Strontium Distribution Coefficients of Basalt Core Samples from the Idaho National Engineering and Environmental Laboratory, Idaho

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CONVERSION FACTORS AND ABBREVIATED UNITS

Multiply	By	To obtain
cubic centimeter (cm^3)	0.06102	cubic inch
centimeter (cm)	2.54	inch
gram (g)	0.03527	ounce
kilometer (km)	0.6214	mile
square kilometer (km^2)	0.3861	square mile
meter (m)	3.281	foot
becquerel per liter (Bq/L)	27	picocuries per liter
terra becquerel (TBq)	27	curies

For temperature, degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) by using the formula F=(1.8)(C) + 32.

Abbreviated units used in report: K_d (distribution coefficient), mg/L (milligrams per liter), mL (milliliter), mL/g, (milliliters per gram), µg/kg (milligrams per kilogram), µs/cm (microsiemens per centimeter), m^2/g (meters squared per gram).

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Abstract

Strontium distribution coefficients (K_d's) were measured for 24 basalt core samples collected from selected sites at the Idaho National Engineering and Environmental Laboratory (INEEL). The measurements were made to help assess the variability of strontium K_d's as part of an ongoing investigation of strontium transport properties through geologic materials at the INEEL. The investigation is being conducted by the U.S. Geological Survey and Idaho State University in cooperation with the U.S. Department of Energy. Batch experiments were used to measure K_d's of basalt core samples using an aqueous solution representative of wastewater in waste-disposal ponds at the INEEL. Calculated strontium K_d's of the 24 basalt core samples ranged from 3.6±1.3 to 29.4±1.6 milliliters per gram. These results indicate a narrow range of variability in the strontium sorptive capacities of basalt relative to those of the sedimentary materials at the INEEL. The narrow range of the basalt K_d's can be attributed to physical and chemical properties of the basalt, and to compositional changes in the equilibrated solutions after being mixed with the basalt. The small K_d's indicate that basalt is not a major contributor in preventing the movement of strontium-90 in solution.

INTRODUCTION

The transport and fate of waste constituents in geologic material is dependent on chemical and physical processes that govern the distribution of constituents between the solid, geologic, stationary phase and an aqueous mobile phase. This distribution often is quantified, at thermodynamic equilibrium, by an empirically determined parameter called the distribution coefficient (K_d). K_d's can be used effectively to summarize the chemical factors that affect transport efficiency of ground-water constituents. Many transport models for radionuclides use K_d's to predict the extent to which the migration of the constituent will be lessened relative to the mean ground-water velocity (Bohn, 1985, p. 153-207; Sposito, 1989, p. 150-155; Fetter, 1993, p. 117-127).

In 1949, the U.S. Atomic Energy Commission, which later became the U.S. Department of Energy (DOE), requested that the U.S. Geological Survey (USGS) describe the water resources of the area now known as the Idaho National Engineering and Environmental Laboratory (INEEL). The purpose of the resulting study was to characterize these resources before the development of nuclear-reactor testing facilities. The USGS since has maintained a monitoring network at the INEEL to determine hydrologic trends and to delineate the movement of facility-related radiochemical and chemical wastes in the Snake River Plain aquifer. As part of this effort, the USGS and Idaho State University (ISU), in cooperation with the DOE, are conducting a study to determine geochemical properties that affect strontium transport in basalt at the INEEL. The purpose of this study is to determine the fate and transport behavior of chemical constituents in wastewater discharged to infiltration ponds and to the Snake River Plain aquifer at the INEEL. Study objectives include assessing the variability of strontium K_d's in basalt at the INEEL.

This report presents experimentally derived strontium K_d's of 24 basalt core samples collected from selected sites at the INEEL. Basalt core samples were mixed with synthesized aqueous solutions using batch experimental techniques to determine the strontium distributions between the solid and aqueous phases. The synthesized aqueous solutions were representative of wastewater in disposal ponds at the INEEL with respect to major cations and pH. Strontium concentrations in the solutions were varied to define strontium sorption isotherms. Strontium K_d's were derived from the isotherms using the linear sorption model described by Fetter (1993, p. 117-119).

Background

The INEEL comprises 2,300 km^2 of the eastern Snake River Plain in southeastern Idaho (fig.1). The INEEL was established in 1949 by the DOE for the development of peacetime atomic-energy applications such as nuclear-safety research, defense programs, and advanced energy concepts. More than 50 nuclear reactors have been operated at the INEEL since its inception. Facilities at the INEEL also are used to store nuclear waste, such as spent fuel rods from the U.S. Navy's nuclear fleet and other DOE sites, and wastes generated onsite.

Aqueous chemical and radiochemical wastes, including strontium-90 (^{90}Sr), have been discharged to wastewater-disposal ponds and wells at the INEEL since 1952. Prior to February 1984, much of the wastewater discharged at the Idaho Chemical Processing Plant (ICPP) was injected directly into the Snake River Plain aquifer through a deep injection well. Since 1984, most of the wastewater has been discharged to unlined infiltration ponds. Some chemical constituents from wastewater may enter the aquifer indirectly following percolation from the infiltration ponds through sediments and basalt layers in the unsaturated zone (Pittman and others, 1988). Disposal of radioactive wastewater to the Test Reactor Area (TRA) radioactive-waste ponds ceased in August of 1993 and the ponds were remediated (Eddie Chew, U.S. Department of Energy, written commun., 1995). Radioactive wastewater at the TRA now is discharged to two lined evaporation ponds.

^{90}Sr is a radionuclide produced by the fission of uranium, has a half-life of 28.8 years, and decays through beta emission (Eisenbud, 1973, p. 83-97). The global deposition of ^{90}Sr is well documented (Eisenbud, 1973, p. 320-331). This radionuclide is present in ground water as the result of fallout from nuclear explosions and as a result of the waste-disposal practices used in the nuclear industry. Because of its tendency to concentrate uniformly throughout bone tissues, ^{90}Sr is a health hazard. The maximum contaminant level allowable in drinking water is 8 pCi/L (0.3 Bq/L) (U.S. Environmental Protection Agency, 1989, p. 551).

Approximately 5.6 TBq of ^{90}Sr was discharged to the subsurface at the INEEL from the early 1950's to 1995, primarily at the ICPP and TRA facilities (Bartholomay and others, 1997, p. 30). Documented disposals include:

1.2 TBq of ^{90}Sr discharged into a pit at the ICPP during 1962-63 (Robertson and others, 1974, p. 119);

0.9 TBq of ^{90}Sr discharged to a disposal well and infiltration ponds at the ICPP (fig. 2) from 1952-95, of which approximately 0.02 TBq was discharged to the waste disposal ponds (Bartholomay and others, 1995, p. 21; Bartholomay and others, 1997, p. 30); and

3.4 TBq of ^{90}Sr discharged to radioactive-waste disposal ponds at the TRA (fig. 2) from 1952-95 (Bartholomay and others, 1997, p. 30).

Concentrations of ^{90}Sr in perched ground water beneath the ICPP ranged from 0 to 0.63±0.07 Bq/L during 1991 through 1995. Concentrations of ^{90}Sr in perched ground water beneath the TRA ranged from 0 to 5.3±0.2 Bq/L during the same period (Bartholomay, 1998, p. 16). Disposal of ^{90}Sr has resulted in a 10-km^2 plume within the eastern Snake River Plain aquifer beneath the ICPP (Bartholomay and others, 1997, p. 33) with concentrations greater than 0.3 Bq/L. In 1995, concentrations of ^{90}Sr in water from wells completed in the Snake River Plain aquifer were as large as 2.8±0.1 Bq/L (Bartholomay and others, 1997, p. 30). ^{90}Sr has not been detected within the eastern Snake River Plain aquifer beneath the TRA. This may, in part, be explained by the use of disposal ponds rather than the disposal well at this facility. Sorption processes in the unsaturated and perched-water zones beneath the disposal ponds

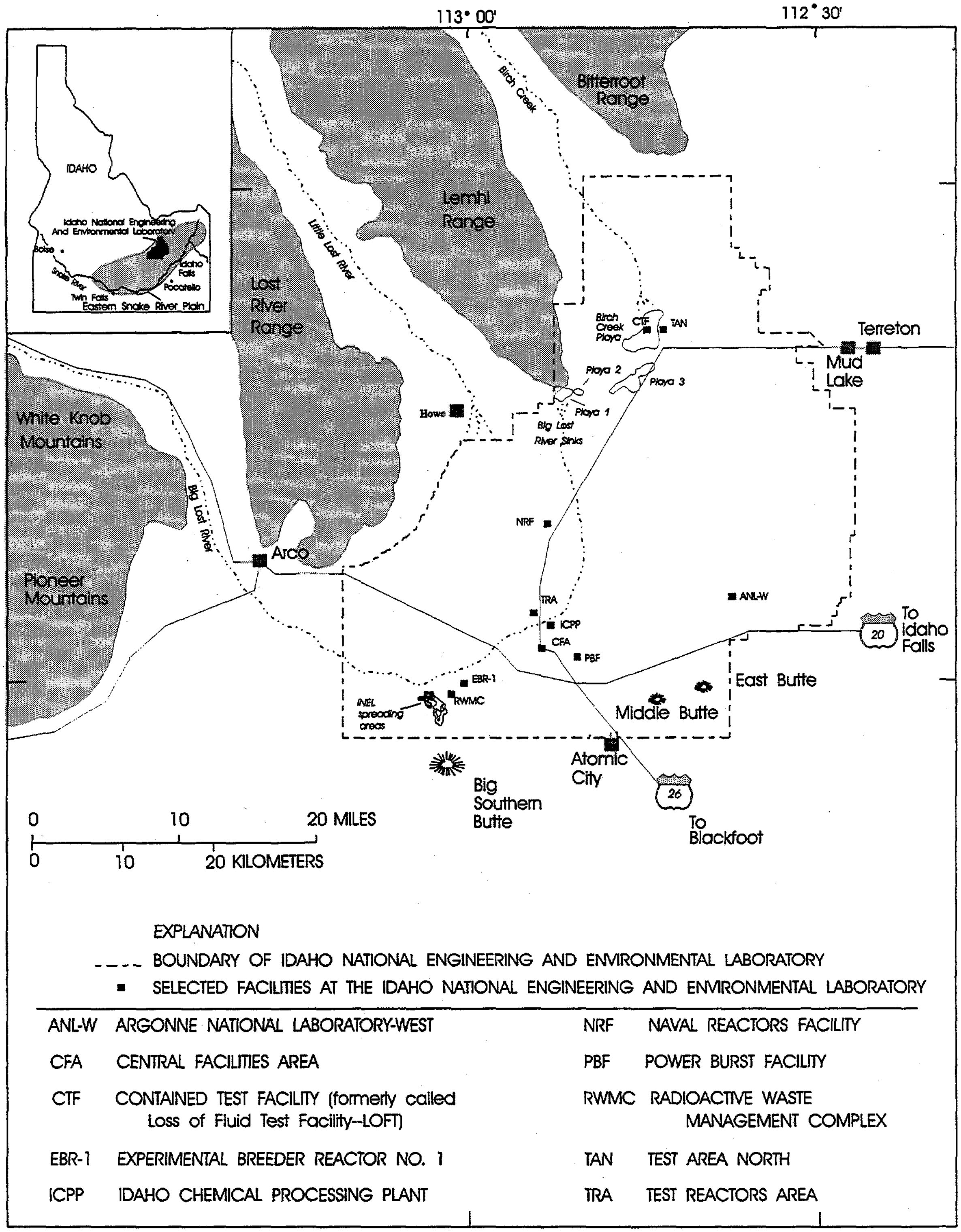

Figure 1. Location of the Idaho National Engineering and Environmental Laboratory and selected facilities.

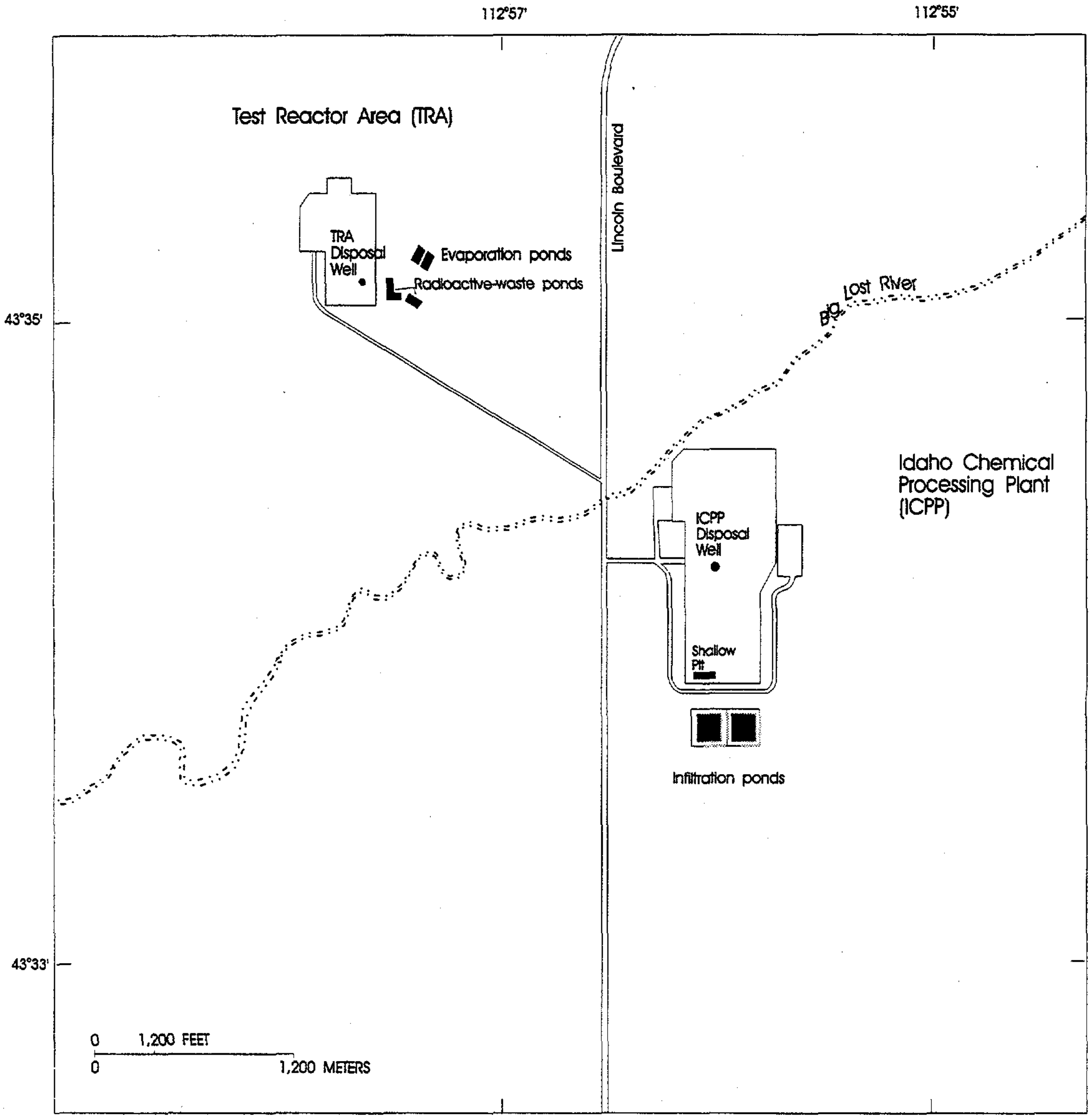

Figure 2. Location of the Idaho Chemical Processing Plant, Test Reactor Area, and selected waste-disposal sites, Idaho National Engineering and Environmental Laboratory.

likely have lessened ^{90}Sr migration at the TRA. Also, more sediment is present beneath the TRA than beneath the ICPP (Anderson, 1991, p. 22-28).

Geohydrologic Setting

The eastern Snake River Plain is a northeast-trending structural basin about 320 km long and 80 to 110 km wide. The plain is underlain by a layered sequence of basaltic rocks and cinder beds intercalated with alluvial and lakebed deposits. Individual layers of basalt range from 3 to 15 m in thickness, although the average thickness may be from 6 to 8 m (Mundorff and others, 1964, p. 143). The sedimentary deposits consist mainly of lenticular beds of sand, silt, and clay, and lesser amounts of gravel. Locally, rhyolitic rocks and tuffs are exposed at the land surface or occur at depth. The basaltic rocks and intercalated sedimentary deposits combine to form the framework for the Snake River Plain aquifer system, which is the main source of ground water on the plain. The depth to water in the aquifer system ranges from about 60 m below land surface in the northern part of the INEEL to more than 275 m in the southern part (Bartholomay and others, 1997, p. 20). The general direction of ground-water flow is from the northeast to the southwest. The INEEL obtains its entire water supply from the Snake River Plain aquifer.

Previous Investigations

Strontium K_d's of sediment collected from the INEEL have been reported by Hawkins and Short (1965), Schmalz (1972), Del Debbio and Thomas (1989), Newman and others (1996), Bunde and others (1997), Hemming and others (1997), Liszewski and others (1997), Bunde and others (1998), and Liszewski and others (1998). Strontium K_d's of basalt collected from the INEEL have been reported by Del Debbio and Thomas (1989) and Newman (1996). Strontium K_d's of the Columbia River basalt have been reported by Barney (1981). Many researchers have studied strontium K_d's and the factors that affect them. A summary and review of available information published through 1976 of strontium and other radionuclide interactions with geologic material was compiled by Ames and Rai (1978).

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MATERIALS AND METHODS

Experiments for measuring K_d's required the collection and preparation of basalt core samples and the preparation of the synthesized aqueous solution. Once the samples and solution were prepared, they were combined in a reaction vessel and agitated using batch experimental techniques for a period of time sufficient for an apparent equilibrium to be reached. Then solutions were analyzed for dissolved-strontium content. The amount of strontium sorbed to the basalt was calculated from the difference between the initial and equilibrium solution concentrations multiplied by the volume-to-mass ratio. Sorption isotherms and K_d's then were calculated using the linear sorption isotherm model (Fetter, 1993, p. 118).

Collection, Description, and Preparation of Basalt Samples

Basalt core samples were collected during October and November of 1996 from archived cores housed at the INEEL lithologic core storage library (Davis and others, 1997). For this study, 24 basalt samples were collected from four corehole sites at the INEEL; USGS 123, WO-1, WO-2, and TAN CH1 (fig. 3). A general description of each sample is given in table 1. More detailed descriptions of basalt cores are given by Lanphere and others (1993) and Lanphere and others (1994). The geochemical compositions of the basalt samples are given in table 2, and Brunauer-Emmett-Teller (BET) surface areas of selected samples are given in table 3. Well USGS 123 is near the ICPP and contains ^{90}Sr concentrations in ground water above the MCL for drinking water (Bartholomay and others, 1997, p. 33). TAN CH1 is near Test Area North (TAN). At both of these facilities, radioactive wastewater containing ^{90}Sr have been dis-

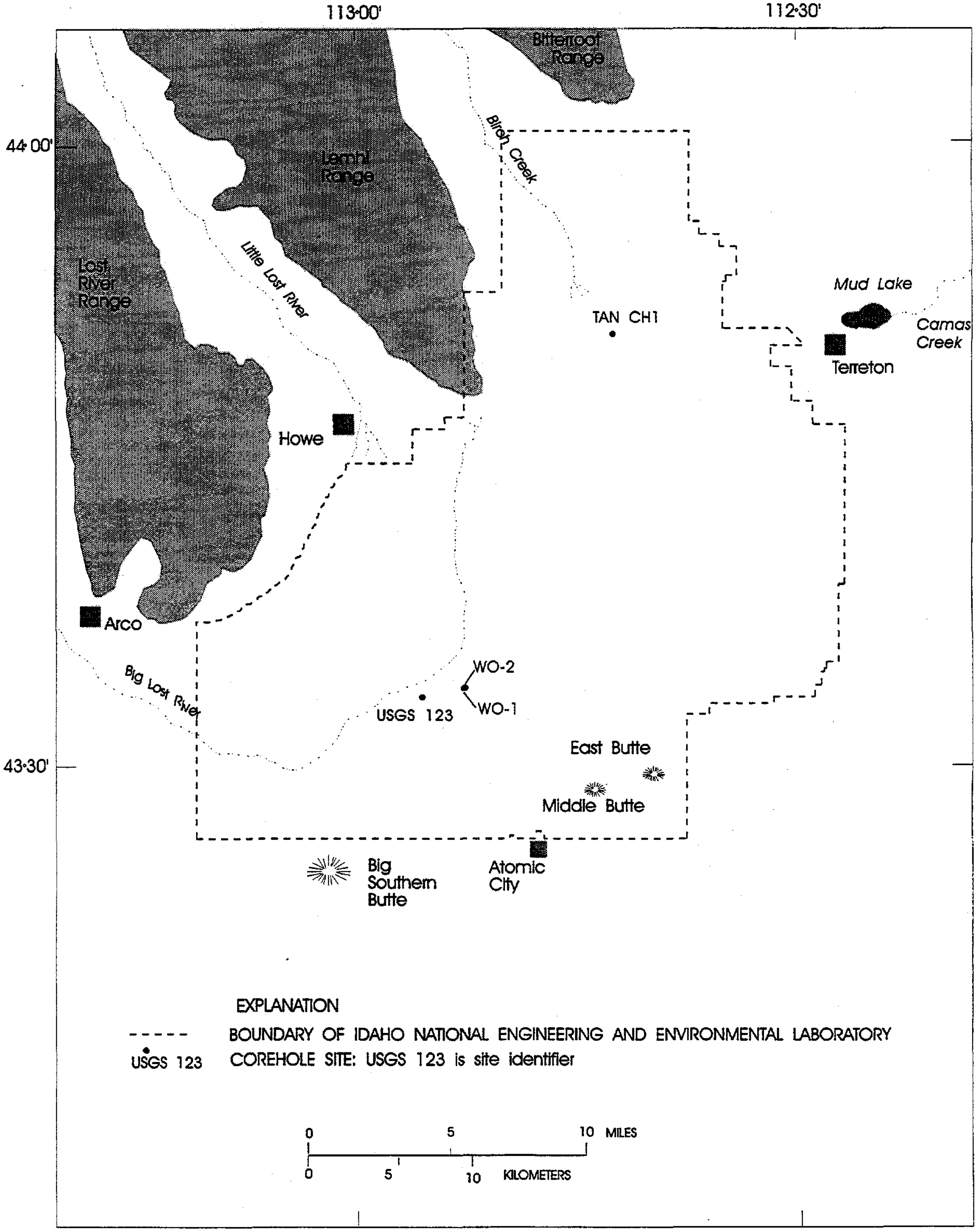

Figure 3. Location of sites where basalt core samples were collected, Idaho National Engineering and Environmental Laboratory.

charged to the subsurface. Additional samples were collected from cores WO-1 and WO-2, which are located approximately 4 km hydraulically upgradient from the ICPP and are outside of the ^{90}Sr waste plume.

Representative 8-cm pieces of core were collected using a core splitter, placed into plastic bags, and then labeled and transported to ISU for preparation and analyses. Sample selection criteria for USGS 123 was based on the availability of samples from the top of every major basalt flow, emphasizing areas of vesicularity, sediment infill, secondary mineralization, and fracture zones because these are the main conduits for groundwater flow. Massive-basalt samples were collected at each corehole site for comparison with vesicular samples. Basalt samples from USGS 123 are from depths of 14, 64, 68, 130, 153, 156, 172, 189, 209, 211, and 221 m. Two samples were collected from the 14-m depth because of major differences in vesicularity. Duplicate analyses were performed for the sample from the 211-m depth. Special attention was given to the I Flow (Anderson, 1991) because it is the thickest and most extensive flow in the Snake River Plain aquifer at the INEEL.

Sample selection at cores from WO-1 and WO-2 concentrated on major flows below the water table, especially the I Flow. Basalt samples from WO-1 are from depths of 141 and 146 m. Basalt samples from WO-2 are from depths of 185, 186, 397, 400, and 520 m.

Samples were collected at TAN CH1 to observe differences in basalt characteristics related to a contamination plume above sedimentary interbed Q-R (Anderson and Bowers, 1995). TAN CH1 also was selected because the basalt is much older than the basalt from the other three sites. One vesicular and three massive samples were collected. Basalt samples from TAN CH1 are from depths of 83, 86, 128, and 176 m.

At ISU the selected basalt samples were prepared for batch experiments by first removing the exterior surface rind. The rind was removed by placing the basalt core on the center of a pre-cleaned circular steel plate and crushing with a pre-cleaned hammer. Fragments with exterior rind were removed from the sample. The samples were then packaged, labeled, and crushed and sieved through a 2.83-mm sieve.

Preparation of the Synthesized Aqueous Solution

A synthesized aqueous solution that chemically represented wastewater in the ICPP infiltration ponds was prepared because of the difficulty in obtaining actual wastewater and because of the potential chemical changes associated with the long-term storage of wastewater. The synthesized aqueous solution contained dissolved calcium, chloride, magnesium, potassium, sodium, strontium, silica, and carbonate alkalinity. The pH of the synthesized aqueous solution was fixed at 8.0±0.1. The use of a synthesized aqueous solution allowed for the control of experimental variables, and potential saturation problems and chemical-phase modifications, and provided a constant supply of solution.

A concentrated stock solution containing 1,000 mg/L of calcium, 200 mg/L of magnesium, and 200 mg/L of potassium was prepared by adding American Chemical Society (ACS) certified reagents of calcium carbonate, magnesium carbonate, and potassium chloride along with concentrated trace-metal-grade hydrochloric acid to deionized water. A concentrated stock solution containing 1,000 mg/L of stable strontium was prepared separately by adding ACS-certified strontium carbonate and concentrated trace-metal-grade hydrochloric acid to deionized water. Stable strontium was substituted for the radioactive ^{90}Sr isotope so that no special handling was required. Stable strontium is assumed to behave geochemically in the same manner as ^{90}Sr. Concentrated trace-metal-grade hydrochloric acid was added to the stock solutions to enhance stability of the concentrated solutions and to evolve carbon dioxide. The resulting pH of the concentrated stock solutions was less than 2.0.

Four volumetric flasks of the synthesized aqueous solution were prepared by first diluting the concentrated stock solution of calcium, magnesium, and potassium with deionized water. The solution in each of the flasks then was spiked with different amounts of the strontium stock solution.

Next, silica, in the form of sodium silicate, was added directly to the solutions using a Fisher Scientific 1,000-mg/L atomic-absorption reference standard. The pH then was adjusted to 8.0±0.1 by adding 1.0-molar sodium hydroxide and hydrochloric acid. Sodium then was added to the synthesized aqueous solutions in the form of solid sodium bicarbonate and the pH was readjusted to 8.0. Finally, the solutions were equilibrated with atmospheric gases by leaving the flasks open to the atmosphere overnight and then adjusting the pH again, if necessary.

The synthesized aqueous solutions were prepared and spiked with strontium. Target concentrations of alkalinity, aluminum, calcium, iron, magnesium, potassium, silica, sodium, and strontium and pH are listed in table 4. Because the strontium concentrate used for spiking was acidified, each of the spiked solutions required different amounts of sodium hydroxide and hydrochloric acid for pH adjustment, which caused slight variations in the concentrations of sodium and chloride. These slight variations were not expected to affect strontium sorption to a measurable degree. Chloride concentrations were not determined analytically. Target concentrations of calcium, magnesium, potassium, silica, sodium, and pH of the synthesized aqueous solution were based on typical concentrations of these constituents in historical wastewater samples from ICPP disposal ponds (table 5). Historical pond-water analyses (table 5) presented as supporting data in this report were performed by the U.S. Geological Survey's National Water Quality Laboratory using analytical techniques prescribed by Skougstad and others (1979). Alkalinity concentrations were dependent on the amount of sodium bicarbonate added to the solution as described above.

Experimental Methods

The strontium K_d studies were done using batch experimental techniques in 50-cm^3 polyethylene centrifuge tubes. Batch experiments were used because they are relatively simple and inexpensive, and many experiments can be done simultaneously. Basalt samples were homogenized and split into 2-g subsamples using a riffler to minimize bias. The 2-g subsamples were equilibrated with 20.0 mL of the synthesized aqueous solution at 30° C in a constant-temperature shaker at a setting of 70 cycles per minute for 144 hours. The 1-to-10 mass-to-volume ratio was selected so that the amount of sorption would be larger than the analytical uncertainty. Del Debbio and Thomas (1989) previously demonstrated that smaller ratios, such as 1 to 20, resulted in significant measurement error. The time of equilibration and the agitation rate were selected to be consistent with Del Debbio and Thomas (1989). The time of equilibration also was demonstrated to be sufficient by kinetic experiments performed in this study that indicated that sorption was relatively rapid and nearly complete within 60 hours. The aqueous phase was separated from the solid phase at the end of the experiment by centrifugation for 12 minutes at 3,500 revolutions per minute. The supernatant samples were preserved by adding a small amount of trace-metal-grade concentrated nitric acid.

Linear sorption isotherms for each basalt sample were determined from strontium-distribution data for four initial-solution concentrations (table 4). Strontium linear sorption isotherms and K_d's were derived from the least-squares regression of equilibrium concentrations of strontium sorbed to the basalt as a function of dissolved strontium in solution (Fetter, 1993, p. 118). Concentrations of dissolved strontium were measured directly using inductively coupled plasma techniques. Concentrations of sorbed strontium were calculated as the difference between the initial and equilibrium concentrations of dissolved strontium multiplied by the volume-to-mass ratio. Initial concentrations were determined on the basis of concentrations in control samples measured at the conclusion of the experiment. Control samples consisted of reaction vessels containing the synthesized aqueous solution and no basalt. The determination of initial-solution concentrations assumed that any changes that occurred during the experiments in the solution concentrations of the control samples also occurred in the regular samples. To best represent field conditions in the unsaturated and perched ground-water zones, the basalt samples were not pretreated with the simulated-wastewater solution before experimentation.

Experiments were grouped into sets consisting of 12 samples of basalt mixed with synthesized aqueous solution in centrifuge tubes, three replicate basalt subsamples at each of four strontium concentrations in the synthesized aqueous solution. Additionally, an experimental blank and four control samples were included in each experimental set. The blank consisted of a centrifuge tube containing only deionized water, and control samples consisted of centrifuge tubes containing only synthesized aqueous solution, one at each of the four strontium concentrations. Blanks and controls provided experimental evidence that the constituents in these experiments did not adsorb onto or desorb from the reaction-vessel walls or experimental apparatus.

The synthesized aqueous solutions, controls, and blanks were analyzed for concentrations of alkalinity, aluminum, iron, calcium, magnesium, potassium, sodium, strontium, pH, and specific conductance before and after equilibration with the basalt. Cation concentrations were determined using a Perkin Elmer Plasma 400 Emission Spectrometer with Plasma 400 software, Color version 4.10, using the standard methods for metals in water (Greenberg and others, 1992); pH was measured using an Orion Research model 231 pH meter, specific conductivity was measured using a Fischer Scientific conductivity meter; and alkalinity was determined using a Hach digital titrator.

Derivation of the Strontium Distribution Coefficient Using the Linear Sorption Isotherm Model

The measured distribution coefficient is defined by Kipp and others (1986, p. 523) as:

$$K_d = [Sr]_s / [Sr]_{eq} \qquad (1)$$

where

K_d is measured in milliliters per gram,

$[Sr]_s$ = concentration of sorbed constituent per unit mass of basalt, in milligram per kilogram, and

$[Sr]_{eq}$ = concentration of dissolved constituent in the equilibrated solution, in milligram per liter.

Equilibrium sorption of solutes on basalt material commonly is described by the linear isotherm model, where the K_d is equal to the slope of a least-squares fit between sorbed and aqueous strontium concentrations at thermodynamic equilibrium (Fetter, 1993, p. 118). Plots of isotherms for the basalt samples used in the study indicated that the basalts conformed to the linear isotherm model. Therefore, the slopes of the linear sorption isotherms were used to calculate the K_d's in this study.

Experimental values of $[Sr]_s$ were determined using assayed concentrations of aqueous strontium and ratios of solution to basalt used in experimentation:

$$[Sr]_s = \{[Sr]_i - [Sr]_{eq}\} V/M \qquad (2)$$

where

$[Sr]_i$ = initial concentration of aqueous strontium in the solution before equilibration with the basalt, in milligrams per liter,

V = volume of solution, in milliliters, and

M = mass of basalt, in grams.

STRONTIUM DISTRIBUTION COEFFICIENTS OF BASALT CORE SAMPLES

The basalt sample mass, initial- and final-solution concentrations of aluminum, calcium, iron, magnesium, potassium, sodium, and strontium, the initial and final specific conductance and pH and measured strontium K_d's of each basalt sample are presented in table 6. The calculated strontium K_d's of the 24 basalt samples ranged from 3.6±1.3 to 29.4±1.6 mL/g (table 7). The calculated K_d's were determined from the slope of the linear isotherm model, and the uncertainties are the standard error of the linear regression.The measured strontium K_d's for three replicate determinations ranged from -10.0±0.02 mL/g for a sample with an initial strontium concentration of 0 mg/L to 27.0±1.1 mL/g for a sample with an initial strontium concentration of 2.5 mg/L (table 7). The negative strontium K_d's for the initial strontium concentrations of 0 mg/L indicate that strontium was desorbing from the basalt samples at that concentration. The isotherm calculations incorporate uniformly the desorption effect for all experimental samples at each site.

The results of the experiments show a narrow range of K_d's of basalt samples compared with the ranges of K_d's of surficial and interbed sediments at the INEEL (Liszewski and others, 1997; Liszewski and others, 1998). The surficial sediment K_d's ranged from 26±1 to 275±3 mL/g; K_d's of interbed sediments ranged from 38±7 to 328±41 mL/g. K_d's of both types of sediments were determined using experimental methods similar to those used for the basalt samples. The results of the sediment experiments indicate that the ion-exchange mechanism was the predominant sorption mechanism. In contrast, the basalts had low strontium sorption and showed little evidence of exchangeable ions in the equilibrium solutions (table 6). Instead the predominant sorption mechanism probably was physisorption, which resulted in significantly smaller K_d values, as shown in table 7.

K_d's of the basalt samples that contained exchangeable cations in small amounts of secondary minerals or sediment infill were among the smallest K_d values. These samples contained elevated calcium concentrations in the equilibrium solutions owing to dissolution of the minerals and sediments. The solvated calcium cations effectively filled the sorption sites, sites that otherwise could have sorbed strontium, on the silicious basalt surface. This process resulted in the small K_d values of the basalt samples.

Initial expectations of this study were that the vesicular basalts would produce larger K_d's than the massive samples. This was expected because many of the vesicular samples had sedimentary infill material and secondary mineralization which was expected to increase the sorption capacity of the analyzed sample. Tables 1 and 7 show that the sorption values were similar for both the massive and vesicular samples. The K_d's ranged from 4.1±0.95 to 23.3±1.4 mL/g for the massive samples and from 3.6±1.3 to 29.4±1.6 mL/g for the vesicular samples. This similarity in K_d ranges may indicate that the results of sample preparation affected K_d's more than the physical nature of the samples before preparation. During sample preparation, significant amounts of fresh surfaces were generated for both massive and vesicular samples. This may have decreased the effect of the texture of the samples on the K_d's. This theory is supported by the BET surface-area analyses (table 3), which indicated a very narrow range of surface-area values for the samples analyzed.

CONCLUSIONS

The results indicate that the basalt samples have small strontium K_d's and a narrow range of K_d's. There was no correlation between K_d's of the basalt samples and any of the following characteristics: presence of secondary mineralization or sediment infill, sample texture (massive or vesicular), sample depth, aerial position, or sample composition. The narrow range of K_d's can be attributed to the physical and chemical properties of the basalt samples and to compositional changes in the equilibrated solutions after being mixed with the basalt. The small K_d's indicate that there is probably only a small amount of sorption of strontium on basalts in the Snake River Plain aquifer system, therefore, basalt probably does not impede the movement of strontium-90 in solution.

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Table 1. Depths and descriptions of basalt core samples from the Idaho National Engineering and Environmental Laboratory

[Depth is the approximate depth below land surface at which the sample was collected. Abbreviation: m, meter]

Core site	Depth (m)	Description
123	14	Samples are from top of flow, diktytaxitic, medium light gray. 14a highly vesicular; 14b massive but contains minor vesicles. Samples contain secondary mineralization, hematite weathering and red oxidized surfaces. Yellow to orange alteration along the bottom of sample 14b.
123	64	Sample is from top of flow, highly vesicular, diktytaxitic, reddish dark gray and contains sediment along fracture and minor calcite/caliche rinds in vesicles.
123	68	Sample is from middle of flow, diktytaxitic, reddish dark gray and contains calcite deposition in rounded vesicles. Vertical fracture is present with caliche deposition and some weathering alteration.
123	130	Sample is from the top of the flow, slightly diktytaxitic, medium dark gray, and contains minor calcite precipitation in rounded vesicles.
123	153	Sample is from top of flow, diktytaxitic, reddish brown, and contains elongate vesicles filled with sediment near top of sample. Minor sediment infill further down sample. Also contains glomerophyric plagioclase phenocrysts and iron oxide deposits associated with olivines.
123	156	Sample is from top of the flow, diktytaxitic, medium dark gray, and contains round to elongate vesicles with minor calcite precipitation.
123	172	Sample is from top of flow, reddish brown, highly vesicular and contains round to elongate vesicles with many precipitated globs of calcite.
123	189	Sample is from middle of flow, reddish gray, massive, and contains tiny spherical vesicles. Iron oxide stain on plagioclase phenocrysts.
123	209	Sample is from bottom of flow, medium gray, massive and contains minor round to elongated vesicles.
123	211	Sample is from bottom of flow from a fracture zone, slightly diktytaxitic, reddish brown, and vesicular. Caliche rinds in some vesicles and calcite coating on fracture surfaces.
123	221	Sample is reddish brown, slightly diktytaxitic, fractured vesicular. Fracture surface is coated with fine purplish precipitate.
WO-1	141	Sample is light gray, slightly diktytaxitic, massive and contains small round vesicles.
WO-1	146	Sample is reddish gray, slightly diktytaxitic and contains minor round vesicles with light coating of white to blue precipitate.
WO-2	185	Sample is medium gray, slightly diktytaxitic, vesicular and contains minor sediment infill in vesicles.
WO-2	186	Sample is massive, gray, diktytaxitic and contains minor vesicles with no infill.
WO-2	397	Sample is massive, gray, diktytaxitic and contains minor round vesicles and no infill.
WO-2	400	Sample is highly vesicular, dark gray and contains minor sediment infill.
WO-2	520	Sample is massive, gray, slightly diktytaxitic and contains minor spherical vesicles and no infill. Sample has many large plagioclase laths and weathered olivines.
TAN CH1	83	Sample is massive, light gray, diktytaxitic and contains minor small vesicles.
TAN CH1	86	Sample is dark gray, diktytaxitic, vesicular and contains some minor sediment infill.
TAN CH1	128	Sample is massive, dark gray, diktytaxitic and contains little vesicularity.
TAN CH1	176	Sample is massive, brownish gray, fractured. Fractures are covered with white bluish precipitate.

Table 2. Whole-rock analysis for selected major, minor, and trace elements of basalt samples from the Idaho National Engineering and Environmental Laboratory

[Silica, titanium, aluminum, iron, manganese, magnesium, calcium, sodium, and potassium are reported as oxide concentrations in weight percent. Strontium and barium are reported as elemental concentrations in parts per million. Whole-rock analysis determined using inductively coupled plasma techniques. Abbreviations: SiO_2, silica dioxide; TiO_2, titanium dioxide; Al_2O_3, aluminum oxide; Fe_2O_3, iron oxide; MnO, manganese oxide; MgO, magnesium oxide; CaO, calcium oxide; Na_2O, sodium oxide; K_2O, potassium oxide; Sr, strontium; Ba, barium]

	Whole rock analysis									**ppm**	
Sample name	**SiO_2**	**TiO_2**	**Al_2O_3**	**Fe_2O_3**	**MnO**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**Sr**	**Ba**
123-14a	46.2	3.78	12.4	16.7	0.22	5.16	9.83	2.75	0.89	268	497
123-14b	45.9	2.60	14.3	15.4	.20	8.25	9.60	2.55	.57	283	326
123-64	45.7	2.95	14.3	15.7	.20	6.92	9.30	2.51	.85	308	501
123-68	46.2	3.24	14.6	15.9	.20	6.58	9.50	2.52	.89	311	507
123-130	47.9	1.76	15.2	12.4	.18	8.50	10.3	2.25	.62	247	297
123-153	46.3	1.35	14.8	11.7	.17	10.5	10.0	2.11	.35	196	193
123-156	47.6	1.67	15.2	12.7	.18	10.3	10.0	2.31	.56	229	270
123-172	46.5	2.72	14.7	15.0	.20	6.94	10.9	2.50	.67	293	411
123-189	47.7	2.25	15.2	14.4	.19	9.02	10.3	2.45	.54	264	288
123-209	47.8	2.20	15.4	14.4	.19	9.46	10.5	2.41	.46	266	266
123-211a	46.7	2.21	15.0	13.9	.19	8.65	9.97	2.34	.74	270	376
123-211b	46.9	2.25	14.9	14.0	.19	8.70	10.4	2.35	.69	269	383
123-221	45.4	3.06	14.2	16.2	.21	6.95	9.39	2.51	.79	315	479
W0-1-141	46.8	3.01	14.5	16.0	.21	7.40	9.84	2.47	.62	352	460
W0-1-146	46.6	2.75	14.7	15.4	.20	7.56	9.57	2.48	.69	344	440
W0-2-185	46.5	2.26	14.9	14.2	.19	8.96	10.3	2.36	.49	259	290
W0-2-186	47.5	2.21	15.3	14.4	.19	9.39	10.5	2.38	.48	264	276
W0-2-397	48.0	2.42	15.0	14.3	.19	8.13	10.2	2.53	.67	305	336
W0-2-400	47.8	2.13	15.1	14.2	.19	9.03	10.3	2.38	.55	257	357
W0-2-520	46.2	3.23	13.8	16.9	.23	8.04	9.58	2.39	.60	286	394
TAN CH1-83	46.9	2.54	14.6	15.1	.20	8.22	9.51	2.53	.53	326	353
TAN CH1-86	45.2	2.58	14.7	15.3	.20	7.36	9.40	2.48	.42	332	451
TAN CH1-128	46.1	2.27	14.9	14.6	.19	7.77	10.40	2.45	.37	271	302
TAN CH1-176	45.5	2.88	14.7	16.1	.20	7.39	9.56	2.71	.46	323	328

Table 3. Brunauer-Emmett-Teller surface areas of selected basalt samples from the Idaho National Engineering and Environmental Laboratory

[The surface area of each basalt sample was determined using the Brunauer-Emmett-Teller (BET) method (Brunauer and others, 1938). BET surface area was determined using a Micromeritics Gemini 2360 surface-area analyzer. Abbreviation: m^2/g, meters squared per gram]

Sample name	**Surface area (m^2/g)**
123-153	0.33
123-156	.96
123-172	1.2
123-189	1.4
123-209	1.5
123-211	1.4
123-221	1.9
WO-1-141	2.5
WO-1-146	1.3
WO-2-185	.99
WO-2-186	1.8
WO-2-400	1.1

Table 4. Target concentrations of alkalinity, aluminum, calcium, iron, magnesium, potassium, silica, sodium, strontium, and pH in the synthesized aqueous solutions used in the strontium batch experiments

[Alkalinity was determined using a Hach digital titrator. Aluminum, calcium, iron, magnesium, potassium, silica, sodium, and strontium concentrations were determined by assay using inductively coupled plasma. pH was measured using an Orion Research model 231 pH meter. Sodium concentrations include sodium additions from sodium bicarbonate, sodium hydroxide, and sodium silicate. Abbreviations: mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; SiO_2, silica dioxide]

Alkalinity (mg/L as $CaCO_3$)	Aluminum (mg/L)	Calcium (mg/L)	Iron (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Silica (mg/L as SiO_2)	Sodium (mg/L)	Strontium (mg/L)	pH
99	0	10	0	2	2	21	79.0	0	8.0
98	0	10	0	2	2	21	78.8	1.0	8.0
100	0	10	0	2	2	21	78.8	2.5	8.0
96	0	10	0	2	2	21	78.7	5.0	8.0

Table 5. Concentrations of alkalinity, calcium, magnesium, potassium, silica, sodium, and strontium, and pH in samples collected from infiltration ponds at the Idaho Chemical Processing Plant

[Analyses were performed by the U.S. Geological Survey's National Water Quality Laboratory using analytical techniques prescribed by Skougstad and others (1979). Abbreviations: mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; SiO_2, silica dioxide. Location of ponds shown on fig. 2]

Date sampled	Alkalinity (mg/L as $CaCO_3$)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Silica (mg/L as SiO_2)	Sodium (mg/L)	Strontium (mg/L)	pH
10/27/86	158	3.7	1.2	1.2	21	87	0.017	8.30
1/28/87	159	5.7	1.4	2.5	21	84	.029	8.29
10/26/87	150	9.7	2.5	1.6	21	88	.051	8.50
1/25/88	125	2.5	.65	.90	24	87	.012	8.00
4/26/88	103	67	29	2.8	21	92	.34	7.20
7/28/88	137	260	53	1.5	24	340	1.3	8.00
10/31/88	145	11	3.0	1.1	22	98	.057	8.00

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final conductivity and pH; and measured distribution coefficients of synthesized solutions

[Sample set refers to all the samples associated with the determination of a single distribution coefficient. Sample numbers 1-3, 5-7, 9-11, and 13-15 represent triplicate experiments at each of 4 strontium concentrations. Sample type 1 refers to regular samples containing basalt and synthesized aqueous solution; type 2 refers to control samples containing only synthesized aqueous solution without basalt, and type 3 (number 17) refers to a blank sample containing only deionized water. Basalt mass is the mass of basalt mixed with 20.0 milliliters of synthesized aqueous solution. Initial concentrations for sample numbers 4, 8, 12, and 16 (control samples) are those determined for the synthesized aqueous solution before the experiments began. Initial concentrations for aluminum (Al), calcium (Ca), iron (Fe), magnesium (Mg), potassium (K), sodium (Na) and strontium (Sr) for sample numbers 1-3, 5-7, 9-11, and 13-15 (regular samples) were determined on the basis of the final concentration of the control samples measured after the conclusion of the experiments. These determinations for the regular samples assume that any changes in solution concentrations that occurred in the control samples during the experiments also occurred in the regular samples. Final concentrations are of dissolved constituents after being equilibrated with the basalt for a period of 144 hours. Aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations were determined by assay using atomic-emission spectroscopy. Abbreviations: µS/cm, microseimens per centimeter; mg/L, milligrams per liter;Δ, change; Kd, distribution coefficient]

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
123-14a	1	1	1.9941	8.24	8.16	851	567	0.03	0.88	10.47	11.91
123-14a	2	1	2.0018	8.24	8.22	851	572	.03	1.25	10.47	11.82
123-14a	3	1	2.0032	8.24	8.13	851	588	.03	1.36	10.47	12.12
123-14a	5	1	2.0032	8.24	8.21	681	552	.03	.46	10.87	11.55
123-14a	6	1	1.9996	8.24	8.12	681	626	.03	1.30	10.87	12.27
123-14a	7	1	1.9954	8.24	8.23	681	745	.03	1.98	10.87	13.87
123-14a	9	1	2.0000	8.03	8.17	665	677	.03	1.39	10.58	13.35
123-14a	10	1	2.0036	8.03	8.21	665	667	.03	1.27	10.58	12.83
123-14a	11	1	2.0024	8.03	8.32	665	660	.03	.79	10.58	12.28
123-14a	13	1	1.9990	8.27	8.21	502	388	.05	.91	11.27	13.50
123-14a	14	1	2.0006	8.27	8.18	502	630	.05	.79	11.27	13.19
123-14a	15	1	1.9986	8.27	8.22	502	424	.05	.79	11.27	13.19
123-14a	4	2		8.03	8.24	472	851	.04	.03	10.20	10.47
123-14a	8	2		8.06	8.24	452	681	.05	.03	9.68	10.87
123-14a	12	2		8.03	8.03	533	665	.05	.03	10.19	10.58
123-14a	16	2		8.00	8.27	563	502	.04	.05	10.45	11.27
123-14a	17	3		5.74	7.64	45	2	.00	.01	.01	.15

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions - Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
123-14a	1	1	0.02	0.98	1.85	2.28	3.08	3.71	105.8	104.8	0.00	0.05	-0.05	-9.81
123-14a	2	1	.02	1.47	1.85	2.26	3.08	3.68	105.8	103.1	.00	.06	-.06	-9.79
123-14a	3	1	.02	1.67	1.85	2.39	3.08	3.65	105.8	104.3	.00	.06	-.05	-9.77
123-14a	5	1	.01	.44	1.80	2.26	2.38	3.04	101.7	103.5	1.04	.41	.63	15.51
123-14a	6	1	.01	1.55	1.80	2.32	2.38	3.11	101.7	97.9	1.04	.41	.64	15.72
123-14a	7	1	.01	5.08	1.80	3.95	2.38	3.20	101.7	97.9	1.04	.42	.62	14.75
123-14a	9	1	.00	2.96	1.78	2.68	2.53	3.28	97.2	98.7	2.56	1.06	1.50	14.07
123-14a	10	1	.00	1.99	1.78	2.53	2.53	3.19	97.2	99.7	2.56	1.01	1.55	15.24
123-14a	11	1	.00	.87	1.78	2.24	2.53	3.17	97.2	96.2	2.56	.97	1.58	16.25
123-14a	13	1	-.01	1.19	1.88	2.69	2.41	3.15	103.5	105.6	5.22	2.27	2.94	12.95
123-14a	14	1	-.01	.95	1.88	2.56	2.41	3.13	103.5	104.7	5.22	2.28	2.94	12.87
123-14a	15	1	-.01	.96	1.88	2.56	2.41	3.15	103.5	102.2	5.22	2.23	2.99	13.41
123-14a	4	2	.01	.02	1.86	1.85	3.02	3.08	105.2	105.8	.00	.00	.00	
123-14a	8	2	.01	.01	1.69	1.80	2.35	2.38	92.0	101.7	.92	1.04	-.12	
123-14a	12	2	.01	.00	1.84	1.78	2.44	2.53	99.5	97.2	2.50	2.56	-.05	
123-14a	16	2	.01	-.01	1.75	1.88	2.34	2.41	99.9	103.5	5.01	5.22	-.21	
123-14a	17	3	-.01	.00	.00	.00	.12	.17	-.8	.4	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions - Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
123-14b	1	1	2.0233	8.22	8.21	874	504	.04	1.07	13.03	12.74
123-14b	2	1	2.0147	8.22	8.32	874	546	.04	1.18	13.03	13.16
123-14b	3	1	2.0137	8.22	8.18	874	635	.04	1.23	13.03	13.69
123-14b	5	1	2.0078	8.13	8.22	522	436	.04	1.54	9.41	11.25
123-14b	6	1	1.9903	8.13	8.19	522	516	.04	1.82	9.41	11.12
123-14b	7	1	2.0048	8.13	8.22	522	526	.04	1.10	9.41	10.63
123-14b	9	1	2.0001	8.18	8.10	593	597	.04	.84	10.41	11.89
123-14b	10	1	2.0035	8.18	8.12	593	441	.04	1.09	10.41	12.21
123-14b	11	1	1.9915	8.18	8.20	593	515	.04	1.22	10.41	12.03
123-14b	13	1	1.9978	7.76	8.18	511	474	.04	1.27	9.61	11.39
123-14b	14	1	2.0017	7.76	8.08	511	329	.04	1.04	9.61	11.39
123-14b	15	1	2.0083	7.76	8.07	511	535	.04	1.45	9.61	11.53
123-14b	4	2		8.05	8.22	545	487	.04	.04	10.20	13.03
123-14b	8	2		7.99	8.13	533	522	.05	.04	9.68	9.41
123-14b	12	2		8.02	8.18	506	593	.05	.04	10.19	10.41
123-14b	16	2		8.01	7.76	525	511	.04	.04	10.45	9.61
123-14b	17	3		5.35	6.28	2	620	.00	.01	.17	.16

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
123-14b	1	1	.00	.71	1.96	2.48	3.09	3.476	110.9	110.1	.00	.05	-.05	-9.53
123-14b	2	1	.00	1.07	1.96	2.74	3.09	3.477	110.9	110.2	.00	.05	-.04	-9.56
123-14b	3	1	.00	.86	1.96	2.52	3.09	3.551	110.9	107.8	.00	.05	-.05	-9.58
123-14b	5	1	.01	1.14	1.91	2.47	2.25	2.905	104.5	104.6	.99	.54	.45	8.40
123-14b	6	1	.01	1.55	1.91	2.59	2.25	2.896	104.5	104.3	.99	.52	.46	8.84
123-14b	7	1	.01	.93	1.91	2.40	2.25	2.740	104.5	102.7	.99	.52	.47	9.07
123-14b	9	1	.01	.53	1.97	2.48	2.40	2.890	103.9	103.6	2.56	1.42	1.14	8.07
123-14b	10	1	.01	.73	1.97	2.51	2.40	2.935	103.9	105.0	2.56	1.40	1.16	8.22
123-14b	11	1	.01	.84	1.97	2.54	2.40	2.929	103.9	104.8	2.56	1.37	1.19	8.72
123-14b	13	1	.01	.90	1.91	2.52	2.29	2.855	102.5	102.0	4.86	2.78	2.08	7.50
123-14b	14	1	.01	.69	1.91	2.42	2.29	2.839	102.5	104.4	4.86	2.83	2.03	7.18
123-14b	15	1	.01	1.63	1.91	2.46	2.29	2.845	102.5	103.2	4.86	2.82	2.04	7.20
123-14b	4	2	.01	.00	1.86	1.96	3.02	3.087	105.2	110.9	.00	.00	.00	
123-14b	8	2	.01	.01	1.69	1.91	2.35	2.246	92.0	104.5	.92	.99	-.07	
123-14b	12	2	.01	.01	1.84	1.97	2.44	2.396	99.5	103.9	2.50	2.56	-.06	
123-14b	16	2	.01	.01	1.75	1.91	2.34	2.285	99.9	102.5	5.01	4.86	.14	
123-14b	17	3	-.01	.01	.00	.01	.12	.141	-.7	.5	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
123-64	1	1	2.0042	8.33	8.12	683	627	.05	.79	12.08	13.63
123-64	2	1	2.0048	8.33	8.40	683	507	.05	1.30	12.08	14.22
123-64	3	1	2.0162	8.33	8.32	683	679	.05	1.34	12.08	14.02
123-64	5	1	2.0057	8.28	8.32	639	600	.03	1.71	9.13	11.59
123-64	6	1	2.0064	8.28	8.27	639	593	.03	2.24	9.13	11.28
123-64	7	1	2.0061	8.28	8.29	639	734	.03	1.75	9.13	11.20
123-64	9	1	1.9905	8.22	8.35	776	547	.03	1.73	9.78	13.07
123-64	10	1	2.0052	8.22	8.21	776	573	.03	1.64	9.78	13.90
123-64	11	1	1.9963	8.22	8.22	776	597	.03	1.69	9.78	13.84
123-64	13	1	1.9994	8.09	8.24	618	641	.04	1.40	8.92	12.42
123-64	14	1	1.9944	8.09	8.27	618	662	.04	.98	8.92	12.26
123-64	15	1	2.0030	8.09	8.21	618	614	.04	1.20	8.92	11.47
123-64	4	2		8.05	8.33	545	683	.04	.05	10.20	12.08
123-64	8	2		7.99	8.28	533	639	.05	.03	9.68	9.13
123-64	12	2		8.02	8.22	506	776	.05	.03	10.19	9.78
123-64	16	2		8.01	8.09	525	618	.04	.04	10.45	8.92
123-64	17	3		5.35	6.79	2	686	.00	.02	.17	.14

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
123-64	1	1	.01	.52	1.79	2.62	3.03	4.09	98.4	102.8	.00	.07	-.07	-9.78
123-64	2	1	.01	.87	1.79	2.84	3.03	4.11	98.4	106.6	.00	.08	-.08	-9.78
123-64	3	1	.01	1.10	1.79	2.89	3.03	4.02	98.4	104.0	.00	.08	-.07	-9.72
123-64	5	1	.01	1.62	1.87	2.75	2.29	3.59	95.1	100.1	.97	.45	.52	11.74
123-64	6	1	.01	2.58	1.87	2.75	2.29	3.57	95.1	96.4	.97	.42	.55	13.08
123-64	7	1	.01	1.29	1.87	2.60	2.29	3.47	95.1	94.6	.97	.43	.54	12.30
123-64	9	1	.02	3.16	1.83	3.99	2.25	3.44	96.5	97.4	2.44	1.16	1.28	11.11
123-64	10	1	.02	7.57	1.83	6.48	2.25	3.51	96.5	96.5	2.44	1.19	1.25	10.50
123-64	11	1	.02	3.87	1.83	4.82	2.25	3.56	96.5	98.8	2.44	1.22	1.22	10.02
123-64	13	1	.01	1.10	1.73	2.73	2.24	3.67	93.0	95.7	4.54	2.31	2.23	9.64
123-64	14	1	.01	.86	1.73	2.69	2.24	2.96	93.0	96.5	4.54	2.20	2.34	10.68
123-64	15	1	.01	.99	1.73	2.64	2.24	3.39	93.0	91.7	4.54	2.17	2.37	10.87
123-64	4	2	.00	.01	1.86	1.79	3.02	3.03	105.2	98.4	.00	.00	.00	
123-64	8	2	.01	.01	1.69	1.87	2.35	2.29	92.0	95.1	.92	.97	-.05	
123-64	12	2	.01	.02	1.84	1.83	2.44	2.25	99.5	96.5	2.50	2.44	.06	
123-64	16	2	.01	.01	1.75	1.73	2.34	2.24	99.9	93.0	5.01	4.54	.47	
123-64	17	3	-.01	.01	.00	.01	.12	.15	-.7	.5	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
123-68	1	1	1.9946	8.39	8.28	650	746	.05	1.21	12.72	13.81
123-68	2	1	1.9959	8.39	8.27	650	632	.05	.99	12.72	14.06
123-68	3	1	2.0068	8.39	8.31	650	583	.05	1.20	12.72	13.71
123-68	5	1	2.0038	8.28	8.18	733	566	.03	1.71	8.79	9.86
123-68	6	1	2.0062	8.28	8.31	733	579	.03	1.82	8.79	10.28
123-68	7	1	2.0013	8.28	8.19	733	655	.03	1.56	8.79	10.49
123-68	9	1	1.9962	8.25	8.20	585	612	.30	1.56	10.49	11.14
123-68	10	1	1.9963	8.25	8.19	585	645	.30	1.34	10.49	10.96
123-68	11	1	1.9930	8.25	8.24	585	395	.30	1.25	10.49	11.09
123-68	13	1	2.0000	8.12	8.13	560	653	.03	1.10	9.44	11.24
123-68	14	1	1.9993	8.12	8.09	560	438	.03	1.12	9.44	11.05
123-68	15	1	1.9944	8.12	8.25	560	524	.03	1.07	9.44	10.56
123-68	4	2		8.05	8.39	545	650	.04	.05	10.20	12.72
123-68	8	2		7.99	8.28	533	733	.05	.03	9.68	8.79
123-68	12	2		8.02	8.25	506	585	.05	.30	10.19	10.49
123-68	16	2		8.01	8.12	525	560	.04	.03	10.45	9.44
123-68	17	3		5.35	7.28	2	353	.00	.00	.17	.14

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
123-68	1	1	.00	.36	1.67	2.39	3.07	3.93	94.4	105.7	.00	.05	-.05	-9.76
123-68	2	1	.00	.32	1.67	2.28	3.07	3.78	94.4	103.8	.00	.05	-.05	-9.76
123-68	3	1	.00	1.62	1.67	2.91	3.07	3.82	94.4	103.9	.00	.05	-.05	-9.70
123-68	5	1	.02	.68	1.78	2.21	2.36	3.22	97.9	97.0	.94	.48	.46	9.56
123-68	6	1	.02	.68	1.78	2.28	2.36	2.89	97.9	101.3	.94	.50	.44	8.70
123-68	7	1	.02	.59	1.78	2.28	2.36	3.20	97.9	98.4	.94	.52	.42	8.16
123-68	9	1	.02	.59	1.91	2.25	2.36	3.47	99.7	96.6	2.60	1.33	1.27	9.62
123-68	10	1	.02	.52	1.91	2.26	2.36	3.22	99.7	100.5	2.60	1.38	1.22	8.90
123-68	11	1	.02	.46	1.91	2.24	2.36	2.93	99.7	98.2	2.60	1.38	1.21	8.80
123-68	13	1	.01	.40	1.76	2.26	2.34	3.09	97.2	100.3	4.86	2.84	2.02	7.11
123-68	14	1	.01	.44	1.76	2.30	2.34	3.13	97.2	99.6	4.86	2.78	2.07	7.44
123-68	15	1	.01	.68	1.76	2.24	2.34	3.08	97.2	93.5	4.86	2.70	2.15	8.00
123-68	4	2	.00	.00	1.86	1.67	3.02	3.07	105.2	94.4	.00	.00	.00	
123-68	8	2	.01	.02	1.69	1.78	2.35	2.36	92.0	97.9	.92	.94	-.02	
123-68	12	2	.01	.02	1.84	1.91	2.44	2.36	99.5	99.7	2.50	2.60	-.10	
123-68	16	2	.01	.01	1.75	1.76	2.34	2.34	99.9	97.2	5.01	4.86	.15	
123-68	17	3	-.01	.01	.00	.01	.12	.24	-.7	.6	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
123-130	1	1	1.9998	8.26	8.26	599	571	.04	1.01	12.16	14.82
123-130	2	1	2.0020	8.26	8.30	599	759	.04	1.20	12.16	12.93
123-130	3	1	2.0019	8.26	8.25	599	628	.04	1.27	12.16	12.19
123-130	5	1	2.0005	8.26	8.31	652	472	.04	1.09	9.39	11.31
123-130	6	1	1.9931	8.26	8.25	652	485	.04	3.58	9.39	14.23
123-130	7	1	2.0032	8.26	8.22	652	590	.04	1.15	9.39	11.29
123-130	9	1	1.9970	8.14	8.16	524	468	.02	.98	10.20	11.92
123-130	10	1	2.0007	8.14	8.18	524	568	.02	.87	10.20	12.59
123-130	11	1	1.9909	8.14	8.16	524	657	.02	1.74	10.20	12.44
123-130	13	1	1.9954	8.16	8.19	632	616	.03	.84	9.44	12.92
123-130	14	1	2.0020	8.16	8.24	632	715	.03	2.19	9.44	13.82
123-130	15	1	1.9968	8.16	8.26	632	725	.03	1.97	9.44	13.79
123-130	4	2		8.05	8.26	545	599	.04	.04	10.20	12.16
123-130	8	2		7.99	8.26	533	652	.05	.04	9.68	9.39
123-130	12	2		8.02	8.14	506	524	.05	.02	10.19	10.20
123-130	16	2		8.01	8.16	525	632	.04	.03	10.45	9.44
123-130	17	3		5.35	7.29	2	301	.00	-.01	.17	.20

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
123-130	1	1	.00	.57	1.99	2.66	3.17	3.79	110.0	109.5	.00	.04	-.04	-9.65
123-130	2	1	.00	.82	1.99	2.72	3.17	3.86	110.0	106.3	.00	.04	-.04	-9.63
123-130	3	1	.00	.91	1.99	2.75	3.17	3.76	110.0	100.8	.00	.04	-.04	-9.59
123-130	5	1	.00	.54	1.88	2.70	2.31	3.01	103.4	108.3	.96	.63	.33	5.26
123-130	6	1	.00	5.79	1.88	6.06	2.31	3.09	103.4	105.5	.96	.64	.32	5.02
123-130	7	1	.00	1.46	1.88	3.18	2.31	3.00	103.4	104.6	.96	.61	.35	5.78
123-130	9	1	.00	.94	1.85	2.72	2.45	3.23	103.0	101.4	2.49	1.65	.84	5.09
123-130	10	1	.00	1.07	1.85	3.00	2.45	3.15	103.0	101.1	2.49	1.68	.82	4.87
123-130	11	1	.00	1.22	1.85	3.04	2.45	3.13	103.0	102.8	2.49	1.65	.84	5.11
123-130	13	1	.00	.37	1.80	2.85	2.32	2.90	101.1	113.3	4.86	3.50	1.37	3.92
123-130	14	1	.00	1.82	1.80	3.66	2.32	2.83	101.1	109.4	4.86	3.58	1.29	3.60
123-130	15	1	.00	3.74	1.80	4.64	2.32	2.86	101.1	112.3	4.86	3.65	1.21	3.33
123-130	4	2	.00	.00	1.86	1.99	3.02	3.17	105.2	110.0	.00	.00	.00	
123-130	8	2	.01	.00	1.69	1.88	2.35	2.31	92.0	103.4	.92	.96	-.04	
123-130	12	2	.01	.00	1.84	1.85	2.44	2.45	99.5	103.0	2.50	2.49	.01	
123-130	16	2	.01	.00	1.75	1.80	2.34	2.32	99.9	101.1	5.01	4.86	.14	
123-130	17	3	-.01	.00	.00	.01	.12	.32	-.7	.0	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
123-153	1	1	1.9993	8.24	8.35	660	525	.04	1.14	13.33	13.75
123-153	2	1	1.9933	8.24	8.26	660	634	.04	1.14	13.33	13.55
123-153	3	1	1.9962	8.24	8.35	660	588	.04	1.25	13.33	13.77
123-153	5	1	2.0048	8.19	8.42	657	614	.03	.83	9.28	10.33
123-153	6	1	1.9997	8.19	8.24	657	838	.03	1.10	9.28	11.08
123-153	7	1	1.9955	8.19	8.21	657	760	.03	2.90	9.28	11.91
123-153	9	1	2.0033	8.24	8.22	602	470	.04	1.18	9.83	11.89
123-153	10	1	2.0057	8.24	8.30	602	654	.04	1.27	9.83	11.87
123-153	11	1	1.9997	8.24	8.27	602	618	.04	1.30	9.83	11.79
123-153	13	1	2.0046	8.18	8.22	650	542	.03	.36	9.44	10.90
123-153	14	1	2.0033	8.18	8.29	650	533	.03	.68	9.44	10.70
123-153	15	1	1.9995	8.18	8.26	650	589	.03	1.11	9.44	11.43
123-153	4	2		8.05	8.24	545	660	.04	.04	10.20	13.33
123-153	8	2		7.99	8.19	533	657	.05	.03	9.68	9.28
123-153	12	2		8.02	8.24	506	602	.05	.04	10.19	9.83
123-153	16	2		8.01	8.18	525	650	.04	.03	10.45	9.44
123-153	17	3		5.35	6.47	2	717	.00	.01	.17	.17

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
123-153	1	1	.00	.54	1.92	2.86	3.02	3.55	109.9	111.9	.00	.04	-.04	-9.56
123-153	2	1	.00	.71	1.92	2.94	3.02	3.41	109.9	109.2	.00	.04	-.04	-9.56
123-153	3	1	.00	.46	1.92	2.89	3.02	3.27	109.9	109.6	.00	.04	-.04	-9.55
123-153	5	1	.00	.26	1.82	2.57	2.43	2.77	102.7	103.9	1.00	.63	.37	5.84
123-153	6	1	.00	.46	1.82	2.71	2.43	2.82	102.7	103.1	1.00	.65	.35	5.42
123-153	7	1	.00	.82	1.82	3.77	2.43	3.03	102.7	100.0	1.00	.65	.35	5.46
123-153	9	1	.01	.39	1.86	2.91	2.48	3.03	101.4	103.1	2.50	1.73	.76	4.41
123-153	10	1	.01	.43	1.86	2.94	2.48	3.04	101.4	103.6	2.50	1.69	.80	4.73
123-153	11	1	.01	.38	1.86	2.89	2.48	2.94	101.4	101.7	2.50	1.73	.76	4.41
123-153	13	1	.01	.08	1.81	2.42	2.50	2.68	101.8	104.5	4.87	3.52	1.35	3.83
123-153	14	1	.01	.95	1.81	2.48	2.50	2.70	101.8	102.0	4.87	3.50	1.37	3.90
123-153	15	1	.01	.41	1.81	2.81	2.50	2.96	101.8	101.4	4.87	3.44	1.44	4.18
123-153	4	2	.00	.00	1.86	1.92	3.02	3.02	105.2	109.9	.00	.00	.00	
123-153	8	2	.01	.00	1.69	1.82	2.35	2.43	92.0	102.7	.92	1.00	-.08	
123-153	12	2	.01	.01	1.84	1.86	2.44	2.48	99.5	101.4	2.50	2.50	.01	
123-153	16	2	.01	.01	1.75	1.81	2.34	2.50	99.9	101.8	5.01	4.87	.14	
123-153	17	3	-.01	.01	.00	.01	.12	.34	-.7	.3	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
123-156	1	1	1.9977	8.22	8.23	723	867	.04	1.16	10.50	12.71
123-156	2	1	2.0026	8.22	8.24	723	781	.04	1.51	10.50	12.78
123-156	3	1	2.0005	8.22	8.40	723	546	.04	1.20	10.50	11.88
123-156	5	1	1.9997	8.18	8.31	527	560	.04	1.27	10.55	12.54
123-156	6	1	1.9966	8.18	8.26	527	581	.04	1.37	10.55	12.37
123-156	7	1	2.0066	8.18	8.31	527	683	.04	1.04	10.55	12.08
123-156	9	1	2.0009	8.24	8.31	705	551	.04	1.27	10.14	12.00
123-156	10	1	2.0072	8.24	8.40	705	630	.04	.98	10.14	12.22
123-156	11	1	1.9951	8.24	8.27	705	782	.04	1.22	10.14	11.94
123-156	13	1	2.0018	8.35	8.32	703	718	.04	.97	10.91	12.70
123-156	14	1	2.0071	8.35	8.31	703	425	.04	3.43	10.91	14.54
123-156	15	1	2.0045	8.35	8.34	703	852	.04	.74	10.91	12.23
123-156	4	2		8.03	8.22	472	723	.04	.04	10.20	10.50
123-156	8	2		8.06	8.18	452	527	.05	.04	9.68	10.55
123-156	12	2		8.03	8.24	533	705	.05	.04	10.19	10.14
123-156	16	2		8.00	8.35	563	703	.04	.04	10.45	10.91
123-156	17	3		5.74	6.35	45	187	.00	.01	.01	.13

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
123-156	1	1	-.01	.53	1.86	2.93	3.13	3.67	104.6	108.1	.00	.05	-.05	-9.72
123-156	2	1	-.01	.86	1.86	2.93	3.13	3.63	104.6	105.0	.00	.04	-.04	-9.67
123-156	3	1	-.01	.81	1.86	2.98	3.13	3.70	104.6	105.9	.00	.04	-.04	-9.66
123-156	5	1	-.01	.72	1.87	2.99	2.42	2.94	102.1	100.7	1.03	.68	.35	5.06
123-156	6	1	-.01	.79	1.87	3.29	2.42	2.81	102.1	98.7	1.03	.68	.35	5.23
123-156	7	1	-.01	.46	1.87	2.74	2.42	2.79	102.1	101.3	1.03	.67	.36	5.40
123-156	9	1	-.01	.66	1.85	2.78	2.50	2.88	98.6	99.5	2.61	1.70	.91	5.33
123-156	10	1	-.01	.44	1.85	2.84	2.50	2.97	98.6	99.1	2.61	1.67	.93	5.56
123-156	11	1	-.01	.49	1.85	2.94	2.50	2.88	98.6	99.3	2.61	1.68	.93	5.57
123-156	13	1	.00	.48	1.86	2.85	2.40	2.95	102.3	103.4	5.28	3.69	1.59	4.29
123-156	14	1	.00	3.29	1.86	6.74	2.40	2.92	102.3	102.0	5.28	3.69	1.59	4.28
123-156	15	1	.00	.43	1.86	2.65	2.40	2.80	102.3	102.0	5.28	3.65	1.63	4.46
123-156	4	2	.00	-.01	1.86	1.86	3.02	3.13	105.2	104.6	.00	.00	.00	
123-156	8	2	.01	-.01	1.69	1.87	2.35	2.42	92.0	102.1	.92	1.03	-.11	
123-156	12	2	.01	-.01	1.84	1.85	2.44	2.50	99.5	98.6	2.50	2.61	-.10	
123-156	16	2	.01	.00	1.75	1.86	2.34	2.40	99.9	102.3	5.01	5.28	-.27	
123-156	17	3	-.01	.00	.00	.00	.12	.23	-.8	.2	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
123-172	1	1	2.0037	8.34	8.47	737	705	.04	.84	12.41	17.82
123-172	2	1	1.9981	8.34	8.47	737	727	.04	.70	12.41	16.75
123-172	3	1	1.9995	8.34	8.44	737	677	.04	2.82	12.41	20.51
123-172	5	1	2.0039	8.21	8.43	581	441	.03	.95	9.26	16.61
123-172	6	1	2.0031	8.21	8.39	581	636	.03	1.01	9.26	15.70
123-172	7	1	1.9930	8.21	8.47	581	364	.03	1.33	9.26	15.95
123-172	9	1	2.0015	8.24	8.44	537	549	.03	1.04	9.89	16.09
123-172	10	1	1.9997	8.24	8.36	537	505	.03	.75	9.89	16.23
123-172	11	1	1.9925	8.24	8.35	537	620	.03	.55	9.89	15.16
123-172	13	1	2.0040	8.25	8.33	552	499	.03	1.07	9.47	16.63
123-172	14	1	2.0008	8.25	8.33	552	628	.03	.70	9.47	15.36
123-172	15	1	1.9925	8.25	8.34	552	712	.03	.64	9.47	14.88
123-172	4	2		8.05	8.34	545	737	.04	.04	10.20	12.41
123-172	8	2		7.99	8.21	533	581	.05	.03	9.68	9.26
123-172	12	2		8.02	8.24	506	537	.05	.03	10.19	9.89
123-172	16	2		8.01	8.25	525	552	.04	.03	10.45	9.47
123-172	17	3		5.35	7.73	2	232	.00	.00	.17	.17

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
123-172	1	1	.01	.55	1.82	3.42	2.94	3.70	102.6	105.4	.00	.09	-.09	-9.82
123-172	2	1	.01	.42	1.82	3.11	2.94	3.77	102.6	104.1	.00	.09	-.09	-9.84
123-172	3	1	.01	2.52	1.82	4.56	2.94	3.86	102.6	104.3	.00	.10	-.10	-9.85
123-172	5	1	.00	.53	1.85	3.31	2.08	3.18	104.8	107.8	1.00	.54	.46	8.52
123-172	6	1	.00	.76	1.85	3.33	2.08	3.20	104.8	104.1	1.00	.53	.47	8.71
123-172	7	1	.00	.96	1.85	3.67	2.08	3.02	104.8	104.3	1.00	.53	.47	8.95
123-172	9	1	-.01	.60	1.85	3.31	2.35	3.05	100.2	102.2	2.50	1.32	1.18	8.90
123-172	10	1	-.01	.82	1.85	3.50	2.35	3.16	100.2	102.0	2.50	1.28	1.22	9.51
123-172	11	1	-.01	.28	1.85	3.00	2.35	3.03	100.2	100.7	2.50	1.31	1.19	9.17
123-172	13	1	.00	.57	1.82	3.37	2.19	3.08	102.8	105.0	4.96	2.72	2.24	8.22
123-172	14	1	.00	.35	1.82	3.05	2.19	3.02	102.8	103.5	4.96	2.73	2.23	8.18
123-172	15	1	.00	.46	1.82	3.07	2.19	3.05	102.8	103.2	4.96	2.72	2.24	8.29
123-172	4	2	.00	.01	1.86	1.82	3.02	2.94	105.2	102.6	.00	.00	.00	
123-172	8	2	.01	.00	1.69	1.85	2.35	2.08	92.0	104.8	.92	1.00	-.08	
123-172	12	2	.01	-.01	1.84	1.85	2.44	2.35	99.5	100.2	2.50	2.50	.00	
123-172	16	2	.01	.00	1.75	1.82	2.34	2.19	99.9	102.8	5.01	4.96	.05	
123-172	17	3	-.01	.00	.00	.01	.12	.10	-.7	-1.0	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
123-189	1	1	2.0024	8.26	8.31	699	602	.04	.81	10.33	11.46
123-189	2	1	1.9947	8.26	8.29	699	542	.04	.54	10.33	10.83
123-189	3	1	2.0007	8.26	8.39	699	577	.04	1.00	10.33	11.52
123-189	5	1	1.9954	8.25	8.38	584	591	.03	1.17	10.53	11.93
123-189	6	1	2.0024	8.25	8.34	584	593	.03	0.89	10.53	11.72
123-189	7	1	2.0048	8.25	8.35	584	642	.03	.71	10.53	11.27
123-189	9	1	1.9995	8.23	8.43	555	617	.03	.85	10.27	11.81
123-189	10	1	1.9943	8.23	8.41	555	570	.03	.87	10.27	11.81
123-189	11	1	2.0023	8.23	8.38	555	545	.03	.84	10.27	11.78
123-189	13	1	2.0015	8.35	8.34	893	549	.04	.91	11.06	12.79
123-189	14	1	2.0072	8.35	8.35	893	528	.04	1.13	11.06	12.85
123-189	15	1	2.0048	8.35	8.32	893	526	.04	1.90	11.06	13.37
123-189	4	2		8.03	8.26	472	699	.04	.04	10.20	10.33
123-189	8	2		8.06	8.25	452	584	.05	.03	9.68	10.53
123-189	12	2		8.03	8.23	533	555	.05	.03	10.19	10.27
123-189	16	2		8.00	8.35	563	893	.04	.04	10.45	11.06
123-189	17	3		5.74	6.54	45	274	.00	.01	.01	.18

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
123-189	1	1	.02	.42	1.90	3.12	3.05	3.37	106.6	112.2	.00	.04	-.04	-9.62
123-189	2	1	.02	.27	1.90	2.71	3.05	3.31	106.6	110.6	.00	.04	-.03	-9.64
123-189	3	1	.02	1.12	1.90	3.48	3.05	3.36	106.6	108.9	.00	.04	-.04	-9.61
123-189	5	1	.01	.57	1.85	3.15	2.35	2.65	102.2	102.5	1.05	.68	.36	5.33
123-189	6	1	.01	.66	1.85	3.12	2.35	2.71	102.2	103.0	1.05	.67	.38	5.70
123-189	7	1	.01	.37	1.85	2.96	2.35	2.59	102.2	101.6	1.05	.67	.37	5.55
123-189	9	1	.01	.50	1.84	3.02	2.40	2.78	102.2	101.1	2.62	1.75	.87	4.96
123-189	10	1	.01	.46	1.84	3.03	2.40	2.73	102.2	102.1	2.62	1.75	.87	4.98
123-189	11	1	.01	.42	1.84	2.99	2.40	2.70	102.2	101.7	2.62	1.73	.89	5.10
123-189	13	1	.01	.62	1.92	3.20	2.33	2.70	105.1	107.7	5.42	3.86	1.55	4.02
123-189	14	1	.01	.92	1.92	3.39	2.33	2.67	105.1	108.0	5.42	3.82	1.60	4.18
123-189	15	1	.01	2.31	1.92	4.15	2.33	2.65	105.1	107.9	5.42	3.88	1.54	3.96
123-189	4	2	.00	.02	1.86	1.90	3.02	3.05	105.2	106.6	.00	.00	.00	
123-189	8	2	.01	.01	1.69	1.85	2.35	2.35	92.0	102.2	.92	1.05	-.12	
123-189	12	2	.01	.01	1.84	1.84	2.44	2.40	99.5	102.2	2.50	2.62	-.12	
123-189	16	2	.01	.01	1.75	1.92	2.34	2.33	99.9	105.1	5.01	5.42	-.41	
123-189	17	3	-.01	.00	.00	.01	.12	.10	-.8	1.4	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
123-209	1	1	2.0025	8.31	8.28	1,265	567	.04	1.60	10.26	12.17
123-209	2	1	2.0072	8.31	8.18	1,265	570	.04	1.09	10.26	11.61
123-209	3	1	2.0060	8.31	8.31	1,265	442	.04	.99	10.26	11.69
123-209	5	1	1.9971	8.29	8.37	764	581	.05	3.52	10.84	13.93
123-209	6	1	1.9947	8.29	8.28	764	685	.05	1.35	10.84	12.09
123-209	7	1	1.9988	8.29	8.34	764	671	.05	.71	10.84	11.47
123-209	9	1	1.9972	8.33	8.28	631	531	.04	.75	10.73	11.94
123-209	10	1	2.0016	8.33	8.40	631	1172	.04	.84	10.73	11.97
123-209	11	1	1.9993	8.33	8.48	631	971	.04	.58	10.73	11.47
123-209	13	1	1.9982	8.32	8.24	726	574	.05	.88	11.51	13.11
123-209	14	1	2.0035	8.32	8.38	726	678	.05	.81	11.51	12.87
123-209	15	1	2.0037	8.32	8.34	726	618	.05	.90	11.51	12.89
123-209	4	2		8.03	8.31	472	1,265	.04	.04	10.20	10.26
123-209	8	2		8.06	8.29	452	764	.05	.05	9.68	10.84
123-209	12	2		8.03	8.33	533	631	.05	.04	10.19	10.73
123-209	16	2		8.00	8.32	563	726	.04	.05	10.45	11.51
123-209	17	3		5.74	7.55	45	393	.00	.01	.01	.19

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
123-209	1	1	.01	1.17	1.93	3.43	3.02	3.27	109.2	113.4	.00	.04	-.04	-9.69
123-209	2	1	.01	.79	1.93	3.18	3.02	3.14	109.2	109.0	.00	.04	-.04	-9.66
123-209	3	1	.01	1.03	1.93	3.23	3.02	3.22	109.2	109.6	.00	.04	-.04	-9.65
123-209	5	1	.01	2.61	1.89	4.67	2.33	2.66	104.0	106.8	1.05	.59	.46	7.74
123-209	6	1	.01	1.20	1.89	3.40	2.33	2.58	104.0	104.9	1.05	.57	.48	8.54
123-209	7	1	.01	.64	1.89	2.97	2.33	2.50	104.0	102.9	1.05	.56	.49	8.66
123-209	9	1	.01	.83	1.90	3.32	2.38	2.66	102.0	104.9	2.61	1.45	1.16	7.97
123-209	10	1	.01	.74	1.90	3.17	2.38	2.59	102.0	104.0	2.61	1.44	1.17	8.16
123-209	11	1	.01	.41	1.90	2.96	2.38	2.58	102.0	102.6	2.61	1.42	1.19	8.39
123-209	13	1	.01	.59	1.96	3.32	2.30	2.57	109.8	110.8	5.47	3.21	2.26	7.04
123-209	14	1	.01	.61	1.96	3.25	2.30	2.56	109.8	111.0	5.47	3.26	2.22	6.79
123-209	15	1	.01	.51	1.96	3.30	2.30	2.51	109.8	110.4	5.47	3.17	2.30	7.24
123-209	4	2	.00	.01	1.86	1.93	3.02	3.02	105.2	109.2	.00	.00	.00	
123-209	8	2	.01	.01	1.69	1.89	2.35	2.33	92.0	104.0	.92	1.05	-.13	
123-209	12	2	.01	.01	1.84	1.90	2.44	2.38	99.5	102.0	2.50	2.61	-.11	
123-209	16	2	.01	.01	1.75	1.96	2.34	2.30	99.9	109.8	5.01	5.47	-.47	
123-209	17	3	-.01	.00	.00	.01	.12	.13	-.8	.6	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (μS/cm)	Final conductivity (μS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
123-211a	1	1	2.0036	8.26	8.25	755	848	.05	2.30	11.01	13.19
123-211a	2	1	1.9999	8.26	8.22	755	450	.05	1.12	11.01	11.98
123-211a	3	1	2.0072	8.26	8.25	755	534	.05	.54	11.01	11.93
123-211a	5	1	2.0056	8.28	8.23	632	566	.05	.63	10.98	12.12
123-211a	6	1	1.9983	8.28	8.34	632	626	.05	.88	10.98	12.03
123-211a	7	1	2.0047	8.28	8.24	632	582	.05	.92	10.98	12.43
123-211a	9	1	1.9961	8.26	8.32	618	758	.05	.87	10.98	13.01
123-211a	10	1	1.9984	8.26	8.27	618	459	.05	.55	10.98	12.38
123-211a	11	1	2.0044	8.26	8.28	618	506	.05	.87	10.98	12.66
123-211a	13	1	1.9990	8.27	8.24	633	633	.05	1.17	11.40	13.89
123-211a	14	1	2.0067	8.27	8.23	633	616	.05	.69	11.40	13.34
123-211a	15	1	1.9991	8.27	8.27	633	620	.05	.90	11.40	13.35
123-211a	4	2		8.03	8.26	472	755	.04	.05	10.20	11.01
123-211a	8	2		8.06	8.28	452	632	.05	.05	9.68	10.98
123-211a	12	2		8.03	8.26	533	618	.05	.05	10.19	10.98
123-211a	16	2		8.00	8.27	563	633	.04	.05	10.45	11.40
123-211a	17	3		5.74	6.55	45	259	.00	.02	.01	.14

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
123-211a	1	1	.01	1.35	1.98	3.51	3.04	3.78	112.6	112.5	.00	.07	-.07	-9.83
123-211a	2	1	.01	.41	1.98	2.71	3.04	3.59	112.6	111.3	.00	.07	-.06	-9.83
123-211a	3	1	.01	.15	1.98	2.50	3.04	3.65	112.6	110.8	.00	.07	-.06	-9.80
123-211a	5	1	.02	.21	1.93	2.56	2.30	2.91	107.0	108.2	1.09	.57	.52	8.98
123-211a	6	1	.02	.28	1.93	2.60	2.30	2.99	107.0	106.1	1.09	.54	.55	10.11
123-211a	7	1	.02	.43	1.93	2.78	2.30	3.01	107.0	107.8	1.09	.56	.53	9.42
123-211a	9	1	.01	.70	1.98	3.14	2.34	3.09	105.0	106.1	2.74	1.45	1.29	8.90
123-211a	10	1	.01	.14	1.98	2.57	2.34	2.88	105.0	106.2	2.74	1.46	1.28	8.73
123-211a	11	1	.01	.28	1.98	2.69	2.34	3.00	105.0	107.1	2.74	1.41	1.33	9.45
123-211a	13	1	.01	.78	1.91	3.15	2.32	2.96	108.4	108.2	5.38	3.20	2.18	6.83
123-211a	14	1	.01	.28	1.91	2.72	2.32	2.92	108.4	108.0	5.38	3.17	2.21	6.95
123-211a	15	1	.01	.30	1.91	2.76	2.32	2.96	108.4	107.6	5.38	3.02	2.36	7.82
123-211a	4	2	.00	.01	1.86	1.98	3.02	3.04	105.2	112.6	.00	.00	.00	
123-211a	8	2	.01	.02	1.69	1.93	2.35	2.30	92.0	107.0	.92	1.09	-.17	
123-211a	12	2	.01	.01	1.84	1.98	2.44	2.34	99.5	105.0	2.50	2.74	-.24	
123-211a	16	2	.01	.01	1.75	1.92	2.34	2.32	99.9	108.4	5.01	5.38	-.37	
123-211a	17	3	-.01	.00	.00	.01	.12	.09	-.8	.8	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (μS/cm)	Final conductivity (μS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
123-211b	1	1	1.9970	8.11	8.30	549	451	.04	5.73	10.05	17.25
123-211b	2	1	1.9953	8.11	8.45	549	649	.04	3.54	10.05	15.15
123-211b	3	1	1.9954	8.11	8.48	549	786	.04	1.97	10.05	14.23
123-211b	5	1	2.0028	8.06	8.30	613	798	.05	2.03	10.60	15.35
123-211b	6	1	2.0009	8.06	8.35	613	634	.05	3.81	10.60	15.86
123-211b	7	1	2.0033	8.06	8.37	613	634	.05	2.82	10.60	15.24
123-211b	9	1	1.9991	8.27	8.27	549	645	.05	1.10	10.74	14.79
123-211b	10	1	2.0045	8.27	8.26	549	549	.05	1.56	10.74	15.51
123-211b	11	1	2.0058	8.27	8.29	549	502	.05	1.69	10.74	14.66
123-211b	13	1	1.9918	8.22	8.46	735	689	.04	2.32	11.11	16.21
123-211b	14	1	1.9996	8.22	8.36	735	535	.04	1.62	11.11	14.84
123-211b	15	1	1.9991	8.22	8.24	735	580	.04	1.84	11.11	15.65
123-211b	4	2		7.90	8.11	570	549	.04	.04	10.74	10.05
123-211b	8	2		8.07	8.06	556	613	.04	.05	11.43	10.60
123-211b	12	2		8.02	8.27	558	549	.05	.05	11.27	10.74
123-211b	16	2		8.03	8.22	573	735	.05	.04	11.86	11.11
123-211b	17	3		4.63	6.93	35	168	.00	.04	.01	.14

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	SrKd
123-211b	1	1	.01	4.96	1.84	6.61	3.63	4.18	106.8	106.8	.00	.09	-.09	-9.87
123-211b	2	1	.01	2.05	1.84	4.01	3.63	4.13	106.8	105.1	.00	.08	-.08	-9.86
123-211b	3	1	.01	1.04	1.84	3.34	3.63	4.08	106.8	107.6	.00	.08	-.07	-9.84
123-211b	5	1	.01	2.09	1.86	4.41	2.51	3.15	101.4	106.4	1.05	.59	.46	7.86
123-211b	6	1	.01	2.22	1.86	4.32	2.51	3.18	101.4	100.5	1.05	.56	.48	8.58
123-211b	7	1	.01	1.40	1.86	3.60	2.51	3.13	101.4	100.0	1.05	.56	.49	8.65
123-211b	9	1	.01	.40	1.89	2.94	2.50	3.21	105.4	108.0	2.69	1.47	1.22	8.35
123-211b	10	1	.01	.88	1.89	3.37	2.50	3.15	105.4	107.2	2.69	1.49	1.20	8.07
123-211b	11	1	.01	1.27	1.89	3.65	2.50	3.10	105.4	106.3	2.69	1.45	1.24	8.56
123-211b	13	1	.01	1.03	1.84	3.32	2.40	3.07	103.8	106.3	5.40	3.10	2.31	7.48
123-211b	14	1	.01	.91	1.84	3.24	2.40	3.13	103.8	106.8	5.40	3.06	2.34	7.67
123-211b	15	1	.01	5.74	1.84	7.51	2.40	2.99	103.8	104.7	5.40	3.13	2.27	7.26
123-211b	4	2	.01	.01	2.06	1.84	3.63	3.63	112.1	106.8	.00	.00	.00	
123-211b	8	2	.00	.01	2.02	1.86	2.49	2.51	106.4	101.4	1.13	1.05	.08	
123-211b	12	2	.00	.01	2.02	1.89	2.58	2.50	106.1	105.4	2.80	2.69	.11	
123-211b	16	2	.00	.01	2.03	1.84	2.52	2.40	109.6	103.8	5.73	5.40	.33	
123-211b	17	3	-.01	.01	.00	.01	.13	.11	-.8	.4	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
123-221	1	1	1.9985	8.20	8.25	636	593	.04	1.81	10.12	12.33
123-221	2	1	2.0053	8.20	8.24	636	523	.04	1.72	10.12	12.41
123-221	3	1	2.0054	8.20	8.24	636	529	.04	1.91	10.12	12.54
123-221	5	1	2.0007	8.23	8.27	421	527	.04	1.57	10.61	12.87
123-221	6	1	2.0073	8.23	8.26	421	340	.04	1.33	10.61	12.51
123-221	7	1	2.0087	8.23	8.30	421	567	.04	1.60	10.61	12.93
123-221	9	1	2.0090	8.24	8.29	601	612	.04	1.30	10.69	12.77
123-221	10	1	1.9967	8.24	8.41	601	717	.04	1.24	10.69	12.37
123-221	11	1	2.0020	8.24	8.28	601	439	.04	2.38	10.69	13.79
123-221	13	1	2.0050	8.26	8.26	683	680	.05	1.22	11.41	13.66
123-221	14	1	1.9964	8.26	8.37	683	458	.05	1.22	11.41	13.68
123-221	15	1	1.9998	8.26	8.31	683	697	.05	.96	11.41	13.52
123-221	4	2		8.03	8.20	472	636	.04	.04	10.20	10.12
123-221	8	2		8.06	8.23	452	421	.05	.04	9.68	10.61
123-221	12	2		8.03	8.24	533	601	.05	.04	10.19	10.69
123-221	16	2		8.00	8.26	563	683	.04	.04	10.45	11.41
123-221	17	3		5.74	6.33	45	279	.00	.01	.01	.17

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
123-221	1	1	.00	.74	1.96	2.98	3.12	4.05	109.4	107.7	.00	.10	-.10	-9.89
123-221	2	1	.00	.74	1.96	2.97	3.12	3.88	109.4	109.4	.00	.10	-.10	-9.85
123-221	3	1	.00	.72	1.96	2.99	3.12	3.91	109.4	106.0	.00	.10	-.10	-9.86
123-221	5	1	.00	1.00	1.90	3.23	2.35	3.29	104.8	104.7	1.06	.47	.59	12.41
123-221	6	1	.00	.46	1.90	2.85	2.35	3.22	104.8	105.4	1.06	.46	.60	13.03
123-221	7	1	.00	.68	1.90	2.94	2.35	3.31	104.8	102.3	1.06	.45	.61	13.51
123-221	9	1	.01	.44	1.85	2.96	2.33	3.31	103.0	103.5	2.63	1.10	1.53	13.79
123-221	10	1	.01	.39	1.85	2.68	2.33	3.30	103.0	102.7	2.63	1.08	1.56	14.47
123-221	11	1	.01	1.44	1.85	3.68	2.33	3.40	103.0	101.5	2.63	1.09	1.55	14.19
123-221	13	1	.01	.45	1.91	2.99	2.29	3.31	104.4	104.1	5.32	2.46	2.86	11.58
123-221	14	1	.01	.48	1.91	2.90	2.29	3.29	104.4	106.2	5.32	2.42	2.90	11.97
123-221	15	1	.01	.43	1.91	2.90	2.29	3.24	104.4	105.2	5.32	2.46	2.86	11.65
123-221	4	2	.00	.00	1.86	1.96	3.02	3.12	105.2	109.4	.00	.00	.00	
123-221	8	2	.01	.00	1.69	1.90	2.35	2.35	92.0	104.8	.92	1.06	-.14	
123-221	12	2	.01	.01	1.84	1.85	2.44	2.33	99.5	103.0	2.50	2.63	-.13	
123-221	16	2	.01	.01	1.75	1.91	2.34	2.29	99.9	104.4	5.01	5.32	-.31	
123-221	17	3	-.01	.00	.00	.00	.12	.06	-.8	.8	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
WO-1-141	1	1	1.9990	8.10	8.08	747	675	.04	2.03	10.26	13.56
WO-1-141	2	1	2.0031	8.10	8.03	747	550	.04	1.64	10.26	12.92
WO-1-141	3	1	2.0086	8.10	8.09	747	694	.04	1.48	10.26	12.64
WO-1-141	5	1	2.0000	8.15	8.09	657	692	.04	1.80	10.76	13.26
WO-1-141	6	1	2.0057	8.15	8.15	657	588	.04	1.34	10.76	12.78
WO-1-141	7	1	2.0084	8.15	8.10	657	482	.04	1.69	10.76	12.95
WO-1-141	9	1	1.9999	8.14	8.07	545	588	.04	2.30	10.46	15.37
WO-1-141	10	1	1.9985	8.14	8.08	545	681	.04	1.01	10.46	13.83
WO-1-141	11	1	1.9936	8.14	8.11	545	819	.04	1.13	10.46	13.12
WO-1-141	13	1	2.0042	8.09	8.01	577	607	.04	0.36	11.13	14.42
WO-1-141	14	1	2.0015	8.09	8.03	577	530	.04	0.74	11.13	14.42
WO-1-141	15	1	1.9961	8.09	8.38	577	859	.04	.72	11.13	13.95
WO-1-141	4	2		7.90	8.10	570	747	.04	.04	10.74	10.26
WO-1-141	8	2		8.07	8.15	556	657	.04	.04	11.43	10.76
WO-1-141	12	2		8.02	8.14	558	545	.05	.04	11.27	10.46
WO-1-141	16	2		8.03	8.09	573	577	.05	.40	11.86	11.13
WO-1-141	17	3		4.63	8.01	35	109	.00	.01	.01	.18

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
WO-1-141	1	1	.01	1.50	1.93	3.09	3.50	4.23	106.1	107.0	.00	.10	-.09	-9.85
WO-1-141	2	1	.01	.99	1.93	2.87	3.50	4.20	106.1	104.5	.00	.09	-.09	-9.82
WO-1-141	3	1	.01	.81	1.93	2.71	3.50	4.06	106.1	103.2	.00	.09	-.09	-9.79
WO-1-141	5	1	.00	1.07	1.85	2.82	2.46	3.41	101.3	101.1	1.03	.35	.68	19.69
WO-1-141	6	1	.00	.77	1.85	2.70	2.46	3.40	101.3	99.4	1.03	.34	.69	20.24
WO-1-141	7	1	.00	.98	1.85	2.73	2.46	3.33	101.3	98.2	1.03	.34	.69	20.25
WO-1-141	9	1	.01	5.93	1.81	4.93	2.42	3.55	99.3	98.2	2.53	.79	1.75	22.14
WO-1-141	10	1	.01	3.92	1.81	4.39	2.42	3.33	99.3	97.9	2.53	.78	1.76	22.68
WO-1-141	11	1	.01	1.12	1.81	2.94	2.42	3.48	99.3	95.6	2.53	.75	1.78	23.65
WO-1-141	13	1	.01	.22	1.80	2.90	2.34	3.39	101.5	101.8	5.25	1.69	3.55	20.96
WO-1-141	14	1	.01	.52	1.80	2.94	2.34	3.51	101.5	101.2	5.25	1.65	3.60	21.82
WO-1-141	15	1	.01	.45	1.80	2.77	2.34	3.47	101.5	99.9	5.25	1.60	3.65	22.88
WO-1-141	4	2	.01	.01	2.06	1.93	3.63	3.50	112.1	106.1	.00	.00	.00	
WO-1-141	8	2	.00	.00	2.02	1.85	2.49	2.46	106.4	101.3	1.13	1.03	.10	
WO-1-141	12	2	.00	.01	2.02	1.81	2.59	2.42	106.1	99.3	2.80	2.53	.27	
WO-1-141	16	2	.00	.01	2.03	1.80	2.52	2.34	109.6	101.5	5.73	5.25	.48	
WO-1-141	17	3	-.01	.00	.00	.01	.13	.11	-.8	-.1	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
WO-1-146	1	1	2.0014	8.14	8.29	899	690	.04	1.57	10.31	12.45
WO-1-146	2	1	2.0007	8.14	8.21	899	592	.04	1.43	10.31	12.52
WO-1-146	3	1	2.0013	8.14	8.25	899	581	.04	1.28	10.31	12.34
WO-1-146	5	1	1.9984	8.19	8.28	594	616	.04	1.21	10.81	13.11
WO-1-146	6	1	1.9929	8.19	8.27	594	629	.04	1.16	10.81	12.79
WO-1-146	7	1	1.9957	8.19	8.23	594	625	.04	1.14	10.81	12.74
WO-1-146	9	1	2.0012	8.20	8.16	648	587	.03	1.11	10.46	12.84
WO-1-146	10	1	1.9919	8.20	8.16	648	554	.03	1.07	10.46	12.74
WO-1-146	11	1	2.0083	8.20	8.20	648	1,194	.03	1.37	10.46	12.88
WO-1-146	13	1	2.0015	8.18	8.16	621	585	.05	1.06	11.35	14.02
WO-1-146	14	1	1.9993	8.18	8.16	621	678	.05	.89	11.35	13.74
WO-1-146	15	1	2.0053	8.18	8.08	621	605	.05	.81	11.35	13.78
WO-1-146	4	2		7.90	8.14	570	899	.04	.04	10.74	10.31
WO-1-146	8	2		8.07	8.19	556	594	.04	.04	11.43	10.81
WO-1-146	12	2		8.02	8.20	558	648	.05	.03	11.27	10.46
WO-1-146	16	2		8.03	8.18	573	621	.05	.05	11.86	11.35
WO-1-146	17	3		4.63	6.15	35	1,103	.00	.01	.01	.15

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
WO-1-146	1	1	.01	.66	1.91	2.59	3.48	4.12	107.7	108.8	.00	.09	-.09	-9.82
WO-1-146	2	1	.01	.85	1.91	2.75	3.48	4.12	107.7	107.9	.00	.09	-.09	-9.82
WO-1-146	3	1	.01	.90	1.91	2.66	3.48	4.07	107.7	107.2	.00	.09	-.09	-9.82
WO-1-146	5	1	.00	.92	1.85	2.84	2.43	3.30	103.7	105.3	1.06	.56	.50	8.86
WO-1-146	6	1	.00	.58	1.85	2.55	2.43	3.27	103.7	101.7	1.06	.54	.52	9.75
WO-1-146	7	1	.00	.46	1.85	2.49	2.43	3.27	103.7	100.6	1.06	.55	.52	9.43
WO-1-146	9	1	.00	.55	1.83	2.54	2.51	3.38	99.5	100.2	2.57	1.33	1.24	9.36
WO-1-146	10	1	.00	.59	1.83	2.58	2.51	3.39	99.5	99.4	2.57	1.27	1.29	10.17
WO-1-146	11	1	.00	.72	1.83	2.60	2.51	3.33	99.5	99.2	2.57	1.30	1.26	9.65
WO-1-146	13	1	.00	.57	1.89	2.66	2.38	3.28	105.0	105.2	5.45	2.90	2.54	8.75
WO-1-146	14	1	.00	.42	1.89	2.57	2.38	3.26	105.0	104.4	5.45	2.85	2.60	9.10
WO-1-146	15	1	.00	.36	1.89	2.56	2.38	3.26	105.0	103.6	5.45	2.84	2.61	9.18
WO-1-146	4	2	.01	.01	2.06	1.91	3.63	3.48	112.1	107.7	.00	.00	.00	
WO-1-146	8	2	.00	.00	2.02	1.85	2.49	2.43	106.4	103.7	1.13	1.06	.07	
WO-1-146	12	2	.00	.00	2.02	1.83	2.59	2.51	106.1	99.5	2.80	2.57	.23	
WO-1-146	16	2	.00	.00	2.03	1.89	2.52	2.38	109.6	105.0	5.73	5.45	.28	
WO-1-146	17	3	-.01	.00	.00	.01	.13	.16	-.8	.1	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
WO-2-185	1	1	1.9963	8.15	8.33	720	607	.05	1.17	10.40	11.35
WO-2-185	2	1	1.9962	8.15	8.12	720	577	.05	.70	10.40	11.73
WO-2-185	3	1	2.0032	8.15	8.23	720	535	.05	1.76	10.40	12.01
WO-2-185	5	1	2.0004	8.20	8.31	586	679	.04	1.54	10.94	12.44
WO-2-185	6	1	2.0003	8.20	8.17	586	565	.04	1.33	10.94	12.15
WO-2-185	7	1	2.0044	8.20	8.19	586	640	.04	1.24	10.94	12.11
WO-2-185	9	1	1.9944	8.21	8.12	574	509	.07	.92	10.73	12.26
WO-2-185	10	1	2.0058	8.21	8.15	574	489	.07	.66	10.73	11.87
WO-2-185	11	1	1.9992	8.21	8.10	574	560	.07	1.22	10.73	12.40
WO-2-185	13	1	1.9940	8.23	8.16	944	453	.04	.80	11.47	13.13
WO-2-185	14	1	1.9992	8.23	8.15	944	616	.04	.93	11.47	13.22
WO-2-185	15	1	2.0068	8.23	8.13	944	473	.04	.78	11.47	13.04
WO-2-185	4	2		7.90	8.15	570	720	.04	.05	10.74	10.40
WO-2-185	8	2		8.07	8.20	556	586	.04	.04	11.43	10.94
WO-2-185	12	2		8.02	8.21	558	574	.05	.07	11.27	10.73
WO-2-185	16	2		8.03	8.23	573	944	.05	.04	11.86	11.47
WO-2-185	17	3		4.63	7.81	35	218	.00	.01	.01	0.19

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
WO-2-185	1	1	.01	.76	1.93	2.77	3.39	4.14	109.3	113.3	.00	.06	-.06	-9.74
WO-2-185	2	1	.01	.33	1.93	2.66	3.39	4.06	109.3	109.1	.00	.06	-.06	-9.74
WO-2-185	3	1	.01	1.20	1.93	3.13	3.39	4.09	109.3	108.3	.00	.06	-.06	-9.71
WO-2-185	5	1	.01	1.42	1.87	3.30	2.29	3.17	104.0	106.5	1.07	.59	.48	8.08
WO-2-185	6	1	.01	.85	1.87	2.77	2.29	3.15	104.0	104.9	1.07	.59	.48	8.14
WO-2-185	7	1	.01	1.00	1.87	3.08	2.29	3.07	104.0	104.9	1.07	.58	.49	8.33
WO-2-185	9	1	.11	.64	1.92	2.90	2.36	3.16	104.4	103.6	2.66	1.47	1.19	8.10
WO-2-185	10	1	.11	.25	1.92	2.62	2.36	3.05	104.4	102.5	2.66	1.48	1.18	7.96
WO-2-185	11	1	.11	1.97	1.92	3.89	2.36	3.11	104.4	102.3	2.66	1.45	1.22	8.41
WO-2-185	13	1	.01	.46	1.90	3.03	2.28	3.10	106.6	108.5	5.36	3.17	2.18	6.91
WO-2-185	14	1	.01	.44	1.90	2.92	2.28	3.06	106.6	105.6	5.36	3.20	2.16	6.77
WO-2-185	15	1	.01	.48	1.90	2.89	2.28	3.01	106.6	103.0	5.36	3.12	2.24	7.15
WO-2-185	4	2	.01	.01	2.06	1.93	3.63	3.39	112.1	109.3	.00	.00	.00	
WO-2-185	8	2	.00	.01	2.02	1.87	2.49	2.29	106.4	104.0	1.13	1.07	.06	
WO-2-185	12	2	.00	.11	2.02	1.92	2.59	2.36	106.1	104.4	2.80	2.66	.14	
WO-2-185	16	2	.00	.01	2.03	1.90	2.52	2.28	109.6	106.6	5.73	5.36	.37	
WO-2-185	17	3	-.01	.00	.00	.01	.13	.07	-.8	.4	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (μS/cm)	Final conductivity (μS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
WO-2-186	1	1	1.9978	8.11	8.11	677	721	.04	5.34	10.32	14.78
WO-2-186	2	1	1.9984	8.11	8.13	677	669	.04	1.87	10.32	11.87
WO-2-186	3	1	2.0001	8.11	8.19	677	695	.04	3.14	10.32	12.73
WO-2-186	5	1	2.0041	8.16	8.17	559	589	.04	1.90	10.89	12.80
WO-2-186	6	1	2.0024	8.16	8.03	559	863	.04	1.94	10.89	12.40
WO-2-186	7	1	2.0071	8.16	8.21	559	605	.04	3.53	10.89	13.79
WO-2-186	9	1	2.0009	8.19	8.17	534	561	.04	3.38	10.56	13.49
WO-2-186	10	1	1.9956	8.19	8.11	534	389	.04	1.39	10.56	11.88
WO-2-186	11	1	1.9990	8.19	8.11	534	684	.04	.95	10.56	11.48
WO-2-186	13	1	2.0009	8.32	8.18	617	628	.04	.96	10.96	12.41
WO-2-186	14	1	2.0034	8.32	8.29	617	522	.04	1.40	10.96	12.46
WO-2-186	15	1	1.9994	8.32	8.35	617	516	.04	1.13	10.96	12.40
WO-2-186	4	2		7.90	8.11	570	677	.04	.04	10.74	10.32
WO-2-186	8	2		8.07	8.16	556	559	.04	.04	11.43	10.89
WO-2-186	12	2		8.02	8.19	558	534	.05	.04	11.27	10.56
WO-2-186	16	2		8.03	8.32	573	617	.05	.04	11.86	10.96
WO-2-186	17	3		4.63	7.45	35	182	.00	.00	.01	.14

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
WO-2-186	1	1	.01	4.44	1.90	4.92	3.26	3.96	108.1	109.7	.00	.06	-.06	-9.74
WO-2-186	2	1	.01	1.26	1.90	3.08	3.26	3.92	108.1	108.0	.00	.05	-.05	-9.67
WO-2-186	3	1	.01	3.13	1.90	4.08	3.26	3.91	108.1	107.6	.00	.05	-.05	-9.69
WO-2-186	5	1	.01	3.45	1.83	4.50	2.35	3.00	102.6	105.0	1.03	.66	.38	5.72
WO-2-186	6	1	.01	.89	1.83	2.83	2.35	3.01	102.6	103.1	1.03	.62	.41	6.58
WO-2-186	7	1	.01	9.13	1.83	7.83	2.35	3.00	102.6	101.6	1.03	.63	.41	6.52
WO-2-186	9	1	.00	1.75	1.83	3.25	2.40	3.16	101.2	101.7	2.56	1.61	.94	5.85
WO-2-186	10	1	.00	.70	1.83	2.71	2.40	3.01	101.2	101.7	2.56	1.59	.97	6.14
WO-2-186	11	1	.00	.46	1.83	2.56	2.40	3.04	101.2	101.1	2.56	1.58	.98	6.23
WO-2-186	13	1	.01	.56	1.81	2.68	2.32	3.19	100.5	103.9	5.15	3.39	1.76	5.19
WO-2-186	14	1	.01	1.09	1.81	2.94	2.32	3.15	100.5	101.8	5.15	3.29	1.86	5.65
WO-2-186	15	1	.01	6.41	1.81	6.64	2.32	3.18	100.5	101.1	5.15	3.39	1.77	5.21
WO-2-186	4	2	.01	.01	2.06	1.90	3.63	3.26	112.1	108.1	.00	.00	.00	
WO-2-186	8	2	.00	.01	2.02	1.83	2.49	2.35	106.4	102.6	1.13	1.03	.10	
WO-2-186	12	2	.00	.00	2.02	1.83	2.59	2.40	106.1	101.2	2.80	2.56	.24	
WO-2-186	16	2	.00	.01	2.03	1.81	2.52	2.32	109.6	100.5	5.73	5.15	.57	
WO-2-186	17	3	-.01	.00	.00	.01	.13	.10	-.8	-.3	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (μS/cm)	Final conductivity (μS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
WO-2-397	1	1	1.9956	8.15	8.31	694	642	.04	.79	10.42	15.18
WO-2-397	2	1	1.9920	8.15	8.29	694	700	.04	.80	10.42	15.44
WO-2-397	3	1	1.9986	8.15	8.22	694	644	.04	1.03	10.42	16.17
WO-2-397	5	1	2.0056	8.18	8.26	536	831	.03	.90	10.94	14.96
WO-2-397	6	1	2.0051	8.18	8.28	536	695	.03	.75	10.94	15.05
WO-2-397	7	1	1.9996	8.18	8.25	536	651	.03	.71	10.94	14.69
WO-2-397	9	1	1.9983	8.17	8.16	468	402	.03	.83	10.51	15.49
WO-2-397	10	1	1.9927	8.17	8.31	468	761	.03	.62	10.51	14.51
WO-2-397	11	1	2.0004	8.17	8.21	468	586	.03	.63	10.51	14.82
WO-2-397	13	1	1.9963	8.18	8.24	620	511	.05	.68	11.36	16.12
WO-2-397	14	1	1.9990	8.18	8.22	620	475	.05	1.32	11.36	16.47
WO-2-397	15	1	1.9964	8.18	8.22	620	652	.05	2.23	11.36	18.91
WO-2-397	4	2		7.90	8.15	570	694	.04	.04	10.74	10.42
WO-2-397	8	2		8.07	8.18	556	536	.04	.03	11.43	10.94
WO-2-397	12	2		8.02	8.17	558	468	.05	.03	11.27	10.51
WO-2-397	16	2		8.03	8.18	573	620	.05	.05	11.86	11.36
WO-2-397	17	3		4.63	7.92	35	280	.00	.01	.01	.14

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
WO-2-397	1	1	.01	1.07	1.94	3.89	3.46	4.25	111.0	112.3	.00	.05	-.05	-9.71
WO-2-397	2	1	.01	1.28	1.94	4.00	3.46	4.16	111.0	109.2	.00	.05	-.05	-9.72
WO-2-397	3	1	.01	2.54	1.94	4.65	3.46	4.04	111.0	110.4	.00	.05	-.05	-9.70
WO-2-397	5	1	.01	1.54	1.91	4.14	2.48	3.23	105.0	107.7	1.09	.58	.51	8.74
WO-2-397	6	1	.01	.88	1.91	3.71	2.48	3.20	105.0	104.6	1.09	.58	.51	8.67
WO-2-397	7	1	.01	.91	1.91	3.78	2.48	3.13	105.0	105.0	1.09	.58	.51	8.68
WO-2-397	9	1	.01	1.05	1.83	3.68	2.47	3.18	101.1	102.6	2.62	1.46	1.16	7.97
WO-2-397	10	1	.01	.86	1.83	3.65	2.47	3.17	101.1	101.2	2.62	1.42	1.21	8.57
WO-2-397	11	1	.01	.71	1.83	3.54	2.47	3.08	101.1	101.5	2.62	1.42	1.20	8.44
WO-2-397	13	1	.01	.79	1.93	3.93	2.35	3.14	107.8	109.4	5.47	3.18	2.30	7.26
WO-2-397	14	1	.01	2.37	1.93	4.63	2.35	3.05	107.8	106.8	5.47	3.12	2.35	7.54
WO-2-397	15	1	.01	14.51	1.93	10.88	2.35	3.04	107.8	106.9	5.47	3.13	2.34	7.50
WO-2-397	4	2	.01	.01	2.06	1.94	3.63	3.46	112.1	111.0	.00	.00	.00	
WO-2-397	8	2	.00	.01	2.02	1.91	2.49	2.48	106.4	105.0	1.13	1.09	.04	
WO-2-397	12	2	.00	.01	2.02	1.83	2.59	2.47	106.1	101.1	2.80	2.62	.18	
WO-2-397	16	2	.00	.01	2.03	1.93	2.52	2.35	109.6	107.8	5.73	5.47	.25	
WO-2-397	17	3	-.01	.00	.00	.01	.13	.07	-.8	.2	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
WO-2-400	1	1	2.0068	8.11	8.25	695	640	.03	1.31	10.10	11.00
WO-2-400	2	1	2.0087	8.11	8.27	695	597	.03	1.23	10.10	10.45
WO-2-400	3	1	1.9956	8.11	8.29	695	801	.03	1.24	10.10	10.74
WO-2-400	5	1	2.0098	8.14	8.19	591	600	.04	1.15	10.64	11.31
WO-2-400	6	1	2.0091	8.14	8.22	591	565	.04	.86	10.64	10.81
WO-2-400	7	1	1.9997	8.14	8.25	591	634	.04	1.35	10.64	11.30
WO-2-400	9	1	1.9940	8.15	8.13	648	565	.03	1.14	10.36	11.07
WO-2-400	10	1	2.0003	8.15	8.14	648	446	.03	.97	10.36	11.18
WO-2-400	11	1	1.9999	8.15	8.07	648	631	.03	1.03	10.36	11.06
WO-2-400	13	1	2.0014	8.27	8.10	1,255	551	.04	.82	11.46	12.39
WO-2-400	14	1	2.0051	8.27	8.15	1,255	648	.04	1.02	11.46	12.36
WO-2-400	15	1	2.0071	8.27	8.18	1,255	654	.04	.94	11.46	12.28
WO-2-400	4	2		7.91	8.11	559	695	.04	.03	10.74	10.10
WO-2-400	8	2		8.09	8.14	546	591	.04	.04	11.43	10.64
WO-2-400	12	2		8.02	8.15	542	648	.05	.03	11.27	10.36
WO-2-400	16	2		8.05	8.27	560	1,255	.05	.04	11.86	11.46
WO-2-400	17	3		8.25	8.07	11	178	.00	.01	.01	.18

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
WO-2-400	1	1	.00	1.38	1.91	3.26	3.42	4.19	107.3	110.2	.02	.04	-.03	-6.33
WO-2-400	2	1	.00	1.10	1.91	3.08	3.42	4.07	107.3	108.3	.02	.04	-.03	-6.11
WO-2-400	3	1	.00	1.36	1.91	3.27	3.42	4.03	107.3	109.0	.02	.04	-.03	-6.22
WO-2-400	5	1	.00	2.00	1.87	3.70	2.36	3.19	104.0	104.9	1.04	.60	.44	7.29
WO-2-400	6	1	.00	.65	1.87	2.89	2.36	3.19	104.0	104.7	1.04	.59	.45	7.66
WO-2-400	7	1	.00	2.56	1.87	3.90	2.36	3.21	104.0	105.2	1.04	.62	.43	6.87
WO-2-400	9	1	.00	1.36	1.83	3.19	2.44	3.29	100.8	103.2	2.58	1.53	1.05	6.83
WO-2-400	10	1	.00	.74	1.83	2.84	2.44	3.28	100.8	100.6	2.58	1.55	1.03	6.66
WO-2-400	11	1	.00	.79	1.83	2.88	2.44	3.23	100.8	100.3	2.58	1.56	1.02	6.58
WO-2-400	13	1	.01	.67	1.94	3.14	2.33	3.17	104.2	107.9	5.46	3.42	2.04	5.97
WO-2-400	14	1	.01	.91	1.94	3.21	2.33	3.12	104.2	104.3	5.46	3.45	2.01	5.81
WO-2-400	15	1	.01	.68	1.94	3.09	2.33	3.08	104.2	105.4	5.46	3.44	2.02	5.84
WO-2-400	4	2	.01	.00	2.06	1.91	3.63	3.42	112.1	107.3	.00	.00	.00	
WO-2-400	8	2	.00	.00	2.02	1.87	2.49	2.36	106.4	104.0	1.13	1.04	.09	
WO-2-400	12	2	.00	.00	2.02	1.83	2.59	2.44	106.1	100.8	2.80	2.58	.22	
WO-2-400	16	2	.00	.01	2.03	1.94	2.52	2.33	109.6	104.2	5.73	5.46	.27	
WO-2-400	17	3	-.01	.01	.00	.01	.13	.09	-.8	.7	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
WO-2-520	1	1	1.9979	8.09	8.11	784	472	.04	1.14	10.30	11.34
WO-2-520	2	1	1.9946	8.09	8.17	784	542	.04	1.14	10.30	11.49
WO-2-520	3	1	2.0048	8.09	8.19	784	401	.04	1.15	10.30	11.80
WO-2-520	5	1	2.0049	8.23	8.23	394	465	.04	1.03	11.00	11.68
WO-2-520	6	1	1.9927	8.23	8.28	394	307	.04	.91	11.00	11.56
WO-2-520	7	1	2.0015	8.23	8.15	394	305	.04	1.04	11.00	11.67
WO-2-520	9	1	1.9975	8.20	8.14	723	497	.04	.74	10.69	11.77
WO-2-520	10	1	2.0034	8.20	8.28	723	537	.04	2.12	10.69	14.12
WO-2-520	11	1	2.0068	8.20	8.17	723	640	.04	.96	10.69	11.97
WO-2-520	13	1	1.9905	8.12	8.15	646	718	.04	.59	11.06	12.57
WO-2-520	14	1	2.0065	8.12	8.17	646	594	.04	.58	11.06	12.24
WO-2-520	15	1	2.0057	8.12	8.22	646	686	.04	.66	11.06	12.10
WO-2-520	4	2		7.91	8.09	559	784	.04	.04	10.74	10.30
WO-2-520	8	2		8.09	8.23	546	394	.04	.04	11.43	11.00
WO-2-520	12	2		8.02	8.20	542	723	.05	.04	11.27	10.69
WO-2-520	16	2		8.05	8.12	560	646	.05	.04	11.86	11.06
WO-2-520	17	3		8.25	6.63	11	191	.00	.00	.01	.17

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
WO-2-520	1	1	.01	1.50	1.92	4.04	3.37	3.72	105.1	105.1	.00	.07	-.07	-9.77
WO-2-520	2	1	.01	1.42	1.92	4.15	3.37	3.86	105.1	105.6	.00	.07	-.07	-9.79
WO-2-520	3	1	.01	1.61	1.92	4.23	3.37	3.81	105.1	103.8	.00	.07	-.07	-9.74
WO-2-520	5	1	.01	1.48	1.91	4.08	2.40	3.09	102.3	102.2	1.06	.36	.71	19.68
WO-2-520	6	1	.01	1.08	1.91	4.04	2.40	3.10	102.3	101.4	1.06	.35	.71	20.06
WO-2-520	7	1	.01	1.57	1.91	4.23	2.40	3.15	102.3	100.9	1.06	.36	.71	19.76
WO-2-520	9	1	.01	.87	1.94	4.11	2.41	3.18	103.9	105.5	2.68	.87	1.81	20.95
WO-2-520	10	1	.01	14.95	1.94	10.90	2.41	3.23	103.9	103.3	2.68	.88	1.79	20.27
WO-2-520	11	1	.01	1.51	1.94	4.24	2.41	3.20	103.9	101.2	2.68	.86	1.82	21.18
WO-2-520	13	1	.01	.64	1.89	4.20	2.30	3.07	106.6	106.7	5.34	1.85	3.49	18.99
WO-2-520	14	1	.01	.96	1.89	4.15	2.30	3.03	106.6	103.9	5.34	1.81	3.53	19.41
WO-2-520	15	1	.01	.84	1.89	4.01	2.30	2.97	106.6	101.3	5.34	1.76	3.58	20.25
WO-2-520	4	2	.01	.01	2.06	1.92	3.63	3.37	112.1	105.1	.00	.00	.00	
WO-2-520	8	2	.00	.01	2.02	1.91	2.49	2.40	106.4	102.3	1.13	1.06	.07	
WO-2-520	12	2	.00	.01	2.02	1.94	2.59	2.41	106.1	103.9	2.80	2.68	.13	
WO-2-520	16	2	.00	.01	2.03	1.89	2.52	2.30	109.6	106.6	5.73	5.34	.38	
WO-2-520	17	3	-.01	.01	.00	.01	.13	.09	-.8	.3	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
TAN CH1 83	1	1	2.0042	8.25	8.08	921	671	.04	4.18	10.15	12.75
TAN CH1 83	2	1	2.0009	8.25	8.10	921	535	.04	3.23	10.15	12.13
TAN CH1 83	3	1	2.0024	8.25	8.13	921	593	.04	3.19	10.15	12.05
TAN CH1 83	5	1	2.0014	8.23	8.21	612	522	.04	2.48	10.68	12.24
TAN CH1 83	6	1	2.0085	8.23	8.35	612	482	.04	2.59	10.68	12.12
TAN CH1 83	7	1	1.9980	8.23	8.25	612	473	.04	2.75	10.68	12.39
TAN CH1 83	9	1	2.0023	8.19	8.08	627	533	.04	1.42	10.82	12.92
TAN CH1 83	10	1	1.9997	8.19	8.17	627	523	.04	1.34	10.82	12.65
TAN CH1 83	11	1	2.0052	8.19	8.23	627	559	.04	1.53	10.82	12.89
TAN CH1 83	13	1	2.0039	8.14	7.89	557	619	.05	1.32	11.49	13.98
TAN CH1 83	14	1	2.0004	8.14	7.97	557	620	.05	.63	11.49	13.44
TAN CH1 83	15	1	1.9966	8.14	8.07	557	579	.05	1.52	11.49	13.95
TAN CH1 83	4	2		7.91	8.25	559	921	.04	.04	10.74	10.15
TAN CH1 83	8	2		8.09	8.23	546	612	.04	.04	11.43	10.68
TAN CH1 83	12	2		8.02	8.19	542	627	.05	.04	11.27	10.82
TAN CH1 83	16	2		8.05	8.14	560	557	.05	.05	11.86	11.49
TAN CH1 83	17	3		8.25	7.95	11	145	.00	.01	.01	.20

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
TAN CH1 83	1	1	.00	2.37	1.87	3.09	3.55	4.22	108.9	106.6	.00	.08	-.08	-9.82
TAN CH1 83	2	1	.00	1.31	1.87	2.73	3.55	4.21	108.9	108.2	.00	.08	-.07	-9.82
TAN CH1 83	3	1	.00	1.23	1.87	2.70	3.55	4.18	108.9	107.5	.00	.08	-.07	-9.81
TAN CH1 83	5	1	.01	.97	1.81	2.57	2.40	3.28	103.4	103.9	1.04	.52	.52	9.91
TAN CH1 83	6	1	.01	1.46	1.81	2.68	2.40	3.25	103.4	101.5	1.04	.51	.54	10.48
TAN CH1 83	7	1	.01	1.41	1.81	2.67	2.40	3.27	103.4	101.6	1.04	.53	.52	9.78
TAN CH1 83	9	1	.01	.58	1.91	2.62	2.45	3.40	104.8	105.8	2.68	1.34	1.34	10.02
TAN CH1 83	10	1	.01	1.25	1.91	2.86	2.45	3.26	104.8	103.3	2.68	1.32	1.35	10.25
TAN CH1 83	11	1	.01	2.38	1.91	3.37	2.45	3.33	104.8	102.5	2.68	1.30	1.38	10.60
TAN CH1 83	13	1	.01	.80	1.94	2.82	2.37	3.26	106.6	107.7	5.50	2.90	2.60	8.93
TAN CH1 83	14	1	.01	.35	1.94	2.55	2.37	3.22	106.6	108.2	5.50	2.89	2.61	9.00
TAN CH1 83	15	1	.01	1.92	1.94	3.27	2.37	3.30	106.6	106.2	5.50	2.83	2.66	9.41
TAN CH1 83	4	2	.01	.00	2.06	1.87	3.63	3.55	112.1	108.9	.00	.00	.00	
TAN CH1 83	8	2	.00	.01	2.02	1.81	2.49	2.40	106.4	103.4	1.13	1.04	.09	
TAN CH1 83	12	2	.00	.01	2.02	1.91	2.59	2.45	106.1	104.8	2.80	2.68	.12	
TAN CH1 83	16	2	.00	.01	2.03	1.94	2.52	2.37	109.6	106.6	5.73	5.50	.23	
TAN CH1 83	17	3	-.01	.00	.00	.01	.13	.04	-.8	-.1	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
TAN CH1 86	1	1	1.9997	8.13	8.16	647	603	.05	.73	10.50	14.29
TAN CH1 86	2	1	2.0059	8.13	8.21	647	650	.05	1.01	10.50	13.93
TAN CH1 86	3	1	2.0022	8.13	8.17	647	623	.05	1.15	10.50	14.19
TAN CH1 86	5	1	1.9929	8.23	8.30	572	860	.04	.81	10.92	14.28
TAN CH1 86	6	1	2.0047	8.23	8.24	572	456	.04	1.20	10.92	14.73
TAN CH1 86	7	1	2.0063	8.23	8.15	572	545	.04	.87	10.92	14.59
TAN CH1 86	9	1	1.9957	8.19	8.15	559	693	.05	.98	10.99	15.13
TAN CH1 86	10	1	1.9996	8.19	8.22	559	598	.05	.99	10.99	15.15
TAN CH1 86	11	1	2.0050	8.19	8.19	559	735	.05	1.00	10.99	14.82
TAN CH1 86	13	1	2.0020	8.21	8.14	735	571	.05	.98	11.64	16.16
TAN CH1 86	14	1	1.9926	8.21	8.07	735	503	.05	.83	11.64	15.88
TAN CH1 86	15	1	2.0001	8.21	8.11	735	610	.05	.86	11.64	15.60
TAN CH1 86	4	2		7.91	8.13	559	647	.04	.05	10.74	10.50
TAN CH1 86	8	2		8.09	8.23	546	572	.04	.04	11.43	10.92
TAN CH1 86	12	2		8.02	8.19	542	559	.05	.05	11.27	10.99
TAN CH1 86	16	2		8.05	8.21	560	735	.05	.05	11.86	11.64
TAN CH1 86	17	3		8.25	7.91	11	207	.00	.01	.01	.18

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
TAN CH1 86	1	1	.00	.22	1.99	3.00	3.59	4.36	109.4	111.2	.00	.14	-.14	-9.97
TAN CH1 86	2	1	.00	.36	1.99	3.04	3.59	4.19	109.4	106.7	.00	.14	-.13	-9.93
TAN CH1 86	3	1	.00	.61	1.99	3.22	3.59	4.26	109.4	107.9	.00	.14	-.14	-9.95
TAN CH1 86	5	1	.00	.32	1.93	3.03	2.50	3.61	104.9	103.1	1.07	.38	.70	18.62
TAN CH1 86	6	1	.00	.79	1.93	3.42	2.50	3.43	104.9	101.4	1.07	.36	.71	19.41
TAN CH1 86	7	1	.00	.24	1.93	3.05	2.50	3.52	104.9	100.0	1.07	.37	.71	19.37
TAN CH1 86	9	1	.00	1.45	1.98	4.11	2.58	3.62	104.8	100.6	2.76	.77	1.99	25.86
TAN CH1 86	10	1	.00	.66	1.98	3.41	2.58	3.66	104.8	100.5	2.76	.74	2.01	27.15
TAN CH1 86	11	1	.00	.32	1.98	3.16	2.58	3.66	104.8	100.4	2.76	.72	2.03	28.09
TAN CH1 86	13	1	.01	.53	1.98	3.43	2.44	3.55	104.8	104.1	5.58	1.54	4.04	26.26
TAN CH1 86	14	1	.01	.44	1.98	3.36	2.44	3.63	104.8	103.6	5.58	1.57	4.01	25.67
TAN CH1 86	15	1	.01	.38	1.98	3.21	2.44	3.57	104.8	102.6	5.58	1.52	4.06	26.63
TAN CH1 86	4	2	.01	.00	2.06	1.99	3.63	3.59	112.1	109.4	.00	.00	.00	
TAN CH1 86	8	2	.00	.00	2.02	1.93	2.49	2.50	106.4	104.9	1.13	1.07	.06	
TAN CH1 86	12	2	.00	.00	2.02	1.98	2.59	2.58	106.1	104.8	2.80	2.76	.05	
TAN CH1 86	16	2	.00	.01	2.03	1.98	2.52	2.44	109.6	104.8	5.73	5.58	.15	
TAN CH1 86	17	3	-.01	.00	.00	.01	.13	.14	-.8	.3	.00	.00	.00	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (μS/cm)	Final conductivity (μS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
TAN CH1 128	1	1	1.9937	8.22	8.16	607	473	.05	2.30	10.69	12.62
TAN CH1 128	2	1	1.9952	8.22	8.37	607	641	.05	1.79	10.69	12.18
TAN CH1 128	3	1	2.0021	8.22	8.31	607	578	.05	1.65	10.69	12.12
TAN CH1 128	5	1	1.9931	8.18	8.31	586	764	.05	1.34	11.10	12.58
TAN CH1 128	6	1	1.9977	8.18	8.20	586	666	.05	2.02	11.10	13.05
TAN CH1 128	7	1	1.9986	8.18	8.19	586	653	.05	1.47	11.10	12.48
TAN CH1 128	9	1	1.9967	8.21	8.06	612	504	.05	1.55	10.77	13.19
TAN CH1 128	10	1	1.9963	8.21	8.16	612	1,067	.05	1.36	10.77	12.83
TAN CH1 128	11	1	2.0081	8.21	8.13	612	534	.05	1.90	10.77	13.14
TAN CH1 128	13	1	1.9952	8.18	8.11	605	635	.05	1.53	11.32	13.76
TAN CH1 128	14	1	2.0027	8.18	8.08	605	562	.05	1.23	11.32	13.46
TAN CH1 128	15	1	2.0099	8.18	8.11	605	593	.05	1.09	11.32	13.11
TAN CH1 128	4	2		7.91	8.22	559	607	.04	.05	10.74	10.69
TAN CH1 128	8	2		8.09	8.18	546	586	.04	.05	11.43	11.10
TAN CH1 128	12	2		8.02	8.21	542	612	.05	.05	11.27	10.77
TAN CH1 128	16	2		8.05	8.18	560	605	.05	.05	11.86	11.32
TAN CH1 128	17	3		8.25	7.83	11	142	.00	.01	.01	.20

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
TAN CH1 128	1	1	.01	2.05	1.99	3.26	3.51	3.96	110.2	109.1	.00	.06	-.06	-9.74
TAN CH1 128	2	1	.01	1.27	1.99	2.98	3.51	3.99	110.2	108.8	.00	.06	-.05	-9.72
TAN CH1 128	3	1	.01	1.23	1.99	2.93	3.51	3.92	110.2	108.7	.00	.06	-.05	-9.68
TAN CH1 128	5	1	.01	.87	1.91	2.92	2.35	3.14	102.5	106.4	1.08	.50	.58	11.81
TAN CH1 128	6	1	.01	1.58	1.91	3.21	2.35	3.12	102.5	106.4	1.08	.51	.58	11.39
TAN CH1 128	7	1	.01	1.03	1.91	2.94	2.35	3.10	102.5	102.8	1.08	.49	.59	12.25
TAN CH1 128	9	1	.02	1.15	1.94	3.15	2.44	3.14	104.9	108.6	2.67	1.27	1.41	11.14
TAN CH1 128	10	1	.02	.88	1.94	2.92	2.44	3.18	104.9	106.0	2.67	1.22	1.45	11.90
TAN CH1 128	11	1	.02	3.42	1.94	4.05	2.44	3.11	104.9	104.7	2.67	1.21	1.46	11.97
TAN CH1 128	13	1	.01	2.73	1.92	4.12	2.40	3.07	106.9	107.6	5.44	2.65	2.79	10.53
TAN CH1 128	14	1	.01	.85	1.92	3.01	2.40	3.14	106.9	106.4	5.44	2.63	2.81	10.69
TAN CH1 128	15	1	.01	.67	1.92	2.87	2.40	3.00	106.9	105.5	5.44	2.60	2.84	10.84
TAN CH1 128	4	2	.01	.01	2.06	1.99	3.63	3.51	112.1	110.2	.00	.00	.00	
TAN CH1 128	8	2	.00	.01	2.02	1.91	2.49	2.35	106.4	102.5	1.13	1.08	.05	
TAN CH1 128	12	2	.00	.02	2.02	1.94	2.59	2.44	106.1	104.9	2.80	2.67	.13	
TAN CH1 128	16	2	.00	.01	2.03	1.92	2.52	2.40	109.6	106.9	5.73	5.44	.29	
TAN CH1 128	17	3	-.01	.01	.00	.01	.13	.07	-.8	.1	.00	.01	-.01	

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Basalt mass (grams)	Initial pH	Final pH	Initial conductivity (µS/cm)	Final conductivity (µS/cm)	Initial Al (mg/L)	Final Al (mg/L)	Initial Ca (mg/L)	Final Ca (mg/L)
TAN CH1 176	1	1	2.0048	8.02	8.18	662	627	.04	1.25	10.10	11.96
TAN CH1 176	2	1	2.0096	8.02	8.12	662	461	.04	1.32	10.10	11.70
TAN CH1 176	3	1	1.9956	8.02	8.14	662	389	.04	2.75	10.10	13.26
TAN CH1 176	5	1	1.9975	8.09	8.26	574	588	.05	1.55	11.07	13.28
TAN CH1 176	6	1	1.9967	8.09	8.28	574	532	.05	1.13	11.07	12.73
TAN CH1 176	7	1	2.0046	8.09	8.30	574	622	.05	1.95	11.07	14.14
TAN CH1 176	9	1	2.0033	8.16	8.25	610	623	.05	1.03	10.73	12.80
TAN CH1 176	10	1	2.0009	8.16	8.25	610	657	.05	.94	10.73	12.48
TAN CH1 176	11	1	2.0029	8.16	8.17	610	605	.05	.99	10.73	12.49
TAN CH1 176	13	1	2.0045	8.13	8.20	571	608	.05	.85	11.18	13.10
TAN CH1 176	14	1	1.9969	8.13	8.25	571	633	.05	.90	11.18	13.30
TAN CH1 176	15	1	1.9952	8.13	8.27	571	567	.05	.84	11.18	13.04
TAN CH1 176	4	2		7.91	8.02	559	662	.04	.04	10.74	10.10
TAN CH1 176	8	2		8.09	8.09	546	574	.04	.05	11.43	11.07
TAN CH1 176	12	2		8.02	8.16	542	610	.05	.05	11.27	10.73
TAN CH1 176	16	2		8.05	8.13	560	571	.05	.05	11.86	11.18
TAN CH1 176	17	3		8.25	7.89	11	187	.00	.01	.01	.20

Table 6. Basalt mass; initial and final aluminum, calcium, iron, magnesium, potassium, sodium, and strontium concentrations; initial and final specific conductance and pH; and measured distribution coefficients of synthesized solutions – Continued

Sample set	Sample number	Sample type	Initial Fe (mg/L)	Final Fe (mg/L)	Initial Mg (mg/L)	Final Mg (mg/L)	Initial K (mg/L)	Final K (mg/L)	Initial Na (mg/L)	Final Na (mg/L)	Initial Sr (mg/L)	Final Sr (mg/L)	Δ Sr	Sr Kd
TAN CH1 176	1	1	.01	1.15	1.89	3.32	3.40	4.08	108.1	109.1	.00	.05	-.05	-9.73
TAN CH1 176	2	1	.01	1.28	1.89	3.20	3.40	3.95	108.1	104.9	.00	.05	-.05	-9.70
TAN CH1 176	3	1	.01	5.76	1.89	5.50	3.40	3.96	108.1	108.2	.00	.06	-.06	-9.80
TAN CH1 176	5	1	.02	1.49	1.94	3.65	2.36	3.07	107.3	110.3	1.09	.59	.50	8.57
TAN CH1 176	6	1	.02	1.35	1.94	3.46	2.36	3.03	107.3	107.7	1.09	.58	.51	8.83
TAN CH1 176	7	1	.02	9.69	1.94	8.22	2.36	3.09	107.3	108.4	1.09	.58	.51	8.84
TAN CH1 176	9	1	.01	.83	1.87	3.22	2.47	3.09	103.6	104.6	2.67	1.45	1.22	8.41
TAN CH1 176	10	1	.01	.75	1.87	3.16	2.47	3.06	103.6	104.9	2.67	1.44	1.23	8.53
TAN CH1 176	11	1	.01	1.00	1.87	3.31	2.47	3.18	103.6	105.3	2.67	1.44	1.23	8.51
TAN CH1 176	13	1	.01	.62	1.83	3.09	2.36	3.06	105.4	108.1	5.34	3.16	2.18	6.87
TAN CH1 176	14	1	.01	1.24	1.83	3.40	2.36	3.06	105.4	107.2	5.34	3.12	2.22	7.14
TAN CH1 176	15	1	.01	.62	1.83	3.05	2.36	3.04	105.4	105.1	5.34	3.09	2.25	7.32
TAN CH1 176	4	2	.01	.01	2.06	1.89	3.63	3.40	112.1	108.1	.00	.00	.00	
TAN CH1 176	8	2	.00	.02	2.02	1.94	2.49	2.36	106.4	107.3	1.13	1.09	.04	
TAN CH1 176	12	2	.00	.01	2.02	1.87	2.59	2.47	106.1	103.6	2.80	2.67	.13	
TAN CH1 176	16	2	.00	.01	2.03	1.83	2.52	2.36	109.6	105.4	5.73	5.34	.39	
TAN CH1 176	17	3	-.01	.01	.00	.01	.13	.07	-.8	.2	.00	.00	.00	

Table 7. Calculated and measured strontium distribution coefficients of basalt samples from the Idaho National Engineering and Environmental Laboratory

[Calculated strontium distribution coefficients (K_d's) are the slope of the linear isotherms; uncertainties are the standard error of the linear regression. Measured K_d's are the average of three replicate determinations reported to the largest whole number; uncertainties are the standard deviation of the three replicate determinations. Abbreviations: mL/g, milliliter per gram; mg/L, milligram per liter]

Sample name	Calculated K_d (mL/g)	Initial strontium concentration (mg/L)	Measured K_d (mL/g)
123-14a	13.4±1.5	0.0	-9.8±0.02
		1.0	15.3±0.51
		2.5	15.2±1.1
		5.0	13.1±0.29
123-14b	7.4±0.96	.0	-9.6±0.02
		1.0	8.8±0.34
		2.5	8.3±0.34
		5.0	7.3±0.18
123-64	10.7±1.2	.0	-9.8±0.03
		1.0	12.4±0.71
		2.5	10.6±0.45
		5.0	10.4±0.45
123-68	7.7±1.4	.0	-9.7±0.03
		1.0	8.8±0.71
		2.5	9.1±0.45
		5.0	7.5±0.45
123-130	3.6±1.3	.0	-9.6±0.03
		1.0	5.4±0.39
		2.5	5.0±0.13
		5.0	3.6±0.30
123-153	4.0±0.79	.0	-9.6±0.00
		1.0	5.6±0.23
		2.5	4.5±0.19
		5.0	4.0±0.18
123-156	4.4±1.0	.0	-9.7±0.03
		1.0	5.2±0.17
		2.5	5.5±0.13
		5.0	4.3±0.10

Table 7. Calculated and measured strontium distribution coefficients of basalt samples from the Idaho National Engineering and Environmental Laboratory--Continued

Sample name	Calculated K_d (mL/g)	Initial strontium concentration (mg/L)	Measured K_d (mL/g)
123-172	8.7±1.1	.0	-9.8±0.02
		1.0	8.7±0.21
		2.5	9.2±0.30
		5.0	8.2±0.06
123-189	4.1±0.95	.0	-9.6±0.01
		1.0	5.5±0.18
		2.5	5.0±0.08
		5.0	4.0±0.11
123-209	7.1±1.0	.0	-9.7±0.02
		1.0	8.3 ±0.50
		2.5	8.2 ±0.21
		5.0	7.0 ±0.23
123-211a	7.3±1.7	.0	-9.8±0.02
		1.0	9.5 ±0.57
		2.5	9.0 ±0.38
		5.0	7.2 ± 0.54
123-211b	7.8±1.1	.0	-9.8±0.01
		1.0	8.4 ±0.44
		2.5	8.3 ±0.24
		5.0	7.5 ±0.20
123-221	12.3±1.8	.0	-9.9 ±0.02
		1.0	13.0±0.55
		2.5	14.2±0.34
		5.0	11.7±0.21
WO-1-141	23.3±1.4	.0	-9.8 ±0.03
		1.0	20.1±0.32
		2.5	22.8±0.77
		5.0	21.9±0.96

Table 7. Calculated and measured strontium distribution coefficients of basalt samples from the Idaho National Engineering and Environmental Laboratory--Continued

Sample name	Calculated K_d (mL/g)	Initial strontium concentration (mg/L)	Measured K_d (mL/g)
WO-1-146	9.4±1.0	.0	-9.8±0.00
		1.0	9.4 ±0.45
		2.5	9.7 ±0.41
		5.0	9.0 ±0.23
WO-2-185	7.1±1.1	.0	-9.7±0.02
		1.0	8.2 ±0.13
		2.5	8.2 ±0.23
		5.0	6.9 ±0.20
WO-2-186	5.5±0.88	.0	-9.7±0.04
		1.0	6.3 ±0.48
		2.5	6.1 ±0.20
		5.0	5.4 ± 0.26
WO-2-397	7.6±0.92	.0	-9.7±0.01
		1.0	8.7 ±0.04
		2.5	8.3 ±0.31
		5.0	7.4 ±0.26
WO-2-400	5.9±0.78	.0	-6.2±0.11
		1.0	7.3 ±0.39
		2.5	6.7 ±0.13
		5.0	5.9 ±0.09
WO-2-520	20.4±1.2	.0	-9.8 ±0.02
		1.0	19.8±0.20
		2.5	20.8±0.47
		5.0	19.6±0.65
TAN CH1 83	9.4±1.2	.0	-9.8 ±0.01
		1.0	10.1±0.38
		2.5	10.3±0.29
		5.0	9.1 ±0.26
TAN CH1 86	29.4±1.6	.0	-10.0 ±0.02
		1.0	19.1±0.45
		2.5	27.0±1.1
		5.0	26.2±0.48

Table 7. Calculated and measured strontium distribution coefficients of basalt samples from the Idaho National Engineering and Environmental Laboratory--Continued

Sample name	Calculated K_d (mL/g)	Initial strontium concentration (mg/L)	Measured K_d (mL/g)
TAN CH1 128	10.9±0.96	.0	-9.7 ±0.03
		1.0	11.8±0.43
		2.5	11.7±0.46
		5.0	10.7±0.16
TAN CH1 176	7.2±1.2	.0	-9.8±0.05
		1.0	8.8 ±0.15
		2.5	8.5 ±0.07
		5.0	7.1 ±0.22