UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Analytical results and sample locality map of heavy-mineral-concentrate and rock samples from the Castle Peaks Wilderness Study Area (CDCA-266), San Bernardino County, California

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Open-File Report 86-416

1986

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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 Castle Peaks Wilderness Study Area (CDCA-266), San Bernardino County, California.

INTRODUCTION

In April 1984, the U.S. Geological Survey conducted a reconnaissance geochemical survey of the Castle Peaks Wilderness Study Area, San Bernardino County, California.

The Castle Peaks Wilderness Study Area comprises about 70 mi^2 (182 km^2) (45,000 acres) in the northern New York Mountains and the southern terminous of the McCullough Range in northeastern San Bernardino County, California (fig. 1). The study area boundaries are defined on the northwest by a powerline road; on the northeast by the Nevada-California state border; on the south by Ivanpah Road; on the east by Hart Mine road; and on the west by the Union Pacific Railroad. Paved and improved dirt roads provide access to the boundaries of the study area and several unimproved dirt roads and jeep and foot trails provide access within it. Elevations within the study area range from 3,200 ft on the west in Ivanpah Valley to 5,829 ft at the top of the Castle Peaks in the New York Mountains. Mountainous parts of the area are characteristically rugged, with elevation changes of 500 to 600 ft over a horizontal distance of 1/4 mi being common.

GEOLOGY

Geologic Setting

Rocks in the northern New York Mountains record a long and complex geologic history. The oldest rocks are Early Proterozoic gneiss that represents mature and immature sedimentary and volcanic rocks that were intruded by granitoid plutons and deformed into broad zones of gneiss and narrow mylonitic zones at about 1.7 Ga (J. L. Wooden, 1985, oral commun.). Paleozoic carbonate strata and early Mesozoic conglomerate and rhyolite were deposited on the Proterozoic gneiss, and in the late Mesozoic rocks in the area were thrust faulted and metamorphosed as part of the Cordilleran thrust belt (Burchfiel and Davis, 1977). Following thrusting, parts of the Teutonia batholith (Hewitt, 1956; Beckerman and others, 1982) were emplaced. Miocene volcanic rocks were deposited in mountainous terrain, faulted, and subsequently buried by huge alluvial fans generated from nearby mountains. Although the New York Mountains area is typically included in the southern Basin and Range province, little evidence points to either normal faulting that blocks out ranges in southern Nevada or detachment faulting that characterizes the province in western Arizona (Miller and others, unpublished report).

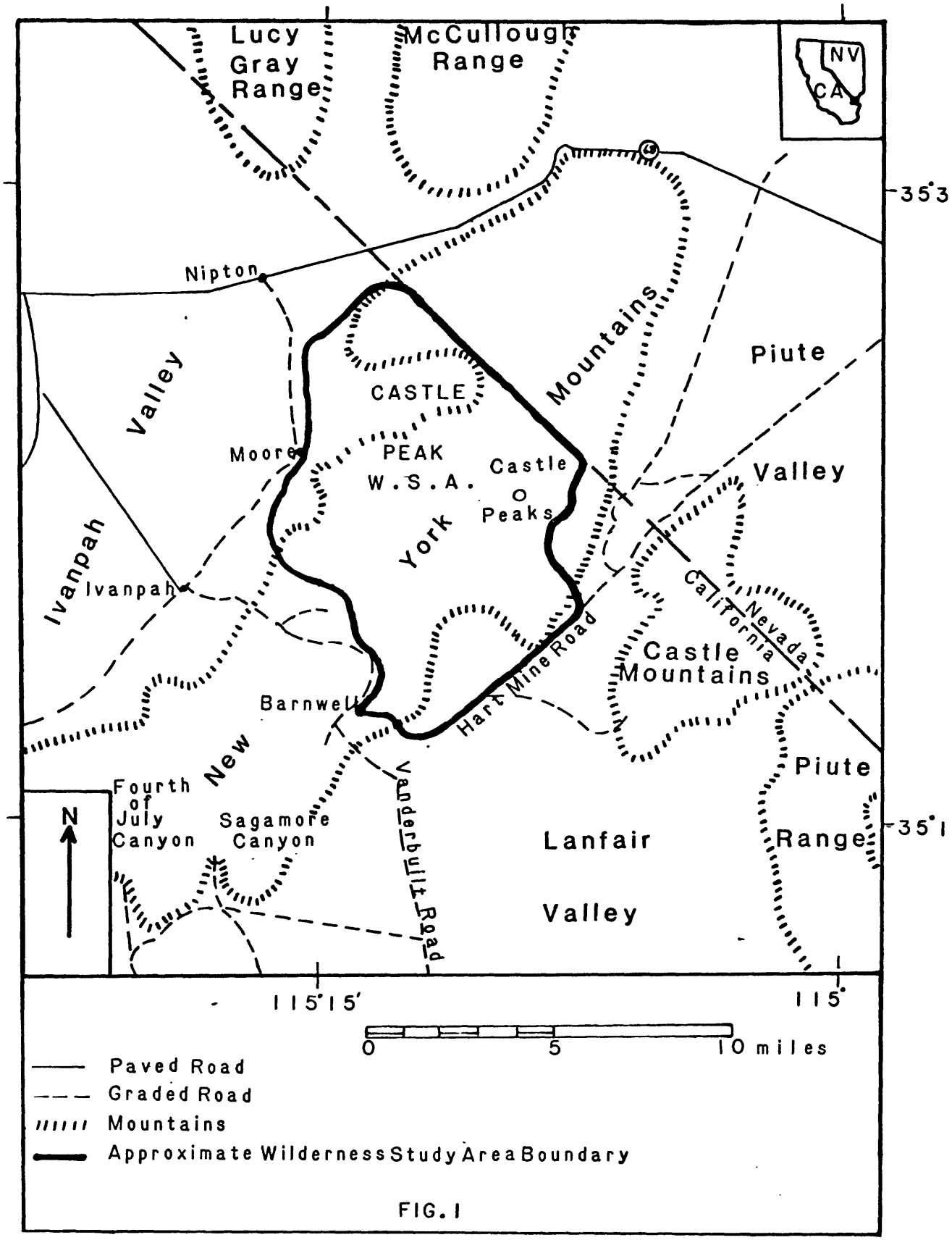

Figure 1. Index map of the Castle Peaks Wilderness Study Area, San Bernardino County, California.

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 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.

Sample Collection

Heavy-mineral-concentrate samples were collected at 69 sites (plate 1). Rock samples were collected at 31 sites. Sampling density was about one sample site per 1 mi^2 for the heavy-mineral concentrates, and about one sample site per 2 mi^2 for the rocks. The area of the drainage basins sampled ranged from 0.5 mi^2 to 2 mi^2.

Heavy-mineral-concentrate samples

Heavy-mineral-concentrate samples were collected from 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 as float or stream cobbles in the vicinity of the plotted site location. Samples were collected from unaltered and/or altered and/or mineralized rocks.

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.

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. The analyses for heavy-mineral-concentrate samples were performed by the Branch of Exploration Geochemistry (Grimes and Marranzino, 1968); analyses for rock samples were performed by the Branch of Analytical Chemistry (Myers and others, 1961). The elements analyzed and their lower limits of determination are listed in table 1. For arsenic (As), gold (Au), and thorium (Th), the lower limit of determination by the two branches varies. The values in the parentheses are the values used by the Branch of Analytical Chemistry. 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 the Castle Peaks Wilderness Study Area are listed in tables 3 and 4.

Chemical Methods

Other methods of analysis used on samples from the Castle Peaks 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 the USGS-assigned sample numbers. These numbers correspond to the numbers shown on the site location map (plate 1). Columns in which the element headings show the letter "s" below the element symbol are emission spectrographic analyses; "aa" indicates atomic absorption analyses;

and "icp" indicates inductively coupled plasma-atomic emission spectroscopy. 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 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.

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, J. Gaccetta, and G. Thurston; analyses, P. H. Briggs, C. Gent, H. Groeneboer, B. J. Libby; and data retrieval, J. L. Jones.

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TABLE 1.--Limits of determination for the spectrographic analysis of rocks, 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 (Grimes and Marranzino) 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)	10		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.--Chemical methods used

[AA = atomic absorption and CP = inductively coupled plasma spectroscopy]

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	Koirtyhann and Kahlil, 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	
Tungsten (W)	rock	ICP	0.5 or 1	Aruscavage and Doughten, unpublished report.

TABLE 3. ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE CASTLE PEAKS WILDERNESS STUDY AREA, SAN BERNARDINO 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	B-ppm s	Ba-ppm s
CP122	35 20 45	115 16 0	.5	.20	10	.20	200	N	N	N	20	300
CP123	35 20 34	115 15 43	.5	.30	20	.50	300	N	N	N	<20	100
CP124	35 20 12	115 14 5	.7	.50	10	2.00	300	N	N	N	20	200
CP125	35 20 4	115 14 24	.7	.20	3	>2.00	100	N	N	N	30	300
CP126	35 19 55	115 14 40	1.0	.50	7	2.00	300	N	N	N	20	300
CP127	35 19 15	115 14 0	.5	1.50	20	.70	300	N	N	N	20	300
CP128	35 20 25	115 15 8	.5	2.00	10	2.00	200	N	N	N	30	150
CP129	35 20 50	115 12 30	.5	.20	10	2.00	150	N	N	N	20	300
CP130	35 20 38	115 13 48	.3	5.00	15	2.00	200	N	N	N	20	2,000
CP131	35 20 18	115 15 27	.7	.70	5	1.00	200	N	N	N	30	200
CP132	35 26 0	115 15 17	.3	.20	10	>2.00	200	N	N	N	30	100
CP133	35 17 28	115 13 20	.7	.50	3	1.00	200	N	N	N	50	300
CP134	35 22 10	115 11 50	.5	.70	10	1.00	200	N	N	N	20	200
CP135	35 22 13	115 12 20	.5	.20	5	.70	150	N	N	N	20	150
CP136	35 23 42	115 12 50	1.0	1.00	5	1.50	300	N	N	N	30	200
CP137	35 23 55	115 13 46	1.0	.50	2	1.00	150	N	N	N	30	200
CP139	35 21 9	115 16 17	1.0	.50	3	2.00	100	N	N	N	30	200
CP140	35 21 30	115 16 15	1.0	.50	15	.50	300	N	N	N	20	300
CP214	35 23 20	115 7 57	.7	.20	10	1.50	700	N	N	N	20	500
CP215	35 22 23	115 7 42	.5	.50	20	2.00	500	N	N	N	20	2,000
CP216	35 21 31	115 5 30	1.0	1.00	3	2.00	300	N	N	N	20	500
CP217	35 20 41	115 6 52	.7	.70	7	1.50	300	N	N	N	20	700
CP218	35 21 30	115 8 35	.7	.50	10	1.50	500	N	N	N	20	500
CP219	35 18 12	115 9 54	1.0	1.00	7	2.00	300	N	N	N	20	700
CP220	35 16 54	115 11 50	1.0	1.00	5	>2.00	200	N	N	N	20	500
CP221	35 19 2	115 13 3	.7	1.00	3	.50	200	N	N	N	20	500
CP222	35 18 49	115 13 7	1.5	2.00	5	2.00	300	N	N	N	30	700
CP223	35 19 51	115 10 32	1.0	1.00	10	1.00	500	N	N	N	20	700
CP224	35 19 31	115 12 43	.7	2.00	5	2.00	300	N	N	N	20	500
CP225	35 19 41	115 11 37	1.0	1.00	5	1.00	200	N	N	N	30	700
CP226	35 19 21	115 12 9	1.5	2.00	7	2.00	500	N	N	N	20	500
CP227	35 26 55	115 11 40	.7	.50	10	2.00	200	N	N	N	20	5,000
CP228	35 24 27	115 11 21	.7	.15	15	2.00	500	N	N	N	<20	150
CP229	35 24 49	115 9 35	1.0	.15	7	>2.00	200	N	N	N	30	10,000
CP230	35 26 3	115 13 51	.5	.20	10	>2.00	150	N	N	N	20	>10,000
CP309	35 20 14	115 13 58	1.5	3.00	10	1.50	500	N	N	N	20	1,000
CP310	35 20 17	115 14 20	1.0	2.00	7	.70	200	N	N	N	20	500
CP311	35 19 46	115 14 25	1.5	.70	2	2.00	200	N	N	N	50	500
CP312	35 19 30	115 14 18	1.0	1.00	3	1.00	200	1.5	N	N	20	700
CP313	35 20 55	115 13 20	1.0	.50	7	.70	300	N	N	N	20	300
CP314	35 20 42	115 12 31	.3	.20	7	.20	70	N	N	N	20	700
CP315	35 20 44	115 12 45	.3	.20	5	.20	70	N	N	N	20	700
CP316	35 20 55	115 14 1	.3	.10	3	.10	50	N	N	N	<20	200
CP317	35 20 40	115 14 50	.5	.50	5	.30	100	N	N	N	20	500
CP318	35 20 43	115 15 4	.5	.50	7	.30	150	N	N	N	20	300

TABLE 3. ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE CASTLE PEAKS WILDERNESS STUDY AREA, SAN BERNARDINO COUNTY, 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
CP122	<2	N	N	N	N	<10	200	N	N	N	20
CP123	<2	N	N	N	N	N	300	N	N	<10	30
CP124	<2	N	N	N	N	N	500	N	N	N	100
CP125	<2	N	N	N	100	N	100	N	N	<10	30
CP126	2	N	N	<10	N	N	500	N	N	<10	200
CP127	<2	N	N	N	N	N	1,000	N	N	N	50
CP128	N	N	N	<10	N	N	300	N	N	<10	50
CP129	N	N	N	N	N	N	300	N	N	N	<20
CP130	N	N	N	N	N	N	100	N	N	N	200
CP131	<2	N	N	<10	N	N	700	N	N	10	200
CP132	N	N	N	N	N	<10	300	N	<50	<10	20
CP133	<2	N	N	<10	N	N	300	N	<50	N	<20
CP134	N	N	N	N	N	N	700	N	N	<10	N
CP135	N	N	N	N	N	N	300	N	N	N	20
CP136	N	N	N	<10	<20	N	700	N	<50	<10	30
CP137	N	N	N	<10	<20	N	200	N	N	N	30
CP139	N	N	N	<10	100	<10	100	N	N	N	N
CP140	N	N	N	<10	N	<10	2,000	N	N	N	70
CP214	N	N	N	<10	N	20	1,000	15	N	N	150
CP215	N	N	N	N	N	N	700	N	<50	N	N
CP216	<2	N	N	<10	<20	<10	500	N	<50	<10	20
CP217	N	N	N	<10	<20	N	500	N	N	N	70
CP218	N	N	N	N	N	N	200	N	N	N	70
CP219	N	N	N	N	<20	N	200	N	<50	N	20
CP220	<2	N	N	<10	N	N	300	N	50	N	N
CP221	N	N	N	<10	N	N	1,000	N	N	<10	30
CP222	N	N	N	<10	50	N	300	N	50	10	N
CP223	N	N	N	N	20	N	300	N	N	10	20
CP224	<2	N	N	<10	N	<10	150	N	70	N	<20
CP225	N	N	N	N	N	<10	200	N	<50	<10	50
CP226	<2	N	N	<10	N	<10	200	N	70	<10	N
CP227	N	N	N	N	N	N	150	N	50	N	100
CP228	N	N	N	N	<20	N	300	N	50	N	20
CP229	2	N	N	<10	20	N	200	N	150	<10	<20
CP230	N	N	N	N	<20	N	200	N	100	N	50
CP309	N	N	N	N	<20	N	500	N	N	N	20
CP310	N	N	N	<10	N	N	300	N	N	<10	30
CP311	N	N	N	10	30	N	2,000	N	N	<10	50
CP312	N	N	N	10	N	10	150	N	N	N	2,000
CP313	N	N	N	<10	<20	N	2,000	N	N	N	50
CP314	N	N	N	<10	N	N	200	N	N	N	<20
CP315	N	N	N	N	N	N	150	N	N	N	N
CP316	N	N	N	N	N	N	N	N	N	N	70
CP317	N	N	N	N	N	N	N	N	N	N	N
CP318	N	N	N	N	N	N	<50	N	N	N	N

TABLE 3. ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE CASTLE PEAKS WILDERNESS STUDY AREA, SAN BERNARDINO COUNTY, CALIFORNIA.--Continued

Sample	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
CP122	N	N	N	N	20	100	300	N	>2,000	N
CP123	N	N	N	N	100	N	700	N	>2,000	N
CP124	N	N	N	1,000	100	N	300	N	>2,000	N
CP125	N	N	N	<200	200	<100	150	N	>2,000	N
CP126	N	N	N	500	100	N	300	N	>2,000	N
CP127	N	N	N	3,000	70	N	200	N	>2,000	N
CP128	N	N	N	500	70	N	300	N	>2,000	N
CP129	N	N	N	1,500	70	N	150	N	>2,000	N
CP130	N	N	N	300	100	N	200	N	>2,000	200
CP131	N	N	N	300	50	N	300	N	>2,000	200
CP132	N	N	N	N	70	N	700	N	>2,000	N
CP133	N	N	N	1,000	70	N	100	N	>2,000	N
CP134	N	N	N	2,000	70	N	200	N	>2,000	N
CP135	N	N	N	700	30	200	300	N	>2,000	N
CP136	N	N	N	700	70	N	300	N	>2,000	200
CP137	N	N	N	N	70	N	150	N	>2,000	N
CP139	N	N	N	N	150	<100	100	N	>2,000	N
CP140	N	N	N	<200	50	N	700	N	>2,000	300
CP214	N	N	N	300	70	N	700	N	>2,000	N
CP215	N	N	N	1,500	70	<100	700	N	>2,000	N
CP216	N	N	N	500	70	N	200	N	>2,000	N
CP217	N	N	N	1,000	70	N	200	N	>2,000	200
CP218	N	N	N	1,000	50	N	500	N	>2,000	N
CP219	N	N	N	700	70	N	300	N	>2,000	N
CP220	N	N	N	500	100	N	200	N	>2,000	300
CP221	N	N	N	500	50	N	200	N	>2,000	<200
CP222	N	N	N	1,000	100	N	150	N	>2,000	N
CP223	N	N	N	1,000	50	N	300	N	>2,000	N
CP224	N	N	N	500	100	N	200	N	>2,000	500
CP225	N	N	N	1,000	70	N	100	N	>2,000	500
CP226	N	N	N	500	100	N	200	N	>2,000	<200
CP227	N	N	N	<200	70	N	500	N	>2,000	N
CP228	N	N	N	N	70	<100	700	N	>2,000	N
CP229	N	N	N	300	100	N	300	N	2,000	N
CP230	N	N	N	1,500	100	<100	200	N	>2,000	N
CP309	N	N	N	700	70	N	300	N	>2,000	N
CP310	N	N	N	500	50	N	150	N	>2,000	N
CP311	N	N	N	<200	100	N	100	N	>2,000	500
CP312	N	N	N	700	50	N	100	N	>2,000	N
CP313	N	N	N	500	50	N	500	N	>2,000	<200
CP314	N	N	N	1,000	30	N	100	N	>2,000	N
CP315	N	N	N	1,000	20	N	70	N	>2,000	N
CP316	N	N	N	N	<20	150	300	N	>2,000	N
CP317	N	N	N	<200	20	N	100	N	>2,000	N
CP318	N	N	N	<200	<20	N	100	N	>2,000	N

TABLE 3. ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE CASTLE PEAKS WILDERNESS STUDY AREA, SAN BERNARDINO COUNTY, 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
CP320	35 23 0	115 15 13	.5	.20	3	.07	70	N	N	N	20	300
CP321	35 22 55	115 15 21	.3	.10	3	.20	50	N	N	N	20	500
CP322	35 23 5	115 15 25	1.0	.50	5	.50	200	N	N	N	20	300
CP323	35 21 48	115 15 46	.5	.20	7	.50	200	N	N	N	<20	100
CP324	35 21 56	115 15 37	.5	.20	10	.20	200	N	N	N	<20	70
CP325	35 22 16	115 11 48	1.0	.50	5	1.00	200	N	N	N	20	500
CP326	35 22 52	115 12 39	1.0	.50	3	.50	200	N	N	N	50	300
CP327	35 23 25	115 14 47	1.0	.50	5	.70	200	N	N	N	50	500
CP415	35 22 55	115 5 55	.5	.20	15	2.00	1,000	N	N	N	20	150
CP416	35 22 13	115 5 54	1.0	1.00	10	2.00	500	N	N	N	30	700
CP417	35 20 37	115 6 10	.5	.50	5	>2.00	200	N	N	N	30	200
CP418	35 21 35	115 8 35	1.5	.50	5	1.00	500	N	N	N	50	200
CP419	35 19 34	115 8 42	.7	.70	5	2.00	200	N	N	N	30	300
CP420	35 17 43	115 10 30	.7	.50	5	>2.00	200	N	N	N	30	300
CP421	35 19 3	115 12 55	.7	1.00	5	2.00	200	N	N	N	50	500
CP422	35 17 43	115 10 30	1.0	1.00	7	1.00	300	N	N	N	30	1,000
CP423	35 19 35	115 12 39	1.5	2.00	5	>2.00	500	N	N	N	30	200
CP424	35 19 41	115 11 48	.7	1.00	5	1.50	200	N	N	N	100	700
CP425	35 19 27	115 12 1	.7	2.00	5	2.00	300	N	N	N	20	300
CP426	35 18 55	115 11 36	.7	2.00	7	2.00	300	N	N	N	20	300
CP427	35 26 50	115 13 32	1.0	.20	10	>2.00	300	N	N	N	20	2,000
CP428	35 24 3	115 9 51	1.0	.30	10	2.00	500	N	N	N	50	7,000
CP429	35 26 28	115 9 0	1.0	.30	5	1.50	500	N	N	N	50	300
CP430	35 26 17	115 12 40	.7	.70	7	.50	300	N	N	N	30	10,000

TABLE 3. ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE CASTLE PEAKS WILDERNESS STUDY AREA, SAN BERNARDINO COUNTY, 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
CP320	N	N	N	<10	N	N	N	N	N	N	500
CP321	N	N	N	<10	N	N	N	N	N	N	20
CP322	N	N	N	N	<20	<10	700	N	N	N	100
CP323	<2	N	N	N	N	N	500	N	N	N	300
CP324	N	N	N	N	N	N	200	N	N	N	20
CP325	N	N	N	<10	N	N	200	N	<50	N	20
CP326	N	N	N	<10	N	N	2,000	N	N	N	100
CP327	N	N	N	<10	<20	N	300	N	N	<0	20
CP415	N	N	N	N	N	N	200	N	N	N	20
CP416	<2	N	N	N	<20	N	1,500	N	<50	10	50
CP417	N	N	N	<10	N	N	200	N	50	<0	50
CP418	<2	N	N	<10	<20	N	1,000	N	N	<0	50
CP419	<2	N	N	N	N	N	500	N	70	<0	<20
CP420	2	N	N	<10	N	N	300	N	50	<0	30
CP421	N	N	N	N	N	N	300	N	<50	N	<20
CP422	<2	N	N	N	N	N	300	N	<50	<0	<20
CP423	<2	N	N	<10	N	N	700	N	100	<0	20
CP424	<2	N	N	<10	N	N	300	N	50	N	N
CP425	<2	N	N	<10	N	20	500	N	70	N	100
CP426	<2	N	N	<10	N	N	200	N	50	N	100
CP427	<2	N	N	<10	<20	N	500	N	70	N	70
CP428	N	N	N	<10	<20	N	500	N	50	N	50
CP429	N	N	N	<10	N	N	1,000	N	N	N	50
CP430	N	N	N	<10	N	10	700	N	N	<0	<20

TABLE 3. ANALYSES OF HEAVY-MINERAL-CONCENTRATE SAMPLES FROM THE CASTLE PEAKS WILDERNESS STUDY AREA, SAN BERNARDINO COUNTY, CALIFORNIA.--Continued

Sample	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
CP320	N	N	N	<200	100	N	100	N	>2,000	N
CP321	N	N	N	N	<20	N	200	N	>2,000	N
CP322	N	N	N	<200	50	N	200	N	>2,000	N
CP323	N	<10	N	N	100	N	500	N	>2,000	N
CP324	N	<10	N	N	20	N	500	N	>2,000	N
CP325	N	N	N	500	50	N	150	N	>2,000	N
CP326	N	N	N	<200	50	150	300	N	>2,000	500
CP327	N	N	N	500	50	N	200	N	>2,000	N
CP415	N	N	N	<200	70	N	500	N	>2,000	N
CP416	N	N	N	1,500	70	N	500	N	>2,000	200
CP417	N	N	N	500	100	N	300	N	>2,000	N
CP418	N	N	N	700	50	200	300	N	>2,000	200
CP419	N	N	N	1,000	100	N	200	N	>2,000	200
CP420	N	N	N	<200	150	N	300	N	>2,000	3,000
CP421	N	N	N	1,000	100	N	150	N	>2,000	N
CP422	N	N	N	1,500	50	N	150	N	>2,000	N
CP423	N	N	<20	N	150	N	300	N	>2,000	300
CP424	N	N	N	1,000	70	N	150	N	>2,000	1,000
CP425	N	N	N	500	150	N	200	N	>2,000	500
CP426	N	N	N	500	150	N	200	N	>2,000	700
CP427	N	N	<20	<200	100	N	500	N	>2,000	N
CP428	N	N	N	500	50	N	300	N	>2,000	N
CP429	N	N	N	N	50	N	300	N	>2,000	200
CP430	N	N	N	2,000	100	N	200	N	2,000	N

TABLE 4. ANALYSES OF ROCK SAMPLES FROM THE CASTLE PEAKS STUDY AREA, SAN BERNARDINO 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	B-ppm s	Ba-ppm s	Be-ppm s
M84NY7B	35 21 47	115 10 45	.7	.15	.15	.030	15	N	N	N	N	50	N
M84NY13	35 22 21	115 10 28	.7	.07	<.05	.020	20	N	N	N	10	150	N
M84NY14	35 22 27	115 10 23	7.0	.50	1.00	.150	100	N	N	N	N	100	N
M84NY76	35 21 29	115 13 46	.7	.15	.50	.070	200	N	N	N	N	1,500	N
M84NY81	35 22 13	115 14 23	3.0	1.00	7.00	.100	700	N	N	N	N	150	N
B84NY80	35 21 15	115 15 35	5.0	.30	15.00	.010	1,500	N	N	N	N	700	N
B84NY89	35 21 41	115 15 52	2.0	.15	.10	.200	100	N	N	N	<10	2,000	N
B84NY101	35 23 8	115 14 57	7.0	3.00	7.00	.015	1,500	N	N	N	N	150	N
B84NY102	35 23 8	115 15 6	3.0	.70	1.00	.100	1,000	1.0	N	N	N	500	N
M84NY6	35 21 17	115 10 34	3.0	.70	1.50	.300	300	N	N	N	N	1,000	1.0
M84NY69B	35 20 34	115 16 4	.3	.15	.20	.030	70	N	N	N	<10	700	N
M84NY77	32 21 27	115 13 52	3.0	.50	2.00	.300	300	N	N	N	N	1,500	1.0
M84NY9	35 21 47	115 10 22	--	--	--	--	--	--	--	--	--	--	--
M84NY7	35 21 47	115 10 45	.3	.15	.15	.030	50	N	N	N	N	1,000	N
M84NY68A	35 20 43	115 16 26	.3	.07	.15	.002	200	N	N	N	N	100	N
M84NY90	35 23 8	115 10 18	1.0	2.00	<.05	.150	70	N	N	N	N	300	N
M84NY72	35 22 18	115 12 15	2.0	.30	1.50	.200	150	N	N	N	N	700	1.5
M84NY69A	35 20 34	115 16 4	5.0	.20	1.00	.300	500	N	N	N	10	200	1.0
CP123	35 20 34	115 15 43	3.0	1.50	3.00	.200	700	N	N	N	10	150	<1.0
CP134	35 22 10	115 11 50	.7	.20	.70	.100	100	N	N	N	N	700	N
CP138	35 21 4	115 16 20	7.0	2.00	.05	.030	150	N	N	N	N	70	N
CP227	35 26 55	115 11 40	3.0	.20	5.00	.300	300	N	N	N	N	1,500	1.5
CP231	35 24 21	115 10 53	2.0	.70	.30	.030	150	N	N	N	N	700	<1.0
CP309	35 20 14	115 13 58	7.0	3.00	7.00	.300	1,500	N	N	N	N	70	<1.0
CP319	35 20 25	115 14 53	7.0	.50	.15	.300	200	.5	N	N	10	700	1.0
CP424	35 19 41	115 11 48	3.0	.70	3.00	.200	300	N	N	N	N	500	1.5
CP429	35 26 28	115 9 0	3.0	.10	1.00	.300	300	N	N	N	N	1,500	1.0
CP430	35 26 17	115 12 40	2.0	.30	1.00	.300	150	N	N	N	N	1,500	N
CP1-1	35 23 20	115 13 30	7.0	.03	.15	.007	30	100.0	2,000	150	<10	30	N
CP1-2	35 23 20	115 13 30	3.0	2.00	3.00	.030	1,000	7.0	700	N	<10	50	N
CP2-1	35 19 40	115 14 50	3.0	7.00	7.00	.020	700	3.0	N	N	<10	30	1.5

TABLE 4. ANALYSES OF ROCK SAMPLES FROM THE CASTLE PEAKS STUDY AREA, SAN BERNARDINO 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
M84NY7B	N	N	N	<10	7	N	N	N	<5	20	N	<10	N	<100
M84NY13	N	N	N	<10	5	N	N	N	<5	15	N	<10	N	<100
M84NY14	N	N	N	15	<5	70	N	N	<5	15	N	5	N	150
M84NY76	N	N	<5	<10	7	N	N	N	<5	15	N	<10	N	150
M84NY81	N	N	10	15	15	N	N	N	15	15	N	7	N	100
B84NY80	N	N	15	15	50	N	N	N	20	15	N	5	N	100
B84NY89	N	N	5	10	70	70	N	N	10	70	N	<10	N	200
B84NY101	N	N	15	20	7	N	20	N	70	10	N	7	N	100
B84NY102	N	N	10	20	3,000	N	N	N	5	20	N	10	N	200
M84NY6	N	N	7	15	20	150	N	<20	7	30	N	10	N	300
M84NY69B	N	N	N	<10	<5	N	N	N	<5	70	N	N	N	150
M84NY77	N	N	10	15	10	70	N	<20	7	10	N	15	N	300
M84NY9	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M84NY7	N	N	N	<10	<5	N	N	N	<5	30	N	N	N	150
M84NY68A	N	N	N	<10	<5	N	N	N	<5	50	N	N	N	<100
M84NY90	N	N	5	<10	<5	30	N	<20	20	N	N	<10	N	<100
M84NY72	N	N	5	<10	<5	50	N	<20	5	15	N	7	N	200
M84NY69A	N	N	15	70	15	N	N	N	30	15	N	10	N	<100
CP123	N	N	15	70	150	N	N	N	20	20	N	20	N	100
CP134	N	N	<5	<10	5	150	N	N	<5	15	N	<10	N	150
CP138	N	N	1,000	<10	70	N	N	N	100	10	N	<10	N	<100
CP227	N	N	7	10	<5	150	N	20	N	30	N	10	N	1,500
CP231	N	N	5	>5,000	N	70	N	N	7	N	N	30	N	<100
CP309	N	N	30	70	700	N	N	N	30	15	N	70	N	700
CP319	N	N	15	15	70	300	N	N	20	700	N	10	N	<100
CP424	N	N	10	15	15	70	N	N	20	15	N	10	N	1,500
CP429	N	N	7	<10	10	150	N	20	N	20	N	10	N	150
CP430	N	N	5	<10	10	200	N	<20	<5	30	N	5	N	300
CP1-1	150	N	20	<10	2,000	N	<5	N	7	>20,000	N	<5	N	<100
CP1-2	15	N	10	15	2,000	N	<5	N	30	500	N	5	N	<100
CP2-1	N	N	15	<10	1,500	N	5	N	15	1,500	N	<5	N	<100

TABLE 4. ANALYSES OF ROCK SAMPLES FROM THE CASTLE PEAKS STUDY AREA, SAN BERNARDINO COUNTY, CALIFORNIA.--Continued

Sample	V-ppm s	W-ppm s	Y-ppm s	Zn-ppm s	Zr-ppm s	Th-ppm s	Au-ppm icp	Hg-ppm icp	As-ppm icp	Zn-ppm icp	Cd-ppm icp	Bi-ppm icp	Sb-ppm icp	W-ppm icp
M84NY7B	10	N	20	N	70	N	--	--	<5	4	<.1	--	--	<.5
M84NY13	<10	N	<10	N	50	N	--	--	41	8	.1	--	--	1.1
M84NY14	150	N	15	N	100	N	--	--	<5	3	.7	--	--	7.6
M84NY76	10	N	N	N	20	N	--	--	<5	18	.1	--	--	<.5
M84NY81	30	N	15	N	30	N	--	--	<5	150	2.5	--	--	1.9
B84NY80	300	N	10	N	N	N	--	--	<5	120	3.4	--	--	.8
B84NY89	30	N	<10	N	200	N	--	--	8	46	.6	--	--	.8
B84NY101	300	N	10	N	15	N	--	--	23	98	3.4	--	--	1.7
B84NY102	20	N	50	N	70	N	--	--	<5	31	.1	--	--	2.0
M84NY6	50	N	10	N	200	N	--	--	<5	60	.3	--	--	<.5
M84NY69B	<10	N	<10	N	15	N	--	--	<5	5	.2	--	--	<.5
M84NY77	50	N	10	N	300	N	--	--	<5	61	.4	--	--	<.5
M84NY9	--	--	--	--	--	--	--	--	--	--	--	--	--	<.5
M84NY7	<10	N	15	N	50	N	--	--	<5	3	<.1	--	--	<.5
M84NY68A	N	N	N	N	N	N	--	--	<5	<2	<.1	--	--	<.5
M84NY90	50	N	10	N	150	N	--	--	<5	5	.1	--	--	<.5
M84NY72	30	N	15	N	100	N	--	--	<5	50	.3	--	--	<.5
M84NY69A	150	N	10	N	70	N	--	--	17	84	1.3	--	--	5.7
CP123	150	N	10	N	20	N	--	--	27	130	2.5	--	--	12.0
CP134	15	N	<10	N	200	N	--	--	<5	14	.2	--	--	<.5
CP138	50	N	20	N	50	N	--	--	190	16	1.4	--	--	<.5
CP227	50	N	70	N	300	N	--	--	<5	8	.2	--	--	1.4
CP231	30	N	50	N	300	N	--	--	<5	<2	<.1	--	--	<.5
CP309	200	N	70	N	20	N	--	--	<5	13	.2	--	--	<.5
CP319	100	N	10	700	100	N	--	--	69	1,000	6.9	--	--	9.6
CP424	70	N	10	N	100	N	--	--	<5	50	.3	--	--	1.0
CP429	50	N	30	N	200	N	--	--	<5	52	.7	--	--	4.1
CP430	70	N	15	N	300	N	--	--	<5	43	.2	--	--	<.5
CP1-1	15	N	<10	2,000	N	N	.3	.85	1,580	1,300	7.6	437	107	--
CP1-2	15	N	15	1,500	30	N	<.1	.10	636	2,850	11.2	17	28	--
CP2-1	15	N	15	3,000	30	N	<.1	.08	58	2,770	6.7	<2	24	--

TABLE 5.--Description of rock samples

[O = outcrop; F = float; S = stream cobble, and D = mine dump or prospect]

M84NY	7B	O	Altered mylonitic gneiss with quartz veins; limonitic
M84NY	13	O	Silicified leucocratic granite
M84NY	14	D	Silicified granite with hematite boxwork
M84NY	76	O	Quartz vein in augen gneiss
M84NY	81	O	Silicified breccia and gouge; limonite, hematite
B84NY	80	O	Limonitic quartz-feldspathic rock from fault zone
B84NY	89	D	Granitic rock near fault zone
B84NY	101	D	Granitic rock unmineralized
B84NY	102	D	Gneiss with copper mineralization
M84NY	6	O	Unaltered biotite granodiorite
M84NY	69B	O	Unaltered metagraywacke(?) gneiss
M84NY	77	O	Unaltered augen gneiss
M84NY	9	O	Unaltered biotite granite
M84NY	7	O	Unaltered mylonitic granite
M84NY	68A	O	Unaltered garnet granite
M84NY	90	O	Slightly chloritized granite
M84NY	72	O	Unaltered augen gneiss
M84NY	69A	O	Limonitic-hematitic breccia and gouge
CP	123	S	Limonitic-hematitic altered drill site rock
CP	134	S	Epidotized gneiss
CP	138	S	Contact gneiss
CP	227	S	Propylitic gneiss
CP	231	F	Chrome mica and quartz
CP	309	S	Epidotized amphibolite
CP	319	S	Sheared altered gneiss
CP	424	S	Epidote-quartz vein
CP	429	S	Altered limonitic granite
CP	430	S	Mafic dike (?)
CP	1-1	D	Gneiss
CP	1-2	D	Gneiss
CP	2-1	D	Igneous rock