STATE OF MONTANA
Thomas L. Judge, *Governor*

BUREAU OF MINES AND GEOLOGY
S. L. Groff, *Director*

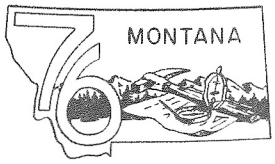
BULLETIN 98
April, 1976

METALLIC MINERAL DEPOSITS OF POWELL COUNTY, MONTANA

by

H. G. McClernan

This report has been prepared in cooperation with the U. S. Bureau of Mines.



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MONTANA COLLEGE OF MINERAL SCIENCE AND TECHNOLOGY
Butte, Montana
1976

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Montana Bureau of Mines and Geology

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Montana College of Mineral Science and Technology

Butte, Montana 59701

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METALLIC MINERAL DEPOSITS OF POWELL COUNTY, MONTANA

by

H. G. McClernan

ABSTRACT

Powell County, in western Montana, is underlain by Precambrian through Recent sedimentary rocks and Tertiary intrusive bodies related to the Boulder Batholith. The county has recorded production of more than $6,000,000 from lode and placer deposits. With the exception of stratabound copper sulfide deposits in the Mineral Hill area, the lode deposits all show magmatic-hydrothermal characteristics. Base and precious metals have been produced from these deposits, and placer gold and silver have been produced from Tertiary and Recent gravel deposits. Throughout the county, recent exploration work is evident.

INTRODUCTION

The purpose of this report is to provide a single, relatively complete source of information on the metallic mineral deposits of Powell County. Figure 1 shows the counties that are discussed in reports of this kind. The time available for field work and literature search precludes complete and detailed study of individual mines. For this reason, many of the individual mining districts have been the subjects of separate studies. For information on the status of the mining-district studies, write to the Montana Bureau of Mines and Geology, Butte, Montana 59701.

A concise outline-type format has been adopted to enable the reader to quickly find the salient characteristics of a particular mine and, if desired, to quickly compare particular characteristics of several mines. Nonmetallic resources are omitted from this report because they are adequately covered on a commodity basis for the entire state. A major nonmetallic resource of Powell County, phosphate rock, has been especially well described (Popoff and Service, 1965, p. 20-55).

Many persons and organizations provided help, information, directions, and advice so that this report could be as nearly complete as possible. Bharat K. Bhatt, Douglas Davies, Donald Jenkins, and Carl Murray were field assistants. Mrs. Toni Freeman aided with sample preparation and drafting, as did D. L. Gilchrist; Parker Davies, Head of the Minerals Section of the U.S. Bureau of Land Management office, Billings, Montana, provided maps of patented claims in Powell County. R. D. Geach examined many of the mines in the county during the field seasons of 1966, 1967, and 1968. Most of the underground maps presented in this report are the result of his examination. The illustrations were prepared by Roger Holmes and Eldon Woods.

The production data presented in the various tables throughout the report were prepared under the direction of Kenneth D. Baber, Acting Chief, Western Field Operation Center, U.S. Bureau of Mines, Spokane, Washington.

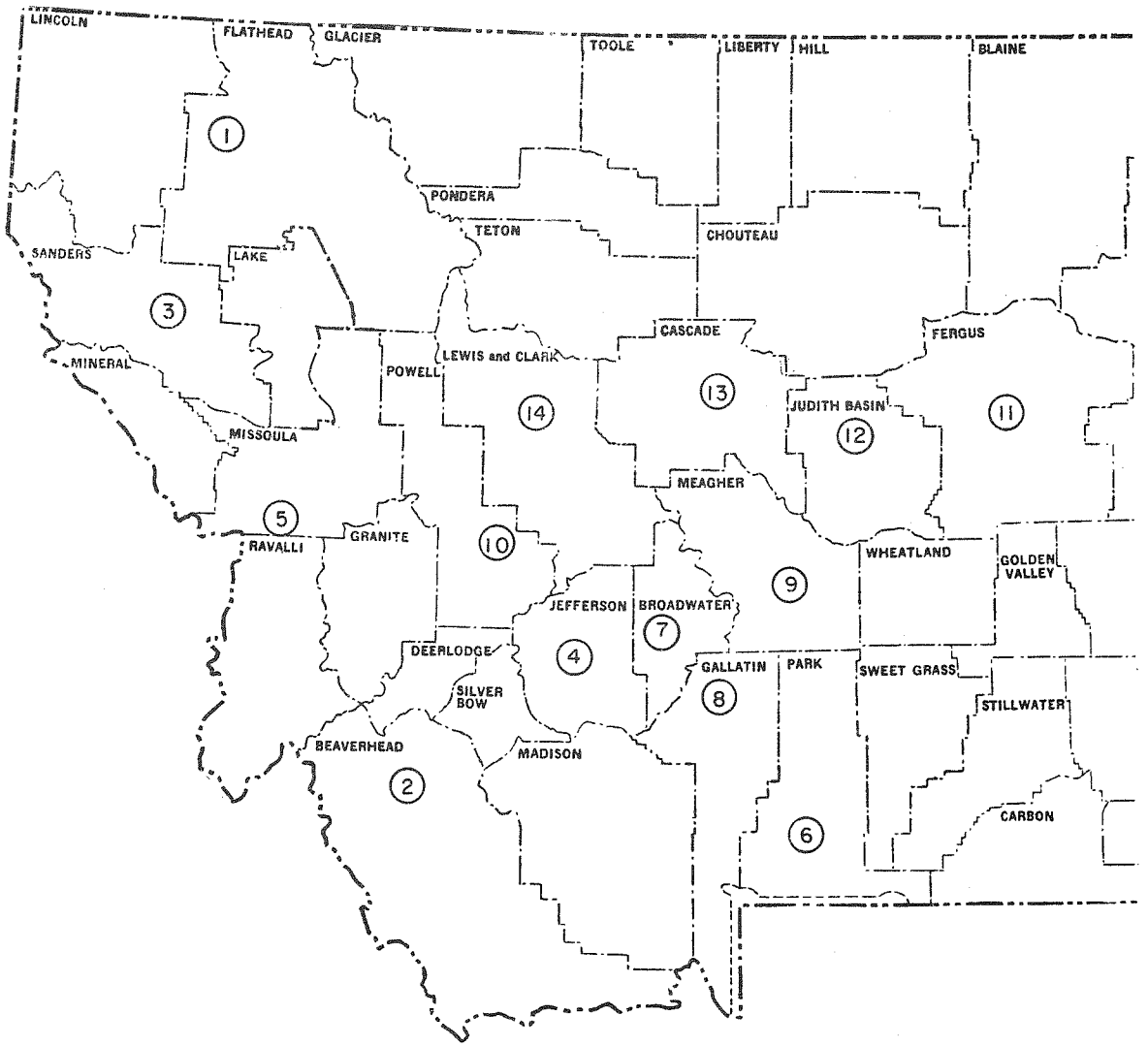


Figure 1.–Index map showing counties for which mineral-deposit reports have been published.

GENERAL GEOLOGY

Rocks exposed in Powell County range in age from Precambrian, represented by several formations of the Belt Supergroup mainly in the northern half of the county, to Quaternary and Recent stream deposits throughout the valleys (Pl. 1). The igneous rocks, especially quartz monzonite and granodiorite of the Boulder Batholith and andesite and basalt of the Elkhorn Mountains Volcanics, are the host rocks for most of the base- and precious-metal vein deposits. Placer gold deposits occur in Recent and Quaternary stream gravels and Tertiary gravel deposits of an unspecified origin. More detailed descriptions of the geology are included in the discussions of the mining districts.

HISTORY AND PRODUCTION

Crowley (1959) noted that Powell County was the birthplace of mining in Montana. In 1852 Francois Finlay found gold near the mouth of Gold Creek, but his discovery was soon overshadowed by discovery of more productive placers at Bannack, Virginia City, and Last Chance Gulch. As is the case in many mining districts, prospectors working the placer deposits upstream were led to the lode deposits, which were also mined. As the price and demand for other metals contained in the lodes increased, so did the activity in the districts. The workings and development of the mines in the county reflect distinct generations of activity, the ages of which corre-

MONTANA BUREAU OF MINES AND GEOLOGY

ADDENDUM

To Bulletin 98, Metallic Mineral Deposits of Powell County, Montana
by H. G. McClernan

Figure 1, page 2–Explanation of numbers identifying published mineral-deposit reports.

1. JOHNS, W. M., 1970, Geology and mineral deposits of Lincoln and Flathead Counties, Montana: Montana Bur. Mines and Geology Bull. 79.
2. GEACH, R. D., 1972, Mines and mineral deposits (except fuels), Beaverhead County, Montana: Montana Bur. Mines and Geology Bull. 85.
3. CROWLEY, F. A., 1963, Mines and mineral deposits (except fuels), Sanders County, Montana: Montana Bur. Mines and Geology Bull. 34.
4. ROBY, R. N., ACKERMAN, W. C., FULKERSON, F. B., and CROWLEY, F. A., 1960, Mines and mineral deposits (except fuels), Jefferson County, Montana: Montana Bur. Mines and Geology Bull. 16.
5. SAHINEN, U. M., 1957, Mines and mineral deposits, Missoula and Ravalli Counties, Montana: Montana Bur. Mines and Geology Bull. 8.
6. REED, G. C., 1950, Mines and mineral deposits (except fuels), Park County, Montana: U. S. Bur. Mines Inf. Circ. 7546.
7. REED, G. C., 1951, Mines and mineral deposits (except fuels), Broadwater County, Montana: U. S. Bur. Mines Inf. Circ. 7592.
8. REED, G. C., 1951, Mines and mineral deposits (except fuels), Gallatin County, Montana: U. S. Bur. Mines Inf. Circ. 7607.
9. ROBY, R. N., 1950, Mines and mineral deposits (except fuels), Meagher County, Montana: U. S. Bur. Mines Inf. Circ. 7540.
10. McCLERNAN, H. G., 1976, Metallic mineral deposits of Powell County, Montana: Montana Bur. Mines and Geology Bull. 98 (this publication).
11. ROBERTSON, A. F., 1950, Mines and mineral deposits (except fuels), Fergus County, Montana: U. S. Bur. Mines Inf. Circ. 7544.
12. ROBERTSON, A. F., and ROBY, R. N., 1951, Mines and mineral deposits (except fuels), Judith Basin County, Montana: U. S. Bur. Mines Inf. Circ. 7602.
13. ROBERTSON, A. F., 1951, Mines and mineral deposits (except fuels), Cascade County, Montana: U. S. Bur. Mines Inf. Circ. 7589.
14. McCLERNAN, H. G., in progress, Metallic mineral deposits of Lewis and Clark County, Montana.

late generally with rising prices for gold, silver, copper, lead, and zinc. The various districts in the county, now seemingly dormant, cannot be regarded as worked out or abandoned but only awaiting renewed interest. Actually, during the course of the author's field work (1969, 1970), activity by individuals and major mining companies was evident throughout the county.

The total estimated production from an individual mine, district, or county depends on the source of information consulted. The U.S. Bureau of Mines started collecting production data for mines in the United States in 1902; this collection has been continued to the present time. Their figures are presented in various tables throughout the report. Because a considerable amount of mining activity occurred before 1902, these figures should be taken as a minimum. Determining the production figures for individual mines presents somewhat of a problem. If the mine was worked prior to 1902, the production was not recorded by the government. Also, the production from a particular mine may have been recorded under several names, and it is virtually impossible to uncover all of the "alias" names for each mine. Production from Powell County is shown in Tables 1 and 2.

ELLISTON DISTRICT

(Illustrations and tables for this district are prefixed by the letter E.)

GENERAL GEOLOGY

This description of the geology of the Elliston district was condensed from Robertson (1956b). Outcropping rocks in this district include sedimentary rocks of Mississippian through Cretaceous age, volcanic rocks of Cretaceous and Tertiary age, and intrusive rocks of the Boulder Batholith of Tertiary age (Pl. E-1).

The oldest rocks exposed belong to the Mission Canyon Formation, the upper part of the Madison Group, of Mississippian age. Robertson (1956b, p. 13) described the formation, which is less than 1,000 feet thick, as massive buff to bluish-white limestone containing local dolomitic zones. The Mission Canyon Formation is well exposed in the western quarry of the Elliston Lime Company (NW¼ sec. 5, T. 9 N., R. 6 W.). The Big Snowy Group, also of Mississippian age, is believed to overlie the Mission Canyon Formation in the district, but definite identification of this unit was impossible because of the heavy soil cover. The Amsden Formation, of Mississippian-Pennsylvanian age, which overlies the Big Snowy Group, is represented by 200 to 300 feet of reddish shale, thin-bedded limestone, and interbedded dolomite and quartzitic sandstone. The upper part of the formation is marked by numerous and relatively thick quartzitic beds. The Quadrant Formation, of Pennsylvanian-Permian age, overlying the Amsden, consists of quartzite, limestone, and some shale units. Shale and limestone are abundant at the base of the formation, and white quartzite, moderately stained by iron oxide, is abundant at the top. The Phosphoria Formation (Permian age), which is 33 feet thick, conformably overlies the Quadrant Formation. The basal part of the formation consists of dark chert and fine-grained quartzite in which a thin phosphate bed occurs. A 4-foot oolitic phosphate bed overlies the chert. The upper part of the formation consists of dark chert and quartzite. Unconformably overlying the Phosphoria, the Swift is the only formation of the Ellis Group (Jurassic) in the district. In this area the Swift is 20 to 30 feet thick and is composed of a basal chert-pebble conglomerate, quartzitic sandstone, and thin limestone units. The Morrison Formation, of Jurassic age, overlies the Swift and consists of purplish-gray to dark-gray shale and mudstone. The Kootenai Formation, of Early Cretaceous age, is 1,500 feet thick and consists principally of quartzitic sandstone and red silty shale, but the oldest unit is a conglomerate of black chert pebbles, and the youngest is a 20- to 30-foot gastropod limestone bed. The youngest sedimentary units, other than the Recent and Quaternary deposits, are shale and sandstone of the Colorado Group (Cretaceous). In this area the group is approximately 200 feet thick.

The oldest igneous rocks are the Elkhorn Mountains Volcanics, of Cretaceous age; they unconformably overlie the Colorado Group and are older than the Boulder Batholith. Most of these rocks are flows, but in places some of them seem to be intrusive. They are generally andesitic and basaltic, although some latite is present in the southern part of the district and in the upper part of the volcanic sequence. Volcanic-derived sediments and intrusive sills are locally interlayered with the flows. In the western part of the district, basaltic flows and sills are more abundant than the andesite. These basalt bodies are virtually identical to the basalt flows in the Zosell district.

The oldest intrusive rock cropping out near the Elliston district is a gabbro sill exposed approximately 12 miles west of Elliston on Hoover Creek. On fresh surfaces the rock is medium grained and dark greenish gray, but the rock weathers severely in outcrop and can rarely be seen fresh. Robertson (1956b, p. 85) called this rock a granogabbro. Throughout the district, the exposed gran-

Table 1.–Production of gold, silver, copper, lead, and zinc at lode mines, in terms of recoverable metals, 1902-68, Powell County.

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902	3,960	3,144	110,506	--	168,000	--	$ 120,514
1903	1,130	751	1,424	--	2,200	--	15,789
1904	2,669	3,381	16,668	1,000	7,200	--	77,437
1905	7,647	1,765	20,855	532	245,428	--	60,693
1906	9,127	2,402	29,174	7,555	180,289	--	80,937
1907	2,954	3,824	20,261	1,397	164,911	--	101,425
1908	948	555	18,256	48,494	120,671	--	32,536
1909	1,802	1,156	13,475	81,791	29,159	--	42,783
1910	1,065	681	15,986	79,767	48,041	--	34,947
1911	2,538	1,787	25,500	41,468	110,796	--	60,627
1912	1,957	1,189	43,936	96,369	42,456	--	69,417
1913	2,177	1,119	60,523	126,882	30,012	--	80,675
1914	1,854	971	64,257	78,386	81,717	--	69,226
1915	1,093	1,070	18,728	9,160	139,188	--	39,749
1916	866	531	13,585	27,957	86,083	--	32,736
1917	2,145	303	8,635	18,859	53,379	--	23,118
1918	1,018	254	8,088	6,072	115,244	--	23,024
1919	431	133	5,158	6,103	55,803	--	12,625
1920	1,470	234	10,129	21,498	88,721	--	26,922
1921	699	809	11,453	3,504	136,364	--	34,770
1922	736	981	14,515	363	117,022	--	41,285
1923	583	670	11,634	802	85,680	--	29,501
1924	308	291	9,184	359	74,119	--	18,140
1925	143	150	5,546	745	48,075	--	11,240
1926	430	253	5,212	349	63,819	--	13,642
1927	517	625	8,253	403	72,949	3,247	22,459
1928	182	250	1,675	41	4,000	--	6,383
1929	121	117	739	693	10,968	--	3,619
1930	106	114	2,064	677	26,816	--	4,588
1931	327	213	1,859	602	807	--	5,034
1932	614	423	8,241	1,460	3,567	--	11,261
1933	1,093	632	25,320	3,297	6,027	--	22,366

1934	1,933	1,206	64,384	4,025	115,216	--	88,356
1935	16,388	4,331	146,706	32,446	159,075	--	266,072
1936	6,790	3,716	113,051	5,087	109,913	--	223,142
1937	7,840	3,189	53,457	2,000	111,000	--	159,755
1938	4,558	2,285	34,534	990	76,152	--	105,900
1939	19,319	4,393	67,974	3,875	127,000	--	206,267
1940	10,390	3,402	75,804	9,000	104,200	7,000	179,643
1941	5,711	2,855	55,374	7,000	153,400	44,000	152,172
1942	2,592	859	5,286	1,300	30,700	--	36,038
1943	2,374	70	5,445	4,000	81,800	31,500	16,379
1944	1,572	39	4,365	1,600	71,700	59,000	17,147
1945	520	19	1,800	200	22,500	16,400	5,793
1946	2,410	577	10,021	2,000	103,000	44,000	45,211
1947	11,718	1,454	35,294	8,400	554,000	376,600	209,939
1948	9,691	1,009	25,393	9,800	386,500	270,100	165,530
1949	1,896	579	8,742	3,500	163,700	30,100	58,463
1950	1,196	212	2,316	43,400	12,000	2,100	20,461
1951	277	64	1,696	6,000	10,000	4,000	7,685
1952	251	34	1,335	2,000	30,000	12,000	9,704
1953	183	41	420	--	8,000	2,000	3,093
1954	514	132	2,820	--	70,000	20,000	18,922
1955	329	33	1,219	--	18,000	4,000	5,432
1956	353	34	498	--	10,000	4,000	3,759
1957	87	15	760	--	10,000	--	2,643
1958	*	--	*	--	--	--	*
1959	*	3	*	--	4,000	2,000	*
1960	64	10	156	2,000	2,000	2,000	1,625
1961	210	233	218	--	--	--	8,357
1962	298	133	232	800	6,700	600	5,838
1963	93	8	1,300	100	25,200	2,800	5,018
1964	1,713	37	8,760	*	26,700	*	17,213
1965	309	29	581	700	10,000	3,900	4,143
1966	151	22	1,118	100	18,100	4,000	5,568
1967	33	4	21	--	4,400	200	817
1968	297	46	855	*	9,600	*	7,910
Total	164,752	61,851	1,343,003	825,408	5,064,067	950,947	$3,294,465

* Withheld to avoid disclosing individual company confidential data. Figures included in totals.

Table 2.—Production of gold and silver at placer mines, 1902-68, Powell County.

Year	Material treated (cubic yards)	Gold (ounces)	Silver (ounces)	Total value
1902	Not available	1,341	--	$ 25,375
1903	"	18	--	350
1904	"	1,034	--	16,972
1905	"	1,472	157	30,524
1906	"	2,124	260	44,074
1907	"	1,182	160	24,532
1908	"	2,396	251	49,654
1909	"	1,365	171	28,310
1910	"	1,395	164	28,919
1911	"	1,129	163	23,429
1912	"	1,292	168	26,809
1913	"	1,148	111	23,799
1914	"	1,224	183	25,403
1915	"	904	111	18,748
1916	"	1,100	145	22,834
1917	"	687	84	14,263
1918	"	405	57	8,436
1919	"	210	27	4,379
1920	"	315	47	6,555
1921	"	435	65	9,034
1922	"	378	57	7,873
1923	"	177	28	3,678
1924	"	127	20	2,642
1925	"	313	82	6,533
1926	"	278	42	5,778
1927	"	317	62	6,582
1928	"	284	47	5,901
1929	"	108	15	2,251
1930	"	97	10	2,010
1931	"	374	47	7,741
1932	"	531	64	10,998
1933	"	1,160	137	24,025
1934	"	16,430	1,700	575,338
1935	"	12,780	1,337	448,247
1936	"	8,516	900	298,771
1937	"	7,471	790	262,096
1938	1,939,535	7,326	837	256,951
1939	1,167,785	4,502	501	157,910
1940	1,117,973	4,209	509	147,677
1941	14,250	645	111	22,654
1942	19,110	606	166	21,328
1943	Not available	5	--	175
1944	"	58	--	2,030
1945	6,775	60	--	2,100
1946	2,500	109	42	3,849
1947	4,965	196	52	6,907
1948	2,650	74	21	2,609
1949	1,900	14	--	490
1950	1,100	21	--	735
1951	1,200	24	--	840
1952-53	No production			
1954	200	3	--	105
1955	*	*	*	*
1956	36,837	344	42	12,078
1957	*	*	*	*
1958	10,000	81	73	2,901
1959	3,850	52	1	1,821
1960	1,000	18	18	646
1961	25,807	67	11	2,355
1962	3,405	16	2	562
1963	*	*	--	*
1964	6,400	65	8	2,285
1965-67	*	*	*	*
1968	--	--	--	--
Total	4,939,480	91,401	10,325	$2,835,737

*Withheld to avoid disclosing individual company confidential data. Figures included in totals.

itic igneous rocks range from greenish-gray medium-grained granodiorite to pink coarse-grained diorite or to fine-grained diorite porphyry. Limonite staining and epidote are common on joint surfaces. The largest intrusive phase of the Boulder Batholith in the Elliston district is quartz monzonite, which is coarse to medium grained and contains a lesser amount of plagioclase than the granodiorite. The youngest intrusive rocks are aplite and alaskite, and dikes are the most common form.

Rocks of rhyolitic composition younger than the batholith occur as flows and welded tuffs. The base of the rhyolite is generally marked by an obsidian vitrophyre, which grades upward to a dense tuff. Robertson (1956b, p. 81) suggested that the uppermost welded tuffs are possibly Pliocene in age.

Four fault systems have been recognized, but because of the lack of correlative rock units, the nature of faulting is uncertain. A fault system striking N. 30° to 60° E. and another striking N. 80° E. are thought to have significant displacement along both dip and strike. Both of these systems must be pre-rhyolite in age because they do not offset the rhyolite. Some of the veins in the district are parallel to the N. 80° E. fault system. Northwest-trending faults have been noted in underground workings and have been inferred from geomorphic evidence. These structures seem to have minor left-lateral displacement and to be offset by the northeast faults, but they do not cut the east-trending veins. Post-rhyolite north-south faults have not been clearly identified, although geomorphic evidence suggests their presence.

GEOLOGY OF THE ORE DEPOSITS

The veins in quartz monzonite strike N. 65° ± 20° E. and dip steeply south; some extend along strike into the Rimini district several miles to the east. Their walls show negligible movement, thus indicating tensional deformation. Robertson (1956b, p. 232) noted that wherever the veins crossed from the quartz monzonite into the volcanic rocks they constricted into narrow veinlets.

The veins in the Cretaceous volcanic rocks are very similar to those in the quartz monzonite. They are all near vertical with the exception of a "flat vein" encountered in the Big Dick mine. This structure is either localized along a contact between two flows or along a low-angle fault. The latter suggestion seems more probable because the width of the vein increases as the dip steepens, indicating fault movement. Robertson (1956b, p. 233) noted that the steeply dipping veins in the Cretaceous volcanic rocks seem to become narrow as their dip changes to the northwest and that some northwest-trending faults are weakly mineralized and have thin quartz stringers. The only observed vein in sedimentary rock is at the Carbonate King mine. This structure is similar in form and composition to those found in the igneous rocks.

All the veins exhibit very similar mineralogy, which is generally uniform throughout the district. Hypogene minerals include pyrite, arsenopyrite, sphalerite, galena, bournonite, boulangerite, tetrahedrite, tennantite, chalcopyrite, bornite, millerite, hematite, and magnetite. The nonmetallic gangue minerals include quartz, tourmaline, calcite, ankeritic carbonate, and chalcedonic quartz. Supergene minerals include covellite, chalcocite, cerussite, and limonite.

In quartz monzonite the hydrothermal-alteration envelopes, from the vein outward, are: (1) quartz and more or less pyrite, tourmaline, and base-metal sulfides; (2) sericite and more or less quartz and pyrite; (3) argillic zone; and (4) fresh quartz monzonite, which is locally marked by slight chloritization of the biotite.

Volcanic rocks that have been hydrothermally altered are bleached as a result of sericitization and argillization of the feldspar minerals, which make up a significant amount of the rock. In most areas adjacent to veins, pyrite and carbonate minerals are also present.

Almost all of the creeks have been placered by hand methods. Placer mine production is shown in Table E-1. Production from lode mines is shown in Table E-2.

Table E-1.--Production of gold and silver at placer mines, 1902-68, Elliston District.

Year	Material treated (cubic yards)	Gold (ounces)	Silver (ounces)	Total value
1902-04	No production			
1905	Not available	26	2	$ 539
1906	"	26	8	814
1907-08	No production			
1909	Not available	15	1	300
1910-13	No production			
1914	Not available	7	2	152
1915	"	64	9	1,326
1916	No production			
1917	Not available	5	--	93
1918	"	10	4	202
1919	"	2	--	36
1920	No production			
1921	Not available	8	--	165
1922	No production			
1923	Not available	6	1	127
1924	"	8	--	175
1925	"	165	57	3,452
1926-28	No production			
1929	Not available	6	--	126
1930-31	No production			
1932	Not available	3	--	68
1933-34	No production			
1935	Not available	2	--	78
1936-37	No production			
1938	30,000	193	31	6,775
1939	Not available	12	--	420
1940	"	3	--	105
1941	"	1	--	35
1942	"	6	--	210
1943-44	No production			
1945	Not available	1	--	35
1946-68	No production			
Total	30,000	569	115	$15,233

LODE DEPOSITS

Anna R. and Hattie M.

Location: SW¼ sec. 10, T. 8 N., R. 6 W.

Workings: 1,100 feet of crosscuts and drifts and 160 feet of shafts (Trauerman and Waldron, 1940, p. 94).

Geology: Field notes of R. D. Geach show that the workings explored a northeast-trending vein that follows the contact of quartz monzonite with an aplite dike. Samples of vein material from the dump consist of vitreous quartz stained by iron and manganese oxide minerals.

Production: Known production from the Anna R. and Hattie M. mine is shown in Table E-3.

Big Dick (Evening Star)

Location: NW¼ sec. 6, T. 8 N., R. 6 W.

Workings: A 1,000-foot tunnel connected to a 300-foot shaft through a 200-foot raise (Pardee and Schrader, 1933, p. 265).

Geology: The workings have developed two veins in andesite breccia. The vein striking due east and dipping 20° N. was the source of most of the production. Another

Table E-2.—Production of gold, silver, copper, lead, and zinc at lode mines, in terms of recoverable metals, 1902-68, Elliston District, Powell County.

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902	1,610	1,407	56,506	124	100	--	$ 56,392
1903	85	22	1,260	--	2,200	--	1,147
1904	85	22	1,260	--	2,200	--	1,147
1905	579	804	4,145	532	111,528	--	24,453
1906	797	928	6,475	6,601	88,733	--	29,844
1907	889	1,467	9,874	704	116,627	--	43,167
1908	15	9	78	--	602	--	259
1909	328	296	4,082	8,677	21,065	--	10,280
1910	41	2	125	2,966	1,726	--	553
1911	90	53	2,367	5,625	4,392	--	3,251
1912	83	56	1,298	5,435	3,291	--	3,002
1913	99	145	2,747	1,317	10,471	--	5,323
1914	189	277	823	1,719	12,467	--	6,900
1915	630	689	7,376	6,667	96,147	--	23,667
1916	210	209	2,736	2,266	29,496	--	8,707
1917	67	99	1,417	1,073	20,637	--	5,285
1918	145	88	2,677	--	39,093	--	7,265
1919	255	105	1,853	--	21,382	--	5,367
1920	1,232	201	5,842	11,484	81,296	--	19,143
1921	381	773	9,059	1,380	132,036	--	30,353
1922	570	827	7,998	363	100,607	--	30,726
1923	233	436	3,555	336	42,858	--	14,976
1924	107	146	2,401	--	30,303	--	7,264
1925	46	47	1,740	34	30,991	--	4,887
1926	214	24	3,029	349	55,243	--	7,143
1927	268	111	2,894	240	45,770	--	6,860
1928	8	7	215	41	4,000	--	501
1929	26	7	692	33	10,968	--	1,155
1930	61	41	1,770	230	26,709	--	2,902
1931	17	14	57	18	746	--	339
1932	52	35	326	32	2,767	--	896
1933	14	10	520	--	5,324	--	587
1934	274	150	2,243	100	14,081	--	7,232
1935	1,905	712	16,992	30,193	14,525	--	40,211

1936	2,523	649	8,173	4,326	22,891	--	$ 30,503
1937	690	270	6,265	1,000	22,407	--	15,739
1938	791	277	4,670	816	26,805	--	14,027
1939	5,382	669	7,696	1,615	87,085	--	32,900
1940	5,906	934	9,474	3,292	67,840	--	43,191
1941	670	278	7,418	3,400	40,000	--	17,686
1942	624	35	2,098	1,300	28,000	--	4,750
1943	2,259	19	5,144	1,100	78,000	31,500	13,718
1944	1,563	30	4,306	1,000	70,200	59,000	16,589
1945	470	12	1,575	200	21,500	15,600	5,210
1946	832	45	4,792	1,500	68,500	20,500	15,657
1947	751	56	5,358	2,200	78,800	17,400	20,723
1948	918	60	4,834	1,100	64,000	23,000	21,229
1949	1,326	187	7,984	3,400	158,200	29,800	43,131
1950	404	51	1,032	800	11,000	1,400	4,569
1951	114	16	1,411	--	8,700	2,500	3,797
1952	239	31	1,317	1,776	26,430	11,934	8,943
1953	78	15	345	--	7,100	200	1,790
1954	514	132	2,820	--	70,000	20,000	18,922
1955	193	21	802	--	17,000	3,100	4,375
1956	338	17	491	--	9,900	4,000	3,141
1957	43	5	98	--	1,400	--	464
1958	*	--	*	--	--	--	*
1959	9	3	220	--	4,000	2,000	994
1960	*	*	*	*	*	*	*
1961	4	2	1	--	--	--	71
1962	20	1	200	--	6,700	600	937
1963	91	7	1,300	100	25,200	2,800	4,983
1964	75	12	1,166	100	22,100	2,400	5,182
1965	*	*	*	*	*	*	*
1966	98	19	961	100	15,000	900	4,341
1967	33	4	21	--	4,400	200	817
1968	66	35	644	100	7,500	700	3,882
Total	38,919	14,139	259,512	119,964	2,257,139	251,534	$776,842

*Withheld to avoid disclosing individual company confidential data. Figures included in totals.

vein exposed in the workings strikes approximately north and dips 40° W. Pardee and Schrader (1933, p. 265) received reports that several ore shoots in this structure were 3½ feet thick and contained 3 to 5 ounces of gold per ton. Minerals present in the vein include quartz, galena, pyrite, sphalerite, arsenopyrite, and tourmaline. In addition, cerussite was found in specimens from the dump.

Production: The combined production of the Big Dick and Black Jack mines is shown in Table E-4.

Black Jack

Location: NW¼ sec. 6, T. 8 N., R. 6 W.

Workings: An adit 300 feet long, and east of the adit an inclined shaft 350 feet deep (Pardee and Schrader, 1933, p. 269).

Geology: The workings explore a north-trending vein that dips 30° W. in andesite breccia and cuts the low-dipping vein exposed in the Big Dick mine. The vein averages 3½ feet wide and contains quartz, calcite, sphalerite, pyrite, arsenopyrite, and galena; a minor amount of chalcopyrite is contained in the sphalerite. In polished section the texture of the ore minerals resembles breccia; in the workings, however, some lineation parallel to the vein walls is evident. Tourmaline is present as a wall-rock alteration product but does not occur in the ore.

Production: Recorded production from the Black Jack mine is shown in Table E-5.

Blue Bell

Location: NW¼ sec. 13, T. 10 N., R. 6 W.

Workings: A tunnel and shaft of unknown extent and numerous surface cuts.

Geology: The data presented below are from Pardee and Schrader (1933, p. 264) who cited Knopf (1913) as their source. The deposit consists of a "garnet vein" in quartz monzonite. The lode is approximately 12 feet wide and consists of fine-grained garnet containing disseminated molybdenite and pyrite. Near the vein, alteration of the wall rock has epidotized the plagioclase feldspar. Malachite and azurite are present in specimens from the dump. The nearest sedimentary rock is approximately one mile from the property.

Production: The recorded production from the Blue Bell mine is shown in Table E-6.

Bluebird

Location: SW¼ sec. 1, T. 8 N., R. 7 W.

Workings: Two adits from which two stopes have been developed.

Geology: The following data are from Robertson (1956b, p. 268). The workings explored a vein that is also exposed in the Big Dick mine. In the Bluebird, however, the vein is localized in a northeast-trending fault zone in andesite. The vein is 2 to 15 inches wide and consists of pyrite and galena in quartz. The stopes were developed where the vein has a flatter dip and is thicker. Hydrothermal alteration extends at least 8 inches into the wall rock and consists of chloritization, kaolinization, and pyritization.

Brooklyne

Location: The specific location is unknown, but from Pardee and Schrader's description (1933, p. 269), it is near the Bluebird and may in fact be the same property.

Workings: A tunnel at least 300 feet long (Pardee and Schrader, 1933, p. 269).

Geology: Several veins in andesite were exposed in the tunnel. The main structure dips steeply southeast and is faulted 300 feet from the mouth of the tunnel. This vein contains sphalerite, pyrite, argentiferous galena, and arsenopyrite in calcite and quartz gangue.

Bullion

Location: NW¼ NW¼ sec. 12, T. 8 N., R. 6 W.

Workings: A vertical shaft, now caved, relatively deep as indicated by the size of the dump.

Geology: The shaft explores an east-trending vein in quartz monzonite. Specimens from the dump contain galena, sphalerite, and pyrite in quartz gangue. Pyrite is also an alteration product of the wall rock.

Carbonate King

Location: SW¼ sec. 13, SE¼ sec. 14, T. 9 N., R. 7 W.

Workings: A vertical shaft and an adit approximately 1,000 feet west of the shaft (Fig. E-1).

Geology: The workings explore a northeast- to east-trending vertical vein in the Kootenai Formation (Cre-

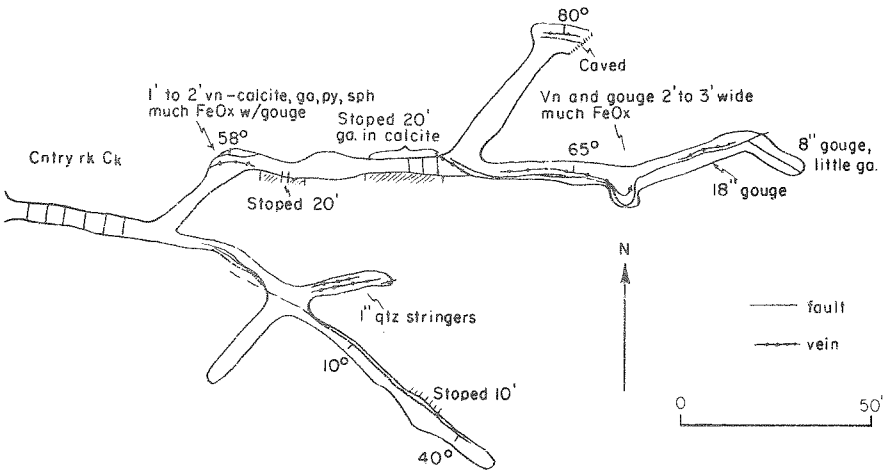


Figure E-1.–Carbonate King mine.

taceous). In the adit the vein is localized along a fault zone and consists of calcite containing galena, pyrite, and sphalerite. Specimens from the dump near the shaft contain quartz and malachite. The vein ranges in width from 1 to 3 feet.

Production: Recorded production from the Carbonate King mine is shown in Table E-7.

Charter Oak

Location: E½ sec. 36, T. 9 N., R. 7 W.

Workings: Five adits of unknown extent. Figure E-2 shown the only adit accessible in 1968.

Geology: Two veins are exposed in the workings of the Charter Oak mine (Pardee and Schrader, 1933, p. 268), but only one steeply dipping structure in andesite was accessible (Fig. E-2). Ore minerals found in the vein and on the dumps include argentiferous galena, boulangerite, arsenopyrite, pyrite, and sphalerite. A secondary lead mineral, plumbojarosite, was also found. The primary minerals occur in a quartz gangue.

Production: Recorded production from the Charter Oak mine is shown in Table E-8.

Clark

Location: SW¼ sec. 19, T. 9 N., R. 6 W.

Workings: An inclined shaft of unknown extent and several open cuts.

Geology: The description of this deposit was taken from Robertson (1956b, p. 272), who classified it as a "breccia deposit". The deposit is composed of bleached andesite fragments cemented by pyrite, quartz, sphalerite, galena, and tetrahedrite. The thickness of the breccia varies directly with its dip; where the dip is about 10 degrees the breccia is only 1 inch thick; as the dip angle increases, the body thickens to a maximum of 4½ feet. A soil-sampling grid by Robertson (1956a, p. 25) indicated that the deposit is approximately 200 feet long. Although Robertson stated that the deposit trends northwest, his soil geochemical anomaly map indicates a southwest trend.

Flora

Location: NW¼ sec. 1, T. 8 N., R. 7 W.

Workings: An adit approximately 500 feet long.

Geology: The vein exposed in the adit (Pardee and Schrader, 1933, p. 268) strikes northeast and dips 20° NW. in andesite. It is 2 to 3 feet wide and consists mostly of crushed and altered wall rock. Alteration consists of pyritization, minor sericitization, chloritization, and addition of carbonate material as "black calcite". The ore minerals, which fill fractures, include argentiferous galena, sphalerite, and pyrite in quartz gangue.

Hard Luck

Location: Sec. 15, T. 8 N., R. 6 W.

Workings: An adit approximately 450 feet long (Fig. E-3).

Geology: The vein exposed in the adit is in quartz monzonite; it strikes N. 70° W. and dips approximately 70° S. The ore minerals, pyrite and sphalerite, occur in

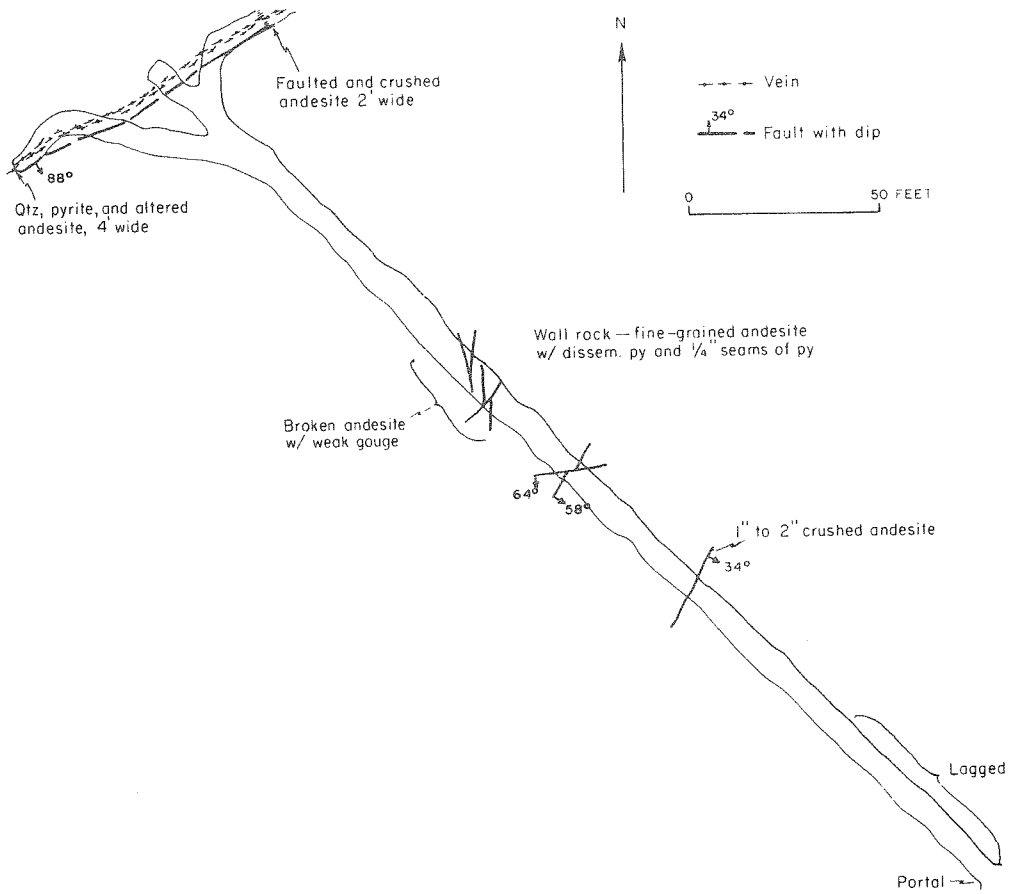


Figure E-2.—Charter Oak mine.

quartz and manganocalcite gangue. In his field notes, R. D. Geach reported that the wall rock is silicified and pyritized for the last 120 feet of the adit.

Hub Camp

Location: NW¼ NW¼ sec. 4, T. 8 N., R. 6 W.

Workings: Two adits of unknown extent.

Geology: Both adits have been driven along a vein trending N. 65° E., 60° S. Near the mouth of the lower adit the vein consists of quartz and pyrite. Alteration of the wall rock includes argillization and pyritization.

Production: Recorded production from the Hub Camp property is shown in Table E-9.

Julia

Location: SW¼ SE¼ sec. 5, T. 8 N., R. 6 W.

Workings: A vertical shaft at least 300 feet deep from which two levels have been driven. At the 200-foot level there is a drift 150 feet long; at the 300-foot level, drifting extends 300 feet west and 900 feet east (Pardee and Schrader, 1933, p. 265).

Geology: The vein is in quartz monzonite; it trends due east and dips 80° S. It pinches and swells abruptly from a minimum width of ½ foot to a maximum of 5 feet. In the wider parts of the structure the ore reaches a maximum width of 3 feet; the rest of the structure is filled with altered wall rock and gouge. The vein is confined within well-defined walls. Development on the east end of the 300-foot level has reached the contact of andesite with quartz monzonite at 900 feet from the shaft. Pardee and Schrader (1933, p. 265) made no mention of what happened to the vein structure beyond this contact. Ore minerals in the vein include galena, sphalerite, pyrite, and tetrahedrite in quartz gangue. Although no evidence of secondary enrichment was noted, ore from near the surface report-

edly contained a relatively large amount of gold, which diminished with depth (Knopf, 1913, p. 77).

Kimball

Location: NE¼ sec. 12, T. 8 N., R. 7 W.

Workings: An adit approximately 250 feet long (Geach, field notes).

Geology: The adit (Fig. E-4) intersects a vein trending N. 35° E. and dipping 48° to 68° SE. in andesite. Although the structure extends to a maximum width of 2 feet, quartz and pyrite extend to a width of only 4 inches. The wall rock is silicified and pyritized.

Lilly-Orphan Boy Group

Location: Sec. 15, T. 8 N., R. 6 W.

Workings: Many surface pits and cuts and a 180-foot vertical shaft with three levels.

Geology: The workings explore an east-trending high-angle vein, which ranges in width from 4 to 6½ feet and consists of pyrite, galena, and sphalerite in quartz and tourmaline gangue. The quartz monzonite wall rock is altered by sericitization and argillization.

Production: Recorded production from this property is shown in Table E-10.

Monarch

Location: N½ sec. 31, T. 8 N., R. 6 W.

Workings: The Monarch is probably the largest mine in the district. According to Pardee and Schrader (1933, p. 266), the underground workings consist of a vertical shaft 350 feet deep, two adits, and approximately 3,000 feet of drifts.

Geology: The vein developed by these workings is localized in a fault zone along a contact between quartz monzonite and andesite. It trends due east, dips steeply northward, and is as much as 20 feet wide. The vein contains galena, sphalerite, pyrite, arsenopyrite, chalcopyrite, and tetrahedrite in quartz gangue. Covellite is present in the oxidized part of the vein. Much altered wall rock, both quartz monzonite and andesite, is also present in the structure. The wall rock is altered by argillization and by addition of disseminated sulfide minerals.

Production: Recorded production from the Monarch mine is shown in Table E-11.

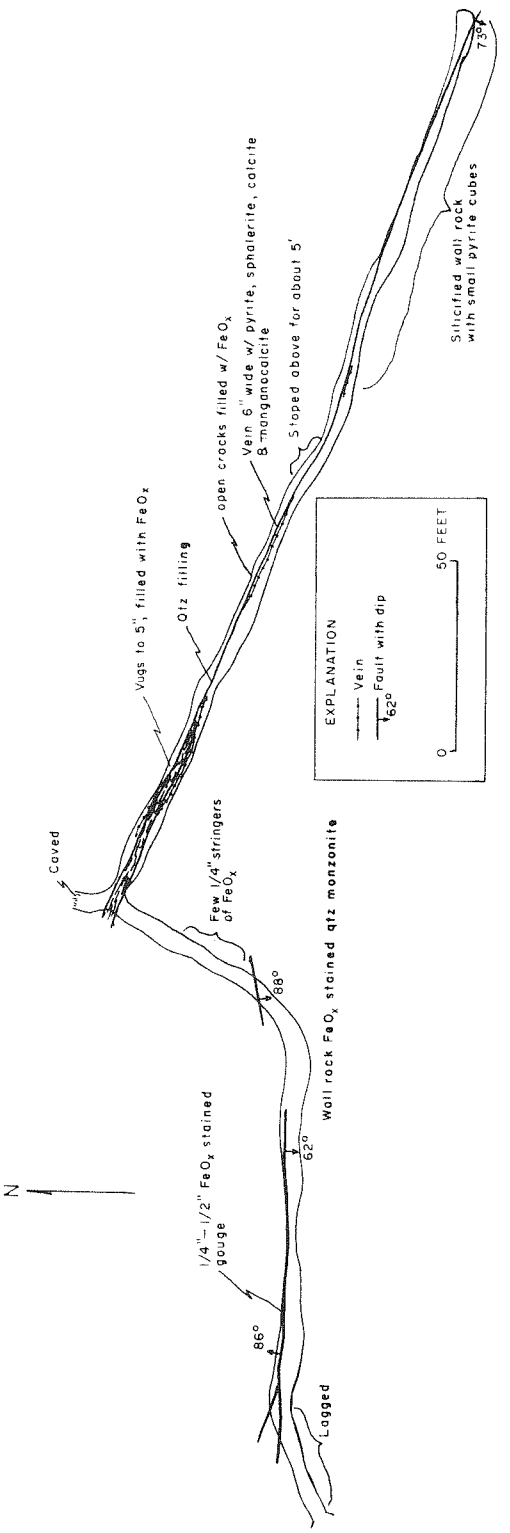


Figure E-3.—Hard Luck mine.

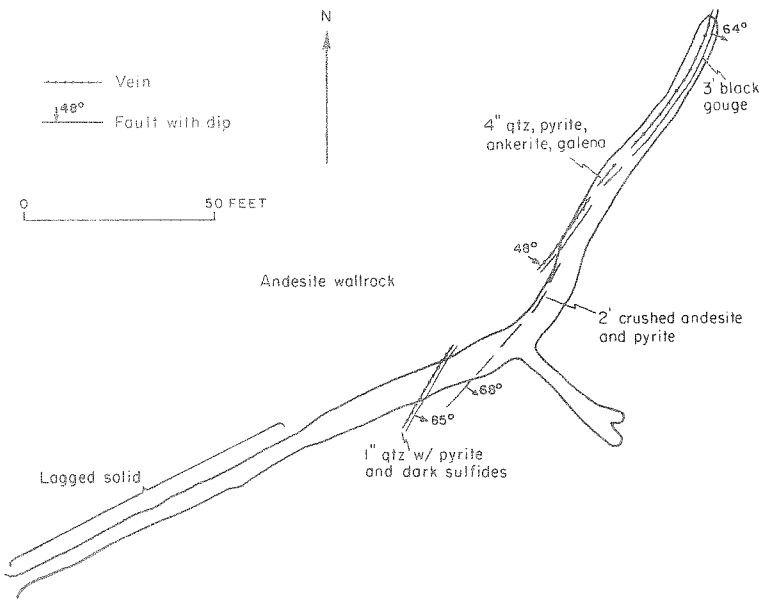


Figure E-4—Kimball mine.

Negros

Location: SE¼ SW¼ sec. 36, T. 9 N., R. 7 W.

Workings: Two adits (Fig. E-5) explore east- and northeast-trending veins. The northern adit was being worked by John Hopkins of Helena when Geach visited the property in 1968. In this adit the vein is stoped both above and 60 feet below the drift level.

Geology: In the southern adit three veins have been exposed in pyritized andesite porphyry. They range in width from ½ foot to 3 feet, although another, wider structure is suggested by the size of a caved stope in this adit. The northern adit develops a single vein, which ranges from 4 to 24 inches in width and contains pyrite, galena, and sphalerite in quartz. In addition, Mr. Hopkins noted that the vein contains values in gold and silver. The wall rock is altered by argillization.

Production: Recorded production from the Negros mine is shown in Table E-12.

Ohio and Speculator

Location: NW¼ NE¼ sec. 13, T. 8 N., R. 7 W.

Workings: According to R. D. Geach, two adits were driven on a vein trending S. 55° E. An upper adit 100 feet vertically above the lower adit is caved; the lower adit is estimated to be more than 150 feet long.

Geology: Both adits are in andesite porphyry. Specimens from the dump contain pyrite in quartz stained with manganese oxide.

Ontario

Location: NE¼ SW¼ sec. 22, T. 8 N., R. 6 W.

Workings: According to Pardee and Schrader (1933, p. 267) the Ontario was one of the largest mines in the district. It was developed by an adit 800 feet long and an internal shaft 320 feet deep.

Geology: Specimens on the dump contain pyrite, sphalerite, and galena in quartz. Quartz monzonite is present at the mouth of the adit.

Production: Recorded production from the Ontario mine is shown in Table E-13.

Sadie

Location: SW¼ sec. 30, T. 9 N., R. 7 W.

Workings: According to Pardee and Schrader (1933, p. 267), development consisted of two tunnels and a shaft, which total about 1,000 linear feet.

Geology: The vein trends northeast, dips almost vertically, and is as much as 23 feet wide. It is localized in a fracture in andesite. Ore minerals identified include pyrite,

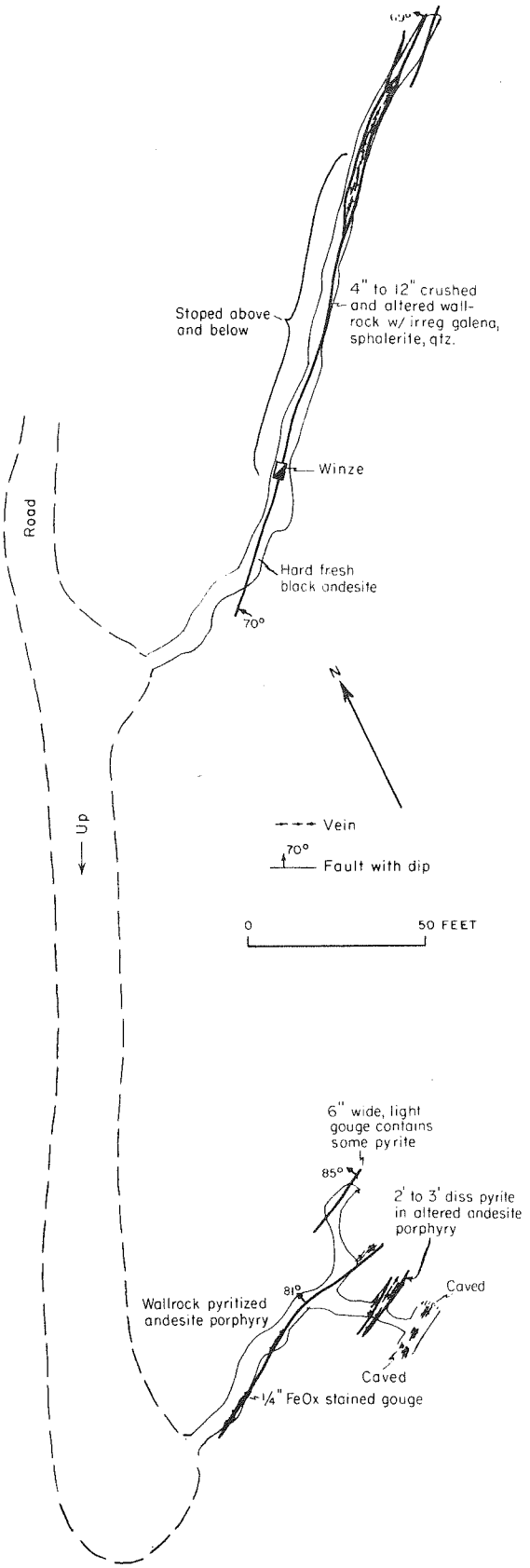


Figure E-5.–Negros mine.

arsenopyrite, galena, sphalerite, tetrahedrite, pyrrhotite, and chalcopyrite in a quartz gangue (Pardee and Schrader, 1933). Brecciation of the vein material and recementation by sulfides was also noted.

Surething

Location: SE¼ sec. 15, T. 8 N., R. 6 W.

Workings: An adit several hundred feet long (Geach, field notes).

Geology: Above the adit an open cut has exposed argillized quartz monzonite in a zone approximately 60 feet wide, which contains an aplite dike trending N. 54° W. The dike has been argillized and contains abundant tourmaline. On the adit dump, vein quartz containing tourmaline and pyrite was found.

Production: Recorded production from the Surething mine is shown in Table E-14.

Telegraph

Location: NW¼ NE¼ sec. 11, T. 8 N., R. 6 W.

Workings: A shallow adit in a stream bed and extensive placer tailings. Geach (field notes) concluded that the adit was driven to explore for the source of the placer gold mined on the surface. A stamp mill on the property suggests that the source, or at least one of the sources, of the placer gold may have been found. The placer piles contain cobbles of aplite and argillized quartz monzonite.

Production: Recorded production from the Telegraph mine is shown in Table E-15.

Third Term

Location: SE¼ sec. 28, T. 9 N., R. 6 W.

Workings: The description of this property is taken from Johns (1952). The workings consist of 900 feet of drift and crosscut.

Geology: The vein exposed in the workings is localized in a steep-dipping fault trending N. 80° W. The vein ranges from ½ foot to 2½ feet in width; the fault structure ranges from 3 to 5½ feet in width, however. Sulfide minerals present include pyrite, chalcopyrite, galena, sphalerite, tetrahedrite, tennantite, and possibly covellite in quartz. Alteration, which extends no more than 1 foot from the structure, consists of sericitization and minor argillization.

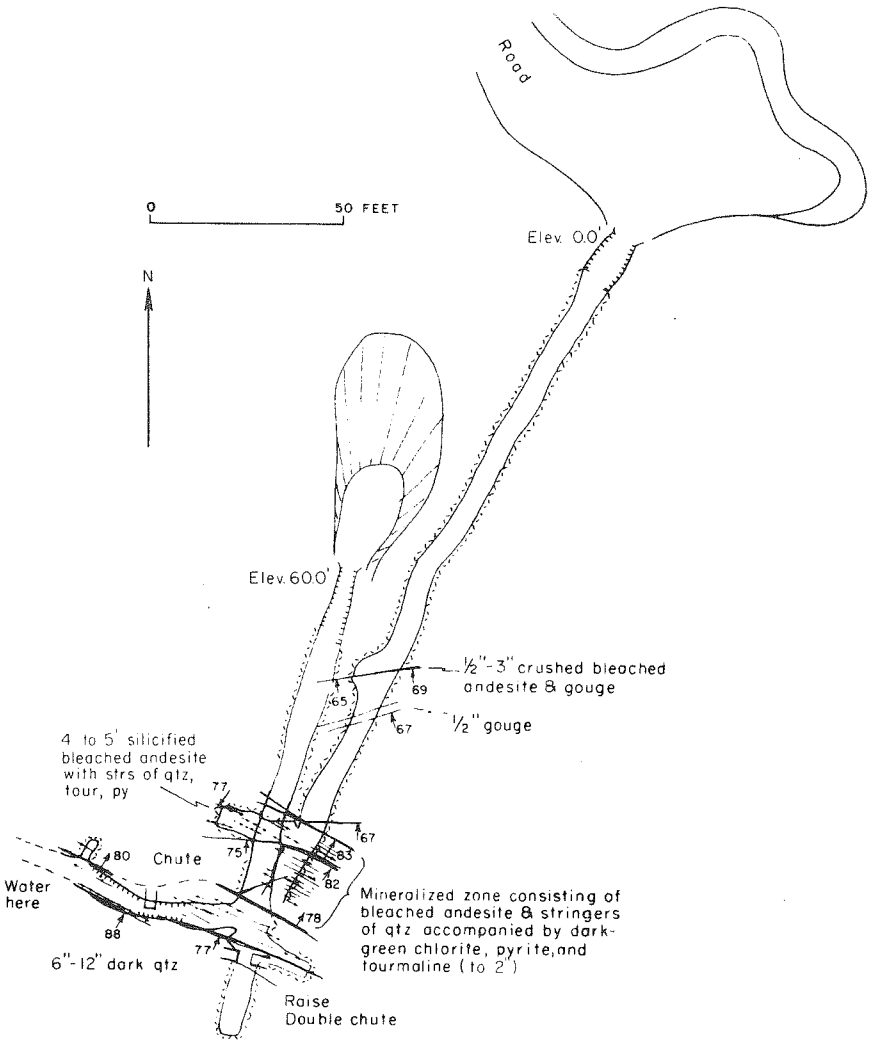


Figure E-6.—Wolverine mine.

Production: Recorded production from the Third Term mine is shown in Table E-16. .

Viking

Location: NE¼ sec. 5, T. 8 N., R. 6 W.

Workings: Although Geach (field notes) visited the property, the adit was caved; he estimated it to be about 500 feet long.

Geology: The adit explores a vein trending N. 70° W. in quartz monzonite. Specimens from the dump contain small "sunbursts" of tourmaline and galena in quartz.

Wolverine

Location: NW¼ sec. 20, T. 8 N., R. 6 W.

Workings: The following description is from Geach (field notes). The workings consist of two crosscut adits (Fig. E-6) and an undetermined length of drift.

Geology: A mineralized zone approximately 10 feet wide, trending N. 20° W. and dipping steeply northward, is exposed in both crosscuts. The structure consists of altered andesite wall rock cut by stringers of quartz containing tourmaline and pyrite. Alteration consists of silicification and bleaching of the andesite.

Production: Recorded production from the Wolverine mine is shown in Table E-17. Table E-18 shows recorded production from other properties in the Elliston district for which no other data are available.

ZOSELL (EMERY) DISTRICT

(Illustrations and tables for this district are prefixed by the letter Z.)

GENERAL GEOLOGY

The following data have been condensed, in part, from Robertson (1953).

Bedrock in the Zosell district (Plate Z-1) is composed entirely of Late Cretaceous lava flows that are part of the Elkhorn Mountains Volcanics. Many investigators have concluded that the Boulder Batholith, which is exposed a short distance south of the district, is present under the flows and was the source of the hydrothermal fluids that formed the ore deposits. The thickness and composition of the flow sequence have been the subject of much discussion. The generally accepted thickness is 2,000 feet (Robertson, 1953, p. 6). Pardee and Schrader (1933, p. 273) classified the flows as andesite, but Robertson (1953, p. 7), on the basis of modal analysis, classified them as basalt. Accordingly, the rocks consist of basalt breccia flows, feldspar-pyroxene basalt flows, pyroxene basalt flows, amygdaloidal basalt flows, an andesite flow, and also a tuff unit.

The basalt breccia, a moderately thick unit, can be traced along the east side of the district for more than a mile; just southwest of the Emery mine, it can be traced eastward. North of the Argus mine its outcrop forms a distinctive topographic bench. The rock weathers to a dull brown on outcrop surfaces, but on fresh surfaces it is bluish gray. Microscopic examination of a thin section shows that the rock consists of labradorite, augite, pigeonite, and another pyroxene. Accessory minerals include magnetite, apatite, and a trace of quartz.

The feldspar-pyroxene basalt overlies the breccia; it is porphyritic, containing phenocrysts of pyroxene and plagioclase, but because other units are also porphyritic, the texture is not a diagnostic feature. The rock weathers dark brown on outcrops but fresh surfaces are greenish black. Phenocrysts, which range from 2 to 4 mm long, locally constitute as much as 25 percent of the rock. The phenocrysts are made up of glomerophyric labradorite clusters, augite, and extensively altered clinoenstatite. Common accessory minerals are magnetite and apatite. Some thin sections show small amygdules containing quartz and carbonate minerals.

The pyroxene basalt, so called because pyroxene phenocrysts are the dominant feature, is exposed in the northern part of the district where it forms conspicuous dip slopes. The rock contains phenocrysts of augite and diopside and smaller ones of plagioclase; magnetite and apatite are accessory minerals.

The most striking feature of the amygdaloidal flows is the various-size almond-shaped amygdules, which contain chalcedonic quartz, hematite, chlorite, and epidote in various amounts.

A thin, deeply weathered, dark-red andesite flow southeast of the Bonanza mine contains andesine plagioclase, altered amphibole, pyroxene phenocrysts, and irregular cavities, which are filled with chalcedonic quartz. Disseminated hematite in the groundmass causes the red coloring.

Thin-bedded tuff units in the same area as the andesite, having a combined thickness of only a few feet, seem to overlie it. Because the tuff weathers easily, it can be traced no more than a few hundred yards. The regional orientation of the flows changes within the district. On the south side the strike is almost due north and the dip is about 10° W. North of the district the flows strike N. 30° W. and dip 10° to 20° W. This change in orientation has produced a west-plunging trough that trends through the central part of the district.

Low-angle reverse or thrust faults, the hosts for the more important ore deposits, tend to follow flow contacts. Evidence of low-angle crosscutting across the flows was noted at the Bonanza mine and at the Emery mine (Elliott, 1939, p. 15). High-angle tension fractures, which are thought to have formed at the same time as the low-angle faults, have also been mineralized.

Of the two systems of post-mineralization faulting, the earlier system trends northeast and has minor displacement. Faults belonging to this system are shown on the maps of the Argus (Fig. Z-1) and the Bonanza (Fig. Z-2) mines. A later system, trending about N. 70° W., shows large amounts of displacement. The Black Rock fault is in this system.

GEOLOGY OF THE ORE DEPOSITS

Most of the ore deposits are confined to the low-angle faults in the basalt flows. Ore minerals identified from the various mines include arsenopyrite, pyrite, sphalerite, galena, boulangerite, tetrahedrite, and chalcopyrite; millerite (NiS) was found in one specimen. Gangue minerals in-

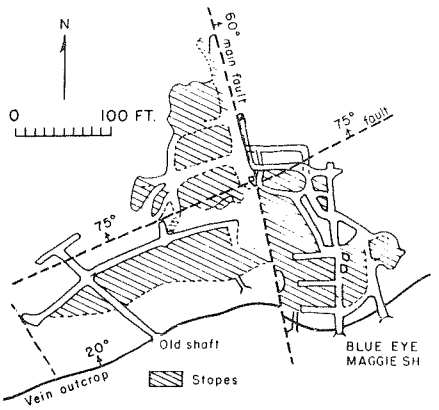


Figure Z-1.–Plan map of Blue Eye Maggie mine.

clude quartz, pyritized tourmaline, and carbonate minerals. Hydrothermal alteration consists of argillization and addition of pyrite and carbonate minerals.

Production from lode mines is shown in Table Z-1.

LODE DEPOSITS

Argus

Location: W½ NW¼ sec. 2, T. 7 N., R. 8 W.

Workings: Three inclined shafts sunk on the vein (Robertson, 1953, Pl. 5B). Figure Z-1 shows the relationship of the vein and the workings.

Geology: The vein, as exposed in the underground workings, trends due north and dips eastward at angles less than 20 degrees. On both the north and south sides of the main workings the vein swings toward the east and is cut by four northeast-trending right-lateral faults, which have 10 to 20 feet of horizontal displacement. The vein, ranging from 6 inches to 3 feet in width, is composed of quartz, ankerite, pyrite, arsenopyrite, sphalerite, galena, chalcopyrite, and calcite. Millerite was found as a vug filling in samples from a lower adit. Amygdaloidal basalt is exposed at the portal of the main inclined shaft. The wall rock adjacent to the vein has been altered by bleaching and silicification. In addition, the wall rock is cut by veinlets of carbonate and quartz.

Production: Recorded production from the Argus mine is shown in Table Z-2.

Black Eyed May

Location: NE¼ SW¼ sec. 2, T. 7 N., R. 8 W.

Workings: A vertical shaft 100 feet deep (Pardee and Schrader, 1933, p. 282).

Geology: The vein, about 1 foot wide, strikes N. 80° W. and dips steeply northward. Specimens from the dump contain arsenopyrite, pyrite, sphalerite, galena, and chalcopyrite in quartz. The host rock, feldspar-pyroxene and amygdaloidal basalt, has been bleached and pyritized.

Production: Production from the Black Eyed May and an adjoining property, the Bertha May, is shown in Table Z-3.

Blue Eye Maggie

Location: N½ SW¼ sec. 10, T. 7 N., R. 8 W.

Workings: A shaft inclined at 8° to 10° N., four levels, and a winze (Fig. Z-1).

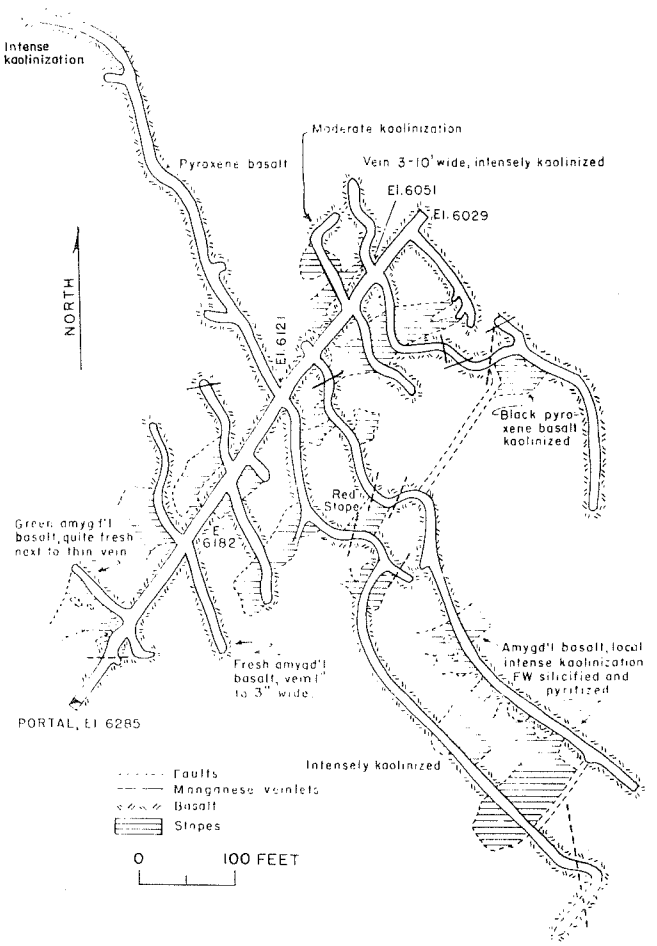


Figure Z-2.–Plan map of Bonanza mine.

Geology: The vein ranges in width from 1 inch to about 12 inches but averages about 6 inches; it is contained within well-defined walls. It strikes N. 40° to 50° W., dips 20° NE., and is similar to the Emery vein. A minor fault trending N. 70° E. and dipping 75° NW. displaces the vein about 1 foot. About 40 feet west of the main workings, this fault has been cut by another, which trends N. 15° W., dips 60° E., contains about 1 foot of gouge, and displaces the vein 22 feet. The upthrown side is west of the fault plane. Ore minerals include arsenopyrite, pyrite, sphalerite, galena, chalcopyrite, tetrahedrite, and boulangerite. The amygdaloidal basalt wall rock was hydrothermally altered by silicification, bleaching, and introduction of sulfide minerals, mainly pyrite. The metal content of the ore, as computed from smelter returns (Pardee and Schrader, 1933, p. 277), is:

Gold	1 to 1.5 oz./ton
Silver	42 to 63 oz./ton
Lead	2 to 6 percent
Zinc	trace to 6 percent
Copper	0.10 to 0.55 percent
Manganese	2 to 3.5 percent
Iron	11 to 18 percent
Arsenic	3 to 21 percent

Production: Recorded production from the Blue Eye Maggie is shown in Table Z-4.

Bonanza

Location: NW¼ NW¼ sec. 11, T. 7 N., R. 8 W.

Workings: The workings (Fig. Z-2) consist of an inclined shaft, which has approximately 3,500 feet of drifts, and a drainage tunnel approximately 400 feet long (Stejer, 1948, p. 22; Robertson, 1953, Pl. 5C). The drainage tunnel is in Little Cottonwood Gulch but reportedly did not reach the main underground workings.

Geology: The vein strikes N. 30° W. and dips 10° to 25° NE.; the width ranges from several inches to 10 feet and averages about 2½ feet. The ill-defined vein structure, which consists of a series of rudely parallel fracture fillings and replacements, is the result of multiple reopening and mineralization. The vein contains stockworks, horses of altered wall rock, and irregular masses of sulfide minerals on the footwall and hanging wall. In places the vein lies within amygdaloidal basalt; in several other places a porphyritic basalt forms the hanging wall and the vein is less steep. Some of the richest ore shoots were found where the vein flattens, and although the vein flattens at the bottom of the shaft, Robertson (1953, p. 18) stated that the ore bottoms above the eighth level. Primary vein minerals include quartz, arsenopyrite, pyrite, sphalerite, galena, chalcopyrite, tetrahedrite, and ankeritic carbonate. Hydrothermal alteration of the amygdaloidal basalt includes silicification and pyritization and minor argillization and sericitization. The porphyritic basalt has been kaolinized and bleached.

Production: Recorded production from the Bonanza is shown in Table Z-5.

Caroline and William Coleman

Location: SE¼ SW¼ sec. 10, T. 7 N., R. 8 W.

Workings: An inclined shaft of unknown extent.

Geology: The workings explore a 2-foot vein in slightly propylitized basalt. Vein minerals in specimens from the dump include galena, sphalerite, pyrite, arsenopyrite, quartz, and ankerite.

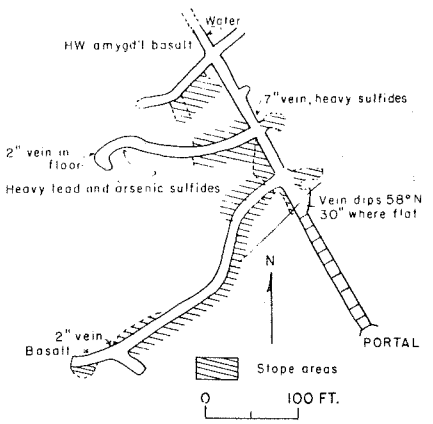


Figure Z-3.—Plan map of Ding Bat mine.

Ding Bat

Location: SW¼ NE¼ sec. 10, T. 7 N., R. 8 W.

Workings: An inclined shaft and approximately 500 feet of drifts (Fig. Z-3).

Geology: The vein explored by these workings is similar to others in the district except that it contains less sphalerite and generally more arsenopyrite. A structural feature that distinguishes the vein from others in

Table Z-1.–Production of gold, silver, copper, lead, and zinc at lode mines, in terms of recoverable metals, 1902-68, Zosell (Emery) District, Powell County.

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902	1,200	1,320	54,000	--	168,000	--	$ 55,818
1903	No production					--	
1904	--	610	13,779	--	--	--	20,330
1905	7,000	914	16,556	--	130,000	--	35,010
1906	6,620	738	22,018	--	89,024	--	35,087
1907	1,580	330	9,338	--	45,684	--	15,404
1908	596	376	15,543	--	119,251	--	21,028
1909	55	56	2,132	--	8,094	--	2,606
1910	83	85	5,001	--	14,759	--	5,097
1911	284	251	5,759	--	41,752	--	10,123
1912	143	112	4,111	4,288	11,513	--	6,073
1913	153	147	5,152	219	--	--	6,188
1914	190	128	10,025	1,727	38,800	--	9,920
1915	324	286	10,380	577	41,645	--	13,221
1916	233	180	8,114	--	36,712	--	11,593
1917	1,216	77	2,274	--	12,361	--	4,531
1918	5	3	188	10	--	--	256
1919	9	2	165	--	2,047	--	343
1920	18	6	280	--	4,173	--	768
1921	25	18	1,039	--	3,180	--	1,548
1922	150	152	6,342	--	15,415	--	10,340
1923	309	225	6,912	59	36,085	--	12,848
1924	159	118	5,086	359	15,994	--	7,168
1925	66	90	3,206	--	8,220	--	4,809
1926	192	119	2,134	--	7,576	--	4,390
1927	195	124	5,216	163	27,179	3,247	7,464
1928	37	45	1,380	--	--	--	1,728
1929	No production				--		
1930	8	11	244	60	--	--	329
1931	47	48	1,655	292	--	--	1,497
1932	200	196	7,681	1,222	--	--	6,303
1933	453	409	24,377	2,906	108	--	17,171

1934	1,378	944	61,906	3,750	100,919	--	77,036
1935	14,373	3,473	129,586	2,169	144,500	--	220,661
1936	4,060	2,981	104,767	652	87,022	--	189,533
1937	6,985	2,778	46,945	1,000	88,000	--	138,855
1938	3,686	1,800	29,601	41	48,304	--	84,362
1939	7,173	3,378	59,699	1,096	39,617	--	160,729
1940	4,375	2,399	66,216	434	35,520	7,000	133,318
1941	4,714	2,312	47,662	2,550	111,600	44,000	124,775
1942	1,860	779	3,157	--	2,400	--	29,671
1943	69	34	180	--	1,600	--	1,438
1944	No production						
1945	50	7	225	--	1,000	800	583
1946	1,515	502	5,026	500	26,000	23,200	27,376
1947	10,961	1,391	29,916	6,200	475,000	359,100	186,757
1948	8,716	931	20,506	4,500	321,800	247,100	142,587
1949	560	385	558	--	4,500	--	14,691
1950	304	63	947	6,100	1,000	700	4,565
1951	16	6	147	--	1,300	1,500	841
1952-56	No production						
1957	44	10	662	--	8,600	--	2,179
1958-59	No production						
1960	6	1	6	--	--	--	40
1961-62	No production						
1963	3	--	208	--	--	--	192
1964-65	*	*	*	*	*	*	*
1966	53	3	157	--	3,100	3,100	1,227
1967-68	No production						
Total	95,151	31,382	865,980	42,974	2,389,754	693,947	$1,884,295

*Withheld to avoid disclosing individual company confidential data. Figures included in totals.

the district is that the vein constricts and is devoid of ore where it flattens.

Elizabeth-Little Emery

Location: N½ SE¼ sec. 3, T. 7 N., R. 8 W.

Workings: A small open pit and approximately 400 feet of drift.

Geology: The workings explore a vein that strikes N. 45° to 80° W., and dips 10° to 30° SW. (this dip is less than the slope of the hillside, so the underground workings are below the vein). The vein is localized in a fracture that has feldspar-pyroxene basalt in the hanging wall and amygdaloidal basalt in the footwall. The vein material has been completely oxidized; no primary minerals were found.

Emery

Location: SE¼ NE¼ sec. 10 and W½ sec. 11, T. 7 N., R. 8 W.

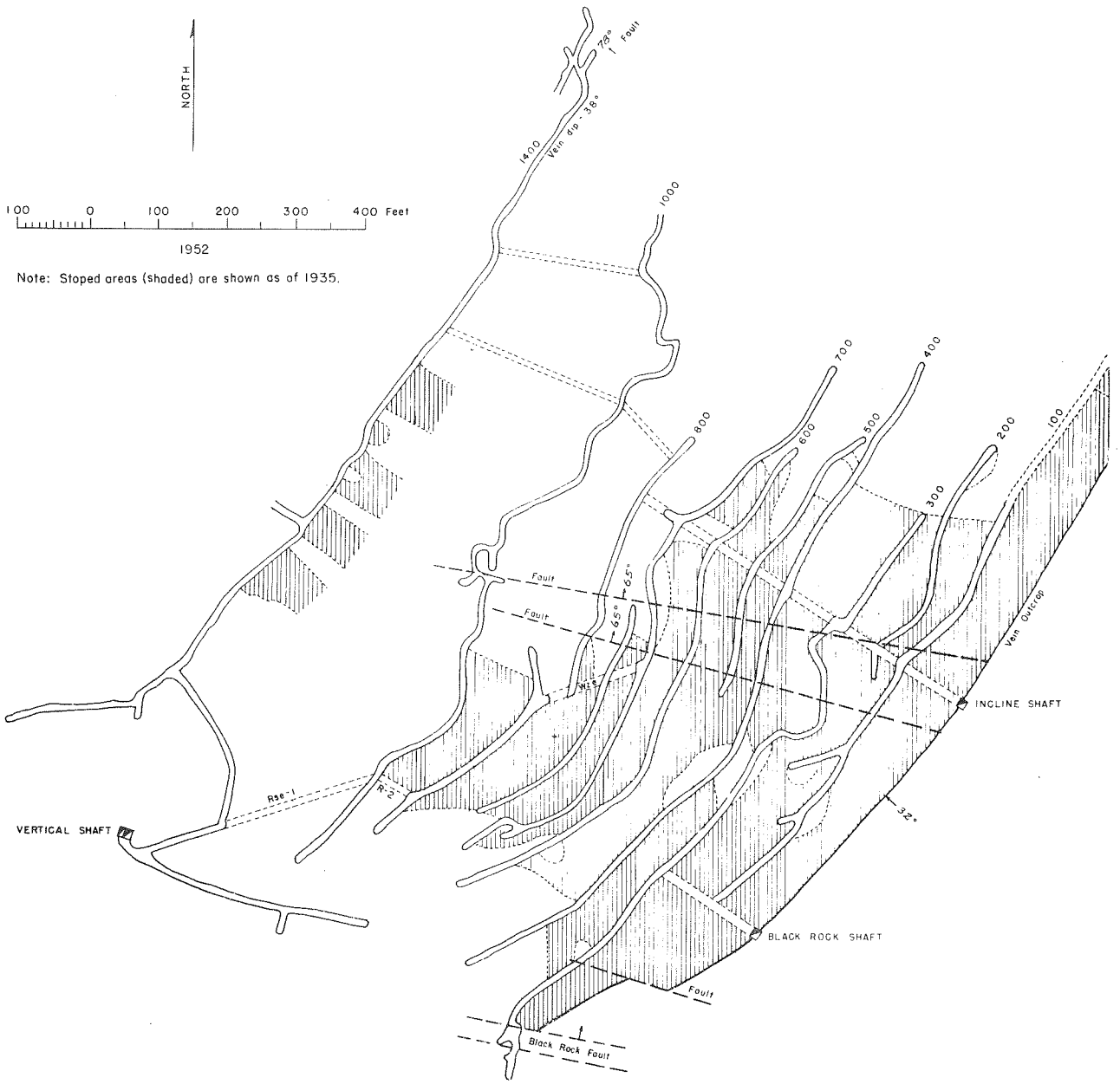


Figure Z-4.–Plan map of Emery mine, Zosell district (Robertson, 1953, Plate 5A).

Workings: A vertical shaft 1,400 feet deep, an inclined shaft 400 feet deep (inclined 30° NW.), an air shaft 300 feet deep, more than 9,600 feet of drifts, and numerous raises and winzes (Fig. Z-4).

Geology: The vein ranges in width from several inches to 24 inches but averages about 7 inches. It strikes generally N. 30° E. and dips about 30° NW. A small amount of gouge is present on the footwall and hanging wall (Elliott, 1939, p. 14). Ore minerals are uniformly distributed throughout the vein structure, as can be seen by the location of stopes in the mine. As in other veins in the district, the dip is inconsistent (from 20° to 35°). Elliott (1939, p. 14) noted that the vein widens as it flattens. Rather than being a simple fracture, the structure consists of many small, rudely parallel fractures that have been filled with ore minerals, including arsenopyrite, pyrite, sphalerite, galena, chalcopyrite, tetrahedrite, boulangerite, and gold. Most of the gold is in the arsenopyrite, but some occurs as small grains of native gold. Gangue minerals include quartz, calcite, ankerite, and a manganiferous mineral. Alteration of the wall rock consists of argillization, local silicification, and sericitization and pyritization. The major post-mineralization fault in the district, the Black Rock, trends N. 70° to 75° W., dips northeast, and offsets the Emery lode 500 to 1,000 feet in a horizontal plane; the amount of vertical displacement is not known.

Production: Recorded production from the Emery mine is shown in Table Z-6.

Emma Darling

Location: NE¼ SE¼ sec. 2, T. 7 N., R. 8 W.

Workings: An adit and shaft of unknown extent.

Geology: The vein developed by the workings is within a high-angle, east-trending fissure that can be traced for about half a mile on the surface by the presence of prospect pits. Near the crest of the hill the vein is about 2 feet wide, but about 200 feet below the hill crest, it is nearly 7 feet wide (Robertson, 1953, p. 23). Specimens from the dump near the shaft contain arsenopyrite, pyrite, sphalerite, galena, chalcopyrite, and quartz, but the prevalent gangue mineral is ankerite. Porphyritic basalt is on the surface, but amygdaloidal basalt on the dump indicates that this rock was encountered at depth. The amygdaloidal basalt has been altered by bleaching, silicification, and pyritization.

Production: Recorded production from the Emma Darling mine is shown in Table Z-7.

Hidden Hand

Location: NW¼ SW¼ sec. 2, T. 7 N., R. 8 W.

Workings: A 350-foot inclined shaft, several other short inclined shafts, an adit about 1,200 feet long, and a small open pit (Fig. Z-5).

Geology: The following description is from Robertson (1953, p. 17). The vein structure itself is ill defined, but the ore is confined to a brecciated shear zone. Although the vein has a general dip of about 20° ENE., the ore shoots differ in orientation within the vein. Where the ore shoots flatten, they are much thicker and, in general, richer. Ore shoots have been found on both the hanging wall and footwall sides of the vein. Several flat areas in the structure indicate a reverse or thrust fault. Gold, especially noteworthy in the oxidized parts of the vein, varies in direct proportion to the intensity of alteration. Other minerals in the vein are quartz, pyrite, galena, arsenopyrite, sphalerite, calcite, and a trace amount of chalcopyrite. Wall-rock alteration is very intense in the vicinity of the vein and is thought to extend more than 20 feet. Alteration of the porphyritic basalt wall rock consists of silicification, argillization, and minor sericitization, all inducing a pervasive bleaching. Dispersed boxworks lined with limonite in the wall rock suggest that pyrite is also an alteration mineral.

Production: Recorded production from the Hidden Hand mine is shown in Table Z-8.

Sterritt

Location: SW¼ SW¼ sec. 2, T. 7 N., R. 8 W.

Workings: Three vertical shafts and two adits of unknown extent.

Geology: Two veins were encountered in the upper adit. The first, 3 inches wide and about 100 feet from the portal, is oxidized and is within intensely iron-stained and kaolinized wall rock. Another vein, 120 feet from the portal, strikes N. 55° E. and dips 70° S. This vein ranges from 12 to 18 inches in width.

Production: Known production from the Sterritt mine is shown in Table Z-9. Production from other properties in the district is shown in Table Z-10.

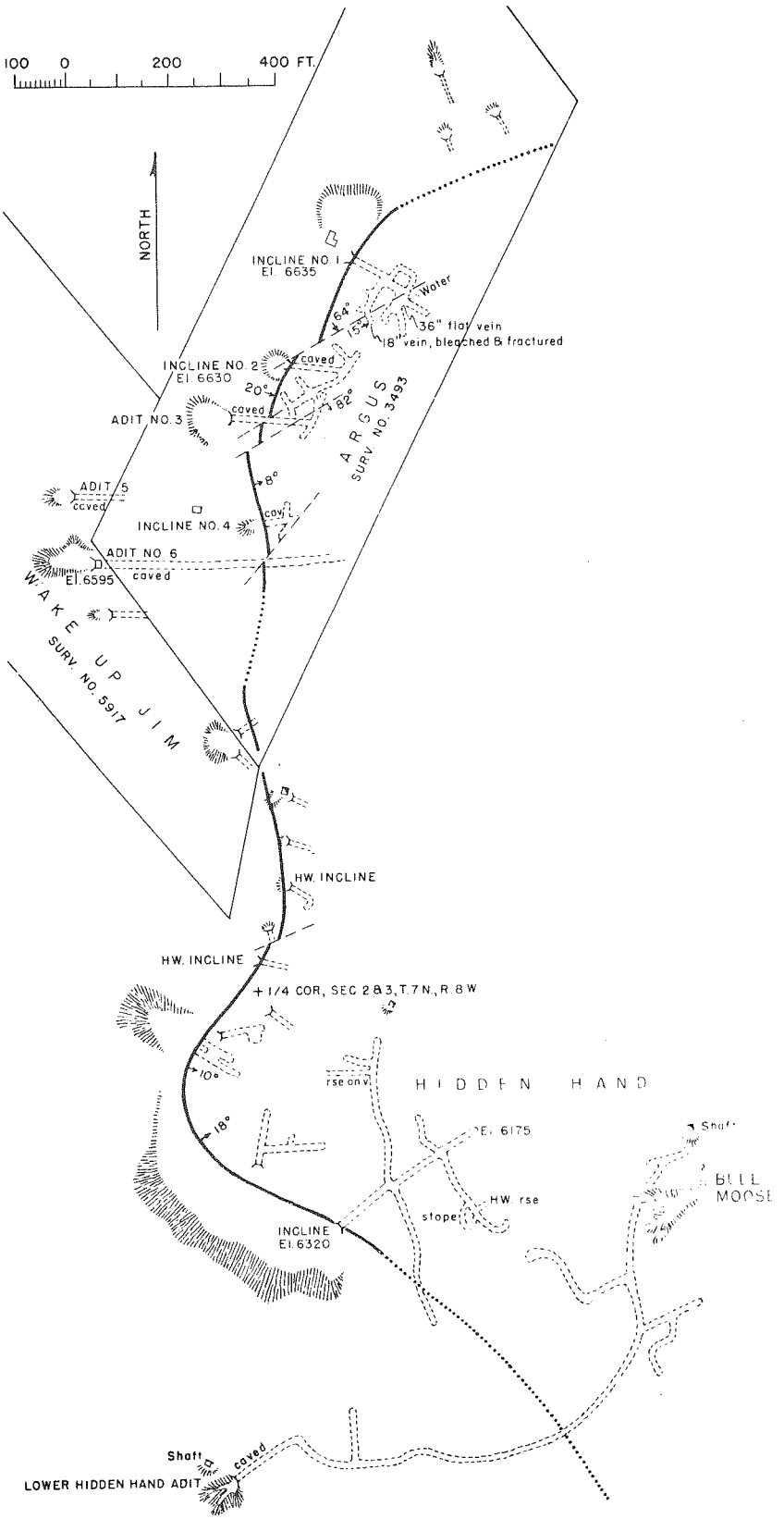


Figure Z-5.–Sketch map of the Argus-Hidden Hand vein (Robertson, 1953, Plate 5B).

RACETRACK DISTRICT

(Illustrations and tables for this district are prefixed by the letter R.)

The Racetrack district, in the Flint Creek Range, has seemingly received little attention from prospectors. Perhaps this neglect is due to the very rugged relief of the mountain range. Figure R-1 is a geologic map of the district, and Table R-1 shows the recorded production. Only two mines of any size are in this district.

LODE DEPOSITS

Amazon Group

Location: SE¼ sec. 7, T. 6 N., R. 11 W.

Workings: Four adits, now caved, explored narrow quartz veins in quartz diorite. The volume of dump material near the largest adit suggests about 450 feet of development (Earll, 1972, p. 48).

Production: Recorded production from this property is shown in Table R-2.

Dark Horse

Location: NE¼ SE¼ sec. 5, T. 6 N., R. 11 W.

Workings: A series of short adits.

Geology: According to Earll (1972, p. 48), the workings developed a series of veinlike lodes in a small roof pendant of Hasmark Formation in porphyritic quartz diorite.

Production: Recorded production from the Dark Horse is shown in Table R-3. The production from two other properties in the Racetrack district is shown in Table R-4.

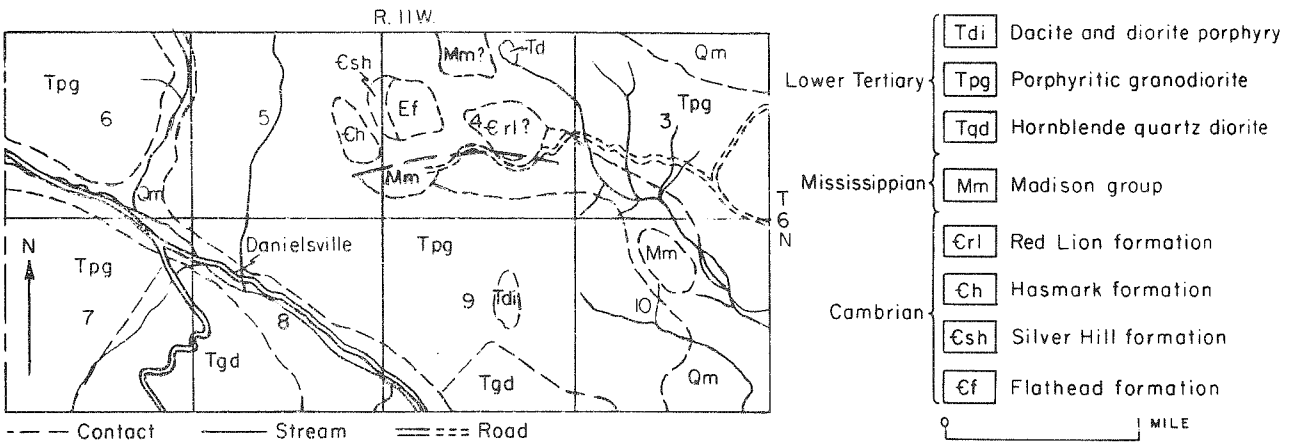


Figure R-1.–Geologic map of the Racetrack district.

OPHIR (SNOWSHOE CREEK, CARPENTER CREEK) DISTRICT

(Illustrations and tables for this district are prefixed by the letter O.)

GENERAL GEOLOGY

The Ophir district lies within T. 10 and 11 N., R. 7 and 8 W. (Plate O-1). The northern part of the district extends into Lewis and Clark County.

The district is underlain by Paleozoic limestone that was intruded and altered by Tertiary quartz monzonite and granodiorite of the Boulder Batholith. The igneous rocks have altered the limestone in various degrees; in many places garnet tactites were produced that were the hosts for the lode deposits and undoubtedly were the source of the placer gold. Tertiary alluvium flanks the mountains and is the bedrock over which the placer deposits of Carpenter Creek and Snowshoe Creek were formed. It is possible that placer deposits exist along the tributaries of Sixmile Creek, but this area has been covered by glacial moraine. The upper reaches of Threemile Creek have been placered; if placer deposits exist in the lower part, they have also been covered by glacial moraine. Lode deposits have been worked mainly for their

Table R-1.–Production of gold, silver, copper, lead, and zinc at lode mines, in terms of recoverable metals, 1902-68, Racetrack (Danielsville) District, Powell County.

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902	1,000	270	--	--	--	--	$ 5,400
1903	No production						
1904	2,000	2,200	--	--	--	--	44,000
1905	1	17	5	--	--	--	354
1906	1,000	632	82	--	--	--	13,123
1907	3	16	6	--	--	--	327
1908	100	69	13	--	--	--	1,350
1909	662	330	254	--	--	--	6,950
1910	2	9	4	--	--	--	185
1911	2	8	4	--	--	--	173
1912-13	No production						
1914	9	10	--	--	--	--	200
1915-31	No production						
1932	4	4	--	--	--	--	87
1933	No production						
1934	71	66	51	75	--	--	2,345
1935	3	2	--	--	--	--	79
1936	No production						
1937	10	1	--	--	--	--	35
1938	25	6	3	--	--	--	212
1939	38	26	25	--	--	--	927
1940-68	No production						
Total	4,930	3,666	447	75	--	--	$75,747

gold and silver, but significant amounts of copper and lead have also been produced. More recently a small amount of tungsten has been mined. The ore deposits occur in the tactite bodies. Pardee and Schrader (1933, p. 31) noted that the nearly vertical ore bodies are cylindrical or pipelike. Primary ore minerals within the host tactite minerals (garnet, serpentine, epidote, hornblende, diopside, chlorite, tourmaline, sericite, plagioclase, calcite, and magnetite) include pyrite, chalcopyrite, gold, tetrahedrite, and possibly several of the ruby-silver minerals. Scheelite and powellite were recognized in the deposits in the 1940's (Walker, 1963, p. 49). The placer gold was found in terrace deposits (termed "bars" by the miners) 2 to 3 feet thick and close to present streams. According to Pardee and Schrader (1933, p. 29), the richest and most productive deposits were Prairie Bar and Carpenter Bar.

The Ophir district has been credited with a production of $310,369 from lode mines (Table O-1) and $344,561 from placer mines (Table O-2).

LODE DEPOSITS

Arnold (Bielenberg, Boulder Ores, Strategic, Snowshoe)

Location: SW¼ sec. 27, T. 11 N., R. 7 W.

Workings: A main adit about 240 feet long (Fig. O-1), many pits and cuts, and four short adits on the west side of the creek, across from the main adit.

Geology: The ore deposits are associated with tactite zones in and near the contact of limestone with granitic rocks. The tactite zones, which are as much as 700 by 180 feet, are composed of garnet, epidote, quartz, and calcite, and they contain various amounts of magnetite, chlorite, chalcopyrite, and scheelite as accessory minerals. Walker (1963, p. 50) presented the results of surface sampling for tungsten. His samples contained 0.01 to 5.15 percent WO_3. Ore shipped from this property in 1943 amounted to 222 tons containing 0.54 percent WO_3.

Production: In addition to the tungsten ore, the recorded production from the Arnold mine is shown in Table O-3.

Bumble Bee

Location: NW¼ NW¼ sec. 20, T. 11 N., R. 7 W.

Workings: A vertical shaft approximately 100 feet deep (Fig. O-2).

Geology: The workings developed a tactite zone having superimposed faulting. Malachite is present in quartz stringers in the tactite.

Production: Recorded production from the Bumble Bee mine is confidential.

Butterfly

Location: SW¼ SW¼ sec. 30, T. 11 N., R. 7 W.

Workings: R. D. Geach's field notes show that development consisted of several small pits, a short adit, and a shaft of undetermined extent.

Geology: From material on the dumps, Geach concluded that the mineralized area was confined to several ¼-inch quartz veinlets in limestone, containing limonite, pyrite, malachite, chalcopyrite, and possibly tetrahedrite. Although limestone was found on the dumps, and outcrops of granodiorite are near the workings, no tactite was found.

Coon's Tungsten

Location: SW¼ sec. 19, T. 11 N., R. 7 W.

Workings: According to the field notes of R. D. Geach, this property was developed by an open cut (Fig. O-3).

Geology: The open cut explored a tactite zone between limestone and granodiorite; the tactite is slightly stained by malachite.

Cyclone

Location: NE¼ NE¼ sec. 20, T. 11 N., R. 7 W.

Workings: An open cut, two inclined shafts, and a vertical shaft (Fig. O-4) all of which explore a contact of porphyritic granite with limestone.

Geology: The open cut developed a tactite zone in limestone. The only evidence of mineralization remaining when Geach examined the property was slight malachite staining.

Production: Recorded production from the Cyclone mine is shown in Table O-4.

Esmeralda

Location: SW¼ sec. 23, T. 11 N., R. 7 W.

Workings: Geach observed numerous surface cuts and an adit approximately 370 feet long.

Table O-1.–Production of gold, silver, copper, lead, and zinc at lode mines, in terms of recoverable metals, 1902-68, Ophir (Carpenter, Deadwood, Snowshoe) District, Powell County.

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902-03	No production						
1904	2	2	--	--	--	--	$ 40
1905	No production						
1906	10	2	127	955	2,532	--	452
1907	No production						
1908	210	59	1,554	47,445	818	--	8,331
1909	366	246	6,733	70,019	--	--	17,696
1910	621	427	10,775	67,561	31,556	--	24,621
1911	1,971	1,295	17,258	35,599	64,047	--	43,257
1912	1,588	870	38,286	81,490	24,123	--	56,071
1913	1,753	802	52,055	95,264	19,541	--	63,638
1914	1,439	555	53,393	71,578	30,450	--	51,705
1915	52	21	504	1,831	1,396	--	1,082
1916	314	20	2,064	25,142	12,663	--	8,829
1917	810	122	2,769	17,786	--	--	9,664
1918	726	156	789	6,052	--	--	5,510
1919	59	20	76	3,581	--	--	1,144
1920	30	8	568	1,064	3,252	--	1,240
1921	11	3	230	167	1,044	--	369
1922	No production						
1923	11	6	3	--	--	--	130
1924	No production						
1925	3	*	3	711	--	--	105
1926	No production						
1927	1	2	3	--	--	--	51
1928	No production						
1929	3	--	9	660	--	--	121
1930	14	18	8	387	--	--	425
1931	4	7	6	80	--	--	148
1932	77	51	32	95	--	--	1,062
1933	100	5	63	16	--	--	128
1934	111	9	85	--	54	--	359
1935-36	No production						

1937	11	8	31	--	254	--	319
1938-39	No production						
1940	50	18	45	5,274	--	--	1,258
1941	61	98	59	1,000	--	--	3,590
1942	1	1	--	--	--	--	35
1943	15	3	52	2,900	--	--	519
1944	3	2	28	600	--	--	171
1945-47	No production						
1948	53	12	43	4,200	--	--	1,370
1949	5	5	74	100	500	--	341
1950	488	98	337	36,500	--	--	11,327
1951	107	18	63	6,000	--	--	2,139
1952	8	--	10	224	3,570	66	649
1953	26	--	18	--	600	1,800	302
1954	No production						
1955	100	7	409	--	1,000	900	875
1956-59	No production						
1960	3	--	3	200	--	--	67
1961	7	3	6	--	--	--	111
1962	28	2	9	800	--	--	326
1963-64	No production						
1965	*	*	*	*	--	--	*
1966-67	No production						
1968	*	*	*	*	--	--	*
Total	11,481	4,991	188,672	591,781	197,400	2,766	$322,872

*Withheld to avoid disclosing individual company confidential data. Figures included in totals.

Table O-2.—Production of gold and silver at placer mines, 1902-68, Ophir (Carpenter, Deadwood, Snowshoe) District.

Year	Material treated (cubic yards)	Gold (ounces)	Silver (ounces)	Total value
1902-05	No production			
1906	Not available	21	2	$ 436
1907	"	38	6	793
1908	"	67	8	1,386
1909	"	154	17	3,396
1910	"	128	18	2,648
1911	"	120	8	2,479
1912	"	84	8	1,749
1913	"	107	13	2,217
1914	"	51	5	1,061
1915	"	126	11	2,601
1916	"	37	2	763
1917	"	77	13	1,597
1918	"	35	3	726
1919	"	29	3	595
1920	"	16	3	337
1921	"	17	2	360
1922	"	8	1	173
1923	"	6	--	122
1924	No production			
1925	Not available	5	--	108
1926	"	16	1	336
1927-29	No production			
1930	Not available	13	2	261
1931	"	17	--	356
1932	"	37	--	750
1933	"	33	--	672
1934	"	6,714	622	235,064
1935	"	1,765	185	61,913
1936	"	136	22	4,791
1937	"	84	9	2,947
1938	4,830	69	3	2,417
1939	20,000	58	3	2,032
1940	523	44	7	1,545
1941	Not available	36	7	1,265
1942	10	45	7	1,580
1943-46	No production			
1947	150	3	--	105
1948	No production			
1949	50	2	--	70
1950	750	14	--	490
1951	1,200	24	--	840
1952-57	No production			
1958	10,000	81	73	2,901
1959	3,000	48	1	1,681
1960	1,000	18	18	646
1961	400	10	4	354
1962-68	No production			
Total	41,913	10,393	1,087	$346,563

Geology: According to Geach's notes, the surface pits contain limestone, andesite, and jasper, all of which probably contain gold. The underground workings (Fig. O-5) explored a tactite zone that contains some chalcopyrite and malachite.

Production: Recorded production from the Esmeralda mine is shown in Table O-5.

Fairview (Coulson)

Location: NE¼ NW¼ sec. 25, T. 11 N., R. 8 W.

Workings: A vertical shaft 275 feet deep (Pardee and Schrader, 1933, p. 32) and a short adit east of the shaft.

Geology: The shaft developed a vein dipping 60° SSW. and cutting quartz monzonite and diorite porphyry (Pardee and Schrader, 1933, p. 32). The 4-foot vein consists predominantly of vuggy, banded quartz and silicified wall-rock fragments. Ore minerals include pyrite, tetrahedrite, gold tellurides, and ruby-silver minerals. Much of the quartz monzonite on the dump shows severe sericitization and kaolinization.

Production: Production from the Fairview mine is shown in Table O-6.

Little Daisy

Location: SE¼ sec. 20, T. 11 N., R. 7 W.

Workings: A tunnel approximately 100 feet long (Pardee and Schrader, 1933, p. 33).

Geology: The workings developed four veins, two of which trend northeastward and dip 45° SE.; these veins contain silver-lead-gold ore and some antimony. Another important vein trends due east, dips 60° N., and contains magnetite, hematite, garnet, diopside, and an undetermined lead mineral. This structure is 4 to 8 feet wide (Pardee and Schrader, 1933).

McKay

Location: NE¼ sec. 23, T. 11 N., R. 7 W.

Geology: According to Pardee and Schrader (1933, p. 35) the vein developed on this property is in a contact zone about 4 feet wide that dips 40° N. and reportedly contains gold ore.

Ophir

Location: SE¼ sec. 25, T. 11 N., R. 8 W.

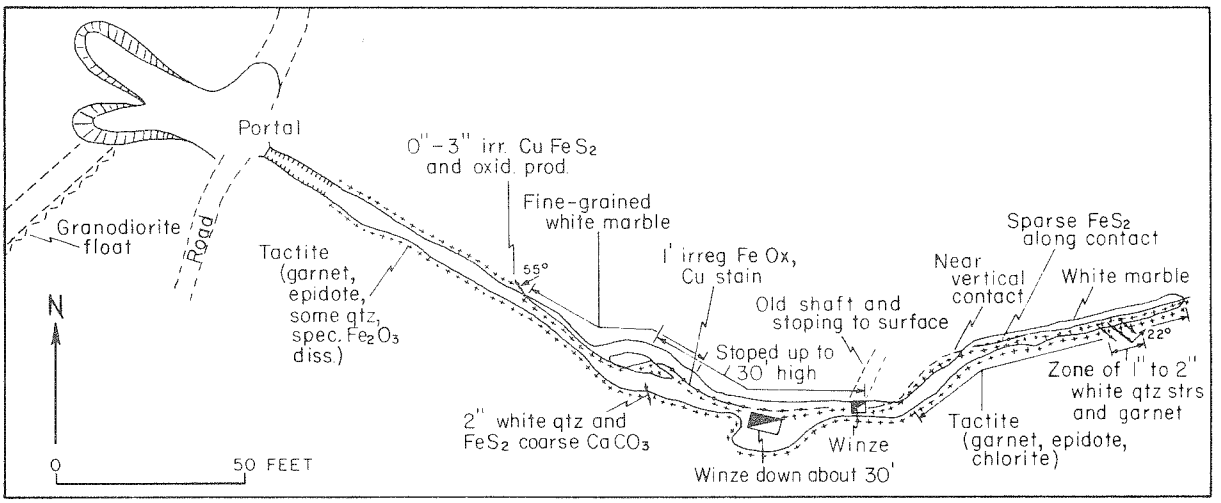


Figure O-1.–Map of the main adit of the Arnold mine (R. D. Geach, 1968).

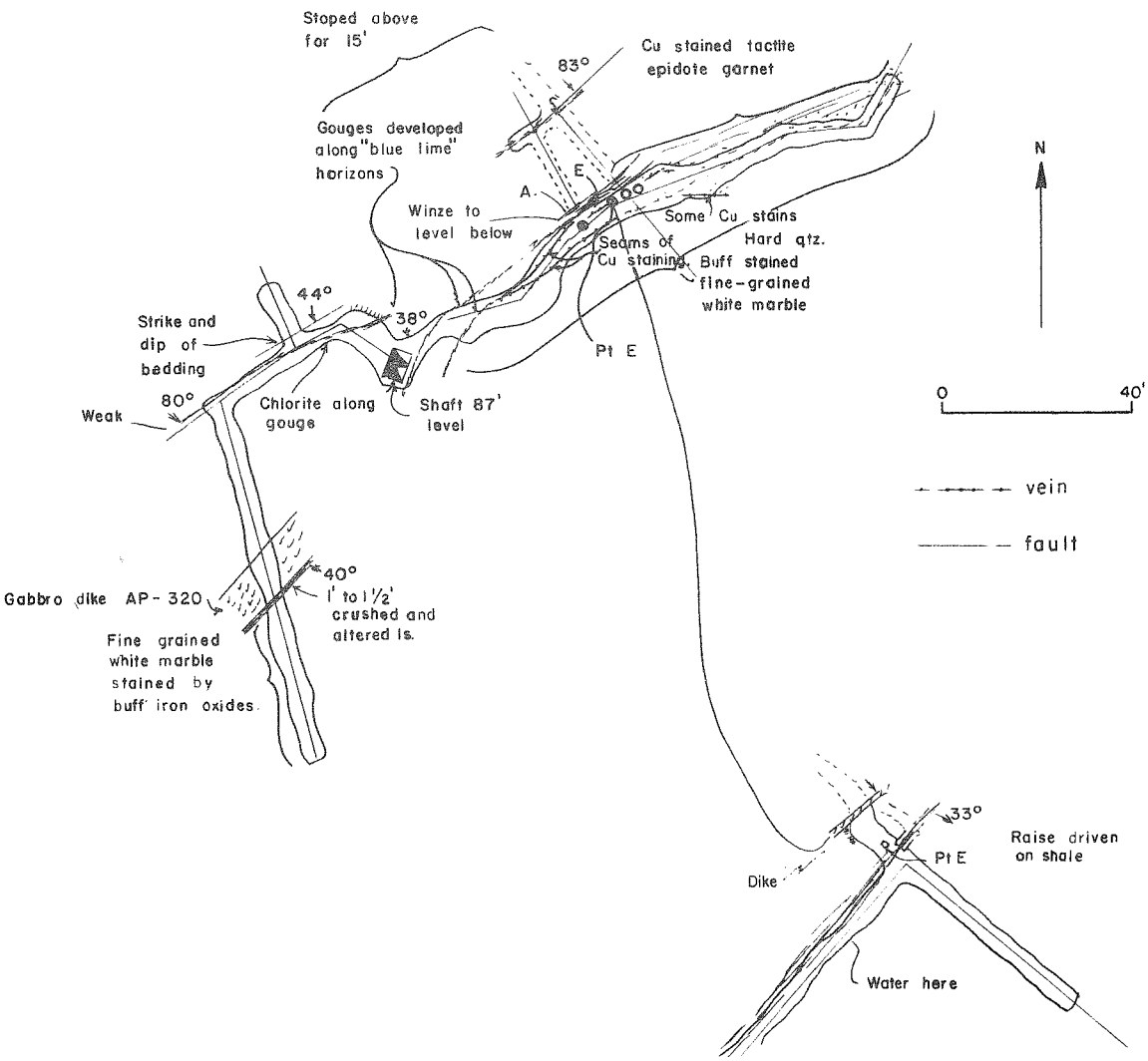


Figure O-2.–Bumble Bee mine.

Workings: Several shafts, one of which is 190 feet deep (Pardee and Schrader, 1933, p. 34).

Geology: According to Pardee and Schrader (1933) the workings developed a vein 15 feet wide, dipping southwest, between quartzite and quartz monzonite. The vein reportedly contains gold and copper values. Table O-7 shows recorded production from other properties in the district for which no additional information is available.

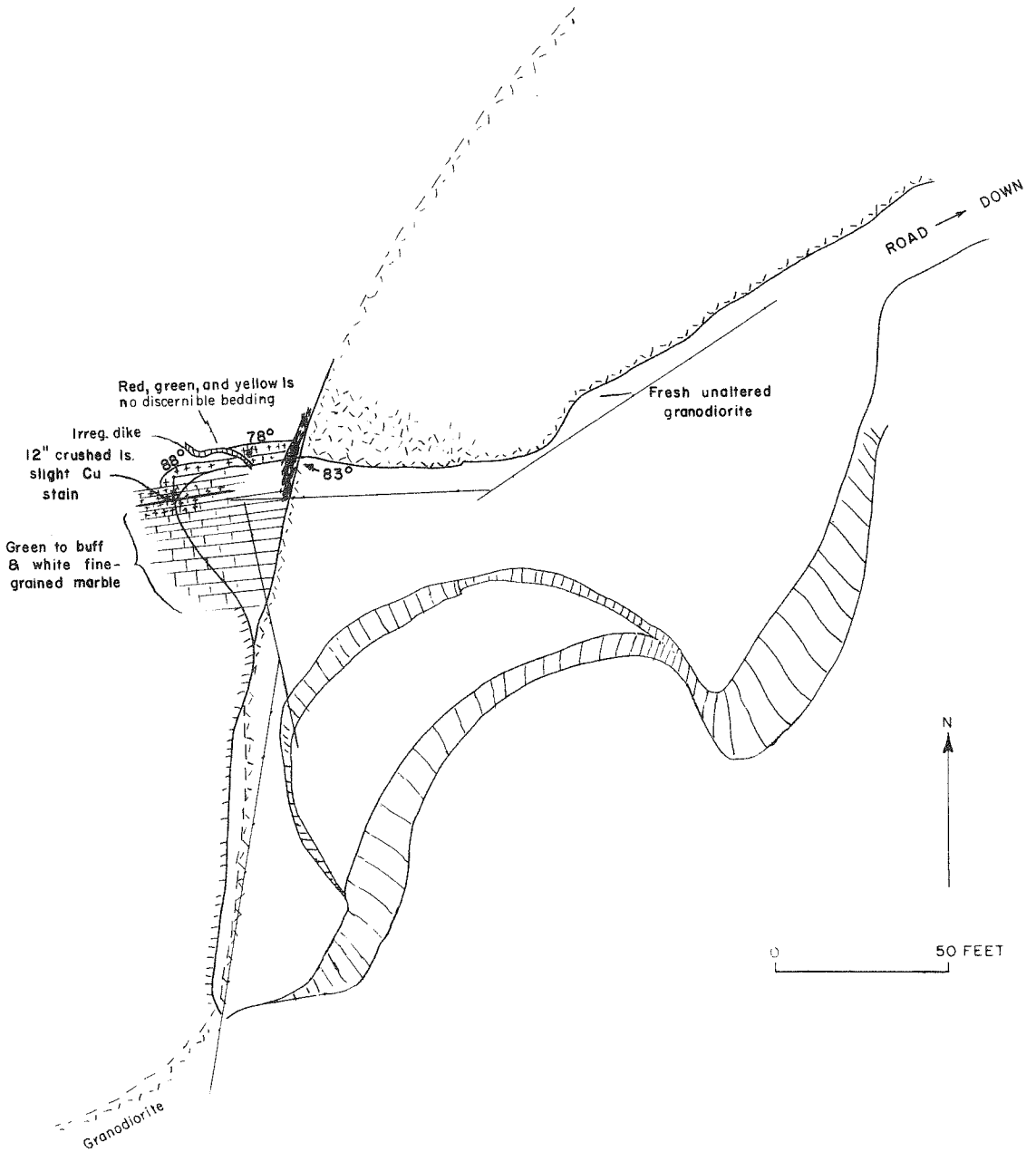


Figure O-3.—Coon's Tungsten Pit.

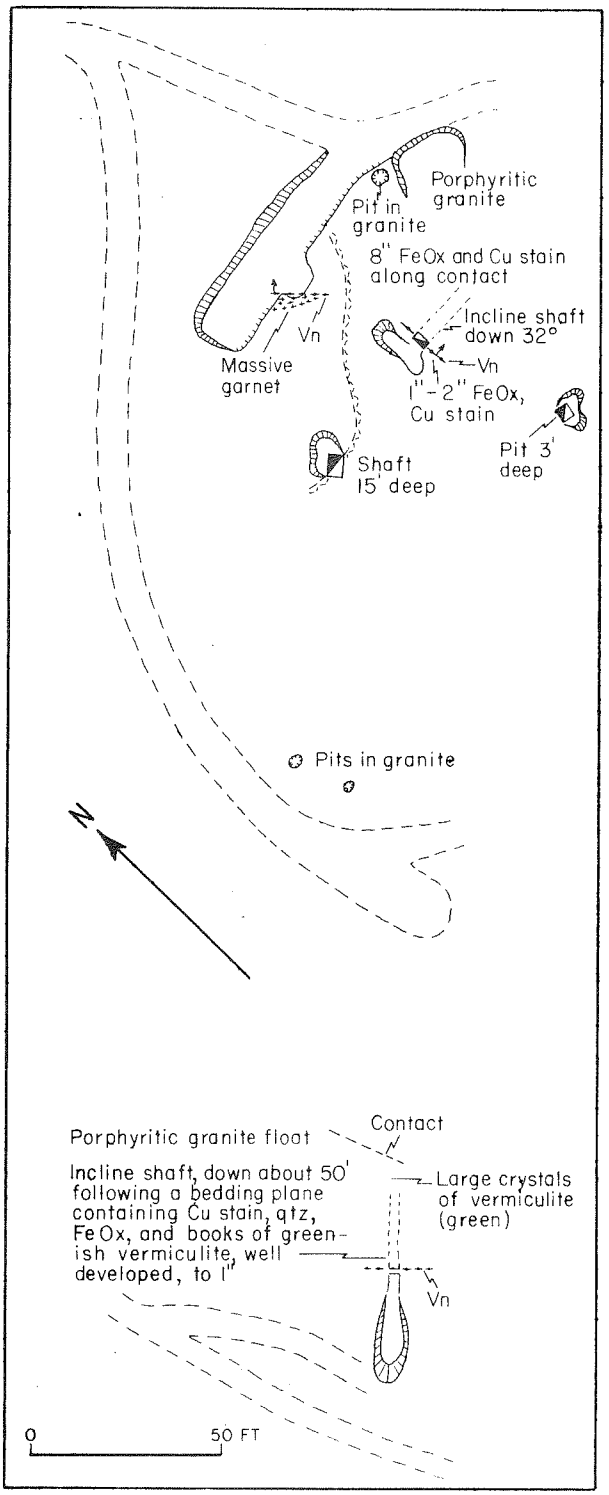


Figure O-4.–Surface map of Cyclone mine.

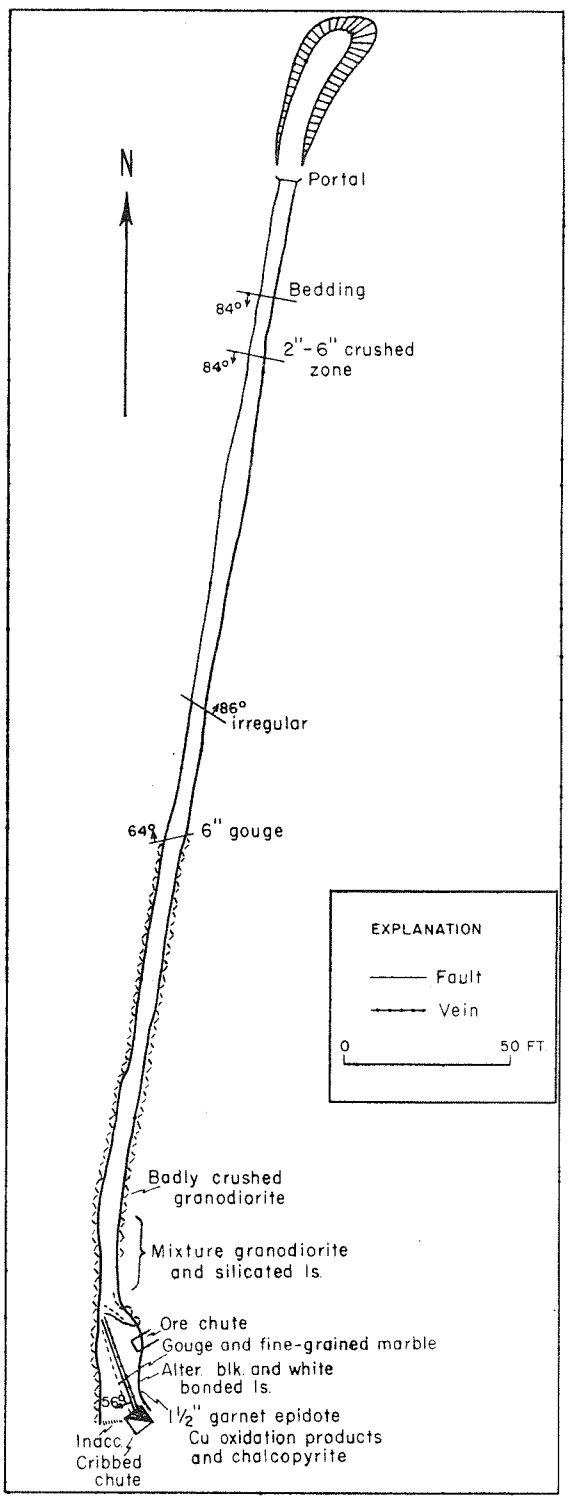


Figure O-5.–Esmeralda mine.

PIONEER (GOLD CREEK) DISTRICT

(Illustrations and tables for this district are prefixed by the letter P.)

The Pioneer district lies on the northern flank of the Flint Creek Range.

The southern part of the district extends into Granite County, but the major placer deposits are in Powell County, especially in T. 8 N., R. 11 W.; T. 9 N., R. 10 and 11 W.; and T. 10 N., R. 10 and 11 W. Gold Creek and its principal tributary, Pikes Peak Creek, drain the area.

The Pioneer district has achieved a certain prominence (in addition to its large placer production) as the site of the first placer mining operation in the state. Pardee (1951, p. 73) stated that gold was discovered and mined by Francois Finlay in 1852; dredge mining began about 1900 and continued intermittently until 1941. The greatest dredging activity was between 1933 and 1941, when the Pioneer Placer Dredging Company mined about 7,500,000 cubic yards of material, which averaged about 18 cents per cubic yard (Pardee, 1951, p. 78). Known production from the placer deposits is shown in Table P-1.

GENERAL GEOLOGY

The oldest rocks exposed in the district are limestone units of the Madison Group (Mississippian), which crop out in the southernmost mountainous part of the district (Pl. P-1). In the northern and north-central parts of the district, the oldest rocks exposed are shale beds of the Colorado Group (Cretaceous). Tertiary mafic sills and the Pikes Peak granitic pluton intruded the sedimentary rocks to the south, metamorphosed them, and provided a host for the gold-quartz veins, which are the source of the placer gold. Several small lode properties, including the Lois-Ryan and the Tibbits, are near the headwaters of Pikes Peak Creek; Mutch's map (1961) shows several other properties that explore gold-quartz veins. Little is known about these properties, but their total production is believed to be small. Production data assembled by the U. S. Bureau of Mines are shown in Table P-2, but because of the lack of definite information on the location of these mines, some may be in Granite County.

Glaciers in the mountain valleys in Quaternary time scoured material from the valleys, including sedimentary, igneous, and metamorphic rocks, as well as the gold-bearing rock, transported it to the flanks of the mountains, and deposited it on ash, clay, and gravel units, commonly referred to as Tertiary "lake beds". Three stages of glaciation and associated drift are represented in the district (Pl. P-1). The oldest drift is composed of boulders and cobbles of sedimentary rock and a minor amount of metamorphic rock. The intermediate drift is composed of metamorphic rock and minor granitic rock, and the youngest drift is composed almost entirely of fresh granitic boulders and cobbles. The three stages of drift were actively eroded and reworked during the interglacial periods by streams that successively reconcentrated the gold.

Microscopic work on samples taken near the junction of the main and south branches of Gold Creek indicated that much of the placer gold was coated by limonite, which was derived from the weathering of pyrite; some of the very fine gold was also protected from amalgamation because it occurred in the pore space of large magnetite grains (Crawford and Starliper, 1933). These authors concluded that 50 percent of the gold is between 10 and 20 mesh, and that most of the rest is between 20 and 200 mesh; they also concluded that the average value of the gravel sampled was $3 per cubic yard.

Pardee (1951, p. 95) noted the decrease in gold content from the oldest to the youngest drift and attributed it to gradually diminishing values in the lode deposits. Other factors may have caused the younger stages of drift to be impoverished in gold, however, including differences in duration of glaciation and in relative extent or depth of glaciation, and possibly several other factors. Therefore the fact that the amount of gold in the youngest glacial drift is small does not necessarily mean that the lode gold deposits are of little value.

PLACER DEPOSITS (Pl. P-1)

Gold Hill Area

The Gold Hill area was worked extensively in the Squaw Gulch pit and the Kelley and Irvine pit during the early days of mining in Powell County. Pardee (1951, p. 87) noted that the drift consists of an "unsorted mass of boulders, cobbles, sand and clay". The gold was recovered from "pay streaks" enclosed by barren gravel. The pay streaks are lenticular bodies of iron-stained gravel 5 to 12 feet thick. The Kelley and Irvine pit was reported (Pardee, 1951, p. 87) to have produced approximately $20,000 in gold, but the production from the Squaw Gulch pit is thought to have been much greater.

Independence Creek

Early drift on Independence Creek has been mined in two large pits, which were reported (Pardee, 1951, p. 92) to have produced exceptionally pure gold (968 fine). The

Table P-1.—Production of gold and silver at placer mines, 1902-68, Pioneer (Gold Creek) District.

Year	Material treated (cubic yards)	Gold (ounces)	Silver (ounces)	Total value
1902-03	No production			
1904	Not available	1,015	--	$ 16,630
1905	"	393	128	8,416
1906	"	2,004	243	41,595
1907	"	570	86	11,834
1908	"	1,777	208	36,844
1909	"	999	134	20,715
1910	"	1,088	128	22,562
1911	"	873	143	18,113
1912	"	1,037	141	21,522
1913	"	906	82	18,776
1914	"	1,080	164	22,421
1915	"	651	84	13,492
1916	"	1,011	135	20,983
1917	"	563	69	11,692
1918	"	317	45	6,587
1919	"	180	24	3,748
1920	"	268	39	5,588
1921	"	205	32	4,265
1922	"	124	18	2,574
1923	"	87	15	1,816
1924	"	71	12	1,477
1925	"	67	12	1,402
1926	"	180	28	3,743
1927	"	104	31	3,827
1928	"	186	31	3,863
1929	"	30	3	621
1930	"	36	5	751
1931	"	149	25	3,089
1932	"	291	39	6,030
1933	"	747	83	15,475
1934	"	8,670	973	303,634
1935	"	9,444	988	331,251
1936	"	6,419	661	225,191
1937	"	6,568	693	230,416
1938	1,867,140	6,764	772	237,239
1939	1,117,485	3,903	442	136,905
1940	1,042,450	3,502	419	122,868
1941	9,000	178	21	6,245
1942	12,000	107	14	3,755
1943	Not available	4	--	140
1944	"	56	--	1,960
1945	"	19	--	665
1946	"	4	--	140
1947	2,575	72	10	2,529
1948	150	2	--	70
1949	50	1	--	35
1950-53	No production			
1954	200	3	--	105
1955	*	*	*	*
1956	36,837	344	42	12,078
1957	*	*	*	*
1958	No production			
1959	850	4	--	140
1960	No production			
1961	*	*	--	*
1962	No production			
1963-67	*	*	*	*
1968	No production			
Total	4,666,360	65,517	7,497	2,051,616

*Withheld to avoid disclosing individual company confidential data. Figures included in totals.

Table F-1.—Production of gold and silver at placer mines, 1902-68, Finn (Washington Gulch) District.

Year	Material treated (cubic yards)	Gold (ounces)	Silver (ounces)	Total value
1902	No production			
1903	Not available	18	--	$ 350
1904	"	19	--	342
1905	"	50	5	1,047
1906	"	59	7	1,229
1907	"	146	16	3,020
1908	"	461	24	9,539
1909	"	438	12	2,854
1910	"	137	12	2,833
1911	"	102	7	2,122
1912	"	1,272	168	26,809
1913	"	93	11	1,922
1914	"	45	5	939
1915	"	64	7	1,329
1916	"	51	8	1,071
1917	"	42	2	881
1918	"	39	4	807
1919-20	No production			
1921	Not available	65	8	1,346
1922	"	44	4	916
1923	"	11	1	221
1924	No production			
1925	Not available	7	1	136
1926	"	5	--	104
1927	"	32	4	661
1928-29	No production			
1930	Not available	37	3	764
1931	"	208	22	4,296
1932	"	61	7	1,264
1933	"	299	37	6,198
1934	"	880	85	30,826
1935	"	1,426	139	49,997
1936	"	1,514	146	53,110
1937	"	783	84	27,470
1938	37,465	264	28	9,258
1939	51,578	493	53	17,291
1940	Not available	651	83	22,844
1941	6,000	60	7	2,105
1942	8,100	102	14	3,580
1943	Not available	1	--	35
1944	"	2	--	70
1945	"	30	--	1,050
1946-47	No production			
1948	1,300	15	--	525
1949	1,800	11	--	385
1950	350	7	--	245
1951-56	No production			
1957	15	2	--	70
1958-60	No production			
1961-62	*	*	*	*
1963	No production			
1964	*	*	*	*
1965-68	No production			
Total	135,820	10,121	1,024	$294,495

*Withheld to avoid disclosing individual company confidential data. Figures included in totals.

gold is very rough, and because the host gravels and boulders have not been reworked by streams, it is thought to have been plucked from vein outcrops.

Lower Pioneer Gulch and Gold Creek Valley

Dredge mining in Quaternary alluvium has recovered about $1,200,000 (Pardee, 1951, p. 91) in gold and silver along a 1½-mile stretch of Pioneer Gulch just below the old town of Pioneer. The gravel mined ranged from 250 to 1,500 feet in width and from 15 to 50 feet in thickness. The material consists of subangular to rounded cobbles of granite, quartzite, diorite, and hornfels and contains minor amounts of sand and gravel. This material is partly late glacial outwash. The placer deposits overlie Tertiary "lake bed" clay, which provided an ideal bedrock for dredge mining.

Mill Creek

The Orphan Boy mine produced rough gold from gravel overlain by intermediate drift (Pardee, 1951, p. 92). The gravel is 20 to 30 feet wide and 3 feet thick (maximum) and extends a considerable distance downstream from the mine. Bedrock is Tertiary clay.

Pikes Peak Creek

About half the gold produced from the district before dredging started in 1934 is believed to have been produced from this area. The placers occur in terrace deposits 5 to 6 feet thick. At Batterton Bar, most of the gravel in the deposit is in angular to subangular cobbles and boulders of quartzite and hornfels. The gravel parts of the deposits are well sorted and washed. Most of the gold occurs as small particles, although a few nuggets have been found. Downstream from the end of the glacial moraine, a narrow pay streak near bedrock was mined by sluicing and by drifting wherever the overburden was extensive. Later, the part of this deposit below Treadwater Bar was reworked by a dragline and washing-plant operation.

Pioneer Bar

Pioneer Bar, west of Pioneer Gulch, is credited (Pardee, 1951, p. 90) with producing gold worth more than a million dollars (calculated at $20.67/oz.). The placer deposit is in six terraces 100 to 300 feet wide and roughly equally spaced through a vertical distance of about 200 feet. The terrace gravels are 8 to 12 feet thick; bedrock is Tertiary clay.

Pioneer Gulch and Squaw Gulch Basin

Workings in the lower third of this area are known collectively as the Kohrs and Kelley mine and workings in the upper two-thirds are known as the Kohrs and Bielenberg mine (Pl. P-1). In 1916, workings in the area (known as the 1916 pit) covered an area 40 to 90 feet wide and about 600 feet along the stream. After expansion, the area being mined was 200 to 1,000 feet wide. The pay streak ranged from only a few feet to 50 feet in thickness. In the 1916 pit the pay streak ranged from 2 to 8 feet in thickness. From this pit approximately 30,000 cubic yards of gravel was mined, yielding $13,033 (about 43¢ per cubic yard). At a price of $35 per oz. for the gold, the average value of the gravel would have been about 73¢ per cubic yard.

FINN DISTRICT

(Illustrations and tables for this district are prefixed by the letter F.)

The Finn district, in north-central Powell County, embraces the upper part of the Nevada Creek drainage (Fig. F-1). Placer mining by hand methods and dredging (Lyden, 1948, p. 128) produced a small but significant amount of gold (Table F-1). Lyden's (1948) report discussed the history of the area briefly, but said nothing about the geology. Examination of the lode deposits north of the district and of other deposits on Poorman Creek, in Lewis and Clark County, indicates that the placer gold probably was derived from outcrops of relatively narrow quartz veins on the divide between Nevada Creek and Poorman Creek. These veins, most of which are in Lewis and Clark County, have been explored only by shallow shafts and adits.

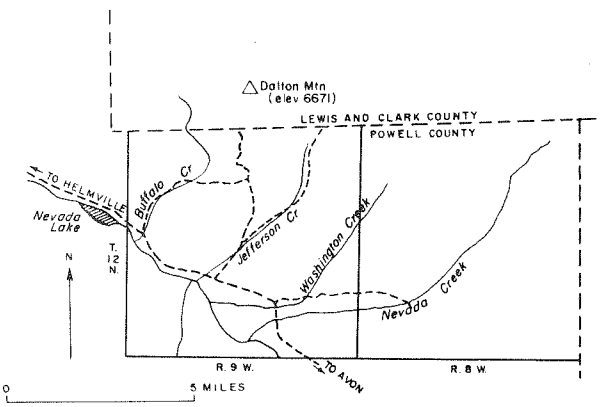
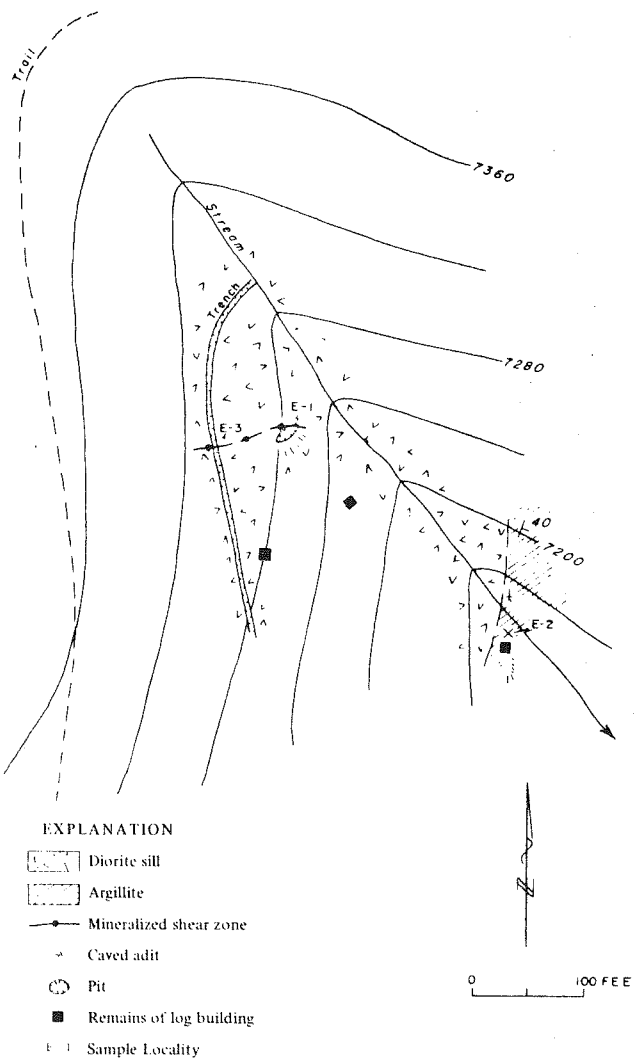


Figure F-1.—Location map of the Finn district.

MINERAL HILL AREA

(Illustrations and tables for this area are prefixed by the letters MH.)

The Mineral Hill area, in northern Powell County, is relatively accessible by county road from Ovando to Coopers Lake, then by trail 3½ miles to the northeast. Very little is known about the early history of mining in the area except that several mining claims were filed prior to 1920, and some exploration work was done by a mining company in the 1950's and 1960's. The results of recent work in the area have been published by Mudge and others (1971) in connection with a geologic study of the Lincoln Back Country (Fig. MH-1).



Sample No.	Length (feet)	Copper (percent)	Lead (percent)	Gold (oz. per ton)	Silver (oz. per ton)
		Assay data			
E-1	3	0.63	–	Tr	0.2
E-2	Grab	18.20	–	0.02	3.1
E-3	3	0.03	–	–	–

Figure MH-1.–Geology and assay data, Porto Rico mine (From Mudge and others, 1971).

LODE DEPOSITS

Porto Rico

Location: NE¼ sec. 19, T. 16 N., R. 10 W. (unsurveyed).

Workings: A small adit and several trenches.

Geology: The workings explore a Precambrian diorite sill as well as the upper brecciated contact between a shear zone within the sill and the argillite of the Spokane and Empire Formations (Precambrian). Sulfide minerals are chalcocite and bornite healing argillite fragments in the breccia zone along the contact. Elsewhere in the shear zone, numerous small quartz stringers are the only evidence of mineralization.

Klondike

Location: SW¼ sec. 17, T. 16 N., R. 10 W. (unsurveyed).

Workings: Shallow surface excavations.

Geology: Copper minerals are exposed along the contact between a diorite dike and Precambrian argillite. The mineralized area trends northwest, as does the contact; the area is approximately 500 feet long and reaches a maximum width of 60 feet. Chalcocite and bornite occur in quartz veinlets 1/8 to ¼ inch wide; malachite coats joints, fractures, and bedding planes. Although the deposit is not believed to be economic at present (Mudge and others, 1971, p. 119), approximately 700,000 tons of rock containing 0.3 percent copper is present (Fig. MH-2).

Mineral Hill Prospect

Location: SE¼ sec. 18, T. 16 N., R. 10 W. (unsurveyed).

Workings: Shallow surface excavations.

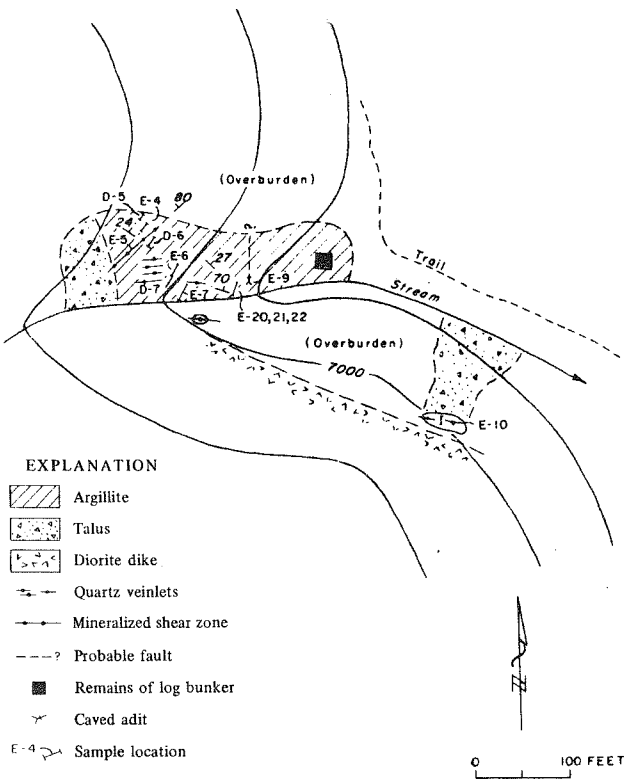
Geology: The pits and trenches on the property expose copper minerals in an argillite bed (Precambrian) and in a shear zone. The argillite hosts chalcocite and bornite in small fractures, and malachite and azurite in joints and along bedding planes. The shear zone, which strikes S. 80° W. and dips 35° N., contains malachite, chalcocite, and bornite. Examination results (Mudge and others, 1971, p. 120) are shown in Figure MH-3.

Bugle Mountain Prospect

Location: Sec. 22, 23, 26, 27, T. 16 N., R. 10 W. (unsurveyed).

Workings: Shallow surface excavations.

Geology: The copper minerals malachite, bornite, and chalcopyrite occur in thin fracture fillings and along bedding planes. Massive malachite, bornite, and covellite are found in a calcite-quartz gangue in fissure

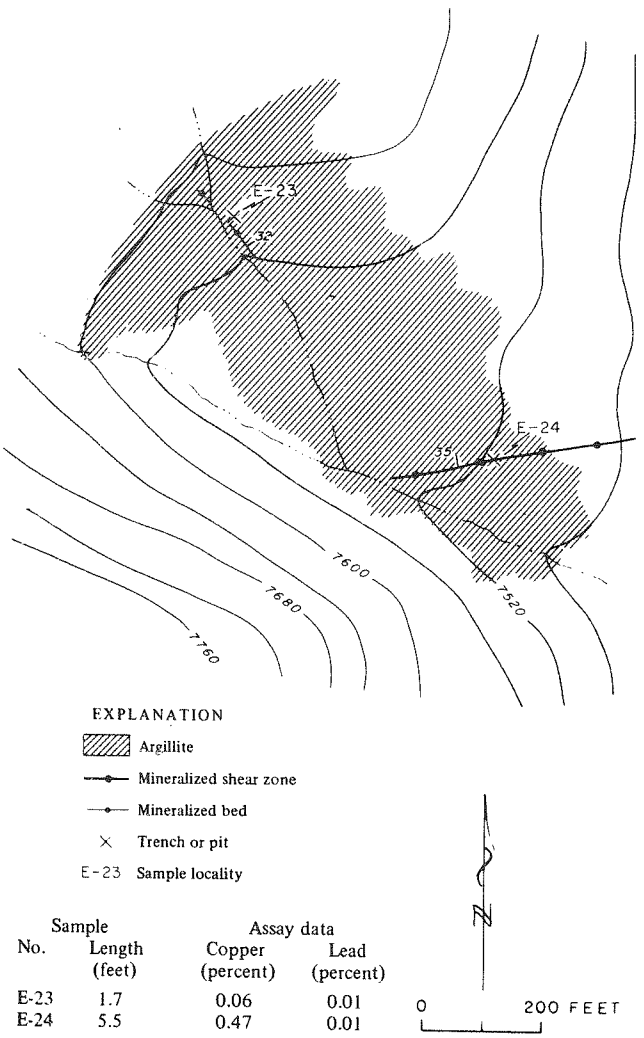


Sample No.	Length (feet)	Assay data: Copper (percent)	Assay data: Lead (percent)
E-4	9.0	0.44	0.04
5	1.8	0.16	0.08
6	6.5	0.30	–
7	20.0	0.63	0.08
9	Grab	0.01	–
10	6.0	0.33	–
20	4.5	0.22	<0.01
21	6.0	0.10	<0.01
22	8.0	0.15	<0.01
D-5	5.0	0.17	–
6	12.0	0.19	0.05
7	7.0	0.17	<0.01

Figure MH-2.–Geology and assay data, Klondike mine (From Mudge and others, 1971).

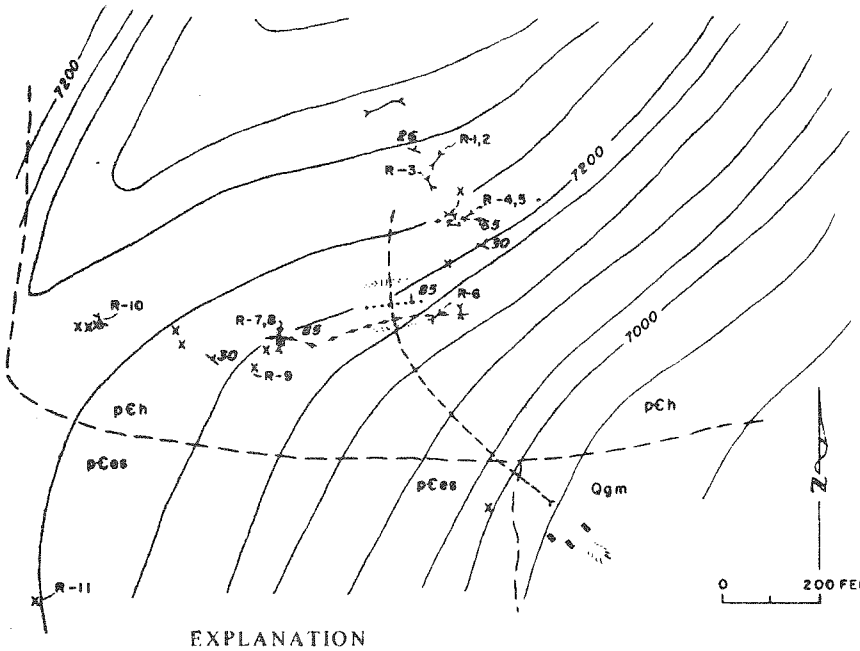
veins. Mudge and others (1971, p. 157) summarized the geology of the area: "...the workings show five zones or favorable stratigraphic intervals of calcareous rocks which contain copper mineralization within an area about 1,000 feet long by 500 feet wide. Three of the mineralized zones are associated with strong shears. One can be projected over a strike distance of about 800 feet...three others are partially exposed on the surface and a fifth is exposed in the adit. Limiting resource estimates to the five zones, with only moderate projection along bedding, there is in the order of 300,000 tons of rock containing 1.8 percent copper.

"There is possibility of a larger tonnage, the shear zones may extend downward to the mineralization exposed in the adit. The resulting resource would be in the order of one million tons of rock containing 1 percent copper, assuming a 20-foot-wide mineralized zone along the shears." A map of the Bugle Mountain area is shown in Figure MH-4.



Sample No.	Length (feet)	Assay data Copper (percent)	Lead (percent)
E-23	1.7	0.06	0.01
E-24	5.5	0.47	0.01

Figure MH-3.–Geology and assay data, Mineral Hill prospect (From Mudge and others, 1971).



Sample No.	Length (feet)	Assay data Copper (percent)	Lead (percent)
R-1	5.4	1.12	--
2	4.0	0.76	--
3	1.4	1.16	--
4	22.0	0.72	--
5	4.0	1.11	--
6	Grab	45.2	ND
7	10.0	1.99	--
8	1.4	0.32	--
9	4.0	0.59	--
10	Grab	2.37	--
11	Grab	1.35	--

EXPLANATION

- Qgm — Quaternary glacial deposits
- pCh — Helena Dolomite
- pCes — Empire and Spokane Formations
- Vein
- Pit
- Cut or trench
- Shaft
- Adit
- Fault zone, adit level
- Boundary of mineralization zone, adit level
- Building
- R-1 — Sample locality
- Dump

Figure MH-4.—Geology and assay data, Bugle Mountain prospect (From Mudge and others, 1971).

BIG BLACKFOOT (OGDEN MOUNTAIN) DISTRICT

(Illustrations and tables for this district are prefixed by the letter B.)

GENERAL GEOLOGY

The part of the Big Blackfoot mining district that is in Powell County has been described by Stout (1949), from whose report the following data were taken. A map of the district is shown in Figure B-1, and production from lode and placer mines is shown in Tables B-1 and B-2, respectively.

The quartz veins developed in the district are related spatially, and perhaps genetically, to the Tertiary quartz monzonite stock in the center of the district. This intrusive body and associated dikes of aplite, felsite, and dolerite cut the Ravalli and Wallace Formations of the Belt Supergroup of Precambrian age. Stout (1949, p. 7, 11) subdivided the Ravalli into the Appekunny, which he described as pink to green quartzite, and the Grinnell, which he described as thin-bedded purple, green, and red argillite. He subdivided the Wallace into the Newland and Spokane Formations and described the Newland as dark-gray to buff limestone and calcareous argillite, and the Spokane as thin-bedded light- to dark-green argillite.* In addition to the igneous rocks mentioned above, a vesicular basalt flow was also noted (Fig. B-1).

Stout (1949, p. 21) concluded that the stock intruded the east flank of a north-trending anticlinal structure in the Belt rocks. Other structural features in the area include north-trending normal faults that are cut by a northeast-trending fault system.

*Recent work, well summarized by Harrison (1972), has shown the Newland and Spokane Formations to be lower Belt and Ravalli equivalents respectively, rather than Siyeh (or middle Belt carbonate) equivalents. This writer's opinion is that the Newland and Spokane as described by Stout should be regarded as the Helena Dolomite (middle Belt carbonate), which is the eastern equivalent of the Wallace.

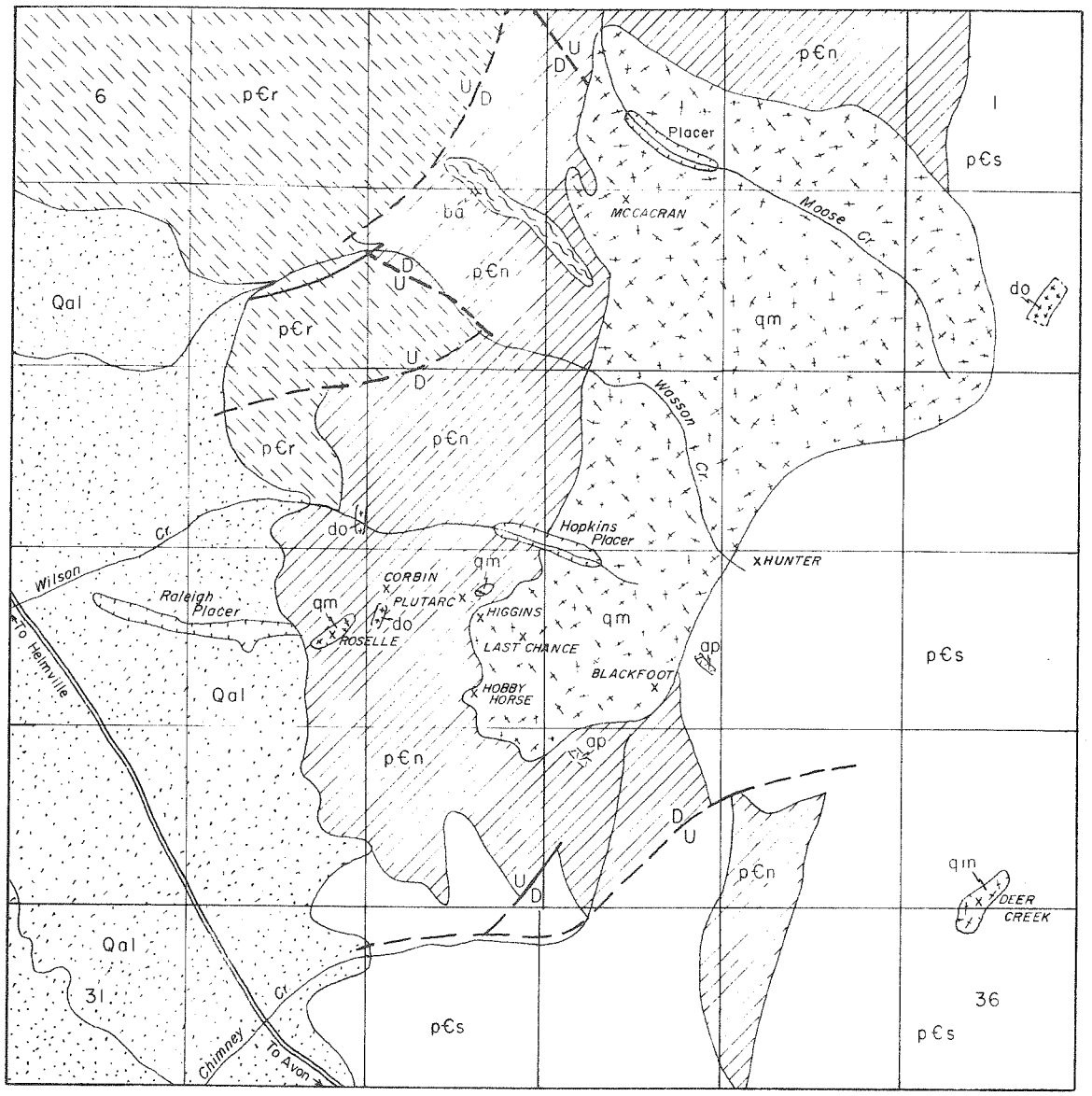


Figure B-1.—Geologic map of the Ogden Mountain mining district, T. 13 N., R. 10 W. (Modified from Stout, 1948.)

Table B-1.–Production of gold, silver, copper, lead, and zinc at lode mines, in terms of recoverable metals, 1902-68, Big Blackfoot District, Powell County.

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902-03	No production						
1904	72	106	9	--	--	--	$ 1,975
1905-07	No production						
1908	7	32	14	--	--	--	659
1909	32	24	49	35	--	--	517
1910	260	135	12	--	--	--	2,797
1911	66	38	18	--	605	--	824
1912-14	No production						
1915	10	16	77	85	--	--	390
1916-17	No production						
1918	1	*	63	10	--	--	67
1919-23	No production						
1924	12	16	27	--	--	--	344
1925-29	No production						
1930	10	13	31	--	107	--	278
1931	202	92	101	32	61	--	1,945
1932	11	30	117	--	800	--	681
1933	No production						
1934	59	32	96	100	162	--	1,201
1935	17	22	50	--	--	--	798
1936	7	23	9	--	--	--	812
1937	81	57	106	--	--	--	2,077
1938	43	65	82	--	304	--	2,342
1939	226	200	442	135	298	--	7,328
1940	19	11	31	--	--	--	407
1941	242	132	173	--	100	--	4,749
1942	16	16	28	--	300	--	600
1943	25	8	66	--	2,200	--	492
1944-45	No production						
1946	61	27	187	--	8,000	--	1,968

1947	5	5	10	--	--	100	196	
1948	1	1	10	--	700	--	169	
1949-50	No production							
1951	24	4	32	--	--	--	169	
1952	4	3	8	--	--		112	
1953	2	--	12	--	200	--	37	
1954-55	No production							
1956	12	15	2	--	--		527	
1957-59	No production							
1960	9	7	45	--	100	300	337	
1961	194	211	3	--	--	--	7,388	
1962	250	130	23	--	--	--	4,575	
1963-68	No production							
Total	1,980	1,471	1,933	397	13,937	400	$46,761	

* Less than an ounce.

Table B-2.–Production of gold and silver at placer mines, 1902-68, Big Blackfoot District.

Year	Material treated (cubic yards)	Gold (ounces)	Silver (ounces)	Total value
1902-07	No production			
1908	Not available	26	5	$ 539
1909	"	50	7	1,045
1910	"	30	5	630
1911	"	6	1	131
1912	"	57	8	1,231
1913	"	7	1	141
1914	"	9	2	189
1915	No production			
1916	Not available	1	--	17
1917	No production			
1918	Not available	5	1	114
1919	No production			
1920	Not available	30	5	630
1921	"	137	23	2,855
1922	"	202	34	4,210
1923	"	67	11	1,392
1924	"	48	8	990
1925	"	69	12	1,435
1926	"	77	13	1,595
1927	"	101	17	2,094
1928	"	94	16	1,951
1929	"	73	12	1,504
1930	"	10	--	211
1931	No production			
1932	Not available	113	18	2,331
1933	"	58	17	1,212
1934	"	153	20	5,360
1935	"	131	21	4,595
1936	"	323	62	11,360
1937	"	36	4	1,263
1938	100	36	3	1,262
1939	1,180	30	3	1,052
1940	Not available	4	--	140
1941	100	370	76	13,004
1942	Not available	346	131	12,203
1943-44	No production			
1945	Not available	10	--	350
1946	2,500	105	42	3,709
1947	2,240	121	42	4,273
1948	750	48	21	1,699
1949-68	No production			
Total	6,870	2,983	641	$86,717

LODE DEPOSITS

Blackfoot

Location: SE¼ sec. 22, T. 13 N., R. 10 W.

Workings: Two adits, now caved (Fig. B-2).

Geology: The Blackfoot mine is the largest property in the Big Blackfoot district, both in amount of develop-

ment and production. The exploited vein consists of quartz-filled fractures in quartz monzonite and argillite of the Newland Formation. Although the vein structure is persistent in the argillite, Stout (1949, p. 32) surmised that the vein does not have sufficient remaining values to warrant further mining. He also noted that the vein is locally vuggy and also is split into stringers that either coalesce or die out in the wall rock. The structure was mined for gold and silver; the native gold occurs with limonite, indicating that the mining was confined to the weathered part of the vein. The ore contains some galena and pyrite (Stout, 1949, p. 33). Scheelite and secondary copper minerals were seen in prospect pits near the major mine workings.

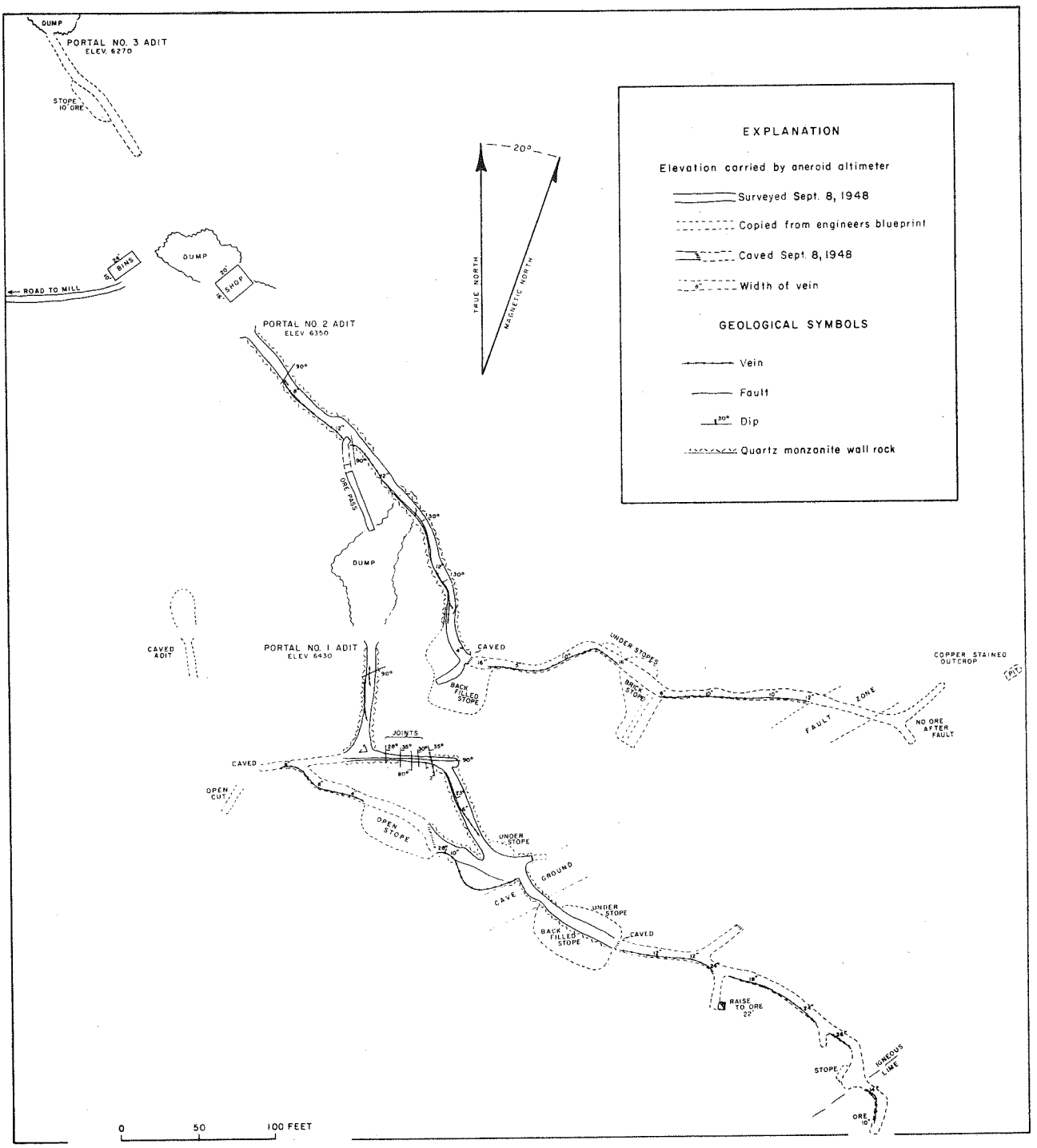


Figure B-2.–Map of Blackfoot mine. (Modified from Stout, 1948.)

Production: Production records from the Blackfoot mine are shown in Table B-3.

Corbin

Location: NW¼ sec. 21, T. 13 N., R. 10 W.

Workings: A 130-foot adit, now caved.

Geology: The quartz vein exposed in the underground workings is localized in a dolerite sill in the Newland Formation (Stout, 1949, p. 35). The vein strikes N. 15° E., dips 16° E. and is a maximum of 10 inches thick. It was mined for native gold in limonite.

Higgins

Location: SW¼ NE¼ sec. 21, T. 13 N., R. 10 W.

Workings: Two adits, now caved. The lower adit was 200 feet long and the upper adit was 40 feet long (Stout, 1949, p. 38).

Geology: The main vein developed by the workings is a quartz fracture filling, which strikes N. 35° W. and dips 50° N. It ranges from 4 to 18 inches in width but averages 10 inches. In addition to gold values (as native gold), pyrite, galena, and scheelite are reported in the vein.

Production: Recorded production from the Higgins mine is shown in Table B-4.

Hobby Horse

Location: SE¼ sec. 21, T. 13 N., R. 10 W.

Workings: A vertical and an inclined shaft, both of which are now caved.

Geology: Material on the dumps shows that the workings seemingly explored a quartz vein in quartz monzonite. The production records indicate that lead, silver, and gold were recovered from the ore.

Production: Recorded production from this property is shown in Table B-5.

McCacran

Location: NW¼ sec. 10, T. 13 N., R. 10 W.

Workings: Four adits of unknown extent.

Geology: Stout (1949, p. 42) noted that his examination of the dump indicated that the vein explored by these workings consisted of quartz containing galena, tetrahedrite, and a small amount of scheelite.

Plutarc

Location: SW¼ NE¼ sec. 21, T. 13 N., R. 10 W.

Workings: An inclined shaft sunk on the dip of the vein (37° NE.) to a depth of 110 feet.

Geology: The quartz vein exposed in the workings is spatially associated with a "light-colored" sill in the Newland Formation (Stout, 1949, p. 43). The structure strikes N. 75° W. and dips 37° NE. In addition to gold, the vein material contains minor pyrite, galena, and scheelite. Table B-6 consists of production records for properties that are believed to be in the Big Blackfoot district but for which no other information is available.

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* Table E-3.–Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Anna R. and Hattie M. mine.

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
1932	16	6	157	--	--	--
1935	93	43	936	46	2,152	--
1936	475	235	4,690	--	--	--
1937	272	110	1,809	--	--	--
1938	249	90	1,250	--	--	--
1940	269	116	4,256	867	--	--
1941	167	72	1,819	--	67	--
Total	1,511	672	14,917	913	2,219	--

Table E-4.–Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Big Dick (Evening Star), Blackjack mine.

1902	200	450	4,000	--	--	--
1905	500	750	3,500	--	100,000	--
1906	484	924	6,178	--	79,373	--
1907	835	1,414	8,350	--	110,584	--
1909	170	195	1,234	--	12,878	--
1914	52	59	652	--	12,467	--
1915	86	129	1,076	--	15,255	--
1919	39	65	600	--	11,433	--
1920	89	144	1,070	--	18,445	--
1921	380	730	6,405	--	94,734	--
1922	404	618	4,266	--	51,783	--
1923	139	230	1,442	--	14,769	--
1924	15	22	168	--	1,328	--
1925	3	10	86	--	863	--
1927	48	90	230	--	3,700	--
1931	7	13	57	18	746	--
1936	1,700	261	1,500	74	19,210	--
1937	13	27	115	--	2,029	--
1938	300	80	206	--	2,752	--
1939	5,000	535	4,145	1,112	75,527	--
1940	5,521	763	3,924	444	59,261	--
1941	127	123	1,546	23	20,975	--
1942	14	24	272	--	4,565	--
1950	39	12	94	99	1,076	--
1954	35	19	120	100	2,800	3,800
Total	16,200	7,687	51,236	1,870	716,553	3,800

*All production figures provided by U.S. Bureau of Mines

Table E-5.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Black Jack mine.

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
1913	34	84	587	--	9,289	--
1915	45	63	927	--	13,643	--
1916	36	66	1,023	--	14,327	--
1917	50	95	1,167	--	18,034	--
1918	25	58	688	--	10,893	--
1919	10	21	135	--	2,077	--
1922	81	189	1,841	--	21,855	--
1923	74	195	1,689	--	23,263	--
1924	21	60	599	--	8,011	--
1925	12	18	135	--	1,574	--
1930	24	36	167	5	488	--
Total	412	885	8,958	5	123,454	--

Table E-6.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Blue Bell mine.

1936	5	1	27	162	--	--

Table E-7.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Carbonate King mine.

1908	26	--	327	--	818	--
1915	77	--	1,365	--	41,354	--
1921	4	--	99	--	169	--
1922	23	1	417	--	14,618	--
1923	2	--	30	--	1,200	--
1926	18	1	265	60	9,127	--
Total	150	2	2,503	60	67,286	--

Table E-8.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Charter Oak mine.

1916	40	7	221	--	6,658	--
1918	5	1	34	--	913	--
1921	55	10	1,360	--	24,534	--
1922	16	3	361	--	9,009	--
1925	2	1	116	--	1,606	--
1926	121	7	934	50	16,569	--
1927	164	6	414	--	8,795	--
1928	1	1	44	16	1,115	--
1929	10	1	89	--	2,070	--
1937	10	2	270	23	5,486	--
1941	63	6	1,152	108	13,064	--
1942	573	3	1,628	164	21,926	--
1943	2,208	10	4,570	1,106	72,207	25,742
1944	1,493	9	3,615	778	62,516	46,580
1945	404	3	937	171	15,247	11,622
1946	757	31	4,191	1,180	62,915	15,461

Table E-8.–Continued

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
1947	610	42	4,223	1,258	67,251	13,275
1948	735	22	3,629	645	46,137	10,422
1949	920	80	6,123	2,721	129,846	20,049
1950	277	8	692	663	9,904	1,470
1951	68	5	1,058	245	5,070	1,291
1952	115	11	757	713	20,208	5,458
1953	4	4	32	--	--	--
1954	345	89	1,937	--	52,900	13,800
1955	70	16	551	--	14,000	2,500
1956	2	1	45	--	1,000	100
1964	7	1	41	--	400	400
1965	50	1	63	200	200	100
1966	2	1	59	--	500	--
Total	9,127	382	39,146	10,041	672,046	168,270

Table E-9.–Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Hub Camp Group.

1937	14	16	474	--	8,039	--
1938	6	17	102	--	2,480	--
1939	6	9	67	22	1,208	--
1944	1	7	18	--	324	--
1947	8	1	364	25	6,193	111
1948	17	1	103	44	1,364	139
Total	52	51	1,128	91	19,608	250

Table E-10.–Production of gold, silver, copper, lead, and zinc in terms of recoverable metals, Lilly-Orphan Boy Group.

1934	46	22	1,616	15	13,158	--
1935	300	55	2,054	72	7,563	--
1936	17	2	110	--	--	--
1937	123	38	1,857	819	6,853	--
1938	215	60	2,956	816	20,356	--
1939	7	2	78	--	507	--
1942	28	6	169	24	972	--
1943	51	9	564	14	5,792	5,708
1944	69	17	686	299	7,346	12,436
1948	70	20	651	234	6,739	10,577
1949	173	59	1,296	390	13,585	9,745
1950	88	31	249	--	--	--
1951	41	12	234	70	2,506	1,433
Total	1,228	333	12,520	2,753	85,377	39,899

Table E-11.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Old Monarch and Monarch mine.

Year	Ore (tons)	Gold (ounces)	Silver (pounds)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
1902	11	7	506	124	100	--
1909	73	50	1,730	6,095	4,000	--
1915	2	--	14	--	--	--
1916	32	7	1,070	2,125	8,511	--
1917	9	2	162	483	2,603	--
1919	184	7	471	--	5,098	--
1920	1,090	49	4,317	11,270	62,851	--
1921	110	6	865	1,380	7,324	--
1923	11	3	282	336	1,951	--
1940	4	4	173	559	--	--
1941	100	21	962	2,598	3,369	--
1952	34	1	85	64	677	48
1964	3	--	40	--	300	--
Total	1,663	157	10,677	25,034	96,514	48

Table E-12.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Negros mine.

1946	4	2	30	--	922	72
1948	42	13	209	108	6,444	411
1949	233	48	565	300	15,160	--
1953	74	11	313	--	7,100	200
1954	133	24	749	--	14,200	1,700
1955	123	5	255	--	4,600	900
1956	6	1	55	--	1,400	--
1962	20	1	196	--	6,700	500
1963	83	6	959	100	23,800	2,300
1964	65	11	1,085	100	21,400	2,000
1965	18	1	143	--	4,000	200
1966	96	18	902	100	14,500	900
1967	33	4	21	--	4,400	200
1968	55	25	636	100	7,400	700
Total	985	170	6,118	808	132,026	10,083

Table E-13.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Ontario mine.

1924	14	13	239	--	805	--
1934	207	120	384	85	923	--
1935	526	309	1,720	--	--	--
1936	131	67	348	--	--	--
1937	111	57	386	--	--	--
1938	8	18	32	--	--	--
1939	94	27	422	31	385	--
1940	1	4	16	--	66	--
Total	1,092	615	3,547	116	2,179	--

Table E-14.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Surething mine.

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
1902	1,600	1,400	56,000	--	--	--
1903	85	22	1,260	--	2,200	--
1904	85	22	1,260	--	2,200	--
1935	245	41	3,795	--	--	--
1937	132	17	1,121	--	--	--
1941	174	24	1,413	--	--	--
1947	51	2	267	--	--	--
Total	2,372	1,528	65,116	--	4,400	--

Table E-15.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Telegraph mine.

1927	5	4	73	24	531	--
1928	3	5	23	--	463	--
1934	22	8	243	--	--	--
Total	30	17	339	24	994	--

Table E-16.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Third Term mine.

1947	16	4	137	787	2,197	835
1952	11	2	77	719	725	1,917
1956	3	2	91	--	1,100	500
1957	18	1	58	--	800	--
1959	2	--	15	100	100	200
Total	50	9	378	1,606	4,922	3,452

Table E-17.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Wolverine mine.

1914	2	--	140	--	1,420	--
1915	2	--	60	--	1,396	--
1926	8	1	98	--	2,237	--
1929	1	--	20	33	204	--
Total	13	1	318	33	5,257	--

Table E-18.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, other mines.

"B"						
1938	3	1	11	--	146	--
Betty Jean						
1937	10	2	200	158	--	--
Big Bluff						
1924	8	3	181	--	2,070	--
Big Boy						
1941	4	1	17	--	176	--

Table E-18.–Continued

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Bison Dump, Bison						
1935	716	217	8,265	30,053	--	--
1936	137	32	1,246	4,087	--	--
1940	26	12	404	1,307	988	--
1941	6	7	184	484	547	--
Subtotal	885	268	10,099	35,931	1,535	--
Black Cloud						
1960	42	2	25	1,800	--	--
Blackfoot						
1948	49	3	110	75	1,657	1,370
Boulin						
1924	3	2	33	--	257	--
Brainstorm Group						
1933	4	9	26	--	455	--
Bunerelle						
1922	4	--	27	155	--	--
Carbonate						
1933	6	--	478	--	4,443	--
Carbonate Boy						
1921	19	15	182	--	4,386	--
1922	9	7	104	--	2,884	--
1923	4	6	84	--	1,250	--
1924	13	10	400	--	8,816	--
1925	19	17	1,105	--	21,503	--
1935	16	24	50	7	620	--
1939	20	13	191	58	5,300	--
1940	16	11	191	44	4,722	--
1941	3	2	30	22	788	--
1942	3	2	16	--	385	--
Subtotal	122	107	2,353	131	50,654	--
Carbonate Extension						
1915	15	3	374	--	6,325	--
Centralia						
1914	103	194	103	74	--	--
1916	54	73	31	45	--	--
Subtotal	157	267	134	119	--	--
Comeback						
1932	5	5	16	--	417	--
Dandy Jim						
1924	4	8	146	--	1,271	--
Daylight						
1914	16	23	29	--	--	--
1915	26	18	29	--	--	--
1916	24	17	20	--	--	--
Subtotal	66	58	78	--	--	--

Table E-18.–Continued

	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Democrat						
1911	22	50	1,125	--	2,711	--
1912	34	53	490	--	3,291	--
1913	54	59	1,009	952	--	--
1915	77	112	1,605	--	6,940	--
1916	24	39	371	96	--	--
1921	13	21	148	--	889	--
1922	9	8	88	--	319	--
1923	2	2	13	--	164	--
1924	3	4	87	14	263	--
1926	6	1	19	--	169	--
Subtotal	244	349	4,955	1,062	14,746	--
Dezielle Group						
1913	11	2	1,151	356	1,182	--
Domain						
1915	2	2	7	48	--	--
Dougherty and Lindquist						
1920	5	3	59	184	--	--
El Capitan						
1936	21	3	97	--	746	--
Elk						
1915	10	18	24	38	--	--
Emilda						
1926	22	19	465	47	3,303	--
1930	2	1	72	70	184	--
Subtotal	24	20	537	117	3,487	--
Finland						
1918	69	8	1,118	--	18,486	--
Foolhead Group						
1917	8	2	88	590	--	--
Geraldine and Emilda						
1922	24	1	894	208	136	--
1927	7	5	151	--	1,171	--
1931	10	2	--	--	--	--
1936	1	1	4	--	66	--
Subtotal	42	9	1,049	208	1,373	--
Golden Anchor						
1952	13	6	88	--	2,024	618
1956	3	2	13	--	200	100
1957	25	4	40	--	900	--
1959	7	3	205	--	4,200	1,500
1960	4	--	77	--	1,900	1,700
1961	4	2	1	--	--	--
Subtotal	56	17	424	--	9,224	3,918
Hahn						
1912	8	--	14	2,453	--	--
Hardie						
1929	3	--	210	--	3,381	--
Head						
1929	1	1	4	--	67	--
Hi-Ore and Hi-Way						
1938	9	7	98	--	753	--
Imilda						
1924	2	--	149	--	205	--
Kershaw						
1936	32	30	37	--	602	--

Table E-18.—Continued

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lamb						
1918	3	1	61	--	353	--
Lathom						
1924	3	2	22	21	450	--
Lee Mantle						
1905	20	30	132	532	9,400	--
1911	68	3	1,242	5,625	1,681	--
1912	41	3	794	2,982	--	--
Subtotal	129	36	2,168	9,139	11,081	--
Little Moose						
1932	4	6	50	8	773	--
Lizzard						
1918	34	20	593	--	2,194	--
1919	11	6	158	--	928	--
Subtotal	45	26	751	--	3,122	--
Lodge						
1907	15	8	460	--	1,000	--
London						
1915	8	--	14	1,707	--	--
Marion						
1924	1	--	15	--	321	--
Montana						
1924	5	7	61	--	1,049	--
1925	1	2	20	--	436	--
1932	2	1	11	--	50	--
Subtotal	8	10	92	--	1,545	--
Moonlight						
1936	7	4	12	--	175	--
1937	5	1	33	--	--	--
Subtotal	12	5	45	--	175	--
Nattie						
1907	14	1	200	--	2,000	--
New Deal						
1935	9	24	172	15	4,190	--
1936	4	13	94	--	2,087	--
1940	2	6	20	--	475	--
Subtotal	15	43	286	15	6,752	--
Newport						
1925	5	1	105	34	2,260	--
1929	6	1	137	--	1,739	--
Subtotal	11	2	242	34	3,999	--
Nora						
1956	4	8	22	--	300	--
1968	3	1	5	--	100	--
Subtotal	7	9	27	--	400	--

Table E-18.—Continued

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
North Pole						
1915	19	3	376	--	--	--
1919	51	4	1,065	2,522	--	--
1920	181	16	3,267	8,732	--	--
1921	50	4	1,074	1,957	--	--
1922	16	2	175	--	--	--
1923	12	1	135	407	--	--
Subtotal	329	30	6,092	13,618	--	--
N P Tract						
1935	8	2	--	--	--	--
1937	1	2	--	--	--	--
1940	10	2	--	--	--	--
Subtotal	19	6	--	--	--	--
Packy McFarland						
1924	10	24	182	--	2,307	--
Parson						
1918	9	--	183	--	6,254	--
Pauper						
1945	2	--	118	8	2,289	30
1947	1	--	42	--	520	--
Subtotal	3	--	160	8	2,809	30
Paymaster						
1940	42	10	440	71	1,922	--
Pioneer						
1933	4	1	16	--	426	--
Reining						
1904	32	46	9	--	--	--
Richards						
1910	23	7	42	2,966	--	--
Robert Emmett						
1913	23	1	450	1,133	--	--
Sandra						
1910	18	1	83	--	1,726	--
Saxon						
1932	4	4	4	24	--	--
Sherman Clark						
1932	4	--	23	--	526	--
Silver Star						
1907	18	13	264	704	3,043	--
1908	15	9	78	--	602	--
Subtotal	33	22	342	704	3,645	--
Speck						
1939	3	--	36	9	--	--
Starlight						
1941	6	10	58	--	892	--
Summit						
1940	15	6	50	--	416	--

Table E-18.–Continued

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Sunset and Sunnyside						
1939	44	11	599	377	2,512	--
1941	23	6	247	--	--	--
1945	42	9	441	138	2,727	3,448
1946	61	11	493	160	3,592	4,912
1947	56	6	280	112	1,891	2,895
Subtotal	226	43	2.060	787	10,722	11,255
Sunrise						
1963	8	1	341	--	1,400	500
Thomas						
1920	48	5	396	30	--	--
Union						
1938	1	4	15	2	318	--
Utah and Montana						
1914	18	1	39	1,645	--	--
Virginia						
1915	6	2	487	--	--	--
Wilson						
1915	11	15	202	--	4,026	--
Youngbauer						
1905	5	8	--	--	--	--

Table Z-2.–Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Argus mine.

1914	102	35	5,672	1,500	38,800	--
1915	19	10	791	--	6,728	--
1934	2	1	35	5	427	--
1935	24	11	555	22	4,008	--
1936	24	12	593	--	5,548	--
1937	27	7	270	26	3,001	--
1938	20	6	231	--	--	--
Total	218	82	8,147	1,553	58,512	--

Table Z-3.–Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Black Eyed May and Bertha May.

1908	26	13	795	--	--	--
1909	15	25	999	--	--	--
1915	19	14	217	--	1,876	--
1919	9	2	165	--	2,047	--
1936	3	1	62	--	--	--
1937	32	7	1,078	--	1,056	--
Total	104	62	3,286	--	4,979	--

Table Z-4.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Blue Eye Maggie mine.

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
1910	60	74	4,317	--	11,138	--
1911	20	29	1,361	--	2,441	--
1912	81	102	3,962	--	11,513	--
1914	27	34	1,890	--	--	--
1915	21	27	1,327	--	2,869	--
1921	9	11	375	--	582	--
1922	93	114	5,015	--	9,041	--
1923	23	30	1,048	--	1,507	--
1924	55	67	3,220	323	4,757	--
1925	45	78	3,032	--	5,066	--
1926	39	45	1,831	--	3,370	--
1927	77	89	3,764	--	5,052	--
1928	37	45	1,380	--	--	--
1930	8	11	244	60	--	--
1931	47	48	1,655	292	--	--
1932	179	184	7,437	1,082	--	--
1933	340	304	22,453	2,485	--	--
1934	976	700	47,202	2,802	75,680	--
1935	937	819	35,120	82	7,878	--
1936	702	635	24,973	--	--	--
1937	536	502	20,260	--	2,393	--
1938	432	494	13,837	--	3,904	--
1939	358	332	14,272	--	--	--
1940	266	249	14,088	--	--	--
1941	134	114	6,849	252	3,633	--
Total	5,502	5,137	240,912	7,378	150,824	--

Table Z-5.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Bonanza mine.

1911	4	--	96	--	3,268	--
1917	16	3	101	--	2,410	--
1920	15	6	181	--	2,411	--
1924	45	13	193	--	3,591	--
1925	14	2	171	--	3,154	--
1926	153	74	303	--	4,206	--
1927	118	35	1,452	163	22,127	3,247
1935	3	1	45	--	--	--
1936	992	399	2,185	--	8,335	--
1937	5,309	1,708	5,945	--	3,037	--
1938	1,366	378	3,430	--	14,415	--
1939	2,348	659	4,324	35	3,267	--
1940	1,970	654	4,446	--	--	--
1941	2,667	1,085	4,305	74	18,745	--
1942	1,706	697	2,374	--	--	--
1946	440	339	190	--	--	--
1947	1,924	694	5,369	120	36,081	6,262
1948	561	215	1,276	167	8,606	4,072
1949	518	371	424	85	2,736	--
1957	7	1	39	--	1,000	--
1960	6	1	6	--	--	--
Total	20,182	7,335	36,855	644	137,389	13,581

Table Z-6.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Emery Group.

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
1902	1,200	1,320	54,000	--	168,000	--
1904	NA	610	13,779	--	--	--
1905	7,000	914	16,556	--	130,000	--
1906	6,620	738	22,018	--	89,024	--
1907	1,570	324	9,178	--	42,359	--
1908	551	351	13,986	--	117,571	--
1909	30	24	653	--	4,257	--
1911	225	193	4,297	--	36,042	--
1912	300	15	3,415	485	1,444	1,594
1913	153	147	5,152	219	--	--
1914	61	58	2,463	227	--	--
1915	260	231	7,741	577	35,299	--
1916	149	123	4,352	--	27,073	--
1917	1,200	75	2,173	--	9,951	--
1918	5	3	188	10	--	--
1922	45	35	934	--	4,635	--
1923	275	189	5,736	--	33,163	--
1924	15	13	425	--	2,175	--
1932	20	12	199	131	--	--
1933	108	101	1,775	406	108	--
1934	308	236	14,318	855	24,348	--
1935	13,348	2,625	92,306	1,985	122,837	--
1936	2,217	1,872	72,456	625	66,340	--
1937	480	287	12,686	615	60,852	--
1938	73	40	1,270	--	--	--
1939	1,204	940	26,198	97	5,388	--
1940	1,216	1,126	32,564	316	16,308	16,718
1941	1,268	833	23,839	1,842	104,473	104,211
1945	50	7	203	26	906	832
1946	1,000	132	4,557	423	23,817	23,241
1947	8,981	675	24,441	6,127	438,187	352,858
1948	8,152	716	19,212	4,273	313,128	243,037
1949	7	2	43	--	653	--
1950	4	9	57	--	1,041	654
1951	16	6	151	--	1,356	1,614
1957	9	7	347	--	2,800	--
1966	1	--	9	--	100	100
Total	58,121	14,989	493,677	19,239	1,883,635	744,859

Table Z-7.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Emma Darling mine.

1908	19	12	762	--	1,680	--
1909	10	7	480	--	909	--
1910	12	9	616	--	1,712	--
1915	22	16	1,158	--	3,296	--
1916	84	57	3,762	--	9,639	--
1924	14	10	663	--	1,850	--

Table Z-7.—Continued

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
1935	18	10	727	10	1,515	--
1936	92	59	3,851	27	5,544	--
1937	301	145	6,211	359	16,638	--
1938	186	136	7,512	21	13,340	--
1939	213	189	10,455	813	26,343	--
1940	218	141	7,774	355	22,857	--
1941	197	101	11,178	851	22,630	--
1942	6	3	534	33	--	--
Total	1,392	895	55,683	2,469	127,953	--

Table Z-8.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Hidden Hand mine.

1937	286	119	368	--	--	--
1938	1,523	722	1,917	--	3,272	--
1939	3,015	1,252	4,022	--	2,989	--
1940	402	194	933	--	2,786	--
1941	404	175	739	--	2,820	--
1942	132	75	168	--	883	--
1946	75	31	286	--	2,044	--
1947	49	22	51	--	481	--
1949	32	11	53	--	322	--
1950	141	50	24	--	--	--
1957	28	2	276	--	5,400	--
1965	51	2	153	100	3,800	3,300
1966	48	1	102	--	2,600	2,600
Total	6,186	2,656	9,092	100	27,397	5,900

Table Z-9.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Sterritt mine.

1921	16	6	664	--	2,598	--
1922	12	4	393	--	1,739	--
1937	10	2	112	--	1,023	--
Total	38	12	1,169	--	5,360	--

Table Z-10.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, other mines.

Bertha May						
1923	11	5	128	59	1,415	--
1924	28	15	485	--	3,621	--
Subtotal	39	20	613	59	5,036	--
Blue Bell						
1912	62	10	149	4,288	--	--
Boone						
1934	78	3	248	88	--	--

Table Z-10.—Continued

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Bull Moose						
1942	15	3	79	--	1,466	--
1943	69	34	175	5	1,544	--
Subtotal	84	37	254	5	3,010	--
Carbonate Extension						
1949	3	1	41	--	723	--
Chorn, Snyder and Fordyce						
1936	6	1	65	--	642	--
Climax						
1933	2	2	2	--	--	--
Cora						
1915	16	8	45	--	--	--
Deer Lodge Queen						
1907	10	6	160	--	3,500	--
Elizabeth Mae or Elizabeth May						
1932	1	1	45	9	--	--
1935	10	1	277	16	2,749	--
1936	4	--	57	--	613	--
Subtotal	15	2	379	25	3,362	--
Galena						
1933	3	2	147	15	--	--
Gold Nugget						
1934	5	1	29	--	464	--
Grizzly Bear						
1938	5	2	139	--	--	--
Henrietta						
1940	29	5	285	--	--	--
Hercules						
1920	3	--	99	--	1,762	--
Hobby Horse						
1940	7	6	12	--	55	--
Independence						
1925	7	10	3	--	--	--
Katie						
1924	2	--	100	36	--	--
Kineo Group						
1910	11	2	68	--	1,909	--
1915	1	--	13	--	181	--
Subtotal	12	2	81	--	2,090	--
Oro King						
1915	4	3	96	--	--	--
Remonitizer						
1938	5	--	140	--	--	--
1940	264	24	6,114	--	--	--
Subtotal	269	24	6,254	--	--	--

Table Z-10.–Continued

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Sabbath Day						
1938	21	2	191	--	4,835	--
1941	44	4	752	78	14,694	--
Subtotal	65	6	943	78	19,529	--
Swan						
1934	9	2	74	--	--	--
1935	25	5	436	45	1,928	--
1937	4	1	15	--	--	--
Subtotal	38	8	525	45	1,928	--
Tamcke						
1942	1	1	--	--	--	--

Table R-2.–Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Amazon Group.

1902	1,000	270	--	--	--	--
1904	2,000	2,200	--	--	--	--
1906	1,000	632	82	--	--	--
1907	3	16	6	--	--	--
1908	100	69	13	39	--	--
1909	662	330	254	52	--	--
1910	2	9	4	4	--	--
1911	2	8	4	--	--	--
1932	4	4	--	--	--	--
1935/*sic*/	2	1	1	--	--	--
1935/*sic*/	2	1	--	--	--	--
1939	18	10	6	--	--	--
Total	4,795	3,550	370	95	--	--

Table R-3.–Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Dark Horse mine.

1934	71	66	51	75	--	--
1935	1	1	--	--	--	--
1937	10	1	--	--	--	--
1938	25	6	3	--	--	--
1939	20	16	16	--	--	--
Total	127	90	70	75	--	--

Table R-4.–Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, other mines.

Rocky Mountain						
1905	1	17	5	--	--	--
Travis						
1914	9	10	--	--	--	--

Table O-3.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Arnold, Boulder mine.

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
1917	306	3	171	11,371	--	--
1918	24	1	51	3,720	--	--
1919	27	--	37	3,028	--	--
1937	1	1	19	19	254	--
1960	3	--	3	200	--	--
Total	361	5	181	18,338	254	

Table O-4.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Cyclone mine.

1942	6	--	13	1,267	--	--
1943	15	3	51	2,888	--	--
1944	3	2	30	517	--	--
1961	7	3	6	--	--	--
Total	31	8	100	4,672	--	--

Table O-5.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Esmeralda mine.

1923	10	6	2	--	--	--

Table O-6.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, Fairview mine.

1907	7	32	600	--	--	--
1908	2	39	719	--	--	--
1909	88	99	5,962	9	--	--
1910	9	7	939	--	--	--
1911	20	10	325	90	3,528	--
1912	1	4	32	--	2,839	--
1918	67	8	585	103	--	--
1919	20	16	14	--	--	--
1933	100	5	63	16	--	--
1934	100	6	42	--	--	--
1968	31	1	13	--	--	--
Total	445	227	9,294	218	6,367	--

Table O-7.—Production of gold, silver, copper, lead, and zinc, in terms of recoverable metals, other mines.

Ajax						
1909	7	29	10	289	--	--
1910	45	144	47	256	--	--
1911	8	14	17	163	--	--
1913	10	16	25	190	--	--
1915	7	11	8	--	--	--
1934	22	9	2	3	--	--
1936	10	4	1	--	--	--
Total	109	227	110	901	--	--

Table O-7.—Continued

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Allen						
1918	3	2	36	280	--	--
Audrey May						
1918	19	--	13	1,949	--	--
Beverly						
1932	7	7	4	45	--	--
Bill Dog						
1927	1	2	3	--	--	--
Blue Bird						
1913	2	1	12	325	--	--
Carlson						
1917	1	3	4	--	--	--
Carpenter						
1913	3	3	68	112	--	--
Centralia						
1913	17	65	32	--	--	--
1915	184	298	169	--	--	--
Subtotal	201	363	201	--	--	--
Copper Tung						
1942	8	--	7	1,002	--	--
Copper Wire						
1919	3	--	6	553	--	--
Cutright						
1916	224	5	354	21,687	--	--
Earnest						
1921	1	--	18	15	23	--
Eldorado						
1948	53	12	45	4,239	--	--
1950	488	98	340	36,515	--	--
1951	107	18	63	6,348	--	--
1952	8	--	8	225	3,570	66
1953	26	--	18	--	600	1,800
Subtotal	682	128	474	47,327	4,170	1,866
Evans, Valiton, and Harpole						
1934	10	2	22	54	--	--
Flagstaff						
1908	66	12	335	20,616	--	--
1909	201	14	704	55,148	--	--
1910	105	7	352	20,484	--	--
1913	15	1	19	3,342	--	--
Subtotal	387	34	1,410	99,590	--	--
Foley						
1912	150	34	75	--	--	--
Fool Hen						
1906	10	2	127	955	2,532	--
Franklin						
1921	2	--	62	53	827	--

Table O-7.–Continued

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Hahn						
1913	19	1	28	3,082	--	--
Home						
1931	2	1	5	--	--	--
Kelley						
1908	26	1	61	6,717	--	--
Kennedy						
1919	9	3	19	--	--	--
Kock						
1911	35	30	6	--	--	--
Ladysmith						
1908	70	4	111	20,112	--	--
1909	20	--	15	13,127	--	--
Subtotal	90	4	126	33,239	--	--
Last Chance						
1930	1	4	1	--	--	--
1931	1	5	--	--	--	--
Subtotal	2	9	1	--	--	--
Lenning						
1912	14	1	30	3,560	--	--
Mary Jane						
1921	2	1	5	--	--	--
Minnie Jane						
1949	5	5	77	138	368	--
Morning Star						
1940	46	13	34	4,777	--	--
Mountain View						
1915	33	10	421	--	--	--
National Bank of Montana						
1913	9	11	1	--	--	--
North American						
1912	2	11	4	--	57	--
N P Tract						
1948	2	3	1	--	--	--
Ona						
1916	2	12	2	--	--	--
Ophir No. 3						
1918	10	8	1	--	--	--
1934	1	--	21	--	--	--
Subtotal	11	8	22	--	--	--
Orater						
1911	1	3	1	26	--	--
Orient						
1921	3	2	58	99	100	--
1937	10	7	12	--	--	--
Subtotal	13	9	70	99	100	--

Table O-7.—Continued

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Rawings						
1910	45	3	238	12,992	--	--
Sewell Daniels						
1915	10	7	1	--	--	--
Silver Coin						
1912	24	2	311	--	6,225	--
Sun Girl						
1941	1	5	6	--	298	--
1942	1	1	1	--	--	--
Subtotal	2	6	7	--	298	--
Sunset						
1916	43	1	489	--	12,663	--
Teskla						
1912	8	4	1	--	--	--
Travis						
1918	3	2	1	--	--	--
Wall Street						
1909	7	--	13	1,446	--	--
1915	10	--	15	1,831	--	--
1916	21	1	35	3,359	--	--
1917	15	--	18	1,930	--	--
Subtotal	53	1	81	8,566	--	--
White						
1914	15	14	2	--	--	--
Opportunity and Last Chance						
1923	1	1	1	--	--	--
1925	3	--	3	711	--	--
1929	3	--	9	600	--	--
Subtotal	7	1	13	1,311	--	--

Table P-2.—Production of gold, silver, copper, lead, and zinc at lode mines, in terms of recoverable metals, 1902-68, Pioneer District, Powell County.

Big Ben						
1949	5	2	123	93	504	310
Bowk						
1915	8	7	2	--	--	--
Cash Grocery						
1919	8	3	66	--	--	--
Clear Grit						
1909	22	60	63	65	--	--
Clippe						
1937	33	4	57	--	--	--
Fourth of July						
1911	15	26	30	--	--	--
1913	3	5	5	--	--	--
1928	6	14	14	--	--	--
Subtotal	24	45	49	--	--	--

Table P-2.–Continued

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Garnett						
1955	36	5	6	--	--	--
Hanner						
1932	2	12	6	--	--	--
Independence						
1926	10	7	5	--	--	--
1927	40	381	138	--	--	--
1928	20	32	10	--	--	--
1929	10	16	5	--	--	--
1931	15	16	16	62	--	--
1932	2	10	--	--	--	--
1935	10	7	9	--	--	--
Subtotal	107	469	183	62	--	--
Kraes						
1928	4	8	8	--	--	--
Lois						
1941	4	1	26	66	775	--
1942	3	1	40	88	1,036	--
1944	3	2	32	58	1,503	--
1946	2	3	17	34	654	284
1947	1	2	8	11	209	--
1948	1	2	--	--	--	--
1961	1	15	--	--	--	--
1963	2	1	--	--	--	--
Subtotal	17	27	123	257	4,177	284
Morning Glory						
1916	5	1	6	549	--	--
1926	3	5	3	--	--	--
Subtotal	8	6	9	549	--	--
Pikes Peak						
1939	450	64	35	--	--	--
Pioneer						
1915	50	48	13	--	--	--
1916	75	76	14	--	--	--
1926	10	87	41	--	--	--
1927	1	4	2	--	--	--
1928	76	139	47	--	--	--
1929	31	53	15	--	--	--
1930	2	25	8	--	--	--
1935	10	68	55	84	--	--
1937	4	3	7	--	--	--
Subtotal	259	503	202	84	--	--
Red Bird						
1929	1	37	16	--	--	--
1930	1	5	3	--	--	--
1931	3	8	4	--	--	--
Subtotal	5	50	23	--	--	--

Table P-2.–Continued

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ruby Gold						
1956	1	1	2	--	--	--
Ryan						
1936	18	6	71	109	--	--
1937	10	6	2	--	--	--
Subtotal	28	12	73	109	--	--
Upper Gold Creek						
1921	2	2	51	--	104	--
Various						
1931	1	7	1	--	--	--
Worster						
1932	1	2	1	--	--	--

Table B-3.–Production of gold, silver, copper, lead, and zinc in terms of recoverable metals, Blackfoot or Blackfoot Gold mine.

1930	10	13	31	5	107	--
1931	200	86	96	32	--	--
1936	4	10	8	--	--	--
1937	56	44	81	--	--	--
1939	217	182	410	133	--	--
1940	500	94	43	--	--	--
1941	236	132	208	--	--	--
1946	5	4	10	38	--	--
1947	5	5	9	52	90	--
1953	2	--	12	--	200	--
Total	1,235	570	908	260	397	--

Table B-4.–Production of gold, silver, copper, lead, and zinc in terms of recoverable metals, Higgins mine.

1934	5	3	14	--	--	--
1940	11	7	19	--	--	--
Total	16	10	33	--	--	--

Table B-5.–Production of gold, silver, copper, lead, and zinc in terms of recoverable metals, Hobby Horse mine.

1931	1	4	4	--	61	--
1932	9	27	111	--	535	--
1937	2	--	4	--	36	--
1951	24	4	32	--	271	--
1961	194	211	3	--	--	--
1962	250	130	23	--	--	--
Total	480	376	177	--	903	--

Table B-6.—Production of gold, silver, copper, lead, and zinc in terms of recoverable metals, other mines

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Bonanza						
1915	9	4	63	85	--	--
Cumberland						
1949	1	1	13	--	677	--
Elk						
1934	3	5	9	--	--	--
1935	17	22	50	--	--	--
Subtotal	20	27	59	--	--	--
Galena Quartz						
1934	3	1	6	2	147	--
High Ore						
1924	2	5	2	--	--	--
Hill Top						
1934	44	17	55	100	--	--
1937	13	9	21	--	--	--
1938	42	33	76	--	304	--
1939	8	11	31	2	294	--
1940	8	4	10	--	--	--
1941	4	4	11	--	129	--
1942	16	16	31	--	341	--
Subtotal	135	94	235	102	1,068	--
Lead King						
1932	1	1	4	--	265	--
Lockey						
1909	90	9	12	--	--	--
1911	25	8	13	--	--	--
1912	1	--	2	--	--	--
1914	7	5	3	--	--	--
1915	10	6	27	--	--	--
1917	10	4	7	--	--	--
1919	3	3	22	--	53	--
Subtotal	146	35	86	--	53	--
Morrison						
1918	1	--	63	10	--	--
McClellan						
1915	1	12	14	--	--	--
Marcum Hill						
1936	20	11	54	--	1,976	--
1943	25	8	65	9	2,147	--
1946	56	23	173	82	7,972	--
Subtotal	101	42	292	91	12,095	--
Moose						
1941	1	2	--	--	--	--
Quinn						
1904	40	60	--	--	--	--

Table B-6.—Continued

Year	Ore (tons)	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Royal						
1956	12	15	2	--	--	--
1960	9	7	45	--	100	100
Subtotal	21	22	47	--	100	100
Trapper						
1908	7	31	14	--	--	--
1909	15	11	2	--	--	--
1910	260	135	12	--	--	--
1911	66	48	18	--	605	--
1912	5	4	2	--	--	--
Subtotal	353	219	48	--	605	--
Wedlake						
1934	*	*				
Welch						
1924	10	11	25	--	--	--
Western Montana						
1934	4	6	12	--	--	--

*Less than ½ ounce.