UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Water-extractable elements from the Panoche Fan area of the San Joaquin Valley, California

by

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INTRODUCTION

In 1983, high concentrations of selenium found in the Kesterson National Wildlife Refuge in the San Joaquin Valley of California were determined to be the cause of fish and waterfowl mortalities (Presser and Barnes, 1985). The source of the selenium was determined to be agricultural drainage from the terminus of the unfinished San Louis Drain which had been planned to carry drain water out of the valley. In 1984, the Department of the Interior and State of California initiated the San Joaquin Valley Drainage Program to evaluate the problem in more detail and assess other options for drainage in the valley. Initial studies by the Program localized the geologic source of the selenium in exposed marine shales of the Coastal Range of Mountains. Three areas below outcrops of the shales were found to have selenium concentrations in the 90th percentile for valley soils (Tidball and others, 1986a and b). One of these areas, formed by the alluvial fans of Panoche and Cantua Creeks, was also the source of drainage water received by Kesterson.

While the mapping adequately identified sources, it did not address the processes of selenium transport due to weathering, ground water, or irrigation, which would cause problems such as those encountered at Kesterson. To investigate these processes Fujii and others (1988) characterized distribution of selenium in soil solution of three agricultural fields in the lower part of the Panoche Fan. To extend this study it was decided to evaluate a subset of samples collected from the soil survey for extractable selenium and other elements potentially transported by groundwater and irrigation. Fujii's data had been determined from saturation-paste (SP) extractions, which were very time consuming to perform. A method of soil preparation was therefore sought which could be done faster than the SP extraction but would still give an estimate of SP concentrations. The purpose of the current study was twofold: (1) to determine if a consistent relationship could be established for extractable selenium and other elements between the SP method and one using a constant ratio of soil to water (1:5), and (2) to evaluate mobilized selenium and other elements throughout the entire Fan. We show that the 1:5 extraction can estimate SP concentrations of selenium and other elements important for irrigation and groundwater quality and can result in major time savings for survey studies.

FIELD SAMPLING

In the spring of 1985, soil profiles from 721 sites in the Panoche Fan were taken from a grid pattern and from 10 additional sites for analysis-of-variance (ANOVA) (Tidball and others, 1986a). Samples were collected with a stainless-steel bucket auger and composited within each of three depth zones: 0-12 inches, 42-48 inches and 66-72 inches. Figure 1 shows the location of the study area and the field sampling sites for the 189 soils examined in the current survey.

SAMPLE PREPARATION

Samples were air dried at room temperature, disaggregated and sieved through a 2-mm (10 mesh) screen. For the first part of the study, the three depth composites from 9 of the 10 ANOVA sites were prepared by two different extraction methods: saturation-paste (SP), and one using a constant ratio of soil to water (1:5). For the SP extraction, deionized water was added to 100 gm of soil to obtain a paste (Richards, 1954). The amount of water varied depending on the soil type. After standing for 16 hours, solution was removed

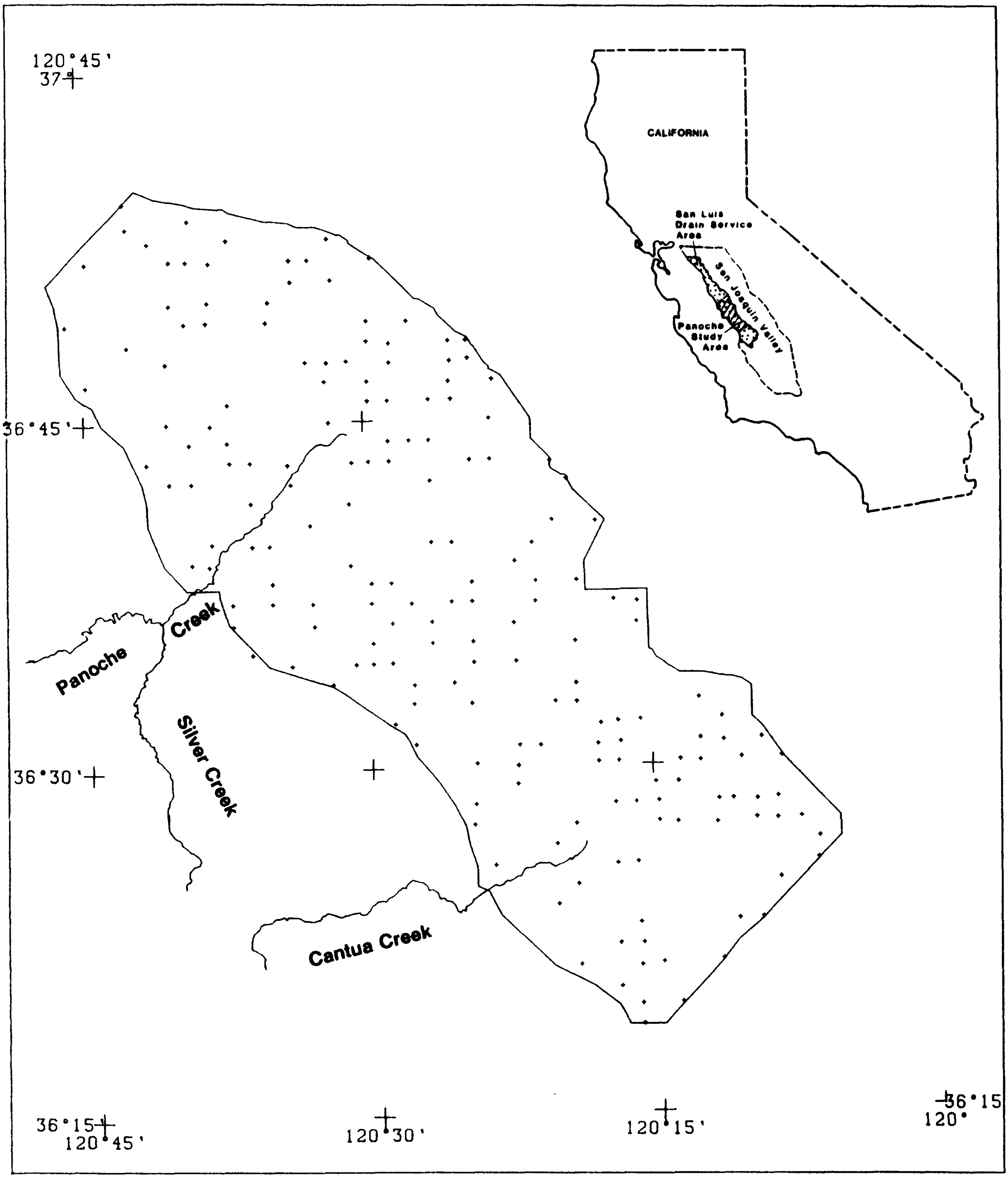

Figure 1. Location of study area and field sampling sites for comparison and survey studies of the Panoche Fan.

from the preparation by suction filtration through Whatman 41 ashless filter paper with a mechanical soil extractor. Because small volumes of solution were obtained from many saturation pastes, extracts were diluted by a factor of 2 with deionized water prior to analysis. For the constant ratio extraction, 50 gm of deionized water were added to 10 gm of soil in polypropylene bottles and the mixture was shaken for 16 hours. Solutions were clarified by centrifugation at 15,000 rpm for 10 minutes and separated into two portions. One portion was stored untreated for anion analysis and the rest was acidified with HNO_3 for cation and selenium analysis. In the second part of the study, the mid-level composite (42-48") from 189 randomly-selected sites of the 721 profiles was prepared using the 1:5 extraction. Solutions from this part of the study were also filtered through 0.45 micron filters.

ANALYTICAL METHODS

Anion (fluoride, chloride, nitrate and sulfate) determinations were made with a Dionex model 2010i ion chromatograph. Total solution conductivity was measured with a Myron Decisiemen conductivity meter and pH determinations were made with an Orion model 601A digital ionanalyzer. Solution cations were determined by inductively coupled argon plasma atomic emission spectroscopy (ICP-AES) with a Jarrell Ash model 1160 spectrometer (Lichte and others, 1987). Total selenium in solution was determined by a modification of the method of Presser and Barnes (1985). Organic matter was decomposed by digestion with sodium persulfate and hydrochloric acid followed by reduction with hydrochloric acid to reduce selenium to selenite. Selenium hydride was then generated and detected by continuous flow atomic absorption spectrometry with a Perkin-Elmer 2380 spectrophotometer (Crock and Lichte, 1982).

RESULTS AND DISCUSSION

Comparison Study

Table 1 shows determination limits and numbers of valid occurrences for data obtained by the saturation-paste (SP) and constant-ratio (1:5) extractions for both studies. Determination limits are normalized to dry weight for the 1:5 extractions, but are reported in solution for the SP extraction, since they vary depending on the saturation percentage (S. Pct., table A). Elements with four or fewer valid occurrences by either method are not included in the data tables or subsequent calculations. Zinc, with 25 valid occurrences by the SP extraction, was the only element which seemed to be detected at lower dilutions but not at the higher dilution of 1:5. A high blank, however, makes the data unreliable.

Geometric means and ranges for the two methods are shown in Table 2. Conductivity and pH are not reported for the SP extractions because the extracts were diluted. For every element except chloride, means are higher by the 1:5 extraction than by the SP extraction, possibly due to ionic strength effects. Except for chloride and nitrate, the maximum values for the 1:5 extraction are higher as well. This trend is similar to that shown by authors who have compared element concentrations at various field moisture contents (Reitemeier, 1945) and saturation extracts to 1:1 and 1:2 extracts (Hogg and Henry, 1984). In the case of calcium and sulfate, SP values may be limited by the solubilities of gypsum and calcite.

Table 1. Determination limits and valid occurrences in comparison and survey studies.
[Values are in solution for SP, dry weight for 1:5, ppm unless otherwise noted.]

Variables		Determination limit		Valid occurrences		
				Comparison n=26		Survey n=189
		SP	1:5	SP	1:5	1:5
Al		1	10	26	3	26
B	ppb	100	1000	23	19	178
Ba	ppb	30	200	11	19	135
Ca		.3	2	26	26	189
Cr	ppb	10	100	0	6	189
Fe		.6	5	0	9	36
K		10	100	0	2	4
Li	ppb	50	400	4	0	16
Mg		.1	1	26	26	189
Mn	ppb	10	100	1	12	40
Mo	ppb	100	1000	22	0	2
Na		3	20	26	26	189
Ni	ppb	60	500	0	2	9
Si		.1	1	26	26	189
Ti	ppb	10	100	0	13	121
V	ppb	80	600	0	1	10
Zn	ppb	40	300	25	0	40
Se		.001	.003	23	21*	153
Cl		.2	.5	26	25*	189
F		.2	.5	25	26	--
SO_4		1	5	26	26	189
NO_3		1	5	17	15	--

*one interference

Table 2. Geometric means and ranges for extractable elements in comparison study.
[Values are ppm dry weight unless otherwise noted.]

Variable	Extraction Method			
	SP		1:5	
	Mean	Range	Mean	Range
B ppb	750	<100-17,200	2500	<1000-35,000
Ba ppb	45	<30-180	320	<200-2300
Ca	65	7-520	250	37-2880
Mg	11	1-143	41	7-396
Na	120	13-3020	310	40-5050
Si	7.5	4.3-12.1	81	30-532
Sr ppb	470	54-4180	1600	390-16,400
Zn ppb	270	<40-2230	--	--
Se	.004	<.001-.024	.015	<.01-.06
Cl	26	4-190	25	7-170
F	.8	<.2-4.8	3.7	1-11
SO_4	240	13-9700	500	19-16,000
NO_3	5	<1-320	15	<5-310
S.Pct %	50	27-125	--	--
EC μmho/cm#	*	--	550	100-6000
pH#	*	--	7.1**	6.4-7.7

in solution
* not reported
**arithmetic

Regressions were calculated using $\log_{10}$ data and standard USGS statistical programs to compare the two data sets. Table 3 shows the intercept (a), slope (b), and coefficients of determination (r^2) for the linear regressions having a significant correlation (probability level=0.05) between the 1:5 values and the SP values. Regressions for barium, silicon and zinc were not significant and are therefore omitted. The elements are arranged in decreasing order of r^2 which indicates the point scatter about the regression. The higher the value for r^2, the less scattered the points are and the better the 1:5 extraction estimates the SP value. Three of the major contributors to soil salinity (sodium, sulfate and chloride) show excellent coefficients of determination (r^2>0.90). SP concentrations of the other major contributors to salinity, calcium (r^2=0.79) and magnesium (r^2=0.65), are not predicted as well by a linear model, or there is wider scatter about the regression. Of the two elements having significant impact on plants and animals, boron shows a very high value for r^2 (0.95) and selenium a much lower one (0.59). The fact that there is a significant relationship at all between the 1:5 and SP values means that, for these soils, estimates of SP concentrations may be obtained quickly with the 1:5 extraction and use of the regression equations.

Figure 2 illustrates the relationship between between r^2 and point scatter about the regression. The points for boron (A, r^2=0.95) show much less scatter than those for selenium (B, r^2=0.59). The point scatter for calcium (C, r^2=0.79) seems to show a lack of fit to the linear model with SP values approaching an upper limit. R^2 increases if the model is changed to a polynomial equation (D, r^2=0.90).

Two samples were prepared in triplicate to determine reproducibility by the two methods. The higher percent relative standard deviation (%RSD) for elements reported in these two samples is shown in table 4. Except for chloride, the %RSD for all constituents is higher by the SP extraction. This is probably due to subjectivity in preparation of the paste. The very high %RSD for zinc (95) shows the effects of the high blank mentioned above. Nitrate also shows very high %RSD by both methods (42 and 34) and is probably not stable in the untreated water solutions.

<u>Survey Study</u>

Table 5 lists the geometric means (pH mean is arithmetic) and ranges for the Panoche Fan survey study and ranges for some Egyptian soils (El-Arquan and others, 1985). As with the comparison study, variables with fewer than four occurrences are not reported (table 1). Nitrate was omitted from this part of the study due to apparent problems with the analysis (table 4). Fluoride was also omitted due to its low abundance in the comparison study (table 2). The 40 samples with valid occurrences of manganese and zinc (table 1) also had the highest values for aluminum, iron, nickel and vanadium. Four were above the 90th percentile for these dissolved constituents as well as titanium.

Minimal survey data are available from other studies, and the Egyptian soils were the only directly comparable data found, since extractant and ratio must be the same. The much higher range for sodium, chloride, and conductivity in the Egyptian soils compared to the Panoche Fan probably reflects groundwater input from marine sources. Extractable sulfate is higher in the Panoche Fan soils indicating their gypsiferous nature. The range for extractable magnesium is similar.

Table 3. Intercept (a), slope (b), and coefficient of determination (r^2) for linear regressions to predict SP concentrations from 1:5 data. Regression is Y = a + bX, Y = log (SP), X = log (1:5), variables significant at 0.05 probability level

Variable	Intercept	Slope	r^2
Na	-.65	1.10	.98
SO_4	.05	.86	.96
B	-1.45	1.27	.95
Cl	-.03	1.04	.93
Ca	-.12	.81	.79
Sr	-.29	.92	.77
NO_3	-.53	1.06	.67
Mg	-.51	.96	.65
Se	-.65	.97	.59
F	-.57	.85	.52

Table 4. Maximum percent relative standard deviations (%RSD) for triplicate analyses in comparison study

Variable	Preparation	
	SP	1:5
B	7	3
Ba	*	6
Ca	8	6
Mg	7	1
Na	6	2
Si	10	4
Sr	3	<1
Zn	95	*
Se	10	9
Cl	10	17
F	21	<1
SO_4	14	8
NO_3	42	34
EC	*	<1
pH	*	1

*no data

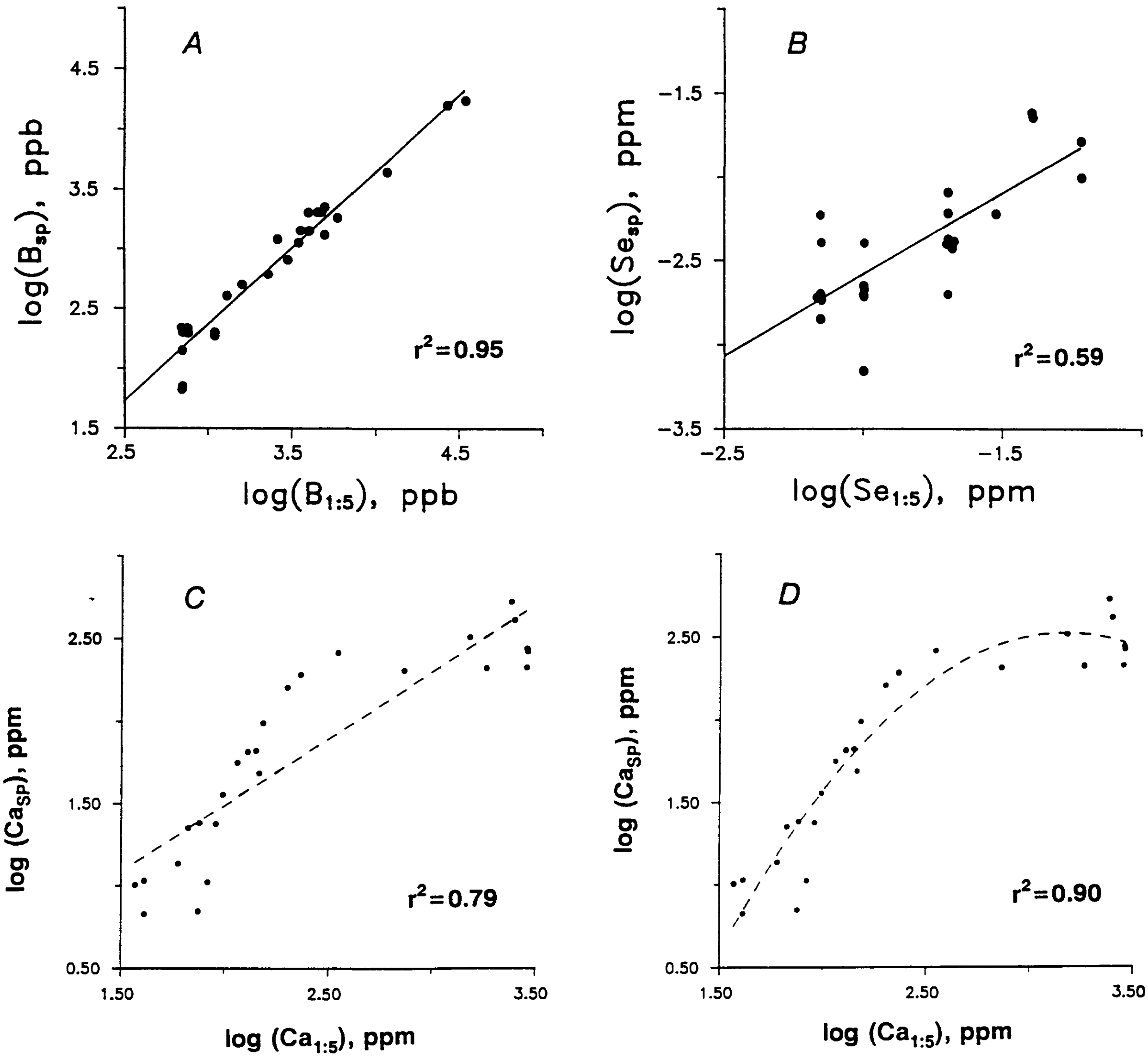

Figure 2. Plots showing relation between point scatter and coefficient of determination r^2. A-boron; B-selenium; C-calcium; linear regressions from table 5. D-calcium; polynomial regression $\log(Ca_{sp}) = -4.41 + 4.37 \log(Ca_{1:5}) - .69 [\log(Ca_{1:5})]^2$

Table 5. Geometric means and ranges of extractable elements in soils from the Panoche Fan and ranges for Egyptian soils.
[Values are ppm dry weight unless otherwise noted.]

Element	Panoche Fan		Egyptian soils[1]
	Mean	Range	Range
Al	<10	<10-1300	
B ppb	3400	<1000-69,000	
Ba ppb	<200	<200-3400	
Ca	290	9-3300	440-1700
Cr ppb	240	100-2800	
Fe	<5	<5-660	
Li ppb	<400	<400-1100	
Mg	52	5-1200	255-1600
Mn ppb	<100	<100-1400	
Na	490	40-11,000	2500-35,000
Ni ppb	<500	<500-1200	
Si	76	21-3400	
Sr ppb	2000	170-33,000	
Ti ppb	170	<100-15,000	
V ppb	<600	<600-3600	
Zn ppb	<300	<300-1300	
Se	.014	<.003-2200	
Cl	54	7-2900	1100-56,000
SO_4	1200	48-33,000	3200-13,000
EC μmho/cm#	880	110-12,000	1400-134,000
pH#	8.2*	7.1-10.3	

#in solution
*arithmetic
[1]El-Arquan and others, 1985; water, 1:5 ratio, 49 Nile River Delta soils

A standard reference soil from the San Joaquin Valley (SJS-1) was included in random positions with each group of samples to assess the precision of the extractions. Table 6 shows the arithmetic mean, range, standard deviation and %RSD for extractable constituents from the standard. In general, the %RSD is higher for trace elements (boron, chromium and titanium) with lower abundance than for major cations (calcium, magnesium, sodium and silicon) determined by ICP. Anions analyzed by ion chromatography (chloride and sulfate) also show higher %RSD than the major cations by ICP. Except for chloride, all %RSD's from the survey study are higher than for similar data from the comparison study (table 4). The %RSD for boron is much higher in the survey study (19 vs. 3 for the comparison study). The generally lower precision for the survey study reflects the combined effects of multiple analyst preparation and instrumental variation over the longer time required for the study.

Results of two levels of analysis of variance (ANOVA) testing are shown in table 7 for 20 random duplicates. The components are between samples (S) and between analytical duplicates (A). The analytical component is significant for chromium and titanium (probability level = 0.05) which explains at least part of their high %RSD in SJS-1 (table 6). This means that differences between samples are less significant than the analytical error, which includes preparation. Barium, conductivity and pH also have a high percentage of the total variation due to differences between duplicates (13.2, 11.6, and 20.0, respectively), but differences between samples are still more significant than differences between duplicates. The analytical component for pH variation (20) is similar to the %RSD for SJS-1 (16). On the other hand, boron shows a very small analytical component to the total variation (0.1) compared to the %RSD found for SJS-1 (19). This means that boron differences between samples in the Panoche Fan are real in spite of the relative imprecision for one reference material.

SUMMARY

The 1:5 extraction should be considered as an alternative to SP extraction in studies seeking to evaluate soil salinity and mobile trace elements. The primary advantage is major time savings in sample preparation. SP concentration of most of the ions responsible for soil salinity can be predicted from the 1:5 extraction, and use of the regression equations which can be established by comparison of a few samples. SP concentrations of environmentally important trace elements such as boron and selenium can also be estimated. A second advantage of the 1:5 extraction is better precision in most cases (cf. tables 6 and 4). The potential disadvantage of a higher determination limit with the 1:5 extraction did not appear to be significant in the Panoche Fan. All samples prepared by the 1:5 extraction showed valid occurrences of major cations and anions (table 1). The determination limit for the mobile trace elements boron and selenium was also adequate in the 1:5 extraction. The determination limit for boron of 1000 ppb (table 1) is just above the Environmental Protection Agency standard of 750 ppb for irrigation water (1986). The determination limit for selenium of .003 ppm is far below the National Academy of Sciences standard of .020 ppm for selenium in irrigation water (1973). Levels less than these, therefore, will be of little concern for reconnaissance or baseline studies and the advantage of time savings clearly outweighs the disadvantage of higher determination limits.

Table 6. Basic statistics for extractable constituents in SJS-1
[Values are ppm dry weight unless otherwise noted, n = 12.]

Element	Arithmetic mean	Range	Standard deviation	% RSD
B ppb	4800	3500-6600	900	19
Ca	290	270-320	12	4
Cr ppb	190	100-200	29	15
Mg	42	40-44	1	3.5
Na	670	650-700	18	2.5
Si	67	59-75	5	7.5
Sr ppb	2100	2000-2250	80	4
Ti ppb	180	100-400	80	44
Se	.022	.017-.025	.003	14
Cl	353	330-440	31	9
SO_4	1320	990-1500	130	10
EC# μmho/cm#	930	900-1000	45	5
pH#	8.1	7.8-8.2	1.3	16

#in solution

Table 7. Variance components expressed as percentage of total variance for random duplicates in survey study

Variable	% total variation by component[a] S	A
B	99.9	0.1
Ba	86.8	13.2
Ca	99.8	0.2
Cr	30.8	69.2*
Mg	99.8	0.2
Na	99.8	0.2
Si	97.5	2.5
Sr	99.6	0.4
Ti	29.9	70.1*
Se	99.5	0.5
Cl	98.0	2.0
SO_4	97.3	2.7
EC	88.4	11.6
pH	80.0	20.0

[a]components
S, between samples
A, between analytical duplicates
*variance component significant at 0.05 probability level

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Table A. Saturation paste data for comparison study

Lab ID	B ppb	Ba ppb	Ca ppm	Mg ppm	Na ppm	Si ppm	Sr ppb	Zn ppb	Se ppm	Cl ppm	F ppm	SO4 ppm	NO3 ppm	S.Pct%
D-266875	1,300	70	190	36	225	8.6	1,410	610	<.003	81	.9	910	<1	76
D-266899	800	<30	7	1	65	6.7	61	90	.002	8	1.2	48	3	41
D-267002	200	<50	24	6	32	9.1	240	1,590	<.002	17	.7	45	22	58
D-267009	<200	50	22	6	24	6.4	210	160	.002	17	.7	43	18	42
D-267067	200	30	14	1	21	5.1	102	400	.002	9	.7	22	2	32
D-267304	<100	150	65	11	18	5.7	416	<40	.002	21	.5	33	97	36
D-267328	1,400	<30	202	13	527	11.5	1,620	940	.024	24	1.2	1,500	3	42
D-267367	17,200	<80	404	131	2,040	6.2	4,180	300	.004	110	3.7	4,900	<1	94
D-267400	15,300	<100	520	143	3,020	8.6	2,370	900	.006	190	4.8	9,700	<1	125
D-267402	400	180	97	18	51	9.6	780	160	.004	50	.6	68	320	63
D-267413	1,400	<50	11	3	231	7.6	100	2,230	.004	96	1.5	120	240	57
D-267678	1,200	<40	271	34	408	10.9	1,940	580	.010	14	.8	1,900	8	55
D-267738	2,200	<50	320	60	545	6.2	1,370	290	.006	20	1.1	2,300	<1	68
D-267779	500	60	11	1	47	6.9	98	120	.002	4	.5	37	2	43
D-267844	200	110	48	4	24	12.1	264	770	.004	27	.4	39	<1	46
D-267886	1,800	<50	10	3	228	8.0	90	310	.004	91	1.5	180	150	59
D-267924	<100	60	24	5	13	6.1	176	60	.002	10	<.2	13	3	35
D-267937	200	<30	7	1	21	4.3	54	740	<.001	6	.8	14	<1	27
D-267981	200	90	36	4	21	9.8	236	200	.002	14	.3	34	4	45
D-268065	600	80	56	15	56	6.6	440	380	.004	40	.4	120	61	59
D-268097	4,300	<40	207	37	803	6.9	1,260	190	.006	27	1.2	2,400	<1	49
D-268111	200	60	66	19	33	4.8	572	170	.004	27	.5	140	7	40
D-268153	2,000	<50	256	50	784	6.4	1,210	290	.008	25	1.1	2,400	<1	59
D-268173	2,000	<40	260	57	295	9.1	1,420	110	.002	19	.8	1,400	<1	50
D-268178	2,000	<30	208	35	607	9.0	1,780	80	.016	50	.9	2,100	29	43
D-268183	1,100	<30	160	11	249	8.2	1,010	80	.024	60	.5	840	2	32

Table B. 1:5 data for comparison study

Lab ID	B ppb	Ba ppb	Ca ppm	Mg ppm	Na ppm	Si ppm	Sr ppb	Se ppm	Cl ppm	F ppm	SO4 ppm	NO3 ppm	EC umho/cm	pH
D-266875	5,000	400	231	50	410	77	1,890	.01	80	2.0	1,000	45	6,000	6.8
D-266899	3,000	1,400	75	42	320	342	810	.01	14	6.0	100	<5	190	7.2
D-267002	<1,000	400	76	16	90	67	750	<.01	13	4.5	110	14	160	7.0
D-267009	<1,000	400	67	16	60	60	650	<.01	16	2.5	82	20	130	6.9
D-267067	<1,000	300	60	7	70	80	460	<.01	7	3.0	42	<5	100	7.1
D-267304	<1,000	600	129	23	40	63	800	<.01	19	1.5	44	160	105	7.2
D-267328	3,600	<200	730	35	1,260	122	4,770	.04	0*	8.3	4,000	<5	1,500	6.7
D-267367	35,000	<200	2,490	396	3,750	30	16,400	<.01	83	10.0	16,000	<5	4,450	6.4
D-267400	27,100	<200	2,400	334	5,050	34	7,200	<.01	170	11.0	16,000	<5	6,000	6.7
D-267402	1,300	600	152	28	110	75	1,170	.01	45	3.3	71	310	280	7.1
D-267413	4,000	2,300	83	70	610	532	800	.01	83	6.5	200	190	410	6.7
D-267678	2,600	<200	2,860	183	880	82	13,100	.06	11	5.0	9,300	9	2,600	6.7
D-267738	5,000	<200	1,510	197	1,110	37	4,970	.02	16	4.0	6,500	<5	2,000	6.8
D-267779	1,600	300	41	8	190	94	420	.01	7	4.5	78	<5	160	7.7
D-267844	1,100	600	146	10	80	128	770	.02	24	3.5	71	21	200	7.4
D-267886	5,900	1,000	37	30	660	232	430	.02	84	7.3	260	130	430	7.6
D-267924	<1,000	400	91	19	40	78	680	.01	12	1.5	19	30	140	7.2
D-267937	<1,000	300	41	7	90	72	390	.01	8	2.0	34	<5	100	7.4
D-267981	<1,000	400	98	11	60	89	630	.02	13	3.5	41	27	160	7.3
D-268065	2,300	300	115	31	140	54	910	.02	37	3.5	170	120	260	7.3
D-268097	11,700	200	1,820	155	1,730	61	7,020	.03	19	4.5	11,000	<5	2,500	7.0
D-268111	1,100	500	141	38	70	50	1,290	.02	26	1.0	190	94	250	7.3
D-268153	4,700	<200	350	57	1,410	42	1,540	.02	21	3.0	3,900	<5	1,400	7.3
D-268173	4,800	<200	2,880	293	590	66	9,640	.01	14	4.5	10,000	<5	2,450	7.3
D-268178	4,000	<200	2,840	180	1,270	77	12,800	.06	30	5.0	11,000	24	2,800	6.9
D-268183	3,500	200	200	12	580	105	1,260	.04	60	1.5	1,400	<5	650	7.2

*Interference

Table C. Extractable elements for Panoche Fan at 1:5

Field ID	Latitude	Longitude	Al ppm	B ppb	Ba ppb	Ca ppm	Cr ppb	Fe ppm	Li ppb	Mg ppm	Mn ppb
0113134	36 49 21	120 29 38	<10	4,400	300	39	200	<5	<400	10	<100
0117143	36 28 23	120 24 34	<10	1,800	<200	3,180	200	<5	<400	274	100
0117154	36 28 22	120 17 5	<10	1,500	300	39	200	<5	<400	14	<100
0117163	36 28 25	120 11 31	<10	23,100	<200	2,460	600	<5	<400	243	<100
0117164	36 28 26	120 10 46	160	3,900	900	48	600	167	<400	96	800
0214122	36 44 54	120 38 13	<10	<1,000	400	71	200	<5	<400	16	<100
0214124	36 44 8	120 37 19	<10	2,500	300	53	400	6	<400	10	<100
0313124	36 49 22	120 38 17	<10	8,400	<200	2,720	200	<5	400	314	<100
0315123	36 38 58	120 39 21	<10	2,600	<200	2,020	300	<5	1,100	438	200
0316134	36 33 39	120 31 59	<10	1,300	<200	3,150	200	<5	<400	390	300
0316144	36 33 38	120 25 30	<10	2,000	<200	2,970	200	<5	<400	259	<100
0317162	36 29 12	120 13 40	<10	2,500	200	33	200	9	<400	16	<100
0413114	36 49 20	120 45 52	<10	4,600	400	59	200	<5	<400	11	<100
0413122	36 50 8	120 40 13	<10	4,000	<200	27	200	6	<400	6	<100
0413124	36 49 20	120 39 27	<10	7,200	300	961	300	<5	<400	210	<100
0414144	36 44 6	120 26 30	20	2,300	300	45	300	17	<400	14	100
0417163	36 28 24	120 14 45	<10	2,700	200	126	300	<5	<400	30	<100
0513144	36 49 19	120 27 29	<10	7,800	<200	2,390	300	<5	400	350	<100
0514144	36 44 7	120 27 34	<10	1,300	400	74	200	<5	<400	11	<100
0515151	36 39 39	120 21 7	<10	49,400	200	2,520	300	<5	<400	163	<100
0515153	36 38 52	120 22 4	<10	10,400	<200	2,350	200	<5	<400	77	<100
0516131	36 34 29	120 34 8	<10	2,200	<200	748	300	<5	<400	30	<100
0517161	36 29 13	120 14 53	<10	2,300	300	30	300	6	<400	13	100
0517174	36 28 27	120 8 22	<10	15,200	<200	2,280	200	<5	<400	218	<100
0518173	36 23 15	120 9 20	<10	1,200	200	37	200	6	<400	11	<100
0613134	36 49 21	120 35 3	<10	2,200	400	59	200	<5	<400	9	<100
0614144	36 44 6	120 28 41	<10	<1,000	400	70	200	<5	<400	12	<100
0615131	36 39 43	120 35 10	380	2,400	1,100	61	1,000	195	<400	87	1,000
0615132	36 39 43	120 36 7	<10	2,900	<200	2,770	300	<5	<400	175	100
0617164	36 28 22	120 15 58	<10	2,300	500	90	200	<5	<400	28	<100
0618164	36 23 10	120 15 55	<10	4,400	200	2,880	300	<5	400	208	<100
0618173	36 23 13	120 10 37	50	2,200	500	32	400	56	<400	38	500
0714124	36 43 18	120 41 39	<10	1,200	400	59	200	<5	<400	7	<100
0714133	36 43 17	120 36 6	<10	1,200	400	86	100	<5	<400	9	<100
0714144	36 43 14	120 28 39	220	1,700	1,400	58	800	167	<400	68	1,300
0715144	36 38 0	120 28 43	<10	1,300	200	1,180	100	<5	<400	111	<100
0717171	36 28 22	120 9 28	<10	12,800	<200	1,160	200	<5	<400	162	<100
0717174	36 27 34	120 9 32	<10	7,000	<200	2,820	200	<5	<400	324	<100
0815133	36 38 3	120 35 4	90	5,900	1,100	45	400	66	<400	39	400
0816141	36 33 34	120 27 39	<10	2,000	<200	2,990	200	<5	<400	302	<100

Table C. Extractable elements for Panoche Fan at 1:5

Field ID	Latitude	Longitude	Al ppm	B ppb	Ba ppb	Ca ppm	Cr ppb	Fe ppm	Li ppb	Mg ppm	Mn ppb
0816144	36 32 46	120 27 41	<10	2,400	200	2,820	300	<5	<400	243	<100
0818163	36 22 17	120 15 48	<10	2,400	300	38	200	5	<400	6	<100
0915153	36 37 59	120 20 59	<10	52,500	<200	2,360	300	<5	<400	175	<100
0916154	36 32 45	120 20 7	<10	7,600	<200	2,500	300	<5	<400	193	<100
0917164	36 27 32	120 14 45	<10	1,300	300	69	200	<5	<400	16	<100
1012123	36 53 42	120 39 7	<10	1,500	400	100	200	<5	<400	20	<100
1014122	36 44 5	120 39 21	<10	1,600	300	2,900	200	<5	<400	58	<100
1015121	36 38 52	120 38 27	<10	4,200	<200	1,920	300	<5	700	171	<100
1016151	36 33 31	120 18 59	<10	1,500	500	79	200	<5	<400	32	<100
1016154	36 32 43	120 18 59	<10	1,500	300	55	100	<5	<400	13	<100
1016164	36 32 46	120 12 25	<10	4,000	200	3,020	200	<5	<400	299	<100
1017154	36 27 29	120 19 14	20	2,400	400	37	300	18	<400	23	200
1017173	36 27 34	120 7 8	<10	13,600	<200	2,190	300	<5	<400	270	<100
1114144	36 43 14	120 24 20	<10	9,400	200	2,580	200	<5	600	406	<100
1115131	36 38 49	120 30 51	30	1,100	400	68	200	14	<400	13	100
1115144	36 37 59	120 24 24	<10	13,600	<200	2,380	400	<5	<400	148	<100
1115153	36 37 59	120 18 48	<10	41,600	300	2,290	400	<5	600	1,180	<100
1116144	36 32 44	120 24 36	<10	<1,000	300	2,360	200	<5	<400	57	<100
1117144	36 27 30	120 24 41	160	2,700	1,300	55	700	148	<400	96	1,000
1212111	36 54 29	120 42 36	<10	2,400	500	81	200	<5	<400	22	<100
1213134	36 48 28	120 29 39	<10	4,100	300	96	100	<5	<400	21	<100
1214123	36 43 17	120 37 12	60	3,100	600	46	400	68	<400	31	600
1214133	36 43 13	120 30 39	50	1,800	700	49	300	40	<400	24	300
1214134	36 43 15	120 29 45	<10	5,800	200	1,070	200	<5	<400	129	<100
1214144	36 43 15	120 23 15	<10	22,400	<200	1,490	200	<5	<400	275	<100
1215134	36 38 0	120 29 47	<10	1,800	300	2,970	200	<5	<400	156	<100
1218154	36 22 17	120 17 3	<10	1,600	500	149	200	<5	<400	18	<100
1315123	36 37 12	120 37 15	30	2,400	400	35	200	24	<400	24	300
1315134	36 37 8	120 29 48	<10	1,000	300	2,930	400	<5	<400	128	<100
1315154	36 37 7	120 16 49	<10	2,000	200	378	200	<5	<400	249	<100
1316154	36 31 52	120 16 49	<10	2,200	<200	57	200	<5	<400	29	<100
1316163	36 31 56	120 11 12	<10	46,700	<200	2,340	200	<5	<400	442	<100
1318163	36 21 30	120 11 32	140	4,100	900	45	500	129	<400	73	700
1412124	36 52 50	120 37 3	<10	2,300	500	74	200	<5	<400	15	<100
1413134	36 47 35	120 30 45	<10	5,000	300	79	200	<5	<400	11	<100
1413141	36 48 25	120 24 19	<10	25,000	<200	2,610	200	<5	500	430	<100
1413144	36 47 37	120 24 15	<10	69,100	<200	2,390	200	<5	<400	405	<100
1415144	36 37 8	120 24 24	<10	9,500	200	2,760	300	<5	500	212	100
1417161	36 27 24	120 11 39	<10	4,700	<200	244	100	<5	<400	30	<100
1512134	36 52 50	120 31 37	1,310	6,200	2,900	91	2,800	504	600	291	1,200

Table C. Extractable elements for Panoche Fan at 1:5

Field ID	Latitude	Longitude	Al ppm	B ppb	Ba ppb	Ca ppm	Cr ppb	Fe ppm	Li ppb	Mg ppm	Mn ppb
1513141	36 48 24	120 25 17	<10	2,500	300	51	300	5	<400	12	<100
1514123	36 42 25	120 39 17	<10	2,800	1,000	819	300	6	500	99	<100
1514154	36 42 21	120 19 11	<10	9,200	<200	922	300	<5	<400	270	<100
1515133	36 37 10	120 32 56	<10	1,600	<200	70	300	<5	<400	7	100
1515144	36 37 9	120 25 31	<10	1,300	400	96	200	<5	<400	7	<100
1517174	36 26 41	120 6 12	<10	7,500	<200	2,040	200	<5	<400	253	<100
1518154	36 21 24	120 19 11	<10	1,200	300	141	200	<5	<400	19	<100
1613134	36 47 34	120 32 57	<10	2,300	300	59	200	<5	<400	9	<100
1614123	36 42 26	120 40 27	<10	2,200	<200	2,260	200	<5	400	316	<100
1614144	36 42 22	120 26 30	<10	1,900	400	62	200	<5	<400	16	<100
1614151	36 43 7	120 20 1	<10	11,000	<200	9	200	9	<400	5	<100
1615153	36 37 6	120 21 1	<10	30,500	200	2,380	400	<5	<400	125	<100
1617154	36 26 37	120 20 18	40	3,700	600	36	400	40	<400	54	400
1617161	36 27 27	120 13 46	<10	2,800	300	42	300	<5	<400	12	<100
1618163	36 21 26	120 14 45	<10	1,300	400	65	200	<5	<400	5	<100
1713124	36 47 35	120 40 29	<10	2,700	300	48	200	<5	<400	13	<100
1713142	36 48 20	120 28 28	<10	7,000	200	226	200	<5	<400	36	<100
1714131	36 43 10	120 34 5	<10	3,200	300	52	300	5	<400	12	<100
1715133	36 37 11	120 35 5	<10	2,200	<200	1,530	300	<5	<400	79	<100
1715144	36 37 7	120 27 39	<10	4,800	<200	2,500	200	<5	<400	118	<100
1716163	36 31 54	120 15 35	<10	<1,000	500	80	200	<5	<400	38	<100
1717171	36 27 30	120 8 24	<10	6,300	<200	709	200	<5	<400	127	<100
1812122	36 53 23	120 42 29	10	3,500	<200	29	200	9	<400	7	<100
1813122	36 48 21	120 42 33	<10	4,200	<200	509	200	<5	<400	54	<100
1816144	36 31 54	120 28 45	<10	3,900	<200	412	400	<5	<400	31	<100
1912143	36 51 59	120 29 20	<10	11,900	200	2,800	200	<5	<400	402	<100
1914133	36 41 33	120 36 7	30	3,200	500	29	200	29	<400	18	300
1915144	36 36 15	120 28 43	<10	1,900	200	3,140	400	<5	<400	143	100
1916163	36 30 59	120 16 42	<10	1,200	400	67	200	<5	<400	29	<100
1916174	36 31 2	120 9 9	<10	45,000	<200	2,260	200	<5	<400	297	<100
1917164	36 25 46	120 15 58	60	1,800	500	37	300	45	<400	20	200
1918161	36 21 21	120 15 55	110	2,100	1,000	75	400	89	<400	46	600
2012122	36 52 45	120 41 19	<10	3,600	<200	34	200	<5	<400	7	<100
2013142	36 47 29	120 28 29	<10	6,000	400	77	300	<5	<400	17	<100
2015162	36 37 1	120 15 33	<10	1,400	200	147	200	<5	<400	86	<100
2016144	36 31 1	120 27 40	<10	1,200	300	3,010	200	<5	<400	479	200
2112123	36 51 58	120 40 10	<10	2,200	300	55	200	<5	<400	14	<100
2112124	36 51 57	120 39 15	<10	1,700	200	77	200	<5	<400	14	<100
2112133	36 51 57	120 33 40	<10	5,100	<200	217	200	<5	<400	32	<100
2112134	36 51 57	120 32 42	<10	1,500	300	83	100	<5	<400	17	<100

Table C. Extractable elements for Panoche Fan at 1:5

Field ID	Latitude	Longitude	Al ppm	B ppb	Ba ppb	Ca ppm	Cr ppb	Fe ppm	Li ppb	Mg ppm	Mn ppb
2114132	36 42 19	120 33 57	<10	<1,000	400	63	200	<5	<400	16	<100
2115144	36 36 17	120 26 36	<10	9,200	<200	2,290	200	<5	<400	81	<100
2212114	36 51 56	120 44 43	<10	2,200	500	85	200	<5	<400	10	<100
2213131	36 47 31	120 31 49	90	3,200	600	53	400	58	<400	40	400
2213134	36 46 43	120 31 59	<10	4,700	200	93	200	<5	<400	16	<100
2216164	36 31 3	120 12 24	<10	11,800	<200	872	200	<5	<400	297	<100
2313142	36 47 31	120 25 13	<10	3,600	200	509	200	<5	<400	136	<100
2314134	36 41 28	120 30 51	<10	2,300	200	2,290	300	<5	<400	324	100
2413134	36 46 43	120 29 42	<10	3,200	400	72	200	<5	<400	14	<100
2416152	36 31 47	120 17 45	<10	1,400	3,400	69	200	<5	<400	22	<100
2417144	36 25 44	120 23 37	<10	2,000	300	37	200	<5	<400	12	<100
2417154	36 25 45	120 17 4	30	1,600	600	42	300	31	<400	24	300
2513134	36 45 51	120 29 43	<10	1,900	400	89	200	<5	<400	20	<100
2515134	36 35 24	120 29 47	<10	2,700	300	3,150	600	<5	<400	111	100
2515122	36 36 15	120 37 16	<10	1,400	600	113	200	<5	<400	14	<100
2516154	36 30 9	120 16 49	<10	2,100	300	50	200	<5	<400	17	<100
2516162	36 30 57	120 11 10	<10	46,000	200	2,260	400	<5	<400	323	<100
2516164	36 30 11	120 10 14	<10	24,700	300	1,790	200	<5	<400	272	<100
2518151	36 20 27	120 17 3	20	2,800	300	47	200	13	<400	10	100
2612122	36 51 53	120 38 2	<10	14,200	300	1,940	200	<5	400	279	<100
2612133	36 51 6	120 31 30	<10	1,900	400	88	300	<5	<400	24	<100
2613143	36 45 51	120 25 15	<10	19,300	300	320	200	<5	<400	74	<100
2615144	36 35 24	120 24 26	<10	6,000	<200	412	200	<5	<400	40	<100
2616144	36 30 8	120 24 25	<10	1,900	<200	3,020	200	<5	<400	267	<100
2616151	36 30 55	120 17 55	<10	3,600	200	163	200	<5	<400	70	<100
2616154	36 30 8	120 17 54	<10	2,200	300	52	100	<5	<400	10	<100
2713111	36 46 39	120 44 50	<10	2,100	200	1,820	200	<5	<400	126	100
2713141	36 46 38	120 25 20	<10	4,500	<200	499	200	<5	<400	86	<100
2715132	36 36 12	120 32 54	<10	2,200	200	2,950	300	<5	<400	214	100
2715154	36 35 20	120 18 57	<10	21,300	200	2,670	300	<5	<400	346	<100
2717154	36 24 53	120 19 13	<10	1,100	300	57	200	<5	<400	16	<100
2717171	36 25 45	120 6 17	<10	6,800	<200	81	300	<5	<400	30	<100
2813144	36 45 51	120 26 27	<10	3,000	400	50	200	<5	<400	13	<100
2814154	36 40 36	120 20 1	<10	54,800	200	1,520	300	<5	<400	55	<100
2815144	36 35 22	120 26 35	<10	5,500	<200	2,710	200	<5	500	201	<100
2816152	36 30 53	120 21 0	<10	<1,000	300	3,060	200	<5	<400	85	<100
2816164	36 30 9	120 13 31	<10	2,600	300	2,360	200	<5	<400	187	<100
2818164	36 19 41	120 13 47	<10	1,600	<200	38	200	<5	<400	12	<100
2916152	36 30 55	120 22 6	<10	<1,000	300	2,910	200	<5	<400	91	<100
2916174	36 30 11	120 8 5	<10	42,200	200	2,330	300	<5	<400	329	<100

Table C. Extractable elements for Panoche Fan at 1:5

Field ID	Latitude	Longitude	Al ppm	B ppb	Ba ppb	Ca ppm	Cr ppb	Fe ppm	Li ppb	Mg ppm	Mn ppb
2917174	36 24 57	120 8 21	<10	2,500	<200	33	200	<5	<400	10	<100
3013144	36 45 50	120 28 39	<10	1,300	700	114	200	<5	<400	21	<100
3013152	36 46 41	120 23 0	<10	5,300	200	2,780	300	<5	<400	420	<100
3015151	36 36 11	120 22 13	<10	6,100	<200	1,940	400	<5	<400	18	<100
3015161	36 36 7	120 15 38	<10	1,900	300	2,950	300	<5	<400	336	100
3018164	36 19 40	120 15 56	<10	1,600	400	69	200	<5	<400	5	<100
3112134	36 50 14	120 34 53	<10	7,400	<200	1,650	200	<5	<400	177	<100
3115144	36 34 31	120 28 46	<10	1,600	300	78	200	<5	<400	11	<100
3116151	36 30 3	120 22 12	<10	<1,000	400	2,800	200	<5	<400	227	<100
3116154	36 29 15	120 22 16	<10	1,200	500	80	200	<5	<400	26	<100
3118164	36 18 48	120 15 55	90	1,600	500	39	400	78	<400	49	800
3213124	36 44 59	120 40 32	<10	1,000	500	86	200	<5	<400	16	<100
3215153	36 34 31	120 22 8	<10	2,900	200	1,560	200	<5	<400	81	<100
3312132	36 51 2	120 33 38	<10	18,700	<200	255	200	<5	<400	38	<100
3314131	36 40 34	120 32 59	<10	<1,000	500	84	200	<5	<400	13	<100
3314144	36 39 45	120 26 31	<10	9,200	200	2,730	300	<5	<400	341	<100
3317154	36 24 1	120 20 18	80	2,000	800	60	300	63	<400	39	700
3412124	36 50 15	120 38 10	<10	12,300	<200	2,550	200	<5	400	303	<100
3413134	36 44 57	120 31 51	30	2,000	600	43	200	40	<400	18	300
3414144	36 39 44	120 25 26	<10	2,800	300	155	200	<5	<400	28	<100
3416161	36 30 6	120 12 26	<10	4,800	<200	85	200	<5	<400	30	<100
3513121	36 45 47	120 37 15	<10	<1,000	300	84	100	<5	<400	15	<100
3514123	36 39 50	120 38 16	<10	4,200	300	3,130	200	<5	600	378	<100
3515144	36 34 30	120 24 25	<10	1,200	200	3,260	200	<5	<400	154	<100
3613144	36 45 0	120 23 13	<10	1,800	400	146	200	<5	<400	26	<100
3614152	36 40 31	120 17 42	320	6,000	1,300	48	1,700	664	<400	179	1,400
3615121	36 35 0	120 36 16	<10	<1,000	500	71	200	<5	<400	6	<100
3615133	36 34 31	120 30 43	<10	2,500	200	2,460	300	<5	<400	183	200
3615134	36 34 30	120 29 48	<10	4,200	300	449	200	<5	<400	38	<100

Table C. Extractable elements for Panoche Fan at 1:5

Field ID	Na ppm	Ni ppb	Si ppm	Sr ppb	Ti ppb	V ppb	Zn ppb	Se ppm	Cl ppm	SO4 ppm	EC umho/cm	pH
0113134	690	<500	67	370	300	<600	<300	.023	75	880	600	8.7
0117143	470	<500	97	10,100	200	<600	<300	.092	70	9,100	2,750	7.7
0117154	190	<500	66	390	200	<600	<300	.005	32	130	210	8.6
0117163	3,890	<500	46	8,190	300	<600	<300	.080	310	15,000	4,000	7.1
0117164	440	600	560	330	700	<600	500	.007	54	310	380	9.2
0214122	40	<500	54	730	200	<600	<300	<.003	10	55	110	8.2
0214124	260	<500	64	410	300	<600	<300	.020	28	250	270	8.1
0313124	2,200	<500	53	13,100	<100	<600	<300	.019	320	12,000	3,800	7.8
0315123	1,090	<500	97	4,010	200	<600	<300	.089	35	5,400	3,000	7.4
0316134	850	<500	92	4,080	<100	<600	<300	2.200	160	9,900	3,100	7.7
0316144	380	<500	94	14,800	<100	<600	<300	.074	23	9,200	2,700	7.7
0317162	420	<500	90	330	<100	<600	<300	.006	85	400	390	8.7
0413114	260	<500	32	660	<100	<600	<300	<.003	19	170	260	8.3
0413122	460	<500	41	380	200	<600	<300	.003	200	280	440	8.8
0413124	1,300	<500	58	6,880	200	<600	300	.007	160	5,400	2,000	8.0
0414144	380	<500	145	410	200	<600	400	.010	50	230	320	8.6
0417163	420	<500	74	920	200	<600	400	.007	51	810	500	8.3
0513144	1,480	<500	47	14,400	<100	<600	<300	.110	85	11,000	3,500	7.9
0514144	120	<500	52	680	<100	<600	<300	.004	22	110	190	8.3
0515151	3,230	<500	46	9,010	200	<600	300	.003	29	14,000	4,400	8.0
0515153	3,220	<500	62	13,900	<100	<600	<300	.200	520	13,000	4,700	8.3
0516131	400	<500	117	2,930	200	<600	300	.006	16	2,600	1,000	7.6
0517161	280	<500	88	240	400	<600	<300	.003	44	160	260	8.9
0517174	3,450	<500	34	7,250	200	<600	<300	.017	130	17,000	5,000	7.8
0518173	180	<500	51	270	<100	<600	<300	<.003	11	120	180	8.6
0613134	380	<500	61	420	<100	<600	<300	<.003	89	310	380	8.6
0614144	60	<500	51	700	200	<600	<300	.005	7	48	130	8.5
0615131	300	<500	1,100	560	8,500	1,100	900	.007	16	100	240	9.1
0615132	480	<500	69	11,300	<100	<600	<300	.028	10	8,500	2,500	7.8
0617164	230	<500	76	730	<100	<600	<300	.005	50	110	290	8.0
0618164	590	<500	76	15,300	200	<600	<300	.027	12	9,300	2,800	7.7
0618173	310	<500	228	290	200	<600	400	<.003	18	84	240	9.1
0714124	160	<500	60	610	200	<600	<300	.005	17	170	170	8.6
0714133	70	<500	55	610	200	<600	<300	.003	10	75	140	8.3
0714144	300	600	716	640	6,000	700	800	.003	27	110	230	9.3
0715144	120	<500	86	6,780	200	<600	<300	.015	17	3,400	1,200	7.9
0717171	1,730	<500	37	4,960	200	<600	<300	.035	50	7,400	2,500	7.8
0717174	1,590	<500	61	8,770	200	<600	<300	.031	80	11,000	3,350	7.6
0815133	470	<500	387	540	500	800	600	.009	18	190	360	9.0
0816141	400	<500	101	8,800	<100	<600	<300	.104	16	8,800	2,700	7.6

Table C. Extractable elements for Panoche Fan at 1:5

Field ID	Na ppm	Ni ppb	Si ppm	Sr ppb	Ti ppb	V ppb	Zn ppb	Se ppm	Cl ppm	SO4 ppm	EC umho/cm	pH
0816144	450	<500	96	4,720	<100	<600	<300	.083	23	9,200	2,800	7.4
0818163	300	<500	82	340	400	<600	300	.003	30	220	270	8.6
0915153	5,660	<500	37	10,800	200	<600	<300	.145	920	18,000	8,700	8.2
0916154	3,560	<500	78	13,200	<100	<600	<300	.094	270	15,000	4,900	8.0
0917164	160	<500	63	670	200	<600	<300	<.003	48	210	220	8.3
1012123	130	<500	44	980	<100	<600	<300	<.003	31	140	170	7.9
1014122	80	<500	67	7,580	200	<600	<300	.022	9	8,000	2,400	7.8
1015121	410	<500	104	6,880	<100	<600	<300	.036	19	6,400	1,800	7.6
1016151	120	<500	69	750	200	<600	<300	.005	28	170	230	8.3
1016154	140	<500	62	450	<100	<600	<300	<.003	17	120	190	7.7
1016164	290	<500	89	19,800	200	<600	<300	<.003	79	9,700	2,700	7.8
1017154	450	<500	169	320	400	<600	400	.004	45	270	410	8.7
1017173	3,930	<500	40	6,000	200	<600	<300	.070	110	15,000	7,200	7.7
1114144	2,230	<500	64	18,000	<100	<600	<300	.065	17	12,000	3,800	7.7
1115131	190	<500	155	410	400	<600	<300	.003	13	95	210	8.4
1115144	4,730	700	60	12,700	<100	<600	500	.310	370	14,000	7,500	8.0
1115153	11,100	<500	25	18,900	200	<600	<300	.310	1,900	33,000	6,900	7.4
1116144	140	<500	96	6,690	200	<600	<300	.030	28	5,900	1,900	7.7
1117144	330	600	576	660	1,000	1,100	300	.005	12	120	260	9.5
1212111	110	<500	30	4,080	200	<600	300	<.003	36	110	190	8.3
1213134	690	<500	56	770	200	<600	<300	.033	140	1,100	700	8.3
1214123	320	<500	269	440	800	<600	500	.014	26	88	250	8.8
1214133	290	<500	231	420	300	<600	<300	.006	17	140	260	8.8
1214134	1,370	<500	62	7,110	200	<600	<300	.010	30	5,500	2,100	7.8
1214144	5,360	<500	31	12,200	<100	<600	<300	.240	2,900	11,000	12,000	8.2
1215134	440	<500	78	10,700	<100	<600	600	.035	24	10,000	2,600	7.6
1218154	110	<500	63	1,030	200	<600	<300	.006	41	160	230	8.2
1315123	250	<500	192	270	300	600	<300	<.003	10	90	200	8.7
1315134	200	<500	84	11,300	<100	<600	<300	.006	8	8,800	2,400	7.1
1315154	850	<500	45	6,740	<100	<600	<300	.013	270	3,000	1,400	7.7
1316154	480	<500	46	590	200	<600	<300	<.003	83	810	500	8.4
1316163	5,300	<500	38	24,500	<100	<600	<300	.030	220	20,000	9,000	7.8
1318163	440	500	497	390	400	<600	300	<.003	30	130	330	9.2
1412124	180	<500	62	680	200	<600	300	.019	30	180	240	8.0
1413134	1,020	<500	62	570	200	<600	<300	.044	380	1,200	900	8.6
1413141	2,750	<500	48	18,800	<100	<600	<300	.010	120	14,000	4,400	7.9
1413144	4,820	600	52	11,100	200	<600	<300	.012	220	15,000	4,500	8.0
1415144	2,150	<500	62	16,400	<100	<600	<300	.250	450	11,000	3,800	7.4
1417161	530	<500	45	860	<100	<600	<300	.017	27	1,500	700	7.6
1512134	690	900	3,390	1,250	15,400	3,300	1,300	.022	620	490	600	9.3

Table C. Extractable elements for Panoche Fan at 1:5

Field ID	Na ppm	Ni ppb	Si ppm	Sr ppb	Ti ppb	V ppb	Zn ppb	Se ppm	Cl ppm	SO4 ppm	EC umho/cm	pH
1513141	290	<500	124	630	400	<600	300	.007	43	210	300	8.6
1514123	130	<500	93	3,380	200	<600	<300	.011	14	2,200	1,000	7.8
1514154	2,660	<500	39	7,270	300	<600	<300	.011	120	8,400	3,300	8.1
1515133	190	<500	94	350	300	<600	300	.013	27	230	240	8.3
1515144	170	<500	59	650	<100	<600	<300	.013	58	260	260	8.3
1517174	1,680	<500	49	9,230	400	<600	<300	.013	75	10,000	2,980	7.8
1518154	160	<500	108	1,020	200	<600	<300	<.003	33	390	270	8.1
1613134	350	<500	65	430	200	<600	<300	.008	37	410	360	8.5
1614123	130	<500	65	12,100	200	<600	<300	.013	11	8,500	2,200	7.6
1614144	330	<500	56	600	200	<600	300	<.003	38	440	360	8.6
1614151	1,550	<500	96	170	400	2,000	<300	.005	540	1,300	1,300	9.9
1615153	4,860	<500	72	10,300	<100	<600	<300	.150	390	16,000	8,200	8.1
1617154	390	600	215	540	<100	<600	<300	.004	31	180	320	8.8
1617161	450	<500	80	390	200	<600	300	.004	85	430	440	8.5
1618163	160	<500	73	710	200	<600	300	<.003	29	150	190	8.0
1713124	150	<500	38	490	<100	<600	<300	.005	16	90	180	8.6
1713142	1,030	<500	53	1,650	<100	<600	<300	.027	61	2,500	1,200	8.2
1714131	320	<500	62	440	400	<600	300	.017	78	50	330	8.4
1715133	450	<500	74	7,620	400	<600	<300	.011	10	4,700	1,800	7.9
1715144	3,090	<500	82	16,400	<100	<600	<300	.230	65	14,000	4,400	7.8
1716163	70	<500	49	940	<100	<600	<300	<.003	29	120	180	8.2
1717171	1,490	<500	56	3,220	200	<600	<300	.110	300	4,800	2,100	8.0
1812122	230	<500	50	380	200	<600	<300	<.003	66	160	270	8.4
1813122	140	<500	43	2,880	200	<600	300	<.003	14	1,600	700	8.0
1816144	1,000	<500	98	1,370	200	<600	<300	.014	470	2,300	1,400	7.6
1912143	1,180	<500	66	10,800	<100	<600	<300	.062	290	10,000	3,200	7.6
1914133	480	<500	136	370	400	<600	<300	.010	56	490	490	8.9
1915144	350	<500	99	12,000	200	<600	<300	.011	16	7,900	2,500	7.6
1916163	120	<500	62	680	200	<600	300	<.003	18	140	200	8.3
1916174	6,470	<500	28	10,100	<100	<600	<300	.016	350	20,000	9,300	7.9
1917164	270	<500	217	390	600	<600	<300	<.003	22	140	240	8.8
1918161	290	<500	434	580	800	<600	400	<.003	15	120	250	9.2
2012122	310	<500	37	520	300	<600	<300	<.003	60	170	280	8.8
2013142	1,260	<500	55	720	300	<600	300	.110	540	1,700	1,100	8.6
2015162	570	<500	38	1,980	400	<600	500	<.003	180	1,100	700	7.9
2016144	150	<500	101	5,040	200	<600	<300	.110	11	9,300	2,700	7.7
2112123	150	<500	26	900	<100	<600	<300	<.003	26	170	190	8.2
2112124	110	<500	30	720	<100	<600	<300	<.003	23	170	180	8.0
2112133	770	<500	51	1,290	<100	<600	<300	.048	180	1,700	900	8.1
2112134	130	<500	40	670	<100	<600	<300	.065	30	240	230	8.3

Table C. Extractable elements for Panoche Fan at 1:5

Field ID	Na ppm	Ni ppb	Si ppm	Sr ppb	Ti ppb	V ppb	Zn ppb	Se ppm	Cl ppm	SO4 ppm	EC umho/cm	pH
2114132	70	<500	37	600	<100	<600	<300	<.003	24	55	140	8.3
2115144	5,710	<500	79	12,500	<100	<600	<300	.570	260	19,000	8,700	7.8
2212114	160	<500	55	550	200	<600	<300	<.003	22	180	220	8.4
2213131	540	<500	339	400	500	<600	<300	.006	44	410	500	9.0
2213134	1,210	<500	45	700	300	<600	<300	.030	470	2,100	1,300	8.6
2216164	1,640	<500	53	4,320	<100	<600	<300	.090	240	6,600	2,300	7.9
2313142	770	<500	55	3,600	200	<600	<300	.114	470	7,800	1,300	8.0
2314134	140	<500	62	11,800	200	<600	300	.029	15	7,200	2,200	7.5
2413134	780	<500	53	510	200	<600	300	.055	310	780	750	8.6
2416152	110	<500	70	570	200	<600	<300	.006	24	150	210	8.4
2417144	220	<500	36	410	100	<600	<300	.005	25	190	280	8.7
2417154	240	<500	166	390	200	<600	<300	.003	16	140	210	8.8
2513134	220	<500	60	760	<100	<600	<300	.018	33	260	310	8.2
2515134	210	<500	91	11,600	<100	<600	<300	.056	17	8,500	2,460	7.1
2515122	140	<500	95	960	200	<600	<300	<.003	21	110	250	8.3
2516154	200	<500	59	450	200	<600	<300	.005	23	160	230	8.6
2516162	6,860	<500	41	10,100	<100	<600	<300	.065	460	19,000	10,000	7.6
2516164	2,360	<500	36	8,380	<100	<600	<300	.032	24	11,000	3,400	7.9
2518151	190	<500	124	450	400	<600	300	<.003	25	93	170	8.3
2612122	3,430	<500	52	13,000	300	<600	<300	.045	230	12,000	4,400	7.7
2612133	350	<500	54	1,000	300	<600	<300	.008	220	380	450	8.4
2613143	3,120	<500	48	3,330	<100	<600	500	.560	880	6,200	3,000	8.1
2615144	1,430	<500	90	2,310	300	<600	<300	.014	54	3,700	1,700	8.2
2616144	410	<500	104	12,800	200	<600	<300	.063	13	9,400	2,700	7.7
2616151	430	<500	52	1,190	200	<600	<300	.015	150	60	700	7.6
2616154	210	<500	66	330	200	<600	<300	.006	23	230	250	8.5
2713111	150	<500	54	6,900	<100	<600	<300	.008	14	5,100	1,700	7.4
2713141	1,130	<500	52	3,360	200	<600	<300	.070	260	4,000	1,700	7.5
2715132	420	<500	73	12,200	<100	<600	<300	.046	16	9,000	2,700	7.8
2715154	1,450	<500	46	8,270	200	<600	<300	.087	51	11,000	3,400	7.6
2717154	150	<500	55	570	300	<600	<300	.003	25	93	200	8.4
2717171	2,690	<500	23	680	<100	<600	<300	.016	450	4,900	2,500	8.8
2813144	470	<500	60	490	200	<600	300	.011	57	500	470	8.6
2814154	6,610	<500	21	8,540	200	<600	<300	.023	1,200	20,000	9,200	8.8
2815144	2,330	<500	84	15,700	<100	<600	<300	.150	46	12,000	3,700	7.8
2816152	90	<500	82	8,130	<100	<600	<300	.022	21	9,300	2,400	7.6
2816164	430	<500	76	9,810	200	<600	<300	.035	33	8,800	2,300	7.7
2818164	210	<500	66	250	<100	<600	<300	<.003	47	110	220	8.4
2916152	110	<500	95	8,050	<100	<600	<300	.028	18	8,000	2,400	7.7
2916174	4,990	<500	34	23,500	200	<600	300	.005	120	19,000	6,500	7.9

Table 6. Extractable elements for Panoche Fan at 1:5

Field ID	Na ppm	Ni ppb	Si ppm	Sr ppb	Ti ppb	V ppb	Zn ppb	Se ppm	Cl ppm	SO4 ppm	EC umho/cm	pH
2917174	300	<500	36	230	<100	<600	<300	<.003	32	240	290	8.7
3013144	230	<500	53	800	200	<600	<300	.004	57	220	320	8.1
3013152	600	<500	97	23,000	<100	<600	300	.010	31	9,800	2,900	7.6
3015151	8,350	<500	73	8,650	<100	<600	<300	1.200	990	21,000	11,000	8.5
3015161	520	<500	122	33,300	200	<600	<300	.004	110	9,300	2,800	7.8
3018164	290	<500	77	360	<100	<600	<300	.003	21	320	290	8.6
3112134	1,820	<500	57	8,940	300	<600	<300	.031	100	8,100	3,000	8.0
3115144	200	<500	121	330	<100	<600	<300	.016	14	170	260	8.4
3116151	160	<500	106	11,000	200	<600	<300	.041	15	8,600	2,600	7.8
3116154	90	<500	78	890	200	<600	<300	.003	25	130	200	8.3
3118164	260	<500	426	310	200	800	400	<.003	17	80	190	8.9
3213124	100	<500	40	720	200	<600	<300	<.003	17	130	180	8.3
3215153	1,290	<500	78	6,170	<100	<600	<300	.240	21	8,300	2,300	7.8
3312132	3,510	<500	43	2,140	200	<600	<300	.500	1,300	6,300	3,400	8.5
3314131	70	<500	57	780	<100	<600	<300	.003	12	120	120	8.4
3314144	2,230	<500	65	17,200	200	<600	<300	.104	380	12,000	3,900	7.8
3317154	280	<500	307	400	500	<600	<300	.008	25	190	270	9.1
3412124	3,050	<500	53	14,300	200	<600	<300	.036	440	12,000	4,700	8.0
3413134	280	<500	150	440	200	<600	<300	.017	17	79	230	8.5
3414144	540	<500	56	1,210	200	<600	<300	.009	310	130	650	8.3
3416161	630	<500	89	660	200	<600	<300	.013	100	1,200	700	8.5
3513121	60	<500	42	700	<100	<600	<300	<.003	26	89	160	8.2
3514123	150	<500	70	13,100	<100	<600	<300	.017	19	9,300	2,600	7.5
3515144	180	<500	97	15,100	200	<600	<300	.038	34	8,200	2,600	7.8
3613144	400	<500	52	1,240	<100	<600	<300	.030	360	410	500	7.9
3614152	1,190	1,200	1,350	740	6,500	3,600	700	<.003	200	250	900	10.3
3615121	80	<500	148	510	<100	900	<300	.005	8	56	130	8.6
3615133	500	<500	80	5,980	200	<600	<300	.062	20	7,800	2,400	7.7
3615134	760	<500	111	1,560	<100	<600	<300	.035	25	2,400	1,100	7.7