UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of heavy-mineral-concentrate and rock samples from the Owens Peak Wilderness Study Area (CA-010-026), Kern and Tulare Counties, California

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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 Owens Peak Wilderness Study Area (CA-010-026), Kern and Tulare Counties, California.

INTRODUCTION

In May 1984, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Owens Peak Wilderness Study Area, Kern and Tulare Counties, California.

The Owens Peak Wilderness Study Area (CA-010-026) is located in the southern Sierra Nevada Mountains (see fig. 1). The study area lies between Walker Pass on the south, Chimney Meadow on the north, Chimney and Canebrake Creeks on the west, borders the Sierran crest on the east, and is about 25 miles east of Isabella, California. Road access to the area is by Highway 178 from the south, County Road J41 from the north, and spurs off of the Canebrake road from the west. There is no road access from the east. The terrane is generally steep and rugged with elevations ranging from about 4,500 ft in the Canebrake Creek valley in the southwest to 8,453 ft at the summit of Owens Peak in the east. The vegetation is typically sagebrush and mountain mahogany on lower slopes. Higher country is covered by Jeffrey Pine, incense cedar, black oak, ceanothus, and rare Sugar Pine on the north side of Lamont Peak. The middle elevations have Digger Pine, live oak, ceanothus, manzanita, and chinquapin.

Miller (1931) completed a reconnaissance geologic study in which he named leucocratic granitic rocks in the region the Isabella Granodiorite. Miller and Webb (1940) published a small-scale geologic map of the Kernville 30-minute quadrangle which describes the Kernville Series and the Sacatar Quartz Diorite. Dibblee (1954) mapped the geology of the Inyokern 15° quadrangle just to the east of the study area. Bergquist and Nitkiewicz (1982) published a geologic map of the Domeland Wilderness, 7 mi west of this study area. The geology and mineral resource potential of the Rockhouse Basin Wilderness Study Area, 15 mi west of the study areas, was described by Taylor and others (1984) and summarized by Taylor (1984).

The geology consists dominantly of granitic rocks of the Sierra Nevada batholith that represent at least three major periods of intrusive activity. The majority of the study area is underlain by leucocratic, nonfoliated Cretaceous rocks of granitic to granodioritic composition. There is also an older set of more mafic granitic rocks of Jurassic and (or) Cretaceous age that are granodioritic to tonolitic in composition and often display a foliated to schlieric texture. The oldest intrusive rocks in the area are probably Jurassic and (or) Triassic in age. These rocks are mesocratic to melanocratic, gabbroic to dioritic, and foliated to gneissic in texture. The granitic rocks intrude Mesozoic to Paleozoic quartz-mica schist, quartzite, and marble. There are zones of garnet-epidote-wollastonite calc-silicate hornfels near marble-granite intrusive contacts.

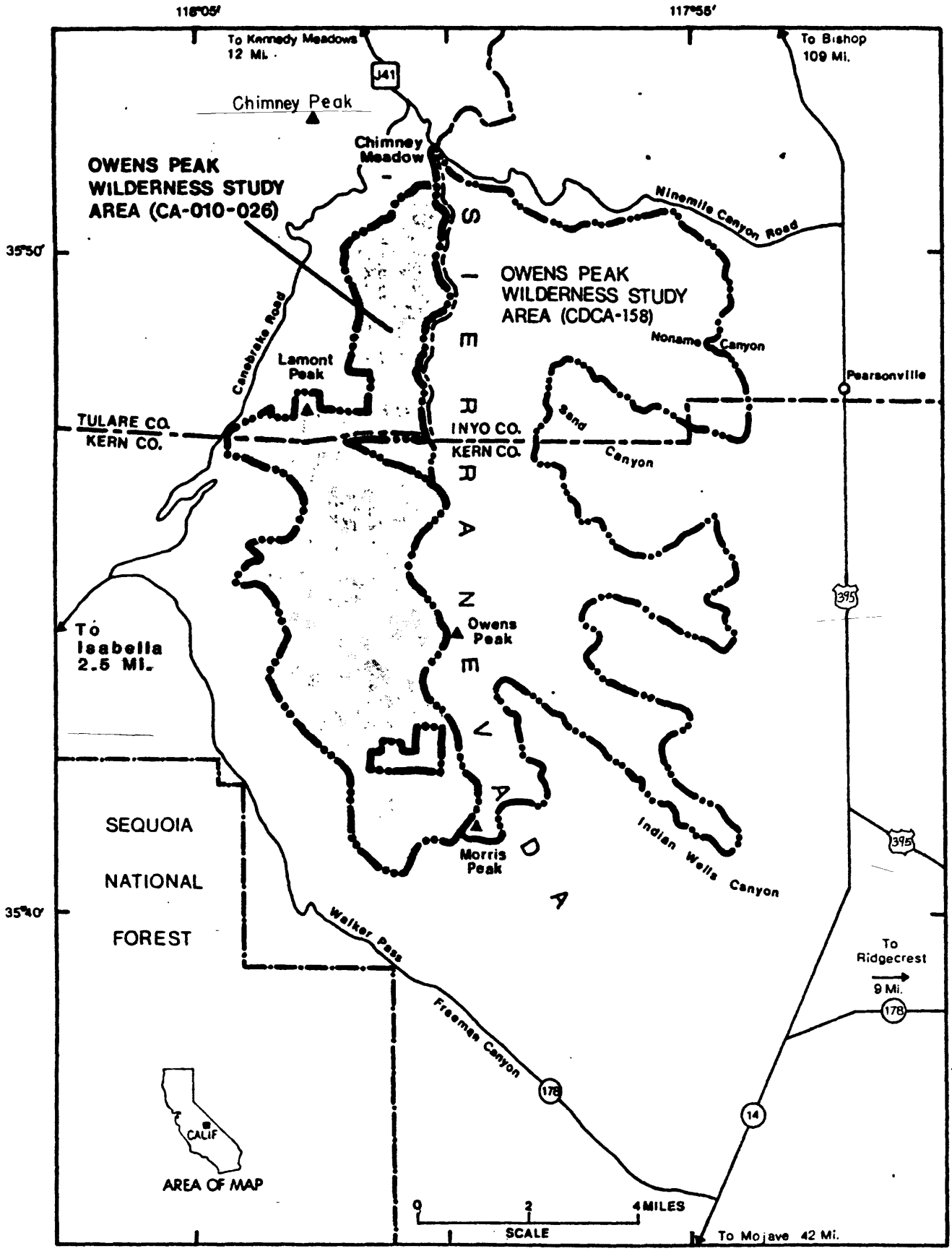

Figure 1. Index map of the Owens Peak Wilderness Study Area, Kern and Tulare Counties, California.

METHODS OF STUDY

Sample Media

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 an unconcentrated stream-sediment sample.

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.

Sample Collection

The eastern border of the study area lies along the crest of the Sierra Nevada Mountains. In order to evaluate the area geochemically, samples were collected along streams draining to the east, as well as from streams located within the study area. Concentrate samples were collected at 53 sites. Fifteen mineralized or altered rocks were also collected (fig. 2).

Heavy-mineral-concentrate samples

Heavy-mineral-concentrate samples were collected from the same active alluvium. 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

Rock samples were collected from outcrops or exposures and from stream gravels in the vicinity of the plotted site location. The samples collected were altered and/or mineralized rocks. The rocks are described in Table 5.

Sample Preparation

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 analysis/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.

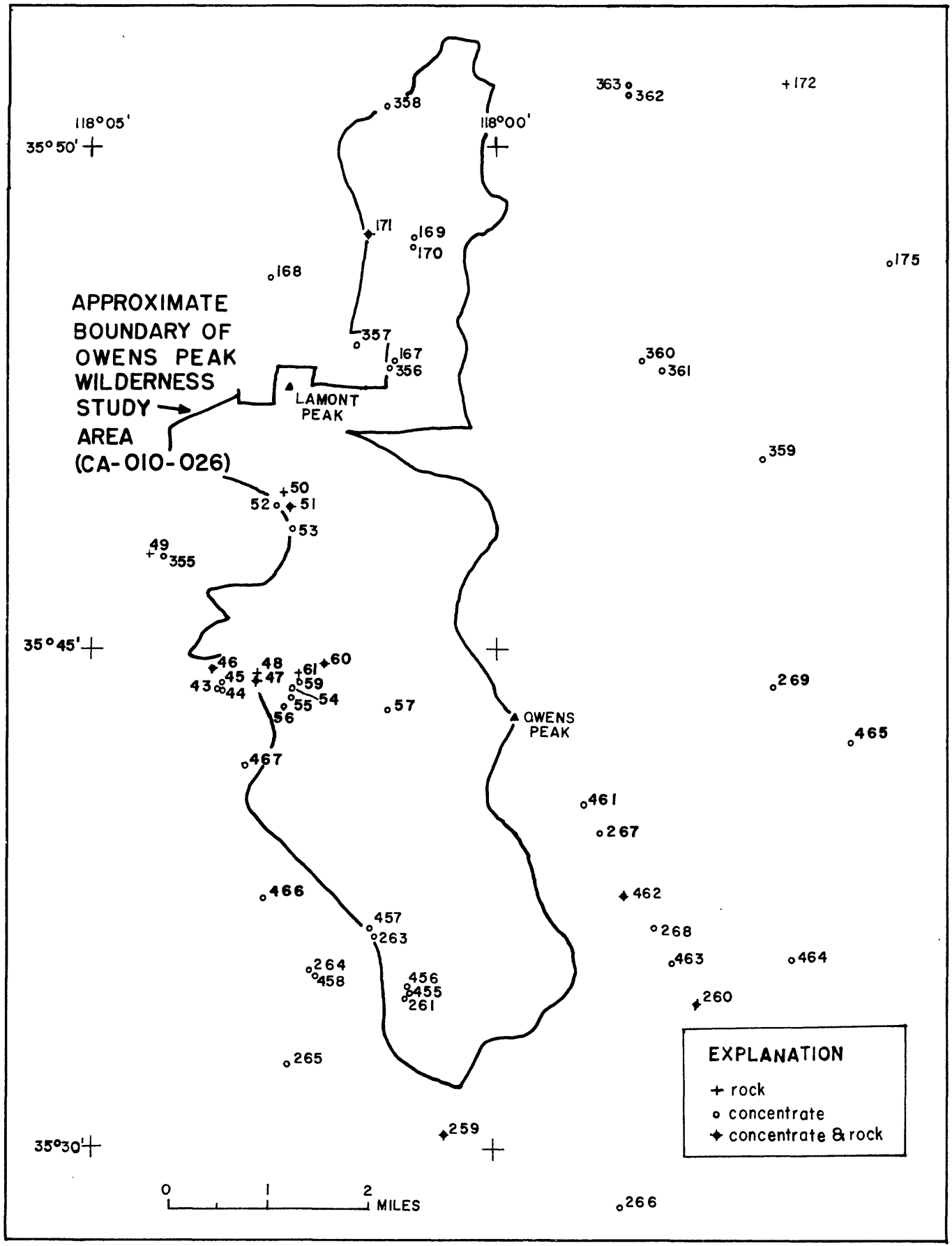

Figure 2. Sampling sites in the Owens Peak Wilderness Study Area, Kern and Tulare Counties, California.

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

Sample Analysis

Spectrographic method

The heavy-mineral-concentrate and rock samples were analyzed for 31 elements using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968; Myers, and others, 1961). The elements analyzed and their lower limits of determination are listed in Table 1. 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 Owens Peak Wilderness Study Area are listed in Tables 3 and 4.

Chemical Methods

Other methods of analysis used on samples from the Owens Peak Wilderness Study Area are summarized in Table 2.

Analytical results for heavy-mineral-concentrate and rock samples are listed in Tables 3 and 4, 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 and 4 list the analyses for the samples of heavy-mineral concentrate and rock, respectively. For the two tables, the data are arranged so that column 1 contains USGS field 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; and "cm" indicates colorimetric. 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 or 2. 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 and 4 in place of an analytical value. Because of the formatting used in the computer program that produced Tables 3 and 4, 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.

Table 5 contains descriptions of the rock samples from the study area.

ACKNOWLEDGMENTS

A number of our colleagues also participated in the collection, preparation, analyses, and data retrieval of these samples: collection, J. C. Gray, K. R. Greene, M. A. Mast, and A. D. McCollaum; preparation, W. Atkinson, J. Gaccetta, and D. Siems; analyses, J. G. Crock, D. Fey, and K. A. Romine; and data retrieval, J. Jones.

REFERENCES CITED

Bergquist, J. R., and Nitkiewicz, 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-1395-A, scale 1:48,000.

Dibblee, T. W., Jr., 1954, Geology of the Inyokern 15-minute quadrangle, Kern County, California: U.S. Geological Survey Open-File Report 59-31.

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.

Miller, W. J., 1931, Geologic sections across the southern Sierra Nevada of California: University of California Publications, Bulletin of the Department of Geological Sciences, v. 20, no. 9, p. 331-360.

Miller, W. J., and Webb, R. W., 1940, Descriptive geology of the Kernville Quadrangle, California: California Journal of Mines and Geology, v. 36, 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.

Taylor, G. C., 1984, Rockhouse Basin Wilderness Study Area, Kern and Tulare Counties: California Geology, v. 37, p. 263-272.

Taylor, G. C., Loyd, R. C., Alfors, J. T., Burnett, J. L., Stinson, M. C., Chapman, R. C., Silva, M. A., Bacon, C. F., and Anderson, T. P., 1984, Mineral resource potential of the Rockhouse Basin Wilderness Study Area, Kern and Tulare Counties, California: California Division of Mines and Geology Special Report 157, 75 p.

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.

Viets, J. G., 1978, Determination of silver, bismuth, cadmium, copper, lead, and zinc in geologic materials by atomic absorption spectrometry with tricaprylylmethylammonium chloride: Analytical Chemistry, v. 50, p. 1097-1101.

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 based on a 10-mg sample

[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 and stream sediments]

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	10,000
Gold (Au)	10	500
Boron (B)	10	2,000
Barium (Ba)	20	5,000
Beryllium (Be)	1	1,000
Bismuth (Bi)	10	1,000
Cadmium (Cd)	20	500
Cobalt (Co)	5	2,000
Chromium (Cr)	10	5,000
Copper (Cu)	5	20,000
Lanthanum (La)	20	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	2,000

Table 2.--Chemical methods used

[AA = atomic absorption and S = spectrophotometry]

Element or constituent determined	Sample Type	Method	Determination limit (micrograms/ gram or ppm)	Analyst	Reference
Gold (Au)	Rock	AA	0.1	J. G. Crock	Thompson and others, 1968
Arsenic (As)	"	AA	5	D. Fey	Modification of Viets, 1978
Antimony (Sb)	"	AA	2		
Zinc (Zn)	"	AA	2		
Bismuth (Bi)	"	AA	2		
Cadmium (Cd)	"	AA	0.1		
Tungsten (W)	Heavy-mineral concentrate	S	2	K. A. Romine	Welsch, 1983.

TABLE 3. ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM OWENS PEAK WILDERNESS STUDY AREA, KERN AND TULARE COUNTIES, 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	B-ppm s	Ba-ppm s
OW043	35 44 36	118 3 25	.7	.20	10	>2	500	N	N	N	50	300
OW044	35 44 35	118 3 21	.7	.20	7	>2	500	N	N	N	50	700
OW045	35 44 39	118 3 22	.7	.20	15	>2	300	N	N	N	30	1,000
OW046	35 44 47	118 3 29	.7	.20	20	>2	500	N	N	N	30	150
OW047	35 44 43	118 2 55	.5	.15	10	>2	700	N	N	N	20	>10,000
OW051	35 46 25	118 2 32	.5	.20	7	>2	300	N	N	N	50	500
OW052	35 46 25	118 2 41	.7	.50	15	>2	700	N	N	N	30	100
OW053	35 46 11	118 2 31	.7	.30	7	>2	300	N	N	N	50	500
OW054	35 44 35	118 2 30	1.0	.50	7	>2	700	N	N	N	50	500
OW055	35 44 30	118 2 31	.7	.20	10	>2	500	N	N	N	30	200
OW056	35 44 24	118 2 37	.5	.15	7	>2	700	N	N	N	30	500
OW057	35 44 22	118 1 20	.7	.30	5	>2	500	N	N	N	50	500
OW059	35 44 39	118 2 28	.7	.50	15	>2	300	N	N	N	50	200
OW060	35 44 49	118 2 5	.5	.15	10	>2	700	N	N	N	30	N
OW167	35 47 52	118 1 16	.5	.07	10	>2	500	N	N	N	20	N
OW168	35 48 41	118 2 49	.5	.05	10	>2	1,000	N	N	N	20	>10,000
OW169	35 49 4	118 1 3	.5	.07	15	>2	700	N	N	N	30	1,000
OW170	35 48 58	118 1 2	.5	.05	20	>2	500	N	N	N	20	200
OW171	35 49 8	118 1 37	.7	.07	7	>2	300	N	N	N	30	500
OW175	35 48 50	117 55 7	.7	.10	10	>2	300	N	N	N	20	200
OW259A	35 40 8	118 0 40	.2	<.05	7	>2	500	N	N	N	30	70
OW259B	35 40 9	118 0 40	.5	<.05	10	>2	700	N	N	N	20	N
OW260	35 41 26	117 57 34	.5	.05	5	>2	500	N	N	N	20	100
OW261	35 41 29	118 1 9	.5	.05	10	>2	700	N	N	N	30	N
OW263	35 42 6	118 1 31	.2	<.05	3	>2	300	N	N	N	20	100
OW264	35 41 46	118 2 19	.7	.05	10	>2	1,000	N	N	N	20	200
OW265	35 40 49	118 2 36	.5	<.05	15	>2	700	N	N	N	20	200
OW266	35 39 23	117 58 29	.7	.07	10	>2	700	N	N	N	20	100
OW267	35 43 7	117 58 43	.7	.05	7	>2	500	N	N	N	<20	200
OW268	35 42 10	117 58 2	.7	.10	15	>2	300	N	N	N	20	N
OW269	35 44 34	117 56 35	.7	.15	10	>2	500	N	N	N	100	N
OW355	35 45 54	118 4 9	.5	.15	10	>2	300	N	N	N	20	150
OW356	35 47 47	118 1 19	.5	.07	10	>2	300	N	N	N	20	5,000
OW357	35 48 1	118 1 45	.5	<.05	7	>2	500	N	N	N	20	>10,000
OW358	35 50 24	118 1 20	.7	.05	10	>2	500	N	N	N	20	200
OW359	35 46 52	117 56 43	.5	.05	10	>2	500	N	N	N	20	1,500
OW360	35 47 51	117 58 11	.7	.07	20	>2	700	N	N	N	20	200
OW361	35 47 46	117 57 57	.5	.07	7	>2	500	N	N	N	20	>10,000
OW362	35 50 30	117 58 20	.5	.05	15	>2	700	N	N	N	20	150
OW363	35 50 36	117 58 21	1.0	.07	10	>2	1,000	N	N	N	20	500
OW455	35 41 33	118 1 5	.5	.05	10	>2	1,000	N	N	N	<20	100
OW456	35 41 36	118 1 5	.7	.05	5	>2	700	N	N	N	20	200
OW457	35 42 10	118 1 35	.7	<.05	7	>2	700	N	N	N	20	<50
OW458	35 41 42	118 2 16	.5	<.05	7	>2	700	N	N	N	20	100
OW460	35 39 19	117 58 19	.7	.05	10	>2	1,000	N	N	N	20	N

TABLE 3. ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM OWENS PEAK WILDERNESS STUDY AREA, KERN AND TULARE COUNTIES, CALIFORNIA.--Continued

Sample	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	Pb-ppm s	Sb-ppm s
OW043	N	N	N	10	N	<10	150	10	50	N	N	N
OW044	N	N	N	<10	N	<10	150	30	<50	<10	N	N
OW045	N	N	N	<10	N	<10	100	<10	N	N	N	N
OW046	N	N	N	<10	N	<10	150	N	50	<10	N	N
OW047	N	N	N	<10	N	5,000	150	N	<50	<10	2,000	N
OW051	<2	N	N	10	N	<10	150	N	50	N	50	N
OW052	N	N	N	10	N	<10	200	N	50	20	N	N
OW053	N	N	N	<10	N	N	100	N	<50	<10	N	N
OW054	N	N	N	10	N	10	<50	10	50	<10	N	N
OW055	N	N	N	<10	N	<10	150	<10	70	N	N	N
OW056	N	N	N	<10	N	<10	200	10	70	N	30	N
OW057	N	N	N	<10	N	<10	150	N	50	N	20	N
OW059	N	N	N	<10	N	15	100	N	50	N	N	N
OW060	N	N	N	<10	N	N	150	15	50	N	N	N
OW167	N	N	N	10	N	N	200	N	50	N	N	N
OW168	N	N	N	10	N	N	300	N	70	N	N	N
OW169	N	N	N	10	N	<10	300	30	50	N	30	N
OW170	N	N	N	20	N	<10	500	N	N	N	150	N
OW171	N	N	N	10	N	<10	200	N	100	N	50	N
OW175	N	300	N	20	N	<10	150	10	150	N	100	N
OW259A	N	N	N	<10	N	10	200	N	N	N	500	N
OW259B	N	N	N	10	N	N	300	10	100	N	150	N
OW260	N	N	N	<10	N	N	200	10	N	<10	200	N
OW261	N	N	N	<10	N	N	150	N	N	N	N	N
OW263	N	20	N	<10	N	N	100	N	N	15	N	N
OW264	N	N	N	<10	N	10	300	10	70	N	N	N
OW265	N	N	N	<10	N	N	200	<10	50	N	N	N
OW266	N	N	N	10	N	N	500	10	100	N	20	N
OW267	N	300	N	<10	N	N	500	15	150	N	N	N
OW268	N	100	N	<10	N	<10	300	N	70	N	N	N
OW269	N	N	N	10	N	N	500	N	100	N	<20	N
OW355	N	N	N	<10	N	N	200	N	70	<10	N	N
OW356	N	N	N	10	N	N	100	N	70	N	N	N
OW357	N	N	N	<10	N	N	300	N	<50	N	N	N
OW358	N	N	N	10	N	<10	300	N	150	N	<20	N
OW359	N	N	N	<10	N	N	500	N	100	N	30	N
OW360	N	N	N	10	N	<10	500	N	100	N	20	N
OW361	N	N	N	10	N	<10	500	N	<50	N	20	N
OW362	N	N	N	10	N	10	300	10	100	N	50	N
OW363	N	N	N	20	N	10	700	30	200	N	<20	N
OW455	N	200	N	<10	N	<10	300	10	70	N	20	N
OW456	N	N	N	<10	N	<10	300	15	70	<10	N	N
OW457	N	N	N	10	N	10	500	20	70	<10	N	N
OW458	N	N	N	<10	N	N	300	15	50	<10	N	N
OW450	N	N	N	20	N	N	500	50	200	N	N	N

TABLE 3. ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM OWENS PEAK WILDERNESS STUDY AREA, KERN AND TULARE COUNTIES, CALIFORNIA.--Continued

Sample	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
OW043	N	N	300	200	<100	300	N	>2,000	N	330.0
OW044	N	N	500	200	300	500	N	>2,000	<200	>1,000.0
OW045	N	N	700	200	300	200	N	>2,000	N	>1,000.0
OW046	N	N	500	200	N	300	N	>2,000	N	44.0
OW047	N	150	<200	200	300	300	N	>2,000	N	--
OW051	N	N	<200	100	500	150	N	>2,000	3,000	>1,000.0
OW052	N	N	N	300	N	700	N	>2,000	N	400.0
OW053	N	N	<200	150	200	150	N	>2,000	N	>1,000.0
OW054	N	N	500	150	N	200	N	>2,000	N	210.0
OW055	N	N	500	200	N	300	N	>2,000	<200	48.0
OW056	N	N	<200	150	<100	300	N	>2,000	N	>1,000.0
OW057	N	N	<200	200	N	500	N	>2,000	N	160.0
OW059	N	N	500	150	N	150	N	>2,000	N	11.0
OW060	<10	N	N	200	N	700	N	>2,000	N	80.0
OW167	N	20	N	200	N	500	N	>2,000	N	22.0
OW168	<10	50	<200	200	N	700	N	>2,000	300	28.0
OW169	<10	20	500	100	200	300	N	>2,000	500	--
OW170	N	50	<200	200	150	700	N	>2,000	5,000	--
OW171	N	30	500	100	100	200	N	>2,000	2,000	410.0
OW175	N	20	<200	200	100	500	N	>2,000	1,500	33.0
OW259A	N	N	N	100	N	200	N	>2,000	N	14.0
OW259B	N	<20	N	200	N	300	N	>2,000	N	8.0
OW260	N	N	N	200	200	500	N	>2,000	N	>2,000.0
OW261	N	N	N	200	N	200	N	>2,000	N	15.0
OW263	N	N	N	100	100	300	N	>2,000	N	100.0
OW264	N	N	N	200	N	300	N	>2,000	N	7.5
OW265	N	N	N	100	N	300	N	>2,000	N	N
OW266	N	<20	N	200	N	500	N	>2,000	N	8.5
OW267	N	20	N	200	150	300	N	>2,000	300	>2,000.0
OW268	N	N	<200	200	500	200	N	>2,000	<200	130.0
OW269	N	20	N	200	100	300	N	>2,000	1,500	31.0
OW355	N	<20	<200	200	N	200	N	>2,000	N	6.0
OW356	N	N	N	200	N	300	N	>2,000	N	1.5
OW357	N	<20	N	150	N	500	N	>2,000	300	4.0
OW358	N	50	<200	150	100	500	N	>2,000	1,000	24.0
OW359	N	<20	500	200	N	200	N	>2,000	300	6.0
OW360	N	50	<200	200	<100	500	N	>2,000	1,000	--
OW361	N	N	N	200	N	700	N	>2,000	1,000	33.0
OW362	N	30	N	200	N	700	N	>2,000	1,000	11.0
OW363	N	100	N	300	N	1,000	N	>2,000	700	15.0
OW455	N	<20	<200	200	N	500	N	>2,000	N	12.0
OW456	N	N	N	200	N	500	N	>2,000	N	61.0
OW457	N	<20	N	200	N	500	N	>2,000	N	61.0
OW458	N	N	N	200	N	500	N	>2,000	N	97.0
OW460	N	20	N	300	N	700	N	>2,000	N	21.0

TABLE 3. ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM OWENS PEAK WILDERNESS STUDY AREA, KERN AND TULARE COUNTIES, CALIFORNIA.--Continued

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	B-ppm S	Ba-ppm S
OW461	35 43 23	117 58 52	1.0	.07	15	>2	700	N	N	N	20	100
OW462	35 42 30	117 58 25	.7	.10	15	>2	700	N	N	N	20	100
OW463	35 41 50	117 57 50	.5	.10	7	>2	300	N	N	N	20	200
OW464	35 41 50	117 56 21	1.0	.07	10	>2	700	N	N	N	20	150
OW465	35 44 1	117 55 35	.5	.10	20	>2	500	N	N	N	20	200
OW466	35 42 29	118 2 53	.5	<.05	15	>2	1,000	N	N	N	<20	N
OW467	35 43 48	118 3 7	.5	<.05	10	>2	1,000	N	N	N	20	N

TABLE 3. ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM OWENS PEAK WILDERNESS STUDY AREA, KERN AND TULARE COUNTIES, CALIFORNIA.--Continued

Sample	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	Pb-ppm s	Sb-ppm s
OW461	N	N	N	10	N	N	700	10	150	N	50	N
OW462	N	70	N	<10	N	<10	500	<10	100	N	1,000	N
OW463	N	N	N	<10	N	<10	150	N	N	<10	30	N
OW464	N	20	N	10	N	N	700	10	200	N	50	N
OW465	N	<20	N	<10	N	N	700	N	70	N	<20	N
OW466	N	N	N	<10	N	N	500	15	100	N	N	N
OW467	N	N	N	10	N	N	500	15	100	N	N	N

TABLE 3. ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM OWENS PEAK WILDERNESS STUDY AREA, KERN AND TULARE COUNTIES, CALIFORNIA.--Continued

Sample	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 ca
OW461	N	50	<200	200	N	500	N	>2,000	200	62.0
OW462	N	50	500	200	200	300	N	>2,000	500	>1,000.0
OW463	N	N	500	150	100	300	N	>2,000	N	460.0
OW464	N	50	N	200	N	500	N	>2,000	N	320.0
OW465	N	30	500	100	N	200	N	>2,000	<200	9.5
OW466	N	<20	N	200	N	300	N	>2,000	N	6.0
OW467	N	<20	N	200	N	500	N	>2,000	N	170.0

TABLE 4. ANALYSES OF ROCK SAMPLES FROM OWENS PEAK WILDERNESS STUDY AREA, KERN AND TULARE COUNTIES, CALIFORNIA.
[N, not detected; <, detected but below the limit of determination shown; >, determined to be greater than the value shown.]

Sample	Latitude	Longitude	Fe-ppm s	Mg-ppm s	Ca-ppm s	Ti-ppm s	Mn-ppm s	Ag-ppm s	As-ppm s	Au-ppm s	B-ppm s	Ba-ppm s	Be-ppm s	Bi-ppm s
OW046R2	35 44 47	118 3 29	5.0	1.50	15.00	.200	1,000	<.5	<700	<15	<10	3,000	1.0	<10
OW047R1	35 44 43	118 2 55	1.5	.50	10.00	.150	700	<.5	<700	<15	<10	70	10.0	10
OW047R2	35 44 43	118 2 56	.7	<.02	.70	.010	700	<.5	<700	<15	<10	30	2.0	<10
OW048R1	35 44 45	118 2 55	5.0	1.50	15.00	.300	2,000	<.5	<700	<15	<10	700	2.0	<10
OW049R1	35 45 56	118 4 17	3.0	1.50	15.00	.200	1,000	<.5	<700	<15	<10	3,000	5.0	<10
OW050R1	35 46 30	118 2 40	7.0	10.00	2.00	.150	300	<.5	<700	<15	<10	150	<1.0	<10
OW051R1	35 46 25	118 2 32	1.5	.30	.30	.150	150	<.5	<700	<15	<10	500	2.0	<10
OW060R1	35 44 49	118 2 5	1.0	.20	1.50	.030	150	2.0	<700	<15	<10	300	<1.0	<10
OW061R1	35 44 42	118 2 28	7.0	1.50	7.00	.300	1,000	<.5	<700	<15	<10	700	1.5	<10
OW061R2	35 44 42	118 2 29	.3	<.02	.07	.003	20	<.5	<700	<15	<10	30	<1.0	<10
OW171R2	35 49 8	118 1 37	1.5	.50	.70	.150	200	<.5	<700	<15	10	2,000	2.0	<10
OW172R2	35 50 36	117 56 27	1.5	.02	<.05	<.015	10	20.0	<700	<15	<10	70	100.0	700
OW259R1	35 40 8	118 0 40	1.5	.15	3.00	.050	300	<.5	<700	<15	30	300	<1.0	<10
OW260R1	35 41 26	118 57 34	7.0	.50	15.00	.100	5,000	<.5	<700	<15	<10	100	1.0	<10
OW462R1	35 42 30	117 58 25	7.0	2.00	10.00	.500	5,000	<.5	<700	<15	<10	300	2.0	<10

TABLE 4. ANALYSES OF ROCK SAMPLES FROM OWENS PEAK WILDERNESS STUDY AREA, KERN AND TULARE COUNTIES, CALIFORNIA.--Continued

Sample	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	V-ppm s
OW046R2	<30	15	50	70	50	7	<20	20	15	<100	20	<10	300	150
OW047R1	<30	5	15	<5	<30	<5	<20	7	<10	<100	5	<10	<100	30
OW047R2	<30	<5	<10	7	<30	7	<20	<5	15	<100	7	<10	<100	<10
OW048R1	<30	7	70	15	<30	<5	20	20	<10	<100	15	<10	150	150
OW049R1	<30	10	70	20	<30	<5	<20	30	15	<100	30	<10	200	100
OW050R1	<30	50	1,000	30	<30	<5	<20	500	<10	<100	10	<10	<100	70
OW051R1	<30	<5	15	7	<30	15	<20	5	30	<100	5	<10	200	30
OW060R1	<30	<5	<10	1,000	<30	<5	<20	<5	10	<100	<5	<10	<100	15
OW061R1	<30	20	10	150	<30	<5	<20	5	10	<100	30	<10	300	200
OW061R2	<30	<5	<10	15	<30	<5	<20	<5	<10	<100	<5	<10	<100	<10
OW171R2	<30	<5	<10	15	<30	<5	<20	<5	15	<100	5	<10	700	30
OW172R2	<30	<5	<10	30	<30	200	<20	<5	50	<100	<5	<10	<100	<10
OW259R1	<30	<5	<10	20	<30	<5	<20	<5	10	<100	<5	<10	300	30
OW260R1	<30	5	30	20	<30	<5	<20	10	10	<100	7	15	<100	150
OW462R1	<30	7	70	30	50	<5	<20	20	10	<100	15	<10	300	150

TABLE 4. ANALYSES OF ROCK SAMPLES FROM OWENS PEAK WILDERNESS STUDY AREA, KERN AND TULARE COUNTIES, CALIFORNIA.--Continued

Sample	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s	As-ppm aa	Bi-ppm aa	Cd-ppm aa	Sb-ppm aa	Zn-ppm aa	Au-ppm aa
OW046R2	<50	20	<200	100	<200	30	<2	.1	23	31	<.1
OW047R1	<50	<10	200	20	<200	<5	<2	<.1	<2	31	--
OW047R2	<50	10	<200	70	<200	26	<2	<.1	<2	9	<.1
OW048R1	70	15	<200	100	<200	19	<2	<.1	5	11	--
OW049R1	<50	15	<200	150	<200	12	<2	.3	<2	22	--
OW050R1	<50	10	<200	20	<200	<5	<2	<.1	8	15	--
OW051R1	<50	<10	<200	100	<200	<5	<2	<.1	<2	7	<.1
OW060R1	<50	<10	<200	15	<200	<5	<2	<.1	2	9	<.1
OW061R1	<50	15	<200	70	<200	<5	<2	.5	<2	67	<.1
OW061R2	<50	<10	<200	<10	<200	<5	<2	<.1	<2	<2	<.1
OW171R2	<50	<10	<200	150	<200	<5	<2	<.1	<2	49	--
OW172R2	<50	<10	<200	<10	<200	<5	910	<.1	<2	4	<.1
OW259R1	<50	<10	<200	20	<200	<5	<2	<.1	<2	10	<.1
OW260R1	<50	10	<200	30	<200	<5	<2	.5	3	22	--
OW462R1	<50	20	<200	150	<200	<5	<2	<.1	42	11	--

Table 5. Description of rock samples

DW 46R2	Disseminated pyrite in very fine grained gneiss
DW 47R1	Quartz epidote skarn
DW 47R2	Iron stained pegmatite
DW 48R1	Quartz garnet epidote skarn
DW 49R1	Quartz epidote skarn
DW 50R1	Composite sample mafic schist, quartz veins, intrusive rocks
DW 51R1	Disseminated pyrite in quartzite and felsic intrusives
DW 60R1	Copper stained quartzite
DW 61R1	Sheared diorite gneiss
DW 61R2	Iron stained quartz
DW 171R2	Disseminated pyrite in granite
DW 172R2	Molybdenite and pyrite in quartz
DW 259R1	Quartz veins in granodiorite
DW 260R1	Skarn ore
DW 462R1	Minor sulfides in skarn