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Geology, alteration, and rock and water chemistry of the Iron, Alum, and Bitter Creek areas, Upper Alamosa River, southwestern Colorado

By

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INTRODUCTION

The geology of altered and mineralized areas in the vicinity of the Summitville Mine, in the southwest San Juan Mountains, Colorado, have been studied to understand contributions of individual drainages to downstream acid and metal contamination in the Alamosa River. Studies in these largely unmined and essentially anthropomorhically undisturbed areas also offer a unique opportunity to understand the interrelationship between specific rock and alteration types and the local stream and spring geochemistry. As implied by the creek names, water in the Iron, Alum, and Bitter Creek (IABC) study area can be highly degraded (pH <2 and conductivity > 2,000) and drains from intensely altered and highly pyritized basins.

Field work for this study was conducted mainly during July and August of 1994; however, some geologic mapping was undertaken during the summer and fall of 1993. Published reports on the study area include: Bove, 1994; Bove and others 1995; Calkin, 1967; Kirkham and others, 1995; Lipman, 1974; Miller and McHugh, 1994; and Barry, in press.

The purpose of this report is to present data with related methodologies from our ongoing study in the following tables (table 1-4), maps (Plates 1-10), and figures (figs. 1-6), and to briefly summarize the relationship between geology, alteration and water geochemistry as discerned by this data.

METHODOLOGY

Rock sample geochemical data by various analytical methods are presented in tables 1 and 2. Seventy-two samples were analyzed for 10 major elements, 6 trace elements, H_2O^+ and H_2O^-, and CO_2 (table 1); sulfur determinations were made on 15 of these samples (table 1). Major elements were analyzed by wavelength-dispersive X-ray fluorescence (Taggart and others, 1987). Trace elements (Rb, Sr, Zr, Y, Nb, and Ba) were determined by energy dispersive X-ray fluoresence (Johnson and King, 1987). Total H_2O was calculated by combustion at 950°C with Karl Fisher titration (Jackson and others, 1987) of H_2O; H_2O^-(moisture) was determined by the sample procedure at 110°C and H_2O^+ was determined by difference (Jackson and others, 1987). Total S was analyzed for using a Leco SR132 automated sulfur analyser. In addition, 113 rock samples were analyzed utilizing 40-element inductively coupled plasma-atomic emission spectrometry (ICP-AES; Lichte and others, 1987)(table 2). Rock sample site locations are shown on Plate 2.

Rock geochemical data for over 1,900 samples collected in the study area by Inspiration Development Company during the late 1970's is presented on Plate 8. Samples were analyzed by emission spectrometry in Inspiration Development Safford Talco Laboratory in 1979. Data from this study was generously provided by W.S. Calkin, who has spent many years studying the geology and mineralization of the area.

Due to the difficulty of accurately identifying alteration mineral assemblages in the field, 242 whole rock samples were analyzed by X-ray diffraction (XRD) utilizing a Phillips APD-3600 diffractometer equipped with MDI Inc. JADE software. Coded alteration assemblage information for individual rock samples is shown on Plate 3. The term "sericite" as used in this study is defined as a fine-grained (typically < 10 microns), highly birefringent micaceous mineral. A review of mineralogical work and XRD data on sericite polytypes can be found in Brindley (1980) and Srodon and Eberl (1984).

A total of 60 water samples (Plate 4) were collected during August 9-31, 1995, including 30 spring samples, 28 stream samples, and 2 adit samples; more detailed methodology is described by Barry (Auburn University, Alabama, masters thesis, in press). Spring samples were taken at the uppermost extent of the tributary where seepage first appears. Stream samples were collected as close to the center of the primary flow as possible, and adit samples were taken as near as possible to the primary emanation. Water samples were collected in polyethylene bottles that were previously rinsed in 10 percent HCL. Six bottles of sample water were collected at each site. These included 1) a 500-mL raw unacidified sample, 2) and 3) two acidified 125-mL samples of raw and filtered water, 4) a 60-mL filtered and acidified sample for Fe^{+2} analysis,5) a 60-mL filtered and unacidified sample, and 6) a 60-mL H-O isotope sample (neither filtered or acidified). Filtered samples passed through a 0.45 μm filter, and acidified samples had ___acid added to pH < 2.

At each site, pH, temperature, conductivity, and dissolved oxygen were measured and recorded. At the beginning of each day, the pH meter (Orion model 230A) and the conductivity pen (Oakton TDS TESTR with ATC) were calibrated; they were also checked and calibrated (if necessary) at each sample site with known solutions. Water temperature was measured by a standard conventional thermometer, and dissolved oxygen content was determined colorometrically.

Anions were determined on the raw unacidified samples using an ion chromatograph (Fishman and Pyen, 1979) and Fe^{+2} analysis was conducted using a Hach DR/2000 spectrophometer. Major, minor, and trace elements were determined according to standard methods of the USGS utilizing inductively coupled plasma-atomic emission spectrometry (ICP-AES; Lichte and others, 1987) and inductively coupled plasma-mass spectrometry (ICP-MS).

Total aqueous metal load values as shown in Plates 9 and 10 is a method of measuring the cumulative effects of metals on streams. Load is the total metal concentration times the stream flow. To be truly quantitative, the stream chemistry samples and streamflow measurements should be taken simultaneously. However, stream flow rates for this study were based on estimated measurements by Robert Kirkham (unpublished data) of the Colorado State Geological Survey during field studies from late July to late August 1993; unfortunately, estimates made during the sampling period in 1994 have been determined to be unreliable. Careful comparison of the rainfall for the years 1993 and 1994 indicates that the flow rates were likely to be similar during both years. Consequently, metal loading values from this study are not rigorously comparable as the stream flow was measured the previous year (1993), and the values should be used in relative, not absolute, terms. Even with the uncertainty of streamflow values, the loads very nearly matched 1993 metal loading values along the Alamosa calculated by Walton-Day and others, 1995.

DISCUSSION OF MAP PLATES 4-10

Several maps have been created to depict the interrelationship between specific alteration assemblages and the local water chemistry. Plate 4 shows water sample site locations and differentiates between stream, spring, or adit samples. Plate 5 includes the pH and specific conductance data from this study superimposed upon the alteration map of the IABC basins. Figures 1 and 2 and table 4 show the relationship between specific alteration assemblages and water pH and conductivity.

Water analyzed from the Alum Creek area, which marks one of the main centers of alteration (quartz-sericite-pyrite) and mineralization within the IABC basins, is by far the most degraded within the study area, with pH values commonly less than 2.5 and conductivity as high as 2,000 to 10,000 microsiemens per centimenter (μs/cm). The extensive zone of quartz-sericite-pyrite (QSP) altered rock in Alum Creek and the associated stockwork veining and sparse molybdenite mineralization is related to an extremely weak molybdenum-copper porphyry system at depth.

Iron Creek at its headwaters appears to be a relatively healthy stream and is known to be a habitat for trout. The first significant influx of degraded water originates from a tributary draining altered and pyritized rock in the saddle between Cropsy and Lookout Mountains. Sheepshead delimits the western extent of intensely hydrothermally altered rocks in the study area. Just to the east of Sheepshead, a prominently altered basin is drained by a tributary with water averaging a pH of about 4.0 and conductivity of about 300 us/cm.

Water quality along Bitter Creek is most adversely affected from relatively acidic water draining from the three altered basins on the north side of Bitter Creek, below and flanking Elephant Mountain.

Plate 6 shows the relationship between the concentrations of iron, aluminum, and sulfate in the waters to the underlying alteration assemblages. Figures 3-5 and table 4 show that the QSP, QSP-K, QSP-PX and argillic alteration assemblages (see map legend for explanation of units), have the highest concentrations of iron, aluminum, and sulfate. Areas of fresh and propylitically altered rock produce waters with the lowest concentration of iron, aluminum, and sulfate.

Plate 7 relates the variations in aqueous base metal concentrations (given as the sum of base metals Zn, Cu, Cd, Co, Ni, and Pb) as a function of pH (Ficklin plot; Ficklin and others, 1992) for waters from the study area. As observed on this map, waters plotting in the high-acid and high metal field (figure 7) are primarily restricted to Alum Creek area. Fresh and propylitically altered rocks yield waters that generally plot in the near-neutral, low-metal fields on the Ficklin diagram (figure 7). Figure 6 demonstrates the show the relationship between the various alteration assemblages and the sum of the Ficklin base metals.

Plate 8 shows Cu, Pb, and Zn concentrations from over 1,900 rock samples from Inspiration Development Company, with thematically shaded aqueous values for Pb, Zn, Cu, and pH. Several important observations can be made from this plate: Metals within the study area are roughly zoned, with Pb and Zn concentrated marginal to, or around, anomalous zones of Cu. This zonation is most readily observed in the Alum Creek area, and in the area southwest of South Mountain, the latter denoted by strongly elevated Pb and Zn. The anomalous zone of Pb-Zn southwest of South Mountain undoubtedly lies on the margin of a zone of highly elevated Cu concentrated just northeast of South Mountain at the Summitville mine site. Second, the highest aqueous metal concentrations correlate positively with the lowest pH values. As a result, the Alum Creek area, center of a large zone of QSP-altered rock, abundant pyrite, and anomalous metal concentrations, has the highest aqueous concentrations of Pb, Zn, and Cu and lowest pH values in the study area. Conversely, a stream draining weakly altered rock containing elevated Pb and Zn concentrations in the area southwest of South Mountain has a relatively high pH and low associated metal concentrations.

Plates 9 and 10 depict the metal loading (in milligrams per second (mg/s)) for sulfate, aluminum, total iron, copper, zinc, and manganese. To analyze the loads, the area was divided into IABC drainage basins (the heavy solid black lines). The first sample, closest to the mouth of the creek is arbitrarily assigned the first order. The next samples upstream are second order and so forth. Generally, the metals at the highest order are carried on down stream and the effects are cumulative. For instance, if two third order streams each carry 30 mg/s then, when those streams join, the second order stream would carry at least 60 mg/s. The stream could carry much more than 60 mg/s if there was additional degraded water from other sources. Generally, the loads increase downstream. If chemical reaction, dilution, or precipitation occur, the load could decrease.

Iron Creek has low metal contents in its upper reaches but as the pH drops and there is anomalous copper in the rocks, and the metal load increases. Load increases dramatically at the third order sample (TMT44) downstream from the copper anomaly even though the stream flow is relatively low. A spring at TMT43 contributes a small amount of metals but before the stream reaches the Alamosa River (TMT42) some sulfate has been removed from the system and iron has increased. As expected, adding the load from Iron Creek to that measured in Alamosa River (AR49.5) is somewhat less than the load at AR49.4.

Alum Creek has low streamflow, low metal content, and low loads in its upper reaches (fourth order and above). Although there are local high concentrations of metals in the eastern-most third order sample the flow is so low that the load is negligible. The western third order stream however, carries much more volume and shows the effects of the Cu and Zn anomalies. Low pH combined with anomalous metal concentrations combine to produce anomalous loads. Adding the load of TMT25 to AR49.4 is somewhat less than that at AR48.1. As there has been plenty of opportunity for at least four side streams to contribute metals, this is good correlation.

Low flows in upper Bitter Creek limit the load of the streams. Effects of a copper anomaly can be seen in third order sample TMT16 and second order sample TMT18. Although the concentrations of metals are very high above those sites, the stream flow is relatively low. A small amount of metal is picked up the remainder of the way to the mouth of Bitter Creek. Again, the contributions from Bitter Creek add to the Alamosa River's load at AR46.9. Very little additional metal is added to the Alamosa River before it's confluence with Wightman Fork. Wightman Fork adds nearly three times the metal load to the River. Why this is the case isn't clear: It may be because mining disturbed the basin, but it may also be due to the naturally higher presence of metals in this drainage.

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Table 1. Original geochemical data for rock samples taken in the Iron, Alum, and Bitter Creek areas. Major elements analyzed by wavelength dispersive XRF, and trace elements by energy dispersive XRF. See methods for detailed analytical descriptions.

[See alteration map (plate 5) and geologic map (plate 1) for explanation of units. Rb, Sr, Zr, Y, Nb, and Ba are reported in parts per million: remainder of samples are in weight percent $FeTO_3$ is total Fe expressed as Fe_2O_3. Sulfur in all alunitized samples devoid of pyrite was calculated as SO_3. In pyritized (alunite-free) samples, all sulfur was converted to FeS_2. N.d. is not determined. Alteration assemblage confirmed by XRD. Pyrite content estimated visually.]

Field ID	Lab Number	Assemblage	Rock unit	Pyrite content	SiO_2	Al_2O_3	$FeTO_3$	MgO	CaO	Na_2O	K_2O
PD01	D573713	PROP	Tmd		58.50	16.10	6.83	2.64	4.24	3.45	3.68
PD02	D573714	FRESH	Tmd		61.80	15.70	5.73	2.06	3.86	3.13	3.92
SD07	D573719	QA	Tsu		80.30	6.92	0.15	0.07	0.24	0.19	1.25
SD17	D573723	QSP-K	Tmd		64.70	19.00	3.45	1.11	0.08	0.11	5.63
SD19	D573724	QA	Tsu		58.20	15.10	0.17	0.07	0.32	0.85	2.79
SD21A	D573725	QSP	Tsu?	sparse	69.20	17.90	0.69	1.10	0.24	0.11	3.94
SD21B	D573726	QA	Tsu?		62.60	15.30	0.27	0.07	0.41	0.63	2.06
SD34	D573728	QSP-K	Tmd	abundant	69.90	17.30	1.95	0.52	0.10	0.11	3.88
SD45	D573734	QSP	Tad	abundant	68.70	15.30	4.81	0.24	0.28	0.15	4.12
SD46A	D573735	QSP-K	Tad		73.80	16.10	0.52	0.83	0.07	0.11	3.93
SD52	D573737	PROP	Tpd		60.30	15.40	6.31	1.53	4.60	3.21	3.65
SD54A	D573738	PROP	Tad		61.70	15.40	6.31	1.93	3.64	3.80	4.32
SD54B	D573739	PROP	Tad-fine phase		58.30	16.50	7.63	2.54	3.82	4.16	3.62
SJ14	D573748	QSP	Tmd		69.40	17.00	3.22	0.45	0.16	0.11	4.50
SJ35	D573756	FRESH	Tri		70.00	14.80	2.81	0.77	1.90	4.18	4.11
SJ38	D573758	QSP	Tdp?		71.20	16.00	1.63	0.43	0.07	0.22	4.39
SJ39	D573759	PROP	Tdp		63.10	16.40	5.34	1.51	3.04	3.71	3.86
SJ49	D573763	W-AS	Tsd	abundant	65.10	15.30	4.65	1.54	0.42	2.39	4.89
SJ51	D573764	PROP	Tdp	sparse	59.20	15.30	8.89	1.96	0.67	4.04	3.41
SJ76	D573772	PROP	Tsu		53.00	17.80	9.28	3.53	6.33	3.49	2.21
SJ79	D573773	FRESH	Tdp		65.30	15.00	3.98	1.10	2.11	2.71	4.31
SJ81	D573775	QSP-K	Tsu	abundant	59.30	19.10	7.66	0.13	0.19	0.35	3.68
SJ82	D573776	PROP	Tds		64.50	14.10	4.07	1.29	3.39	3.80	3.26
SJ84	D573777	PROP	Tmd		61.70	16.20	6.05	1.65	3.19	4.12	3.42
SK01	D573778	PROP	Tmd		59.00	15.80	7.21	3.07	4.86	3.46	3.73
SK06	D573779	PROP	Tmd		56.30	16.00	8.45	3.73	4.88	3.37	3.25
SK09	D573781	PROP	Trp?	sparse	53.80	15.00	8.80	4.39	5.81	2.92	2.71
SK12	D573782	FRESH	Tsu		52.60	17.30	10.30	4.28	7.24	3.20	2.31
SK13	D573783	?	Tsu		64.00	13.80	7.16	5.19	0.50	0.11	1.27
SK23	D573793	W-AS	Tsu		73.20	15.10	1.45	0.15	0.23	0.11	3.06
SK25	D573795	QSP	Trp?		71.20	18.00	0.61	0.48	0.10	0.36	4.48
SK26	D573796	QSP	Tmd		69.80	17.50	1.19	0.87	0.29	0.11	4.65
SK27	D573797	PROP	Tmd		61.00	16.00	6.22	2.32	3.08	3.61	4.27
SK30	D573799	FRESH	Trp?		61.40	15.90	5.45	2.39	3.95	3.76	3.82
SK35A	D573802	PROP	Tdp		60.80	15.90	6.36	2.25	4.78	3.20	3.62
SK42A	D573808	FRESH	Tad		63.70	16.10	4.89	0.68	2.64	3.28	3.66
SK42B	D573809	CHL-P	Tsu	moderate	67.30	16.40	2.42	0.26	1.81	3.19	4.68
SK43B	D573810	ARG	Tsu	sparse	88.20	3.78	2.43	0.07	0.05	0.11	0.17
SK43C	D573811	ARG	Tsu		73.80	17.30	0.17	0.07	0.10	0.11	0.08
SK44	D573812	PROP	Tsu		58.30	16.10	6.76	1.48	5.95	3.00	3.36
SK47A	D573813	?	Tsu		70.50	12.20	4.88	2.51	0.16	0.11	2.33

Table 1. (cont'd)

Field ID	TiO_2	P_2O_5	MnO	LOI 925C	CO_2	FeO	TOTAL H_2O	H_2O^+	H_2O^-	TOTAL S	Rb	Sr
PD01	0.91	0.38	0.12	1.65	0.01	3.65	1.83	1.68	0.15	n.d.	108	760
PD02	0.78	0.31	0.09	1.29	0.70	2.79	1.35	1.20	0.15	n.d.	98	590
SD07	0.94	0.24	0.01	7.87	0.01	0.03	2.48	2.41	0.07	2.68	7	740
SD17	1.13	0.11	0.01	4.07	0.01	0.17	3.75	3.24	0.51	n.d.	235	53
SD19	0.86	0.28	0.01	16.90	0.01	0.03	5.14	5.05	0.09	5.95	7	420
SD21A	1.19	0.17	0.01	3.98	0.01	0.04	3.01	2.45	0.56	0.22	166	182
SD21B	0.96	0.32	0.01	13.30	0.01	0.05	4.12	4.04	0.08	4.45	7	210
SD34	1.12	0.12	0.01	4.31	0.01	0.20	3.69	3.02	0.67	0.71	116	54
SD45	0.66	0.40	0.01	4.74	0.01	0.18	2.31	1.87	0.44	3.43	104	55
SD46A	0.78	0.10	0.01	3.32	0.01	0.08	3.23	2.94	0.29	0.05	102	16
SD52	0.83	0.34	0.11	3.13	1.59	2.68	1.60	1.06	0.54	n.d.	100	710
SD54A	0.74	0.32	0.18	0.81	0.22	2.44	0.87	0.67	0.20	n.d.	132	550
SD54B	0.94	0.40	0.19	1.58	0.15	2.94	1.59	1.28	0.31	n.d.	94	660
SJ14	0.95	0.10	0.01	3.42	0.01	0.08	3.27	2.93	0.34	n.d.	120	110
SJ35	0.41	0.18	0.05	0.51	0.01	0.68	0.40	0.31	0.09	n.d.	102	510
SJ38	0.74	0.19	0.01	4.19	0.01	0.07	2.63	2.59	0.04	n.d.	130	280
SJ39	0.68	0.34	0.07	0.16	0.01	1.87	1.46	1.14	0.32	n.d.	95	540
SJ49	0.75	0.26	0.08	4.11	0.01	1.77	3.15	2.39	0.76	n.d.	142	250
SJ51	0.92	0.50	0.25	4.80	0.01	1.13	3.75	2.79	0.96	n.d.	88	320
SJ76	1.10	0.47	0.16	1.61	0.30	4.28	1.96	1.82	0.14	n.d.	42	850
SJ79	0.62	0.29	0.07	3.57	1.10	0.88	2.55	2.10	0.45	n.d.	98	580
SJ81	1.18	0.55	0.01	7.36	0.01	0.14	3.23	3.08	0.15	5.76	79	660
SJ82	0.57	0.26	0.09	3.98	2.37	1.62	1.95	1.70	0.25	n.d.	84	425
SJ84	0.74	0.32	0.14	2.11	0.15	2.06	1.94	1.58	0.36	n.d.	80	530
SK01	0.93	0.37	0.13	0.90	0.22	3.68	1.11	1.03	0.08	n.d.	116	680
SK06	1.05	0.37	0.17	1.81	0.51	3.87	1.86	1.68	0.18	n.d.	98	640
SK09	1.02	0.34	0.16	4.26	1.90	4.19	3.13	2.90	0.23	n.d.	55	400
SK12	1.25	0.51	0.19	0.65	0.01	4.49	1.09	0.98	0.11	n.d.	55	900
SK13	1.15	0.53	0.10	5.76	0.01	2.99	5.31	4.22	1.09	n.d.	30	440
SK23	0.88	0.39	0.01	4.45	0.01	0.12	3.27	2.77	0.50	n.d.	57	455
SK25	1.00	0.16	0.01	3.05	0.01	0.14	2.66	2.45	0.21	n.d.	130	210
SK26	1.14	0.11	0.01	3.75	0.01	0.19	3.30	2.58	0.72	n.d.	134	315
SK27	0.82	0.32	0.12	1.74	0.01	2.69	1.90	1.50	0.40	n.d.	138	550
SK30	0.74	0.30	0.16	1.26	0.22	2.46	1.43	1.17	0.26	n.d.	83	670
SK35A	0.84	0.31	0.13	1.30	0.15		1.36	1.15	0.21	n.d.	97	540
SK42A	0.49	0.22	0.21	2.81	0.81	0.49	2.22	1.41	0.81	n.d.	86	415
SK42B	0.49	0.21	0.01	2.71	0.01	0.32	1.71	1.04	0.67	1.35	104	415
SK43B	0.77	0.16	0.01	3.55	0.01	0.15	1.61	1.45	0.16	n.d.	n.d.	n.d.
SK43C	0.54	0.25	0.01	6.87	0.01	0.02	6.43	6.14	0.29	n.d.	7	1000
SK44	0.97	0.36	0.12	2.43	2.02	2.72	1.27	0.93	0.34	n.d.	83	650
SK47A	0.86	0.16	0.05	5.76	0.01	0.62	3.68	3.26	0.42	n.d.	59	45

Table 1. (cont'd)

Field ID	Zr	Y	Nb	Ba	FeS_2	SO_3
PD01	240	22	11	830	n.d.	n.d.
PD02	230	20	13	790	n.d.	n.d.
SD07	255	7	10	345	0.00	10.00
SD17	390	31	22	190	n.d.	n.d.
SD19	245	10	14	480	0.00	22.21
SD21A	315	36	20	405	0.41	0.00
SD21B	225	29	11	440	0.00	16.61
SD34	178	26	10	710	1.33	0.00
SD45	176	21	10	142	6.40	0.00
SD46A	176	18	10	560	0.09	0.00
SD52	210	21	10	720	n.d.	n.d.
SD54A	198	16	11	760	n.d.	n.d.
SD54B	200	18	7	710	n.d.	n.d.
SJ14	270	34	13	1500	n.d.	n.d.
SJ35	180	7	13	1150	n.d.	n.d.
SJ38	172	15	12	475	n.d.	n.d.
SJ39	150	17	12	810	n.d.	n.d.
SJ49	285	23	15	860	n.d.	n.d.
SJ51	255	34	13	830	n.d.	n.d.
SJ76	166	22	7	630	n.d.	n.d.
SJ79	140	12	10	1050	n.d.	n.d.
SJ81	210	22	7	600	10.75	0.00
SJ82	146	10	12	620	n.d.	n.d.
SJ84	215	23	14	890	n.d.	n.d.
SK01	194	21	12	720	n.d.	n.d.
SK06	245	26	11	590	n.d.	n.d.
SK09	154	22	11	750	n.d.	n.d.
SK12	136	26	7	690	n.d.	n.d.
SK13	220	24	12	375	n.d.	n.d.
SK23	215	13	7	770	n.d.	n.d.
SK25	215	23	11	355	n.d.	n.d.
SK26	300	21	15	820	n.d.	n.d.
SK27	345	27	11	780	n.d.	n.d.
SK30	250	21	11	960	n.d.	n.d.
SK35A	265	25	11	780	n.d.	n.d.
SK42A	205	27	7	770	n.d.	n.d.
SK42B	210	18	7	850	2.52	0.00
SK43B	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
SK43C	245	18	7	180	n.d.	n.d.
SK44	260	28	10	790	n.d.	n.d.
SK47A	124	14	7	470	n.d.	n.d.

Table 1. (cont'd)

Field ID	Lab Number	Assemblage	Rock unit	Pyrite content	SiO_2	Al_2O_3	$FeTO_3$	MgO	CaO	Na_2O	K_2O
SK47B	D573814	QSP	Tsu	abundant	57.30	18.10	6.72	4.10	0.21	0.11	4.15
SK47C	D573815		Tsu		54.50	17.60	8.37	3.09	6.23	3.22	1.83
SK49A	D573816	SILIC	Tsu		96.40	0.78	0.27	0.07	0.05	0.11	0.07
SK49B	D573817	SILIC	Tsu		96.20	0.79	0.53	0.07	0.06	0.11	0.08
SK49C	D573818	SILIC	Tsu		96.40	0.58	0.22	0.07	0.05	0.11	0.10
SK49D	D573819	QSP-K	Tsu		73.00	16.90	0.51	0.24	0.23	0.57	1.85
SK54A	D573821	QA	Tsu	moderate	52.40	17.10	0.27	0.07	0.18	0.33	4.16
SK54B	D573822	ARG	Tsu		71.40	18.10	0.21	0.19	0.26	0.19	0.67
SK55A	D573823	PROP	Tsu	sparse	58.60	16.30	9.45	1.31	2.72	2.46	2.50
SK55B	D573824	W-AS	Tsu		70.40	15.80	2.26	0.49	0.12	0.54	2.83
SK60	D573826	QSP-K	Tmd	abundant	63.50	17.70	5.22	0.93	0.11	0.11	3.91
SK61	D573827	QSP-K	Tsd		70.40	18.00	0.97	0.76	0.07	0.11	3.78
SK64A	D573829	W-AS	Tmd	abundant	61.50	16.50	5.25	2.61	0.18	1.98	4.71
SK64B	D573830		Tmd		64.60	19.20	1.54	1.21	0.04	0.11	5.31
SK66A	D573832	QSP	Tad		72.90	15.70	0.50	1.33	0.12	0.11	4.18
SK66B	D573833		Tmd		68.30	18.90	1.17	0.48	0.23	0.48	2.90
SK67B	D573834	W-AS	Tad	moderate	69.20	14.20	3.43	0.37	0.13	2.81	4.90
SK68	D573836	ARG	Tsu		65.90	20.60	0.94	0.07	0.20	0.11	0.07
SK69A	D573837	QSP	Tsu	abundant	60.30	18.50	6.77	0.79	0.04	0.11	4.79
SK69D	D573838	ARG	Tsu		66.00	20.10	1.01	0.60	0.13	0.15	1.12
SK71	D573840	QSP	Tad		69.90	17.90	0.39	0.35	0.22	0.21	4.67
SK73B	D573842	PROP	Tds		63.60	15.30	5.29	1.77	3.16	3.71	3.69
SK74A	D573843	QSP-K	Tsu		71.40	14.90	1.43	0.80	0.13	0.11	3.23
SK74B	D573844	QA	Tsu	moderate	45.20	19.30	1.34	0.07	0.19	0.52	4.65
SK79A	D573847	FRESH	Tdp		67.40	15.00	4.22	1.21	2.05	3.45	4.08
SR04	D573852	PROP	Tds		67.10	13.40	3.51	1.44	2.50	2.18	4.48
SR20	D573858	W-AS	Tds		72.60	15.30	0.78	0.55	0.32	2.54	3.63
SR21	D573859	FRESH	Tds		69.20	15.10	2.64	0.76	2.21	4.19	4.07
SR24	D573860	QSP	Tsl		66.90	20.70	0.50	0.38	0.12	0.58	4.69
SR30	D573861	PROP	Tad		60.50	15.30	6.08	2.41	3.40	3.76	3.46
SR33A	D573862	PROP	Tad		61.40	15.80	6.17	1.95	4.11	3.65	3.35

Table 1. (cont'd)

Field ID	TiO_2	P_2O_5	MnO	LOI 925C	CO_2	FeO	TOTAL H_2O	H_2O^+	H_2O^-	TOTAL S	Rb	Sr
SK47B	1.20	0.42	0.08	6.91	0.01	1.10	4.76	4.14	0.62	3.30	102	30
SK47C	1.06	0.47	0.17	1.82	0.77	3.95	2.09	1.92	0.17	n.d.	32	940
SK49A	1.09	0.09	0.01	0.48	0.01	0.06	0.57	0.53	0.04	n.d.	7	122
SK49B	0.95	0.07	0.01	0.63	0.01	0.04	0.58	0.49	0.09	n.d.	7	102
SK49C	1.21	0.07	0.01	0.66	0.01	0.04	0.53	0.53	0.04	n.d.	7	83
SK49D	1.11	0.34	0.01	4.43	0.01	0.04	4.12	3.22	0.90	n.d.	60	395
SK54A	0.78	0.44	0.01	20.20	0.01	0.03	6.38	6.18	0.20	n.d.	24	1300
SK54B	1.08	0.45	0.01	6.09	0.01	0.03	4.83	4.36	0.47	n.d.	24	930
SK55A	0.97	0.35	0.27	4.41	1.10	2.96	3.45	2.67	0.78	n.d.	56	540
SK55B	1.32	0.08	0.01	4.73	0.01	0.16	4.51	3.35	1.16	n.d.	112	225
SK60	0.92	0.41	0.01	6.53	0.01	0.20	3.89	3.19	0.70	3.97	134	230
SK61	0.70	0.14	0.01	4.25	0.01	0.13	4.05	3.83	0.22	n.d.	114	73
SK64A	0.78	0.31	0.08	5.40	0.01	1.24	3.46	2.40	1.06	2.70	134	220
SK64B	1.02	0.20	0.02	5.68	0.01	0.19	4.98	3.52	1.46	n.d.	152	560
SK66A	0.72	0.07	0.03	3.78	0.01	0.09	3.57	2.71	0.86	0.06	124	28
SK66B	1.13	0.40	0.01	5.12	0.01	0.14	4.53	4.09	0.44	0.31	66	690
SK67B	0.56	0.14	0.01	3.56	0.01	0.11	1.94	1.16	0.78	2.06	126	290
SK68	1.04	1.26	0.01	8.39	0.01	0.07	7.73	7.37	0.36	n.d.	18	1050
SK69A	1.22	0.23	0.02	6.76	0.01	0.16	3.53	2.86	0.67	n.d.	130	54
SK69D	1.31	0.34	0.01	7.75	0.01	0.04	7.27	5.56	1.71	n.d.	31	520
SK71	0.81	0.32	0.01	4.21	0.01	0.05	2.76	3.69	0.07	n.d.	134	360
SK73B	0.68	0.32	0.11	1.27	0.55	2.13	1.33	1.09	0.24	n.d.	94	550
SK74A	0.69	0.26	0.01	5.99	0.01	0.05	4.11	3.57	0.54	n.d.	114	730
SK74B	0.78	0.42	0.01	22.50	0.01	0.07	6.86	6.75	0.11	n.d.	11	1200
SK79A	0.53	0.24	0.08	1.13	0.01	1.44	1.18	0.86	0.32	n.d.	106	460
SR04	0.56	0.24	0.06	2.44	1.60	1.70	2.14	1.63	0.51	n.d.	114	225
SR20	0.66	0.17	0.01	2.09	0.01	0.10	2.53	1.80	0.73	n.d.	77	194
SR21	0.46	0.22	0.03	0.35	0.01	0.59	0.38	0.38	0.04	n.d.	106	530
SR24	1.46	0.19	0.01	3.41	0.01	0.06	3.18	2.81	0.37	0.04	116	178
SR30	0.73	0.30	0.12	2.41	1.27	2.58	2.08	1.77	0.31	n.d.	97	510
SR33A	0.71	0.34	0.14	1.54	0.58	2.52	1.47	1.19	0.28		82	580

Table 1. (cont'd)

Field ID	Zr	Y	Nb	Ba	FeS_2	SO_3
SK47B	178	28	10	820	6.16	0.00
SK47C	186	20	10	810	n.d.	n.d.
SK49A	200	21	10	166	n.d.	n.d.
SK49B	144	12	7	1100	n.d.	n.d.
SK49C	196	17	12	540	n.d.	n.d.
SK49D	196	27	7	660	n.d.	n.d.
SK54A	142	11	7	950	n.d.	n.d.
SK54B	310	32	12	750	n.d.	n.d.
SK55A	265	25	13	700	n.d.	n.d.
SK55B	365	32	20	1500	n.d.	n.d.
SK60	320	38	14	960	7.41	0.00
SK61	255	17	12	780	n.d.	n.d.
SK64A	260	23	13	1100	5.04	0.00
SK64B	355	35	18	1300	n.d.	n.d.
SK66A	150	20	13	410	0.11	0.00
SK66B	205	31	12	900	0.00	0.00
SK67B	136	12	14	870	3.85	0.00
SK68	250	7	10	2000	n.d.	n.d.
SK69A	205	14	13	890	n.d.	n.d.
SK69D	240	24	12	485	n.d.	n.d.
SK71	160	12	11	840	n.d.	n.d.
SK73B	170	20	11	770	n.d.	n.d.
SK74A	375	21	14	780	n.d.	n.d.
SK74B	146	7	7	650	n.d.	n.d.
SK79A	120	7	7	670	n.d.	n.d.
SR04	124	10	10	870	n.d.	n.d.
SR20	156	12	14	620	n.d.	n.d.
SR21	200	7	14	1150	n.d.	n.d.
SR24	295	27	11	600	0.07	0.00
SR30	178	22	12	1700	n.d.	n.d.
SR33A	168	20	11	960	n.d.	n.d.

Table 2. 40 element ICP-AES geochemical data for rock samples taken in the Iron, Alum, and Bitter Creek areas. XRF, and trace elements by energy dispersive XRF. See methods for detailed analytical descriptions.

[See alteration map (plate 5) and geologic map (plate 1) for explanation of units. Alteration assemblage confirmed by XRD.]

FIELD ID	Lab number	Rock unit	Assemblage	AL %-S	CA %-S	FE %-S	K %-S	MG %-S	NA %-S	P %-S	TI %-S
EPD2A	D573710	Tsl	SILIC	9.10	0.05	1.10	0.11	0.01	0.04	0.14	0.57
EPD3A	D573711	Tsl	ARG	1.40	0.04	1.10	0.07	0.01	0.03	0.04	0.47
EPD3C	D573712	Tsl	SILIC	1.70	0.07	0.61	0.11	0.01	0.03	0.10	0.49
SA01	D573715	Tsl	ARG	8.70	0.15	4.50	0.02	0.03	0.02	0.24	0.13
SA03	D573716	Tsl?	QSP-K	8.50	0.06	6.70	2.80	0.45	0.04	0.21	0.52
SA11	D573717	Tsl	QA	8.20	0.34	0.43	1.20	0.01	1.30	0.19	0.14
SA14	D573718	Tsl	W-AS	8.80	0.54	1.50	3.40	0.24	2.40	0.08	0.20
SD07	D573719	Tsu	QA	3.50	0.16	0.07	0.96	0.01	0.23	0.08	0.13
SD13A	D573721	Tsu	SILIC	0.44	0.08	0.30	0.08	0.01	0.02	0.09	0.10
SD13C	D573722	Tsu	SILIC	1.40	0.28	0.10	0.13	0.02	0.03	0.26	0.80
SD17	D573723	Tmd	QSP-K	9.80	0.05	2.50	4.50	0.69	0.08	0.04	0.21
SD19	D573724	Tsu	QA	7.60	0.24	0.10	2.20	0.02	0.69	0.12	0.12
SD21A	D573725	Tsu?	QSP	8.60	0.18	0.48	3.20	0.70	0.18	0.06	0.56
SD21B	D573726	Tsu?	QA	6.10	0.31	0.16	1.70	0.04	0.60	0.12	0.32
SD34	D573728	Tmd	QSP-K	9.30	0.07	1.40	3.20	0.33	0.13	0.04	0.37
SD35B	D573729	Tmd	QSP-K	8.40	0.08	2.80	3.60	0.71	0.07	0.04	0.08
SD38	D573730	Tmd	QSP-K	7.20	0.05	5.50	2.80	0.54	0.03	0.13	0.22
SD40A	D573731	Vein	SILIC	5.40	0.04	4.60	2.40	0.18	0.09	0.04	0.08
SD43A	D573733	Tmd	CHL-P	7.90	1.20	4.50	3.00	1.90	2.80	0.12	0.28
SD45	D573734	Tad	QSP	8.20	0.22	3.60	3.40	0.15	0.20	0.18	0.07
SD46A	D573735	Tad	QSP-K	8.20	0.04	0.35	3.10	0.50	0.05	0.04	0.24
SD56A	D573740	Tmd	QSP	7.80	0.09	1.60	3.60	0.57	0.05	0.06	0.23
SD57A	D573741	Vein	VEIN	2.80	0.83	1.70	0.76	0.33	0.02	0.04	0.03
SD57B	D573742	Tmd	QSP	6.10	0.11	0.35	2.70	0.31	0.04	0.01	0.12
SD57C	D573743	Tmd	QSP	8.70	0.08	0.56	3.90	0.48	0.04	0.02	0.36
SD58	D573744	Tmd	QSP	8.80	0.17	0.33	3.40	0.18	0.14	0.10	0.24
SD59B	D573745	Tmd	QSP	6.20	0.06	1.20	2.00	0.03	0.17	0.18	0.04
SJ03	D573746	Tap	QSP-K	8.90	0.04	4.90	3.60	0.38	0.08	0.05	0.31
SJ13	D573747	Tdp	SILIC	0.54	0.08	0.12	0.05	0.02	0.01	0.06	0.51
SJ14	D573748	Tmd	QSP	8.70	0.11	2.30	3.50	0.28	0.10	0.03	0.15
SJ15	D573749	Tsu	W-AS	9.10	2.40	6.00	4.00	0.32	1.40	0.14	0.50
SJ20	D573750	Tsu	W-AS	9.40	0.20	4.40	1.80	0.30	3.40	0.03	0.77
SJ22	D573751	Tsu	ARG	7.20	0.17	0.44	0.11	0.02	0.08	0.19	0.75
SJ24	D573752	Tsu	SILIC	1.10	0.10	0.28	0.14	0.02	0.07	0.09	0.52
SJ26	D573753	?	SILIC	0.55	0.09	0.25	0.07	0.02	0.01	0.11	0.20
SJ27	D573754	Tsu	SILIC	1.90	0.30	0.24	0.25	0.01	0.06	0.38	0.12
SJ37	D573757	Tsu	QSP	8.80	0.16	0.14	2.90	0.13	0.46	0.14	0.11
SJ45	D573761	Tmd	QSP	8.90	0.09	5.00	3.70	0.53	0.09	0.10	0.09
SJ46	D573762	Tmd	QSP	7.50	0.07	5.70	3.30	0.56	0.07	0.09	0.08
SJ49	D573763	Tsd	W-AS	7.80	0.31	3.30	3.70	0.92	1.80	0.11	0.38
SJ54	D573766	Tsu	CHL-P	8.90	0.36	5.20	1.50	1.60	3.70	0.16	0.31
SJ69	D573770	Tad	QSP	6.80	0.07	0.21	2.60	0.28	0.13	0.01	0.09
SJ72	D573771	Tsu	QA	6.40	0.13	5.70	1.10	0.01	0.82	0.11	0.34
SJ80	D573774	Breccia	QSP	7.60	0.13	3.20	2.20	0.22	0.31	0.13	0.19

Table 2. (cont'd)

FIELD ID	MN PPM-S	AG PPM-S	AS PPM-S	AU PPM-S	B PPM-S	BA PPM-S	BE PPM-S	BI PPM-S	CD PPM-S	CE PPM-S	CO PPM-S
EPD02A	13	< 2	18	< 8	-	82	1	< 10	< 2	70	< 1
EPD03A	26	< 2	22	< 8	-	860	< 1	< 10	< 2	21	1
EPD03C	13	< 2	18	< 8	-	440	< 1	< 10	< 2	69	1
SA01	10	< 2	< 10	< 8	-	220	< 1	< 10	< 2	39	16
SA03	260	< 2	43	< 8	-	320	2	< 10	< 2	74	27
SA11	7	< 2	< 10	< 8	-	250	< 1	< 10	< 2	41	< 1
SA14	85	< 2	< 10	< 8	-	700	1	< 10	< 2	74	5
SD07	19	< 2	< 10	< 8	-	300	< 1	< 10	< 2	48	< 1
SD13A	9	< 2	< 10	< 8	-	580	< 1	< 10	< 2	72	1
SD13C	13	< 2	< 10	< 8	-	870	< 1	14	< 2	160	< 1
SD17	94	< 2	< 10	< 8	-	400	3	< 10	< 2	69	< 1
SD19	6	< 2	< 10	< 8	-	180	< 1	< 10	< 2	69	< 1
SD21A	110	< 2	< 10	< 8	-	470	1	< 10	< 2	27	< 1
SD21B	30	< 2	< 10	< 8	-	190	< 1	< 10	< 2	18	< 1
SD34	100	< 2	< 10	< 8	-	630	1	< 10	< 2	41	2
SD35B	84	< 2	< 10	< 8	-	650	2	< 10	< 2	72	7
SD38	99	< 2	13	< 8	-	420	2	< 10	< 2	52	13
SD40A	46	< 2	< 10	< 8	-	160	1	< 10	< 2	23	13
SD43A	1000	< 2	< 10	< 8	-	260	2	< 10	< 2	84	18
SD45	19	< 2	11	< 8	-	130	1	< 10	< 2	16	13
SD46A	82	< 2	< 10	< 8	-	530	2	< 10	< 2	74	< 1
SD56A	82	< 2	120	< 8	-	320	2	< 10	< 2	32	< 1
SD57A	230	< 2	12	< 8	-	45	1	< 10	< 2	22	5
SD57B	28	< 2	< 10	< 8	-	91	1	< 10	< 2	56	< 1
SD57C	66	< 2	< 10	< 8	-	560	2	< 10	< 2	71	< 1
SD58	14	< 2	< 10	< 8	-	540	< 1	< 10	< 2	54	< 1
SD59B	9	< 2	24	< 8	-	380	< 1	< 10	< 2	47	3
SJ03	41	< 2	< 10	< 8	-	48	2	< 10	< 2	48	21
SJ13	21	< 2	< 10	< 8	-	620	< 1	< 10	< 2	40	< 1
SJ14	43	< 2	< 10	< 8	-	1500	1	< 10	< 2	27	< 1
SJ15	210	< 2	38	< 8	-	45	2	< 10	< 2	71	24
SJ20	51	< 2	< 10	< 8	-	34	1	< 10	< 2	67	15
SJ22	6	< 2	< 10	< 8	-	480	< 1	12	< 2	63	< 1
SJ24	30	< 2	< 10	< 8	-	800	< 1	< 10	< 2	44	< 1
SJ26	47	< 2	< 10	< 8	-	1300	< 1	< 10	< 2	47	< 1
SJ27	36	< 2	< 10	< 8	-	260	< 1	< 10	< 2	110	1
SJ37	16	< 2	< 10	< 8	-	350	< 1	< 10	< 2	81	< 1
SJ45	65	< 2	< 10	< 8	-	50	2	< 10	< 2	54	20
SJ46	78	< 2	10	< 8	-	29	1	< 10	< 2	21	16
SJ49	570	< 2	< 10	< 8	-	230	2	< 10	< 2	78	11
SJ54	880	< 2	< 10	< 8	-	40	1	< 10	< 2	38	22
SJ69	32	< 2	< 10	< 8	-	1500	1	< 10	< 2	51	< 1
SJ72	31	< 2	31	< 8	-	160	< 1	< 10	< 2	46	6
SJ80	29	< 2	< 10	< 8	-	330	< 1	< 10	< 2	34	2

Table 2. (cont'd)

FIELD ID	CR PPM-S	CU PPM-S	EU PPM-S	GA PPM-S	GE PPM-S	HO PPM-S	LA PPM-S	LI PPM-S	MO PPM-S	NB PPM-S	ND PPM-S	NI PPM-S
EPD02A	19	5	2	20	-	< 4	39.0	13	< 2	23	37	< 2
EPD03A	8	12	< 2	5	-	< 4	14.0	6	< 2	10	9	< 2
EPD03C	12	7	< 2	13	-	< 4	52.0	7	< 2	11	20	< 2
SA01	6	37	< 2	18	-	< 4	22.0	68	4	11	21	10
SA03	22	63	< 2	20	-	< 4	39.0	11	< 2	16	38	18
SA11	3	1	< 2	9	-	< 4	23.0	< 2	< 2	10	21	< 2
SA14	3	15	< 2	18	-	< 4	44.0	< 2	< 2	15	37	< 2
SD07	13	1	< 2	8	-	< 4	34.0	< 2	< 2	6	12	< 2
SD13A	5	3	< 2	7	-	< 4	48.0	< 2	< 2	< 4	18	< 2
SD13C	22	< 1	< 2	6	-	< 4	81.0	< 2	< 2	9	68	< 2
SD17	9	39	< 2	21	-	< 4	39.0	3	< 2	16	34	< 2
SD19	9	1	< 2	12	-	< 4	38.0	< 2	< 2	10	31	< 2
SD21A	22	34	< 2	23	-	< 4	12.0	< 2	< 2	20	16	< 2
SD21B	18	11	< 2	18	-	< 4	9.0	< 2	3	13	13	< 2
SD34	7	4	< 2	23	-	< 4	23.0	20	< 2	15	20	< 2
SD35B	10	8	< 2	19	-	< 4	38.0	6	4	11	36	4
SD38	12	22	< 2	15	-	< 4	26.0	3	18	11	28	10
SD40A	8	53	< 2	9	-	< 4	13.0	< 2	12	6	12	8
SD43A	15	72	< 2	18	-	< 4	45.0	7	3	16	42	12
SD45	10	14	< 2	17	-	< 4	7.0	< 2	7	9	11	7
SD46A	13	3	< 2	19	-	< 4	44.0	9	3	13	33	< 2
SD56A	9	13	< 2	20	-	< 4	17.0	12	< 2	13	16	< 2
SD57A	3	59	< 2	2.8	-	< 4	12.0	< 2	2	4	12	6
SD57B	7	10	< 2	14	-	< 4	33.0	2	< 2	11	26	< 2
SD57C	10	7	< 2	19	-	< 4	41.0	< 2	< 2	18	32	< 2
SD58	7	2	< 2	23	-	< 4	28.0	< 2	< 2	16	28	< 2
SD59B	14	22	< 2	12	-	< 4	28.0	7	2	7	22	2
SJ03	14	29	< 2	21	-	< 4	26.0	2	< 2	15	24	13
SJ13	8	5	< 2	2.8	-	< 4	23.0	< 2	< 2	4	19	< 2
SJ14	14	10	< 2	20	-	< 4	14.0	< 2	< 2	13	14	< 2
SJ15	5	46	< 2	19	-	< 4	36.0	7	< 2	16	39	8
SJ20	17	19	< 2	20	-	< 4	35.0	2	< 2	21	31	13
SJ22	6	1	< 2	21	-	< 4	34.0	18	< 2	16	33	< 2
SJ24	5	4	< 2	4	-	< 4	24.0	< 2	< 2	6	20	< 2
SJ26	79	3	< 2	5	-	< 4	41.0	< 2	3	< 4	13	< 2
SJ27	89	6	< 2	8	-	< 4	79.0	< 2	2	< 4	29	2
SJ37	11	14	< 2	20	-	< 4	45.0	< 2	3	12	39	< 2
SJ45	11	16	< 2	23	-	< 4	27.0	< 2	< 2	12	25	14
SJ46	10	45	< 2	14	-	< 4	11.0	2	< 2	9	12	14
SJ49	9	66	< 2	18	-	< 4	44.0	3	< 2	20	36	7
SJ54	6	120	< 2	18	-	< 4	18.0	9	18	14	19	13
SJ69	8	12	< 2	17	-	< 4	28.0	< 2	58	10	22	< 2
SJ72	2	27	< 2	10	-	< 4	40.0	8	< 2	11	19	< 2
SJ80	6	12	< 2	16	-	< 4	18.0	< 2	< 2	11	18	< 2

Table 2. (cont'd)

FIELD ID	PB PPM-S	SC PPM-S	SN PPM-S	SR PPM-S	TA PPM-S	TH PPM-S	U PPM-S	V PPM-S	W PPM-S	Y PPM-S	YB PPM-S	ZN PPM-S
EPD02A	60	7	< 5	1300	< 40	11	< 100	100	-	88	8	3
EPD03A	96	5	< 5	390	< 40	6	< 100	25	-	2	< 1	2
EPD03C	63	5	< 5	820	< 40	15	< 100	43	-	4	< 1	< 2
SA01	86	5	< 5	1800	< 40	5	< 100	110	-	3	< 1	17
SA03	21	16	< 5	45	< 40	8	< 100	120	-	13	1	17
SA11	200	3	< 5	1400	< 40	< 4	< 100	96	-	5	< 1	< 2
SA14	25	7	< 5	490	< 40	8	< 100	37	-	16	2	46
SD07	53	5	< 5	610	< 40	7	< 100	42	-	< 2	< 1	2
SD13A	170	3	< 5	600	< 40	6	< 100	12	-	3	< 1	9
SD13C	62	13	< 5	1700	< 40	16	< 100	59	-	8	1	2
SD17	17	21	< 5	50	< 40	18	< 100	130	-	8	< 1	18
SD19	62	5	< 5	440	< 40	9	< 100	110	-	3	< 1	2
SD21A	21	18	< 5	170	< 40	6	< 100	170	-	5	1	8
SD21B	160	11	< 5	210	< 40	6	< 100	120	-	4	< 1	3
SD34	18	15	< 5	36	< 40	7	< 100	170	-	4	< 1	14
SD35B	7	10	< 5	61	< 40	11	< 100	96	-	6	< 1	16
SD38	30	9	< 5	32	< 40	12	< 100	90	-	6	< 1	14
SD40A	44	6	< 5	21	< 40	< 4	< 100	61	-	3	< 1	120
SD43A	16	10	< 5	320	< 40	12	< 100	96	-	21	2	120
SD45	78	9	< 5	42	< 40	9	< 100	81	-	4	< 1	10
SD46A	10	10	< 5	14	< 40	9	< 100	93	-	7	< 1	7
SD56A	29	12	< 5	34	< 40	12	< 100	110	-	6	1	18
SD57A	23	4	< 5	34	< 40	5	< 100	29	-	5	< 1	12
SD57B	7	10	< 5	19	< 40	6	< 100	68	-	5	< 1	6
SD57C	34	11	< 5	63	< 40	9	< 100	100	-	8	1	19
SD58	21	11	< 5	380	< 40	20	< 100	110	-	8	1	< 2
SD59B	260	3	< 5	840	< 40	11	< 100	58	-	< 2	< 1	2
SJ03	11	15	< 5	37	< 40	9	< 100	140	-	10	1	12
SJ13	16	1.4	< 5	660	< 40	6	< 100	18	-	3	< 1	7
SJ14	11	14	< 5	110	< 40	8	< 100	130	-	4	< 1	4
SJ15	17	14	< 5	620	< 40	7	< 100	110	-	25	2	30
SJ20	6	13	< 5	470	< 40	< 4	< 100	220	-	3	< 1	11
SJ22	20	6	< 5	1500	< 40	4	< 100	210	-	< 2	< 1	3
SJ24	15	1.4	< 5	560	< 40	< 4	< 100	39	-	< 2	< 1	2
SJ26	46	1.4	< 5	1000	< 40	16	< 100	12	-	< 2	< 1	3
SJ27	500	1.4	< 5	2200	< 40	13	< 100	52	-	2	< 1	< 2
SJ37	140	15	< 5	110	< 40	19	< 100	120	-	4	< 1	31
SJ45	21	16	< 5	140	< 40	20	< 100	93	-	6	< 1	12
SJ46	16	15	< 5	99	< 40	10	< 100	79	-	4	< 1	15
SJ49	24	11	< 5	260	< 40	23	< 100	90	-	17	2	41
SJ54	29	11	< 5	340	< 40	6	< 100	99	-	8	< 1	130
SJ69	35	8	< 5	23	< 40	6	< 100	67	-	4	< 1	11
SJ72	21	6	< 5	1400	< 40	< 4	< 100	95	-	< 2	< 1	6
SJ80	18	10	< 5	600	< 40	4	< 100	120	-	4	< 1	16

Table 2. (cont'd)

FIELD ID	Lab number	Rock unit	Assemblage	AL %-S	CA %-S	FE %-S	K %-S	MG %-S	NA %-S	P %-S	TI %-S
SJ81	D573775	Tsu	QSP-K	9.30	0.10	5.80	2.70	0.08	0.35	0.20	0.18
SK06	D573779	Tmd	PROP	8.30	3.50	6.00	2.50	2.20	2.50	0.16	0.63
SK07	D573780	Ferricrete	W-AS	5.60	0.27	14.00	1.90	0.37	1.20	0.35	0.25
SK09	D573781	Tad	PROP	7.90	4.20	6.20	2.10	2.50	2.30	0.14	0.66
SK13	D573783	Tsu	?	7.30	0.36	5.10	1.00	3.00	0.19	0.22	0.21
SK17	D573784	Tsu	QSP-K	9.00	0.26	0.20	1.00	0.10	0.08	0.22	0.19
SK18	D573785	Tds	W-AS	8.50	0.18	0.40	1.90	0.21	0.98	0.12	0.08
SK19A	D573786	?	QSP-K	8.00	0.08	0.34	2.50	0.17	0.55	0.14	0.08
SK19B	D573787	?	QSP-K	10.00	0.22	0.37	2.50	0.32	0.69	0.18	0.10
SK20	D573788	Tds	ARG	1.60	0.08	0.17	0.10	0.01	0.02	0.10	0.04
SK21A	D573789	?	QSP-K	9.50	0.20	0.68	2.50	0.19	0.14	0.16	0.09
SK21B	D573790	?	QSP-K	9.40	0.06	0.28	2.10	0.02	0.32	0.19	0.05
SK22A	D573791	Tds	QA	8.90	0.09	0.48	2.60	0.01	0.91	0.12	0.05
SK22B	D573792	Tds	?	5.90	0.08	2.80	1.50	0.01	0.66	0.10	0.06
SK23	D573793	Tsu	W-AS	7.40	0.14	1.00	2.40	0.10	0.14	0.13	0.11
SK25	D573795	Tad	QSP	9.60	0.07	0.44	3.70	0.30	0.37	0.05	0.19
SK26	D573796	Tmd	QSP	9.00	0.22	0.83	3.70	0.53	0.05	0.03	0.25
SK28	D573798	Tsu	W-AS	9.40	3.60	5.10	2.20	0.54	1.60	0.20	0.58
SK35A	D573802	Tdp	PROP	8.40	3.40	4.40	3.10	1.40	2.50	0.13	0.54
SK35B	D573803	Tsu	CHL-P	8.90	3.00	5.10	2.10	1.10	2.40	0.17	0.63
SK35C	D573804	Tsu	QA	4.40	0.08	3.80	1.10	0.02	0.49	0.06	0.05
SK35D	D573805	Tsu	QSP	7.90	0.07	2.00	3.40	0.30	0.06	0.03	0.13
SK42A	D573808	Tad	FRESH	8.50	1.90	3.30	3.10	0.43	2.50	0.08	0.27
SK42B	D573809	Tsl	CHL-P	8.70	1.40	1.70	4.00	0.17	2.40	0.08	0.32
SK43B	D573810	Tsl	ARG	2.10	0.03	1.90	0.14	0.00	0.06	0.05	0.50
SK43C	D573811	Tsl	ARG	9.60	0.06	0.09	0.06	0.01	0.03	0.08	0.36
SK47A	D573813	Tsu	?	6.80	0.12	3.60	2.00	1.60	0.06	0.06	0.50
SK47B	D573814	Tsu	QSP	10.00	0.17	5.20	3.80	2.60	0.10	0.20	0.80
SK47C	D573815	Tsu	?	9.40	4.40	5.80	1.60	1.90	2.50	0.20	0.66
SK49A	D573816	Tsu	SILIC	0.41	0.05	0.19	0.05	0.02	0.01	0.02	0.53
SK49B	D573817	Tsu	SILIC	0.37	0.04	0.38	0.06	0.02	0.01	0.02	0.38
SK49C	D573818	Tsu	SILIC	0.32	0.04	0.18	0.07	0.01	0.02	0.01	0.63
SK49D	D573819	Tsu	QSP-K	9.10	0.18	0.37	1.50	0.14	0.55	0.15	0.69
SK52	D573820	Tsu	QSP	8.30	0.08	0.69	3.20	0.27	0.20	0.05	0.12
SK54A	D573821	Tsu	QA	9.10	0.14	0.17	3.30	0.01	0.38	0.21	0.47
SK54B	D573822	Tsu	ARG	8.40	0.17	0.13	0.55	0.11	0.25	0.18	0.65
SK60	D573826	Tmd	QSP-K	9.70	0.08	4.30	3.20	0.62	0.07	0.19	0.33
SK61	D573827	Tsd	QSP-K	9.40	0.05	0.65	3.00	0.48	0.05	0.06	0.16
SK63	D573828	Tmd	QSP	7.50	0.06	6.90	3.00	0.53	0.08	0.05	0.17
SK64A	D573829	Tmd	W-AS	8.50	0.13	3.70	3.60	1.50	1.50	0.14	0.21
SK64B	D573830	Tmd	?	9.60	0.02	1.00	4.00	0.72	0.09	0.08	0.32
SK65B	D573831	Ferricrete		0.49	0.00	41.00	2.30	0.02	0.14	0.18	0.03
SK66A	D573832	Tad	QSP	7.90	0.09	0.38	3.20	0.80	0.05	0.02	0.21
SK66B	D573833	Tmd	?	10.00	0.17	0.85	2.30	0.31	0.47	0.17	0.22
SK67B	D573834	Tad	W-AS	7.60	0.10	2.60	3.90	0.24	2.20	0.06	0.16
SK67C	D573835	Tmd	W-AS	8.40	0.16	9.60	1.40	1.50	3.40	0.12	0.25

Table 2. (cont'd)

FIELD ID	MN PPM-S	AG PPM-S	AS PPM-S	AU PPM-S	B PPM-S	BA PPM-S	BE PPM-S	BI PPM-S	CD PPM-S	CE PPM-S	CO PPM-S
SJ81	18	< 2	< 10	< 8	-	32	1	< 10	< 2	48	22
SK06	1300	< 2	< 10	< 8	-	590	2	< 10	< 2	75	28
SK07	180	< 2	< 10	< 8	-	620	3	< 10	< 2	33	4
SK09	1300	< 2	< 10	< 8	-	780	2	< 10	< 2	51	28
SK13	780	< 2	17	< 8	-	380	1	< 10	< 2	40	5
SK17	19	< 2	< 10	< 8	-	770	1	< 10	< 2	30	< 1
SK18	25	< 2	< 10	< 8	-	460	< 1	< 10	< 2	26	< 1
SK19A	39	< 2	< 10	< 8	-	410	2	< 10	< 2	29	< 1
SK19B	72	< 2	< 10	< 8	-	690	< 1	< 10	< 2	48	< 1
SK20	25	< 2	12	< 8	-	360	< 1	< 10	< 2	58	< 1
SK21A	82	< 2	< 10	< 8	-	570	< 1	< 10	< 2	41	1
SK21B	7	< 2	< 10	< 8	-	510	< 1	< 10	< 2	35	< 1
SK22A	19	< 2	< 10	< 8	-	170	< 1	< 10	< 2	32	< 1
SK22B	14	< 2	< 10	< 8	-	210	< 1	< 10	< 2	23	12
SK23	13	< 2	< 10	< 8	-	300	< 1	< 10	< 2	34	< 1
SK25	37	< 2	< 10	< 8	-	360	1	< 10	< 2	23	< 1
SK26	76	< 2	< 10	< 8	-	790	2	< 10	< 2	42	< 1
SK28	330	< 2	< 10	< 8	-	73	2	< 10	< 2	72	23
SK35A	960	< 2	< 10	< 8	-	770	2	< 10	< 2	79	19
SK35B	480	< 2	< 10	< 8	-	60	2	< 10	< 2	70	79
SK35C	23	< 2	< 10	< 8	-	270	< 1	< 10	< 2	47	11
SK35D	31	< 2	< 10	< 8	-	110	2	< 10	< 2	22	3
SK42A	1600	< 2	< 10	< 8	-	750	2	< 10	< 2	73	7
SK42B	45	< 2	< 10	< 8	-	110	2	< 10	< 2	62	4
SK43B	88	< 2	15	< 8	-	480	< 1	< 10	< 2	32	2
SK43C	13	< 2	< 10	< 8	-	180	< 1	< 10	< 2	61	< 1
SK47A	390	< 2	< 10	< 8	-	82	2	< 10	< 2	46	12
SK47B	700	< 2	12	< 8	-	340	1	< 10	< 2	76	21
SK47C	1300	< 2	< 10	< 8	-	810	2	< 10	< 2	61	23
SK49A	38	< 2	11	< 8	-	160	< 1	< 10	< 2	37	< 1
SK49B	32	< 2	10	< 8	-	1200	< 1	< 10	< 2	8	< 1
SK49C	57	< 2	< 10	< 8	-	570	< 1	< 10	< 2	30	3
SK49D	24	< 2	48	< 8	-	670	1	< 10	< 2	24	< 1
SK52	23	< 2	< 10	< 8	-	500	1	< 10	< 2	63	< 1
SK54A	33	< 2	< 10	< 8	-	63	< 1	< 10	< 2	72	< 1
SK54B	13	< 2	< 10	< 8	-	690	< 1	< 10	< 2	75	< 1
SK60	75	< 2	< 10	< 8	-	85	3	< 10	< 2	52	17
SK61	73	< 2	< 10	< 8	-	760	2	< 10	< 2	67	< 1
SK63	79	< 2	14	< 8	-	49	2	< 10	< 2	58	32
SK64A	590	< 2	< 10	< 8	-	85	1	< 10	< 2	63	18
SK64B	160	< 2	< 10	< 8	-	1200	2	< 10	< 2	96	< 1
SK65B	28	< 2	170	< 8	-	91	< 1	< 10	< 2	5	7
SK66A	200	< 2	< 10	< 8	-	390	2	< 10	< 2	81	< 1
SK66B	90	< 2	< 10	< 8	-	880	1	< 10	< 2	35	< 1
SK67B	41	< 2	16	< 8	-	90	1	< 10	< 2	53	9
SK67C	1200	< 2	< 10	< 8	-	41	1	< 10	< 2	49	44

Table 2. (cont'd)

FIELD ID	CR PPM-S	CU PPM-S	EU PPM-S	GA PPM-S	GE PPM-S	HO PPM-S	LA PPM-S	LI PPM-S	MO PPM-S	NB PPM-S	ND PPM-S	NI PPM-S
SJ81	4	37	< 2	22	-	< 4	23.0	4	< 2	14	26	9
SK06	49	93	< 2	21	-	< 4	43.0	9	< 2	22	37	29
SK07	13	150	< 2	15	-	< 4	21.0	17	< 2	19	14	2
SK09	120	92	< 2	19	-	< 4	28.0	8	< 2	17	29	46
SK13	270	20	< 2	23	-	< 4	21.0	9	< 2	13	23	58
SK17	6	7	< 2	21	-	< 4	16.0	37	< 2	12	20	< 2
SK18	73	10	< 2	21	-	< 4	15.0	3	< 2	11	12	< 2
SK19A	37	46	< 2	19	-	< 4	15.0	3	< 2	10	24	< 2
SK19B	12	15	< 2	22	-	< 4	22.0	7	< 2	12	36	< 2
SK20	5	54	< 2	2.8	-	< 4	30.0	3	4	< 4	24	< 2
SK21A	9	3	< 2	23	-	< 4	23.0	8	< 2	11	19	< 2
SK21B	11	14	< 2	13	-	< 4	16.0	4	6	11	23	< 2
SK22A	14	21	< 2	7	-	< 4	16.0	< 2	< 2	11	18	< 2
SK22B	6	43	< 2	2.8	-	< 4	11.0	< 2	< 2	7	13	7
SK23	18	37	< 2	17	-	< 4	20.0	< 2	13	11	15	< 2
SK25	71	4	< 2	24	-	< 4	13.0	2	< 2	12	13	< 2
SK26	17	2	< 2	24	-	< 4	25.0	6	< 2	14	23	4
SK28	6	36	< 2	22	-	< 4	41.0	12	< 2	18	38	7
SK35A	15	44	< 2	21	-	< 4	45.0	10	< 2	23	39	12
SK35B	20	33	< 2	21	-	< 4	38.0	15	< 2	20	37	42
SK35C	4	20	< 2	9	-	< 4	30.0	< 2	5	5	20	6
SK35D	7	2	< 2	31	-	< 4	12.0	< 2	< 2	13	10	< 2
SK42A	2	15	< 2	20	-	< 4	42.0	8	< 2	18	37	4
SK42B	3	9	< 2	17	-	< 4	37.0	6	< 2	18	30	3
SK43B	5	15	< 2	5	-	< 4	21.0	3	4	9	11	3
SK43C	4	< 1	< 2	18	-	< 4	33.0	5	2	22	30	< 2
SK47A	3	20	< 2	18	-	< 4	23.0	8	< 2	14	23	6
SK47B	4	23	< 2	26	-	< 4	41.0	8	< 2	22	43	11
SK47C	3	76	< 2	23	-	< 4	35.0	3	< 2	17	34	12
SK49A	5	5	< 2	2.8	-	< 4	24.0	4	< 2	6	17	< 2
SK49B	4	2	< 2	4	-	< 4	5.0	4	3	5	2.8	< 2
SK49C	5	10	< 2	2.8	-	< 4	19.0	2	< 2	8	13	< 2
SK49D	1	5	< 2	20	-	< 4	14.0	13	< 2	20	13	< 2
SK52	2	6	< 2	19	-	< 4	35.0	< 2	< 2	16	30	< 2
SK54A	26	2	< 2	19	-	< 4	38.0	< 2	< 2	17	36	< 2
SK54B	9	13	< 2	16	-	< 4	39.0	12	< 2	22	36	< 2
SK60	22	150	< 2	21	-	< 4	26.0	12	< 2	14	24	13
SK61	12	14	< 2	10	-	< 4	38.0	2	12	13	31	3
SK63	14	18	< 2	13	-	< 4	30.0	< 2	580	12	28	32
SK64A	15	65	< 2	18	-	< 4	33.0	5	3	14	30	13
SK64B	22	6	< 2	22	-	< 4	55.0	4	< 2	16	44	< 2
SK65B	0.7	75	< 2	24	-	< 4	4.0	< 2	< 2	< 4	2.8	< 2
SK66A	16	5	< 2	17	-	< 4	49.0	3	4	14	35	< 2
SK66B	0.7	5	< 2	22	-	< 4	18.0	4	< 2	12	22	< 2
SK67B	35	25	< 2	17	-	< 4	33.0	6	< 2	13	23	12
SK67C	6	100	< 2	19	-	< 4	24.0	10	< 2	12	26	24

Table 2. (cont'd)

FIELD ID	PB PPM-S	SC PPM-S	SN PPM-S	SR PPM-S	TA PPM-S	TH PPM-S	U PPM-S	V PPM-S	W PPM-S	Y PPM-S	YB PPM-S	ZN PPM-S
SJ81	30	13	< 5	490	< 40	6	< 100	160	-	10	1	7
SK06	13	20	< 5	660	< 40	13	< 100	200	-	25	2	96
SK07	20	8	< 5	230	< 40	12	< 100	280	-	4	< 1	45
SK09	11	23	< 5	430	< 40	5	< 100	210	-	19	1	92
SK13	72	15	< 5	450	< 40	6	< 100	150	-	7	< 1	97
SK17	140	11	< 5	750	< 40	< 4	< 100	170	-	3	< 1	26
SK18	130	10	< 5	240	< 40	6	< 100	100	-	2	< 1	27
SK19A	510	7	< 5	970	< 40	7	< 100	72	-	5	< 1	17
SK19B	650	12	< 5	1100	< 40	5	< 100	100	-	6	< 1	48
SK20	230	1.4	< 5	1100	< 40	< 4	< 100	17	-	< 2	< 1	42
SK21A	270	10	< 5	460	< 40	8	< 100	92	-	4	< 1	15
SK21B	1700	5	9	1100	< 40	6	< 100	77	-	< 2	< 1	18
SK22A	990	5	< 5	470	< 40	8	< 100	99	-	< 2	< 1	11
SK22B	1100	3	19	260	< 40	5	< 100	70	-	< 2	< 1	12
SK23	140	8	< 5	270	< 40	9	< 100	93	-	2	< 1	22
SK25	44	16	< 5	140	< 40	5	< 100	150	-	< 2	< 1	9
SK26	28	13	< 5	310	< 40	9	< 100	110	-	3	< 1	17
SK28	33	14	< 5	1100	< 40	9	< 100	140	-	24	2	120
SK35A	17	14	< 5	550	< 40	13	< 100	120	-	26	2	120
SK35B	15	15	< 5	530	< 40	8	< 100	150	-	21	2	280
SK35C	28	4	< 5	450	< 40	7	< 100	58	-	2	< 1	11
SK35D	17	18	< 5	110	< 40	9	< 100	79	-	16	< 1	4
SK42A	21	5	< 5	440	< 40	8	< 100	39	-	26	3	120
SK42B	18	5	< 5	440	< 40	8	< 100	40	-	16	1	84
SK43B	19	3	< 5	630	< 40	< 4	< 100	42	-	< 2	< 1	2
SK43C	21	3	< 5	860	< 40	6	< 100	48	-	6	< 1	< 2
SK47A	13	14	< 5	44	< 40	< 4	< 100	140	-	4	< 1	16
SK47B	15	20	< 5	24	< 40	6	< 100	240	-	7	1	29
SK47C	15	17	< 5	970	< 40	7	< 100	170	-	19	2	180
SK49A	76	2	< 5	120	< 40	5	< 100	18	-	< 2	< 1	3
SK49B	43	1.4	< 5	110	< 40	< 4	< 100	21	-	< 2	< 1	4
SK49C	82	1.4	< 5	77	< 40	5	< 100	20	-	< 2	< 1	8
SK49D	12	12	< 5	400	< 40	< 4	< 100	160	-	2	< 1	9
SK52	22	9	< 5	360	< 40	19	< 100	66	-	4	< 1	9
SK54A	20	9	< 5	1300	< 40	5	< 100	230	-	3	< 1	< 2
SK54B	18	3	< 5	750	< 40	7	< 100	190	-	< 2	< 1	4
SK60	29	14	< 5	180	< 40	12	< 100	130	-	8	< 1	140
SK61	44	9	< 5	72	< 40	10	< 100	77	-	2	< 1	21
SK63	32	12	< 5	290	< 40	10	< 100	98	-	4	< 1	52
SK64A	47	12	< 5	220	< 40	13	< 100	110	-	6	< 1	91
SK64B	60	14	< 5	590	< 40	17	< 100	130	-	9	< 1	15
SK65B	13	3	< 5	210	< 40	7	< 100	120	-	< 2	< 1	13
SK66A	35	10	< 5	29	< 40	13	< 100	98	-	5	< 1	13
SK66B	41	14	< 5	700	< 40	< 4	< 100	110	-	4	< 1	21
SK67B	16	6	< 5	300	< 40	20	< 100	58	-	6	< 1	12
SK67C	15	16	< 5	190	< 40	5	< 100	140	-	3	< 1	61

Table 2. (cont'd)

FIELD ID	Lab number	Rock unit	Assemblage	AL %-S	CA %-S	FE %-S	K %-S	MG %-S	NA %-S	P %-S	TI %-S
SK69A	D573837	Tsu	QSP	9.90	0.03	5.20	3.90	0.50	0.14	0.10	0.15
SK69D	D573838	Tsu	ARG	11.00	0.10	0.75	0.93	0.38	0.22	0.16	0.35
SK70A	D573839	Tsu	QSP-K	8.40	0.10	0.49	2.70	0.64	0.14	0.11	0.17
SK71	D573840	Tad	QSP	9.50	0.15	0.24	3.70	0.23	0.24	0.12	0.17
SK74A	D573843	Tsu	QSP-K	7.70	0.09	0.98	2.50	0.48	0.08	0.10	0.08
SK74B	D573844	Tsu	QA	9.80	0.14	0.94	3.60	0.01	0.49	0.20	0.21
SK81A	D573848	Tsu	W-AS	9.50	0.13	7.40	1.70	3.10	2.20	0.11	0.26
SK82A	D573849	Tsu	CHL-P	9.90	0.25	8.00	2.30	2.70	1.60	0.20	0.39
SK86A	D573850	Tsu	QSP-K	10.00	0.05	1.50	4.40	0.46	0.12	0.02	0.31
SK86B	D573851	Tsu	W-AS	9.40	0.43	5.60	2.50	2.40	0.87	0.21	0.27
SR11	D573853	Tsl	ARG	7.90	0.11	8.70	0.15	0.02	0.04	0.18	0.78
SR13B	D573854	Tsl	QSP-K	9.50	0.06	5.50	2.80	0.46	0.07	0.16	0.69
SR15	D573855	Tmd	QSP-K	8.20	0.07	2.70	2.00	0.22	0.42	0.10	0.19
SR18	D573856	Tsl	ARG	6.80	0.23	3.20	0.35	0.01	0.79	0.14	0.28
SR19	D573857	Tsl	QSP	6.30	0.09	1.00	2.30	0.31	0.03	0.04	0.11
SR20	D573858	Tds	W-AS	7.90	0.25	0.57	2.60	0.34	1.90	0.07	0.15
SR24	D573860	Tsl	QSP	11.00	0.09	0.37	3.50	0.25	0.56	0.07	0.56
SR46	D573863	Tsl	ARG	7.60	0.03	3.30	0.03	0.01	0.02	0.05	0.47
SR47	D573864	Tpd	QA	2.40	0.22	8.30	0.66	0.10	0.08	0.32	0.64
SR57	D573865	Tmd	QSP	8.40	0.05	2.20	3.30	0.53	0.06	0.08	0.36
SR58C	D573866	Tmd	QSP	8.10	0.03	2.10	3.00	0.07	0.10	0.08	0.08
SR60	D573867	Tsu	QSP	9.60	0.10	0.52	3.60	0.33	0.25	0.03	0.15
SR64	D573868	Tsu	QSP	7.90	0.02	2.20	2.50	0.45	0.44	0.02	0.75

Table 2. (cont'd)

FIELD ID	MN PPM-S	AG PPM-S	AS PPM-S	AU PPM-S	B PPM-S	BA PPM-S	BE PPM-S	BI PPM-S	CD PPM-S	CE PPM-S	CO PPM-S
SK69A	150	< 2	10	< 8	-	53	1	< 10	< 2	22	32
SK69D	80	< 2	< 10	< 8	-	520	1	< 10	< 2	80	< 1
SK70A	130	< 2	< 10	< 8	-	680	2	< 10	< 2	52	< 1
SK71	36	< 2	< 10	< 8	-	460	< 1	< 10	< 2	38	< 1
SK74A	60	< 2	< 10	< 8	-	350	1	< 10	< 2	49	< 1
SK74B	15	< 2	< 10	< 8	-	55	< 1	< 10	< 2	81	5
SK81A	1800	< 2	< 10	< 8	-	130	1	< 10	< 2	48	32
SK82A	2200	< 2	< 10	< 8	-	74	1	< 10	< 2	51	36
SK86A	160	< 2	< 10	< 8	-	2100	1	< 10	< 2	19	< 1
SK86B	990	< 2	< 10	< 8	-	630	1	< 10	< 2	35	9
SR11	10	< 2	< 10	< 8	-	100	< 1	< 10	< 2	57	33
SR13B	140	< 2	17	< 8	-	40	1	< 10	< 2	40	23
SR15	33	< 2	< 10	< 8	-	620	1	< 10	< 2	37	3
SR18	10	< 2	< 10	< 8	-	55	< 1	< 10	< 2	31	11
SR19	63	< 2	< 10	< 8	-	1200	1	< 10	< 2	59	1
SR20	36	< 2	< 10	< 8	-	600	2	< 10	< 2	62	< 1
SR24	27	< 2	< 10	< 8	-	590	2	< 10	< 2	21	< 1
SR46	7	< 2	< 10	< 8	-	47	< 1	< 10	< 2	25	6
SR47	250	< 2	45	< 8	-	160	1	< 10	< 2	93	10
SR57	53	< 2	11	< 8	-	220	2	< 10	< 2	81	4
SR58C	14	< 2	12	< 8	-	46	< 1	< 10	< 2	5	8
SR60	15	< 2	< 10	< 8	-	180	1	< 10	< 2	36	< 1
SR64	66	< 2	< 10	< 8	-	63	2	< 10	< 2	19	7

Table 2. (cont'd)

FIELD ID	CR PPM-S	CU PPM-S	EU PPM-S	GA PPM-S	GE PPM-S	HO PPM-S	LA PPM-S	LI PPM-S	MO PPM-S	NB PPM-S	ND PPM-S	NI PPM-S
SK69A	11	39	< 2	21	-	< 4	10.0	< 2	< 2	12	11	22
SK69D	0.7	6	< 2	32	-	< 4	44.0	9	< 2	16	37	< 2
SK70A	0.7	4	< 2	18	-	< 4	31.0	3	< 2	13	28	< 2
SK71	25	12	< 2	22	-	< 4	23.0	2	< 2	14	16	< 2
SK74A	6	8	< 2	17	-	< 4	28.0	4	4	11	24	< 2
SK74B	11	5	< 2	23	-	< 4	39.0	< 2	< 2	14	44	3
SK81A	0.7	36	< 2	25	-	< 4	24.0	17	< 2	12	29	4
SK82A	0.7	21	< 2	25	-	< 4	25.0	9	< 2	12	31	5
SK86A	2	18	< 2	25	-	< 4	11.0	5	5	14	9	< 2
SK86B	3	40	< 2	21	-	< 4	18.0	17	18	13	23	4
SR11	11	51	< 2	14	-	< 4	30.0	120	< 2	17	32	25
SR13B	2	23	< 2	19	-	< 4	20.0	9	< 2	20	21	3
SR15	13	13	< 2	17	-	< 4	18.0	7	< 2	14	23	3
SR18	3	22	< 2	11	-	< 4	18.0	11	< 2	11	15	3
SR19	4	8	< 2	13	-	< 4	42.0	< 2	< 2	15	20	< 2
SR20	14	4	< 2	16	-	< 4	40.0	3	< 2	11	26	< 2
SR24	29	5	< 2	26	-	< 4	9.0	< 2	< 2	20	12	< 2
SR46	2	12	< 2	13	-	< 4	12.0	44	< 2	15	12	< 2
SR47	33	18	< 2	40	-	< 4	58.0	< 2	< 2	9	30	6
SR57	12	18	< 2	19	-	< 4	46.0	8	< 2	16	38	< 2
SR58C	4	14	< 2	18	-	< 4	4.0	38	8	10	2.8	< 2
SR60	13	15	< 2	22	-	< 4	18.0	3	< 2	13	20	< 2
SR64	8	19	< 2	19		< 4	10.0	3	< 2	22	12	3

Table 2. (cont'd)

FIELD ID	PB PPM-S	SC PPM-S	SN PPM-S	SR PPM-S	TA PPM-S	TH PPM-S	U PPM-S	V PPM-S	W PPM-S	Y PPM-S	YB PPM-S	ZN PPM-S
SK69A	28	15	< 5	43	< 40	< 4	< 100	160	-	2	< 1	16
SK69D	96	11	< 5	540	< 40	9	< 100	81	-	4	< 1	15
SK70A	32	11	< 5	410	< 40	< 4	< 100	63	-	5	< 1	25
SK71	31	15	< 5	290	< 40	9	< 100	140	-	2	< 1	12
SK74A	310	7	< 5	620	< 40	18	< 100	60	-	7	< 1	25
SK74B	23	7	< 5	1200	< 40	11	< 100	180	-	6	< 1	< 2
SK81A	16	19	< 5	95	< 40	6	< 100	210	-	6	< 1	110
SK82A	15	20	< 5	110	< 40	5	< 100	240	-	7	< 1	150
SK86A	87	16	< 5	58	< 40	4	< 100	170	-	3	< 1	58
SK86B	29	16	< 5	210	< 40	6	< 100	170	-	9	< 1	290
SR11	70	7	< 5	1900	< 40	4	< 100	180	-	< 2	< 1	3
SR13B	19	16	< 5	24	< 40	< 4	< 100	220	-	4	< 1	79
SR15	27	11	< 5	230	< 40	8	< 100	230	-	13	< 1	12
SR18	120	4	< 5	2000	< 40	4	< 100	150	-	3	< 1	2
SR19	17	3	< 5	39	< 40	23	< 100	27	-	9	1	14
SR20	29	6	< 5	210	< 40	14	< 100	51	-	5	< 1	15
SR24	24	14	< 5	160	< 40	5	< 100	240	-	3	< 1	3
SR46	11	5	< 5	770	< 40	< 4	< 100	80	-	< 2	< 1	3
SR47	19	9	< 5	1400	< 40	18	< 100	130	-	2	< 1	31
SR57	23	18	< 5	24	< 40	14	< 100	160	-	7	< 1	6
SR58C	110	6	< 5	36	< 40	< 4	< 100	100	-	< 2	< 1	< 2
SR60	29	14	< 5	62	< 40	15	< 100	150	-	8	1	3
SR64	20	10	< 5	46	< 40	4	< 100	170	-	< 2	< 1	46

Table 3. Water geochemical data for the Iron, Alum, and Bitter Creek areas.

[Major ions used filtered ICP-AES unless below limit; if below limit used ICP-MS data. Anions reported from unfiltered data. Trace elements from filtered ICP-MS data. See methodology section for more details uS/cm is microsiemens per centimeter.]

Sample #	Type	Lat. (dec)	Long. (dec)	pH	Sp. Cond. (uS/cm)	Dis. O_2 (mg/l)	Temp (°C)	Fe^{2+} (mg/l)	Fe-Tot (ppm)	Al^{3+} (ppm)	Mg^{2+}(ppm)	K^{1+}(ppm)
TMT-08	stream	37.40927194	-106.571206	7.37	50	7	10	0.01	1.3	0.15	1.5	0.2
TMT-09	spring	37.41515861	-106.570856	6.21	40	3	5	0.01	0.092	0.063	1.4	0.22
TMT-10	spring	37.40910778	-106.556136	6.85	20	7	4.7	0.01	2.6	0.37	0.48	1
TMT-11	spring	37.41095778	-106.562142	6.41	710	0	8.5	36	40	0.02	38	1.9
TMT-12	spring	37.41123972	-106.548454	3.03	570	?	9.1	13.5	18	8	4.9	2.1
TMT-13	stream	37.3949525	-106.551935	3.38	450	7	8.7	5.65	8.2	6.3	8.2	1.3
TMT-14	spring	37.40175861	-106.552559	6.24	380	4	8.5	0	0.52	0.62	11	0.74
TMT-15	stream	37.40465306	-106.554632	3.16	980	5	13.3	54	66	16	20	2
TMT-15S	stream	37.40465306	-106.554632	2.91	870	?	?	23	42	25	17	1.6
TMT-16	stream	37.40384583	-106.570584	3.42	160	7	7.1	1	1.4	2.5	1.1	0.57
TMT-17	spring	37.40384778	-106.568092	3.34	550	5	8.2	25	34	6.2	12	1.6
TMT-18	strean	37.3992075	-106.555924	3.64	240	9	10.6	4.25	5.1	4	5.7	1.2
TMT-19	adit	37.38962917	-106.561549	6.71	760	0.1	7.2	10.4	7.5	0.007	28	2.1
TMT-20	spring	37.39790806	-106.591343	2.59	1380	>12	13.1	2	54	19	0.68	0.38
TMT-21	spring	37.39844694	-106.586854	4.69	20	7	8.7	0.05	0.06	0.025	0.12	0.31
TMT-22	spring	37.40416722	-106.5899	6.17	30	7	4	0.01	0.08	0.02	0.55	2.4
TMT-23	spring	37.41266056	-106.586111	6.13	90	6	6	0.01	< 0.03	< 0.007	1	0.65
TMT-24	stream	37.38808111	-106.56286	3.59	400	4	8.6	3.9	5.2	7.6	13	2
TMT-25	stream	37.38493056	-106.566061	2.83	1720	>12	10.5	95.5	160	61	27	2.5
TMT-26	stream	37.37722889	-106.582049	3.23	530	7	16.1	2.16	3.4	8	8.5	1.7
TMT-27	adit	37.37634694	-106.567889	6.6	270	>12	5.1	0.62	0.57	0.031	7.6	0.76
TMT-28	spring	37.38829278	-106.58125	2.84	1430	4	5.4	135	130	70	11	1.2
TMT-29	spring	37.38821722	-106.582193	2.34	2540	>12	6.4	5	150	66	2.5	0.02
TMT-30	spring	37.38720806	-106.588506	6.94	20	6	3.1	0.01	0.07	0.01	0.4	2.3
TMT-31	spring	37.3901025	-106.586581	6.4	10	3.1	n.d.	n.d	n.d	n.d	n.d	n.d
TMT-32	spring	37.39397583	-106.589526	5.44	20	3.1	3.1	0.02	1.2	0.32	0.3	1.3
TMT-33	spring	37.39490917	-106.58408	3.01	560	5.3	5.3	20.5	22	18	0.49	1.1
TMT-34	stream	37.39620278	-106.581241	2.74	1130	12.2	12.2	48.5	100	27	14	1.4
TMT-35	stream	37.39071833	-106.578072	2.88	960	10	10	13	36	21	12	1.7
TMT-36	stream	37.39038361	-106.578424	3.22	1390	13	13	44	53	27	53	2.3
TMT-37	spring	37.39218861	-106.571764	3.63	90	4.7	4.7	0.07	0.16	2.2	0.49	0.48
TMT-38	spring	37.3894425	-106.573567	2.28	10860	8.9	8.9	1590	1900	390	130	4.8
TMT-39	stream	37.38767667	-106.572517	2.38	5240	12.4	12.4	99	1000	200	83	0.1
TMT-40	stream	37.38792083	-106.574107	2.76	1640	9.8	9.8	126.5	200	70	23	2.7
TMT-41	stream	37.38549222	-106.570746	2.79	1630	10.1	10.1	123	170	61	25	2.6
TMT-42	stream	37.37221833	-106.583325	3.44	380	7.1	7.1	4.2	9.3	9.7	4.8	2
TMT-43	spring	37.37688611	-106.593948	2.91	860	9.8	9.8	26	39	14	4.3	3.6
TMT-44	stream	37.38183167	-106.602218	3.5	310	9.9	9.9	3.2	4.7	7.2	3.5	1.1
TMT-45	spring	37.3763475	-106.614325	4.75	590	10.9	10.9	25.5	31	2.6	19	1.9
TMT-46	spring	37.38412889	-106.623632	4.22	50	5.1	5.1	0.01	0.05	1.3	1	0.33
TMT-47	spring	37.38763889	-106.615437	3.37	450	13.9	13.9	1.3	2.1	3.9	8.4	1.1
TMT-48	stream	37.38928389	-106.622674	2.94	1150	10.7	10.7	1.5	28	21	98	1.4
TMT-49	stream	37.38549806	-106.607511	3.43	420	7.9	7.9	2.5	5.9	5.2	9.5	1.1
TMT-50	spring	37.38930389	-106.599356	4.93	40	7.7	7.7	0.02	0.42	0.14	0.54	1
TMT-51	spring	37.39216306	-106.599929	2.3	3870	3.2	3.2	575	850	340	2.9	0.15
TMT-52	stream	37.39519611	-106.604109	3.5	370	10.4	10.4	1.6	3.4	5.5	4	1.2

Sample #	Type	Lat. (dec)	Long. (dec)	Mn (ppm)	Ca^{2+} (ppm)	Na^{1+} (ppm)	Si^{4+} (ppm)	SO_4 ($^{2-}$) (ppm)	Cl^- (ppm)	F^- (ppm)	PO_4 ($^{3-}$) (ppm)	Pb ppb	Zn ppb
TMT-08	stream	37.40927194	-106.5712058	0.024	8.4	2.4	3.9	11	< 0.1	0.07	< 1	< 0.4	6.7
TMT-09	spring	37.41515861	-106.5708561	0.013	9.1	2.4	3.8	8.8	0.14	< 0.05	< 1	< 0.1	< 6
TMT-10	spring	37.40910778	-106.5561358	0.046	2.3	3	8.8	2.5	0.27	0.23	< 1	0.1	7
TMT-11	spring	37.41095778	-106.5621419	3	81	5.1	15	343	0.58	1.2	< 1	< 0.4	30
TMT-12	spring	37.41123972	-106.5484544	0.37	11	4.8	21	163	0.55	0.32	< 1	< 0.1	50
TMT-13	stream	37.3949525	-106.551935	1	25	3.6	15	183	0.34	0.54	< 1	< 0.4	91
TMT-14	spring	37.40175861	-106.5525594	0.013	46	6.9	9.6	177	0.52	0.57	< 1	0.6	< 2
TMT-15	stream	37.40465306	-106.5546317	3.5	72	5.7	19	433	0.43	2.4	< 1	1.2	150
TMT-15S	stream	37.40465306	-106.5546317	3	51	3.6	10	479	0.39	0.5	< 1	0.5	180
TMT-16	stream	37.40384583	-106.5705839	0.13	3.5	2.3	11	53	0.21	0.15	< 1	0.6	67
TMT-17	spring	37.40384778	-106.5680917	1.7	37	5.1	19	262	0.42	0.39	< 1	0.1	120
TMT-18	stream	37.3992075	-106.5559244	0.59	19	3.4	15	101	0.14	0.15	< 1	0.1	51
TMT-19	adit	37.38962917	-106.5615492	0.89	96	5.5	10	321	0.7	0.76	< 1	< 0.4	3
TMT-20	spring	37.39790806	-106.5913431	0.14	4	3.3	30	328	0.38	0.40	< 1	< 0.4	310
TMT-21	spring	37.39844694	-106.5868539	0.012	0.8	1.3	3.6	4.8	0.14	< 0.05	< 1	< 0.3	4.1
TMT-22	spring	37.40416722	-106.5898997	0.0096	3.5	1.9	12	3.2	0.23	< 0.05	< 1	< 0.4	6.1
TMT-23	spring	37.41266056	-106.5861111	0.002	12	2.2	2.5	21	1.0	< 0.05	< 1	< 0.4	< 2
TMT-24	stream	37.38808111	-106.5628603	1.2	30	2.8	18	167	0.42	0.33	< 1	1.2	89
TMT-25	stream	37.38493056	-106.5660606	5.6	63	3.7	35	1024	0.62	1.8	< 1	2.4	550
TMT-26	stream	37.37722889	-106.5820494	0.78	15	3	18	83	0.32	0.49	< 1	< 0.4	90
TMT-27	adit	37.37634694	-106.5678889	0.89	36	2.8	4.4	117	0.3	0.37	< 1	< 0.4	94
TMT-28	spring	37.38829278	-106.58125	1.7	13	2.9	41	1010	< 1	1.8	< 1	< 0.4	610
TMT-29	spring	37.38821722	-106.5821931	0.13	4.3	2.4	38	407	1.1	0.88	< 1	< 0.3	420
TMT-30	spring	37.38720806	-106.5885064	0.002	2.3	2.8	15	1.0	0.19	< 0.05	< 1	< 0.4	< 2
TMT-31	spring	37.3901025	-106.5865806	n.d.	n.d.	n.d.	n.d.	n.d.	0.18	0.06	< 1	< 0.1	< 6
TMT-32	spring	37.39397583	-106.5895261	0.002	2.6	1.9	14	8.7	0.22	0.06	< 1	< 0.1	50
TMT-33	spring	37.39490917	-106.5840797	0.029	1.5	1.4	27	197	0.43	0.49	< 1	1.7	240
TMT-34	stream	37.39620278	-106.5812414	2.4	16	1.9	29	323	0.36	0.61	< 1	0.8	270
TMT-35	stream	37.39071833	-106.5780722	2.3	25	3.1	24	400	0.38	1.5	< 1	2.6	590
TMT-36	stream	37.39038361	-106.5784239	8.8	120	5.7	32	847	0.18	0.07	< 1	0.3	10
TMT-37	spring	37.39218861	-106.5717644	0.049	2.3	1.3	16	25	3.6	8.4	< 10	26	2700
TMT-38	spring	37.3894425	-106.5735667	45	150	2	39	13400	2.5	6.9	< 1	< 0.4	2400
TMT-39	stream	37.38767667	-106.5725172	24	120	1.9	30	4790	1	1.4	< 1	4.3	530
TMT-40	stream	37.38792083	-106.5741067	5.1	50	3.5	33	1860	0.76	2.2	< 1	3.2	560
TMT-41	stream	37.38549222	-106.5707461	5.2	58	3.5	35	1090	0.30	0.32	< 1	< 0.1	60
TMT-42	stream	37.37221833	-106.583325	0.68	18	4	17	146	0.40	0.22	< 1	< 0.4	190
TMT-43	spring	37.37688611	-106.5939483	1.1	11	2.4	18	310	0.27	0.27	< 1	< 0.3	45
TMT-44	stream	37.38183167	-106.6022183	0.41	13	3.7	11	170	0.47	0.6	< 1	< 0.4	29
TMT-45	spring	37.3763475	-106.614325	1.7	72	6.6	15	306	0.14	0.07	< 1	< 0.4	21
TMT-46	spring	37.38412889	-106.6236317	0.7	2.8	1.8	5.4	23	0.36	0.63	< 1	< 0.4	110
TMT-47	spring	37.38763889	-106.6154367	3	15	3.6	14	138	2.2	1.2	< 1	< 0.4	1500
TMT-48	stream	37.38928389	-106.6226744	71	100	6.3	23	1050	< 0.1	0.48	< 1	< 0.4	94
TMT-49	stream	37.38549806	-106.6075114	1.7	21	3.4	13	161	0.19	< 0.05	< 1	< 0.4	< 2
TMT-50	spring	37.38930389	-106.5993564	0.0051	2.5	1.7	8.5	12	3.6	2.7	< 1	< 0.1	150
TMT-51	spring	37.39216306	-106.5999294	0.16	4.9	2.1	37	9250	0.24	0.31	< 1	< 0.4	75
TMT-52	stream	37.39519611	-106.6041092	0.69	13	2.7	12	121	0.22	0.16	< 1	< 0.1	6

Sample #	Type	Lat. (dec)	Long. (dec)	Cu ppb	Cd ppb	Ni ppb	Co ppb	Mo ppb	Cr ppb	As ppb	Sb ppb	Ag ppb	Sr ppb
TMT-08	stream	37.40927194	-106.5712058	3	0.9	< 1	0.59	< 0.2	< 2	< 0.9	< 0.1	< 0.1	60
TMT-09	spring	37.41515861	-106.5708561	23	< 0.4	< 0.5	0.4	< 0.1	< 0.9	< 1	< 0.1	< 0.1	46
TMT-10	spring	37.40910778	-106.5561358	4.5	< 0.4	0.6	0.98	0.3	< 0.9	< 1	0.2	< 0.1	12
TMT-11	spring	37.41095778	-106.5621419	1	0.7	5.2	27	< 0.2	< 2	< 0.9	0.1	< 0.1	490
TMT-12	spring	37.41123972	-106.5484544	1.8	< 0.4	4.3	13	< 0.1	< 0.9	< 1	0.5	< 0.1	42
TMT-13	stream	37.3949525	-106.551935	19	0.9	9.6	28	< 0.2	< 2	< 0.9	< 0.1	< 0.1	130
TMT-14	spring	37.40175861	-106.5525594	< 0.9	0.7	2	0.3	< 0.2	< 2	< 0.9	< 0.1	< 0.1	300
TMT-15	stream	37.40465306	-106.5546317	47	0.7	16	56	< 0.1	< 0.9	< 1	< 0.1	< 0.1	340
TMT-15S	stream	37.40465306	-106.5546317	200	2	20	66	0.3	2	< 0.9	0.1	< 0.1	340
TMT-16	stream	37.40384583	-106.5705839	3.0	< 0.4	4.0	6.4	< 0.2	< 2	< 0.9	0.1	< 0.1	44
TMT-17	spring	37.40384778	-106.5680917	12	< 0.4	11	27	< 0.1	< 0.9	1	< 0.1	< 0.1	78
TMT-18	stream	37.3992075	-106.5559244	5.4	< 0.4	4.9	12	< 0.1	< 0.9	< 1	< 0.1	< 0.1	88
TMT-19	adit	37.38962917	-106.5615492	< 0.9	0.5	5.6	5.0	0.4	< 2	27	0.4	< 0.1	1700
TMT-20	spring	37.39790806	-106.5913431	96	2	31	77	< 0.2	< 2	< 0.9	< 0.1	< 0.1	89
TMT-21	spring	37.39844694	-106.5868539	< 1	< 0.8	0.3	0.6	< 0.1	< 0.7	< 0.9	0.3	< 0.1	12
TMT-22	spring	37.40416722	-106.5898997	1	1	< 1	< 0.1	< 0.2	< 2	< 0.9	< 0.1	< 0.1	27
TMT-23	spring	37.41266056	-106.5861111	< 0.9	0.7	< 1	0.2	< 0.2	< 2	< 0.9	< 0.1	< 0.1	110
TMT-24	stream	37.38808111	-106.5628603	12	1	9.2	16	< 0.2	< 2	< 0.9	0.2	< 0.1	110
TMT-25	stream	37.38493056	-106.5660606	220	6.7	78	150	0.8	7.5	5.3	< 0.1	< 0.1	230
TMT-26	stream	37.37722889	-106.5820494	30	0.8	14	29	< 0.2	< 2	< 0.9	0.2	< 0.1	73
TMT-27	adit	37.37634694	-106.5678889	19	0.9	4.0	3.3	0.5	< 2	1	0.7	< 0.1	140
TMT-28	spring	37.38829278	-106.58125	65	15	110	210	< 0.2	4	1	0.1	< 0.1	140
TMT-29	spring	37.38821722	-106.5821931	1300	14	110	200	0.3	17	1	< 0.1	< 0.1	180
TMT-30	spring	37.38720806	-106.5885064	< 0.9	0.8	< 1	< 0.1	< 0.2	< 2	< 0.9	< 0.1	< 0.1	16
TMT-31	spring	37.3901025	-106.5865806	5	< 0.4	0.7	0.61	< 0.1	< 0.9	< 1	0.3	< 0.1	17
TMT-32	spring	37.39397583	-106.5895261	4.2	< 0.4	15	37	< 0.1	0.9	2	< 0.1	< 0.1	53
TMT-33	spring	37.39490917	-106.5840797	250	6.1	17	66	0.70	< 2	1	< 0.1	< 0.1	110
TMT-34	stream	37.39620278	-106.5812414	52	2.2	31	67	< 0.2	2	< 0.9	< 0.1	< 0.1	140
TMT-35	stream	37.39071833	-106.5780722	130	5.7	72	150	0.4	2	2	< 0.1	< 0.1	550
TMT-36	stream	37.39038361	-106.5784239	3.4	< 0.4	2	2.6	< 0.1	< 0.9	< 1	< 0.1	< 0.1	16
TMT-37	spring	37.39218861	-106.5717644	2000	29	280	530	130	54	44	< 0.1	< 0.1	290
TMT-38	spring	37.3894425	-106.5735667	1100	24	180	330	20	23	29	< 0.1	< 0.1	230
TMT-39	stream	37.38767667	-106.5725172	170	8.1	68	130	0.77	6	9.0	0.1	< 0.1	190
TMT-40	stream	37.38792083	-106.5741067	220	6.8	75	150	1	6.5	6.4	0.1	< 0.1	230
TMT-41	stream	37.38549222	-106.5707461	24	< 0.4	12	22	< 0.1	< 0.9	< 1	< 0.1	< 0.1	140
TMT-42	stream	37.37221833	-106.583325	3.0	0.5	26	53	< 0.2	< 2	< 0.9	< 0.1	< 0.1	91
TMT-43	spring	37.37688611	-106.5939483	29	< 0.8	8.6	14	< 0.1	0.8	< 0.9	< 0.1	< 0.1	160
TMT-44	stream	37.38183167	-106.6022183	< 0.9	0.6	12	24	< 0.2	< 2	< 0.9	0.2	< 0.1	160
TMT-45	spring	37.3763475	-106.614325	3	0.9	2	4.0	< 0.2	< 2	< 0.9	< 0.1	< 0.1	19
TMT-46	spring	37.38412889	-106.6236317	21	0.9	13	34	< 0.2	< 2	< 0.9	0.2	< 0.1	130
TMT-47	spring	37.38763889	-106.6154367	110	5.4	130	420	< 0.2	< 2	< 0.9	< 0.1	< 0.1	540
TMT-48	stream	37.38928389	-106.6226744	20	1	12	27	< 0.2	< 2	< 0.9	< 0.1	< 0.1	130
TMT-49	stream	37.38549806	-106.6075114	0.9	0.7	< 1	0.92	< 0.2	< 2	< 0.9	0.3	< 0.1	24
TMT-50	spring	37.38930389	-106.5993564	1800	1.8	180	390	0.9	31	60	< 0.1	< 0.1	530
TMT-51	spring	37.39216306	-106.5999294	10	0.6	7.2	19	< 0.2	< 2	< 0.9	0.3	< 0.1	94
TMT-52	stream	37.39519611	-106.6041092	0.79	< 0.4	1	0.3	< 0.1	< 0.9	< 1	< 0.1	< 0.1	110

Sample #	Type	Lat. (dec)	Long. (dec)	pH	Sp. Cond. (uS/cm)	Dis. O_2 (mg/l)	Temp (°C)	Fe^{2+} (mg/l)	Fe-Tot (ppm)	Al^{3+} (ppm)	Mg^{2+} (ppm)	K^{1+} (ppm)
TMT-53	stream	37.39593472	-106.6060078	7.28	100	1.11	1.11	0.07	0.24	0.073	2.1	1.4
TMT-54	spring	37.40391278	-106.5980164	5.32	80	3.8	3.8	0.03	0.11	0.1	0.76	7.2
TMT-55	spring	37.40990778	-106.6060814	4.46	280	3.8	3.8	8.4	7.7	1.3	1.2	2.2
TMT-56	spring	37.41552056	-106.6069056	6.39	30	4.2	4.2	0.02	< 0.03	0.02	0.39	0.68
TMT-57	stream	37.40369944	-106.6144556	7.2	70	12.8	12.8	0.02	0.04	0.02	1.1	1.4
TMT-58	stream	37.40360694	-106.6153781	7.16	70	17.8	17.8	0.01	0.076	0.014	1	0.32
TMT-59	stream	37.39055944	-106.6063675	3.75	300	15.1	15.1	2.43	4.5	6.3	3.1	1.6
TMT-60	spring	37.41079278	-106.6230367	7.22	60	7.8	7.8	0.33	0.51	0.057	1.3	0.74
TMT-61	spring	37.40180861	-106.6269361	3.64	260	6.7	6.7	5.2	4.7	4.2	1	1
TMT-62	stream	37.40373694	-106.6467539	7.29	50	9.6	9.6	0.06	0.23	0.039	0.87	0.22
TMT-63	stream	37.39733861	-106.6494178	7.26	50	10.7	10.7	0.05	0.14	0.026	0.74	0.5
TMT-64	stream	37.39046694	-106.6074139	6.77	120	7.5	7.5	0.46	0.74	0.02	2.6	0.61
TMT-65	stream	37.39522444	-106.6154733	5.02	160	15	15	3.8	3.3	0.63	2.4	0.28

Sample #	Type	Lat. (dec)	Long. (dec)	Mn (ppm)	Ca^{2+} (ppm)	Na^{1+} (ppm)	Si^{4+} (ppm)	SO_4 ($^{2-}$) (ppm)	Cl^- (ppm)	F^- (ppm)	PO_4 ($^{3-}$) (ppm)	Pb ppb	Zn ppb
TMT-53	stream	37.39593472	-106.6060078	0.024	12	4.8	11	32	0.27	0.1	< 1	< 0.1	10
TMT-54	spring	37.40391278	-106.5980164	0.032	4.7	4.8	21	29	0.40	0.53	< 1	< 0.4	730
TMT-55	spring	37.40990778	-106.6060814	1	9.5	11	20	83	0.23	< 0.05	< 1	< 0.4	< 2
TMT-56	spring	37.41552056	-106.6069056	0.0006	3	3.5	8.1	2.3	0.13	0.11	< 1	< 0.4	120
TMT-57	stream	37.40369944	-106.6144556	0.065	6.2	4.7	9.5	21	0.27	0.06	< 1	< 0.3	3.3
TMT-58	stream	37.40360694	-106.6153781	0.0098	6.1	3.2	4.7	21	0.25	0.26	< 1	< 0.1	32
TMT-59	stream	37.39055944	-106.6063675	0.27	15	4.5	13	94	0.18	0.06	< 1	< 0.4	< 2
TMT-60	spring	37.41079278	-106.6230367	0.018	5.3	7.7	2.9	2.1	1.1	0.1	< 1	< 0.4	24
TMT-61	spring	37.40180861	-106.6269361	0.082	5.4	2.7	10	65	< 0.1	< 0.05	< 1	< 0.1	< 6
TMT-62	stream	37.40373694	-106.6467539	0.02	7.8	3.3	5.1	1.5	< 0.1	0.05	< 1	< 0.4	< 2
TMT-63	stream	37.39733861	-106.6494178	0.011	5.8	3.2	3.8	1.1	0.26	0.08	< 1	< 0.4	12
TMT-64	stream	37.39046694	-106.6074139	0.27	11	2.6	3.8	41	0.20	0.16	< 1	< 0.3	16
TMT-65	stream	37.39522444	-106.6154733	0.19	13	3.7	5.8	63	0.14	< 0.05	< 1	< 0.4	< 2

Sample #	Type	Lat. (dec)	Long. (dec)	Cu ppb	Cd ppb	Ni ppb	Co ppb	Mo ppb	Cr ppb	As ppb	Sb ppb	Ag ppb	Sr ppb
TMT-53	stream	37.39593472	-106.6060078	0.5	< 0.4	4	0.5	< 0.1	< 0.9	< 1	< 0.1	< 0.1	47
TMT-54	spring	37.40391278	-106.5980164	< 0.9	0.6	16	9.2	< 0.2	< 2	2	< 0.1	< 0.1	140
TMT-55	spring	37.40990778	-106.6060814	< 0.9	0.6	< 1	0.1	< 0.2	< 2	< 0.9	0.2	< 0.1	33
TMT-56	spring	37.41552056	-106.6069056	< 0.9	1	2	0.53	< 0.2	< 2	< 0.9	< 0.1	< 0.1	69
TMT-57	stream	37.40369944	-106.6144556	1	< 0.8	0.4	0.2	< 0.1	< 0.7	< 0.9	< 0.1	< 0.1	91
TMT-58	stream	37.40360694	-106.6153781	26	< 0.4	6.2	10	< 0.1	< 0.9	< 1	< 0.1	< 0.1	130
TMT-59	stream	37.39055944	-106.6063675	< 0.9	0.7	1	0.40	< 0.2	< 2	< 0.9	< 0.1	< 0.1	40
TMT-60	spring	37.41079278	-106.6230367	46	0.6	5.5	15	< 0.2	< 2	7.0	0.7	< 0.1	62
TMT-61	spring	37.40180861	-106.6269361	19	< 0.4	< 0.5	0.3	0.2	< 0.9	< 1	< 0.1	< 0.1	48
TMT-62	stream	37.40373694	-106.6467539	< 0.9	0.6	< 1	0.3	< 0.2	< 2	< 0.9	< 0.1	< 0.1	65
TMT-63	stream	37.39733861	-106.6494178	1	0.6	1	1.1	< 0.2	< 2	< 0.9	< 0.1	< 0.1	140
TMT-64	stream	37.39046694	-106.6074139	< 1	< 0.8	1.8	1.3	< 0.1	< 0.7	< 0.9	< 0.1	< 0.1	200
TMT-65	stream	37.39522444	-106.6154733	14	1	< 1	0.2	< 0.2	< 2	< 0.9	0.2	< 0.1	100

Table 4. Geometric mean of waters draining specific alteration assemblages. N represents number of samples. See plate 5 for description of alteration assemblages. Note: pH denotes median value.

Alteration assemblage	ARG	F	PROP	QA + SIL	QSP >> QSP-K	QSP-K	QSP-PX	W-AS + F	W-AS >> PROP
N	3	2	15	1	4	13	2	2	5
pH	2.59	6.56	6.77	5.44	2.78	3.22	3.04	6.63	4.46
Sp. Cond. (uS/cm)	597.79	24.49	87.81	20.00	1914.95	591.97	923.36	119.16	206.63
Fe-Tot (ppm)	26.81	0.07	0.25	1.20	187.04	11.48	52.65	10.20	1.88
Al^{3+} (ppm)	9.67	0.01	0.06	0.32	65.08	10.38	20.00	0.09	1.29
Mg^{2+} (ppm)	1.02	0.47	1.50	0.30	27.51	5.76	18.44	4.27	2.43
K^{1+} (ppm)	0.38	2.35	0.51	1.30	1.05	0.88	1.79	1.38	1.84
Mn (ppm)	0.05	0.00	0.02	0.00	6.19	0.83	3.24	0.37	0.43
Ca^{2+} (ppm)	3.66	2.84	9.14	2.60	54.31	11.98	60.60	13.65	9.98
Na^{1+} (ppm)	2.28	2.31	3.35	1.90	2.91	2.51	4.53	3.91	4.96
Si^{4+} (ppm)	21.13	13.42	4.81	14.00	30.20	20.32	13.78	11.49	14.82
SO_4 ($^{2-}$) (ppm)	331.44	1.79	13.69	8.70	1403.89	225.02	455.42	29.28	77.31
Cl^- (ppm)	0.64	0.21	0.19	0.18	0.91	0.39	0.41	0.40	0.33
F- (ppm)	0.34	0.04	0.08	0.06	1.90	0.44	1.10	0.53	0.23
PO_4 ($^{3-}$) (ppm)	0.70	0.70	0.70	0.70	0.70	0.84	0.70	0.70	0.70
Pb (ppb)	0.18	0.28	0.24	0.07	1.33	0.55	0.77	0.17	0.16
Zn (ppb)	40.23	2.92	5.57	4.20	662.23	148.96	164.32	14.49	46.71
Cu (ppb	53.78	0.79	2.45	5.00	215.06	35.40	96.95	2.12	1.01
Cd (ppb)	1.36	0.89	0.63	0.28	7.34	2.03	1.18	0.44	0.48
Ni (ppb)	15.75	0.70	1.02	0.70	73.04	18.63	17.89	1.77	5.81
Co (ppb)	30.23	0.07	0.53	0.61	144.10	39.33	60.79	5.14	5.65
Mo (ppb)	0.26	0.14	0.14	0.07	1.21	0.26	0.14	0.20	0.11
Cr (ppb)	3.93	1.40	1.09	0.63	6.51	2.10	1.12	0.94	1.02
Zn+Cu+Cd+Pb +Co+Ni	185.47	5.96	15.19	10.86	1120.60	276.02	356.25	29.39	69.94

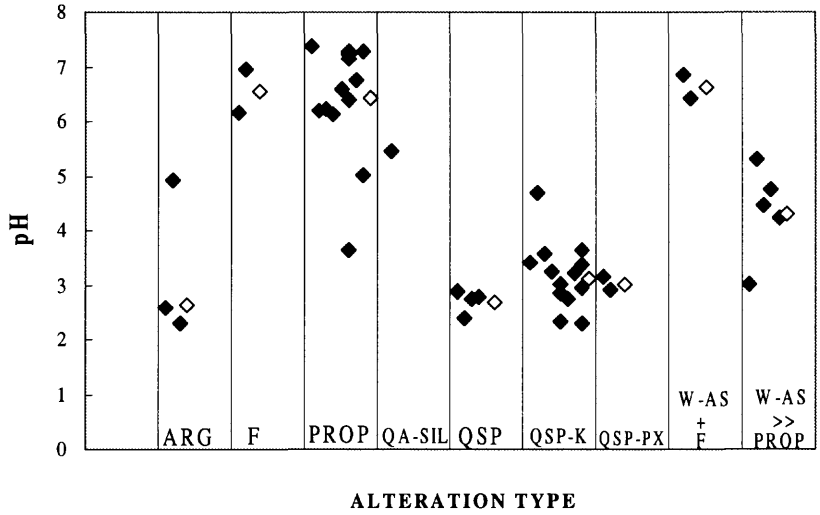

fig. 1

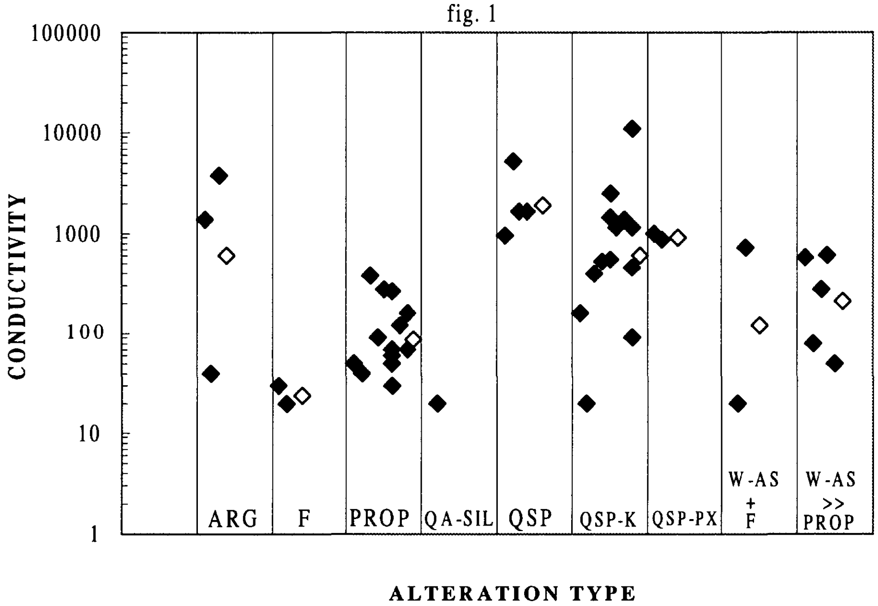

fig.2

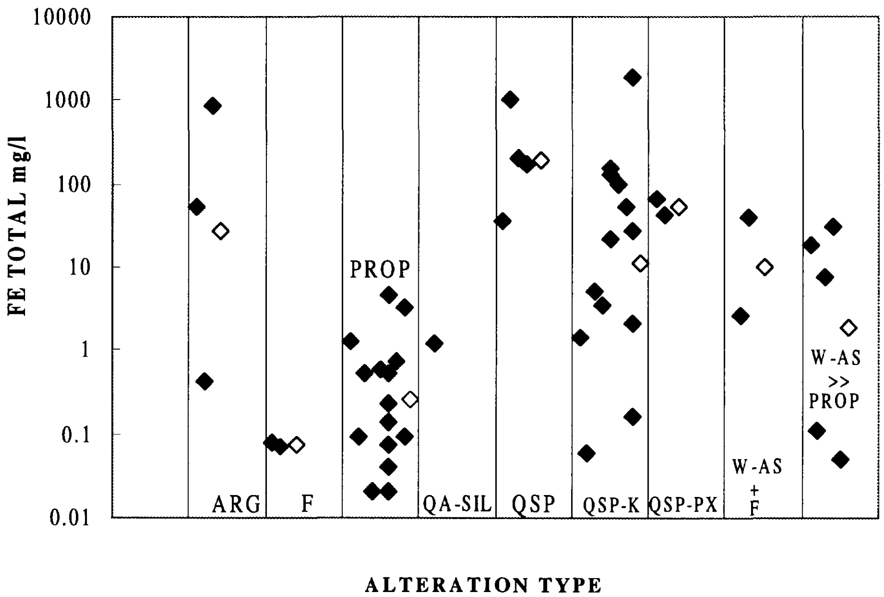

fig. 3

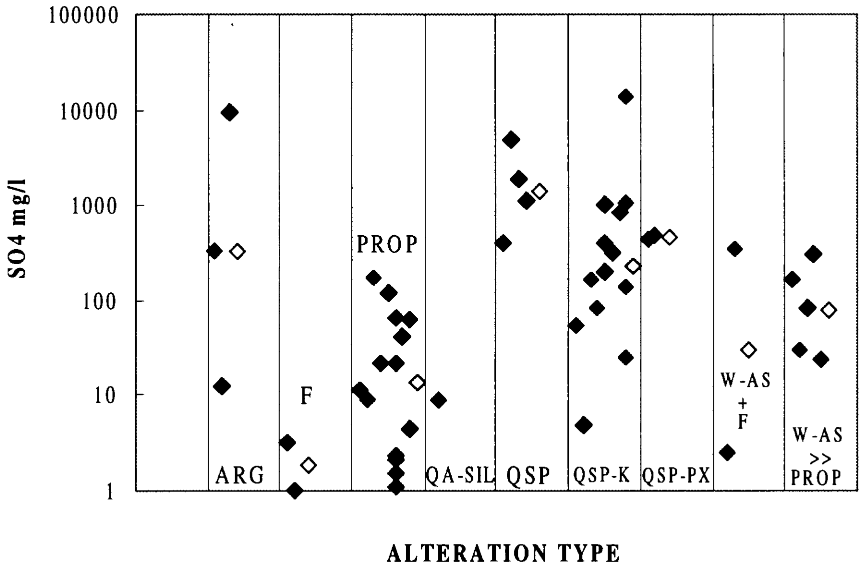

fig. 4

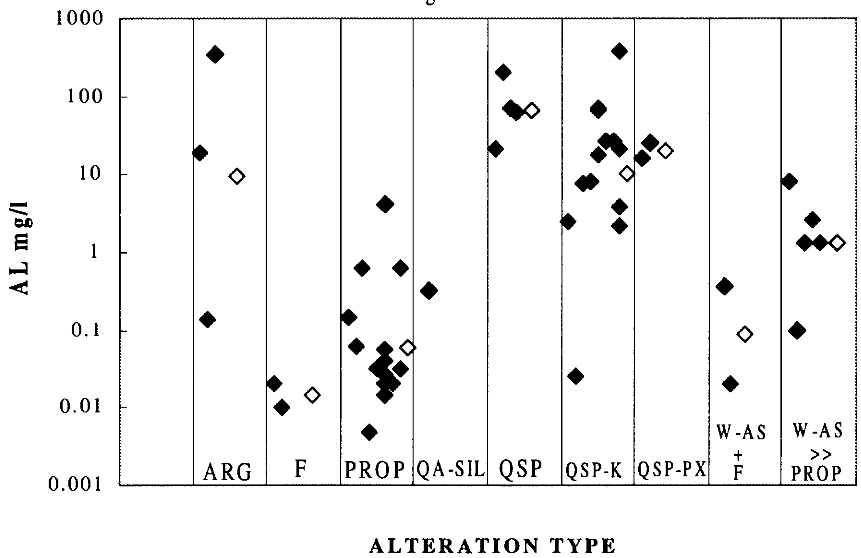

fig. 5

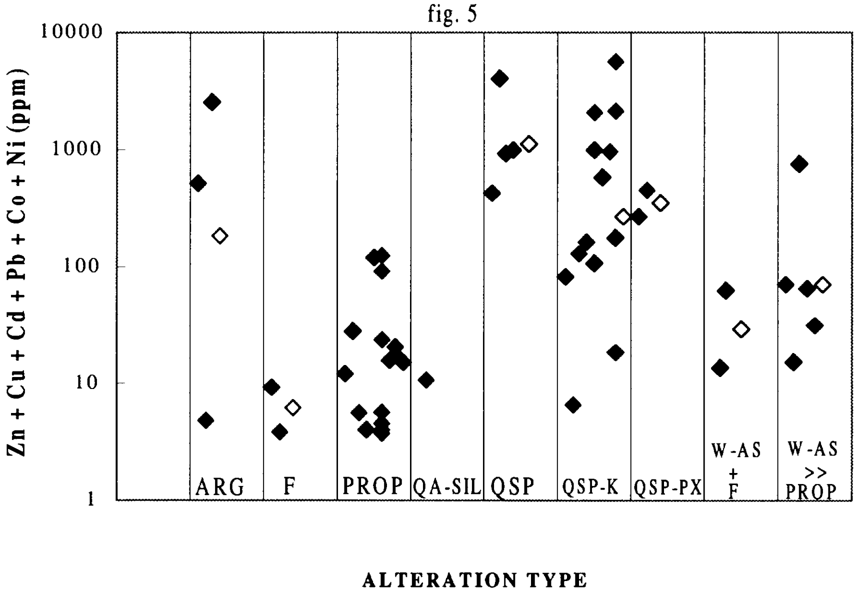

fig. 6

MODIFIED FIKCLIN PLOT (FICKLIN AND OTHERS, 1992)