UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Chemical analyses for samples of rock, stream sediment, and nonmagnetic heavy-mineral concentrates, Condrey Mountain Roadless Area, Siskiyou County, California

By

B. M. Adrian, D. B. Smith, R. B. Vaughn,

and C. M. McDougal

Open-File Report 83-812

1983

CONTENTS

ILLUSTRATIONS

TABLES

Studies Related to Wilderness

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands to determine their mineral-resource potential. 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 Condrey Mountain Roadless Area, Forest Service Number 5704, in the Klamath National Forest, Siskiyou County, California. The Condrey Mountain Roadless Area was classified as a further planning area during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

INTRODUCTION

A geochemical study of the Condrey Mountain Roadless area (fig. 1) was undertaken to aid in the evaluation of its mineral potential. Seventeen stream sediments, 17 concentrates from stream sediments, and 9 rock samples were taken througout the area (pl. 1).

GEOCHEMICAL SAMPLING

Stream sediments and heavy-mineral concentrates were chosen as the primary sample medium for this study because they represent a composite of rock and soil exposed in the drainage basin upstream from the sample site. Two samples were collected at each sample site. One sample was sieved to minus 80 mesh (less than 0.18 mm), and pulverized to minus 100 mesh. The second sample was panned to produce a heavy-mineral concentrate. Rock samples were also taken.

Sediments

Sediment material was composited from active alluvium collected from several locations within an area that may extend as much as 15 m (50 ft) from the site plotted on the map. The resulting sample was air dried and that portion passing through an 80-mesh (0.18-mm) screen was saved and pulverized for analysis.

Heavy-mineral concentrates

Material was composited in a manner similar to that discussed above for the stream sediments. The bulk sample was passed through a 10-mesh (2.0-mm) screen to remove the coarsest material. The sample passing through the screen was wet panned, air dried, and then sieved to minus 18 mesh (less than 1.00 mm). The remaining light material was removed from the concentrate using bromoform (specific gravity = 2.86). Magnetite was then removed from the heavy concentrate using a hand magnet. The resulting heavy-mineral fraction was divided into subfractions based on magnetic susceptibility. A split of the heavy, nonmagnetic subfraction was ground by hand using an agate mortar and pestle, and then analyzed spectrographically. This subfraction contains the common ore-forming sulfide and oxide minerals as well as barite and other nonmagnetic minerals. The concentrate medium generally gives a greatly enhanced anomaly pattern because all of the more common rock-forming minerals, such as quartz and feldspar that tend to dilute the anomalies, have been removed.

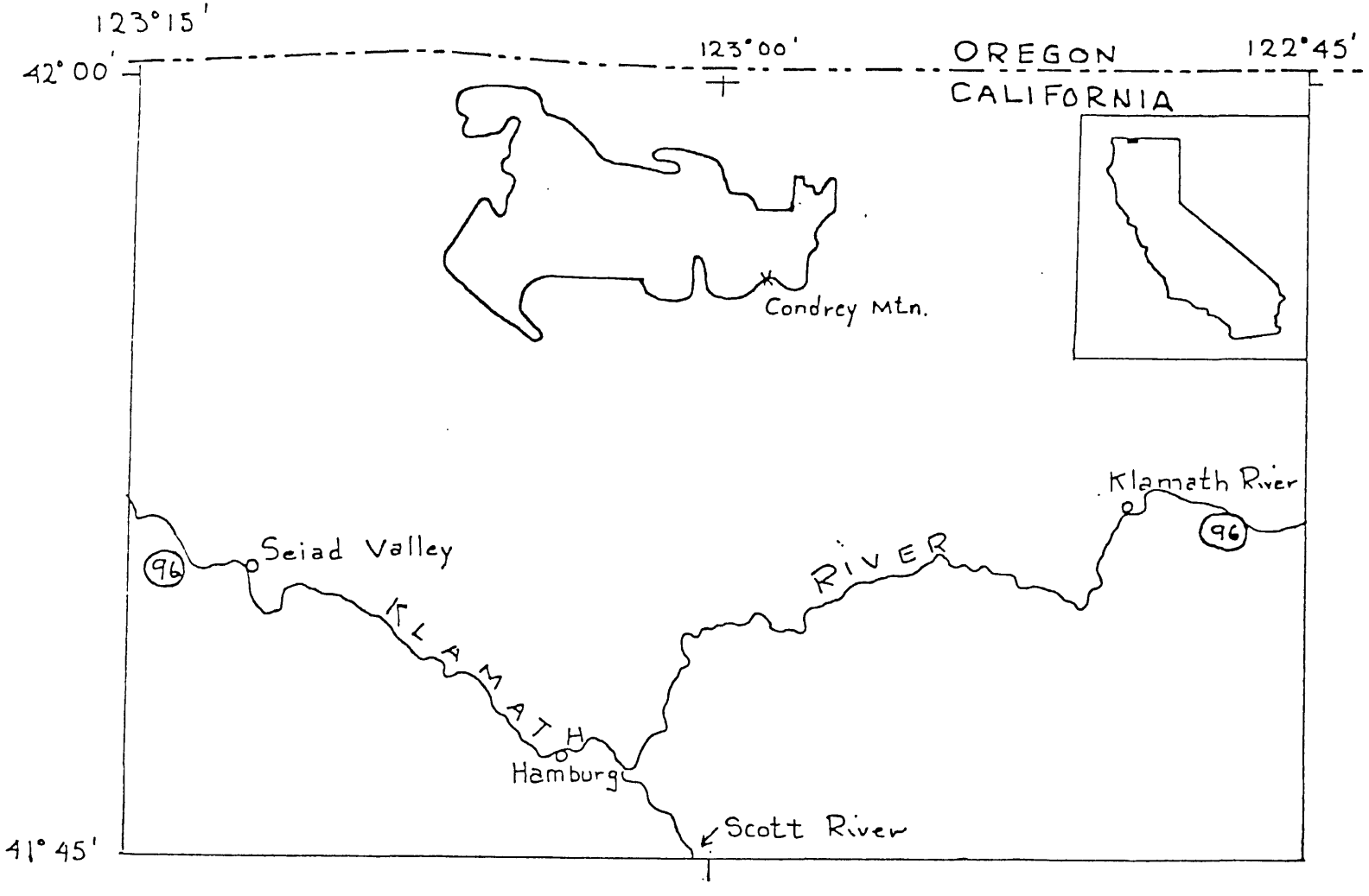

Figure 1.--Index map showing location of the Condrey Mountain Roadless Area, California

Rocks

All rock samples were collected from the Blue Ledge mine, located near the western margin of the study area, to determine the suite of elements associated with the mineralization. All samples were crushed and pulverized to minus 100 mesh (less than 0.15 mm), and then analyzed by emission and atomic absorption spectrographic techniques.

Table 2A contains descriptions of rocks from Condrey Mountain Roadless Area, Siskiyou County, California.

CHEMICAL ANALYSIS

All three types of samples were analyzed for 31 elements (Ag, As, Au, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, La, Mg, Mn, Mo, Nb, Ni, Pb, Sb, Sc, Sn, Sr, Th, Ti, V, W, Y, Zn, and Zr) using a six-step semiquantitative emission spectrographic method (Grimes and Marranzino, 1968).

The spectrographic analytical values are reported as the approximate geometric midpoints (0.15, 0.2, 0.3, 0.5, 0.7, and 1.0 or appropriate powers of ten of these values) of concentration ranges whose respective boundaries are 0.12, 0.18, 0.26, 0.38, 0.56, 0.83, and 1.2 (or appropriate powers of ten of these values). The precision of the method is approximately plus or minus one reporting unit at the 83-percent confidence level and plus or minus two reporting units at the 96-percent confidence level (Motooka and Grimes, 1976). Values determined for the major elements (Mg, Ca, Fe, and Ti) are given in weight percent; all others are given in parts per million (micrograms/gram). Detection limits for the spectrographic analyses are listed in table 1. The analysis of nonmagnetic heavy-mineral-concentrate samples was modified due to matrix interference problems. As a result, the lower limits of determination for the elements analyzed for this type of sample are all raised two reporting values above the normal lower limit value (table 1).

In addition to the spectrographic analysis, the rock samples were analyzed by the A-to-Z atomic absorption methods (modification of Viets, 1978). For the six elements discussed here, the reported lower limit of analytical determination can be found in table 1.

DESCRIPTION OF TABLES 2B-4

Tables 2B-4 list the chemical analysis for the samples of rock, minus-80-mesh stream sediment, and nonmagnetic heavy-mineral concentrate, respectively. For the three sample sets the data are arranged so that column 1 contains the USGS assigned sample numbers. These numbers coincide with the numbers on the site location map (pl. 1). In tables 2B-4, rock samples are suffixed by R, and concentrates by C; stream sediments are not suffixed.

Columns 2 and 3 list the latitudes (north) and longitudes (west) for the sample sites in degrees, minutes, and seconds. Columns in which the element heading show the letter "s" below the element symbol are emission spectrographic analyses. Columns in which the element headings are prefixed by "aa" are atomic absorption analyses.

Because of the formatting used in the computer program that produced tables 2B-4, some of the elements listed in these tables (Fe, Mg, Ca, Ti, and Be) carry one or more nonsignificant zeros to the right of the significant digits. The analyst did not determine these elements to the accuracy suggested by the nonsignificant zeros.

The elements Au, Sb, Th, and W were not detected spectrographically in any of the rock, stream sediment, and concentrate samples. Consequently, these elements were deleted from tables 2B-4.

Analytical data for samples from the Condrey Mountain Roadless Area, were entered into the USGS Rock Analysis Storage System (RASS). These data for rocks, sieved sediments, and nonmagnetic heavy-mineral concentrates are listed in tables 2B-4, respectively.

ACKNOWLEDGMENTS

We wish to thank the following persons who contributed to this study: Mark Woempner, Jim Kilburn, and Sherry Benge assisted in all aspects of sample preparation; Dave Siems and Gordon Day assisted with the spectrographic analyses.

REFERENCES

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.

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

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

Table 1.--Determination limits for elements analyzed by semiquantitative emission spectrography and atomic absorption spectrometry

Element	Lower limits of determination		
	Emission spectrography		Atomic absorption spectrometry
	Rocks and sediments	Concentrates	Rocks
Fe	0.05%	0.1%	
Mg	0.02	0.05	
Ca	0.05	0.1	
Ti	0.002	0.005	
Mn	10 ppm	20 ppm	
Ag	0.5	1	
As	200	500	5
Au	10	20	.05
B	10	20	
Ba	20	50	
Be	1	2	
Bi	10	20	2
Cd	20	50	.1
Co	5	10	
Cr	10	20	
Cu	5	10	
La	20	50	
Mo	5	10	
Nb	20	50	
Ni	5	10	
Pb	10	20	
Sb	100	200	1
Sc	5	10	
Sn	10	20	
Sr	100	200	
Th	100	200	
V	10	20	
W	50	100	
Y	10	20	
Zn	200	500	5

Table 2A.--Descriptions of rock samples from Condrey Mountain Roadless Area, Siskiyou County, California

Sample No.	Description
CM 18R	Iron-oxide-rich breccia
19R	Sulfide-bearing schist
20R	Sulfide-bearing schist
21R	Chlorite schist with small quartz vein and secondary copper minerals
22R	Sulfide-bearing sericite schist
23R	Quartz vein with secondary copper minerals and minor pyrite
24R	Massive pyrite-chalcopyrite
25R	Quartz vein
26R	Sulfide-rich quartz vein

Table 2B. Analytical data for rocks from the Condrey Mountain Roadless Area, Siskiyou County, California.

(The following qualifiers are used in reporting analytical data: --, no determination made; N, element not detected; <, detected but present at a concentration less than the value reported; and >, element present at a concentration greater than the upper detection limit.)

Sample	LATITUDE	LONGITUD	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-AS	S-B	S-BA	S-BE
CM18R	41 57 48	123 5 41	>20.0	.30	.07	.150	70	<.5	N	N	500	N
CM19R	41 57 48	123 5 41	>20.0	.20	N	.003	70	20.0	N	10	700	1.0
CM20R	41 57 43	123 5 41	10.0	1.50	.30	.200	1,000	2.0	N	15	700	1.5
CM21R	41 57 48	123 5 41	2.0	.50	.10	.150	700	<.5	N	15	200	N
CM22R	41 57 48	123 5 41	>20.0	.10	<.05	.070	10	5.0	N	<10	1,000	N
CM23R	41 57 48	123 5 41	2.0	.50	10.00	.100	1,000	20.0	N	<10	500	N
CM24R	41 57 48	123 5 41	>20.0	<.02	N	<.002	100	30.0	200	<10	1,000	N
CM25R	41 57 48	123 5 41	.5	.03	<.05	.002	15	N	N	10	200	N
CM26R	41 57 48	123 5 41	20.0	.20	5.00	.070	700	30.0	N	N	>2,000	N

Sample	S-BI	S-CD	S-CO	S-CR	S-CU	S-LA	S-MO	S-NB	S-NI	S-PB	S-SC	S-SN
CM18R	N	N	N	30	700	N	N	N	5	50	7	N
CM19R	50	100	N	10	1,500	N	300	N	100	500	<5	N
CM20R	N	20	30	100	1,000	50	15	<20	50	70	20	N
CM21R	N	N	20	30	1,000	N	N	N	70	15	7	N
CM22R	N	N	10	N	70	N	30	N	5	15	5	N
CM23R	20	N	N	10	2,000	N	N	N	5	2,000	10	N
CM24R	10	200	20	<10	>20,000	N	10	N	70	500	N	N
CM25R	N	N	N	N	300	N	N	N	<5	N	N	N
CM26R	20	200	20	50	15,000	N	30	N	100	700	10	N

Sample	S-SR	S-V	S-Y	S-ZN	S-ZR	AA-AU-P	AA-AS-P	AA-ZN-P	AA-CD-P	AA-BI-P	AA-SB-P
CM18R	N	150	10	N	70	.35	50	200	.7	<2	3
CM19R	N	50	N	2,000	N	N	N	1,200	50.0	40	2
CM20R	100	200	30	300	200	N	<5	720	1.6	<2	<1
CM21R	100	30	10	500	70	--	N	1,000	2.5	<2	<1
CM22R	N	10	N	N	30	.60	85	65	.3	2	2
CM23R	500	20	10	700	50	<.05	N	1,100	11.5	8	<1
CM24R	<100	20	N	>10,000	N	1.50	75	10,000	210.0	20	12
CM25R	N	<10	<10	N	N	--	N	160	.7	<2	<1
CM26R	300	20	N	>10,000	10	.30	90	10,000	220.0	20	8

Table 3. Analytical data for stream sediments from the Condrey Mountain Roadless Area, Siskiyou County, California.

(The following qualifiers are used in reporting analytical data: --, no determination made; N, element not detected; <, detected but present at a concentration less than the value reported; and >, element present at a concentration greater than the upper detection limit.)

Sample	LATITUDE	LONGITUD	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-AS	S-B	S-BA	S-CD
CM001	41 56 34	122 56 8	5	2	.5	1.0	700	N	N	30	500	N
CM002	41 56 27	122 56 9	5	2	2.0	1.0	1,000	N	N	20	500	N
CM003	41 57 5	122 55 35	5	2	1.0	1.0	1,000	N	N	30	500	N
CM004	41 56 53	122 55 52	5	1	.5	1.0	1,000	N	N	30	700	N
CM005	41 54 56	123 4 23	5	2	5.0	.5	1,000	N	N	15	500	N
CM006	41 54 41	123 4 6	5	2	.5	1.0	700	N	N	20	700	N
CM007	41 57 22	123 7 46	3	1	5.0	.2	1,000	.5	N	10	300	N
CM008	41 59 52	123 7 45	3	2	2.0	.2	700	.5	N	20	500	20
CM009	41 59 5	123 3 46	5	2	5.0	.5	700	N	N	50	300	N
CM010	41 59 31	123 4 14	5	5	5.0	.5	700	N	N	50	300	N
CM011	41 58 1	122 59 20	2	1	.5	.5	300	N	N	100	500	N
CM012	41 53 10	122 58 25	3	2	.2	.5	700	N	N	100	700	N
CM013	41 58 48	122 57 1	3	1	2.0	.5	700	N	N	30	200	N
CM014	41 58 54	122 57 2	3	1	1.0	.5	500	N	N	20	200	N
CM015	41 58 9	122 52 52	3	3	2.0	.5	700	N	N	50	500	N
CM016	41 59 53	123 1 59	3	2	1.0	.5	700	N	N	50	300	N
CM017	41 54 33	122 58 22	3	1	.5	.7	700	N	N	50	300	N

Sample	S-CO	S-CR	S-CU	S-LA	S-NI	S-PB	S-SC	S-SR	S-V	S-Y	S-ZN	S-ZR
CM001	20	300	70	70	70	10	20	100	150	30	N	150
CM002	20	200	70	70	50	10	30	150	150	100	N	150
CM003	30	150	100	50	70	10	20	100	150	50	N	100
CM004	20	200	70	70	70	10	20	100	150	100	N	100
CM005	20	300	100	20	70	30	50	300	150	50	N	100
CM006	30	1,000	70	70	200	20	15	150	150	100	N	100
CM007	20	70	30	<20	15	30	50	300	200	30	<200	50
CM008	20	200	1,500	<20	50	30	20	150	100	20	500	50
CM009	30	1,000	50	70	150	10	50	200	150	100	N	70
CM010	30	1,000	50	20	100	10	50	300	200	100	N	100
CM011	20	300	50	20	100	10	15	100	100	100	N	100
CM012	20	200	50	50	70	30	15	100	150	100	N	150
CM013	15	100	30	30	30	10	20	200	150	30	N	70
CM014	15	70	30	30	30	10	20	150	100	20	N	70
CM015	30	700	70	30	100	20	20	200	150	30	N	100
CM016	30	500	50	50	100	20	15	150	100	30	N	70
CM017	15	150	50	50	70	10	15	100	150	70	N	150

Table 4. Analytical data for heavy-mineral concentrates from Condrey Mountain Roadless Area, Siskiyou County, California.

(The following qualifiers are used in reporting analytical data: --, no determination made; N, element not detected; <, detected but present at a concentration less than the value reported; and >, element present at a concentration greater than the upper detection limit.)

Sample	LATITUDE	LONGITUD	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-B	S-BA
CM001C	41 56 34	122 56 8	3	.5	.5	>2.0	300	1	200	300
CM002C	41 56 27	122 56 8	3	.5	1.5	>2.0	500	<1	200	300
CM003C	41 57 5	122 55 35	3	.5	1.0	>2.0	500	1	200	300
CM004C	41 56 58	122 55 52	5	.5	1.5	>2.0	500	1	200	300
CM005C	41 54 56	123 4 23	7	1.0	2.0	2.0	700	<1	100	150
CM006C	41 54 41	123 4 6	5	1.0	1.5	>2.0	500	1	200	300
CM007C	41 57 22	123 7 46	7	.5	5.0	1.0	1,500	N	20	70
CM008C	41 59 52	123 7 45	7	1.0	5.0	1.5	1,000	1	70	1,000
CM009C	41 59 5	123 3 46	5	1.0	5.0	2.0	1,000	N	70	100
CM010C	41 59 31	123 4 14	5	1.0	5.0	2.0	1,000	N	100	100
CM011C	41 58 1	122 59 20	5	2.0	2.0	>2.0	700	1	150	200
CM012C	41 58 10	122 58 25	5	1.0	1.0	>2.0	500	1	500	500
CM013C	41 58 48	122 57 1	5	1.5	2.0	>2.0	1,000	N	300	500
CM014C	41 58 54	122 57 2	5	1.5	2.0	>2.0	1,000	N	200	500
CM015C	41 58 9	122 52 52	5	3.0	3.0	>2.0	1,000	N	200	200
CM016C	41 59 53	123 1 59	5	2.0	3.0	>2.0	1,000	5	200	500
CM017C	41 54 33	122 58 22	3	1.0	.7	>2.0	500	1	200	300

Sample	S-BE	S-CO	S-CR	S-CU	S-LA	S-MO	S-NB	S-NI	S-PB	S-SC
CM001C	3	30	200	50	500	10	200	100	30	50
CM002C	2	30	150	70	200	N	100	70	<20	50
CM003C	2	30	150	100	200	N	150	70	<20	70
CM004C	2	30	150	200	500	10	150	100	20	50
CM005C	N	50	150	100	100	N	70	100	<20	50
CM006C	2	50	500	150	200	N	100	200	20	30
CM007C	N	15	50	30	50	N	N	20	150	100
CM008C	N	20	150	2,000	50	N	N	50	50	70
CM009C	N	20	500	50	150	N	70	100	<20	100
CM010C	N	20	500	50	100	N	70	100	<20	100
CM011C	2	30	700	70	150	N	100	150	20	50
CM012C	5	50	700	100	300	N	100	100	50	30
CM013C	5	30	200	100	300	N	70	70	30	50
CM014C	3	50	500	100	300	<10	70	100	30	50
CM015C	N	50	1,000	70	150	N	50	500	20	50
CM016C	<2	50	700	500	200	N	50	200	20	30
CM017C	3	20	200	200	300	N	100	70	50	30

Table 4. Analytical data for heavy-mineral concentrates from Condrey Mountain Roadless Area, Siskiyou County, California. (continued)

Sample	S-SR	S-V	S-Y	S-ZN	S-ZR
CM001C	<200	300	200	N	200
CM002C	200	200	200	N	200
CM003C	<200	300	200	N	200
CM004C	200	300	300	N	200
CM005C	300	300	150	N	200
CM006C	200	300	200	N	200
CM007C	700	500	50	N	100
CM008C	500	500	50	1,000	100
CM009C	500	500	100	N	150
CM010C	500	500	100	N	150
CM011C	<200	300	200	N	200
CM012C	200	300	300	N	200
CM013C	300	500	200	N	300
CM014C	200	300	200	N	150
CM015C	200	300	100	N	150
CM016C	300	300	150	N	150
CM017C	200	300	100	N	200