UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of stream-sediment, heavy-mineral-concentrate, and rock samples from the Sacatar Meadows Wilderness Study Area (CA-010-027), Tulare County, California

By

B. M. Adrian[1], J. G. Frisken[2], M. J. Malcolm[3],
D. L. Kelley[4], R. B. Vaughn[5], and Cliff D. Taylor[1]

Open-File Report 87-172

[1]DFC, Box 25046, MS 973, Denver, CO 80225
[2]DFC, Box 25046, MS 955, Denver, CO 80225
[3]DFC, Box 25046, MS 928, Denver, CO 80225
[4]DFC, Box 25046, MS 905, Denver, CO 80225
[5]DFC, Box 25046, MS 424, Denver, CO 80225

1987

CONTENTS

ILLUSTRATIONS

TABLES

STUDIES RELATED TO WILDERNESS

Bureau of Land Management Wilderness Study Areas

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine their mineral values, if any. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a geochemical survey of the Sacatar Meadows Wilderness Study Area (CA-010-027), Tulare County, California.

INTRODUCTION

In May 1985, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Sacatar Meadows Wilderness Study Area, Tulare County, California.

The Sacatar Meadows Wilderness Study Area comprises about 17 mi^2 (47 km^2) (11,447 acres) in the southeast corner of Tulare County, California. The study area is about 15 miles north of the town of Inyokern on U.S. highway 395 then 9 miles west up Nine Mile Canyon (fig. 1). The eastern boundary of the study area follows the Inyo/Tulare County Line along the crest of the Sierra Nevada Mountains. Access to the southern half of the WSA is by Scodie Meadow and Big Pine Meadow roads, to the central WSA via the Sacatar Canyon Road, and to the northern WSA via the Long Canyon Road. There is no access by road from the east.

The topographic relief in the study area is about 2400 ft (732 m), with a maximum elevation of 8800 ft (2682 m). Vegetation in the lower elevations is predominantly chapparal, pinyon pine, and some juniper. At the higher elevations, ponderosa pine, fir, and aspen predominate.

The Sacatar Meadows WSA is located within the Mesozoic Sierra Nevada batholith. Rock types of the batholith range from granite to gabbro. Locally, three phases of plutonic rock have been identified within the WSA (Miller and Webb, 1940). These are the Sacatar quartz diorite, the Sacatar contaminated facies, and the Sacatar mixed facies. Bergquist and Nitkiewiez (1982) and Smith (1964) classified these rocks as a tonalite.

METHODS OF STUDY

Sample Media

Analyses of the stream-sediment samples represent the chemistry of the rock material eroded from the drainage basin upstream from each sample site. Such information is useful in identifying those basins which contain concentrations of elements that may be related to mineral deposits. Heavy-mineral-concentrate samples provide information about the chemistry of certain minerals in rock material eroded from the drainage basin upstream from each sample site. The selective concentration of minerals, many of which may be ore related, permits determination of some elements that are not easily detected in stream-sediment samples.

Analyses of unaltered or unmineralized rock samples provide background geochemical data for individual rock units. On the other hand, analyses of altered or mineralized rocks, where present, may provide useful geochemical information about the major- and trace-element assemblages associated with a mineralizing system.

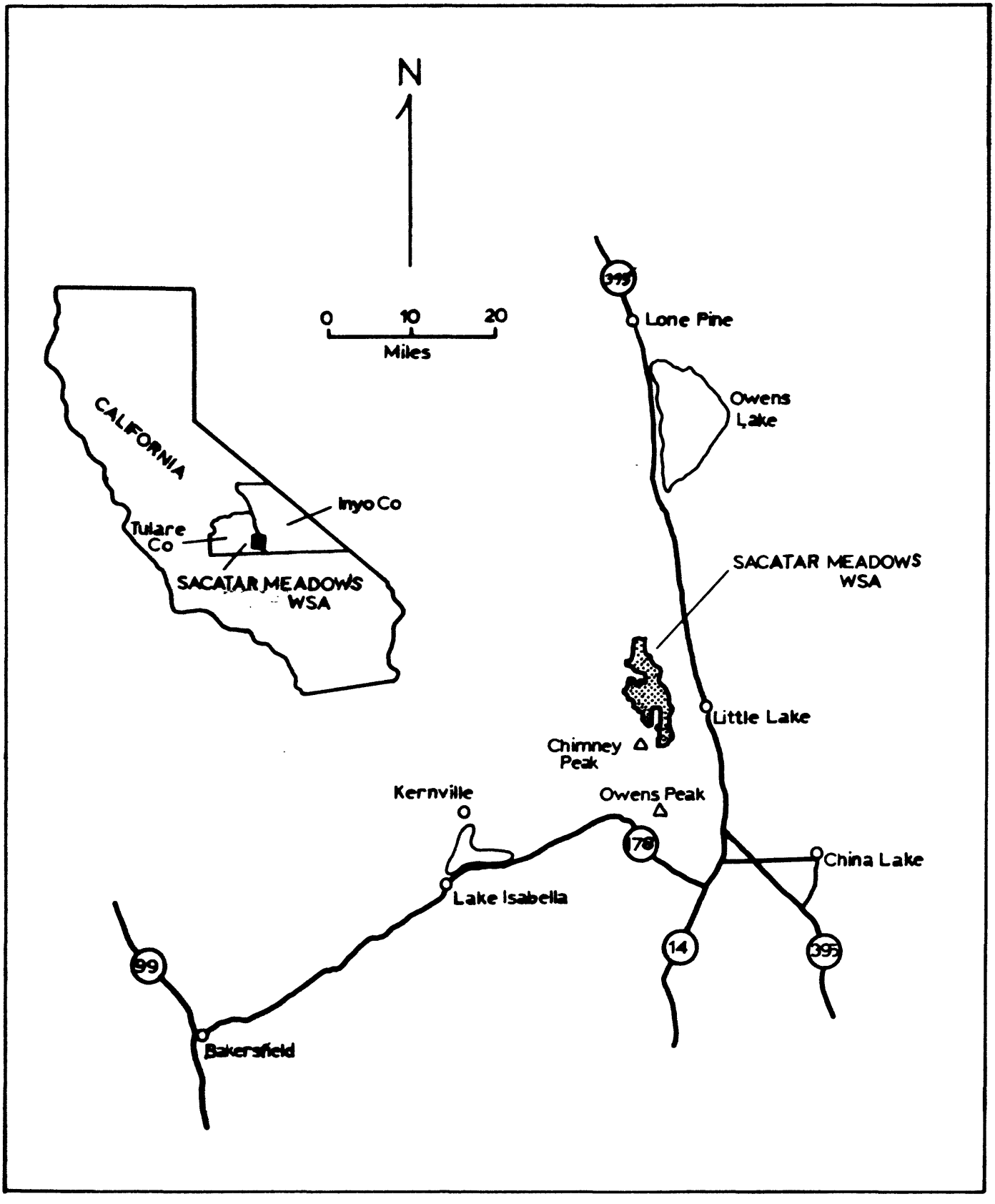

Figure 1. Location map of the Sacatar Meadows Wilderness Study Area (CA-010-027), Tulare County, California.

Sample Collection

Heavy-mineral-concentrate and stream-sediment samples were collected at 21 sites (fig. 2). Rock samples were collected at 3 sites. Sampling density was about one sample site per 1.33 mi^2 for the stream sediments and heavy-mineral concentrates. The area of the drainage basins sampled ranged from .25 mi^2 to 4 mi^2.

Stream-sediment samples

The stream-sediment samples consisted of active alluvium collected primarily from first-order (unbranched) and second-order (below the junction of two first-order) streams as shown on USGS topographic map (fig. 2). Each sample was composited from several localities within an area that may extend as much as 20 ft from the site plotted on the map.

Heavy-mineral-concentrate samples

Heavy-mineral-concentrate samples were collected from the same active alluvium as the stream-sediment samples. Each bulk sample was screened with a 2.0-mm (10-mesh) screen to remove the coarse material. The less than 2.0-mm fraction was panned until most of the quartz, feldspar, organic material, and clay-sized material were removed.

Rock samples

Samples were collected from various rock types in the vicinity of the plotted site location. Descriptions of rock samples are in table 6.

Sample Preparation

The stream-sediment samples were air dried, then sieved using 80-mesh (0.17-mm) stainless-steel sieves. The portion of the sediment passing through the sieve was saved for analysis.

After air drying, bromoform (specific gravity 2.8) was used to remove the remaining quartz and feldspar from the heavy-mineral-concentrate samples that had been panned in the field. The resultant heavy-mineral sample was separated into three fractions using a large electromagnet (in this case a modified Frantz Isodynamic Separator). The most magnetic material, primarily magnetite, was not analyzed. The second fraction, largely ferromagnesian silicates and iron oxides, was saved for archival storage. The third fraction (the least magnetic material which may include the nonmagnetic ore minerals, zircon, sphene, etc.) was split using a Jones splitter. One split was hand ground for spectrographic analysis; the other split was saved for mineralogical analysis. These magnetic separates are the same separates that would be produced by using a Frantz Isodynamic Separator set at a slope of 15° and a tilt of 10° with a current of 0.1 ampere to remove the magnetite and ilmenite, and a current of 1.0 ampere to split the remainder of the sample into paramagnetic and nonmagnetic fractions.

Rock samples were crushed and then pulverized to minus 0.15 mm with ceramic plates.

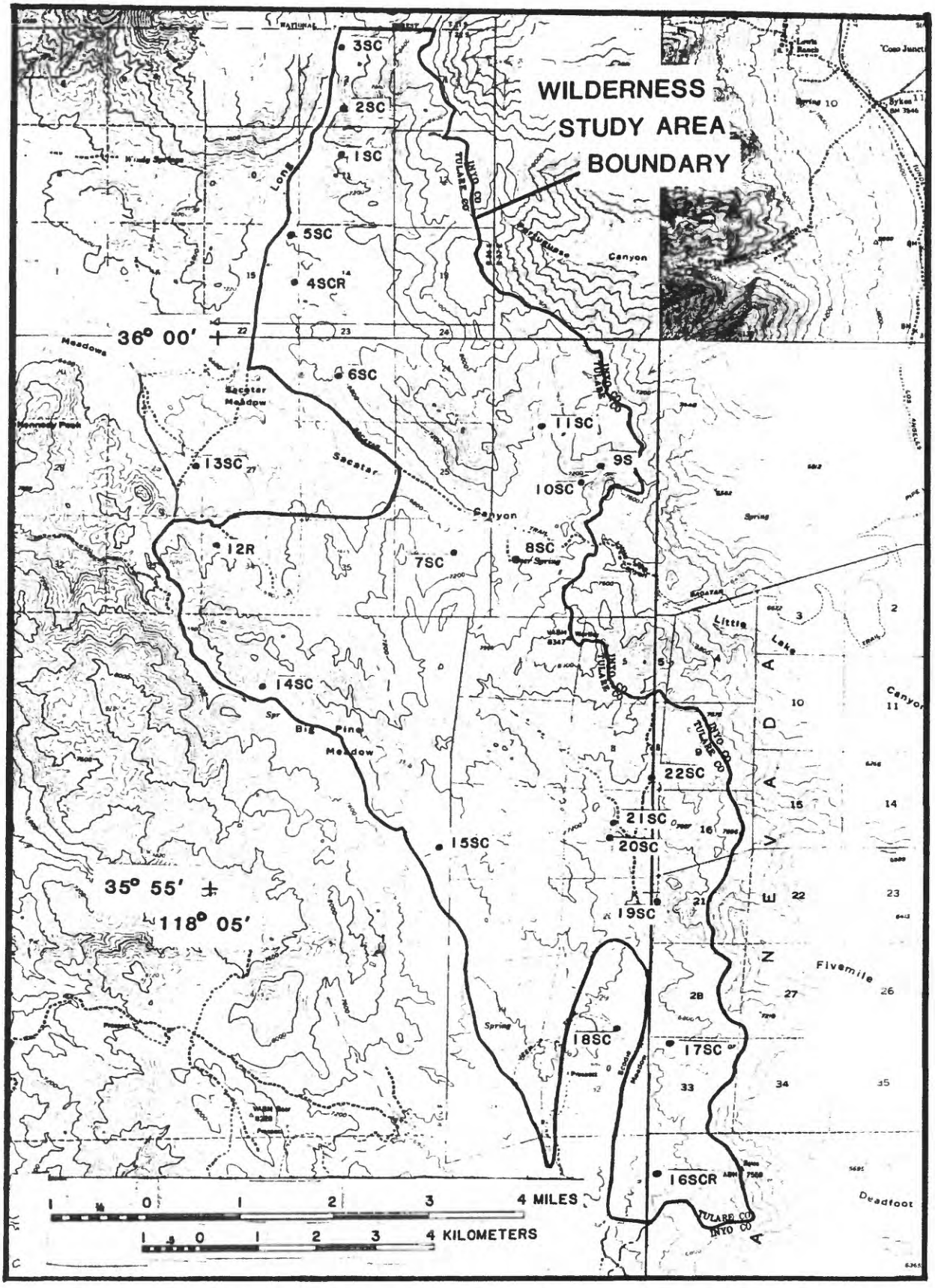

Figure 2. Localities of heavy-mineral-concentrate (C), stream-sediment (S), and rock (R) samples from the Sacatar Meadows Wilderness Study Area, Tulare County, California.

Sample Analysis

Spectrographic method

The stream-sediment, heavy-mineral-concentrate, and rock samples were analyzed for 31 elements using semiquantitative, direct-current arc emission spectrographic methods. The analyses for heavy-mineral-concentrate samples were performed by analysts in the Branch of Exploration Geochemistry using the method of Grimes and Marranzino (1968); analyses for stream-sediment and rock samples were performed by analysts in the Branch of Analytical Chemistry using the method of Myers and others (1961). The elements analyzed and their lower limits of determination are listed in table 1. For arsenic (As), gold (Au), cadmium (Cd), lanthanum (La), and thorium (Th), the lower limits of determination of the two analytical methods varies. The values in the parentheses are the limits of determination for Myers and others (1961). Spectrographic results were obtained by visual comparison of spectra derived from the sample against spectra obtained from standards made from pure oxides and carbonates. Standard concentrations are geometrically spaced over any given order of magnitude of concentration as follows: 100, 50, 20, 10, and so forth. Samples whose concentrations are estimated to fall between those values are assigned values of 70, 30, 15, and so forth. The precision of the analytical method is approximately plus or minus one reporting interval at the 83 percent confidence level and plus or minus two reporting intervals at the 96 percent confidence level (Motooka and Grimes, 1976). Values determined for the major elements, iron, magnesium, calcium, and titanium, are given in weight percent; all others are given in parts per million (micrograms/gram). Analytical data for samples from the Sacatar Meadows Wilderness Study Area are listed in tables 3, 4, and 5.

Chemical methods

Other analytical methods used on samples from the Sacatar Meadows Wilderness Study Area are summarized in table 2. The analytical method used for determining As, Bi, Cd, Sb, and Zn is a modification and adaptation for the inductively coupled plasma method (ICP) based on the method of O'Leary and Viets (1986).

Analytical results for stream-sediment, heavy-mineral-concentrate, and rock samples are listed in tables 3, 4, and 5, respectively.

ROCK ANALYSIS STORAGE SYSTEM

Upon completion of all analytical work, the analytical results were entered into a computer-based file called Rock Analysis Storage System (RASS). This data base contains both descriptive geological information and analytical data. Any or all of this information may be retrieved and converted to a binary form (STATPAC) for computerized statistical analysis or publication (VanTrump and Miesch, 1977).

DESCRIPTION OF DATA TABLES

Tables 3-5 list the results of analyses for the samples of stream sediment, heavy-mineral concentrate, and rock, respectively. For the three tables, the data are arranged so that column 1 contains the USGS-assigned sample numbers. These numbers correspond to the numbers shown on the site

location map (fig. 2). Columns in which the element headings show the letter "s" below the element symbol are emission spectrographic analyses; "aa" indicates atomic absorption analyses; "icp" indicates inductively coupled plasma-atomic emission spectroscopy; "cm" indicates colorimetric; and "dn" indicates delayed neutron activation analyses. A letter "N" in the tables indicates that a given element was looked for but not detected at the lower limit of determination shown for that element in table 1. If an element was observed but was below the lowest reporting value, a "less than" symbol (<) was entered in the tables in front of the lower limit of determination. If an element was observed but was above the highest reporting value, a "greater than" symbol (>) was entered in the tables in front of the upper limit of determination. If an element was not looked for in a sample, two dashes (--) are entered in tables 3-5 in place of an analytical value. Because of the formatting used in the computer program that produced tables 3-5, some of the elements listed in these tables (Fe, Mg, Ca, Ti, Ag, and Be) carry one or more nonsignificant digits to the right of the significant digits. The analysts did not determine these elements to the accuracy suggested by the extra zeros.

ACKNOWLEDGMENTS

A number of our colleagues also participated in preparation and analyses of these samples: preparation, Robin Sanchez; and analyses, Paul Briggs, J. G. Crock, S. Danahey, Kay Kennedy, and J. Storey.

REFERENCES CITED

Bergquist, J. R., and Nitkiewiez, A. M., 1982, Geologic map of the Domeland Wilderness and contiguous roadless areas, Kern and Tulare Counties, California: U.S. Geological Survey Miscellaneous Field Studies Map MF 1359-A, scale 1:48,000.

Crock, J. G., Lichte, F. E., and Briggs, P. H., 1983, Determination of elements in National Bureau of Standards Geological Reference Materials SRM278 obsidian and SRM668 basalt by Inductively Coupled Argon Plasma-Atomic Emission Spectrometry: Geostandards Newsletter, no. 7, p. 335-340.

Grimes, D. J., and Marranzino, A. P., 1968, Direct-current arc and alternating-current spark emission spectrographic field methods for the semiquantitative analysis of geologic materials: U.S. Geological Survey Circular 591, 6 p.

Koirtyohann, S. R., and Khalil, Moheb, 1976, Variables in the determination of mercury by cold vapor atomic absorption: Analytical Chemistry, 48, p. 136-139.

Millard, H. T., Jr., 1976, Determination of uranium and thorium in U.S. Geological Survey standard rocks by the delayed neutron technique: U.S. Geological Survey Professional Paper 840, p. 61-65.

Miller, J. W., and Webb, R. W., 1940, Descriptive geology of the Kernville quadrangle, California: California Journal of Mines and Geology, v. 36, no. 4, p. 343-378.

Motooka, J. M., and Grimes, D. J., 1976, Analytical precision of one-sixth order semiquantitative spectrographic analyses: U.S. Geological Survey Circular 738, 25 p.

Myers, A. T., Havens, R. G., and Dunton, P. J., 1961, A spectrochemical method for the semiquantitative analyses of rocks, minerals, and ores: U.S. Geological Survey Bulletin 1084-I, p. 1207-1229.

O'Leary, R. M., and Viets, J. G., 1986, Determination of antimony, arsenic, bismuth, cadmium, copper, lead, molybdenum, silver, and zinc in geologic materials by atomic absorption spectrometry using a hydrochloric acid-hydrogen peroxide digestion: Atomic Spectroscopy, 7, p. 4-8.

Smith, A. R., compiler, 1964, Geologic map of California Bakersfield sheet: California Division of Mines and Geology, scale 1:250,000.

Thompson, C. E., Nakagawa, H. M., and Van Sickle, G. H., 1968, Rapid analysis for gold in geologic materials, in Geological Survey research 1968: U.S. Geological Survey Professional Paper 600-B, p. B130-B132.

VanTrump, George, Jr., and Miesch, A. T., 1977, The U.S. Geological Survey RASS-STATPAC system for management and statistical reduction of geochemical data: Computers and Geosciences, v. 3, p. 475-488.

Welsch, E. P., 1983, Spectrophotometrical determination of tungsten in geological materials by complexing with dithiol: Talanta, v. 30, p. 876-878.

TABLE 1.--Limits of determination for the spectrographic analysis of rocks and stream sediments, based on a 10-mg sample

[The values shown are the lower limits of determination assigned by the Grimes and Marranzino method, except for those values in parentheses, which are the lower values assigned by the Myers and others method. The spectrographic limits of determination for heavy-mineral-concentrate samples are based on a 5-mg sample, and are therefore two reporting intervals higher than the limits given for rocks.]

Elements	Lower determination limit		Upper determination limit
	Percent		
Iron (Fe)	0.05		20
Magnesium (Mg)	.02		10
Calcium (Ca)	.05		20
Titanium (Ti)	.002		1
	Parts per million		
Manganese (Mn)	10		5,000
Silver (Ag)	0.5		5,000
Arsenic (As)	200	(700)	10,000
Gold (Au)	10	(15)	500
Boron (B)	10		2,000
Barium (Ba)	20		5,000
Beryllium (Be)	1		1,000
Bismuth (Bi)	10		1,000
Cadmium (Cd)	20	(30)	500
Cobalt (Co)	5		2,000
Chromium (Cr)	10		5,000
Copper (Cu)	5		20,000
Lanthanum (La)	20	(30)	1,000
Molybdenum (Mo)	5		2,000
Niobium (Nb)	20		2,000
Nickel (Ni)	5		5,000
Lead (Pb)	10		20,000
Antimony (Sb)	100		10,000
Scandium (Sc)	5		100
Tin (Sn)	10		1,000
Strontium (Sr)	100		5,000
Vanadium (V)	10		10,000
Tungsten (W)	50		10,000
Yttrium (Y)	10		2,000
Zinc (Zn)	200		10,000
Zirconium (Zr)	10		1,000
Thorium (Th)	100	(200)	2,000

TABLE 2.--Commonly used chemical methods

[AA = atomic absorption; ICP = inductively coupled plasma spectroscopy; DN = delayed neutron; and S = spectrophotometry]

Element or constituent determined	Sample type	Method	Determination limit (micrograms/ gram or ppm)	Reference
Gold (Au)	rock	AA	.1	Modification of Thompson and others, 1968.
Mercury (Hg)	rock	AA	0.02	Koirtyohann and Khalil, 1976.
Arsenic (As)	rock	ICP	5	Crock and others, 1983, and modification of O'Leary and Viets, 1986.
Antimony (Sb)	rock	ICP	2	
Zinc (Zn)	rock	ICP	2	
Bismuth (Bi)	rock	ICP	2	
Cadmium (Cd)	rock	ICP	0.1	
Thorium (Th)	rock	DN		Millard, 1976.
Uranium (U)	rock	DN		Millard, 1976.
Tungsten (W)	conc	S	5	Welsch, 1983.

TABLE 3. RESULTS OF ANALYSES OF STREAM-SEDIMENT SAMPLES FROM THE SACATAR MEADOWS WILDERNESS STUDY AREA, TULARE COUNTY, CALIFORNIA.

[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown.]

Sample	Latitude	Longitude	Fe-pct. s	Mg-pct. s	Ca-pct. s	Ti-pct. s	Mn-ppm s	Ag-ppm s	As-ppm s	Au-ppm s
SM001	36 1 39	118 3 37	7	1.5	5	.5	700	N	N	N
SM002	36 2 3	118 3 35	7	1.5	3	.3	1,000	N	N	N
SM003	36 2 38	118 3 37	7	3.0	3	.3	1,000	N	N	N
SM004	36 0 30	118 4 8	10	1.5	5	.5	700	N	N	N
SM005	36 0 56	118 4 10	10	1.5	5	.5	700	N	N	N
SM006	35 59 40	118 3 35	7	1.5	3	.3	1,000	N	N	N
SM007	35 58 5	118 2 18	10	1.5	5	.5	1,000	N	N	N
SM008	35 58 2	118 1 38	15	2.0	7	.5	1,000	N	N	N
SM009	35 58 50	118 0 40	10	1.5	5	.3	700	N	N	N
SM010	35 58 43	118 0 53	5	2.0	3	.3	700	N	N	N
SM011	35 59 13	118 1 20	7	1.5	7	.5	700	N	N	N
SM013	35 58 50	118 5 14	5	2.0	7	.3	700	N	N	N
SM014	35 56 50	118 4 28	7	1.5	3	.5	700	N	N	N
SM015	35 55 25	118 2 25	7	1.5	7	.3	700	N	N	N
SM016	35 52 25	117 59 55	7	1.5	7	.3	700	N	N	N
SM017	35 53 37	117 59 49	7	2.0	7	.3	700	N	N	N
SM018	35 54 56	117 59 59	7	1.5	7	.3	700	N	N	N
SM019	35 55 31	118 0 30	7	1.5	3	.5	700	N	N	N
SM020	35 55 41	118 0 30	7	1.5	7	.5	1,000	N	N	N
SM021	35 55 41	118 0 28	10	1.5	7	.3	700	N	N	N
SM022	35 56 2	118 0 2	7	2.0	5	.5	700	N	N	N

TABLE 3. RESULTS OF ANALYSES OF STREAM-SEDIMENT SAMPLES FROM THE SACATAR MEADOWS WILDERNESS STUDY AREA, TULARE COUNTY, CALIFORNIA.--Continued

Sample	B-ppm s	Ba-ppm s	Be-ppm s	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s
SM001	N	500	1	N	N	20	30	50	70	N	20	15
SM002	N	500	<1	N	N	15	30	30	70	N	20	10
SM003	N	300	<1	N	N	20	70	50	30	N	<20	50
SM004	N	300	<1	N	N	20	70	50	50	N	<20	15
SM005	N	300	<1	N	N	15	100	50	70	N	<20	30
SM006	N	500	1	N	N	15	30	50	50	N	<20	15
SM007	N	300	<1	N	N	15	70	50	70	N	<20	15
SM008	N	300	1	N	N	20	70	50	150	N	<20	15
SM009	10	500	1	N	N	15	50	50	50	N	<20	15
SM010	<10	700	1	N	N	15	20	50	30	N	<20	15
SM011	15	700	1	N	N	15	20	50	50	N	<20	15
SM013	<10	500	<1	N	N	15	30	70	30	N	<20	15
SM014	10	700	1	N	N	15	20	30	70	N	<20	7
SM015	<10	300	<1	N	N	15	70	30	50	N	<20	15
SM016	<10	500	<1	N	N	15	50	50	30	N	<20	20
SM017	<10	700	<1	N	N	15	30	50	50	N	<20	15
SM018	<10	500	<1	N	N	15	20	30	50	N	<20	10
SM019	<10	500	<1	N	N	15	30	70	50	N	<20	10
SM020	<10	500	<1	N	N	15	20	30	50	N	<20	10
SM021	N	300	<1	N	N	15	30	30	70	N	<20	10
SM022	<10	500	<1	N	N	15	20	50	70	N	<20	10

TABLE 3. RESULTS OF ANALYSES OF STREAM-SEDIMENT SAMPLES FROM THE SACATAR MEADOWS WILDERNESS STUDY AREA, TULARE COUNTY, CALIFORNIA.--Continued

Sample	Pb-ppm s	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s	U-ppm dn	Th-ppm dn
SM001	15	N	70	N	700	300	N	70	N	300	N	6.53	16.30
SM002	15	N	30	N	700	300	N	50	N	300	N	6.29	24.70
SM003	10	N	30	N	700	300	N	20	N	200	N	2.68	12.90
SM004	15	N	50	N	700	300	N	30	N	300	N	10.20	43.80
SM005	15	N	50	N	700	300	N	30	N	300	N	8.46	26.70
SM006	15	N	30	N	700	150	N	20	N	150	N	6.81	24.60
SM007	15	N	70	N	700	300	N	50	N	300	N	10.70	48.20
SM008	15	N	70	N	700	700	N	50	N	700	N	8.77	28.60
SM009	15	N	50	N	700	300	N	30	N	200	N	8.02	53.00
SM010	15	N	30	N	700	150	N	20	N	200	N	4.54	16.40
SM011	15	N	70	N	700	200	N	50	N	300	N	5.15	20.40
SM013	10	N	20	N	700	150	N	20	N	150	N	7.96	16.30
SM014	15	N	30	N	700	150	N	30	N	200	N	8.53	34.00
SM015	15	N	70	N	700	300	N	70	N	200	N	15.40	70.00
SM016	15	N	70	N	700	300	N	30	N	200	N	4.91	6.66
SM017	15	N	50	N	700	200	N	30	N	150	N	4.27	14.60
SM018	15	N	70	N	700	200	N	50	N	300	N	8.62	26.40
SM019	15	N	30	N	700	300	N	30	N	200	N	5.38	19.80
SM020	15	N	70	N	700	200	N	70	N	150	N	7.58	28.80
SM021	15	N	50	N	700	300	N	50	N	500	N	15.80	80.90
SM022	15	N	50	N	700	200	N	50	N	300	N	11.60	57.80

TABLE 4. RESULTS OF ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE SACATAR MEADOWS WILDERNESS STUDY AREA, TULARE COUNTY, CALIFURNIA.

[N, not detected; <, detected but below the limit of determination shown; >, determined tc be greater than the value shown.]

Sample	Latitude	Longtude	Fe-pct. s	Mg-pct. s	Ca-pct. s	Ti-pct. s	Mn-ppm s	Ag-ppm s	As-ppm s	Au-ppm s
SM001	36 1 39	118 3 37	.2	.05	3.0	1.0	150	N	N	N
SM002	36 2 3	118 3 35	.2	.07	3.0	2.0	200	N	N	N
SM003	36 2 38	118 3 37	.2	.10	2.0	.7	100	N	N	N
SM004	36 0 30	118 4 8	.3	.05	2.0	2.0	100	N	N	N
SM005	36 0 56	118 4 10	.3	.07	1.5	2.0	100	N	N	N
SM006	35 59 40	118 3 35	.5	.10	1.5	2.0	200	N	N	N
SM007	35 58 5	118 2 18	.3	.07	2.0	2.0	200	N	N	N
SM008	35 58 2	118 1 38	.5	.10	2.0	.3	150	N	N	N
SM010	35 58 43	118 0 53	.2	.05	10.0	>2.0	500	N	N	N
SM011	35 59 13	118 1 20	.5	.05	5.0	2.0	200	N	N	N
SM013	35 58 50	118 5 14	.7	.07	7.0	>2.0	300	N	N	N
SM014	35 56 50	118 4 28	.5	.07	5.0	>2.0	500	N	N	N
SM015	35 55 25	118 2 25	.5	.07	2.0	2.0	100	N	N	N
SM016	35 52 25	117 59 55	.7	.07	7.0	>2.0	300	N	N	N
SM017	35 53 37	117 59 49	.3	.07	5.0	>2.0	200	N	N	N
SM018	35 53 46	118 0 21	.5	.05	5.0	>2.0	200	N	N	N
SM019	35 54 56	117 59 59	.5	.07	2.0	1.5	150	N	N	N
SM020	35 55 31	118 0 30	.3	.05	7.0	>2.0	300	N	N	N
SM021	35 55 41	118 0 28	.5	.07	2.0	2.0	100	N	N	N
SM022	35 56 2	118 0 2	.3	.05	2.0	1.0	150	N	N	N

TABLE 4. RESULTS OF ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE SACATAR MEADOWS WILDERNESS STUDY AREA, TULARE COUNTY, CALIFORNIA.--Continued

Sample	B-ppm s	Ba-ppm s	Be-ppm s	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s
SM001	<20	700	N	N	N	10	N	N	100	N	<50	10
SM002	<20	300	N	N	N	N	N	N	300	N	<50	10
SM003	<20	500	N	N	N	10	N	N	<50	N	N	<10
SM004	<20	500	N	N	N	10	N	N	100	N	<50	N
SM005	<20	500	<2	N	N	10	N	N	100	N	N	10
SM006	20	500	N	N	N	10	N	N	150	<10	70	N
SM007	<20	500	N	N	N	10	N	N	200	<10	70	<10
SM008	20	500	N	N	N	10	N	<10	<50	N	N	<10
SM010	<20	<50	N	N	N	<10	N	<10	500	N	<50	<10
SM011	20	300	N	N	N	10	N	<10	300	N	<50	10
SM013	20	300	N	N	N	10	N	<10	200	N	50	10
SM014	30	700	N	N	N	10	N	10	300	10	100	10
SM015	20	700	N	N	N	10	N	N	<50	<10	100	N
SM016	<20	<50	N	N	N	N	N	10	300	10	50	10
SM017	<20	300	N	N	N	10	N	<10	200	N	70	10
SM018	<20	300	N	N	N	10	N	<10	200	<10	70	<10
SM019	20	500	<2	N	N	10	N	N	150	N	50	N
SM020	<20	<50	N	N	N	10	N	<10	300	N	70	10
SM021	20	700	<2	N	N	10	N	N	200	N	70	10
SM022	20	500	<2	N	N	10	N	N	150	N	N	<10

TABLE 4. RESULTS OF ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE SACATAR MEADOWS WILDERNESS STUDY AREA, TULARE COUNTY, CALIFORNIA.--Continued

Sample	Pb-ppm s	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s	W-ppm cm
SM001	N	N	N	N	500	50	N	100	N	>2,000	N	N
SM002	N	N	20	<20	200	70	N	300	N	>2,000	300	N
SM003	N	N	N	N	500	30	N	50	N	>2,000	N	15.0
SM004	N	N	N	N	500	50	N	100	N	>2,000	300	N
SM005	N	N	<10	N	300	70	100	200	N	>2,000	500	650.0
SM006	N	N	N	N	200	70	N	100	N	>2,000	200	45.0
SM007	N	N	N	N	200	70	N	150	N	>2,000	200	N
SM008	50	N	N	N	500	50	N	100	N	>2,000	300	<5.0
SM010	N	N	<10	N	200	150	N	300	N	>2,000	1,500	N
SM011	N	N	N	N	200	100	N	150	N	>2,000	500	5.0
SM013	N	N	<10	N	200	150	N	200	N	>2,000	<200	<5.0
SM014	N	N	N	<20	200	100	N	150	N	>2,000	<200	5.0
SM015	N	N	N	N	300	70	100	100	N	>2,000	500	250.0
SM016	N	N	20	N	200	200	N	500	N	>2,000	N	15.0
SM017	N	N	<10	N	300	100	N	150	N	>2,000	<200	15.0
SM018	N	N	<10	N	300	100	N	150	N	>2,000	200	N
SM019	N	N	N	N	500	50	N	100	N	>2,000	N	N
SM020	N	N	20	<20	200	150	N	300	N	>2,000	700	5.0
SM021	N	N	<10	N	300	70	N	150	N	>2,000	500	15.0
SM022	N	N	N	N	300	30	N	70	N	>2,000	200	10.0

TABLE 5. RESULTS OF ANALYSES OF ROCK SAMPLES FROM THE SACATAR MEADOWS WILDERNESS STUDY AREA, TULARE COUNTY, CALIFORNIA.

[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown.]

Sample	Latitude	Longtude	Fe-pct. s	Mg-pct. s	Ca-pct. s	Ti-pct. s	Mn-ppm s	Ag-ppm s	As-ppm s	Au-ppm s	B-ppm s	Ba-ppm s	Be-ppm s
SM012	35 58 6	118 5 0	2.0	<.02	.05	.01	70	N	N	N	N	500	N
SM004	36 0 30	118 4 8	1.5	.30	.70	.15	150	N	N	N	700	500	N
SM016	35 52 25	117 59 55	3.0	1.00	2.00	.20	500	N	N	N	N	3,000	1

TABLE 5. RESULTS OF ANALYSES OF ROCK SAMPLES FROM THE SACATAR MEADOWS WILDERNESS STUDY AREA, TULARE COUNTY, CALIFORNIA.--Continued

Sample	Bi-ppm s	Cd-ppm s	Co-ppm s	Cr-ppm s	Cu-ppm s	La-ppm s	Mo-ppm s	Nb-ppm s	Ni-ppm s	Pb-ppm s	Sb-ppm s	Sc-ppm s	Sn-ppm s	Sr-ppm s
SM012	N	N	<5	<10	5	N	10	N	<5	N	N	N	N	<100
SM004	N	N	<5	20	30	N	N	N	<5	N	N	7	N	150
SM016	N	N	10	15	70	30	N	N	10	15	N	7	N	1,500

TABLE 5. RESULTS OF ANALYSES OF ROCK SAMPLES FROM THE SACATAR MEADOWS WILDERNESS STUDY AREA, TULARE COUNTY, CALIFORNIA.--Continued

Sample	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s	Au-ppm aa	Hg-ppm aa	Th-ppm dn	U-ppm dn	As-ppm icp	Bi-ppm icp	Ca-ppm icp	Sb-ppm icp	Zn-ppm icp
SM012	20	N	N	N	10	N	<.1	<.02	<1.7	.425	<5	<2	.3	<2	6
SM004	70	N	<10	N	30	N	<.1	<.02	3.1	1.280	<5	<2	.2	<2	9
SM016	150	N	10	N	70	N	--	<.02	17.8	2.950	<5	<2	.3	<2	45

Table 6. Description of rock samples

SM004	Quartz-Tourmaline vein; composite float sample
SM012	Hematite stained quartz; massive outcrop sampled
SM 016	Granite; stream cobble