008-11-11	15765	0.200	0.99	19.6	11.7	7.56	6.90	0.523	0.0086
SSM000042	2008-03-11	15385	0.380	1.11	9.27	8.91	8.76	8.30	0.695	0.0051
SSM000042	2008-05-14	15554	0.200	1.13	9.20	9.21	8.99	8.77	0.686	0.0046
SSM000042	2008-08-19	15638	0.500	1.17	10.6	5.40	22.3	21.7	0.620	0.0063
SSM000042	2008-11-11	15766	0.200	1.42	15.1	8.18	4.96	4.19	0.505	0.0073
SSM000228	2008-03-04	15383	0.200	2.27	10.2	6.70	6.67	6.43	0.532	0.0098
SSM000228	2008-05-13	15551	0.200	2.13	10.2	6.54	6.10	6.35	0.606	0.0088
SSM000228	2008-08-19	15639	0.500	1.56	10.4	7.19	6.52	6.43	0.545	0.0102
SSM000228	2008-11-13	15768	0.200	2.23	12.8	7.86	7.12	7.05	0.560	0.0109
SSM000240	2008-03-12	15387	3.880	1.20	9.36	0.970	0.943	0.904	0.974	0.0239
SSM000240	2008-05-21	15555	1.980	1.36	9.42	0.960	0.886	0.865	0.857	0.0218
SSM000240	2008-08-27	15642	3.260	0.560	9.83	0.920	0.931	0.816	1.01	0.0271
SSM000240	2008-11-18	15770	4.670	1.42	10.3	0.879	0.888	0.882	1.14	0.0276
SSM000241	2008-03-13	15388	181	0.690	20.4	0.937	0.904	0.927	0.614	0.1410
SSM000241	2008-05-22	15556	135	0.720	21.4	1.330	1.05	1.04	0.700	0.1470
SSM000241	2008-08-28	15643	193	0.760	22.2	1.420	1.46	1.45	0.671	0.1530
SSM000241	2008-11-19	15771	159	0.850	22.4	1.210	1.14	1.12	0.757	0.1580
SSM000242	2008-04-08	15494	62.4	0.510	21.7	6.79	2.00	5.81	1.69	0.0888

Site number	Date	Sample number	Sr (mg/l)	pH	Conductivity (mS/m)	S ₂ (mg/l)	P (mg/l)	Charge balance (%)
SSM000014	2008-11-19	15769	0.081	5.96	25.1	0.006	0.1400	5.92
SSM000022	2008-03-11	15386	0.267	7.93	117	0.048	0.0133	-5.17
SSM000022	2008-05-13	15552	0.259	7.81	117	0.045	0.0156	-3.58
SSM000022	2008-08-21	15640	0.317	7.97	194	0.060	0.0143	0.40
SSM000022	2008-11-11	15764	0.304	7.96	121	0.056	0.0175	-1.69
SSM000030	2008-03-04	15381	0.269	7.18	50.2	0.030	0.1260	-1.56
SSM000030	2008-05-13	15550	0.262	7.19	51.2	0.024	0.1600	-2.26
SSM000030	2008-08-21	15641	0.273	7.18	49.8	0.030	0.1600	1.57
SSM000030	2008-11-13	15767	0.276	7.22	49.3	0.033	0.1670	1.26
SSM000037	2008-03-04	15382	0.209	6.92	47.9	0.023	0.0221	-1.04
SSM000041	2008-03-04	15384	0.135	6.34	39.1	0.006	0.0885	2.76
SSM000041	2008-05-14	15553	0.116	6.16	32.2	0.023	0.0581	5.76
SSM000041	2008-08-19	15637	0.162	6.53	42.9	0.052	0.0949	13.26
SSM000041	2008-11-11	15765	0.139	6.73	45.5	0.008	0.1640	-6.73
SSM000042	2008-03-11	15385	0.135	6.87	65.5	0.043	0.0196	1.03
SSM000042	2008-05-14	15554	0.132	6.88	66.1	0.011	0.0113	-1.04
SSM000042	2008-08-19	15638	0.147	6.73	58.5	0.021	0.0207	5.27
SSM000042	2008-11-11	15766	0.124	6.56	45.9	0.064	0.1410	5.90
SSM000228	2008-03-04	15383	0.089	6.64	34.1	0.015	0.0104	-0.80
SSM000228	2008-05-13	15551	0.098	6.54	30.4	0.011	0.0111	8.25
SSM000228	2008-08-19	15639	0.101	6.76	37.4	0.011	0.0118	-7.91
SSM000228	2008-11-13	15768	0.088	6.52	32.0	0.043	0.0571	6.24
SSM000240	2008-03-12	15387	0.856	7.31	421	0.455	0.3440	-2.44
SSM000240	2008-05-21	15555	0.727	7.36	297	0.323	0.1820	-3.10
SSM000240	2008-08-27	15642	0.981	7.33	384	0.435	0.3980	-1.36
SSM000240	2008-11-18	15770	1.07	7.30	389	0.365	0.3790	0.06
SSM000241	2008-03-13	15388	4.84	7.20	1,970	2.270	29.7	-13.71
SSM000241	2008-05-22	15556	4.87	6.70	1,970	3.000	30.2	-15.42
SSM000241	2008-08-28	15643	5.08	6.67	1,990	0.323	57.4	-8.96
SSM000241	2008-11-19	15771	5.10	6.83	1,950	2.440	39.4	-12.79
SSM000242	2008-04-08	15494	3.35	7.33	1,400	-	24.1	-9.72

Site number	Date	Sample number	Al (µg/l)	Ba (µg/l)	Cd (µg/l)	Cr (µg/l)	Cu (µg/l)	Co (µg/l)	Hg (µg/l)
SSM000014	2008-11-19	15769	3,870	60.1	0.0521	6.36	17.2	3.59	0.0027
SSM000022	2008-03-11	15386	26.1	28.4	0.0030	0.030	0.134	0.050	0.0020
SSM000022	2008-05-13	15552	21.4	27.6	0.0020	0.076	0.252	0.034	0.0020
SSM000022	2008-08-21	15640	5.8	33.4	0.0030	0.059	0.162	0.039	0.0020
SSM000022	2008-11-11	15764	156	30.7	0.0024	0.569	0.692	0.156	0.0020
SSM000030	2008-03-04	15381	141	36.0	0.0036	0.598	0.285	0.125	0.0020
SSM000030	2008-05-13	15550	115	35.3	0.0020	0.533	0.233	0.110	0.0020
SSM000030	2008-08-21	15641	57.5	38.9	0.0032	0.535	0.208	0.070	0.0020
SSM000030	2008-11-13	15767	136	35.6	0.0020	0.698	0.329	0.129	0.0020
SSM000037	2008-03-04	15382	146	33.9	0.0020	0.501	0.295	0.098	0.0020
SSM000041	2008-03-04	15384	1090	37.3	0.0290	2.38	2.25	1.86	0.0020
SSM000041	2008-05-14	15553	683	31.5	0.0229	2.25	2.31	1.51	0.0020
SSM000041	2008-08-19	15637	1,040	40.0	0.0203	2.60	2.45	1.63	0.0020
SSM000041	2008-11-11	15765	1,610	42.0	0.0283	3.81	3.80	1.99	0.0020
SSM000042	2008-03-11	15385	270	74.4	0.0078	1.21	1.23	0.394	0.0020
SSM000042	2008-05-14	15554	129	69.3	0.0020	0.994	0.718	0.257	0.0020
SSM000042	2008-08-19	15638	312	83.9	0.0139	1.41	2.45	0.563	0.0020
SSM000042	2008-11-11	15766	1,930	77.5	0.0261	5.27	11.1	1.88	0.0020
SSM000228	2008-03-04	15383	319	25.6	0.0021	1.41	0.365	0.734	0.0020
SSM000228	2008-05-13	15551	224	27.0	0.0020	1.26	0.331	1.05	0.0020
SSM000228	2008-08-19	15639	243	30.7	0.0026	1.22	0.376	0.763	0.0020
SSM000228	2008-11-13	15768	847	30.2	0.0081	2.23	1.04	0.746	0.0020
SSM000240	2008-03-12	15387	5.38	141	0.0020	0.558	0.112	0.049	0.0020
SSM000240	2008-05-21	15555	22.7	126	0.0020	0.723	0.136	0.050	0.0020
SSM000240	2008-08-27	15642	11.5	184	0.0038	0.616	0.100	0.057	0.0020
SSM000240	2008-11-18	15770	8.32	183	0.0020	0.617	0.210	0.060	0.0020
SSM000241	2008-03-13	15388	7.00	718	0.0500	6.84	0.500	5.47	0.0250
SSM000241	2008-05-22	15556	17.0	823	0.0500	8.55	1.06	5.05	0.0020
SSM000241	2008-08-28	15643	11.7	881	0.0500	8.55	0.721	5.62	0.0020
SSM000241	2008-11-19	15771	27.6	829	0.0500	10.4	0.500	4.88	0.0020
SSM000242	2008-04-08	15494	23.5	539	0.0489	3.64	2.01	5.45	0.0020

Site number	Date	Sample number	Mo (µg/l)	Ni (µg/l)	Pb (µg/l)	Se (µg/l)	V (µg/l)	Zn (µg/l)
SSM000014	2008-11-19	15769	0.510	9.27	17.6	-	11.6	21.9
SSM000022	2008-03-11	15386	12.7	0.271	0.070	-	0.857	0.950
SSM000022	2008-05-13	15552	13.4	0.367	0.067	-	0.909	189
SSM000022	2008-08-21	15640	12.9	0.330	0.034	-	0.840	1.11
SSM000022	2008-11-11	15764	12.4	0.745	0.242	-	1.12	3.45
SSM000030	2008-03-04	15381	0.831	0.956	0.260	-	4.27	2.50
SSM000030	2008-05-13	15550	0.840	0.452	0.189	-	4.91	2.60
SSM000030	2008-08-21	15641	0.851	0.292	0.116	-	4.27	2.10
SSM000030	2008-11-13	15767	0.768	0.434	0.255	0.069	4.73	2.56
SSM000037	2008-03-04	15382	2.10	0.629	0.166	-	1.69	2.46
SSM000041	2008-03-04	15384	0.352	5.82	1.05	-	3.96	9.30
SSM000041	2008-05-14	15553	0.317	4.52	0.624	0.071	3.74	11.1
SSM000041	2008-08-19	15637	0.782	7.06	1.05	0.105	4.70	11.9
SSM000041	2008-11-11	15765	0.477	7.76	2.17	0.124	6.18	13.2
SSM000042	2008-03-11	15385	1.46	1.01	0.495	-	3.14	4.71
SSM000042	2008-05-14	15554	1.40	0.863	0.219	0.036	2.88	3.23
SSM000042	2008-08-19	15638	1.63	1.07	0.502	0.072	3.89	4.83
SSM000042	2008-11-11	15766	1.71	3.38	3.77	0.109	12.1	13.7
SSM000228	2008-03-04	15383	0.536	0.511	0.296	-	7.67	2.52
SSM000228	2008-05-13	15551	0.612	0.718	0.230	0.073	7.58	3.45
SSM000228	2008-08-19	15639	0.700	1.52	0.297	0.093	7.94	3.02
SSM000228	2008-11-13	15768	0.404	1.60	1.52	0.125	10.3	5.54
SSM000240	2008-03-12	15387	0.413	0.154	0.019	-	4.62	0.454
SSM000240	2008-05-21	15555	0.431	0.222	0.042	0.055	5.78	1.47
SSM000240	2008-08-27	15642	0.385	0.050	0.100	0.082	4.65	1.14
SSM000240	2008-11-18	15770	0.382	0.195	0.015	0.071	4.83	1.63
SSM000241	2008-03-13	15388	0.500	2.09	0.300	-	15.2	2.39
SSM000241	2008-05-22	15556	0.500	8.24	0.424	-	18.0	17.3
SSM000241	2008-08-28	15643	0.500	2.28	0.469	-	15.8	7.45
SSM000241	2008-11-19	15771	0.500	2.95	0.371	-	16.6	2.50
SSM000242	2008-04-08	15494	0.633	3.32	1.94	-	5.07	46.5

Site number	Date	Sample number	U (µg/l)	Th (µg/l)	Sc (µg/l)	Rb (µg/l)	Y (µg/l)	Zr (µg/l)	Sb (µg/l)	Cs (µg/l)
SSM000014	2008-11-19	15769	9.08	1.46	0.681	12.2	12.4	4.91	0.116	0.734
SSM000022	2008-03-11	15386	2.06	0.0340	0.0500	2.15	0.444	0.730	0.0548	0.0300
SSM000022	2008-05-13	15552	2.56	0.0354	0.0500	1.92	0.396	1.22	0.0934	0.034
SSM000022	2008-08-21	15640	2.27	0.0200	0.0500	2.17	0.421	0.643	0.0277	0.0300
SSM000022	2008-11-11	15764	1.960	0.0654	0.0500	3.44	0.499	0.865	0.0897	0.783
SSM000030	2008-03-04	15381	0.147	0.184	0.0607	5.47	0.719	2.37	0.0205	0.363
SSM000030	2008-05-13	15550	0.140	0.151	0.0500	4.57	0.691	3.71	0.0211	0.336
SSM000030	2008-08-21	15641	0.113	0.0657	0.0500	4.58	0.542	1.89	0.0218	0.323
SSM000030	2008-11-13	15767	0.175	0.177	0.0560	4.83	0.685	2.15	0.0285	0.362
SSM000037	2008-03-04	15382	0.790	0.118	0.0500	3.23	0.975	0.921	0.0282	0.0656
SSM000041	2008-03-04	15384	0.476	0.660	0.286	6.98	4.65	2.41	0.0409	0.237
SSM000041	2008-05-14	15553	0.384	0.344	0.207	4.94	4.64	2.71	0.0481	0.126
SSM000041	2008-08-19	15637	0.903	0.667	0.392	8.60	4.17	2.55	0.0381	0.269
SSM000041	2008-11-11	15765	0.751	0.879	0.491	8.90	5.05	3.60	0.0502	0.380
SSM000042	2008-03-11	15385	0.882	0.381	0.171	4.36	3.16	1.66	0.0202	0.212
SSM000042	2008-05-14	15554	0.823	0.209	0.102	3.34	2.85	2.04	0.0264	0.115
SSM000042	2008-08-19	15638	0.793	0.405	0.218	4.92	3.62	1.73	0.0294	0.221
SSM000042	2008-11-11	15766	1.31	2.29	0.744	9.64	9.91	5.41	0.0455	1.00
SSM000228	2008-03-04	15383	1.05	0.422	0.343	2.18	9.63	3.31	0.0713	0.0451
SSM000228	2008-05-13	15551	1.12	0.317	0.300	1.95	8.96	4.78	0.204	0.0442
SSM000228	2008-08-19	15639	1.28	0.410	0.418	2.23	8.74	3.10	0.0656	0.0542
SSM000228	2008-11-13	15768	1.24	0.824	0.435	3.88	9.84	4.47	0.0901	0.252
SSM000240	2008-03-12	15387	0.327	0.0318	0.0500	12.4	0.763	2.29	0.0832	0.741
SSM000240	2008-05-21	15555	0.338	0.0537	0.0500	9.34	0.800	3.72	0.310	0.568
SSM000240	2008-08-27	15642	0.383	0.0368	0.0500	12.9	0.696	2.05	0.0931	0.884
SSM000240	2008-11-18	15770	0.352	0.115	0.0500	14.8	0.597	2.19	0.116	1.74
SSM000241	2008-03-13	15388	0.0356	0.0200	0.5000	65.0	0.223	16.9	0.226	2.17
SSM000241	2008-05-22	15556	0.0541	0.0200	0.5000	57.3	0.267	24.5	0.512	2.14
SSM000241	2008-08-28	15643	0.0477	0.0200	0.5000	69.1	0.281	17.4	1.38	2.36
SSM000241	2008-11-19	15771	0.116	0.0200	0.5000	61.2	0.379	15.8	0.235	3.10
SSM000242	2008-04-08	15494	0.0979	0.0200	0.4000	33.0	0.318	5.03	1.53	0.420

Site number	Date	Sample number	La (µg/l)	Hf (µg/l)	Ti (µg/l)	Ce (µg/l)	Pr (µg/l)	Nd (µg/l)	Sm (µg/l)	Eu (µg/l)
SSM000014	2008-11-19	15769	21.4	0.121	0.0762	38.6	5.37	22.0	3.69	0.641
SSM000022	2008-03-11	15386	0.325	0.0247	0.0100	0.546	0.0717	0.312	0.0535	0.0050
SSM000022	2008-05-13	15552	0.307	0.116	0.0100	0.511	0.0574	0.253	0.0427	0.0050
SSM000022	2008-08-21	15640	0.291	0.0050	0.0100	0.460	0.0640	0.276	0.0508	0.0050
SSM000022	2008-11-11	15764	0.662	0.0100	0.0100	1.07	0.147	0.591	0.0993	0.0092
SSM000030	2008-03-04	15381	0.714	0.0676	0.0100	1.47	0.172	0.726	0.133	0.0173
SSM000030	2008-05-13	15550	0.714	0.303	0.0100	1.46	0.156	0.652	0.114	0.0133
SSM000030	2008-08-21	15641	0.400	0.0212	0.0100	0.734	0.0945	0.414	0.0791	0.0062
SSM000030	2008-11-13	15767	0.815	0.0321	0.0100	1.84	0.204	0.758	0.144	0.0182
SSM000037	2008-03-04	15382	1.03	0.0346	0.0100	1.83	0.216	0.923	0.168	0.0204
SSM000041	2008-03-04	15384	7.41	0.0630	0.0240	14.3	1.94	8.02	1.37	0.187
SSM000041	2008-05-14	15553	8.00	0.0443	0.0171	15.0	1.70	7.26	1.21	0.164
SSM000041	2008-08-19	15637	7.15	0.0672	0.0236	14.2	1.79	7.63	1.27	0.170
SSM000041	2008-11-11	15765	9.69	0.0792	0.0341	24.3	2.83	10.9	1.79	0.247
SSM000042	2008-03-11	15385	5.31	0.0444	0.0100	8.59	1.07	4.63	0.771	0.0955
SSM000042	2008-05-14	15554	4.35	0.0354	0.0100	6.68	0.679	3.13	0.480	0.0553
SSM000042	2008-08-19	15638	5.80	0.0421	0.0100	9.01	1.22	5.10	0.842	0.114
SSM000042	2008-11-11	15766	23.2	0.132	0.0417	44.1	4.85	20.9	3.08	0.449
SSM000228	2008-03-04	15383	12.8	0.0996	0.0100	23.2	2.84	12.6	2.04	0.360
SSM000228	2008-05-13	15551	13.2	0.104	0.0100	24.9	2.50	10.5	1.64	0.295
SSM000228	2008-08-19	15639	10.7	0.0788	0.0100	20.5	2.44	11.1	1.75	0.307
SSM000228	2008-11-13	15768	14.1	0.112	0.0132	31.7	3.40	13.2	2.24	0.379
SSM000240	2008-03-12	15387	0.203	0.0351	0.0100	0.393	0.0531	0.264	0.0629	0.0050
SSM000240	2008-05-21	15555	0.269	0.0566	0.0100	0.516	0.0594	0.321	0.0676	0.0050
SSM000240	2008-08-27	15642	0.181	0.0288	0.0100	0.361	0.0498	0.240	0.0586	0.0050
SSM000240	2008-11-18	15770	0.152	0.0295	0.0100	0.337	0.0443	0.202	0.0469	0.0050
SSM000241	2008-03-13	15388	0.099	0.116	0.100	0.108	0.0500	0.0785	0.0500	0.0050
SSM000241	2008-05-22	15556	0.302	0.113	0.100	0.233	0.0500	0.136	0.0500	0.0050
SSM000241	2008-08-28	15643	0.153	0.102	0.100	0.173	0.0500	0.109	0.0500	0.0050
SSM000241	2008-11-19	15771	0.582	0.0873	0.100	0.884	0.105	0.382	0.0644	0.0050
SSM000242	2008-04-08	15494	0.366	0.0367	0.0500	0.575	0.072	0.314	0.0572	0.0200

Site number	Date	Sample number	Gd (µg/l)	Tb (µg/l)	Dy (µg/l)	Ho (µg/l)	Er (µg/l)	Tm (µg/l)	Yb (µg/l)	Lu (µg/l)
SSM000014	2008-11-19	15769	2.84	0.336	2.09	0.404	1.21	0.162	1.09	0.174
SSM000022	2008-03-11	15386	0.0566	0.0068	0.0486	0.0107	0.0352	0.0050	0.0338	0.0056
SSM000022	2008-05-13	15552	0.0492	0.0057	0.0360	0.0094	0.0271	0.0042	0.0267	0.0059
SSM000022	2008-08-21	15640	0.0504	0.0062	0.0449	0.0100	0.0326	0.0044	0.0297	0.0053
SSM000022	2008-11-11	15764	0.0812	0.0108	0.0661	0.0140	0.0417	0.0055	0.0370	0.0067
SSM000030	2008-03-04	15381	0.117	0.0163	0.110	0.0238	0.0778	0.0122	0.0822	0.0152
SSM000030	2008-05-13	15550	0.110	0.0150	0.0903	0.0217	0.0705	0.0109	0.0737	0.0151
SSM000030	2008-08-21	15641	0.0773	0.0097	0.0768	0.0180	0.0609	0.0093	0.0675	0.0137
SSM000030	2008-11-13	15767	0.150	0.0173	0.105	0.0264	0.0776	0.0136	0.0857	0.0166
SSM000037	2008-03-04	15382	0.151	0.0191	0.129	0.0266	0.0838	0.0120	0.0810	0.0144
SSM000041	2008-03-04	15384	0.987	0.113	0.703	0.145	0.424	0.0608	0.412	0.0717
SSM000041	2008-05-14	15553	0.957	0.104	0.598	0.150	0.369	0.0637	0.380	0.0737
SSM000041	2008-08-19	15637	0.903	0.102	0.654	0.129	0.384	0.0517	0.360	0.0616
SSM000041	2008-11-11	15765	1.49	0.147	0.898	0.195	0.535	0.0761	0.497	0.0904
SSM000042	2008-03-11	15385	0.609	0.0706	0.446	0.0907	0.261	0.0359	0.220	0.0395
SSM000042	2008-05-14	15554	0.442	0.0514	0.293	0.0759	0.180	0.0300	0.150	0.0296
SSM000042	2008-08-19	15638	0.715	0.0771	0.499	0.0976	0.293	0.0381	0.250	0.0435
SSM000042	2008-11-11	15766	2.71	0.274	1.55	0.347	0.830	0.125	0.720	0.119
SSM000228	2008-03-04	15383	1.76	0.206	1.33	0.276	0.826	0.115	0.767	0.134
SSM000228	2008-05-13	15551	1.75	0.176	1.05	0.276	0.693	0.113	0.659	0.124
SSM000228	2008-08-19	15639	1.59	0.167	1.10	0.239	0.744	0.0989	0.682	0.118
SSM000228	2008-11-13	15768	2.16	0.219	1.32	0.302	0.866	0.121	0.779	0.146
SSM000240	2008-03-12	15387	0.0764	0.0109	0.0763	0.0210	0.0721	0.0116	0.0863	0.0176
SSM000240	2008-05-21	15555	0.0964	0.0115	0.0800	0.0227	0.0754	0.0134	0.0854	0.0190
SSM000240	2008-08-27	15642	0.0710	0.0090	0.0750	0.0177	0.0665	0.0109	0.0839	0.0164
SSM000240	2008-11-18	15770	0.0645	0.0084	0.0600	0.0163	0.0582	0.0098	0.0695	0.0144
SSM000241	2008-03-13	15388	0.0500	0.0500	0.0500	0.0500	0.0616	0.0500	0.0500	0.0500
SSM000241	2008-05-22	15556	0.0500	0.0500	0.0500	0.0500	0.0663	0.0500	0.0500	0.0500
SSM000241	2008-08-28	15643	0.0500	0.0500	0.0500	0.0500	0.0584	0.0500	0.0500	0.0500
SSM000241	2008-11-19	15771	0.0580	0.0500	0.0500	0.0500	0.0728	0.0500	0.0500	0.0500
SSM000242	2008-04-08	15494	0.0478	0.0200	0.0443	0.0200	0.0483	0.0200	0.0355	0.0200

Site number	Date	Sample number	δ ³⁷ Cl (‰ SMOC)	δ ² H (‰ VSMOW)	³ H (TU)	δ ¹⁸ O (‰ VSMOW)
SSM000014	2008-11-19	15769	–	–67.8	11.00	–10.00
SSM000022	2008-03-11	15386	–	–78.6	3.10	–10.50
SSM000022	2008-05-13	15552	–	–75.2	1.20	–10.90
SSM000022	2008-08-21	15640	–	–80.1	1.00	–10.70
SSM000022	2008-11-11	15764	–	–71.6	1.60	–10.50
SSM000030	2008-03-04	15381	–	–81.1	8.40	–10.80
SSM000030	2008-05-13	15550	–	–73.7	8.50	–11.10
SSM000030	2008-08-21	15641	–	–80.6	8.60	–11.10
SSM000030	2008-11-13	15767	–	–74.7	8.10	–10.80
SSM000037	2008-03-04	15382	–	–81.9	8.00	–10.90
SSM000041	2008-03-04	15384	–	–77.9	10.70	–10.50
SSM000041	2008-05-14	15553	–	–72.8	7.80	–11.40
SSM000041	2008-08-19	15637	–	–82.5	8.00	–10.70
SSM000041	2008-11-11	15765	–	–69.3	8.70	–10.50
SSM000042	2008-03-11	15385	–	–77.7	8.50	–10.80
SSM000042	2008-05-14	15554	–	–73.8	7.60	–11.10
SSM000042	2008-08-19	15638	–	–97.8	9.00	–11.00
SSM000042	2008-11-11	15766	–	–70.2	8.20	–10.50
SSM000228	2008-03-04	15383	–	–78.6	12.30	–10.50
SSM000228	2008-05-13	15551	–	–74.1	10.50	–10.90
SSM000228	2008-08-19	15639	–	–80.7	8.70	–10.90
SSM000228	2008-11-13	15768	–	–70.1	9.60	–10.30
SSM000240	2008-03-12	15387	–	–73.2	7.70	–10.00
SSM000240	2008-05-21	15555	–	–69.9	8.40	–10.20
SSM000240	2008-08-27	15642	–	–77.2	7.80	–10.00
SSM000240	2008-11-18	15770	–	–70.1	7.40	–9.70
SSM000241	2008-03-13	15388	–	–64.8	1.30	–8.90
SSM000241	2008-05-22	15556	–0.51	–57.7	–0.80	–8.70
SSM000241	2008-08-28	15643	–0.55	–70.5	–0.80	–8.80
SSM000241	2008-11-19	15771	–0.21	–62.0	2.00	–8.60
SSM000242	2008-04-08	15494	0.52	–65.8	1.60	–8.20

Site number	Date	Sample number	NH ₄ -N (mg/l)	NO ₂ -N (mg/l)	NO ₂ /NO ₃ -N (mg/l)	NO ₃ -N (mg/l)	N-tot (mg/l)	P-tot (mg/l)
SSM000014	2008-11-19	15769	0.266	0.0004	0.0129	0.0125	0.555	0.175
SSM000022	2008-03-11	15386	0.696	0.0002	0.0003	0.0003	0.830	0.0144
SSM000022	2008-05-13	15552	0.690	0.0006	0.0020	0.0014	0.805	0.0145
SSM000022	2008-08-21	15640	0.705	0.0002	0.0008	0.0007	0.815	0.0136
SSM000022	2008-11-11	15764	0.712	0.0005	0.0015	0.0010	0.811	0.0192
SSM000030	2008-03-04	15381	1.61	0.0002	0.0027	0.0025	1.69	0.147
SSM000030	2008-05-13	15550	1.71	0.0006	0.0071	0.0065	1.97	0.159
SSM000030	2008-08-21	15641	1.61	0.0005	0.0016	0.0012	1.88	0.358
SSM000030	2008-11-13	15767	1.50	0.0018	0.0157	0.0139	1.76	0.161
SSM000037	2008-03-04	15382	0.270	0.0002	0.0045	0.0045	0.393	0.0212
SSM000041	2008-03-04	15384	0.234	0.0006	0.2090	0.2080	0.640	0.0881
SSM000041	2008-05-14	15553	0.179	0.0006	0.0021	0.0015	0.572	0.0844
SSM000041	2008-08-19	15637	0.237	0.0004	0.0225	0.0221	0.673	0.211
SSM000041	2008-11-11	15765	0.270	0.0042	0.0546	0.0504	0.593	0.144
SSM000042	2008-03-11	15385	0.274	0.0002	0.0012	0.0012	0.424	0.0201
SSM000042	2008-05-14	15554	0.279	0.0028	0.0028	0.0003	0.524	0.0114
SSM000042	2008-08-19	15638	0.307	0.0008	0.0572	0.0565	0.960	0.126
SSM000042	2008-11-11	15766	0.278	0.0011	0.0028	0.0017	0.595	0.113
SSM000228	2008-03-04	15383	0.109	0.0005	0.0004	0.0003	0.386	0.0102
SSM000228	2008-05-13	15551	0.116	0.0003	0.0010	0.0008	0.455	0.0098
SSM000228	2008-08-19	15639	0.116	0.0003	0.0023	0.0021	0.467	0.0122
SSM000228	2008-11-13	15768	0.128	0.0012	0.0031	0.0019	0.494	0.0502
SSM000240	2008-03-12	15387	1.97	0.0002	0.0003	0.0003	2.18	0.3460
SSM000240	2008-05-21	15555	1.73	0.0018	0.0022	0.0004	1.98	0.190
SSM000240	2008-08-27	15642	2.34	0.0008	0.0013	0.0005	2.52	0.245
SSM000240	2008-11-18	15770	2.35	0.0003	0.0014	0.0011	2.52	0.332
SSM000241	2008-03-13	15388	633	0.0003	0.0005	0.0003	608	20.1
SSM000241	2008-05-22	15556	609	0.0007	0.0048	0.0042	632	28.5
SSM000241	2008-08-28	15643	631	0.0002	0.0004	0.0003	637	30.2
SSM000241	2008-11-19	15771	626	0.0002	0.0012	0.0011	629	28.5
SSM000242	2008-04-08	15494	264	0.0012	0.0186	0.0174	278	52.5

Site number	Date	Sample number	PO ₄ -P (mg/l)	PO ₄ -P (Hlysis) (mg/l)	POP (mg/l)	PON (mg/l)	POC (mg/l)	TOC (mg/l)	DOC (mg/l)
SSM000014	2008-11-19	15769	0.0130	0.0108	0.103	0.124	2.72	16.0	15.1
SSM000022	2008-03-11	15386	0.0116	0.0112	0.0013	0.0096	0.0570	5.0	4.9
SSM000022	2008-05-13	15552	0.0120	0.0122	0.0015	0.0136	0.159	5.1	5.1
SSM000022	2008-08-21	15640	0.0125	0.0123	0.0003	0.0059	0.0820	5.0	5.1
SSM000022	2008-11-11	15764	0.0125	0.0166	0.0021	0.0141	0.602	5.0	5.0
SSM000030	2008-03-04	15381	0.0625	0.1330	0.0017	0.0292	0.287	8.7	8.6
SSM000030	2008-05-13	15550	0.0961	0.1450	0.0020	0.0107	0.213	8.9	8.8
SSM000030	2008-08-21	15641	0.0715	0.1360	0.0291	0.0732	0.684	8.7	8.5
SSM000030	2008-11-13	15767	0.0965	0.1160	0.0159	0.0377	0.433	7.9	8.1
SSM000037	2008-03-04	15382	0.0034	0.0147	0.0019	0.0194	0.237	5.9	6.1
SSM000041	2008-03-04	15384	0.0080	0.0406	0.0143	0.0321	0.470	8.8	8.9
SSM000041	2008-05-14	15553	0.0140	0.0223	0.0474	0.0556	0.995	10.4	9.8
SSM000041	2008-08-19	15637	0.0034	0.0083	0.113	0.120	2.16	12.5	9.5
SSM000041	2008-11-11	15765	0.0110	0.1740	0.0325	0.0470	0.787	8.5	8.5
SSM000042	2008-03-11	15385	0.0008	0.0008	0.0195	0.0420	1.06	5.1	6.2
SSM000042	2008-05-14	15554	0.0010	0.0035	0.0115	0.0376	1.13	6.3	6.1
SSM000042	2008-08-19	15638	0.0007	0.0030	0.0552	0.0950	1.96	6.7	7.2
SSM000042	2008-11-11	15766	0.0008	0.0365	0.0336	0.0537	1.36	5.6	7.1
SSM000228	2008-03-04	15383	0.0043	0.0046	0.0003	0.0046	0.0660	14.8	14.8
SSM000228	2008-05-13	15551	0.0045	0.0052	0.0017	0.0065	0.115	13.9	13.5
SSM000228	2008-08-19	15639	0.0055	0.0060	0.0007	0.0135	0.554	12.9	11.7
SSM000228	2008-11-13	15768	0.0130	0.0220	0.0127	0.0168	0.361	14.3	16.0
SSM000240	2008-03-12	15387	0.199	0.3510	0.0008	0.0033	0.0170	10.1	10.2
SSM000240	2008-05-21	15555	0.0629	0.1390	0.0009	0.0096	0.1170	10.4	10.6
SSM000240	2008-08-27	15642	0.284	—	0.0011	0.0128	0.607	9.9	10.0
SSM000240	2008-11-18	15770	0.423	0.4220	0.0023	0.0064	0.0670	10.0	10.1
SSM000241	2008-03-13	15388	27.1	28.6	0.005	0.0215	0.154	73.4	74.3
SSM000241	2008-05-22	15556	28.1	28.4	0.0197	0.181	1.46	75.5	77.8
SSM000241	2008-08-28	15643	28.1	—	0.144	0.312	2.74	73.5	72.9
SSM000241	2008-11-19	15771	26.5	24.7	0.0029	0.0221	0.241	75.4	75.4
SSM000242	2008-04-08	15494	19.2	19.1	1.15	0.631	7.18	75.3	72.8

Primary results. Field analysis

Site number	Sampling date	Sample number	Water depth (before purging) from T.O.C. (m)	Water depth (sampling day) from T.O.C. (m)	Water temperature (° C)	pH	EC (mS/m)
SSM000014	2008-11-19	15769	1.34	1.34	7.9	7.94	–
SSM000022	2008-03-11	15386	0.71	0.70	7.3	6.92	–
SSM000022	2008-05-13	15552	0.77	0.78	9.1	7.18	–
SSM000022	2008-08-21	15640	0.75	0.77	12.6	7.42	–
SSM000022	2008-11-11	15764	0.69	0.67	10.1	7.91	–
SSM000030	2008-03-04	15381	1.43	1.44	9.1	6.04	–
SSM000030	2008-05-13	15550	1.54	1.54	9.6	6.67	–
SSM000030	2008-08-21	15641	1.60	1.60	12.1	6.41	–
SSM000030	2008-11-13	15767	1.39	1.40	7.6	7.36	–
SSM000037	2008-03-04	15382	1.38	1.39	6.3	6.01	–
SSM000041	2008-03-04	15384	1.56	1.64	5.2	6.40	–
SSM000041	2008-05-14	15553	1.76	1.85	8.9	6.20	–
SSM000041	2008-08-19	15637	1.92	1.89	15.5	6.74	–
SSM000041	2008-11-11	15765	1.55	1.53	12.3	7.37	–
SSM000042	2008-03-11	15385	1.80	1.80	9.0	5.91	–
SSM000042	2008-05-14	15554	2.08	2.08	9.7	6.35	–
SSM000042	2008-08-19	15638	2.02	1.98	13.2	7.09	–
SSM000042	2008-11-11	15766	1.51	1.51	10.9	7.53	–
SSM000228	2008-03-04	15383	2.69	2.71	6.1	6.44	–
SSM000228	2008-05-13	15551	2.82	2.82	9.5	6.47	–
SSM000228	2008-08-19	15639	2.84	2.83	11.4	7.05	–
SSM000228	2008-11-13	15768	2.49	2.51	8.4	7.47	–
SSM000240	2008-03-12	15387	1.04	1.03	6.8	6.05	317.8
SSM000240	2008-05-21	15555	1.53	1.53	14.2	6.60	299.0
SSM000240	2008-08-27	15642	1.29	1.35	17.8	5.74	377.4
SSM000240	2008-11-18	15770	1.08	1.26	8.5	6.97	385.0
SSM000241	2008-03-13	15388	2.08	2.13	6.3	6.30	–
SSM000241	2008-05-22	15556	2.23	2.63	13.8	6.21	–
SSM000241	2008-08-28	15643	2.40	2.53	17.1	7.28	–
SSM000241	2008-11-19	15771	2.09	2.25	6.2	7.10	–
SSM000242	2008-04-08	15494	3.36	3.37	–	–	–

Measurements on water depth are made from top of casing (T.O.C.). For length of casing above ground see table below.

Site number	Measurement from top of casing (T.O.C.) to ground (m)	Site number	Measurement from top of casing (T.O.C.) to ground (m)
SSM000014	0.800	SSM000042	0.800
SSM000022	0.400	SSM000228	1.000
SSM000030	1.200	SSM000240	1.000
SSM000037	0.350	SSM000241	0.500
SSM000041	0.800	SSM000242	0.500