UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

RESULTS OF CHEMICAL ANALYSES FOR SAMPLES OF STREAM SEDIMENTS AND NONMAGNETIC HEAVY-MINERAL CONCENTRATES, ORLEANS MOUNTAIN ROADLESS AREA, HUMBOLDT AND SISKIYOU COUNTIES, CALIFORNIA

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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 Orleans Mountain Roadless Area, Forest Service Number 5079, in the Klamath and Six Rivers National Forest, Humboldt County, California. The Orleans 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 Orleans Mountain Roadless area (fig. 1) was undertaken to aid in the evaluation of its mineral potential. Eighteen stream sediments and 18 panned concentrates from stream sediments were taken througout the area.

GEOCHEMICAL SAMPLING

Stream sediments 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 stream-sediment samples were collected at each sample site. One sample was sieved to -80 mesh (less than 0.18 mm), pulverized, and analyzed for 31 elements by a semiquantitative spectrographic method (Grimes and Marranzino, 1968). The second stream-sediment sample was panned to produce a heavy-mineral concentrate. After panning, 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 material was then separated into a magnetic and nonmagnetic fraction using a Frantz Isodynamic Magnetic Separator set at 0.6 amperes. A split of the heavy, nonmagnetic subfraction was ground by hand using an agate mortar and pestle, and analyzed spectrographically. The remaining portion of this subfraction was retained for mineral identification.

CHEMICAL ANALYSIS

Both 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.

Each spectrographic film includes analytical spectra for up to 23 field samples and one reference standard sample. The reference standard sample is included with each set of field samples to monitor the quality of the analyses from film to film; however, the analyses for these samples have been omitted from tables 2 and 3.

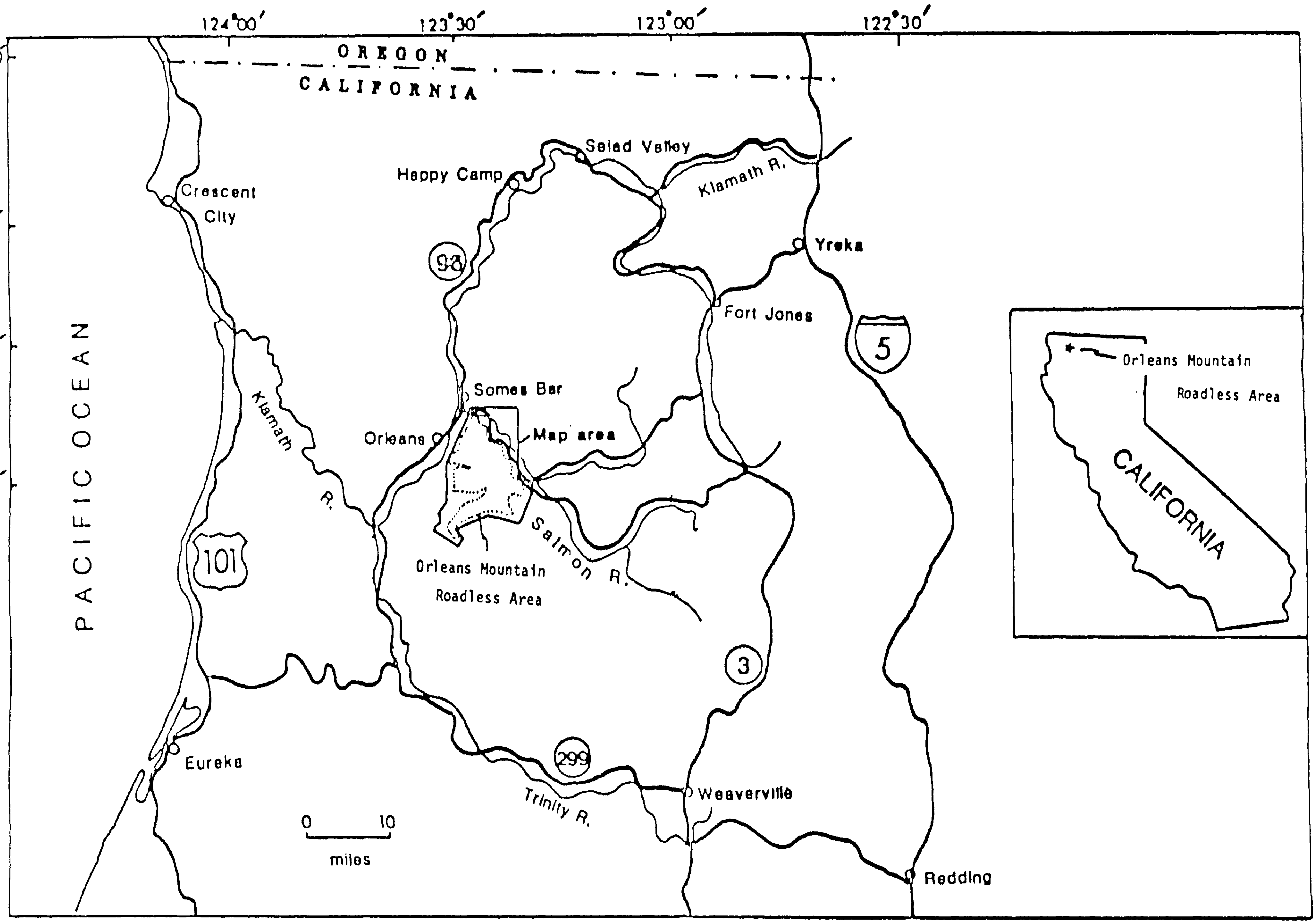

Figure 1.--Index map showing location of the Orleans Mountain Roadless Area, California.

Table 1.--Detection limits for elements analyzed by semiquantitative emission spectrography

Element	Lower limits of detection: Rocks and sediments	Lower limits of detection: Concentrates
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
Au	10	20
B	10	20
Ba	20	50
Be	1	2
Bi	10	20
Cd	20	50
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
Sc	5	10
Sn	10	20
Sr	100	200
Th	100	200
V	10	20
W	50	100
Y	10	20
Zn	200	500
Zr	10	20

DESCRIPTION OF TABLES 2 and 3

Tables 2-3 list the chemical analyses for the samples of minus-80-mesh stream sediment and nonmagnetic heavy-mineral concentrate, respectively. For the two 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 2 and 3 concentrates are suffixed 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.

If a given element was looked for on the spectrographic film but not detected, then the letter "N" is entered in the tables in place of an analytical value. If an element was observed but was below the lowest reporting value, then a "less than" (<) 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, then a "greater than" (>) was entered in the tables in front of the upper limit of determination. Because of matrix interference problems, the spectrographic technique was modified for the analysis of nonmagnetic heavy-mineral-concentrate samples. 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).

Because of the formatting used in the computer program that produced tables 2-3, 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 Bi, Cd, Sb, Th, and Zn were not detected in any of the stream sediment and concentrate samples; consequently, these elements were deleted from tables 2 and 3. Au, As, Mo and W were rarely detected; where their presence was determined the respective concentrations are noted in footnotes.

ANALYTICAL DATA

Analytical data for samples from the Orleans Mountain Roadless Area were entered into the USGS Rock Analysis Storage System (RASS). These data for sieved sediments and nonmagnetic heavy-mineral concentrates are listed in tables 2 and 3. Abbreviations used on the element columns are as follows:

pct - percent
ppm - parts per million
s - semiquantitative emission spectrographic analyses
N - not detected at the limit of detection
-- - no data available

RESULTS

Semiquantitative spectrographic analyses (Table 3) of the heavy, nonmagnetic fraction of the panned concentrates from stream sediments proved to be the most useful in evaluating the study area. This sample medium contains the common ore-forming sulfide and oxide minerals as well as other nonmagnetic minerals (e.g., barite, zircon, rutile, etc.). The concentrate medium also gives a greatly enhanced anomaly pattern because the more common rock-forming minerals (quartz and feldspar) that tend to dilute the anomalies have been preferentially removed.

Two samples (4 and 8) showed both Au and Ag values in heavy-mineral concentrates greater than their determination limits. Both Grant Creek (sample 4) and Nordheimer Creek (sample 8) flow into the Salmon River which has been a major producer of placer gold (Koschmann and Bergendahl, 1968). A heavy-mineral concentrate taken from Boise Creek below the confluence with Little South Fork of Boise Creek (sample site 2) showed Co, Cu, and Ni values that were greater than 10 times the average concentration of these elements in the study area. The samples also contained detectable Au and As plus 2 ppm Ag. No Co-, Ni-, or Cu-minerals were recognized during mineralogical inspection of this sample, but one grain of cinnabar and numerous grains of partially oxidized pyrite were found. Energy dispersive X-ray analysis (EDXRA) on the pyrite grains showed them to be Ni-bearing. It is assumed that the sulfides are also the source of high Co and Cu values.

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.

Koschmann, A. H., and Bergendahl, M. H., 1968, Principal gold-producing districts of the United States: U.S. Geological Survey Professional Paper 610, p. 81.

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.

Table 2. Analytical data for stream sediments from the Orleans Mountain Roadless Area, California.

Sample	LATITUDE	LONGITUDE	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-B	S-BA	S-BE	S-CO	S-CR
OM01	41 13 36	123 29 29	7	5.0	2.0	.5	1,000	N	20	300	<1.0	70	700
OM02	41 15 26	123 30 43	7	5.0	1.5	.5	1,000	N	15	300	<1.0	70	3,000
OM03	41 15 48	123 22 47	7	1.5	1.5	.5	1,000	N	15	1,000	1.0	20	150
OM04	41 20 2	123 23 39	7	2.0	1.5	.7	1,500	N	30	700	1.0	30	150
OM05	41 20 10	123 24 29	5	1.5	2.0	.3	1,000	N	<10	700	<1.0	20	150
OM06	41 20 50	123 24 26	5	2.0	2.0	.5	1,500	N	15	700	1.0	20	150
OM07	41 22 20	123 27 13	7	5.0	1.5	.3	1,000	N	20	700	N	50	1,000
OM08	41 16 41	123 22 49	7	3.0	1.5	.7	1,500	<.5	50	700	1.0	30	500
OM09	41 17 7	123 22 56	7	3.0	2.0	.5	1,500	N	10	1,000	<1.0	30	150
OM10	41 14 25	123 23 31	7	3.0	1.5	1.0	1,500	N	70	700	1.0	50	300
OM11	41 14 26	123 23 40	5	2.0	2.0	.3	1,000	N	15	300	1.0	30	300
OM13	41 19 56	123 30 30	7	3.0	1.5	.3	1,500	N	10	200	N	50	500
OM14	41 18 31	123 30 52	7	5.0	1.0	1.0	1,500	N	15	300	<1.0	70	2,000
OM15	41 16 40	123 34 19	7	3.0	1.0	.7	1,000	.5	50	1,000	1.0	50	5,000
OM16	41 16 59	123 33 56	7	2.0	.7	.7	1,000	.5	50	1,000	1.0	50	300
OM17	41 17 19	123 32 47	5	1.0	.1	.5	700	.5	70	1,000	1.0	15	150
OM18	41 15 34	123 19 50	5	1.5	1.0	1.0	1,500	N	100	1,000	1.5	30	300

Sample	S-CU	S-LA	S-NB	S-NI	S-PB	S-SC	S-SN	S-SR	S-V	S-Y	S-ZR
OM01	70	N	N	300	15	30	N	300	300	15	100
OM02	70	N	N	700	<10	20	N	200	150	15	50
OM03	70	<20	<20	70	10	30	N	200	200	20	100
OM04	50	N	<20	70	10	20	N	200	200	20	100
OM05	50	<20	N	30	15	30	N	200	200	20	200
OM06	50	<20	N	100	20	30	N	200	200	20	100
OM07	70	N	N	150	15	30	N	200	200	20	50
OM08	70	N	<20	150	20	20	N	200	200	20	70
OM09	50	N	N	100	20	30	N	300	200	30	70
OM10	70	50	<20	200	15	30	N	200	200	30	100
OM11	70	N	N	100	10	20	N	500	200	20	70
OM13	100	N	N	150	10	30	N	150	200	15	50
OM14	70	N	N	700	10	20	N	150	150	20	100
OM15	100	N	N	300	15	20	N	200	200	70	100
OM16	50	N	N	150	15	20	N	150	200	20	200
OM17	50	N	<20	100	20	15	N	<100	150	70	300
OM18	50	50	20	150	15	20	N	150	150	30	150

Table 3. Analytical data for heavy-mineral concentrates from the Orleans Mountain Roadless Area, California.

Sample	LATITUDE	LONGITUD	S-FE%	S-MG%	S-CA%	S-TI%	S-MN	S-AG	S-B	S-BA	S-BE	S-CO	S-CR
OM01C	41 13 36	123 29 29	7.0	3.0	30	1.0	1,500	N	70	200	N	30	700
OM02C1/	41 15 26	123 30 43	20.0	2.0	20	1.5	1,000	2	1,000	1,000	<2	3,000	500
OM03C2/	41 18 48	123 22 47	5.0	1.0	30	1.0	1,000	N	1,000	1,000	2	50	200
OM04C3/	41 20 2	123 23 39	5.0	3.0	30	2.0	1,500	5	100	500	2	20	70
OM05C4/	41 20 10	123 24 29	5.0	1.0	20	.7	1,500	N	200	700	<2	20	70
OM06C5/	41 20 50	123 24 26	3.0	3.0	30	2.0	1,000	N	100	500	<2	15	70
OM07C	41 22 20	123 27 13	3.0	2.0	20	1.5	1,000	N	500	5,000	2	20	1,000
OM08C6/	41 16 41	123 22 49	7.0	.7	30	2.0	700	10	500	2,000	5	15	70
OM09C	41 17 7	123 22 56	5.0	.7	20	.5	1,000	N	30	1,000	2	15	200
OM10C	41 14 25	123 23 31	30.0	.7	10	1.0	500	5	1,000	1,500	2	20	150
OM11C7/	41 14 26	123 23 40	3.0	.7	30	.2	700	N	150	150	3	15	30
OM12C8/	41 21 40	123 29 20	5.0	3.0	15	>2.0	700	N	1,000	1,500	<2	30	1,500
OM15C	41 16 40	123 34 19	2.0	5.0	30	1.5	700	N	200	5,000	N	30	70
OM16C	41 16 59	123 33 56	.5	1.0	15	>2.0	200	N	500	5,000	N	15	100

Sample	S-CU	S-LA	S-NB	S-NI	S-PB	S-SC	S-SN	S-SR	S-V	S-Y	S-ZR
OM01C	30	100	N	50	20	50	N	200	300	50	500
OM02C	1,000	N	N	1,500	50	20	N	>10,000	50	30	1,500
OM03C	15	50	<50	30	50	15	N	1,000	100	70	1,500
OM04C	15	100	50	30	30	30	N	1,500	100	100	2,000
OM05C	20	70	N	20	200	30	150	1,000	150	100	2,000
OM06C	20	100	<50	20	300	30	N	1,000	100	70	2,000
OM07C	20	100	N	50	30	20	N	1,000	150	100	1,000
OM08C	30	50	<50	20	100	15	N	500	100	70	1,000
OM09C	15	50	N	15	30	20	N	700	100	50	2,000
OM10C	100	<50	50	50	50	15	N	300	70	70	500
OM11C	70	50	N	10	50	15	20	300	150	30	1,000
OM12C	70	50	50	30	30	30	N	500	100	100	2,000
OM15C	10	50	N	100	<20	15	N	500	100	50	500
OM16C	<10	100	50	50	50	30	N	500	50	200	>2,000

Footnotes

1/Contains less than 20 ppm Au, less than 500 ppm As.

2/Contains less than 100 ppm W.

3/Contains 30 ppm Au, 150 ppm W.

4/Contains less than 100 ppm W.

5/Contains less than 100 ppm W.

6/Contains 150 ppm Au, 200 ppm W.

7/Contains 200 ppm W.

8/Contains 10 ppm Mo.