STATE OF MONTANA
J. Hugo Aronson, *Governor*

BUREAU OF MINES AND GEOLOGY
E. G. Koch, *Director*

BULLETIN 16
June, 1960

MINES AND MINERAL DEPOSITS (EXCEPT FUELS) JEFFERSON COUNTY, MONTANA

By

R. N. ROBY, W. C. ACKERMAN, F. B. FULKERSON, AND F. A. CROWLEY

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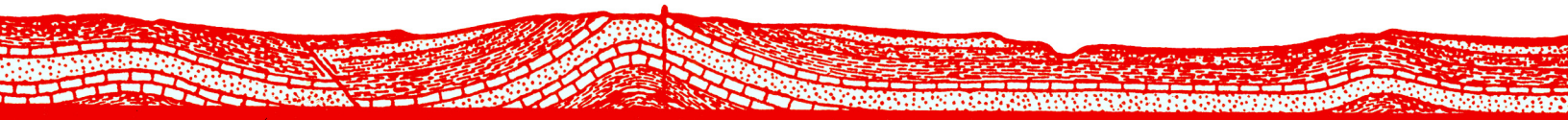

MONTANA BUREAU
of
MINES AND GEOLOGY

Butte, Montana

STATE OF MONTANA

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MONTANA SCHOOL OF MINES

Butte, Montana

1960

ARTCRAFT PRINTERS BOZEMAN, MONTANA

CONTENTS

ILLUSTRATIONS

ILLUSTRATIONS

TABLES

MONTANA BUREAU OF MINES AND GEOLOGY
Butte, Montana

E R R A T A

Bulletin 16, Mines and Mineral Deposits (Except Fuels), Jefferson County, Montana.

Page	
1	Paragraph 7, line 14, for "datta" read "data."
2	Paragraph 8, line 6, for "moutains" read "mountains."
7	Table 7, under Total Lead, for "85,957,431" read "85,857,431."
8	Paragraph 2, line 3, for "that only production" read "that the only production."
11	Paragraph 3, line 6, for "grandiorite" read "granodiorite."
11	Paragraph 4, line 1, for "meatmorphosed" read "metamorphosed."
13	Table 8, under Gold-year 1920, for "5" read "29."
13	Table 8, under Total Value, total, for "3,811,263" read "3,311,253."
13	Paragraph 5, line 7, for "the crek south" read "the creek south."
15	Paragraph 15, line 3, for "and 1870" read "and in 1870."
16	Paragraph 1, line 6, for "lower Creek placer" read "lower Basin Creek placer."
17	Table 9, under Lead-year 1916, for "698" read "4,698."
17	Table 9, under Copper-year 1935, for "3,227" read "3,277."
19	Paragraph 5, line 7, for "was state locally" read "was stated locally."
22	Paragraph 11, line 13, for "of zoing in" read "of zoning in."
23	Table 11, under Lead-year 1952, for "59,020" read "79,020."
24	Paragraph 14, line 5, for "the owned to" read "the owner to."
25	Paragraph 5, line 7, for "and 1902" read "and in 1902."
25	Paragraph 11, line 11, for "tetrahdrite" read "tetrahedrite."
26	Paragraph 6, line 9, for "wears" read "years."
29	Paragraph 1, line 4, for "sphalrite" read "sphalerite."
33	Paragraph 8, line 1, for "Kaite" read "Katie."
34	Paragraph 4, line 23, for "auhedral" read "euhedral."
35	Paragraph 6, line 10, for "prousite" read "proustite."
40	Paragraph 11, line 6, for "Crek" read "Creek."
42	Paragraph 6, line 3, for "ump" read "dump."
42	Paragraph 7, line 1, for "briefly by" read "briefly described by."
43	Paragraph 4, line 6, for "Nenning" read "Henning."
50	Paragraph 1, line 12, for "shpalerite" read "sphalerite."
51	Paragraph 8, line 1, for "Knopt" read "Knopf."
54	Paragraph 13, line 24, for "nonmarien" read "nonmarine."
55	Paragraph 1, line 2, for "volvanic" read "volcanic."
57	Table 16, under Ore-year 1909, for "52,062" read "52,082."
57	Table 16, under Ore-year 1912, for "20,863" read "28,863."
61	Paragraph 5, line 9, for "topes" read "stopes."
64	Paragraph 1, line 4, for "cerargyite" read "cerargyrite."
64	Paragraph 5, line 12, for "cyanid" read "cyanide."
67	Paragraph 10, line 3, for "approxiately" read "approximately."
70	Paragraph 2, line 9, for "aluvium" read "alluvium."
71	Paragraph 11, line 6, for "9.075" read "9,075."
73	Table 21, under Total Value, for "127,332" read "127,322."
76	Paragraph 1, line 8, for "Pipesotne" read "Pipestone."
76	Paragraph 5, line 1, for "crediated" read "credited."

Page

76 Paragraph 7, line 3, for "calim" read "claim."

78 Table 24, under Total Value 1932, for "790" read "1,029."

78 Table 24, under Copper-year 1933, insert 31.

78 Table 24, under Year 1947, for "1947" read "1948."
Insert 1947, Ore 90, Gold 63, Silver 32, Copper --, Lead 100, Zinc --, Total Value 2,248.

85 Paragraph 9, line 8, for "dififcult" read "difficult."

86 Paragraph 8, line 1, for "lense-shaped" read "lens-shaped."

98 Robert Emmet mine, under Lead-year 1953, for "2,409" read "2,404."

100 Basin Jib mine, under Gold-year 1925, for "10,374" read "10,734."

101 Boulder mine, under Gold-year 1957, for "20" read "29."

101 Boulder mine, under Total Lead, for "4,195" read "4,915."

101 Comet mine, under Ore-year 1902, for "1,366" read "1,336."

101 Comet mine, under Copper-year 1919, for "75,784" read "75,874."

102 Eva May mine, under Copper-year 1908, for "1,433" read "1,443."

102 Gray Lead mine, for second appearing year "1942" read "1943."

103 High Ore mine, insert between 1925 and 1937 the following: 1927, Ore 3, Gold 1, Silver 171, Copper --, Lead 2,654, Zinc --.

103 Jennie B. mine, under Lead-year 1926, for "5,975" read "5,974."

105 Wendell Phillips mine, under Total Ore, for "16" read "66."

106 Legal Tender mine, under Total Ore, for "459" read "450."

107 Alta mine, under Copper-year 1926, for "88,893" read "88,892."

109 Gregory mine, omit the line which follows 1952.

109 Lohrer group, under Silver-year 1936, for "331" read "831."

109 Minah mine, under Lead-year 1944, for "109,006" read "108,006."

109 Minah mine, under Zinc-year 1956, insert 400.

109 Mount Washington mine, under Ore-year 1915, for "3,349" read "3,439."

109 Mount Washington mine, under Silver-year 1923, for "24,744" read "24,774."

111 Elkhorn (Holter) mine, under Copper-year 1908, for "2,358" read "2,359."

111 Elkhorn Queen mine, under Silver-year 1949, for "9,918" read "8,918."

112 Peacock mine, under Gold-year 1908, for "4" read "2."

113 Big Chief mine, under Zinc-year 1952, for "432" read "342."

114 Ida mine, under Ore-year 1937, for "3" read "33."

115 Golden Sunlight mine, under Ore-year 1956, for "1,805" read "7,805."

116 Ironside mine, under Gold-year 1946, insert 1.

116 Lone Eagle mine, under Gold-year 1941, for "3" read "1."

117 Sunny (Sunny Corner) mine, under Gold-year 1935, for "46" read "233."

117 Sunny (Sunny Corner) mine, under Silver-year 1935, for "401" read "1,911."

117 Sunny (Sunny Corner) mine, under Copper-year 1935, insert 771.

117 Sunny (Sunny Corner) mine, under Ore-year 1947, for "112" read "122."

MINES AND MINERAL DEPOSITS EXCEPT FUELS JEFFERSON COUNTY, MONTANA

By

R. N. ROBY, W. C. ACKERMAN, F. B. FULKERSON
and F. A. CROWLEY

ABSTRACT

This bulletin outlines the geology, summarizes the metallic mineral production, and briefly describes the mining districts and many of the individual mines of Jefferson County.

The geology, for the most part, has been condensed from earlier writers supplemented by personal observations of the present authors. Production data are given in some detail. The majority of the individual properties herein described were idle and mostly inaccessible at the time of field examination, and consequently much of the information concerning them was summarized from older reports.

The principal rocks of the area are igneous rocks related to the Boulder batholith, which underlies most of the county. Some sedimentary rocks ranging in age from Precambrian (Beltian) to Tertiary are exposed in the southeastern part of the county. Ore deposits are related to the batholith, and at least two ages of ore deposition have been recognized.

The area has yielded mineral wealth to a value in excess of $100,000,000.

INTRODUCTION

The purpose of this bulletin is to provide a compact and up-to-date source of information on the mineral deposits and their economic factors, and the mines and mineral production of Jefferson County. The report summarizes data from early investigations and the results of more recent field examinations. It also lists annual production totals from 1902 to 1957 by mine, district, and county.

This report represents the combined efforts of two Bureaus, State and Federal. A wealth of unpublished data for the study was available as the result of field work by R. N. Roby during 1949 and 1950 in connection with the Federal Bureau of Mines' investigation of mineral resources of the Missouri Basin. Also, mineral production data for Jefferson County were on file at the Albany (Oreg.) Office of Mineral Resources, Region 1, Bureau of Mines. Recognizing the advantages of publishing a comprehensive account of the mineral activity in the county, the Montana Bureau of Mines and Geology entered into a cooperative agreement with the Bureau of Mines for the purpose of preparing this bulletin. In 1958 and 1959 W. C. Ackerman and F. A. Crowley of the Montana Bureau of Mines and Geology brought Roby's work up-to-date by additional field checking.

For more than half a century the Bureau of Mines and the Geological Survey before it, have collected mineral production data from thousands of mines. The production figures were obtained on a confidential basis, and unless permission was granted by mine owners production figures were not included, except where individual output could be concealed in a larger district, county, or State total. In 1959 the Bureau of Mines corresponded with Jefferson County property owners to obtain permission to publish their figures. In most instances the Bureau was released from its pledge of confidence, particularly where idle mines and early datta were concerned.

F. B. Fulkerson, commodity-industry analyst, Betty J. Thornton, editorial clerk, and Ruth G. Coon, statistical clerk, prepared a historical summary, assembled the statistics, and canvassed the owners.

Changing technology in mining and metallurgical methods may provide a stimulus to renewed investigations of domestic resources. The Bureau of Mines hopes that publication of mine-production statistics in reports such as this will be one step towards development of dormant and latent resources by providing reliable information on metals produced by mines that in many instances are inaccessible now with entries caved or workings flooded.

ACKNOWLEDGMENTS

Information concerning their respective activities, as related to the mining industry in Jefferson County, was provided by officials of The Anaconda Co., the American Smelting and Refining Co., the Montana Power Co., and the Montana Railroad Assoc. Climatological data were provided by the U.S. Weather Bureau, Helena, Montana.

Reports and unpublished manuscripts of the Montana Bureau of Mines and Geology, the Federal Geological Survey, the Federal Bureau of Mines, and numerous individuals have provided much valuable information. Acknowledgement of the source of such information is indicated in the text of the report by the author's name, year of publication, and page number in parentheses, which refers to the Bibliography given at the end of the report.

Our sincere appreciation is due to the following persons who materially aided the investigations by providing maps or other information necessary for the successful completion of this report: Del Brown, Del and Chester Bullock, John Buttleman, A. F. Carlson, L. T. Carmody, Lee Hicks, Gil Holshue, Ed Lahey, Louis Peura, H. M. Redding, E. A. Scholz, E. Strassburger, Dave P. Walker, and E. W. Wolfe.

John Willard, Director, Montana Railroad Assoc., compiled the data on railroad freight rates and Richard Setterstrom, Industrial Development Engineer, Montana Power Co., contributed the section on electric power rates.

GEOGRAPHY

Jefferson County, in west-central Montana, has an area of 1,637 square miles. The population (1950 census) is 4,005. Boulder, the county seat, (pop. 495) and Whitehall (pop. 931) are the largest towns. Helena and Butte are the leading mining supply and equipment centers. (See fig. 1.)

Jefferson County is mountainous but includes several moderately broad inter-mountain valleys. The mountains are neither extremely high nor rugged. Most of the higher summits are quite flat or gently sloping, suggestive of erosional remnants of a pre-existing surface of moderate relief that formerly extended over the entire area. Altitudes range from 4,000 feet in the northern part of the county to 9,416 feet at the summit of Crow Peak in the Elkhorn Mountains. The western boundary is formed by the broad back of the Continental Divide that here averages about 7,000 feet in altitude.

The county is drained mainly by the Boulder River and Prickly Pear Creek. The headwaters of Boulder River originate on the Continental Divide. Above Boulder, the river and its tributaries occupy relatively narrow steep-walled canyons, but below Boulder the canyon opens to form a wide intermountain valley that extends southward to the junction of the Boulder and Jefferson Rivers about 8 miles east of Whitehall, Montana. Prickly Pear Creek flows northward from its principal source in the Elkhorn Mountains to join the Missouri River a few miles north of Helena.

The climate of Jefferson County is similar to that of other mountainous regions in the northern Rocky Mountains. The average annual precipitation is about 12 inches a year. Snowfall is not excessive except near the summits of the higher moutains. Mine operation is practicable the year around. Climatological data are given in tables 1 and 2.

TABLE 1.—Average monthly and annual precipitation and snowfall in inches at following U. S. Weather Bureau stations in and adjacent to Jefferson County, Montana. (From U. S. Weather Bureau, Helena, Montana.)

Station	Boulder		Butte		Helena	
	Precipitation [1]	Snowfall	Precipitation[1]	Snowfall	Precipitation[1]	Snowfall
Length of record (yrs.)	13	13	27	27	30	18
January	0.35	4.9	0.53	7.2	0.51	8.6
February	0.29	4.1	.053	6.8	0.41	6.3
March	0.42	3.8	0.78	9.5	0.72	8.3
April	0.62	2.5	1.04	5.4	0.88	3.3
May	1.74	0.1	1.89	4.2	1.60	1.4
June	2.58	0.3	2.28	0.4	2.15	0.1
July	1.01	0	1.24	T	0.98	0
August	1.17	0	1.12	T	0.93	0
September	1.34	0.3	1.20	1.2	1.16	1.9
October	0.48	1.5	0.79	2.7	0.68	1.7
November	0.60	3.9	0.69	5.8	0.64	7.5
December	0.42	5.6	0.61	7.9	0.64	8.9
Annual Average	11.02	27.0	12.67	51.1	11.30	48.0

1/ Includes snowfall converted to water. T=Trace.

Jefferson County includes a part of the Helena and Deer Lodge National Forests. Most of the mountain slopes are forested with dense stands of lodgepole pine. Spruce and fir are plentiful and support numerous small sawmills. Timber for mine use is adequate on most mining properties except those in the southeastern part of the county near Whitehall. Rough lumber can usually be obtained from local sawmills.

Perennial streams provide sufficient water for the mines except those in the vicinity of St. Paul Gulch, northeast of Whitehall, where water must be hauled for mining purposes. Numerous water wheels were used in the early days for developing power at small mining and milling operations. One can still be observed at the King Cole mine on High Ore Creek.

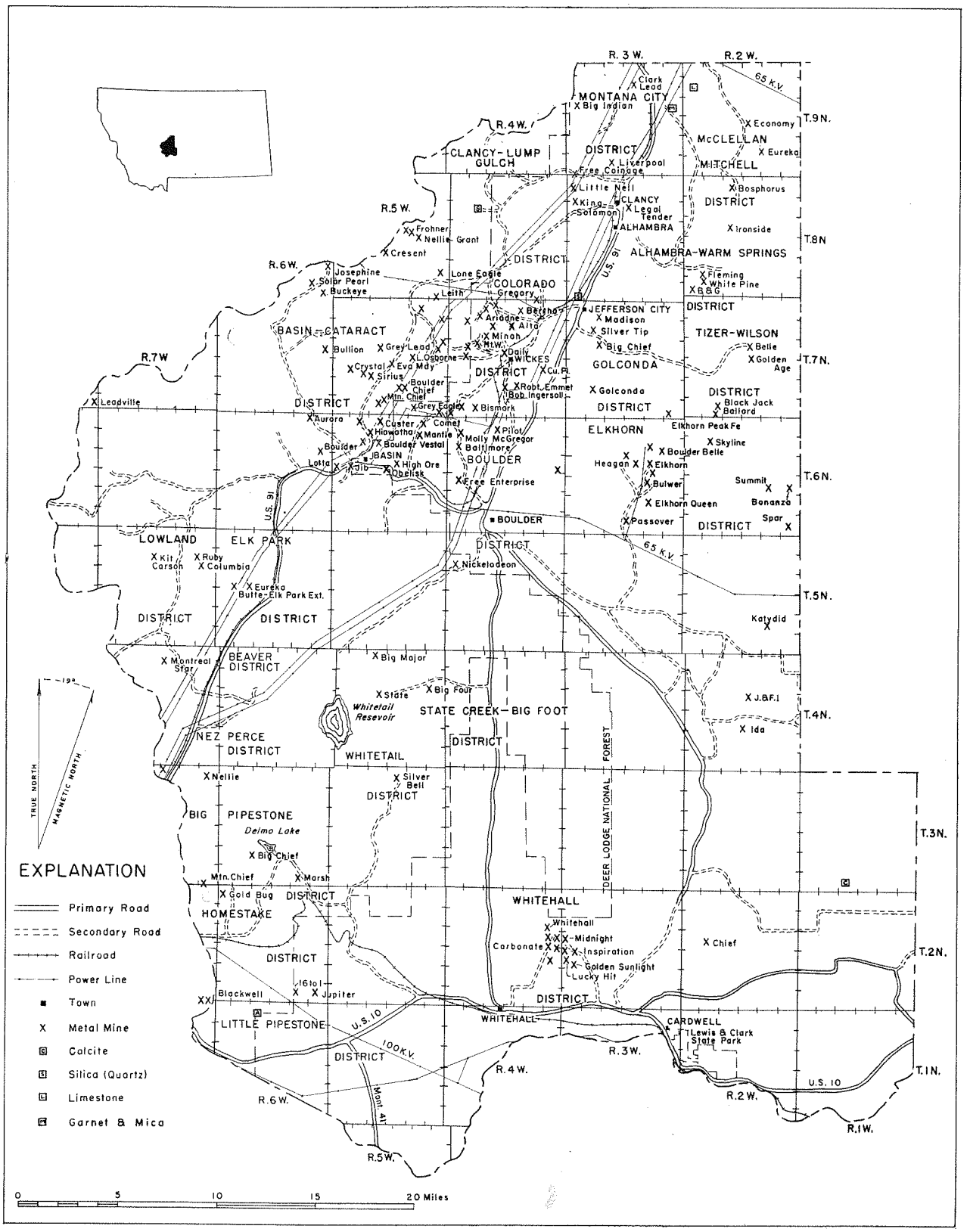


FIGURE 1.—Map of Jefferson County showing location of mines and mining districts.

TABLE 2.—Average temperature data (degree Fahrenheit) at following U. S. Weather Bureau stations in and adjacent to Jefferson County, Montana. (From U. S. Weather Bureau, Helena, Montana.)

Station	Boulder	Butte	Helena
Elevation, feet	4,904	5,530	4,124
Lenth of record, years	13	27	30
Annual average	41.8	38.3	43.0
Mean maximum			
January	32.0	28.0	27.7
July	79.0	79.8	83.8
Annual	54.4	52.6	55.4
Mean minimum			
January	9.9	0.4	7.5
July	45.4	45.0	52.2
Annual	26.9	24.0	30.6
Highest			
January	57	54	62
July	98	100	99
Annual	105 (June)	100	102 (Aug.)
Lowest			
January	—39	—48	—42
July	22	29	36
Annual	—39	—52 (Feb.)	—42
Latest date 32° or lower in spring	6/11	6/8	5/12
Earliest date 32° or lower in fall	9/6	8/28	9/23

ECONOMICS

LABOR AND POWER

The supply of experienced mine labor in Jefferson County is adequate for the present needs. Most of the recent mining has been done by lessees or by companies employing only a small number of men. Mine wages in the county are governed largely by the Butte wage scale. The base wage scale at Butte during 1960 for all underground labor was $18.39 per 8-hour shift. Surface labor received 50 cents a day less. Although the daily wage scale is set by union contract, wages to miners are greater because of the incentive bonus provided for in contract mining.

An electric hoist was used at the Alta mine in 1895. The power was generated at the Helena Mining Reduction Co.'s hydroelectric plant at Jefferson City (Bushnell, 1910, p. 1155). In 1902 an electric-operated 60-stamp mill was erected at the Big Indian mine 4 miles south of Helena. Electric power was supplied from the Missouri River Power Co.'s plant at Canyon Ferry. These were the first electrical installations at mines in the county and were among the first in the state. Most of the mining regions now are supplied with electric power by the Montana Power Co.

Figure 1 shows the electric transmission and distribution lines in the county. Two major transmission lines, a 110,000-volt line and a 66,000-volt line, extend from Helena to Butte from Great Falls. A 66,000-volt line extends from Boulder to Townsend. Two additional transmission lines cross the northern and southern parts of the county. In addition to the high-voltage transmission lines, numerous distribution lines extend into the mining regions. The voltage and capacity of the various distribution lines vary according to the required load.

The Montana Power Co. provides electric energy to consumers in Montana under the following GS-44 schedule, which is based upon a sliding scale for actual kilowatt-hour consumption, plus a charge based on peak kilowatt demand.

Montana Power Co. Schedule GS-44 Power Scale Rates: Net monthly bill

$0.75 for the first 12 kw-hr., or less
0.035 per kw-hr. for the next 288 kw-hr.
0.025 per kw-hr. for the next 1,500 kw-hr.
0.015 per kw-hr. for the next 3,200 kw-hr.
0.009 per kw-hr. for the next 15,000 kw-hr.
0.007 per kw-hr. for the next 200 kw-hr. per kw. of demand.
0.005 per kw-hr. for all additional kw-hr.

Plus demand charge

First 10 kw ..... no charge
Next 20 kw ..... $0.95 per kw.
All additional kw ..... 0.75 per kw.

FREIGHT RATES

No quoted trucking rates on ore or concentrate have been established owing to the variation in roads and hauling conditions. Individual rates are based upon the length of haul, condition and grade of roadway, facilities for loading ore or concentrate at mine or mill, tonnage to be hauled, and regularity of shipments. Special rates have been made for hauling mill tailings or mine dump material where the tonnage was sufficient to justify the use of large trucks and mechanical loaders. Rates usually are based on an average of 10 cents per ton-mile over paved or good-quality roads with little grade. The rate for trucking ore 14 miles from mine at an altitude of 7,800 feet to Clancy at an altitude of 4,220 feet was 21 cents per ton-mile. Ore from a mine near Wickes at an altitude of 5,600 feet was trucked to the East Helena smelter, a distance of 23 miles, for 8 cents per ton-mile.

Freight rates on ore and concentrates per ton in 30-ton minimum carload lots from railroad points in Jefferson County to smelters in Montana, Idaho, and Utah as of July 1, 1959 appear on table 3.

Freight rates between the above shipping points and smelters outside of Montana not mentioned may be established upon application to the traffic agent of the railroad concerned.

SMELTER SCHEDULES

It is difficult and sometimes impossible for smelters and custom mills to establish a price schedule applicable to all types of ore and concentrates. Smelting charges frequently are based upon results of the analysis of representative samples of the ore or concentrate and a determina-

TABLE 3.—Freight rates on ore from different shipping points in Jefferson County, Montana, to different smelters in cents per net ton of 2,000 lbs.

	$15.00	$25.00	$30.00	$40.00	$50.00	$60.00	$70.00	$80.00	$90.00	$100.00	Over $100.00
Homestake to East Helena, Montana	251	277	314	370	370	388	388	388	388	388	(1)
Whitehal to Butte, Montana	251	277	314	370	370	388	388	388	388	388	(1)
Clancy to Helena, Montana	118	135	177	199	199	222	222	222	222	222	239(3)
Wicks to Helena, Montana	158	177	222	277	277	277	277	277	277	277	297(3)
Basin to Helena, Montana	197	222	260	297	297	314	314	314	314	314	332(3)
Boulder to Helena, Montana	177	199	239	277	277	297	297	297	297	297	314(3)
Clancy to Butte, Montana	216	239	297	351	351	370	370	370	370	370	424
Wicks to Butte, Montana	197	222	260	297	297	314	314	314	314	314	332
Basin to Butte, Montana	158	177	222	277	277	277	277	277	277	277	297
Boulder to Butte, Montana	177	199	239	277	277	297	297	297	297	297	314
Clancy to Tacoma, Wash.	2261	2261	2261	2261	2261	2261	2261	2261	2261	2261	(1)
Wicks to Tacoma, Wash.	2261	2261	2261	2261	2261	2261	2261	2261	2261	2261	(1)
Basin to Tacoma, Wash.	2261	2261	2261	2261	2261	2261	2261	2261	2261	2261	(1)
Boulder to Tacoma, Wash.	2261	2261	2261	2261	2261	2261	2261	2261	2261	2261	(1)
Clancy to Garfield, Utah Midvale, Utah	868	893	961	1124	1219	1339	1437	1535	1681	1712	(4)
Wicks to Garfield, Utah Midvale, Utah	848	873	917	1059	1155	1274	1371	1469	1614	1712	(4)
Basin to Garfield, Utah Mdvale, Utah	810	829	873	1035	1133	1229	1328	1425	1571	1712	(4)
Boulder to Garfield, Utah Midvale, Utah	829	850	893	1035	1133	1254	1351	1447	1592	1712	(4)
Whitehall to Garfield, Utah Homestake to Midvale, Utah	996	996	1042	1205	1302	1424	1520	1617	1762	1773	(4)
Whitehall to Tacoma, Wash.	996	996	1042	1205	1302	2505	2505	2505	2505	2505	—)
Homestake to Tacoma, Wash.	996	996	1042	1205	1305	2425	2425	2425	2425	2425	—)

(1) For each $50.00 per ton (or fraction thereof) increase in value above $100.00 per ton, add 20% to the rates on $100.00 valuation.

(3) N. P. switch Helena to East Helena $5.53 per car (NP Tariff 89-C item 1075).

(4) Values over $100.00 increased per item 110 UP Tariff 6015-X.

tion of the tonnage to be treated. Summarized schedules for ore and concentrates at smelters in Montana, Idaho, and Utah as in effect in 1959 are given in Appendix A, table 26.

ECONOMIC STATUS[1]

Because most of the land is range and forest, Jefferson County is sparsely populated (table 4), having less than 3 persons per square mile. Following a sharp decrease from 1940 to 1950, the population has remained about the same, while the State has registered a 9-percent gain for the period 1950-1957.

TABLE 4.—Population of Jefferson County and Montana, 1920-57.

	1920	1930	1940	1950	1957
Jefferson County	5,203	4,133	4,664	4,014	4,100
Montana	548,889	537,606	559,456	591,024	678,000

More than half (52 percent) of the county area is federal land, principally in the Deer Lodge and Helena National Forests, extending into adjoining counties. Timber production from these forests is small, totaling 8.2 million feet in 1956 as against the State figure of 500 million board feet.

Agriculture is the principal income source (table 5). About 37 percent of the land area is in farms and ranches, which are of large size (average 1,441 acres). Most of the land is pastured in the raising of livestock. Value of farm products sold in 1955 was $1.9 million of which $1.5 million was made up of sales by the cattle and sheep raising industry.

TABLE 5.—Labor force, Jefferson County and Montana, 1950.

Industry Group	Jefferson County	Montana
Agriculture	459	54,105
Forestry and fisheries	6	884
Mining	88	9,342
Construction	99	14,771
Manufacturing	51	18,515
Transportation and utilities	102	22,509
Trade	202	41,628
Services and finance	211	42,964
Public administration	94	10,107
Not reported	12	3,635
TOTAL	1,324	218,460

In 1950, the year of the last census of population, 35 percent of the labor force (wage earners and self-employed) was in agriculture. Retail, wholesale, and service trades serving the county's range economy were important with 30 percent of the labor force in these occupations. Mining, construction, and manufacturing were less important in the county than in the state.

The 1950 census reported median income per family of $2,395 in the county as against $3,222 in the state. About 15 percent of the families had income of $5,000 or more; in the state, 21 percent of families had incomes exceeding this figure.

1. Statistics from 1957 Montana Almanac (Montana State University) and 1956 County and City Data Book (U. S. Bureau of the Census)

Although unimportant during most years in its share of Montana mineral output, mining has contributed substantially to Jefferson County economic activity (table 6). In 1950, of a total labor force of only 1,324, about 88 were engaged in mining full time; probably that many more were mining or prospecting on a part-time basis.

TABLE 6.—Value of mineral production, 1952-58

Year	Value	Commodities produced in order of value
1952	$644,846	Lead, silver, limestone, zinc, gold, copper, sand and gravel, granite.
1953	397,294	Stone, lead, silver, gold, zinc, copper.
1954	358,190	Lead, stone, silver, zinc, gold, copper, sand and gravel.
1955	[1]	Stone, lead, silver, zinc, copper, gold.
1956	444,779	Lead, gold, stone, silver, zinc, copper.
1957	293,054	Stone, lead, gold, silver, zinc, copper, uranium.
1958	254,000	Stone, gold, lead, silver, zinc, copper.

1 Figure withheld to avoid disclosure of individual output.

HISTORY AND PRODUCTION

As first created in 1865, Jefferson County extended north to the Missouri River and included a large part of the present Broadwater County. Present county boundaries were established in 1897. The first placer gold discovery was made in Jefferson County in July 1862. However, the real influx of prospectors did not occur until after discovery of gold at Helena in 1864. By the end of 1868, Jefferson County placers had produced gold valued at $4½ million (Sanders, 1913, v. 1, p. 181). The first silver-lead mining operation in the county probably was conducted on the Gregory vein, discovered in 1864. The second smelter to operate in Montana Territory was erected at the Gregory mine 1867 (Raymond, 1868, p. 151). Raymond (1869, p. 301-302) states that 2 smelters were built at Wickes in 1869. Strahorn (1879, p. 171) credits the Montana Co.'s Wickes smelters with a production of $75,000 in lead and silver in 1878. The ore treated at these smelters was mined principally from the Alta, Minah, Comet, Argenta, and several other nearby deposits, all of which were discovered in the late sixties.

A major difficulty encountered by the early day mining and smeltering operations was the lack of adequate transportation facilities. The ore was siliceous and required large quantities of flux for smelting; the bullion produced had to be freighted great distances for refining. At first, supplies and bullion were hauled a distance of about 175 miles to and from the mines and Fort Benton, the upper terminus for river boats from St. Louis and eastern markets. River transportation to Fort Benton was possible for only about 4 to 6 weeks each year during the high-water season. After the completion of the Union Pacific Railroad in 1869, considerable freight came into Montana from Corinne, Utah, 450 miles to the south. In 1883, the transcontinental Northern Pacific Railroad was completed to Helena, and late in the same year a branch line was constructed to Wickes. These improved transportation facilities

gave great impetus to the mining industry in Jefferson County. New concentrators were built, and existing plants were enlarged; the capacity of the Wickes smelters was doubled. In 1890, 3 concentrating mills, 6 stamp mills, and 4 smelters were operating in Jefferson County. In the same year, 1,660 mining claims were located (Swallow, 1891, p. 33).

The period of accelerated activity lasted 10 years, or until the drop in the price of silver in 1893 when many of the mines ceased operating. Others operated only intermittently thereafter. From then to the present, mining has continued with a few periods of accentuated activity, but production has never reached the peak of the heyday years from 1883 to 1893.

Table 7 shows production of gold, silver, copper, lead, and zinc from Jefferson County for the years

TABLE 7.—Production of gold, silver, copper, lead, and zinc from lode mines, Jefferson County, Montana, 1902-57, in terms of recoverable metals.

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902	28,240	7,309	666,845	202,095	1,332,593	—	$531,104
1903	4,966	412	104,179	50,000	120,000	—	70,526
1904	34,377	8,010	331,072	11,100	455,307	—	346,838
1905	34,434	8,476	434,083	174,073	1,081,817	—	515,399
1906	20,631	8,515	268,801	255,428	811,616	—	451,676
1907	41,829	15,382	775,135	238,822	1,414,952	—	952,327
1908	61,687	6,649	1,047,142	338,331	1,747,463	—	810,482
1909	57,587	5,055	1,031,095	241,655	1,568,696	—	739,539
1910	57,271	6,250	1,029,541	122,109	1,975,492	—	787,585
1911	69,614	4,440	823,665	161,719	2,088,236	—	642,504
1912	42,313	8,380	510,491	776,072	1,589,588	55,542	690,603
1913	44,149	3,000	227,746	874,164	1,519,768	10,501	402,536
1914	15,997	3,674	125,829	65,633	461,944	1,923,286	270,357
1915	11,229	3,516	93,428	70,627	975,852	19,796	180,733
1916	54,331	4,811	164,693	852,857	679,760	898,348	584,895
1917	67,632	5,257	324,674	1,215,385	2,455,350	3,638,085	1,290,239
1918	54,861	6,091	537,769	345,545	3,881,482	2,463,673	1,248,816
1919	33,213	6,207	482,383	342,018	2,772,805	410,956	909,159
1920	39,170	3,882	480,838	256,044	3,414,357	40,460	927,879
1921	16,192	1,906	113,730	23,947	817,266	—	192,999
1922	64,216	6,981	175,484	77,124	577,703	3,797	362,200
1923	46,267	6,954	107,916	39,919	520,422	328,712	296,894
1924	93,691	33,557	291,907	325,509	806,698	374,027	1,020,744
1925	120,349	12,592	355,427	239,246	1,435,132	396,396	695,928
1926	66,729	4,023	353,369	247,074	1,964,025	1,096,183	577,585
1927	40,941	1,965	321,807	224,420	1,639,930	1,278,260	437,617
1928	9,162	1,021	73,849	67,414	795,178	1,025,482	182,698
1929	22,136	1,850	180,062	157,380	1,975,024	2,827,213	472,940
1930	11,137	1,032	101,475	87,573	1,062,973	967,213	171,363
1931	434	292	2,979	2,985	48,852	—	8,974
1932	3,261	1,520	12,663	7,666	18,666	—	36,047
1933	57,090	4,589	60,957	69,922	153,513	4,881	126,558
1934	34,272	5,093	128,044	63,775	576,027	435,907	305,942
1935	109,097	9,888	428,768	248,145	2,769,800	2,151,136	880,295
1936	147,189	13,862	619,357	327,924	4,253,326	3,332,920	1,357,351
1937	159,335	11,660	591,947	320,000	4,692,000	2,155,000	1,321,594
1938	102,050	9,758	395,440	304,398	3,322,631	1,209,417	837,892
1939	128,423	14,455	546,595	391,721	4,003,787	2,142,308	1,217,264
1940	120,800	14,236	582,518	431,000	4,244,100	1,547,000	1,270,864
1941	53,954	8,198	228,721	125,000	1,115,700	215,600	544,091
1942	53,622	7,180	155,139	89,000	1,493,300	1,185,000	582,646
1943	100,551	7,392	294,120	90,200	2,750,000	1,493,000	847,092
1944	47,240	7,170	159,300	66,000	1,979,200	1,599,000	713,762
1945	36,944	5,523	158,850	33,400	1,294,000	1,506,600	595,317
1946	17,837	4,978	55,068	26,500	594,000	336,500	328,817
1947	29,636	4,504	107,315	58,200	754,500	717,400	458,131
1948	22,166	4,277	77,684	48,700	757,300	508,600	433,772
1949	29,121	3,212	104,381	32,000	1,039,500	649,700	457,998
1950	18,506	1,410	96,535	24,200	779,800	368,800	299,396
1951	24,415	1,448	139,643	34,000	1,616,000	522,000	559,864
1952	21,627	1,120	142,873	36,000	1,726,000	526,000	542,421
1953	17,734	988	84,644	22,000	958,000	230,000	269,449
1954	17,141	1,008	86,815	30,000	768,000	362,000	267,014
1955	8,774	420	39,676	12,000	456,000	160,000	142,709
1956	30,358	2,824	86,657	46,000	748,000	254,000	349,053
1957	13,914	1,543	51,662	28,000	522,000	152,000	201,468
1958	12,000*	1,821	32,293	22,000	482,000	184,000	174,000
	2,681,842	337,566	17,005,079	11,074,019	85,957,431	41,706,699	31,893,946

* Estimated.

1902 to 1958 inclusive. Accurate production data are not available for the years prior to 1902. Estimates made in several reports indicate this additional production to have been as much as $68,000,000. The total production for the county, accordingly, would be about $100,000,000. Jefferson County probably ranks second in Montana in value of metals produced (Davis, 1923, p. 102).

Minerals and metals other than those shown in table 7 have been produced only in minor quantities. It is of interest that only production of molybdenum in the United States in 1906 came from the Homestake district in Jefferson County (Petar, 1932, p. 21). Although molybdenum is reported in many of the ores, it has not been produced in commercial quantities. Iron ore was mined from a number of deposits for use as flux in the early day lead smelters. A small tonnage of metallurgical-grade manganese ore was produced in 1943.

Only a few nonmetallic minerals have been mined. Limestone was mined at a number of quarries near Montana City and Limespur. Gypsum was mined from a small deposit near Limespur. Building stone has been quarried in a number of places. Individual nonmetallic deposits are described later in the report.

GENERAL GEOLOGY

Many studies have been made of the geology of Jefferson County, particularly in regard to the Boulder batholith. The following geologic descriptions are abstracted largely from published reports of some of these studies (Knopf, 1913a; Pardee and Schrader, 1933; Billingsley and Grimes, 1918; Grout and Balk, 1934).

Sedimentary rocks ranging in age from Precambrian to Tertiary occur in the eastern part of the county. These rocks comprise an apparently conformable succession of limestone, shale quartzite, and sandstone. In places Tertiary "lake beds" consisting of poorly consolidated clay, gravel, and tuff rest unconformably upon the older rocks. The principal igneous rocks are quartz monzonite, andesite, aplite, dacite, and rhyolite. The most prevalent of these is the quartz monzonite of the Boulder batholith. (See fig 2.)

The oldest rocks exposed in Jefferson County are sediments of the Missoula and North Boulder groups of the Belt series. Helena limestone and Empire shale (upper Missoula group) crop out several miles southeast of Helena, and the Spokane and Greyson shales (lower Missoula group) form the exposed core of the Devil's Fence anticline east of Boulder valley. The Geologic Map of Montana (1955) depicts outcroppings of the North Boulder group northeast of Whitehall. Recently, Alexander (1955, p. 11-13) has designated these rocks as belonging to the Greyson shale and to the LaHood formation.

All Paleozoic, Mesozoic, and Cenozoic rocks common to southwestern Montana are exposed in scattered localities in the northern, western, and southern parts of the country.

For the sake of simplicity, pertinent data concerning the sedimentary rocks are tabulated below:

Cenozoic
- Quaternary
  - Younger gravels: Thickness 0 to 75 feet.
    Gravel, sand, and mud of the present valley floors.
    Locally contain workable gold placers.
  - Older gravels: Thickness unknown.
    Bench gravels and glacial till.
- Tertiary
  - Miocene beds: Poorly consolidated gravel, sand, silt, and clay.
    Oligocene beds: Conglomerate, shale, volcanic tuffs, some beds of limestone.

Mesozoic
- Cretaceous and Jurassic
  - South of Helena and east of Boulder River; includes Kootenai sandstone and shales, Ellis sandstone and shale, and Morrison limestone thoroughly metamorphosed into hornfels and other metamorphic rock by contact action of adjacent igneous rocks.

Paleozoic
- Permian
  - Phosphoria formation:
    Chert, dolomite, siltstone, sandstone, and locally thin beds of oolitic phosphate rock. East of Whitehall chert occurs in light-tan and light-grey sandy dolomite. Poorly exposed shale brown to light grey, weathering light brown. Some black limestone with strong oily odor. Siltstone, brownish, slightly calcareous. Sandstone, brown to red to light grey, medium-grained (Alexander, 1955, p. 58).
- Carboniferous
  - Quadrant formation:
    Interbedded light-colored sandtsones and light-grey sandy dolomite. Predominantly sandstone in lower portion and sandy dolomite in upper portion (Klepper & others, 1957, p. 20, 21).
  - Amsden formation:
    Whitehall area, red to tan siltstone in lower portion with minor dolomitic limestone and light-colored sandstone in upper portion (Alexander, 1955, p. 56). West and north of Boulder valley, red to greyish-red mudstone shale and minor carbonate rock with interbedded argillaceous sandstone and some thick-bedded dolomite (Klepper & others, 1957, p. 20).
- Madison
  - Mission Canyon limestone (Upper Madison)
    Massive-bedded fossiliferous limestone, medium-grey to bluish-grey except where metamorphosed to white coarsely crystalline marble by contact action.

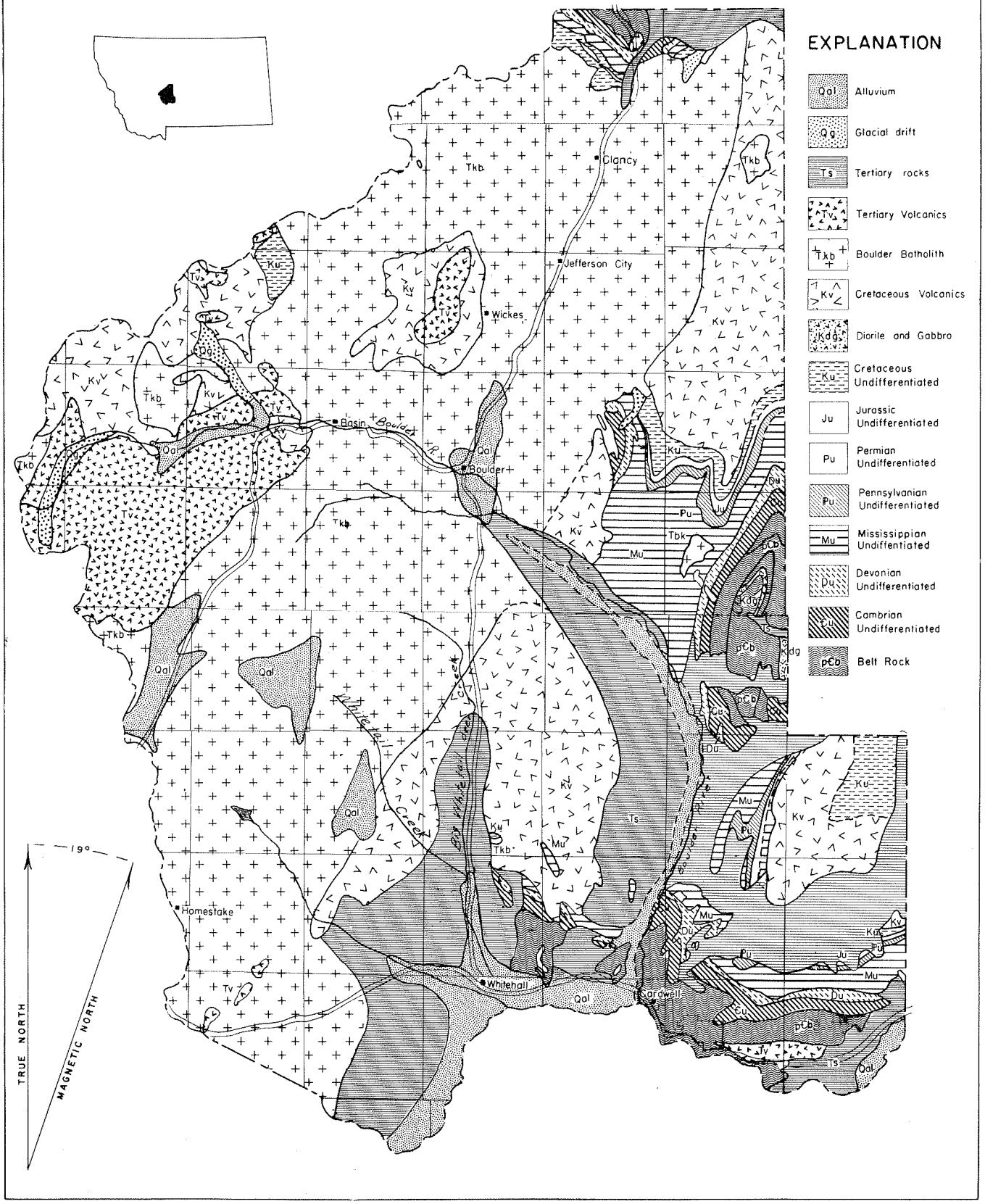


FIGURE 2.—Geologic map of Jefferson County.

Lodgepole limestone (Lower Madison)
Thin-bedded fine- to medium-grained light grey to bluish grey. May be brownish to reddish. Contains thin interbeds of shale and mudstone.

Devonian
Three Forks shale:
Poorly exposed fossiliferous green to purple-grey poorly bedded fissle shale with a few thin interbedded sandstones and with limestone near top.
Jefferson formation:
Dolomitic limestone, dark grey to brownish, fetid odor when broken. Contains some light-grey limestone. Formation weathers white to light grey.

Devonian-Cambrian
"Dry Creek shale" horizon:
Distinguished as Maywood and Red Lion formations by Klepper and others (1957, p. 12), and described as varicolored red and yellowish-brown argillaceous dolomites and calcareous rocks.
In Whitehall area, poorly exposed brown, grey, red, and pink thin-bedded limestone, dolomite, siltstone, and claystone.

Cambrian
Pilgrim formation:
Fine to medium-grained dolomitic limestone, light to dark grey. Mottled and conglomeratic near base.
Park shale:
Black, grey, olive-grey, and green shales with minor thin-interbedded limestone and sandstone. Hornfelsic near igneous contacts.
Meagher formation:
"Black and gold" mottled marble. Dark-grey limestone with tan or light-grey mottling. Some oolitic beds.
Wolsey formation:
Interbedded grey argillaceuos limestone with greenish to yellowish-grey shales. Lower part is greenish sandstone and shale with some glauconite-bearing beds.
Flathead formation:
Grey, pinkish, brownish, and purplish-grey quartzite, medium-grained, crossbedded, pebbly near base.

Unconformity
Precambrian
Belt
Missoula group
Helena limestone:
South and southeast of Helena is thin-bedded to laminated fine-grained bluish-grey and grey dolmitic limestone. Minor partings of thin shaly limestone. Weathers into tan to reddish-brown platy fragments.
Empire shale:
Southeast of Helena, greenish-gray massively-bedded and banded siliceous shale. (Distinguished from Spokane by its predominant green color.)
Spokane shale:
Interbedded red and green shales and sandy shales. East of Boulder River, greyish-red mudstone, shale, and sandstone with a few thin limy beds at base. (Klepper & others, 1957, p 5,6.) (Distinguished from Empire by its predominant red color.)
Greyson shale:
Dark-colored siliceous and arenaceous shale at base and bluish-grey fissile shale at top. Thin-bedded, weathers brown.
North Boulder group (northeast of Whitehall):
Undifferentiated (Designated Greyson and LaHood formations by Alexander, 1955.) Greenish-grey coarse conglomerate at base (LaHood ?) with arkose, conglomerate, and impure sandstone and shales above.

IGNEOUS ROCKS

The Boulder batholith with its related outliers is the most important economic geologic feature in Montana. The main quartz monzonite mass extends from the northern part of Jefferson County to the Highland Mountains about 16 miles south of Butte or a distance of about 80 miles; its width is about 24 to 36 miles. Billingsley (1915, p 39-42) contends that the Boulder batholith is a dome-shaped mass that made room for itself in the rocks that it invaded by stoping. Probably the rocks over the center of the mass were elevated; the rocks around the edges are not highly tilted. It occupies an area of about 2,000 square miles, 69 percent of which is in Jefferson County.

Billingsley and Grimes (1918, p. 288, 290), who have made a comprehensive study of the geology of the area, contend that these igneous rocks are all related to an igneous cycle that took place in 3 phases during the Cretaceous and Tertiary periods. The rocks emplaced during the 3 phases are as follows:

1. Gabbro, diabase, andesite.
2. Diorite, quartz monzonite, aplite, and quartz porphyry.
3. Dacite, rhyolite.

Andesite is by far the most extensive rock of the first phase; it is also the principal roof remnant of the Boulder batholith. It was poured out on an erosion surface developed during and after Laramide folding. The andesite comprises a bedded series of lava, breccia, and tuff. The thickness is not known but on the southeast side of Elkhorn Peak a thickness of at least 2,000 feet is indicated (Knopf, 1913a, p. 28,29). The original thickness probably was much greater. The andesite at the eastern edge of the batholith near Elkhorn dips

gently to the east away from the granite. At the west edge of batholith near Cliff Peak, beyond the boundary of Jefferson County, the andesite dips westward away from the granite at angles of 15° to 20° (Knopf, 1913a, p. 24). The andesite forms the host rock of many important ore deposits in the Wickes district and east of Jefferson County in the Winston, Townsend, and Radersburg districts.

The dominant geologic event in the area was the intrusion of the Boulder batholith in Paleocene (?) time following the period of Laramide folding and thrust faulting.

The quartz monzonite consists chiefly of plagioclase, orthoclase, quartz, biotite, and honrblende; it is truly quartz monzonite, although it often is popularly called granite. The rock becomes more basic near the borders of the batholith, where it approaches the composition of grandiorite or quartz diorite. Rapid changes in composition and texture are common.

The invaded rocks have been meatmorphosed at their contacts with the batholith. Limestone has been changed to marble; andesite has been recrystallized; both have been garnetized. Some contact-metamorphic sulfide ore deposits have been formed.

Aplite is commonly associated with the quartz monzonite in forms of dikes and masses within the batholith and as irregular border deposits at its edges. Some of the masses are a few square miles in area. Knopf (1913a, p. 35) concludes that the aplite originated from the quartz monzonite magma by a process of fractionation during the period of cooling and consolidation.

The youngest igneous rocks are dacite and rhyolite; they are a bedded series composed of lava, tuff, and breccia. The most common variety of dacite is a porous ash-grey rock consisting of numerous crystals of plagioclase feldspar and quartz with scattered flakes of biotite. The largest exposures of the late volcanics are just west of Wickes and in an area extending from Basin south to Butte. Flows of rhyolite in the form of lava and lava breccias, and also obsidian, occur at a number of places in the northern part of the county. Like the dacite, the rhyolite is younger than the quartz monzonite. The relative age of the dacite and rhyolite is uncertain. Neither the early nor late rhyolites are very important as host rocks of metalliferous ore deposits, but are genetically related to younger ore deposits.

ORIGIN

It is generally conceded that the ore deposits of the Boulder batholith and adjacent areas are genetically related to the batholith itself, or to the magma that produced it, but there is some difference of opinion as to the mechanics of the formation of the deposits. There is no question but that the Boulder batholith crystallized from a molten state, but it is inconceivable to the writer that this huge mass of granitic rock, the present outcrop area of which is approximately 2,000 square miles, all could have been in a molten state at one and the same time. A molten mass of that size could not have supported the few thousand feet of heterogeneous sediments and lava flows that composed the roof rock. The roof would have collapsed and the batholith would have spread out as a huge lava flow. A more logical explanation is that the batholith was intruded and solidified in overlapping stages and that each stage occurred at a slightly different time. Such a procedure would prevent collapse of the relatively thin roof and also account for the segregation of metalliferous deposits into districts. Some supporting evidence for such a theory is found in the fact that the granitic rock is not uniform in mineralogic composition or texture throughout the batholith (Sahinen, 1959, p. 134).

Regardless of the mechanics of intrusion, we can proceed to a discussion of the ore deposits themselves. As a stage cooled, it began to crystallize first along the chilled borders as diorite or granodiorite. As the more basic minerals crystallize, the remaining magma of a stage becomes more siliceous progressing from diorite through granodiorite, quartz monzonite, and aplite to quartz porphyry in places. Billingsley and Grimes (1918) describe several phases for the period of granitic intrusion, namely: the granite phase, the aplite phase, and the quartz porphyry phase, with ore deposition in each phase. The final stage would be pure quartz, and masses of magmatic quartz are not uncommon. As a granitic mass cools, it shrinks, causing cracks and fissures which extend outward from the granitic mass into the roof-rock. Fissures were also formed by exterior forces acting on the batholith. If these cracks and fissures extend to the depth of molten rock, they are immediately filled, and dikes are formed. Otherwise, they provide channelways for mineralizing solutions which could result in deposition of sulfide-bearing quartz veins. These solutions are the last liquid phase of the magmatic stage. All the solutions are not expelled in a single stage, for studies of the veins show different periods or surges of mineralization. These surges are due to changing conditions within the mass.

CLASSIFICATION

Excluding placers, the ore deposits of this area can be classified into 2 general groups: (1) the older group, and (2) the younger group. The older group is genetically related to the granite period, or to the granite-aplite phases of intrusion and were formed shortly after the igneous rocks solidified and were fractured. They are probably Eocene in age. Veins of the older group are all of the same geologic age, but are not necessarily con-

temporaneous — that is, they may have been formed in the same geologic "year," but not on the same geologic "day."

The older group can be further subdivided into magmatic depositsc, contact metamorphic deposits, and veins.

Magmatic deposits are rare. Billingsley and Grimes (1918, p. 297) cite the Spring Hill mine near Helena as an example, but Pardee and Schrader (1933, p. 207) cite the same mine as an example of a contact metamorphic deposit. Knopf (1913b, p. 42) classifies the Golden Curry deposit at Elkhorn as a segregation of pyrrhotite, chalcopyrite, and augite in quartz monzonite.

Contact metamorphic deposits are found in the Elkhorn district, where 2 deposits were exploited for iron as smelter flux.

The older veins are by far the most important deposits in the area. They have been formed along fissures that served as channelways for ore-bearing solutions. They are further classified according to their mineral content, both as to ore minerals and gangue minerals. They may be classed as gold veins, silver-lead veins, or lead-zinc veins, depending on the preponderance of the different metals. In some, sericite is the principal gangue mineral. Sericite is an extremely fine, scaly form of muscovite mica formed by the hydrothermal alteration of the granite. Some have a tourmaline gangue, the tourmaline probably having been introduced into the vein systems slightly ahead of the sulfide mineraliztaion. The sulfide mineralization is thought to have continued after the tourmaline deposition ceased, and some veins are entirely devoid of tourmaline. Ankerite is another typical gangue mineral.

Billingsley and Grimes (1918, p. 312) examined a great number of veins in the area and found a vertical zoning of ore minerals in the veins with a zinc zone between a lead zone above and a lean copper zone below. Some veins may show the presence of all three zones, and such zoning is extremely well developed and conspicuous at Butte. In the primary sulfide ores, the lead is present as galena, the zinc as sphalerite, and the copper as tetrahedrite, bornite, and chalcopyrite. Some ores contain much arsenopyrite, and pyrite is universally present.

The younger group of veins are essentially gold and silver deposits in irregular fissure veins. They are represented as being genetically related to the rhyolite period of igneous activity and are consequently of late Tertiary (Pliocene?) age. Having been deposited relatively late in geologic time —after much of the batholith cover had been removed, exposing the batholith in places—the veins were formed at a fairly shallow depth and are characterized by minerals common to shallow deposits. Cryptocrystalline quartz (chalcedony) is the common gangue mineral, and its resistance to erosion often causes the veins to stand out as bold reefs. Lamellar calcite, often pseudomorphically replaced by quartz, occurs in places. Auriferous pyrite is the principal gold mineral; silver may occur native or as ruby silver. Uranium minerals occur locally.

Younger veins occur both within the batholith and in the sedimentary rocks surrounding it. Wall rock alteration is commonly sericitic, but is visibly different from that of the older group in that the feldspars remain as chalky white spots. Locally carbonates and chlorite are developed.

Some of the older veins were reopened and remineralized during the period of the formation of the younger veins, and becauseof this, some of the older veins (notably in the Wickes-Basin area) contain some uranium. However, uranium is definitely associated with the younger chalcedonic quartz veins that have produced small amounts of gold and silver. These uranium-bearing veins are found principally in the area from Clancy south to Boulder and Basin. The uranium occurs as primary uranite (pitchblende) and the secondary minerals, autunite, metatorbernite, zeunerite, rutherfordine, torbernite, gummite, phosphuranylite, uranocircite, and voglite. Autunite and metatorbernite are the most abundant (Roberts and Gude, 1953a and b). Brown limonites and black manganese oxide are always in surface and near-surface exposures, and where uranium occurs, the dark-grey chalcedonic quartz commonly shows a superimposed reddish-brown stain.

OXIDATION AND ENRICHMENT

Except the so-called "blind veins" that do not outcrop, all vein deposits in the area have been subject to a long period of erosion and oxidation. Erosion has removed a large part of many of the veins, and the gold contained in the eroded parts accumulated in placer deposits. The remaining portions have been oxidized to the ground-water level, which may have fluctuated considerably in past times.

Pyrite, being universally present in the primary ore, is oxidized to limonite, and as a result all outcrop ores are "iron stained" to different shades of yellow, brown, or red. Galena is usually oxidized to the carbonate, cerussite, or the sulfate, anglesite; however, galena is often found very near the grassroots, and the cerussite and anglesite may be found with cores of unaltered galena. Sphalerite usually goes into solution in the oxide zone and is carried away, although sometimes the zinc carbonate, smithsonite, is found coating other minerals. Copper sulfides are readily oxidized, and may stay in the oxidized zone as the green carbonate, malachite, or the blue-green silicate, chrysocolla; or it may be carried downward to be redeposited as secondary chalcocite or bornite. Chalcopyrite, the iron-copper sulfide, may oxidize to a

copper pitch consisting of a mixture of black copper oxide (tenorite or melaconite) and brown or red iron oxide ("limonite" or hematite). Gold-pyrite veins are usually enriched by oxidation and removal of the valueless material. Silver may be enriched by downward migration, and the grade may fall off as the sulfide zone is reached.

PLACER MINING

During the 5½ decades between 1902 and 1957, placer mining operations in Jefferson County recovered 109,629 fine ounces of gold and 39,628 fine ounces of silver with a combined value of $3,811,253. Average value per cubic yard of material treated was slightly less than 20 cents. Approximately 98 percent of the gold was produced and sold at $35 per fine ounce; in other words, the bulk of placer mining during this span of years was carried on after 1933. No records are available for production prior to 1902; however, it is estimated that about $1,200,000 in placer gold was produced from 1870 to 1902.

One of the earliest recorded placer-gold discoveries in Montana was at Montana City where a Mr. Hurlbut and his Negro companion noted the shiny yellow metal. The discovery took place about the middle of July 1862. However, it was not until July 14, 1864, when gold was discovered in Last Chance Gulch that the real influx of prospectors began. Between the 2 dates, discoveries at Bannack and Virginia City were made. The initial surge of placer mining was short-lived and by 1875 activitiy was at a low ebb.

A boost in gold prices from $20.67 per fine ounce revitalized the placer-mining industry in 1932. Average value of gold, in 1933, was $25.50 per fine ounce, and production increased to 1,360 ounces from 162 ounces in 1932. By 1934 the value of gold reached its present price of $35 per fine ounce and placer mining boomed, especially along Prickly Pear Creek where a large dredge was installed. Production records reflect the surge of activity, for between 1902 and 1932 only 2,433 ounces of gold were produced, whereas between 1932 and 1949, 107,196 ounces of gold were produced. Placer operations were restricted during World War II, hence there is no recorded production for the years 1943 to 1945. Placer gold production for the county by years since 1902 is given in table 8. Annual production of districts is given in seperate tables in Appendix C. Distribution of placer mining areas is shown in figure 3.

PRICKLY PEAR DRAINAGE

The placer gravels along Prickly Pear Creek have been the most productive of all placers in the county. However, large scale gold production did not begin until 1933 when Winston Bros. Co. installed a dragline dredge north of Clancy. The same company installed a Yuba connected-bucket dredge on the crek south of Clancy in 1938. The new dredge was electrically powered, the digging ladder was equipped with 88.6-cubic foot buckets, and gold recovery was affected entirely by Pan-

TABLE 8.—Production of gold and silver at placer mines, Jefferson County, Montana, 1902-57

Year	Material treated (cubic yards)	Gold (fine ounces)	Silver (fine ounces)	Total Value
1902-03	No production			
1904	—	83	11	$1,435
1905	—	290	55	6,019
1906	—	198	6	4,089
1907	—	143	24	2,966
1908	—	78	15	1,617
1909	—	287	51	5,966
1910	—	218	38	4,526
1911	—	209	39	4,339
1912	—	103	18	2,136
1913	10,000	102	18	2,122
1914	3,000	150	29	3,111
1915	—	61	13	1,274
1916	—	46	10	977
1917	—	36	12	753
1918	—	26	8	538
1919	—	5	1	108
1920	—	5	12	605
1921	30	50	14	1,051
1922	—	12	3	254
1923	—	10	5	217
1924	—	37	14	782
1925	—	18	7	385
1926	2,300	29	9	610
1927	—	5	1	94
1928	—	9	2	184
1929	36	7	—	137
1930	266	16	—	324
1931	—	14	—	287
1932	2,200	162	50	3,373
1933	163,460	1,360	283	28,214
1934	474,217	4,052	871	142,192
1935	430,498	2,732	647	96,086
1936	341,761	3,116	909	109,757
1937	2,067,493	10,276	3,541	362,399
1938	1,880,447	9,422	3,680	332,149
1939	2,920,566	16,529	6,597	582,993
1940	2,602,221	15,440	5,881	544,582
1941	2,713,297	13,511	5,012	476,449
1942	1,546,285	8,868	3,396	312,795
1943-45	No production			
1946	1,663,841	9,344	3,557	329,914
1947	1,645,748	8,870	3,389	313,517
1948	604,480	3,676	1,400	129,927
1949-57	No production			
TOTAL	19,072,146	109,629	39,628	3,811,263

American jigs; the new plant was placed in operation August 20, 1938. Both dredges operated continuously for a number of years. The dragline and floating washer were dismantled June 24, 1939 after all available ground had been worked, but the Yuba continued to operate until 1948 except for a few years during World War II. A dry-land dredge was placed in operation on the Dutton Ranch in 1938 and worked until May 1939. During the summers of 1958 and 1959 the Yuba dredge was operated by Lee & Ward Corp., but production ceased in August 1959.

Undoubtedly the bulk of placer-gold production as recorded for the Montana City and Clancy-

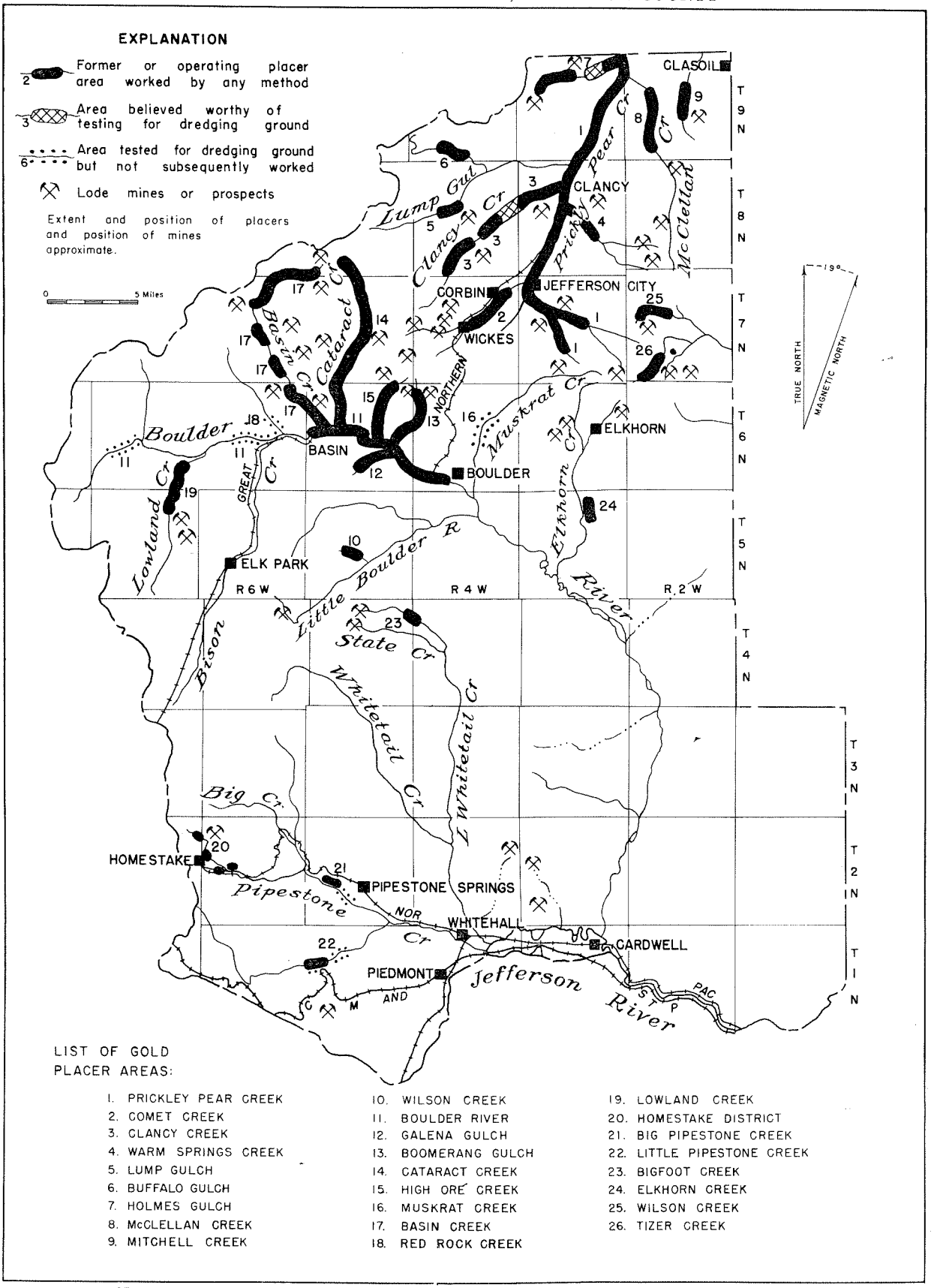


FIGURE 3.—Map showing location of gold placers in Jefferson County, Montana.

Lump Gulch districts came from Prickly Pear Creek. Coinciding with the installation of Winston Bros.' dredge north of Clancy, the Montana City records show a total production of 10,383 fine ounces of gold between 1932 and 1936. After 1936 gold production virtually ceased at Montana City, but the Clancy-Lump Gulch records show an increase of production from 26 ounces of gold in 1935 and no production in 1936 to 10,050 fine ounces in 1937. The Clancy-Lump Gulch district continued to be the major producer of placer gold in Jefferson County, which coincides with the operation of the Yuba dredge until 1948.

In 1937 Humphreys Gold Corp. dismantled a large portable screening and washing plant, dragline excavators, etc., in Colorado and reassembled the equipment on Clancy Creek, a northeast-flowing tributary of Prickly Pear Creek. It processed 1,433,445 cubic yards of gravel during a period of 7 months with a recovery of 5,551 fine ounces of gold. A second dry-land dredge worked gravels along Clancy Creek between 1940 and 1942. After the war a dry-land dredge and dragline dredge were operated on Clancy Creek by the Roger Gold Mining Co. Increasing depths of gravels caused the dragline to cease operation in 1946, and the dry-land dredge stopped production in 1947. Between 1937 and 1947 approximately 9,000 ounces of gold were recovered from the creek.

Lump Gulch, which intersects Prickly Pear Valley about a mile north of Clancy, has been worked intermittently.

A dry-land dredge operated for 20 days on the Weber placer along Buffalo Creek in 1939 and sluicing was carried on in 1930 and 1932.

The wider portions of Holmes Gulch have been worked by different methods. Early-day operations consisted of sluicing stream and bench gravels. During the late 1930's and early 1940's portions of the main gulch and a small tributary gulch were worked with dragline and dry-land dredges. The stream bed between the dredge working and the old sluicing grounds is considered by Lyden (1948, p. 46) to be ideally suited for dry-land dredging.

An unusual placer occurence is known on Beavertown Creek which joins Prickly Pear Creek about a mile south of Jefferson City. Here metallic copper nuggets occur in stream gravels, and early-day travelers noted that the buggy wheels and horses' shoes became coated with bright metallic copper when they drove through the stream. The deposit is described in greater detail in the Golconda district as the "Copper Nugget placer."

Small-scale placer mining has been carried on in several of the other tributaries of Prickly Pear Creek. Among these are Comet and Warm Springs Creeks. McClellan Creek, which joins Prickly Pear Creek about a mile south of the mouth of Holmes Gulch, has been worked intermittently for placer gold. However, according to Lyden (1948, p. 47), it is unlikely that gravel deposits on this creek are sufficiently large or rich enough to support a dredging operation.

Mitchell Creek has undoubtedly been the largest producer of placer gold in the McClellan-Mitchell district. Prior to 1939 ground sluicing was the predominant method of gold recovery, but in 1939 a stationary washing plant was built on the Lewis placer. It washed 35,000 cubic yards of gravel in 1939 and 1940 and recovered 302 fine ounces of gold and a little silver valued in all at $10,599.

BOULDER RIVER DRAINAGE

Boulder River drains a major portion of Jefferson County, and although placer-gold production from the river has not been extensive since 1902, several of its tributaries have contributed significant amounts of gold.

Unrecorded gold production prior to 1902 was undoubtedly large, for much of the river bottom has been claimed. Lyden (1948, p. 48) states that in 1939 a scraper and dry washer treated 7,350 cubic yards of gravel and recovered 63 ounces of gold. In 1940, 75 ounces of gold were recovered, probably by the same method. These 2 years constitute the most productive period since before 1902.

Lyden (1948, p. 48) brings out a significant point in the following paragraph, which may be the underlying reason for lack of recent production along the river.

"There are several places along Boulder River between Basin and Boulder that possibly could be worked profitably by a dry-land dredge. However, thorough tests should be made, especially to determine whether or not the boulders would be so numerous or large that profits would be lost in the expense of handling them."

Cataract Creek which flows into Boulder River near Basin has been placer-mined by hydraulic and sluicing operations. The gulches of Overland and Rocker Creeks have been the most productive, although placer claims cover the valley bottom of the main stream for about 10 miles upstream from its mouth.

Many of the creeks tributary to the Boulder River either have been worked sporadically or have been tested, but in general the results have not been encouraging and gold production has been small. Among these relatively non-productive creeks are High Ore, Muskrat, Wilson, and Red Rock as well as Galena and Boomerang Gulches. Perhaps the largest production came from Wilson Creek a tributary of Little Boulder River, where 2 operators in 1913 recovered placer gold valued at $946 (Lyden, 1948, p, 47).

Ruppel (1958) states that production of placer gold in the Basin district reached a maximum between 1868 and 1872, and 1870 the Basin Creek placers were the major producers of placer gold in Jefferson County. After 1872 placer mining was completely overshadowed by lode mining, but sev-

eral thousand dollars worth of gold was produced each year from the placer mines until 1890. From 1890 to 1932 the placer deposits were worked intermittently, but the value of the gold produced was small. In 1906 a small floating dredge was constructed to work the lower Creek placer. It ceased operation after a year or two. From 1933 to 1938, 845 fine ounces of gold were recovered from Basin Creek, and small amounts of gold were mined from several of the creeks until 1841. Small shipments of stream tin collected from 1932 to 1941 were made in 1939 and in 1941. In 1940 a dragline dredge was assembled on Basin Creek near the hull of the early dredge, but it was removed after one season.

Dredging has been carried on in several streams in the Boulder River drainage system. A small floating dredge was assembled on Basin Creek a short distance above Winter's Camp, but production data cannot be published.

A dry-land dredge on Lowland Creek recovered gold valued at $296,590 between 1938 and 1941. Strangely enough, for the earlier years, 1902 to 1937, placer operations were relatively unprofitable on the same stream. However, records are not sufficiently complete to evaluate placer mining success during the last half of the 19th Century. The total gold production from Lowland Creek far exceeds that of any other stream in the Boulder River drainage.

A short section of the east side of Elkhorn Creek was worked in 1940 by a dragline dredge. Although the plant treated 272,760 cubic yards of gravel, only 678 ounces of gold were recovered—less than 9 cents per cubic yard. An abundance of large boulders also contributed to the shutdown of this dredge.

OTHER PLACER MINING AREAS

Wilson and Tizer Creeks, tributaries of Crow Creek on the north flank of the Elkhorn Mountains, have both been worked in a desultory manner for placer gold. In 1947, a dry-land dredge was installed on Wilson Creek, and a portion of the creek has been worked.

Several placer mining operations have been carried on in the Jefferson River drainage near Whitehall and in the Pipestone-Whitehall area.

Various small creeks in the Homestake district have produced gold, but large boulders of quartz monzonite in all of the streams probably have prevented any large-scale mining. Total gold recovery from 1,100 cubic yards of material treated has been 40 ounces valued at $1,017.

Little and Big Pipestone Creeks have produced small amounts of placer gold. Little Pipestone Creek, the most productive, yielded 542 fine ounces of gold valued at $11,291 between 1902 and 1957, most of which was produced as the result of hydraulic mining in an area now traversed by U.S. Highway 10 near Cactus Junction. Big Pipestone Creek yielded only 22 fine ounces of gold valued at $612 during the same span of years.

The Whitehall-Cardwell district has produced 293 fine ounces of gold and 30 ounces of silver with a value of $6,244.

TIN-BEARING PLACERS

Ruppel (1958, p. 175-176) has described the tin-bearing placers of the Basin quadrangle in detail. The following is a condensation of his description:

"Wood tin, a nodular variety of the tin oxide mineral cassiteriate, has been found in the gravels of several creeks in Jefferson County. Tenmile, Clancy, and Basin Creeks, which have their headwaters in rhyolitic rocks, all contain cassiterite. In certain sections the cassiterite was abundant enough to clog the riffles in the sluice boxes. A total of about 3,000 pounds cassiterite was shipped from the Basin Creek placers in 1939 and 1941."

"The cassiterite occurs as rounded masses and angular fragments in the gravels, and where the gravels are undisturbed the mineral usually occurs in the lower few feet of the beds."

Several hypotheses have been advanced to explain the presence of cassiterite. Knopf (1913a, p. 45) suggested that the mineral was derived from erosion of oxidized lode deposits that contained slightly stanniferous (tin-bearing) sulfides. Brinker (1949, p. 26-30) concluded that the placer cassiterite was derived from cassiterite in the rhyolite, and Ruppel suggests that the tin oxide was transported from rhyolitic rocks as a colloid, or in solution, and deposited in the gravels by flocculation or precipitation.

Although cassiterite-bearing veins have not been found near the vicinity of the placer deposits, a few spectrographic analyses have revealed minor amounts of tin locally in the rhyolite flow rocks west of the Josephine mine on the headwaters of Basin Creek near the Continental Divide, and small amounts of stannite, a copper-iron-tin sulfide, have been observed in ores from the Morning Glory mine on Cataract Creek.

DESCRIPTION OF MINES AND PROSPECTS

ALHAMBRA-WARM SPRINGS DISTRICT

The Warm Springs district is 10 miles southeast of Helena, west of the Prickly Pear valley, and is traversed by the Butte-Helena highway and Great Northern Railroad. Alhambra (pop. 40) is the largest community in the district. To the east, the district encompasses an area drained by Warm Springs Creek and its tributaries. Altitudes range from 4,100 feet on Prickly Pear Creek to 7,900 feet in the upper reaches of the Warm Springs drainage. The topography is characterized by mature well-rounded mountains that locally have steep but not precipitous slopes. The mountains are for-

ested with lodgepole pine, fir, and spruce. Timber for mine support is therefore available as well as water from the streams for milling purposes.

The bedrock is mainly quartz monzonite. Aplite occurs in dikes and large masses (segregations). Pegmatite and granite porphyry are common and rhyolite is present. Sedimentary rocks are absent. Ore deposits include placers as well as lodes of 2 ages, Late Cretaceous or early Tertiary, and late Tertiary. The older lodes are vertical east-trending quartz veins carrying pyrite and chalcopyrite with some galena, sphalerite, and arsenopyrite. Some deposits contain molybdenite and tourmaline. The younger lodes are characterized by a chalcedonic quartz gangue which causes conspicuous outcrops. The ore minerals are sulfides of silver, copper, lead, zinc, and iron. The placers in the districts were largely exhausted by 1875 but a little placer gold is reclaimed by reworking the bedrock and small patches of gravel.

The yearly production of the district since 1902 is shown in table 9. Annual data for individual mines are given in Appendix B. Claim map of part of Alhambra-Warm Springs District is seen on figure 4.

B & G

The B & G Eagles Nest and R. P. Bland claims owned by George M. Hoffman, Helena, were located on what appears to be the western extension of the vein on the White Pine claim. The 3 claims (M.S. 9022) are in sec. 31, T. 8 N., R. 2 W.

Production from the B & G for the years 1910, 1934, and 1936 totals 85 tons of ore yielding 80 ounces gold, 1,430 ounces silver, 1,832 pounds copper, and 18,756 pounds of lead; and from the Eagles Nest for 1910 and 1939, 27 tons ore yielding 23 ounces gold, 234 ounces silver, 147 pounds copper, and 1,836 pounds lead.

The mine workings consist of 2 adits, 100 feet and 200 feet in length, together with 2 shafts 90 feet and 250 feet in depth. The extent of the underground workings is estimated at about 1,200 feet; they are now inaccessible.

The vein is vertical and strikes N. 80° E. It can be traced by the alignment of surface workings for about 3,000 feet. The thickness of the vein in old surface trenches ranges from 1 to 6 feet. The granite on each side of the vein is softened and somewhate bleached. Cerussite, iron pyrite, and arsenopyrite are present in some of the mine

TABLE 9.—Production of gold, silver, copper, lead, and zinc from lode mines, Alhambra, Warm Springs district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902	No production						
1903	36	75	437	—	—	—	$1,753
1904	15	19	86	—	—	—	430
1905	321	189	843	—	19,000	—	5,305
1906	1,819	1,660	22,542	19,503	155,319	—	62,028
1907	5,020	6,379	54,192	50,369	190,603	—	187,801
1908-15	No production						
1916	7	2	281	150	698	—	580
1917	No production						
1918	24	5	633	—	10,272	—	1,473
1919-33	No production						
1934	7,001	526	1,881	550	16,919	—	20,269
1935	18,179	1,868	6,994	3,227	65,950	—	73,316
1936	18,240	1,658	7,308	2,228	73,630	—	67,275
1937	10,134	933	6,181	4,000	46,000	—	40,634
1938	14,364	1,692	13,713	21,653	131,587	—	76,260
1939	264	216	856	923	2,915	—	8,374
1940	18	22	76	—	460	—	847
1941	61	16	284	—	1,000	—	819
1942	77	72	329	300	1,600	5,000	3,362
1943	24	50	149	100	400	—	1,899
1944	7	—	28	—	400	—	52
1945-46	No production						
1947	24	4	53	100	600	900	399
1948	119	36	1,022	500	18,400	4,600	6,200
1949	No production						
1950	59	4	85	100	200	500	336
1951	No production						
1952	9	1	81	—	839	1,042	416
1953-55	No production						
1956	1	—	3	—	—	—	3
1957	No production						
TOTAL	75,823	15,427	118,057	103,753	740,792	12,042	559,831

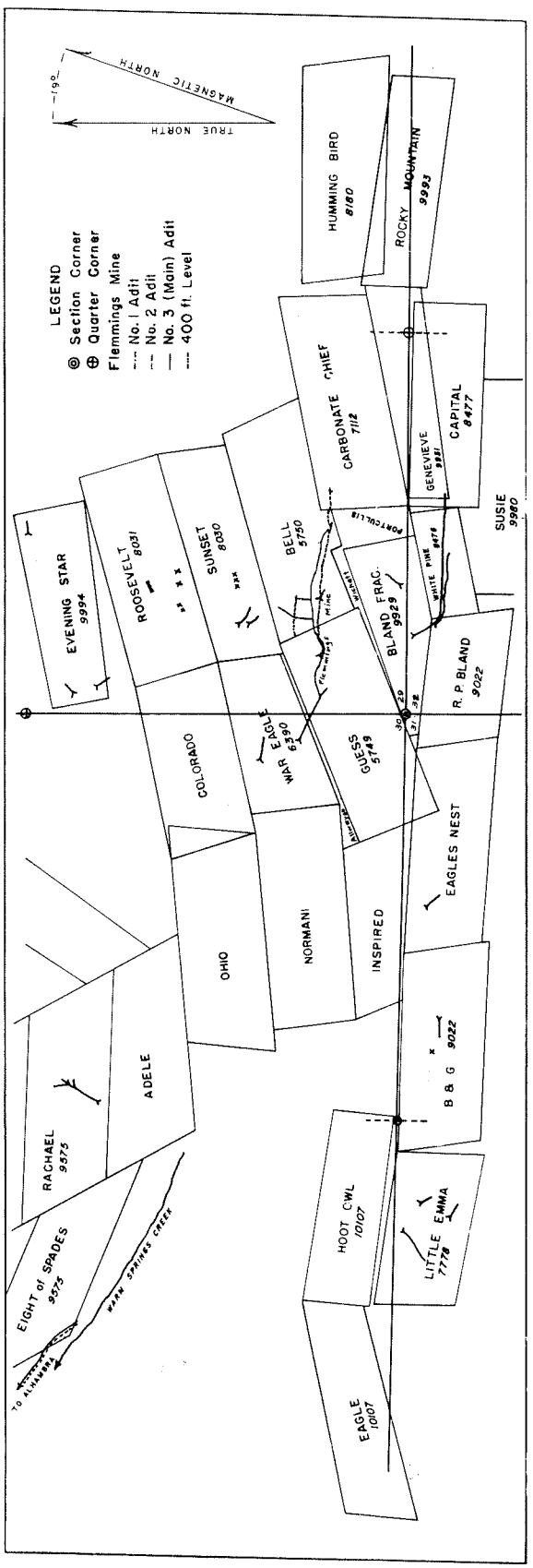


FIGURE 4.—Claim map of part of Alhambra-Warm Springs district, Jefferson Co., Montana.

dumps. No sphalerite was observed, but the ore from the nearby White Pine mine contains considerable zinc. The gangue is principally quartz. Pardee & Schrader (1933, p. 229) report the occurrence of molybdenite in the Eagles Nest vein and also mention a test shipment from this mine which netted more than $40 per ton.

Badger

The Badger claim in sec. 13, T. 8 N., R. 3 W. was operated intermittently from 1915 through 1947. In 8 of the years during the period it produced 195 tons ore which yielded 72 ounces gold, 2,893 ounces silver, 915 pounds copper, 79,740 pounds lead, and 469 pounds zinc.

Katie

In 1934, the Katie mine, near Blue Grouse Creek, reported production of 13 tons ore yielding 644 ounces silver, 9 pounds copper, and 81 pounds lead. The property was operated by the Alhambra Gold Mines, Inc., in 1939 and 1940, and a small amount of gold ore was shipped crude to smelters.

Legal Tender

The Legal Tender (M.S. 58A) was probably the first lode mine to operate in the region. The Legal Tender mine, owned by the Anaconda Co., Butte, is about a quarter mile east of Clancy, in secs. 9 and 10, T. 8 N., R. 3 W.

The lode was discovered in 1866 but was not developed until 1872 (Raymond, 1873.) The mine was opened by a 160-foot shaft and an 80-foot shaft, both of which are now caved. The extent of the underground horizontal workings is estimated by the size of the dump to be about 1,000 feet. The sorted ore was hauled by wagon to Corrine, Utah, and shipped from there by railroad to San Francisco, and in turn shipped to Europe for smelting. The value of the ore is said to have ranged from $120 to $870 per ton. The total production for 5 years between 1909 and 1927 was 450 tons ore, which yielded 4 ounces gold, 38,471 ounces silver, 77 pounds copper, 11,312 pounds lead, and 11,833 pounds zinc.

The shafts were sunk on aplitic lenses in granite that strike N. 75° to 80° E. The dip of the aplite is vertical. South of the workings 15 to 30 feet is an outcrop of chalcedonic quartz 8 to 12 feet thick. In places the quartz is stained with manganese oxide. A shallow pit was sunk to a depth of about 6 feet on the south wall of the quartz vein. Exposed on the wall of the pit is a veinlet half an inch or less in thickness, which in places contains galena and tetrahedrite. A chip sample of the vein filling assayed as follows: gold, 0.02 ounce per ton; silver, 80.4 ounces per ton; lead, 5.7 percent.

M'Cormick

The M'Cormick prospect, on the east side of Warm Springs Creek valley, is on a deposit of pyrite, sphalerite, and galena. The sphalerite, which

is abundant, contains small inclusions of pyrrhotite, whereas the galena encloses grains of arsenopyrite and quartz. Of particular interest is the observation that covellite ocurs in veinlets in galena. (Pardee & Schrader, 1933, p. 230.)

Mocking Bird

The Mocking Bird mine, on the north fork of Warm Springs Creek, near the Bell and Carbonate Chief, was operated in 1907 and 1908. During the 2 years, 957 tons ore was produced, yielding 966 ounces gold, 10,325 ounces silver, and 686 pounds copper. It was developed by a vertical shaft 250 feet deep.

Newburgh (Fleming)

A number of claims near the head of the middle fork of Warm Springs Creek were exploited from about 1895 to 1910. Included in this group are the War Eagle, Bell (M.S. 5750), Humming Bird, Flemming, and Carbonate Chief (M.S. 7112). The mine workings, which total a mile or more of drifts and crosscuts, are inaccessible. Old maps suggest that these mines may all be on the same east-striking vein system. Figure 4 shows a portion of this property in sec. 29, T. 8 N., R. 2 W.

In 1934 the Newburgh Min. and Mill. Co. was organized. This company reopened and explored some of the workings and built a flotation mill to concentrate the mine dumps. In 1934, nearly 7,000 tons of gold ore from the Fleming dumps were treated by gravity concentration and flotation. The company continued to operate the Fleming mine until late in 1938. In 1937, nearly 1,000 tons of gold concentrates were shipped, and in 1938, 1,500 tons of concentrates and 316 tons of crude ore were shipped to smelters. From 1934 through 1939, inclusive, 67,352 tons of ore were shipped from the Fleming dump. The ore contained 6,424 ounces of gold, 32,922 ounces silver, 29,903 pounds copper, and 101,105 pounds lead. In 15 years between 1902 and 1935 (not continuous production), the Bell mine produced 3,663 tons ore yielding 4,310 ounces gold, 29,533 ounces silver, 15,248 pounds copper, and 101,105 pounds lead. Between 1905 and 1913 the Carbonate Chief produced 6,575 tons ore with 8,055 ounces gold, 66,037 ounces silver, 76,364 pounds copper, and 403,584 pounds lead.

The mine workings are in quartz monzonite at the eastern margin of the Boulder batholith. The andesite contact is about three-fourths of a mile east of the workings. Half a mile north of the workings is a mass of rhyolite known as Lava Mountain. Many of the mine dumps contain scattered pieces of obsidian. It was state locally that often a thin dike of obsidian accompanied one wall of the vein. Ore minerals from the vein consist of galena, chaycopyrite, arsenopyrite, and pyrite in a gangue of quartz. The ore contains considerable gold and silver.

Sullivan

A prospect about 250 feet north of Alhambra Hot Springs, reportedly owned by M. J. Sullivan (1933), is on 3 nearly parallel veins, 1 to 5 feet wide, containing 1- to 2-inch streaks of pyrite, galena, and chalcopyrite in quartz. The veins, associated with an aplite dike in normal quartz monzonite, strike N. 60° E. and dip 60° to 70° SE.

White Pine

The White Pine property, consisting of 3 patented claims owned by George M. Hoffman, Helena, is about a quarter mile south of the Fleming mine. The property consists of the White Pine (M. S. 8476), Capitol (M. S. 8477), and Genevieve (M. S. 9931) in sec 32, T. 8 N., R. 2 W.

The White Pine group produced a total of 255 tons ore containing 36 ounces gold, 4,426 ounces silver, 928 pounds copper, 82, 894 pounds lead, and 52,196 pounds zinc in the years 1908, 1909, 1917, 1928, and 1929.

The mine workings consist of a 1,200-foot adit and a 300-foot adit. In 1943 a crosscut was started from the nearby Fleming mine to cut the White Pine vein about 250 feet below the bottom adit. However, this crosscut never reached its objective.

The vein occupies a vertical fissure in granite that strikes east. The ore consists of galena, sphalerite, iron pyrite, chalcopyrite, and arsenopyrite in a gangue of quartz. The White Pine ore contains less gold and more lead and zinc than the ore from the Carbonate Chief, War Eagle, and Flemming mines to the north. Pardee & Schrader (1933, p. 229) cite an ore assay of 30 ounces of silver, a little gold, and 18 percent of lead and zinc.

AMAZON DISTRICT

The Amazon district is 6 miles north of Boulder. It lies in secs. 32, 33, and 34, T. 7 N., R. 4 W. and in secs. 3, 4, 5, 6, 8, and 9, T. 6 N., R. 4 W. Portal is a station on the Great Northen Railway (at the entrance to the Wickes tunnel). The district is bordered on the east by the Butte-Helena highway and on the west by a ridge between the High Ore and Upper Amazon Creek drainage. The northern boundary is an arbitrary east-west line between Portal and Amazon.

The district lies along the western side of the broad Boulder Valley, gently sloping to the east and south. The topography is characterized by well-rounded hills, and the elevation within the district averages between 5,000 and 6,000 feet. The district is well timbered with pine and spruce, but very little water is available for milling, except for Boomerang Creek, 2 miles to the southwest.

The bedrock consists of the quartz monzonite of the Boulder batholith overlain by andesite. Both andesite and quartz monzonite are cut by rhyolite dikes. Veins of the district are considered to be

eastward extensions of the Comet and Rumley veins. The ores are complex, carrying gold, silver, and lead, with a little copper and arsenic.

The district was most active from 1872 to the late 80's. The Australia, Australian, Bismark, Magna Charta, Paul Jones, Amazon, Spencer, and Robert Emmet were the most productive mines prior to 1885.

Patented claims of the Amazon district are shown on plate 1 (in pocket). The yearly production of the district since 1902 is shown in table 10. Annual data for individual mines are given in Appendix B.

Amazon

Knopf (1913a, p. 120) describes this property as follows: "The Amazon mine is on the west side of Boulder Valley, 4 miles north of Boulder. The country rock is granite. The ore contains much sphalerite and galena, with a small amount of chalcopyrite and pyrite in a quartz gangue." An earlier report (1872) mentions a 5- to 10-foot vein of galena and brown carbonate, assaying $150 in silver and 65 percent lead.

In 1882, a Mr. Nave built a mill at Boulder to treat Amazon ore. Ore milled consisted of red iron oxide containing gold and a soft silver-lead ore. The

TABLE 10.—Production of gold, silver, copper, lead, and zinc from lode mines, Amazon district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902-05	No production						
1906	145	16	2,101	750	3,757	—	$2,102
1907	No production						
1908	55	7	1,095	200	18,811	—	1,517
1909	74	11	1,245	1,329	21,155	—	1,968
1910	56	10	553	951	8,456	—	996
1911	212	152	3,284	5,677	22,176	—	6,585
1912	366	77	3,460	3,249	52,860	—	6,631
1913	130	41	890	1,216	12,570	—	2,126
1914	No production						
1915	80	53	1,201	—	11,345	—	2,240
1916	81	6	1,400	2,943	8,500	—	2,346
1917	246	28	3,267	—	15,555	—	4,619
1918	133	26	1,887	60	6,414	—	2,900
1919	99	8	1,461	288	24,994	—	3,189
1920	23	2	365	316	6,314	—	994
1921	58	10	251	424	2,556	—	627
1922	174	39	3,340	427	1,535	—	4,282
1923	583	106	9,995	554	3,967	—	10,744
1924	118	13	1,509	1,951	12,203	—	2,521
1925	188	32	5,357	298	26,232	—	6,697
1926	52	13	1,191	305	7,771	1,554	1,787
1927	89	15	1,164	455	24,463	—	2,563
1928	42	8	647	346	11,607	—	1,275
1929	59	12	931	724	18,107	—	2,010
1930	No production						
1931	5	1	95	24	1,390	—	92
1932	No production						
1933	39	13	883	438	8,108	—	897
1934	28	8	512	75	5,919	—	837
1935	272	36	3,520	8,434	5,275	—	4,713
1936	161	22	1,756	4,978	3,652	—	2,777
1937	264	37	2,552	2,000	5,000	—	3,806
1938	63	8	478	41	2,674	—	716
1939	127	33	1,457	211	16,787	—	2,955
1940	275	69	3,614	381	38,600	—	6,958
1941	85	22	1,291	600	13,300	—	2,517
1942	152	10	841	1,200	10,600	—	1,803
1943	317	35	1,748	3,200	18,000	—	4,234
1944	No production						
1945	59	13	630	1,000	5,500	3,200	1,879
1946	75	12	542	1,000	4,500	3,000	1,876
1947	48	—	253	700	1,800	2,300	899
1948	No production						
1949	60	3	379	—	800	—	574
1950	3	—	42	—	400	100	106
1951	236	17	2,212	1,800	16,100	3,700	6,491
1952	67	12	284	—	4,000	482	1,401
1953	79	7	916	900	10,200	8,200	3,611
1954-57	No production						
TOTAL	5,478	1,043	70,599	49,445	493,953	22,536	119,861

mill had been adapted to treating such ores. Later in 1884 this mill was used as a customs mill to treat ore from other mines, such as the Boulder Chief and Silver Butte, but the mill was found to be too limited in capacity and too remote from the mines to admit hauling the ores for reduction.

Total production from this mine for 11 years between 1915 and 1939 was 234 tons ore containing 49 ounces gold, 1,892 ounces silver, 569 pounds copper, and 28,713 pounds lead.

Australia

The Australia (M. S. 556), in secs. 31 and 32, T. 7 N., R. 4 W. and presently owned by Justin, Jr. and Georgia M. Bourquin of Butte, lies west of the Australian and was developed by 2 adits and a 70-foot shaft. The ore averaged .005 to 0.47 ounces of gold per ton.

In 1872, the mine is reported to have exposed a 2- or 3-foot vein of iron and lead ores assaying $60 to $150 per ton; 60 tons of ore were shipped. No production has been reported since that time.

Australian

The Australian (M. S. 397) in sec. 31, T. 7 N., R. 4 W., presently owned by the Bannock Trading Co. of Boulder, was developed by 2 shafts about 60 feet deep, which were sunk about 200 feet apart on the outcrop of an east-west vein. On the eastern side an adit was driven along the vein in a westerly direction. An average sample of the quartz vein material on 2 dumps assayed as follows: gold .075 ounces and silver 11.0 ounces per ton, with about 1.10 lead and zinc and a small amount of arsenic. The width of the vein is reported as 60 feet.

Eight years production between 1908 and 1951 amounted to 692 tons ore containing 122 ounces gold, 8,999 ounces silver, 3,613 pounds copper, 76,-783 pounds lead, and 21 pounds zinc.

Bismark

The Bismark (M. S. 322) is in sec. 32, T. 7 N., R. 4 W. and is owned by Charles and Lillian Haupt of Long Beach, Calif. The quartz vein is strong and continuous, and was developed by several adits driven to the east during the period between 1873 to 1892. Ore was mined from a drift 200 feet long at a depth of 50 feet. The ore averaged 0.25 ounces gold and 19.0 ounces silver per ton; with lead, 8.9 percent; zinc, 6.4 percent; and a small amount of copper. An early report (1872) mentions a "4-foot vein of galena and milling ores," from which 40 tons had been shipped.

Between 1922 and 1938 (11 producing years) the total production came to 1,342 tons ore containing 258 ounces gold, 23,721 ounces silver, 540 pounds copper, and 28,840 pounds lead.

Bob Ingersoll

The Bob Ingersoll mine is in secs. 27 and 28, T. 7 N., R. 4 W. about 1,000 feet north of the west portal of the Wickes tunnel of the Great Northern Railroad. The property is owned by Robert D. and Dennis D. Claxton. The mine has not been worked for several years.

The mine is developed by an adit estimated to be 300 feet long and a number of shallow shafts, all of which are inaccessible. The vein is in aplitic quartz monzonite near an andesite contact. It strikes N. 80° E., and can be traced by the old workings for about 300 feet. Minerals in the dump material are principally iron pyrite with a small amount of arsenopyrite and fine-grained galena.

Golden Point

The Golden Point unpatented mining claim is 4 miles north of Boulder. It is across the ridge about a mile east of the Baltimore mine. The altitude at the property ranges from about 5,650 feet to 5,800 feet.

From 1936 to 1940 production totaled 288 tons ore from which were recovered 43 ounces gold, 4,154 ounces silver, 15,464 pounds copper, and 6,463 pounds lead.

The mine workings comprise 3 adits all of which were caved and inaccessible when visited. The lengths of the adits were estimated at 200, 350, and 150 feet. These adits explored the deposit through a horizontal range of about 350 feet and a vertical range of about 150 feet.

The vein, which is in quartz monzonite, strikes N. 80° E., its dip is vertical. It can be traced by old surface pits for about 2,000 feet. In the mine workings it ranged from 2 to 5 feet in width, according to Sandford Davis, Boulder, who holds the claim by location. Metallic minerals observed in rock fragments near the old mine ore bin included galena, iron pyrite, and chalcopyrite.

Pilot

The Pilot mine is 5 miles north of Boulder and a mile south of the small settlement of Amazon at the west portal of the Wickes tunnel. The property consists of 2 patented claims, Pilot (M. S. 1177) and East Pilot (M. S. 4315) in sec. 4, T. 6 N., R. 4 W. The property is owned by Jeanette Taylor of Richland, Wash., and Ellen Augusta Donovan of Carmel, Calif.

Total production for the 4 years 1906, 1924, 1931, and 1949 amounted to 237 tons ore containing 24 ounces gold, 2,979 ounces silver, 1,226 pounds copper, and 7, 697 pounds lead.

The mine workings comprise 2 shafts whose depths are estimated at 100 feet and 200 feet. The level workings from these shafts, which are inaccesible, are estimated to aggregate about 500 or 600 feet of drifts and crosscuts.

The deposit is along an eastward striking vein in quartz monzonite. The vein has ben explored

through a horizontal range of about 500 feet. It occurs in a bleached zone, 8 to 10 feet wide, in the quartz monzonite. The only metallic mineral noted on the shaft dumps was iron pyrite. The gangue is quartz.

Robert Emmet

The Robert Emmet mine is about 2 miles south of Wickes in sec. 27, T. 7 N., R. 4 W. It is just south of the summit of the ridge that divides the drainage of Prickly Pear Creek and Boulder River. The owner is F. R. Van Sickle of Fort Harrison. The altitude in the vicinity of the mine workings is about 5,750 feet. The mine was one of the first in the vicinity to be equipped with electrical machinery. Electrical power was supplied by the United Missouri River Power Co. from a plant at Canyon Ferry on the Missouri River.

Total production from underground mining in 1916, 1926, and 1953 plus dump shipments in 1947 was 122 tons ore, from which 1 ounce gold, 1,151 ounces silver, 2,711 pounds copper, 5,897 pounds lead, and 7,356 pounds zinc were recovered.

The mine was visited in 1911 by Knopf (1913a). At that time the shaft was 470 feet deep, with levels at 200 and 350 feet. When visited during the summer of 1950, all of the mine openings were caved and the workings inaccessible.

The vein occupies a vertical fissure in quartz monzonite that strikes N. 60° W. It appears to have been explored for a distance of about 300 feet. Ore minerals on the dumps include galena and dark sphalerite in a quartz gangue. Considerable iron pyrite is ascociated with the ore minerals.

BASIN-CATARACT DISTRICT

The Basin-Cataract mining district lies north and south of the town of Basin. The district is drained by Cataract Creek and Basin Creek and their tributaries on the north, and on the south by Kleinschmidt and Galena Gulches. Traversing the district are the Butte-Helena highway and the Great Northern Railway.

Altitudes range from 5,200 feet in the valley of the Boulder River near Basin to 7,869 feet above sea level on Pauper Mountain near the headwaters of Basin Creek. The area is drained by many permanent streams tributary to Basin Creek and the Boulder River. Water for mining and milling is plentiful. The mountain slopes are forested with lodgepole pine, fir, and spruce that would provide an adequate timber for mining purposes.

The rocks exposed in the Basin district are principally Cretaceous and Tertiary volcanic rocks and granitic rocks of the Boulder batholith. Ruppel (1958) states that the quartz monzonite and related rocks were emplaced at or near the close of Cretaceous time. Throughout most of the area, the roof of the batholith is at or near a single "stratigraphic" horizon in the Elkhorn Mountains volcanics. Early Tertiary erosion exposed the top of the batholith and produced a mountainous surface on which quartz latite was extruded in early Oligocene time. Miocene-Pliocene rhyolitic rocks were then extruded over the eroded surface of the latite. The present topography was formed by glaciation, and glacial deposits cover a large part of the area.

Ruppel (1958) classifies the mineral deposits as (1) disseminated deposits of auriferous pyrite; (2) base and precious metal-bearing quartz veins in east-trending fault zones; (3) placer deposits of gold and minor tin; and (4) nonmetallic deposits. Disseminated gold-bearing pyrite occurs in a breccia pipe in rhyolite at the Boulder mine. The base- and precious metal-bearing veins occur mainly in relatively distinct groups in the vicinity of Winters Camp on Basin Creek, at the head of Basin Creek, and on the north slope of Jack Mountain. The Jack Mountain and lower Basin Creek groups are the largest from the standpoint of ore production and number of veins, but most of the ore produced in each of these groups has come from 1 or 2 mines. Patented claims are shown on plate 1. Placer deposits occur below the area of rhyolitic outcrops on Basin Creek.

Rhyolite has been quarried near the Josephine mine, and a deposit of dumortierite on Jack Creek Ridge has been slightly developed.

The ore deposits comprise both older lead-zinc-silver fissure replacements and younger, low-temperature, gold-silver deposits. The former have been the more productive. A tendency toward zoning of the metals in the veins has been noted by Billingsley and Grimes (1918). This zoning is expressed typically with manganese oxide and galena, the chief metallic minerals in the upper portion of the vein, followed in depth by sphalerite and a decrease in galena with little or no manganese oxide; at additional depth the sphalerite-galena gives way to pyrite with some chalcopyrite. The relative importance of zoing in the region cannot be determined at the present time because of the inaccessibility of most of the workings and lack of geologic and assay maps.

Several of the veins are cut by post mineral faults but the displacement is generally not great. The one known exception is a fault that is said to displace the eastern extension of the Hope-Katie vein 820 feet to the north (Pardee & Schrader, 1933, p. 290). Few other fault systems in the region have been mapped in detail.

Lode production of the district by years is shown in table 11; placer gold and silver production by years is given in Appendix C.

Allport

Pardee & Schrader (1933, p. 296) describes this small mine, which was developed by a 110-foot

TABLE 11.—Production of gold, silver, copper, lead, and zinc from lode mines, Basin-Cataract district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902	4,705	660	121,541	30,395	491,320	—	$37,364
1903	4,124	319	97,616	45,000	120,000	—	62,569
1904	10,019	977	146,444	—	150,000	—	109,946
1905	11,117	1,408	133,029	150,693	181,529	—	141,506
1906	5,563	2,151	110,050	36,015	335,519	—	144,307
1907	3,372	5,090	100,814	10,457	396,702	—	194,878
1908	10,486	2,547	91,502	74,660	445,442	—	129,704
1909	2,910	2,155	66,563	37,733	60,397	—	86,655
1910	1,719	2,608	44,112	5,272	55,093	—	80,841
1911	2,058	519	23,045	5,208	226,928	—	33,811
1912	2,585	868	46,975	62,012	282,452	—	69,777
1913	3,444	836	67,600	103,544	606,861	—	100,845
1914	10,040	321	75,953	11,655	145,478	1,923,286	153,954
1915	1,190	363	24,801	14,959	156,849	19,796	32,504
1916	18,715	1,383	67,897	126,299	432,508	854,148	248,633
1917	22,183	2,475	152,977	186,043	1,063,054	3,509,184	677,356
1918	33,210	3,052	204,879	181,667	1,496,920	2,463,673	643,319
1919	11,761	3,299	144,799	175,661	832,982	374,356	334,503
1920	10,059	2,349	149,409	157,075	1,228,464	40,460	341,861
1921	1,661	400	37,065	14,402	164,609	—	54,592
1922	1,998	504	27,722	45,758	51,577	3,797	47,367
1923	412	108	8,126	9,142	24,833	—	11,973
1924	68,198	32,765	183,793	281,582	214,495	—	854,495
1925	67,155	11,135	161,817	161,577	685,799	348,376	451,581
1926	6,480	2,165	59,268	81,905	384,925	319,083	147,925
1927	925	277	17,585	9,385	131,673	158,988	35,391
1828	5,709	504	40,945	27,741	442,753	732,759	108,752
1929	20,044	1,587	164,580	143,125	1,718,719	2,593,437	425,160
1930	10,881	919	100,407	80,734	1,038,305	967,213	166,499
1931	49	128	76	—	250	—	2,686
1932	433	283	5,766	825	10,966	—	7,865
1933	49,974	1,508	44,477	55,141	92,378	4,881	53,893
1934	14,684	1,779	110,682	44,675	517,514	424,349	174,689
1935	76,086	4,546	367,022	224,024	2,454,100	2,058,636	630,253
1936	86,122	6,676	521,060	300,174	3,407,870	2,707,780	957,002
1937	75,320	6,204	439,757	282,000	3,892,000	2,086,000	956,632
1938	42,634	4,268	292,760	224,388	2,651,370	1,209,417	540,644
1939	63,517	6,125	403,889	278,952	3,343,383	2,140,500	785,986
1940	60,446	7,127	462,517	360,487	3,807,860	1,546,000	906,872
1941	12,830	1,877	133,920	74,800	709,800	186,000	224,162
1942	2,210	553	27,104	30,700	52,600	—	45,868
1943	5,087	426	23,376	14,100	230,000	51,500	56,178
1944	2,013	265	12,714	4,200	118,900	39,500	32,898
1945	1,126	142	15,840	2,400	70,000	18,000	24,648
1946	279	100	6,078	500	9,500	4,500	10,077
1947	2,448	157	9,894	4,100	39,400	35,800	25,101
1948	560	82	4,939	2,700	29,000	29,100	16,987
1949	1,197	135	7,688	2,900	44,700	38,200	24,054
1950	927	81	5,402	2,000	16,600	26,200	14,101
1951	336	50	2,581	4,600	9,500	8,500	8,389
1952	2,835	243	9,659	15,257	59,020	175,760	62,837
1953	1,019	262	3,592	3,300	12,000	11,600	16,274
1954	2,401	366	2,696	1,000	16,700	13,500	19,291
1955	415	2	645	—	31,200	14,600	7,099
1956	5,705	1,265	10,433	30,200	59,600	44,000	81,937
1957	2,171	646	7,419	4,400	21,300	18,300	35,818
TOTAL	865,547	129,040	5,603,300	4,237,522	35,293,697	27,201,179	11,700,309

shaft and a number of short levels. The vein, carrying bluish-grey cryptocrystalline quartz with minor pyrite and sphalerite, was said to be 5 to 6 feet wide on the 55-foot level. Quartz monzonite is the host rock for the vein which strikes N. 36° E. and dips vertically. No production is recorded.

Aurora

The Aurora mine is in the NE¼ sec. 2, T. 6 N., R. 6 W., at the mouth of Soul Haggerty Gulch on Basin Creek. The mine comprises 5 adits that crosscut to and drift along the vein (Ruppel, 1958). The 3 short adits on the east side of Basin Creek are inaccessible, probably none of them are more than 200 feet long and probably little, if any, ore was mined from this part of the vein. The two adits on the west side of Basin Creek were open in 1955, and the upper adit, which is about 500 feet long, was being worked at that time. Several

stopes above this upper adit have produced virtually all of the ore that has been mined from the Aurora vein. The lower adit is about 60 feet below the upper adit and is connected by an inclined raise; the vein at the level of this lower adit contains only pyrite.

Total production for 7 years between 1943 and 1956 was 2,058 tons ore which yielded 9 ounces gold, 3,080 ounces silver, 14,760 pounds copper, 111,000 pounds lead, and 114,262 pounds zinc.

According to Ruppel, the mine explores a vein 2 to 10 feet thick that occupies a fault zone that trends N. 80° W., dips 60° to 85° N., and cuts metamorphosed Elkhorn Mountains volcanics. At its east end the fault dies out in medium-grained medium-grey quartz monzonite. The vein is offset by numerous north-trending traverse faults of small displacement and is cut off by one of these faults at its west end in the present mine workings. The metallic sulfide minerals in the vein are disseminated and massive pyrite, sparse fine-grained galena, brown sphalerite, and sparse chalcopyrite. The gangue is massive grey quartz and white quartz.

Basin Bell (Latsch)

The Basin Bell (M. S. 9765) or Latsch property is 1½ miles north of Basin on Basin Creek. The property, consisting of 5 patented claims, is owned by Oscar and Minnie Latsch of Butte.

From 1919 and 1923 the Ardsley-Butte Min. Co. of Butte spent considerable money on development work at the property. It was reported locally that ore was shipped from these operations. Recorded production since 1907 has amounted to 107 tons yielding 3.52 ounces gold, 1,045 ounces silver, 7,467 pounds copper, and 11,867 pounds lead.

The mine workings consist of 2 adits with a combined length of about 1,000 feet. The workings were partly accessible in 1950; some were blocked by caves. The ore minerals, galena and sphalerite, are contained in quartz veins in granite.

Black Bear

One mile west of the Eva May mine and on the same vein structure is the Black Bear mine. The altitude is 7,620 feet, or almost a thousand feet above the Eva May adit. The Black Bear is credited with a total production of 504 tons ore which yielded 64 ounces gold, 557 ounces silver, 6,720 pounds copper, and 97 pounds lead. Output is for the years 1902, 1911, and 1917.

The mine was worked through a vertical shaft that is now caved. The workings aggregate several thousand feet as estimated by the size of the dump. Galena and sphalerite associated with considerable iron pyrite are the metallic minerals in the dump.

Boulder

The Boulder mine (M. S. 869) is in secs. 12 and 13, T. 6 N., R. 6 W. on the south slope of Pole Mountain, 1½ miles northeast of Basin. The property, consists of 1 patented and 5 unpatented claims. Formerly owned by the Basin Gold fields, Ltd., it has been acquired recently by James Bragg of Basin.

The earliest production reported was in 1881, when gold and silver ore valued at $24,000 was mined. The mine was inactive in 1882, and except for brief periods in the late 1890's and early 1900's remained inactive until 1931. Recorded production from the mine dates from 1931. This production to 1957 amounted to 4,425 tons ore that yielded 3,305 ounces gold, 8,527 ounces silver, 1,173 pounds copper, 4, 915 pounds lead, and 1,763 pounds zinc.

The mine workings include 2 adits, which together comprise about 8,000 feet of drifts and crosscuts. These workings explore the deposit through a horizontal range of 1,300 feet and a vertical range of 160 feet. Most of the underground workings are accessible.

The deposit consists of 3 or more fissure veins in quartz monzonite. The strike of the veins ranges from N. 68° W. to east-west; they dip steeply to the south. The vein has been intruded and split along its strike by a quartz latite dike about 500 feet long and 50 feet thick. Previous owners have reported vein width ranging from 8 inches to 30 feet (Gilbert, 1935, p. 27). The ore consists principally of hematite containing auriferous pyrite and free gold; chalcopyrite, galena, and sphalerite may occasionally be observed in massive grey quartz and brecciated and altered wall rock.

Boulder Chief

Three miles northwest of Comet in sec. 27, T. 7 N., R. 5 W. at an altitude of 7,520 feet is the Boulder Chief patented claim owned by John H. Shober of Helena and Margaret Evans.

A horse whim was used to hoist rock from the shaft. The property was once equipped with a gravity concentrator. The mill and hoisting machinery have all been removed. The shaft, said by the owned to be 19 feet deep, is caved at the collar. The workings comprise an estimated 1,200 to 1,500 feet of drifts and crosscuts.

From evidence of material on the dump, the caved deposit is in brecciated andesite near a contact with quartz monzonite. Old caved shallow workings east of the shaft show the strike of the structure to be N. 70° W.

Considerable material in the shaft dump has as its principal metallic constituent fine-grained galena disseminated in bleached silicified andesite; sphalerite is rare. A few tons of ore piled separately a few feet north of the shaft dump contain mostly sphalerite with little or no galena in a gangue of quartz.

Boulder Vestal

West of Big Limber Creek is sec. 9, T. 6 N., R. 5 W., about half a mile above the junction with Cataract Creek is the Boulder Vestal claim owned by H. F. Table.

It was reported locally that high-grade silver ore was mined from the property in the early days. In 1918 and 1919, the mine produced 46 tons ore which contained 29 ounces gold and 3,994 ounces silver.

An adit estimated to be 500 feet long explored and developed a vein in quartz monzonite striking N. 70° E. and dipping 80° S. The vein has been stoped to the surface for a distance of about 125 feet. The stope averaged in width about 2½ feet. The wall rock of the stope was only slightly altered.

The vein can be observed only in places where pillars had been left. In these pillars the vein consisted of fine-grained iron pyrite in a gangue of dense grey quartz. No silver minerals were noted, and the pillars may have been left in barren parts of the vein.

Buckeye (Boston)

The Buckeye mine (M. S. 374) is at the head of Basin Creek about 1½ miles south of the Josephine mine, or about 10 miles north of Basin. The property is in sec. 36, T. 8 N., R. 6 W. and is owned by M. R. Anderson of Butte. The vein was discovered in 1868 by C. K. Riale and the claim patented in 1875. The property was worked from 1863 to 1908, from a shaft 100 feet deep. According to Ruppel (1958) some ore was mined in 1882-1884, and the shaft was rehabilitated.

A few small shipments were made of ore valued at $15 per ton containing gold-bearing pyrite and minor quantities of silver-bearing galena. New machinery was installed in 1897, and from 1898 to 1901 the mine made apparently small but regular shipments of gold-bearing pyrite concentrates. The original shaft caved in late 1901, and 1902 a new shaft was sunk to a depth of 200 feet. A level was driven westward on the vein at that depth. The ore from this level was milled at the mine, and the concentrates were reportedly valued at about $30 per ton. The mine was closed in 1903 and briefly reopened in 1907-1908. It has been idle since 1908, except during World War II, when a small flotation plant was built to re-treat tailings from the former gravity concentrator.

Total Buckeye production for 12 years between 1902 and 1949 was 1,813 tons ore that yielded 309 ounces gold, 18,227 ounces silver, 3,425 pounds copper, 76,590 pounds lead, and 13,797 pounds zinc. Under the name of Boston, the mine produced 107 tons ore which yielded 9 ounces gold, 1,692 ounces silver, 23,886 pounds lead, and 489 pounds zinc.

The vein, where exposed near the surface in subsided workings, occupies a wide bleached zone in quartz monzonite; it comprises 3 to 5 feet of altered quartz monzonite and vein quartz. Metallic minerals in the dumps include pyrite, galena, and sphalerite in a quartz gangue. The vein strikes N. 85° and dips vertically. The gangue consists of massive grey quartz in which small amounts of tourmaline may ocassionally be observed.

Bullion

The Bullion mine (M. S. 5108), in secs. 13 and 14, T. 7 N., R. 6 W., is owned by the Bullion Min. Co., c/o Joseph P. Lyden of Joplin, Mo. The property consists of 2 patented claims, the Bullion and the West Bullion Ext. (M. S. 10199).

Ruppel (1958) states that the Bullion vein was discovered about 1882 and patented in 1897 when the major exploration and development work was started. In 1905, the mine was operated by the Cataract Copper Min. Co., which installed a 150-ton concentrator. The company also had a 200-ton smelter. In 1912 and 1913, the Northwestern Metals Co. operated the Bullion mine in conjunction with the Grey Eagle, Crystal, and Comet mines. During 1918 and several years after, it was operated by the Bullion Min. Co which shipped both copper ore and lead ore. In 1929, the Schmit- Bullion Min. Co., was organized to work the property, and about $10,000 was spent in new mining and milling equipment. A small flotation mill was installed. Several hundred tons of sulfide lead ore were treated in this plant by the company in 1930. The next reported shipments were made in 1937 and consisted of crude ore. The mine has been operated intermittently since that time. The 2 adits on the west side were opened in 1955, and the upper adit was actively worked. The total production for 25 intermittent years between 1905 and 1947 is 22,779 tons ore which yielded 3,564 ounces gold, 217,519 ounces silver, 426,241 pounds copper, 762,-990 pounds lead, and 2,847 pounds zinc.

The mine consists of 3 adits, a shaft started in 1882, and several stopes, crosscuts, winzes, and raises. The lowest adit extends eastward on the vein about 2,000 feet. From about 600 feet to 1,100 feet inside the portal the vein has been developed by 4 crosscuts, an inclined winze 100 feet deep on the vein, 2 inclined raises to the intermediate adit, and a stope 250 feet long. The intermediate adit is about 900 feet long and explores the vein through several short crosscuts into the footwall and by a stope 500 feet long. The intermediate adit is connected with the upper adit by inclined raises. The upper adit is about 350 feet long and has a few short appended crosscuts.

Ruppel states further that the Bullion vein is the western extension of the vein explored by the Crystal mine and occupies a fault zone that trends N. 70° W., dips 50° to 70° N., and cuts coarse-grained light-grey quartz monzonite. The vein ranges from a few inches to about 40 feet in thickness; it is thickest in the lower adit and thins to only a few feet at the surface. According to Knopf (1913a, p. 124) the metallic sulfides in the vein, in order of decreasing abundance, are pyrite, tetrahdrite, galena, dark-colored sphalerite, chalcopyrite, and arsenopyrite in a gangue of white

quartz and post-sulfide grey flinty quartz. Uranium is associated with late chalcedonic quartz and pyrite. The lower adit is known as the carbonate tunnel because of abundant siderite. The intermediate adit is called the sulfide tunnel because of the abundant pyrite.

Assay and smelter returns on the ore mined from 1935 to 1947 were: gold, .04 to .05 ounce per ton; silver, 3 to 5 ounces per ton; lead, 2 to 5 percent; zinc, 3 to 4 percent; copper, about 0.1 percent; and iron, 6.5 percent. The metal content of the vein decreases appreciably eastward, and near the face of the lower tunnel the vein is essentially barren of metallic sulfide.

Records and maps of the intermediate adit suggest that the typical ore grade at this level was about as follows: gold, 0.2 ounce per ton; silver, 9.0 to 9.5 ounces per ton; copper, 1 to 1.5 percent; and iron, 15 percent. The intermediate adit appears to have been mined for its precious metal and copper content; galena and sphalerite occurred only in small, although commonly high-grade pods.

Butte and Philadelphia

The Butte and Philadelphia prospect is on the flank of the Three Brothers peaks. In 1911 one of 3 parellel veins had been developed by a 250-foot adit. Pyrite, along with minor amounts of galena, sphalerite, and quartz, occurs in a 7- to 10-foot crushed zone in quartz monzonite. No production is recorded. (Pardee & Schrader, 1933, p. 294.)

Comet

The Comet mine is 6 miles northeast of Basin at the head of High Ore Creek. The altitude at the shaft collar is about 6,400 feet. The property is owned by R. H. Mills, Spokane, Wash., successor to the Basin Montana Tunnel Co.

This is one of the oldest mines in Jefferson County. The first attempt at large-scale operation was made by the Alta-Montana Co. about 1880. In 1883 the Comet mine and the Alta mine near Wickes, together with several others in the vicinity, were sold to the Helena Min. and Reduction Co. This company did extensive development work and increased the capacity of the concentrating plant from 35 tons to 120 tons per day. The wears from 1883 to 1893 were the most productive in the mine's history.

Many large mines in the vicinity were permanently closed in 1893 as a result of the silver panic, but the Comet continued to operate. In 1907, the Montana Consolidated Copper Co. (which also owned the Grey Eagle) deepened the Comet shaft to 600 feet. The mine was operated continuously for the next 20 years. In 1929 lessees shipped several cars of crude ore to smelters and 12,000 tons of milling ore to the Timber Butte mill in Butte. Shipments to Timber Butte were discontinued on October 1, 1930, when that mill was closed.

The Basin Montana Tunnel Co. was organized in 1926. This company acquired the Comet property, together with other claims in the Basin district, aggregating about 2,000 acres. The Comet mine was the principal operation. A 200-ton flotation mill was constructed at the Comet to treat ore from company mines as well as custom ore from other district mines. This operation flourished until 1941, when in April the mill was closed and later dismantled. Since that time operations have comprised small leasing activities.

Knopf (1913a) credits the Comet mine with a production valued at $13,000,000 prior to 1911. Since 1902, when the recording of production figures in greater detail was started by the U.S. Geological Survey, the Comet mine is credited with a production of 496,086 tons ore yielding 42,443 fine ounces gold, 3,117,779 fine ounces silver, 2,235,676 pounds copper, 28,535,228 pounds lead, and 23,486,020 pounds zinc.

The mine is opened by a 900-foot vertical shaft with 9 levels. Drifts and crosscuts on the upper 7 levels aggregate more than 20,000 lineal feet. Little development has been done on the 2 lowest levels. The mine was inaccessible when the property was visited in 1950.

Ore shoots in the Comet mine are enclosed in a zone of mineralized granite or grano-aplite about 150 feet wide striking N. 80° W. and dipping steeply north. The granitic zone has been highly sericitized and contains considerable tourmaline. The presence of tourmaline classifies the ore deposits as being in the older group as described by Knopf (1913a). This assumption is further verified by the fact that the deposit is cut by a younger dacite dike 35 feet wide.

Figure 5 shows the plan of the 300-foot level which contains the most development workings and a longitudinal section of the mine workings showing the general outline of stopes.

Individual ore bodies comprise stringers or bands of sulfides and quartz separated by altered granite or altered grano-aplite. Sulfide minerals include galena, sphalerite, pyrite, chalcopyrite, and rarely arsenopyrite.

Comstock

The Comstock group, 2½ miles east of Basin, includes 2 patented claims owned by Howard Johnson of Butte and 6 unpatented claims held by the partners Paul K. Williams of Helena, W. L. Sandquist and George Mayer of Basin.

The group has been prospected for a number of years and has made a small production of lead-silver ore. Interest recently has centered about a small but definite radioactivity in the ore. No production has been made for the uranium content.

The mine workings comprise a few shallow pits along the vein outcrop, a few shallow prospect

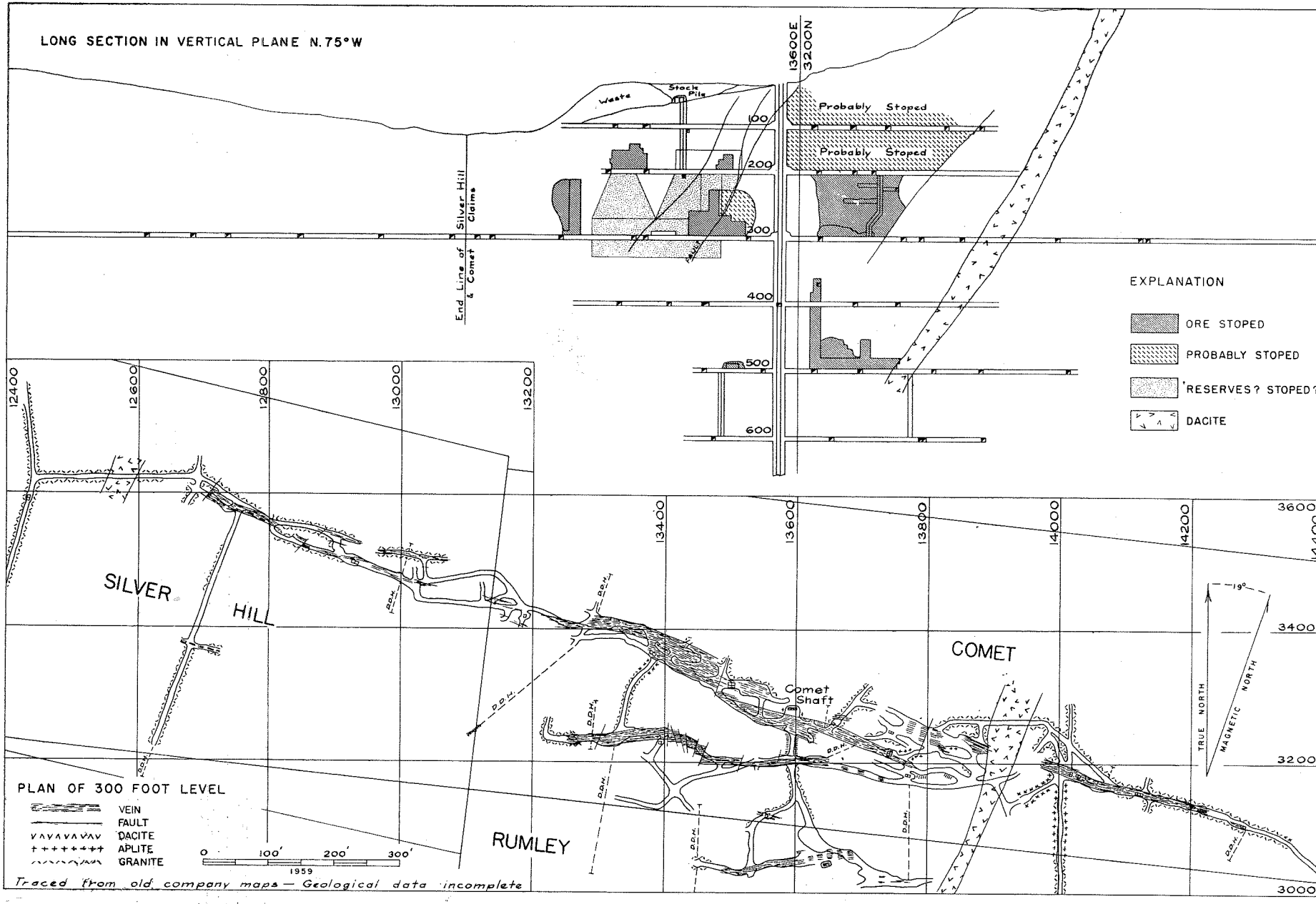


FIGURE 5.—Plan and section of Comet mine, Basin-Cataract District, Jefferson County, Montana.

crosscuts, and a main crosscut adit 90 feet below the vein outcrop. Altogether, there is about 400 feet of drifts and crosscuts. The workings are open and in good condition. The deposit is a northwesterly striking structure in fine-grained granite or grano-aplite. A northeasterly striking dacite dike cuts both the granite and the vein. The principal ore mineralization of the vein took place in the vicinity of the dike. A small ore body about 2 feet wide and 8 to 10 feet long was mined from surface to a depth of about 6 feet. The vein in the main adit workings ranges in width from 1 to 6.5 feet. The combined stope length on both sides of the dike is about 40 feet.

The visible ore minerals are cerussite and fine-grained galena in a gangue of quartz ranging from the normal crystalline to the chalcedonic variety. A small amount of pyrite is present. The radioactive mineral, torbernite, appears to be associated with chalcedonic quartz, galena, cerussite, sphalerite, limonite, malachite, azurite, and chrysocolla.

Copper King

Paradee & Schrader (1933, p. 296) described the Copper King as a prospect 3 miles northeast of Basin which was developed (in 1911) by a 125-foot tunnel and a 35-foot shaft. The narrow east-trending vein contains quartz, tetrahedrite, and pyrite. They further state that "a product containing 24 ounces of silver and $1.60 in gold to the ton and running 94 percent silica is obtained. This ore was shipped to copper smelters for use as converter lining, and a bonus of 15 cents was paid for each unit in excess of 75 percent silica."

Cracker (Mt. Thompson)

The unpatented Cracker claim is 5 miles northeast of Basin. It is about a quarter of a mile east of Cataract Creek at an altitude of 6,550 feet. The workings are also known as the Mt. Thompson mine but should not be confused with the Mt. Thompson claim about a mile to the southeast. The property is held by W. E. Paget and John MacGinniss of Basin.

Numerous pieces of lead ore scattered about an old ore bin gave evidence of some past production. The mine is developed by an adit which, according to MacGinniss, is 1,600 feet long. The adit is caved at the portal. The width and extent of the vein could not be determined. Pieces of vein material 12 to 18 inches across in the dump contain galena, pyrite, chalcopyrite, and manganese oxide.

Crescent

On the crest of the Continental Divide in secs. 20, 21, 28, and 29, T. 8 N., R. 5 W., 2 miles east of the Josephine mine, is the Crescent mine owned by the Holter Estate of Helena. During the summer of 1959 the property was being developed by the Montana Gold and Silver Co. The altitude in the vicinity of the mine workings ranges from 7,700 feet to 8,000 feet. The property is accessible by automobile over 6 miles of steep mountain road from Rimini, on the eastern slope of the Continental Divide; there is no access to the property by roads from the Basin-Boulder region.

The Crescent property was discovered and developed prior to 1900. According to local reports, the high penalty on zinc imposed by ore buyers and the cost of pumping water from the lower workings resulted in the mine being closed shortly before the turn of the century. Production statistics are available for the years 1935 to 1956. During these years 399 tons of ore were shipped that yielded 190 ounces gold, 3,392 ounces silver, 5,466 pounds copper, 45,934 pounds lead, and 15,138 pounds zinc.

The mine workings include 2 shafts and 2 levels. The upper level, which is a 670-foot adit-drift, is 60 feet below the collar of the No. 1 shaft. In 1959 the adit was examined. The vein is in quartz monzonite and contains argentiferous galena, pyrite, chalcopyrite, and quartz. It has a strike ranging between N. 85° E. to east, and a dip between 35° S. and vertical. The No. 2 shaft sunk near the portal of the adit-drift connects with the 120-foot drifts and crosscuts. Shaft No. 1 is caved, and shaft No. 2 is flooded.

Crystal

The Crystal mine, 8 miles north of Basin in secs. 19 and 20, T. 7 N., R. 5 W. at the head of Uncle Sam Gulch, is about at the center of the known strike-length of the Eva May-Crystal- Bullion vein. The altitude at the portal of the main workings is 7,800 feet. The property, consisting of 10 patented claims and 3 claims held by location, is owned by the Golden Messenger Corp., W. S. Norman, president, Spokane, Wash.

The mine, a small but steady producer since 1908, has a recorded total production of 22,58[illegible] tons ore which yielded 3,579 ounces gold, 343,591 ounces silver, 536,915 pounds copper, 2,060,623 pounds lead, and 939,190 pounds zinc. Production for the period 1911 to 1919 is included with the Comet mine.

The mine workings consist of 2 adits, each about 3,000 feet in length. Raises and crosscuts from the adits develop the vein through a vertical range of about 200 to 300 feet. A few shallow winzes have been sunk below the lower adit.

The Crystal vein is a zone of sericitized aplite or grano-aplite enclosed in quartz monzonite. It strikes N. 70° to 80° W. and dips 70° N.; it averages about 50 feet in width. The ore shoots within the zone comprise numerous disconnected lenses of quartz and sulfides 2 to 5 feet or more in width and of varying length separated from each other by aplite or grano-aplite. Post-mineral cross faults and strike faults displace the ore within the zone.

Metallic minerals include galena, sphalerite, chalcopyrite, and pyrite in a gangue of quartz. Ore piled on the ore house contains principally galena and sphalrite.

Custer

The Custer mine is in sec. 4, T. 6 N., R. 5 W., on the broad divide between Big Timber Creek and Cataract Creek 3 miles northeast of Basin. The altitude at the portal of the adit is 6,700 feet.

The principal period of operation at the mine was during the first decade of the present century. Production for 6 years between 1903 and 1912 is: 8,472 tons ore containg 470 ounces gold and 106,065 ounces silver.

The chief mine opening is an adit, the length of which is estimated to be 1,500 feet. The mine workings, in addition to the adit, include a 150-foot winze and a shallow shaft.

According to Knopf (1913a), the vein, in places as much as 30 feet wide, is enclosed in sericitized granite. Ore shoots within the vein generally are under 1 foot in width and are very irregular in width and direction. The ore was said to contain about 40 ounces silver and $18 in gold per ton.

East Katie

The East Katie (Lot 7) as described by Pardee & Scharder (1933, p. 290) is on the north side of the Boulder River at Basin almost opposite the Hope-Katie or Basin Jib mine. Recent production (1952 to 1956) which was credited to the Basin Jib mine probably came from this property.

According to Pardee & Schrader (1933, p. 290), C. H. Clapp determined that the east-striking East Kaite vein is a part of the Hope-Katie lode that had been displaced about 800 feet to the north by faulting. The vein, which is cut, but not displaced, by a quartz porphyry dike, contains quartz, pyrite, and a little chalcopyrite. The ore is classed as a low-grade milling ore. The authors state that a streak of galena was found on the 200-foot level and that rich gold ore occurs in places.

The property was developed in 1929 by a 200-foot shaft and drifts. In 1955 the shaft was extended.

Enterprise

Adjoining the Buckeye claim on the east is the patented Enterprise claim (M.S. 1329) owned by the Hauser Investment Co. of Helena. This property is in sec. 36, T. 8 N., R. 6 W., about 10 miles north of Basin.

It appears probable that the Buckeye mine and the Enterprise mine were worked as a single operation during past periods of activity. The 2 shafts are within 200 yards of each other.

The extent of the mine workings is estimated at about 1,000 feet. The shaft is caved and inaccessible. Material on the shaft dump indicates that the vein is in a bleached zone in quartz monzonite similar to the vein in the Buckeye mine. Metallic minerals in the dump are galena and sphalerite with considerable iron pyrite in a quartz gangue.

Eva May

The Eva May mine is on Cataract Creek 8 miles north of Basin. The property, consisting of 7 patented and 7 unpatented claims in secs. 21 and 22, T. 7 N., R. 5 W., is owned by Neuberg Bros. & Sloan, Inc., Basin.

The mine was one of the important early producers in the vicinity of Basin. Early in the present century the property was equipped with a large gravity concentrator. The remaining tailing pond gives evidence of a substantial successful period of operation. Between 1905 and 1949 the mine produced 206 tons ore containing 8 ounces gold, 2,506 ounces silver, 6,035 pounds copper, and 7,106 pounds lead.

The Eva May shaft reached a depth of 1,200 feet in 1907, and it is still the deepest mine in the Boulder batholith outside of the Butte district. The horizontal workings from the shaft comprise 8 levels aggregating several thousand feet of drifts and crosscuts. The collar of the shaft is now covered by the dump of a bulldozer cut excavated recently to further explore the vein. Additional recent work includes a 420-foot adit driven to explore the vein at about the 100-foot level of the shaft.

The Eva May mine is at the eastern end of the Eva May-Crystal-Bullion vein which has a recognized strike length of more than 3½ miles. Its width averages about 30 feet according to Billingsley and Grimes (1918). Information about the vein in the Eva May mine was obtained from numerous local residents familiar with the early-day operations. The vein, according to these people, ranged in width from 20 to 50 feet, with ore shoots within the vein ranging from 2 to 12 feet in width and from 50 to 100 feet in length. The ore shoots are near the walls of the enclosing vein, which is composed largely of granite and granoaplite. Knopf (1913a) states that the aplite, as well as some of the coarse crystalline ore-bearing quartz, contains black tourmaline. He further states that the mine dump contains considerable blue-grey cryptocrystalline quartz.

Metallic minerals in the ore are chalcopyrite, galena, sphalerite, tetrahedrite, and iron pyrite. Stringers of ore encountered in the recently driven adit contain chiefly galena and sphalerite in a white quartz gangue.

Gray Eagle

The Gray Eagle mine is in sec. 35, T. 7 N., R. 5 W. on Bishop Creek about 1¾ miles west of the Comet mine, northeast of Basin, at an altitude of 6,580 feet. It is owned by R. H. Mills, Spokane, Wash.

In 1905, the mine was already developed by 3 adits aggregating 3,400 feet and was operated by lessees. In 1907 the mine (together with the Comet) was purchased by the Montana Consolidated Copper Co. The Northwestern Metals Co. operated it in 1913. In 1926 the property (together with other nearby mines) was acquired by the Basin-Montana Tunnel Co. In June 1927 this company started operations at the Gray Eagle. No production was made this year, but the old tunnel was repaired, machinery installed, and about 1,500 feet development done on silver-lead-zinc ores. The Basin-Montana Co. owned 74 claims covering 1,200 acres. A new tunnel was planned to start from near the junction of High Ore Creek and Boulder River. The projected tunnel (about 3½ miles long) would have cut the Comet-Gray Eagle vein about 1,200 feet below the main Gray Eagle adit. In 1929, the mine was being worked while exploration progressed. At this time the mine was opened by a main 400-foot level adit and a vertical winze from the adit-level to the 600-foot level, and 3,000 feet of development was completed and an electrically driven compressor and hoist were installed. In 1930, 5,000 feet of drifts crosscuts, and raises were run, and preparatory work to start drifting the long tunnel was done. In 1934, Basin-Montana Tunnel Co. completed the construction of a new 100-ton flotation mill at the Comet. About 9,800 tons ore were treated yielding 3 concentrates —lead, zinc, and iron. In 1937, the mill treated 65,000 tons ore, and 5,500 feet of development were reported from the Gray Eagle and Comet combined. The Basin-Montana Tunnel Co. suspended operations in April 1941, but leased the Gray Eagle dump 1942 & 43. The mine has been idle since.

Production from the mine has been grouped largely with that from the Comet, Rumley, and other nearby properties during periods when the mines were all operated by 1 company. Production records for the Gray Eagle for 17 intermittent years between 1902 and 1930, excluding the years 1913, 1914, and 1921, credit the mine with 15,203 tons ore that yielded 1,297 ounces gold, 339,529 ounces silver, 85,966 pounds copper, 1,035,407 pounds lead, and 230,734 pounds zinc. After 1930 production was included with that of the Comet mine.

The mine has 4 adits ranging in length from 480 feet to 3,000 feet. Two additional levels are opened below the lower main adit by a 250-foot shaft. The combined workings aggregate about 10,000 feet of drifts and crosscuts. All of the adit portals are caved, and the mine was inaccessible in the summer of 1950.

The vein is thought to be the westward continuation of the Comet vein. The zone of crushed altered granite and grano-aplite ranges in width from 20 to 50 feet. Ore shoots are confined chiefly to the altered rock near the walls of the zone.

The metallic minerals in the vein are galena, sphalerite, pyrite, and in places, chalcopyrite and tetrahedrite. The copper minerals are not uniformly distributed in all the ore bodies but rather appear to be segregated in ore shoots along the south wall of the zone. The copper minerals are younger than the other minerals in the zone (Pardee & Schrader, 1933, p. 288).

Gray Lead

The Gray Lead property is in sec. 16, T. 7 N., R. 5 W., about 8 miles north of Basin along the Cataract Creek road and 1 mile northwest along a jeep trail. The mine is developed by 2 adits, 300 and 500 feet long, and by several prospect pits. At the time of examination there was a small gasoline-powered gravity mill on the property.

Total production from 1928 to 1949 amounted to 2,235 tons ore which yielded 135 ounces gold, 775 ounces silver, 104 pounds copper, 27,308 pounds lead, and 31 pounds zinc. The zinc was produced in 1 year—1946.

Lead and gold are the principal metals. The gold occurs with pyrite and the lead as cerussite; however, production records indicate the presence of silver and copper. The low-grade deposit occurs in a wide zone of altered granite which strikes east-west and which has a maximum width of 10 feet.

Hattie Ferguson

"The Hattie Ferguson mine of the Western Reserve Min. Co., on Cataract Creek 6 miles from Basin, was formerly worked through a shaft 140 feet deep, but a crosscut, now more than 1,400 feet long, is being driven (1933) and is expected to cut the vein at a depth of 362 feet. The country rock is aplite The ore minerals are galena, pyrite, and sphalerite, and 40 percent of the value is said to be in gold." (Pardee & Schrader, 1933, p. 294.)

The Hattie Ferguson is credited with a total production of 1,516 tons ore, which yielded 313 ounces gold, 27,982 ounces silver, 38,333 pounds copper, 311,717 pounds lead, and 33,802 pounds zinc.

Hiawattaha (Hiawatha)

Adjoining the Custer claim on the east is the Hiawattaha patented claim at an average altitude of 6,700 feet. The claim is in sec. 4, T. 6 N., R. 5 W., about 3 miles northeast of Basin.

The Hiawattaha property made a substantial production in the early years of the present century. The record includes the years 1902 to 1906. During this period 4,222 tons ore were shipped that yielded 577 ounces gold and 90,713 ounces silver.

The mine workings include a 400-foot shaft (sunk prior to 1906) and an estimated 1,000 feet of drifts and crosscuts. The shaft was caved at the collar when it was visited in the summer of 1950.

The vein, which probably is the eastern extension of the vein in the Custer mine, traverses both quartz monzonite and andesite. Metallic minerals in the ore include tetrahedrite, native silver, and iron pyrite.

High Ore (Montana Consolidated)

The High Ore, or Montana Consolidated adit is about 2 miles above the mouth of High Ore Creek on the slope west of the stream. The altitude is 5,900 feet. The property, comprising several patented claims in the vicinity, is in sec. 15, T. 6 N., R. 5 W. and is owned by Howard and Alice Johnson of Butte.

The property has been an intermittent small producer since 1905. The largest production was in 1947 when 428 tons ore were shipped that yielded 240 ounces gold, 2,745 ounces silver, 857 pounds copper, 17,891 pounds lead, and 14,991 pounds zinc. Total production to 1947 (11 producing years) is 757 tons ore, 86 ounces gold, 10,401 ounces silver, 1,402 pounds copper, 45,861 pounds lead, and 14,991 pounds zinc.

The mine is opened by a 1,100-foot crosscut adit. Total workings are estimated to be about 2,500 feet of drifts and crosscuts. Ore deposits occur in the crushed zone along the walls of an aplite dike intruded into quartz monzonite. Ore minerals are galena, sphalerite, pyrite, and chalcopyrite.

Hope and Bullion

At the head of Boomerang Creek, in sec. 6 and 31, Ts. 6 and 7 N., R. 4 W., are 2 patented claims named the Hope and Bullion. This property, which adjoins the Comet property on the west, is owned by Delight Romerio of Los Angeles, Calif. The altitude of the workings is about 6,500 feet.

According to local accounts, the claims were first prospected about 1872. Some ore has been produced, but the amount is not a matter of record.

The mine workings include 2 shafts 92 feet and 100 feet deep and a 100-foot adit. These workings are caved and inaccessible. A second adit was being driven during the summer of 1950. In the summers of 1949 and 1950, several bulldozer cuts were excavated to explore the vein.

The structure on the property is a 50-foot wide, highly bleached zone in quartz monzonite. The zone can be traced for about 2,500 feet. It strikes N. 80° W. Specimens of ore from former operations contain galena and pyrite.

Ida M.

Adjoining the Boulder Chief claim on the west in sec. 27, T. 7 N., R. 5 W. is the Ida M. patented claim owned by E. A. McPhearson of Spokane, Wash. The altitude at the mine workings is 7,375 feet.

The property was operated last about 1937. An adit estimated to be about 1,000 feet long explored a mineralized zone, which is probably a westward continuation of the ore body in the Boulder Chief mine. The adit portal was caved in the summer of 1950.

Ore minerals in the dump material are fine-grained galena and a small amount of sphalerite and pyrite in a gangue of quartz. The relationship between the ore deposit and the granite-andesite contact is not known. The outcrop of the vein between the Boulder Chief shaft and the Ida M. adit portal is deeply covered with overburden.

Jib (Hope-Katie)

Within and adjacent to the townsite of Basin are 15 patented claims comprising the property of the Jib or Hope-Katie mine owned by the Jefferson Development Co. of Everett, Wash. The property consists of the following claims in secs. 17 and 18, T. 6N., R. 5 W. (Numbers in parentheses are Mineral Survey numbers.) Avalanche (2156), Atlantic (2156), Nellie (2156), Fair Play (2156), Lotta (2155), Balerat (2156), Hopeful (1465), Jib Lot (1665), Jib Mill Site (1665), Darwin (4338), Apache Chief (4339), Eureka (4340), President (4341), Fraction (6460), and Hope (1966).

The Hope-Katie vein was discovered before 1900, and in 1905 the mine was operated by the Basin Gold & Copper Min. Co.; however, it was not worked extensively until 1919 when the Jib Min. Co. produced some exceptionally rich gold ore. Some ore was also treated by concentration. At this time the mine was worked by vertical and inclined shafts and had 3,500 feet of drifts and raises. In 1922, lessees shipped 1,000 tons of ore, and the Jib Min. Co. did considerable development work on the 400-foot level. The following year (1923) the Jib Consolidated Min. Co. shipped only 2 lots of ore, but did 2,000 feet of development work in the mine and erected a 300-ton mill equipped for gravity concentration and flotation. The development work in the mine was successful in locating the faulted extensions of the main ore body. In 1924, the Jib Cons. Min. Co. produced several thousand tons of rich gold concentrates and first-class shipping ore valued at $600,000 and became the largest gold producer in Monana. The mine was developed by over 15,000 feet of shafts, crosscuts, drifts, and raises. Over 5,000 feet of development was done in 1924. The 300-ton mill, built in 1922 and 1923, was active from March 1 to the end of the year. In 1925, the property passed from the Jib Cons. Min. Co. to trustees for creditors, and thereafter, the mill was not operated at full capacity. The mine was operated through 4 shafts (the deepest, 600 feet), and 1,500 feet of development work was done during 1925. In 1926, the mine was operated by Brown and Melcher as trustees. Because the 300-ton mill was closed January 20, lessees, who did most of the shipping, were compelled to resort to selective mining, yet

shipped 2,000 tons of siliceous gold ore, gold-silver ore, and lead ore. In November 1927, the Basin Cataract Min. Co. took over the properties of the Jib Cons. Min. Co. Operations after 1927 were intermittent until 1933 when the property was taken over by Roy E. Miller, Inc. The mill was remodeled, and the mine was unwatered. This company re-treated 48,300 tons of gold tailings by flotation and also shipped some crude siliceous gold-silver ore after the mine was unwatered in December. In 1934, this company shipped 3,300 tons of siliceous gold and silver ore. Operations were sporadic until 1953 when the property was taken over by the Basin Jib Gold Mines, Ltd., of Toronto, Canada, which started some open-pit mining. This company sank a new 345-foot vertical shaft using a new type mechanical mucker. The shaft was completed in 1956, and drifting on the 300-foot level started. The mine was closed shortly thereafter.

Recorded production since 1905 amounts to 228,588 tons ore, which at 1950 prices of metals would be worth about $2,500,000. The ore yielded 53,605 ounces gold, 481,816 ounces silver, 721,158 pounds copper, 928,316 pounds lead, and 33,056 pounds zinc.

The mine is opened by 3 shafts 200 feet, 500 feet, and 610 feet in depth. Mine workings on 6 levels aggregate more than 5,000 feet of drifts and crosscuts. All workings are flooded.

A description of the Hope-Katie deposit given by Pardee & Scharder (1933, p. 290 credited to C. H. Clapp is as follows:

"The Hope-Katie ore deposits occur in a well defined vein in a marginal basic phase of the Boulder batholith. The vein has been formed by the filling and replacement in a fissure zone striking N. 89° W. and dipping 76° N. It is regular and persistent and has been developed for 2,000 feet in length and 610 feet in depth. It averages 20 feet wide. It is composed chiefly of quartz and pyrite but also contains sphalerite, galena, chalcopyrite, and tetrahedrite, which either replace the older quartz and pyrite or recement them where fractured and brecciated. Occurring usually in small irregular veinlets are still younger minerals, a telluride of gold and silver and native gold in a gangue of fine grained, in places flinty, quartz. The vein is widely banded and in general consists of footwall, center, and hanging wall streaks. Ore occurs in shoots, which are larger and extend deeper as the east end of the Katie mine is approached, where the vein is cut by a rhyolite porphyry dike. The property has 2 distinct veins, one containing galena, chalcopyrite, pyrite and quartz, and a much richer one containing native gold and silver with sphalerite and other minerals. A large fault striking north cuts the Hope-Katie vein and displaces the eastern end 820 feet to the north (see East Katie).

Josephine

The Josephine mine (M.S. 2142), near the Continental Divide, is 11 miles north of Basin. The property is in the NE¼ sec. 25, T. 8 N., R. 6 W. and is presently owned by Murray and others, Washington, D.C. and H. L. Maury of Butte. It may be reached by country road along Basin Creek. The altitude at the collar of the shaft is 7,500 feet. The mine was discovered in 1887 and worked intermittently until 1950. During this time about 2,000 tons of ore were mined containing gold, silver, and lead.

A period of operation from 1934 to 1953 yielded 1,489 tons ore from which was recovered 335 ounces gold, 6,233 ounces silver, 616 pounds copper, 1,887 pounds lead, and 1,293 pounds zinc. The most recent activity at the property was during the summer of 1950 when it was operated by the Seven Cons. Gold Mines, Inc. This company equipped the mine with a 225-hp Diesel generator set, an electric hoist, a compressor, and other mining equipment. The shaft was pumped out to the 400-foot level on which development work was being done.

Ruppel (1958) reports that the mine consists of an inclined shaft 200 feet deep, a vertical shaft 400 feet deep, an adit, and a number of shallow pits and shafts. The inclined shaft was connected through winzes from its level workings with the adit. All the ore produced through the shaft, its level workings, and the adit seemingly was mined from an oxidized zone preserved beneath the Tertiary rhyolite. A vertical shaft was completed by 1903 and probably has been the main working shaft since 1893. Several hundred feet of level workings reportedly have been extended from the shaft on the 200-foot, 300-foot, and 400-foot levels.

Ruppel reports that the quartz veins at the Josephine mine occupy a fault zone that trends about east and dips from 55° to 70° N. The vein is almost entirely concealed at the surface by Tertiary rhyolites. The fault zone cuts medium-grained light-grey quartz monzonite. The vein apparently contained pyrite, galena, arsenopyrite, and chalcopyrite in a gangue of massive white quartz. In the adit, the only part of the mine accessible in 1955, the sulfide minerals had been entirely oxidized, and abundant earthy hematite and limonite occur in seams and stringers and also stain the vein quartz.

Jumbo

Three-quarters of a mile southeast of the Eva May mine is the Jumbo claim held by Buford Nyland and Murry E. Gow of Basin. An adit at an altitude of 7,100 feet has been driven to explore an easterly striking vein. As evidenced by material in the adit dump, the vein penetrated both granite and andesite. The adit is caved and inaccessibile. Pieces of ore in the dump and below an

old ore bin contain galena and cerussite. Gangue minerals are manganese-stained granite and andesite.

King Cole (Boulder-California)

The King Cole property of the Boulder-San Francisco Min. Co. of Boulder is on the east side of High Ore Creek across from the High Ore mine in sec. 2, T. 6 N., R. 5 W. The property comprises several patented mining claims. A small tonnage of ore has been produced by intermittent operation since 1918. Total production for 5 years is 160 tons ore from which 13 ounces gold, 2,090 ounces silver, and 378 pounds copper were recovered.

Two adits estimated to be about 700 and 900 feet in length have explored an east-striking vein in granite through a vertical range of about 150 feet. Both adits were inaccessible in the summer of 1950. Vein material in the dump of the lower adit contains galena, chalcopyrite, sphalerite, and pyrite.

Klondyke (Klondike)

The Klondyke mine is on the ridge west of Cataract Creek 1½ miles southwest of the Eva May mine in sec. 20 T. 7 N., R. 5 W. north of Basin.

Between 1907 and 1946 (5 producing years) the mine is credited with a total production of 342 tons ore containing in recoverable metals 192 ounces gold, 7,650 ounces silver, 8,342 pounds copper, 126,309 pounds lead, and 2,500 pounds zinc.

The mine is opened by a 165-foot shaft with 3 levels. The level workings aggregate about 300 feet of drifts. The mine workings were opened when visited in the summer of 1950.

Information about the deposit was furnished by J. K. Curtiss and George Meyer of Basin. The deposit is at the contact of andesite and granite with andesite forming the hanging wall. The contact strikes east and dips 60° N. The ore shoot was said to be 100 feet long and ranged in width from 8 inches to 2 feet. Metallic minerals in the ore were galena, sphalerite, and pyrite. The ore that was shipped averaged about 12 percent lead, 5.5 percent zinc, with 12 ounces of silver and 0.5 ounce of gold per ton.

Lady Leith-Katie Leith

The Lady Leith (M.S. 3327) and Kaite Leith (M.S. 3326) claims are in secs. 6 and 32, T. 7 and 8 N., R. 5 W. on the west flank of the Three Brothers Mountain. The property is owned by Theodore Thompson of Anaconda.

Ruppel (1958) reports that the deposits were discovered before 1890 and mined intermittently from 1890 to 1911, but have been idle since. The mine openings include an upper adit about 500 feet long and a vertical shaft 50 to 100 feet deep; lower workings that include an adit 350 to 400 feet long and appended drift; and a number of other short adits and pits. The mines explore 3 closely spaced parallel fault zones that cut medium-grained medium-gray quartz monzonite, trend N. 80° to 85° W., and dips about 65° N. The maximum thickness of any fault zone is about 10 feet. The fault zones are occupied by quartz veins that contain abundant pyrite, and sparse chalcopyrite, galena, sphalerite, and chalcocite. The gangue consists of early massive grey quartz and later white quartz, black tourmaline, siderite, and thin stringers of barite.

Leadville

Although Pardee & Schrader (1933, p. 292) did not visit this group of mines and prospects, their bulletin contains the following description furnished by J. F. Upson of Marion, Conn., who has visited the district at different times in the last 20 years.

"Prospecting has been carried on intermittently for the last 35 years. About 20 years ago the Leadville Min. and Smelting Co. undertook to develop a group of 12 claims situated just below the divide (SE¼ sec. 36, T. 7 N., R. 8 W., east side of the Continental Divide at the head of the north branch of the Boulder River about 12 miles north-northwest of Bernice), but the project failed through mismanagement and lack of capital. Since then prospectors have shipped to smelters several small lots of ore aggregating probably less than 100 tons but of very good metallic content. The ore occurs in well-defined but narrow veins. Smelter returns on carbonate ore run about $50 a ton, on galena ore somewhat higher. . . . The pay streak is from 3 to 12 inches wide and carries about 50 percent lead and 20 ounces of silver and $6 in gold to the ton.

"In the middle of the district is a large dike of chert-like rock. The properties mentioned are on the northside of this dike. South of it are some prospects that show lead and silver with some gold and copper, and in places also contain antimony."

Lewis

A mineralogical curosity is described by Pardee & Schrader (1933, p. 293) as follows:

"The occurence of quicksilver in the prospect of A. G. Lewis, about half a mile north of Boulder Station on the Great Northern Railway and 300 feet from the track, is mentioned in Mineral Resources for 1917 (p. 415). At that locality several fissures that traverse granitic rock contain chalcedonic quartz. Pits on 1 end of these veins show earthy cinnabar coating fragments of the vein material. This particular vein is about 1 foot wide."

Lizzie Osborne (Cataract)

The only evidence of prospecting for the Eva May vein east of Cataract Creek is on the Lizzie Osborne claim three-quarters of a mile east of the Eva May mine in secs. 22 and 23, T. 7 N., R. 5 W.

A bleached zone in granite 4 feet wide striking N. 75° E. has been explored by an adit estimated to be about 400 feet long. Pieces of vein quartz on the dump indicate a vein about 12 inches wide. The metallic minerals in order of decreasing abundance are iron pyrite, sphalerite, and scattered crystals of galena.

About 800 feet north of the above adit are additional old shallow adit workings with much iron pyrite on the dump.

Lotta

The Lotta mine (M.S. 2155), owned by the Jefferson Development Co., c/o A. B. Moody, Everett, Wash., is in sec. 18, T. 6 N., R. 5 W. The mine is a mile west of Basin and about 50 feet north of U.S. Highway 91. The mine was opened in 1890.

Ruppel (1958) reports that the adit was started as a haulage and exploration adit to crosscut a series of northeast-trending fault zones, some of which are occupied by quartz veins. The original length of the adit reportedly was about 775 feet. Until 1953 the adit was caved and inaccessible. In 1953 and 1954 it was reopened and about 660 feet of its total length was cleared. The adit is in medium-grained medium-grey quartz monzonite and cuts a number of fault zones 0.1 to 1 foot thick. About 500 feet from the portal the adit cuts across a fault zone 3 to 15 feet thick that trends N. 45° E., dips 35° to 45° NW., and is occupied by a quartz vein. Drifts extend along the vein about 120 feet southwest and 170 feet northeast from the adit, and a stope 10 to 30 feet wide and about 130 feet long further explore the vein above the east drift. The vein consists of 0.1- to 6-foot thick irregular veins and pods of massive grey quartz that locally has been brecciated by post-ore movement on the fault zone. Pyrite is abundant in the quartz and is also common as small auhedral crystals disseminate in the gouge and breccia that form the remaining parts of the fault zone. In 1958, lessees opened up some very rich gold ore in the bottom of the northeast drift. The vein matter consisted of brecciated grey quartz with free gold with some finely disseminated pyrite. Assays of this ore as high as 17 ounces per ton in gold were reported.

The same vein was originally mined from the surface by short adits, drifts, and stopes, and about $75,000 worth of free-milling gold ore reportedly was produced from a shoot 3 to 4 feet thick.

Mantle and South Mantle (Rock of Ages)

A number of properties near the mouth of Cataract Creek canyon have been exploited chiefly for gold. The Mantle and South Mantle claims are on the north and south sides of Cataract Creek in secs. 8 and 9, T. 6 N., R 5 W., about 1½ miles north of Basin.

Recorded intermittent production from the property from 1921 to 1939 amounted to 326 tons from which were recovered 489 ounces gold, 637 ounces silver, 184 pounds copper, and 4,868 pounds lead.

The mine workings include 2 adits, each 300 to 400 feet in length, a 100-foot shaft, and a 165-foot shaft. The workings were inaccessible during the summer of 1950. The property formerly was equipped with a water-powered gravity mill.

The vein, as described by J. K. Curtiss of Basin, is enclosed in quartz monzonite; the width ranges from 6 to 16 inches. The ore minerals are iron pyrite and a small amount of galena.

Marguerite

The Marguerite mine (M.S. 8419) is on the summit of the ridge between Basin and Cataract Creeks, 3 miles north of Basin. The altitude at the mine is 6,500 feet . The mine is in sec. 31, T. 7 N., R. 4 W. and is owned by Mayme Nelson of Helena.

Recorded production figures show that only 58 tons ore were produced from 1914 to 1942. The ore yielded 38 ounces gold and 960 ounces silver.

The mine workings consist of an adit estimated to be 500 feet long and a shaft about 150 feet deep. The workings explored a narrow quartz vein in granite striking N. 80° W. and dipping 80° north. Old subsided workings showed a stope-width of 4 feet. A small amount of iron pyrite was the only metallic mineral observed in the dump material; the gangue is quartz.

Minneapolis

The Minneapolis mine is on the divide between Cataract Creek and Big Limber Creek 2 miles north of Basin in sec. 4, T. 6 N., R. 5 W. The average altitude at the property is about 6,100 feet.

The Minneapolis deposit was discovered about 1900 or a short time before. In 1928 and 1929 it was operated by the Creeden Mines Corp. under lease from the Basin-Montana Tunnel Co. Production records cover the years from 1905 to 1949. Intermittent production during this period aggregated 1,113 tons ore, from which were recovered 97 ounces gold, 19,031 ounces silver, 6,640 pounds copper, and 149,364 pounds lead. From 442 tons of this ore, 33,789 pounds of zinc were recovered.

The mine is opened by 2 adits 400 feet and 1,400 feet long respectively. The combined length of workings, including drifts and crosscuts, is estimated at about 4,000 feet. The portals of the adits were caved when the property was visited in the summer of 1950.

Pardee (1933, p. 289) states: "The country rock is quartz monzonite, which is intruded by a dike of light-colored rock characterized by quartz phenocrysts. The lode includes several veins formed along fractures that strike nearly east and are distributed through a zone 40 to 80 feet wide. The veins cut the quartz monzonite and are close-

ly associated with the porphyry dike but do not cut it so far as exposed. In fact, the relationship of the dike to the veins indicates that it is either contemporaneous with them or somewhat younger and was intruded along 1 of the same fractures. The principal veins within the zone and north of the dike are known as the north and intermediate veins. Those south of the dike are known as the middle and south veins. All are of fairly definite tabular form, and as shown by surface workings, they are from 4 to 6 feet or more thick and persist for considerable distances. From the north vein several branch veins extend northeastward. Several westward-dipping cross faults displace the veins from a few inches to a foot. A northwest fault that dips about 45° SW. crosses the veins, the small faults mentioned, and the dike, and causes a maximum horizontal displacement of 12 feet.

"The structure of the veins indicates that after a first generation of quartz and pyrite, with small amounts of sphalerite and galena, had been deposited, the veins were reopened and received a second generation that included most of the galena and sphalerite. The copper-bearing sulfides came in still later and apparently represent a distinct phase of the mineralization."

Morning Glory

The Morning Glory mine is 4½ miles northeast of Basin at the junction of Cataract Creek and Uncle Sam Gulch.

The mine has been a consistent small producer for many years. The largest recorded production was made during the 1930's at which time the ore was concentrated in a 50-ton flotation plant. From 1920 to 1957 the production was 19,231 tons ore yielding 2,484 ounces gold, 268,054 ounces silver, 4,138 pounds copper 83,140 pounds lead, and 7,793 pounds zinc.

The mine workings comprise 3 adits and a 245-foot shaft. The combined length of the adits is 3,200 feet. The shaft is flooded, but most of the adit workings are open.

The ore deposit as described by J. K. Curtiss, lessee of the property, consists of a wide crushed zone in grano-aplite. Ore shoots 6 inches to 5 feet in width have been mined from 4 steeply dipping irregular veins in the zone. The strike of the zone is about east, but the strike of the veins within the zone ranges from southeast to northeast. Ore shoots range from 50 to 100 feet in length. The principal ore mineral is said to be ruby silver, probably prousite. Native silver is also present, as well as small amounts of galena, pyrite, and chalcopyrite.

Morning Star

The Morning Star mine is on the west side of Basin Gulch. Small amounts of galena, sphalerite, pyrite, and chalcopyrite occur in an east-striking ore body in altered andesite. (Pardee & Schrader, 1933, p. 295.) This may be the Morning Star mine which has a reported total production for 2 years, 1908 and 1952, of 65 tons containing 10 ounces gold, 372 ounces silver, 43 pounds copper, 6,969 pounds lead, and 427 pounds zinc, and which has been erroneously reported as in the Amazon district.

Mt. Chief

The Mt. Chief mine is in sec. 33, T. 7 N., R. 5 W., on the west slope of the ridge dividing Cataract Creek and High Ore Creek. It is about a quarter of a mile west of the Mt. Thompson mine or about 5 miles northeast of Basin. The altitude is 7,200 feet.

The mine has not been in operation for many years. The remains of an old ore bin indicate, however, that some ore was mined. The mine is opened by an adit estimated to be 300 feet in length and by a shaft about 100 feet deep. These workings were caved and inaccessible when inspected in July 1950.

The vein, enclosed in granite walls, strikes N. 70° W., and can be traced by old workings and shallow pits for about 1,000 feet. Pieces of vein material around the old ore bin contain fine-grained galena, sphalerite, and pyrite disseminated in dense hard grey quartz.

Mt. Thompson

The Mt. Thompson claim is on the summit of the divide between the drainage of High Ore Creek and Cataract Creek; it is about a mile west of the Gray Eagle mine. The altitude of the surface in the vicinity of the workings is 7,620 feet.

The workings are not extensive; they include 3 shafts estimated to range in depth from 20 to 100 feet. All are now caved. The total underground development probably would not exceed 400 or 500 feet of shafts, drifts, and crosscuts.

The vein where exposed in the collars of the caved shafts is a zone of bleached and altered granite. These exposures are in line with a projected westward extension of the Comet-Gray Eagle vein. No metallic minerals were observed in place, but galena and cerussite were found in the dumps of the workings.

Obelisk

The Obelisk claim is 1½ miles east of Basin in sec. 15 and 16, T. 6 N., R. 5 W. The portal of the adit and the ore bin are alongside of U. S. Highway 91. Altitudes at the mine openings range from 5,300 to 5,500 feet. The property is owned by E. F. Perkins, c/o John McGoff, Boulder. Joseph LaComb and James Goodrich have a lease on the property.

Some rich silver ore was shipped during 1921. According to Braden, a former lessee, the property was equipped at one time with a small mill.

Production for the years 1920, 1921, and 1954 totals 342 tons ore which yielded 2 ounces gold, 9,432 ounces silver, 4,842 pounds lead, and 700 pounds zinc.

The mine workings comprise a lower adit about 1,000 feet long, an upper adit 100 feet long, a 200-foot shaft extending from surface to the lower adit, and a 200-foot winze below the lower adit. Both adits are accessible, but the lower adit at the time of examination (1948) was badly caved in the vicinity of the old stopes. The winze was caved at the adit level.

The ore deposit appears to be a crescent-shaped body possibly 30 feet long and 20 feet wide at the end of an elliptical plug of brecciated granite and grano-aplite approximately 100 feet long and 50 feet wide. The ore minerals, galena and sphalerite, are associated with the quartz filling that cements the breccia fragments.

Red Wing

The Red Wing group is at the head of Big Limber Creek, 4 miles north of Basin. The 4 unpatented claims in the group are held by W. L. Sandquist of Basin. From 1922 to 1940 the Red Wing mine produced 120 tons ore which yielded 15 ounces gold, 4,367 ounces silver, 54 pounds copper, and 19,958 pounds lead.

The mine is opened by an adit which is estimated to be about 700 feet in length. The adit was caved at the portal in the spring of 1950. The vein is enclosed in quartz monzonite; it is probably the same vein that has been mined in the Hiawattaha and Custer mines. Pieces of ore below an old ore bin contain galena, sphalerite, and pyrite in a gangue of quartz and manganese-stained quartz monzonite.

Rumley

According to Raymond (1872, p. 234) the Rumley lode which is adjacent to the Comet was developed by a 50-foot shaft and a 36-foot drift north along 2 veins. The veins, galena- and cerussite-bearing, which assayed $65 to $200 per ton at that time, were said to be 6 feet wide and contained 50 percent lead. Raymond also mentioned 2 rich gold-bearing quartz veins with reported gold content of $45 to $120 per ton. Total production from 1902 to 1941 was 3,191 tons ore which yeilded 1,230 ounces gold, 95,786 ounces silver, 5,970 pounds copper, and 619,888 pounds lead.

Saturday Night

The Saturday Night claim, on Cataract Creek about a mile north of the Mantle property, has been a small producer of gold-silver ore that contained a small amount of lead. The claim is in sec. 5, T. 6 N., R. 5 W. Total production between 1936 and 1939 amounted to 232 tons ore, which yielded 31 ounces gold, 2,868 ounces silver, 268 pounds copper, and 1,723 pounds lead.

The mine is opened by an adit, estimated to be about 500 feet long, and a shaft 150 feet deep. The workings were inaccessible when visited during the summer of 1950. The Saturday Night vein strikes east and is nearly vertical. The enclosing rock is quartz monzonite. According to J. K. Curtiss of Basin, the ore shoot averaged 6 inches in width. He said the ore mineral was ruby silver, probably proustite.

Sirius

The Sirius claim, in secs. 20, 21, and 29, T. 7 N., R. 5 W., joins the Klondyke property on the south. The altitude in the vicinity of the workings is 7,300 feet. The property has been a small intermittent producer since 1906. The recorded output since that time amounts to 446 tons ore from which were recovered 287 ounces gold, 5,197 ounces silver, 1,561 pounds copper, 73,017 pounds lead, and 2,667 pounds zinc.

The property has been developed by a 1,400-foot adit and a 150-foot shaft. A 150-foot winze has been sunk below the adit level. The entire workings have an aggregate length of about 2,000 feet. The entrance to the workings was partly blocked by fallen rock when visited in 1950. According to local reports, the ore body was at the contact of granite and one wall of an aplite dike. The strike is northeast, and the dip is 70° NW. The length of the ore shoot was about 175 feet; its width ranged from 6 inches to 3 feet. Metallic minerals in the ore are galena, chalcopyrite, and iron pyrite; the gangue is quartz.

Solar Pearl (Solar and Pearl)

The Solar claim (M.S. 4208) is 2 miles southwest of the Josephine mine. The altitude at the shaft collar is about 7,200 feet. The property is in the NE¼ sec. 35, T. 8 N., R. 6 W. and is owned by Alta Madden of Basin and Gertrude McConnell of Clancy.

Allan J. Bullock of Basin said that some of the ore contained as much as 3 ounces of gold and 300 ounces of silver per ton. This production was made about 1900. Total production between 1903 and 1922 was 251 tons ore which gave 166 ounces gold, 10,048 ounces silver, 245 pounds copper, and 6,142 pounds lead.

The mine workings consist of 2 levels driven from a 120-foot shaft. The combined workings are estimated at about 500 feet below the shaft collar. Material on the dump shows the deposit to be enclosed in quartz monzonite. The vein outcrop is covered by overburden. Metallic materials in the dump include marcasite, arsenopyrite, and iron pyrite.

Uncle Sam (Jennie B)

The Uncle Sam and Jennie B claim are on Uncle Sam Creek 1 mile north of its junction with Cataract Creek. The altitude of the lower adit is 6,700 feet.

Recorded production since 1911 for both claims has amounted to 550 tons of ore. The Jennie B is credited with producing 259 tons ore, which contained 5 ounces gold, 4,764 ounces silver, 76 pounds copper, 26,869 pounds lead, and 35,854 pounds zinc. Knopf (1913a) states that in early days some 12,000 tons of ore were mined from the Uncle Sam and hauled to Wickes for treatment. The value of this ore ranged from $30 to $90 per ton.

The mine workings consist of 1 shaft and several adits, all of which are now caved. The combined length of the workings is estimated to be about 2,000 to 3,000 feet.

The deposit was described by Knopf as follows: "The country rock is aplite, forming a border between the main body of granite, which is encountered in the tunnel, and a capping composed of andesites. An aplite dike, 10 to 15 feet wide with gouge on both contacts, was crosscut in the tunnel. The vein is near the contact of the aplite with the overlying andesites; in fact, the pits on the extension of the vein are in andesite. The andesites, or probably more accurately latites, are flow-banded varieties; they have been considerably metamorphosed by the intrusion of the granitic rocks and in consequence are not easily recognizable. They are light colored and because of their light color and highly developed flow banding have been regarded as rhyolites and phonolites.

"The old workings took out a shoot of ore extending 80 feet east of the inclined shaft and reaching a depth on the incline of 130 feet. The ledge is said to be 12 feet wide, and the ore minerals are galena and sphalerite with subordinate tetrahedrite."

BIG FOOT-STATE CREEK DISTRICT

The Big Foot-State Creek district is in T. 4 N., R. 5 W. The district is approximately 12 miles south of Boulder and 19 miles north Whitehall. Accessibility is by a dirt road which is a branch of the main county highway between Whitehall and Boulder. Rolling topography characterizes the district. It is drained by 3 main streams, namely, Big Foot, State, and Beaver Creeks which drain into Whitetail Creek. The area is heavily timbered with lodgepole pine and poplar.

The bed rock is composed of quartz monzonite of the Boulder batholith. Replacement veins strike east-west, and some contain considerable altered granite between small fissures. Ore deposits are of 2 kinds: complex gold, silver, copper, lead, and zinc ore; and siliceous gold ore with small amounts of silver. The Big Four ore bodies typify the complex ore whereas the State group contains siliceous gold ore.

The yearly production of the district since 1902 is shown in table 12.

TABLE 12.—Production of gold, silver, copper, lead, and zinc from lode mines, Big Foot-State Creek district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902-19	No production						
1920	78	98	486	1,001	—	—	$2,744
1921	63	63	711	1,178	3,858	—	2,345
1922-23	No production						
1924	18	7	164	—	3,390	—	517
1925	No production						
1926	350	55	1,257	950	27,493	11,397	5,121
1927	20	29	16	—	—	—	614
1928	106	23	584	660	24,019	13,612	3,132
1929	619	27	3,388	2,206	126,708	91,553	16,777
1930-31	No production						
1932	33	26	14	—	—	—	542
1933	102	80	537	250	19,405	—	2,584
1934	34	30	512	50	2,162	—	1,467
1935	9	4	57	—	—	—	181
1936	112	59	581	1,946	—	—	2,694
1937	35	7	181	91	2,000	—	514
1938	20	14	116	255	—	—	590
1939	26	29	249	212	1,213	—	1,263
1940	68	17	204	451	280	—	805
1941	33	5	38	—	—	—	202
1942	46	28	464	—	10,000	3,300	2,287
1943-44	No production						
1945	334	11	900	400	39,500	10,200	5,649
1946	No production						
1947	123	23	348	900	9,000	1,400	2,766
1948	343	62	1,853	2,200	47,200	5,900	13,558
1949-55	No production						
1956	37	2	202	—	4,600	600	1,057
1957	No production						
TOTAL	2,609	699	12,862	12,750	320,828	137,962	67,409

Big Four

The Big Four group consists of 6 patented claims as follows, (survey number in parentheses): Hoosier Boy (4060), Big Four (6909), Terror (6911), Nickel Plate (6912), Searchlight (9275), and Ajax in secs. 7, 12, 13, and 14, T. 4 N., Rs. 4 and 5 W. These properties are presently owned by O. W. Humphrey of Santa Ana, Calif., Fred Morgan of Tucson, Ariz., and Mary A. Drake of Salt Lake City, Utah. Between 1902 and 1945 the Big Four produced 1,577 tons ore, from which were recovered 84 ounces gold, 7,236 ounces silver, 4,037 pounds copper, 272,203 pounds lead, and 123,699 pounds zinc. The largest production came during 1929. The group of claims had been developed by a 100-foot shaft on the Hoosier Boy and Ajax claims and a 180-foot shaft on the Big Four claim with 3 levels at 40, 60 and 100-foot depths.

Although the Ajax workings were inaccessible in 1959, it was noted that 1 vein at the shaft collar had a strike of S. 72° W. The dip could not be determined. An inspection of dump material revealed galena, sphalerite, pyrite, chalcopyrite in a quartz gangue.

State

The State group in the NE¼ sec. 16, T. 4 N., R. 5 W. has produced more gold than any other mine in the Big Foot district—384 ounces from 544 tons of ore. This tonnage also yielded 2,594 ounces silver, 5,075 pounds copper, and 6,885 pounds lead during a total of 14 years between 1905 and 1940.

In 1959 the workings, which consisted of numerous adits, were inaccessible. Although the vein was not observed a series of adits, one above the other at about 100-foot intervals, indicated that the vein strikes approximately east-west and may be vertical.

Ore minerals observed on the dump were pyrite, chalcopyrite in quartz along with minor amounts of galena. The host rock is a coarse-grained quartz monzonite.

BOULDER DISTRICT

The Boulder district is directly south of the Amazon district and east of the Basin-Cataract district. It includes the area adjacent to the town of Boulder, a station on the Great Northern Railroad. U.S. Highway 91 also runs though the town. The mining areas are readily accessible by good unimproved roads. A few mines in the Little Boulder River area south of Boulder are also included in the district. Patented claims are shown in plate 1 (in pocket).

The region is on the west side of the Boulder valley. In the south it is drained by the Boulder River flowing from west to southeast. Muskrat Creek flows from the north into the Boulder River near Boulder. The elevation of the Boulder valley is about 4,900 feet. Vegetation, consisting of grass and brush and a few scattered trees, is sparce. Timber for mining and construction may be obtained from the Deer Lodge National Forest a few miles to the west.

Bedrock consists predominantly of quartz monzonite of the Boulder batholith, which is overlain by Tertiary dacite and Late Cretaceous andesite to the north and east. The andesite is pre-batholithic and the dacite post-batholithic. The andesite and monzonite are cut by dikes of dacite and rhyolite.

Ore deposits include small placer and lode deposits of Late Cretaceous and of Tertiary age. Deposits in the older group (andesite and dacite) are valued chiefly for silver, lead, and zinc; and the younger deposits (monzonite) for gold and silver. Some re-opened fissures contain deposits of both groups. At Boulder Hot Springs, about 2 miles south of town, the hot waters still fill fissures marked by reefs, and are now forming deposits whose weathered outcrops show the presence of gold and silver in small amounts.

Gold and silver were first discovered in this district about 1870. The district has been more or less active since its discovery, but production figures prior to 1902 are not available. Production from 1902-1957 is shown in table 13. The largest production was from 1912-1917, and the largest producer was the Baltimore mine.

Baltimore

The Baltimore mine (M.S. 1540) is on the east slope of the canyon of Boomerang Creek, 4 miles northwest of Boulder in sec. 7, T. 6 N., R. 4 W. The altitude at the property ranges from 5,900 feet to 6,200 feet.

The Baltimore was one of the most consistent producers in the Boulder-Basin region. For the years 1903 to 1953 production was reported for all but 12 years. Recorded production for these years of operation amounted to 18,148 tons ore, from which were recovered 1,734 ounces gold, 275,489 ounces silver, 271,266 pounds copper, and 1,263,965 pounds lead. Zinc was recovered from 4,648 tons of ore; this recovery amounted to 280,750 pounds of metal. The mine was idle from 1946 to 1950.

The mine workings include 6 or more adits, most of which are now caved and inaccessible. In 1907, the mine was worked through a 140-foot vertical shaft and 2,000 feet of levels. Only the lowest adit, the portal of which is slightly above the bed of Boomerang Creek, was being worked in 1911 when the mine was visited by Knopf (1913a). Only 4 adits are mentioned by Gilbert (1935); they ranged in length from 300 feet to 750 feet. The combined workings, which are estimated at 3,000 feet of drifts and crosscuts, explore the property through a horizontal range of about 1,000 feet and a vertical range of about 300 feet.

Knopf (1913a) states that the principal mine workings are in aplite which in turn is enclosed

TABLE 13.—Production of gold, silver, copper, lead, and zinc from lode mines, Boulder district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902	843	826	15,722	10,000	144,000	—	$28,972
1903	700	12	3,400	—	—	—	4,200
1904	No production						
1905	713	146	19,554	—	43,300	—	16,864
1906	296	92	9,015	1,403	24,481	—	9,607
1907	1,400	203	21,616	10,500	85,500	—	25,086
1908	23	11	433	516	5,984	—	768
1909	168	7	3,553	4,655	6,930	—	2,900
1910	165	56	2,949	1,935	25,483	—	4,122
1911	65	10	810	439	18,174	—	1,500
1912	2,756	422	40,618	79,722	234,114	—	57,392
1913	424	50	6,624	10,956	55,378	10,501	9,772
1914	1,456	55	29,373	9,801	191,672	—	26,141
1915	52	9	440	701	1,951	—	630
1916	1,119	89	19,569	39,271	56,637	44,200	34,211
1917	2,266	293	24,753	52,001	191,726	124,865	69,863
1918	258	33	3,776	4,946	32,461	—	7,957
1919	1,407	112	22,312	22,215	99,565	36,600	39,377
1920	1,070	107	16,111	43,366	30,986	—	30,221
1921	113	18	1,837	1,619	8,549	—	2,796
1922	35	6	677	1,144	4,051	—	1,194
1923	13	5	127	—	—	—	201
1924	1,278	119	27,093	13,853	156,614	—	34,965
1925	1,031	57	17,436	15,168	85,574	—	22,877
1926	1,042	55	14,168	16,213	68,709	21,746	19,384
1927	130	21	2,479	1,126	18,655	—	3,168
1928	549	21	5,328	10,594	39,886	58,318	10,952
1929	139	13	1,514	1,843	5,386	5,451	2,102
1930	No production						
1931	129	11	2,269	336	22,256	—	1,748
1932-33	No producton						
1934	4	2	31	—	405	—	93
1935	60	12	576	1,084	5,900	—	1,146
1936	509	38	9,277	609	63,826	—	11,730
1937	63	7	1,086	—	9,000	—	1,616
1938	84	9	2,475	265	21,565	—	2,933
1939	178	24	1,622	134	9,086	—	2,382
1940	257	30	2,077	522	13,840	—	3,278
1941	424	39	3,839	400	10,900	—	4,763
1942	6	—	218	—	—	—	155
1943	322	16	1,471	1,400	31,400	—	4,143
1944	674	20	5,625	3,800	21,000	—	6,893
1945	93	6	675	200	3,500	3,400	1,409
1946-47	No production						
1948	1,179	44	8,426	4,300	74,600	100,400	36,805
1949	No production						
1950	126	7	400	500	5,800	3,300	1,963
1951-52	No production						
1953	168	7	1,810	100	8,000	600	3,029
1954	4	—	8	—	1,300	—	185
1955	No production						
1956	17	1	53	—	600	300	218
1957	32	3	487	700	2,600	1,600	1,315
TOTAL	23,840	3,124	353,712	368,337	1,946,344	411,281	553,026

in quartz monzonite. The ore bodies were short irregular veins with numerous branches that swell locally to widths up to 6 to 8 feet. A map of the Baltimore mine by Billingsley and Grimes (1918) shows 2 groups of veins: one strikes about N. 60° W. and dips steeply north; the other strikes N. 60° to 80° E. and dips south. Each group includes 1 or more main veins from which many veinlets and stringers "spray out" into the adjoining country rock. Metallic minerals in the ore are principally pyrite, together with sphalerite, galena, and chalcopyrite.

Free Enterprise

The Silver Bell shaft (M.S. 10857) of the Free Enterprise group is 2 miles northwest of Boulder (sec. 19, T. 6 N., R. 4 W.). The altitude in the vicinity of the workings is 5,520 feet.

It is known that early-day production was not large, but small amounts of high-grade silver ore were mined. In June 1949 radioactive minerals were discovered in the dump of the Silver Bell shaft by Wade V. Lewis, Sanford Davis, and Edward Miles. As a result of the discovery, 10 min-

ing claims were located in the vicinity by the Elkhorn Min. Co. In the fall of 1949 the Sunshine Min. Co. of Kellogg, Idaho, entered into an operating agreement with the Elkhorn Min. Co. to explore the deposit. This work consisted of deepening the shaft and drifting on the vein. Early in 1950 operation of the property reverted to the Elkhorn Min. Co. which has continued mining and development work on the upper level of the mine.

No production data are available on the early-day silver ore shipments from the property. Small shipments of uranium-bearing ore have been made recently, but the mineral content of these shipments has not been disclosed.

The Silver Bell shaft is 150 feet deep. Levels have been driven at a depth of 80 feet and 141 feet. The upper level is a 230-foot drift on the vein; the lower level was driven partly as a drift on the vein and partly as a crosscut into the wall. The extent of this level is about 125 feet. The work in recent months has been confined to the 80-foot level.

The vein consists of 1 to 12 inches of dark cryptocrystalline quartz with 1 to 3 feet of bleached, silicified quartz monoznite adjoining the walls of the vein. Minerals in the vein are ruby silver, native silver, galena, pyrite, molybdenite, arsenopyrite, chalcopyrite, uraninite, pitchblende, torbernite, gummite, zeunerite, uranophane, metatorbernite, and autunite. Limonite and black manganese oxide are also present. The galena and silver minerals are confined principally to the quartz vein, but the secondary uranium minerals are associated also with the silicified quartz monzonite along the vein walls.

Molly McGregor (Emma Bell)

The Molly McGregor or Emma Bell, in secs. 6 and 7, T. 6 N., R. 4 W., is about half a mile north of the Baltimore mine. The most recent workings on the property are in the bottom of Boomerang Creek canyon, but the principal mine openings, which were made many years ago, are about a quarter of a mile west of the creek at an altitude of 6,400 feet.

The earliest recorded production from the property was for the years 1911 to 1941. During these years 200 tons of ore was produced from which were recovered 65 ounces gold, 2,364 ounces silver, 315 pounds copper, and 33,553 pounds lead. In 1939 and 1940 production is listed in the Amazon district under the name of the Adolphus mine.

The mine workings comprise 5 adits and 5 shafts. The adits range in length from about 50 to 500 feet. The shaft depths range from 40 to 100 feet. All of the workings are inaccessible.

The vein is enclosed in quartz monzonite. It strikes N. 80° E. and is nearly vertical. The vein can be traced by shallow pits and old workings for about 3,000 feet. The width of the vein as indicated at the caved collars and portals of the old workings ranged from 5 to 15 feet. The width of the ore shoots could not be determined. Galena and pyrite in considerable amounts were noted in the dumps of the workings west of Boomerang Creek, and scattered blebs of galena were noted in the dump material of several of the old cuts and pits east of the creek.

Nickelodeon

Sahinen (1956, p. 6) contains the following description of a uranium occurrence south of Boulder.

"Nickelodeon (sec. 7, T. 5 N., R. 4 W.) 3½ miles south of Boulder. Vein in quartz monzonite cut by aplite carries quartz, chrysocolla limonite, tenorite, chalcopyrite, pyrite, molybdenite, powellite, and scheelite. Uranium in micaceous yellow-green crystals coating secondary copper minerals."

CLANCY-LUMP GULCH DISTRICT

The Clancy-Lump Gulch district embraces that part of Jefferson County tributary to Lump Gulch and Clancy Creek. The district centers in T. 8 N., Rs. 4 and 5 W. The Butte-Havre branch of the Great Northern Railway, U.S. Highway 91, and Prickly Pear Crek traverse and border the district to the east, the Continental Divide on the west, Quartz Creek to the south, and Jack Mountain and the divide between Jack Creek and Clark Gulch to the north. The town of Clancy (pop. 350) is the principal settlement in the area, and Helena, one of the chief supply points for the area, is 10 miles to the north.

Altitudes range from 4,000 feet at the lower end of Prickly Pear Valley to 7,500 feet at the summit of some of the peaks near the head of Lump Gulch. The topography is characterized by mature well-rounded mountains that locally have steep but not precipitous slopes. The mountains are forested with lodgepole pine, fir, and spruce, together with scattered yellow pine. Several small sawmills provide rough lumber for local use. Timber for mine support is available on or near most of the mining properties. Water for mining and milling purposes is adequate in most creeks in the district.

Gold was discovered in Prickly Pear Creek in 1862, 2 years before the more important discovery in nearby Last Chance Gulch at Helena. The first lode mine on record in the region is the Legal Tender, which was discovered in 1866. By 1890 most of the mines in the area that are known today were either producing or being developed. The peak of mining activity was passed shortly after 1900. Production records for individual mines for years after 1902 are found in Appendix B. Yearly production for the district is shown in table 14.

The bedrock is composed of quartz monzonite of the Boulder batholith, together with its related segregations of aplite and quartz porphyry. Rhyolites are present in considerable overlying masses. A few dikes of dacite have been observed accom-

TABLE 14.—Production of gold, silver, copper, lead, and zinc from lode mines, Clancy-Lump Gulch district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902	1,666	197	5,800	—	—	—	6,974
1903	6	—	726	—	—	—	394
1904	12,795	3,671	163,344	—	238,377	—	155,402
1905	6,019	2,105	201,071	—	300,870	—	179,077
1906	1,249	4	61,579	2,225	119,655	—	48,579
1907	476	—	43,363	—	39,778	—	30,727
1908	685	587	12,146	735	14,233	—	19,284
1909	326	58	11,492	1,447	40,352	—	9,105
1910	120	73	3,413	2,220	21,600	—	4,590
1911	175	22	3,882	2,117	3,715	—	2,947
1912	1,662	1,821	19,939	16,382	33,315	—	54,102
1913	249	224	4,100	2,233	21,231	—	8,387
1914	27	—	1,827	21	2,326	—	1,107
1915	119	54	2,898	325	50,496	—	5,019
1916	290	181	7,497	2,704	40,156	—	12,118
1917	79	83	2,038	1,026	6,846	—	4,256
1918	156	1	14,982	—	19,227	—	16,371
1919	770	16	61,905	190	9,248	—	70,193
1920	4,446	54	178,537	299	279,214	—	218,116
1921	416	35	23,612	62	36,946	—	25,996
1922	21	3	1,290	—	7,759	—	1,791
1923	53	—	280	—	5,706	13,800	1,568
1924	59	1	989	28	8,852	16,822	2,481
1925	10	—	504	—	510	—	395
1926	13	—	541	167	1,473	—	483
1927	59	1	4,681	102	7,962	11,833	3,946
1928	235	37	3,331	724	59,258	45,545	9,034
1929	44	13	1,108	156	22,403	6,651	2,732
1930	1	—	5	20	156	—	21
1931-32	No production						
1933	39	37	163	203	4,189	—	992
1934	25	3	696	75	81	—	553
1935	No production						
1936	136	1	1,388	—	1,630	—	1,199
1937	3	—	62	—	85	—	53
1938	No production						
1939	31	17	212	125	297	—	766
1940	135	146	2,340	248	15,780	—	7,591
1941	142	14	429	200	1,800	—	922
1942	27	6	246	—	3,400	—	613
1943	No production						
1944	13	—	111	—	200	500	152
1945	5	—	495	—	500	600	464
1946-47	No production						
1948	64	—	432	100	900	500	641
1949	882	36	7,204	1,400	32,500	24,500	16,229
1950	1,793	2	22,096	1,300	18,800	50,100	29,990
1951	268	5	10,353	200	8,000	15,000	13,707
1952	71	17	413	116	6,019	4,832	2,768
1953	1,546	17	12,100	1,400	3,600	30,000	15,870
1954	3,713	128	19,821	3,800	78,300	65,500	41,341
1955	108	23	1,253	300	23,900	4,300	6,141
1956	1,989	62	11,620	1,800	61,000	39,300	28,413
1957	642	380	5,485	2,500	102,200	25,200	36,554
TOTAL	43,858	10,135	933,799	46,950	1,754,845	354,983	1,100,154

panying most of the veins in the silver mines in the vicinity of Clancy. Ore bodies occur in 2 genetically separate types. The older group is nearly vertical eastward trending quartz veins carrying gold, pyrite, and chalcopyrite with minor amounts of galena, sphalerite, and arsenopyrite with occasional occurrences of molybdenite and tourmaline. The younger group consists of veins characterized by a chalcedonic quartz gangue carrying rich silver-bearing sulfides and enclosed in quartz monzonite; tetrahedrite may be found in this type in sporadic occurrences.

Free Coinage (Little Alma)

The Free Coinage mine, on the east side of Lump Gulch 2 miles north of the Liverpool mine, appears to be typical of other silver mines in the vicinity of Clancy. The Little Alma claim (M.S. 4487) is in secs. 6 and 31, T. 8 and 9 N., R. 3W. and is owned by Louise Tomlinson of Danbury, Conn. The property was under development by the Amalgamated Silver Mines Co. in 1919. The mine was worked through a 250-foot shaft and 3,000 feet of drifts. Development in 1919 amounted to 1,000 feet of drifting.

Production from 1919 to 1949 is given as 1,390 tons ore, yielding 14 ounces gold, 68,611 ounces silver, 673 pounds copper, 46,216 pounds lead, and 7,514 pounds zinc.

The workings are caved and inaccessible. The strike of the vein is N. 85° E. as indicated by the alignment of the Free Coinage and Little Alma shafts, together with other prospect trenches. The vein is in quartz monzonite.

Frohner

The Frohner group is in secs. 14 and 15, T. 8 N., R. 5 W., consisting of 12 patented claims at the head of Lump Gulch, is owned by C. E. Pew of Helena. The Frohner was 1 of the first mines in the region to be worked.

From 1928 to 1954 the Frohner mine is credited with producing 161 ounces gold, 7,329 ounces silver, 2,305 pounds copper, 91,503 pounds lead, and 26,000 pounds zinc from a total of 1,917 tons ore. The principal workings consist of an adit, which is estimated to comprise at least 2,000 feet of horizontal workings but is now caved and inaccessible.

Below the mine dump a short distance is a mill tailings dump consisting of ¼-inch material. A small flotation mill was built to re-treat the original mill tailings; part of the machinery of the flotation mill still remains.

The Frohner vein is in granite. The strike of the vein is a few degrees north of west. Vein material on the ump contains considerable iron pyrite with some galena and sphalerite in a gangue of dense white quartz. Veins on other claims of the group were worked through adits and shallow shafts but to a lesser extent that at the Frohner mine.

Kennedy or Jackson Creek

This early-day property is briefly by Pardee & Schrader (1933, p. 232) as follows: "Rich silver sulfides are said to have been hauled from the Kennedy mine in 1872 to Fort Benton by ox teams and shipped to Swansea, Wales. The old workings are no longer accessible. The country rock is a coarse granite with dikes of aplite. Three parallel ledges occur on the property."

No production has been recorded for this property since 1902.

King Solomon

The King Solomon property comprises 2 patented claims owned by the Monarch Mines and Mills Co., Long Beach, Calif. The 2 patented claims, King Solomon (M.S. 10673) and Monarch (M.S. 10673), are in secs. 6 and 7, T. 8 N., R. 3 W. The property is between Clancy Creek and Lump Gulch, 2 miles west of Clancy.

The claims were located in 1889 but were never worked continuously for any period of time. Six years production between 1908 and 1936 aggregated 287 tons ore, with a recovery of 7 ounces gold, 18,026 ounces silver, 615 pounds copper, and 24,524 pounds lead. In 1911 they were examined by Knopf (1913a, p. 104-105). The following is based largely upon his description.

The shaft was sunk on the vein to a depth of 300 feet. The deposit was developed by 3 levels driven from the shaft. The ore is in a zone of sheared granite said to be 25 feet or more in thickness that follows the footwall of a wide dacite dike. The ore occurs in short shoots comprised of slabs of sulfides. The thickness of the ore shoots ranged from 1 to 2 feet. The principal minerals in the ore are galena, sphalerite, and tetrahedrite in a gangue of chalcedonic quartz which has been brecciated and recemented by siderite. Very weak radio-activity has been detected at the mine.

Little Nell

The Little Nell claim (M.S. 4507) is on the west side of Lump Gulch across from the Liverpool mine. The property is owned by Margaret Larson and Mary B. Head of Helena and is in sec. 6, T. 8 N., R. 3 W.

The mine was developed by a 500-foot shaft sunk prior to 1908 and an adit at the 150-foot level of the shaft. Work at the mine started about 1894 and active mining operations continued until 1956. The mine was a sizable producer during 1953, 1954, and 1956. Its total recorded production since 1902 was 7,064 tons ore from which 10 ounces gold, 129,214 ounces silver, 4,285 pounds copper, 75,606 pounds lead, and 99,570 pounds zinc were recovered.

The strike of the Little Nell vein as shown at the collar of the caved shaft is N. 52° E. The dip is vertical. Little information is available concerning other geologic features of the deposit. Specimens of ore in the dump contain galena and sphalerite in a gangue of chalcedonic quartz similar to other silver mines in the vicinity of Clancy.

Liverpool

The Liverpool mine, owned by Ora B. Guffey, Helena, was one of the principal silver mines in the Clancy region. The property consists of 2 patented claims, Liverpool (M.S.1379) and Washington (M.S. 40), in sec 33, T. 9 N., R. 3 W. The period of most active operation was from 1893 to 1907 when it was operated by the Liverpool Min. Co. The latest activity was in 1951. Between 1904 and 1951 (18 producing years) the Liverpool produced 82 ounces gold, 570,078 ounces silver, 1,707 pounds copper, 799,994 pounds lead, and 49,115 pounds zinc from a total of 11,743 tons ore.

The Liverpool shaft is 750 feet deep, and the nearby Washington shaft is 250 feet deep. Both shafts are caved at the collar, and the workings are inaccessible. At the collar of the Liverpool shaft, a vertical vein is exposed that strikes N.

85° E. The vein is in a shear zone in granite and follows a dacite dike. The granite is soft and bleached. The vein is coarse-grained quartz, grey chalcedonic quartz, pink ankerite, calcite, pyrite, arsenopyrite, galena, and sphalerite with some tetrahedrite, argentite, uraninite, and pitchblende.

Loeber

In 1957 the Loeber mine recorded its initial production of 60 tons ore which yielded 16 ounces gold, 855 ounces silver, 100 pounds copper, 19,000 pounds lead, and 500 pounds zinc. The mine, in the NE¼ sec. 15, T. 8 N., R. 5 W., is owned by C. E. Pew and operated by W. Beaver, both of Helena.

The property is developed by 1 adit, which follows a dog-leg shaped vein for about 100 feet. The vein strikes N. 76° E. and dips 60° SE. near the portal, but at the face of the adit the vein strikes S. 82° E. and dips 52° SW. Metal-bearing minerals which occur in irregular small lenses and veinlets and as scattered grains in quartz are pyrite, galena, and sphalerite. The veinlet-bearing quartz zone ranges from 3 to 4½ feet wide, and the mineralized veinlets and lenses range from 3 to 6 inches wide.

Meadow (Haab)

The lode of the Meadow mine was discovered in 1936 on 2 claims owned by Kate Haab of Clancy as a result of gold dredging operations on Clancy Creek. During the spring of 1949, 9 holes were diamond-drilled to delimit the ore shoot. Alfred Nugent and Nenning Norgaard of Helena organized the N & N Min. Co. to exploit the deposit.

Production records show 23,890 ounces silver, 230 pounds copper, 9,791 pounds lead, and 22,579 pounds zinc were recovered from 187 tons ore. Producing years were 1949, 1950, and 1951.

The vein occupies a fissure in granite along the footwall of an aplite dike; it strikes N. 70° E. and dips 80° S. The length of the ore shoot is about 100 feet and its thickness, 1 foot. The ore consists of galena, sphalerite, tetrahedrite, and pyrite in a gangue of quartz. The ore contains about 8 percent lead and 200 ounces of silver per ton.

Nellie Grant

The Nellie Grant mine, reportedly part of the Frohner group, is in sec. 14, T. 8 N., R. 5 W. and is owned by C. E. Pew of Helena. From 1,057 tons of Nellie Grant ore, there have been recovered 293 ounces gold, 10,279 ounces silver, 3,481 pounds copper, 216,242 pounds lead, and 47,156 pounds zinc. Recorded production was between 1948 and 1957. During the summers of 1958 and 1959, the mine was being operated by Central Mines, Inc.

A shaft, 80 feet of which was accessible, and several drifts and adits have exposed a 4- to 5-foot vein in quartz monzonite. The vein, which strikes N. 82° W. and dips 61° SW., carries steel galena, sphalerite, pyrite, and chalcopyrite in a quartz gangue.

President-Haynes-Hinman

Several groups of uranium-bearing claims near Clancy have been described by Roberts and Gude (1953). In general the groups are between Prickly Pear Creek and Clancy Creek in T. 8 N., R. 3 W. Mr. Wayne Hinman of Clancy discovered uranium in this area in 1949 and early 1950.

Quartz monzonite of the Boulder batholith is the predominant rock type, along with intrusive bodies of alaskite, aplite, and pegmatite. Dacite and andesite volcanics are also present. The important geological event which is pertinent to the uranium mineralization in this area was the deposition of silica along north-south trending fractured and brecciated zones. The uranium mineralization occurs intimately associated with these silicified zones or reefs. Pitchblende, a primary mineral, was found only at 1 locality, the W. Wilson claim. It is found in vugs in silicified rock as clusters and probably also occurs as very minute grains in dark-grey cryptocrystalline silica. Torbernite-zeunerite, autunite or uranocircite, rutherfordine, uranophane, and voglite were detected associated with pitchblende as disseminated grains in altered quartz monzonite. Pyrite and galena, in small disseminated grains, are associated with the uranium-bearing reefs. Between 1952 and 1958 the President group shipped about 760 tons ore containing 0.28 to 0.50 percent uranium oxide (U_3O_8).

Among the more notable claims in this area are those in the President group (secs. 8, 17, and 18, T. 8 N., R. 3 W.), W. Wilson, A. Lincoln, G. Washington, and the Forty-Niner. All are claimed by Mr. Hinman. The name Haynes enters the picture because several claims (W. Wilson, A. Lincoln, and G. Washington) are on the Haynes homestead. The Hinman or King Solomon Ridge group is in secs 5 and 6, T. 8 N., R. 3 W.

Yama

The Yama group of 4 patented claims owned by Frank Yama of Clancy is about 2 miles south of the Frohner mine. The only production from the mine was made in 1921 when 8 tons of ore were shipped. Heavy penalties for the contained zinc discouraged further production.

The vein is in quartz monzonite on the north slope of Lump Gulch. The out-crop length is about 1,500 feet; it has been partly explored through a vertical range of about 300 feet by 3 adits ranging in length from 90 to 500 feet. The adits were poorly directed and much of their length was driven in the walls of the vein, which strikes N. 80° E. and dips 70° to 80° SE. A few of the mine openings show a vein width of 5 to 6 feet. It is claimed that the vein ranges in width up to 15 feet in some of the workings that are not accessible.

The ore minerals are principally galena and sphalerite in a gangue of white quartz. A few tons of ore in a bin at the portal of the lowest adit was said to contain 8 percent lead and 8 percent zinc.

Yellowstone

No location is given for the Yellowstone prospect except that Pardee & Schrader (1933, p. 231) in describing it, place the prospect in the Clancy district.

The property was developed by a 90-foot shaft and a tunnel 200 feet long which intersected a number of ore veinlets in a zone cutting a dacite dike. The ore minerals are reported as chalcopyrite and galena with small amounts of sphalerite and pyrite in a quartz gangue.

COLORADO-WICKES-CORBIN-GREGORY DISTRICT

The Colorado district is 20 miles south of Helena and in general embraces the Spring Creek drainage and extends southward from Quartz Creek and the headwaters of Clancy Creek to the headwaters of Spring Creek and the Great Northern Railway tunnel. The district is bordered on the east by U.S. Highway 91 and that branch of Prickly Pear Creek called Beavertown Creek and on the west by the divide between the Cataract Creek drainage and Clancy, Wood Chute, and Spring Creeks. Within the district are the settlements of Wickes, Corbin, and Jefferson City, each with a present population of less than 100. Plate 1 (in pocket) shows the relative position of the different patented properties within this mining district. Jefferson City is on U.S. Highway 91. County roads lead from the highway to the mines. The 3 towns are on the Butte-Havre branch of the Great Northern Railway.

This part of Montana was first settled in 1864. The principal veins in this country are situated in the vicinity of Jefferson City and Beavertown. The second smelter in Montana Territory was built at the Gregory mine in 1867. Raymond (1869, p. 301) states that the development on the Gregory, made at great expense, was highly encouraging, and smeltering works were erected to beneficiate the ores. Unfortunately, however, the American hearth was selected as the apparatus supposed to be adapted to the treatment of these ores. The ores carried too much gangue to permit successful smelting in this furnace. Operations were suspended, and the next furnace was erected to smelt Alta mine ore with little more success. A short time later 2 other smelters were built in the vicinity of what is now Wickes. The Wickes smelters purchased ore from surrounding mines as well as from districts as far away as Coeur d'Alene, Idaho. In 1893 smelting operations were transferred to a new smelter built at East Helena. The Wickes smelter was then dismantled.

A railroad, built to Wickes in 1883, linked the smelters with the recently completed transcontinental Northern Pacific Railroad at Helena. With improved transporation facilities for ore and supplies, many mines were soon developed and exploited. The years from 1883 to 1893 were the heyday for the mines of the region. From that time until the present, numerous periods of activtity have been followed by periods of depression. Production for the district subsequent to 1902 is shown in table 15.

The topography is characterized by rounded-top mountains and relatively mature valleys. Altitudes range from 4,400 feet to 7,500 feet .Drainage from all of the region is tributary to Prickly Pear Creek which in turn is tributary to the Missouri River. Water for milling purposes is scarce in some parts of the region. Some mills have been partly dependent on water from mine drainage.

The north slope of most of the mountains are forested with lodgepole pine, fir, and spruce. A few scattered yellow pine still remain, but most of these trees have been cut. Local sawmills can supply rough lumber for mine use. Timber for mine support can be obtained from the surrounding forests.

The principal rocks in the region are quartz monzonite, andesite, aplite, and dacite. Many of the productive mines are in a roof pendant of andesite. The andesite appears to be an erosional remnant of the rock into which the quartz monzonite was intruded. This remnant occupies an area about 8 miles long by 4 miles wide; the long axis trends north and south. Dacite flows, younger than the quartz monzonite, cover an area in the central part of the andesite mass about 5 miles long and 1 mile wide; the long axis also trending north-south (Knopf, 1913a, p. 10). The apexes of some of the veins in andesite are partly covered by dacite flows. Dikes of aplite are of common occurrence in both the andesite and the quartz monzonite.

The veins in the region are of the older group of deposits characterized by tourmaline (Knopf, 1913a, p. 11). These veins are enclosed in either andesite or quartz monzonite and usually are within a few hundred feet of the contact. Most of the ore deposits are steeply dipping, east trending, fissure-replacement lodes.

The chief ore minerals are argentiferous galena, sphalerite, chalcopyrite, and tetrahedrite. Gold in varying amounts is present in most of the ores. Arsenopyrite, pyrite, and rhodochrosite are common accessory minerals.

Alta

The Alta Min. Corp, L. E. Wicher, president, 25 Broad St., New York City, owns 10 patented mining claims on Alta Mountain, 2 miles southwest of Corbin. The different claims are listed with their survey numbers as follows: Faith (591), Alta California and mill site (741), Custer and mill site (1072), Grandfather and mill site

TABLE 15.—Production of gold, silver, copper, lead, and zinc from lode mines, Colo-Colorado district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902	3,966	1,346	94,071	161,700	472,840	—	$100,999
1903	100	6	2,000	5,000	—	—	1,610
1904	1,548	343	21,198	11,100	66,930	—	21,060
1905	3,298	776	66,368	23,380	409,672	—	79,050
1906	2,393	304	23,066	168,374	104,572	—	60,191
1907	1,929	196	25,515	167,496	77,688	—	58,526
1908	2,288	317	50,612	165,424	41,028	—	56,943
1909	1,884	173	49,752	111,177	173,906	—	51,385
1910	1,401	314	26,537	47,304	172,684	—	34,418
1911	1,973	221	49,842	96,257	227,377	—	53,243
1912	5,600	424	87,318	313,031	406,806	55,542	136,240
1913	35,341	683	138,440	675,631	739,128	—	234,983
1914	424	165	5,450	6,741	34,362	—	8,673
1915	4,204	485	53,154	26,196	718,845	—	75,338
1916	25,633	288	58,106	589,864	67,365	—	193,937
1917	35,945	1,143	128,696	895,792	910,160	4,036	452,903
1918	14,145	2,149	239,357	124,125	2,253,681	—	474,459
1919	11,218	2,201	210,826	138,665	1,751,879	—	400,266
1920	21,018	953	128,045	47,145	1,846,033	—	315,624
1921	5,724	140	30,504	6,217	522,377	—	57,698
1922	5,796	714	40,242	14,639	507,184	—	84,865
1923	3,903	421	32,424	26,151	478,237	314,912	94,036
1924	3,263	295	22,873	13,848	369,074	357,205	75,988
1925	26,470	918	102,515	58,701	567,336	48,020	151,465
1926	55,882	1,270	237,656	138,180	1,325,420	741,984	355,568
1927	37,426	1,301	284,629	207,689	1,362,881	1,107,439	372,233
1928	1,412	206	20,686	24,767	156,477	175,248	39,709
1929	1,023	92	7,104	9,326	62,183	130,121	19,832
1930	2	—	15	17	593	—	38
1931	No production						
1932	94	43	3,280	3,873	3,167	—	2,149
1933	80	15	1,463	234	21,162	—	1,625
1934	181	22	3,021	1,875	23,162	11,558	4,243
1935	3,300	393	22,233	6,627	208,625	92,500	42,693
1936	16,056	254	45,570	15,696	633,804	625,140	106,047
1937	10,206	542	50,203	24,000	343,000	69,000	85,428
1938	24,176	499	63,640	49,337	255,152	—	75,178
1939	51,866	1,256	123,171	107,385	517,851	1,808	163,168
1940	45,841	1,213	84,579	64,708	252,220	1,000	122,586
1941	32,721	1,424	78,719	40,800	284,600	29,600	129,074
1942	31,982	829	102,060	49,700	1,160,000	1,176,700	294,758
1943	55,007	652	104,400	45,300	1,302,200	1,441,500	356,296
1944	17,249	917	64,682	27,000	1,043,500	1,559,000	342,942
1945	2,018	108	9,000	2,400	152,500	203,000	46,964
1946	1,082	113	4,859	7,000	27,000	15,000	13,788
1947	600	53	4,315	11,600	36,000	9,600	14,484
1948	3,114	201	21,327	15,600	224,000	107,400	84,102
1949	7,965	335	33,323	12,000	333,200	284,600	132,184
1950	9,503	517	39,727	13,600	529,600	112,300	144,322
1951	16,878	724	70,016	19,000	988,600	217,000	303,823
1952	13,109	405	74,252	12,934	745,223	108,590	222,514
1953	13,357	590	55,650	12,900	728,200	111,400	182,923
1954	9,947	421	47,290	24,000	418,000	246,000	148,449
1955	7,315	312	31,028	10,000	251,900	110,100	93,807
1956	14,243	510	59,862	12,800	557,700	146,500	185,093
1957	10,988	481	37,987	16,400	387,700	104,000	123,656
TOTAL	714,087	30,673	3,472,658	4,880,706	27,254,784	9,717,803	7,483,586

(1600 A & B), Somewhere and mill site (734), Keystone (3634), Glytie (9981), Pondora ((9981), Silver King (10038). All the patented claims are in secs. 9 and 10, T. 7 N., R. 4 W.

The Alta lode was discovered in 1869. A short time later the property was sold to the Alta Montana Co. which spent a large sum of money for development work but failed to operate at a profit.

The property, together with several others in the vicinity, was purchased by the Helena Min. and Reduction Co. in 1883. It was reported that this company spent $190,000 to increase the capacity of the mines, mills, and smelters (Leeson, 1885, p. 662). The first Alta concentrator with a daily capacity of 150 tons was built at Corbin. It was increased later to 250 tons in 12 hours. A railroad, built from Helena to Wickes in 1883, provided the much-needed transportation facili-

ties that were a large factor in the success of the Alta operation.

The Helena Min. and Reduction Co. operated the mine until 1896, at which time operations ceased except for intermittent lessee work. After the mine was closed, the company installed a mill known as the Peck concentrator. This mill was operated for several years in re-treating old tailings from the former mill.

In 1909 the mine was sold to the Boston and Alta Co. which sank the 665-foot vertical shaft at the portal of the No. 8 adit and drove the 1,300-foot level. This company planned to mine low-grade ore that was thought to remain in the mine from the former operation. This work stopped in 1910.

In 1925 a concentrator, known as the Hewitt mill, was erected about a mile east of Corbin to re-treat the Alta tailings a third time. About 100,000 tons of old tailings were treated. Four years later the Knickerbocker Mines Co. bought the nearby Bertha property and acquired a lease on the Alta property including the Hewitt mill. The company planned to operate the Alta property through the Bertha shaft, but these plans never materialized. From 1938 to 1941, 146,000 tons of Alta tailings were concentrated in the Hewitt mill.

Activity in 1949 consisted of trucking the mill tailings to the American Smelting and Refining Co. smelter at East Helena. Subsequently Ed Lahey of Butte, who has a lease on the property, commenced open cutting the vein on the crest of Alta Mountain where the vein surfaces in the andesite-dacite roof pendant. The open cut is approximately 50 to 75 feet deep, several hundred feet long and about 75 feet wide. Several cars of this fluxing ore have been shipped each week since the removal of the tailings. Future plans call for an underground exploration program with a continuation of the open-cut method of mining, providing the grade of ore merits this type of operation. All of the mine workings are inaccessible.

The recorded production from 1902 to 1957 for the Alta mine is 349,839 tons ore which yielded 8,174 ounces gold, 1,165,299 ocnues silver, 546,286 pounds copper, 8,134,488 pounds lead, and 1,234,-644 pounds zinc. The greatest proportion of zinc has been produced since 1951. It is known that the largest part of the production was made before 1902. According to **Mineral Resources of the United States** for 1909, the Alta mine is credited with having produced 1.2 million tons of ore netting $32 million previous to 1892, and up to that time only the highest grade ore was shipped.

The mine is developed through a vertical range of 1,200 feet by 8 adit levels and 5 shaft levels. More than 4 miles of drifts and crosscuts comprise the workings. The main No. 8 adit, approximately 800 feet below the top of the mountain on which the vein outcrops, is 4,900 feet long. The altitude of this adit is 5,254 feet. Levels 9, 10, 11, and 12 were driven from an inclined winze below the No. 8 adit. Level 13 was driven from the bottom of a 665-foot vertical shaft at the portal of the No. 8 adit. (See figs. 6, 7 and 8)

The Alta mine is in andesite, a remnant of the cover over the quartz monzonite about 2 miles in diameter. A zone of crushed and sheared andesite reported to be 40 to 120 feet in width encloses the ore (Ropes, 1922). The zone has been explored for a length of about 2,000 feet. Northeast-striking faults, younger than the ore mineralization, cross the crushed zone forming 3 offset shoots. The ore bodies were distributed irregularly in the crushed andesite of these 3 shoots. Individual bodies of shipping grade ore were reported that ranged from 50 to 150 feet in length and from 10 to 24 feet in width.

The ore minerals consist of argentiferous galena, sphalerite, and pyrite (Knopf, 1913a, p. 109). Manganese is a prominent accessory mineral. It occurs as black oxide in the workings near surface and as rhodochrosite in the deeper workings (Ropes, 1922). Some copper was produced, but no information is available as to what copper minerals were present. It has been reported that the copper replaced lead in the lower levels.

Ariadne

The Ariadne (M.S. 10738) is in secs. 4 and 5, T. 7 N., R. 4 W. The patented claim is owned by Joe Gable of Helena. The claim is east of Clancy Creek between the Minnesota mine and the Gregory mine. The mine was leased to J. M. Mantel of Helena in 1949, who engaged in clearing and retimbering the main shaft.

Production recorded since 1917 through 1937 totals 153 tons ore, 17 ounces gold, 1,001 ounces silver, 653 pounds copper, 26,613 pounds lead, and 15,743 pounds zinc. It was reported locally that the property was operated as early as 1865, but early production figures are not available.

The workings consist of 2 shafts, 70 to 165 feet deep, both of which were inaccessible in 1958. The total underground workings are estimated at about 1,100 feet.

The ore is said to be in a steeply dipping fissure replacement vein striking east in andesite. The vein at the west end of the claim is covered by a Tertiary dacite flow. The possibility has been suggested that enriched silver ore may be encountered in the upper parts of the vein immediately below the dacite flow. Ore minerals on the dumps of the caved shafts include argentiferous galena and sphalerite in a gangue of quartz and altered andesite.

Beaverton

At the Beavertown Ranch, 5 miles south of Jefferson City, in sec. 24, T. 7 N., R. 4 W., a very minor amount of metatorbernite has been reported (Sahinen, 1956, p. 7).

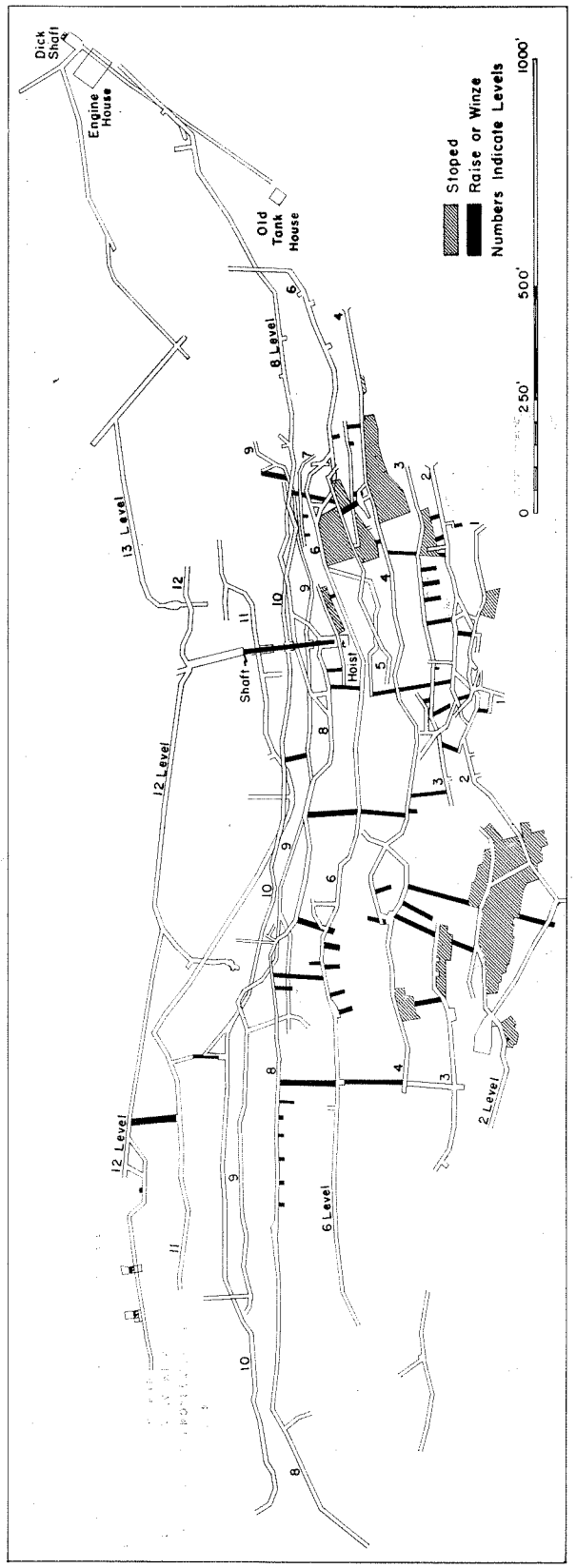


FIGURE 6.—Composite map of underground workings, Alta mine, Jefferson Co., Mont.

The uranium mineral occurs in a narrow vein in quartz monzonite that has been intruded by aplite. The minerals are vuggy quartz, limonite, secondary copper minerals, and a little metatorbernite. Grade is approximately 0.05 percent uranium oxide (U_3O_8).

Bertha

The Glenore Mines, Inc., J. T. Halin, president, Spokane, Wash., owns the 11 patented claims of the Bertha group. The property is on the northeast slope of Alta Mountain in secs. 2 and 3, T. 7 N., R. 4 W.; it joins the Alta property to the south. The 11 claims, with Mineral Survey nos. in parentheses, are: Bertha (7652), Bertha No. 2 (7652), Daphne No. 2 (8325), C. & M. (8326), C. & B. (8327), Fairview (8328), Jack Rabbit (8329), Corbin (8330), D. & E. (8331), Helena (8931), Boston Fraction (8932), and Jeffers (8935).

Production records are given as follows: Bertha and Corbin, 90,660 tons ore which yielded 279 ounces gold, 162,043 ounces silver, 2,423,143 pounds copper, and 26,730 pounds lead. The mine produced continuously from 1906 to 1918 except for the year 1910.

The mine was acquired by the Boston & Corbin Copper & Silver Min. Co. in 1906, and active development started. Two adits were driven, and a 900-foot shaft was sunk. The 2 adits and the 5 levels from the shaft comprise about 14,000 feet of drifts and crosscuts that partly develop a number of veins through a vertical range of 1,300 feet. The collar of the shaft is at an altitude of 4,765 feet; it is about 300 feet below the surface discovery of the main vein. In 1911 construction was started on a 100-ton flotation plant to supplement the 200-ton gravity concentrator already on the property. By this time the main shaft was down 1,050 feet, and the main adit, 2,000 feet long.

The Boston & Corbin Co. closed the mine about 1917 after a fire destroyed the 200-ton concentrator. In 1929 the Knickerbocker Corp. purchased the Bertha mine and obtained a lease on the Alta property. This company planned to drive a drift from the 1,200-foot level of the Bertha mine to intersect the Alta vein. The drift would have been about 700 feet below the lowest Alta workings. This work was not accomplished. The Bertha property was acquired by the Glenore Mines, Inc. in 1949.

The veins are in grey quartz monzonite; they strike about N. 35° E. and have nearly vertical dips. The width of the veins is said to range from a few inches to 10 feet (Knopf, 1913a, p. 110). The granite adjoining the vein has been softened and bleached.

The ore contains chalcopyrite and pyrite in a gangue of white quartz. Assay maps of the mine indicate that the ore ranged from 1 to 5 percent copper and from 1 to 10 ounces of silver per ton. It was reported in a company prospectus that a

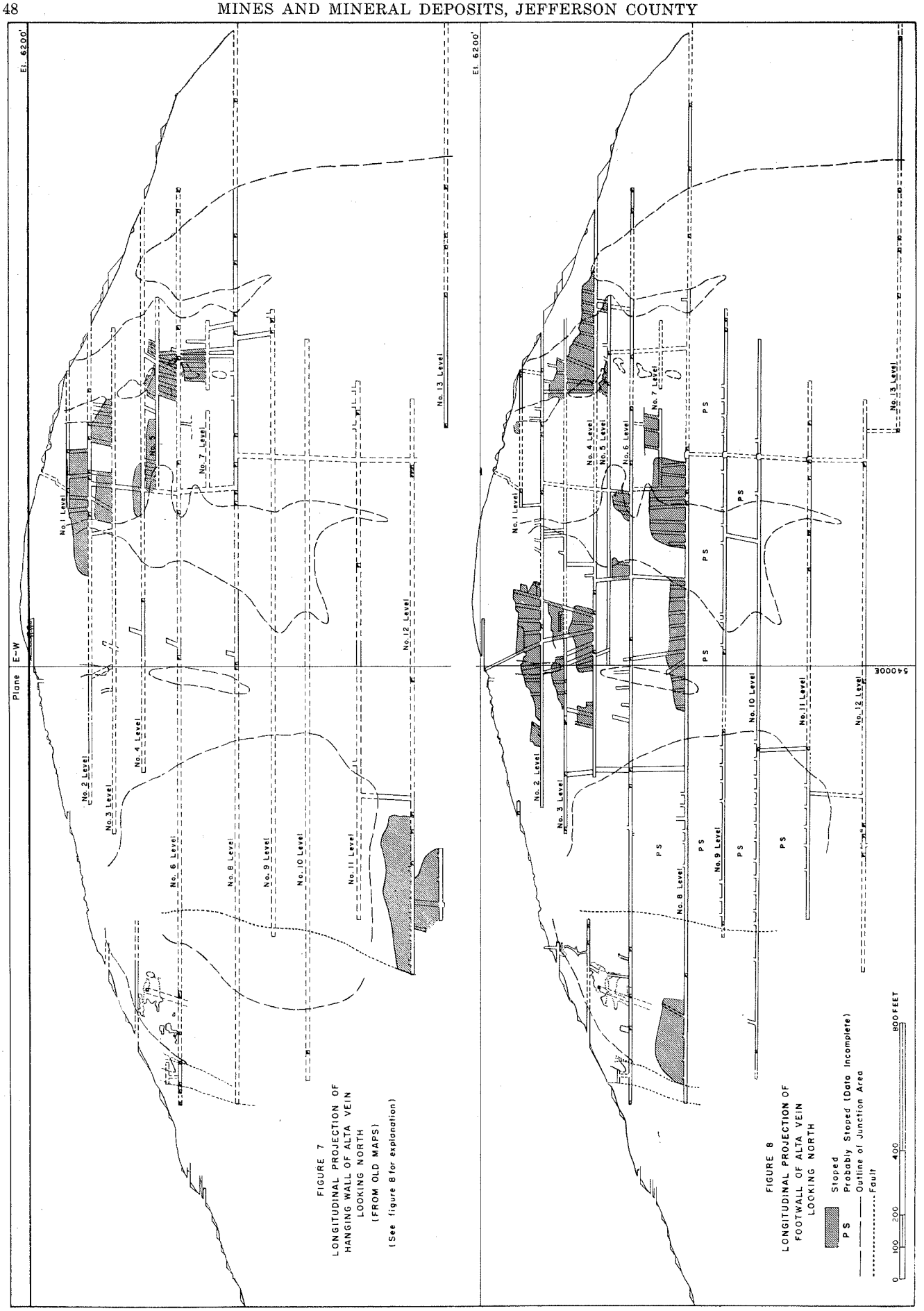


FIGURE 7
LONGITUDINAL PROJECTION OF
HANGING WALL OF ALTA VEIN
LOOKING NORTH
(FROM OLD MAPS)
(See figure 8 for explanation)

FIGURE 8
LONGITUDINAL PROJECTION OF
FOOTWALL OF ALTA VEIN
LOOKING NORTH

high-grade lead-silver vein in andesite was discovered in a crosscut in the 1,200-foot level shortly before operations at the mine were suspended in 1917.

Blizzard

The Blizzard property consists of 6 patented claims owned by C. S. and Alice Renouard, Butte. The claims, in secs. 17 and 18, T. 7 N., R. 4 W., are: (Mineral Survey nos. in parentheses) Blizzard, (5456), Blizzard No 2 (10033), Deer (10032), Deer Extension (10032), Wickes (10032), and Houghton (10032). The property is leased to Charles F. Hendrickson, Corbin.

It is reported that the mine was operated from 1888 to 1896 by a company and from 1899 to 1906 by lessees. From 1909 to 1949 the Blizzard has produced 2,751 tons ore which yielded 315 ounces gold, 19,657 ounces silver, 21,003 pounds copper, 133,581 pounds lead, and 25,205 pounds zinc. Total zinc production is for 2 years, 1946 and 1949.

The workings consist of 2 adit levels (1 over 1,000 feet long), an intermediate level, and 2 shafts. Probably the earliest workings were through the shafts which are now caved. The workings comprise about 4,100 feet of drifts and crosscuts. Two veins are exposed in the mine, and a third has been cut by an adit driven across the Blizzard property to gain access to the nearby Mount Washington mine. All of the veins are in steeply dipping fissures striking east in andesite. The ore ranges in thickness from a few inches to 6 feet.

The principal production in recent years has been silver-lead-zinc ore mined from the middle vein on the lower adit. The north vein contains chiefly copper ore with some gold and silver. The south vein has not been explored in the Blizzard mine. As indicated by its strike in the Mount Washington adit, the south vein would be about 200 feet south of the main No. 8 Blizzard drift.

It is reported that about 70,000 tons of milling grade ore are indicated above the No. 8 adit. No exploration work has been done below the No. 8 adit.

Bluebird

This property of 5 patented claims is near the west edge of the Wickes-Corbin region. The 5 claims are in sec. 13, T. 7 N., R. 5 W. and consist of the Bluebird (M.S. 3203), Evening Star (M.S. 5880), Escanaba (M.S. 8943), Blue Bell (M.S. 8943), and Black Bird (M.S. 8942). The claims are owned by Maud C. Bell of Helena. The mine, discovered in 1887, is one of the oldest in the district and operated every year from 1907 to 1921 with the exception of 1909, 1915, and 1920. It is reported that 1,000 tons of ore were mined between 1887 and 1893 that averaged 0.56 ounces gold and 65 ounces silver per ton (Winchell & Winchell, 1912, p. 287). Total production from 1902 to 1946 (28 producing years) was 17,989 tons ore, from which 3,454 ounces gold, 33,393 ounces silver, 960,259 pounds copper, and 203,949 pounds lead were recovered.

The mine is in the western margin of an andesite remnant of the cover over the quartz monzonite. The country rock in the vicinity of the mine is chiefly andesitic tuff that grades into hard shale (Knopf, 1913a, p. 112); Winchell & Winchell, 1912). The andesitic rocks have been fractured and intruded by dikes of porphyritic diorite (locally termed granite) and dacite.

The ore is reported to be in irregular shoots along the brecciated and tourmalinized contact between shale and a granite dike. The vein ranges in thickness from a few feet to more than 30 feet. The ore-bearing zone strikes about N. 80° W. and dips steeply to the south. Faulting has occurred along the zone both before and after the ore was deposited. The chief ore minerals are tetrahedrite and chalcopyrite, with small amounts of galena and sphalerite. Accessory minerals are rhodochrosite, pyrite, arsenopyrite, and malachite. Gangue minerals are quartz and tourmaline. The average metal content per ton of the recorded production was as follows: Gold, 0.19 ounces, and silver, 18.65 ounces per ton; copper, 2.69 percent and lead, 0.57 percent.

The **Mineral Resources of the United States** for 1911 reports the "property had been opened by a 1,000-foot vertical shaft, 4,146 feet of drifts, and a 2,320-foot adit." The main level of the mine is a 2,000-foot adit driven at an altitude of 7,200 feet to cut the vein 400 feet below its outcrop. Two levels were driven from a 200-foot winze below the main adit, and at least 1 level was driven above the main adit from a 200-foot shaft. The combined workings probably comprise more than 5,000 feet of drifts and crosscuts.

Bluestone

The Bluestone adit is about half a mile west of the Salvail mine at the junction of Wood Chute and Curtain Gulches. The last reported owner (1928) was Isaac Nyland & Bros. of Wickes. Production is reported for only 1 year, 1919, when the mine produced 25 tons ore, 3 ounces gold, 352 ounces silver, and 2,011 pounds copper.

An adit, estimated to be 500 feet in length, has been driven on a vein in hard blue andesite. The adit is caved at the portal. The dump contains a small amount of lead carbonate. The vein can be traced on surface west from the adit portal for about 600 feet.

Bonanza, Dewey, Montana, and Rosalie

According to Knopf (1913a, p. 115-116) the Corbin Copper Co. owned about 40 patented claims at the head of Clancy Creek, a few miles west of Corbin. At that time a large amount of development work was being done, and a concentrator had been built by 1910.

Volcanic tuffs and breccias comprise the host rock for tourmalinized silver-lead-copper-zinc veins in the Dewey, Rosalie, and Bonanza tunnels whereas the Montana tunnel contains mainly pyrite. Above the Dewey tunnel the volcanic tuffs have been shattered and leached. A red-weathering tourmalinized andesite is described from near the mouth of the Bonanza, but a granitic rock is exposed within the tunnel. Knopf (1913a, p. 116) describes the ore bodies intersected by the Dewey and Bonanza as local masses, composed of galena, chalcopyrite, pyrite, and shpalerite in a tourmalinized rock. The Rosalie, 2,000 feet southeast of the Dewey and Bonanza, contained a narrow oxidized vein containing pyrite and tourmaline and was supposedly of good grade.

Pyritized dacite "conglomerate" in the Montana tunnel is reported to contain little galena, 3 to 4 percent pyrite, and averages 8 ounces silver for 130 feet in the upper tunnel.

Dailey

The Dailey copper mine, known also as the Atlas mine, is in Wickes. The property, consisting of 4 patented claims, is owned by the Dailey Copper Min. and Smelting Co., W. W. Dailey of Wickes, president. The 4 claims, in secs. 15 and 16, T. 7 N., R. 4 W., consist of the Atlas (M.S. 4784), G.O.P. (M.S. 7145), Go Between (M.S. 7145), Steamboat and Steamboat mill site (M.S. 690).

The mine is one of the oldest in the region; the vein was discovered some time prior to 1879. It is developed by a 300-foot shaft, a 500-foot adit, and 2 levels from the shaft. All of the workings aggregate about 1,400 feet of drifts and crosscuts. Recorded production from the mine since 1911 is not large, but it is said that about $50,000 was produced in the early days above the 100-foot level. From 1911 to 1922 (5 producing years) total production was 796 tons ore which gave up 48 ounces gold, 10,127 ounces silver, 36,242 pounds copper, and 49,599 pounds lead.

The ore is in a fissure vein in andesite. The strike is east, and the dip is vertical. The width of the vein is reported to range from 6 to 16 feet. Minerals in the vein are chalcopyrite, arsenopyrite, chalcocite, and tetrahedrite enclosed in a gangue of quartz and altered andesite.

The property, at the present time (1959), is being explored by the Uranium Corp. of America of Portland, Ore. under the direction of Steve Giulio of Helena. Exploration at the 300-foot level continues and future plans call for sinking the shaft another level, under a Government exploration contract.

Edelweiss (Argentine)

The Edelweiss property contains 2 patented claims and 1 unpatented claim owned by R. E. Nicolls and E. G. Erickson of Helena. The patented claims are in sec. 2, T. 7 N., R. 5 W. and consist of the Edelweiss (M.S. 2554) and Argentine (M.S. 1565).

The property is in the quartz monzonite of the Boulder batholith about half a mile north of the contact with the andesite of the Wickes roof pendant.

A bulldozer trench excavated by the owners in 1946 or 1947 exposed a fault-vein in quartz monzonite for a distance of about 30 feet. The vein, which strikes east and has a vertical dip, comprises 5 feet of bleached granite and gouge on the north together with 2 feet of quartz and galena on the south. The 2 feet of ore are estimated to contain 15 to 18 percent lead. The enclosing granite contains considerable manganese oxide. A second bulldozer trench, excavated about 500 feet east of the first one, disclosed loose vein quartz in the overburden but failed to expose the vein in place.

Elkador

The 4 patented claims of the Elkador group are owned by C. L. West of Jefferson City. The group is in secs. 17 and 18, T. 7 N., R. 4 W. and consists of the Elkador (M.S. 2028), Elkador Ext. (M.S. 8939), Little Nancy (M.S. 8939), and Little Nancy Ext. (M.S. 8939).

The early-day work at the property was done through a 160-foot shaft. It is said the high-grade silver ore was mined from the vein in the oxidized zone. In recent years a 900-foot adit-drift was driven on the vein. About 50 tons of copper ore were mined from this drift. Three years production is reported between 1941 and 1949, but is shown in the Golconda district. Totals are 39 tons ore which yielded 4 ounces gold, 611 ounces silver, 2,506 pounds copper, and 320 pounds lead.

The vein is along a fracture in andesite; it strikes east and dips 70° to 80° N. One shoot was developed that ranged from 1 inch to a foot in width and was about 30 feet long. The ore is principally chalcopyrite with some gold and silver; it contains from 15 to 25 percent copper. A small prospect hole about 150 feet east of the adit discloses indications of a second vein that has not been developed on the property. This second vein was being explored by Leroy Barr of Butte during the summer of 1958. A 150-foot drift had been completed at the time of the visit.

Gregory

The Gregory mine is reported as the first silver-lead deposit to be mined in this part of Montana. The vein was discovered in 1864 (Swallow & Trevarthen, 1890, p. 34). The property is in sec. 4, T. 7 N., R. 4 W. and consists of 4 patented claims, Bonner (M.S. 866), Compromise (M.S. 42), Gregory and mill site (M.S. 427 and 428), and the Matchless (M.S. 1634). The claims are owned by the Helena-Livingston Smelting & Refining Co. through a consolidation with the Helena Mining

& Reduction Co., the owner of the Alta property, started the construction of the first smelter at East Helena in 1887. Operations at the Gregory mine stopped about 1900. In 1929 the Knickerbocker Mines Corp. was organized to work the Bertha and Gregory mines, but no production is reported. Since that time, work at the mine has consisted only of sporadic small-scale leasing operations. In 1941-1943 the mine was unwatered and sampled by the American Smelting & Refining Co.

For 17 producing years, between 1917 and 1957, the Gregory is credited with a total of 1,381 ounces gold, 66,655 ounces silver, 38,470 pounds copper, 862,370 pounds lead, and 132,563 pounds zinc from 18,977 tons ore.

The mine has 6 levels driven from a 720-foot shaft and 3 adits driven above the shaft collar. The extent of these workings is not known, but the aggregate is several thousand feet of drifts and crosscuts.

The Gregory vein strikes east and dips about 90°. The vein is in andesite above the 521-foot level, and in diorite on the two levels below. Dacite is exposed on surface a few hundred feet south of the shaft, but there is no record of it having been cut in the workings. The ore consists of argentiferous galena, sphalerite, arsenopyrite, and pyrite in a gangue of quartz and altered andesite. It is said that the ore that was smelted contained as much as 15 percent zinc.

Helena-Jefferson

Pardee & Schrader (1933, p. 238-240) describe this property as being 3 miles northeast of Wickes and 100 feet above the Helena-Butte Highway on its west side, at an altitude of about 4,900 feet. The operator and owner at that time (1932-33 ?) was the Helena-Jefferson Mines Co. which began operating on a small scale in March 1928. Records show production for only 1 year, 1928, as follows: 29 tons ore, yielding 113 ounces silver, 159 pounds copper, 5,231 pounds lead, and 6,216 pounds zinc.

The property was developed by several inclined shafts, one of which was 550 feet deep, and a crosscut tunnel. Six or more veins are on the property, but at the time of Pardee & Schrader's visit only the Helena vein was being worked. It strikes NW. and dips about 50° NE., is 6 inches to 6 feet wide, and lies between a hanging wall of aplite and footwall of quartz monzonite. The Helena vein contains lead, zinc, and a little silver. The ore minerals are steel galena, black sphalerite, and some molybdenite in a siliceous gangue. Several other veins, the Manganese and the New York veins, which are about 300 and 800 feet northwest of the Helena vein, contain considerable rhodochrosite (manganese carbonate) with some rhodonite (manganese silicate) and a rare manganese mineral alabandite (manganese sulfide). Minor amounts of pyrite, sphalerite, galena, chalcopyrite, quartz, and calcite occur with the manganese minerals.

Horseshoe

Knopt (1913a, p. 117-118) describes the Horseshoe prospect which is about 2 miles west of Corbin. The country rock is andesite which contains highly altered aplite. The aplite shows tourmaline and pyrite. Apparently development work which consisted of several hundred feet of tunnel was unsuccessful because no production is recorded.

Lone Eagle

A minor amount of uranium ore (65 short tons) is reported from the Lone Eagle property in sec. 25, T. 8 N., R. 5 W. (West, 1959, p. 127). Grade of ore ranged from 0.24 to 0.28 percent U_3O_8. Production was between 1952 and 1955. The mineralization occurs in pods in a quartz fracture filling. Pitchblende, pyrite, sphalerite, and galena are the important minerals. The mineralized zone ranges from 1 to 5 feet in width and is 230 feet long.

Minah

The Minah is one of the oldest mines in the region. The first claim location in the group was recorded on September 28, 1865 (Lorain and Hundhausen, 1948). In 1886 a quarter interest in the property was bought by John Oliver Briscoe, who organized the Minah Con. Min. Co. and operated the mine until 1890. At this time property was sold to the Minah Cons. Min. Co., Ltd. of London, England. After making one payment on the property, the English company defaulted. A long legal battle ensued, and after 15 years clear title to the property was awarded to Briscoe. His estate still owns the property, which consists of 8 lode claims, 1 placer claim, and 1 mill site. All of the claims are patented. The property is in secs. 8, 9, 16, 17, and 18, T. 7 N., R. 4 W. The claims (with Mineral Survey nos. in parentheses) are: Iron Dollar (2027), Annie B. (2064), Minah (286), Hillside (1870), Iowa (2026), San Pedro and mill site (4747), Minah East (324), Homestake (2025), and a placer (189). The Minah mine was under lease and option to Mr. H. M. Lancaster of Helena, who gave a sublease in 1949-1950 on the property to the Minah Development Co., Alfred Nugent of Helena, manager.

In 24 productive years between 1905 and 1956, the Minah produced 14,596 tons ore from which 740 ounces gold, 74,438 ounces silver, 12,491 pounds copper, 445,229 pounds lead, and 34,598 pounds zinc were recovered. Zinc was produced only after 1945.

The first work on the Minah vein was done through a 200-foot shaft. Later, 4 adit levels were driven with a combined length of about 8,000 feet, and a 110-foot winze was sunk below the lowest adit. These workings have developed the vein for a length of about 1,700 feet and to a depth of

about 900 feet. The upper levels are inaccessible, but the lowest level was cleared and retimbered to a point 2,100 feet from the portal by the Minah Development Co. in 1947. This company also unwatered the 100-foot winze and drifted 100 feet west on the vein at the bottom of the winze. The vein averaged about 2 feet in width in the winze drift.

The ore bodies are in a fissured zone of andesite. The zone has been traced west for about 1,700 feet from a point where the vein is covered with dacite to a fault striking N. 20° W. The fissured zone ranges from 5 to 15 feet in width, but the ore probably averaged much less than this. The ore consists chiefly of galena, tetrahedrite, and iron sulfides in a gangue of altered andesite and a small amount of quartz. Arsenopyrite was prominent in some of the ore mined.

Minnesota

The Minnesota property, which consists of 2 patented claims and a mill site, is owned by Edna M. Adamson, V. H. Manuel, and E. R. Manuel, all of Helena. The 2 claims and mill site are in secs. 4 and 5, T. 7 N., R. 4 W. and consist of the Minnestota (M.S. 16), and the Charlotte and mill site (M.S. 185).

From 1902 to 1953 the Minnesota produced 1,677 tons ore which yielded a total of 457 ounces gold, 8,582 ounces silver, 2,759 pounds copper, 116,076 pounds lead, and 6,836 pounds zinc. Zinc production was recorded in 1948, 1952, and 1953.

The mine is on the contact between andesite and quartz monzonite at the north end of the andesite roof pendant. The vein is enclosed in both andesite and quartz monzonite, but it appears to cross the contact rather than to follow it. It is said that the productive part of the vein was in the granite only (Knopf, 1913a, p. 118). The vein strikes N. 85° E. and dips 75° N., and appears to be about 2½ feet wide where it is exposed in the end of an open-cut. The vein is developed by 2 adits and a 400-foot shaft. The collar of the shaft is at an altitude of about 5,540 feet.

Mount Washington

The Mount Washington mine, which was owned by the North Range Min. Co. of Helena, in recent years has been the largest and most steady producer in the Wickes-Corbin region. The property is at the present time owned by the L. H. & L. Min. Co., Inc. of Grand Junction, Colo. and consists of 6 claims in secs. 17 and 18, T. 7 N., R. 4 W. The claims, with Mineral Survey nos. in parentheses, are: Keystone (9807), Mount Washington (9807), Monongahela (9807), Iron Mask (9807), Homestake (9807), Handy Andy (9807, and 1 placer (4154).

In only 17 out of the past 52 years has the mine failed to produce ore. The vein was located before 1890 by the Kauf brothers. In 1913 the mine was one of the largest producers in the district and has operated every year since that time. During the period 1913-1926, it was operated by the Angelica Min. Co. In 1926 the mine was taken over by the Elm Orlu Min. Co. of Butte, and was operated by them during 1926 and 1927. In 1928 the mine was being operated by a lessee (Warner Nikolla).

The last and largest company operation was from 1942 to 1945. During these years the Monongahela Mount Washington Min. Co. mined 91,300 tons of ore which was concentrated in the company's 150-ton mill. The mine was closed in 1945, and the mill was sold. The most recent work was done by lessees in the carbonate zone above the 400-foot level during 1949.

Since 1902 through 1951, the Mount Washington produced a total of 182,601 tons ore which yielded 11,651 ounces gold, 1,344,082 ounces silver, 543,770 pounds copper, 14,509,148 pounds lead, and 8,044,639 pounds zinc.

The mine is developed by a 1,000-foot shaft with 11 levels. The 8th level has been opened to surface by an 1,800-foot crosscut tunnel, which has served as the main haulageway for the mine. However, this tunnel is now caved and access to the mine at the present time is through the shaft. The mine has about 12,000 feet of drifts and crosscuts. The vein has been explored for a length of 2,500 feet and to a depth of 1,050 feet below its outcrop. It strikes east and dips 70° N. A major fault displaces the west part of the vein 300 feet to the south. Other faults have made minor displacements. The ore occurs in irregular lens-like shoots along 1 wall or the other of a rhyolite dike that intrudes andesite. In a few places the ore is on both walls of the dike. The dike ranges in thickness from 10 to 50 feet. The ore is crushed in places by post-mineral movement.

Ore in the primary zone includes galena, sphalerite, chalcopyrite, tetrahedrite, arsenopyrite, and pyrite. Some of the ore mined below the tenth level is reported to contain bismuth (Pardee & Schrader, 1933, p. 237). From surface to the 400-foot level, the ore was oxidized and sulfide ore was mined; below the 500-foot level the ore was chiefly sulfides.

Northern Pacific

Knopf (1913a, p. 119) briefly describes the Northern Pacific as follows: "The Northern Pacific, in sec. 9, T. 7 N., R. 4 W., lies on the west side of Alta Mountain. The country rock of this mine is a highly flow-banded andesite. The ore contains galena, pyrite, and sphalerite in a gangue of manganiferous calcite holding fragments of brecciated andesite."

Total recovered metals are 67 ounces gold, 6,303 ounces silver, and 47,373 pounds lead from 353 tons ore. The mine produced in 1908, 1910, 1911, 1912, and 1913.

Pen Yan

The Pen Yan claim and the Bluebird claim to the east are joined end to end. The Pen Yan mine should be included in the Cataract district because it is west of the divide that bounds the 2 regions. However, it is included in the Colorado district because the mineralized zone appears to be a continuation of the same zone that is in the Bluebird mine, and its production is recorded in the Colorado district totals. The Pen Yan claim is owned by John Williams of Boulder, Stanley Reilly of Wickes, Paul Smith of Helena, and Maurice Nelligan of Boulder. The property consists of a patented claim and mill site in sec. 13, T. 7 N., R. 5 W. recorded as the Pen Yan and mill site (M.S.2204).

Four years of production, 1921, and 1939-41, totaled 428 tons ore, which yielded 79 ounces gold, 4,268 ounces silver, 275 pounds copper, and 836 pounds lead.

The mine is developed by a 200-foot shaft from which levels have been driven at the 80-, 140-, and 190-foot levels. The 140-foot level is reported to connect with the Bluebird mine (Hogan & Oliver, 1891, p. 39).

The vein is said to be a continuation of the Bluebird vein, which is along the brecciated and tourmalinized contact between shale and a granite dike. The Pen Yan ore is reported to contain more gold than the Bluebird ore (Winchell & Winchell, 1912, p. 287).

Salvail (Three Horns)

The Salvail mine is in Wood Chute Gulch about a quarter of a mile south of the Mount Washington mine. The vein was located about 1903. The high zinc content of the ore prevented profitable operation at the time. In 1927 Dr. Salvail, the owner, began active development and shipped ore in 1928 and 1929. Only 2 years of production are recorded for the Salvail (1928-1929). The total amount of recovered metals are 163 ounces gold, 9,283 ounces silver, and 21,820 pounds copper from 459 tons ore.

The mine is on 2 veins both of which strike east and are enclosed in andesite. The veins are cut by an adit reported to be 1,200 feet long. The adit is now caved about 370 feet from the portal. The workings on neither vein are accessible.

The north vein, said to be 800 feet from the portal, strikes east and dips 70° N. (Pardee & Schrader, 1933, p. 237). Drifts from the adit crosscut have been driven on the vein for about 800 feet. The vein averaged about 5 feet in width with ore shoots as wide as 3 feet. The south vein is in a wide shear zone; it contains some low-grade ore.

The ore minerals are reported to be chalcocite, chalcopyrite, galena, pyrite, arsenopyrite, ruby silver, and bournonite (Pardee & Schrader, 1933, p. 237).

Silver King

The Silver King, as described by Knopf (1913a, p. 116-117), was owned by the Corbin Metals Min. Co. The property is about 2 miles southeast of Corbin. A 400-foot inclined shaft intersects 5 parallel veins, which trend N. 30° to 45° E. and which are in granite (quartz monzonite) country rock. Vein widths range from a few inches to 8 feet. Metallic minerals noted (by Knopf) on the dump are pyrite, galena, sphalerite, and rarely molybdenite. This property is now part of the Alta group.

Wickes-Corbin

As described by Pardee & Schrader (1933, p. 244), the Wickes-Corbin Copper Co.'s property was developed by a tunnel about 900 feet long in Picnic Gulch, southeast of Wickes. Country rock is andesite and quartz monzonite of the Boulder batholith, and a coarsely porphyritic aplite or alaskite. Chalcanthite and gypsum needles coat some upper tunnels and drifts, and cupriferous pyrite occurs disseminated through the country rock. Galena, sphalerite, chalcopyrite, and pyrite are found in ill-defined, quartz-bearing shear zones.

Wickes-Corbin (Blackbird)

The 17 patented claims of the Wickes Manganese property, formerly owned by the United Securities Corp., St. Paul, Minn., and now owned by E. R. Van Sickle of Fort Harrison, were located about 1885 for the purpose of developing a local source of manganese for a proposed iron smelter in Montana. The claims are in 5 groups in secs. 6, 7, and 8, T. 7 N., R. 4 W. and secs. 1 and 12, T. 7 N., R. 5 W. Most of the development work has been done on the Blackbird group, which is near the head of Clancy Creek in secs. 7 and 12, T. 7 N., Rs. 4 and 5 W.

This latter group now consists of the following 25 patented claims (Mineral Survey nos. in parentheses): D.E.D. (9184), Prosper (8940), Missing Link (9184), S.P.D. (9184), Maggie D. (8939), Helena (9184), F.E.R. Frac. (8940), Anna (8940), Black Rock No. 3 (8940), Glenkeg No. 1 (8940), Pine Ridge (8940), Rosalie (8940), Dow (8940), Roy (9814), Black Rock No. 1 (8940), Edwards (8940), Chief Joseph (8940), F.F.C. (8940), Glenkeg No. 2 (8940), Dewey (8940), Tell (8940), Henrietta (8940), Col Farish (8940), Albert (8940), and Walker (8940).

Four adits with a combined length of about 1,000 feet and 1 shallow shaft comprise the underground workings on the Blackbird group. The workings were all driven years ago, so many of them have since caved. In 1942 the Federal Bureau of Mines, as part of an exploration project, rehabilitated and sampled most of these workings and advanced some of the headings. The outcrop of the vein was explored by excavating 13 bulldozer cuts totaling 2,425 linear feet.

The andesitic roof pendant in which the workings occur is here represented by dense fine-grained andesite, andesite breccia, and tuff. All of these rocks are intensely and irregularly jointed. The breccia fragments range in size from fine-grained particles to andesite blocks a foot across. The tuff, which is subordinate in amount, has been altered to fine clay-like material.

The manganese ore is in small disconnected veins in andesite breccia and tuff, which are overlain by dense fine-grained andesite. Considerable fault movement has occurred along the breccia-tuff horizon. The altitude of the veins is conformable to that of the enclosing rocks; the strike ranges from N. 64° W. to west, and the dip ranges from 35° to 70° N. The underground workings and the bulldozer cuts disclose 3 ore shoots that average about 33 feet in length and depth and about 4 feet in thickness. The ore averaged about 19 percent manganese. The surface trenches indicated 2 additional ore shoots, but the overburden was too deep to completely determine their extent.

The ore consists principally of psilomelane, pyrolusite, and wad (an impure mixture of manganese and other oxides, also called bog manganese). The gangue is andesite with small amounts of calcite, quartz, and some gypsum.

Three bog manganese deposits occur on other claims of the property. These bog deposits were explored by bulldozer trenches and test pits. The total area of the 3 deposits is about 1/3 of an acre; the thickness averages 2.5 feet. The ore is porous, black manganese dioxide that contains about 39.7 percent manganese and up to 40 percent moisture.

Several carloads of ore aggregating about 150 tons were shipped to the Metals Reserve Co.'s stock pile at Butte in 1942 and 1943.

ELKHORN DISTRICT

The Elkhorn mining district embraces that part of Jefferson County in the Elkhorn Mountains drained by Elkhorn Creek, a southerly flowing tributary to the Boulder River. The district lies in Ts. 5 and 6 N., R. 3 W.

The only settlement in the region is the village of Elkhorn at an altitude of 6,500 feet. Although at one time it had a population of over a 1,000, it now has only a few families. Elkhorn is 8 miles (airline distance) northeast of Boulder, from which it is accessible by 20 miles of paved and improved dirt road. Most of the mining properties on the southwest slope of the Elkhorn Mountains are accessible by mountain roads leading from the Boulder-Elkhorn road.

Altitudes range from 4,800 feet at the lower end of Elkhorn Gulch to 9,416 feet at the summit of Crow Peak, the highest point in Jefferson County. The mines in the vicinity of Elkhorn, which are the most numerous, are at altitudes ranging from 6,400 feet to 8,600 feet. The mountain slopes are steep but not preciptious.

Lodgepole pine, fir, and spruce grow on most of the mountain slopes. Timber for mine support is plentiful. The nearest sawmill is at Boulder. Sufficient water for milling purposes is available in most of the creeks. Numerous mills have been operated near Elkhorn.

The region did not become prominent until the Elkhorn mine started producing silver ore from Holter lode about 1875. Activity at this mine continued with only a few interuptions until about 1912, when company operations ceased. The Elkhorn mine then was purchased by Henningsen, Stockpole, and Walker and produced sporadically from 1916 to 1951.

Lode gold mines in the area have produced intermittently to the present time. Figure 9 shows the patented properties near Elkhorn. Production from the district as recorded since 1902 is shown in table 16.

The geology of the area has ben studied by Weed (1901), Stone (1910), Knopf (1913b), and Klepper and others (1957). The following brief description is taken largely from Klepper's report. (See fig. 10).

Klepper states that the southern Elkhorn Mountains are carved in a thick sequence of sediment ary and layered volcanic rocks that have been folded and faulted and cut by a variety of intrusive rocks. The oldest rocks exposed are mudstones, shale, and sandstone which are assigned to the Belt series of upper Precambrian age. These rocks are overlain, apparently with slight angular unconformity, by the thin but widespread Flathead quartzite of Middle Cambrian age, which in turn is overlain by marine carbonate rocks, shale, and sandstone of Cambrian, Devonian, Carboniferous, and Permian age. At least 2 significant erosional unconformities have been recognized within the Paleozoic sequence, 1 between the Upper Cambrian and Devonian and 1 within the Mississippian. Resting with slight erosional unconformity on Permian sandstone and chert is a thin Upper Jurassic marine sandstone that is succeeded without recognizable unconformity by nonmarine Upper Jurassic and Lower Cretaceous sandstone and shale. The Lower Cretaceous rocks are overlain with probable slight erosional unconformity by a thick sequence of alternating nonmarien and marine sandstone, mudstone, and dark-colored shale of the Colorado group that grades upward into sandstone and sedimentary tuff, most of which is probably nonmarine. In some localities these rocks grade upward imperceptibly into andesitic volcanic rocks that are probably of Late Cretaceous age, elsewhere a major erosional unconformity, which is almost certainly distinctly angular in some places, separated the sedimentary rock from volcanic rocks. A major angular unconformity separates the volcanic rock from poorly consolidated

FIGURE 9.—Claim map of part of T. 6 N., R. 3 W., Elkhorn District, Jefferson County, Montana.

Oligocene, and possible Miocene, basin-filling of volvanic ash and stream gravel.

The Elkhorn district has a much larger variety of ore deposits than any other region in Jefferson County. The deposits are in either the sedimentary rocks or the andesite, or at the contact of these rocks with the quartz monzonite. Only 1 deposit is known to be wholly contained in granite, and this is within a few hundred feet of a limestone contact so is undoubtedly associated with contact metamorphism. Some 22 different ore minerals have been descirbed from this district.

Bonanza

Although not in the Elkhorn district proper, the Bonanza is included here. The Bonanza is about ½ mile west ofthe Jefferson-Broadwater County line in sec. 24, T. 6 N., R. 2 W.

Klepper and others (1957, p. 74) have described the mine as follows: "The Bonanza mine—explored galena-bearing veins in the upper part of the Mission Canyon limestone on the crest of the major domal structure of the southern Elkhorn Mountains. Stone (1911, p. 91) reported that the ore

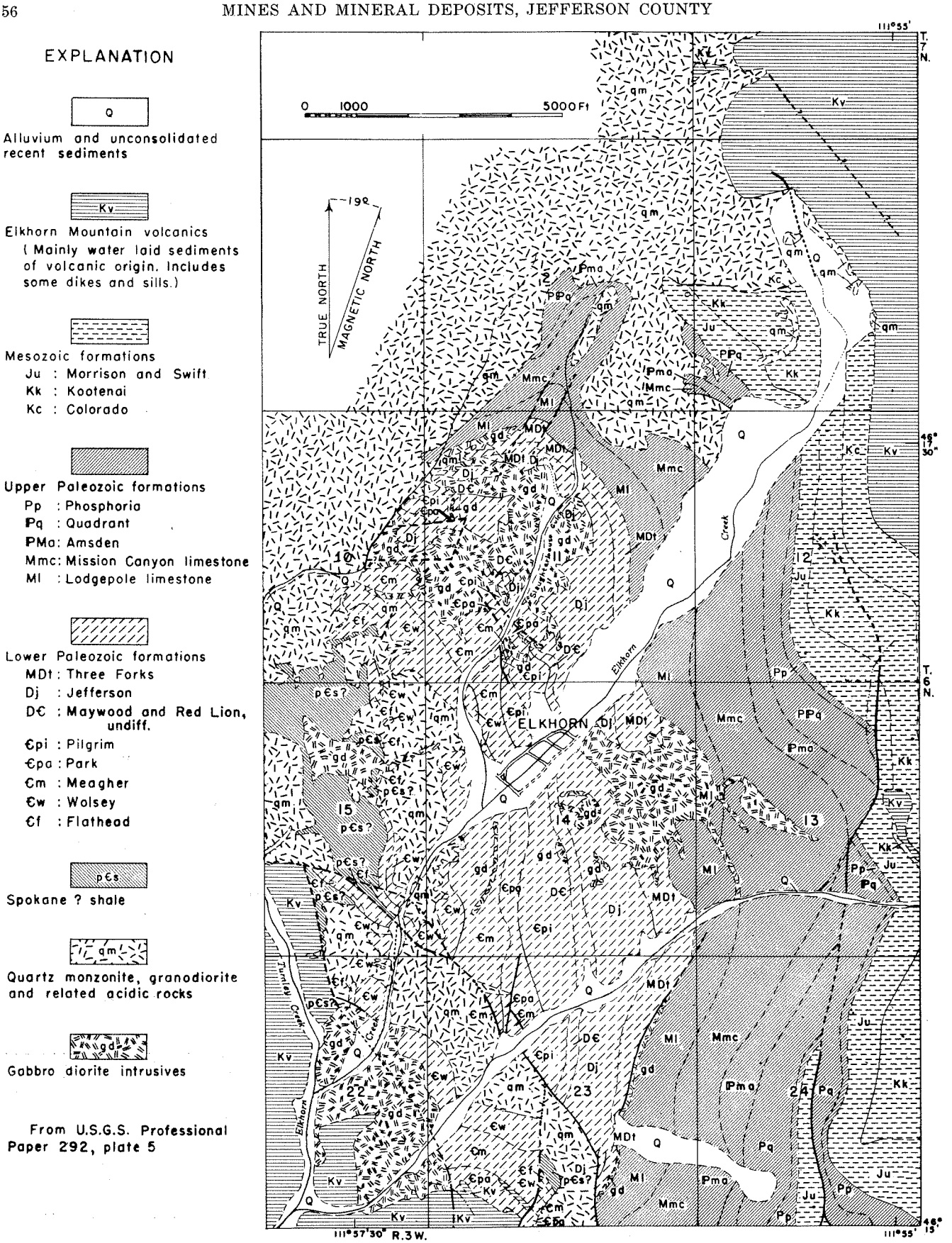


FIGURE 10.—Geologic map of the Elkhorn District, Jefferson Co., Mont.

TABLE 16.—Production of gold, silver, copper, lead, and zinc from lode mines, Elkhorn district,* Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902	14,583	1,207	428,878	—	224,433	—	$244,918
1903	No production						
1904	10,000	3,000	—	—	—	—	60,000
1905	12,707	3,741	12,754	—	121,446	—	90,743
1906	8,964	3,951	39,788	27,158	68,313	—	117,453
1907	29,553	3,433	529,361	—	623,346	—	453,385
1908	48,064	3,011	890,900	96,796	1,221,718	—	598,518
1909	52,062	2,592	897,864	84,055	1,226,047	—	584,111
1910	53,429	2,857	950,519	64,145	1,642,105	—	652,738
1911	64,625	2,868	738,691	51,892	1,547,608	—	526,923
1912	20,863	4,281	305,322	298,214	493,414	—	347,688
1913	4,198	914	8,673	73,087	36,680	—	37,072
1914	3,341	1,582	3,594	27,294	12,701	—	38,807
1915	4,675	1,571	6,315	27,533	31,778	—	41,997
1916	7,665	2,513	4,227	56,293	34,526	—	70,966
1917	5,910	1,028	9,113	17,222	105,235	—	42,521
1918	6,437	272	67,585	10,185	12,960	—	76,653
1919	7,723	483	38,567	4,237	20,776	—	55,084
1920	2,447	313	7,670	6,842	9,232	—	16,830
1921	8,061	1,194	15,929	—	44,404	—	42,619
1922	56,173	5,689	102,168	15,108	5,269	—	222,094
1923	41,281	6,264	56,889	4,038	7,090	—	177,230
1924	20,631	264	54,695	13,541	2,382	—	44,064
1925	25,087	184	64,406	2,406	—	—	48,844
1926	2,343	206	35,207	2,425	10,594	419	27,438
1927	2,046	259	9,673	4,564	—	—	11,429
1928	816	153	1,444	1,975	—	—	4,289
1929	139	90	21	—	—	—	1,871
1930	208	85	212	6,484	—	—	2,682
1931	139	44	66	2,363	—	—	1,140
1932	1,172	249	135	—	2,200	—	5,240
1933	865	226	23	—	—	—	4,685
1934	8,316	407	147	50	1,162	—	14,366
1935	6,042	269	19,456	807	14,525	—	24,034
1936	17,519	484	24,115	1,815	43,935	—	37,812
1937	57,661	533	86,137	5,000	319,000	—	104,708
1938	13,670	409	6,568	1,653	32,870	—	20,235
1939	745	323	2,136	875	17,809	—	13,683
1940	503	258	2,226	1,451	39,720	—	12,763
1941	132	153	211	—	1,600	—	5,596
1942	2,036	70	13,701	1,300	77,700	—	17,556
1943	22,730	577	156,915	18,900	918,600	—	203,131
1944	10,454	270	68,670	8,400	373,900	—	89,328
1945	18,563	740	123,435	14,000	569,500	1,198,200	302,336
1946	4,768	353	37,094	8,000	230,000	277,500	102,548
1947	14,134	266	82,663	30,400	307,200	593,500	202,994
1948	3,882	409	34,019	7,900	111,900	199,400	93,368
1949	5,676	204	48,289	8,000	226,800	242,800	118,362
1950	2,937	98	24,140	4,200	84,200	154,500	59,458
1951	5,665	368	52,797	5,800	455,800	252,800	186,932
1952	3,731	268	53,194	4,417	585,291	170,910	181,195
1953	976	31	9,016	1,400	110,000	39,200	28,565
1954	1,030	87	16,830	1,200	244,400	33,000	55,678
1955	617	66	6,243	1,100	90,300	21,300	24,445
1956	440	97	3,854	600	44,100	20,900	16,925
1957	1	31	10	—	—	—	1,094
TOTAL	726,455	61,295	6,152,555	1,025,125	12,404,569	3,204,429	6,567,144

*Includes some production from South Elkhorn district.

was along bedding that dips 25° N., and that workings consisted of about 10 adits. All were relatively short and are now caved. Ore specimens selected from the dumps contain galena, in part oxidized to cerussite, intergrown with milky quartz, limonite, coarsely crystalline calcite, and sparce sphalerite. The largest vein fragment found consists of a 2-inch band of quartz with abundant galena and a 4-inch band of coarsely crystalline calcite. Stone noted that the ore was valuable principally for silver."

Boulder

The Boulder iron deposit is in the rolling foothills east of the Boulder River in the southwestern corner of the Elkhorn region at an altitude of 5,100 feet.

The deposit is along a vertical contact of shale and limestone. On surface the deposit is about

100 feet in length, north and south, along the contact, and its maximum width is about 15 feet. The ore mineral is hematite. No silicate minerals, usually associated with contact metamorphic deposits, were noted in either the shale or limestone. Between the iron ore and the limestone to the south is a seam of clay gouge 6 inches to 1 foot thick. Several hundred tons of ore appear to have been mined from 2 steep-walled pits that are separated by a surface pillar. The lateral extent of the workings appears to be about 15 feet in width by 85 feet in length. The sides oif the pit have sluffed so that now the depth is about 20 feet.

The limestone-shale contact can be traced for almost a mile, but only a few of the other numerous prospect pits along this contact contain even a small amount of iron-stained shale; none contain iron ore.

Bulwer (Elkhorn-Bulwer)

The Bulwer is in the NW¼ sec. 23, T. 6 N., R. 3 W. It was last operated by D. C. Walker. The owner is William Dawson of Elkhorn.

Two adits, said to total 560 feet in length, and a 180-foot shaft were excavated to exploit a contact replacement deposit between porphyritic granodiorite and Cambrian and Devonian carbonate rocks. The contact strikes north, and the dip is nearly vertical. The workings are all inaccessible, and only a small amount of copper carbonate (malachite) ore can be seen on the dumps.

It was said locally that ore was mined from the 180-foot level of the mine, and that mining operations ceased when the shaft caved. In 1940 lessees diamond-drilled 2 holes from surface to explore the vein below the 180-foot level but failed to recover either core or sludge from the holes. Some additional work was done later under a DMEA contract.

C & D (Boulder-Belle) and Louise

The C & D in secs. 11 and 12, T. 6 N., R. 3 W. is 1 of the oldest mines in the vicinity of Elkhorn. It is owned by the C & D Min. Co., c/o C. A. Clark, Sandy, Ore., and was last operated by Dutton Clark and J. Kalstead in 1942. The 3 mining claims comprising the property were located about 1875. The main workings, which are on the C & D claim (M.S. 1620), consist of a 400-foot adit and a 250-foot incline shaft. The shaft is caved and inaccessible, but most of the adit workings are open. The Louise workings consist of only a 205-foot shaft, from which apparently little or no work was done. Between 1902 and 1942, the C & D produced 1,860 tons ore, which yielded 641 ounces gold, 7,748 ounces silver, 769 pounds copper, and 90,770 pounds lead.

The ore zone is in Madison limestone near a quartz-monzonite plug; however, no quartz monzonite is reported in the accessible workings. The replacement ore body trends N. 35° E. and dips 45° to vertical. The old stope from which ore has been mined is about 200 feet in length and in places as much as 25 feet in width.

Little information is available concerning the early-day production from this mine. The Montana Mine Inspector's report for 1893 states, "The ore is hematite iron carrying a percentage of gold." (Shoemaker, 1893, p. 12.) The report further stated that the ore from the C & D was used as flux at the East Helena smelter. Small shipments of ore made since 1909 have averaged about ½ an ounce of gold per ton. The material in some drift headings consists of brecciated quartz and limestone with minor argentiferous galena and cerussite, all of which are cemented by iron oxide. This is probably the limonitic gold-lead replacement along bedding that is mentionad by Klepper and others (1957, p. 69). The mass has the appearance of being almost a conglomerate because the breccia fragments are partly rounded. Klepper also mentioned a second vein which is described as a steeply dipping silver-bearing vein and suggests that this structure may terminate upward against the limonitic breccia zone.

Carmody

L. F. Carmody owns property about a ½ mile south of Elkhorn comprising 7 patented and 4 unpatented claims. In 1933, 6,000 tons of ore were milled by the cyanide process in a mill on the property. Two adits with a combined length of about 1,500 feet have been driven in limestone to explore a fissure vein about 300 feet below its outcrop.

The vein, containing iron pyrite, arsenopyrite, and gold in a gangue of quartz and calcite, ranges in width from a few feet to 24 feet. It is said that the ore was mined from 8 to 12 feet wide. This property is probably the same as the Carmody-Papesh mine mentioned by Klepper (1957, p. 70). Production has been recorded from the Carmody and Papesh group in the Big Foot (State Creek) district with a total output of 4,512 tons ore, which yielded 238 ounces gold and 50 ounces silver in 1933 and 1934.

Dunstone

The Dunstone claim (M.S. 2359) is just east of the Klondyke and is owned by S. C. and Marjorie Kennett of Helena. Prior to 1900 the mine was operated but closed when the price of lead dropped. It is reported that during the productive years the mine produced high-grade galena from an ore shoot at the intersection of an east- and north-trending vein. The ore body, long since worked out, was developed to about the 100-foot level by a vertical shaft and by drifts and crosscuts. The ore minerals, sphalerite and galena with a quartz-pyrite-limonite gangue, occur as a replacement in fractured Jefferson dolomite. In 1955 a DMEA contract was let to explore other vein intersections; however, it is reported that mineralization was not encountered.

The Homestake, three-fourths of a mile northwest of Elkhorn, is briefly mentioned in conjunction with the Dunstone (Weed, 1901, p. 508) as having an ore body in dolomite.

Elkhorn (Holter)

The famous Elkhorn mine property consists of 5 patented lode claims, 2 patented placer claims, and 2 mill sites in NW¼ sec. 14, T. 6 N., R. 3 W. The group is owned by L. I. Walker and others, 904 West Platinum St., Butte and include the Elkhorn, Keene, Hardin, Silver Star, and Sophia claims. The Elkhorn was the largest mine in the Elkhorn region. The main shaft is 2,300 feet deep and has ben driven on a slope of about 40° from the horizontal, making the 2,300-foot level 1,439 feet below surface. Ninteen levels have been driven from the shaft, totaling about 12,000 feet of horizontal workings. (See fig. 11).

In 1906, the Elkhorn mine was unwatered and reopened by J. H. Longmaid; a mill on the property was equipped with Frue vanners. Unwatering was completed in 1907, and 400 feet of development work was done. In 1908 construction was in progress on a new mill for treating tailings by the Baker-Burwell process. In 1909 Elkhorn Electro Metals Co. completed the plant and claimed to have made a successful extraction of gold and silver from tailings. In 1922 the Western Metallurgical Co. worked the old tailings dump by gravity concentration followed by cyanidation. The dumps were said to contain 150,000 tons of material averaging 7 ounces of silver per ton with a little gold. In 1929, the Elkhorn Silver Min. Co. sunk about 100 feet of shaft and drove about 150 feet of drifts. In 1937 the Elkhorn Metals, Inc. operated flotation plant on old tailings until late in the year when operations were suspended. In 1943, Elkhorn tailings were again shipped for flux. The material contained an average of 6.9 ounces of silver a ton with 2.1 percent lead, 3.0 percent zinc, and minor amounts of gold and copper. The operation was profitable only because of the premium payments received from the Government. In 1944 material shipped averaged 6.6 ounces of silver per ton with 1.8 percent lead, 4.5 percent zinc, and a litlle gold and copper. In 1948 the mine was operated 1 month by the Elkhorn Min. Co. and the rest of the year by the Associated Mines Development Co. In 1951 Elkhorn Min. Co. again operated the mine, but only for 6 months. No production has been reported since that time.

The largest producer (in tons) in Jefferson County since 1902, the Elkhorn mine is credited with 11,504 ounces gold, 5,860,389 ounces silver, 148,336 pounds copper, 10,004,780 pounds lead, and 2,839,742 pounds zinc. The metals were recovered from 497,760 tons ore during the period between 1902 and 1952 (36 producing years). Weed (1901, p. 414-415) gives the production of the Elkhorn mine, prior to 1901, as follows: 8,513 ounces gold, 8,922,363 ounces silver, and 4,000,000 pounds lead. Since 1946 and during an interval of years between 1917 and 1938, the bulk of production came form old mill tailings.

The Sophia is credited with an individual production of 137 tons ore from which 6 ounces gold, 3,740 ounces silver, 25 pounds copper, and 5,479 pounds zinc were recovered. Production was for 7 years between 1915 and 1942.

Two types of ore shoots occur in the Elkhorn mine: the hanging-wall deposits and the footwall or "chamber" deposits. The hanging-wall deposits are in dolomitic marble immediately below impervious indurated shale. The deposits were localized in crushed zones in dolomite on the underside of local pitching anticlinical folds in the shale. Two principal ore shoots of this type were mined, one north of the shaft and the other south. The shaft was sunk on the dip of the dolomite-shale contact, and the levels were driven along the strike of the contact. Weed (1901) states that, although there was some fault movement between the dolomite and shale, the contact is not mineralized nor does it have any vein quartz except in the ore shoots below the anticlinal folds.

The footwall or "chamber" deposits are irregular replacement bodies in the footwall dolomite. Their localization seems at least partly to have been controlled by a number of stratification planes in the dolomite along which there may have been fault movement. Some of the "chambers" have been found as far as 80 feet below the shale contact measured normal to the dip of the enclosing beds. In the words of Knopf (1913a, p. 136), "Many of them (footwall deposits) extend by exceedingly devious courses back to the hanging-wall hornstone, or slate as it is known locally."

The hanging-wall ore was reported to contain galena, tetrahedrite, pyrite, and sphalerite in a gangue of quartz. The footwall ore contains galena, sphalerite, and pyrite. The gangue is principally dolomite.

Elkhorn Peak

This deposit of iron ore is in the SW¼ sec. 36, T. 7 N., R. 3 W. at an altitude of 8,500 feet near the summit on the north side of Elkhorn Peak. It is accessible from Elkhorn by 4.5 miles of steep mountain trail. In 1900 ore from this deposit was mined at the rate of 75 to 100 tons per day for use as flux at the East Helena smelter.

The ore is in lenses along a northeast-trending contact of andesite and overlying limestone. The contact dips 20° to 45° SE. into the mountain. Iron-bearing material is exposed in the overburden and in mine excavation dumps for a distance of 700 or 800 feet, but it is impossible to tell how continuous the ore lenses are throughout this distance because of the caved condition of the workings. The width of the iron ore where it is exposed in a number of open-cuts ranges up to 15 feet.

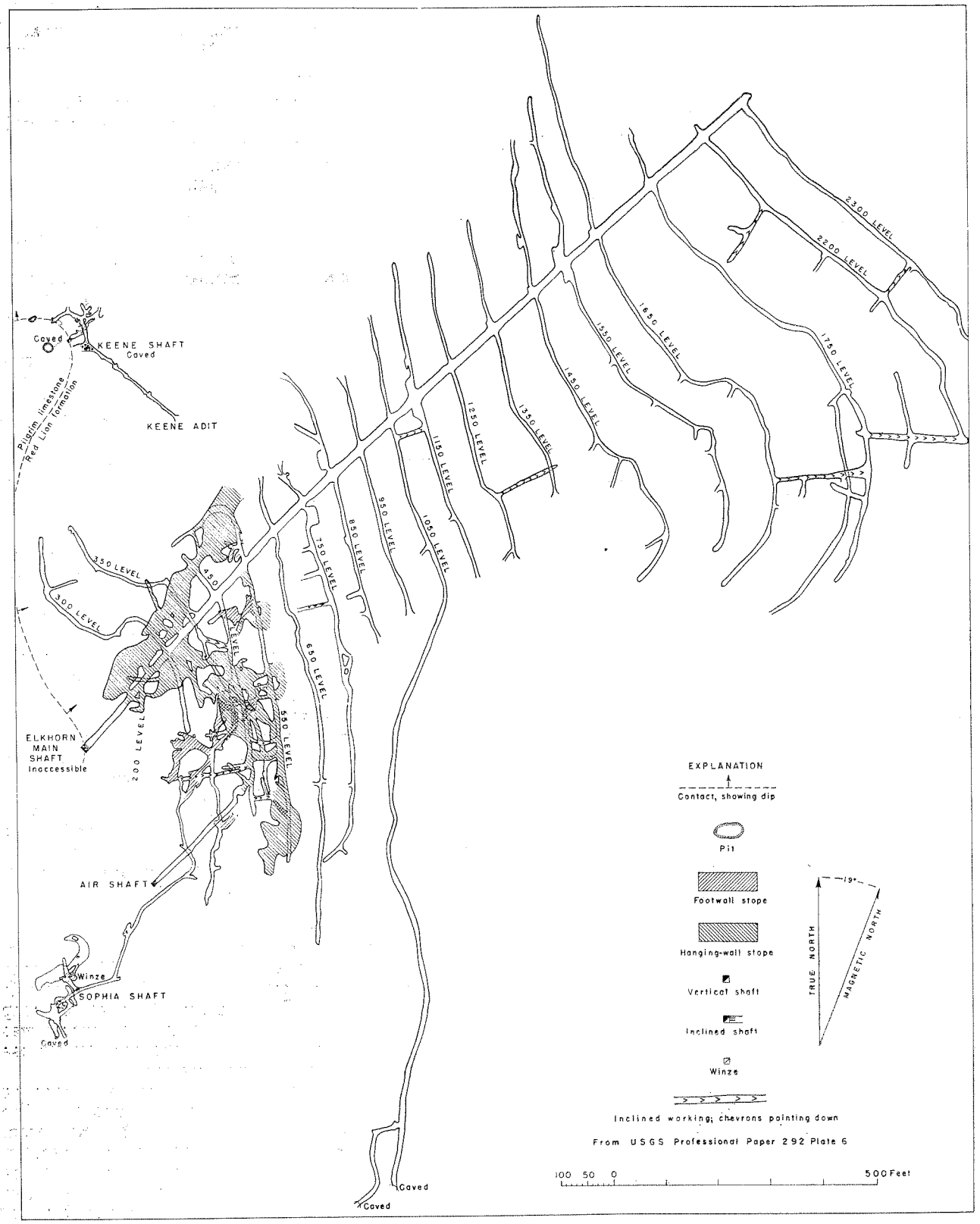


FIGURE 11.—Composite map of underground workings, Elkhorn mine, Jefferson Co., Mont.

At least 5 adits, all of which are caved, and a number of surface cuts have been excavated to explore the deposit and to mine the iron ore.

The ore consists principally of magnetite with scattered grains of chalcopyrite. The ore has been extensively oxidized, and the softer iron oxide has mingled with the andesite on the slope below the ore so that the deposit appears more impressive at frist sight than it actually is. The limestone adjoining the ore is intensely garnetized.

Elkhorn Queen

The New Elkhorn Queen Min. Co., Inc. owns the Elkhorn Queen mine. The property, consisting of 1 patented mining claim (M.S. 2054), is about 2 miles south of Elkhorn in sec. 26, T. 6 N., R. 3 W. A total of 11,820 tons ore were mined from the Elkhorn Queen between 1905 and 1956. From this ore there were recovered 1,857 ounces gold, 149,794 ounces silver, 13,138 pounds copper, 1,940,063 pounds lead, and 356,163 pounds zinc.

The mine is opened by a vertical shaft to the 300-foot level, from which the vein has been mined to an additional depth of 140 feet by underhand stoping. The open underhand stope served as a winze for hoisting ore mined from the bottom or 440-foot level.

The deposit was discovered about 1880, and before 1900 it had been mined to the depth of the present workings. From that time until 1942 the mine was idle except for a few brief periods of leasing activity. In 1942 the present owner acquired the property and secured a development loan from the Government to re-open the mine. Enough ore was mined from the walls of the old topes to repay the loan, and subsequently a continuation of the main ore shoot was discovered on the bottom level of the mine. In 1949 the owner was engaged in developing the lateral extent of this ore body.

The ore body mined prior to 1900 was in the form of a pipe or chimney at the contact of limestone and quartz porphyry. The contact strikes N. 20° E. and dips steeply northwest; the limestone forms the hanging wall. The present ore shoot on the bottom level appears to be a continuation of the main ore shoot to the southwest along the contact. When the mine was visited in 1949 a drift had been driven along the contact for 26 feet from the southwest wall of the stope. This drift was all in ore. Slab rounds blasted from the old stope wall exposed ore for a width of about 24 feet.

The ore consists of dense vitreous quartz containing coarse crystalline galena and small amounts of sphalerite. The ore also contains appreciable quantities of gold and silver. Ore shipped in 1948 averaged as follows: gold, 0.33 ounce per ton; silver, 9.2 ounces per ton; lead, 5 percent; and zinc, 1.5 percent.

Golden Curry (Sourdough) (Jacquemin)

The Golden Curry property, owned by the Golden Curry Cons. Min. Co. of Helena, is about a mile west of Elkhorn in sec. 10, T. 6 N., R. 3 W. From 1904 to 1951 the mine produced 98,445 tons ore that yielded 23,868 ounces gold, 11,542 ounces silver, and 650,549 pounds copper. Knopf states that the ore mined prior to about 1911 averaged 40 percent iron. The ore at that time was mined principally for smelter flux.

The principal mine workings consist of an open-cut about 500 feet long by 100 feet wide, together with 2 adits having a combined length of about 1,300 feet. The lower of the 2 adits is 100 feet below the open-cut and served as a haulage level. The upper adit is only a few feet below the level of the open-cut. All of the underground workings are now inaccessible.

The open-cut is at the contact of quartz monzonite and thin-bedded limestone. The limestone along the contact has been altered to a mass of lime silicate minerals. The deposit differs from most contact replacement deposits in which magnetite replaces limestone near the contact in that the magnetite is in granite near the contact; it occurs in veins as much as 3 feet in width. Pyrrhotite is associated with the magnetite in places. One ore body consisting predominantly of pyrrhotite enclosed in granite was found 250 feet from the contact. It is said that this ore body was 100 feet in length, 18 feet in maximum width, and was stoped to a height of 10 to 12 feet. Knopf (1913a, p. 137-138) believes that the pyrrhotite body was formed by magnetic segregation.

Golden Moss

A patented claim and a mill site held by location comprise the Golden Moss property owned by John Williams of Boulder. Production from this property is included in the figures for the Peacock mine.

The claim was located along a northward-trending limestone-shale contact (Three Forks shale). An inclined shaft, said to be 100 feet deep, was sunk on the contact which dips about 65° E. The size of the dump indicates that the extent of the workings is not great. (Klepper and others, 1957, p. 69.) The shaft dump contains a small quantity of iron-stained galena-bearing quartz. The few shipments of ore made from the mine have averaged more than 1 ounce of gold per ton, but no lead was reported from the shipments. The gold ore was probably mined from the near-surface oxidized zone.

Hardcash (Dolcoath)

The unpatented claim known as the Dolcoath when Weed examined it in 1900 has been relocated and is known as the Hardcash.

From 1909 to 1935 the mine as the the Dol-

coath is credited with a production of 3,182 tons ore, which yielded 761 ounces gold, 384 ounces silver, 12,832 pounds copper, and 336 pounds lead. Betwen 1938 and 1942, under the name Hardcash, production is given as 71 tons ore, which yielded 48 ounces gold, 8 ounces silver, 31 pounds copper, and 55 pounds lead.

The property is developed by an adit estimated to be 400 or 500 feet long and a 20-foot shaft. In 1949 the adit was caved about 100 feet from the the portal.

The ore deposit is a replacement of an impure limestone bed 12 to 18 inches thick that has been altered by contact metamorphism to garnet, diopside, calcite, and epidot. The bed strikes N. 20° W. and dips 60° NE. The ore minerals bismuthinite and tetradymite (a sulfide and telluride of bismuth) and chalcopyrite carry gold. (Knopf 1913a, p. 133-134, Klepper and others, 1957, p. 69.) Shipments of ore have ranged up to 5 ounces of gold per ton, but the average has been about 0.25 ounce per ton. The ore also contained a small amount of silver, copper, and lead.

Heagan

The Heagan property in secs. 10, 11, 14 and 15, T. 6 N., R. 3 W. consists of 5 patented claims owned by the Heagan Estate and John Rothfus of Boulder. It lies between the Swissmont and Golden Curry property and was last operated in 1930 by Fred Zendron of Elkhorn. A gravity and amalgamation mill, situated at the lower end of the property on a west branch of Elkhorn Creek, was operated for a number of years. The mill building still stands, but most of the machinery has been removed.

A total of 620 tons ore was produced in 7 active years between 1906 and 1930. Recovery was 191 ounces gold, 294 ounces silver, 241 pounds copper, and 710 pounds lead.

Separate intrusions of diorite and quartz monzonite into a sedimentary series of limestone, shale, and quartzite have formed a geological complex at this property. The mine workings, which include numerous shallow shafts and near surface adits, have been excavated to explore the contact zones of these different rocks throughout a horizontal range of about 1,500 feet and a vertical range of about 200 feet. These workings are badly caved and, with few exceptions, are inaccessible. The shaft and adit dumps, however, disclose the nature of the material that the workings penetrate. This material indicates the ore bodies to be chiefly gold-bearing contact replacement deposits. Minerals observed on the dumps include pyrite, pyrrhotite, and a small amount of chalcopyrite. A sample containing principally pyrrhotite was assayed to determine its nickel content. The analysis was as follows: gold, 0.11 ounce per ton; silver, 0.05 ounce per ton; iron, 36.5 percent; and nickel, 0.04 percent.

Ida

The Ida mine in SW¼SW¼ sec. 22, T. 4 N., R. 2 W. is the only mine that has recorded production from the South Elkhorn district. Therefore, it has been included in the Elkhorn district proper for convenience.

During 10 productive years between 1915 and 1951 the Ida has yielded 1,332 tons ore from which 107 ounces gold, 22,191 ounces silver, 1,619 pounds copper, 171,010 pounds lead, and 40,889 pounds zinc have been recovered.

The Ida mine is developed by a 100-foot shaft, a level 60 feet below the collar, and a winze. Several parellel veins arching from N. 20° E. to north, to N. 20° W. and dipping 50° W. have been explored for a distance of 300 feet. The main vein, which averages 2½ feet in width, follows the footwall contact of a diorite sill near the contact between Greyson shale and the Spokane shale; the other vein is within the diorite sill. Ore minerals are galena and sphalerite that occur in lenses of quartz and silicified argillite. Most of the ore was mined from a single shoot on the principal vein which rakes northwest, averages about 3 feet thick, and ranges from 10 to 50 feet in breadth. The ore shoot has ben mined for 200 feet along the rake. (Klepper and others, 1957, fig. 6 p. 76-77.)

J & F No. 1 (Valley View, Silver Hill)

The J & F No. 1 is in N½ sec. 15, T 4 N., R. 2 W., and although not in the Elkhorn district proper is included here for convenience.

The workings consist of a number of pits, short adits, and shallow shafts which explore silicified and altered Greyson argillite near the contact with a 50-foot thick diorite sill. Galena was the only ore mineral observed on the dumps.

Katiedid

Klepper and others (1957, p. 74) descirbe this property as a prospect in sec. 26, T. 5 N., R. 2 W. which is developed by two 50-foot vertical shafts and a short adit. The workings are on a east-trending quartz vein in Greyson shale. Barite, chalcopyrite, malachite, melaconite, cuprite (?), and some pyrite were noted in the vein, which has an average thickness of about 1½ feet.

Klondyke

The Klondyke claim (M.S. 10252) in sec. 11, T. 6 N., R. 3 W., about half a mile northeast of the Hardcash, is owned by H. J. Schriener of Pony. Total production, between 1915 and 1957, was 609 tons ore, yielding 539 ounces gold, 309 ounces silver, 8,640 pounds copper, and 567 pounds lead. The gold content ranged from 0.30 to 6 ounces per ton and averaged 0.84 ounces per ton. The principal ore mineral is the gold-bearing bismuth tell-

uride, tetradymite, or else fine gold resulting from the oxidation of the telluride mineral.

A 100-foot adit and 3 shallow shafts, the deepest of which is 56 feet, have been excavated to exploit a gold-bearing deposit similar to the one at the Hardcash property. This deposit, like that at the Hardcash, is enclosed in garnetized rock resulting from contact metamorphism. However, in places the mineralization was not confined to a single stratum as in the Hardcash, but appears to have followed an irregular fracture more or less across Jefferson dolomite strata. Klepper and others (1957, p. 69) noted that siliceous ore-bearing zones are, in part, localized by bedding planes. Both deposits differ from most contact-replacement deposits in which the ore is along the actual contact because in these deposits the ore is confined to individual stratum or fractures in the altered limestone some distance from the actual contact. Also, there is little evidence of magnetite or copper minerals in these deposits. The ore occurred in irregular pockets.

Luxemburgh, Monte Cristo, and Mountain View

The Luxemburgh is in sec. 14, T. 6 N., R. 3 W., half a mile east of the town of Elkhorn at an altitude of 7,000 feet. Two years (1920 and 1923) of recorded production show 91 tons ore that yielded 6 ounces gold, 192 ounces silver and 7,860 pounds copper.

Two adits 60 and 100 feet long and 2 shafts 100 feet deep have apparently opened a contact between limestone and diorite. Dumps contain mostly iron-stained gossan and some copper carbonate. Weed (1901, p. 508) noted that the Luxemburgh mine, then at a depth of 35 feet, contained a 6-foot vein of copper-lead ore which carried precious metal—"the country rock being granite."

Weed briefly mentions the Monte Cristo as being 1,000 yards west of Elkhorn and containing a 10-foot vein of copper ore lying in slate and granite. The Mountain View, "1½ miles up the gulch (north of Elkhorn) is said to have shown a 3½-foot vein of silver-lead ore in slate and syenite."

Passover

An inclined shaft, which explores a small pipe-like replacement body in Quadrant dolomite on the Passover claim, has resulted in the production of 171 tons ore, yielding 1 ounce gold, 3,096 ounces silver, 383 pounds copper, 69,498 pounds lead, and 532 pounds zinc. This property, in NW¼ sec. 34, T. 6 N., R. 3 W., produced for 6 years starting in 1915. Last production was in 1951.

Klepper and others (1957, p. 74) descirbe the deposit as a pipe-like replacement in Quadrant dolomite. The pipe probably did not exceed 3 feet by 15 feet in cross section. It was mined to a depth of 60 feet. The dump material contained sparce crystals of galena and films of malachite in a gangue of jasper and limonite.

Skyline

The Skyline property, consisting of the Rene Outcrop No. 1 and Golden Butte claims, is about 3 miles northeast of Elkhorn in sec. 8, T. 6 N., R. 2 W. at an altitude of 8,400 feet. The deposit was discovered many years ago but only a small amount of development was done because of its inaccessibility. A bulldozer trail was built from Elkhorn to the mine during the summer of 1949. The deposit has since been explored by diamond drilling by the Elkhorn Skyline Mining Co. Results of the drilling have not been disclosed.

The mine workings consist of 3 adits and 2 shallow shafts, of which only the middle adit is accessible. This crosscut adit is 260 feet long and attains a maximum depth below surface of about 50 feet. A 50-foot winze has been sunk below the middle adit level.

The deposit consists of an elliptical-shaped zone of bleached and brecciated andesite enclosed in dense flow-banded andesite. The length of the axis of the zone, which trends north and south, is about 200 feet; the short axis is about 150 feet. The zone appears to have a steep easterly dip. Many of the former open spaces between the breccia fragments are filled with quartz and tourmaline.In the adit at the eastern margin of the deposit argentiferous galena and sphalerite are associated with the quartz filling. The 50-foot winze below the adit level at this point is reported to be all in ore. Much of the breccia exposed in the adit, especially that near the portal, is iron-stained and has the appearance of being leached. The leached material contains only about 0.5 percent lead. The report by Klepper and others (1957) contains several geological maps of this property.

Spar

The Spar mine, not in the Elkhorn district, is in SW¼NE¼ sec. 36, T. 6 N., R. 2 W. and is described by Klepper and others (1957, p. 74-75); a geologic map of the mine is also shown.

Production from 1900 to 1953 totaled about 2,670 tons ore from which about 110 ounces gold, 63,700 ounces silver, 3 tons zinc, and less than 1 ton each lead and copper were recovered. (Klepper and others, 1957, p. 74).

A replacement ore body explored by the mine is in Jefferson dolomite and is restricted to a 3- to 5-foot bed bounded by thin shale beds near the middle of the formation. The authors state that, "The width of the ore body ranges from 25 to 50 feet; the length is unknown, although the body has been followed down the rake from the outcrop for about 325 feet." High-grade ore occupies a 2-foot zone which is either overlain or underlain, or both, by a low-grade siliceous ore. Sparsely dis-

seminated tetrahedrite, argentite, sphalerite, and galena occur in a barite-quartz-dolomite-calcite replacement gangue. Oxidation products are embolite or cerargyite, films of black manganese oxide, malachite, and at least 1 unidentified earthy greenish-yellow mineral.

Summit

The Summit claim, in sec. 23, T. 6 N., R. 2 W., is described by Klepper and others (1957, p. 74). This property is not in the Elkhorn district proper, but is included here for convenience.

"No work appears to have been done at these prospects (on a bald knob between Swamp Creek and Sand Creek) since his (Stone, 1911) examination, and at the present time all workings are caved. The principal workings appear to have been an inclined shaft along argillaceous beds in the lower part of the Morrison formation. The dump contains silicified shale, jasper, and limonite, but no ore minerals were recognized."

Swissmont (Moreau, Peacock, Turkey)

The 3 patented claims of the Swissmont property are now owned by H. B. Chessher.

The first recorded gold production from the property was in 1909. In 1915 and 1916 the East Butte Copper Min. Co., which then owned the property, built a 100-ton cyanide mill on the property but did not operate it until 1921. The company had been waiting several years for costs to decrease so that operations could be resumed on a paying basis. This mill was subsequently increased in capacity to 175 tons per day. In 1922, the East Butte Copper Min. Co. was the largest producer of gold in the district and operated the cyanid plant all through 1922 and 1923 on low-grade ore. In December 1923 the mine and mill were closed. The company's annual report for 1923 stated:

> Development work on the 200 level of the gold property owned by the Pittsmont Copper Co. at Elkhorn, Mont., was a keen disappointment. Only 14,00 tons of commercial ore were obtained from this work; and as all ores carrying commercial values had previously been mined out above the 100-foot level, mining operations were discontinued on this property in September. Milling operations were carried on with material recovered from old dumps on the property and low-grade ores obtained from development work on the Hoffman property until early in December. The Hoffman group of claims adjoin the Pittsmount property to the west, and the development of this property was undertaken under an option to purchase, agreement entered into on the 23rd day of August 1923. As soon as it was definitely ascertained that the showing on this property did not warrant further expenditures all development work was stopped and milling operations were discontinued.
>
> The total operating loss, which amounted to $24,358.89 for a period of 27 months, is traceable to unfavorable developments on the 200-foot level, to the high cost of wages and materials, and to lower recoveries than those obtained in preliminary tests, due to changes in the character of the ore.

The mine workings consist of a 300-foot shaft and about 1,345 feet of drifts and crosscuts driven on 3 levels. The ore was mined by the top slice method, and as a consequence the surface above the ore body has subsided, forming a depression about 150 feet long, 50 feet wide, and 10 to 20 feet deep.

The deposit occurs at the contact of diorite and overlying Meagher limestone. The contact strikes north and dips 60°-70° E. The ore body was lens-shaped and consisted essentially of iron-stained quartz. It was about 150 feet in length and was 30 feet in thickness down to the 100-foot level, from which it narrowed to about a foot in thickness on the 300-foot level. The gold was associated with hematite, magnetite, limonite, and pyrite.

Tacoma

The upper contact of flat-lying andesite in Cambrian limestone is exposed on both sides of a narrow canyon about 3 miles south of Elkhorn. Work was started at the Tacoma mine to explore the contact in April 1890 (Hogan, 1891, p. 37, 38). Six adits estimated to range in length from 25 to 150 feet were driven, but only 3 are now partly accessible; the others are caved at the portal.

The ore deposit where it was observed in the accessible workings consists of quartz ranging from a few inches to 2 feet in thickness with a concentration of galena near the upper and lower surfaces. The quartz is iron-stained in some places and white in others. No iron pyrite was observed. The ore is said to contain considerable gold.

It is said that ore from the mine was shipped to the smelter at Tacoma, Wash. in 1890 (Hogan 1891). Between 1911 and 1940 (4 producing years) the Tacoma mine produced 89 tons ore, yielding 26 ounces gold, 694 ounces silver, and 15,091 pounds lead.

Tourmaline (Tourmaline Queen)

The Tourmaline Gold Min. Co., Inc of Boulder, Wade V. Lewis, president, owns 8 unpatented claims about 1½ miles south of Elkhorn at the mouth of Queen Gulch.

Gold ore occurs at the contact of andesite and Precambrian sediments. The deposit has been explored by 12 adits ranging in length from 25 to 100 feet and by several diamond-drill holes having a combined length of 3,300 feet. The deposit is about 500 feet long and strikes N. 20° W. The

ore in some drill holes was reported to be as much as 72 feet in thickness. It is contended that about 300,000 tons of ore averaging $4.50 in gold were indicated by the exploration work. No ore has been produced from the property. The ore contains iron pyrite, pyrrhotite, and arsenopyrite in a gangue of tourmaline, epidote, and actinolite. Fluorite is also said to be present.

Union

Two patented claims comprise the Union property owned by D. D. Walker of Butte and others.

This is one of the oldest properties in the region, and in 7 productive years between 1905 and 1922 produced 422 tons ore, from which 11 ounces gold, 13,439 ounces silver, 1,062 pounds copper, and 75,870 pounds lead were recovered.

The mine workings comprise an 80-foot shaft and a 240-foot adit drift, both of which are now caved and inaccessible. (See fig. 12.) The adit was driven along a shale-limestone contact that strikes N. 60° W. and dips 65° to 70° NE. This contact vein can be traced on surface by old pits and trenches for about 1,000 feet. The surface exposure of the vein shows no ore, but the adit and shaft dumps contain considerable galena-bearing material. The galena occurs in blebs and veinlets in silicified shale. Sphalerite, pyrite, minor azurite, siderite or ankerite were also observed in dump material.

GOLCONDA DISTRICT

The Golconda district is southeast of Jefferson City in T. 7 N., R. 3 W. The district is drained by Golconda Creek and a portion of Prickly Pear Creek. Beavertown Creek borders the district on the west; the crestline between Dutchman and Prickly Pear Creek, to the north; and the crestline between Golconda Creek headwaters and Muskrat Creek, to the south with the west slope of the Elkhorn Mountain forming the border to the east.

The topography is hilly and moderately covered by lodgepole pine. The bedrock is composed of quartz monzonite of the Boulder batholith and andesite-latite flows. Tertiary rhyolite may also be observed. Production from the district is given in table 17.

Big Chief

The Big Chief claim (M.S. 2574) in Golconda Gulch is in sec. 17, T. 7 N., R. 3 W. Dan Pyfer of Whitehall is listed as the last operator (1957) and as owner.

Recorded production since 1919 amounts to 114 tons ore, yielding 30 ounces gold, 772 ounces silver, 875 pounds copper, 23,800 pounds lead, and 11,922 pounds zinc. Totals are for 8 producing years.

Two shafts, estimated to be 50 to 100 feet deep, sunk on the vein and an adit drift about 750 feet

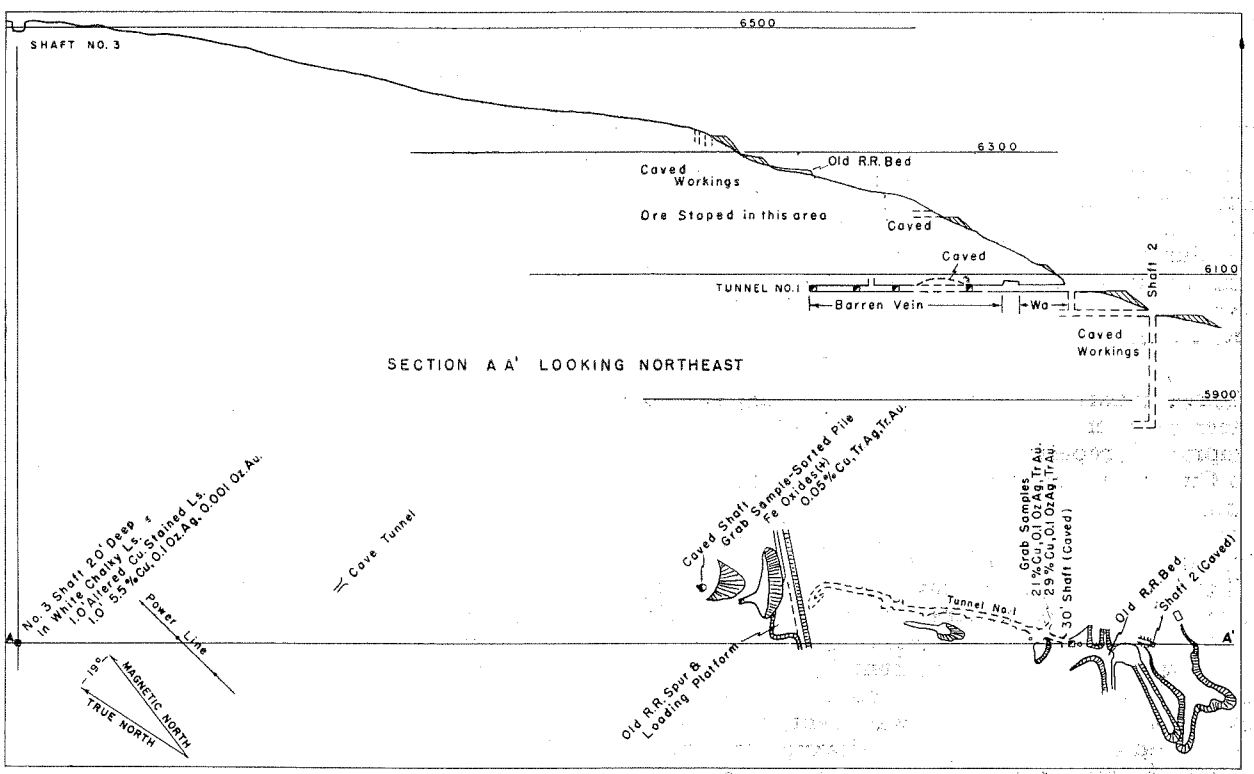


FIGURE 12.—Plan and section of Union mine, Elkhorn District, Jefferson Co., Mont.

TABLE 17.—Production of gold, silver, copper, lead, and zinc from lode mines, Golconda district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902-20	No production						
1921	43	40	2,611	—	33,226	—	$4,931
1922	1	2	1	—	—	—	48
1923-24	No production						
1925	2	2	1	—	—	—	37
1926-31	No production						
1932	3	3	14	—	500	—	85
1933	13	7	3	—	—	—	141
1934	7	6	51	—	2,919	—	364
1935-38	No production						
1939	15	7	59	10	957	—	331
1940	21	7	457	—	1,240	—	632
1941	60	58	284	—	2,000	—	2,346
1942	6	1	69	—	600	—	124
1943	No production						
1944	23	3	367	1,600	—	—	582
1945	No production						
1946	45	26	474	—	12,000	1,500	2,784
1947	34	19	232	—	4,900	400	1,627
1948	5	2	63	100	2,100	900	645
1949	5,221	366	1,485	1,000	3,000	3,300	15,234
1950	516	73	336	100	6,800	4,800	4,480
1951	No production						
1952	2	—	12	—	429	343	137
1953-56	No production						
1957	17	1	66	—	2,200	2,500	700
TOTAL	6,034	623	6,585	2,810	72,871	13,743	35,228

long comprise the workings driven many years ago. They are now inaccessible. The present owner drove an adit about 100 feet long in 1948 near the creek level below the old main adit. The ore was narrow in this adit so the work was abandoned.

The vein follows a fracture in bleached and softened quartz monzonite, and the surface expression of the old workings indicate that the vein has an east strike and nearly a vertical dip. Minerals in the vein are pyrite, galena, minor stibnite, and principally the iron-bearing variety of sphalerite known as marmatite or blackjack (Pardee & Schrader, 1933, p. 241). Six samples taken by the Bureau of Mines from the shaft and adit dumps assayed as follows: gold, 0.054 ounces, and silver, 0.46 ounces per ton; lead, 0.9 percent; and zinc, 1.9 percent.

Copper Nugget

Three unpatented lode claims and 1 unpatented placer claim in secs. 23 and 24, T. 7 N., R. 4 W. comprise a property 3.5 miles southwest of Jefferson City known as the Copper Nugget Placer. The claims are held by a number of individuals; the power of attorney for the property is invested in Mrs. James A. Flynn of Helena.

The deposit was discovered about 1870 by placer miners who at first thought the metallic copper in the gravel was gold. In 1871 a barrel of metal was freighted to Fort Benton, Montana, and shipped from there by boat down the Missouri River to St. Louis. There it was identified as copper instead of gold, much to the disappointment of the miners, who immediately abandoned the property. Since then, numerous attempts have been made to exploit the deposit, but no record is available of any copper having been produced. Over 1,000 feet of adit drifts have been driven, and several shallow shafts have been sunk. The Bureau of Mines in 1942-43 sank 6 test pits and 8 churn-drilled holes.

The deposit is in a small gulch, known locally as Copper Gulch, tributary to Beavertown Creek, which in turn is a headwater tributary to Prickly Pear Creek. The deposit consists of a peat bog containing alternate layers of sand in a quagmire of decayed trees and other vegetable matter. The swamp was at least partly caused by a damming action of recemented iron oxide deposits that formed reefs across the lower end of the gulch. Copper-bearing solutions, possibly derived from numerous small copper-bearing veins in the aplitic granite near the head of the gulch, were the source of the copper. Copper was deposited from the solutions upon reaching the swamp by the reducing action of either the carbonaceous peat material or the iron oxide. Forrester, who examined the deposit, thinks that the reducing action was due largely to the iron oxide (Forrester, 1942, p. 133-135). The principal concentration of metallic copper is in layers or pockets mixed with sand near bedrock. Some pieces of bright spongy metallic copper were found as large as a baseball. Copper oxide is found in the peat bog. Some mineralogical study by the Bureau of Mines at the Salt Lake City laboratory has shown that about half of the contained copper in the deposit is metallic and the remainder is principally in the form of oxide.

Exploration by the Bureau of Mines indicates that the deposit contains about 77,000 cubic yards of material averaging 8.7 pounds of copper per cubic yard.

Golconda (Golden Assets)

The Golconda or Golden Assets property is west of Golconda Creek. The property is owned by the Buckeye Min. Co. and is managed by M. I. Laydig of Helena. The property consists of 10 patented claims as follows: (Mineral Survey nos. in parentheses) Gold Coin 1, 2, 3, 4, 5 (10455), Gold Coin 7 (10457), Gold Coin Placer (10458), Gold Coin Frac. No. 6 (10456), Blue Jacket (5914), Yellow Jacket (5543), and Yellow Jacket mill site (5654). The group is in secs. 20 and 29, T. 7 N., R. 3 W.

Although the mine reflects the name of the district, production has been recorded for the Golconda mine in the Colorado district (1937) and in the Cataract district (1938, 1939), but not in the Golconda district. Total production for 3 years (1937, 1938, 1939) was 1,142 tons ore, from which 116 ounces gold, 20,189 ounces silver, 5,218 pounds copper, 10,397 pounds lead, and 2,800 pounds zinc were recovered.

In years past numerous shallow drifts have been driven along narrow high-grade gold seams. The small amount of ore thus produced has averaged more than 2.5 ounces of gold per ton. In the present operation (1949) of the Buckeye Min. Co. about 75 tons of ore were mined per day from open-cuts. The ore was trucked to company's nearby mill, where the gold was recovered by the cyanide process. The ore was crushed and rolled to about ¼-inch size and fed dry into leaching tanks. The gold was leached by simple downward percolation. The mill was powered by electricity generated by a 100-horsepower Diesel generator set.

The ore deposit is a mineralized stockwork in soft, altered, and bleached granite. The gold is in small reticulated veinlets containing principally iron-stained quartz with minor amounts of manganese oxide. Galena in minable quantities is found within the otherwise oxidized zone of the deposit at certain places. The fractures containing the galena probably represent the main channels of mineralization from which solutions penetrated out into the stockwork, depositing the gold in the small veinlets. Individual bodies of minable-grade gold ore range up to 35 feet in width and to 150 feet in length. The ore bodies strike about N. 60° W. and dip about 35° N. The zone of bleached granite in which the ore bodies are found extends for a distance of at least 2,000 feet southeast from the Buckeye operation. Numerous exploratory excavations within this distance have disclosed the bleached granite, and there is evidence that some ore has been mined from these workings.

Madison (Black Rock)

The Madison mine is in sec. 5, T. 7 N., R. 3 W. Vein filling is quartzose material heavily coated with manganese and iron oxide in granite. Several short tunnels and pits expose the ore which is chiefly galena, assaying high in silver and gold (Pardee & Schrader, 1933, p. 241).

Silver Tip

The Silver Tip mine (M.S. 10681) is in sec 8, T. 7 N., R. 3 W. The property is owned at present (1958) by Hilda M. Redding of Helena. Ore was discovered on the property in 1870; however, production was not recorded from the property until 1925, 1926, 1927, and 1928.

The lode is a sheeted zone in quartz monzonite, and the ore minerals consist of cerussite, galena, pyrite, and sphalerite, which occur in scattered small lenses and pods in a vein that strikes N. 53° W. and dips 36° SW. The mine has been developed by 800 feet of irregular drifts to a depth of 100 feet (Pardee & Schrader, 1933, p. 240).

The Bureau of Mines production records show a Silver Tip mine (Colorado district) with a total production of 93 tons ore, which yielded 18 ounces gold, 12,995 ounces silver, 20,616 pounds lead, and 45 pounds zinc. Production was for a total of 6 years between 1925 and 1953. This is, most likely, the Silver Tip mine at the junction of Prickly Pear and Golconda Creeks. The owner reported (1959) that approximately 100 tons of hand-cobbed ore had been shipped from the property.

HOMESTAKE DISTRICT

The Homestake district lies along the crest of the Continental Divide, the boundary of Jefferson and Silver Bow Counties, approxiately 9 miles southeast of Butte. The district is in T. 2 N., R. 6 and 7 W., in the vicinity of Homestake, a station on the Northern Pacific Railway. The district is accessible by country roads from Butte and Whitehall. Some of the mining claims are shown in fig. 13.

Topography of the district is hilly at an average elevation of 7,000 feet. The area is drained by two eastward flowing creeks, Homestake and Beefstraight, which empty into Big Pipestone Creek. Lodgepole pine is found over the greater portion of the area.

Bedrock is composed of granite (quartz monzonite) of the Boulder batholith. Numerous aplite dikes and pegmatite with some diabase prevail throughout the district. Small quartz veins occur in the granite associated with aplite. Veins containing gold and silver are comparatively short and irregular, but are frequently rich. Scattered occurrences of molybdenite may be observed in the sheeting of the aplite or in narrow quartz veins. Some molybdenum was shipped in 1906 and 1907.

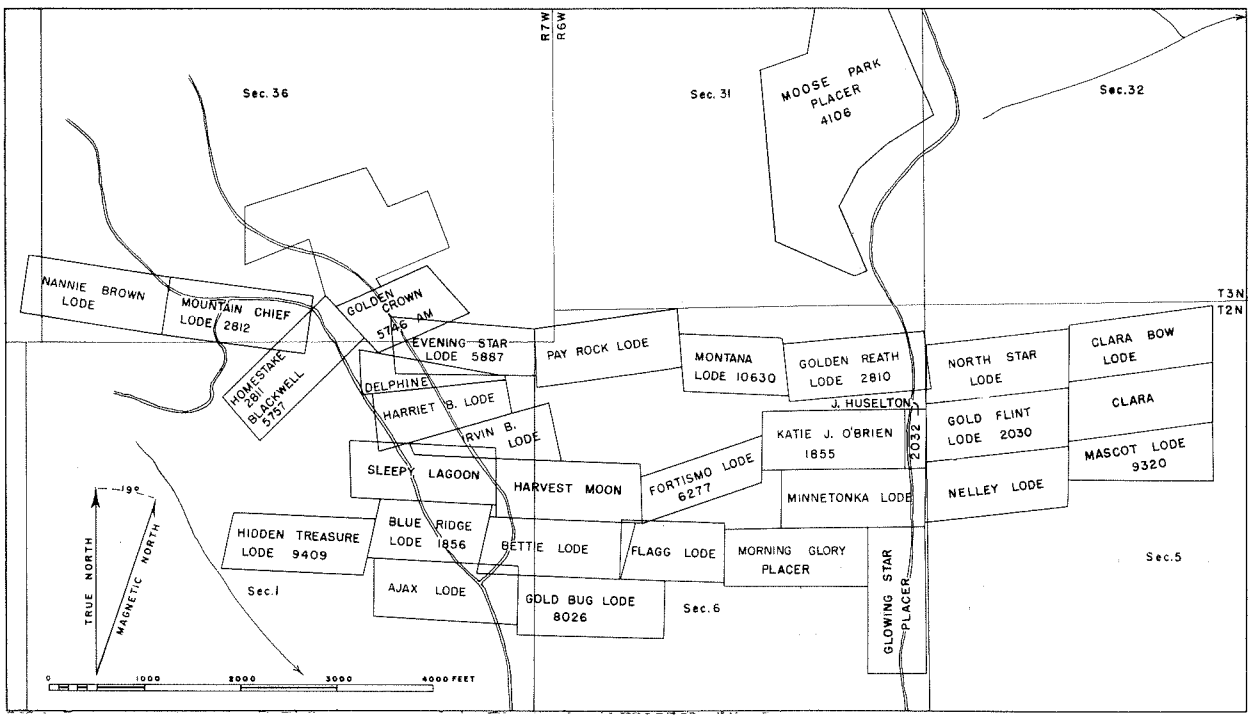


FIGURE 13.—Claim map of the Homestake District in Jefferson County.

Gold placers were discovered and worked in the 60's and 70's on Blacktail Creek. Placer production is estimated at about $50,000 from verbal reports. Lode production is shown in table 18.

Big Chief

The Big Chief consists of 3 patented and 2 unpatented claims in secs. 28 and 29, T. 3 N., R. 6 W. The 3 patented claims are the Big Chief (M.S. 9595), Elroy (M.S. 9595), and Extension (M.S. 9595). The property has been developed by 3 shafts and tunnels on a quartz vein in the granite carrying silver and gold. The claims are owned by the Butte East Slope Mining Co., Box 71, Butte. No production is recorded.

Blackwell (Kendall, Homestake)

Several inaccessible adits and 5 caved shafts in sec. 36, T. 3 N., R. 7 W., and sec. 1, T. 2 N., R. 7 W., comprise the workings of the Blackwell mine. The adits were estimated to be 300 feet long, whereas the shafts were estimated to range from 150 feet to 500 feet in depth.

This property, 2½ miles by road from Homestake, was discovered in 1864 and ceased producing prior to 1900. The remains of a 10-stamp mill does, however, testify to a more glorious past.

Fissure filled veins apparently strike a 45° E. with an unknown dip. The veins contain quartz with scattered pyrite and were developed for gold.

Flagg

The Flagg Placer, in sec. 1, T. 2 N., R. 7 W., was being worked during the summer of 1959 for silica flux. Here, a small area is covered with old placer dumps. The predominant mineral is quartz that contains scattered pyrite and sphalerite grains. A vibrating screen was being set up on the property to separate the fine and coarse material, which probably carries some gold, and was to be shipped to the Anaconda Smelter. Allanite, a cerium epidote, is abundant and occurs as small individual grains scattered throughout the coarse gravels.

Gold Bug

In sec. 6, T. 2 N., R. 6 W., 2 adits 50 to 100 feet long and 3 shafts 50 to 100 feet deep have, in the past, developed high-grade gold veins. All underground workings are caved. The property, owned by L. F. Carmody of Elkhorn, is known as the Gold Bug, and has a recorded production of 30 tons ore, from which was obtained 98 ounces gold, 2,639 ounces silver, and 22 pounds copper. Shipments were made in 1911, 1912, and 1933. One ton of ore, in 1911, yielded 55 ounces gold and 298 ounces silver.

Fissure-filled veins, which strike N. 60° to 80° W., and dip 80° S., range from 2 to 5 feet in thickness. Quartz and pyrite were the only minerals noted on the dumps.

TABLE 18.—Production of gold, silver, copper, lead, and zinc from lode mines, Homestake district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902-09	No production						
1910	54	86	109	131	—	—	$1,845
1911	107	148	3,054	129	—	—	4,699
1912	58	57	4,833	84	—	—	4,171
1913	4	8	14	50	—	—	178
1914	85	26	5,768	—	—	—	3,729
1915	91	65	2,190	41	—	—	2,453
1916	66	26	3,324	130	—	—	2,747
1917	31	15	235	—	—	—	501
1918	1	—	110	45	—	—	122
1919	43	4	1,092	61	—	—	1,321
1920	No production						
1921	4	—	381	45	—	—	388
1922	1	3	15	—	—	—	71
1923	5	8	15	—	—	—	181
1924	2	2	2	—	—	—	40
1925	27	27	772	—	—	—	1,100
1926	20	22	642	—	—	—	852
1927	10	7	256	—	—	—	287
1928	No production						
1929	12	8	782	—	—	—	582
1930	6	12	599	17	115	—	478
1931	1	2	—	—	—	—	42
1932	45	48	564	127	—	—	1,169
1933	122	65	720	172	—	—	1,604
1934	55	22	628	75	54	—	1,177
1935	12	20	—	—	—	—	708
1936	8	6	—	—	—	—	217
1937	21	18	287	—	1,390	—	934
1938	27	8	444	102	2,326	—	684
1939	8	9	25	—	—	—	332
1940	26	6	429	—	360	—	533
1941	83	51	488	—	—	—	2,132
1942	7	2	45	—	—	—	102
1943-57	No production						
TOTAL	1,042	781	27,823	1,209	4,245	—	35,379

Leslie

The Leslie consists of 5 unpatented claims in Leslie Gulch. The vein consists of an 18-inch quartz lead in granite. The mine was developed by an 85-foot shaft and 120-foot drift.

Mountain Chief

The Mountain Chief mine, whose recorded owners are E. B. Worly and H. F. Weyerstall of Homestake, is in sec. 36, T. 3 N., R. 7 W., and sec 1, T. 2 N., R. 7 W. The mine was developed by an adit about 200 feet long and a shaft 200 feet deep. All workings are caved.

Quartz-pyrite veins, which occur along both walls of an aplite dike range from 4 to 10 feet in thickness and have an approximate strike and dip of N. 84° W., and 80° S. Production for 4 years (1910, 1911, 1932, 1941) total 61 tons ore. Recovery was 31 ounces gold and 627 ounces silver.

Nellie

The Nellie group consists of 1 patented claim and 6 unpatented claims. The patented claim, Nellie (M.S. 6082), lies in sec. 1, T. 3 N., R. 7 W., The quartz vein high in silver cuts an aplite facies of the Boulder batholith. The mine was developed by two 50-foot shafts and 6 adits; 150, 100, 1,000, 700, 300, and 700 feet; 2,000 feet of drifts; 400 feet of crosscuts ;and 300 feet of raises.

The Nellie and Mascot produced 125 tons ore in 8 years between 1911 and 1940. Recovered from the ore were 50 ounces gold, 8,053 ounces silver, and 178 pounds lead.

Sixteen-to-One (High Grade)

Several patented claims in sec 35, T. 2 N., R. 6 W., make up the Sixteen-to-One, or High Grade property. One adit approximately 300 feet long and several prospect pits is the sum total of development, which explored an iron stained east-striking shear zone in quartz monzonite. Gold was, undobutedly the sought-after mineral, but production records are lacking.

LOWLAND, ELK PARK, BEAVER CREEK, AND NEZ PERCE DISTRICTS

Lowland, Elk Park, Beaver Creek, and Nez Perce districts occupy an area in western Jefferson County, and have been grouped because of a scarcity of information on the area as a whole. In general, these 4 districts are drained by Lowland Creek and Bison Creek, and its tributaries, Beaver and Nez Perce Creeks. Although a large area is involved, relatively little production is recorded. The Columbia and Ruby, and Kit Carson in the Lowland district, were the largest producers in

the area, but their production is credited to the Basin-Cataract district totals. This has probably been the result of available shipping points, the ores from the Columbia and Ruby, and Kit Carson, were undoubtedly shipped from Bernice and credited to the Basin district. Production for Lowland (exclusive of Columbia and Ruby, and Kit Carson) and Elk Park districts are given in Tables 19 and 20.

Geologically, these four districts are well within the confines of the Boulder batholith. However, bedrock of the Lowland district is predominantly dacite and rhyolite of Tertiary age. Tuffs, welded tuffs, breccias, and flows are expressions of the volcanic period. The other three districts are underlain predominantly by quartz monzonite, even though the surface expression of one district is mostly recent aluvium that fills a broad valley known as Elk Park. As in the Boulder batholith as a whole, the quartz monzonite has been intruded by aplite and pegmatite. Pegmatites in the Elk Park area contain tourmaline and display iron-stained vugs which are possibly the result of pyrite oxidation.

Active mines are not present in the Elk Park, Beaver Creek, or Nez Perce districts and relatively few prospects pits are observed. Pyrite-bearing quartz veins in chloritized quartz monzonite were observed in several places, but underground workings were not accessible for examination.

Timber and water supplies are adequate, and transportation should not be a problem.

Butte-Elk Park Extension

This property, which was formerly owned by the Butte-Elk Park Extension Mining Co., is in secs. 17, 18, 19, and 20, T. 5 N., R. 6 W. Nineteen patented claims comprise the property. All workings are inaccessible, but formerly the properties were opened by 2 shafts, 250 and 600 feet deep, with 500 feet of drifts.

Records show a production of 57 tons ore from which 595 ounces silver, 1,392 pounds copper, and 1,077 pounds lead were recovered.

TABLE 19.—Production of gold, silver, copper, lead, and zinc from lode mines, Lowland district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902-24	No production						
1925	1	1	106	—	—	—	$95
1926-33	No production						
1934	4	2	—	—	—	—	65
1935	7	18	64	—	—	—	676
1936	No production						
1937	10	11	9	—	—	—	392
1938	No production						
1939	50	17	3	—	—	—	597
1940	308	21	1,177	1,407	4,440	—	1,953
1941	237	4	69	500	—	—	248
1942	246	8	3,337	2,700	—	—	2,980
1943-46	No production						
1947	184	41	2,042	200	8,000	1,000	4,592
1948-49	No production						
1950	511	25	2,792	500	3,400	300	4,008
1951	20	13	52	—	—	—	502
1952-57	No production						
TOTAL	1,578	161	9,651	5,307	15,840	1,300	16,108

Note: Columbia, Ruby and Kit Carson production included in Basin-Cataract district totals.

TABLE 20.—Production of gold, silver, copper, lead, and zinc from lode mines, Elk Park district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902-11	No production						
1912	10	—	75	1,504	—	—	$301
1913-18	No production						
1919	31	—	477	420	—	—	618
1920	No production						
1921	7	—	126	—	—	—	126
1922-25	No production						
1926	41	—	454	972	1,077	—	513
1927-34	No production						
1935	28	12	480	398	9,075	—	1,147
1936-57	No production						
TOTAL	117	12	1,612	3,294	10,152	—	2,705

The vein structure, at the site of one caved shaft, is 3 to 4 feet wide, but appears to be made up of numerous 2- to 3-inch veinlets in quartz monzonite. Strike of the vein is N. 65° W. and the dip is about 85° SW. Quartz, pyrite, minor galena, tetrahedrite, along with abundant fibrous tourmaline were noted on the mine dumps.

The last known owner (1940) was the Ardsley Butte Mines Corp. of Butte.

Carlson (Jefferson)

The Carlson prospect embraces 3 patented claims, Wisconsin (M.S. 5704), Jefferson (M.S. 5703), and North Boulder (M.S. 3239), and 22 unpatented claims in secs. 13, 14, 23, and 24, T. 6 N., R. 7 W. F. Carlson of Bernice is the owner. Development consists of several shallow shafts and numerous bulldozer cuts.

In 1952, about 82 tons of lead-zinc ore were shipped to the Metals Milling Co. of Basin. Average metal content was 0.025 ounces gold, 1.33 ounces silver, 2.3 percent lead, and 2.03 percent zinc.

The ore minerals, which occur in fissure-filled veins in altered quartz latite, are pyrite, sphalerite, galena, chalcopyrite, and manganese oxides along with minor amounts of smithsonite and cerussite. Federal Bureau of Mines mill tests indicate that most of the precious metal content is associated with the lead minerals. A composite sample of the mill-test ore contained 0.02 ounces gold, 1.4 ounces silver, 0.38 percent copper, 3.44 percent lead, 3.06 percent zinc, and 6.4 percent manganese.

Columbia

The Columbia mine in secs. 11, 12, 13 ,and 14, T. 5 N., R. 7 W., is about 1,500 feet southeast of the Ruby mine. The altitude in the vicinity of the principal workings is 6,600 feet. The property is owned by the First National Bank and Trust Co. of Butte.

Production records cover the years from 1906 to 1927. This production is combined with that of the Ruby and aggregates 6,202 tons ore from which were recovered 11,387 ounces of gold, 194,100 ounces silver, and 524 pounds copper. Work has been done at the property in recent years, but details of the recent work are not available.

The underground mine workings comprise 3 or more adits the lengths of which were estimated to range from 100 feet to 1,000 feet. Most of the workings are inaccessible owing to caved portals. According to Knopf (1913a, p. 125-127), one of the adits connects with the workings of the Ruby mine to the northwest.

The ore deposit in the Columbia mine is similar to the deposit in the Ruby mine. Knopf described the Columbia deposit as follows:

"A pronounced joint system, trending N. 20° W., occurs in the Columbia tunnels and appears to have governed the trend of the ore body. The Columbia vein represents a zone of brecciation 12 feet or more wide. The individual fragments of dacite coated with a crystalline crust of quartz. In places, however, there is considerable white quartz unmixed with country rock."

Eureka

The Eureka claim (M.S. 2469) is west of the Butte-Elk Park Extension ,in secs. 17 and 20, T. 5 N., R. 6 W. Its production for three years (1919, 1921, 1935) was 50 tons ore, yielding 12 ounces gold, 942 ounces silver, 398 pounds copper, and 9.075 pounds lead.

Kit Carson

The Kit Carson mine in secs. 9 and 10, T. 5 N., R. 7 W. is on the north side of Lowland Creek about 1,000 feet northwest of the remains of Ruby mill.

Production records show that the property was worked intermittently from 1908 to 1935. During this time 138 tons ore was produced that yielded 144 ounces gold, 7,959 ounces silver, and 21 pounds copper.

The mine workings comprise 2 adits, each estimated to be about 500 feet long, and a shaft the depth of which was not determined. The deposit is in a zone of brecciated dacite that strikes N. 20° E. The dip appears to be about 75° SE. Breccia fragments are recemented with chalcedonic quartz. The only metallic mineral noted was a small amount of iron pyrite.

Memphis

A short description of the Memphis prospect in the Lowland district is provided by Knopf (1913a, p. 128) as follows: "The Memphis prospect is on Lowland Creek, half a mile upstream from the stamp mill of the Ruby mine. The geologic features are similar to those of the Kit Carson mine. The dacite is cut by irregular veinlets of cryptocrystalline silica, carrying a little pyrite in cubes and pentagonal dodecahedrons. In addition to the dark gray-blue quartz the porcelainic variety is common."

Production is not recorded.

Montreal Star

The Montreal Star is in SW¼ SW¼ sec 3, T. 4 N., R. 7 W. It is presently being developed by Lee and Bill Hicks. Three claims comprise the property, which is developed by several open cuts, a 500-foot adit, a 100-foot shaft and several drifts.

Predominant between 2 ore-bearing zones is a 5-foot vein which strikes N. 65° E., and dips 55° SE. A large breccia zone near a rhyolite quartz monzonite contact cuts the vein and contains

rounded wall rock and ore fragments. The breccia can be observed at the bottom of the shaft. Several east-west-trending veinlets can be observed on the surface and in the adit.

Metallic minerals are pyrrhotite, chalcopyrite, and bismuthinite. Quartz is the predominant gangue mineral. Traces of cobalt, nickel, and tellurium have been detected in the ore.

Ruby

The Ruby mine in secs. 2 and 11, T. 5 N., R. 7 W., is on the slope south of Lowland Creek about 14 miles by road southwest from Basin. The altitude at the mine is 6,750 feet. The property, consisting of 2 patented claims, is owned by the First National Bank of Butte.

The property was located in the 70's and was surveyed for patent in 1888. A 10-stamp mill was built about 1907 on Lowland Creek, half a mile northwest of the mine. Production was reported each year from 1906 through 1917, but total production is combined with Columbia mine totals. The last year of reporting was in 1920. The total of the recorded production is 5,522 tons ore from which were recovered 10,796 ounces gold and 176,292 ounces silver.

The mine workings include a 400-foot shaft and an adit estimated to be 300 feet long. The adit intersects the shaft at a point 150 feet below the shaft collar. The shaft was sunk on an ore shoot that subsequently was mined. Caving of the stope walls has destroyed the shaft, rendering it inaccessible. The ore deposit has been described by Knopf (1913a, p. 126) as follows: "The general country rock at the Ruby mine is dacite, or rhyolite, as it is better known locally. It lies in the heart of the great area of dacites that extends southward to Butte and forms Big Butte at that city. At the Ruby mine the original thickness of the superposed succession of dacite lavas and breccias was at least 2,500 feet. The dacite at the mine is markedly porphyritic rock, showing numerous crystals of quartz and glassy striated feldspar embedded in a light-greyish groundmass of dense texture. In the vicinity of the mill the rock is prevailingly a dacite breccia.

"The ore-bearing zone extends from the main shaft to the Columbia claim, a distance of several thousand feet, the general trend being S. 20° E. Within this zone the ore occurs in shoots, or more properly in parallel veins, dipping steeply westward and apparently disposed roughly in echelon fashion. The Ruby shaft was sunk on a shoot of ore which, as shown on the stope map, was 260 feet deep, 40 feet long, and 20 feet wide. The maximum length was on the 200-foot level. This shoot of ore, or pipe, as it is termed locally, yielded $600,000. The country rock in the vicinity of this shoot is extremely sheared and shattered. To the north the ore body is terminated by a southward-dipping fault zone, which is breccited and mineralized through a width of 40 feet or more.

"South of the Ruby shoot another vein was found, in which the productive portion was 170 feet long and 4 feet wide. The walls of this vein are generally well defined. A marked vertical undulation is a characteristic feature of the hanging wall. In places the vein is filled with fault breccia, some fragments of which are 20 inches long. Toward the north the fissure is apparently cut off by a cross fault dipping 45° S., although the fissure is here so small as hardly to be recognizable. The fissure is traceable by a well-defined footwall for a distance of 60 feet south of the productive portion, where it is terminated by a cross fault dipping south. It is not impossible that some of the cross faults are fractures contemporaneous with the major fissuring. The ore consists of angular dacite fragments cemented by quartz, calcite, and minor adularia. The adularia, where embedded in quartz and calcite, is not easily distinguishable, but in places forms crystals up to ¼-inch in diameter. Its identity was established chemically and optically. The quartz is commonly clear, glassy, and drusy, but where it is solid it is of compact saccharoidal texture. Some of the siliceous veinlets show a porcelain-like texture, but such cryptocrystaline quartz is far less common at the Ruby mine than at the surrounding properties. The sulphides, which are confined to the gangue material that cements the dacite fragments, comprise pyrite, argentite, and possibly others that because of their fine sub-division are not readily recognizable. Native silver is common locally. The grade of the ore decreases with increase in size of the dacite fragments filling the fissure."

Sunset

The Sunset claim (M.S. 7377) is in sec 3, T. 3 N., R. 7 W. The property, owned by Leonora Scalabrin, was developed by the Sunset-National Min. Co. In 1906 a 150-foot drift was driven eastward from a shaft and an ore body carrying gold and silver was opened; however, production is not recorded until 1935 and 1936. The total ore shipped in these two years amounted to 87 tons which yielded 64 ounces gold, 128 ounces silver, 8 pounds copper, and 5,983 pounds lead.

The Mining World magazine (1906, p. 73) provides some information on the geology of the property and reports that a large dike was intersected about 200 feet east of the shaft. The Mining World further reports that high grade ore was removed from the 80-foot drift and that development was pointed toward defining 2 ore shoots. The May issue of Mining World (1906, p. 645) stated that the company had opened a 8- to 12-foot vein, carrying gold, silver, and copper, on the Jim Jr. claim (M.S. 5463) which is in sec 16, T. 3 N., R. 6 W.

McCLELLAN-MITCHELL CREEK DISTRICT

The McClellan-Mitchell Creek district lies in the northeastern corner of Jefferson County. The area

is drained by the northward flowing McClellan and Mitchell Creeks. McClellan Creek is a tributary entering Prickly Pear Creek a few miles south of East Helena. Mitchell Creek is a tributary of the Missouri River. The main line of the Northern Pacific Railway runs through the district, and the East Helena smelter of the American Smelting & Refining Co. is only 10 miles to the north. The district is essentially in T. 8 and 9 N., R. 2 W.

The bedrock consists of the quartz monzonite of the Boulder batholith which contacts Cretaceous andesites to the east. The area has yielded gold from both placers and deep mines. Placer production is given in Appendix C and lode production in table 21.

Argentum

Raymond, R. W. (1872, p. 233) states that the Argentum mine was the principal mine in the district when it was discovered November 18, 1866, by N. Merriam and Hershel Axe. It is a fissure vein in granite, carrying argentiferous galena and silver ores. The first 723 tons yielded about $135,000. The vein strikes N. 40° E. and dips 10° to 15° NW. Vein matter is largely composed of quartz and clays carrying galena, sphalerite, and chalcopyrite. In 1873 over 100 tons of ore were shipped from the mine to Omaha.

Bosphorus

The Bosphorus is on upper McClellan Creek in sec. 4, T. 8 N., R. 2 W. Owners are Frances and Vesta McCarthy of East Helena. One abandoned shaft, estimated to be about 40 feet deep, was the sole development of the property. A mineralized zone, about 2 feet thick, which strikes east-west, contains minor pyrite in quartz gangue. There is no record of production.

Economy (Last Chance, John & Jim)

The Economy mine is on the John & Jim group of claims in NW¼ sec. 22, T. 9 N., R. 2 W. It is owned by George Kokaruda of Helena. The Last Chance is several hundred yards west of the Economy, across Mitchell Creek.

The Economy is developed by 1 inclined shaft, reported to be 500 feet deep, and by an estimated 500 feet of underground workings. At the shaftsite, a mineralized zone about 4 to 5 feet wide strikes east-west and dips 71° N. The country

TABLE 21.—Production of gold, silver, copper, lead, and zinc from lode mines, McClellan Creek-Mitchell district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902-05	No production						
1906	202	337	660	—	—	—	$7,409
1907	79	81	274	—	1,335	—	1,924
1908-09	No production						
1910	161	157	494	151	—	—	3,528
1911	113	84	230	—	552	—	1,889
1912	183	109	813	—	42,211	—	4,658
1913	89	41	267	—	5,427	—	1,253
1914	270	514	3,036	740	75,405	—	15,344
1915	640	640	2,149	872	—	—	14,483
1916	311	300	1,047	3,932	—	—	7,867
1917	No production						
1918	7	5	30	—	—	—	125
1919-21	No production						
1922	17	21	29	48	328	—	488
1923-25	No production						
1926	10	24	64	42	—	—	534
1927	No production						
1928	70	24	42	38	—	—	521
1929-31	No production						
1932	163	153	358	270	—	—	3,289
1933	363	328	1,014	750	27	—	7,187
1934	387	271	642	325	—	—	9,917
1935	482	319	423	48	525	—	11,493
1936	54	46	111	—	—	—	1,668
1937	55	45	874	231	678	—	2,319
1938	219	197	3,909	1,673	2,217	—	9,688
1939	339	339	1,385	779	362	—	12,903
1940	12	5	31	—	—	—	197
1941	82	82	187	100	400	—	3,038
1942	219	100	377	300	—	—	3,804
1943	No production						
1944	21	41	90	—	—	—	1,499
1945	No production						
1946	3	6	10	—	—	—	218
1947-49	No production						
1950	6	2	10	—	—	—	79
1951-57	No production						
TOTAL	4,557	4,271	18,556	10,299	129,467	—	127,332

rock appears to be a fine-grained quartz diorite and is undoubtedly a border phase of the Boulder batholith. Ore specimens on the dumps contain quartz, pyrite, tetrahedrite, and calcite.

Between 1915 and 1941 (12 producing years) the John and Jim group is credited with an output of 1,887 tons of ore, making it the largest producer in the district. From this ore 1,700 ounces gold, 4,738 ounces silver, and 2,469 pounds copper were recovered.

The Last Chance is also developed by shaft. Production records for the Last Chance show a total of 186 tons ore, from which 193 ounces gold, 355 ounces silver, 522 pounds copper, 87 pounds lead, and 2 pounds zinc were recovered. Productive years were 1932 through 1934 and 1944 through 1946. Other properties to the south and east, neither of which recorded production, are the Smith and Sterret mines, owned by a C. L. Hewett.

Iron Side

One short adit and a shaft, estimated to be 50 feet deep, develop the Iron Side property in sec. 16, T. 8 N., R. 2 W.

The underground workings are caved, but surface evidence seems to indicate an east-west gold-bearing pyrite-quartz vein in quartz monzonite. Stone (1911) reported that the vein was 3 feet wide and caried 0.30 ounces of gold and 5 ounces of silver per ton.

Montana-Chicago (Eureka)

The Montana-Chicago or Eureka mine is on a patented claim in secs. 26 and 27, T. 9 N., R. 2 W. Last production was in 1922, but the mine also produced during 1910 and 1911. The 3 years output totaled 89 tons ore, and a recovery was made of 87 ounces gold, 156 ounces silver, 199 pounds copper, and 328 pounds lead.

A 200-foot adit and a 400-foot drift developed a narrow east-west gold-bearing fissure vein in andesite. Quartz and pyrite were observed on the dumps.

MONTANA CITY DISTRICT

The Montana City district embraces that part of Jefferson County drained by Clark and Holmes Gulch. The heart of the district lies approximately 3 miles southeast of East Helena. The northern and western boundaries of the district are the county line; the southern boundary, the divide between Clark Gulch and Jackson Creek; and the eastern boundary, the divide between Prickley Pear and McClellan Creeks. The district lies in the north half of T. 9 N., R. 3 W., and is bisected by the Butte-Helena highway, Prickley Pear Creek, and the Northern Pacific Railway.

The topography is hilly and the elevation of the district averages between 4,100 feet in Prickley Pear Valley, to 6,000 feet in the upper reaches of Holmes and Clark Gulches.

The bedrock within this district is composed of sedimentary rocks of Precambrian to Recent age, and the "granite" of the Boulder batholith. The oldest rocks of the district are indurated sediments of the Belt series. Lying uncomformably above the Belt is a thick series conformable within itself that consists dominantly of limestones, shale, and quartzite from Cambrian to Cretaceous in age. The lowest formation of this sequence is the Flathead quartzite of middle Cambrian age and the highest is a metamorphosed sandstone and shale of Cretaceous age. Erosional remnants of rhyolite and dacite flows may be found lying on top of the sediments. Several rhyolite volcanic plugs are also present near the Montana City railroad siding.

Knopf (1913a, p. 42) states that the deposits fall into two distinct groups formed during widely separated periods of mineraliztaion. Both groups include silver-lead and gold-silver ores, but heavy lead ores are not common in the younger lodes, which are mainly valuable for their content of precious metals. The older group of metalliferous deposits was formed subsequent to the intrusion of the Boulder batholith and prior to the eruption of the rhyolitic and dacitic lavas; the younger group was formed after the extrusion of the volcanic rocks. Older deposits are probably of late Cretaceous or early Eocene age, and the younger are post-Miocene in age.

Production from lode mines is shown in table 22. Placer production is listed in Appendix C.

Big Indian

The Big Indian gold mine is 3 miles south of Helena, Montana, near the head of Holmes Gulch in sec. 18, T. 9 N., R. 3 W.

The 2 main claims of the property were located in 1875. For the 11 years from 1891 to 1902 the deposit was mined from an open cut and the gold recovered in a 15-stamp mill. In 1902 a 60-stamp mill was constructed. This mill was equipped with the most modern machinery of the time and was operated by electric power generated at the Missouri River Power Co.'s plant at Canyon Ferry, on the Missouri River. It was estimated that ore could be mined and milled at a cost not to exceed 60 cents per ton. During 1903 and 1904 the Big Indian mine was the largest producer of gold in Jefferson County. Soon after 1905 the mine ceased operating and has been idle ever since. Between 1902 and 1905 the mine produced 14,808 tons ore; 4,456 ounces gold were recovered.

The mine workings consist of 2 open cuts; the larger is about 200 feet by 300 feet, and the smaller is 75 feet by 100 feet. The deposit has been mined by the open cuts to a maximum depth

TABLE 22.—Production of gold, silver, copper, lead, and zinc from lode mines, Montana City district,* Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902-04	No production						
1905	164	65	—	—	—	—	$1,350
1906-31	No production						
1932	15	5	57	—	1,500	—	166
1933	No production						
1934	29	7	17	25	—	—	265
1935	13	3	231	434	—	—	306
1936	50	16	22	—	283	—	604
1937-42	No production				?		
1943	9	8	239	400	—	—	502
1944	No production						
1945	16	16	45	—	—	—	592
1946	1	3	—	—	—	—	105
1947	2	2	10	—	200	—	108
1948	50	2	126	200	—	—	227
1949-50	No production						
1951	23	5	53	—	2,200	500	695
1952	133	3	808	116	3,863	3,030	1,989
1953-57	No production						
TOTAL	505	135	1,608	1.175	8,046	3,530	6,909

*Includes some production from Mitchell-McClellan Cr. district.

of about 75 feet. Ore was drawn from the cuts through a "glory hole" and trammed to the mill through an adit. The extent of the underground workings is not known.

The deposit is in quartz monzonite about half a mile south of a contact with sedimentary rocks. The granite in the open cuts is soft and bleached. In the larger open cut the granite is invaded by a number of diorite dikes. The ore body is a mineralized stockwork consisting of a multitude of net-like veinlets of iron-stained quartz, tourmaline, and pyrite. The character of the deposit can be seen most plainly in the smaller cut. It was said that the ore treated in the 15-stamp mill averaged about $5 per ton in gold. (Knopf, 1913a, p. 100).

Clark

In sec. 10, T. 9 N., R. 3 W. a few prospect pits have explored irregular pockets of lead ore along southeast-trending bedding planes in limestone. Cerussite is the predominant ore mineral and occurs in a jasper gangue. The ore lenses range from a few inches to 2 feet in thickness. Production, if any, is not recorded.

Yellowjacket

Pardee and Schrader (1933, p. 209-210) report that the Yellowjacket mine, owned by the late Colonel Hamilton, is 4 miles south of Helena at the head of Holmes Gulch. The country rock is quartz monzonite. The mine is on 2 veins, one of which strikes northeast and lies mainly in Holmes Gulch, and the other extends eastward over the ridge into Clark Gulch. Both veins were worked in early days for gold and silver by shafts and tunnels. One shaft was 100 feet deep. The northeastward-trending vein, the only one exposed, is typical of the veins in quartz monzonite. It is 3 to 5 feet or more thick, dips 80° N. and is composed mainly of crushed and altered iron-stained granite. In places it contains broken seams of quartz.

PIPESTONE AND WHITETAIL DISTRICTS

The Big Pipestone district is directly east of Butte approximately 6 miles. It lies within T. 3 N., R. 6 W., and the eastern portion of T. 3 N., R. 7 W. The district is bordered on the west by the Continental Divide and on the east by the crestline between Pipestone and Whitetail Creeks. The northern border of the district separates the drainage of Nez Perce Creek from the headwaters of International and Honey Creeks. The latter 2 drain the district and subsequently empty into Delmoe Lake.

The topography is hilly or rolling at an average elevation of 7,000 feet. Small marshy parks lie scattered between the hills throughout the district.

The bedrock consists of quartz monzonite of the Boulder batholith. Ore deposits occur as placers or lodes. Some of the latter are mineralized zones in brecciated and recemented quartz monzonite. The lodes have yielded some ore but the brecciated zones have not been successfully worked. The ore consists essentially of free gold in quartz-filled fractures.

The Whitetail district lies adjacent to the Big Pipestone district on the east and embraces an area surrounding Whitetail reservoir. For this district, production has been recorded only for the year 1948 when 12 tons ore was produced, yielding 42 ounces silver, 100 pounds copper, 2,300 pounds lead, and 1,100 pounds zinc, valued in all at $618.

The Little Pipestone district lies approximately 10 miles southeast of Butte and about 12 miles due west of Whitehall. The district is traversed by U. S. Highway 10 and the main line of the Chicago, Milwaukee, and St. Paul Railway. The district lies essentially within the northeast portion of T. 1 N., R. 6 W. and T. 1 N., R. 5 W. The district is drained by Little Pipesotne and Rader Creeks which are tributary to Big Pipestone Creek.

The bedrock is composed of quartz monzonite of the Boulder batholith. Ore deposits occur as placers, lodes, and mineralized zones in brecciated and recemented granite. The ore occurs as free gold in the quartz fissures. Some placer gold has been recovered from the gravels of Rader and Little Pipestone Creeks, and the "lake beds" near by.

Production from the Pipestone mines is given in table 23. Figure 14 is a claim map of the Pipestone district.

Blue Bell (Marsh)

The Blue Bell mine, in sec 35, T. 3 N., R. 6 W., is owned by Ed Scheitlin of Butte. The property consists of 1 patented and 7 unpatented claims. Mine workings consist of a shaft, a 700-foot adit, and a 16-foot winze. In 1959, the stoped area below the adit was filled with water.

The Blue Bell mine is crediated a total of 98 tons ore between 1909 and 1949, with a recovery of 84 ounces gold, 402 ounces silver, 1,228 pounds copper, 19,285 pounds lead, and 665 pounds zinc. Records also list one year's production for the Marsh mine in 1941 as 66 tons ore which yielded 34 ounces gold, 373 ounces silver, 1,026 pounds copper ,and 8,755 pounds lead. Most of the ore was milled on the property. The remains of a jig mill can be seen on surface, along with a water-powered electric generator and other equipment.

The fissure-filled vein in quartz monzonite is about 3 to 4 feet wide, strikes N. 80° W., is nearly vertical, and contains galena, pyrite, and chalcopyrite in quartz. Mineralization was, in part, by replacement. Several samples were observed which contained disseminated grains of galena and pyrite in quartz monzonite.

Jupiter

An early-day producer with no recent production record, the Jupiter is in sec. 36, T. 2 N., R. 6 W. The 1 unpatented calim was developed by 2 adits 38 and 150 feet long and by a 60-foot shaft.

The shaft is caved. Last known owner was Joe Costello of Philipsburg.

Here a 3-foot fissure vein in diorite can be traced for 300 feet in length. The vein strikes east-west and dips 50° N. Metallic ore minerals are pyrite and chalcopyrite with minor galena.

Silver Bell

John Gillespie of Whitehall was the last known owner of the Silver Bell mine, which is in sec 3, T. 3 N., R. 5 W. The 1 patented claim is developed by 3 adits ranging from 100 to 250 feet in length (estimated) and by one 75-foot shaft. All are abandoned.

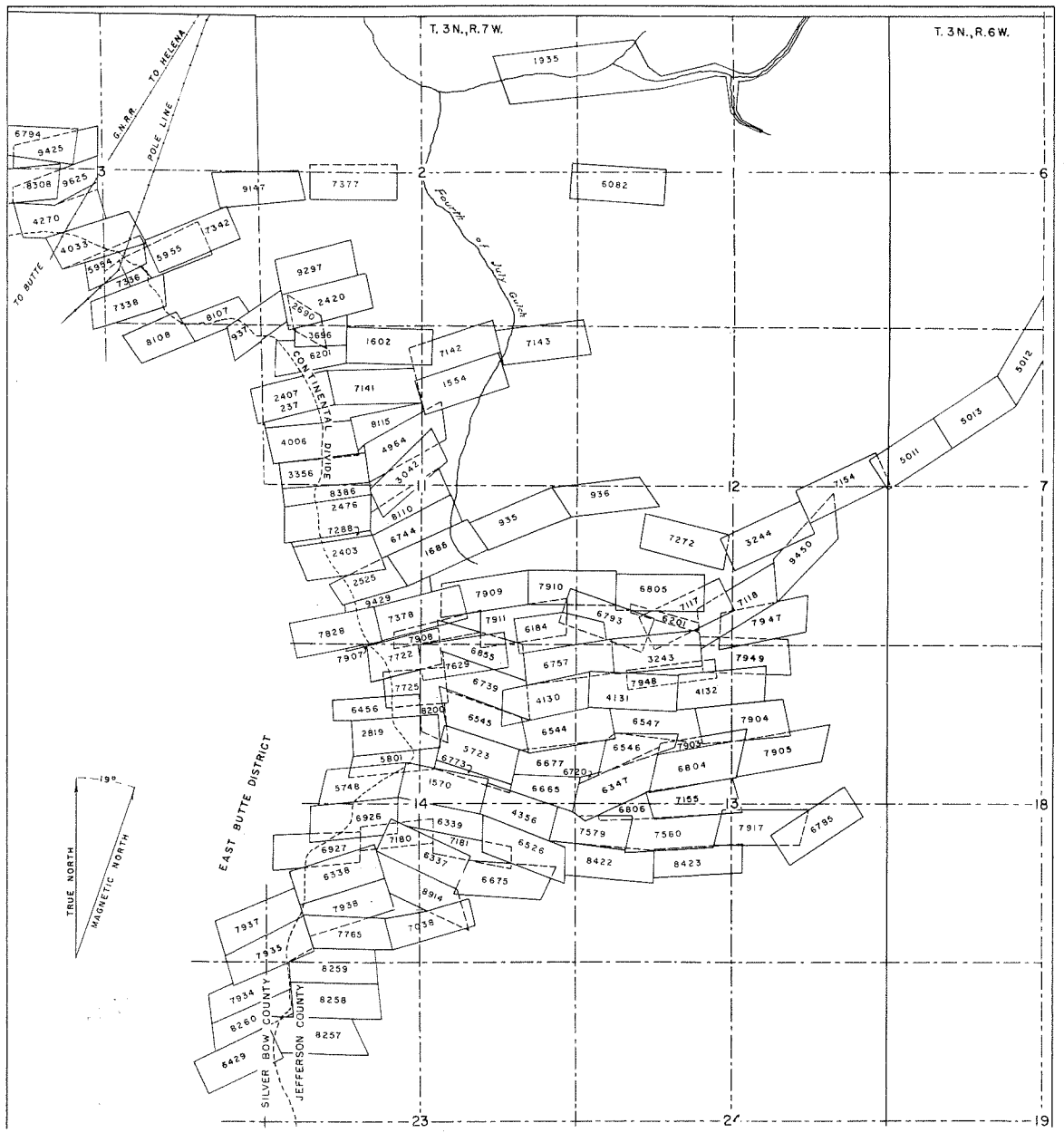
Mineralization consists of a black quartz vein in granite together with a zone of galena-impregnated quartz monzonite. The vein strikes N. 87° W., is vertical and about 2 to 4½ feet wide, and can be traced for 200 feet along the strike. The black quartz portion of the vein is about 2½ feet wide, whereas the altered and impregnated quartz monzonite zone is about 2 feet wide. No production is recorded.

TIZER-WILSON DISTRICT

The Tizer district embraces a part of Jefferson County within the Elkhorn Mountains in T. 7 N., R. 2 W. It is drained by Tizer and Wilson Creeks, tributaries to Crow Creek. Elevations range between 6,000 feet near Crow Creek falls to 9,391 feet at Elkhorn Peak and 9,416 feet at Crow Peak near the headwaters of Tizer Creek. Crow Peak is the highest point in Jefferson County.

TABLE 23.—Production of gold, silver, copper, lead, and zinc from lode mines, Pipestone district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902-20	No production						
1921	13	4	267	—	332	—	$369
1922-27	No production						
1928	2	5	11	38	631	—	156
1929-31	No production						
1932	1	1	—	—	—	—	18
1933	63	38	240	375	3,000	—	1,009
1934	32	14	68	175	730	—	568
1935	356	133	2,080	1,988	1,475	—	6,368
1936	107	36	1,242	152	—	—	2,236
1937	64	8	746	58	7,203	—	1,289
1938-41	No production						
1942	3	2	3	—	—	—	72
1943-57	No production						
TOTAL	641	241	4,657	2,786	13,371	—	12,085



Sur. No.	Name	Sec.	T.	R.
935	FOURTH OF JULY	11	3N	7W
936	FIFTH OF JULY	11-12	"	"
937	MAJOR BUDD	2-10	"	"
1554	HATTIE BELL	11	"	"
1570	SUMMIT	14	"	"
1602	SILVER KING	11	"	"
1685	KING SOLOMAN	11	"	"
1935	SUMMIT PLACER	1-2	"	"
2403	ROSABELLA	11	"	"
2407	LOST TREASURE	10-11	"	"
2420	MAJOR BUDD EXT. EAST	2	"	"
2476	DUBUQUE	11	"	"
2525	WIDE WEST	11	"	"
2690	MONITOR	2-11	"	"
2819	MARY ELLEN	14	"	"
3042	CASCADE	11	"	"
3243	MULDOON	12-13	"	"
3244	LAST CHANCE	12	"	"
3356	HILAND	11	"	"
3696	SYNDICATE	2-11	"	"
4006	MADIEN	11	"	"
4033	NELLIE KINMAN	3	"	"
4130	AJAX	13-14	"	"
4131	BERTIE	13	"	"
4132	JASON	13	"	"
4270	LURGAN	3	"	"
4356	BALTIMORE	14	"	"
4964	MAY BELLE	11	"	"
5011	GREAT NORTH WESTERN	7	3N	6W
5012	JOE HOOKER	6-7	"	"
5013	CARLOW	7	"	"
5723	BEAR PAW	14	3N	7W
5748	FANNIE SCOTT	14	"	"
5801	SPOKANE	14	3N	7W
5954	BLIND TREASURE	3	"	"
5955	GRAND PRIZE	3	"	"
6082	NELLIE	1-2	"	"
6184	REX	11-14	"	"
6201	MAUD C.	11	"	"
6337	MAY BELLE	14	"	"
6338	COPPER MOUNTAIN	14	"	"
6339	DAVENPORT	14	"	"
6347	JOHANNA	13	"	"
6429	MANILLA	22-23	"	"
6456	HANK	14	"	"
6526	JOHANNA C.	14	"	"
6544	MONT D'OR	13-14	"	"
6545	MONTE CRISTO	14	"	"
6546	MOUNT HOPE	13	"	"
6547	MOUNT DIABLO	13	"	"
6665	ELMER REMLE	14	"	"
6675	SWAMP ANGEL	14	"	"
6677	THELMER DEPAULI	13-14	"	"
6720	HANNAH	13	"	"
6739	USONA	14	"	"
6744	OAK FIELD	11	"	"
6757	VINDICATOR	13-14	"	"
6773	ELIZABETH	14	"	"
6785	ALBERT PIKE	13	"	"
6793	BEAR	12	"	"
6794	ATLANTIC SLOPE	3	"	"
6804	CONTRA COSTA	13	"	"
6805	COMBINATION	12	"	"
6806	DELEWARE FRACTION	13	"	"
6855	ASA	11-14	"	"
6926	McCLOSKEY	14	3N	7W
6927	ONTARIO	14	"	"
7038	GOLD BUG	14	"	"
7171	MOLLIE	12	"	"
7118	YANKEE	12	"	"
7141	JOHNSON	11	"	"
7142	BUTTE	11	"	"
7143	BOUCHER	11-12	"	"
7154	BUFFALO	12	"	"
7155	EVERGREEN	13	"	"
7180	JUPITER	14	"	"
7181	CAPELL	14	"	"
7272	HAMBURG	12	"	"
7288	BIDDLE	11	"	"
7336	COPPER BLOSSOM	3	"	"
7338	CONSTITUTION	3-10	"	"
7342	FLATHEAD FARM	3	"	"
7377	SUNSET	2	"	"
7378	DIVIDE	11	"	"
7535	PARASITE	3	"	"
7579	MARYLAND	13-14	"	"
7580	ALABAMA	13	"	"
7629	LUCKEY TOM	11-14	"	"
7722	USOV	11-14	"	"
7725	LIMIT	14	"	"
7765	SENATOR	14	"	"
7828	WOODLAND	11-14	"	"
7903	MUM	13	"	"
7904	ANNA	13	"	"
7905	MEOLA	13	"	"
7907	ANONA	11	"	"
7908	ADA	11	"	"
7909	BOB	11	3N	7W
7910	NAVARRE	11-12	"	"
7911	OTTO	11	"	"
7917	MOUNTAIN VIEW	13	"	"
7934	SECOND CHANCE	22-23	"	"
7935	WALK OVER	14-22	"	"
7937	GREEN COPPER	14-15	"	"
7938	BLUE COPPER	14	"	"
7947	NOON	12-13	"	"
7948	ADAM RUSH	13	"	"
7949	MADAM	12-13	"	"
8107	HURRY	3-10	"	"
8108	HURRY EXT. WEST	3-10	"	"
8110	EAST EXTENSION	11	"	"
8115	ALLIE BELLE	11	"	"
8200	SIS	14	"	"
8201	DUMB BELL	12	"	"
8257	ONTA	23	"	"
8258	WEBFOOT	23	"	"
8259	SLEDGE	14-23	"	"
8260	POLO	22-23	"	"
8308	PRUNE DEALER	3	"	"
8386	GYPSY	11	"	"
8422	GEORGIA	13-14	"	"
8423	LOUISIANA	13	"	"
8914	JOHNSTON	14	"	"
9147	THIEF OF POSTERITY	2-3	"	"
9297	PERT	2	"	"
9425	TOWNSITE	3	"	"
9429	WOODLAND FRACTION	11	"	"
9450	ZAZA	12	"	"
9625	RANGER	3	"	"

FIGURE 14.—Claim map of area east of the Continental Divide, Pipestone District, Jefferson County, Montana.

The properties in Tizer Basin on the northeast slope of the mountains are almost inaccessible. An extremely poor, steep trail, which can be traversed by only the most rugged automobile, preferably one with a four-wheel drive, ascends Prickley Pear Gulch from the north and passes over a divide into Tizer Basin. The only other access to this area is by foot or horseback over forest trails. The mountain slopes are steep but not precipitous.

Lodgepole pine, fir, and spruce grow on most of the mountain slopes. Timber for mine support is plentiful. Sufficient water is available for milling purposes in most creeks.

The bedrock is composed of volcanic rock described by Klepper, Weeks, and Ruppel (1957, p. 36-37) to be composed of dark-greenish-grey, greyish-green, greenish-black, dull reddish-grey, and dull purplish-grey pyroclastic rocks, water-laid tuff, conglomerate and flows, mainly of andesitic compositions. The welded tuff is probably quartz latite in composition. It is interlayered in the upper part. This sequence includes andesitic and dioritic dikes, sills, and other hypabyssal rocks. A large portion of the basin is almost entirely covered by glacial deposits. Andesitic fragmental rocks and flows that are cut by intrusive rocks similar in composition and related in origin to the extrusive rocks that crop out around and presumably underlie the covered area. The margin of the Boulder batholith is 2 to 3 miles west.

The veins are narrow and mineralogically simple, consisting of an oxidized zone composed principally of soft limonitic material with some vuggy quartz and gold. Vuggy quartz, sparse pyrite, galena, sphalerite, chalcopyrite, and rare specks of gold and tetrahedrite occur beneath the oxide zone in sheared and altered andesite. Ore shoots are small, but some are high grade. Production has come almost entirely from the oxidized portions of veins. Limited exploration in the Callahan and Center Reef veins indicates that the grade of primary ore is distinctly lower than that of oxidized ore.

Gold placers were operated along the headwaters of Crow Creek as early as 1858; however, production has been recorded for but one year (1933) when $45 in placer gold was produced. Lode mine production is shown in table 24.

Belle

The Belle mine is near the mouth of Moose Creek in secs. 15 and 16, T. 7 N., R. 2 W., and is accessible from the Prickly Pear drainage by a trail. The property consists of 3 patented claims, the Belle, Best, and Lost, all Mineral Survey No. 10575 and owned by Jerlie Eikerson of Boulder.

Klepper, Weeks, and Ruppel (1957, p. 73) report that a narrow vein in andesitic tuff has been explored by a 700-foot adit at the Belle mine. The vein has been traced at the surface for about 2,000 feet. In the accessible part of the adit the vein trends N. 75° to 80° E. and dips from 50° SE. to

TABLE 24.—Production of gold, silver, copper, lead, and zinc from lode mines, Tizer-Wilson Creeks district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902-20	No production						
1921	3	2	1	—	—	—	$49
1922	No production						
1923	17	42	60	34	589	—	961
1924	53	75	254	—	1,476	—	1,843
1925	1	1	2	—	—	—	14
1926	23	40	58	—	765	—	916
1927	1	3	12	—	330	—	92
1928-30	No production						
1931	41	37	90	—	—	—	790
1932	34	49	25	16	—	—	790
1933	18	43	37	—	487	—	919
1934	13	18	31	25	162	—	677
1935	9	13	18	—	50	—	484
1936	4,170	1,323	1,060	217	11,109	—	47,650
1937	1,405	570	309	25	3,000	—	20,369
1938	1,855	361	464	1,082	1,978	—	13,132
1939	310	62	115	288	2,574	—	2,399
1940	1,090	244	291	637	3,360	—	8,987
1941	300	746	831	2,600	12,300	—	27,709
1942	297	832	1,416	1,800	16,400	—	31,444
1943	189	301	893	1,100	12,000	—	12,213
1944	81	248	855	1,400	4,700	—	9,853
1945	287	116	135	—	500	200	4,222
1946	285	438	297	—	1,000	—	15,679
1947	130	28	—	—	—	—	980
1949	131	173	221	100	1,800	500	6,621
1950	74	206	210	100	1,000	100	7,570
1951	100	201	221	200	2,700	700	7,877
1952-57	No production						
TOTAL	11,007	6,235	7,938	9,655	78,380	1,500	226,727

vertical. In places it consists of one or more bands of quartz as much as 6 inches thick with smaller amounts of calcite, pyrite, and galena. In other places the vein is a zone of altered andesitic rock as much as 6 feet thick containing disseminated pyrite and galena. Malachite stain is common in the oxidized part of the vein. Typically the rock adjacent to the vein is bleached and pyritic andesitic tuff. The ore produced until 1950 is reported to have averaged 0.77 ounces gold, 17 ounces silver, and 17 percent lead, and to have a total value of $16,000.

Blackjack

The Blackjack claim is in the SE¼ sec. 32, T. 7 N., R. 2 W. Klepper, Weeks, and Ruppel (1957, p. 73) report that the claim is a pipelike deposit and may be similar to the Skyline deposit, but pyrite is the only metallic mineral that has been found in 4 shallow shafts. Stone (1911, p. 92-93) states . . . "the claim is interesting as it is located on a mass of brecciated andesite 75 feet in diameter, carrying a large amount of rusty quartz and radiating black crystals of tourmaline." Sparse epidote is associated with the quartz and tourmaline. Part of the pyrite is well-formed crystals in vugs in tourmaline and quartz.

Center Reef (Ballard)

The Center Reef mine (M.S. 7965) is in the SE¼ sec. 32, T. 7 N., R. 2 W., and it is accessible from the Prickly Pear road. The property consists of 4 patented claims, Loon (M.S. 7964), Center Reef (M.S. 7965), Policy (M.S. 7966), and Black Bear (M.S. 7967), owned by David E. Loughran of Portland, Ore., V. B. Mead of Mill Valley, Calif., and Wm. McAllister of New Milford, N. J.

Klepper, Weeks, and Ruppel (1957, p. 73) report that the Center Reef mine explores a narrow vein of siliceous gold ore in gently dipping andesitic fragmental rocks of the Elkhorn Mountain volcanics. The vein trends N. 70° E., dips 70° SE. to vertical, and in internal structure and mineralogy closely resembles the Callahan veins. It has been explored discontinuously for at least 500 feet along the strike and to a depth of 230 feet by shallow surface workings and 2 crosscut adits, the lower of which is accessible. Discontinuous shoots of oxidized ore were stoped for about 200 feet along the vein between the upper adit level and the surface, a vertical distance of about 110 feet. Recorded production (13 producing years between 1906 and 1940) of 975 tons ore yielded 2,725 ounces gold, 7,173 ounces silver, 133 pounds of copper, and 9,753 pounds lead.

Golden Age (Deer Horn, Callahan)

The Golden Age group of 20 unpatented claims is in the central part of the Crow Basin in secs. 15 and 22, T. 7 N., R. 2 W. This group is owned by the Callahan Gold Min. Co. of Butte.

The property is developed by 2 adits driven at altitudes of 6,110 feet and 6,360 feet, respectively, and by 2 intermediate levels between the adits. The combined length of the accessible workings is about 3,600 feet.

The deposit is in andesite and appears to accompany a branching fault system, although not enough development work has been done to determine all the structural features. Two parallel ore shoots, about 75 feet apart in the upper adit, have been mined from near surface downward to the upper intermediate level where the vein material changed to low-grade primary ore. The lower adit was driven in the footwall of the vein and failed to cut it until the primary zone was reached beneath the ore shoots on the upper levels. The oxidized zone of the vein on this level was not subsequently explored.

Klepper, Weeks, and Ruppel (1957, p. 72, 73) report that the vein strikes on the average N. 50° E., and dips from 50° SE. to vertical, averaging about 70° SE. In the central part of the explored area, the vein splits into two subparallel veins. The vein and its splits have been explored for a length of about 1,500 feet and to a maximum depth of about 400 feet by 2 adit levels and 2 short interconnected levels between them (fig. 15). Records show the Deer Horn and Callahan total production for 25 years as follows: 10,833 tons ore, 6,080 ounces gold, 7,461 ounces silver, 9,972 pounds copper, 69,129 pounds lead, and 1,594 pounds zinc. Production started in 1921 and ceased in 1951. Most of this ore was stoped from a discontinuous ore shoot on the south (hanging wall) split of the vein that was about 400 feet long and 250 feet high (fig. 15). A smaller quantity was mined from a steeply plunging shoot on the north (footwall) split of the vein that was about 100 feet long and 200 feet high. Most of the ore that was mined was oxidized. On the bottom level of the mine, where the vein is incompletely oxidized, little minable ore has been found.

The veins are as much as 6 feet thick but average between 2 and 3 feet and consist of alternate strands of gouge, altered pyritic andesite and vuggy quartz that, below the oxidized zone, contains sparse pyrite, galena, sphalerite, and chalcopyrite, and rare specks of gold and tetrahedrite. Typically the andesitic wall rock is somewhat bleached and pyritic for a few feet adjacent to the vein. Although narrow high-grade lenses of gold ore have been found, the average grade of minable widths of ore have been about half an ounce of gold.

Three general sets of fractures cut the andesitic extrusive rocks, an early northwestward-trending set a N. 60 to 85° E. intermediate set, and the youngest set including the hanging-wall vein that is trending about N. 40 to 50° E. The bulk of the mineralization has occurred in the youngest set, with smaller amounts in the intermediate set. The oldest set is only weakly mineralized.

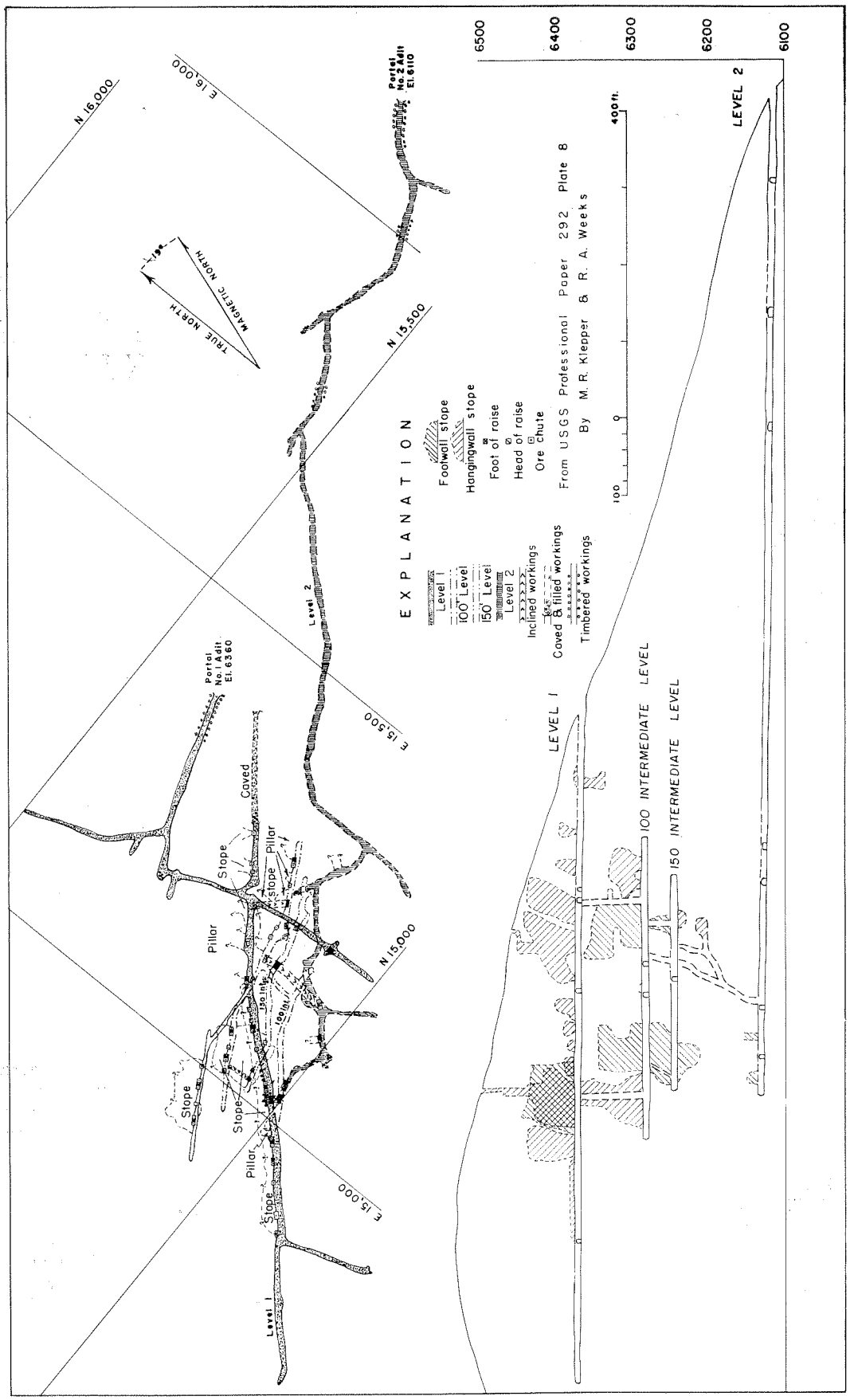


FIGURE 15.—Composite plan and section of working Callahan mine, Jefferson County, Montana.

Wilson Creek and Crow Creek

The Wilson and Crow Creek placer deposits are in secs. 23 and 24, T. 7 N., R. 2 W., on Wilson and Crow Creeks.

Klepper, Weeks, and Ruppel (1957, p. 73) report that small placer operations have been carried on intermittently at several localities along Wilson Creek and for several hundred yards along Crow Creek below the mouth of Wilson Creek. None of the early operations was mechanized, but in recent years small scale mechanical operations have been conducted in a few places. Total production has probably been small. Narrow veins along the contact zone between andesite and quartz monzonite that have been prospected on and west of Bullock Hill were probably the source of the placer gold in the middle and upper parts of Wilson Creek. Part of the placer gold near the mouth of Wilson Creek and along Crow Creek may have been derived from the Callahan veins.

WHITEHALL (CARDWELL) DISTRICT

The Whitehall district occupies the south end of Bull Mountain in the south central part of Jefferson County north of the Jefferson River. The mines within this district are centered about St. Paul Gulch approximately 3 to 4 miles northeast of the town of Whitehall in T. 2 N., Rs. 3 and 4 W.

The area is serviced by 2 railroads, the Chicago, Milwaukee, St. Paul and Pacific, and the Northern Pacific. A main arterial highway, 10-S, passes through Whitehall. The district lies at the north end of the Jefferson River valley, a plain extending 40 miles due south from Whitehall. It is drained by Whitetail Creek and its tributaries to the west, and by the Boulder River and its tributaries to the east.

A terrace about 25 feet high has been developed along the valley floor of the creeks. This older surface, or terrace, rises uniformly but with considerable steepness toward the foot of the mountain ridges on either side of the valley.

The bedrock within the district is composed of Precambrian rocks essentially shales, sandstones, and sandy limestones of the Belt series. The Belt rocks are conformably overlain by pink quartzites, and limestones of Paleozoic age and by Cretaceous sediments. The benchlands are underlain by a flat-lying conglomerate resting on the upturned edges of Tertiary "lake beds."

Ore deposits occur as lodes or veins in the faulted sedimentary rocks. These sediments are cut by intrusions of porphyritic rocks. The ore is a quartzose material carrying gold-bearing pyrites. Minor amounts of galena, sphalerite, copper, and manganese minerals have been noted.

Prior to 1890, there was very little activity, until the discovery of the Mayflower mine across the Jefferson River in Madison County, which gave the area the impetus to prospecting. The largest producers in this district were the Golden-Sunlight-Ohio group, Burlington and Columbia mines. Yearly production figures for the district are given in table 25.

Carbonate

The Anaconda Company owns one of the largest producers in the Whitehall district, the Carbonate mine (See fig. 16). The mine is in secs. 13 and 24, T. 2 N., R. 4 W., and was last operated in 1957 by Lester Lindquist of Whitehall. Total production for 26 years between 1909 and 1957 was 6,098 tons ore that yielded 325 ounces gold, 16,215 ounces silver, 8,622 pounds copper, 1,649,315 pounds lead, and 147,387 pounds zinc.

Development consists of a 325-foot shaft and 3 levels with about 1,000 feet of drifts. It is equipped with a gasoline-driven hoist and compressor.

A fissure-filled vein in Greyson shale has been exposed for about 400 feet laterally by the underground workings. The vein strikes N. 60° to 70° E. and the dip ranges from 80° S. to vertical. Galena, sphalerite, and pyrite, along with manganese oxide and chalcopyrite occur in the quartz-filled vein that ranges from 6 inches to 6 feet in thickness.

Chief

The Chief mine, owned by H. R. Meggers of Whitehall, is in sec. 17, T. 2 N., R. 2 W. It is developed by one 50-foot adit that has exposed a contact replacement vein. The vein occurs along a contact between Madison limestone and a diorite intrusive body and contains chrysocolla in calcite. The property was developed for gold, but no production is recorded.

Columbia

Winchell (1914, p. 98) states that at the Columbia mine, the country rock is shale dipping about 30° NE. and striking about N. 40° W. The vein strikes N. 10° E. and dips about 80° E., is highly quartzose and contains pyrite and some gold. Adjoining the vein to the southeast is a dike of mica andesite, but both the dike and the vein are rather narrow. A crosscut tunnel runs about 300 feet to the vein.

Production for 3 years 1911, 1912, and 1916 totaled 190 tons ore, from which 450 ounces gold, 618 ounces silver, and 172 pounds copper were recovered.

Examiner (Three Dots and a Dash)

Two unpatented claims in sec. 13, T. 2 N., R. 4 W., were held by Peter Antonioli (deceased). The claims are developed by a 300-foot shaft and an estimated 1,000 feet of underground workings. The fissure-filled vein in Greyson shale contains galena, cerussite, and manganese oxide. It strikes N. 83° E., dips 73° S., and is about 3 feet thick. There is no recorded production.

TABLE 25.—Production of gold, silver, copper, lead, and zinc from lode mines, Whitehall district, Jefferson County, Montana, 1902-57, in terms of recoverable metals

Year	Ore (tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1902	2,477	3,073	833	—	—	—	$61,877
1903-04	No production						
1905	95	46	464	—	6,000	—	1,504
1906-07	No production						
1908	86	169	454	—	247	—	3,748
1909	143	59	626	1,259	39,909	—	3,415
1910	166	89	855	—	50,071	—	4,507
1911	286	416	827	—	41,706	—	10,907
1912	230	321	1,138	1,874	44,416	—	9,643
1913	270	203	1,138	7,447	42,493	—	7,920
1914	354	1,011	828	9,381	—	—	22,602
1915	178	276	280	—	4,588	—	6,069
1916	444	23	1,345	31,271	35,370	—	11,490
1917	972	192	3,595	63,301	162,774	—	38,220
1918	490	548	4,530	24,517	49,547	—	25,437
1919	161	84	944	281	33,361	—	4,608
1920	29	6	215	—	14,114	—	1,489
1921	26	—	435	—	409	—	463
1922-23	No production						
1924	71	16	535	706	38,212	—	3,830
1925	377	235	2,511	1,096	69,681	—	12,823
1926	473	173	2,863	5,915	135,798	—	17,064
1927	235	52	1,312	1,099	93,966	—	7,894
1928	221	40	831	531	60,547	—	4,878
1929	57	8	634	—	21,518	—	1,874
1930	39	16	237	301	23,804	—	1,645
1931	70	69	383	262	24,956	—	2,476
1932	1,268	660	2,450	2,555	333	—	14,495
1933	5,412	2,229	11,397	12,328	4,757	—	51,022
1934	3,472	1,976	9,125	15,800	4,838	—	76,392
1935	4,242	2,242	5,614	1,024	4,300	—	82,777
1936	3,945	3,243	5,867	109	8,587	—	118,440
1937	4,094	2,745	3,563	2,595	63,644	—	102,900
1938	4,938	2,293	10,873	3,949	220,892	—	97,832
1939	10,947	5,998	11,416	1,827	90,553	—	222,125
1940	11,800	5,071	22,500	708	65,940	—	196,862
1941	6,764	3,707	8,131	5,000	78,000	—	140,563
1942	16,308	4,667	4,929	1,000	160,400	—	177,718
1943	16,866	5,327	4,929	5,700	237,400	—	208,496
1944	16,705	5,406	6,158	19,600	416,600	—	229,563
1945	14,443	4,371	7,695	13,000	452,500	69,800	207,154
1946	11,299	3,927	5,714	10,000	310,000	35,000	181,742
1947	11,949	3,876	7,473	10,200	347,300	72,500	202,913
1948	12,708	3,411	5,435	15,000	246,900	59,300	179,641
1949	7,989	1,960	5,792	6,600	396,700	55,800	144,740
1950	2,051	395	1,295	1,800	113,000	16,600	32,983
1951	889	65	1,358	2,400	133,100	23,800	31,443
1952	1,670	171	4,170	3,160	301,316	61,011	69,164
1953	589	74	1,560	2,000	86,000	29,000	19,177
1954	46	6	170	—	9,300	4,000	2,070
1955	319	17	507	600	58,700	9,700	11,217
1956	7,926	887	630	600	20,400	2,400	35,402
1957	63	1	208	4,000	6,000	400	2,331
TOTAL	186,652	71,850	176,772	290,796	4,830,947	439,311	3,105,545

Gold King

Winchell (1914, p. 98) states that at the Gold King mine, a vein of quartzose ore carrying auriferous pyrite occurs in calcareous shale. It is closely associated with a dike of porphyritic rock, apparently quartz porphyry, that strikes approximately east-west. Total production for 2 years, 1909 and 1911, was 83 tons ore, yielding 210 ounces gold, 182 ounces silver, and 8 pounds copper.

Golden Sunlight

The Golden Sunlight property, in secs. 19, 20, and 30, T. 2 N., R. 3 W., has been worked intermittently since its discovery by Anthony H. Hedley in 1890. The property was bought by the American Development and Min. Co. at that time; this company subsequently located the Mineral Hill and Ohio claims. A mill was built in 1905, but the recover from it was poor. In 1910, H. C. Bacorn took over the property and located several more claims as he worked the Mineral Hill and Sunlight. The property changed hands in the early 1920's

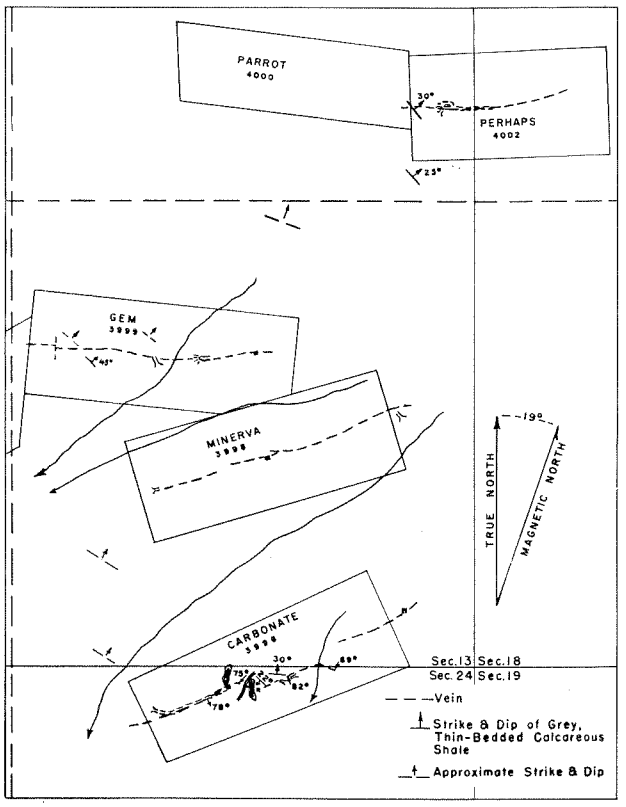


FIGURE 16.—Carbonate group of claims. Jefferson Co., Mont.

and the mine was worked until 1930 by Dan Zink, Lot Border, and Mike Mufly of Whitehall, and Tidball of Butte. In 1930 H. W. Carver took over the lease. Meanwhile ownership of the different claims was slowly acquired, a claim at a time, by McKay and Welcome of Whitehall.

In 1936, the A. O. Smith Corp. of Milwaukee, Wis., examined the workings and bought all 23 claims and subsequently located 3 more claims. Claims (with Mineral Survey nos. in parentheses) are: Golden (4146), Sunlight (4147), Lost Chance (4148), Telluride (4149), Sommerville Placer (4458), Foraker (4451), Ohio (4452), Mineral Hill (4453), Macomber (4454), Madge (4455), Prairie (4456), Astley (4473), Buffalo (4472), Starlight (4488), Hematite of Iron (4489), Hillside (4477), Moonlight (4478), Lamplight (4479), Red, White, and Blue (4486), Meteor (4474), Lapear & Mill Site (4463), Excelsior (4172), Blue Moose (10793), West End (10793), and Sunlight No. 19 (10793). The White Development Corp. operated the mine until 1957. American Exploration Co. of San Francisco, Calif., was examining the mine during 1958 and 1959.

Production for the Golden Sunlight group totals 154,308 tons ore which yielded 57,117 ounces gold, 78,089 ounces silver, and 55,503 pounds copper. The above totals are for 27 producing years between 1902 and 1956. A footnote to the production records states: "American Exploration and Min. Co. has advised the Bureau of Mines that reports in its possession estimate production from 1890 to 1910 of 75,000 tons of ore with gross value of gold and silver of $1.5 million and output from 1910 to 1917 of 5,000 tons of ore with gross gold and silver value of $200,000."

Alexander (1951, p. 84) states that the valuable ore mineral is auriferous pyrite occuring with quartz in veins cutting both latite and brecciated Greyson shale. Minor amounts of chalcopyrite occur, which when subjected to ground-water circulation have been altered to covellite and chalcocite. Minor amounts of primary tetrahedrite occur, and barite is frequently encountered and usually accompanies an increase in gold values. Mineralization is thought to be related to the late stages of the magma from which the latite body was derived. The mineralizing solutions were injected into an irregular vein system transecting the igneous rocks and the surrounding rocks alike. The sphere of mineralization has a general ellipsoidal shape with a north-south axis of 1,400 feet, an east-west axis of 600 feet, and a depth of 400 feet. Very late stage lamprophyre dikes cut both the mineralized portions of the latite and the shale. These carry no gold, but low concentrations are present along the contact of these dikes with the intruded rocks.

Hudson

Winchell (1914, p. 98) states that the Hudson mine, near the mouth of St. Paul Gulch, is in black shales that are broken and impregnated with gypsum and melanterite. Melanterite is produced by oxidation and hydration of sulfide ores, especially pyrite, and from resulting reactions of solutions carrying sulphuric acid with calcareous shales. The ore carries galena and pyrite, and occurs in a breccia of shale and limestone apparently produced by faulting.

Inspiration

The Inspiration property consists of 1 unpatented claim in sec. 19, T. 2 N., R. 3 W., held by Wm. G. Wegener of Whitehall. The mine is developed by one 170-foot shaft and 3 underground levels with about 200 feet of drifts. The mine is equipped with several cabins and a gasoline-driven compressor and hoist. From 1945 to 1949 (4 producing years) the Inspiration produced 290 tons ore with a recovery of 149 ounces gold, 1,291 ounces silver, 9,248 pounds copper, 37,135 pounds lead, and 10,054 pounds zinc.

The vein is a replacement and fissure-filling in shale (Greyson). It strikes N. 80° W., dips 58° S., and averages about 14 inches in thickness. The vein is exposed for about 70 feet between 2 faults and carries galena, sphalerite, chalcopyrite, chalcocite, and pyrite in altered shale and quartz.

Kronholm

Winchell (1914, p. 98) states that at the Kronholm claim, at an elevation of more than 6,000 feet, a quartz vein in calcareous shales dipping about 25° E. carries auriferous pyrite and a little galena and sphalerite. There are faults close by, but they do not affect the vein so far as developed.

Lucky Hit

One patented claim in NW¼ sec. 19, T. 2 N., R. 3 W. comprises the Lucky Hit property, which is owned by E. W. Wolfe of Whitehall. The main shaft is inclined and is about 175 feet deep. Three drifts and numerous dog-holes and stopes make up the underground workings.

The Lucky Hit has been a substantial producer in the Whitehall district. Production was almost continuous from 1932 to 1953 during which time a total of 6,174 tons ore were mined. Recovered metals total 2,995 ounces gold, 13,850 ounces silver, 22,529 pounds copper, 333,699 pounds lead, and 78,195 pounds zinc.

A vein striking N. 65° E. and up to 6 feet thick has been exposed and explored for approximately 300 feet laterally and 150 feet vertically. The vein dips 45° to 53° SE. and is at the contact between Greyson shale and andesite. Galena, sphalerite, and pyrite are the predominant ore minerals in a quartz and calcite gangue.

Midnight

One shaft 200 feet deep, several adits about 250 to 3,000 feet long, comprise the Midnight mine in sec. 18, T. 2 N., R. 3 W. The property, owned by H. R. Houghton of Boulder, has a past production record of 561 tons ore that yielded 102 ounces gold, 3,798 ounces silver, 1,309 pounds copper, and 240,965 pounds lead. Production was for 12 years between 1917 and 1949.

A fissure-filled vein in shale carries galena, sphalerite, pyrite, and cerussite. The vein strikes east and dips 60° to 70° S.; thickness ranges from 6 inches to 3 feet.

Parrot (Paroll Chief)

The Parrot mine, owned by Donald Hedly, is in secs. 13 and 18, T. 2 N., Rs. 3 and 4 W., about 6 miles north of Whitehall on the St. Paul Gulch road. Total production between 1912 and 1953 (12 producing years) was 590 tons ore. Metal recovery totaled 45 ounces gold, 2,337 ounces silver, 12,033 pounds copper, 116,895 pounds lead, and 8,823 pounds zinc. All zinc was produced during 1948, 1949, 1951, and 1953. Several shafts 65 and 100 feet deep have explored a fissure-filling and replacement vein in shale. Cerussite, galena, pyrite, and manganese oxides occur in quartz and altered shale gangue of the vein, which is up to 4 feet thick.

South View

Charles O. Weber of Whitehall owns the South View mine in sec. 19, T. 2 N., R. 3 W. Total production for 4 years between 1948 and 1954 amounted to 40 tons ore that yielded 8 ounces gold, 190 ounces silver, 100 pounds copper, 12,342 pounds lead, and 803 pounds zinc. The 1 unpatented claim (1950) is developed by 3 adits 185, 250, and 330 feet long. A vein in latite near the contact between latite and shale strikes east and dips 65° S.; it contains cerussite, galena, and pyrite as ore minerals. Thickness ranges from 6 inches to 4 feet.

Sunny Corner (Sunny)

A contact replacement vein between shale and latite has been exposed by one 230-foot shaft and 3 levels at the Sunny Corner mine in sec. 24, T. 2 N., R. 4 W. Aggregate length of underground workings is about 2,000 feet.

William Williamson of Butte is the owner of Sunny Corner which has a past production record totaling 1,485 tons ore. The ore yielded 1,275 ounces gold, 11,387 ounces silver, 12,315 pounds copper, 77,011 pounds lead ,and 4,763 pounds zinc.

General strike of the vein, which may reach 5 feet in thickness, is east and the dip is south. The vein contains pyrite, galena, cerussite, and chalcopyrite in a gangue of quartz and latite.

Surprise (Olson's)

An unpatented claim in secs. 13 and 18, T. 2 N., Rs. 3 and 4 W., has been developed by a shaft and an adit. The adit is an estimated 300 feet long and the shaft is an estimated 150 feet deep. Both workings expose a 6-inch to 4-foot fissure vein that contains galena, cerussite, and pyrite. The vein strikes east-west and ranges in dip 80° S. to vertical. The vein is probably an extension of the vein at the Carbonate mine just west of the Surprise.

The present owner is not known. The mine had been fairly active and production was continuous between 1930 and 1946, during which time 1,125 tons ore were mined. The ore yielded 138 ounces gold, 5,601 ounces silver, 5,708 pounds copper, 536,632 pounds lead, and 12,225 pounds zinc.

Whitehall

The Whitehall mine was owned by the Monida Trust Co. of Butte in 1950, and the last known lessees were Ralph Huckaba and George Stacy of Whitehall. The property is in secs. 12 and 13, T. 2 N., R. 4 W., and is developed by a 200-foot shaft.

Between 1917 and 1953, or 8 producing years, the Whitehall mine produced a total of 949 tons ore. Recovered metals totaled 1 ounce gold, 1,533 ounces silver, 1,136 pounds copper, 298,614 pounds lead, and 37,369 pounds zinc.

Like many other veins in the Whitehall district, the Whitehall vein is a fissure filling in shale. It strikes N. 56° W. and dips 80° S. Thickness may be as much as 5 feet and the predominant minerals are galena, pyrite, and manganese oxides.

NONMETALLIC MINERAL DEPOSITS

CALCITE

The Dunbar calcite property is in sec. 33, T. 3 N., R. 1 W. Optical-grade calcite is said to occur in veins cutting andesite. The deposits are on patented agricultural land owned by Herbert Dunbar of Three Forks. The calcite veins range from 4 to 6 feet wide and have been exposed for about 500 feet laterally by shallow surface cuts, but there is no record of production.

CLAY

Clays are common in the Tertiary sediments of the larger valleys, but these are generally quite silty, limy, or bentonitic—properties that render them unsuitable for ceramic use. Some Belt shales have been tested for ceramic properties and, although quite hard, have been found promising.

Belt (Precambrian) shale from the SW¼ sec. 25, T. 2 N., R. 4 W., northeast of Whitehall, could be used for common brick and like products. The P.C.E. is cone 11 (2,345° F.), but the clay would require grinding before use (Sahinen, Smith, & Lawson, 1960, sample 91).

A sample of indurated black micaceous Belt shale from the NW¼ sec. 31, T. 2 N., R. 2 W., could be used for common brick. The P.C.E. is cone 17 (2,669° F.) and the fired color is light to dark red; but the clay gives some difficulty in firing (Sahinen, Smith, & Lawson, 1958, sample 42).

A dark-red weathering pinkish-grey indurated Belt shale from the NW¼ sec. 36, T. 2 N., R. 3 W. (Rogers Clay Pit) has been recently (1959) used to some extent in the manufacture of brick at the Western Clay Products plant at Helena. At this locality the shale beds strike N. 25° E. and dip 65° NW., and the exposure is at least 200 feet across. The shale is hard and would require grinding. The P.C.E. is cone 16 (2,642° F.), and the fired color is red to purple. It has been successfully used in the manufacture of face brick (Sahinen, Smith, & Lawson, 1958, sample 41).

DUMORTIERITE

A small deposit of dumortierite, a boron-aluminum silicate mineral, was discovered by E. T. Ruppel (1958, p. 179-181) during the mapping of the Basin quadrangle. The dumortierite occurs as disseminated fibrous aggregates and in veinlets in quartz latite welded tuff on Jack Creek Ridge in sec. 14, T. 7 N., R. 6 W. Because the dumortierite interlocks with quartz, sericite, and feldspar, it breaks down at temperatures too low to permit its use as a refractory. However, a small amount of the pale-blue rock was shipped from the deposit in 1955 and used as roofing aggregate.

GYPSUM

The gypsum deposit near Limespur in southeastern Jefferson County has been described by Perry (1949, p. 19) as follows: "A small deposit of rather impure gypsum occurs in Jefferson County about one mile east of Limespur, a siding on the Northern Pacific Railway about 50 miles east of Butte. It lies about half a mile north of the railroad and about 300 feet higher. The deposit was mined by the Three Forks Portland Cement Co. in 1915 and 1918 by open cut methods, and the crude gypsum shipped to Trident to be used as a retarder in the manufacture of cement. The deposit is relatively unimportant because of limited size and shale impurities.

"The strata in this locality have been involved in the most intense and complicated type of Rocky Mountain deformation. Faults whose magnitude is measured in terms of miles pass close to the deposit, and the strata lie in closely compressed folds. The gypsum is crushed and compressed and mixed with associated red shale. Geologic age is dififcult to determine because of the complicated structure and the lack of fossils, but it is believed to be either of Devonian age, or else more recently deposited gypsite. Gypsite is a term used for gypsum deposits developed by shallow ground water action."

LIMESTONE

Limespur

The Limespur limestone quarry has been described by Minister (1930) and Perry (1949, p. 40). The following is from the latter report:

Limespur was a major source of limestone for the Butte smelters in the early days. Until 1925, quarrying was carried on by the East Butte Copper Co., and at some time during the active years of the quarry, exceptionally pure limestone was shipped to the Great Western Sugar Co. at Billings. No limestone has been mined from this quarry since 1925.

Selective mining of certain beds in the north-dipping Mission Canyon formation was carried on, at first, by open cut methods; later a large open stope, which can be seen from the highway (U. S. 10), supplied most of the rock. Apparently the rock was moved from the stope through a chute and into dump trucks. A large haulage tunnel beneath the stope accommodated the trucks.

Perry (1949, p. 40) states that "an average of 11 analyses of run-of-the mine material made by the East Butte Copper Min. Co. prior to 1911 and used for smelter flux shows 95.55 percent calcium carbonate, 2.42 percent magnesium carbonate, and

1.38 percent silica and alumina, but selected material is reported to contain over 99 percent calcium carbonate." Perry further states that "rock shipped to sugar refineries contained 97.5 percent calcium carbonate, 1.9 percent magnesium carbonate, and 0.6 percent insolubles, iron and alumina."

Maronick

The Maronick limestone quarry is in sec. 7, T. 9 N., R. 2 W. The quarry is operated by E. B. Maronick of East Helena. The limestone is used for smelter flux at the East Helena plant of the American Smelting and Refining Co. Production of metallurgical grade limestone from the Meagher formation of Cambrian age has been virtually continuous since 1904. Present production capacity is 50,000 to 60,000 tons annually. The quarry is equipped to crush and size the limestone before rail-shipment to the nearby East Helena plant. An analysis of the limestone is as follows: Calcium oxide (CaO) 52.40 percent, magnesia (MgO) 2.85 percent, iron oxide 0.50 percent, and insoluble 2.70 percent (Perry, 1949, p. 39).

Montana City

Several limestone quarries were operated near Montana City about the turn of the century. The quarries supplied limestone flux for the smelters at Butte and East Helena. The large white quarry-scars, which can be seen from U. S. Highway 91, are in marbleized Madison limestone near the contact of the granitic rocks of the Boulder batholith. Size of the excavations indicates that a large amount of material was shipped, but the quarries have been inactive since the early 1900's (Perry, 1949, p. 38).

MICA - GARNET

Montana Metals

The Montana Metals, Inc., of Oregon holds the mining leases on a garnet deposit and a chlorite mica deposit in sec. 13, T. 9 N., R. 3 W.

During the summer of 1959 the properties were being explored by bulldozing and trenching. The oval-shaped garnet deposit is in limestone at the contact with granitic rock of the Boulder batholith. Pyrope and grossularite are the predominant minerals. Minor amounts of chalcopyrite, cuprite, and malachite occur in the garnet rock.

Chlorite occurs in a band 40 to 60 feet wide along the contact between quartz monzonite and the garnet zone. Length and depth of the deposit have not been determined. According to Mr. D. E. Loughran (personal communication) the chlorite mica has possibilities for use in paints, lacquers, rubber, and plastics. However, the deposit is still in the prospect stage.

SEMIPRECIOUS STONES

Pohndorf Amethyst

The Pohndorf amethyst mine is in sec. 4, T. 1 N., R. 6 W. at an altitude of about 5,500 feet. The mine was once operated by Pohndorf, a Denver jeweler and mineral dealer, who obtained much tourmalinated quartz and amethyst. It was last operated in 1938 by Montgomery and Over, who secured some beautiful small amethysts.

The deposit is a lense-shaped pegmatite in quartz monzonite, and is 140 feet long and as much as 55 feet wide. It trends N. 60° E. and from the internal structure is probably of limited vertical extent. The flat-lying core of massive quartz, 60x25 feet, lies at the northeast end of the deposit. It is enclosed in a zone of fine- to medium-grained rock composed of microcline, quartz, plagioclase, apatite, biotite, muscovite, magnetite, and sphene. A third type of rock appears to underlie the fine-grained pegmatite and dip beneath the core to the east. This part of the deposit has been mined by means of 3 pits. It consists of vesicular to vuggy microcline and quartz, with tourmaline, sericite, albite, and amethyst. "The deposit is by no means exhausted and will undoubtedly yield more amethyst; however, amethyst is not abundant, nor is it all of gem quality" (Henrich, 1949, p. 48-49).

SILICA

Basin Quartz Mass

Pardee and Schrader (1933, p. 294-295) describe this deposit as follows: "A large mass of quartz inclosed in granite 1 mile east of Basin was formerly quarried and shipped to Butte. It is 200 feet high from its top to the floor of the pit. Most of it forms a sheer face of coarse solid white quartz devoid of any metallic sulfides. On the level of the pit it is 350 feet wide." A tunnel 100 feet below the floor of the pit is in coarse porphyritic alaskite.

Brown

This silica deposit is near Jefferson City in Sec. 31, T. 8 N., R. 3 W. It is described by West (1959, p. 134) as a "ring-shaped quartz dike cutting Boulder batholith; 60 feet wide and about 1,200 feet long; minor iron staining." The silica content is 99.63 percent, and is estimated to contain more than 200,000 tons of quartz available by open pit mining. The deposit is within a quarter of a mile of a railroad and is favorable for immediate development. West gives the analysis of a grab sample in percent as follows: silica (SiO_2), 99.63; iron oxide (Fe_2O_3), 0.07; alumina (Al_2O_3), 0.14; and titania (TiO_2), 0.01.

Corral Creek

The Corral Creek silica deposit is on Corral Gulch, a tributary of Lump Gulch 8 miles west of Clancy. The deposit lies in sec. 8, T. 8 N., R. 4 W.

It is described by West (1959, p. 37 and 134) as a lenticular dike about 150 feet wide and more than 160 feet long. The dike is nearly pure quartz and cuts the quartz monzonite of the Boulder batholith vertically. It is estimated to contain in excess of 200,000 tons of high silica quartz available by open pit mining.

STONE

Building stone has been quarried at a number of places in Jefferson County. The granite used in the wings of the State Capitol was quarried about 2 miles west of Clancy. A beautiful rhyolite "porphyry" occurs about 3 miles southeast of Helena, and has been used in building several homes in Helena. Some monumental stone has been quarried by Trevillion-Johnson Memorial Co. in sec. 15, T. 1 N., R. 6 W., and by Dumos in sec. 22, T. 1 N., R. 6 W., both in southwestern Jefferson County. "Granite" has been quarried near Welch east of Butte.

Welch Placer

The Welch placer is a stone claim in secs. 10 and 11, T. 2 N., R. 6 W. The property is one mile north of Welch siding on the Northern Pacific Railway 7 miles east of Homestake. It is owned by E. B. Worley of Homestake.

The quarry is in massive sheeted quartz monzonite, and it is reported that blocks 6 to 10 feet thick could be cut with other dimensions as required. The stone was used principally in Butte buildings and in railroad bridge construction.

Alexander, R. G., Jr., 1955, Geology of the Whitehall area, Montana: The Yellowstone-Big Horn Research Assn., Inc., Contribution 195, 111 p.

Barrell, Joseph, 1901, The microscopical petrography of the district, in Weed, W. H., Geology and ore deposits of the Elkhorn mining district; U. S. Geol. Survey, 22nd annual report, pt. 2, p. 511-549.

Billingsley, Paul, 1915, The Boulder batholith of Montana: Am. Inst. Min. Eng. Trans., v. 51, p. 31-47.

Billingsley, Paul, and Grimes, J. A., 1918, Ore deposits of the Boulder batholith of Montana: Am. Inst. Min. Eng. Trans., v. 58, p. 284-368.

Brinker, W. F., 1944, Placer tin deposits north of Basin. Montana: Unpublished Master of Science thesis, Montana School of Mines, Butte, Mont.

Brown, J. R., 1867, Mineral resources of the states and territories west of the Rocky Mountain for 1866: U. S. Dept. Treas.

Bushnel, Floyd, 1910, The Corbin district, Jefferson County, Montana: Eng. Mining Jour., v. 89, p. 1154-1155.

Byrne, John ,and Hunter, Frank, 1898, Ninth annual report of the Inspector of Mines of Montana, 1897.

Byrne, John, 1900, Annual report of Inspector of Mines of the State of Montana (for the year ending November 30, 1900).

Byrne, John, and Barry, J. J., 1902, Fourteenth annual report of the Inspector of Mines for the State of Montana (for the years 1901 and 1902).

Condit, D. D., Finch, E. H., and Pardee, J. T., 1928, Phosphate rock in the Three Forks-Yellowstone Park region, Montana: U. S. Geol. Survey Bull. 795-G, p. 147-209.

Davis, C. C., and Greenfield, C. D., Jr., 1923, Montana industrial resourse edition, Department of agriculture, labor, and industry, 171 p.

Fenneman, N. M., 1931, Physiography of Western United States: McGraw-Hill Book Co., New York, N. Y., p. 214-215.

Forrester, J. D., 1942, A native copper deposit near Jefferson City, Montana: Econ. Geology, v. 37, no. 2, p. 126-135.

Freeman, H. C., 1895, Boulder mining district, Montana: Eng. Mining Jour., v. 59, p. 583-634.

Freeman, V. L., Ruppel, E. T., and Klepper, M. R., 1958, Geology of part of the Townsend Valley, Broadwater and Jefferson Counties, Montana: U. S. Geol. Survey Bull. 1042-N, p. 481-556.

Gilbert, F. C., 1935, Directory of Montana mining properties: Mont. Bur. Mines and Geol., Memoir 15, 99 p.

Grout, F. F., and Balk, Robert, 1934, Internal structure in the Boulder batholith: Geol. Soc. Am. Bull., v. 45, pt. 2, p. 112-117.

Heinrich, E. W., 1949, Pegmatite mineral deposits in Montana: Montana Bur. Mines and Geol., Memoir 28, p. 48-49.

Hill, J. M., 1912, Mining districts of the Western U. S.: U. S. Geol. Survey Bull. 507, p. 181-198.

Hogan, Joseph, and Oliver, Jacob, 1891, Third annual report of the Inspetcor of Mines for the fiscal year 1891.

Horton, F. W., 1916, Molybdenum; its ores and their concentrations: U. S. Bur. Mines Bull. 111, 132 p.

Klepper, M. R., Weeks, R. A., and Ruppel, E. T., 1957, Geology of the southern Elkhorn Mountains, Jefferson and Broadwater Counties, Montana: U. S. Geol. Survey Prof. Paper 292, 82 p.

Knopf, Adolph, 1913a, Ore deposits of the Helena mining region, Montana: U. S. Geol. Survey Bull. 527, 139 p.

———, 1913b, A magmatic sulfide ore body at Elkhorn, Montana: Econ. Geology, v. 8, no. 4, p. 323-336.

Leeson, M. A., (editor) 1885, History of Montana, 1739-1885: Warner Beers and Co., Chicago, Ill.

Lorain, S. H., and Hundhausen, R. J., 1948, Investigation of the Minah lead-silver mine, Jefferson County, Montana: U. S. Bur. Mines Rept. Inv. 4359, 9 p.

Lyden, C. J., 1948, The gold placers of Montana: Mont. Bur. Mines and Geol., Memoir 26, 152 p.

Mining World, The, 1906a, Mining news from busy mining camps, Montana: The Mining World, v. 24, no. 3, p. 73.

———, 1906b, Mining news from busy mining camps, Montana: The Mining World, v. 24, no. 21, p. 648.

Minister, P. F., 1930, Quarrying of limestone at Limespur, Montana: Mining and Metal., v. 11, no. 278, p. 108-110.

Pardee, J. T., and Schrader, F. C., 1933, Metalliferous deposits of the greater Helena mining region: U. S. Geol. Survey Bull. 842, 318 p.

Perry, E. S., 1949, Gypsum, lime, and limestone in Montana: Mont. Bur. Mines and Geol., Memoir 29, 45 p.

Petar, A. V., 1932, Molybdenum: U. S. Bur. Mines, Econ. Paper 15, 38 p.

Raymond, R. W., 1868-1873, Statistics of mines and mining in the States and Territories west of the Rocky Mountains: U. S. Treas. Dept.

Roberts, W. A., and Gude, A. J., III, 1953a, Uranium-bearing deposits west of Clancy, Jefferson County, Montana: U. S. Geol. Survey Bull. 988-F, p. 69-85.

———, 1953b, Geology of the area adjacent to the Free Enterprise mine, Jefferson County, Montana: U. S. Geol. Survey Bull. 988-G, p. 143-155.

Ruppel, E. T., 1958, Geology of the Basin quadrangle, Montana: U. S. Geol. Survey, Open File Report.

Ropes, L. S., 1922, Unpublished report on the Alta mine, Wickes district.

Sahinen, U. M., 1956, Prospecting for uranium in Montana: Mont. Bur. Mines and Geol., Inf. Circ. 6, 13 p.

———, 1959, Metalliferous deposits in the Helena area, Montana: Billings Geol. Soc., 10th Annl Field Conf., Guidebook, p. 129-140.

Sahinen, U. M., Smith, R. I., and Lawson, D. C., 1958, Progress report on clays of Montana: Mont. Bur. Mines and Geol., Inf. Circ. 23, 41 p.

———, 1960, Progress report on clays of Montana, 1958-1960: Mont. Bur Mines and Geol. Bull. 13, 83 p.

Sanders, H. F., 1913, A history of Montana: The Lewis Publishing Co., Chicago & New York, v. 1.

Shoemaker, C. S., 1893, Fifth annual report of the Inspector of Mines of the State of Montana.

Stone, R. W., 1911, Geologic relations of ore deposits in the Elkhorn Mountains, Montana: U. S. Geol. Survey Bull. 470-B, p. 75-98.

Strahorn, R. E., 1879, To the Rockies and beyond: The New West Publishing Co., Omaha, Nebr., 2d ed., p. 136-201.

Swallow, G. C., and Trevarthen, J. B., 1890, Reports of the Inspector of Mines and Deputy Inspector of Mines for the six months ending November 30, 1889.

Swallow, G. C., Trevarthen, J. B., and Oliver, Jacob, 1891, Reports of Inspectors of Mines, State of Montana, year ending November 30, 1890.

Weed, W. H., 1901 Geology and ore deposits of the Elkhorn mining district, Jefferson County, Montana: U. S. Geol. Survey 22d annual report, pt. 2, p. 399-550.

West, J. M., 1959, Mineral resources (except oil and gas) of Helena-Great Falls Division, Montana: U. S. Dept. Int., Bur. Mines Preliminary Rept. 127, 139 p.

Winchell, A. N., 1914, Mining districts of the Dillon quadrangle, Montana: U. S. Geol. Survey Bull. 574, 191 p.

Winchell, H. V., and Winchell, A. N., 1912, Notes on the Blue Bird mine: Econ. Geology, v. 7, no. 3, p. 287-294.

U. S. Geological Survey, Mineral Resources of the U. S.: annual volumes, 1882 to 1924, U. S. Geol. Survey.

U. S. Bureau of Mines, Mineral Resources of the U. S.: annual volumes, 1924 to 1931, U. S. Bur. Mines.

U. S. Bureau of Mines, Minerals Yearbook: annual volumes, 1931 to present, U. S. Bur. Mines.

APPENDIX A

SMELTER SCHEDULES

TABLES 26 THROUGH 33

TABLE 26.—East Helena smelter—American Smelting & Refining Co. Copper, lead, gold, silver ore and concentrate, cont'd.

Schedule for Ores and Concentrates,
Effective August 1, 1957
Delivery:—F.O.B. East Helena smelter, East Helena, Mont.

Payments for Metals

Gold.—If 0.03 ounce per dry ton and up to and including 3.0 ounces, pay for all at $31.81825 per troy ounce; if over 3.0 ounces up to and including 5 ounces per dry ton pay for all at $32.31826 per troy ounce. If over 5 ounces up to and including 10 ounces, pay for all at $32.67433. Over 10 ounces, pay for all at $33.03037.

Silver.—Pay for 95% at the average of the Handy & Harman New York silver quotations for the calendar week including date of arrival of the last car of each lot at the plant of the Buyer, or at Mint Price provided silver qualifies for Government purchase and affidavit is furnished, minimum deduction one Troy ounce per dry ton, less one cent per ounce.

Lead.—If 3.0% or over by wet assay, deduct from the wet lead assay 1.5 units and pay for 90% of the remaining lead at the average of the daily published quotations as published in the E. & M. J. Metal and Mineral Markets of New York, for common desilverized domestic lead for delivery in New York City for the calendar week including date of arrival of the last car of each lot at the plant of the Buyer, less a deduction of 2.0c per pound of lead accounted for.

Copper.—If one percent or over, deduct from the wet copper assay one unit and pay for 100% of the remaining copper at the daily net refinery quotations for electrolytic Wire Bar as published in the E. & M. J. Metal and Mineral Markets of New York averaged for the calendar week preceding date of arrival of last car of each lot at the plant of the Buyer, less deduction of 9.0c per pound of copper accounted for.

Bullion freight: Lead and copper quotations are based on a bullion freight rate of $26.97 per ton from East Helena, Montana to New York City. Any increase in freight for acocunt of shipper, to the extent of the payable lead and copper content.

No payment will be made for any metal or content except as specified above.

Deductions

Base charge.—$10,00 per net dry ton for ores having a settlement lead content of 20% or less, deduct 10c per ton from the base charge for each unit of lead over 20%, fractions in proportion. $9.00 per ton for ores having no payable lead content.

Arsenic and antimony combined.—2% free. Excess charged at 50c per unit, fractions in proportion.

Bismuth.—0.1% of the lead content by wet assay allowed free, excess charged at 50c per pound, fractions in proportion.

Sampling and assaying.—Charge $10.00 per lot when ore is less than $200.00 value and $20.00 per lot when ore is over $200.00 value, for shipments containing less than 5 tons dry weight.

Charge $5.00 per lot when ore is less than $200.00 and $10.00 per lot when ore is over $200.00 value, for shipments containing less than 10 tons dry weight.

Weighing and sampling (at which Seller or a representative may be present) as done by Buyer according to standard practice, promptly after receipt of product, will be accepted as final. The absence of Seller or a representative shall be deemed a waiver of the right in each instance. After sampling, the product may be placed in process, comingled, or otherwise disposed of by Buyer. In case of disagreement on assays, an umpire shall be selected in rotation from a list mutually agreed upon whose assays shall be final if within the limit of the assays of the two parties, and if not, the assay of the party nearer to the umpire shall prevail. Losing party shall pay cost of umpire. In case of Seller's failure to make or submit assays, Buyer's assays shall govern.

Seller should advise at the time shipment is made whether or not he desires to submit assays, also direct Buyer where to send control pulp samples.

All rates quoted subject to change without notice. The Company reserves the right to reject any or all shipments.

Consign all shipments to American Smelting & Refining Company, East Helena, Montana. Mail to same address bill of lading and letter of advice with reference to shipment.

TABLE 27.—Washoe sampler—The Anaconda Company, Butte, Montana. Copper, gold, silver ore and concentrates

Schedule for Copper, Gold, & Silver Ores,
Effective November 1, 1956
Subject to Change Without Notice

Payments for Metals

Copper.—96% of copper content, with minimum deduction of 10 pounds per ton, at Engineering and Mining Journal average price of electrolytic for week ending Wednesday preceding date of sampling, less 3.5c per pound.

Silver.—95% of silver content, with minimum deduction of one ounce per ton at Government price less 6c per ounce. This applies to silver eligible for Government price. Silver not eligible for Government price will be paid for at open market quotation, using the average price for week ending Wednesday preceding date of sampling, as quoted by Engineering and Mining Journal.

Gold.—95% of gold content, with minimum deduction of 0.01 ounce per ton, at $20.00 per ounce, plus 90% of premium in excess of $20.67 per ounce. (At present Governments price of $35.00 per ounce this is equivalent to paying for 100% at $31.81825 per ounce.)

Treatment Charge F.O.B. Washoe Sampler, Butte

Base charge.—$4.00 per ton.

Add.—10% of sum of metal payments in excess of $15.00 per dry ton.

Add.—12c for each 1% iron (Fe).

Deduct.—2.5c for each 1% silica (SiO_2) in excess of alumina (Al_2O_3).

Maximum total treatment charge to be $5.50 per dry ton.

In case we elect to have shipments made direct to smelter in Anaconda for sampling, the Base Treatment Charge will be $3.75 per dry ton, F.O.B., Anaconda Reduction Works, Anaconda, Montana, with maximum total treatment charge of $5.25 per dry ton.

Lots of less than tons will be assessed an extra sampling charge of $5.00 flat on each lot.

Small lots of unusually high grade will be purchased only by special arrangement.

Shipping Instructions

Consign all shipments to: Washoe Sampler, Butte, Montana, unless instructed otherwise. Forward bills of lading and communications to: Washoe Sampler, Butte, Montana. Advise name of mine, and state whether ore is newly mined or from a dump. We request that shipments be made in dump bottom gondola cars.

TABLE 28.—Great Falls or Anaconda zinc plant, The Anaconda Co. Zinc concentrates

The Anaconda Company tries to purchase all zinc concentrate produced in Montana which, after, test, is found to be acceptable for treatment in our plants. The terms for purchase vary somewhat with variation in assay. The following terms might be considered typical.

Terms

Terms for purchase of zinc concentrates F.O.B. Black Eagle or Anaconda, Montana, Zinc Plants. Concentrates to be delivered to either plant as Anaconda may elect.

TABLE 28.—Great Falls or Anaconda zinc plant, The Anaconda Co. Zinc concentrates, cont'd.

A representative sample of zinc concentrate must be sent to Anaconda and the concentrate accepted for treatment before shipment can be made under this schedule.
All quotations used will be Engineering and Mining Journal averages for the calendar week during which the shipment arrives at the Montana plant.

Payments

Zinc.—For 80% of zinc content at St. Louis price for Prime Western zinc.
Lead.—For 80% of lead content in excess of 3%, at New York price, less 2.0c per pound.
Silver.—For 80% if 1.0 ounces per ton or over, at New York price for domestic silver.
Gold.—For 77% if 0.010 ounces per ton or over, at $34.91 per ounce.
Other metals.—No payment shall be made for other metals contained in the concentrate, and such metals shall be the property of the Anaconda Co.

Treatment Charges

Base Treatment Charge shall be $44.00 per dry ton based on a St. Louis price for Prime Western Zinc of 13.5c per pound, a Cost of Employment of $20.50 per eight-hour day, and a lead content of 3%.
Zinc price.—Add or deduct $1.00 per ton for each 1c change in the quotation for Prime Western Zinc above or below 13.5c per pound.
Employment cost.—Add or deduct 1c per ton for each increase or decrease of 1c per day in the Cost of Employment above or below $20.50 per eight-hour day.
Lead Penalty.—Add one dollar ($1.00) per ton for each 1% lead below 3% lead in the concentrate, fractions in proportion.

TABLE 29.—United States Smetling, Refining, and Mining Company, c/o International Smelting and Refining Company, International, Utah. Direct smelting lead ore and concentrates

Delivery.—F.O.B. International, Utah.
Sampling.—By Buyer free of charge.

Payments

Gold.—Based on present Mint price of $34.9125 per ounce. $31.8183 per ounce if .02 ounce per ton and up to 5 ounces per ton. $32.3183 per ounce if over 5 ounces and up to 10 ounces per ton. $32.818 per ounce if over 10 ounces per ton. No payment if less than .02 ounce per ton
Silver.—95% (minimum deduction ½ ounce per ton) at New York quotation date of assay. No payment if less than 1 ounce per ton.
Lead.—90% of dry assay (wet assay less 1½ units) paid for at the average Engineering and Mining Journal quotation for E. & M. J. week preceding date of arrival, less 2.7c per pound. No payment if under 3% dry assay.
Copper.—80% of wet assay (minimum deduction 15 pounds) paid for at the average Enginering and Mining Journal cathode price for the E. & M. J. week preceding date of arrival, less 9.5c per pound.
Iron.—No credit.
Lime.—5c per unit if 5% or more contained.
Zinc.—If 10% or more, pay for 75% at 22% of East St. Louis price.

Charges

Insoluble.—Charged for at 10c per unit.
Arsenic.—None free; all charged for at 50 per unit.
Sulphur.—2% free; excess charged for at 25c per unit. Maximum charge $2.50 per ton.
Treatment.—$10.50 per ton on the basis of 30% dry lead assay. Debit 10c for each unit of lead under 30% and credit 10c for each unit of lead above 30%.
If lots of less than 10 tons are shipped there shall be a charge of $15.00 on the lot to cover sampling and assaying.
Bill all shipments to United States Smelting, Refining and Mining Co., International, Utah, sending bill of lading to the Midvale office, Box 68, Midvale, Utah.

TABLE 30.—United States Smelting, Refining, and Mining Co., Midvale, Utah. Gold, silver, copper, lead, zinc ore and concentrate

Delivery.—F.O.B. Midvale, Utah.
Sampling.—By Buyer free of charge.

Payments

Gold.—Pay for 75% of the gold content at $22.4643 per ounce, as long as present Mint price of $34.9125 per ounce prevails. No payment if less than .02 ounce per ton.
Silver.—Pay for 70% of the silver content (minimum dededuction one ounce per ton) at the Handy and Harmon New York official quotation, as published in the Engineering and Mining Journal, for date of assay at Midvale plant, or if higher, at the realized mint price, if silver qualifies for government purchase. No payment if less than one ounce per ton.
Lead and copper.—Pay for 70% of the sulfide lead and copper combined, at the average New York quotation for lead as published in the Engineering and Mining Journal for the E. & M. J. week previous to date of receipt, less 3.27c per lb. No payment if less than 3.0% total lead and copper combined.
Zinc.—Pay for 60% of the sulfide zinc content at 40% of the East St. Louis price for zinc as published in the Engineering and Mining Journal for the E. & M. J. week previous to date of receipt. No payment for zinc if product contains less than 3.0% zinc, total assay.
Special payment.—For each percent zinc in excess of 15% and 1% to the percentage zinc paid for; but in no event shall the percentage zinc paid for exceed 70%.
For each percent zinc in excess of 15% add to the payment for such metal .05c per lb., but in no event shall the additional payment per lb. exceed ½c per lb.

Charges

Treatment charge.—$4.50 per ton.
If lots of less than 10 tons are shipped there shall be a charge of $15.00 on the lot to cover sampling and assaying.
Above rates are subject to change without notice.
Bill all shipments to United States Smelting, Refining, and Mining Co., Midvale, Utah, sending bill of lading to the company, Ore Purchasing Dept., P. O. Box 68, Midvale, Utah.

TABLE 31.—International Smelting and Refining Co., Tooele, Utah. Crude lead-zinc sulphide ores amenable to selective flotation

Delivery.—F.O.B. Tooele, Utah.

Payments

Gold.—If .02, pay for 50% @ $35.00 per oz.
Silver.—If 1 oz., pay for 75% @ Mint Price. Minimum deduction 0.5 oz. per ton.
Lead.—Deduct non-sulphide content, pay for 80% of the remaining sulphide lead content at the New York Price for lead, less 3.25c lb. Minimum deduction 20 pounds per ton.
Zinc.—Deduct non-sulphide content, pay for 70% of the remaining sulphide zinc content at E. St. Louis Prime Western Zinc quotation, less 6.5c lb. on 12.5c zinc price ±0.3c each one cent variation in zinc price. Minimum deduction 60 lbs. per ton.

Charges

Arsenic and Antimony.—1% free, charge excess over 1% at $1.00 per unit.
Treatment charge.—$5.50 per dry ton, F.O.B. Plant in carload lots.

TABLE 32.—Interntaional Smelting and Refining Co., Tooele, Utah. Typical lead-zinc smelting schedule

Delivery.—F.O.B. Tooele, Utah.

Payments

Gold.—If .02 oz. per ton or over, pay for 91% of the gold content at the Government price which is now $35.00 per oz.

Silver.—If 1 oz. per ton or over, pay for 95% of the silver content on the basis of the Mint Price as defined in the silver schedule attached hereto and expressly made a part hereof, except as therein provided. Minimum deduction ½ oz. per dry ton.

If, however, the Seller shall so elect, the price payable for the silver content of Seller's product shall be based on the average of the Handy and Horman New York quotations for foreign silver for the week ending Wednesday, next preceding date of sampling of last car of each lot at the plant of the Smelting Company, provided notice of such election shall be given to the Smelting Company in advance of said quotational period.

Copper.—Deduct 15 lbs. of copper per ton and pay for the balance at the average of the quotations for electrolytic copper in New York as published in the E. & M. J. for the week ending Wednesday, next preceding date of sampling, less 6.7c per lb.

Lead.—Deduct 1½ units of lead from the wet assay and pay for 90% of the balance of the average of the quotations for lead in New York for the week ending Wednesday, next preceding date of sampling, as published in the E. & M. J., less 2.4c per lb.

Zinc.—If 8% or over, pay for 75% of the zinc content at 30% of the average East St. Louis price for Prime Western Zinc, as published in the E. & M. J. for the week ending Wednesday, next preceding date of sampling. (Nothing paid for zinc if less than 8%.)

Charges

Arsenic.—Charge all arsenic at $1.00 per unit.

Antimony.—Charge all antimony at 75c per unit.

Treatment charge.—$ ___ per net dry ton delivered at the smelter in carload lots.

This schedule is based upon the present costs of $___ for labor, $26.46 for coke and $26.97 for bullion fregiht. Variations in these costs would be reflected in the schedule.

TABLE 33.—The Bunker Hill Company Smelter, Bradley, Idaho

General Clauses Covering Ore Purchase Schedules, July 1, 1959

Weights and samples.—All settlements shall be made on the basis of weights and samples taken by the Company.

Representation.—Representation is urged and welcomed. Every shipper is urged, especially for his initial shipment, to be represented in person or by a member of his company while the shipment is being weighed and sampled. In lieu of this, the services of an independent professional representative are available. Because of limited storage space for individual shipments, it is impractical to hold shipments intact until assays and settlements are completed. The company, therefore, reserves the right to comingle all shipments immediately upon completion of weighing and sampling.

Assays.—Every shipper shall, without delay, deliver to the Smelter, his assay certificates on the samples taken by the Smelter. These assays shall be compared with those of the Smelter, observing the usual splitting limits. If no assays are received from the shipper the Smelter's assays will be considered the settlement assays. In case of disagreement of assays, a sample may be sent to umpire. The umpire's assays shall be final if within the limits of the two parties and, if not, the assays of the party nearer to the umpire assays shall pay costs of umpire.

Date of arrival.—For rail shipments, the day (until 3:00 p.m.) that the Union Pacific delivers, or constructively places, the car on our Smelter highline track, will be the "date of receipt." Cars so placed after 3:00 p.m. will be considered as received the next day. When several cars are grouped together into one settlement lot, the date of receipt of the last car will be considered the date of receipt of the entire lot for settlement purposes.

For truck shipments, the "date of receipt" will be the date on the written notification from the shipper that the lot is completed.

Since the Ore Receiving Department does not work on that day, the "date of receipt" for any deliveries on Sunday will be Monday.

Hand samples.—Before actually making shipment, it is required that prospective shippers submit to the company a small, thoroughly representative sample of two or three pounds for assay and quotation.

Small shipments.—All lots of less than 5 tons (dry weight) are subject to an additional charge for sampling and assaying of $10.00 per lot.

Advices and shipments.—Shippers shall notify the Smelter promptly at time of shipments, advising number of lots in car (if more than one lot) and giving instructions as to how remittance is to be made, including the particulars of royalties, if such payments are called for. Consign shipments to The Bunker Hill Company, Lead Smelter, Box 29, Kellogg, Idaho.

Termination.—All open rates are subject to change without notice.

Open Zinc Schedule (Oct. 15, 1957)

Delivery.—F.O.B. Silver King, Idaho.

Payments

Zinc.—If 55% or over, pay for 85% @ E. St. Louis quotation.
If 54% but under 55%, pay for 84% @ E. St. Louis quotation.
If 53% but under 54%, pay for 83% @ E. St. Louis quotation.
If 52% but under 53%, pay for 82% @ E. St. Louis quotation.
If 51% but under 52%, pay for 81% @ E. St. Louis quotation.
If 50% but under 51%, pay for 80% @ E. St. Louis quotation.
If under 50% zinc, pay for 75% @ E. St. Louis quotation.

Lead.—Deduct 3%, pay 80% @ N. Y. quotation less 2c.

Cadmium.—Deduct .25%, pay 70% @ Commercial Stick quotation less 50c.

Silver.—If 1.0 oz. or over, pay 80% @ H. & H. N. Y. quotation or U. S. Government quotation.

Gold.—If .03 oz. or over, pay 80% @ $34.2425.

Charges

Base.—$45.00 per short dry ton when zinc quotation is 10c. Plus $2.00 for each 1c increase in quotation above 10c.
Iron.—Charge over 2% @ 40c per unit.
Insolubles.—Charge over 4% @60c per unit.
Lead.—Charge under 3% @ $1.50 per unit.
Lime.—Charge over 0.5% @ 50c per unit.
Magnesia.—Charge over 0.1% @ $2.50 per unit.
Arsenic—Charge over 0.1% @ $1.00 per unit.
Antimony.—Charge over 0.1% @ $3.00 per unit.

Domestic Open Schedule (July 1, 1959)

Delivery.—F.O.B. Bunker Hill Smelter, Bradley, Idaho

TABLE 33.—The Bunker Hill Company Smelter, Bradley, Idaho, cont'd.

Payments

Gold.—If .03 ozs. and under 3.0 ozs., pay for 100% @ $31.81825. 3.0 ozs. or over, pay for 100% @ $32.81825.

Silver.—If 1.0 oz. or over, pay for 95% @ applicable quotation.

Lead.—If

2.5% and under 25.0%,	pay for 90%	of wet assay @ New York quotation less 2c per pound.
25.0% and under 50.0%,	pay for 91%	
50.0% or over,	pay for 92%	

Zinc.—If 2.5% or over, pay for 50% @ 25% of E. St. Louis quotation

Quotation.—Average for calendar month following date of receipt.

Charges

Base.—$18.00 per short dry ton. Based on 50.0% Wet Lead. Credit lead over 50% @ 10c per unit.

Silver.—If Government quotation used, charge ½c per oz. silver paid for. If Handy & Harmon quotation used, charge 1c per oz. silver paid for. Charge over 50.0 ozs. per ton paid for @ 1½c per oz.

Arsenic.—Charge over 1.0% @ $1.00 per unit.

Bismuth.—Charge over 0.1% of Wet Lead @ 50c per pound.

Sulphur.—Charge over 16.0% @ 10c per unit.

Moisture.—Charge over 10.0% @ 20c per unit.

Labor.—Base hourly labor rate $2.5889. Charge or credit 8c for each 1c increase or decrease in labor rate.

Freight.—Base New York freight rate $28.62. Any change in rate or tax thereon for Seller's account. Figured on lead pounds paid for.

Payment.—80% on agreement of weights & assays. Final payment when settlement quotations are determined.

APPENDIX B

TABLE 54.—Production of Gold and Silver at Placer Mines, 1902-57.

TABLE 34 —Production of gold and silver at placer mines, 1902-57

Year	Material treated (cubic yards)	Gold (fine ounces)	Silver (fine ounces)	Total value
BOULDER				
1902-03	No production			
1904	—	54	9	$901
1905-07	No production			
1908	—	29	11	614
1909	—	23	4	483
1910	—	30	8	623
1911	—	26	5	537
1912	—	28	5	576
1913	—	46	9	951
1914	—	32	9	667
1915	—	6	2	126
1916	—	4	—	88
1917	—	3	1	68
1918-19	No production			
1920	—	4	2	84
1921	30	6	1	135
1922-23	No production			
1924	—	14	7	299
1925	No production			
1926	—	3	1	63
1927	No production			
1928	—	2	—	37
1929-32	No production			
1933	200	4	—	84
1934	—	8	3	282
1935	—	2	—	76
1936-38	No production			
1939	7,350	63	9	2,211
1940	13,200	75	14	2,635
1941	400	10	—	350
1942-57	No production			
Total	21,180	472	100	11,890
CATARACT				
1902-04	No production			
1905	—	94	18	$1,957
1906-08	No production			
1909	—	29	6	605
1910	—	33	8	690
1911	—	46	11	948
1912	—	34	6	701
1913	—	5	—	100
1914	—	6	3	130
1915	—	11	3	235
1916	—	12	3	250
1917	—	8	2	156
1918	—	14	3	279
1919	—	5	1	108
1920	—	3	1	63
1921	No production			
1922	—	3	—	69
1923	—	9	5	188
1924	—	9	3	183
1925	—	16	6	338
1926	2,300	26	8	547
1927	—	5	1	94
1928	No production			
1929	36	4	—	87
1930	No production			
1931	—	2	—	31
1932	1,830	91	32	1,897
1933	6,460	59	17	1,230
1934	1,700	139	62	4,882
1935	6,500	77	28	2,707
1936	100	401	115	14,124
1937	4,400	170	84	6,015
1938	5,600	38	3	1,332
1939	2,280	71	19	2,498
1940	6,300	88	45	3,112
1941	—	24	7	845
1942	—	5	—	175
1943-46	No production			
1947	200	4	—	140
1948	—	3	—	105
1949-57	No production			
Total	37,676	1,544	500	46,821
CLANCY AND LUMP GULCH				
1902-08	No production			
1909	—	9	2	$179
1910-12	No production			
1913	—	13	5	270
1914	—	2	—	44
1915	—	7	2	130
1916	—	7	3	148
1917	—	16	6	336
1918	—	12	5	259
1919	No production			
1920	—	22	9	458
1921	—	28	10	$585
1922	—	8	3	167
1923	No production			
1924	—	9	2	198
1925	—	2	1	47
1926-27	No production			
1928	—	7	2	147
1929	—	1	—	20
1930	266	11	—	228
1931	No production			
1932	200	24	7	515
1933	600	30	14	634
1934	—	20	8	696
1935	700	26	11	940
1936	No production			
1937	2,063,093	10,050	3,448	354,417
1938	1,451,347	7,446	2,540	262,252
1939	2,255,936	12,955	4,536	456,504
1940	2,118,855	12,255	4,455	432,093
1941	2,188,097	12,402	4,417	437,211
1942	1,535,042	8,688	3,358	306,468
1943-45	No production			
1946	1,663,841	9,344	3,557	329,914
1947	1,645,548	8,866	3,389	313,377
1948	604,480	3,673	1,400	129,822
1949-57	No production			
Total	15,528,005	85,933	31,190	3,028,059
COLORADO				
1902-08	No production			
1909	—	15	9	$310
1910	—	19	4	395
1911	—	5	2	107
1912	No production			
1913	—	6	—	116
1914-16	No production			
1917	—	2	1	43
1918-21	No production			
1922	—	1	—	18
1923	No production			
1924	—	5	2	102
1925-30	No production			
1931	—	2	—	41
1932-57	No production			
Total	—	55	18	1,132
ELKHORN				
1902-08	No production			
1909	—	4	1	$88
1910-14	No production			
1915	—	4	2	86
1916	—	5	2	111
1917	—	6	2	127
1918-20	No production			
1921	—	3	—	58
1922-33	No production			
1934	—	1	—	51
1935-37	No production			
1938	500	1	—	35
1939	No production			
1940	272,766	678	60	23,779
1941-57	No production			
Total	273,266	702	76	24,335
HOMESTAKE				
1902-28	No production			
1929	—	2	—	$30
1930	—	5	—	96
1931	No production			
1932	—	6	—	117
1933	—	12	3	243
1934	—	1	—	52
1935	—	4	—	128
1936-39	No production			
1940	500	6	—	210
1941	600	4	—	140
1942-57	No production			
Total	1,100	40	3	1,016
LITTLE PIPESTONE				
1902-04	No production			
1905	—	196	37	$4,062
1906	—	198	6	4,089
1907	—	143	24	2,966
1908-33	No production			
1934	—	5	—	174
1935-57	No production			
Total	—	542	67	11,291

TABLE 34.—Production of gold and silver at placer mines, 1902-57, continued.

Year	Material treated (cubic yards)	Gold (fine ounces)	Silver (fine ounces)	value Total
LOWLAND				
1902-32	No production			
1933	—	3	—	$53
1934	—	16	3	550
1935	—	2	—	69
1936	—	5	—	175
1937	No production			
1938	423,000	1,937	1,137	68,530
1939	630,000	3,215	2,095	114,936
1940	180,600	2,221	1,284	78,648
1941	524,200	1,071	588	37,903
1942-57	No production			
Total	1,757,800	8,500	5,017	300,864
McCLELLAN CREEK				
1902-08	No production			
1909	—	83	11	$1,720
1910	—	125	16	2,581
1911	—	106	18	2,198
1912	—	41	7	859
1913	10,000	10	1	219
1914	3,000	110	17	2,270
1915	—	33	4	697
1916	—	18	2	380
1917	—	1	—	23
1918-20	No production			
1921	—	13	3	273
1922-30	No production			
1931	—	6	—	122
1932	200	7		141
1933	5,500	43	6	894
1934	—	2	—	64
1935	—	66	14	2,315
1936	—	43	9	1,505
1937	—	56	9	1,967
1938	No production			
1939	25,000	195	28	6,844
1940	10,000	107	14	3,755
1941-57	No production			
Total	53,700	1,065	159	28,827
MONTANA CITY				
1902-31	No production			
1932	—	23	11	$475
1933	150,000	1,190	243	24,687
1934	472,517	3,856	795	135,283
1935	423,298	2,547	590	89,588
1936	341,661	2,667	785	93,953
1937-41	No production			
1942	11,043	171	38	6,012
1943-57	No production			
Total	1,398,519	10,454	2,462	349,998
PIPESTONE				
1902-22	No production			
1923	—	1	—	$29
1924-31	No production			
1932	—	11	—	228
1933	No production			
1934	—	1	—	43
1935	—	5	4	172
1936-41	No production			
1942	200	4	—	140
1943-57	No production			
Total	200	22	4	612
WHITEHALL				
1902-03	No production			
1904	—	29	2	$534
1905-07	No production			
1908	—	49	4	1,003
1909	—	122	17	2,524
1910	—	9	1	196
1911	—	26	3	549
1912	No production			
1913	—	22	3	466
1914-30	No production			
1931	—	3	—	72
1932	No production			
1933	400	17	—	344
1934	—	3	—	115
1935	—	3	—	91
1936-39	No production			
1940	—	10	—	350
1941-57	No production			
Total	400	293	30	6,244

APPENDIX C

TABLE 35.—Mine Production of Gold, Silver, Copper, Lead, and Zinc, 1902-57, by Mines in Terms of Recoverable Metals

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals

AMAZON DISTRICT

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
ALICE						
1925	20	—	174	298	3,381	—
1937	3	—	60	56	780	—
Total	23	—	234	354	4,161	
AMAZON						
1915	12	37	176	—	—	—
1917	36	2	188	152	2,494	—
1919	32	2	571	177	9,003	—
1929	8	1	171	—	3,373	—
1921 (slag)	38	—	72	—	1,577	—
1923 do.	39	—	77	162	3,967	—
1928	11	—	113	—	2,281	—
1931	1	—	4	—	83	—
1937	27	3	309	56	4,220	—
1938	9	2	103	22	1,715	—
1939	21	2	108	—	—	—
Total	234	49	1,892	569	28,713	—
AUSTRALIAN						
1908	8	2	236	—	2,173	—
1911	30	8	992	301	10,076	—
1912	328	62	3,152	3,249	47,701	—
1916	21	3	364	—	2,528	—
1917	210	26	2,927	—	8,626	—
1918	70	16	1,025	60	3,017	—
1919	24	5	252	—	2,039	—
1951	1	—	51	—	623	21
Total	692	122	8,999	3,613	76,783	21
BISMARK						
1922	153	36	3,054	102	—	—
1923	528	105	9,675	—	—	—
1924	46	8	782	—	—	—
1925	147	30	4,755	—	15,119	—
1926	27	9	923	—	3,893	—
1933	39	13	883	438	8,108	—
1934	15	6	345	—	1,720	—
1935	108	16	845	—	—	—
1936	50	5	274	—	—	—
1937	186	26	1,852	—	—	—
1938	43	4	333	—	—	—
Total	1,372	258	23,721	540	28,840	—
BOULDER						
1939	8	2	50	14	272	—
1942 (tailings)	93	3	513	1,146	5,110	—
1943 do.	226	6	782	1,302	7,750	—
Total	327	11	1,345	2,462	13,132	—
CLEVELAND						
1924	44	1	318	1,517	10,340	—
1925	21	1	428	—	7,732	—
1927	6	1	88	—	2,294	—
1937	40	2	280	—	5,027	—
1951	62	1	410	52	4,204	1,250
1953	31	1	643	748	7,032	4,820
Total	204	7	2,176	2,347	36,629	6,070
EAST MINT						
1940	171	42	2,293	827	15,440	—
1941	82	22	1,265	672	12,900	—
1942	20	6	155	291	1,817	—
1943	86	20	926	1,908	9,327	—
1945	59	13	648	948	5,475	3,185
1946	77	12	541	1,123	4,562	3,056
Total	495	124	5,828	5,769	49,521	6,241
EMMA MAY						
1909	24	5	207	942	2,071	—
1910	22	6	309	951	3,846	—
1915	65	15	972	—	9,896	—
1918	26	5	397	—	2,594	—
1920	7	—	105	—	1,347	—
1921	13	2	126	424	720	—
1922	14	2	214	325	—	—
Total	171	35	2,330	2,642	20,474	—
EVENING STAR						
1919	20	1	304	—	7,448	—
1942	39	1	175	—	3,725	—
1943	5	—	40	4	881	—
Total	73	2	519	4	12,054	—
FREIBERG						
1908	34	3	659	200	12,633	—
GIFT						
1922	7	1	72	—	1,535	—
1951	19	2	108	—	2,575	297
Total	26	3	180	—	4,110	297
GOLDEN POINT						
1935	128	18	2,450	8,722	3,282	—
1936	94	14	1,255	4,754	1,867	—
1937	48	8	331	1,888	—	—
1938	11	2	42	19	959	—
1940	7	1	76	381	355	—
Total	288	43	4,154	15,464	6,463	—
HIE ORE						
1921	37	36	2,281	—	28,426	—
1952	7	3	99	—	975	—
1953	10	3	65	—	743	—
Total	54	42	2,445	—	30,144	—
INDEPENDENCE & AURELLA						
1916	16	1	309	776	2,968	—
1920	8	1	89	316	1,594	—
Total	24	2	398	1,092	4,562	—
MAYFLOWER						
1912	38	15	308	—	5,159	—
1913	84	34	113	—	—	—
1915	3	1	53	—	1,449	—
Total	125	50	474	—	6,608	—
MONO						
1913	30	1	567	593	12,570	—
1917	9	—	176	—	3,428	—
1919	14	1	334	111	6,504	—
Total	53	2	1,077	704	22,502	—
MONTANA (HECTOR & VICTOR)						
1918	37	5	465	—	803	—
1921	7	8	53	—	259	—
Total	44	13	518	—	1,062	—
MORNING STAR						
1908	13	2	200	—	4,005	—
1952	52	8	172	43	2,964	427
Total	65	10	372	43	6,969	427
NEW ALBANY						
1916	15	1	156	457	3,004	—
PILOT						
1906	145	16	2,101	750	3,757	—
1924	28	5	409	404	1,863	—
1931	4	—	91	24	1,307	—
1949 (Dump)	60	3	378	48	770	—
Total	237	24	2,979	1,226	7,697	—
ROBERT EMMETT						
1916	29	1	571	1,710	—	—
1926	8	—	129	305	1,595	1,554
1947 (Dump)	48	—	255	696	1,898	2,347
1953	37	—	196	—	2,409	3,455
Total	122	1	1,151	2,711	5,897	7,356
SIVER STAR						
1910	34	4	244	—	4,610	—
1911	16	1	231	171	5,432	—
1912	17	—	27	171	103	—
1913	8	—	61	—	1,302	—
Total	75	5	563	342	11,447	—

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

AMAZON DISTRICT, continued

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
WEST NOBLE						
1909	17	1	302	277	4,674	—
WILBUR SILVER						
1917	7	2	122	—	1,520	—
1926	17	4	139	—	2,283	—
1927	83	14	1,076	455	22,169	—
1928	31	8	534	346	9,326	—
1929	59	12	931	724	18,107	—
1934	13	2	167	75	4,199	—
1939	57	10	399	26	5,768	—
1940	72	13	813	—	17,533	—
Total	339	65	4,181	1,626	89,905	—

BIG FOOT (STATE CREEK) DISTRICT

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
BIG FOOT						
1918	17	2	218	—	9,479	—
1920	33	25	19	—	—	—
Total	50	27	237	—	9,479	—
BIG FOUR						
1920	54	4	452	—	20,600	—
1926	266	29	866	678	21,351	11,397
1928	81	3	573	660	24,019	13,612
1929	619	27	3,388	2,206	126,708	91,553
1933	51	4	476	236	19,405	—
1934	6	—	44	—	1,942	—
1943 (Dump)	207	7	625	129	24,780	—
1945 (Dump)	293	10	812	128	33,398	7,137
Total	1,577	84	7,236	4,037	272,203	123,699
BLUE JAY						
1945	41	1	99	252	5,987	3,069
CARMODY & PAPESH GROUP						
1933	12	35	13	—	—	—
1934*	4,500	203	37	—	—	—
Total	4,512	238	50	—	—	—
LAST CHANCE & LUCRATIVE						
1933	9	32	48	14	—	—
1934	7	21	27	2	—	—
Total	16	53	75	16	—	—
LOST CABIN						
1924	18	7	164	—	3,390	—
1926	34	6	293	272	6,142	—
Total	52	13	457	272	9,532	—
MOUNTAIN QUEEN						
1939	76	17	540	291	11,900	—
1940	260	58	1,943	654	37,536	—
1947	123	23	350	889	8,881	1,368
1948	343	62	1,849	2,162	47,244	5,943
1956	37	2	202	100	4,600	600
Total	839	162	4,884	4,096	110,161	7,911

* 1934 production included in Elkhorn district total.

STATE GROUP						
1905	15	10	64	—	—	—
1906	15	12	66	—	—	—
1920	45	74	467	1,001	—	—
1921	63	63	711	1,178	3,858	—
1926	50	20	98	—	—	—
1927	20	29	16	—	—	—
1928	25	20	11	—	—	—
1932	33	26	14	—	—	—
1933	30	10	5	—	—	—
1936	112	59	581	1,946	—	—
1937	29	6	81	39	1,530	—
1938	20	14	116	255	—	—
1939	19	24	160	214	1,213	—
1940	68	17	204	442	284	—
Total	544	384	2,594	5,075	6,885	—

BOULDER DISTRICT

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
BALTIMORE						
1903	700	12	3,400	—	—	—
1905	713	146	19,554	—	43,300	—
1906	259	90	7,929	—	14,064	—
1907	1,400	203	21,616	10,500	85,500	—
7909	73	4	1,040	4,202	—	—
1911	166	143	2,061	5,202	6,668	—
1912	2,695	420	39,505	79,551	228,536	—
1913	399	49	6,193	10,956	52,973	10,501
1914	1,361	39	28,537	1,307	190,820	—
1915	23	2	257	701	—	—
1916	904	68	13,637	18,302	45,183	44,200
1917	1,193	70	12,765	25,600	76,988	124,865
1918	85	5	1,810	631	8,391	—
1919	1,407	112	22,312	22,215	99,565	36,600
1920	788	69	11,451	28,732	—	—
1921	107	12	1,809	1,555	8,549	—
1922	14	4	309	—	3,585	—
1924	1,227	76	26,542	13,672	148,623	—
1925	978	49	16,794	14,178	77,337	—
1926	931	49	13,051	12,966	67,327	21,746
1927	111	13	1,990	479	13,711	—
1928	549	21	5,328	10,594	39,886	58,318
1929	133	5	1,424	1,827	4,899	5,541
1935	29	—	303	1,014	—	—
1936	158	4	1,082	609	3,739	—
1939	96	7	1,196	117	3,940	—
1940	195	13	1,445	428	1,801	—
1941	352	13	2,936	339	—	—
1943	197	7	1,265	1,414	7,434	—
1944	674	20	5,636	3,862	20,986	—
1945	63	2	497	170	2,095	815
1953	168	7	1,815	143	8,065	640
Total	18,148	1,734	275,489	271,266	1,263,965	303,136
BLAND & WEAVER (SHEILS & IRONSIDE)						
1916	215	21	5,932	20,969	11,454	—
1917	938	158	10,544	25,727	91,073	—
1918	156	25	1,748	4,315	14,591	—
1920	117	7	2,724	13,945	—	—
1922	15	1	330	1,144	—	—
1925	33	2	375	837	3,783	—
1926	83	4	946	2,767	—	—
Total	1,557	218	22,599	69,704	120,901	—
BOOMERANG						
1902	100	28	2,500	—	34,000	—
BOULDER SMELTER AND MILL SITE						
1948	556	6	1,474	3,110	31,617	61,776
1950	121	4	397	491	5,869	3,266
Total	677	10	1,871	3,601	37,486	65,042
BUCKHORN (ING)						
1935	17	1	204	—	5,900	—
1940	41	15	242	92	8,052	—
1941	35	14	267	72	5,567	—
1942	41	28	453	—	9,668	3,300
1943	5	1	36	—	1,159	—
Total	139	59	1,202	164	30,346	3,300
COPPER ORE						
1926	2	—	84	237	—	—
1927	3	—	233	647	—	—
Total	5	—	317	884	—	—
CRAZY						
1920	31	20	417	311	10,386	—
DAWSON, WICKHAM & GLINES						
1938	35	4	818	176	7,160	—
EMMA BELL						
1917	80	51	1,040	—	18,970	—
EUREKA & SARSFIELD						
1902	250	88	8,750	10,000	110,000	—
GRANITE BUTTE						
1917	12	2	55	—	1,423	—
1922	16	1	147	217	—	—
1924	13	1	94	77	—	—
Total	41	4	296	294	1,423	—

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

BOULDER DISTRICT, continued

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
MOLLY McGREGOR GROUP						
1911	24	4	193	—	3,575	—
1922	6	1	38	—	466	—
1923	13	5	127	—	—	—
1924	36	10	447	104	7,991	—
1925	20	6	267	153	4,454	—
1927	4	2	104	—	1,443	—
1937	30	4	174	—	2,744	—
1939*	20	9	371	58	5,661	—
1940*	25	13	455	—	5,272	—
1941	22	11	188	—	1,947	—
Total	200	65	2,364	315	33,553	—
MORGAN						
1911	14	1	276	198	5,292	—
ST. JOHN						
1911	23	4	1,375	—	2,333	—
1912	24	2	782	—	—	—
1913	11	—	91	—	—	—
1941	11	1	421	—	2,758	—
Total	69	7	2,669	—	5,091	—
SANDQUIST						
1911	27	5	341	241	9,307	—
SCOTIA						
1906	36	2	1,021	1,403	9,737	—
SUMMIT						
1943	120	9	172	32	22,752	—

* 1939 and 1940 production is included in Amazon district.

CATARACT DISTRICT

ALEXANDRIA						
1925	4	3	90	—	1,741	—
1926	9	4	193	—	3,546	—
Total	13	7	283	—	5,287	—
ALLOY						
1934	13	8	252	126	4,586	—
APOLLO						
1905	60	57	—	—	—	—
1906	200	201	40	—	—	—
Total	260	258	40	—	—	—
ASPEN						
1921	33	2	873	—	—	—
ATLANTIS						
1909	8	—	396	—	1,457	—
1925	2	—	83	—	—	—
Total	10	—	479	—	1,457	—
AURORA						
1943	516	3	1,039	1,629	41,606	45,507
1944	381	2	790	1,348	26,479	28,688
1945	51	—	111	166	4,144	4,924
1948	30	—	47	77	2,071	1,143
1954	425	1	203	100	9,400	2,000
1955	350	1	532	—	22,600	6,800
1956	305	2	358	11,440	4,700	25,200
Total	2,058	9	3,080	14,760	111,000	114,262
BARTEAN						
1914	27	1	2,053	363	21,015	—
BASIN BELL						
1933	55	1	610	5,969	8,867	—
1939	16	—	52	447	—	—
1942	18	—	85	1,051	—	—
Total	89	1	747	7,467	8,867	—

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
BASIN JIB (INCLUDES HOPE AND KATIE CLAIMS)						
1905	710	150	12,646	—	18,000	—
1917	245	33	3,273	954	21,276	—
1918	106	78	1,436	961	4,326	—
1919	966	1,521	4,338	17,819	—	—
1920	2,019	1,100	10,348	59,221	3,026	—
1921 (Tailings)	25	24	11	—	—	—
1922	958	303	7,058	16,401	—	—
1923	86	45	768	5,960	1,188	—
1924	68,112	32,724	182,355	281,582	199,043	—
1925	53,473					
(Tailings)	10,432	10,374	124,680	147,336	341,311	—
1926	4,371	1,895	28,835	75,694	159,655	—
1928	(*)	27	11	—	—	—
1930	12	8	90	—	—	—
1931	(*)	4	2	—	—	—
1933	626					
(Tailings)	48,300	1,027	27,823	45,260	31,500	—
1934	3,316	444	18,826	9,858	—	—
1935	14,294	606	16,531	19,473	39,919	—
1936	9,560	330	21,343	12,457	31,498	—
1938	75	60	768	430	856	—
1939	300	98	425	618	661	—
1940	62	14	36	132	161	—
1941	328	44	3,023	2,559	4,766	—
1942	321	33	1,488	993	1,466	—
1943	120	2	279	506	2,076	—
1944	24	1	131	—	—	—
1952	215	17	711	133	688	—
1953	457	222	1,245	411	1,700	456
1954	1,923	354	2,038	1,000	6,300	10,800
1956	5,108	1,109	5,756	17,300	38,900	5,700
1957	2,044	598	5,542	4,100	20,000	16,100
Total	228,588	53,605	481,816	721,158	928,316	33,056

(*) Less than one ton.

BEACON						
1920	7	2	415	—	—	—
BESSIE						
1921	12	6	266	—	3,960	—
BLACK BEAR						
1902	500	50	540	6,720	—	—
1911	1	8	9	—	97	—
1917	3	6	8	—	—	—
Total	504	64	557	6,720	97	—
BLUEBIRD						
1942	49	5	171	—	2,253	—
1943 (Tlngs)	2,634	273	9,535	2,766	127,168	—
1944 do.	1,063	139	4,370	442	57,594	—
1949	33	1	143	480	—	—
1952	35	7	153	30	—	—
1956	15	—	36	13	1,700	600
Total	3,829	425	14,408	3,731	188,715	600
BONANZA JACK						
1911	3	24	86	—	—	—
1927	11	8	60	—	—	—
1933	3	26	9	—	—	—
1954	40	11	163	—	—	300
Total	57	69	318	—	—	300
BOSTON						
1905	80	8	1,416	—	20,170	—
1921	12	1	227	—	3,119	—
1947 (Dump)	15	—	49	—	597	489
Total	107	9	1,692	—	23,886	489
BOULDER						
1931	2	2	2	—	—	—
1932	113	102	188	218	—	—
1933	103	119	313	430	—	—
1934	186	287	430	238	1,739	—
1935	128	167	354	—	—	—
1936	155	358	457	—	—	—
1937	556	605	1,673	—	—	—
1938	899	396	1,009	—	—	—

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

CATARACT DISTRICT, continued

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
BOULDER, continued						
1939	1,141	525	1,611	—	—	—
1940	506	298	670	—	186	—
1941	186	95	975	—	518	—
1942	79	72	220	120	—	—
1944	58	21	46	—	—	—
1946	49	39	71	—	—	—
1947	9	9	15	—	—	—
1948	5	2	5	—	112	43
1952	127	113	250	88	2,360	720
1956	93	66	131	79	—	1,000
1957	30	20	107	—	—	—
Total	4,425	3,305	8,527	1,173	4,195	1,763
BOULDER VESTEL						
1918	33	18	2,733	—	—	—
1919	13	11	1,261	—	—	—
Total	46	29	3,994	—	—	—
BUCKEYE (BOSTON)						
1902	400	125	1,042	—	—	—
1908	810	104	2,326	1,491	—	—
1921	67	10	2,893	—	14,780	—
1922	111	13	4,641	450	23,912	3,797
1923	62	8	1,727	270	15,319	—
1925 (Tailings)	9	2	104	—	938	—
1926	28	12	474	330	4,190	—
1928	10	1	398	—	1,650	—
1937	37	6	588	166	4,773	—
1938	91	6	1,361	35	1,000	—
1939	149	9	2,534	683	10,028	10,000
1949	39	13	139	—	—	—
Total	1,813	309	18,227	3,425	76,590	13,797
BULLION						
1905	6,539	783	48,272	129,683	—	—
1909	1,064	283	17,707	33,785	—	—
1912	1,325	339	20,841	40,998	103,046	—
1913	1,577	261	30,246	30,043	405,165	—
1914	186	10	4,937	1,032	8,365	—
1915	100	8	2,023	—	21,385	—
1917	72	7	1,118	—	19,454	—
1918	1,069	344	17,403	39,382	60,618	—
1919	1,596	533	18,309	45,928	2,304	—
1920	682	182	9,167	17,820	26,027	—
1921	133	59	1,359	2,809	—	—
1925	68	27	624	1,166	—	—
1927	59	30	1,025	—	—	—
1928	132	56	1,595	—	—	—
1930	600	22	5,769	4,060	72,452	—
1935	500	40	2,265	3,549	6,908	—
1936	6,000	425	25,487	58,956	8,888	—
1937	414	76	3,645	8,276	—	—
1938	14	3	73	—	—	—
1940	136	20	1,280	3,743	—	—
1941	250	43	2,434	4,639	—	—
1943 (Dump)	169	6	550	223	7,195	—
1944	29	2	363	85	5,684	—
1945	39	3	635	20	9,727	1,787
1947	26	2	392	44	5,772	1,060
Total	22,779	3,564	217,519	426,241	762,990	2,847
BURT						
1929	5	2	157	—	2,628	—
1932	5	3	126	7	1,705	—
Total	10	5	283	7	4,333	—
CANADIAN GROUP						
1917	11	—	42	—	—	—
1918	35	18	2,852	43	—	—
Total	46	18	2,894	43	—	—
CAVANAUGH						
1934	23	13	184	272	7,538	—
COLEMAN & JOHNSON						
1952	183	10	345	—	9,011	11,507
COLUMBIA & RUBY						
1906	841	720	23,717	—	—	—
1907	924	4,374	56,569	—	—	—
1908	817	1,363	24,447	—	—	—
1909	1,205	1,751	34,518	—	—	—
1910	1,099	2,420	35,507	345	—	—
COLUMBIA & RUBY, continued						
1911	784	159	325	—	—	—
1912	149	128	3,653	14	—	—
1913	108	113	7,134	—	—	—
1914	17	10	524	—	—	—
1915	35	28	865	—	—	—
1916	94	261	6,051	165	—	—
1917	5	3	279	—	—	—
1920	98	46	379	—	—	—
1925	1	2	8	—	—	—
1926	1	3	6	—	—	—
1927	24	6	118	—	—	—
Total	6,202	11,387	194,100	524	—	—
COMET						
1902	1,366	360	19,216	—	288,320	—
1904	348	61	2,746	—	60,880	—
1905	1,550	429	27,358	—	232,253	—
1906	1,600	709	13,880	—	115,432	—
1907	1,398	459	21,881	3,793	209,870	—
1908	7,780	608	44,924	37,469	374,458	—
1909	204	38	4,535	1,633	38,246	—
1910	84	24	1,233	3,094	5,800	—
1911	865	213	12,640	3,956	163,325	—
1912	892	253	15,054	20,689	151,335	—
1913	1,500	386	23,548	73,207	151,515	—
1914	272	97	3,923	9,561	7,598	2,899
1916	16,546	657	38,214	40,578	327,484	854,148
1917	19,690	2,007	113,847	103,277	892,713	3,356,400
1918 (Tailings)	8,375 / 21,522	2,246	138,420	89,405	1,202,838	2,294,099
1919	6,745	913	70,930	75,784	384,578	281,010
1920	3,051	536	38,499	14,924	498,231	40,460
1921	227	40	4,225	896	33,305	—
1922	28	—	750	—	—	—
1925 (Tlgs)	1,444	100	7,661	—	66,642	212,398
1926 do.	977	58	5,362	—	49,244	140,040
1928 (Tailings)	35) 4,978)	334	28,761	24,286	364,670	667,614
1929 (Tailings)	12,233) 5,729)	1,290	118,908	110,812	1,559,100	2,403,586
1930 (Tailings)	2,190) 6,761)	801	73,914	61,595	863,648	840,828
1932	61	30	881	352	8,579	—
1933	431	111	3,680	2,625	51,101	4,881
1934	10,080	755	66,244	32,966	476,931	419,910
1935 (Tailings)	58,992 773	3,288	317,369	200,539	2,393,155	2,048,476
1936 (Tailings)	62,323 408	5,040	424,276	226,188	3,319,667	2,707,780
1937	65,190	4,727	375,212	254,300	3,835,200	2,086,000
1938	38,188	3,156	249,351	191,071	2,589,152	1,193,140
1939	59,420	4,914	372,896	272,740	3,255,425	2,113,000
1940	57,824	6,354	425,408	328,704	3,777,385	1,546,000
1941	9,756	1,060	89,924	42,285	679,526	186,000
1942 (Dump)	793	84	7,382	1,530	38,131	—
1943 do.	491	18	3,423	1,029	14,340	—
1944 (Clngs)	2	2	30	10	476	—
1945 (Dump)	34	20	458	165	2,502	2,963
1946 do.	28	21	362	275	2,122	2,038
1947 (Tlgs)	1,527	59	2,273	2,784	8,793	16,602
1948 do.	232	44	2,016	955	17,860	25,173
1949 (Dump)	112 280	23	2,178	575	11,390	17,713
1950	676	24	3,375	1,444	9,831	20,709
1951	100	4	535	90	2,038	1,693
1952	5	—	77	—	229	460
Total	496,086	42,443	3,177,779	2,235,676	28,535,228	23,486,020
CONGO						
1939	40	22	839	261	1,829	—
1940	178	85	3,095	1,390	3,112	—
1941	89	35	884	498	—	—
Total	307	142	4,818	2,149	4,941	—
COPPER BELL						
1937	3	—	24	—	108	—
1943 (Tlngs)	425	57	2,181	54	1,213	—
Total	428	57	2,205	54	1,321	—
COPPER BLOCK						
1910	26	24	616	—	8,470	—
1913	7	4	105	—	879	—
1915	28	9	244	—	—	—
Total	61	37	965	—	9,349	—

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

CATARACT DISTRICT, continued

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
CRESCENT						
1935	8	9	192	57	705	—
1939	30	12	264	452	3,101	—
1940	32	14	356	159	2,340	—
1941	10	5	63	138	951	—
1942	127	69	995	2,364	18,710	—
1943	10	4	100	151	2,625	—
1947	52	13	286	381	3,243	2,542
1952	39	14	165	264	2,059	3,396
1956	91	50	971	1,500	12,200	9,200
Total	399	190	3,392	5,466	45,934	15,138
CRYSTAL						
1908	605	230	8,247	29,855	—	—
1911, 1912, 1913, and 1914	production included with Comet mine.					
1915	279	132	3,571	12,865	—	—
1916	1,408	290	14,994	81,096	12,338	—
1917	1,620	219	20,058	80,428	69,582	152,784
1918	1,584	195	22,350	51,822	129,993	169,574
1919	1,365	130	32,134	30,538	357,157	—
1920	3,152	343	70,697	62,332	655,728	—
1921	588	110	11,648	9,404	59,426	5,722
1922	549	121	6,720	28,523	—	—
1923	93	15	1,038	2,912	—	—
1925	1,052	95	18,305	8,874	185,397	94,597
1926	768	40	11,882	5,282	145,410	147,297
1927	668	43	10,173	8,859	113,285	154,914
1928	283	9	5,915	3,070	73,602	65,145
1929	214	10	5,916	3,028	61,852	61,240
1930	69	2	1,996	794	28,575	10,269
1932	12	13	88	55	—	—
1935	67	4	616	198	7,614	10,160
1936	134	13	1,490	913	6,756	—
1937	520	113	6,766	18,155	6,736	—
1938	2,031	417	22,218	29,411	20,055	16,277
1939	1,645	394	20,784	2,323	30,098	14,000
1940	1,183	209	21,560	25,390	16,793	—
1941	652	135	8,149	22,210	7,380	—
1942	447	152	4,110	8,093	—	—
1943	119	17	1,201	2,848	4,611	6,242
1944	56	17	759	—	—	—
1945	631	61	7,331	1,979	53,305	7,813
1948 (Dump)	39	8	304	1,470	—	—
1952	230	12	828	1,840	8,740	15,640
1953 (Dump)	523	30	1,743	2,348	6,190	7,516
Total	22,586	3,579	343,591	536,915	2,060,623	939,190
CUSTER						
1903	305	25	5,279	—	—	—
1904	6,560	295	78,720	—	—	—
1905	1,344	67	16,128	—	—	—
1908	202	46	5,486	—	—	—
1910	37	35	132	—	—	—
1912	24	2	320	—	—	—
Total	8,472	470	106,065	—	—	—
DAILY WEST No. 1, 2, 3						
1951	30	—	42	81	1,820	3,115
1953	12	—	18	—	737	1,093
1955	56	—	81	—	8,300	7,800
1957	4	—	7	—	600	600
Total	102	—	148	81	11,457	12,608
DORIS						
1934	55	1	81	368	3,570	4,439
EMMA B.						
1911	17	—	605	—	4,900	—
EVA MAY						
1905	23	2	414	2,070	2,300	—
1908	12	—	341	1,433	—	—
1936	19	1	354	260	731	—
1937	8	1	245	386	1,427	—
1943	102	3	882	1,486	2,648	—
1949 (Dump)	42	1	270	390	—	—
Total	206	8	2,506	6,035	7,106	—
FIRST SHOT						
1909	119	23	3,437	238	—	—
GARFIELD						
1904	26	18	450	—	—	—
1905	40	25	1,039	—	—	—
1920	16	1	292	198	—	—
1921	35	11	413	418	3,573	—
1926	4	2	27	23	500	—
1939	69	5	330	—	—	—
Total	190	62	2,551	639	4,073	—
GOLCONDA						
1938	589	57	9,592	1,154	8,995	—
1939	68	4	475	129	1,402	2,800
Total	657	61	10,067	1,283	10,397	2,800
GOLDEN THREAD						
1954*	30	4	197	87	1,320	2,499
1949 (Tlngs)	345	32	2,039	1,020	14,100	17,487
1950	22	3	204	71	1,862	1,750
1951	66	1	58	—	521	453
1956	20	2	145	60	1,100	1,900
1957	5	2	32	—	100	200
Total	488	44	2,675	1,238	19,003	24,289
GRAY LEAD						
1928 (Dump)	150	11	4	—	—	—
1929 do.	50	12	5	—	—	—
1930	150	6	2	—	—	—
1931	25	5	3	—	—	—
1932	135	12	4	—	—	—
1934	170	12	4	—	—	—
1935	180	5	1	—	—	—
1934	170	12	4	—	—	—
1935	180	5	1	—	—	—
1936	80	13	342	86	11,849	—
1938	300	10	104	—	4,633	—
1939	150	6	82	15	2,869	—
1940	45	5	83	—	2,710	—
1941	80	4	19	—	768	—
1942	150	10	33	—	971	—
1942	90	4	11	—	423	—
1944	70	3	21	—	783	—
1945	70	4	10	3	337	31
1946	20	2	1	—	—	—
1947	150	5	29	—	1,273	—
1948	70	2	1	—	—	—
1949	100	4	16	—	692	—
Total	2,235	135	775	104	27,308	31
GREEN MOUNTAIN						
1916	11	—	252	—	544	—
1920	34	—	554	—	298	—
Total	45	—	806	—	842	—

* 1945 production included in Boulder district.

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
GRAY EAGLE						
1902	4,000	400	112,000	—	448,000	—
1903	3,000	150	72,000	45,000	120,000	—
1904	1,000	120	16,000	—	30,000	—
1905	1,200	120	25,200	—	102,000	—
1906	2,407	209	49,896	—	129,422	—
1907	215	47	5,892	—	14,602	—
1909	43	6	774	215	—	—
1910	249	19	3,779	—	11,631	—
1911	76	10	1,437	—	11,815	—
1912	24	1	322	156	5,032	—
1913 and 1914	production included with Bulion mine.					
1915	47	4	1,042	—	4,037	—
1916	35	1	688	—	2,868	—
1919	124	6	2,252	442	—	—
1920	311	11	5,729	—	8,070	—
1921	production included with Comet mine.					
1922	73	7	1,526	167	—	—
1929	1,353	131	22,909	25,873	78,914	114,618
1930	1,046	55	18,083	14,143	69,016	116,116
Production after 1930	included with Comet.					
Total	15,203	1,297	339,529	85,996	1,305,407	230,734
GIULIO						
1907	51	28	675	857	9,543	—
1910	21	9	271	455	2,939	—
Total	72	37	946	1,312	12,482	—
HATTIE FERGUSON						
1904	320	60	7,895	—	120,000	—
1905	12	4	300	—	3,427	—
1906	132	28	2,395	34,760	—	—
1907	399	94	7,685	1,295	86,726	—
1914	19	4	322	—	2,104	—
1924	74	16	1,427	—	15,452	—
1925	460	90	6,957	1,807	73,330	33,802
1928	16	1	374	385	2,831	—
1934	77	15	563	86	7,193	—
1941	7	1	64	—	654	—
Total	1,516	313	27,982	38,333	311,717	33,802

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

CATARACT DISTRICT, continued

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
HELPER						
1906	54	23	355	—	6,872	—
1918	14	4	105	—	2,852	—
1944	46	5	273	183	7,717	7,900
Total	114	32	733	183	17,441	7,900
HENNEFY						
1914	17	—	169	—	5,026	—
HENNESSY ESTATE						
1910	35	1	485	—	—	—
HIAWATHA (HIWATTAHA)						
1902	67	9	1,430	—	—	—
1903	754	89	14,969	—	—	—
1904	2,018	241	40,357	—	—	—
1905	940	182	24,720	—	—	—
1906	443	56	9,237	—	—	—
Total	4,222	577	90,713	—	—	—
HIDDEN TREASURE						
1946	9	2	53	—	454	—
1949	3	—	56	—	188	—
1951	78	2	442	4,348	277	90
1952	367	12	1,418	10,508	5,591	4,426
Total	457	16	1,969	14,856	6,510	4,516
HIGH ORE						
1905	24	17	318	320	—	—
1906	29	2	1,173	—	4,473	—
1907	20	2	594	—	4,473	—
1909	201	17	3,972	225	1,123	—
1912	16	1	285	—	629	—
1917	9	4	525	—	9,338	—
1920	5	3	127	—	2,616	—
1925	17	14	471	—	7,186	—
1937	5	1	20	—	—	—
1947	428	24	2,745	857	17,842	14,991
Total	757	86	10,401	1,402	45,861	14,991
H. T.						
1906	16	3	36	—	8,640	—
1908	18	5	277	—	6,031	—
Total	34	8	313	—	14,671	—
IDLER						
1938	34	26	1,021	1,323	395	—
I DON'T KNOW						
1917	18	10	1,992	—	—	—
1918	8	4	839	—	—	—
Total	26	14	2,831	—	—	—
INDEPENDENCE						
1904	37	189	250	—	—	—
1931	1	5	2	—	—	—
1932	2	2	4	—	45	—
Total	40	196	256	—	45	—
JENNIE B.						
1911	19	—	408	—	3,506	—
1920	40	—	719	76	4,377	—
1921	35	1	1,248	—	7,217	—
1925	34	1	411	—	3,366	7,579
1926	113	3	1,632	—	5,975	24,201
1927	18	—	346	—	2,429	4,074
Total	259	5	4,764	76	26,869	35,854
JOHN T.						
1917	15	7	176	—	3,274	—
JOSEPHINE						
1934	32	11	189	108	—	—
1935	403	79	1,844	—	—	—
1937	699	164	2,587	—	—	—
1940	34	6	278	—	—	—
1941	93	22	197	—	—	—
1949	63	16	317	129	689	499
1950	160	32	639	303	315	272
1953	5	5	182	76	883	522
Total	1,489	335	6,233	616	1,887	1,293
JUPITER						
1945	29	10	848	122	—	—
1949	3	1	98	—	—	—
Total	32	11	946	122	—	—
KING COLE						
1918	19	3	336	—	—	—
1920	80	6	1,067	378	—	—
1922	33	3	491	—	—	—
1923	22	1	133	—	—	—
1937	6	—	63	—	—	—
Total	160	13	2,090	378	—	—
KIT CARSON						
1908	19	4	955	—	—	—
1909	12	9	19	—	—	—
1911	11	22	674	21	—	—
1912	41	96	3,724	—	—	—
1913	18	3	594	—	—	—
1914	7	2	450	—	—	—
1919	28	8	1,491	—	—	—
1935	2	—	52	—	—	—
Total	138	144	7,959	21	—	—
KLONDYKE (KLONDIKE)						
1907	123	79	3,104	4,512	51,227	—
1908	136	78	3,518	2,967	59,286	—
1910	23	17	319	520	3,932	—
1944	34	15	398	118	6,289	—
1946	26	12	311	225	5,575	2,500
Total	342	192	7,650	8,342	126,309	2,500
LADY HENNESSY						
1947	89	8	491	—	119	65
LAST CHANCE						
1917	24	3	353	497	—	—
LEE						
1911	78	23	1,011	724	19,343	—
LITTLE MAY & BASIN BELL						
1907	18	22	300	—	2,850	—
LOUISE						
1923	18	11	66	—	—	—
1925	26	7	151	—	5,888	—
1926	29	10	206	276	5,096	—
1937	15	5	83	124	2,511	—
Total	88	33	506	400	13,495	—
McKINLEY (INCLUDES ROOSEVELT MINE)						
1902	92	22	3,645	23,675	—	—
MAE LILLY						
1939	53	9	704	71	1,293	—
1940	44	7	512	—	—	—
1941	20	2	213	—	—	—
1947	5	—	55	—	—	—
Total	122	18	1,484	71	1,293	—
MANTLE						
1921	3	5	3	—	—	—
1926	25	59	126	78	1,253	—
1927	46	162	160	—	—	—
1928	9	15	29	—	—	—
1931	3	13	10	—	104	—
1932	38	56	64	9	382	—
1933	140	84	50	—	203	—
1934	29	28	59	18	825	—
1935	20	47	101	56	1,846	—
1939	13	20	35	23	255	—
Total	326	489	637	184	4,868	—
MARGUERITE						
1914	15	9	297	—	—	—
1915	1	5	16	—	—	—
1920	38	24	607	—	—	—
1942	4	—	40	—	—	—
Total	58	38	960	—	—	—
MARTIN						
1911	23	1	684	—	—	—

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

CATARACT DISTRICT, continued

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
MINNEAPOLIS						
1905	92	1	2,928	—	23,802	—
1906	35	6	1,009	—	4,148	—
1907	163	13	2,114	—	17,884	—
1910	46	3	632	—	17,229	—
1915	220	44	3,458	2,094	47,897	19,796
1920	195	14	3,073	—	—	—
1921	83	8	2,131	847	5,352	—
1929	222	6	2,671	3,361	11,875	13,993
1935	8	—	79	24	865	—
1938	13	1	142	216	—	—
1939	30	1	743	98	19,084	—
1941	2	—	26	—	764	—
1949	4	—	25	—	464	—
Total	1,113	97	19,031	6,640	149,364	33,789
MORNING (INCLUDES MIDNIGHT OR MIDNITE CLAIM)						
1939	22	4	123	—	—	—
1941	3	2	47	—	580	—
1942	29	14	246	20	2,841	—
1947	12	2	73	—	1,375	—
1948	25	8	277	63	4,464	378
1949	53	23	658	78	5,955	—
1952	131	22	730	256	5,225	3,762
1956	7	1	50	23	300	300
1957	32	3	487	700	2,600	1,600
Total	314	85	2,691	1,140	23,340	6,040
MORNING GLORY						
1920	19	7	948	—	—	—
1921	30	7	872	—	—	—
1922	34	7	1,387	—	—	—
1923	76	17	2,749	—	—	—
1925	19	12	1,552	—	—	—
1926	82	70	8,347	—	—	—
1927	31	12	1,467	—	—	—
1928	70	27	3,850	—	—	—
1929	222	136	13,566	—	—	—
1932	62	46	4,474	215	—	—
1933	282	93	11,919	822	—	—
1934	580	152	21,721	469	3,627	—
1935	676	288	26,743	108	795	—
1936	7,368	459	45,750	1,079	27,540	—
1937	7,700	460	47,646	499	31,667	—
1938	122	60	4,010	475	15,482	—
1940	111	64	6,809	—	—	—
1941	439	186	20,831	—	—	—
1942	157	109	11,529	—	—	—
1942	154	25	3,410	—	—	—
1944	153	31	4,018	—	—	—
1945	235	39	5,975	—	—	—
1946	139	24	4,986	—	—	—
1947	115	30	3,376	—	—	—
1948	115	9	1,916	—	—	—
1949	46	10	1,243	81	456	1,454
1950	54	18	926	136	245	2,240
1951	41	39	1,346	54	1,901	2,773
1953	6	2	105	—	527	426
1956	35	31	2,912	100	900	—
1957	58	14	1,671	100	—	900
Total	19,231	2,484	268,054	4,138	83,140	7,793
MOSCOW						
1911	32	4	451	3	312	—
1921	22	1	117	—	3,791	—
Total	54	5	568	3	4,103	—
NEW BUCKEYE						
1906	47	7	2,027	229	12,478	—
OBELISK						
1920	173	1	3,374	—	—	—
1921	158	1	5,774	—	4,442	—
1954	11	—	284	—	400	700
Total	342	2	9,432	—	4,842	—
OPTION						
1915	32	6	1,133	—	—	—
1919	11	5	799	—	—	—
1921	6	3	302	28	—	—
Total	49	14	2,234	28	—	—
POTTER & EDWARDS						
1910	12	2	260	—	—	—
1911	22	3	484	—	—	—
Total	34	5	744	—	—	—
QUEEN OF THE HILLS						
1945	21	2	349	9	272	52
RED EAGLE						
1937	49	18	58	—	—	—
1939	41	11	41	—	—	—
1941	401	155	439	—	—	—
Total	491	184	538	—	—	—
RED WING						
1922	28	4	1,968	—	3,342	—
1923	29	4	1,070	—	4,048	—
1929	16	2	448	51	4,350	—
1930	12	3	171	—	4,857	—
1935	20	—	615	3	1,136	—
1940	15	2	95	—	2,225	—
Total	120	15	4,367	54	19,958	—
RELIANCE						
1905	133	—	1,064	18,620	8,000	—
1906	61	1	2,353	294	4,022	—
1907	60	—	2,000	—	4,000	—
Total	254	1	5,417	18,914	16,022	—
ROCK OF AGES						
1931	14	78	49	—	146	—
1933	19	36	47	35	300	—
1934	7	18	39	—	192	—
1935	4	8	7	6	—	—
Total	44	140	142	41	638	—
ROSE						
1936	22	20	231	—	259	—
1937	13	11	25	30	646	—
1938	4	2	8	—	403	—
Total	39	33	264	30	1,308	—
RUMLEY (EAST & WEST)						
1902	86	54	2,884	—	43,320	—
1905	140	60	2,706	—	18,311	—
1906	156	77	3,452	—	23,507	—
1907	35	34	571	—	8,435	—
1910	159	54	2,864	1,858	25,032	—
1911	111	53	2,338	—	18,214	—
1912	107	40	2,621	155	21,964	—
1913	166	58	3,013	—	21,429	—
1914	361	119	13,321	—	93,378	—
1915	285	102	8,649	—	54,650	—
1916	140	60	2,233	—	15,073	—
1917	247	110	8,090	—	37,553	—
1918	384	148	19,604	—	84,086	—
1919	172	65	6,014	1,270	37,440	—
1920	142	43	3,431	—	30,791	—
1921	140	53	2,827	—	25,417	—
1922	89	23	1,683	—	22,029	—
1923	23	6	394	—	4,278	—
1926	24	7	1,726	222	6,323	—
1927	58	13	3,956	526	13,305	—
1930	31	11	378	142	—	—
1934	80	22	1,980	153	8,030	—
1941	55	18	1,051	1,644	7,323	—
Total	3,191	1,230	95,786	5,970	619,888	—
SATURDAY NIGHT						
1936	22	3	767	218	—	—
1938	122	22	1,663	50	1,723	—
1939	88	6	438	—	—	—
Total	232	31	2,868	268	1,723	—
SCHUMAN						
1917	19	4	685	—	—	—
SERIES						
1919	26	5	250	23	4,796	—

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

CATARACT DISTRICT, continued

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
SILVER BLUE & SILVER TRAIL						
1911	1	—	115	—	13	—
1920	8	2	262	—	—	—
1921	22	11	1,808	—	227	—
1922	3	1	494	—	—	—
1925	2	2	354	—	—	—
Total	36	16	3,033	—	240	—
SILVER HILL						
1905	83	16	1,281	—	4,658	—
1906	140	25	2,494	—	12,355	—
1909	28	6	531	—	4,561	—
1916	81	12	871	—	9,042	—
1919	615	86	5,215	3,665	31,670	93,346
1922	54	8	543	—	2,294	—
1925 production included with the Comet mine.						
1941	97	18	1,614	263	6,102	—
1942	21	5	587	14	2,818	—
1944	73	23	1,117	1,921	8,462	—
1946	8	—	295	—	1,094	—
1949	4	1	104	—	2,095	—
1950	13	4	241	26	4,150	1,192
1951	10	3	153	—	2,358	355
1952	165	3	2,186	1,423	7,005	59,864
1955	9	1	33	—	300	—
1956	38	5	124	100	100	400
1957	8	1	48	38	600	100
Total	1,447	217	17,437	7,450	99,664	155,257
SILVER RIGHT						
1936	13	6	509	—	—	—
SILVERSMITH						
1912	5	6	122	—	—	—
1915	12	4	131	—	—	—
1916	8	7	150	—	—	—
Total	25	17	403	—	—	—
SIRIUS GROUP (INCLUDES MORNING STAR)						
1906	255	180	3,567	693	50,032	—
1910	34	27	241	—	3,945	—
1911	25	18	460	473	8,319	—
1925	2	3	1	—	—	—
1926	7	—	61	—	1,172	2,183
1933	7	4	25	—	407	—
1938	62	32	551	137	6,241	—
1939	32	17	189	215	2,849	—
1945	13	3	68	43	52	484
1947	9	3	34	—	—	—
Total	446	287	5,197	1,561	73,017	2,667
SOCKERSON						
1915	11	2	199	—	3,488	—
SOLAR PEARL (SOLAR & PEARL)						
1903	65	55	5,368	—	—	—
1904	78	54	2,772	—	—	—
1906	12	7	365	—	—	—
1908	15	1	371	—	5,035	—
1914	13	13	232	—	—	—
1915	21	9	340	—	1,107	—
1917	25	9	284	245	—	—
1921	1	10	4	—	—	—
1922	21	8	312	—	—	—
Total	251	166	10,048	245	6,142	—
SUNRISE						
1942	13	3	91	26	1,019	—
1948	14	2	85	—	957	342
Total	27	5	176	26	1,976	342
VERGENIA						
1926	42	3	391	—	2,562	5,362
VINDICATOR						
1937	9	5	24	—	—	—
1938	16	5	25	—	—	—
1939	43	6	188	—	—	—
1940	24	6	33	—	—	—
Total	92	22	270	—	—	—
VIRGINIA						
1916	14	2	452	—	2,804	—
1918	37	5	934	54	6,998	—
1938	4	1	29	—	—	—
Total	55	8	1,415	54	9,802	—
WENDELL PHILLIPS						
1948	11	—	207	38	2,488	1,829
1949	38	—	454	190	7,660	805
1952	17	—	234	37	2,739	1,225
Total	16	—	895	265	12,887	3,859

CLANCY AND LUMP GULCH DISTRICT

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
ARGONAUT						
1921	20	16	438	—	3,031	—
BADGER						
1915	93	35	1,793	—	48,932	—
1916	64	26	871	781	25,508	—
1922	5	3	85	—	3,424	—
1929	2	3	5	—	—	—
1935	3	1	30	22	457	—
1939	8	2	41	40	389	—
1944	7	—	28	1	362	—
1947	13	2	45	71	668	469
Total	195	72	2,898	915	79,740	469
BALTIC						
1903	5	—	726	—	—	—
BELL						
1902	493	710	4,472	—	—	—
1903	36	75	436	—	—	—
1904 (Dump)	15	19	86	—	—	—
1905 do.	321	189	843	—	19,000	—
1906	464	450	6,021	6,685	33,117	—
1907	1,308	1,755	9,132	617	17,322	—
1908	315	432	3,251	—	—	—
1911	24	16	92	—	—	—
1912	284	331	2,478	3,451	20,427	—
1913	74	88	302	909	—	—
1916	150	154	1,044	1,505	5,019	—
1917	35	22	368	880	2,201	—
1928	40	14	96	—	—	—
1934*	7	3	94	35	662	—
1935	97	52	818	1,166	3,357	—
Total	3,663	4,310	29,533	15,248	101,105	—
B & G						
1910	68	58	1,315	1,789	17,888	—
1934**	4	5	40	30	517	—
1936**	13	17	75	13	351	—
Total	85	80	1,430	1,832	18,756	—

* 1934 Bell Mine production in Warm Springs district total.

** 1934 and 1936 B & G production included in Warm Springs district total.

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
BIG INDIAN						
1902	1,630	197	—	—	—	—
1904	11,178	3,671	—	—	—	—
1905	2,000	588	—	—	—	—
Total	14,808	4,456	—	—	—	—
CANNON						
1949	33	7	333	133	3,705	—
1950	5	2	41	17	480	162
1951	11	2	55	—	629	187
1952	38	9	197	48	2,542	557
1953	57	15	252	65	3,668	330
Total	144	35	878	263	11,024	1,236
CAPITAL						
1909	12	—	209	—	4,550	—
1917	6	1	220	120	1,248	—
Total	18	1	429	120	5,798	—

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

CLANCY AND LUMP GULCH DISTRICT (Con.)

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
CARBONATE CHIEF						
1905	1,162	1,508	10,794	—	91,340	—
1906	1,280	1,210	11,053	12,818	121,702	—
1907	2,812	3,724	35,070	49,752	173,281	—
1912	1,191	1,485	7,610	12,470	—	—
1913	130	128	1,510	1,324	17,261	—
Total	6,575	8,055	66,037	76,364	403,584	—
DAN TUCKER						
1918	16	—	2,296	—	3,441	—
1920	18	—	401	81	2,634	—
Total	34	—	2,697	81	6,075	—
EAGLE'S NEST						
1910	6	9	133	133	1,583	—
1939	21	14	101	34	253	—
Total	27	23	234	147	1,836	—
FREE COINAGE						
1909	6	—	894	—	1,558	—
1918	127	1	11,854	—	14,722	—
1910	468	8	36,908	—	5,521	—
1920	235	1	9,854	—	13,681	—
1921	79	1	5,566	—	4,660	—
1927	11	—	448	18	558	—
1944 (Dump)	11	—	72	—	—	—
1948 do.	64	—	433	109	884	522
1949 do.	389	3	2,582	546	4,632	6,992
Total	1,390	14	68,611	673	46,216	7,514
FROHNER						
1928	22	11	690	321	13,119	—
1929	18	8	686	86	16,254	—
1939	359	5	178	78	2,871	—
1940	15	12	301	23	2,366	—
1941	132	10	214	—	1,628	—
1942	7	4	84	57	1,296	—
1949 (Dump)	12	3	130	40	1,469	800
1954	1,361	108	5,046	1,700	52,500	25,200
Total	1,917	161	7,329	2,305	91,503	26,000
GOLD CROWN						
1909	12	—	314	634	892	—
1949	4	—	12	13	40	—
Total	16	—	326	647	932	—
GOOD CHEER						
1909	11	1	401	—	735	—
1910	32	6	574	299	1,495	—
Total	43	7	975	299	1,495	—
HAYNES						
1906	60	2	548	2,225	51,022	—
KATIE						
1934	13	—	644	9	81	—
KING SOLOMON						
1908	18	—	1,307	—	2,274	—
1909	107	2	6,837	154	5,602	—
1912	114	4	7,851	461	11,076	—
1916	14	1	905	—	2,783	—
1920	10	—	433	—	1,159	—
1936	24	—	693	—	1,630	—
Total	287	7	18,026	615	24,524	—
LEGAL TENDER						
1909	1	—	77	—	95	—
1918	13	—	832	—	1,064	—
1919	281	3	24,457	—	3,390	—
1920	120	1	10,079	—	2,493	—
1927	35	—	3,026	77	4,270	11,833
Total	459	4	38,471	77	11,312	11,833

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
LITTLE NELL						
1902	36	—	5,800	—	—	—
1906	53	—	4,735	—	2,431	—
1907	341	—	39,932	—	36,699	—
1908	43	—	3,249	—	1,674	—
1910	11	—	1,170	—	1,105	—
1911	107	—	2,912	—	2,802	—
1912	9	—	467	—	449	—
1920	307	2	27,269	—	19,910	—
1921	36	—	2,066	—	1,696	—
1922	6	—	985	—	816	—
1923	1	—	40	—	26	—
1924	1	—	129	—	124	—
1925	8	—	402	—	286	—
1928	2	—	113	—	101	—
1929	2	—	126	—	102	—
1936	571	6	4,949	—	—	—
1937	3	—	62	—	85	—
1953 (Dmp)	1,479	2	11,642	985	—	29,670
1954 do.	2,289	—	13,944	2,000	7,300	38,000
1956 do.	1,759	—	9,222	1,300	—	31,900
Total	7,064	10	129,214	4,285	75,606	99,570
LIVERPOOL						
1904	1,617	—	163,344	—	238,377	—
1905	2,671	—	187,965	—	198,530	—
1906	964	—	49,022	—	65,960	—
1907	135	—	3,431	—	3,079	—
1908	33	—	1,061	—	1,358	—
1912	49	—	1,241	—	1,263	—
1913 (Dump)	35	—	2,284	—	3,970	—
1914	24	—	1,650	—	2,326	—
1915 (Dump)	14	—	993	—	1,564	—
1916 do.	53	—	4,602	—	6,846	—
1919	8	—	249	—	—	—
1920	3,730	39	130,060	62	237,253	—
1921	250	2	13,249	—	25,558	—
1939	1	—	40	4	68	—
1940 (Dump)	1	—	15	—	32	—
1949 do.	326	1	1,876	378	2,116	7,950
1950 (Dump)	8) 1,695)	—	8,299	1,109	10,425	37,736
1951 do.	129	—	697	154	1,269	3,429
Total	11,743	42	570,078	1,707	799,994	49,115
LOEBER						
1957	60	16	855	100	19,000	500
MAMMOTH						
1905	132	1	1,146	—	8,000	—
1906	75	—	5,468	—	500	—
1908	18	—	951	13	131	—
1909	22	—	417	—	—	—
1921	12	—	2,100	—	1,535	—
1934*	2	1	18	—	535	—
1937*	12	3	30	—	515	—
1955	26	—	186	—	500	900
1958 (Clngs)	93	232	294	500	—	400
Total	392	237	10,610	513	11,716	1,300
MEADOW OR HAAB RANCH						
1949	7	—	934	—	370	1,165
1950	81	—	13,479	134	5,623	10,640
1951	99	—	9,477	96	3,798	10,774
Total	187	—	23,890	230	9,791	22,579

* 1934 and 1937 Mammoth production included in Warm Springs district.

MOCKING BIRD						
1907	900	900	9,990	—	—	—
1908	57	66	335	686	—	—
Total	957	966	10,325	686	—	—
NELLIE GRANT						
1948*	119	36	1,026	551	18,358	4,636
1949	61	12	351	143	6,799	901
1951	26	3	116	22	2,108	244
1952	33	8	215	65	3,477	4,275
1954	61	19	810	200	18,100	2,200
1955	82	23	1,067	200	23,400	3,300
1956	186	60	2,361	400	60,800	7,300
1957	489	132	4,333	1,900	83,200	24,300
Total	1,057	293	10,279	3,481	216,242	47,156

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

CLANCY AND LUMP GULCH DISTRICT (con.)

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
NORMA						
1905	45	—	945	—	3,000	—
1906 (Tlngs)	160	2	3,033	—	—	—
1908	16	—	665	36	—	—
Total	221	2	4,643	36	3,000	—
OLD ABE						
1911	1	—	176	152	—	—
1919	1	—	93	—	96	—
1920	3	—	150	—	202	—
Total	5	—	419	152	298	—
OREGON						
1922	9	—	92	—	3,360	—
RACHEL						
1910	2	—	125	—	166	—
1911	2	—	142	—	156	—
1912	14	—	201	—	—	—
Total	18	—	468	—	322	—
RAYMOND						
1905	3	—	221	—	—	—
1906	12	—	1,208	—	242	—
1909	5	—	748	204	768	—
1914	1	—	29	4	—	—
Total	21	—	2,206	208	1,010	—
REVENUE						
1924	4	—	295	—	327	—
1925	2	—	102	—	224	—
1927	11	1	1,078	7	3,013	—
Total	17	1	1,475	7	3,564	—
SANDMAN						
1926	4	—	275	20	892	—
SILVER QUEEN						
1921	2	—	57	62	137	—
1945	5	—	479	24	467	593
Total	7	—	536	86	604	593
TWO DOT						
1917	11	—	1,263	—	2,284	—
WHITE PINE GROUP						
1908	19	5	471	—	8,287	—
1909	36	15	1,080	455	19,208	—
1917	7	1	152	—	3,314	—
1928	171	13	2,432	403	46,038	45,545
1929	22	2	291	70	6,047	6,651
Total	255	36	4,426	928	82,894	52,196

COLORADO DISTRICT

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
ALTA						
1902	257	102	6,000	—	—	—
1904	910	200	10,509	—	—	—
1905	685	242	18,707	—	95,603	—
1906	223	47	5,673	3,664	30,507	—
1907	168	58	4,667	412	30,834	—
1908	72	43	2,095	130	17,215	—
1909	414	63	18,124	1,053	162,375	—
1910	200	34	9,177	179	100,348	—
1911	304	20	12,798	525	139,420	—
1912	343	62	18,503	151	179,388	55,542
1913	232	32	6,919	326	102,143	—
1914	45	24	1,110	—	1,874	—
1916	114	27	3,679	495	33,810	—
1917	257	40	5,464	—	53,696	—
1918	209	20	5,595	—	53,644	—
1919	220	24	6,687	292	78,342	—
1920	431	41	7,193	2,187	56,491	—
1921	47	1	1,173	—	16,539	—
1922	125	57	2,980	3,658	17,254	—
1923	7	1	534	—	4,481	—
1925	25,007)	733	94,582	49,264	461,605	—
(Slag)	156)					
1926 (Tls)	49,534 }	600	132,075	88,893	592,250	—
	2 }					
ALTA, continued						
1927	33)	345	71,306	54,815	274,431	—
(Tlngs)	28,000)					
1928	48	9	1,255	1,390	9,148	6,362
1933 (Clngs)	2	3	35	9	300	—
1934 (Dump)	12	2	234	41	2,815	—
1935	35 }	46	8,223	335	66,591	—
(Tailings)	664 }					
1936	1,189	74	9,644	544	68,746	—
1937 (Tlgs)	4,694	71	19,110	13,792	98,788	—
1938 do.	23,788	433	59,857	46,273	224,856	—
1939	48,850	659	105,190	84,472	404,638	—
1940	43,810	486	65,358	57,220	227,117	—
1941	29,753	367	47,935	36,641	182,050	29,600
1942	48 }	24	2,504	1,383	23,940	—
(Dump)	60 }					
1943 do.	234	13	1,166	184	18,599	—
1949	5	193	23,188	8,486	166,322	247,925
(Tailings)	5,817					
1950	3,641	213	29,024	8,586	393,988	65,328
(Dump)	2,059					
1951	13,769	436	58,730	13,455	862,321	142,425
1952	12,810	376	73,387	12,600	735,406	104,446
1953	12,490	489	52,965	12,032	701,813	106,416
1954	8,298	387	40,073	7,600	319,000	137,200
1955	7,306	312	30,908	9,800	250,400	109,500
1956	12,765	385	56,229	11,800	518,900	134,300
1957	9,697	380	34,734	13,600	356,500	95,600
Total	349,839	8,174	1,165,299	546,286	8,134,488	1,234,644
ARIADNE						
1917	9	2	72	100	930	1,156
1920	5	1	31	40	—	—
1921	4	2	73	128	1,829	—
1922	18	6	234	286	6,010	—
1924	56	—	295	—	10,100	12,852
1925	44	3	115	—	1,351	1,735
1936	9	2	110	33	4,327	—
1937	8	1	71	66	2,066	—
Total	153	17	1,001	653	26,613	15,743
AROGON						
1937	11	3	130	—	—	—
1938	15	7	280	8	—	—
1939	13	6	71	—	—	—
Total	39	16	481	8	—	—
ASSETS						
1913	19	90	213	—	3,056	—
1914	55	102	550	—	4,400	—
Total	74	192	763	—	7,456	—
ATLAS						
1902	384	58	21,120	53,760	—	—
1903	100	6	2,000	5,000	—	—
1904	110	4	2,750	11,100	4,800	—
1907	16	—	144	960	—	—
1908	53	1	467	2,149	—	—
1913	5	6	5	—	—	—
1915	45	3	734	2,813	—	—
1916	34	—	119	729	—	—
Total	747	78	27,339	76,511	4,800	—
BAKAMA (BA-KA-MAA)						
1918	24	—	1,338	3,097	—	—
1942	2	—	47	93	—	—
Total	26	—	1,385	3,190	—	—
BANNER						
1904	180	75	5,193	—	1,250	—
1906	46	17	643	—	1,765	—
1918	17	10	217	—	—	—
Total	243	102	6,053	—	3,015	—
BELL						
1905	24	1	956	2,660	5,980	—
1908	8	10	15	—	—	—
1938	11	2	77	—	—	—
Total	43	13	1,048	2,660	5,980	—

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

COLORADO DISTRICT (Con.)

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
BERTHA & CORBIN						
1906	1,582	19	8,775	164,409	—	—
1907	1,022	—	7,284	112,689	—	—
1908	180	—	1,600	18,035	—	—
1909	83	2	1,016	792	—	—
1911	188	4	4,679	11,450	15,111	—
1912	2,757	32	20,203	183,853	11,619	—
1913	30,360	73	39,039	540,591	—	—
1915	360	2	898	12,786	—	—
1916	23,985	53	26,599	463,153	—	—
1917	28,575	90	49,675	877,750	—	—
1918	1,568	4	2,275	31,575	—	—
Total	90,660	279	162,043	2,423,143	26,730	—
BILLY TOTTEN						
1935	14	29	369	341	—	—
BLACK JACK						
1908	29	6	567	1,146	5,094	—
1917	46	7	365	—	—	—
1918	70	12	478	914	3,954	—
1934 (Dump)	4	1	40	64	224	—
Total	149	26	1,450	2,124	9,272	—
BLIZZARD						
1909	18	3	100	256	—	—
1910	23	5	275	—	5,461	—
1911	32	12	336	296	3,101	—
1920	21	5	529	1,248	—	—
1922	8	1	180	98	—	—
1925	61	11	498	968	—	—
1926	31	8	366	397	1,238	—
1932	94	43	3,280	3,873	3,167	—
1933	31	8	549	75	4,790	—
1934	34	6	677	205	6,092	—
1937	384	33	3,724	915	41,794	—
1938	124	14	1,493	589	13,175	—
1939	26	2	232	88	2,624	—
1940	124	15	824	6,491	962	—
1941	128	21	568	3,243	—	—
1944 (Dump)	130	15	676	77	3,250	—
1946 do.	863	76	3,540	1,264	22,112	11,625
1949 do.	619	37	1,810	920	25,815	13,580
Total	2,751	315	19,657	21,003	133,581	25,205
BLUE BIRD						
1902	1,799	720	44,975	107,940	143,920	—
1907	587	82	10,905	52,735	27,346	—
1908	1,874	197	42,615	139,904	—	—
1909	1,305	73	29,424	108,858	—	—
1910	750	154	10,622	38,108	—	—
1911	945	95	24,668	79,434	—	—
1912	1,399	179	33,141	111,873	—	—
1913	2,065	148	47,280	134,714	—	—
1914*	12	3	177	49	852	—
1915	41	—	879	2,218	8,052	—
1916	1,159	130	25,366	114,114	7,866	—
1917	129	7	3,042	12,531	—	—
1918	230	32	4,269	24,928	—	—
1919	49	20	737	—	—	—
1920	114	7	1,406	10,579	—	—
1921	34	1	387	2,002	—	—
1924	246	32	1,743	273	—	—
1935	101	12	628	2,824	442	—
1937	8	2	88	—	—	—
1938	76	3	950	2,339	13,855	—
1939	213	32	2,811	14,628	1,616	—
1940	1,505	541	14,222	197	—	—
1941	2,038	714	20,881	—	—	—
1942	1,023	209	10,986	—	—	—
1943	47	10	208	—	—	—
1944	89	21	393	11	—	—
1945	21	7	121	—	—	—
1946	136	32	466	—	—	—
Total	17,980	3,454	333,393	960,259	203,949	—
BLUESTONE						
1919	25	3	352	2,011	—	—
BOA, KOA, MOA						
1915	14	—	167	3,675	—	—

* 1914 Blue Bird mine production included in Boulder district total.

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
BUCKEYE, BLUE JACKET & YELLOW JACKET						
1910	64	33	18	—	—	—
1924	21	30	647	—	15,225	—
1925	21	58	639	50	13,035	—
1928	1	9	5	—	—	—
1929	3	14	79	—	1,519	—
1933	23	14	15	30	—	—
1939	302	138	533	967	—	—
1940	126	113	930	82	3,068	—
1941	525	295	6,019	746	85,782	—
1942	553	220	6,235	1,071	126,335	7,700
Total	1,639	924	15,120	2,946	244,964	7,700
CHALCOPYRITE						
1929	16	1	138	1,637	—	—
1946	44	2	429	5,371	—	—
1947	139	6	1,048	10,599	—	—
1949	8	—	29	825	—	—
Total	207	9	1,644	18,432	—	—
CORBETT (INCLUDES IDA MAY)						
1911*	8	—	581	—	6,417	—
1913*	12	2	1,250	—	9,113	—
1914*	15	2	966	—	7,992	—
1915*	19	2	1,657	—	10,811	—
1919*	13	1	539	—	3,430	—
1945	2	—	123	21	1,003	618
1946	5	—	302	23	2,034	2,641
1947	2	—	69	—	606	284
1948	10	—	856	60	4,191	4,857
1949	19	1	820	34	10,355	3,992
1950	4	—	283	—	2,280	1,564
Total	109	8	7,446	138	58,232	13,956
DAILEY GROUP						
1911	30	—	130	653	—	—
1912	92	1	1,335	11,154	—	—
1918	127	3	2,043	9,145	—	—
1919	40	1	1,005	3,205	—	—
1922 (Slag)	507	43	5,614	2,085	49,599	—
Total	796	48	10,127	26,242	49,599	—

* Corbett mine production from 1911-19 shown in Cataract district total.

DEVALL						
1922	17	8	527	—	6,446	—
DRAKE						
1916	15	3	137	34	3,117	—
DUMP NEAR WICKES, MONTANA						
1951 (Dump)	97	6	591	254	9,067	10,105
ENTERPRISE						
1916	78	46	370	—	3,368	—
1945	28	4	94	72	2,850	1,488
Total	106	50	464	72	6,218	1,488
FLAGSTAFF						
1935 (Tlns)	1,039	139	5,283	661	39,472	—
1936	126	20	828	168	7,144	—
1951 (Tlns)	299	32	1,382	255	11,772	1,068
Total	1,464	191	7,493	1,084	58,388	1,068
GLENBEG						
1914	37	3	669	4,839	—	—
1916	10	—	295	3,170	—	—
1919	13	—	169	571	—	—
Total	60	3	1,133	8,580	—	—
GOLCONDA						
1937	485	55	10,122	3,935	—	—
GREGORY						
1917 (Dump)	44	7	421	1,470	4,892	—
1920 (Slag)	11 / 2,918	1	9,672	7,596	126,797	—
1921 (Dump)	36	7	11,102	41	251,291	—
(Slag)	3,221					
1922	74	3	1,298	—	—	—

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

COLORADO DISTRICT (Con.)

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
1935 (Tlns)	115	31	907	274	9,725	—
1937 do.	1,522	286	8,051	425	67,702	—
1939	1,230	231	6,474	5,346	59,604	—
1940	21	3	125	—	966	—
1942	168	26	925	294	7,799	—
1944 (Tlns)	330	15	1,785	4,396	25,331	—
1947 (Dump)	130	13	423	262	5,307	1,785
1948 do.	817	25	3,105	6,982	53,742	36,510
1950 do.	3,059	244	7,752	3,775	84,890	27,800
1951 do. (Slag)	2,208 } 249 }	240	7,999	4,236	91,264	47,809
1952	180	16	514	173	5,260	2,659
1957	1,247	101	2,826	2,109	31,200	8,000
1956 (Dmp)	1,388	124	3,276	1,100	36,600	8,000
1957	1,247	101	2,826	2,100	31,200	8,000
Total	18,977	1,381	66,655	38,470	862,370	132,563
HANNA						
1935	2	—	34	6	1,906	—
1939	14	—	512	164	8,306	—
1941	14	—	512	164	8,306	—
1953	5	—	27	—	508	38
1954*	2	—	10	—	700	—
Total	37	—	1,095	334	19,726	38
HATTIE						
1914	7	—	72	739	—	—
1915	19	—	220	2,579	—	—
1916	18	—	174	1,574	—	—
1920	8	—	109	752	—	—
Total	52	—	575	5,644	—	—
HELENA-JEFFERSON						
1928	29	—	113	159	5,231	6,216
HELENA & LIVINGSTON						
1915	228	41	8,195	—	57,589	—

* 1954 production included in Cataract district totals.

HOLLYHEAD						
1910	9	63	39	—	—	—
1911	7	3	31	—	1,449	—
1918	7	4	36	—	1,675	—
1932	2	2	14	—	510	—
1934	4	3	44	—	2,567	—
Total	29	75	164	—	6,201	—
LISCOL (LISCOE)						
1920 (Slag)	2,642	1	9,660	1,819	201,272	—
1921 do.	1,361	—	4,015	—	115,724	—
1922	265	—	771	155	19,169	—
1923 (Slag)	118	—	254	877	6,064	—
1924 do.	374	—	1,056	2,572	32,052	—
Total	4,760	1	15,756	5,423	374,281	—
LOHRER GROUP						
1936	24	1	331	5,337	—	—
1937	31	—	600	3,326	—	—
Total	55	1	1,431	8,663	—	—
MAYO						
1908	14	—	270	4,000	—	—
MIDWAY						
1941	33	—	1,013	—	—	—
1949	3	—	68	—	83	—
1951	19	1	625	—	—	—
1956	21	—	257	—	—	—
Total	76	1	1,963	—	83	—
MINAH						
1905 (Tlns)	609	—	13,411	—	36,000	
1906	69	11	1,109	—	3,075	—
1910	19	6	440	146	3,351	—
1920	32	5	453	—	3,064	—
1921	48	9	1,146	—	6,443	—
1922	33	7	143	537	—	—
1924	85	20	190	412	—	—
1925	33	—	195	1,714	—	—
1927	10	4	234	—	1,049	—
1936 (Dump)	42	9	314	34	2,028	—
1937 do.	56	7	314	61	1,633	—
1938	81	11	619	—	—	—
1939	262	39	1,868	—	—	—
1940	23	4	174	—	—	—
1941	18	3	325	—	—	—
1942 (Dump)	703	47	2,550	363	20,378	—
1943 do.	6,727	245	23,904	2,816	162,355	—
1944 do.	3,720	175	13,317	2,097	109,006	—
1945 do.	713	20	2,088	466	27,121	8,718
1947	164	15	1,717	382	9,940	2,990
1948	849	93	9,168	3,035	54,062	18,421
1949 (Dump)	132	6	317	220	3,110	—
1950 do.	123	4	404	208	3,614	4,069
1956 (Tlns)	54	—	38	—	—	—
Total	14,596	740	74,438	12,491	445,229	34,598
MINNESOTA						
1902	120	96	1,920	—	28,000	—
1905	56	20	270	—	1,355	—
1906	125	95	941	301	16,016	—
1909	10	5	81	—	2,472	—
1920	12	7	84	148	1,031	—
1925	52	16	405	—	5,466	—
1929	8	4	23	104	—	—
1933	14	4	143	125	4,189	—
1938	3	1	16	—	233	—
1939	271	83	1,879	953	20,732	—
1940	13	4	175	233	2,674	—
1948 (Dump)	68	13	277	120	4,533	554
1949 do.	8	2	30	—	530	—
1952 do.	119	13	351	131	4,557	986
1953 do.	798	94	1,987	644	24,288	5,296
Total	1,677	457	8,582	2,759	116,076	6,836
MONTANA						
1942	47	1	486	—	—	—
1950	6	—	18	—	—	—
1957	43	—	422	—	—	—
Total	96	1	926	—	—	—
MOON						
1920	11	—	106	217	—	—
1924	41	—	273	366	385	459
Total	52	—	379	583	385	459
MOUNTAIN VIEW						
1911	3	—	45	—	2,266	—
1917	9	—	103	—	6,131	—
1924	1	—	49	—	503	—
1925	1	—	10	—	585	—
1934	1	—	7	—	352	—
Total	15	—	214	—	9,837	—
MOUNT WASHINGTON						
1902	70	10	840	—	12,600	—
1906	167	26	2,407	—	29,702	—
1907	70	16	974	517	8,707	—
1908	2	—	95	—	1,311	—
1910	187	40	3,317	—	51,391	—
1911	129	19	2,565	—	35,421	—
1912	961	135	13,547	—	210,405	—
1913	2,546	257	44,286	—	626,687	—
1914	179	18	1,800	—	28,088	—
1915	3,349	430	41,503	—	653,204	—
1917	6,645	981	67,202	—	817,423	—
1918	11,887	2,063	223,057	54,466	2,193,734	—
1919	10,648	2,128	199,792	127,632	1,672,581	—
1920	5,125	768	63,471	2,221	770,121	—
1921	699	97	8,846	—	109,486	—
1922	4,450	404	26,724	—	400,936	—
1923	2,388	380	24,744	11,979	368,183	314,912
1924	2,089	213	17,550	7,677	287,787	342,211
1925	187	8	1,469	64	27,083	27,095
1926	6,187	650	95,652	48,701	712,167	741,559
1927	9,366	947	211,285	152,874	1,083,693	1,107,439
1928	976	68	11,794	6,123	139,999	162,670
1929	868	29	4,655	2,379	60,105	124,418
1933	47	4	879	150	16,072	—
1935	592	24	2,694	2,005	61,942	92,500
1936	14,592	131	33,474	9,444	548,919	625,140
1937	3,000	83	7,856	1,444	129,443	69,000

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

COLORADO DISTRICT (Con.)

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
1939	117	20	762	501	14,183	—
1941	127	5	475	98	8,126	—
1942	29,128	311	78,372	46,918	981,462	1,169,000
(Dump)	252					
1943	47,993	384	79,103	42,313	1,120,353	1,441,400
1944	12,925	691	48,457	19,484	906,939	1,559,106
1945	1,254	77	6,596	1,803	121,325	192,159
1946	34	3	121	—	2,918	720
1947	165	19	1,055	343	20,206	4,618
1948	907	54	5,640	1,759	79,643	17,994
1949	1,052	95	7,697	1,669	135,291	21,990
(Dump)	301					
1950	547	54	2,520	1,006	46,982	15,171
(Dump)	66					
1951 do.	237	9	776	200	14,530	15,532
Total	182,601	11,651	1,344,082	543,770	14,509,148	8,044,634
NORTH PACIFIC						
1908	11	—	1,193	—	10,804	—
1910	82	15	1,555	—	11,341	—
1911	171	30	2,432	—	14,839	—
1912	48	15	589	—	5,394	—
1913	41	7	534	—	4,995	—
Total	353	67	6,303	—	47,373	—
PEN YAN						
1921	27	5	209	—	712	—
1939	196	41	2,457	128	—	—
1940	128	18	1,058	105	124	—
1941	77	15	544	42	—	—
Total	428	79	4,268	275	836	—
PORTAL						
1914	26	1	704	372	—	—
1917	8	—	139	—	—	—
Total	34	1	843	372	—	—
RARUS						
1917	88	1	390	799	375	2,880
1934	55	1	141	479	1,923	11,558
Total	143	2	531	1,278	2,298	14,438
ROGER (ROGERS)						
1921	32	5	541	128	4,415	—
1929	19	—	160	430	559	5,703
Total	51	5	701	558	4,974	5,703
SALVAIL						
1928	350	120	7,234	17,044	—	—
1929	109	43	2,049	4,776	—	—
Total	459	163	9,283	21,820	—	—
SILVER CLAIM						
1955	4	—	28	—	600	200
1956	14	1	57	—	1,600	3,400
Total	18	1	85	—	2,200	3,600
SILVER CROSS						
1907	7	2	334	—	—	—
SILVER TIP						
1925	4	1	961	—	1,092	—
1926	62	10	9,074	—	13,856	—
1927	17	5	1,804	—	3,708	—
1928	3	—	248	—	367	—
1940	2	2	418	—	1,096	—
1953	5	—	490	—	497	45
Total	93	18	12,995	—	20,616	45
SOUTH BUTTE						
1911	62	—	382	3,596	—	—
STEGMILLER						
1921	25	1	200	2,766	—	—
1922	67	1	441	7,820	—	—
Total	92	2	641	10,586	—	—
THREE HORNS						
1914	39	9	302	791	—	—
1915	29	7	175	—	—	—
1921	15	2	111	—	714	—
1923	18	7	228	404	—	—
Total	101	25	816	1,195	714	—
TULAR						
1917	31	—	550	3,043	—	—
WHITE FAWN						
1925	6	1	265	272	2,365	—
1926	2	—	92	116	772	—
Total	8	1	357	388	3,137	—
WICKES SMELTER & DUMP						
1916 (Tlns)	210	20	1,236	3,951	19,952	—
1917 (Slag)	49	—	162	—	3,627	—
1919 (Dump)	183	16	1,959	4,459	—	—
1920 (Slag)	9,673	102	35,090	20,320	681,990	—
1921 do.	144	10	1,207	1,152	14,454	—
1923 do.	1,372	34	6,634	12,891	99,509	—
1924 do.	332	—	925	2,548	20,084	—
1925 do.	639	13	2,716	6,087	41,321	—
1926 do.	50	1	200	—	3,890	—
1948 do.	460	16	2,251	3,600	26,764	28,955
1954 do.	1,649	34	7,222	16,600	98,700	108,800
Total	14,761	246	59,602	71,608	1,010,291	137,755

ELKHORN DISTRICT

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
ALBION						
1913	17	15	250	—	7,406	—
1914	33	37	326	—	12,701	—
1915	19	19	82	—	4,266	—
1916	33	—	—	3,635	—	—
1918	7	1	36	—	888	—
1922	10	6	73	—	3,446	—
Total	119	78	767	3,635	28,707	—
BALTZER						
1911	16	1	990	156	977	—
BIG GOLDIE						
1932	163	40	120	—	2,200	—
BLACK DIAMOND						
1914	12	1	1,575	171	—	—
1915	5	—	1,349	19	—	—
Total	17	1	2,924	190	—	—
C & D						
1902	500	112	3,000	—	60,000	—
1909	188	120	784	68	—	—
1910	571	267	1,206	—	—	—
1912	70	7	963	—	3,174	—
1919	32	15	324	—	5,165	—
1926 (Slag)	163	—	183	388	10,235	—
1937	46	20	41	—	—	—
1938	90	41	233	—	—	—
1939	187	57	956	313	10,107	—
1941	5	1	31	—	1,040	—
1942	8	1	27	—	1,049	—
Total	1,860	641	7,748	769	90,770	—
CENTER REEF (BALLARD)						
1906	43	204	468	—	2,113	—
1907	120	1,158	3,000	—	—	—
1908	216	860	2,011	—	3,982	—
1909	27	52	283	—	426	—
1910	24	34	206	—	386	—
1911	29	32	177	—	813	—
1913	2	6	18	—	149	—
1915	18	17	63	—	—	—
1923*	15	34	37	—	48	—
1924*	48	69	208	—	—	—
1931	39	33	89	18	—	—
1939	359	206	504	101	1,053	—
1940	35	20	109	14	783	—
Total	975	2,725	7,173	133	9,753	—

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

ELKHORN DISTRICT (Con.)

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
COPPER KING						
1916 production included in Swissmont mine.						
1924	20	4	200	5,432	—	—
1927	14	3	142	2,807	—	—
1928	8	2	76	1,975	—	—
Total	42	9	418	10,214	—	—
DOLCOATH (DOLCOTH)						
1909	45	39	68	3,599	—	—
1912	114	83	57	2,158	197	—
1913	18	94	6	—	139	—
1915	2	1	3	—	—	—
1916	400	102	46	—	—	—
1917	1	3	—	—	—	—
1930	115	45	156	6,484	—	—
1931	32	12	13	591	—	—
1932	1,005	204	15	—	—	—
1933	450	99	8	—	—	—
1934	500	22	3	—	—	—
1935	500	57	9	—	—	—
Total	3,182	761	384	12,832	336	—
ELKHORN & BOWDEN PLACER CLAIM TAILINGS						
1925 (Tlns)	25,000	154	64,405	—	—	—
ELKKHORN (HOLTER)						
1902	14,083	1,095	425,878	—	164,433	—
1906	674	60	34,516	—	38,734	—
1907	26,525	897	522,751	—	623,346	—
1908	42,105	1,352	888,279	2,358	1,215,080	—
1909	47,592	1,070	892,682	16,543	1,225,621	—
1910	49,109	1,209	948,853	18,682	1,641,150	—
1911	59,842	1,743	736,303	5,490	1,527,432	—
1912	17,642	446	300,279	3,095	490,043	—
1913	71	4	2,425	—	3,030	—
1917 (Tailings)	16 / 130	7	2,051	—	7,147	—
1918 (Tlns)	89 / 5,891	241	66,680	—	—	—
1919 (Tailings)	1,644 / 4,183	188	37,245	—	3,062	—
1920	107	8	4,952	—	—	—
1921 (Tlns)	1,644	40	13,475	—	—	—
1922 (Tlns)	45 / 22,155	217	100,473	396	—	—
1923 do.	17,736	114	56,628	—	7,090	—
1924 (Dump)	8 / 20,000	105	54,283	—	1,745	—
1926 (Tailings)	19 / 1,500	101	34,882	26	359	419
1927 do.	532	18	9,390	—	—	—
1928 do.	68	3	1,294	—	—	—
1935 do.	3,129	28	19,386	566	14,236	—
1936 do.	12,500	59	23,957	1,451	41,256	—
1937 do.	56,000	347	86,048	5,000	319,000	—
1938 do.	5,400	27	6,124	764	32,603	—
1941 (Clngs)	5	1	166	27	622	—
1942 (Dump)	53) / 1,720)	44	12,438	1,176	64,761	—
1943 do.	22,708	561	156,795	18,925	917,934	—
1944 do.	10,438	263	68,667	8,308	373,843	—
1945 do.	17,677	411	117,258	5,308	503,673	1,169,391
1946 (Tailings)	287 / 3,769	82	26,944	7,195	115,049	227,027
1947 (Tlngs)	1,805 / 12,329	266	82,658	30,332	397,167	593,304
1948 (Tlngs)	1,188 / 2,361	281	30,953	7,215	78,679	187,439
1949 (Tailings)	1,630 / 3,158	69	39,145	6,900	119,370	229,860
1950 (Tailings)	798 / 1,656	53	21,522	3,249	57,243	149,307
1951 (Tailings)	912 / 2,366	58	24,976	3,149	71,621	197,752
1952 do.	1,461	33	10,033	2,180	39,451	85,243
Total	496,760	11,504	5,860,389	148,336	10,004,780	2,839,742

* 1923 and 1924 production included in Wilson & Tizer Creek (Woodland Park) district totals.

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
ELKHORN QUEEN (RENAMED NEW ELKHORN QUEEN IN 1955)						
1905	143	—	1,716	—	53,768	—
1907	16	25	111	—	—	—
1913	124	29	1,551	—	19,609	—
1915	32	12	183	—	3,147	—
1916	244	79	2,830	—	32,994	—
1917	525	157	4,327	—	53,384	—
1920	8	2	115	—	2,304	—
1939	131	10	642	184	6,602	—
1942	201	21	1,122	237	11,356	—
1945	507	122	5,911	133	65,645	28,796
1946	712	271	10,152	737	114,675	50,148
1948	333	128	3,066	719	33,164	11,923
1949	863	134	9,918	1,095	105,930	12,030
1950 (Dump)	483	45	2,621	1,014	27,035	5,258
1951 (Dump)	2,089) / 221)	307	27,614	2,728	382,214	52,803
1952 (Dump)	2,243) / 27)	235	43,161	2,236	546,076	85,658
1953	831	30	8,829	1,155	103,560	34,247
1954	1,030	87	16,830	1,200	244,400	33,100
1955	617	66	6,241	1,100	90,200	21,300
1956	440	97	3,854	600	44,000	20,900
Total	11,820	1,857	149,794	13,138	1,910,063	356,163
GOLDEN CURRY						
1904	10,000	3,000	—	—	—	—
1905	12,000	3,483	—	—	—	—
1906	7,984	3,326	—	23,797	—	—
1907	2,564	274	—	—	—	—
1908	5,366	779	227	80,609	—	—
1909	2,201	660	—	63,845	—	—
1910	3,662	1,333	—	44,568	—	—
1911	4,324	950	—	46,204	—	—
1912	10,953	3,732	3,911	280,140	—	—
1913	3,786	746	3,076	55,477	—	—
1914	1,200	671	696	22,441	—	—
1915	2,985	811	890	10,549	—	—
1916	441	99	99	205	—	—
1917	5,079	860	518	2,017	—	—
1918	336	25	—	—	—	—
1919	1,788	266	337	—	—	—
1920	2,195	293	335	—	—	—
1921	3,333	529	256	—	—	—
1922	2,149	337	182	14,004	—	—
1923	212	39	332	—	—	—
1924	54	2	11	641	—	—
1926	661	102	142	2,011	—	—
1927	1,500	238	141	1,757	—	—
1928	740	148	74	—	—	—
1931	77	21	16	371	—	—
1933	350	99	9	—	—	—
1934	3,300	176	34	—	—	—
1935	2,400	173	23	—	—	—
1936	5,000	425	50	—	—	—
1937	1,600	158	44	—	—	—
1938	56	37	28	889	—	—
1939	31	22	12	238	—	—
1940	115	50	99	786	—	—
1951	3	1	—	—	—	—
Total	98,445	23,868	11,512	650,549	—	—
HARD CASH						
1938	40	14	5	—	—	—
1939	4	5	2	31	—	—
1940	23	26	—	—	55	—
1942	4	3	1	—	—	—
Total	71	48	8	31	55	—
HEAGEN						
1906	34	3	8	—	—	—
1910	27	1	161	—	569	—
1911	283	32	49	—	—	—
1913	42	18	40	241	141	—
1919	28	14	1	—	—	—
1929	139	90	21	—	—	—
1930	67	33	14	—	—	—
Total	620	191	294	241	710	—

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

ELKHORN DISTRICT (Con.)

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
HOFFMAN						
1923	1,176	140	—	—	—	—
KLONDYKE (KLONDIKE)						
1915	2	—	—	—	473	—
1938	6	36	2	—	—	—
1939	20	6	1	—	—	—
1940	45	86	21	—	—	—
1941	121	150	18	—	—	—
1943	21	16	3	14	—	—
1944	16	7	2	6	94	—
1945	377	207	252	8,620	—	—
1957	1	31	10	—	—	—
Total	609	539	309	8,640	567	—
LITTLE GOLDIE						
1930	26	7	42	—	—	—
1938	29	13	37	—	—	—
1939	3	4	5	13	54	—
1940	11	10	22	—	222	—
1941	1	1	1	—	—	—
Total	70	35	107	13	276	—
LITTLE HOPE						
1906	41	—	319	—	4,032	—
LUXEMBURG						
1920	60	4	117	4,154	—	—
1923	31	2	75	3,706	—	—
Total	91	6	192	7,860	—	—
MIDNIGHT BELLE						
1912	18	—	4	4,026	—	—
MOREAU						
1915	1,315	666	537	3,922	—	—
1916 production included with Swissmont mine.						
1924	18	3	157	4,838	—	—
1938 (Tlns)	8,044	237	31	—	—	—
1939	1	10	3	—	—	—
Total	9,378	916	728	8,760	—	—
MUNTZER						
1922	110	40	170	—	—	—
PASSOVER						
1915	12	—	115	—	2,790	—
1917	85	—	1,615	—	39,607	—
1918	14	1	546	—	10,747	—
1919	23	—	658	—	12,549	—
1936	19	—	108	364	2,679	—
1951	18	—	54	19	1,126	532
Total	171	1	3,096	383	69,498	532
PEACOCK (INCLUDES GOLDEN MOSS & TURKEY MINES)						
1905	200	242	—	—	—	—
1906	71	75	135	748	—	—
1907	28	35	59	—	—	—
1908*	4	4	84	—	1,446	—
1910	18	10	41	788	—	—
1911	41	27	103	—	1,611	—
1913	55	57	33	—	237	—
1914	23	10	5	—	—	—
1915	25	12	28	175	—	—
1925	75	30	—	—	—	—
1935	11	7	35	241	—	—
1938	†	1	—	—	—	—
Total	551	508	523	1,952	3,294	—
PITTSBURGH & MONTANA						
1908	126	12	303	13,828	—	—
RED ROCK						
1953	145	1	192	108	6,452	4,941

* 1908 Peacock production included in Colorado district total.
† Less than one ton.

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
ROSE GOLD						
1906	40	256	856	—	1,062	—
1907	300	1,045	3,441	—	—	—
1908	14	28	230	—	—	—
Total	354	1,329	4,527	—	1,062	—
SARACEN						
1912	15	—	6	3,803	—	—
SCIOTA (SCIOTO)						
1905	31	—	1,007	—	13,020	—
1906	28	2	879	1,226	10,037	—
1908	12	1	309	295	4,419	—
Total	71	3	2,195	1,521	27,476	—
SOPHIA						
1915	12	1	883	—	4,806	—
1917	2	—	384	—	316	—
1918	2	—	259	25	—	—
1920	49	2	1,489	—	—	—
1936	20	1	525	—	—	—
1938	3	1	107	—	267	—
1942	49	1	93	—	90	—
Total	137	6	3,740	25	5,479	—
SWISSMONT						
1909	1,817	645	—	—	—	—
1912	18	4	42	2,143	—	—
1914	2,047	859	986	2,074	—	—
1916*	6,272	2,233	1,176	—	—	—
1921	2,830	615	—	—	—	—
1922	31,653	5,077	306	—	—	—
1923	22,126	5,969	186	—	—	—
1924 (Clngs)	520	149	5	—	—	
Total	67,283	15,551	2,701	4,217	—	—
TACOMA						
1911	60	14	570	—	12,062	—
1918	12	3	59	—	1,325	—
1924	3	1	39	—	637	—
1940	14	8	26	—	1,067	—
Total	89	26	694	—	15,091	—

* 1916 Swissmont production includes production from the Moreau and Copper King mines.

TWO SONS						
1911	10	—	299	—	4,713	—
UNION						
1905	250	—	8,750	—	50,000	—
1908	12	1	309	295	4,419	—
1909*	45	2	1,891	453	6,930	—
1913	62	2	1,300	—	6,206	—
1917	27	3	390	—	—	—
1920	18	3	662	314	6,928	—
1922	8	—	137	—	1,387	—
Total	422	11	13,439	1,062	75,870	—
WOODROW						
1922	34	1	561	—	—	—

* 1909 Union production included in Boulder district total.

ELK PARK DISTRICT

BUTTE-ELK PARK EXTENSION						
1919	16	—	141	420	—	—
1926	41	—	454	972	1,077	—
Total	57	—	595	1,392	1,077	—
EUREKA						
1919	15	—	336	—	—	—
1921	7	—	126	—	—	—
1935	28	12	480	398	9,075	—
Total	50	12	942	398	9,075	—

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

Year	Ore (tons)	Gold (oz)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb)
GOLCONDA DISTRICT						
BIG CHIEF						
1919*	40	9	125	495	956	—
1946	13	3	166	47	6,254	—
1947	9	2	48	52	2,040	143
1948	5	2	62	73	2,081	929
1949	12	5	96	95	3,135	3,308
1950	16	8	193	113	6,701	4,700
1952	2	—	13	—	433	432
1957	17	1	69	—	2,200	2,500
Total	114	30	772	875	23,800	11,922
ELKADOR						
1941	7	—	58	—	320	—
1944	23	3	370	1,561	—	—
1949	9	1	183	945	—	—
Total	39	4	611	2,506	320	—
GOLD COIN (BUCKEYE GROUP)						
1922**	222	182	965	—	6,614	—
1946	32	23	306	—	5,464	1,513
1947	25	17	181	21	2,890	245
1949	5,200	360	1,211	—	—	—
1950	500	65	138	—	—	—
Total	5,979	647	2,801	21	14,968	1,758
MIDDLESEX						
1916	7	2	281	150	4,698	—
1918***	24	5	633	—	10,272	—
Total	31	7	914	150	14,970	—
WAR EAGLE						
1941	49	55	193	39	987	—
1942	53	72	296	166	1,397	—
1943****	24	50	153	128	458	—
Total	126	177	642	333	2,842	—

* 1919 Big Chief production included in Colorado district total.
** 1922 Gold Coin production included in Colorado district total.
*** 1918 Middlesex production included in Warm Springs district.
**** 1943 War Eagle production included in Warm Springs district total.

WILLARD						
1923*	52	—	240	—	5,680	13,890
1924	52	1	520	—	8,250	16,822
1925**	93	12	341	—	7,240	16,398
1935	76	67	221	14	1,279	—
1936	184	58	656	50	12,976	—
1937***	122	25	139	19	1,432	—
1942***	24	—	32	95	470	5,000
Total	603	163	2,149	178	37,327	52,020
WONDER						
1934****	18	8	7	—	—	—
1935	3	1	17	—	378	—
1936	8	2	23	—	199	—
1937	5	3	19	—	328	—
1939	15	7	62	14	957	—
1940	1	—	7	—	147	—
1941	2	2	25	—	475	—
1942	4	1	21	—	642	—
Total	56	24	181	14	3,126	—

* 1923 Willard production included in Clancy and Lump Gulch district total.
** 1925 Willard production included in Colorado district total.
*** 1937 and 1942 Willard production included in Warm Springs district total.
**** 1934 Wonder production included in Cataract district total.

HOMESTAKE DISTRICT						
CRYSTAL HILL						
1938	8	—	248	—	—	—
1940	9	—	267	—	—	—
Total	17	—	515	—	—	—

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
EMMA						
1918	1	—	110	45	—	—
1919	2	—	209	61	—	—
1921	4	—	381	45	—	—
Total	7	—	700	151	—	—
EVENING STAR						
1918	11	2	91	—	—	—
1925	24	27	573	—	—	—
1926	20	22	642	—	—	—
1927	10	7	256	—	—	—
Total	65	58	1,562	—	—	—
GOLD BUG						
1911	1	55	298	—	—	—
1912	26	42	2,334	22	—	—
1933	3	1	7	—	—	—
Total	30	98	2,639	22	—	—
GOLDEN VALLEY						
1933	12	9	7	65	—	—
1934	1	1	1	—	—	—
1935	12	20	—	—	—	—
1936	8	6	—	—	—	—
1938	3	1	—	—	—	—
1939	1	1	—	—	—	—
Total	37	38	8	65	—	—
IRENE						
1931*	3	4	8	31	—	—
1932	4	8	39	—	—	—
1933	18	21	83	67	—	—
1934	13	8	29	40	—	—
Total	38	41	159	138	—	—

* 1931 Irene production included in Whitehall district total.

MONTANA						
1914	83	18	5,742	—	—	—
1915	43	8	2,095	—	—	—
1919	32	1	628	—	—	—
1922	1	3	15	—	—	—
1925	3	1	199	—	—	—
Total	162	31	8,679	—	—	—
MOUNTAIN CHIEF						
1910	3	—	148	—	—	—
1911	34	24	400	—	—	—
1932	2	1	10	—	—	—
1941	22	6	69	—	—	—
Total	61	31	627	—	—	—
NANNIE BROWN						
1910	9	38	28	—	—	—
1911	18	36	31	—	—	—
Total	27	74	59	—	—	—
NELLIE AND MASCOT						
1911	31	15	2,007	47	—	—
1912	31	13	2,495	61	—	—
1916	51	17	3,252	70	—	—
1919	2	2	81	—	—	—
1930	2	2	34	—	—	—
1932	1	1	31	—	—	—
1937	1	1	103	—	—	—
1940	6	1	47	—	—	—
Total	125	52	8,353	178	—	—
PAY ROCK						
1932	6	7	324	28	—	—
1933	6	5	607	10	—	—
1937	5	10	55	—	580	—
1941	18	31	246	—	—	—
Total	35	53	1,232	38	580	—
LOWLAND DISTRICT						
BOB HILL (RENAMED INFINITE IN 1937)						
1932	9	12	3	17	—	—
1933	2	3	—	—	—	—

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

LOWLAND DISTRICT (Con.)

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
1934	3	1	—	—	—	—
1935	5	18	3	—	—	—
1937	10	11	9	—	—	—
1939	50	17	3	—	—	—
1940	14	4	—	—	—	—
1941	200	3	—	—	—	—
1942	8	2	—	—	—	—
Total	301	71	18	17	—	—
MONTREAL GROUP						
1941	37	1	69	500	—	—
1942	246	8	3,337	2,403	95	—
Total	283	9	3,406	2,903	95	—
MONTREAL STAR						
1940	254	4	1,108	1,407	4,440	—
NORTH BOULDER						
1947	54	5	351	187	7,980	1,024
1950	51	3	122	26	2,763	254
Total	105	8	473	213	10,743	1,278

McCLELLAN CREEK (MITCHELL) DISTRICT

DOBLER						
1912	148	86	706	—	41,895	—
1913	71	24	163	—	5,427	—
1914	229	464	2,902	—	75,405	—
Total	448	574	3,771	—	122,727	—
EUREKA						
1910	54	18	93	151	—	—
1911	18	18	34	—	—	—
1922	17	21	29	48	328	—
Total	89	87	156	199	328	—
GOLD BAR						
1916	125	156	734	3,799	—	—
GOLD COIN						
1934	35	24	88	52	—	—
1937	8	3	41	26	237	—
1941	5	4	5	—	66	—
1942	4	1	3	—	—	—
Total	52	32	137	78	303	—
GREENLEAF						
1939	69	14	131	400	739	—
1941*	61	16	284	89	1,000	—
1942	104	5	250	—	—	—
1947	2	2	9	—	226	—
Total	236	37	674	489	1,965	—
HAYSTACK BUTTE						
1933	11	5	7	—	—	—
1938	34	31	68	—	—	—
1939	8	6	18	29	—	—
Total	53	42	93	29	—	—

* 1941 Greenleaf production included in Warm Springs District total.

JOHN & JIM GROUP						
1915	483	438	1,595	287	—	—
1918	7	5	30	—	—	—
1928 (Clng)	70	24	42	38	—	—
1932	89	70	209	65	—	—
1933	295	273	853	598	—	—
1934	307	216	477	228	—	—
1935	139	126	245	16	—	—
1936	46	40	86	—	—	—
1937	29	32	50	15	—	—
1938	102	139	322	653	—	—
1939	298	323	789	569	—	—
1941	22	14	40	—	—	—
Total	1,887	1,700	4,738	2,469	—	—

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
LAST CHANCE						
1932	74	74	83	205	—	—
1933	46	40	111	152	—	—
1934	26	16	31	13	—	—
1944	21	41	90	120	—	—
1945*	16	16	32	14	—	21
1946	3	6	8	18	87	—
Total	186	193	355	522	87	21
MORNING STAR						
1911	59	41	66	—	—	—
OVERLAND & GOLD BUG						
1935	314	176	133	22	—	—
1940	28	71	40	36	—	—
1941	37	59	38	83	—	—
1942	73	85	44	47	—	—
1952 (Tailings)**	133	3	808	113	3,863	3,022
Total	585	394	1,063	301	3,863	3,022
SHAW						
1937	13	7	775	190	441	—
1938	75	22	3,513	1,020	2,217	—
1939	21	2	555	165	233	—
Total	109	31	4,843	1,375	2,891	—

* 1945 Last Chance poduction included in Montana City district total.

** 1952 Overland & Gold Bug production included in Montana City district total.

MONTANA CITY DISTRICT

MARY ELLEN						
1905	164	65	—	—	—	—
OUR TICKET 45						
1941*	5	3	190	257	—	—
1943	4	3	230	350	—	—
Total	9	6	420	607	—	—

* 1941 Our Ticket 45 production included in Clancy & Lump Gulch district total.

PIPESTONE DISTRICT

COLUMBIA						
1934	6	2	5	—	—	—
1935	42	9	74	55	497	—
1937	8	3	84	—	884	—
1938	10	7	171	59	1,938	—
Total	66	21	334	114	3,319	—
MOUNTAIN GEM						
1921	12	4	265	—	—	—
SLIM CEDAR						
1934	18	6	51	125	—	—
1935	132	50	651	1,711	—	—
Total	150	56	702	1,836	—	—

SOUTH ELKHORN (UNORGANIZED) DISTRICT

IDA						
1915	39	10	1,424	—	9,827	—
1931*	129	11	2,269	336	22,256	—
1936*	351	33	8,195	—	65,087	—
1937*	3	3	912	—	6,256	—
1938*	44	5	1,404	23	14,405	—
1939*	14	2	282	—	3,977	—
1940*	21	2	393	—	3,992	—
1948*	623	38	6,952	1,215	43,021	38,631
1949	25	1	222	—	1,565	940
1951	53	2	138	45	624	1,318
Totals	1,332	107	22,191	1,619	171,010	40,889

* 1931 though 1949 Ida production included in Boulder district.

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
WARM SPRINGS (ALHAMBRA) DISTRICT						
FLEMING DUMP						
1934 (Dmp)	6,988	517	1,729	485	15,205	—
1935 do.	18,000	1,747	5,908	2,075	60,479	—
1936 do	18,040	1,562	5,971	1,664	55,939	—
1937 do.	10,000	905	6,012	3,981	44,053	—
1938 do.	14,316	1,689	13,279	21,653	131,587	—
1939 do.	8	4	23	45	235	—
Total	67,352	6,424	32,922	29,903	307,498	—
WHITEHALL DISTRICT						
ANNA & AVON						
1908	22	88	142	—	247	—
1910	17	22	92	—	1,112	—
1912	13	8	76	468	—	—
1914	35	567	209	—	—	—
1915	21	107	123	—	—	—
1817	13	7	150	—	1,484	—
Total	121	799	792	468	2,843	—
APEX & LEAH						
1935	33	25	279	—	—	—
1936	43	27	280	—	—	—
1937	58	38	302	46	—	—
1938	107	81	515	—	—	—
1940	88	53	447	25	689	—
1941	44	28	134	—	—	—
1942	65	77	540	—	—	—
1943	22	11	227	—	—	—
Total	465	340	2,724	71	689	—
BIG SPOT						
1950	60	2	108	195	9,890	500
BLUE BELL						
1909	9	15	48	218	2,727	—
1928*	2	5	11	38	631	—
1933*	7	15	33	158	3,000	—
1934	3	3	7	50	730	—
1935	2	2	10	10	573	—
1939	16	19	67	58	4,495	—
1940	10	2	21	23	1,936	—
1948	37	21	178	616	4,613	665
1949	12	2	27	57	580	—
Total	98	84	402	1,228	19,285	665
BUTTE CARDWELL						
1917	424	2	417	53,587	—	—

* 1928 and 1933 Blue Bell production included in Pipestone district.

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
CARBONATE						
1909	63	5	415	—	35,785	—
1910	100	37	648	—	48,959	—
1911	111	54	452	—	41,706	—
1912	91	18	298	—	22,564	—
1917	27	1	123	—	12,467	—
1918	14	1	98	—	8,508	—
1919	23	—	134	—	14,230	—
1925	7	2	32	—	3,304	—
1926	53	19	333	158	35,868	—
1927	77	4	508	167	49,709	—
1929	4	—	23	—	3,330	—
1939	55	2	133	93	12,756	—
1940	149	7	241	150	25,402	—
1943	217	33	784	329	60,475	—
1944	616	17	1,912	621	214,428	—
1945	599	16	1,523	281	187,325	14,570
1946	427	15	1,148	388	130,715	10,381
1947	593	19	1,816	1,277	188,672	37,661
1948	567	14	1,121	1,323	118,120	29,508
1949	521	11	1,213	1,145	124,840	16,250
1950	188	6	420	237	43,070	3,980
1951	555	11	927	862	92,000	13,034
1952	592	13	1,163	943	94,482	9,603
1955	319	17	511	500	58,400	9,700
1956	111	2	181	100	17,200	2,400
1957	19	1	58	48	5,000	300
Total	6,098	325	16,215	8,622	1,649,315	147,387
CARDWELL						
1909	25	34	87	—	—	—
1938	38	—	23	3,010	—	—
Total	63	34	110	3,010	—	—
COLUMBIA						
1911	112	163	238	—	—	—
1912	77	285	378	165	—	—
1916	1	2	2	7	—	—
Total	190	450	618	172	—	—
COLUMBIA BUTTE						
1908	64	82	312	—	—	—
1909	11	1	56	944	4,124	—
1910	49	30	115	—	—	—
Total	124	113	483	944	4,124	—
EIGHTY ACRE						
1916	299	—	30	31,264	—	—
1917	82	—	9	9,238	—	—
1918	253	—	15	23,904	—	—
Total	634	—	54	64,406	—	—
EMIGRANT						
1932	2	1	10	31	—	—
1933	18	37	107	242	333	—
1934	45	26	83	156	1,927	—
1935	4	9	29	120	196	—
Total	69	73	229	549	2,456	—
FLORENCE (FLORENCE FRACTION)						
1940	148	74	359	—	—	—
1941	530	218	1,066	469	1,926	—
1942	74	22	82	—	—	—
1946	36	1	493	—	—	—
1949	25	1	67	117	5,728	490
1950	97	32	97	164	—	—
Total	910	348	2,164	750	7,654	490
GEM						
1947	13	—	33	—	3,799	335
1948	61	1	106	104	11,609	1,226
Total	74	1	139	104	15,408	1,561
GOLDEN SUNLIGHT*						
1902	77	73	833	—	—	—
1905	95	46	464	—	—	—
1911	5	4	2	—	—	—
1913	95	132	63	—	—	—
1914	256	400	99	—	—	—
1915	111	128	7	—	—	—
1917	21	22	112	—	—	—
1932 (Tailings)	778 } 391 }	353	2,305	2,330	—	—
1933 (Tailings)	1,676 } 3,457 }	1,616	9,710	10,431	—	—
1934	3,027	1,108	6,678	13,365	—	—
1935	3,513	1,223	2,277	—	—	—
1936	3,591	2,981	3,856	85	—	—
1937	3,522	2,487	1,270	—	—	—
1938	3,425	1,523	5,693	—	—	—
1939	9,621	5,399	7,786	—	—	—
1940	10,854	4,693	20,109	—	—	—
1941	5,105	3,075	4,142	—	—	—
1942	15,363	4,440	1,483	—	—	—
1943	15,640	5,109	1,607	597	—	—
1944	15,047	5,111	1,402	14,470	—	—
1945	12,339	4,022	2,524	5,832	—	—
1946	9,838	3,651	1,520	6,060	—	—
1947	10,195	3,465	1,018	1,762	—	—
1948	10,840	3,025	1,125	571	—	—
1949	6,272	1,869	1,792	—	—	—
1950	1,348	278	69	—	—	—
1956 (Clngs)	1 } 1,805 }	884	143	—	—	—
Total	154,308	57,117	78,089	55,503	—	—

* Includes Golden Sunlight, Blue Moose, Minera Hill, Sunlight, Moonlight, Buffalo, Telluride, and Excelsior Mines. American Exploration and Mining Co. has advised the Bureau of Mines that reports in its possession estimate production from 1890 to 1910 of 75,000 tons of ore with gross value of gold and silver of $1.5 million and output from 1910 to 1917 of 5,000 tons of ore with gross gold and silver value of $200,000.

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

WHITEHALL DISTRICT (Con.)

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
GOLD HILL						
1902	2,400	3,000	—	—	—	—
1925	14	20	123	98	—	—
1947	14	11	76	366	—	—
Total	2,428	3,031	199	464	—	—
GOLD KING						
1909	25	15	47	8	—	—
1911	58	195	135	—	—	—
Total	83	210	182	8	—	—
HACKENSACK						
1910*	26	10	13	—	—	—
1911*	1	3	5	—	—	—
1912*	1	2	4	1	—	—
1913*	2	6	8	—	—	—
1914*	2	8	26	—	—	—
1915*	5	3	1	—	—	—
1923*	5	8	15	—	—	—
1924*	2	2	2	—	—	—
1931	1	4	6	17	—	—
Total	45	46	80	18	—	—
HOPE						
1938	5	2	10	94	—	—
1957	41	—	30	4,000	—	—
Total	46	2	40	4,094	—	—
INSPIRATION						
1945	87	7	392	811	25,783	7,839
1947	37	4	174	158	7,693	181
1948	136	134	664	7,684	3,659	2,034
1949	30	4	61	595	—	—
Total	290	149	1,291	9,248	37,135	10,054

* 1910-1924 production of Hackensack mine included in Homestake district.

IRONSIDE						
1917	15	—	170	—	7,720	—
1918	15	—	155	86	6,262	—
1946	155	—	577	320	40,888	5,715
1947	279	2	1,230	1,040	71,348	12,002
1948	168	2	544	463	34,070	4,975
1949	35	—	151	115	7,672	1,100
1950	5	—	21	—	722	78
Total	672	5	2,848	2,024	168,682	23,870
JACK BENNY						
1939	76	38	120	44	—	—
1940	236	96	448	25	—	—
1941	42	13	66	—	—	—
Total	354	147	634	69	—	—
LONE EAGLE						
1931	7	11	26	28	—	—
1933	45	29	246	—	—	—
1934	78	122	772	19	1,821	—
1935	211	103	726	70	471	—
1936	120	107	884	15	1,115	—
1937	8	7	24	—	—	—
1939	13	12	65	31	250	—
1941	3	3	13	—	—	—
Total	485	392	2,756	163	3,657	—
LUCKY BOY						
1915	9	—	54	—	4,588	—
LUCKY HIT						
1932	1	3	2	—	—	—
1933	69	66	790	839	2,630	—
1934	88	30	240	110	1,090	—
1936 production included in Streak of Luck mine.						
1937	159	77	444	—	1,451	—
1938	918	564	2,794	665	62,381	—
1939	819	395	2,679	1,210	53,914	—
1940	157	90	477	149	5,229	—
1941	598	184	1,161	1,649	50,609	—
1942	182	53	416	71	11,940	—
1943	322	89	458	2,265	17,361	—
1944	424	235	598	1,756	22,446	—
1945	560	279	768	2,864	28,719	19,392
1946	332	218	523	1,807	20,081	9,389
1947	316	223	468	2,135	8,189	3,518
1948	315	189	483	1,952	995	2,054
1949	64	34	136	735	—	—
1950	171	73	253	1,024	4,985	3,946
1951	189	53	235	1,267	7,008	5,583
1952	341	97	650	1,231	28,586	28,343
1953	149	43	275	800	6,085	5,970
Total	6,174	2,995	13,850	22,529	333,699	78,195
M & T						
1956	5	1	305	—	3,200	—
1957	3	—	120	—	1,000	100
Total	8	1	425	—	4,200	100
MAMMOTH						
1913	42	15	218	2,970	—	—
1914	16	4	339	4,728	—	—
Total	58	19	557	7,698	—	—
MARSH						
1941	66	34	373	1,026	8,755	—
MARY LUCILLE						
1937	49	18	34	—	216	—
1938	26	12	60	3	3,258	—
1939	6	4	12	30	1,147	—
1940	10	7	1	—	—	—
Total	91	41	107	33	4,621	—
MIDNIGHT						
1917	104	13	1,049	—	50,826	—
1920	29	6	215	—	14,114	—
1924	67	15	532	288	38,212	—
1925	68	12	605	251	31,992	—
1926	102	20	604	173	48,070	—
1927	82	18	451	160	36,770	—
1928	8	1	32	68	3,746	—
1929	8	2	68	—	5,362	—
1939	30	2	99	51	7,720	—
1940	34	11	58	243	—	—
1943	12	1	27	33	2,073	—
1949	17	1	58	42	2,080	—
Total	561	102	3,798	1,309	240,965	—
MILBURN						
1916	99	1	1,103	—	23,902	—
1917	196	132	1,266	—	55,353	—
1918	123	486	3,759	—	31,880	—
1919	138	83	810	281	19,131	—
Total	556	702	6,938	281	130,266	—
MINERVA						
1926	5	1	39	—	2,972	—
1944	79	1	339	117	26,684	—
1945	513	32	1,538	719	140,986	11,984
1946	70	4	188	95	18,265	1,327
1948	68	3	195	188	13,461	1,527
1949	174	10	514	400	44,590	4,930
1952	230	20	945	229	79,452	3,216
1953	49	2	159	84	7,252	720
Total	1,188	73	3,917	1,832	333,662	23,704
OHIO						
1931	12	30	7	20	—	—
1932	65	257	33	58	—	—
1933	106	421	104	—	—	—
1934	150	497	96	35	—	—
1935	210	494	157	23	—	—
Total	543	1,699	397	136	—	—

TABLE 35.—Mine production of gold, silver, copper, lead, and zinc, 1902-57, by mines, in terms of recoverable metals, continued.

WHITEHALL DISTRICT (Con.)

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
PARROT						
1912	25	3	198	1,190	14,923	—
1913	95	11	726	4,291	37,858	—
1917	18	2	108	476	7,193	—
1918	8	2	57	438	2,897	—
1925	26	2	164	—	8,655	—
1926	25	3	115	565	3,820	—
1927	18	4	135	690	4,100	—
1943	9	1	40	231	1,400	—
1948	144	5	259	1,251	9,993	3,731
1949	149	8	335	2,135	16,215	3,998
1951	15	1	36	176	1,516	321
1953	58	3	164	590	8,325	773
Total	590	45	2,337	12,033	116,895	8,823
PAY DAY						
1936	59	46	302	—	1,048	—
1937	48	18	155	—	900	—
1938	26	13	56	—	—	—
1939	25	11	43	12	404	—
1940	3	2	9	—	106	—
1941	35	16	88	—	—	—
Total	196	106	653	12	2,458	—
PERHAPS						
1925	27	2	199	—	9,399	—
1926	91	6	519	160	25,827	—
1928	147	12	446	299	50,334	—
1929	29	3	97	—	8,939	—
1942	339	34	973	164	77,055	—
1943	539	89	1,252	2,073	107,910	—
1944	426	35	1,326	1,670	112,657	—
1946	185	10	467	630	35,312	5,951
1946	279	22	711	895	53,317	6,103
1947	370	17	827	1,232	55,309	14,036
1948	247	14	651	749	35,600	7,897
1949	239	11	466	538	30,522	9,750
1952	433	39	1,229	615	83,800	12,432
1953	300	26	920	364	56,969	21,644
1954	40	3	109	—	6,000	4,100
Total	3,691	314	10,192	9,389	748,950	81,913
PINE TREE						
1913	9	—	54	—	4,635	—
1917	8	1	30	—	2,417	—
1949	5	—	17	42	1,255	—
Total	22	1	101	42	8,307	—
PIONEER						
1921	26	—	435	—	409	—
PLEICHE						
1916	14	1	55	—	5,386	—
SOUTH VIEW						
1948	14	3	56	—	4,217	228
1949	12	1	35	—	2,721	267
1950	8	1	38	—	2,104	208
1954	6	3	61	100	3,300	100
Total	40	8	190	100	12,342	803
STAR OF WHITEHALL						
1916	12	12	73	—	—	—
1917	15	14	35	—	—	—
1918	4	4	9	—	—	—
Total	31	30	117	—	—	—
SUNNY (SUNNY CORNER)						
1925	235	196	1,388	747	16,331	—
1926	152	115	1,200	1,803	13,639	—
1927	57	21	208	82	3,387	—
1928	66	27	353	164	6,467	—
1931	10	5	69	81	4,287	—
1932	3	6	47	50	333	—
1933	24	47	409	816	1,568	—
1934	53	171	1,154	2,097	—	—
1935	68	46	401	—	—	—
1936	18	46	401	—	—	—
1937	126	76	713	1,726	—	—
1938	78	40	195	—	—	—
1941	325	118	1,076	1,764	16,653	—
SUNNY (SUNNY CORNER), continued						
1942	116	30	420	—	—	—
1946	32	13	93	136	2,079	—
1947	112	131	1,750	2,078	12,267	4,763
Total	1,485	1,275	11,387	12,315	77,011	4,763
SUNNYSIDE						
1929	6	2	38	—	1,469	—
1930	8	10	70	98	—	—
1931	7	10	66	18	—	—
1932	3	6	3	—	—	—
1934	16	6	26	18	—	—
1935	37	7	62	—	—	—
1938	19	21	35	—	—	—
1939	15	17	26	—	—	—
1940	10	10	13	—	—	—
Total	121	89	339	134	1,469	—
SUNSET						
1935	43	56	24	8	—	—
1936	44	8	104	—	5,983	—
Total	87	64	128	8	5,983	—
SURPRISE						
1930	25	2	138	175	23,804	—
1931	27	2	198	55	20,669	—
1934	15	16	76	—	—	—
1935	73	67	61	15	3,633	—
1936	11	8	11	9	441	—
1937	71	2	481	630	59,266	—
1938	259	17	1,396	174	152,162	—
1939	11	3	65	—	7,311	—
1940	37	1	212	103	32,578	—
1942	150	9	973	873	69,278	—
1943	105	3	534	269	48,245	—
1944	104	3	523	1,000	40,401	—
1945	107	3	472	1,911	34,432	10,073
1946	130	2	461	494	44,412	2,152
Total	1,125	138	5,601	5,708	536,632	12,225
VELJACIC						
1912	17	4	73	51	6,038	—
WATERMAN						
1916	14	1	82	—	6,082	—
WHITEHALL						
1917	57	—	156	—	27,731	—
1926	19	—	38	—	5,602	—
1948 (Dump)	111	—	52	94	10,593	5,428
1949 do.	430	1	815	679	160,497	19,020
1950 do.	155	—	284	202	52,277	7,927
1951	110	—	132	104	30,326	3,861
1952	34	—	22	29	4,219	808
1953	33	—	34	28	7,369	325
Total	949	1	1,533	1,136	298,614	37,369

WILSON AND TIZER CREEK DISTRICT

Year	Ore (tons)	Gold (oz.)	Silver (oz.)	Copper (lb.)	Lead (lb.)	Zinc (lb.)
DEER HORN & CALLAHAN						
1921	3	2	1	—	—	—
1923	2	8	23	34	541	—
1924	3	6	19	—	269	—
1926	23	40	58	—	765	—
1927	1	3	12	—	330	—
1931	2	4	1	—	—	—
1932	34	49	25	16	—	—
1933	18	43	37	31	487	—
1934	11	14	17	—	—	—
1936	4,170	1,323	1,060	217	11,109	—
1937	1,400	570	275	25	1,700	—
1938	1,855	361	464	1,082	1,978	—
1939	310	62	123	286	2,584	—
1940	1,090	244	291	623	3,352	—
1941	300	746	831	2,742	12,249	—
1942	297	832	1,415	1,765	16,148	—
1943	140	301	848	1,083	5,436	—
1944	81	248	855	1,457	4,664	—
1945	287	116	121	105	355	314
1946	285	438	298	82	1,401	—
1947	90	63	34	20	139	—
1948	130	28	5	—	—	—
1949	127	172	216	135	1,865	525
1950	74	206	212	89	1,035	69
1951	100	201	220	180	2,722	686
Total	10,833	6,080	7,461	9,972	69,129	1,594
DIAMOND DUMP						
1943 (Dump)	49	—	46	28	6,525	—