

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Analytical results and sample locality map of
rock samples from the Clan Alpine Wilderness Study Area,
Churchill County, Nevada

By

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This report is preliminary and has not been reviewed for
conformity with U.S. Geological Survey editorial standards
and stratigraphic nomenclature.

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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 the mineral resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the analytical results of a geochemical survey of the Clan Alpine (NV-030-102) Wilderness Study Area, Churchill County, Nevada.

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SUMMARY

The Clan Alpine Wilderness Study Area (NV-030-102) is located approximately 50 miles east of Fallon, Nevada, and encompasses nearly 68,458 acres (fig. 1). The area is accessible by improved roads extending north from Nevada Highway 50 to Dixie Valley and Edwards Creek Valley, and 4-wheel-drive trails that continue into the wilderness study area. Elevations range from 3,600 feet in the northwest to 9,966 feet at Mount Augusta in the south-central part of the range.

A reconnaissance geologic map of the Clan Alpine Mountains was included in geologic studies of Churchill County published cooperatively by the University of Nevada and the USGS (Willden and Speed, 1974). Detailed mapping, sampling, and geophysical studies of the Clan Alpine Wilderness Study Area were carried out during the summer of 1986 by the USGS in conjunction with geochemical sampling of mineralized areas by the USBM (U.S. Bureau of Mines). Geologic mapping, description of rock units, and mineral resource potential are discussed in Riehle and others (1972), Willden and Speed (1974), and Hardyman and others (in press).

Rocks exposed in the study area are chiefly Tertiary igneous rocks and minor Mesozoic sedimentary rocks. Thirteen whole-rock analyses of the igneous rocks in the southern Clan Alpine Mountains are listed in Riehle and others (1972). Compositions range from 55.2 to 76.7 wt% SiO₂. In order to better understand the chemistry and evolution of the igneous rocks of the proposed volcanic centers in the Clan Alpine Mountains (Riehle and others, 1972; Hardyman and others, in press) an additional 32 samples were submitted for X-ray fluorescence (XRF) major-oxide analysis as part of this wilderness study (table 1).

Limited production of gold and silver was reported from the Clan Alpine Mountains in the 1860's. Mineralized zones containing anomalous silver were found in faulted, silicified volcanic rock near the mouth of Florence Canyon, approximately 1 mile southeast of the wilderness study area boundary (Schrader, 1947) and several workings are located in faulted and hydrothermally altered volcanic rocks east and northeast of Mount Augusta in the general area of Starr Canyon. Samples from these workings and other altered areas within the wilderness study area were analyzed. Other work in the study area includes a discussion of mineral resources and mining claims (Olson, 1987) and a stream-sediment geochemical survey in 1985 by H. N. Barton (USGS, unpub. data).

Analyses of unaltered and unmineralized rock samples provide background geochemical data for the individual rock units. On the other hand, analyses of altered or mineralized rocks near Florence and Starr Canyons, in the south part of the Clan Alpine Wilderness Study Area, provide geochemical information about the mineralized zones located primarily in the faulted and silicified Tertiary volcanic rocks.

DESCRIPTION OF DATA TABLES

Table 1 lists the XRF analyses for rock samples from the Clan Alpine Wilderness Study Area. The data are arranged so that the last 3 digits of the USGS-assigned sample number in table 1 correspond to the numbers shown on the sample locality map (pl. 1). Latitude and longitude for samples listed in table 1 are given in Appendix 1.

Table 2 lists the analyses for geochemically analyzed samples from the wilderness study area. The samples were geochemically analyzed using a semiquantitative, direct-current arc emission spectrographic method (Grimes and Marranzino, 1968). The elements analyzed and their limits of

determination are listed in table 3. 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). The data in table 2 are arranged so that the USGS-assigned sample numbers correspond to the numbers shown on the sample locality map (pl. 1). A letter "N" in the tables indicates that a given element was not detected at the lower limit of determination; a letter "L" indicates that a given element was detected, but was below the lower limit of determination. The samples were rock chips collected from outcrops at the locations shown on plate 1. Latitude and longitude for samples listed in table 1 are given in Appendix 2.

Table 2.--Analytical results of geochemically analyzed rock samples from the Clan Alpine Wilderness Study Area, Churchill County, Nevada

[Alteration symbols: A, propylitic; B, argillic; C, siliceous; D, sericitic; F, other; H, iron/manganese]

Field No.	B6013	B6031A	B6069	B6072	B6175	B6188	B6194	B6196	B6197	B6198	B6199	B6209	B6210	B6211	B6213	B6214	E786	E2386	E2486
Lab No.	JBB 739	JBB 740	JBB 741	JBB 742	JBB 743	JBB 744	JBB 745	JBB 746	JBB 747	JBB 748	JBB 749	JBB 750	JBB 751	JBB 752	JBB 753	JBB 754	JBB 755	JBB 756	JBB 757
Alteration	A	B	C	A	H	D,C	A	A	A	H	A	A	A	A	A	H	A	H	H
Fe%	3	1.5	.7	1.5	1	.7	1.5	1	3	1	3	2	1	1.5	1	3	1.5	1.5	2
Mg%	.7	.07	.05	.2	.07	.1	.2	.2	.7	.2	.5	.5	.2	.7	.3	.5	.3	.07	.15
Ca%	3	.2	1.0	.7	.15	.15	1	1	2	.3	2	.7	.2	1	.5	10	.15	.2	.3
Ti%	.5	.2	.07	.2	.07	.3	.15	.2	.5	.07	.7	.2	.07	.2	.07	.1	.3	.3	.15
Mn-ppm	1000	150	200	200	150	100	300	500	300	200	700	500	300	300	500	500	300	70	100
Ag-ppm	N	N	N	N	N	1	N	L	N	N	N	N	N	N	N	L	N	N	N
As-ppm	N	N	N	N	N	L	N	N	N	N	N	N	N	N	N	N	N	N	N
Au-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
B-ppm	15	L	20	30	70	70	30	30	10	20	20	70	50	20	30	30	10	20	15
Ba-ppm	700	3000	50	1000	L	100	1500	1500	1000	300	1500	700	300	700	300	150	1500	5000	1500
Be-ppm	L	1.5	7	1.5	3	1	2	2	L	2	L	3	3	3	3	L	2	3	3
Bi-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Cd-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Co-ppm	10	N	N	N	N	L	N	N	10	N	10	L	N	L	N	10	N	N	N
Cr-ppm	50	L	N	N	15	50	10	10	50	10	50	10	N	10	10	50	10	10	L
Cu-ppm	7	L	L	L	N	7	L	L	30	N	10	L	L	L	L	50	L	L	L
La-ppm	20	20	30	20	20	L	20	20	20	20	20	20	20	20	20	L	20	20	20
Mo-ppm	N	N	N	N	L	15	N	N	N	N	N	N	N	N	N	N	N	N	N
Nb-ppm	N	N	L	N	L	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Ni-ppm	L	L	L	L	L	5	L	L	20	L	10	L	L	L	L	50	L	L	L
Pb-ppm	20	30	90	30	50	N	30	30	20	30	30	30	30	30	50	L	20	30	30
Sb-ppm	N	N	N	N	N	700	N	N	N	N	N	N	N	N	N	N	N	N	N
Sc-ppm	15	5	L	L	L	L	5	L	15	L	20	5	5	5	L	5	L	5	L
Sn-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Sr-ppm	500	150	150	300	N	100	200	300	500	150	700	100	100	200	100	300	100	100	100
V-ppm	100	10	L	30	L	100	30	50	150	15	150	50	50	50	20	70	15	10	15
W-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Y-ppm	20	20	50	15	20	N	15	15	20	15	20	20	20	20	20	20	20	15	15
Zn-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Zr-ppm	150	150	200	150	150	30	150	150	150	150	150	150	150	150	150	50	150	200	150
Th-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Table 2.--Analytical results of geochemically analyzed rock samples from the Clan Alpine Wilderness Study Area, Churchill County, Nevada (continued)

Field No.	E3286	E3386	E3686	E3986	E4186	E4286	E4386	E4486	E4586	E4786	E4886	E5486	E5486	E5586	E5786	E5886	E6686
Lab No	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB
Alteration	H	H	H	A	H	H	H	H	H	F	H	H	H	H	H	H	H
Fe%	1.5	2	1	.7	1.5	1.5	1.5	1.5	.7	1	3	1.5	2	.7	1.5	1.5	3
Mg%	.1	.2	.15	.1	.2	.15	.1	.1	.07	.05	.02	.03	.15	.02	.07	.07	.07
Ca%	L	.07	L	L	.07	.2	.05	.15	L	L	L	L	L	L	L	.15	L
Ti%	.15	.2	.15	.15	.15	.1	.1	.1	.05	.1	.03	.07	.1	.07	.1	.1	.07
Mn-ppm	150	1000	150	1000	300	1500	1000	150	70	700	150	1000	500	100	500	200	1500
Ag-ppm	7	3	1.5	1	L	N	N	1.5	200	5	5	100	50	20	20	5	N
As-ppm	300	N	N	N	N	N	N	N	N	N	200	N	N	N	N	500	N
Au-ppm	N	N	N	N	N	N	N	N	N	N	N	15	N	N	N	N	N
B-ppm	20	15	30	10	20	20	20	15	10	10	20	10	10	10	10	15	10
Ba-ppm	700	1000	500	1000	1000	1000	700	300	300	300	1000	500	500	700	1000	1000	100
Be-ppm	3	3	5	5	5	5	7	3	3	15	3	7	7	5	5	20	3
Bi-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Cd-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Co-ppm	N	10	N	N	N	7	N	N	N	N	N	N	N	N	N	N	N
Cr-ppm	L	L	L	N	N	L	N	N	L	L	N	N	N	L	N	N	N
Cu-ppm	5	L	L	L	5	5	L	5	30	10	5	150	100	20	15	15	L
La-ppm	20	30	30	20	30	30	30	20	N	20	20	20	20	L	20	L	20
Mo-ppm	100	7	L	N	N	N	N	N	L	7	N	70	20	20	15	10	100
Nb-ppm	L	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	L
Ni-ppm	L	5	L	L	L	L	L	L	L	L	L	L	L	5	L	L	L
Pb-ppm	70	50	20	15	30	50	50	20	20	L	30	200	100	30	30	20	70
Sb-ppm	N	N	N	N	N	N	N	N	L	N	N	150	150	N	N	N	N
Sc-ppm	L	L	5	5	L	L	L	L	N	L	L	L	L	N	L	L	L
Sn-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Sr-ppm	200	L	N	150	100	200	L	L	N	N	150	L	L	N	L	L	N
V-ppm	15	30	15	L	30	30	30	50	15	10	30	20	15	10	15	50	10
W-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Y-ppm	15	20	20	15	20	20	20	15	15	10	15	30	N	L	20	20	30
Zn-ppm	N	N	N	N	N	L	N	N	N	N	N	N	N	N	N	300	N
Zr-ppm	150	150	150	150	150	150	150	150	30	150	20	30	30	50	100	150	200
Th-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Table 2.--Analytical results of geochemically analyzed rock samples from the Clan Alpine Wilderness Study Area, Churchill County, Nevada (continued)

Field No.	E6786	E6886	E7086	E7186	E7286	E7486	E7586	E8286	E9286	E9386	E6086	E6186	E7786	B2112	RHCA1g	RHCA2g	RHCA3g	RHCA4g	
Lab No.	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB	JBB
Alteration	H	H	H	H	H	H	H	H	H	H	H	A	C	A	C	C	C	C	C
Fe%	1	1.5	.7	.7	.7	.7	1	3	1.5	1.5	1.5	2	1.5	1.5	.7	1	1.5	1.5	.15
Mg%	.15	.2	.07	.07	.07	.07	.07	.15	.03	.02	.3	1	.15	.3	.02	.05	.05	.05	.02
Ca%	.15	.15	L	.2	.1	L	.15	L	L	.05	.3	1	.3	.3	.15	.05	.05	.1	.05
Ti%	.1	.2	.1	.07	.07	.5	.3	.2	.15	.05	.15	.3	.1	.1	.05	.05	.1	.1	.05
Mn-ppm	500	300	150	1000	200	500	1000	1500	200	100	200	700	300	70	200	100	150	100	100
Ag-ppm	N	2	N	5	15	N	N	2	N	N	N	N	N	N	N	N	N	N	2
As-ppm	N	N	N	N	N	N	N	200	N	N	N	N	N	N	N	N	N	N	N
Au-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
B-ppm	50	15	15	10	10	10	20	15	L	L	20	L	20	70	50	50	50	L	
Ba-ppm	700	1500	700	500	500	500	1000	1000	150	N	1500	1500	1000	500	100	L	L	N	
Be-ppm	3	3	2	2	2	L	L	7	2	1	2	2	3	2	3	7	3	3	5
Bi-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Cd-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Co-ppm	N	N	N	N	N	L	N	5	N	N	L	L	N	N	N	N	N	N	N
Cr-ppm	L	N	N	N	L	L	N	N	L	N	L	N	N	L	N	L	L	L	L
Cu-ppm	5	L	L	20	7	7	7	30	N	10	L	L	L	L	N	L	15	15	N
La-ppm	20	20	L	20	20	20	20	70	20	30	30	20	30	20	20	20	20	20	L
Mo-ppm	N	N	N	N	L	7	L	50	N	N	N	N	N	N	N	N	100	7	N
Nb-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	L	N	N
Ni-ppm	L	L	L	L	L	L	L	70	L	L	L	L	L	L	L	L	L	L	L
Pb-ppm	30	50	20	70	70	30	50	70	20	30	50	30	50	15	30	30	50	30	30
Sb-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Sc-ppm	L	L	L	L	L	L	L	5	L	L	L	5	L	L	N	N	L	L	7
Sr-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
St-ppm	N	200	N	N	N	300	500	N	N	N	150	300	100	100	N	N	N	N	N
V-ppm	15	20	15	15	10	70	70	20	L	10	15	30	10	15	15	15	15	15	10
W-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Y-ppm	15	15	L	15	L	10	10	50	20	30	20	20	20	15	15	20	30	20	N
Zn-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Zr-ppm	100	150	100	70	100	200	150	150	150	200	150	150	150	150	100	200	300	200	200
Ti-ppm	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Table 3.--Limits of determination for the spectrographic analysis of rocks,
based on a 10-mg sample

Element	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

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Appendix 1.--Latitude and longitude of rock samples used for XRF analysis
from the Clan Alpine Wilderness Study Area, Churchill County, Nevada

Field No.	Lab No.	Latitude	Longitude
B6169	D277747	39°37'13"	117°53'30"
B6170	D277748	39°37'23"	117°53'23"
B6171	D277749	39°37'30"	117°53'20"
E486	D277376	39°35'04"	117°54'11"
E1186	D277377	39°35'47"	117°56'23"
E1386	D277378	39°35'20"	117°58'18"
E3786	D277382	39°31'30"	117°55'39"
E5186	D277383	39°30'37"	117°55'00"
E6086	D277384	39°32'33"	117°57'30"
E7686	D277386	39°32'32"	117°58'08"
E7786	D277387	39°32'25"	117°58'18"
E7886	D277388	39°32'22"	117°58'19"
E7986	D277389	39°32'19"	117°58'23"
E8086	D277390	39°32'16"	117°58'37"
E3586	D277394	39°33'50"	117°53'26"
E1786	D277379	39°34'42"	117°57'34"
E1886	D277380	39°34'44"	117°57'35"
E6186	D277385	39°31'40"	117°58'04"
B6065	D277750	39°36'15"	117°49'00"
B6177	D277751	39°37'50"	117°52'12"
B6178	D277752	39°38'08"	117°51'44"
B6179	D277753	39°38'00"	117°51'35"
B6180	D277754	39°38'02"	117°51'23"
B6181	D277755	39°38'00"	117°51'15"
B6186	D277756	39°38'23"	117°51'13"
B6204	D277757	39°38'21"	117°49'55"
B6205	D277758	39°38'23"	117°49'50"
B6206	D277759	39°38'35"	117°49'50"
B6207	D277760	39°38'40"	117°49'49"
B6208	D277761	39°38'46"	117°49'45"
E186	D277375	39°36'19"	117°53'15"
E3086	D277381	39°32'21"	117°55'08"

Appendix 2.--Latitude and longitude of geochemically analyzed rock samples
from the Clan Alpine Wilderness Study Area, Churchill County, Nevada

Field No.	Lab No.	Latitude	Longitude
B6013	JBB739	39°36'08"	117°50'15"
B6031A	JBB740	39°35'37"	117°51'00"
B6069	JBB741	39°34'53"	117°50'07"
B6072	JBB742	39°35'00"	117°48'00"
B6175	JBB743	39°39'13"	117°53'30"
B6188	JBB744	39°40'37"	117°52'15"
B6194	JBB745	39°39'53"	117°50'30"
B6196	JBB746	39°39'45"	117°49'50"
B6197	JBB747	39°39'49"	117°50'20"
B6198	JBB748	39°39'00"	117°49'05"
B6199	JBB749	39°39'23"	117°49'12"
B6209	JBB750	39°40'00"	117°51'42"
B6210	JBB751	39°39'53"	117°51'28"
B6211	JBB752	39°39'19"	117°50'43"
B6213	JBB753	39°39'43"	117°52'22"
B6214	JBB754	39°37'50"	117°47'38"
E786	JBB755	39°33'50"	117°50'49"
E2386	JBB756	39°35'12"	117°57'44"
E2486	JBB757	39°32'22"	117°50'03"
E3286	JBB758	39°33'22"	117°54'30"
E3386	JBB759	39°33'09"	117°54'25"
E3686	JBB760	39°33'48"	117°54'14"
E3986	JBB761	39°34'10"	117°54'25"
E4186	JBB762	39°32'40"	117°53'45"
E4286	JBB763	39°32'41"	117°53'46"
E4386	JBB764	39°32'48"	117°53'44"
E4486	JBB765	39°32'48"	117°53'35"
E4586	JBB766	39°32'46"	117°53'20"
E4686	JBB767	39°30'27"	117°51'56"
E4786	JBB768	39°32'11"	117°51'32"
E4886	JBB769	39°31'26"	117°51'40"
E5486	JBB770	39°31'17"	117°51'40"
E54A86	JBB771	39°30'17"	117°52'10"
E5586	JBB772	39°30'13"	117°52'00"
E5686	JBB773	39°30'22"	117°52'15"
E5786	JBB774	39°30'19"	117°52'24"
E5886	JBB775	39°30'33"	117°51'45"
E6686	JBB776	39°31'30"	117°58'32"

Appendix 2.--Latitude and longitude of geochemically analyzed rock samples
from the Clan Alpine Wilderness Study Area, Churchill County, Nevada--Continued

Field No.	Lab No.	Latitude	Longitude
E6786	JBB777	39°32'10"	117°53'50"
E6886	JBB778	39°32'17"	117°53'52"
E6986	JBB779	39°32'21"	117°53'54"
E7086	JBB780	39°32'25"	117°53'48"
E7186	JBB781	39°32'23"	117°53'41"
E7286	JBB782	39°32'19"	117°53'45"
E7486	JBB783	39°34'47"	118°00'21"
E7586	JBB784	39°34'37"	118°00'20"
E8286	JBB785	39°34'15"	117°57'21"
E9286	JBB786	39°34'15"	117°57'21"
E9386	JBB787	39°33'57"	117°59'55"
E6086	JBB792	39°32'33"	117°57'30"
E6186	JBB793	39°31'40"	117°58'04"
E7786	JBB794	39°32'25"	117°58'18"
B2112	JBB795	39°39'35"	117°49'50"
RHCA1g	JBB803	39°40'	117°55'
RHCA2g	JBB804	39°40'	117°55'
RHCA3g	JBB805	39°37'30"	117°57'30"
RHCA4g	JBB806	39°37'30"	117°57'30"