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Oskarshamn site investigation

Monitoring of shallow ground water chemistry, 2006

Ulf Ericsson, Medins Biologi AB

November 2008

Svensk Kärnbränslehantering AB

Swedish Nuclear Fuel
and Waste Management Co

Box 250, SE-101 24 Stockholm
Phone +46 8 459 84 00



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Abstract

In 2006 sampling of shallow ground water in water wells in soil has been performed at 21 sites within the site investigation area at Oskarshamn. The purpose of the activity is to 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 2006.

Two nonconformities have occurred. Results from two samples were error coded in SICADA and omitted from this report. The reason stated was too high charge balance. The samples in question were the spring samples from the water wells SSM00041 and SSM00241. Further the evaluation of data for this report revealed one questionable result from the analysis of aluminum. The result 0.2 µg/l is about one thousand times lower than what can be expected from the site (SSM00034, sampled 2006-03-30).

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. Likewise the concentration of HCO₃ varied extensively throughout the investigation area with high concentrations in most wells. In two wells the concentration of HCO₃ was lower with an indication of a problem with acidification in the ground water.

As with the ions measurements on 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.

The average ratios of boron (¹⁰B/¹¹B) were similar in most wells and there seems to be low variation in the investigated area. With the exception of two sites the ratio of δ¹⁸O showed a good relationship with the conductivity (Figure 6-8). The two sites were SSM000241 and SSM000242 and these results might indicate occurrence of relict seawater at the two sites. The isotopes of δ³⁷Cl and δ³⁴S varied more between the different wells with the greatest variation in δ³⁴S.

The average hydrogen stable isotope ratios (δ²H) and tritium (³H) had similar values in most wells. However three wells differed with a markedly lower ratio for ³H. The δ²H ratio correlates well with the δ¹⁸O ratio. The linear relation differs markedly from the "Global Meteoric Line" (δ²H=8*δ¹⁸O+10) which is based on precipitation data.

The concentration of nitrate varied with considerable higher concentration in some of the wells. The concentration in these wells can be termed as moderately high according to Swedish environmental quality criteria. These results might indicate leakage from the surrounding farmland areas. The concentration of NH₄-N and PO₄-P varied with markedly higher values in the ground water wells situated close to the sea. The two sites SSM000241 and SSM000242 differed even more with extremely high values of NH₄-N and PO₄-P. The concentration of carbon (TOC and DOC) varied with results between 4 and 20 mg/l in most wells. The two wells SSM000241 and SSM000242 differed markedly with values between 70 and 75 mg/l.

Sammanfattning

Provtagning av ytligt grundvatten i jordrör har under 2006 skett vid 21 platser inom platsundersökningsområdet vid Oskarshamn. Målsättningen med aktiviteten är att 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 2006.

Två avvikelser har identifierats. Resultaten från två prover har felmarkerats i SICADA och dessa resultat har uteslutits från denna rapport. Skälet var att jonbalansberäkningarna visat på ett allt för stort fel. De aktuella proverna var från vårprovtagningen i jordrör SSM00041 och SSM00241. Vidare visade utvärderingen av data till denna rapport ett tveksamt resultat för aluminium. Provet ifråga hade ett värde på 0,2 µg/l och kom från jordrör SSM00034 som provtogs 2006-03-30. Detta resultat är ungefär tusen gånger lägre än vad som kan förväntas i området.

Resultaten av undersökningarna visade på en ganska stor variation mellan de olika grundvattenrören i området. Koncentrationen av joner och konduktiviteten varierade mellan vad som kan betecknas som låga till väldigt höga värden. Likadant varierade koncentrationen av HCO_3 mycket med höga koncentrationer vid de flesta provplatserna. I två av grundvattenrören var koncentrationen så låg att resultatet indikerade problem med försurning av grundvattnet.

Liksom för jonerna varierade värdena för miljömetaller och spårelement ganska mycket mellan de olika provplatserna. En hög koncentration av bly vid några av platserna indikerade någon sorts förorening. Men eftersom relationen mellan koncentrationen av bly och aluminium liknade den som flertalet andra metaller och spårelement hade med aluminium drogs slutsatsen att resultatet med höga blyhalter kan förklaras med mineralets naturliga sammansättning i området.

Isotopkvoterna av bor ($^{10}\text{B}/^{11}\text{B}$) var liknande vid de flesta provplatserna och det verkar vara en liten variation inom undersökningsområdet. Med undantag av två jordrör, SSM000241 och SSM000242, visade isotopen av $\delta^{18}\text{O}$ en god relation med konduktiviteten i vattnet. Dessa resultat kan indikera förekomst av relict havsvatten vid de bägge platserna. Isotoperna av klor ($\delta^{37}\text{Cl}$) och svavel ($\delta^{34}\text{S}$) varierade mer med en något större variation för $\delta^{34}\text{S}$.

Medelvärdena av väteisotoperna deuterium ($\delta^2\text{H}$) och tritium (^3H) var liknande i de flesta grundvattenrören. Resultatet från tre av rören skiljde sig dock med en märkbart lägre kvot för ^3H . Kvoterna av $\delta^2\text{H}$ var väl korrelerade till kvoterna av $\delta^{18}\text{O}$ men den linjära relationen skiljde sig märkbart från "the Global Meteoric Line" vilken baseras på data från nederbörd.

Koncentrationen av nitrat varierade med betydligt högre värden i några av grundvattenrören. Dessa värden kan klassas som måttligt höga enligt Naturvårdsverkets kriterier. Koncentrationen av $\text{NH}_4\text{-N}$ och $\text{PO}_4\text{-P}$ varierade med märkbart högre halter i jordrören som ligger nära havet. Resultaten från de två 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 and DOC) varierade med värden mellan 4 och 20 mg/l i de flesta jordrören. De två jordrören SSM000241 och SSM000242 hade ännu högre halter med värden mellan 70 och 75 mg/l.

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1 Introduction

This document reports the data gained by sampling of shallow ground water 2006, which is one of the activities performed within the site investigation at Oskarshamn. The work was carried out in accordance with activity plans AP PS-400-04-024, AP PS-400-04-77 and AP PS-400-06-039. In Table 1-1 controlling documents for performing this activity are listed. The activity plan is an SKB's internal controlling document.

Within the site investigation area water has been sampled from shallow ground water wells in soil. During 2006 sampling was performed at 21 sites on up to 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 numbers. 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
Vattenprovtagning i jordrör 2005 (Ävrö, Hälö och Simpevarphalvön)	AP PS 400-05-024	1.0
Vattenprovtagning i jordrör, Laxemar 2004–2006	AP PS 400-04-077	1.0
Vattenprovtagning i jordrör under monitoring 2006	AP PS-400-06-039	1.0

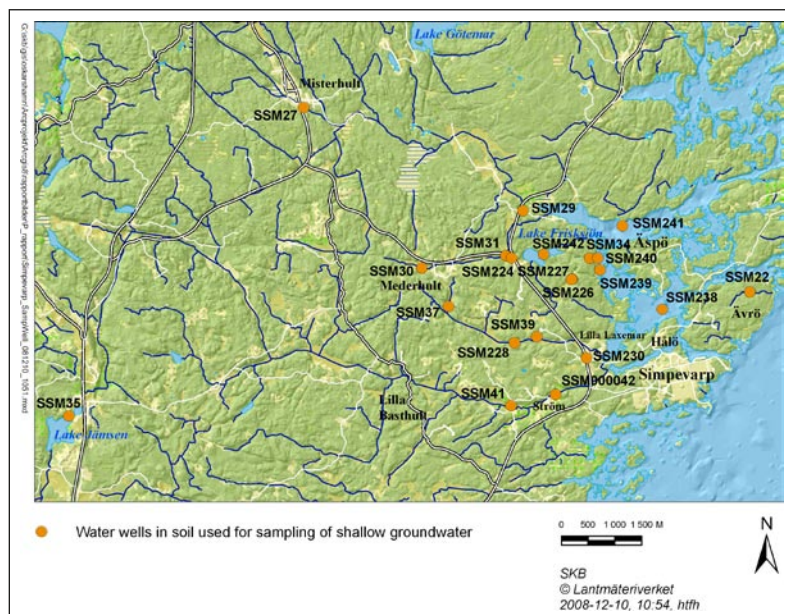


Figure 1-1. The site investigation area and the location of the water wells in soil used for sampling of shallow ground water in 2006.

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 plans sampling was planned to be performed at 21 different ground water wells, at one or more occasions during 2006. One of these water wells are situated in the Ävrö, Hålö and Simpevarp peninsula area, and 20 in the Laxemar area.

Some physical and chemical parameters were measured in the field. Water samples were then taken for analysis of further parameters. The samples were later sent to different 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 2006 in both areas 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 from January 2006 to December 2006.

Table 2-1. Analysed components and priority order when sampling ground water wells in the Simpevarp and Laxemar area 2006.

Chemical programme class 5 – reduced 2006			
Components	Priority	Optional components:	Priority
Alkalinity, pH, Conductivity	2	Deuterium, O-18	4
Anions (F ⁻ , Cl ⁻ , Br ⁻ , SO ₄ ²⁻)	3	Tritium	5
Standard elements	1	Cl-37	11
B-10	1	S-34	12
Environmental metals	1	NH ₄ , NO ₃ , NO ₂ , NO ₂ +NO ₃ , PO ₄	6
Lantanoides	1	Tot-N and Tot-P	7
Trace elements	1	DOC	8
Archive (acid rinsed)	13	TOC	9
Archive	13	POP, PON and POC	10

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.

Volume graded five litre containers, used in field as collecting vessels. Acid rinsed vessels were used when sampling for analysis of Fe (II) + Fe (tot) and main components, trace elements, lantanoides and environmental metals.

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 21 (Appendix 1). During 2006, sampling was performed at 20 sites situated in the Laxemar area and at one site (SSM000022) in the Ävrö, Hålö, and Simpevarp peninsula area (Appendix 2).

The ground water wells sampled in 2006 are presented in Appendix 3. During the year there was a change in sampling effort in the Laxemar area. It was decided that sampling should cease in many of the sampling wells after the May/June sampling period (AP-PS 400-06-039). Before the December sampling period it was also decided that sampling should commence in two ground water wells in the sea (SSM000240 and SSM000241).

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 10 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 sample for analysis of DOC was filtered in field with a syringe and 0.45 µm filter.

After sampling in field the samples were taken to a preparation room where most of the samples were prepared before analysis (Table 4-1). The sample in the collecting bottles was divided into smaller bottles. Many of the samples were also prepared with different types of filtrations and/or different type of conservations. This 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 or freezer till the end of the week, when they were sent to the laboratory.

During the year some changes of the methods used have occurred:

In March some new water wells were installed (SSM000238, SSM000239, SSM000240, SSM000241, SSM000242). In connection with the installation water samples were taken and analysed. These water wells were not to be sampled further.

In December a new decision was made and it was decided that the water wells SSM000240 and SSM000241 should be permanently added to the sampling program. It was also decided that the water for analysis of HS⁻ should not be filtered and that the reagents should be added to the Winkler bottles in the field.

4.3 Documentation

All activities were continuously documented. Notes were taken on field conditions, time of sampling, marking 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 4-1. Indoor treatments of samples.

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	Filter with “Pallfilter” 0.45 µm, add 0.5 ml 1M ZnAc and 0.5 ml 1M NaOH
125 ml	1	red	Standard elements, B-10, As, In, environment. metals lantanoides, trace elements	Fill up	Filter with membrane filter, add 1 ml concentrated HNO ₃
100 ml	1	green	NO ₃ ⁻ , NO ₂ ⁻ , (NO ₂ ⁻ +NO ₃ ⁻), PO ₄ ³⁻	Fill 80%	Filter with “Pallfilter” 0.45 µm
100 ml	1	green	Tot-N and Tot-P	Fill up	–
1,000 ml	1	green	POP, POC and PON	Fill up	–
20 ml scintillation vessel	1	green	DOC ¹	Fill 80%	Add 2 drops of 2 M HCL
20 ml scintillation vessel	1	green	TOC	Fill 80%	Add 2 drops of 2 M HCL
100 ml quadrangular	1	green	Deuterium, O-18	Fill 80%	–
500 ml dried	1	green	Tritium	Flow over	–
1,000 ml	1	green	Cl-37	Fill 80%	–
1,000 ml	1	green	S-34	Fill 80%	–
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

¹ The sample was filtered in field with syringe and 0.45 µm filter.

Table 4-2. Treatments of samples when storing and delivering to analysing laboratories.

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
250 ml	1	green	Density	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, As, In, environment. metals lantanoides, trace elements	Refrigerator	Analytica	Parcel post
100 ml	1	green	NO ₃ ⁻ , NO ₂ ⁻ , (NO ₂ ⁻ +NO ₃ ⁻), PO ₄ ³⁻	Freezer	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
250 ml	1	green	DOC	Freezer	Systemekologen	Parcel post
250 ml	1	green	TOC	Freezer	Systemekologen	Parcel post
100 ml quadrangular	1	green	Deuterium, O-18	Freezer	IFE, Norway	Parcel post
1,000 ml dried	1	green	Tritium, Cl-37	Refrigerator	Waterloo	Parcel post
1,000 ml	1	green	S-34	Freezer	IFE, Norway	Parcel post
250 ml	2	green	Archive	Freezer	–	–
100 ml	2	red	Archive	Freezer	–	–

5 Nonconformities

Results from two samples were error coded in SICADA and omitted from this report. The reason stated was to high charge balance. The samples in question were the spring samples from the water wells SSM000041 and SS000241.

The evaluation of data for this report reviled one questionable result from the analysis of aluminum. The result 0.2 $\mu\text{g}/\text{l}$ is about one thousand times lower than what can be expected from the site (SSM000034, sampled 2006-03-30).

6 Results

6.1 Primary results

All primary results from the laboratory analysis and from the field measurements are presented in Appendix 4 and 5.

6.2 Dissolved ions and conductivity

The concentrations of ions and the conductivity varied quite much between the sites (Table 6-1). Most of 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 was an exception with comparably high concentrations of ions.

According to the Swedish Environmental Quality Criteria /Swedish Environmental Protection Agency 1999/ the chloride concentrations range 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.

Table 6-1. Average concentration of major ions and conductivity in shallow ground water wells 2006. Figures in italic indicate that some or all individual values in the calculation were below the detection limit of the analysis.

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)
SSM000022	0.224	0.244	214.3	5.82	21.8	6.8	0.023
SSM000027	5.910	6.290	5.8	1.19	5.0	1.1	0.003
SSM000029	3.080	3.260	100.1	8.20	19.1	9.6	0.013
SSM000030	1.833	2.080	29.3	2.54	70.0	8.6	0.009
SSM000031	3.420	3.490	8.2	1.01	12.0	2.6	0.003
SSM000034	5.810	6.320	75.1	12.80	100.8	45.0	0.025
SSM000035	3.940	4.640	8.5	3.08	15.1	6.0	0.006
SSM000037	3.613	3.750	41.8	3.70	52.5	7.6	0.014
SSM000039	0.272	0.377	6.2	1.87	30.6	4.3	0.004
SSM000041	6.163	7.183	11.2	5.64	48.1	8.7	0.013
SSM000042	6.390	6.723	76.0	4.39	58.6	12.3	0.007
SSM000224	0.258	0.296	29.1	3.98	16.7	4.1	0.003
SSM000226	0.208	0.287	4.5	2.01	19.3	2.3	0.003
SSM000227	0.414	0.461	4.6	2.59	4.8	2.3	0.003
SSM000228	3.582	3.827	54.5	2.93	38.8	6.8	0.012
SSM000230	0.340	0.506	93.9	5.94	32.6	4.8	0.007
SSM000238			1,910.0	67.80	110.0	243.0	0.033
SSM000239			1,290.0	51.80	89.6	155.0	0.027
SSM000240	0.666	0.705	302.0	13.80	72.6	39.0	0.021
SSM000241	0.885	0.880	2,660.0	125.00	316.0	421.0	0.152
SSM000242			2,230.0	94.00	258.0	341.0	0.099

Table 6-1. Continued.

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)
SSM000022	267.00	136.3	132.75	47.48	4.34	0.262	116.3
SSM000027	6.73	5.7	14.70	5.04	0.26	0.020	8.3
SSM000029	197.00	86.4	22.55	8.06	3.30	0.119	65.4
SSM000030	252.75	14.3	42.20	15.05	2.45	0.278	52.9
SSM000031	35.85	6.9	16.10	5.77	2.13	0.040	13.6
SSM000034	520.00	130.5	0.29	0.29	0.57	0.496	117.5
SSM000035	64.45	3.8	13.70	5.13	1.75	0.046	16.5
SSM000037	196.50	33.8	43.20	15.09	2.06	0.210	52.1
SSM000039	35.05	8.7	69.85	20.45	2.18	0.066	26.4
SSM000041	99.13	21.7	41.23	14.80	1.07	0.140	32.6
SSM000042	159.25	83.5	86.88	32.10	1.16	0.152	69.7
SSM000224	37.05	49.0	16.75	6.08	2.15	0.068	28.9
SSM000226	49.60	5.1	9.47	3.47	0.66	0.062	13.9
SSM000227	4.85	6.2	13.90	5.07	0.39	0.037	8.6
SSM000228	138.75	59.7	36.35	13.17	2.70	0.107	51.2
SSM000230	36.10	169.0	18.00	6.70	0.35	0.159	72.9
SSM000238	194.00	3,610.0	480.00	171.00	0.68	1.520	1,140.0
SSM000239	504.00	2,480.0	130.00	104.00	2.02	1.350	823.0
SSM000240	254.50	526.0	52.15	18.40	1.48	0.535	217.5
SSM000241	5,370.00	5,070.0	10.60	12.60	0.82	5.130	1,970.0
SSM000242	3,520.00	3,570.0	0.54	10.80	0.61	3.630	1,420.0

As a quality control the charge balance has been calculated for the samples. In some 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. Samples with high positive deviation in charge balance had all comparatively low conductivity though (Figure 6-1). This might be an indication of an occurrence of ions not included in the calculation of charge balance instead of analytical errors. One possible example is organic anions which has not been included in the calculations. In one case (Table 6-2) there was a negative deviation of more than ten percent. Likewise this could indicate an analytical problem or a significant concentration of a positive ion not included in the calculation.

Table 6-2. Samples with a charge balance which deviates more than 10 percent. Sampling in shallow ground water wells 2006.

Site number	Sampling date	Sample number	Charge balance (%)
SSM000027	2006-05-23	11074	20.61
SSM000035	2006-05-23	11075	10.97
SSM000041	2006-12-07	11580	19.74
SSM000228	2006-03-23	10931	11.18
SSM000241	2006-12-13	11588	-15.96

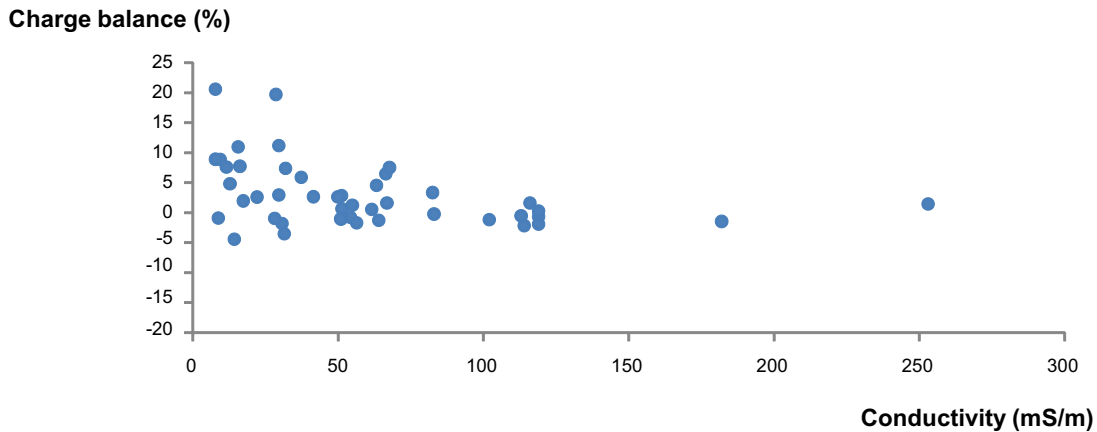


Figure 6-1. Relation of charge balance and conductivity in samples from all ground water wells 2006.

6.3 Acidification

As with other ions the concentration of HCO_3 varied extensively throughout the investigation areas (Table 6-3). In most 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 Environmental Protection Agency 1999/. In two wells (SSM000027 and SSM000227) the concentration of HCO_3 was lower than 10 mg/l which is termed as very low concentrations according to the Swedish EQC. In the latter cases the result is an indication of a problem with acidification in the ground water.

The field measurements of pH were in most cases considerably higher than the laboratory measurements (Table 6-3 and Figure 6-2). In most ground waters the opposite is normal due to a shift in the carbonate system when the gas pressure in the water is equalised prior to the analysis in the laboratory. An explanation to the observed results might be high contents of inorganic manganese and iron which is oxidised when the water is aerated prior to the analysis. Since there is both a very poor relation between the field and the laboratory measurements of pH and a very poor relation between the field measurements of pH and the concentration of HCO_3 (Figure 6-3) the best explanation is probably analysis errors. If this is true it is most likely the field measurements of pH that are faulty.

6.4 Environmental metals and trace elements

The results of measurements on environmental metals and trace elements are presented as average concentrations 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 some cases apparent out layers exists indicating pollution, contamination or analytical errors. Two examples are Zn and Cu in well SSM000230 (sample number 10897 and 11069) (Figure 6-5).

Some of the environmental metals can be classified according to the Swedish Environmental Quality Criteria's /Swedish Environmental 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 concentration of Pb were high ($> 3 \mu\text{g/l}$) in some of the wells (Table 6-4b and Figure 6-6). This could be an indication of some kind of pollution However the relation to aluminium is similar to most other elements and therefore the high concentration of Pb in these wells can probably be explained as a natural composition of the mineral in the site investigation area.

Table 6-3. Average concentration of HCO₃, calculated alkalinity (HCO₃) and pH in shallow ground water wells 2006.

Site number	HCO ₃ (mg/l)	Alkalinity (meq/l)	pH-lab	pH-field
SSM000022	267	4.38	7.92	8.24
SSM000027	6.73	0.11	5.48	7.73
SSM000029	197	3.23	6.73	7.68
SSM000030	253	4.14	7.17	7.69
SSM000031	35.8	0.59	6.26	7.84
SSM000034	520	8.52	6.87	7.51
SSM000035	64.4	1.06	6.41	7.35
SSM000037	196	3.22	6.92	7.30
SSM000039	35.0	0.57	6.13	7.50
SSM000041	99.1	1.63	6.49	7.74
SSM000042	159	2.61	6.75	7.61
SSM000224	37.0	0.61	6.15	7.62
SSM000226	49.6	0.81	6.38	7.89
SSM000227	4.85	0.08	5.18	7.75
SSM000228	138	2.27	6.73	7.48
SSM000230	36.1	0.59	6.34	7.68
SSM000238	194	3.18	7.11	7.86
SSM000239	504	8.26	7.31	7.48
SSM000240	254	4.17	7.40	7.94
SSM000241	5,370	88.03	6.56	6.76
SSM000242	3,520	57.70	6.74	

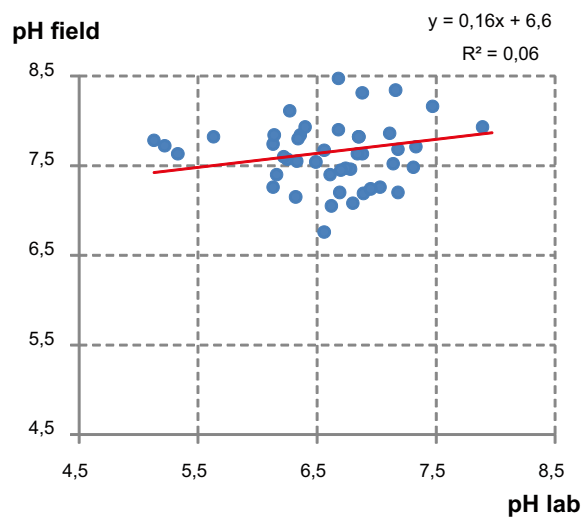


Figure 6-2. Relation of pH measured in the laboratory and in the field in ground water wells 2006.

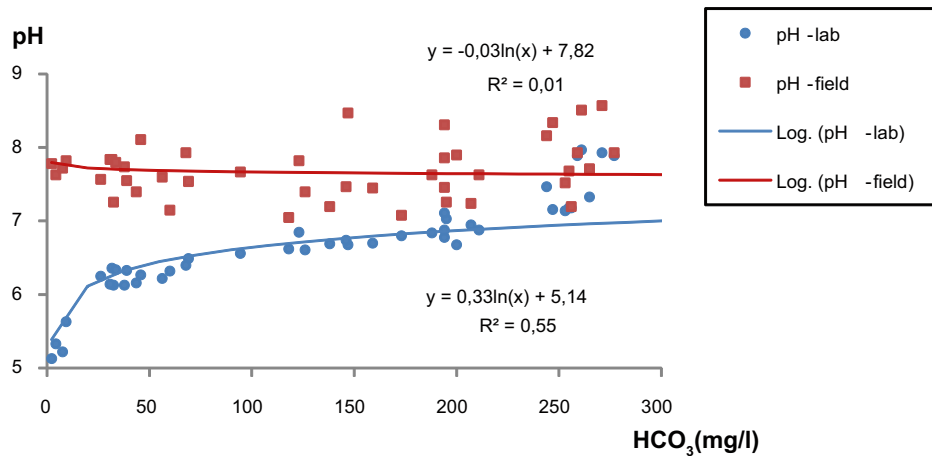


Figure 6-3. Relations of pH measured in the laboratory (blue dots) and in the field (red dots) with the concentration of HCO₃ in ground water wells 2006.

Table 6-4a. Average concentration of environmental metals in shallow ground water wells 2006. 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)
SSM000022	464	30.2	<i>0.0116</i>	3.31	0.925	0.300	<i>0.0020</i>
SSM000027	321	29.0	<i>0.0187</i>	0.750	2.30	2.54	<i>0.0020</i>
SSM000029	2,327	61.2	<i>0.0370</i>	5.73	4.55	1.53	<i>0.0020</i>
SSM000030	317	39.9	<i>0.0121</i>	1.17	0.98	0.277	<i>0.0020</i>
SSM000031	562	16.4	0.0052	1.53	0.83	0.113	<i>0.0020</i>
SSM000034	<i>231</i>	101	<i>0.0065</i>	0.49	<i>0.605</i>	0.203	<i>0.0020</i>
SSM000035	2,530	49.8	<i>0.0432</i>	2.65	6.51	3.30	<i>0.0025</i>
SSM000037	686	43.1	0.0126	1.67	2.14	0.637	<i>0.0020</i>
SSM000039	1,005	23.1	0.0271	0.63	4.40	0.492	<i>0.0030</i>
SSM000041	4,537	62.8	0.0396	7.08	7.41	3.65	<i>0.0024</i>
SSM000042	312	86.6	0.0198	1.36	2.60	0.559	<i>0.0020</i>
SSM000224	471	32.9	0.0410	0.78	7.86	3.08	<i>0.0029</i>
SSM000226	762	19.8	0.0157	0.94	6.34	0.475	<i>0.0083</i>
SSM000227	1,885	38.6	0.1080	1.71	5.06	2.28	0.0044
SSM000228	1,111	45.0	0.0365	2.30	2.56	1.06	<i>0.0024</i>
SSM000230	479	13.8	0.0715	0.94	33.4	0.332	0.0113
SSM000238	237	148	0.0097	0.90	0.696	0.232	<i>0.0020</i>
SSM000239	1,000	386	0.0040	2.35	1.25	0.940	<i>0.0020</i>
SSM000240	1,763	92.8	0.0189	2.21	1.39	0.729	<i>0.0020</i>
SSM000241	66.5	768	0.0516	6.99	2.30	5.94	<i>0.0020</i>
SSM000242	163	699	<i>0.0040</i>	4.15	1.30	13.3	<i>0.0020</i>

Table 6-4b. Average concentration of environmental metals in shallow ground water wells 2006. Figures in italic indicate that some or all individual values in the calculation were below the detection limit of the analysis.

Site number	Mo (µg/l)	Ni (µg/l)	Nb (µg/l)	Pb (µg/l)	V (µg/l)	Zn (µg/l)	Zr (µg/l)
SSM000022	11.6	3.32	0.035	0.416	1.67	3.08	1.15
SSM000027	0.168	2.21	0.127	0.318	1.58	5.16	0.331
SSM000029	0.955	3.12	2.25	4.26	15.7	11.9	6.70
SSM000030	0.698	1.56	0.241	0.676	5.58	4.41	1.85
SSM000031	1.60	0.421	0.119	0.313	6.26	2.19	1.19
SSM000034	<i>0.059</i>	0.651	0.113	0.691	0.784	3.62	0.857
SSM000035	1.40	3.89	0.689	4.61	11.4	21.7	2.76
SSM000037	1.53	1.80	0.729	1.05	4.30	7.35	1.58
SSM000039	0.264	2.60	0.126	0.761	1.15	4.92	0.818
SSM000041	0.564	8.34		5.28	11.3	21.2	4.16
SSM000042	1.99	1.34	0.299	0.642	3.02	5.47	1.38
SSM000224	0.998	5.19	0.053	0.438	0.218	5.97	0.802
SSM000226	0.091	2.13	0.094	0.319	0.815	4.14	0.789
SSM000227	<i>0.050</i>	3.07	0.170	0.776	1.08	16.4	0.854
SSM000228	1.81	2.16	1.11	2.82	9.91	12.4	3.87
SSM000230	7.10	5.34	0.139	1.30	5.46	74.1	0.616
SSM000238	1.33	0.806	0.227	0.398	2.95	2.00	0.435
SSM000239	0.109	1.98	0.350	0.226	6.91	4.44	1.08
SSM000240	0.521	1.49	0.848	3.09	8.30	4.95	3.34
SSM000241	1.00	2.41		0.844	16.0	7.93	15.0
SSM000242	0.624	6.10		0.527	7.44	10.0	6.58

Table 6-5a. Average concentration of trace elements in shallow ground water wells 2006. 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)	Sb (µg/l)	Cs (µg/l)	La (µg/l)
SSM000022	3.63	0.235	<i>0.104</i>	2.66	0.822	0.041	0.088	1.32
SSM000027	0.417	0.187	0.135	2.37	3.32	0.030	<i>0.039</i>	5.46
SSM000029	1.14	2.54	0.641	9.46	8.31	0.035	0.330	10.7
SSM000030	0.297	0.422	0.131	5.35	1.05	0.028	0.440	1.59
SSM000031	0.620	0.695	0.345	1.66	5.22	0.068	<i>0.030</i>	7.77
SSM000034	0.084	<i>0.329</i>	<i>0.075</i>	2.56	0.590	0.045	<i>0.055</i>	0.92
SSM000035	2.10	2.74	0.557	8.24	12.5	0.083	0.366	22.8
SSM000037	0.945	0.754	0.213	4.43	3.70	0.041	0.267	7.85
SSM000039	2.58	0.411	0.184	3.41	7.02	0.104	0.132	14.9
SSM000041	0.972	2.60	1.23	15.2	10.2	0.048	0.918	20.7
SSM000042	1.36	0.446	0.218	4.72	4.02	0.029	0.254	7.09
SSM000224	2.96	0.310	0.224	7.72	5.30	0.123	0.117	6.21
SSM000226	0.601	0.287	0.284	6.29	4.63	0.170	0.057	8.66
SSM000227	0.532	0.196	0.187	7.68	3.95	0.100	0.089	8.59
SSM000228	4.09	1.73	0.611	5.35	11.4	0.234	0.396	18.0
SSM000230	0.604	0.226	0.103	14.0	2.10	0.375	0.093	4.55
SSM000238	0.256	0.103	0.071	19.0	0.668	0.064	0.259	1.17
SSM000239	0.537	0.181	0.166	23.2	1.36	0.063	0.781	2.14
SSM000240	1.06	0.839	<i>0.311</i>	12.2	2.18	0.072	0.991	3.07
SSM000241	0.058	<i>0.200</i>	<i>0.500</i>	62.2	0.322	1.07	2.23	0.136
SSM000242	1.02	<i>0.400</i>	<i>0.800</i>	32.0	0.773	0.200	0.397	0.615

Table 6-5b. Average concentration of trace elements in shallow ground water wells 2006. Figures in italic indicate that some individual values in the calculation were below the detection limit of the analysis.

Site number	Hf (µg/l)	Tl (µg/l)	Ce (µg/l)	Pr (µg/l)	Nd (µg/l)	Sm (µg/l)	Eu (µg/l)	Gd (µg/l)
SSM000022	0.026	<i>0.021</i>	1.87	0.293	1.14	0.190	0.024	0.166
SSM000027	0.016	0.007	12.3	1.59	6.45	1.12	0.172	0.856
SSM000029	0.226	0.038	21.9	2.74	10.8	1.92	0.291	1.71
SSM000030	0.038	<i>0.019</i>	3.08	0.372	1.45	0.269	0.041	0.228
SSM000031	0.045	<i>0.050</i>	18.5	2.34	10.2	1.79	0.301	1.36
SSM000034	0.026	<i>0.029</i>	1.92	<i>0.246</i>	<i>0.908</i>	<i>0.157</i>	<i>0.019</i>	<i>0.150</i>
SSM000035	0.104	0.045	42.4	5.26	20.4	3.38	0.486	2.85
SSM000037	0.046	0.015	12.0	1.48	5.96	0.933	0.140	0.853
SSM000039	0.027	0.026	11.3	3.35	13.0	2.08	0.334	1.78
SSM000041	0.130	0.086	40.9	4.81	18.5	3.11	0.458	2.56
SSM000042	0.040	0.012	9.42	1.42	5.84	0.943	0.136	0.854
SSM000224	0.033	0.007	12.9	1.62	6.53	1.13	0.193	0.972
SSM000226	0.030	0.033	11.5	2.17	8.49	1.43	0.250	1.16
SSM000227	0.037	0.038	16.4	2.12	7.94	1.30	0.220	1.02
SSM000228	0.126	0.030	30.2	3.81	15.9	2.53	0.433	2.43
SSM000230	0.023	0.017	6.50	0.949	3.73	0.599	0.097	0.531
SSM000238	0.012	0.050	2.02	0.241	0.953	0.145	0.036	0.141
SSM000239	0.032	0.011	3.88	0.463	1.77	0.292	0.075	0.271
SSM000240	0.077	<i>0.044</i>	6.07	0.673	2.71	0.468	0.076	0.424
SSM000241	0.114	<i>0.050</i>	0.19	<i>0.050</i>	0.099	<i>0.050</i>	<i>0.050</i>	<i>0.050</i>
SSM000242	0.064	<i>0.050</i>	0.83	0.142	0.537	0.108	<i>0.040</i>	0.109

Table 6-5c. Average concentration of trace elements in shallow ground water wells 2006. Figures in italic indicate that some individual values in the calculation were below the detection limit of the analysis.

Site number	Tb (µg/l)	Dy (µg/l)	Ho (µg/l)	Er (µg/l)	Tm (µg/l)	Yb (µg/l)	Lu (µg/l)
SSM000022	<i>0.021</i>	0.119	0.023	0.069	<i>0.010</i>	0.062	<i>0.010</i>
SSM000027	0.095	0.527	0.106	0.331	0.048	0.375	0.064
SSM000029	0.224	1.32	0.259	0.770	0.109	0.763	0.120
SSM000030	0.030	0.175	0.035	0.112	0.016	0.110	0.019
SSM000031	0.150	0.821	0.156	0.454	0.060	0.409	0.064
SSM000034	<i>0.020</i>	<i>0.103</i>	<i>0.021</i>	<i>0.059</i>	<i>0.010</i>	<i>0.056</i>	<i>0.011</i>
SSM000035	0.342	1.95	0.379	1.07	0.136	0.885	0.142
SSM000037	0.096	0.524	0.099	0.281	0.036	0.229	0.037
SSM000039	0.188	1.02	0.190	0.534	0.066	0.442	0.070
SSM000041	0.310	1.73	0.320	0.905	0.123	0.817	0.126
SSM000042	0.095	0.530	0.107	0.308	0.039	0.260	0.043
SSM000224	0.123	0.753	0.153	0.482	0.069	0.505	0.082
SSM000226	0.138	0.780	0.146	0.432	0.058	0.397	0.060
SSM000227	0.128	0.716	0.131	0.393	0.053	0.347	0.049
SSM000228	0.277	1.58	0.320	0.947	0.126	0.846	0.141
SSM000230	0.058	0.316	0.059	0.166	0.022	0.140	0.022
SSM000238	0.017	0.091	0.019	0.053	0.007	0.053	0.009
SSM000239	0.034	0.188	0.035	0.098	0.013	0.094	0.014
SSM000240	0.055	0.326	0.065	0.202	0.028	0.207	0.035
SSM000241	<i>0.050</i>	<i>0.050</i>	<i>0.050</i>	0.071	<i>0.050</i>	<i>0.050</i>	<i>0.050</i>
SSM000242	<i>0.040</i>	0.095	<i>0.040</i>	0.101	<i>0.040</i>	0.066	<i>0.040</i>

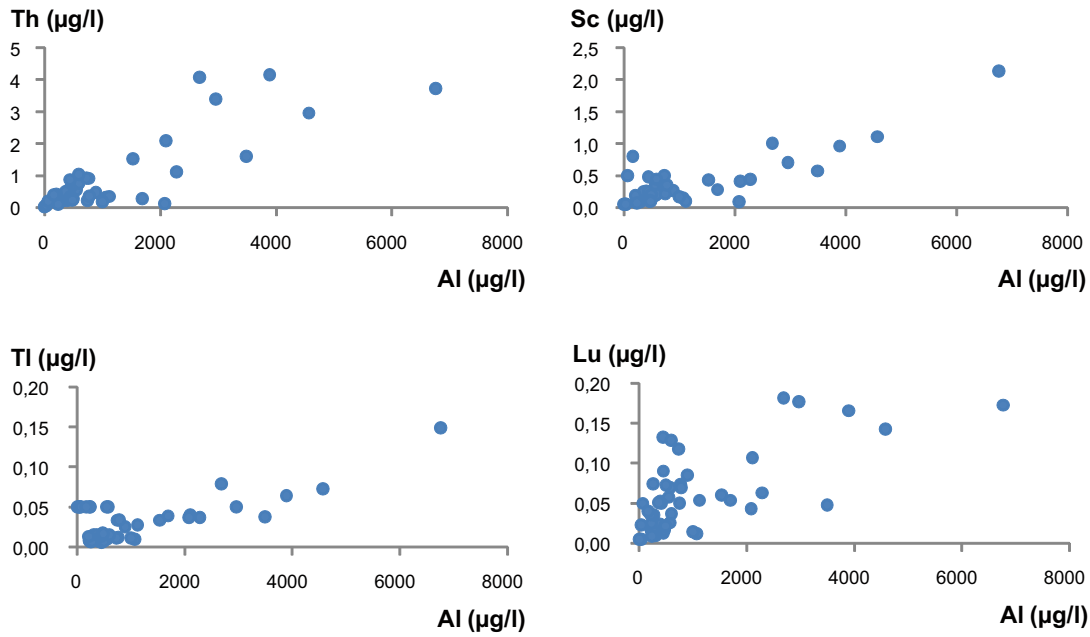


Figure 6-4. Relations between concentrations of Al and some other elements in ground water wells 2006.

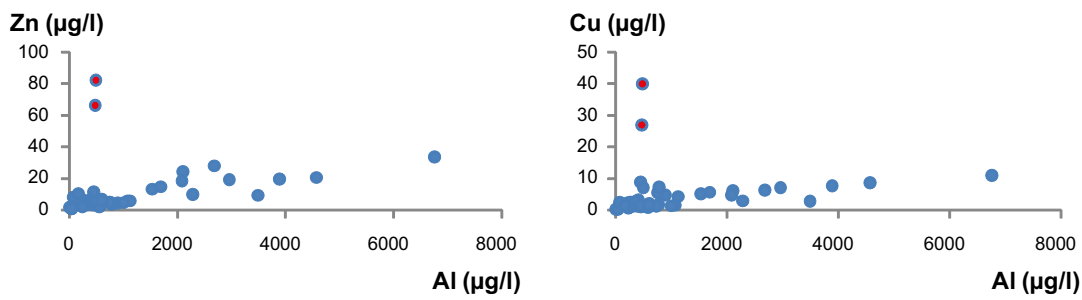


Figure 6-5. Relations between concentrations of Al and Zn and Al and Cu in ground water wells 2006. Out layers are marked red.

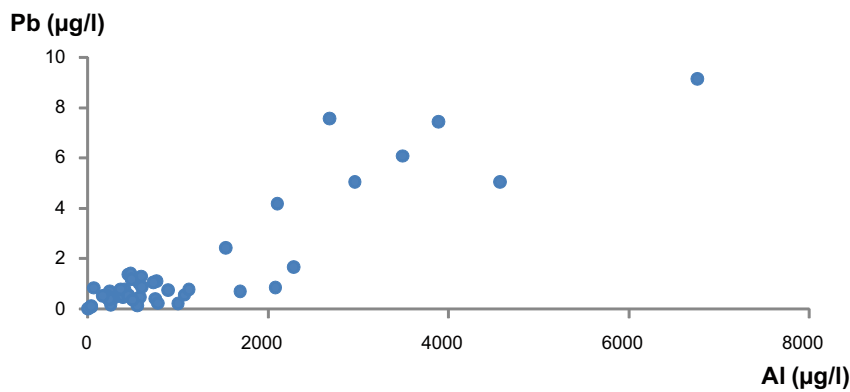


Figure 6-6. Relations between concentrations of Al and Pb in ground water wells 2006.

6.5 Isotopes

The results of the measurements of isotopes are presented in Table 6-6. The average ratios of boron ($^{10}\text{B}/^{11}\text{B}$) were similar in most wells and there seems to be low variation in the investigated area. With the exception of two sites the ratio of $\delta^{18}\text{O}$ showed a good relationship with the conductivity (Figure 6-7). The two sites were SSM000241 and SSM000242 and these results might indicate occurrence of relict seawater at the two sites. The isotopes of $\delta^{37}\text{Cl}$ and $\delta^{34}\text{S}$ varied more between the different wells with the greatest variation in $\delta^{34}\text{S}$.

The average hydrogen isotope ratios of $\delta^2\text{H}$ and ^3H had similar values in most wells. However the wells SSM000022, SSM000241 and SSM000242 differed with a markedly lower ratio for ^3H . The $\delta^2\text{H}$ ratio correlates well with the $\delta^{18}\text{O}$ ratio (Figure 6-8). The linear relation differs markedly from the "Global Meteoric Line" ($\delta^2\text{H}=8\times\delta^{18}\text{O}+10$) which is based on precipitation data.

6.6 Nutrients and carbon

The concentration of nitrate varied with considerable higher concentration in some of the wells (Table 6-7). According to the Swedish Environmental Quality Criteria /Swedish Environmental Protection Agency 1999/ the concentration of nitrate was moderately high (1–5 $\mu\text{g}/\text{l}$) in these wells. These results might indicate leakage from the surrounding farmland areas. The concentration of $\text{NH}_4\text{-N}$ and $\text{PO}_4\text{-P}$ varied with markedly higher values in the ground water wells situated close to the sea. The two sites 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 results between 4 and 20 mg/l in most wells (Table 6-7). Again the two wells SSM000241 and SSM000242 differed markedly with values between 70 and 75 mg/l .

Table 6-6. Average ratio of isotopes in shallow ground water wells 2006. Measurements not performed is marked with.

Site number	$\delta^2\text{H}$ (‰ VSMOW)	^3H (TU)	$\delta^{18}\text{O}$ (‰ VSMOW)	$\delta^{34}\text{S}$ (‰ CDT)	$^{10}\text{B}/^{11}\text{B}$ (atomic)	$\delta^{37}\text{Cl}$ (‰ SMOC)
SSM000022	-76.8	1.63	-10.5	22.8	0.2378	0.27
SSM000027	-77.9	11.03	-11.1	1.5	0.2442	-0.12
SSM000029	-78.8	9.90	-10.9	25.3	0.2392	0.17
SSM000030	-76.8	9.46	-10.8	9.4	0.2403	0.22
SSM000031	-80.2	10.85	-11.2	-2.1	0.2389	0.27
SSM000034	-76.9	13.65	-10.9	-	0.2447	-0.77
SSM000035	-78.1	9.90	-11.1	0.4	0.2454	-0.02
SSM000037	-80.0	8.10	-11.0	13.5	0.2394	0.03
SSM000039	-80.8	11.65	-11.4	-18.1	0.2412	-0.18
SSM000041	-79.2	10.43	-11.0	0.8	0.2425	-0.20
SSM000042	-77.0	8.40	-10.8	-8.8	0.2387	0.03
SSM000224	-79.5	10.60	-11.2	-4.5	0.2423	-0.01
SSM000226	-81.3	11.36	-11.3	5.7	0.2380	-0.04
SSM000227	-78.8	13.12	-11.2	5.4	0.2390	-0.02
SSM000228	-79.2	9.31	-11.0	10.0	0.2390	0.14
SSM000230	-83.3	10.85	-11.7	2.2	0.2448	0.21
SSM000238	-54.3	13.50	-7.0	19.8	0.2370	0.08
SSM000239	-59.9	9.70	-7.6	32.1	0.2386	0.01
SSM000240	-75.1	8.50	-10.5	23.0	0.2380	0.20
SSM000241	-69.3	1.50	-9.7	-	0.2409	-
SSM000242	-63.9	1.40	-8.1	10.1	0.2407	0.43

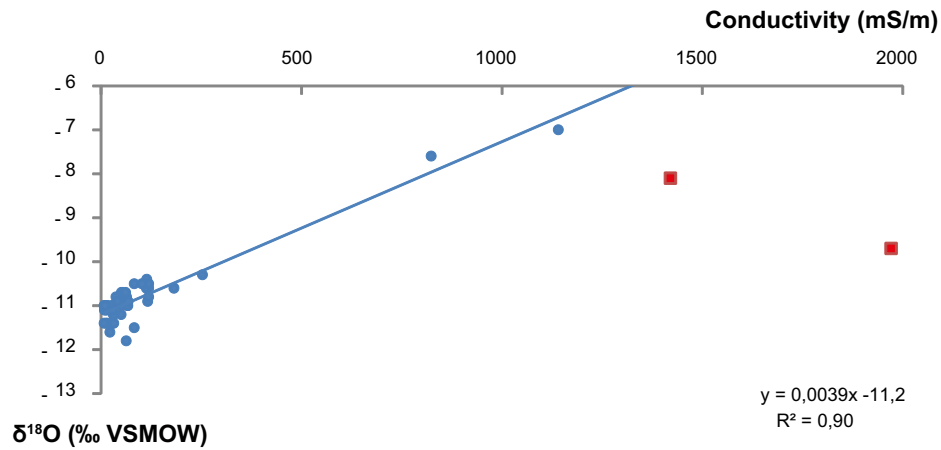


Figure 6-7. The relationship between the conductivity and the ratio of $\delta^{18}\text{O}$ in ground water wells 2006. Red dots show the two sites SSM000241 and SSM000242 which had a different relationship between the conductivity and the ratio of $\delta^{18}\text{O}$.

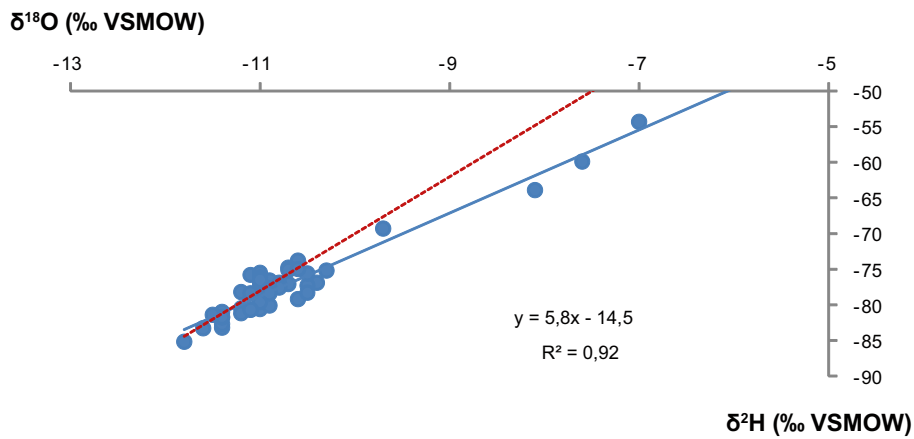


Figure 6-8. The local relationship between the ratios of $\delta^2\text{H}$ and $\delta^{18}\text{O}$ in ground water wells 2006. The red dotted line shows the "Global Meteoric Line" ($\delta^2\text{H} = 8 \times \delta^{18}\text{O} + 10$).

Table 6-7. Average concentration of nitrogen and phosphorus compounds, and carbon in shallow ground water wells 2006. Figures in italic indicate that some individual values in the calculation were below the detection limit of the analysis. Measurements not performed is marked with.

Site number	NO2-N (mg/l)	NO3-N (mg/l)	NO2/NO3-N (mg/l)	NH4-N (mg/l)	N-tot (mg/l)	PON (mg/l)
SSM000022	0.0214	0.2149	0.236	0.654	0.880	0.027
SSM000027	0.0016	0.5685	0.570	0.017	0.730	0.028
SSM000029	0.0125	0.1473	0.160	0.861	1.565	0.247
SSM000030	0.0021	0.2407	0.243	1.164	2.123	0.121
SSM000031	0.0004	0.0020	0.002	0.266	0.247	0.011
SSM000034	0.0010	0.0063	0.007	1.148	0.786	0.020
SSM000035	0.0017	0.0042	0.006	0.053	0.291	0.067
SSM000037	0.0007	0.0090	0.010	0.258	0.545	0.077
SSM000039	0.0019	0.5745	0.576	0.078	0.850	0.018
SSM000041	0.0033	0.2415	0.245	0.224	0.705	0.289
SSM000042	0.0010	0.1842	0.185	0.417	0.602	0.068
SSM000224	0.0058	0.1837	0.190	0.069	0.551	0.006
SSM000226	0.0018	0.2140	0.216	0.055	0.734	0.014
SSM000227	0.0008	0.4995	0.501	0.005	1.159	0.260
SSM000228	<i>0.0009</i>	0.1168	0.118	0.172	0.515	0.039
SSM000230	0.0006	3.8100	3.810	0.128	6.365	0.010
SSM000238	0.0003	0.0012	0.001	3.280	3.550	0.109
SSM000239	0.0002	0.0003	0.001	10.90	11.40	0.125
SSM000240	0.0003	<i>0.0003</i>	0.001	1.249	1.575	0.089
SSM000241	–	–	0.003	646	611	0.240
SSM000242	0.0042	0.0003	0.003	269	270	0.175
Site number	PO4-P (mg/l)	P-tot (mg/l)	POP (mg/l)	TOC (mg/l)	DOC (mg/l)	POC (mg/l)
SSM000022	0.012	0.030	0.003	5.8	5.7	0.24
SSM000027	0.015	0.013	0.005	4.4	3.7	0.42
SSM000029	0.044	0.181	0.095	12.3	10.9	2.24
SSM000030	0.016	0.222	0.026	10.0	9.0	1.13
SSM000031	0.004	0.008	0.002	10.2	10.1	0.14
SSM000034	0.002	0.161	0.026	7.7	7.4	0.28
SSM000035	0.004	0.286	0.061	5.8	5.5	1.63
SSM000037	<i>0.004</i>	0.056	0.031	10.5	9.8	1.11
SSM000039	0.002	0.036	0.004	6.5	6.7	0.17
SSM000041	<i>0.001</i>	0.818	0.294	11.4	9.4	3.69
SSM000042	<i>0.002</i>	0.087	0.044	7.0	6.8	1.28
SSM000224	0.005	0.004	0.001	7.8	7.7	0.06
SSM000226	0.004	0.012	0.002	16.0	15.2	0.12
SSM000227	0.004	0.046	0.040	19.8	15.4	2.58
SSM000228	0.001	0.049	0.034	12.7	12.2	0.60
SSM000230	0.015	1.860	0.007	12.8	11.4	0.11
SSM000238	0.364	0.465	0.009	7.6	7.6	0.79
SSM000239	0.552	0.679	0.013	11.3	9.9	0.98
SSM000240	0.038	0.104	0.009	10.7	10.5	0.80
SSM000241	28.8	27.8	0.039	73.4	72.7	1.94
SSM000242	10.6	17.0	0.130	71.2	71.3	1.06

References

Swedish Environmental Protection Agency, 1999. Bedömningsgrunder för miljö kvalitet, grundvatten. Naturvårdsverket, rapport 4915.

Sites, co-ordinates and sampling depths

Sites, sample depths and co-ordinates for sampled ground water wells

ID-code	Co-ordinate (X)	Co-ordinate (Y)	Sampling depth (m)
SSM000022	6367458	1553120	5–7
SSM000027	6370909	1544779	3–5
SSM000029	6368976	1548879	5–7
SSM000030	6367908	1546986	4–5
SSM000031	6368133	1548563	3–4
SSM000034	6368090	1550123	3–4
SSM000035	6365138	1540387	3–4
SSM000037	6367186	1547490	3–4
SSM000039	6366620	1549136	3–5
SSM000041	6365332	1548655	2–4
SSM000042	6365541	1549488	3–5
SSM000224	6368092	1548667	16–17
SSM000226	6367696	1549790	4–5
SSM000227	6367693	1549788	1–2
SSM000228	6366504	1548718	6–7
SSM000230	6366220	1550069	4–5
SSM000238	6367133	1551485	11–12
SSM000239	6367871	1550325	4–5
SSM000240	6368093	1550283	5–6
SSM000241	6368695	1550739	32–33
SSM000242	6368160	1549267	17–18

Schedule – Sampling of shallow ground water 2006

Sampling occasions in ground water wells 2006

Month	February/March	May/June	September	December
Programme	Week number			
Chemical class 5 reduced	7–13	20–22	37–38	49–50

Sampling occasions 2006

Sampling occasions in different groundwater wells 2006				
ID-code	February/March	May/June	September	December
	Week number 7–13	Week number 20–22	Week number 37–38	Week number 49–50
SSM000022	X	X	X	X
SSM000027	X	X		
SSM000029	X	X		
SSM000030	X	X	X	X
SSM000031	X	X		
SSM000034	X	X		
SSM000035	X	X		
SSM000037	X	X	X	X
SSM000039	X	X		
SSM000041	X	X	X	X
SSM000042	X	X	X	X
SSM000224	X	X		
SSM000226	X	X		
SSM000227	X	X		
SSM000228	X	X	X	X
SSM000230	X	X		
SSM000238	X			
SSM000239	X			
SSM000240	X			X
SSM000241	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)
SSM000022	2006-03-30	10946	220.0	5.84	23.0	6.7	261.00	144.0	131.00	48.30
SSM000022	2006-06-01	11114	212.0	5.64	21.1	6.6	259.00	131.0	130.00	46.60
SSM000022	2006-09-14	11317	208.0	5.96	21.5	7.0	277.00	130.0	129.00	46.70
SSM000022	2006-12-05	11579	217.0	5.84	21.5	7.0	271.00	140.0	141.00	48.30
SSM000027	2006-03-21	10905	5.6	1.22	5.5	1.2	9.20	5.8	15.30	5.27
SSM000027	2006-05-23	11074	5.9	1.15	4.4	0.9	4.26	5.5	14.10	4.80
SSM000029	2006-03-15	10895	96.2	8.44	19.9	10.4	200.00	87.2	20.80	8.17
SSM000029	2006-05-16	11063	104.0	7.95	18.3	8.8	194.00	85.6	24.30	7.95
SSM000030	2006-03-21	10906	29.5	2.46	71.6	8.7	253.00	16.4	46.50	16.30
SSM000030	2006-05-30	11090	31.7	2.67	72.6	9.0	255.00	15.6	45.40	16.20
SSM000030	2006-09-12	11312	27.1	2.58	70.2	8.4	247.00	12.9	40.00	14.80
SSM000030	2006-12-05	11570	29.0	2.43	65.6	8.2	256.00	12.3	36.90	12.90
SSM000031	2006-03-15	10896	8.4	0.97	12.7	2.7	45.60	7.6	13.10	4.67
SSM000031	2006-05-16	11064	8.0	1.05	11.2	2.4	26.10	6.1	19.10	6.87
SSM000034	2006-03-30	10947	74.3	13.20	102.0	45.2	518.00	124.0	0.38	0.30
SSM000034	2006-05-30	11091	75.9	12.40	99.6	44.8	522.00	137.0	0.20	0.27
SSM000035	2006-03-21	10907	8.4	2.87	15.8	5.8	69.00	4.0	14.70	5.37
SSM000035	2006-05-23	11075	8.6	3.29	14.4	6.2	59.90	3.6	12.70	4.89
SSM000037	2006-03-23	10929	51.3	4.01	45.7	7.8	173.00	45.7	36.00	12.40
SSM000037	2006-05-16	11065	40.9	3.38	50.3	7.0	195.00	34.7	26.50	9.54
SSM000037	2006-09-22	11356	32.8	3.61	58.9	7.6	211.00	20.1	49.30	18.10
SSM000037	2006-12-05	11571	42.3	3.81	55.1	8.1	207.00	34.8	61.00	20.30
SSM000039	2006-03-23	10930	6.4	2.03	38.2	5.1	32.40	10.1	90.20	28.60
SSM000039	2006-05-23	11077	6.0	1.70	22.9	3.5	37.70	7.2	49.50	12.30
SSM000041	2006-05-18	11067	9.8	5.32	39.7	8.4	94.30	18.9	40.30	15.10
SSM000041	2006-09-12	11310	12.1	5.34	56.7	8.2	147.00	19.9	36.80	13.50
SSM000041	2006-12-07	11580	11.6	6.25	47.8	9.5	56.10	26.4	46.60	15.80
SSM000042	2006-03-28	10938	51.2	3.08	55.5	12.2	138.00	61.7	86.20	31.70
SSM000042	2006-05-18	11068	66.8	3.83	61.6	12.8	146.00	72.0	87.50	33.40
SSM000042	2006-09-12	11311	99.5	5.63	56.6	11.5	194.00	116.0	84.90	31.20
SSM000042	2006-12-05	11581	86.6	5.01	60.8	12.6	159.00	84.3	88.90	32.10
SSM000224	2006-03-28	10935	28.7	3.75	15.2	3.7	43.50	44.8	15.80	5.77
SSM000224	2006-05-16	11066	29.4	4.21	18.1	4.4	30.60	53.1	17.70	6.39
SSM000226	2006-03-28	10936	4.0	1.73	14.8	2.0	31.50	6.7	9.99	3.66
SSM000226	2006-05-30	11092	5.0	2.29	23.8	2.6	67.70	3.4	8.94	3.28
SSM000227	2006-03-28	10937	4.9	2.38	5.2	2.6	2.15	8.2	14.70	5.45
SSM000227	2006-05-30	11093	4.2	2.79	4.4	2.0	7.54	4.1	13.10	4.68
SSM000228	2006-03-23	10931	15.0	3.62	46.0	8.3	126.00	9.3	22.80	8.87
SSM000228	2006-05-23	11076	9.9	2.04	34.7	5.8	123.00	8.8	32.10	11.20
SSM000228	2006-09-22	11357	157.0	3.37	38.1	6.9	188.00	183.0	52.30	19.60
SSM000228	2006-12-05	11572	36.1	2.70	36.2	6.2	118.00	37.6	38.20	13.00
SSM000230	2006-03-15	10897	102.0	6.75	39.1	5.7	38.70	194.0	19.40	7.20
SSM000230	2006-05-18	11069	85.7	5.12	26.0	3.9	33.50	144.0	16.60	6.19
SSM000238	2006-03-14	10885	1,910.0	67.80	110.0	243.0	194.00	3,610.0	480.00	171.00
SSM000239	2006-03-14	10886	1,290.0	51.80	89.6	155.0	504.00	2,480.0	130.00	104.00
SSM000240	2006-03-15	10889	249.0	12.40	56.3	31.5	244.00	424.0	46.10	16.10
SSM000240	2006-12-12	11585	355.0	15.20	88.9	46.4	265.00	628.0	58.20	20.70
SSM000241	2006-12-13	11588	2,660.0	125.00	316.0	421.0	5,370.00	5,070.0	10.60	12.60
SSM000242	2006-02-16	10814	2,230.0	94.00	258.0	341.0	3,520.00	3,570.0	0.54	10.80

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)
SSM000022	2006-03-30	10946	0.550	4.12	5.43	0.0813	–	–	0.07290	0.024
SSM000022	2006-06-01	11114	0.486	4.65	8.20	0.9840	0.284	0.262	0.08710	0.022
SSM000022	2006-09-14	11317	0.650	4.17	6.46	0.5720	0.213	0.182	0.08910	0.023
SSM000022	2006-12-05	11579	4.460	4.43	6.18	0.6490	0.235	0.229	0.08820	0.024
SSM000027	2006-03-21	10905	0.200	0.32	8.20	2.6400	–	–	0.09500	0.004
SSM000027	2006-05-23	11074	0.027	0.20	6.69	1.3900	6.290	5.910	0.05880	0.002
SSM000029	2006-03-15	10895	0.680	3.17	18.50	8.8300	–	–	0.23900	0.014
SSM000029	2006-05-16	11063	0.560	3.42	12.10	4.4300	3.260	3.080	0.17900	0.012
SSM000030	2006-03-21	10906	0.200	2.38	9.86	2.3700	–	–	0.62400	0.008
SSM000030	2006-05-30	11090	0.200	2.46	10.30	3.2500	2.170	1.850	0.64000	0.010
SSM000030	2006-09-12	11312	0.200	2.37	9.41	2.5700	2.140	1.790	0.63100	0.009
SSM000030	2006-12-05	11570	0.200	2.58	9.01	2.3500	1.930	1.860	0.58500	0.010
SSM000031	2006-03-15	10896	0.200	2.12	7.99	4.3400	–	–	0.11600	0.004
SSM000031	2006-05-16	11064	0.200	2.13	7.52	3.6300	3.490	3.420	0.10100	0.002
SSM000034	2006-03-30	10947	0.745	0.55	14.20	5.7700	–	–	1.35000	0.025
SSM000034	2006-05-30	11091	0.805	0.58	15.40	7.2300	6.320	5.810	1.32000	0.025
SSM000035	2006-03-21	10907	0.200	1.73	13.80	5.9000	–	–	0.70100	0.004
SSM000035	2006-05-23	11075	0.200	1.77	15.00	7.5800	4.640	3.940	0.32500	0.007
SSM000037	2006-03-23	10929	0.200	1.77	13.20	4.6600	–	–	0.65200	0.014
SSM000037	2006-05-16	11065	0.200	1.96	11.40	5.3400	4.680	4.420	0.61400	0.013
SSM000037	2006-09-22	11356	0.200	2.09	12.50	6.5400	1.230	1.200	0.72800	0.014
SSM000037	2006-12-05	11571	0.200	2.42	11.80	5.8300	5.340	5.220	0.76100	0.015
SSM000039	2006-03-23	10930	0.200	2.99	8.00	0.4310	–	–	0.09960	0.004
SSM000039	2006-05-23	11077	0.200	1.36	8.56	0.7170	0.377	0.272	0.03520	0.003
SSM000041	2006-05-18	11067	0.200	0.91	20.70	14.3000	9.990	8.530	0.57000	0.013
SSM000041	2006-09-12	11310	0.210	1.23	17.80	8.2200	5.940	4.890	0.72100	0.010
SSM000041	2006-12-07	11580	0.200	1.07	23.60	13.6000	5.620	5.070	0.69500	0.016
SSM000042	2006-03-28	10938	0.435	1.06	9.70	11.0000	–	–	0.71200	0.005
SSM000042	2006-05-18	11068	0.535	1.06	10.10	9.5400	8.980	8.920	0.81600	0.006
SSM000042	2006-09-12	11311	0.610	1.28	11.40	5.8700	5.330	4.500	0.77100	0.009
SSM000042	2006-12-05	11581	0.315	1.23	10.30	6.1800	5.860	5.750	0.84000	0.008
SSM000224	2006-03-28	10935	0.200	2.20	6.71	0.1610	–	–	0.03830	0.004
SSM000224	2006-05-16	11066	0.200	2.10	6.92	0.1200	0.296	0.258	0.04410	0.002
SSM000226	2006-03-28	10936	0.200	0.62	7.23	0.3590	–	–	0.05550	0.004
SSM000226	2006-05-30	11092	0.200	0.70	6.99	0.3340	0.287	0.208	0.08580	0.001
SSM000227	2006-03-28	10937	0.200	0.40	13.00	0.6110	–	–	0.05230	0.004
SSM000227	2006-05-30	11093	0.200	0.38	8.39	0.6960	0.461	0.414	0.03930	0.002
SSM000228	2006-03-23	10931	0.200	2.24	15.50	8.1600	–	–	0.71700	0.013
SSM000228	2006-05-23	11076	0.200	2.49	11.70	5.7800	5.170	4.840	0.52400	0.011
SSM000228	2006-09-22	11357	0.715	3.38	8.47	6.0600	1.140	0.846	0.48700	0.011
SSM000228	2006-12-05	11572	0.200	2.69	10.50	5.6600	5.170	5.060	0.51500	0.011
SSM000230	2006-03-15	10897	0.200	0.36	15.10	0.7650	–	–	0.01100	0.007
SSM000230	2006-05-18	11069	0.200	0.33	14.30	0.6050	0.506	0.340	0.01010	0.007
SSM000238	2006-03-14	10885	12.200	0.68	5.58	0.5730	–	–	0.26300	0.033
SSM000239	2006-03-14	10886	9.930	2.02	19.90	1.0600	–	–	0.25800	0.027
SSM000240	2006-03-15	10889	2.130	1.50	18.10	3.4400	–	–	0.48200	0.020
SSM000240	2006-12-12	11585	3.080	1.45	10.20	0.7260	0.705	0.666	0.71500	0.022
SSM000241	2006-12-13	11588	159.000	0.82	21.40	0.8270	0.880	0.885	0.64200	0.152
SSM000242	2006-02-16	10814	63.000	0.61	26.30	6.6700	–	–	2.02000	0.099

Site number	Date	Sample number	Sr (mg/l)	pH	Conductivity (mS/m)	S ₂ (mg/l)	NH ₄ -N (mg/l)	P (mg/l)	Charge balance (%)
SSM000022	2006-03-30	10946	0.257	7.97	119.0	–	–	0.01350	–0.66
SSM000022	2006-06-01	11114	0.250	7.89	113.0	0.031	–	0.02900	–0.54
SSM000022	2006-09-14	11317	0.266	7.89	114.0	0.091	–	0.03190	–2.17
SSM000022	2006-12-05	11579	0.274	7.93	119.0	0.021	–	0.02730	–1.93
SSM000027	2006-03-21	10905	0.023	5.63	8.8	–	–	0.01800	–0.89
SSM000027	2006-05-23	11074	0.016	5.33	7.8	0.003	–	0.00510	20.61
SSM000029	2006-03-15	10895	0.124	6.68	64.0	–	–	0.21300	–1.27
SSM000029	2006-05-16	11063	0.113	6.78	66.8	0.010	–	0.12600	1.63
SSM000030	2006-03-21	10906	0.274	7.14	54.3	–	–	0.17000	–0.81
SSM000030	2006-05-30	11090	0.265	7.18	54.9	0.005	–	0.20300	1.23
SSM000030	2006-09-12	11312	0.290	7.16	51.3	0.026	–	0.16700	0.64
SSM000030	2006-12-05	11570	0.284	7.18	51.1	0.018	–	0.16500	–1.07
SSM000031	2006-03-15	10896	0.043	6.27	14.3	–	–	0.00555	–4.43
SSM000031	2006-05-16	11064	0.037	6.25	12.8	0.003	–	0.00730	4.81
SSM000034	2006-03-30	10947	0.498	6.85	116.0	–	–	0.00174	1.61
SSM000034	2006-05-30	11091	0.494	6.89	119.0	0.009	0.3340	0.12300	0.26
SSM000035	2006-03-21	10907	0.048	6.49	17.4	–	–	0.10900	1.96
SSM000035	2006-05-23	11075	0.043	6.32	15.6	0.006	–	0.18300	10.97
SSM000037	2006-03-23	10929	0.225	6.80	51.2	–	–	0.08240	2.86
SSM000037	2006-05-16	11065	0.178	7.03	49.9	0.005	–	0.04380	2.63
SSM000037	2006-09-22	11356	0.205	6.88	50.9	0.029	–	0.05540	–1.04
SSM000037	2006-12-05	11571	0.233	6.95	56.4	0.016	–	0.04920	–1.72
SSM000039	2006-03-23	10930	0.074	6.13	30.7	–	–	0.02050	–1.82
SSM000039	2006-05-23	11077	0.057	6.13	22.1	0.002	–	0.03130	2.60
SSM000041	2006-05-18	11067	0.114	6.56	31.9	0.012	–	0.35000	7.41
SSM000041	2006-09-12	11310	0.158	6.68	37.3	0.070	–	0.13400	5.91
SSM000041	2006-12-07	11580	0.147	6.22	28.6	0.006	–	0.39700	19.74
SSM000042	2006-03-28	10938	0.138	6.69	61.6	–	–	0.03140	0.53
SSM000042	2006-05-18	11068	0.141	6.74	66.4	0.008	–	0.02070	6.48
SSM000042	2006-09-12	11311	0.160	6.88	83.0	0.041	–	0.02890	–0.24
SSM000042	2006-12-05	11581	0.167	6.70	67.7	0.006	–	0.02410	7.52
SSM000224	2006-03-28	10935	0.062	6.16	28.2	–	–	0.00402	–0.95
SSM000224	2006-05-16	11066	0.073	6.14	29.6	0.003	–	0.00320	2.95
SSM000226	2006-03-28	10936	0.050	6.36	11.6	–	–	0.00949	7.59
SSM000226	2006-05-30	11092	0.074	6.40	16.2	0.006	0.0042	0.01000	7.75
SSM000227	2006-03-28	10937	0.041	5.13	9.4	–	–	0.01800	8.89
SSM000227	2006-05-30	11093	0.032	5.22	7.8	0.008	–	0.01740	8.92
SSM000228	2006-03-23	10931	0.124	6.61	29.6	–	–	0.17300	11.18
SSM000228	2006-05-23	11076	0.078	6.85	31.5	0.006	–	0.03020	–3.54
SSM000228	2006-09-22	11357	0.120	6.84	102.0	0.026	–	0.02270	–1.16
SSM000228	2006-12-05	11572	0.105	6.62	41.5	0.016	–	0.02770	2.65
SSM000230	2006-03-15	10897	0.189	6.33	82.5	–	–	1.62000	3.35
SSM000230	2006-05-18	11069	0.128	6.34	63.2	0.016	–	1.98000	4.55
SSM000238	2006-03-14	10885	1.520	7.11	1140.0	–	–	0.64100	–2.45
SSM000239	2006-03-14	10886	1.350	7.31	823.0	–	–	0.71900	–6.42
SSM000240	2006-03-15	10889	0.413	7.47	182.0	–	–	0.13000	–1.47
SSM000240	2006-12-12	11585	0.656	7.33	253.0	0.868	–	0.07470	1.44
SSM000241	2006-12-13	11588	5.130	6.56	1,970.0	4.970	–	29.10000	–15.96
SSM000242	2006-02-16	10814	3.630	6.74	1,420.0	–	–	27.00000	–6.46

Site number	Date	Sample number	Al (ug/l)	Ba (ug/l)	Cd (ug/l)	Cr (ug/l)	Cu (ug/l)	Co (ug/l)	Hg (ug/l)
SSM000022	2006-03-30	10946	39	28.0	0.0040	0.0788	0.2330	0.0869	0.0020
SSM000022	2006-06-01	11114	1,070	30.3	0.0197	1.0400	1.4100	0.4240	0.0020
SSM000022	2006-09-14	11317	300	31.2	0.0186	11.4000	1.1100	0.3730	0.0020
SSM000022	2006-12-05	11579	449	31.4	0.0040	0.7050	0.9460	0.3170	0.0020
SSM000027	2006-03-21	10905	388	26.0	0.0206	0.7870	2.3000	2.3100	0.0020
SSM000027	2006-05-23	11074	253	31.9	0.0168	0.7130	2.3000	2.7600	0.0020
SSM000029	2006-03-15	10895	3,890	75.7	0.0627	8.1200	7.5900	2.6000	0.0020
SSM000029	2006-05-16	11063	763	46.7	0.0112	3.3400	1.5000	0.4660	0.0020
SSM000030	2006-03-21	10906	235	40.3	0.0020	0.9390	0.6780	0.2260	0.0020
SSM000030	2006-05-30	11090	566	42.8	0.0199	1.7300	1.5200	0.4440	0.0020
SSM000030	2006-09-12	11312	223	38.9	0.0202	0.9170	0.5720	0.1980	0.0020
SSM000030	2006-12-05	11570	243	37.5	0.0063	1.0800	1.1600	0.2380	0.0020
SSM000031	2006-03-15	10896	575	17.8	0.0080	1.6800	0.5960	0.1160	0.0020
SSM000031	2006-05-16	11064	548	14.9	0.0024	1.3700	1.0600	0.1090	0.0020
SSM000034	2006-03-30	10947	0.200	106.0	0.0020	0.1580	0.1000	0.0327	0.0020
SSM000034	2006-05-30	11091	461	95.2	0.0109	0.8280	1.1100	0.3740	0.0020
SSM000035	2006-03-21	10907	2,100	46.8	0.0486	2.2700	6.0400	3.5900	0.0020
SSM000035	2006-05-23	11075	2,960	52.8	0.0378	3.0300	6.9700	3.0000	0.0030
SSM000037	2006-03-23	10929	1,530	52.4	0.0255	3.1000	4.9900	1.4000	0.0020
SSM000037	2006-05-16	11065	389	35.9	0.0105	0.9560	1.0000	0.3480	0.0020
SSM000037	2006-09-22	11356	228	38.7	0.0051	1.1100	0.6140	0.2300	0.0020
SSM000037	2006-12-05	11571	598	45.5	0.0094	1.5000	1.9400	0.5710	0.0020
SSM000039	2006-03-23	10930	1,120	25.1	0.0338	0.5540	4.1800	0.6130	0.0020
SSM000039	2006-05-23	11077	890	21.0	0.0204	0.7070	4.6100	0.3700	0.0040
SSM000041	2006-05-18	11067	4,570	64.7	0.0511	6.5400	8.5300	3.7800	0.0033
SSM000041	2006-09-12	11310	2,280	37.1	0.0349	2.9900	2.8000	1.7000	0.0020
SSM000041	2006-12-07	11580	6,760	86.7	0.0329	11.7000	10.9000	5.4600	0.0020
SSM000042	2006-03-28	10938	407	66.4	0.0099	1.8600	3.1600	0.7880	0.0020
SSM000042	2006-05-18	11068	267	84.7	0.0228	1.0300	2.2700	0.4420	0.0020
SSM000042	2006-09-12	11311	364	99.1	0.0281	1.5500	2.7500	0.4960	0.0020
SSM000042	2006-12-05	11581	208	96.0	0.0184	1.0100	2.2000	0.5100	0.0020
SSM000224	2006-03-28	10935	447	30.6	0.0339	0.8800	8.7700	2.7800	0.0028
SSM000224	2006-05-16	11066	495	35.1	0.0481	0.6750	6.9400	3.3700	0.0030
SSM000226	2006-03-28	10936	747	17.2	0.0062	0.8390	5.4600	0.5300	0.0020
SSM000226	2006-05-30	11092	777	22.3	0.0252	1.0500	7.2100	0.4200	0.0146
SSM000227	2006-03-28	10937	2,080	43.6	0.1130	1.8300	4.6200	2.8100	0.0025
SSM000227	2006-05-30	11093	1,690	33.6	0.1030	1.5900	5.4900	1.7500	0.0062
SSM000228	2006-03-23	10931	2,680	56.3	0.1000	4.3000	6.2400	2.4000	0.0020
SSM000228	2006-05-23	11076	728	27.3	0.0125	1.6400	1.1300	0.5610	0.0037
SSM000228	2006-09-22	11357	445	58.8	0.0195	1.6100	1.3700	0.4130	0.0020
SSM000228	2006-12-05	11572	591	37.5	0.0138	1.6600	1.4800	0.8480	0.0020
SSM000230	2006-03-15	10897	473	18.3	0.0735	0.9920	26.8000	0.3530	0.0044
SSM000230	2006-05-18	11069	485	9.2	0.0694	0.8830	39.9000	0.3110	0.0181
SSM000238	2006-03-14	10885	237	148.0	0.0097	0.8990	0.6960	0.2320	0.0020
SSM000239	2006-03-14	10886	1,000	386.0	0.0040	2.3500	1.2500	0.9400	0.0020
SSM000240	2006-03-15	10889	3,490	81.6	0.0357	3.7400	2.6400	1.3900	0.0020
SSM000240	2006-12-12	11585	35	104.0	0.0021	0.6730	0.1440	0.0677	0.0020
SSM000241	2006-12-13	11588	67	768.0	0.0516	6.9900	2.3000	5.9400	0.0020
SSM000242	2006-02-16	10814	163	699.0	0.0040	4.1500	1.3000	13.3000	0.0020

Site number	Date	Sample number	Mo (ug/l)	Ni (ug/l)	Nb (ug/l)	Pb (ug/l)	V (ug/l)	Zn (ug/l)	Zr (ug/l)
SSM000022	2006-03-30	10946	11.7000	0.3620	0.0349	0.0791	0.8710	0.7590	0.6880
SSM000022	2006-06-01	11114	11.5000	1.2700	–	0.5630	2.1100	5.6300	1.3700
SSM000022	2006-09-14	11317	10.5000	10.7000	–	0.4770	1.9600	3.0100	1.0300
SSM000022	2006-12-05	11579	12.6000	0.9570	–	0.5450	1.7300	2.9200	1.5100
SSM000027	2006-03-21	10905	0.2390	2.0000	0.1270	0.4600	1.9700	5.5900	0.3810
SSM000027	2006-05-23	11074	0.0973	2.4200	–	0.1760	1.1900	4.7200	0.2810
SSM000029	2006-03-15	10895	0.9510	5.2100	2.2500	7.4200	19.6000	19.4000	9.1300
SSM000029	2006-05-16	11063	0.9580	1.0300	–	1.1000	11.7000	4.3400	4.2700
SSM000030	2006-03-21	10906	0.7420	0.6790	0.2410	0.4840	4.9500	2.6100	1.5400
SSM000030	2006-05-30	11090	0.7020	1.1000	–	1.0300	6.8800	4.8000	2.0800
SSM000030	2006-09-12	11312	0.6570	0.9310	–	0.4710	5.0600	3.8000	1.8000
SSM000030	2006-12-05	11570	0.6900	3.5400	–	0.7180	5.4400	6.4400	1.9600
SSM000031	2006-03-15	10896	0.2710	0.2600	0.1190	0.4750	6.6100	2.6100	1.4100
SSM000031	2006-05-16	11064	2.9200	0.5820	–	0.1500	5.9000	1.7600	0.9670
SSM000034	2006-03-30	10947	0.0683	0.4880	0.1130	0.0122	0.0577	1.5900	0.4430
SSM000034	2006-05-30	11091	0.0500	0.8140	–	1.3700	1.5100	5.6400	1.2700
SSM000035	2006-03-21	10907	1.8800	4.0200	0.6890	4.1700	9.4400	24.2000	2.4100
SSM000035	2006-05-23	11075	0.9170	3.7500	–	5.0400	13.4000	19.2000	3.1000
SSM000037	2006-03-23	10929	2.1900	3.3300	0.7290	2.4200	6.8100	13.0000	2.4700
SSM000037	2006-05-16	11065	1.3800	0.8450	–	0.5090	3.2100	3.5700	1.1400
SSM000037	2006-09-22	11356	1.2600	1.0900	–	0.3890	3.0800	6.0900	1.0700
SSM000037	2006-12-05	11571	1.2900	1.9300	–	0.8750	4.1100	6.7400	1.6400
SSM000039	2006-03-23	10930	0.3430	3.5400	0.1260	0.7740	0.9760	5.5900	0.6760
SSM000039	2006-05-23	11077	0.1840	1.6500	–	0.7480	1.3300	4.2400	0.9600
SSM000041	2006-05-18	11067	0.2890	7.9200	–	5.0400	11.4000	20.4000	3.9400
SSM000041	2006-09-12	11310	0.7930	3.9000	–	1.6700	6.0000	9.8400	2.9100
SSM000041	2006-12-07	11580	0.6100	13.2000	–	9.1300	16.4000	33.5000	5.6200
SSM000042	2006-03-28	10938	2.4600	1.6300	0.2990	0.7800	3.4600	7.2200	1.3100
SSM000042	2006-05-18	11068	1.5100	1.1600	–	0.4540	2.2300	5.2400	1.0900
SSM000042	2006-09-12	11311	2.2600	0.9680	–	0.7920	3.9100	5.4400	1.7000
SSM000042	2006-12-05	11581	1.7100	1.6100	–	0.5400	2.4800	3.9600	1.4100
SSM000224	2006-03-28	10935	1.2300	5.4100	0.0526	0.5180	0.2330	5.8900	0.9440
SSM000224	2006-05-16	11066	0.7660	4.9700	–	0.3570	0.2030	6.0500	0.6600
SSM000226	2006-03-28	10936	0.0890	2.0100	0.0937	0.4080	0.8190	4.6900	0.6990
SSM000226	2006-05-30	11092	0.0920	2.2500	–	0.2290	0.8110	3.5800	0.8790
SSM000227	2006-03-28	10937	0.0500	3.3600	0.1700	0.8510	1.0000	18.2000	0.7270
SSM000227	2006-05-30	11093	0.0500	2.7800	–	0.7000	1.1500	14.6000	0.9810
SSM000228	2006-03-23	10931	1.6900	4.7500	1.1100	7.5600	12.9000	27.9000	6.0700
SSM000228	2006-05-23	11076	1.0800	0.9990	–	1.0500	8.2000	4.7900	2.7100
SSM000228	2006-09-22	11357	3.4300	1.5200	–	1.3700	10.2000	11.2000	3.5700
SSM000228	2006-12-05	11572	1.0200	1.3700	–	1.3000	8.3200	5.7900	3.1400
SSM000230	2006-03-15	10897	6.4200	4.6800	0.1390	1.4100	5.3500	66.2000	0.6060
SSM000230	2006-05-18	11069	7.7800	5.9900	–	1.1900	5.5700	82.0000	0.6250
SSM000238	2006-03-14	10885	1.3300	0.8060	0.2270	0.3980	2.9500	2.0000	0.4350
SSM000239	2006-03-14	10886	0.1090	1.9800	0.3500	0.2260	6.9100	4.4400	1.0800
SSM000240	2006-03-15	10889	0.5800	2.7600	0.8480	6.0700	11.4000	9.2100	4.4700
SSM000240	2006-12-12	11585	0.4620	0.2220	–	0.1110	5.2000	0.6870	2.2000
SSM000241	2006-12-13	11588	1.0000	2.4100	–	0.8440	16.0000	7.9300	15.0000
SSM000242	2006-02-16	10814	0.6240	6.1000	–	0.5270	7.4400	10.0000	6.5800

Site number	Date	Sample number	U (ug/l)	Th (ug/l)	Sc (ug/l)	Rb (ug/l)	Y (ug/l)	Sb (ug/l)	Cs (ug/l)	La (ug/l)
SSM000022	2006-03-30	10946	4.5500	0.0656	0.0500	2.0100	0.3420	0.0570	0.0308	0.3060
SSM000022	2006-06-01	11114	3.6500	0.3250	0.1510	3.1300	1.1500	0.0476	0.1300	2.0400
SSM000022	2006-09-14	11317	2.9800	0.2110	0.0849	2.5600	0.7860	0.0290	0.0668	1.1100
SSM000022	2006-12-05	11579	3.3400	0.3390	0.1290	2.9400	1.0100	0.0289	0.1230	1.8400
SSM000027	2006-03-21	10905	0.4320	0.2150	0.1400	2.6300	3.1500	0.0279	0.0471	5.3100
SSM000027	2006-05-23	11074	0.4010	0.1590	0.1300	2.1100	3.4800	0.0325	0.0300	5.6000
SSM000029	2006-03-15	10895	1.8800	4.1600	0.9640	12.9000	12.0000	0.0366	0.5380	17.5000
SSM000029	2006-05-16	11063	0.4000	0.9110	0.3170	6.0100	4.6100	0.0337	0.1210	3.8200
SSM000030	2006-03-21	10906	0.2370	0.3130	0.1040	5.2400	0.8550	0.0200	0.4370	1.2700
SSM000030	2006-05-30	11090	0.4320	0.6880	0.1850	5.5100	1.5400	0.0322	0.5190	2.5600
SSM000030	2006-09-12	11312	0.2570	0.3110	0.1020	5.1500	0.8860	0.0241	0.3810	1.1500
SSM000030	2006-12-05	11570	0.2610	0.3770	0.1330	5.5000	0.9260	0.0364	0.4210	1.3700
SSM000031	2006-03-15	10896	0.7220	0.8370	0.3910	1.7700	5.5700	0.0373	0.0300	8.5000
SSM000031	2006-05-16	11064	0.5170	0.5520	0.2980	1.5400	4.8700	0.0981	0.0300	7.0300
SSM000034	2006-03-30	10947	0.0222	0.0200	0.0500	2.1200	0.0196	0.0774	0.0300	0.0069
SSM000034	2006-05-30	11091	0.1460	0.6370	0.0997	2.9900	1.1600	0.0129	0.0799	1.8400
SSM000035	2006-03-21	10907	1.8000	2.0900	0.4100	7.6100	9.1600	0.1040	0.3080	16.7000
SSM000035	2006-05-23	11075	2.3900	3.3900	0.7040	8.8700	15.9000	0.0625	0.4240	28.9000
SSM000037	2006-03-23	10929	1.8500	1.5200	0.4310	6.3000	6.6600	0.0532	0.5410	16.1000
SSM000037	2006-05-16	11065	0.5620	0.4380	0.1370	3.1900	2.4700	0.0298	0.1550	5.0100
SSM000037	2006-09-22	11356	0.5660	0.2880	0.0783	3.9000	2.3200	0.0396	0.1100	4.0100
SSM000037	2006-12-05	11571	0.8030	0.7690	0.2060	4.3100	3.3500	0.0408	0.2630	6.2700
SSM000039	2006-03-23	10930	3.2100	0.3430	0.1020	3.6500	5.6400	0.1080	0.1130	12.5000
SSM000039	2006-05-23	11077	1.9400	0.4780	0.2650	3.1700	8.4000	0.0993	0.1510	17.2000
SSM000041	2006-05-18	11067	0.7960	2.9600	1.1100	13.7000	12.1000	0.0470	0.9270	23.4000
SSM000041	2006-09-12	11310	0.8690	1.1100	0.4440	8.6200	4.6500	0.0456	0.3260	7.8700
SSM000041	2006-12-07	11580	1.2500	3.7300	2.1400	23.3000	13.7000	0.0500	1.5000	30.7000
SSM000042	2006-03-28	10938	1.1800	0.5280	0.2590	4.2400	4.9400	0.0381	0.2410	10.2000
SSM000042	2006-05-18	11068	1.1000	0.3580	0.1740	4.1800	3.2700	0.0220	0.2160	5.2600
SSM000042	2006-09-12	11311	1.6600	0.4850	0.2510	5.5800	4.6200	0.0296	0.3190	7.9800
SSM000042	2006-12-05	11581	1.5100	0.4140	0.1890	4.8900	3.2600	0.0249	0.2400	4.9000
SSM000224	2006-03-28	10935	3.4300	0.3480	0.2440	7.6200	5.8100	0.1580	0.1150	6.9200
SSM000224	2006-05-16	11066	2.4800	0.2710	0.2040	7.8200	4.7900	0.0881	0.1180	5.4900
SSM000226	2006-03-28	10936	0.4240	0.2240	0.2110	5.6400	3.9400	0.1970	0.0652	7.6500
SSM000226	2006-05-30	11092	0.7780	0.3500	0.3570	6.9300	5.3200	0.1430	0.0480	9.6700
SSM000227	2006-03-28	10937	0.5670	0.1150	0.0937	7.3000	3.7800	0.0953	0.0984	8.6100
SSM000227	2006-05-30	11093	0.4970	0.2760	0.2800	8.0500	4.1200	0.1050	0.0799	8.5600
SSM000228	2006-03-23	10931	7.2700	4.0800	1.0100	10.5000	14.3000	0.6330	1.0200	28.6000
SSM000228	2006-05-23	11076	1.7800	0.9250	0.5030	2.7800	10.1000	0.0668	0.1750	13.9000
SSM000228	2006-09-22	11357	5.1900	0.8740	0.4830	4.5000	11.6000	0.1410	0.1940	17.1000
SSM000228	2006-12-05	11572	2.1100	1.0400	0.4460	3.6300	9.6400	0.0959	0.1930	12.5000
SSM000230	2006-03-15	10897	0.6100	0.2260	0.1110	14.9000	2.2000	0.3690	0.1050	4.5300
SSM000230	2006-05-18	11069	0.5970	0.2260	0.0942	13.0000	2.0000	0.3800	0.0811	4.5600
SSM000238	2006-03-14	10885	0.2560	0.1030	0.0708	19.0000	0.6680	0.0638	0.2590	1.1700
SSM000239	2006-03-14	10886	0.5370	0.1810	0.1660	23.2000	1.3600	0.0630	0.7810	2.1400
SSM000240	2006-03-15	10889	1.7600	1.6000	0.5720	14.5000	3.4500	0.0488	1.3500	5.8200
SSM000240	2006-12-12	11585	0.3660	0.0779	0.0500	9.8500	0.9110	0.0950	0.6310	0.3270
SSM000241	2006-12-13	11588	0.0581	0.2000	0.5000	62.2000	0.3220	1.0700	2.2300	0.1360
SSM000242	2006-02-16	10814	1.0200	0.4000	0.8000	32.0000	0.7730	0.2000	0.3970	0.6150

Site number	Date	Sample number	Hf (ug/l)	Tl (ug/l)	Ce (ug/l)	Pr (ug/l)	Nd (ug/l)	Sm (ug/l)	Eu (ug/l)	Gd (ug/l)
SSM000022	2006-03-30	10946	0.0139	0.0500	0.4160	0.0578	0.2490	0.0397	0.0074	0.0418
SSM000022	2006-06-01	11114	0.0321	0.0096	2.8200	0.4480	1.7100	0.2860	0.0327	0.2380
SSM000022	2006-09-14	11317	0.0239	0.0151	1.6500	0.2550	0.9740	0.1630	0.0213	0.1460
SSM000022	2006-12-05	11579	0.0354	0.0103	2.6100	0.4120	1.6400	0.2710	0.0353	0.2400
SSM000027	2006-03-21	10905	0.0180	0.0076	10.9000	1.3600	5.5200	0.9460	0.1540	0.7510
SSM000027	2006-05-23	11074	0.0142	0.0060	13.7000	1.8200	7.3800	1.2900	0.1900	0.9600
SSM000029	2006-03-15	10895	0.3320	0.0641	35.7000	4.4000	16.9000	2.9900	0.4580	2.6100
SSM000029	2006-05-16	11063	0.1190	0.0120	8.1000	1.0800	4.6000	0.8500	0.1240	0.8030
SSM000030	2006-03-21	10906	0.0322	0.0500	2.3300	0.2810	1.1300	0.2070	0.0370	0.1810
SSM000030	2006-05-30	11090	0.0436	0.0106	5.0600	0.6270	2.2900	0.4130	0.0613	0.3420
SSM000030	2006-09-12	11312	0.0346	0.0080	2.2600	0.2650	1.0700	0.1880	0.0301	0.1820
SSM000030	2006-12-05	11570	0.0433	0.0091	2.6600	0.3160	1.2900	0.2660	0.0363	0.2050
SSM000031	2006-03-15	10896	0.0533	0.0500	19.7000	2.5300	10.8000	1.9300	0.3260	1.5000
SSM000031	2006-05-16	11064	0.0367	0.0500	17.3000	2.1500	9.5000	1.6400	0.2760	1.2100
SSM000034	2006-03-30	10947	0.0088	0.0500	0.0061	0.0050	0.0050	0.0050	0.0054	0.0050
SSM000034	2006-05-30	11091	0.0426	0.0073	3.8400	0.4870	1.8100	0.3090	0.0330	0.2950
SSM000035	2006-03-21	10907	0.0932	0.0399	31.9000	3.7000	14.5000	2.4300	0.3610	2.1000
SSM000035	2006-05-23	11075	0.1150	0.0499	52.9000	6.8200	26.3000	4.3300	0.6100	3.5900
SSM000037	2006-03-23	10929	0.0805	0.0334	24.0000	2.9500	11.8000	1.8200	0.2760	1.6200
SSM000037	2006-05-16	11065	0.0297	0.0075	7.4100	0.9560	3.8600	0.6010	0.0865	0.5570
SSM000037	2006-09-22	11356	0.0252	0.0070	6.1100	0.7710	3.1600	0.5010	0.0718	0.4990
SSM000037	2006-12-05	11571	0.0480	0.0139	10.5000	1.2400	5.0300	0.8110	0.1240	0.7370
SSM000039	2006-03-23	10930	0.0249	0.0277	8.5800	2.5400	10.3000	1.6100	0.2540	1.4300
SSM000039	2006-05-23	11077	0.0299	0.0250	14.1000	4.1500	15.7000	2.5400	0.4140	2.1300
SSM000041	2006-05-18	11067	0.1230	0.0726	45.0000	5.5300	20.9000	3.5200	0.4890	2.8000
SSM000041	2006-09-12	11310	0.0837	0.0368	15.1000	1.8700	7.5300	1.3100	0.1890	1.0800
SSM000041	2006-12-07	11580	0.1830	0.1490	62.6000	7.0400	27.2000	4.4900	0.6960	3.7900
SSM000042	2006-03-28	10938	0.0443	0.0108	13.3000	2.0500	8.5300	1.3000	0.1950	1.1100
SSM000042	2006-05-18	11068	0.0329	0.0070	6.9200	1.0600	4.2400	0.6710	0.0909	0.6040
SSM000042	2006-09-12	11311	0.0449	0.0154	10.5000	1.6100	6.5100	1.1100	0.1590	1.0100
SSM000042	2006-12-05	11581	0.0388	0.0130	6.9600	0.9730	4.0700	0.6910	0.0993	0.6900
SSM000224	2006-03-28	10935	0.0382	0.0056	14.2000	1.7900	7.2700	1.2500	0.2170	1.0900
SSM000224	2006-05-16	11066	0.0279	0.0074	11.6000	1.4400	5.7800	1.0000	0.1680	0.8540
SSM000226	2006-03-28	10936	0.0261	0.0334	9.2100	1.8900	7.4200	1.2300	0.2180	1.0500
SSM000226	2006-05-30	11092	0.0339	0.0335	13.7000	2.4500	9.5500	1.6200	0.2810	1.2700
SSM000227	2006-03-28	10937	0.0302	0.0369	15.4000	2.0600	7.6500	1.2700	0.2130	0.9950
SSM000227	2006-05-30	11093	0.0436	0.0388	17.4000	2.1800	8.2300	1.3200	0.2260	1.0400
SSM000228	2006-03-23	10931	0.2080	0.0789	43.6000	5.8500	23.3000	3.6700	0.6160	3.3800
SSM000228	2006-05-23	11076	0.0929	0.0114	25.6000	3.0500	12.6000	2.0300	0.3410	1.9100
SSM000228	2006-09-22	11357	0.0978	0.0136	28.8000	3.5300	15.4000	2.4100	0.4240	2.4800
SSM000228	2006-12-05	11572	0.1070	0.0151	22.6000	2.8100	12.2000	2.0000	0.3490	1.9400
SSM000230	2006-03-15	10897	0.0234	0.0176	6.1100	0.8980	3.5500	0.5790	0.0941	0.5230
SSM000230	2006-05-18	11069	0.0230	0.0166	6.8900	1.0000	3.9000	0.6190	0.0995	0.5390
SSM000238	2006-03-14	10885	0.0117	0.0500	2.0200	0.2410	0.9530	0.1450	0.0357	0.1410
SSM000239	2006-03-14	10886	0.0315	0.0111	3.8800	0.4630	1.7700	0.2920	0.0745	0.2710
SSM000240	2006-03-15	10889	0.1160	0.0375	11.5000	1.2600	4.9800	0.8450	0.1420	0.7300
SSM000240	2006-12-12	11585	0.0389	0.0500	0.6450	0.0853	0.4440	0.0915	0.0093	0.1170
SSM000241	2006-12-13	11588	0.1140	0.0500	0.1880	0.0500	0.0994	0.0500	0.0500	0.0500
SSM000242	2006-02-16	10814	0.0641	0.0500	0.8250	0.1420	0.5370	0.1080	0.0400	0.1090

Site number	Date	Sample number	Tb (ug/l)	Dy (ug/l)	Ho (ug/l)	Er (ug/l)	Tm (ug/l)	Yb (ug/l)	Lu (ug/l)
SSM000022	2006-03-30	10946	0.0050	0.0323	0.0079	0.0245	0.0050	0.0211	0.0050
SSM000022	2006-06-01	11114	0.0299	0.1720	0.0322	0.0929	0.0120	0.0809	0.0120
SSM000022	2006-09-14	11317	0.0190	0.1060	0.0220	0.0623	0.0091	0.0602	0.0097
SSM000022	2006-12-05	11579	0.0283	0.1640	0.0315	0.0966	0.0125	0.0867	0.0129
SSM000027	2006-03-21	10905	0.0852	0.4620	0.0933	0.2840	0.0413	0.3040	0.0527
SSM000027	2006-05-23	11074	0.1040	0.5920	0.1190	0.3770	0.0549	0.4450	0.0745
SSM000029	2006-03-15	10895	0.3520	2.0300	0.3830	1.1100	0.1580	1.0900	0.1660
SSM000029	2006-05-16	11063	0.0955	0.6190	0.1340	0.4290	0.0597	0.4360	0.0739
SSM000030	2006-03-21	10906	0.0243	0.1430	0.0281	0.0893	0.0123	0.0888	0.0155
SSM000030	2006-05-30	11090	0.0449	0.2580	0.0515	0.1620	0.0218	0.1520	0.0257
SSM000030	2006-09-12	11312	0.0233	0.1360	0.0280	0.0910	0.0138	0.0914	0.0170
SSM000030	2006-12-05	11570	0.0272	0.1640	0.0325	0.1040	0.0150	0.1090	0.0189
SSM000031	2006-03-15	10896	0.1690	0.8960	0.1700	0.4940	0.0652	0.4480	0.0699
SSM000031	2006-05-16	11064	0.1300	0.7450	0.1420	0.4140	0.0545	0.3700	0.0578
SSM000034	2006-03-30	10947	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
SSM000034	2006-05-30	11091	0.0350	0.2010	0.0372	0.1130	0.0146	0.1060	0.0168
SSM000035	2006-03-21	10907	0.2570	1.4600	0.2790	0.7960	0.1030	0.6590	0.1070
SSM000035	2006-05-23	11075	0.4260	2.4300	0.4780	1.3500	0.1690	1.1100	0.1770
SSM000037	2006-03-23	10929	0.1880	0.9890	0.1810	0.5020	0.0637	0.3960	0.0603
SSM000037	2006-05-16	11065	0.0585	0.3300	0.0640	0.1880	0.0227	0.1550	0.0240
SSM000037	2006-09-22	11356	0.0531	0.2950	0.0599	0.1690	0.0220	0.1460	0.0252
SSM000037	2006-12-05	11571	0.0837	0.4830	0.0912	0.2650	0.0342	0.2190	0.0370
SSM000039	2006-03-23	10930	0.1490	0.7850	0.1450	0.4070	0.0509	0.3370	0.0538
SSM000039	2006-05-23	11077	0.2260	1.2600	0.2340	0.6610	0.0808	0.5460	0.0855
SSM000041	2006-05-18	11067	0.3420	1.9300	0.3560	1.0100	0.1370	0.9550	0.1430
SSM000041	2006-09-12	11310	0.1320	0.7190	0.1390	0.4140	0.0565	0.3770	0.0631
SSM000041	2006-12-07	11580	0.4560	2.5300	0.4640	1.2900	0.1750	1.1200	0.1730
SSM000042	2006-03-28	10938	0.1270	0.6930	0.1370	0.3900	0.0487	0.3070	0.0498
SSM000042	2006-05-18	11068	0.0666	0.3790	0.0788	0.2250	0.0290	0.1910	0.0355
SSM000042	2006-09-12	11311	0.1150	0.6190	0.1270	0.3590	0.0471	0.3150	0.0510
SSM000042	2006-12-05	11581	0.0732	0.4300	0.0853	0.2580	0.0320	0.2250	0.0364
SSM000224	2006-03-28	10935	0.1390	0.8320	0.1700	0.5290	0.0739	0.5420	0.0904
SSM000224	2006-05-16	11066	0.1070	0.6740	0.1360	0.4340	0.0632	0.4680	0.0731
SSM000226	2006-03-28	10936	0.1220	0.6690	0.1250	0.3640	0.0486	0.3300	0.0502
SSM000226	2006-05-30	11092	0.1540	0.8910	0.1660	0.5000	0.0666	0.4630	0.0697
SSM000227	2006-03-28	10937	0.1280	0.6900	0.1250	0.3640	0.0492	0.3160	0.0435
SSM000227	2006-05-30	11093	0.1280	0.7410	0.1370	0.4220	0.0565	0.3780	0.0539
SSM000228	2006-03-23	10931	0.4010	2.2300	0.4380	1.2600	0.1700	1.1200	0.1820
SSM000228	2006-05-23	11076	0.2160	1.2700	0.2640	0.8030	0.1040	0.7140	0.1180
SSM000228	2006-09-22	11357	0.2680	1.4800	0.3080	0.9000	0.1190	0.7930	0.1330
SSM000228	2006-12-05	11572	0.2210	1.3200	0.2710	0.8240	0.1100	0.7550	0.1290
SSM000230	2006-03-15	10897	0.0587	0.3180	0.0589	0.1630	0.0218	0.1340	0.0216
SSM000230	2006-05-18	11069	0.0577	0.3140	0.0594	0.1690	0.0215	0.1450	0.0219
SSM000238	2006-03-14	10885	0.0170	0.0908	0.0190	0.0528	0.0070	0.0530	0.0088
SSM000239	2006-03-14	10886	0.0341	0.1880	0.0350	0.0977	0.0128	0.0942	0.0144
SSM000240	2006-03-15	10889	0.0946	0.5400	0.1020	0.3060	0.0425	0.2950	0.0478
SSM000240	2006-12-12	11585	0.0151	0.1120	0.0270	0.0975	0.0143	0.1190	0.0228
SSM000241	2006-12-13	11588	0.0500	0.0500	0.0500	0.0712	0.0500	0.0500	0.0500
SSM000242	2006-02-16	10814	0.0400	0.0948	0.0400	0.1010	0.0400	0.0661	0.0400

Site number	Date	Sample number	$\delta^2\text{H}$ (‰ VSMOW)	^3H (TU)	$\delta^{18}\text{O}$ (‰ VSMOW)	$\delta^{34}\text{S}$ (‰ CDT)	$^{10}\text{B}/^{11}\text{B}$ (atomic)	$\delta^{37}\text{Cl}$ (‰ SMOC)	$^{87}\text{Sr}/^{86}\text{Sr}$ (ratio)
SSM000022	2006-03-30	10946	-73.8	1.40	-10.60	22.9	0.2371	0.36	-
SSM000022	2006-06-01	11114	-79.2	2.30	-10.60	22.7	0.2388	0.18	-
SSM000022	2006-09-14	11317	-76.9	1.90	-10.40	-	0.2371	-	-
SSM000022	2006-12-05	11579	-77.3	0.90	-10.50	-	0.2383	-	-
SSM000027	2006-03-21	10905	-75.8	10.70	-11.10	1.8	0.2419	-0.14	-
SSM000027	2006-05-23	11074	-80.0	11.36	-11.00	1.1	0.2464	-0.09	-
SSM000029	2006-03-15	10895	-76.9	10.00	-10.80	25.3	0.2377	0.23	-
SSM000029	2006-05-16	11063	-80.6	9.80	-11.00	25.2	0.2406	0.10	-
SSM000030	2006-03-21	10906	-74.8	8.80	-10.70	9.5	0.2386	0.14	-
SSM000030	2006-05-30	11090	-77.7	11.15	-10.90	9.2	0.2418	0.30	-
SSM000030	2006-09-12	11312	-77.1	9.90	-10.70	-	0.2419	-	-
SSM000030	2006-12-05	11570	-77.4	8.00	-10.80	-	0.2390	-	-
SSM000031	2006-03-15	10896	-77.1	10.60	-11.00	6.6	0.2372	0.66	-
SSM000031	2006-05-16	11064	-83.2	11.10	-11.40	-10.8	0.2405	-0.12	-
SSM000034	2006-03-30	10947	-76.6	12.70	-10.90	-	0.2433	-0.78	-
SSM000034	2006-05-30	11091	-77.1	14.59	-10.80	-	0.2460	-0.75	-
SSM000035	2006-03-21	10907	-75.5	9.00	-11.00	3.1	0.2431	0.10	-
SSM000035	2006-05-23	11075	-80.7	10.80	-11.10	-2.4	0.2477	-0.14	-
SSM000037	2006-03-23	10929	-79.2	8.10	-11.00	13.1	0.2381	0.08	-
SSM000037	2006-05-16	11065	-80.5	9.60	-11.20	13.9	0.2407	-0.03	-
SSM000037	2006-09-22	11356	-80.1	7.70	-10.90	-	0.2399	-	-
SSM000037	2006-12-05	11571	-80.1	7.00	-10.90	-	0.2389	-	-
SSM000039	2006-03-23	10930	-78.2	10.90	-11.20	-19.3	0.2378	-0.11	-
SSM000039	2006-05-23	11077	-83.3	12.40	-11.60	-16.9	0.2445	-0.24	-
SSM000041	2006-05-18	11067	-81.2	11.10	-11.20	0.8	0.2439	-0.20	-
SSM000041	2006-09-12	11310	-77.6	11.30	-10.80	-	0.2413	-	-
SSM000041	2006-12-07	11580	-78.7	8.90	-11.00	-	0.2423	-	-
SSM000042	2006-03-28	10938	-75.1	8.90	-10.70	-8.7	0.2370	0.04	-
SSM000042	2006-05-18	11068	-79.6	9.80	-11.00	-8.8	0.2396	0.02	-
SSM000042	2006-09-12	11311	-75.6	8.20	-10.50	-	0.2386	-	-
SSM000042	2006-12-05	11581	-77.7	6.70	-10.90	-	0.2395	-	-
SSM000224	2006-03-28	10935	-76.2	11.10	-11.00	-0.4	0.2417	0.00	-
SSM000224	2006-05-16	11066	-82.7	10.10	-11.40	-8.6	0.2428	-0.01	-
SSM000226	2006-03-28	10936	-80.7	11.40	-11.10	5.7	0.2339	-0.17	-
SSM000226	2006-05-30	11092	-81.8	11.32	-11.40	5.6	0.2421	0.09	-
SSM000227	2006-03-28	10937	-76.5	11.80	-11.00	6.3	0.2349	-0.23	-
SSM000227	2006-05-30	11093	-81.0	14.44	-11.40	4.5	0.2430	0.20	-
SSM000228	2006-03-23	10931	-78.4	12.80	-11.10	12.0	0.2386	0.12	-
SSM000228	2006-05-23	11076	-81.7	11.74	-11.40	8.0	0.2419	0.15	-
SSM000228	2006-09-22	11357	-78.3	4.50	-10.50	-	0.2370	-	-
SSM000228	2006-12-05	11572	-78.4	8.20	-10.90	-	0.2385	-	-
SSM000230	2006-03-15	10897	-81.4	11.00	-11.50	3.2	0.2433	0.52	-
SSM000230	2006-05-18	11069	-85.2	10.70	-11.80	1.2	0.2462	-0.11	-
SSM000238	2006-03-14	10885	-54.3	13.50	-7.00	19.8	0.2370	0.08	-
SSM000239	2006-03-14	10886	-59.9	9.70	-7.60	32.1	0.2386	0.01	-
SSM000240	2006-03-15	10889	-75.0	9.20	-10.60	23.0	0.2366	0.20	-
SSM000240	2006-12-12	11585	-75.2	7.80	-10.30	-	0.2394	-	-
SSM000241	2006-12-13	11588	-69.3	1.50	-9.70	-	0.2409	-	-
SSM000242	2006-02-16	10814	-63.9	1.40	-8.10	10.1	0.2407	0.43	0.711671

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)
SSM000022	2006-03-30	10946	0.67600	0.00510	0.15200	0.14700	0.86700	0.02000
SSM000022	2006-06-01	11114	0.52300	0.00330	0.00800	0.00470	0.81900	0.02820
SSM000022	2006-09-14	11317	0.51700	0.04670	0.64800	0.60200	0.95700	0.03790
SSM000022	2006-12-05	11579	0.89800	0.03030	0.13600	0.10600	0.87700	0.03300
SSM000027	2006-03-21	10905	0.02100	0.00280	0.53900	0.53700	0.73300	0.01930
SSM000027	2006-05-23	11074	0.01230	0.00040	0.60000	0.60000	0.72600	0.00740
SSM000029	2006-03-15	10895	1.10000	0.02260	0.03920	0.01660	1.67000	0.20900
SSM000029	2006-05-16	11063	0.62100	0.00240	0.28000	0.27800	1.46000	0.15200
SSM000030	2006-03-21	10906	1.63000	0.00090	0.06030	0.05930	2.29000	0.20600
SSM000030	2006-05-30	11090	0.57300	0.00230	0.50700	0.50400	2.18000	0.24500
SSM000030	2006-09-12	11312	0.73300	0.00410	0.39300	0.38900	2.11000	0.27200
SSM000030	2006-12-05	11570	1.72000	0.00120	0.01170	0.01050	1.91000	0.16300
SSM000031	2006-03-15	10896	0.03710	0.00030	0.00120	0.00080	0.25400	0.00740
SSM000031	2006-05-16	11064	0.49400	0.00050	0.00370	0.00320	0.24000	0.00870
SSM000034	2006-03-30	10947	0.73500	0.00090	0.00460	0.00370	0.79500	0.16900
SSM000034	2006-05-30	11091	1.56000	0.00100	0.00990	0.00890	0.77700	0.15300
SSM000035	2006-03-21	10907	0.06850	0.00290	0.00740	0.00450	0.26300	0.15300
SSM000035	2006-05-23	11075	0.03680	0.00050	0.00440	0.00380	0.31800	0.41800
SSM000037	2006-03-23	10929	0.24000	0.00190	0.00210	0.00030	0.52300	0.04080
SSM000037	2006-05-16	11065	0.14600	0.00010	0.00090	0.00080	0.47200	0.09350
SSM000037	2006-09-22	11356	0.27500	0.00040	0.03490	0.03450	0.63600	0.05540
SSM000037	2006-12-05	11571	0.37100	0.00020	0.00050	0.00040	0.55000	0.03450
SSM000039	2006-03-23	10930	0.14600	0.00340	0.59900	0.59600	0.98700	0.03920
SSM000039	2006-05-23	11077	0.00900	0.00040	0.55300	0.55300	0.71300	0.03220
SSM000041	2006-05-18	11067	0.26500	0.00660	0.12900	0.12200	0.58300	0.40300
SSM000041	2006-09-12	11310	0.31700	0.00110	0.02070	0.01960	0.68200	0.34000
SSM000041	2006-12-07	11580	0.08990	0.00220	0.58500	0.58300	0.85100	1.71000
SSM000042	2006-03-28	10938	0.05300	0.00040	0.70100	0.70100	0.64100	0.09170
SSM000042	2006-05-18	11068	0.26100	0.00040	0.00290	0.00260	0.49500	0.02170
SSM000042	2006-09-12	11311	1.03000	0.00230	0.03260	0.03030	0.71000	0.11500
SSM000042	2006-12-05	11581	0.32400	0.00070	0.00360	0.00290	0.56000	0.12000
SSM000224	2006-03-28	10935	0.01010	0.00660	0.07800	0.07140	0.36700	0.00390
SSM000224	2006-05-16	11066	0.12700	0.00500	0.30100	0.29600	0.73400	0.00470
SSM000226	2006-03-28	10936	0.00280	0.00330	0.26900	0.26600	0.76000	0.01120
SSM000226	2006-05-30	11092	0.10700	0.00030	0.16300	0.16200	0.70800	0.01200
SSM000227	2006-03-28	10937	0.00170	0.00100	0.76700	0.76600	1.51000	0.05360
SSM000227	2006-05-30	11093	0.00850	0.00060	0.23400	0.23300	0.80800	0.03780
SSM000228	2006-03-23	10931	0.02750	0.00230	0.46200	0.46000	0.45600	0.11000
SSM000228	2006-05-23	11076	0.12300	0.00020	0.00100	0.00090	0.45600	0.03840
SSM000228	2006-09-22	11357	0.35900	0.00020	0.00160	0.00140	0.68000	0.02270
SSM000228	2006-12-05	11572	0.17700	0.00070	0.00570	0.00500	0.46700	0.02620
SSM000230	2006-03-15	10897	0.03870	0.00060	5.52000	5.52000	7.01000	1.62000
SSM000230	2006-05-18	11069	0.21700	0.00060	2.10000	2.10000	5.72000	2.10000
SSM000238	2006-03-14	10885	3.28000	0.00030	0.00140	0.00120	3.55000	0.46500
SSM000239	2006-03-14	10886	10.90000	0.00020	0.00050	0.00030	11.40000	0.67900
SSM000240	2006-03-15	10889	0.91800	0.00030	0.00050	0.00030	1.21000	0.13000
SSM000240	2006-12-12	11585	1.58000	–	0.00220	–	1.94000	0.07810
SSM000241	2006-12-13	11588	646.00000	–	0.00310	–	611.00000	27.80000
SSM000242	2006-02-16	10814	269.00000	0.00420	0.00320	0.00030	270.00000	17.00000

Site number	Date	Sample number	PO ₄ -P (mg/l)	POP (mg/l)	PON (mg/l)	POC (mg/l)	TOC (mg/l)	DOC (mg/l)
SSM000022	2006-03-30	10946	0.01150	0.0016	0.02090	0.16900	5.30	5.40
SSM000022	2006-06-01	11114	0.00860	0.0032	0.02700	0.21800	5.90	5.90
SSM000022	2006-09-14	11317	0.01690	0.003	0.02940	0.26200	6.30	5.90
SSM000022	2006-12-05	11579	0.01290	0.0028	0.02880	0.32200	5.70	5.60
SSM000027	2006-03-21	10905	0.02680	0.0089	0.04070	0.63500	4.40	3.40
SSM000027	2006-05-23	11074	0.00390	0.0018	0.01610	0.20200	4.30	3.90
SSM000029	2006-03-15	10895	0.06660	0.133	0.29200	2.69000	11.40	11.00
SSM000029	2006-05-16	11063	0.02230	0.0569	0.20100	1.78000	13.10	10.80
SSM000030	2006-03-21	10906	0.00090	0.0342	0.09310	1.00000	11.50	9.00
SSM000030	2006-05-30	11090	0.01420	0.0396	0.14900	1.36000	9.60	9.70
SSM000030	2006-09-12	11312	0.04450	0.0274	0.21500	1.90000	9.50	8.80
SSM000030	2006-12-05	11570	0.00410	0.0045	0.02600	0.25300	9.20	8.30
SSM000031	2006-03-15	10896	0.00260	0.0017	0.00540	0.06100	9.90	9.80
SSM000031	2006-05-16	11064	0.00470	0.0025	0.01620	0.22100	10.40	10.30
SSM000034	2006-03-30	10947	0.00220	0.0162	0.01460	0.18700	7.40	7.10
SSM000034	2006-05-30	11091	0.00130	0.0364	0.02490	0.37700	8.00	7.70
SSM000035	2006-03-21	10907	0.00700	0.0521	0.04550	1.25000	4.90	4.50
SSM000035	2006-05-23	11075	0.00050	0.0698	0.08880	2.01000	6.60	6.50
SSM000037	2006-03-23	10929	0.00380	0.0353	0.06200	1.00000	7.90	7.10
SSM000037	2006-05-16	11065	0.00030	0.0388	0.07630	1.10000	8.50	7.30
SSM000037	2006-09-22	11356	0.00950	0.0247	0.11300	1.39000	19.90	19.30
SSM000037	2006-12-05	11571	0.00050	0.0234	0.05620	0.94500	5.80	5.50
SSM000039	2006-03-23	10930	0.00270	0.0052	0.01650	0.16000	5.30	5.20
SSM000039	2006-05-23	11077	0.00140	0.0036	0.01860	0.17200	7.60	8.10
SSM000041	2006-05-18	11067	0.00110	0.205	0.17800	2.41000	12.70	10.20
SSM000041	2006-09-12	11310	0.00190	0.149	0.14300	1.90000	11.40	9.40
SSM000041	2006-12-07	11580	0.00050	0.528	0.54600	6.76000	10.00	8.60
SSM000042	2006-03-28	10938	0.00140	0.0522	0.10100	1.70000	6.60	6.40
SSM000042	2006-05-18	11068	0.00030	0.0172	0.04630	1.15000	6.20	6.00
SSM000042	2006-09-12	11311	0.00750	0.0299	0.05600	1.03000	8.50	8.50
SSM000042	2006-12-05	11581	0.00050	0.0781	0.06820	1.25000	6.80	6.20
SSM000224	2006-03-28	10935	0.00870	0.0004	0.00490	0.05500	8.00	7.90
SSM000224	2006-05-16	11066	0.00040	0.0008	0.00680	0.06600	7.60	7.40
SSM000226	2006-03-28	10936	0.00630	0.0018	0.01660	0.15600	13.70	12.70
SSM000226	2006-05-30	11092	0.00150	0.0017	0.01110	0.08800	18.20	17.60
SSM000227	2006-03-28	10937	0.00460	0.0536	0.35600	3.26000	17.70	12.40
SSM000227	2006-05-30	11093	0.00370	0.0263	0.16400	1.89000	21.90	18.40
SSM000228	2006-03-23	10931	0.00400	0.122	0.09500	1.72000	12.70	12.10
SSM000228	2006-05-23	11076	0.00050	0.0042	0.01460	0.20100	13.30	12.60
SSM000228	2006-09-22	11357	0.00050	0.0026	0.03250	0.26700	12.00	11.90
SSM000228	2006-12-05	11572	0.00050	0.0068	0.01330	0.22300	12.80	12.30
SSM000230	2006-03-15	10897	0.02810	0.0092	0.01140	0.13000	10.60	9.20
SSM000230	2006-05-18	11069	0.00160	0.0053	0.00940	0.08100	14.90	13.60
SSM000238	2006-03-14	10885	0.36400	0.0094	0.10900	0.79000	7.60	7.60
SSM000239	2006-03-14	10886	0.55200	0.013	0.12500	0.98400	11.30	9.90
SSM000240	2006-03-15	10889	0.03610	0.0106	0.09120	0.84900	10.80	10.80
SSM000240	2006-12-12	11585	0.04010	0.0078	0.08670	0.74500	10.60	10.20
SSM000241	2006-12-13	11588	28.80000	0.039	0.24000	1.94000	73.40	72.70
SSM000242	2006-02-16	10814	10.60000	0.13	0.17500	1.06000	71.20	71.30

Primary results, field analysis

Site number	Date	Sample number	Water temperature (°C)	pH
SSM000022	2006-03-30	10946	7.3	8.51
SSM000022	2006-06-01	11114	11.7	7.93
SSM000022	2006-09-14	11317	11.7	7.93
SSM000022	2006-12-05	11579	7.8	8.57
SSM000027	2006-03-21	10905	7.0	7.82
SSM000027	2006-05-23	11074	10.1	7.63
SSM000029	2006-03-15	10895	8.0	7.90
SSM000029	2006-05-16	11063	10.0	7.46
SSM000030	2006-03-21	10906	9.6	7.52
SSM000030	2006-05-30	11090	10.5	7.68
SSM000030	2006-09-12	11312	11.2	8.34
SSM000030	2006-12-05	11570	11.7	7.20
SSM000031	2006-03-15	10896	6.6	8.11
SSM000031	2006-05-16	11064	11.0	7.57
SSM000034	2006-03-30	10947	7.7	7.82
SSM000034	2006-05-30	11091	10.1	7.19
SSM000035	2006-03-21	10907	5.5	7.54
SSM000035	2006-05-23	11075	9.5	7.15
SSM000037	2006-03-23	10929	8.5	7.08
SSM000037	2006-05-16	11065	9.4	7.26
SSM000037	2006-09-22	11356	11.4	7.63
SSM000037	2006-12-05	11571	9.7	7.24
SSM000039	2006-03-23	10930	6.0	7.26
SSM000039	2006-05-23	11077	10.0	7.74
SSM000041	2006-05-18	11067	8.1	7.67
SSM000041	2006-09-12	11310	12.3	8.47
SSM000041	2006-12-07	11580	11.1	7.60
SSM000042	2006-03-28	10938	7.0	7.20
SSM000042	2006-05-18	11068	8.0	7.47
SSM000042	2006-09-12	11311	11.6	8.31
SSM000042	2006-12-05	11581	9.3	7.45
SSM000224	2006-03-28	10935	10.0	7.40
SSM000224	2006-05-16	11066	10.6	7.84
SSM000226	2006-03-28	10936	7.8	7.84
SSM000226	2006-05-30	11092	8.0	7.93
SSM000227	2006-03-28	10937	5.5	7.78
SSM000227	2006-05-30	11093	10.1	7.72
SSM000228	2006-03-23	10931	6.6	7.40
SSM000228	2006-05-23	11076	10.8	7.82
SSM000228	2006-09-22	11357	11.7	7.63
SSM000228	2006-12-05	11572	9.3	7.05
SSM000230	2006-03-15	10897	5.7	7.55
SSM000230	2006-05-18	11069	9.5	7.80
SSM000238	2006-03-14	10885	5.9	7.86
SSM000239	2006-03-14	10886	6.5	7.48
SSM000240	2006-03-15	10889	9.6	8.16
SSM000240	2006-12-12	11585	6.9	7.71
SSM000241	2006-12-13	11588	8.2	6.76
SSM000242	2006-02-16	10814	–	–