GOLD AND SILVER IN OREGON

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By

Howard C. Brooks and Len Ramp

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Frontispiece. Compact gold sponge after retorting of amalgam in crucibles at the Greenback mine, Josephine County, about 1910 (?). Each gold "biscuit" is about $2\frac{1}{2}$ inches in diameter. The total weight of the four biscuits is estimated to be 250 to 300 ounces, worth around $10,000 at today's price.

FOREWORD

"Gold mining was originally the mainstay of the economy of southern (and northeastern) Oregon. It started settlements, built roads and schools, promoted local government, and established law and order. It was about the only source of new wealth and was a common means of earning a livelihood. It is now at best only a token of its past. Not only is gold mining as an industry dead, but its history and the knowledge of its individual mines, which formerly represented a large part of the area's payrolls, are fading into the hazy past. The critical point in its downfall was World War II's Administrative Order L-208, which was designed to stop the mining of gold, thus forcing gold miners to seek employment in base-metal mines, especially copper, in which there was supposed to be a shortage of miners. The order failed essentially to accomplish its objective, but the final result was to deal a crushing blow to gold mining. Shutdowns, always a serious operating matter in an underground mine because of the maintenance problem, compounded the gold miners' difficulties. After the war and the termination of L-208, costs of labor and supplies had multiplied but the price of gold remained the same. Thus gold mining was effectively killed."

Thus wrote Mr. F.W. Libbey, formerly Director of the Department, in his article "Lest We Forget," that appeared in The ORE BIN in June 1963. What Mr. Libbey said in 1963 is just as true today (April 1968). However, the Department was of the opinion that the need and demand for gold would increase and therefore that a bulletin collecting the salient facts on gold and silver in Oregon as known today would aid in the future development of Oregon's mineral industry.

The authors of this publication have spent the past five years researching the literature and compiling the data found herein. They have been greatly aided by Margaret Steere, staff geologist of the Department, in coordinating and arranging the information, and by other members of the staff in preparation of the report for publication -- namely, Miriam Roberts in editing and typing the text, James Powell in drafting the numerous charts and maps, and Raymond Corcoran in reviewing the stratigraphic data.

But this publication was not turned out merely for its historic interest. Events of recent months have indicated that a rise in the price of gold is imminent. This will come as no surprise to those who have attended the Gold and Money Sessions of the Pacific Northwest Metals and Minerals Conference, the Proceedings of which were distributed by the Department. Not only is great concern expressed by many monetary authorities, especially those in countries outside the United States, over the need for more gold to back money, but also the use of gold in the arts and industries is increasing at such a rate that its value will likely have to be raised if only to meet these demands. We consider the outlook for a more realistic gold price as good. Consequently, the information contained in this volume should prove of great value to those who wish to evaluate Oregon's gold mining regions.

It is hoped that study of this publication will suggest properties or areas that should be investigated more thoroughly even with the price of gold at $35 an ounce. We feel that attention should be paid especially to those districts where there have been considerable prospecting and tunneling. Such districts may still contain unrecognized areas of gold mineralization of sufficient grade and tonnage to warrant mining by the large-scale methods used in copper mining today. The U.S. Department of Interior, through its Heavy Metals Program, is looking at some of these areas and results of its work should be followed closely.

In addition to this broad coverage of gold and silver in Oregon, the Department has in the past published on two regions in greater detail than is found in this volume. These publications are: Bulletin 34, "Mines and Prospects of the Mount Reuben Mining District, Josephine County, Oregon" (1947); and Bulletin 49, "Lode Mines of the Central Part of the Granite Mining District, Grant County, Oregon" (1959). Reports on specific properties are: GMI Short Paper 23, "Oregon King Mine, Jefferson County, Oregon" (1962); and GMI Short Paper 24, "The Almeda Mine, Josephine County, Oregon" (1967).

Gold mining was once the backbone of Oregon's mining industry. Its early importance to the State is demonstrated by the fact that a pick occurs with other symbols representing her industry on the Great Seal of the State of Oregon. It is our hope that this publication will aid in re-establishing the mining for gold once again as a significant industry in our State.

Hollis M. Dole
State Geologist

April 10, 1968

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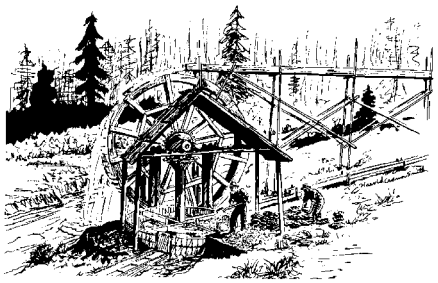

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GOLD AND SILVER IN OREGON

BY HOWARD C. BROOKS and LEN RAMP

PART I. GENERAL DISCUSSION

INTRODUCTION

Status of the industry

Gold mining was the primary reason for the settlement and early growth of northeastern and southwestern Oregon--the two regions where the principal deposits are found. Between 1850 and 1965, Oregon produced roughly 5.8 million fine ounces of gold and 5.4 million fine ounces of silver worth a total of about $210,000,000 at today's prices, and probably 60 percent of the gold was mined before 1900.

Prior to World War II and for a few years afterward the annual dollar value of gold and silver far surpassed that of any other metallic product of Oregon mines. During the late 1930's and early 1940's the industry flourished and showed every indication of continuing strength. But in 1942, gold mining was stopped by government order for the duration of World War II. Owing to subsequent inflation of costs without compensating increase in the price of gold, the industry never recovered. Oregon's gold mining has since been only a token of what it was in the past -- or what it could be in the future under a more realistic price structure.

Purpose and scope of report

This bulletin represents a compendium of information on the known gold and silver occurrences in the state. It gathers together significant facts which otherwise are scattered throughout a great number of published and unpublished records. No new field work was done in the preparation of this report.

In order to facilitate the handling of the material, the bulletin is divided into three parts, as follows: Part I discusses the economics of gold and silver mining and the production, geologic occurrence, and distribution of these metals in Oregon. Parts II and III describe the principal gold-mining areas of the state and give information on individual mines. For convenience in presentation, the state is divided into eastern and western Oregon along the 121st meridian. Part II is concerned with (a) the "gold belt" of the eastern Blue Mountains and (b) isolated districts of eastern Oregon. Part III treats (a) the Klamath Mountains of southwestern Oregon and (b) the Western Cascades in western Oregon.

Method of presentation

Oregon's gold deposits tend to occur in clusters in certain areas. This natural segregation of mineralization is caused by fundamental differences in the geology and is the basis for dividing and describing the deposits. Geologically distinct segments of mineralized regions are referred to here as "areas," such as the Gold Hill-Applegate-Waldo area in southwestern Oregon and the Wallowa Mountains area in northeastern Oregon.

In some of the mineralized areas, particularly those in northeastern Oregon, the deposits have been further separated into groups known as mining districts. In the early days of mining, before county lines

and other legal subdivisions were made, it was the custom to refer to territory containing a group of deposits as a "mining district." Each district was given a name, commonly that of some geographic feature within it such as Canyon, Connor Creek, and Greenhorn districts in northeastern Oregon, to name only a few. The early inhabitants often set up and administered local mining regulations. Boundaries of most of the districts were never formally defined, and eventually many of the smaller districts were combined to form larger ones. District names in use today are those that have become firmly established in published reports.

The description of each mineralized area is accompanied by an index map showing mine and prospect locations. Available data concerning the geology, development, and production of each mine is summarized, and souces of this information are listed. A number of prospects and small mines have been omitted because of lack of information; some of these, however, may have greater economic potential than many that are described.

Production records are incomplete for most mines and many of the available figures are based in part on estimates. Unless otherwise stated, production figures given in dollars reflect metal prices current at the time output was made.

Most of the information given in the bulletin has been compiled from published works listed in the bibliography. The remainder is from unpublished reports and records supplied by the Department staff and others. Nearly all of the published material is now out of print, but copies of these can be consulted at some libraries and at the three offices of the Department. Additional information, not printed in this or previous reports, is available for a number of the mines and is kept in Department files for public use.

ECONOMICS OF GOLD AND SILVER

Gold: uses, prices, and controls

The gold production of the world is used mainly for monetary purposes, either as money or, more generally, as reserves in the form of bullion to back currencies which in themselves have no intrinsic value. Large quantities of gold are used in the decorative arts, particularly for jewelry and watches and for gilding and plating. Smaller amounts are used in industry, dentistry, and medicine.

In the United States the Federal Government has long controlled the price of gold -- first by establishing its coinage value and then, in 1934, by withdrawing it from circulation as a medium of exchange and eliminating the right of citizens to buy or sell refined gold without a license.

In 1792 the U.S. Treasury price for gold was set at $19.393939 per fine troy ounce. The price was raised to $20.689658 on June 28, 1834, then lowered to $20.671835 on January 18, 1837. The latter price remaining in effect until 1933, when various Government decrees and legislation led to the establishment on January 31, 1934, of the present price of $35.00 per fine troy ounce. The average weighted price for gold in 1933 was $25.56; for 1934 it was $34.95. Since 1934, the price paid for gold purchased by the mints has been $35.00 per fine troy ounce, less a quarter of one percent for handling.

As a result of the 1933-34 legislation, gold was withdrawn from circulation in the United States and it has since been unlawful for any unlicensed person or group to buy, sell, or transport gold except in its natural state. Natural gold is defined by the Treasury as gold recovered from a natural occurrence and not melted, smelted, refined, or otherwise treated by a chemical or electrical process. All newly mined gold which does not fall into the category of "natural gold" must be sold to the U.S. mint or to a licensed buyer. Gold amalgam produced from domestic sources may be dealt with in the same manner as gold in its natural state. Retort sponge resulting from heating the amalgam may be held and transported without a license by the person who mined or panned the gold, except that he may not hold at any one time an amount which exceeds 200 troy ounces in fine gold content. Unlicensed persons may purchase retort sponge containing up to 200 ounces gold, but can then resell it to no one except the United States or a licensed buyer.

Silver: uses, prices, and controls

Silver, like gold, has long been monetized, but unlike gold, silver is still in circulation in the

form of coins in the United States and the general public can legally buy and sell silver bullion. The principal non-monetary consumers of silver are tableware, photographic, and electroplating industries.

The coinage value of silver was set at $1.2929+ in 1837 by Government legislation establishing the amount of contained silver in the silver dollar as 412½ grains 900 fine or 0.7734 troy ounce of pure silver. Except for a brief period during 1873-1878, this has remained the standard weight and fineness of the silver dollar. Silver values have fluctuated widely over the years (figure 1), reaching a record annual low of 28 cents an ounce in 1932. In 1933 the Treasury buying price for newly mined domestic silver began to be set by legislative action under the coinage law. On December 21, 1933, the Treasury buying price for newly mined domestic silver was set at $0.6464 per fine troy ounce. Changes in Treasury price have been as follows: It decreased to 0.5001 in August 1934; increased to $0.7111 on April 10, 1935; increased to $0.7757 on April 24, 1935; decreased to $0.6464 on January 1, 1938; increased to $0.7111 on July 1, 1939; and increased to $0.90505 on July 1, 1946. The last price cited held until June 4, 1963, when Public Law 88-36 went into effect. This law repealed all existing silver-purchase laws and for the first time in nearly 30 years freed silver from special legislative restrictions. Prices in the open market rose rapidly and on September 9, 1963 reached 129.29 cents per ounce, at which price the silver dollar contains exactly $1.00 worth of silver.

Effect of price on the industry

In most other segments of the metal-mining industry, increases in mining costs are generally, although often belatedly, offset by increases in metal prices. This is not true of gold mining. Because gold prices remain fixed by law, the health of the industry fluctuates with the national economy. Periods of inflation are unfavorable for gold mining for, while the costs of labor and materials for mining increase, the value of the product remains the same and is thus less able to cover rising expenses. Increasing costs must, therefore, be offset by decreasing expenditures for maintenance of equipment and for the development of future reserves, and generally the minimum grade of ore mined must be raised, with the result that the amount of ore available for mining is proportionately lowered. Eventually, the mine must close. Often considerable ore remains that could be mined under more favorable economic conditions.

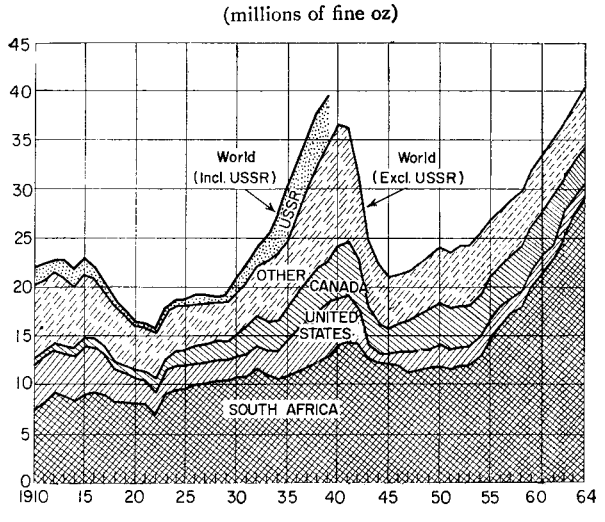
The great depression of the 1930's and the increase in the price of gold in 1934 resulted in a peak output for the United States industry in 1940. At the beginning of World War II, production began to decrease because of high wages and scarcity of materials. Then in 1942 War Production Board Order L-208 was promulgated and effectively stopped gold mining for the avowed purpose of providing additional manpower and equipment for mines producing metals and minerals more directly essential to the war effort. The gold-mining industry contended generally that the order was arbitrary and foredoomed to failure and that it violated constitutional rights. In 1951 and 1952 litigation was started to obtain compensation from the Government for damages caused by the order. More than 200 claims for damages were eventually filed with the United States Court of Claims. On February 20, 1956 the Court ruled in favor of the claimants, but in 1958 this decision was reversed by the U.S. Supreme Court. Subsequent industry appeals to Congress died in committee.

Order L-208 was rescinded in mid-1945 but the death knell of the industry had already rung in the form of inflation. Most of the mines that were productive in pre-war years were not reopened. The immediate reasons were that materials and labor costs had risen greatly while the price of gold remained fixed, and the years of idleness had resulted in such deterioration of plants and workings that prohibitively large expense would have been required for rehabilitation. These conditions have steadily deteriorated.

The manner in which costs of mining have risen over the years is reflected by a comparison of the equivalent prices of gold for certain years in terms of 1940 and 1965 dollars.

	1935	1940	1950	1960	1965
Quoted price	35	35	35	35	35
Equivalent price in 1940 dollars	34	35	17	15	14
Equivalent price in 1965 dollars	81	83	41	36	35

Figure 1. Trends in annual average price of silver, 1900 - 1965.
(From Engineering and Mining Journal Annual Survey and Outlook, February 1965.)
U.S. Treasury buying prices for newly mined domestic silver, 1933 - 1963, are given in the text.



	1964[1]	1963	1962	1953	1945	1940
North America:						
Canada	**3.7**	4.0	4.2	4.1	2.7	5.3
U. S.	**1.5**	1.5	1.6	2.0	0.9	4.9
Latin America:						
Colombia	**0.3**	0.3	0.4	0.4	0.5	0.6
Mexico	**0.2**	0.2	0.2	0.5	0.5	0.9
Nicaragua	**0.2**	0.2	0.2	0.3	0.2	0.2
Chile	**0.1**	0.1	0.1	0.1	0.2	0.3
Africa:						
South Africa	**29.3**	27.4	25.5	11.9	12.2	14.0
Ghana	**0.9**	0.9	0.9	0.7	0.5	0.9
Southern Rhodesia	**0.6**	0.6	0.6	0.5	0.6	0.8
Congo (Leopoldville)	**n.a.**	0.2	0.2	0.4	0.3	0.6
Asia:						
Philippines	**0.4**	0.4	0.4	0.5	—	1.1
India	**0.1**	0.1	0.2	0.2	0.2	0.3
Australia	**1.0**	1.0	1.1	1.1	0.7	1.6
Total	**38.3**	36.9	35.6	22.7	19.5	31.6
Other[2]	**2.1**	2.1	1.5	1.5	1.5	4.1
World[2]	**40.4**	39.0	37.1	24.2	21.0	35.7

[1]Tentative figures based on preliminary data. [2]Excluding the USSR, other Eastern European countries, Mainland China and North Korea. n.a.—not available.

Figure 2. World gold production, 1910 - 1964.
(Engineering and Mining Journal, Feb. 1965.)

Thus, during the decade 1940-1950, the purchasing power of an ounce of gold shrank from $35 to $17. In 1965 an ounce of gold was worth only $14 in terms of purchasing power compared to 1940. Stated another way, if gold prices had been allowed to keep pace with average commodity price increases since 1940, in 1965 they would have reached $83.00 per ounce. By continuing to buy gold from the Treasury at $35 per ounce, U.S. consumers are getting a real bargain.

Looking at the problem another way, labor costs, which constitute about 60 percent of the cost of mining gold, have risen greatly since 1934, when gold was revalued at $35 per ounce. In 1934 underground miners received about $4 to $5 per shift. Today, with all fringe benefits, the wage is between $30 and $40 per shift. The cost of mining is many times what it was in 1934 and may be as much as 10 times the 1934 figure. Greater productivity per man, as a result of mechanization, offsets only part of this increase.

Domestic v. world production

United States mine output of gold dwindled from 4.9 million ounces from 5,393 lode mines and 4,176 placer mines in 1940 to 1.5 million ounces from 355 mines in 1964. In 1940 output from 30 of the largest producers accounted for only 50 percent of the total; comprising these 30 mines, none of which produced less than 19,000 ounces, were 18 lode gold mines, 5 placer gold mines, 6 copper mines, and 1 lead-zinc mine. Of the 1964 production, more than one third came from the Homestake mine at Lead, South Dakota and 93 percent of the total was contributed by this and 24 other mines. Of the latter, 9 were large-scale open-pit copper mines and 6 were copper-lead-zinc and lead-zinc mines in which gold was a relatively unimportant by-product. While United States output is dwindling, world production has been rising, due almost entirely to escalation of output from the Rand in South Africa. Trends in world output and the major sources are shown in figure 2.

The United States which, during the latter half of the 1800's, led the world in gold output and for many years thereafter ran second only to the Union of South Africa, now ranks a poor fourth in world production. On the other hand the United States is, and long has been, the world's leading industrial consumer of gold and this consumption is increasing rapidly. During the late 1950's consumption averaged about 1.7 million ounces per year. In 1962, industrial consumption was 3.6 million ounces and in 1964 it was 4.8 million ounces. In contrast to these figures, the 1955-1964 average output was only 1.65 million ounces. This growing supply-demand deficit is balanced by withdrawals from gold stocks of the United States Treasury.

OREGON'S GOLD AND SILVER INDUSTRY

Production

The U.S. Bureau of Mines' Minerals Yearbooks report the total production for Oregon from 1852 through 1964 as 5,795,987 ounces of gold (valued at $130,822,000) and 5,454,106 ounces of silver (valued at $5,030,000). Of the total ounces of gold, about 2.3 million came from lode deposits and 3.5 million from placers. The production figures given above are but crude approximations because records were poorly kept prior to 1880 when organized Government canvassing of mine output began*. Earlier statistics are based on records of shipping agencies, banks, and the Director of the Mint.

Most of Oregon's early gold output eventually reached the San Francisco Mint, but the source of much of it became obscured because it passed through several hands en route, or it was mixed with

* F. W. Libbey (1963) reports: "An organized canvass of mineral production in Western States by the Government began about 1880, although U.S. Mineral Commissioners J. Ross Browne (in the 1860's) and Rossiter W. Raymond (in the 1870's) reported on the mineral industry in Western States and included incomplete production statistics. These pioneer efforts grew into the reliable annual Mineral Resources volumes of the U.S. Geological Survey, the statistical duties of which were, in 1933, assigned to the U. S. Bureau of Mines. Since then mineral industry statistics have been assembled and published annually in the Bureau's comprehensive Minerals Yearbook. Figures for annual production of gold in Oregon, beginning in 1881, are believed to be reliable."

shipments from other states, or it was circulated as a medium of exchange. Some of the gold produced never reached the mint. As was common in most early-day gold camps, Chinese labor was often employed in working the placers; when the cream was skimmed off the better diggings, the white miners moved on leaving the semi-depleted ground to the Chinese, who hoarded much of what they produced and even carried some of it to their homeland.

Production figures for Oregon for the years 1852-1876 can only be estimated. One of the lowest figures comes from the Report of the Director of the Mint for 1882 (p. 44) which indicates that the gold and silver from Oregon deposited at the United States Mints and assay offices from the time of their organization to June 30, 1882, amounted to $16,816,275.39 in gold.

A higher value is obtained by subtracting the recorded 1877-1964 totals from the totals for the entire period 1852-1964, as given by the U.S. Bureau of Mines. This gives 2,095,838 ounces ($43,320-971) gold and 8,805 ounces ($11,358) silver for the 1852-1876 period, the dollar values being calculated at $20.67 per ounce for gold and $1.29 for silver. Even these figures are low as compared to those of Lindgren (1901, p. 569), who suggested that Oregon's output during the four years 1862-1865 alone might approach $50,000,000. Browne (1867, p. 9) states: "In 1865 the generally accepted estimate for Oregon was $19,000,000 though that was probably above the actual product."

Table 1 shows the amount of gold and silver carried to Portland and sold to banks or transmitted directly to the San Francisco Mint by Wells-Fargo between 1864 and 1870. However, much Oregon gold probably never reached Portland but was shipped to San Francisco by other routes. Some of the gold sold in Portland was carried in from mines in Idaho, Washington, Montana, and British Columbia. Taking these factors into account, Browne and Raymond estimated Oregon and Washington production for 1866-1875 to be as shown in table 2. No official statistics are available for 1876, but Lindgren (1901, p. 570) estimated output at roughly $1,100,000. Oregon production for 1877-1899 as reported by the Director of the Mint is shown in table 3.

Relative amounts of lode and placer gold and silver produced annually from 1900 through 1965 are given in table 4. These statistics were taken from the Mineral Resource volumes of the U.S. Geological Survey and from Mineral Yearbooks of the U.S. Bureau of Mines. Figure 3-A illustrates the trends in gold production in Oregon from 1877 through 1964 and compares the annual output of lode versus placer mines for the period 1897-1964. Figure 3-B shows the placer production by various methods of mining for 1897-1962. Of the total 1902-1965 placer output of 1,076,821 fine ounces, 542,850 fine ounces came from the bucketline dredges operating mainly between 1913 and 1954. Figure 4 compares graphically the production by bucketline and dragline dredges between 1933 and 1954.

Early gold and silver production by counties (Baker and Grant, 1880-1899; Jackson and Josephine, 1852-1901) is given in tables 5 and 6. Figure 5 illustrates graphically the production from these counties during 1902-1965. Of the 2,185,778 fine ounces of gold recorded for this period, about 94 percent came from four counties: 57 percent from Baker County; 16 percent from Grant County; 12 percent from Josephine County; and 9 percent from Jackson County. The remaining 6 percent came mainly from Malheur and Lane Counties. Output from other counties has been very small. During the 1902-1965 period, Baker County furnished 75 percent of the total lode gold output for the state.

Figure 6 compares the value of gold in Oregon with the total value of gold, silver, copper, lead, and zinc during the period 1905-1964. Production of gold or silver as a by-product of copper, lead, or zinc mining has been small in comparison to that of some other western states. Table 7 gives the annual output of gold, silver, copper, lead, and zinc from Baker, Grant, Josephine, Jackson, Lane, and Malheur Counties from 1902 through 1965.

Total mine output of copper from Oregon, according to United States Bureau of Mines statistics, has been about 12,500 tons. Lead and zinc output is much less.

Deposits in which copper is the most valuable metal occur in several areas, but only a few of them have been productive on an important scale. The more productive copper deposits are in the Homestead area of Baker County in the northeastern part of the state and the Waldo area of Josephine County in the southwestern part.

Table 1. Treasure shipments of gold and silver from Portland, Oregon, 1864-1870 (as recorded by R.W. Raymond, 1872)

Year	Gold and Silver
1864	$ 6,200,000[1]
1865	5,800,000[1]
1866	5,400,000[1]
1867	4,000,000[1]
1868	3,677,850[1,2]
1869	2,979,137[1,3]
1870	1,797,800[1,4]
	$29,854,787

1. Shipments from the Portland office of Wells-Fargo & Co.; mostly from Oregon mines but also includes bullion from Washington, Idaho, Montana, and British Columbia.
2. Includes $640,850 shipped by Ladd and Tilton, Portland bankers.
3. Includes $419,657 shipped by Ladd and Tilton, and $480 by private hands.
4. Includes an estimated $250,000 shipped by private hands.

Table 2. Production of gold and silver in Oregon and Washington from 1866 to 1875, inclusive. (Compiled from the official reports on the production of the precious metals by Browne and Raymond.)

Year	Gold and Silver
1866	$ 8,000,000[1]
1867	3,000,000
1868	4,000,000
1869	3,000,000
1870	3,000,000
1871	2,500,000
1872	2,000,000
1873	1,376,400[2]
1874	609,070[3]
1875	1,246,978[3]
	$ 28,732,448

1. Estimated by some as high as $20,000,000.
2. Estimate of total by Wells Fargo Express Company; Oregon only.
3. Oregon only.

Table 3. Production of gold and silver in Oregon from 1877 to 1899.

(Values compiled from reports of the Director of the Mint on the production of the precious metals. Ounces of gold calculated.)

	Gold		Silver	
Year	Fine ounces	Value at $20.67 per ounce	Coinage value $1.29+ per ounce	Total value
1877	48,379	$1,000,000	$100,000	$ 1,100,000
1878	48,379	1,000,000	100,000	1,100,000
1879	55,636	1,150,000	20,000	1,170,000
1880	52,734	1,090,000	15,000	1,105,000
1881	53,217	1,100,000	50,000	1,150,000
1882	40,155	830,000	35,000	865,000
1883	31,930	660,000	3,000	663,000
1884	31,930	660,000	20,000	680,000
1885	38,704	800,000	10,000	810,000
1886	47,896	990,000	5,000	995,000
1887	43,541	900,000	10,000	910,000
1888	39,913	825,000	15,000	840,000
1889	58,055	1,200,000	38,787	1,238,787
1890	52,588	1,087,000	129,199	1,216,199
1891	96,498	1,994,622	296,280	2,290,902
1892	72,171	1,491,781	64,080	1,555,861
1893	81,807	1,690,951	13,557	1,704,508
1894	102,243	2,113,356	10,315	2,123,671
1895	88,906	1,837,682	15,192	1,852,874
1896	62,456	1,290,964	71,811	1,362,775
1897	65,534	1,354,593	109,643	1,464,236
1898	58,862	1,216,669	165,916	1,382,585
1899	70,991	1,467,379	187,932	1,655,311
	1,342,525	$27,749,997	$1,485,712	$29,235,709

1. Census reports: Gold, $964,000; silver, $23,383; total, $987,383.

TABLE 4. GOLD AND SILVER PRODUCTION IN OREGON, 1900 - 1965. *

Year	Gold				Silver				No. of mines		Tons of ore & old tailings treated
	Lode (fine oz.)	Placer (fine oz.)	Total (fine oz.)	Total value	Lode (fine oz.)	Placer (fine oz.)	Total (fine oz.)	Total value	Lode	Placer	
1900 [1]			81,980	$1,694,700			115,400	$ 71,548			
1901 [1]			87,950	1,818,100			160,100	96,060			
1902 [1]			87,881	1,816,700			93,300	49,449			
1903 [1]			62,411	1,290,000			118,000	62,720			
1900 [2]	68,319	15,268	83,587	1,727,894			132,042	81,866			
1901 [2]	68,790	19,969	88,759	1,834,808			163,873	98,324			
1902 [2]	77,086	11,798	88,884	1,837,392			109,463	58,015			
1903 [2]	55,447	10,000	65,447	1,352,907			125,599	67,823			
1904 [3]	51,426	16,895	68,321	1,412,186	131,981	96	132,077	75,284	84	211	121,189
1905	55,806.17	12,172.06	67,978.23	1,405,235	88,691	1,945	90,636	54,744			150,268
1906	48,633.32	17,490.46	66,123.78	1,366,900	75,992	3,354	79,346	53,162			138,274
1907	38,596.23	16,031.77	54,628.00	1,129,261	83,927	2,791	86,718	57,234			110,698
1908	28,661.37	13,186.68	41,848.05	865,076	37,751	5,851	43,602	23,109	66	173	50,684
1909	27,121.25	10,706.26	37,827.51	781,964	25,773	2,054	27,827	14,470	66	96	59,281
1910	24,601.73	8,268.50	32,870.23	679,488	34,739	1,239	35,978	19,428	64	116	82,132
1911	22,500.81	8,140.25	30,641.06	633,407	43,964	1,257	45,221	23,967	40	136	98,558
1912	28,103.21	9,147.52	37,250.73	770,041	55,140	1,941	57,081	35,105	54	156	90,945
1913	56,941.34	21,799.13	78,740.47	1,627,710	173,543	5,493	179,036	108,139	79	94	155,901
1914	50,462.09	26,524.83	76,986.92	1,591,461	137,040	5,512	142,552	78,831	28	77	124,331
1915	66,739.41	23,324.97	90,064.38	1,861,796	112,420	5,527	117,947	59,799	30	65	155,791
1916	49,809.90	42,208.01	92,017.91	1,902,179	222,093	9,249	231,342	152,223	33	75	159,071
1917	36,979.40	35,186.33	72,165.73	1,491,798	118,496	7,160	125,656	103,541	23	53	142,438
1918	37,355.95	24,102.79	61,458.74	1,270,465	103,221	4,102	107,323	107,323	42	78	126,681
1919	28,889.26	18,413.99	47,303.25	977,845	107,451	3,670	111,121	124,455	23	55	96,173
1920	27,398.29	21,822.79	49,221.08	1,017,490	77,890	4,853	82,743	90,190	20	47	82,156
1921	19,509.68	23,158.71	42,668.39	882,034	37,829	4,291	42,120	42,120	23	84	40,333
1922	8,970.24	16,744.36	25,714.60	531,568	148,801	3,011	151,812	151,812	44	126	27,522
1923	10,702.39	13,388.75	24,091.14	498,008	94,260	2,062	96,322	78,984	55	151	50,385
1924	10,945.32	15,750.04	26,695.36	551,842	35,824	2,279	38,103	25,529	43	71	44,842
1925	9,945.42	9,037.38	18,982.80	392,409	31,662	1,131	32,793	22,758	53	94	27,483
1926	7,304.68	5,938.42	13,243.10	273,759	28,890	843	29,733	18,553	49	100	21,727
1927	5,789.80	8,886.36	14,676.16	303,383	44,675	1,155	45,830	25,986	36	150	26,839
1928	5,100.79	5,830.40	10,931.19	225,968	30,145	779	30,924	18,091	41	90	12,676
1929	5,144.87	11,947.13	17,092.00	353,323	28,231	1,778	30,009	15,995	45	111	10,509
1930	4,028.80	10,372.54	14,401.34	297,702	7,421	1,579	9,000	3,465	47	143	8,994
1931	4,231.07	11,119.03	15,350.10	317,315	5,690	1,564	7,254	2,104	57	139	7,092
1932	3,659.31	16,201.90	19,861.21	410,568	6,371	2,245	8,616	2,430	99	169	5,195
1933	5,456.90	14,782.76	20,239.66	517,326	18,594	2,166	20,760	7,266	111	292	11,557
1934	11,471.68	22,239.91	33,711.59	1,178,220	42,983	3,577	46,560	30,099	95	332	62,145
1935	21,456.08	32,704.03	54,160.11	1,895,604	106,410	3,975	110,385	79,339	115	268	184,543

TABLE 4 (CONTINUED)

Year	Gold				Silver				No. of mines		Tons of ore & old tailings treated
	Lode (fine oz.)	Placer (fine oz.)	Total (fine oz.)	Total value	Lode (fine oz.)	Placer (fine oz.)	Total (fine oz.)	Total value	Lode	Placer	
1936	21,332	39,421	60,753	$ 2,126,335	79,411	5,650	85,061	$ 65,880	93	166	136,338
1937	18,443	34,219	52,662	1,843,170	55,540	5,024	60,564	46,846	104	150	77,230
1938	27,398	54,331	81,729	2,860,515	92,206	8,301	100,507	64,974	84	157	74,936
1939	32,593	60,779	93,372	3,268,020	94,794	10,594	105,388	71,536	116	201	69,025
1940	41,825	71,577	113,402	3,969,070	206,317	12,795	219,112	155,813	112	192	113,402
1941	36,135	60,430	96,565	3,379,775	264,953	11,205	276,158	196,379	91	153	96,565
1942	7,897	38,336	46,233	1,618,155	80,235	7,141	87,376	62,134	48	83	31,728
1943	889	208	1,097	38,395	10,495	28	10,523	7,483	16	16	2,680
1944	1,076	293	1,369	47,915	20,205	38	20,243	14,395	13	10	4,217
1945	481	3,986	4,467	156,345	9,672	789	10,461	7,439	9	10	1,378
1946	1,096	16,502	17,598	615,930	3,698	3,229	6,927	5,597	23	37	3,264
1947	1,331	17,648	18,979	664,265	26,852	3,527	30,379	27,493	20	49	3,277
1948	2,089	12,522	14,611	511,385	10,939	2,657	13,596	12,305	23	38	3,119
1949	1,761	14,465	16,226	567,910	9,488	2,707	12,195	11,037	28	29	6,215
1950	2,036	9,022	11,058	387,030	11,706	1,859	13,565	12,227	32	42	4,257
1951	763	7,164	7,927	277,445	4,455	1,763	6,218	5,628	14	21	1,495
1952	613	4,896	5,509	192,815	2,952	1,085	4,037	3,654	13	25	931
1953	1,199	7,289	8,488	297,080	10,333	1,926	12,259	11,095	8	21	1,215
1954	1,528	4,992	6,520	228,200	13,049	1,286	14,335	12,974	20	26	2,916
1955	1,505	203	1,708	59,780	8,795	20	8,815	7,978	19	21	3,835
1956	2,384	354	2,738	95,830	13,491	51	13,542	12,256	15	15	1,991
1957	3,202	179	3,381	118,335	15,897	27	15,924	14,412	25	17	2,594
1958	878	545	1,423	49,805	2,663	65	2,728	2,469	17	33	1,947
1959	236	450	686	24,010	180	62	242	219	10	27	356
1960	167	668	835	29,225	183	101	284	257	13	34	1,231
1961	349	705	1,054	36,890	1,918	104	2,022	1,830	15	27	782
1962	411	411	822	28,770	5,989	58	6,047	5,473	14	21	2,117
1963	1,281	528	1,809	63,315	58,172	62	58,234	52,702	16	14	4,599
1964	339	322	661	23,135	14,327	45	14,372	18,583	5	14	1,782
1965	265	234	499	17,465	8,771	30	8,801	11,353	2	2	500
	1,246,065.76	1,112,058.06	2,358,123.82	$66,382,147			4,147,319	$ 3,213,761			

Compiled from annual reports of the U.S. Geological Survey and U.S. Bureau of Mines.

(1) As estimated by the Director of the Mint.
(2) As estimated by officers and agents of the Mint.
(3) 1908-1952 figures.

* Silver production 1904 - 1965 inclusive totals 3,616,312 ounces: 3,435,584 ounces from lode mines and 180,758 ounces from placers. Lode and placer silver production figures for 1900-1903 are combined.

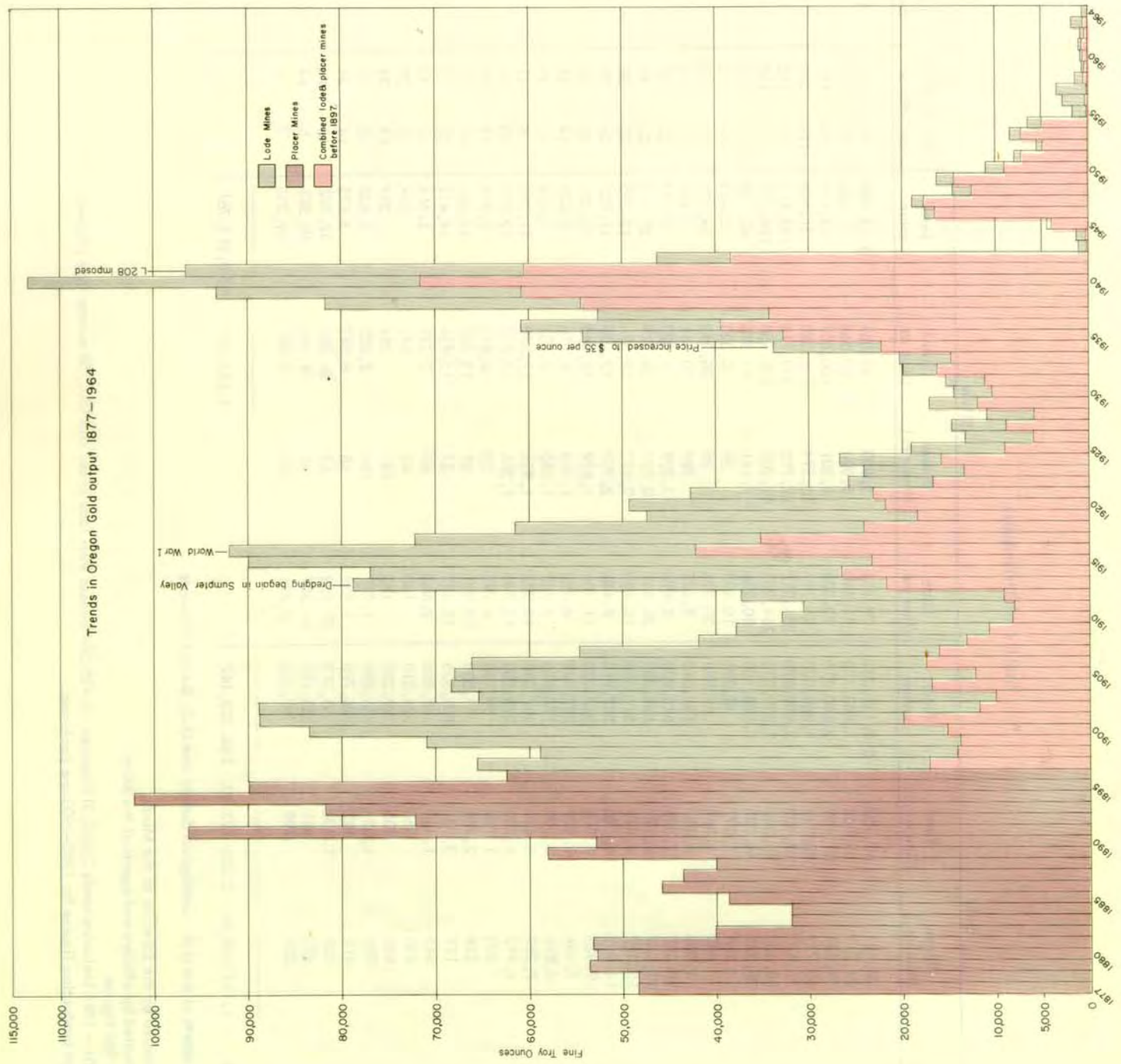


Figure 3-A. Trends in Oregon gold output, 1877 - 1964.

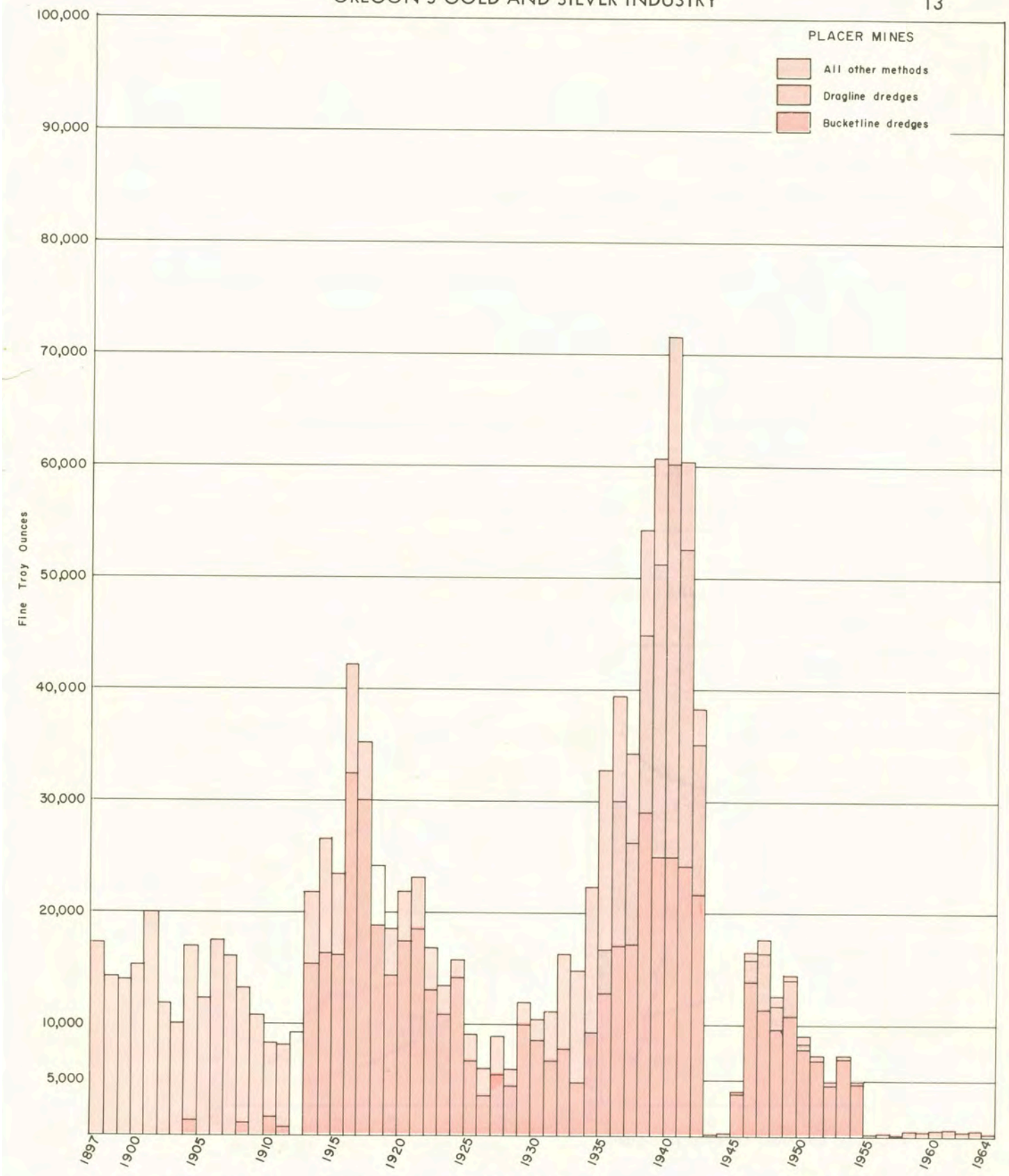


Figure 3-B. Trends in Oregon placer gold output by various mining methods, 1897 - 1964.

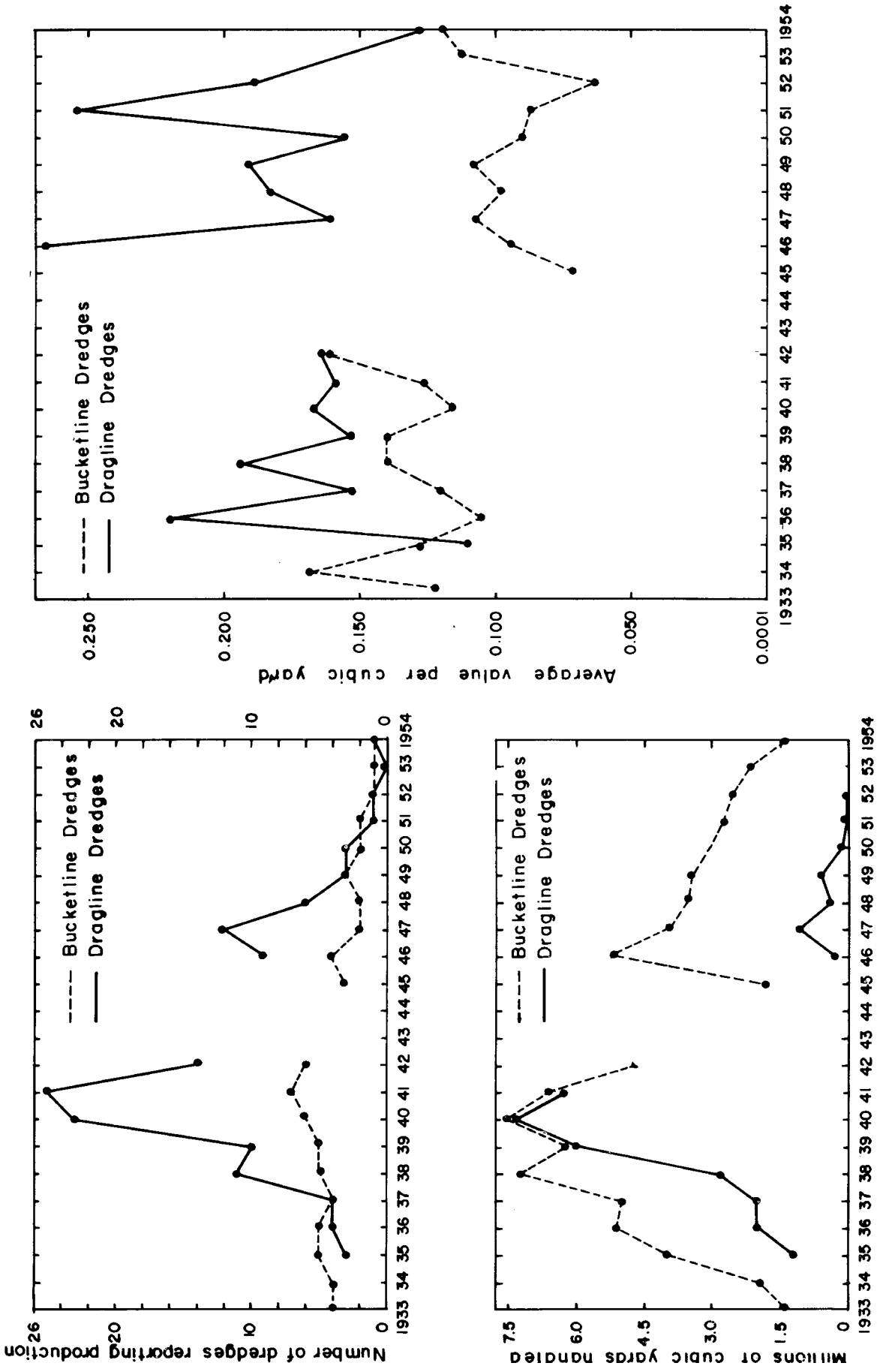


Figure 4. Production from bucketline and dragline dredges, 1933 - 1954.

Table 5. Production of gold and silver in Baker, Grant, and Union (1) Counties, Oregon, from 1880 to 1899. [Compiled from the reports of the Director of the Mint.] *

Year	Baker			Grant			Union			Total
	Gold	Silver	Total	Gold	Silver	Total	Gold	Silver	Total	
1880	$ 226,647	$ 400	$ 227,047	$ 85,400	$ 543	$ 85,943	$ 60,347	$	$ 60,347	$ 373,337
1881	250,000	10,000	260,000	280,000	20,000	300,000	40,000		40,000	600,000
1882	190,000	5,000	195,000	240,000	25,000	265,000	60,000	800	60,800	520,800
1883	160,000	2,500	162,500	200,000	15,000	215,000	45,000	300	45,300	422,800
1884	160,000	2,500	162,500	200,000	15,000	215,000	45,000	300	45,300	422,800
1885	348,044		348,044	194,600		194,600	7,322		7,322	549,966
1886	396,115	9,005	405,120	198,580		198,580	20,650		20,650	624,350
1887	173,558	5,153	178,711	163,896	11,797	175,693	15,000		15,000	369,404
1888	190,000	5,000	195,000	140,000	10,000	150,000	15,000		15,000	360,000
1889	463,604	7,500	471,104	73,989	9,550	83,539	574,989	1,028	576,017	1,130,660
1890	335,000	127,540	462,540	90,000	129	90,129	400,000		400,000	952,669
1891	873,058	217,833	1,090,891	124,487	4,297	128,784	625,956	3,500	629,456	1,849,131
1892	367,587	3,257	370,844	53,780	40	53,820	753,715	1,900	755,615	1,180,279
1893	728,947	10,454	739,401	198,650		198,650	420,237	3,046	423,283	1,361,334
1894	447,996	2,251	450,247	129,853		129,853	1,059,070	8,100	1,067,170	1,647,270
1895	942,483	7,963	950,446	101,853		101,853	144,800	3,000	147,800	1,200,099
1896 (2)	800,000	20,000	820,000	100,000		100,000	300,000		300,000	1,220,000
1897	796,741	50,088	846,829	86,969	4,880	91,841	211,699	36,071	247,770	1,186,440
1898	525,945	42,690	568,635	143,463	32,769	176,232	292,324	67,816	360,140	1,105,007
1899	582,348	55,418	637,766	217,054	86,626	303,680	114,212	19,466	133,678	1,075,124
Total	$8,958,073	$ 584,552	$9,542,625	$3,022,574	$ 235,631	$3,258,197	$5,205,321	$ 145,327	$5,350,648	$18,151,470

(1) Output from Union County came mostly from areas that have since been ceeded to Baker County.
(2) No product by counties given in mint reports. Figures for this year are only rough estimates.
* From Lindgren, 1901, p. 573, totals adjusted.

Table 6. Production of gold and silver in Jackson and Josephine Counties, Oregon from 1852 to 1901 *

Years	Jackson County		Josephine County		Total value
	Gold	Silver	Gold	Silver	
1852-1863	$1,500,000	$75,000	$1,000,000	$50,000	$2,625,000
1864-1869	1,200,000	60,000	1,000,000	50,000	2,310,000
1870-1879	800,000	40,000	800,000	40,000	1,680,000
1880	180,000	8,800	195,000	6,200	390,000
1881	240,000	10,000	195,000	5,000	450,000
1882	135,000	2,000	175,000	2,000	314,000
1883	100,000	1,000	110,000	1,000	212,000
1884	100,000	1,000	110,000	1,000	212,000
1885	57,000	1,000	70,000	1,000	129,000
1886	105,000	840	150,000	2,500	258,340
1887	238,000	900	140,000	5,400	384,300
1888	195,000	1,000	130,000	5,000	331,000
1889	59,000	5,250	38,000	1,000	103,250
1890	85,000	1,275	85,000	255	171,530
1891	140,000	2,000	47,000	1,000	190,000
1892	41,000	1,000	72,000	300	114,300
1893	107,000	500	113,000	400	220,900
1894	107,000	650	123,000	700	231,350
1895	142,800	2,200	282,000	500	427,500
1896	100,000	1,000	200,000	1,000	302,000
1897	28,000	1,500	132,000	4,700	166,200
1898	29,300	1,800	147,000	3,900	182,000
1899	103,400	3,100	236,000	7,000	349,500
1900	100,000	3,000	250,000	7,000	360,000
1901	100,000	3,000	300,000	9,000	413,000
Total	$6,441,000	$227,815	$6,100,000	$205,855	$12,527,170

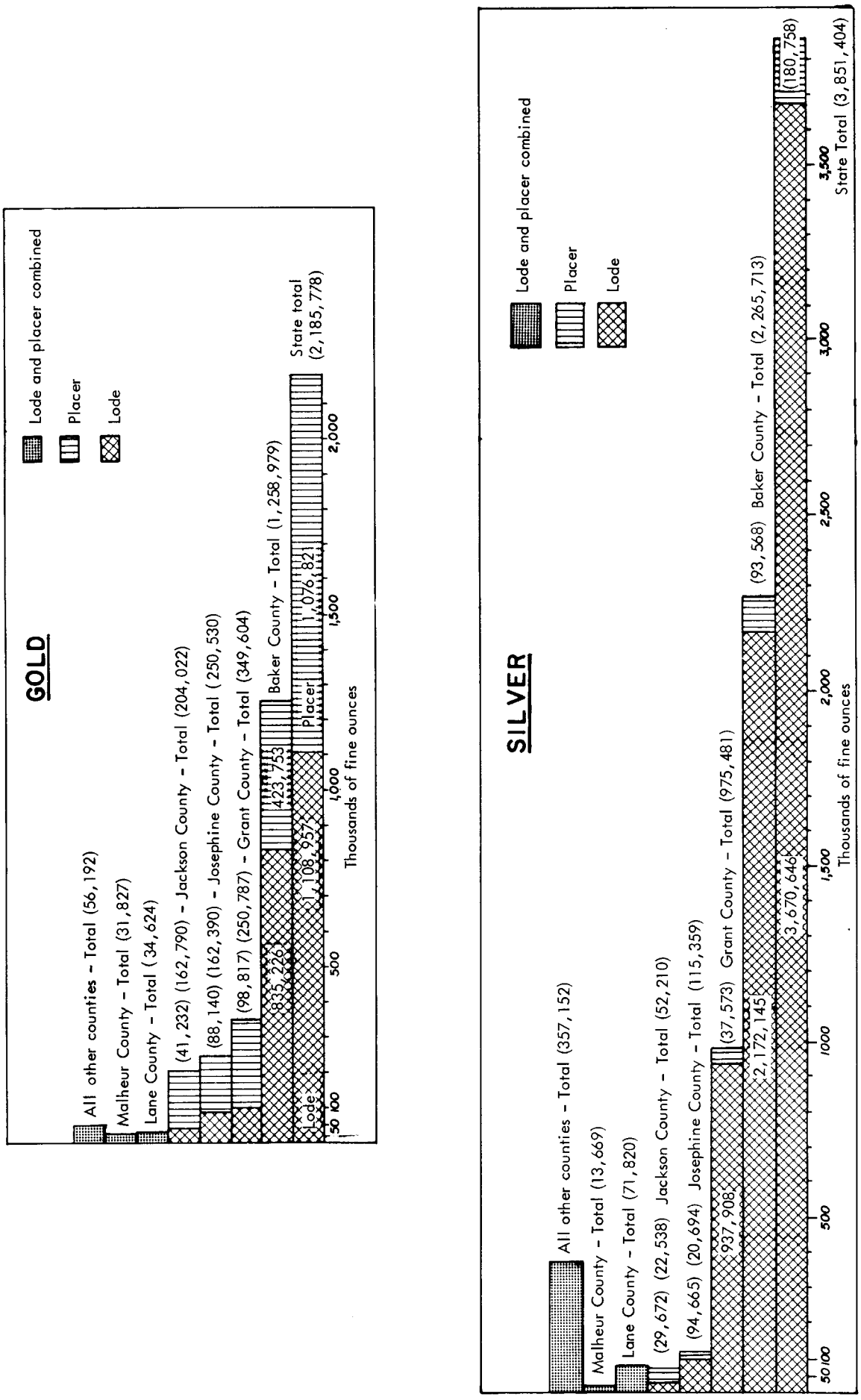


Figure 5. Ounces of gold and silver produced; total and by counties, 1902 - 1965.

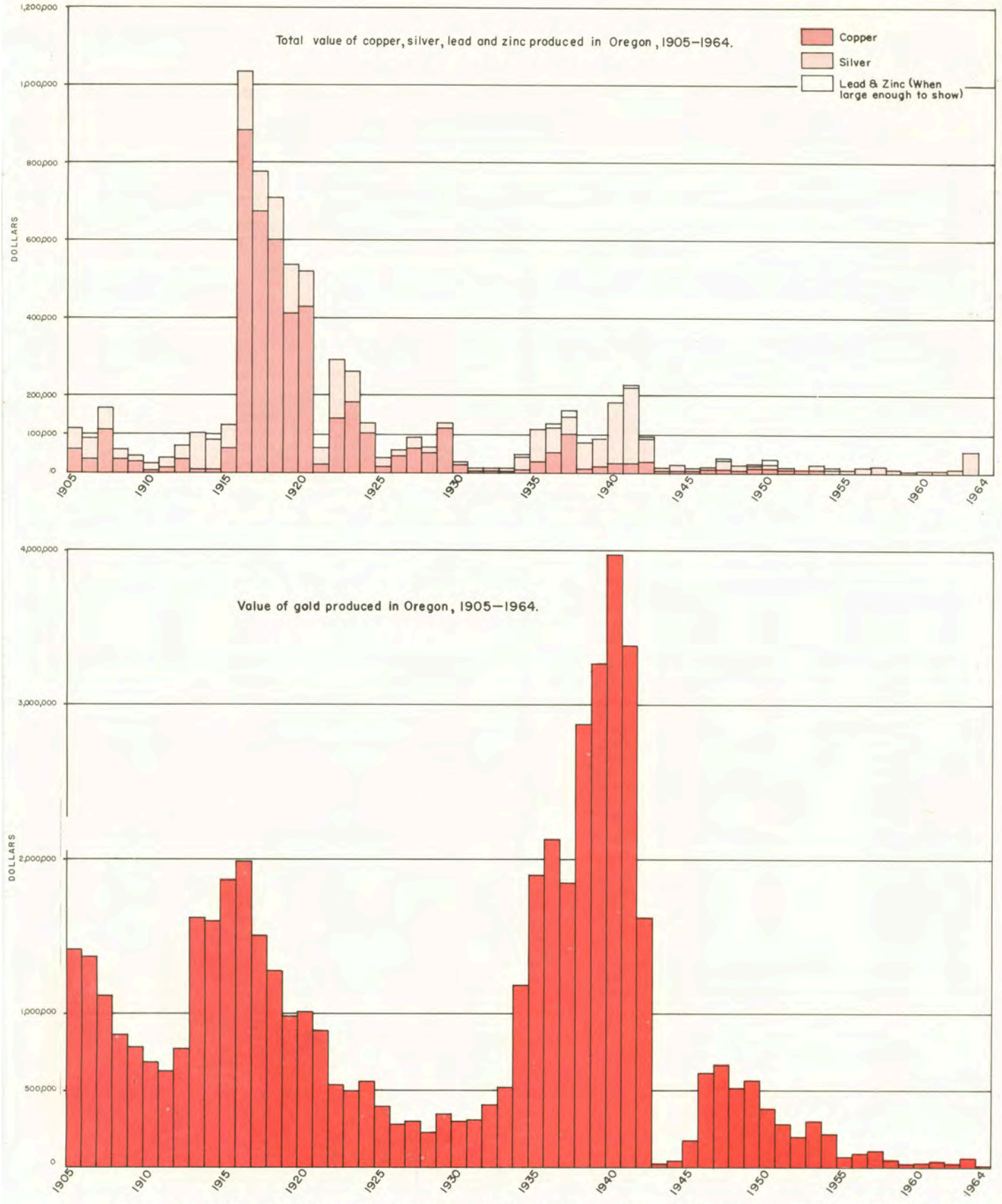


Figure 6. Value of gold compared with total value of copper, silver, lead, and zinc, 1905 - 1964.

TABLE 7A. PRODUCTION OF GOLD, SILVER, COPPER, AND LEAD, BAKER COUNTY, OREGON, 1902 - 1965.

From U.S.B.M. statistics.

	PLACER MINES					LODE MINES			
		Gold		Silver			Gold		
Year	No. of mines	Troy ounces	Value $	Troy ounces	Value $	Total placer value $	No. of mines	Short tons	Troy ounces	Value $
1902	24	5,814	$ 98,758	-	-	98,758	17	43,885	53,055	1,096,659
1903	36	4,036	83,440	20	$ 11	83,451	19	47,010	29,958	619,297
1904	23	2,508	51,855	7	4	51,859	31	69,973	35,748	738,973
1905	19	1,232	25,476	297	179	25,655	18	75,053	36,094	746,131
1906	29	1,638	33,859	376	252	34,111	22	58,889	32,014	661,794
1907	25	2,987	61,754	561	370	62,124	21	69,881	27,539	569,291
1908	29	1,857	38,397	409	217	38,614	21	38,413	22,713	469,532
1909	22	797	16,470	183	95	16,565	20	32,521	19,402	401,068
1910	13	545	11,276	117	63	11,339	25	56,263	18,853	389,726
1911	23	841	17,381	178	94	17,475	11	74,558	18,015	372,405
1912	26	1,830	37,834	574	353	38,187	23	70,631	21,585	446,207
1913	27	17,401	359,701	4,275	2,582	362,283	14	117,040	49,042	1,013,779
1914	19	17,874	369,482	4,450	2,461	371,943	12	97,722	45,689	944,485
1915	14	17,604	363,908	4,540	2,302	366,210	12	143,727	63,926	1,321,474
1916	14	32,028	662,075	8,076	5,314	667,389	12	144,129	47,337	978,551
1917	10	25,011	517,016	6,263	5,160	522,176	11	131,208	34,403	711,183
1918	22	15,073	311,589	3,125	3,125	314,714	20	118,960	33,769	698,067
1919	10	11,975	247,539	2,797	3,132	250,671	12	95,062	28,557	590,324
1920	8	16,432	339,684	3,849	4,196	343,880	9	80,243	26,640	550,696
1921	12	14,541	300,593	3,235	3,235	303,828	10	38,569	14,748	304,872
1922	36	9,195	190,089	2,148	2,148	192,237	18	24,350	6,414	132,599
1923	44	5,476	113,204	1,177	965	114,169	22	47,608	8,572	177,199
1924	17	8,817	182,255	1,511	1,012	183,267	12	37,239	6,869	141,997
1925	19	3,542	73,210	509	353	73,563	-	24,874	5,226	108,041
1926	24	1,341	27,714	320	200	27,914	17	12,950	2,315	47,850
1927	30	2,962	61,234	483	274	61,508	13	16,518	1,019	21,071
1928	17	206	4,255	39	23	4,278	9	3,111	346	7,153
1929	15	1,054	21,796	150	80	21,876	11	566	184	3,805
1930	12	395	8,171	79	30	8,201	10	4,907	592	12,231
1931	20	1,578	32,622	231	67	32,689	15	701	689	14,233
1932	32	2,098	43,377	384	108	43,485	15	767	711	14,691
1933	53	1,519	31,408	318	111	31,519	24	5,842	2,948	60,949
1934	65	4,570	159,730	797	515	160,245	25	37,376	6,895	240,968
1935	51	7,288	255,094	1,296	932	256,026	28	144,338	12,796	447,873
1936	28	10,110	353,850	2,239	1,734	355,584	26	88,494	12,700	444,500
1937	24	8,999	314,965	2,072	1,603	316,568	30	47,409	11,800	413,000
1938	29	14,301	500,535	3,247	2,099	502,634	23	51,339	22,478	786,730
1939	39	22,002	770,070	5,193	3,525	773,595	30	38,632	21,994	769,790
1940	36	21,206	742,210	4,848	3,447	745,657	26	55,941	26,446	925,610
1941	31	23,025	805,875	4,881	3,471	809,346	22	38,448	18,503	647,605
1942	11	16,455	575,925	3,811	2,710	578,635	11	6,623	2,731	95,585
1943	1	34	1,190	4	3	1,193	8	1,283	378	13,230
1944	-	27	945	4	3	948	5	2,488	468	16,380
1945	2	2,961	103,635	686	488	104,123	3	1,015	179	6,265
1946	6	9,540	333,900	2,133	1,723	335,623	5	2,579	176	6,160
1947	10	10,800	378,000	2,288	2,071	380,071	6	969	207	7,245
1948	5	8,019	280,665	1,717	1,554	282,219	8	1,187	345	12,075
1949	6	5,774	202,090	1,019	922	203,012	9	900	185	6,475
1950	9	5,981	209,335	1,190	1,077	210,412	10	1,029	397	13,895
1951	4	5,536	193,760	1,193	1,080	194,840	3	302	140	4,900
1952	6	4,630	162,050	1,058	957	163,007	2	420	61	2,135
1953	6	7,040	246,400	1,884	1,705	248,105	3	101	86	3,010
1954	5	4,790	167,650	1,262	1,142	168,792	7	710	374	13,090
1955	7	38	1,330	- -	- -	1,330	6	1,921	261	9,135
1956	2	108	3,780	21	19	3,799	8	545	201	7,035
1957	1	34	1,190	7	6	1,196	7	118	144	5,040
1958	3	W	W	W	W	W	W	W	W	W
1959	1	W	W	W	W	W	W	W	W	W
1960	8	W	W	W	W	W	W	W	W	W
1961	3	W	W	W	W	W	W	W	W	W
1962	4	63	2,205	2	2	2,207	2	60	101	3,535
1963	2	10	350	3	4	354	6	132	26	910
1964	2	W	W	W	W	W	W	W	W	W
1965	-	-	-	-	-	-	2	W	W	W
Total		423,753	$11,511,326	93,568	$ 71,339	$11,582,665			835,226	$19,274,879

(W) Indicates information withheld because of individual company data.

TABLE 7 A (CONTINUED)

LODE MINES

Silver		Copper		Lead		Total lode value $	Total value lode and placer	Year
Troy ounces	Value $	Pounds	Value $	Pounds	Value $			
37,387	18,721	-	-	-	-	1,115,380	1,214,138	1902
27,053	14,609	7,000	910	-	-	634,816	718,267	1903
76,467	44,351	1,800	232	8,121	290	783,846	835,705	1904
54,864	33,138	3,200	499	-	-	779,768	805,423	1905
53,332	35,732	185	36	-	-	697,562	731,673	1906
69,029	45,559	-	-	-	-	614,850	676,974	1907
17,086	9,056	-	-	-	-	478,588	517,202	1908
19,331	10,052	-	-	-	-	411,120	427,685	1909
29,718	16,048	13,861	1,760	-	-	407,534	418,873	1910
30,766	16,306	-	-	-	-	388,711	406,186	1911
38,566	23,718	951	157	-	-	470,082	508,269	1912
74,907	45,244	2,783	431	19,796	871	1,060,325	1,422,608	1913
53,817	29,761	692	92	11,179	436	974,774	1,346,717	1914
105,584	53,531	397,103	69,493	1,872	88	1,444,586	1,810,796	1915
205,407	135,158	2,631,727	647,405	-	-	1,761,114	2,428,503	1916
94,405	77,790	1,386,271	378,452	-	-	1,167,425	1,689,601	1917
87,260	87,260	1,655,319	408,864	7,663	544	1,194,735	1,509,449	1918
87,666	98,186	2,095,491	389,761	-	-	1,078,271	1,328,942	1919
72,580	79,112	2,355,276	433,371	-	-	1,063,179	1,407,059	1920
36,274	36,274	174,300	22,485	-	-	363,631	667,459	1921
140,434	140,434	1,041,196	140,561	75,694	4,163	417,757	609,994	1922
83,084	68,129	1,277,494	187,792	26,666	1,867	434,987	549,156	1923
25,070	16,797	761,141	99,709	-	-	258,503	441,770	1924
19,787	13,732	106,325	15,098	2,079	181	137,052	210,615	1925
8,741	5,454	234,578	32,841	-	-	86,145	114,059	1926
8,465	4,800	486,480	63,729	-	-	89,600	151,108	1927
1,373	803	71,841	10,345	-	-	18,301	22,579	1928
317	169	126	22	-	-	3,996	25,872	1929
781	301	-	-	-	-	12,532	20,733	1930
144	42	-	-	-	-	14,275	46,964	1931
628	177	-	-	-	-	14,868	58,353	1932
16,713	5,850	9,071	581	2,480	92	67,472	98,991	1933
37,040	23,945	26,150	2,092	517	19	267,024	427,269	1934
83,054	59,695	352,945	29,294	2,610	104	536,966	792,992	1935
49,136	38,056	442,000	38,824	14,000	644	522,024	877,608	1936
32,578	25,199	556,000	67,276	32,000	1,888	507,363	823,931	1937
83,750	54,141	74,000	7,252	42,000	1,932	850, 055	1,352,689	1938
84,043	57,047	92,000	9,568	18,000	846	837,251	1,610,846	1939
128,129	91,114	132,000	14,916	16,000	800	1,032,440	1,778,097	1940
79,165	56,295	88,000	10,384	14,000	798	715,082	1,524,428	1941
7,148	5,083	6,000	726	-	-	101,394	680,029	1942
672	478	6,300	819	-	-	14,527	15,720	1943
1,502	1,068	-	-	-	-	17,448	18,396	1944
927	659	-	-	-	-	6,924	111,047	1945
981	793	-	-	-	-	6,953	342,576	1946
1,590	1,439	-	-	-	-	8,684	388,755	1947
560	507	-	-	-	-	12,582	294,801	1948
1,861	1,684	400	79	-	-	8,238	211,250	1949
595	539	1,100	228	-	-	14,662	225,074	1950
524	474	400	97	-	-	5,471	200,311	1951
14	13	-	-	-	-	2,148	165,155	1952
12	11	-	-	-	-	3,021	251,126	1953
136	123	-	-	-	-	13,213	182,005	1954
171	155	700	261	-	-	9,551	10,881	1955
922	834	900	383	-	-	8,252	12,051	1956
317	287	-	-	-	-	5,327	6,523	1957
W	W	W	W	W	W	W	W	1958
W	W	W	W	W	W	W	W	1959
W	W	W	W	W	W	W	W	1960
W	W	W	W	W	W	W	2,861	1961
9	10	-	-	-	-	3,545	5,752	1962
7	9					919	1,273	1963
W	W	W	W	W	W	W	4,384	1964
W	W	-	-	-	-	W	W	1965
2,172,145	$1,586,196	16,318,806	$3,086,825	294,677	$15,563	$23,963,463	$35,546,128	

TABLE 7B. PRODUCTION OF GOLD, SILVER, COPPER, LEAD, AND ZINC IN GRANT COUNTY, OREGON, 1902-1965.

From U.S.B.M. statistics.

	PLACER MINES					LODE MINES			
		Gold		Silver			Gold		
Year	No. of mines	Troy ounces	Value $	Troy ounces	Value $	Total placer value $	No. of mines	Short tons	Troy ounces	Value $
1902	10	1,989.70	33,570	-	-	33,570	8	7,403	2,690.99	40,871
1903	8	819.52	16,941	-	-	16,941	12	11,576	4,129.92	85,372
1904	16	1,081.42	22,355	-	-	22,355	20	11,099	2,898.87	59,925
1905	13	1,163.76	24,057	262	158	24,215	11	12,662	3,105.14	64,189
1906	13	1,562.42	32,298	415	278	32,576	12	2,346	1,102.66	22,794
1907	12	741.93	15,337	164	108	15,445	10	9,058	3,159.27	65,308
1908	16	1,106.87	22,881	623	330	23,211	11	5,251	3,180.90	65,755
1909	11	531.45	10,986	131	68	11,054	16	7,058	1,467.79	30,342
1910	13	871.77	18,021	148	80	18,101	14	3,215	879.46	18,180
1911	13	573.20	11,849	94	50	11,899	8	4,382	1,233.19	25,492
1912	17	561.73	11,612	138	85	11,697	5	1,400	486.70	10,061
1913	17	399.19	8,252	68	41	8,293	3	23,711	2,679.98	55,400
1914	3	998.65	20,644	118	65	20,709	3	13,147	1,898.91	39,254
1915	3	66.23	1,369	14	7	1,376	2	1,864	235.97	4,878
1916	7	2,903.27	60,016	315	207	60,223	3	874	173.04	3,577
1917	5	5,685.22	117,524	518	427	117,951	1	4,600	976.98	20,196
1918	8	4,687.39	96,897	408	408	97,305	5	378	245.94	5,084
1919	6	2,929.68	60,562	306	343	60,905	5	360	190.26	3,933
1920	7	2,816.88	58,230	716	781	59,011	5	1,766	542.91	11,223
1921	10	4,771.52	98,636	525	525	99,161	2	900	463.09	9,573
1922	7	4,737.95	97,942	507	507	98,449	9	1,978	1,080.03	22,326
1923	14	6,283.92	129,900	657	539	130,439	16	1,581	1,348.22	27,870
1924	9	5,680.70	117,430	584	391	117,821	8	6,137	2,600.19	53,751
1925	10	3,753.41	77,590	401	278	77,868	10	1,210	1,645.58	34,017
1926	11	3,044.88	62,943	324	202	63,145	6	717	2,495.62	51,589
1927	24	3,777.80	78,094	400	227	78,321	5	9,836	3,621.11	74,855
1928	13	2,166.12	44,674	224	131	44,805	5	7,170	1,798.95	37,188
1929	14	1,855.46	38,356	245	131	38,487	5	3,410	1,688.09	34,896
1930	8	4,425.96	91,493	685	264	91,757	4	991	645.78	13,349
1931	8	2,571.94	53,167	332	96	53,263	6	549	588.11	12,157
1932	17	3,334.97	68,940	435	123	69,063	14	429	607.64	12,561
1933	25	1,446.98	29,912	215	75	29,987	16	887	442.07	9,138
1934	33	5,450.02	190,478	897	580	191,058	18	1,828	740.80	25,891
1935	41	9,308.61	325,801	1,134	815	326,616	17	4,302	1,466.56	51,330
1936	24	17,803.00	623,105	2,082	1,613	624,718	17	15,345	2,434.00	85,190
1937	23	10,187.00	356,545	1,255	971	357,516	15	8,928	1,663.00	58,205
1938	28	22,501.00	787,535	2,844	1,839	789,374	19	2,926	1,146.00	40,110
1939	32	26,648.00	932,680	3,955	2,685	935,365	17	11,222	6,008.00	210,280
1940	24	24,541.00	858,935	4,421	3,144	862,079	17	23,889	8,112.00	283,920
1941	21	17,383.00	608,405	3,610	2,567	610,972	14	31,788	11,522.00	403,270
1942	15	11,541.00	403,935	2,011	1,430	405,365	7	4,721	1,502.00	52,570
1943	4	32.00	1,120	4	3	1,123	-	-	-	-
1944	1	17	595	-	-	595	1	23	110	3,850
1945	1	830	29,050	75	53	29,103	-	-	-	-
1946	6	5,735	200,725	911	736	201,461	1	31	259	9,065
1947	11	3,834	134,190	834	755	134,945	2	623	W	W
1948	7	3,553	124,355	803	727	125,082	3	1,652	W	W
1949	7	8,369	292,915	1,648	1,492	294,407	2	1,049	W	W
1950	6	2,227	77,945	566	512	78,457	6	687	631	22,085
1951	1	1,262	44,170	514	465	44,635	2	422	W	W
1952	4	20	700	3	3	703	2	386	438	15,330
1953	3	64	2,240	12	11	2,251	3	1,113	1,069	37,415
1954	2	W	W	W	W	W	3	2,108	1,032	36,120
1955	-	-	-	-	-	-	5	1,869	1,132	39,620
1956	2	10	350	1	1	351	2	1,417	2,148	75,180
1957	1	1	35	1	1	36	3	2,079	2,566	89,810
1958	4	27	945	2	2	947	2	1,650	564	19,740
1959	2	40	1,400	7	6	1,406	-	-	-	-
1960	2	W	W	-	-	W	3	741	W	W
1961	3	14	490	1	1	491	3	402	W	W
1962	1	3	105	2	2	107	4	1,098	176	6,160
1963	2	W	W	W	W	W	2	1,430	W	W
1964	1	4	140	1	1	141	2	657	W	W
1965	1	W	W	-	-	W	2	1,159	W	W
TOTAL		250,787	7,632,767	37,573	27,348	7,660,115		283,490	98,817	2,723,035

W = Withheld because of company confidential data.

TABLE 7 B (CONTINUED)

LODE MINES

Silver		Copper		Lead		Zinc		Total lode	Total value (Lode and	
Troy ounces	Value $	Pounds	Value $	Pounds	Value $	Pounds	Value $	Value $	placer)	Year
76,837	40,076	-	-	-	-			80,947	114,517	1902
63,775	34,439	4,000	376	-	-			120,187	137,128	1903
50,718	29,417	4,710	590	500	20			89,952	112,307	1904
24,493	14,794	1,000	156	-	-			79,139	103,354	1905
3,304	2,214	42,886	8,277	-	-			33,285	65,861	1906
10,603	6,998	54,440	10,888	-	-			83,194	98,639	1907
17,364	9,203	583	67	-	-			75,025	98,236	1908
1,563	813	-	-	-	-			31,155	42,209	1909
2,174	1,174	-	-	-	-			19,354	37,455	1910
2,226	1,180	-	-	-	-			26,672	38,571	1911
446	274	-	-	-	-			10,335	22,032	1912
91,589	55,320	424	66	162	7			110,793	119,086	1913
68,438	37,846	406	54	154	6			77,160	97,869	1914
1,428	724	-	-	-	-			5,602	6,978	1915
1,284	845	1,204	296	-	-			4,718	64,941	1916
22,534	18,568	-	-	-	-			38,764	156,715	1917
12,618	12,618	-	-	-	-			17,702	115,007	1918
19,356	21,678	-	-	-	-			25,611	86,516	1919
5,270	5,745	-	-	-	-			16,968	75,979	1920
1,088	1,088	-	-	-	-			10,661	109,822	1921
6,164	6,164	4,724	638	-	-			29,128	127,577	1922
10,178	8,346	5,976	878	-	-			37,094	167,533	1923
10,274	6,884	947	124	513	41			60,800	178,621	1924
11,138	7,730	-	-	-	-			41,747	119,615	1925
15,415	9,619	2,566	359	11,273	902			62,469	125,614	1926
35,780	20,287	1,720	225	5,300	334			95,701	174,022	1927
25,306	14,804	1,422	205	13,246	768			52,965	97,770	1928
20,573	10,965	2,040	359	20,180	1,271			47,491	85,978	1929
4,835	1,861	502	65	6,053	303			15,578	107,335	1930
3,944	1,144	308	28	1,711	63			13,392	66,655	1931
2,120	598	111	7	1,211	36			13,202	82,265	1932
137	48	100	6	-	-			9,192	39,179	1933
1,206	780	2,838	227	689	25			26,923	217,981	1934
5,998	4,311	6,807	565	1,079	43			56,249	382,865	1935
17,732	13,733	-	-	-	-			98,923	723,641	1936
11,385	8,806	-	-	-	-			67,011	424,527	1937
7,090	4,583	2,000	196	2,000	92			44,981	834,355	1938
9,090	6,170	2,000	208	4,000	188			216,846	1,152,211	1939
53,197	37,829	10,000	1,130	28,000	1,400			324,279	1,186,358	1940
93,340	66,375	16,000	1,888	64,000	3,648			475,181	1,086,153	1941
2,925	2,080	4,000	484	-	-			55,134	460,499	1942
-	-	-	-	-	-			-	1,123	1943
900	640	-	-	-	-			4,490	5,085	1944
-	-	-	-	-	-			-	29,103	1945
821	663	-	-	-	-	-	-	9,728	211,189	1946
W	W	-	-	W	W	-	-	W	W	1947
W	W	W	W	W	W	-	-	W	W	1948
W	W	W	W	W	W	-	-	W	W	1949
4,391	3,974	700	146	4,300	581	1,000	142	26,928	105,385	1950
2,565	2,321	300	73	1,600	277	1,800	328	12,519	57,154	1951
2,570	2,326	400	97	1,900	306	2,000	332	18,391	19,094	1952
10,310	9,331	18,000	5,166	10,000	1,310	-	-	53,222	55,473	1953
12,879	11,656	10,000	2,950	10,000	1,370	-	-	52,096	52,764	1954
8,604	7,787	7,300	2,723	6,000	894	-	-	51,024	51,024	1955
12,554	11,362	3,500	1,487	10,000	1,570	-	-	89,599	89,950	1956
15,449	13,982	40,000	12,040	10,000	1,430	-	-	117,262	117,298	1957
2,473	2,238	20,000	5,260	2,000	234	-	-	27,472	28,419	1958
-	-	-	-	-	-	-	-	-	1,406	1959
W	W	W	W	-	-	-	-	W	W	1960
W	W	-	-	W	W	-	-	W	W	1961
2,478	2,689	600	185	1,600	147	-	-	9,181	9,288	1962
W	W	W	W	W	W	W	W	W	W	1963
W	W	W	W	W	W	W	W	W	W	1964
W	W	W	W	W	W	W	W	W	W	1965
937,908	637,933	328,614	75,715	260,071	23,659	17,300	2,461	3,462,803	11,122,918	

TABLE 7 C. PRODUCTION OF GOLD, SILVER, COPPER, AND LEAD IN JOSEPHINE COUNTY, OREGON, 1902 - 1965.

From U.S.B.M. statistics.

	PLACER MINES				LODE MINES								
	Gold		Silver		Gold		Silver		Copper		Lead		
Year	Troy ounces	Value $	Troy ounces	Value $	Troy ounces	Value $	Troy ounces	Value $	Pounds	Value $	Pounds	Value $	Total value $
1902	1,659.58	19,806	-	-	1,494.70	30,339	-	-	28,154	2,800	-	-	52,945
1903	8,837.78	182,758	46	22	7,768.35	160,506	23,894	12,903	14,000	1,563	-	-	357,752
1904	6,969.00	144,062	17	10	8,688.54	179,608	647	375	263,000	34,190	-	-	358,245
1905	5,872.23	121,390	793	479	9,179.25	189,752	3,494	2,110	842,615	131,447	-	-	445,178
1906	6,248.16	129,161	1,103	739	7,211.84	149,082	1,752	1,174	372,732	71,937	-	-	352,093
1907	5,866.10	121,263	894	590	1,906.22	39,405	806	532	499,664	99,933	-	-	261,723
1908	5,639.94	116,588	3,664	1,942	1,747.99	36,134	2,343	1,242	289,645	38,233	-	-	194,139
1909	5,158.37	106,633	663	345	2,049.36	42,364	981	510	235,000	30,550	-	-	180,402
1910	4,197.74	86,775	517	279	3,060.83	63,273	448	242	-	-	-	-	150,569
1911	4,187.20	86,557	441	234	619.49	12,806	9,995	5,297	82,808	10,351	-	-	115,245
1912	2,816.35	58,219	389	239	863.10	17,842	10,385	6,387	254,380	41,973	-	-	124,660
1913	1,992.86	41,196	273	165	365.13	7,548	187	113	32,558	5,046	6,928	305	54,373
1914	5,006.43	103,492	579	320	383.90	7,936	12,499	6,912	38,150	5,074	-	-	123,734
1915	3,400.71	70,299	578	293	715.13	14,783	3,470	1,759	53,663	9,391	52,617	2,473	98,998
1916	3,128.12	64,664	384	253	1,442.40	29,817	14,582	9,595	939,122	231,024	11,652	804	336,157
1917	2,381.12	49,222	208	171	1,195.97	24,723	67	55	1,087,216	296,810	-	-	370,981
1918	2,802.36	57,930	339	339	732.59	15,144	242	242	795,697	196,537	-	-	270,192
1919	2,037.41	42,117	305	341	50.07	1,035	151	169	118,501	22,041	-	-	65,703
1920	1,953.82	40,389	194	211	155.72	3,219	26	28	-	-	-	-	43,847
1921	2,301.78	47,582	301	301	3,789.51	78,336	169	169	-	-	-	-	126,388
1922	1,368.51	28,290	179	179	369.89	7,646	309	309	435	59	-	-	36,483
1923	609.91	12,608	88	72	197.04	4,073	18	15	-	-	-	-	16,768
1924	647.09	13,377	81	54	447.57	9,252	71	48	-	-	-	-	22,731
1925	851.42	17,600	89	62	2,041.71	42,206	245	170	-	-	-	-	60,038
1926	826.78	17,091	96	60	1,920.68	39,704	157	98	12,118	1,697	-	-	58,650
1927	1,460.99	30,201	184	104	1,070.34	22,126	328	186	-	-	-	-	52,617
1928	672.57	13,903	89	52	970.65	20,065	376	220	148,250	21,348	-	-	55,588
1929	1,271.13	26,277	139	74	1,211.99	25,054	1,018	543	464,393	81,733	-	-	133,681
1930	1,201.87	24,845	139	54	1,408.10	29,108	332	128	149,274	19,406	-	-	73,541
1931	2,241.10	46,328	289	84	1,298.35	26,839	336	97	-	-	-	-	73,348
1932	3,438.51	71,080	437	123	750.10	15,506	165	47	-	-	-	-	86,756
1933	3,602.78	74,476	462	162	793.01	16,393	188	66	100	6	1,048	39	91,142
1934	4,345.45	151,873	596	385	896.59	31,336	933	603	932	75	-	-	184,272
1935	9,283.59	324,926	880	633	732.04	25,621	141	101	167	14	50	2	351,297
1936	8,156.00	285,460	869	673	1,516.00	53,060	351	272	-	-	-	-	339,465
1937	9,759.00	341,565	971	751	1,591.00	55,685	565	437	4,000	484	-	-	398,922
1938	10,371.00	362,985	1,126	728	2,671.00	93,485	648	419	-	-	-	-	457,617
1939	3,499.00	122,465	379	257	3,098.00	108,430	424	288	-	-	-	-	231,440
1940	5,813.00	203,455	697	496	5,256.00	183,960	744	529	26,000	2,938	-	-	391,378

1941	3,435.00	120,225	389	277	4,215.00	147,525	502	357	16,000	1,888	-	-	270,273
1942	1,521.00	53,235	149	106	1,859.00	65,065	377	268	16,000	1,936	-	-	120,610
1943	81.00	2,835	10	7	-	-	-	-	-	-	-	-	2,842
1944	198.00	6,930	24	17	-	-	-	-	-	-	-	-	6,947
1945	119.00	4,165	14	10	14	490	5	4	-	-	-	-	4,669
1946	484.00	16,940	64	52	38	1,330	10	8	-	-	-	-	18,330
1947	369.00	12,915	48	43	16	560	4	4	-	-	-	-	13,522
1948	290.00	10,150	35	32	35	1,225	16	14	W	W	-	-	W
1949	205.00	7,175	22	20	36	1,260	30	27	5,800	1,142	-	-	9,624
1950	556.00	19,460	56	51	120	4,200	135	122	-	-	-	-	23,833
1951	244.00	8,540	31	28	28	980	35	32	8,700	2,105	-	-	11,685
1952	152.00	5,320	15	13	15	525	2	2	-	-	-	-	5,860
1953	74.00	2,590	8	7	-	-	-	-	-	-	-	-	2,597
1954	39.00	1,365	-	-	4	140	-	-	-	-	-	-	1,505
1955	67.00	2,345	2	2	2	70	-	-	-	-	-	-	2,417
1956	96.00	3,360	10	9	18	630	11	10	9,200	3,910	-	-	7,919
1957	71.00	2,485	9	8	7	245	20	18	6,000	1,806	-	-	4,562
1958	W	W	W	W	W	W	W	W	-	-	-	-	W
1959	W	W	W	W	W	W	W	W	-	-	-	-	W
1960	W	W	W	W	W	W	W	W	6,000	1,926	-	-	W
1961	W	W	W	W	W	W	-	-	-	-	-	-	W
1962	W	W	W	W	W	W	W	W	-	-	-	-	W
1963	W	W	W	W	W	W	-	-	-	-	-	-	W
1964	W	W	W	W	-	-	-	-	-	-	-	-	W
1965	W	W	W	W	W	W	W	W	-	-	-	-	W
Total	162,389.76	4,226,363	20,694	13,294	88,140.15	2,140,351	94,665	55,286	6,822,274	1,371,807	72,295	3,623	7,811,225

W = Withheld because of company confidential data.

TABLE 7 D. PRODUCTION OF GOLD, SILVER, COPPER, AND LEAD IN JACKSON COUNTY, OREGON, 1902 - 1965.

From U.S.B.M. statistics.

	Placer Mines					Lode Mines								
	Gold		Silver		Tons	Gold		Silver		Copper		Lead		Tot
Year	Ounces	Value $	Ounces	Value $	ore	Ounces	Value $	Ounces	Value $	Pounds	Value $	Pounds	Value $	valu
1902	6,565	111,631	-	-	2,200	2,327	48,103	3	2	-	-	-	-	$159,73
1903	4,961	102,558	-	-	1,719	988	20,421	20	11	-	-	-	-	122,99
1904	4,121	85,208	36	21	1,310	1,129	23,345	120	70	-	-	-	-	108,64
1905	2,148	44,403	356	215	5,919	2,210	45,697	541	327	-	-	-	-	90,64
1906	6,342	131,094	1,118	749	9,644	2,296	47,467	2,051	1,374	-	-	-	-	180,68
1907	5,181	107,099	944	623	14,923	3,502	72,391	2,324	1,534	-	-	-	-	181,64
1908	2,517	52,043	769	408	3,293	720	14,890	585	310	-	-	-	-	67,65
1909	3,416	70,612	927	482	5,329	1,432	29,606	1,011	526	-	-	400	17	101,24
1910	1,835	37,296	298	161	63	220	4,540	780	421	-	-	-	-	42,41
1911	1,245	25,740	293	155	8,980	1,006	20,787	464	246	-	-	-	-	46,92
1912	2,094	43,284	361	222	3,375	953	19,701	1,088	669	-	-	3,532	159	64,03
1913	1,065	22,031	182	110	922	721	14,905	975	589	-	-	433	19	37,65
1914	1,633	33,752	231	128	265	278	5,754	40	22	-	-	5,103	199	39,85
1915	1,216	25,150	221	112	315	244	5,051	546	277	-	-	2,489	117	30,70
1916	1,765	36,491	220	145	2,306	313	6,478	21	14	-	-	-	-	43,12
1917	839	17,353	87	72	20	17	351	2	2	-	-	-	-	17,77
1918	1,093	22,594	176	176	1,810	1,296	26,790	419	419	-	-	1,576	112	50,09
1919	1,292	26,715	239	267	86	41	848	163	183	823	153	-	-	28,16
1920	405	8,374	67	73	13	5	105	1	1	-	-	-	-	8,55
1921	1,152	23,813	143	143	451	411	8,496	43	43	-	-	-	-	32,49
1922	1,049	21,679	133	133	43	187	3,862	44	44	-	-	-	-	25,71
1923	673	13,906	94	77	718	322	6,656	302	248	-	-	155	11	20,89
1924	404	8,344	73	49	98	163	3,371	28	19	-	-	-	-	11,78
1925	401	8,286	58	40	779	815	16,859	350	243	-	-	3,533	307	25,73
1926	425	8,792	64	40	160	105	2,178	19	12	-	-	-	-	11,02
1927	543	11,229	71	40	60	39	800	8	5	-	-	-	-	12,07
1928	2,689	55,585	412	241	88	51	1,051	203	119	-	-	-	-	56,99
1929	7,596	157,025	1,210	645	48	76	1,572	19	10	-	-	-	-	159,25
1930	4,250	87,848	662	255	271	1,111	22,976	257	99	-	-	-	-	111,17
1931	3,687	76,224	516	150	356	897	18,535	386	112	-	-	1,786	66	95,08
1932	6,419	132,685	870	245	1,352	719	14,857	410	116	-	-	692	21	147,92
1933	6,941	143,481	1,000	350	2,581	702	14,518	952	333	-	-	926	34	158,71
1934	6,627	231,613	1,107	716	12,789	1,527	53,367	2,172	1,404	2,213	177	535	20	287,29
1935	5,766	201,819	586	421	25,358	3,746	131,103	5,091	3,659	4,918	408	1,920	77	337,48
1936	2,690	94,150	374	290	17,222	2,597	90,895	3,312	2,565	-	-	4,000	184	188,08
1937	4,799	167,965	668	517	2,301	861	30,135	533	412	-	-	2,000	118	199,14
1938	6,434	225,190	991	641	2,587	940	32,900	687	444	-	-	2,000	92	259,26
1939	7,651	267,785	946	642	2,743	1,119	39,165	859	583	-	-	2,000	94	308,26
1940	15,729	550,515	2,354	1,674	3,159	1,530	53,550	1,152	819	-	-	8,000	400	606,95
1941	14,789	517,615	2,014	1,432	2,227	909	31,815	900	640	-	-	6,000	342	551,84
1942	8,423	294,805	1,104	785	524	354	12,390	232	165	-	-	2,000	134	308,27
1943 *	W	W	W	W	W	W	W	W	W	-	-	W	W	W
1944	48	1,680	10	7	30	117	4,095	31	22	-	-	-	-	5,80
1945	76	2,660	14	10	1	59	2,065	10	7	-	-	-	-	4,74
1946	518	18,130	74	60	61	76	2,660	15	12	-	-	-	-	20,86
1947	1,781	62,335	227	205	59	12	420	1	1	-	-	-	-	62,96
1948	290	10,150	43	39	107	121	4,235	23	21	-	-	-	-	14,44
1949	96	3,360	16	14	55	76	2,660	14	13	-	-	-	-	6,04
1950	221	7,735	35	31	28	21	735	4	4	-	-	-	-	8,50
1951	76	2,660	12	11	106	16	560	6	5	-	-	-	-	3,23
1952	40	1,400	4	4	11	12	420	3	3	-	-	-	-	1,82
1953	108	3,780	22	20	*	W	W	W	W	-	-	-	-	W
1954	104	3,640	18	16	31	90	3,150	26	24	-	-	-	-	6,83
1955	56	1,960	9	8	43	110	3,850	20	18	-	-	-	-	5,83
1956	104	3,640	15	14	3	17	595	3	3	-	-	-	-	4,25
1957	60	2,100	8	7	200	473	16,555	108	98	-	-	-	-	18,76
1958	69	2,415	8	7	120	239	8,365	54	49	-	-	-	-	10,83
1959	51	1,785	9	8	255	150	5,250	35	32	-	-	-	-	7,07
1960	W	W	8	7	320	W	W	-	-	-	-	-	-	98
1961	63	W	W	W	113	W	W	55	51	W	W	-	-	11,98
1962	W	W	W	W	406	W	W	W	W	18,700	5,760	-	-	7,93
1963	53	1,855	4	5	141	27	945	13	17	-	-	W	W	2,83
1964	W	W	W	W	4	W	W	W	W	-	-	-	-	2,11
1965	-	-	-	-	21	34	1,190	8	10	-	-	-	-	1,20
Total	162,790	4,440,982	22,538	14,144	140,581	41,232	1,080,636	29,672	19,589	34,654	8,898	49,380	2,549	5,566,79

W = Withheld because of company confidential data.

* Less than one-half ton.

TABLE 7 E. PRODUCTION OF GOLD, SILVER, COPPER, LEAD, AND ZINC IN LANE COUNTY, OREGON, 1902 - 1965. *

Year	Gold		Silver		Copper		Lead		Zinc		Total value $
	Ounces	Value $	Ounces	Value $	Pounds	Value $	Pounds	Value $	Pounds	Value $	
1902	2,419	50,004	1,007	503	-	-	-	-	-	-	50,507
1903	1,105	31,115	1,019	535	-	-	-	-	-	-	31,650
1904	2,419	50,000	-	-	-	-	-	-	-	-	50,000
1905	4,395	90,844	2,814	1,319	-	-	-	-	-	-	92,163
1906	4,066	84,046	13,833	9,268	-	-	-	-	-	-	93,314
1907	1,846	38,158	727	480	-	-	-	-	-	-	38,638
1908	42	876	143	76	629	83	2,138	90	-	-	1,125
1909	686	14,172	1,335	694	-	-	-	-	-	-	14,866
1910	196	4,054	67	36	-	-	-	-	-	-	4,090
1911	1,459	30,154	466	247	-	-	-	-	-	-	30,401
1912	2,411	49,834	1,655	1,018	5,098	841	35,785	1,610	-	-	53,303
1913	343	7,098	1,820	1,099	7,565	1,173	59,204	2,605	-	-	11,975
1914	127	2,627	9	5	-	-	-	-	-	-	2,632
1915	470	9,718	57	29	406	71	5,979	281	-	-	10,099
1916	160	3,307	128	84	1,390	342	16,348	1,128	-	-	4,861
1917	96	1,984	328	270	-	-	-	-	-	-	2,254
1918	51	1,054	93	93	-	-	1,362	97	-	-	1,244
1919	-	-	-	-	-	-	-	-	-	-	-
1920	-	-	-	-	-	-	-	-	-	-	-
1921	48	991	232	232	-	-	-	-	-	-	1,223
1922	-	-	-	-	-	-	-	-	-	-	-
1923	W	W	W	W	W	W	-	-	-	-	W
1924	97	2,006	46	31	-	-	-	-	-	-	2,037
1925	63	1,312	29	20	-	-	-	-	-	-	1,332
1926	82	1,689	28	17	-	-	-	-	-	-	1,706
1927	-	-	-	-	-	-	-	-	-	-	-
1928	64	1,318	29	17	-	-	-	-	-	-	1,335
1929	15	303	9	5	-	-	-	-	-	-	308
1930	20	405	8	3	-	-	-	-	-	-	408
1931	271	5,594	120	35	-	-	-	-	-	-	5,629
1932	280	5,797	182	51	125	8	1,361	41	-	-	5,897
1933	W	W	W	W	W	W	-	-	-	-	W
1934	910	31,792	655	423	3,850	308	11,800	437	-	-	32,960
1935	1,857	65,007	4,440	3,191	28,541	2,369	48,106	1,924	-	-	72,491
1936	1,807	63,245	4,476	3,467	34,000	3,128	140,000	6,440	122,000	6,100	82,380
1937	2,292	80,220	4,853	3,754	28,000	3,388	184,000	10,856	48,000	3,120	101,338
1938	15	525	9	6	-	-	-	-	-	-	531
1939	259	9,065	337	229	2,000	208	6,000	282	-	-	9,784
1940	13	455	2,638	1,876	2,000	226	-	-	-	-	2,557
1941	23	805	1,620	1,152	2,000	236	-	-	-	-	2,193
1942	W	W	W	W	W	W	W	W	-	-	W
1943	-	-	-	-	-	-	-	-	-	-	-
1944	-	-	-	-	-	-	-	-	-	-	-
1945	W	W	W	W	W	W	W	W	W	W	W
1946	454	15,890	838	677	4,000	648	4,000	436	-	-	17,651
1947	361	12,635	1,802	1,631	20,000	4,200	6,000	864	2,000	242	19,572
1948	-	-	-	-	-	-	-	-	-	-	-
1949	717	25,095	3,853	3,487	33,000	6,501	17,400	2,749	12,000	1,488	39,320
1950	810	28,350	4,688	4,243	35,500	7,384	28,500	3,847	41,000	5,822	49,646
1951	272	9,520	1,320	1,195	12,600	3,049	2,400	415	4,200	764	14,943
1952	83	2,905	362	327	1,600	387	100	16	-	-	3,635
1953-57	-	-	-	-	-	-	-	-	-	-	-
1958	W	W	W	W	-	-	-	-	-	-	W
1959	-	-	-	-	-	-	-	-	-	-	-
1960	W	W	W	W	-	-	-	-	-	-	W
1961	W	W	W	W	-	-	W	W	W	W	W
1962	W	W	W	W	W	W	W	W	-	-	W
1963-65	-	-	-	-	-	-	-	-	-	-	-
Total	34,624	884,326	71,820	51,681	393,059	55,424	605,883	36,807	237,200	18,456	1,046,694

W = Withheld because of company confidential data.

* From U.S.B.M. statistics.

TABLE 7F. PRODUCTION OF GOLD, SILVER, AND COPPER IN MALHEUR COUNTY, OREGON, 1902 - 1965.*

From U.S.B.M. statistics

Year	Gold		Silver		Total value $
	Ounces	Value $	Ounces	Value $	
1902	1,715	31,255	-	-	31,255
1903	1,414	29,227	-	-	29,227
1904	1,116	23,069	17	10	23,079
1905	895	18,495	133	80	18,575
1906	687	14,207	121	81	14,288
1907	925	19,127	132	87	19,214
1908	711	14,699	96	51	14,750
1909	2,049	42,353	1,540	801	43,154
1910	1,513	31,274	1,574	850	32,124
1911	684	14,133	126	67	15,491
1912	2,101	43,430	407	250	43,680
1913	3,969	82,041	3,355	2,026	84,067
1914	2,421	50,052	2,279	1,260	51,312
1915	1,627	33,639	1,377	698	34,337
1916	691	14,276	71	47	14,323
1917	92	1,892	13	11	1,903
1918	46	947	6	6	953
1919	62	1,285	12	13	1,298
1920	10	200	2	2	202
1921	165	3,410	40	40	3,450
1922	461	9,536	96	96	9,632
1923	250	5,159	65	53	5,212
1924	398	8,224	112	75	8,299
1925	161	3,336	84	58	3,394
1926	401	8,288	343	214	8,502
1927	63	1,306	99	56	1,362
1928	52	1,076	8	5	1,081
1929	109	2,262	21	11	2,273
1930	-	-	-	-	-
1931	768	15,884	166	48	15,932
1932	384	7,930	71	20	7,950
1933	189	3,898	29	10	3,908
1934	268	9,353	174	112	9,465
1935	117	4,105	18	13	4,118
1936	61	2,135	11	9	2,144
1937	67	2,345	12	9	2,354
1938	146	5,110	27	17	5,127
1939	291	10,185	38	26	10,211
1940	1,658	58,030	311	221	58,251
1941	1,130	39,550	177	126	39,676
1942	247	8,645	38	27	8,672
1943	-	-	-	-	-
1944	-	-	-	-	-
1945	-	-	-	-	-
1946	W	W	6	W	W
1947	W	W	W	W	W
1948	357	12,495	59	53	12,548
1949	5	175	1	1	176
1950	8	280	2	2	282
1951	8	280	2	2	282
1952	-	-	-	-	-
1953	W	W	-	-	W
1954-55	-	-	-	-	-
1956	9	315	2	2	317
1957	10	350	2	2	352
1958	W	W	W	W	W
1959	W	W	W	W	W
1960	W	W	-	-	W
1961	W	W	W	W	W
1962	W	W	W	W	W
1963	W	W	W	W	W
1964	-	-	-	-	-
1965	W	W	W	W	W
Total	31,827	735,323	13,669	8,025	744,639

* Only copper production was in 1911 - 10,328 pounds valued at $1,291.
W = Withheld because of company confidential data.

History

Mining of placer gold deposits began in southwestern Oregon in 1850 and in northeastern Oregon in 1862. These principal gold-mining regions of Oregon owe their discovery to the wave of prospectors that invaded California in 1849 and from there spread through all the mountain areas of the West, following the constantly shifting centers of excitement. Many of the virgin placers were very rich and the first few years after discovery mark the high point of Oregon gold production.

The thoroughness of the early search for gold in Oregon is attested to by the fact that by 1865 placer deposits were being worked in nearly all the districts of prominence known today. No doubt many of the lode deposits were discovered during these early days, but the comparative difficulty of exploitation made the miners reluctant to abandon the easy pickings provided by the placers, and so the development of lode mining was much slower. Despite this, the initial development of most of the important lode mines in the state dates back at least to the 1880's.

Because of the great influx of miners, the better placer diggings were depleted within a few years, and a marked decline in output began with production dropping from possibly as much as $19,000,000 in 1865 to less than a million annually during 1882-1888. Lode mining then began to develop rapidly, pushing output to above $2 million in 1891 and 1894. From then until 1921 lode mines were the chief source of Oregon gold. Combined lode and placer output for 1891-1907 averaged $1.6 million annually. In 1904 production was made by 84 lode mines and 211 placers. Between 1908 and 1912 inclusive, the combined annual value of gold and silver for the state again fell below the million-dollar mark, mainly as a result of a decline in lode-mine production.

Placer mining in Oregon was done largely with hand-operated equipment until early in the present century, when dredges came into use. The first floating bucketline dredge known to have been employed in the state was operating on Burnt River near Durkee in northeastern Oregon at the time of Lindgren's visit in 1900. In southwestern Oregon a steam-powered dredge began operations on Foots Creek in 1903. It was converted to electric power in 1905. In 1913 the first of several large-scale dredges began work in Sumpter Valley, the largest dredge field in the state. Placer output for the state that year more than doubled the 1912 production, the increase being due almost entirely to the introduction of the dredge. Placer output nearly doubled again in 1916, when dredging began at John Day. The apparent success and scale of these operations stimulated use of mechanized equipment for placer mining elsewhere and by 1921 placer-mine output again began to exceed that of lode mines and continued to do so until 1954.

The general prosperity of the 1920's provided an economic climate unfavorable for gold mining and Oregon production declined sharply. The great depression which began in 1929 brought labor and materials costs back into line with gold prices; then when gold was revalued at $35 per ounce in 1934 the industry flourished. Output for the seven years, 1935-1941, averaged about $3,000,000 per year. The 1940 gold and silver production was valued at $4,124,883, the highest figure since the heyday of placer mining in the 1860's.

In 1940 output was made by 112 lode mines and 192 placer mines. Of the latter, 29 were operated by floating dredges and 29 used non-floating mechanized washing plants. Sixty-two percent of the total output for 1940 was produced by 10 different properties. In the order of their productive rank these were: Cornucopia Gold Mines, Inc. (lode); Sumpter Valley Dredging Co. (connected bucket dredge); Northwest Development Co. (dragline dredge); Porter & Co. (connected bucket dredge); Cougar-Independence Lessees (lode); Murphy-Murray Dredging Co. (connected bucket dredge); Ferris Mining Co. (dragline dredge); Lewis Investment Co. (lode); Timms Gold Dredging Co. (connected bucket dredge); and the B-H Co. (dragline dredge).

With the curtailment of gold mining brought about by War Production Board Order L-208 in 1942, Oregon gold production virtually ceased. Output in 1943 totaled 1,097 ounces gold and 10,523 ounces silver having a combined value of $55,400.

Oregon gold production reached its post-war high in 1947 of 18,979 ounces, only 17 percent of the 1940 output. Ninety-three percent of this came from placer mines. Since 1947, production has followed a generally diminishing trend and in 1965 totaled a mere 499 ounces.

Total gold output for the 21 years since the end of World War II (1945-1965) is only 126,999 ounces, 78 percent of which was produced from placer-mine operations and was mainly from dredges in northeastern Oregon during 1945-1954. The largest part of this came from the Sumpter Valley dredge, which resumed

operations in 1945 and continued almost without interruption through September 1954. Next in rank was the Porter & Co. dredge working in Clear, Olive, and Crane Creeks west of Granite from 1946 through early 1951. Since the shut-down of the Sumpter Valley dredge in 1954, output from placer mines has averaged little more than 400 ounces per year from small, periodic operations.

Very few lode mines have been operated since World War II and only one has any consistent record of production. Of the 23,800 ounces of gold produced from lode mines during 1945-1965, more than 60 percent came from the Buffalo mine in the Granite district of Grant County. Output from this mine has been small since 1958.

In 1940, lode mines in Oregon produced 41,825 ounces of gold. The greatest output of lode gold for a single year since World War II was 3,202 ounces in 1957, of which 91 percent was from the Buffalo. Lode mines produced 264,953 ounces of silver in 1941. The largest output since was 58,172 ounces in 1963. Most of the latter came from the then newly reopened Oregon King mine near Ashwood in Jefferson County. Activity at this mine dwindled in 1964 and ceased the following year.

Future

Oregon's gold-mining industry has been nearly defunct for several years, mainly because the price of gold has remained fixed at a point set in 1934 while operating costs have soared. Government legislation to raise the price of gold or to subsidize gold mining could revitalize this very important basic industry. Such legislation may eventually become inevitable, because of our continual loss of monetary gold in international trade and our need for gold to back the ever-increasing amount of currency required to serve our expanding population.

It seems probable that the larger placer deposits of the state, particularly dredgeable areas, are for the most part worked out or so seriously depleted that under any price structure that can reasonably be anticipated for the future, placer mining cannot be expected to resume its pre-war importance. On the other hand, there are many lode deposits in the state that have not been fully investigated. Few productive deposits have been developed to depths of 1,000 feet below surface croppings and the workings of many mines open only small portions of potentially ore-bearing zones. Of particular significance are the facts that there are a great number of old mines and little-developed prospects in the northeastern and southwestern parts of the state and that most of these deposits are grouped together in zones of interrelated fracturing and widespread mineralization. Explorations for gold within these zones have, in the past, been largely confined to the investigation of narrow, well-defined veins found initially by the prospector with a gold pan. The recent improvements in geochemical and geophysical equipment for prospecting make possible the investigation of intervening areas for buried deposits or for zones of low-grade mineralization that would be amenable to large-scale open-pit mining.

Unfortunately, the important workings of nearly all of Oregon's lode gold mines are now caved or inaccessible. Consequently, the search for new ore will require costly rehabilitation or driving of new accessways into deeper or lateral portions of previously worked ore bodies. At some mines important information can be acquired by drilling from the surface or from accessible undergound stations, but this is at best only a preliminary step in the development of ore bodies and must, where warranted, be followed by underground work.

Whatever the potential for future developments might be, the fact remains that until something occurs to narrow the gap greatly between the fixed price of gold on the one hand and the increasing cost of labor and materials on the other, or until large, low-grade deposits amenable to open-pit mining are found, Oregon gold output must be expected to remain very small.

OCCURRENCE OF GOLD AND SILVER IN OREGON

Geology and distribution

Gold and silver deposits occur in many parts of Oregon (figure 7), but most of the production has come from mines in the Blue Mountains in the northeastern part of the state and from the Klamath Mountains in the southwestern part (figure 8). In these widely separated areas folded, faulted, and

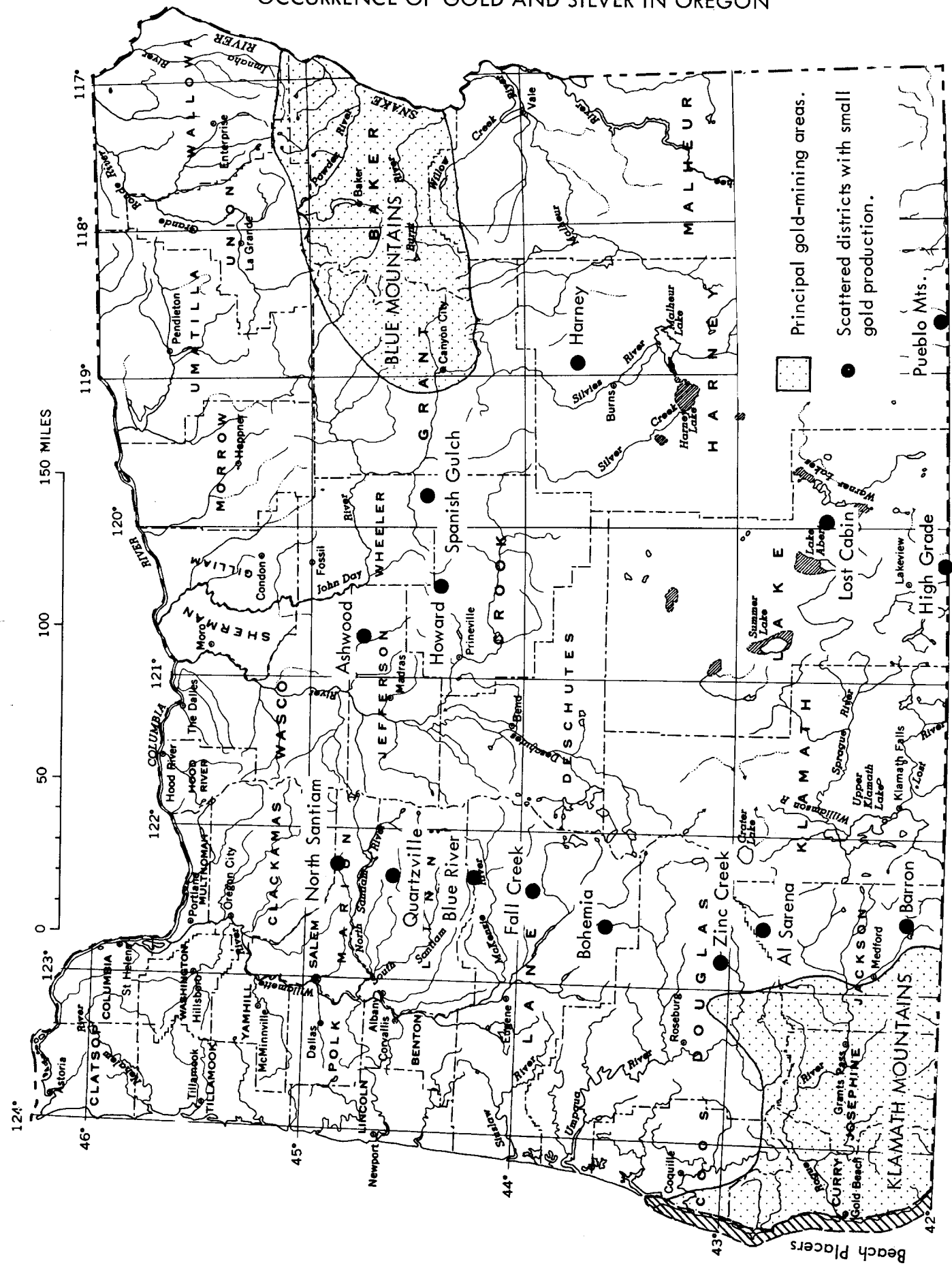


Figure 7. Index map showing distribution of gold-producing areas in Oregon.

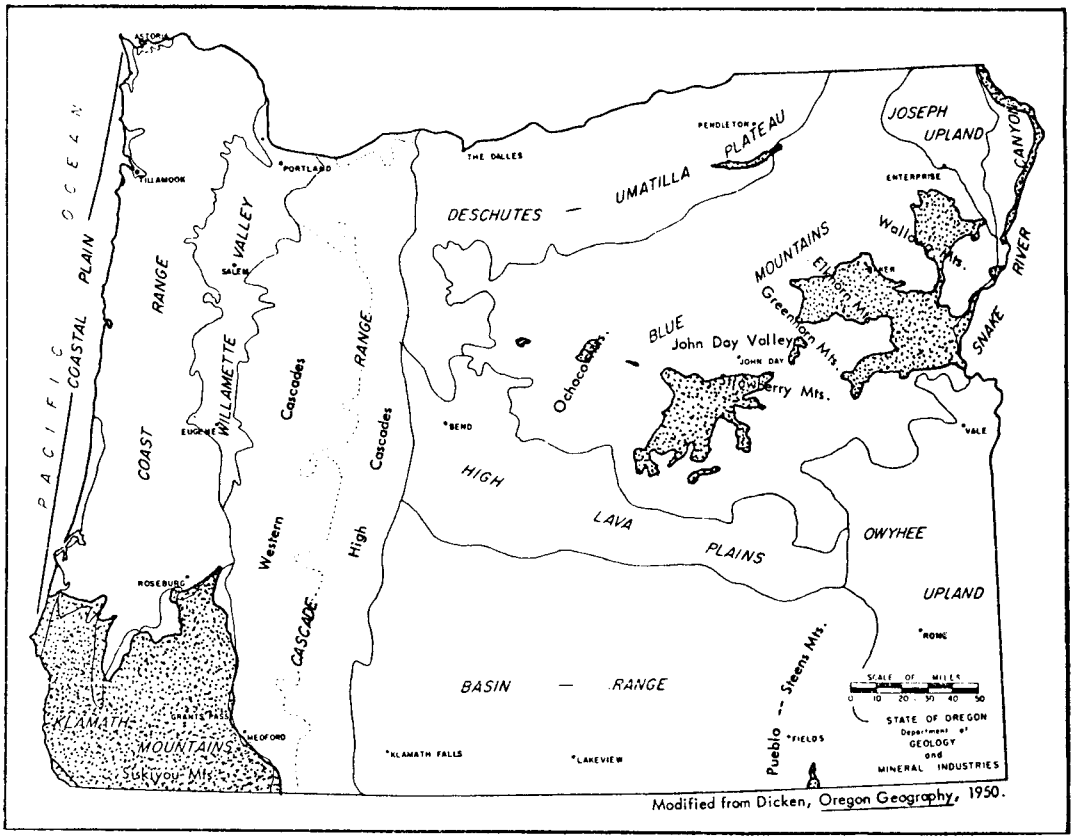
metamorphosed sedimentary, volcanic, and intrusive rocks of pre-Late Jurassic age have been invaded by Late Jurassic-Early Cretaceous granitic rocks. Lode deposits are clustered in certain areas along the edges of the granitic intrusives and occur both in the intrusive bodies and in the older invaded rocks. Placer gravels in and near the lode-mining areas have yielded more than half of the gold produced in Oregon.

A few gold prospects occur in pre-Tertiary rocks in the Pueblo Mountains in southern Harney County and in the Spanish Gulch area of Wheeler County (figures 7 and 8).

Other gold deposits shown on figure 7 are contained in Cenozoic volcanic and sedimentary rocks, and most appear to be related to small intrusive bodies of Tertiary age. Deposits in eastern Oregon include those of the Ashwood district in Jefferson County, the Harney district in Harney County, the High Grade and Lost Cabin districts in Lake County, and the Howard district in Crook County. Deposits in western Oregon occur in volcanic rocks of the Western Cascades. Mineralized areas in this province are, from north to south, the North Santiam, Quartzville, Blue River, Fall Creek and Bohemia districts in Marion, Linn, Lane, and Douglas Counties, and scattered occurrences in Douglas and Jackson Counties.

Mineralogy

Gold occurs chiefly as the native metal. In ores it is often in particles too small to be seen with the unaided eye. Silver is always alloyed with the gold and many primary deposits also contain silver sulfides, the most common of which are freibergite, pyrargyrite, stephanite, argentite, and argentiferous galena. Tellurides are rare. Petzite and hessite occur in the ores of the Cornucopia district and at a few other places in northeastern Oregon. Petzite is also one of the ore minerals of the Bunker Hill mine in



Modified from Dicken, Oregon Geography, 1950.

Figure 8. Geomorphic provinces and distribution of pre-Tertiary rocks (stippled).

the Galice district of southwestern Oregon.

The chief gangue mineral is quartz, which is nearly always accompanied by a little calcite. More rarely calcite predominates. Except in near-surface oxidized portions of gold veins, sulfide minerals are usually present. Pyrite generally predominates, although arsenopyrite is common and is the more abundant sulfide mineral in some deposits. The sulfides of copper, lead, and zinc are contained in many gold-silver ores and antimony sulfides are occasionally present. Cobalt minerals occur in several of the gold deposits in the Quartzburg district in Grant County.

In its ores, gold may occur as discrete particles or it may occur in a finely divided state intermixed with sulfide minerals. If the gold particles can be separated from associated gangue by simple grinding and amalgamation, it is said to be "free milling." When intimately mixed with sulfides which must be roasted or smelted before separation of the gold is accomplished, the ore is generally referred to as "sulfide" or "base" ore.

The ratio of gold to silver varies widely from one deposit to the other, but few deposits contain one of these metals to the total exclusion of the other. Silver often exceeds gold in quantity, but rarely in sufficient amount to supersede it in value because of the wide difference in the price of the two metals. Notable exceptions include the Oregon King mine in Jefferson County, where the ratio of silver to gold was as much as 100 to 1 in some portions of the ore body, and the Bay Horse silver mine in Baker County, where the ores contain almost no gold. The purest bullion from Oregon mines of significant size came from the Virtue mine in the northeastern part of the state, where the gold averaged more than 920 fine. (Fineness defines the proportion of gold or silver in bullion or coin expressed in parts per thousand.) Bullion shipments from the Columbia mine, several miles west of the Virtue, averaged 518 fine gold. Placer gold usually contains 10 to 20 percent silver.

Nature and origin of gold deposits

Most of Oregon's gold and silver output has been from narrow vein (lode) deposits valued mainly for these two metals and from placers derived from them by erosion. Deposits amenable to large-scale, open-pit mining, such as recently developed in Nevada, have not yet been found.

Gold-bearing veins are rarely uniform in value and many are too small or contain insufficient values to sustain a profitable mining operation. Portions of veins that contain valuable minerals in minable quantity are termed "ore shoots" or "ore bodies." Although some ore bodies have been mined continuously along the strike for many hundreds of feet, most are interrupted at intervals by zones too lean to pay for mining. In Oregon's gold deposits, ore shoots vary considerably in width as a result of pinching and swelling. Few attain minable widths of more than 10 feet and most average less than 4 feet.

Lode deposits: The majority of the primary gold-silver deposits were formed in and along fissures in the earth's crust which provided conduits for mineral-rich hot waters or vapors migrating upward from deep-seated igneous sources. Because the gold-silver deposits are generally clustered along the edges of acid to intermediate intrusive rocks, it appears likely that the metallizing fluids originated during late stages of the igneous activity and that the deposits were formed shortly after emplacement of the intrusives. Because the intrusive rocks solidified at considerable depths, deposits that formed from accompanying mineralizing fluids have since been exposed at the surface only as the result of long periods of uplift and erosion. Some ore bodies may have been partly or wholly destroyed by erosion; others may still exist along the edge of granitic masses hidden far below the earth's surface.

In most, if not all, important lode-gold districts the workable deposits are closely related to zones fractured by folding, faulting, or shearing. Such zones of broken rock provide the channelways or conduits for the circulation of mineralizing solutions and the openings in which deposition takes place. Ore deposits occur as fissure veins and replacement veins. In the former, deposition of the ore and gangue minerals was confined mainly within the fissure openings. Replacement veins were developed by substitution of ore and gangue minerals for minerals of the rocks along the fissures. Many deposits show evidence of both processes of mineralization.

Certain wall rocks are more susceptible to replacement by mineralizing solutions than others, and as the vein passes from one formation to another the width and grade of ore may change, or the ore may spread

out along a favorable contact. Ore bodies are often richer and wider in brittle, easily shattered rocks.

Where the ore-forming solutions followed clear-cut fissures, the resulting veins are likely to be massive, well defined, tabular bodies with fairly constant strike and dip. In more intensely broken zones through which the solutions spread widely by way of a broad, interconnected series of openings, the resulting deposits commonly comprise a network of small veins and stringers interspersed through shattered and often highly silicified country rock. Gouge, which develops from the grinding together of rocks along a fault, is commonly associated with gold veins.

Pockets: Many of the rich accumulations of gold found in oxidized portions of deposits are believed to be the result of supergene or near-surface enrichment. Miners commonly refer to such accumulations as "pockets." Supergene enrichment involves the action of circulating ground water at or near the surface. When attacked by these waters for sufficient time, certain gangue minerals, particularly the sulfides, oxidize to other compounds, some of which may be carried away in solution. Regarding the role of gold in the process, Emmons (1933) states: "In certain gold deposits the gold seems to be dissolved sparingly if at all. By subtraction of other material, the gold in the oxidized zone is enriched. It accumulates at the outcrop from which it may be washed away to form placer deposits. Since more material is removed from the upper than the lower part of the oxidized zone, more enrichment is likely to take place near the surface. Where gold is dissolved by acid waters containing chlorides in the presence of an oxidizing agent, such as manganese oxide, the outcrop may be impoverished and the gold carried downward so that the lower part of the oxidized zone is enriched."

In his discussion of pockets in the Kerby quadrangle, Wells (1949, p. 21) writes: "Owing to the nature of pockets and pockethunters, record of all but the largest pockets does not exist, traces of the holes are soon obliterated, and memory of them is gone with the passage of the pockethunter."

Because supergene pockets formed near the surface, erosional processes eventually removed them and transferred them to placer deposits, thus preserving occasional large nuggets such as those described below.

Placer deposits: Because gold has a very high specific gravity (19.33 when pure as compared to 2.5 to 3.5 for the quartz and other major rock components with which it is usually associated) and great resistance to weathering, it becomes concentrated in alluvial deposits as the parent rocks are disintegrated and carried away by the processes of erosion. The principal concentrations occur in the beds of streams and gulches below the veins.

Occasionally placer gold accumulates at or very near its bedrock source during disintegration and removal of the matrix. "Residual placers" are thus formed. More often, running water carries the loosened material and much of the gold away from its place of origin. Because of its greater weight, the gold works toward the bottom of the moving debris, and with time eventually reaches bedrock or some other impervious layer known to miners as "false bedrock." The coarser gold, tending to work downward more rapidly, is often found mixed with sand and gravel in crevices in the bedrock.

Generally, only parts of an auriferous gravel deposit are rich enough to be worked profitably. The "pay streaks" are commonly very irregular and have to be located by hit-or-miss prospecting. Gold may be transported long distances, but as a rule the greater the distance from the source the finer and more scattered it becomes and the more rounded or flattened are the particles. The general run of gold recovered from placers ranges in size from that of a mustard seed to a wheat grain.

Gold may become so finely divided that several thousand "colors" may be required to equal the value of one cent. In such condition it is extremely difficult to "save" by any known method of placer mining that is of a sufficiently large scale to be profitable.

At the other extreme, many nuggets the size of chicken eggs or larger have been won from Oregon placer deposits. Lindgren (1901, p. 636) states that a nugget worth $14,000 (at $20.67 per ounce) was reportedly discovered in McNamee Gulch in the Greenhorn district of western Baker County. Such a nugget would be equivalent to 677.31 ounces of pure gold. The Armstrong nugget, weighing 80½ ounces troy, was found at Susanville in Grant County; it is on display at the United States National Bank of Oregon branch in Baker. Spreen (1939), in covering the 1850 to 1870 history of placer mining in Oregon, reported sources of information on several remarkably large nuggets found in southwestern Oregon. The largest was discovered in 1859 on the east fork of Althouse Creek in Josephine County. It weighed

204 ounces (17 pounds troy) and was then valued at $3,500. A single piece weighing more than 15 pounds was reportedly found near Sailors Diggings at Waldo in Josephine County some time between 1860 and 1864. It was valued then at more than $3,100. It should be pointed out that values of large nuggets as collector's items or museum pieces are often more than twice the value of their metal content.

Workable gold placers usually lie in or near districts where gold veins occur. Thus, the tracing of placer gold up hill to its source has led to the discovery of important lode mines. Most lode mines were located in this manner. On the other hand, the source of the gold in some placers has never been determined and for others the source is thought to have been numerous small veins and stringers, none of which alone are large enough to be mined profitably.

Streams continually change course or disappear entirely as erosion and orogenic movements alter the configuration of the earth's surface. Thus, gold-bearing gravels may be found on the sides or even the tops of hills far from present drainages. Graveled terraces or "high bars" along valley walls may mark the former courses of streams. Old gravels may be buried by lava, by glacial or landslide debris, or by gravels from rejuvenated streams. Gravels long buried may become firmly cemented and thus prove difficult to work with ordinary placer-mining methods.

MINING METHODS AND TREATMENT

Lode mining

Most of Oregon's lode-gold deposits occur in steeply dipping veins and mineralized fault zones and rarely exceed 10 feet in economic width. Therefore, underground methods of mining are required except within a few feet of the surface. The mines are developed by shafts or adits with haulage levels at convenient intervals. Raises are run in the ore or just beneath it from level to level. The ore is then drilled and blasted from the vein, loaded into cars, and taken to the surface.

Gold is recovered from its ores by several processes. The treatment utilized at any particular mine depends primarily on the mineralogical character of the ore. Each process requires crushing and fine grinding as initial steps. Free gold and gold-bearing sulfide minerals may then be removed from the finely ground ore by amalgamation, flotation, cyanidation, jigging, table concentration, or a combination of these processes. Free gold recovered by amalgamation or cyanidation is sold as bullion. Sulfide concentrates are usually shipped to a smelter.

Some of the earliest operators in Oregon utilized the arrastra (figure 9), a device that ground ores by dragging a heavy stone around a circular bed. For many years, however, the mainstay of ore reduction was the stamp mill, which employed heavy iron pestles (stamps) working mechanically in a huge iron mortar. Stamps ranged up to 2,000 pounds in weight, rising and dropping 6 or 8 inches a hundred or more times a minute. The pulverized ore was then brought into contact with mercury, which combined with the free gold to form amalgam. The gold was then recovered by distilling off the mercury to make gold sponge (see frontispiece).

Gold-bearing sulfides from which the gold could not be liberated economically by simple crushing were separated from waste material with concentrating devices such as the vanner or concentrating table. Compared with today's standards, these methods of concentration were inefficient, often resulting in losses of 25 percent or more of the values contained in the sulfides. This factor is in part responsible for the lack of deep development of a great many mines in Oregon, for as depth was gained in mining, the amount of sulfides in the ore generally increased until the bulk of the gold values was contained in the sulfides. Photographs (figure 10) taken about 1905 at the Granite Hill mine, Josephine County, show a typical early-day mining camp and concentration mill.

Eventually flotation and cyanidation began to supplant gravity concentration in the treatment of sulfide ores, thus making possible much greater recovery of the contained values.

In the flotation process, finely ground ore mixed with water is agitated and aerated with small amounts of certain compounds which adhere to the desirable minerals and float them to the surface, where they are skimmed off as a concentrate. Waste materials remain submerged and are discarded. In the cyanidation process, finely crushed ores or concentrates are placed in vats containing a dilute solution of sodium cyanide. The gold dissolves to form sodium gold cyanide. The solution is then brought into contact with zinc or aluminum, which causes the gold to precipitate.

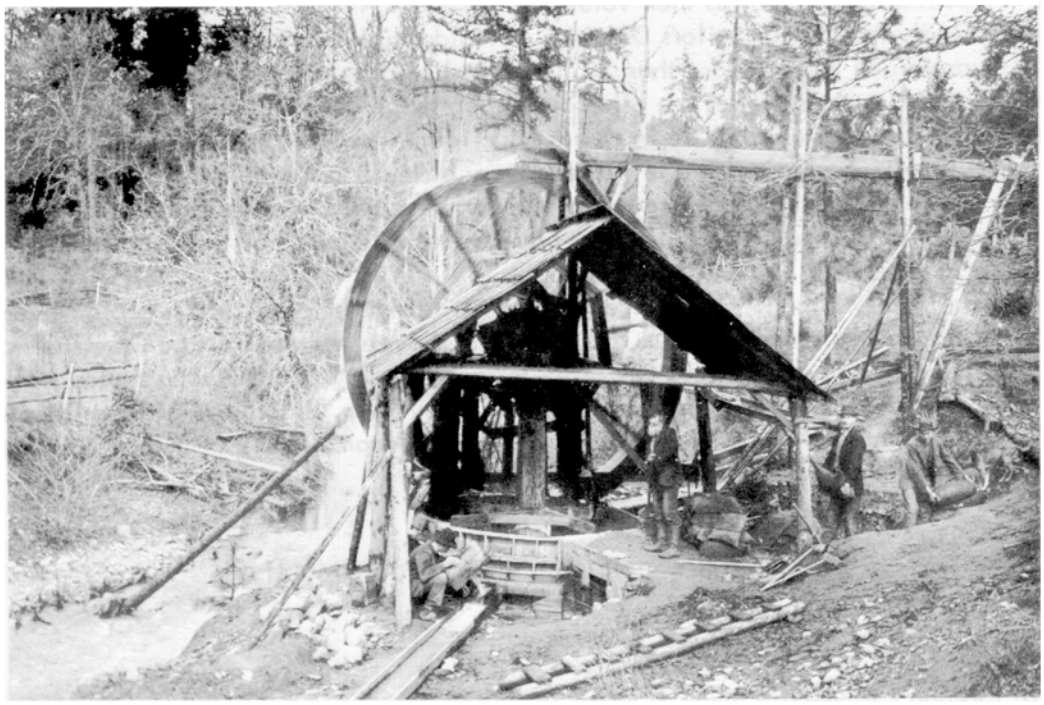


Figure 9. An arrastra was a primitive device used to grind gold and silver ores in the early days of mining in Oregon. The ore was spread on a floor, usually made of rock, and ground beneath heavy stones suspended from arms attached to a vertical shaft. At some arrastras, horses or oxen were utilized to turn the shaft instead of a water wheel as shown in the above photograph.

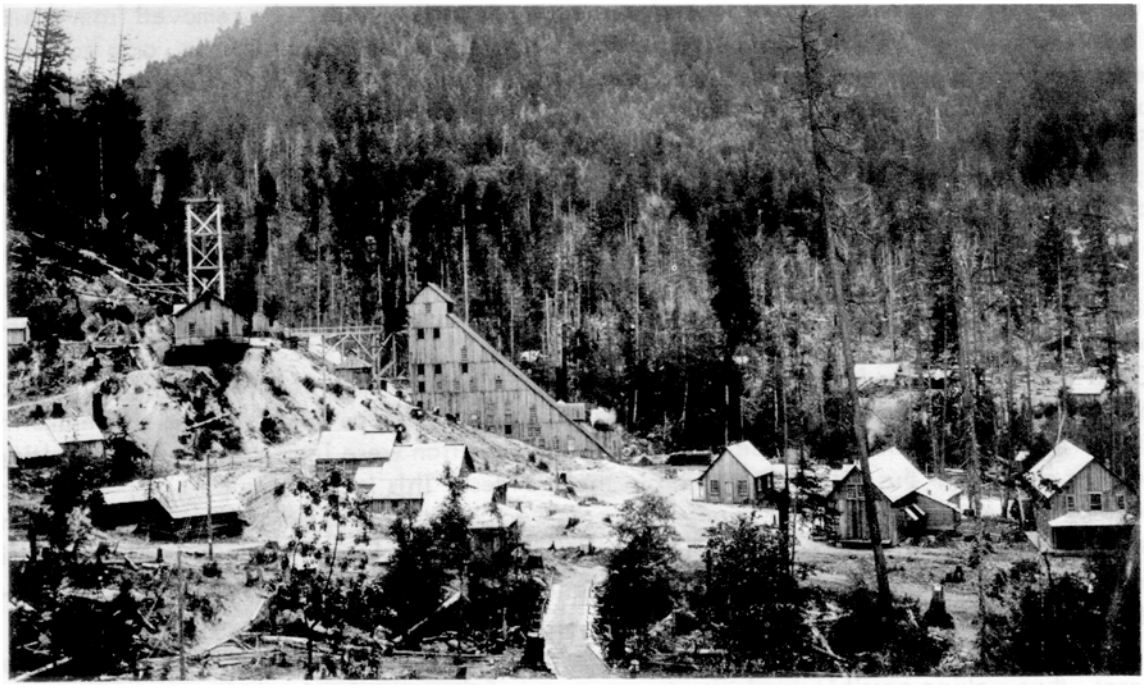
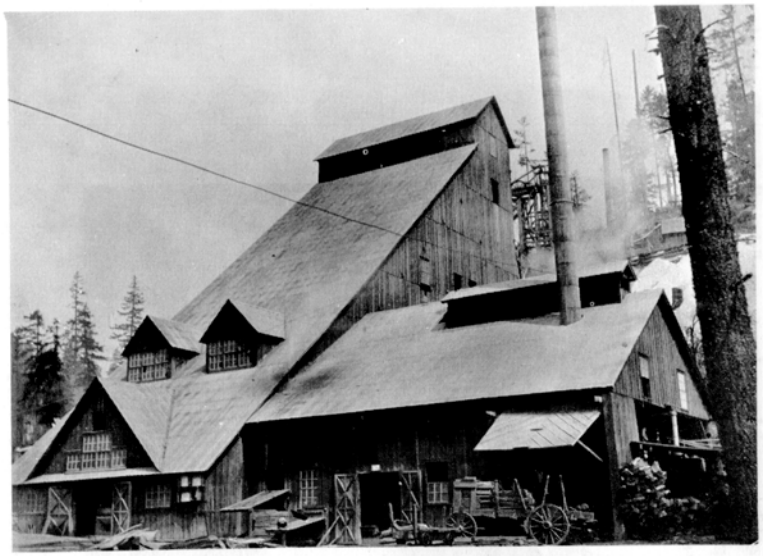
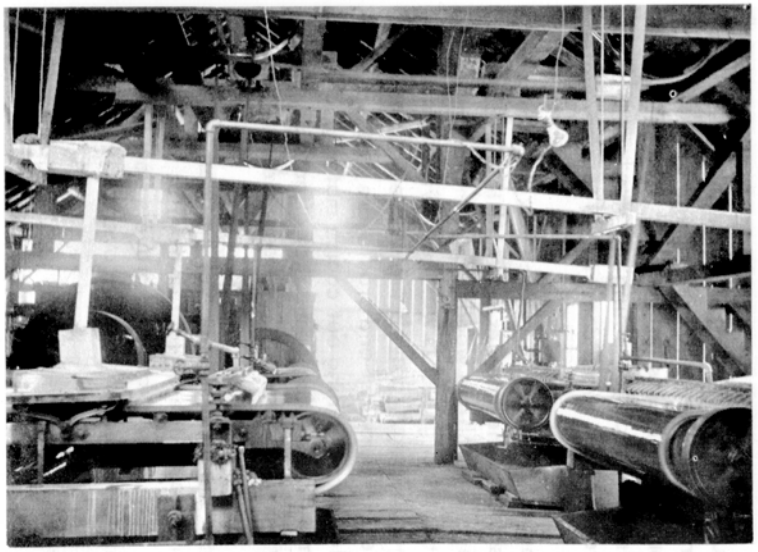


Figure 10. Granite Hill mining camp, Josephine County, between 1902 and 1907. The 20-stamp mill housed boiler, stamps, amalgamation plates, Frue vanners, jaw crusher, and 150-HP electric motor. Hoist was steam operated. Views on opposite page show the mill building, equipment, and portal of mine adit. (Photographs courtesy of W. R. Graham)

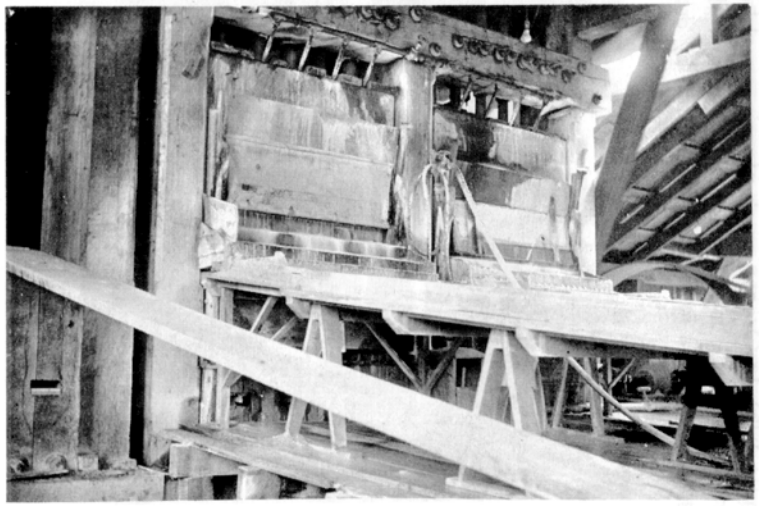


a) Exterior of Granite Hill mill building.

(See Figure 10 on opposite page)



b) Frue vanners at Granite Hill mill.



c) Two 5-stamp batteries and amalgamation plates.

d) Collar of shaft and head fram at portal of adit.

Placer mining

The methods of extracting gold from placer gravels are numerous, but all take advantage of the fact that gold is much heavier than the accompanying rock debris and thus works downward during agitation. Running water is nearly always used to wash away the rock debris, leaving the gold behind. For this reason, the amount of water available is a prime factor in determining methods of mining and the length of the annual operating season. In the early days ditches, some of great length, were constructed to carry water to placer ground.

Among the simplest placer-mining devices are the common miner's pan, the sluice box, and the rocker or cradle. Miner's pans are round, shallow containers for shaking the heavier material to the bottom and washing lighter particles off the top. Sluice boxes are slightly inclined wooden or iron troughs with transverse ridges or "riffles" fixed across the bottom. As the auriferous gravel is washed down through the box, gold and heavy sands are caught by the riffles. In "ground sluicing," gravels are washed across bedrock and the gold trapped by natural riffles in the rock surface. The rocker and cradle are, in effect, short sluice boxes with superimposed detachable sieves or riddles for screening out coarse material ahead of the apron and riffles. The apron is a sagging canvas on a removable sloping frame that effectively pans the sieved material. A rocking motion, generally supplied by hand, is employed to keep the sand and gravel moving.

Where water is abundant, "hydraulicking" greatly increases the amount of gravel that can be worked in a given time. Hydraulic mining employs a large, pipe-fed nozzle called a giant or monitor to direct a powerful jet of water against banks of auriferous gravel (figure 11). The excavated gravels flow through a long sluice where the gold is recovered. Significant amounts of gold may also be recovered by cleaning bedrock after the gravel is stripped away.

Dredging is by far the fastest method of working placer gravels and, after 1913, produced more gold in Oregon than all other processes combined. Although cost of installation is high, operating costs amount to only a few cents per cubic yard of gravel handled. The capacity of dredges ranges from 1,000 yards to 15,000 yards of gravel per day.

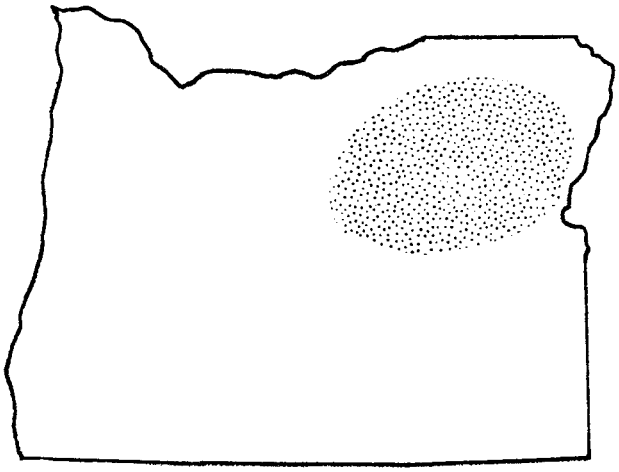
The bucketline dredge consists of a wood- or steel-hulled barge upon which is mounted a continuous chain of buckets for excavating, a screening and washing plant, and one or more conveyor belts for stacking tailings (figure 12a). Some dredges, instead of utilizing connected bucket excavators, are fed by dragline (figure 12b). In Oregon much placer gravel has been worked by washing plants or "doodlebugs" which are mounted on skids, or sometimes on wheels so they can be operated on dry land. The dry-land rigs must be dragged from place to place and are fed by dragline or power shovel.

Figure 11. Sterling hydraulic mine near Jacksonville about 1880.

Figure 12-a. Murphy-Murray dredge on Foots Creek, Jackson County, in January 1941. Capacity 4000 cubic yards daily, electric powered, 67 buckets, of $3\frac{1}{2}$-cubic-foot capacity; dug 20 feet below water line. Steel hull 81 by 37 by 6 feet, gantries, and superstructure.

Figure 12-b. Dragline dredge (doodlebug) at the Johnson placer on upper Pleasant Creek, Jackson County, in 1960.

part two. deposits in eastern oregon gold belt of the blue mountains



GOLD BELT OF THE BLUE MOUNTAINS

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GOLD BELT OF THE BLUE MOUNTAINS

INTRODUCTION

Approximately three-fourths of the gold produced in Oregon has come from lode and placer deposits in the Blue Mountains geomorphic province, which occupies much of the northeastern part of the state. The deposits lie in a region named by Lindgren (1901) "the gold belt of the Blue Mountains." The belt is about 50 miles wide and 100 miles long, extending from John Day on the west to Snake River on the east. The principal mining areas are in Baker and Grant Counties, although some mining has been done in adjacent parts of Malheur and Union Counties. All of the lode deposits are in pre-Tertiary rocks and are believed to be associated with Jurassic-Cretaceous dioritic intrusions (figure 13).

GEOGRAPHY

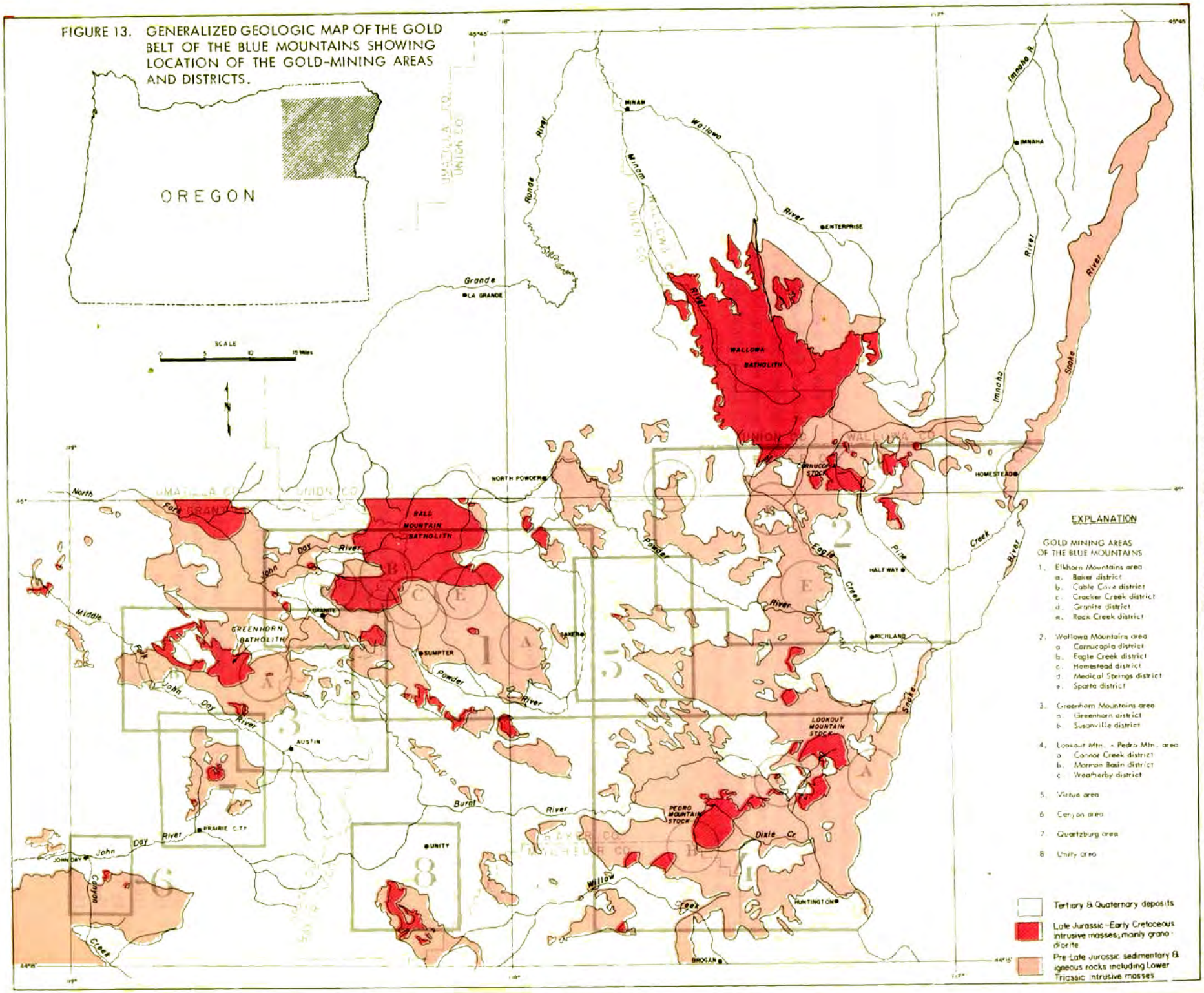
The Blue Mountains comprise a complex system of mountain ranges, high plateaus, and deep canyons interrupted in places by broad, fertile valleys. In the eastern part of the province, elevations range from less than 1600 feet in the Hells Canyon of the Snake River to 9845 feet on Matterhorn Peak in the Wallowa Mountains. The larger valleys lie between 2000 and 4000 feet above sea level. The elevation at Baker, the largest city (9500 population) in the gold belt, is 3450 feet. The main drainage systems are the Burnt, Powder, Grande Ronde, and Imnaha Rivers which flow eastward to the Snake River, and the vast John Day River system which flows westward, then north to the Columbia. The Blue Mountains complex continues eastward into Idaho and is there known as the Seven Devils Mountains. Between the Blue Mountains and the Seven Devils Mountains the Snake River has cut a canyon even deeper than the Grand Canyon of the Colorado.

The average annual precipitation varies from about 10 inches in the lower valleys to about 45 inches in the high mountains. Areas of high elevation are commonly snowbound between November and May. Much of the region between 4000 and 7000 feet elevation is heavily forested, chiefly with pine. Below 4000 feet the hills and valleys support desert grasses and brush. The larger valleys are farmed. Lumber and cattle long ago supplanted gold as the most valuable products of the region.

PREVIOUS WORKERS

The earliest systematic geologic report on the gold belt of the Blue Mountains was by Lindgren (1901) who studied the gold deposits in detail and prepared a large-scale reconnaissance geologic map of the region. His report remains the best source of information on many of the old mines. Pardee discussed faulting and vein structure in the Cracker Creek district (1909) and the placer gravels of the Sumpter and Granite districts (1910). A geologic map and description of the mines in the Sumpter quadrangle was published by Pardee and Hewett (1914). The map and text were later revised (Pardee, Hewett, and others, 1941). The earlier report was accompanied by a description of several mines near Baker (Grant and Cady, 1914). Lindgren's study of the mines of the Blue Mountains was complemented by a comprehensive re-examination

FIGURE 13. GENERALIZED GEOLOGIC MAP OF THE GOLD BELT OF THE BLUE MOUNTAINS SHOWING LOCATION OF THE GOLD-MINING AREAS AND DISTRICTS.



by Swartley (1914). Parks and Swartley (1916) prepared descriptions in alphabetical order of a great many mines throughout the state. Much of the data came from previous publications. A report by Livingston (1925) contains a geologic map of the Snake River canyon below Huntington and a description of the Bay Horse mine. Hewett (1931) discussed mineralogic variations observed in the lodes of the Sumpter quadrangle. Reconnaissance investigations were made of many of the mining districts of the region during 1929 and 1930 by geologists of the U.S. Geological Survey. This work led to publications by Gilluly (1931), Gilluly, Reed, and Park (1933), and Gilluly (1937). The latter report describes the geology of the Baker quadrangle. Lorain (1938) briefly summarized the mining geology of the region and described some of the mines, mostly those that were then active, with emphasis on mining and milling methods. Goodspeed (1939) discussed the gold quartz veins of Cornucopia. Oregon Department of Geology and Mineral Industries (1939 and 1941) summarized most of the previously accumulated data on the mines and mining districts of the region. The information is supplemented by interim reports and notes supplied by the Department staff and others. G.S. Koch (1959) described the lode mines of the central part of the Granite district including the Buffalo, the only consistently active lode-gold mine in the region at the time.

In addition to coverage given in some of the reports cited above, geologic maps and other stratigraphic, structural, and petrologic data have been compiled for certain areas by geologists of the Oregon Department of Geology and Mineral Industries and the U.S. Geological Survey and by geology professors and candidates for master's and doctoral degrees at several universities. Published reports which should be mentioned are those by Ross (1938) and Smith and Allen (1941) on the Wallowa Mountains; Prostka (1962 and 1967) on the Sparta and Durkee quadrangles; and the various papers listed in the bibliography by Taubeneck on the Bald Mountain batholith, Wallowa batholith, and Cornucopia stock; and by Thayer and Brown on the John Day - Canyon City area.

HISTORY AND PRODUCTION

Placer Mining

According to legend, gold was discovered somewhere in eastern Oregon in 1845 by the Meek immigrant party bound for the Willamette Valley. During the 1850's small groups of prospectors reportedly found placer gold in the Burnt and John Day River areas. In the fall of 1861 Henry Griffin, with a party of prospectors from Portland, discovered gold in what is now Griffin Gulch, a tributary of Powder River a few miles south of Baker. The following spring another group of prospectors found gold in Canyon Creek near the present site of John Day. In early 1862 the first white settlement in the region was established at Auburn about 5 miles south of Griffin Gulch. So great was the influx of miners and adventurers that by the end of that year the population of the camp was estimated at between 5000 and 6000 persons. A camp of similar proportions sprang up near what is now Canyon City.

From Auburn and Canyon City prospectors spread in all directions, and by 1864 almost every placer-mining district in eastern Oregon was being exploited. Supplies were hauled from The Dalles. Because of the difficulty of access and transportation costs, gravels which did not yield $8 per day per man were not considered workable.

Among the most productive of the early-day placer-mining districts were the Canyon, Dixie Creek, Granite, and Susanville in Grant County, and the Sumpter, Auburn, Pocahontas, Sanger, Sparta, Malheur, Mormon Basin, Rye Valley, Eldorado, and Connor Creek in Baker County (figure 14).

Water for working the gravels in several areas was scarce and for that reason ditches, some of great length, were constructed. The Auburn Ditch was completed in 1863, the Rye Valley Ditch in 1864, and the Sparta and Eldorado Ditches in 1873. The Eldorado Ditch, which took 10 years to complete, carried water more than 100 miles from near the head of Burnt River to the placers near Malheur. Use of these ditches for mining ceased long ago. The Auburn Ditch is now part of the Baker city water system and the Sparta Ditch is used for irrigation.

Sketchy records indicate that many of the early diggings were rich, but there are no reliable statistics to show the total amount of gold produced in eastern Oregon during the period of 1861-1880. Production probably was at its peak during 1863-1866, then began to decline gradually as the richest placers were worked out. Raymond (1870) estimated that production from the placers of Canyon Creek averaged

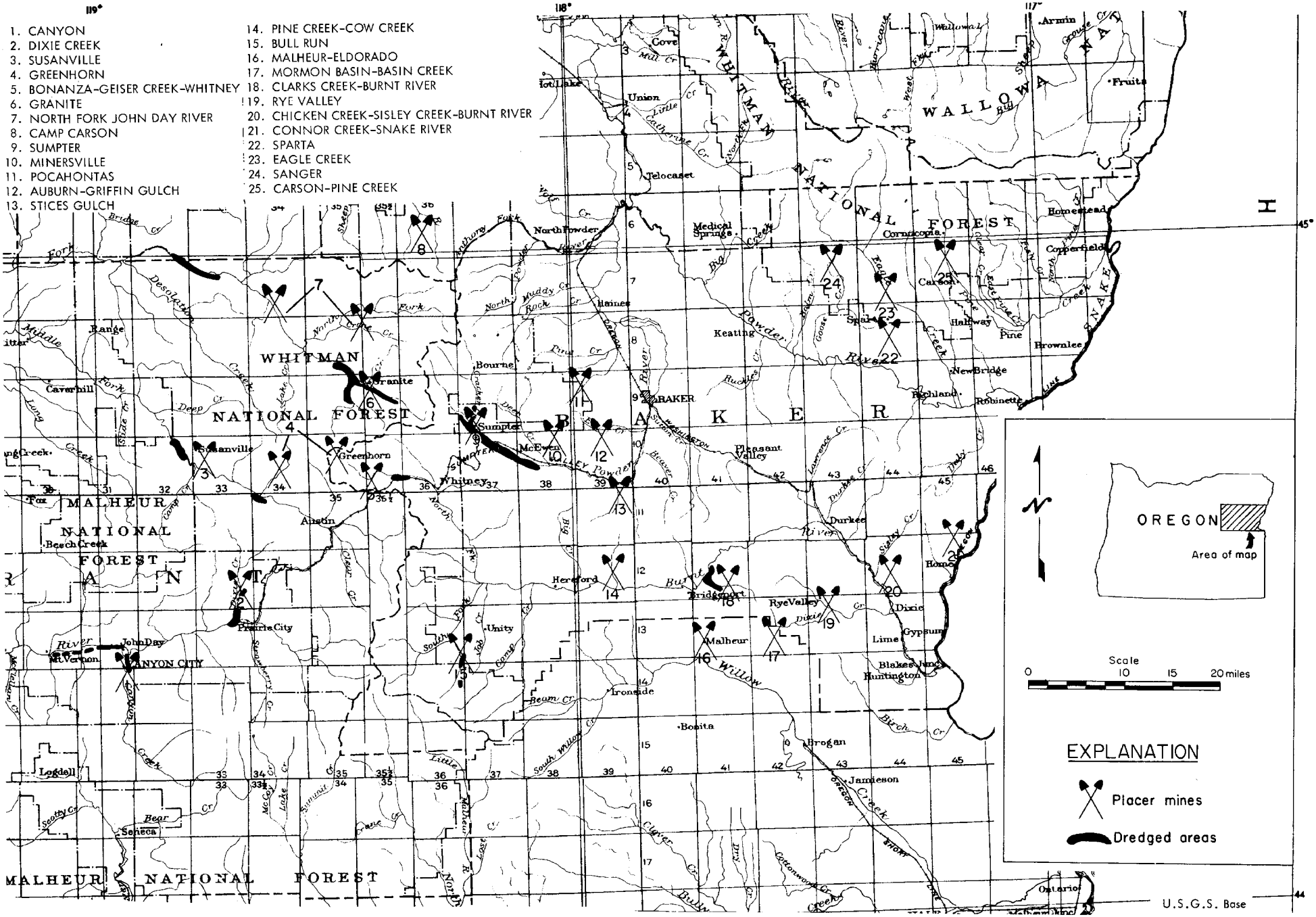


Figure 14. Index map of the principal placer mining areas in the Blue Mountains.

about $22,000 per week during the mining season of 1865. In 1869, output averaged about $8,000 per week from April to October and perhaps $20,000 per month the rest of the year. For the year 1870, Raymond (1872) estimated "...the total shipments of gold from eastern Oregon exclusive of Canon City and other districts west of the Blue Range" at $600,000. W. H. Packwood (in Raymond, 1872, p. 184) stated that the yearly gold output of Baker and Union Counties "...cannot have been less than from one to one and one-half million dollars from 1863 to 1870. The gold has been, we may say, the sole product of labor. The number of miners has been from one to three thousand averaging for several years about fifteen hundred."

By 1914, according to Pardee and Hewett (1914, p. 10-11), the placer mines of the Sumpter quadrangle had produced a minimum of $5,231,000 in gold and silver. They state:

"During the most active period of placer mining in the Sumpter quadrangle, records of production were seldom kept. Therefore the exact yield from this source is not known. It is possible, however, to estimate approximately the amount that must have been produced to have made operations profitable.... In a very few instances authentic records of production were obtained and were used for the mines they represent in arriving at the totals. The cubic contents of the principal placer excavations in the quadrangle were estimated to aggregate 21,500,000 cubic yards, the minimum yield of which was computed to be $5,231,000, or an average of about 25 cents a cubic yard. The minimum yields computed for the various districts are as follows:

North Fork drainage basin	$ 893,000
Granite Creek	1,033,000
Sumpter district	1,691,000
Greenhorn district	1,140,000
Bonanza	396,000
Minersville district	36,000
Whitney Valley	32,000
Scattering	10,000
Total	$5,231,000

"The actual placer production of the quadrangle is doubtless much larger than the total arrived at. Miners and others familiar with the region invariably make higher estimates than those given, in some instances estimating more for a single district than the total for the whole as given above. As nearly as can be ascertained the portion of silver alloyed with placer gold ranged from 5 to 30 percent and probably averaged 17 percent, equivalent to a gold fineness of 830 or value of $17.15 an ounce. Assuming the gold and silver values combined in the total given, it is calculated that of the total amount about $30,000 was silver."

Estimates of production are available for few placers outside the Sumpter quadrangle. In his account on the Canyon area (1901, p. 712-720), Lindgren stated "...it is scarcely probable that the total production [of that area, Ed.] much exceeds $15,000,000." Swartley (1914, p. 169) credits the placers of Elk Creek near Susanville with total output of approximately $600,000 and suggests the same figure for the Dixie Creek placers (p. 198). Swartley also states (p. 228) that production from the Rye Valley placers amounted to more than $1,000,000. The placers near Sanger reportedly produced about $500,000 in gold up to 1901 (Lindgren, 1901, p. 738).

The first successful large-scale bucketline dredge employed in eastern Oregon began work in Sumpter Valley in 1913 (one of the later dredges is shown in figure 15). Bucketline dredges were used on Canyon Creek and on the John Day River near John Day; along the Middle Fork of the John Day below Bates and at Susanville; on Granite, Clear, and Bull Run Creeks in the Granite area; on Burnt River near Whitney; and on Clarks Creek and Burnt River near Bridgeport. Numerous dragline dredges and dry-land washing plants worked gravels in the Sumpter, Granite, Prairie City, and John Day areas.

Recorded output of gold from the bucketline dredges alone is nearly 480,000 ounces. Calculated at the present price of gold, the value of recorded gold production from both bucketline and dragline dredges operating in the Sumpter area during 1913-1954 amounts to about $12,250,000. Value of output from the John Day - Prairie City area, 1916-1949, amounts to a little more than $5,000,000.

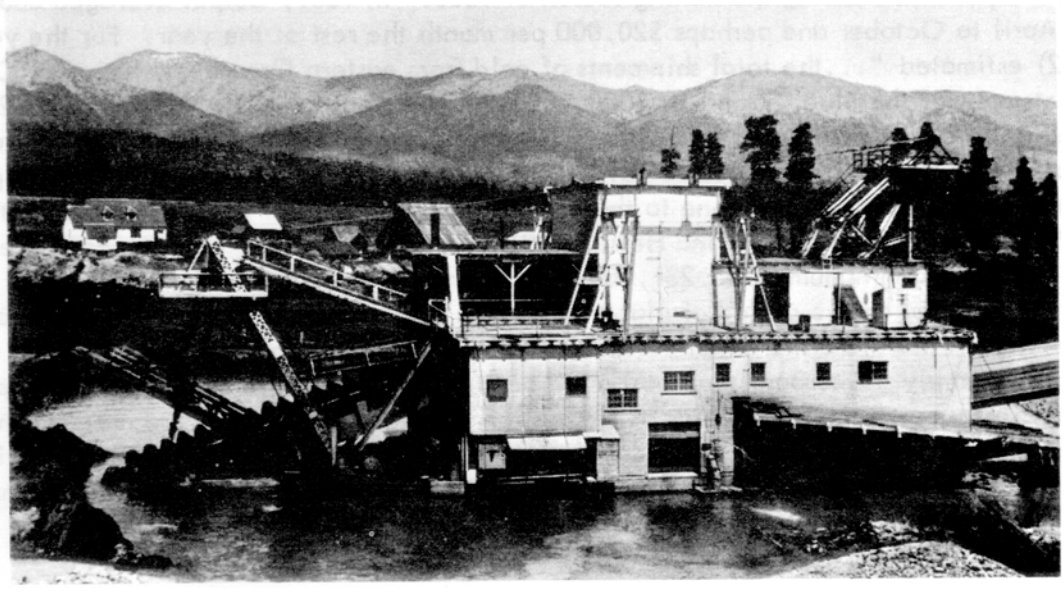


Figure 15. Sumpter Valley dredge working the gravels in Sumpter Valley a few miles below Sumpter about 1941. Elkhorn Ridge in background. (Photograph courtesy of Brooks Hawley.)

Figure 16. Main Street of Sumpter, Baker County, Oregon about 1914. Note board construction of street. (Photograph courtesy of Brooks Hawley.)

Lode Mining

Vein deposits were discovered soon after the advent of placer mining. Development of the Virtue mine about 8 miles northeast of Baker began in 1862, and a 10-stamp mill used to treat the ore was erected on the outskirts of Baker in 1864. An arrastra was in use near the present Sanger mine in the Eagle Creek district before 1865. Quartz mines were worked as early as 1865 and 1868 in the Susanville and Mormon Basin districts and in the Connor Creek, Granite, and Cable Cove districts in the early 1870's. The first claims on the great North Pole - Columbia Lode in the Cracker Creek district near Sumpter were located in 1877. Lode-gold deposits were discovered near the present site of Cornucopia in about 1880.

Early production from lode mines was dominated by the Virtue, Sanger, and Connor Creek mines, whose ores were amenable to the crude treatment methods of the time. The Virtue mine was almost continuously active during 1864-1884 and 1893-1899. Production totaled about $2,200,000. At the Sanger mine the principal vein was discovered in 1870 and worked more or less actively through 1897 with a total output of about $1,500,000. The Connor Creek mine on Connor Creek about $2\frac{1}{2}$ miles from Snake River was placed in operation in 1872, but the period of greatest productivity was between 1880 and 1890. Production from this mine totals about $1,250,000. There has been little production from the Virtue, Sanger, or Connor Creek mines since 1900.

With the exception of the early production described above, the development of lode mining in the Blue Mountains region was slow and sporadic until after extension of the transcontinental railroad to Baker in 1886. Completion of the Sumpter Valley Railroad to Sumpter in 1896 caused a mining boom in that area that lasted until about 1908. Sumpter grew from a small hamlet of a few hundred population to a town of 3000 or more (figure 16). Many of the most productive mines of the surrounding area were developed during this period. There was also considerable speculation. Much money was unwisely invested in the development of worthless prospects.

From 1904 to 1908 a 100-ton-per-day smelter erected at Sumpter was operated on ores and concentrates hauled in from the mines (figure 17). The plant was well built and efficiently run, but the amount of ores and concentrates supplied by the mines was inadequate to sustain operations. According to an article in the Blue Mountain American newspaper of July 30, 1910 only 19,068 tons of ore and concentrates were treated between November 15, 1904 and November 15, 1907. In regard to the mines in the Sumpter quadrangle, Pardee and Hewett (1914, p. 10-11) stated:

"The greater part of the deep mine production of the quadrangle has been made since 1900 and for this period authentic records show an output of $8,943,486 from 53 of the mines, only eight of which exceeded $100,000 production. Some of the records are incomplete, however, and for some of the mines no reliable records are available. This additional production, as based on estimates believed to be fairly reliable, amounts to $800,000. Prior to 1900 few records are available but estimates which seem to be reasonable place the production for that period at $1,600,000. Thus it appears that the total deep mine production of the Sumpter quadrangle is not far from $11,350,000 in gold and silver. Of this amount probably about 5 per cent, or $565,000, has been derived from silver."

Of the total production cited, about $8,000,000 came from the North Pole, E. & E., Taber Fraction, Columbia, and Golconda mines which worked contiguous parts of the North Pole - Columbia Lode near Bourne in the Cracker Creek district. Other mines whose total output at the time was near or above the $1,000,000 mark were the Bonanza and Red Boy mines in the Greenhorn district and the Baisley-Elkhorn mine in the Rock Creek district. The principal period of activity of each of these mines occurred between 1892 and 1916. Although there have been attempts to reactivate some of these mines, production has been relatively small.

Lode-mine output for Baker and Grant Counties reached a high of 55,746 ounces from 27 mines in 1902 when the Sumpter "boom" was at its peak. Output in 1911 after most of the large mines had closed was only 19,248 ounces from 19 mines. In 1913 production of the two counties bounded back to 51,721 ounces from 17 mines. The increase was largely the result of increased productivity of the Union-Companion and Last Chance mines in the Cornucopia district and the Rainbow mine in the Mormon Basin district. Production from the Rainbow from the year of its discovery in 1901 through 1919 was more than $2,323,000. During 1913-1915 it was the largest producer in the state.

Figure 17. Oregon Smelting & Refining Co. smelter at Sumpter, Oregon, in 1903. The plant was erected to service the numerous gold and silver mines in the area. Railroad tracks in the foreground are those of the Sumpter Valley Railroad, a narrow gauge line (now abandoned) which extended from Baker to Prairie City.

From the point of view of productivity and long life the Cornucopia mines, 12 miles north of Halfway, rank first among the lode mines of Oregon. Total output of these mines has been estimated at more than $10,000,000. Except for short periods of inactivity during 1921-1922 and 1926-1933, Cornucopia dominated lode-mine output from 1915 through 1941 and for several of those years accounted for more than half of the total lode-gold production of the entire state. The mine closed in October 1941 as a result of escalated costs of production and shortage of men and materials brought about by the threat of World War II.

Gold production since 1945 has been largely from the Buffalo mine in the Granite district.

Most of the mines mentioned by name in this discussion have recorded output of more than $1,000,000; however, the fact should not be overlooked that a large percentage of the gold produced from lode mines in the Blue Mountains has come from intermittent operation of a great number of smaller mines and prospects. During the 41-year period from 1902 to 1942, the number of lode mines reporting production each year in Baker County ranged from 9 to 30, averaging about 18. For Grant County the average was about 9. There are at least 20 small mines in the region whose production is known or reliably estimated to be in excess of $100,000 but less than $1,000,000.

GEOLOGY

The rocks of the gold belt of the Blue Mountains fall into two main groups, those of pre-Tertiary age and those of Tertiary and Quaternary age. The two groups are separated by a major unconformity.

Pre-Tertiary Rocks

The pre-Tertiary rocks comprise thick sequences of eugeosynclinal sedimentary and volcanic strata of late Paleozoic and Late Triassic-Jurassic age and at least two independent and dissimilar suites of plutonic intrusive rocks, one of Late Permian-Early Triassic age and the other of Late Jurassic-Early Cretaceous age. The bedded rocks and older intrusives have been tightly folded and regionally metamorphosed. The dominant structural trends are east to northeast and dips of bedding and foliation planes are generally steep. Mineral transformations tend toward the greenschist facies. The Paleozoic sediments and volcanics are in general more intensely deformed than the younger strata and they are locally foliated.

Rocks older than Permian are unknown in the eastern part of the Blue Mountains, but it is possible that earlier periods are represented by some of the more highly metamorphosed and deformed rocks. Older Paleozoic beds are exposed in the Suplee area to the west (Merriam and Berthiaume, 1943; Kleweno and Jeffords, 1961). Bedded rocks of Early Triassic age have not been recognized.

Sedimentary and volcanic strata

Elkhorn Ridge Argillite: Typifying the major part of the upper Paleozoic sequence are thick sections of argillite and chert, with subordinate metavolcanic rocks and lenticular limestones that occupy the middle third of the Sumpter quadrangle (Pardee, Hewett, and others, 1941).

In general the rocks are fine grained and gray to black in color owing to incorporated carbonaceous matter. Gradations of argillite to chert or tuff or conglomerate are common, as is repetitious interlayering of the various components. No well-marked type of beds characterizes any particular portion of the series. The argillite layers commonly range from several inches to several feet in thickness, while the cherty rocks more often occur as contorted bands a fraction of an inch to 3 inches thick separated by thin layers of argillite.

The limestone occurs as small detached bodies with angular boundaries. It is light gray to dark blue in color. Most of the masses are less than 300 feet in longest dimension, although some exceed 1500 feet in length and 500 feet in width. The sequence is particularly well exposed on Elkhorn Ridge and along Cracker Creek above Sumpter. Gilluly (1937) traced the argillite series from Elkhorn Ridge eastward across the middle third of the Baker quadrangle and named it the Elkhorn Ridge Argillite. Contiguous rocks

extend easterly to the Snake River and beyond into Idaho (Prostka, 1967; Brooks and Williams, in progress). The thickness of the series is unknown, but Gilluly's provisional estimate of 5000 feet appears conservative. Limited fossil evidence indicates that most of the formation is Permian in age but according to Bostwick and Koch (1962) younger rocks may be included.

Burnt River Schist: A severely deformed sequence of thinly layered phyllite and chert, massive to schistose greenstone and tuff, and marble that occurs along Burnt River in the southern part of the Baker quadrangle was named the Burnt River Schist by Gilluly (1937). These rocks extend westward into the southern part of the Sumpter quadrangle, southward through Mormon Basin, and eastward into Idaho. The age and stratigraphic relationships of the series is unknown. However, Prostka (1967) considers it to be partly Permian and partly Late Triassic in age.

Clover Creek Greenstone: A group of rocks consisting of altered lavas, pyroclastics, and volcaniclastic sandstones, breccias, and conglomerates with subordinate argillite, chert, and limestone is exposed over wide areas in the Wallowa Mountains and farther east in Snake River canyon. Exposures in the northern part of the Baker quadrangle were named the Clover Creek Greenstone by Gilluly (1937) and the name was adopted for similar rocks in the Wallowa Mountains (Ross, 1938; Smith and Allen, 1941; and Prostka, 1962). Gilluly assigned the group to the Permian but the later works cited (see also Wetherell, 1960; Bostwick and Koch, 1962; and Vallier, 1967) have shown that the formation is largely Late Triassic in age.

Martin Bridge and Hurwal Formations: Structurally conformable above the Upper Triassic greenstones and volcaniclastic rocks in the Wallowa Mountains - Snake River canyon area are the Martin Bridge Formation of Late Triassic age and the Hurwal Formation of Late Triassic-Early Jurassic age. The Martin Bridge Formation, about 1500 feet thick, consists mainly of massive limestone with associated shales. The Hurwal Formation, about 4000 feet thick, is made up mainly of graywacke, siltstone, and shale with minor chert, conglomerate, and limestone.

Unnamed Upper Triassic-Jurassic rocks in the Huntington area: About 30 miles south of the Wallowa Mountains, undifferentiated Upper Triassic-Jurassic sedimentary and volcanic rocks are exposed in several places within a broad belt extending from the Snake River near Huntington westward to the vicinity of Ironside Mountain southwest of Unity. Farther west are the better known Mesozoic beds of the John Day country (Brown and Thayer, 1966). The lower part of the sequence along Snake River near Huntington is made up mainly of massive greenstones, tuffs, and volcaniclastic sedimentary rocks with subordinate interbedded argillite, chert, and limestone. These rocks are correlative with Upper Triassic greenstones in the southern Wallowa Mountains. The upper part of the sequence comprises several thousand feet of sheared graywacke, slate, and phyllite with intercalated volcanic and conglomeratic layers and scattered limestone lenses. Late Triassic and Jurassic fossils are present. Contiguous rocks in the Ironside Mountain area were named the Rastus Formation by Lowry (in press). Lithologic similarity and stratigraphic position suggest partial correlation of these rocks with the Hurwal Formation to the north.

Intrusive rocks

Pre-Late Triassic: The older of the two groups of plutons includes a wide variety of ultramafic rocks, gabbro, diorite, quartz diorite, and albite granite. The rocks have been strongly deformed, fractured, and chemically altered; commonly they show a gneissic banding. Exposures are widespread and are associated with Paleozoic formations in many parts of the gold belt. Locally, masses of the plutonic rocks have been remobilized and squeezed upward into younger, Mesozoic formations.

The older intrusives are typified by the Canyon Mountain magma series of the John Day area, which has been dated as Lower to Middle Triassic (Thayer, 1963; Thayer and Brown, 1964; and Brown and Thayer, 1966). There is evidence of a similar age for occurrences in the Sumpter quadrangle (Pardee, Hewett, and others, 1941), in the Baker quadrangle (Gilluly, 1937), and in the Sparta quadrangle (Gilluly, 1933; Prostka, 1962).

In the John Day area the plutonic rock types are dominantly peridotite and gabbro. In the Sumpter and Baker quadrangles, altered gabbros are the most plentiful, although albite granite and quartz diorite are common. A large part of the Sparta quadrangle is underlain by albite granite.

Jurassic-Cretaceous: The younger group of plutonic rocks is mainly granodiorite, although in the larger bodies more basic and acid differentiates are present. Distribution of the larger exposures is shown on figure 13. In addition there are many small masses and related dikes too small to show to scale. The dominant exposures are the Wallowa batholith and the Bald Mountain batholith, which underlie the highest, most rugged mountain ranges of the region. The Wallowa intrusive covers more than 225 square miles and the Bald Mountain batholith more than 170 square miles. Other important exposures are the Pedro Mountain and Lookout Mountain stocks and the Greenhorn Mountain intrusive. The plutons are probably related to the great Idaho batholith and are of Late Jurassic or Early Cretaceous age.

Since the Jurassic-Cretaceous intrusive rocks are the source of the gold mineralization of the region, the descriptions of the individual plutonic bodies are presented later in this bulletin under the discussion of the mining areas associated with them.

Tertiary and Quaternary Rocks

Overlying the pre-Tertiary rocks with profound angular discordance is a wide variety of lavas, pyroclastics, and loosely consolidated fresh-water sediments and gravels of Cenozoic age. The most widespread are the Miocene lavas of the Columbia River Group; also occupying large areas are Eocene-Oligocene rhyolitic and dacitic lavas and Miocene-Pliocene lake beds and tuffs. The Tertiary rocks have been deformed into broad, open folds and are cut by northwest-trending faults.

Quaternary gravels and alluvium fill present drainages. A few small alpine glacial moraines occur in the Wallowa Mountains and in the Bald Mountain-Elkhorn Ridge area.

ORE DEPOSITS

Most of the gold deposits in the Blue Mountains appear to be genetically related to the Jurassic-Cretaceous granitic rocks, for they occur in greatest profusion near the contacts of these intrusives with the older rocks. The majority occupy fissures in argillite or in the granodiorite itself. Important veins and replacement deposits were also formed in metavolcanic rocks and in the sheared, highly altered gabbros, diorites, and albite granites in the older group of intrusives. Deposits in serpentinites and other ultrabasic rocks are numerous in some areas, particularly in the Greenhorn district, but production has been relatively small, most of it having come from discontinuous lenses and pockets of high-grade ore.

The Cenozoic volcanic and sedimentary rocks in the region are not known to contain lode-gold deposits. It may well be that in some areas these rocks mask important gold deposits in the older formations.

The lode-gold deposits in the Blue Mountains are predominantly narrow, quartz-rich fissure veins, breccia fillings, and associated replacement bodies along faults and shear zones. Probably the majority were formed by the filling of open spaces with accompanying replacement of the fissure walls and intervening fragments of broken rock. Most of the veins strike northeast, but several of major importance strike northwest -- notably the Virtue and Connor Creek veins.

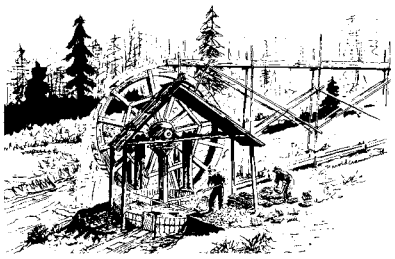
Some of the zones of fracturing and mineralization that contain ore bodies, such as the North Pole-Columbia lode in the Cracker Creek district, are quite wide and contain parallel, branching, and overlapping veins. Individual ore shoots, however, rarely exceed 10 feet in width; probably most of those mined had an average width of $1\frac{1}{2}$ to 5 feet.

The Union-Companion vein at Cornucopia had a productive strike length of about 2500 feet. It has been developed to a vertical depth of 1400 feet below the outcrop with little decrease in gold content. Other nearby productive veins crop out 1000 to 1600 feet higher than the Union-Companion vein. The productive vertical range in this district has, therefore, been demonstrated to be about 3000 feet. The North Pole-Columbia lode has been mined almost continuously through a horizontal distance of about 12,000 feet and to a depth of about 2500 feet below the highest point on the outcrop. Several other deposits

have been developed to depths of 750 to 1000 feet. However, the great majority of mine workings have attained vertical depths of less than 500 feet. Work on many veins ceased with the exhaustion of ore above a working level or of a particular shoot; for some, there is good reason to suspect that ore of similar character is present, either below existing levels or laterally along strike.

Most of the ore mined in the Blue Mountains has averaged from $\frac{1}{2}$ to 1 ounce per ton in gold and varying amounts of silver, although many ore bodies locally yielded bunches of high-grade gold. One small ore body at the North Pole mine yielded 1115 tons of ore averaging $500 per ton.

GOLD AND SILVER IN OREGON



GOLD MINING AREAS IN THE GOLD BELT OF THE BLUE MOUNTAINS

Descriptions of the gold-producing districts and mines of the gold belt of the Blue Mountains are herein divided into eight areas, each of which contains one or more districts as shown in figure 13. The area divisions segregate the dominant Jurassic-Cretaceous intrusive bodies and their associated gold deposits. In the order of their productive rank they are as follows:

1. The Elkhorn Mountains area includes the Baker, Cable Cove, Cracker Creek, Granite, and Rock Creek districts, which lie in and along the edges of the Bald Mountain batholith.

2. The Wallowa Mountains area encompasses the Wallowa batholith and satellitic intrusives, the most prominent of which is the Cornucopia stock. This area contains the Cornucopia, Eagle Creek, Homestead, Medical Springs, and Sparta districts.

3. The Greenhorn Mountains area, which is in part underlain by the Greenhorn batholith, contains the Greenhorn and Susanville districts.

4. The Lookout Mountain-Pedro Mountain area with its several exposures of Jurassic-Cretaceous granodiorite contains the Connor Creek, Mormon Basin, and Weatherby districts.

5-8. The Virtue, Canyon, Quartzburg, and Unity areas each include one district wherein only small intrusive bodies are exposed.

ELKHORN MOUNTAINS AREA

Location

The area lies in the Elkhorn Mountains west of Baker and north of Sumpter (figure 18). It embraces several groups of gold-silver deposits which appear to be genetically associated with the Bald Mountain batholith, a large granodiorite body which has an outcrop area of more than 170 square miles.

The mining districts in which the lode mines occur are, in the order described: Baker, Cable Cove, Cracker Creek, Granite, and Rock Creek. The Baker, Cracker Creek, and Rock Creek districts are in northwestern Baker County; the Cable Cove district straddles the Baker-Grant County line; and the Granite district is in eastern Grant County. These five districts lie along the southern edge of the batholith within an area about 12 miles wide and extending from Baker Valley westward through Sumpter and across the John Day River divide to the vicinity of Granite, a distance of 28 miles. On the northern edge of the batholith, in southern Union County, is the Camp Carson district (not shown on index map), which is known primarily for its placer deposits.

Described separately are the placers of the Baker, Granite, Sumpter, and Camp Carson districts, which were important producers in the past but are now largely of historical interest.

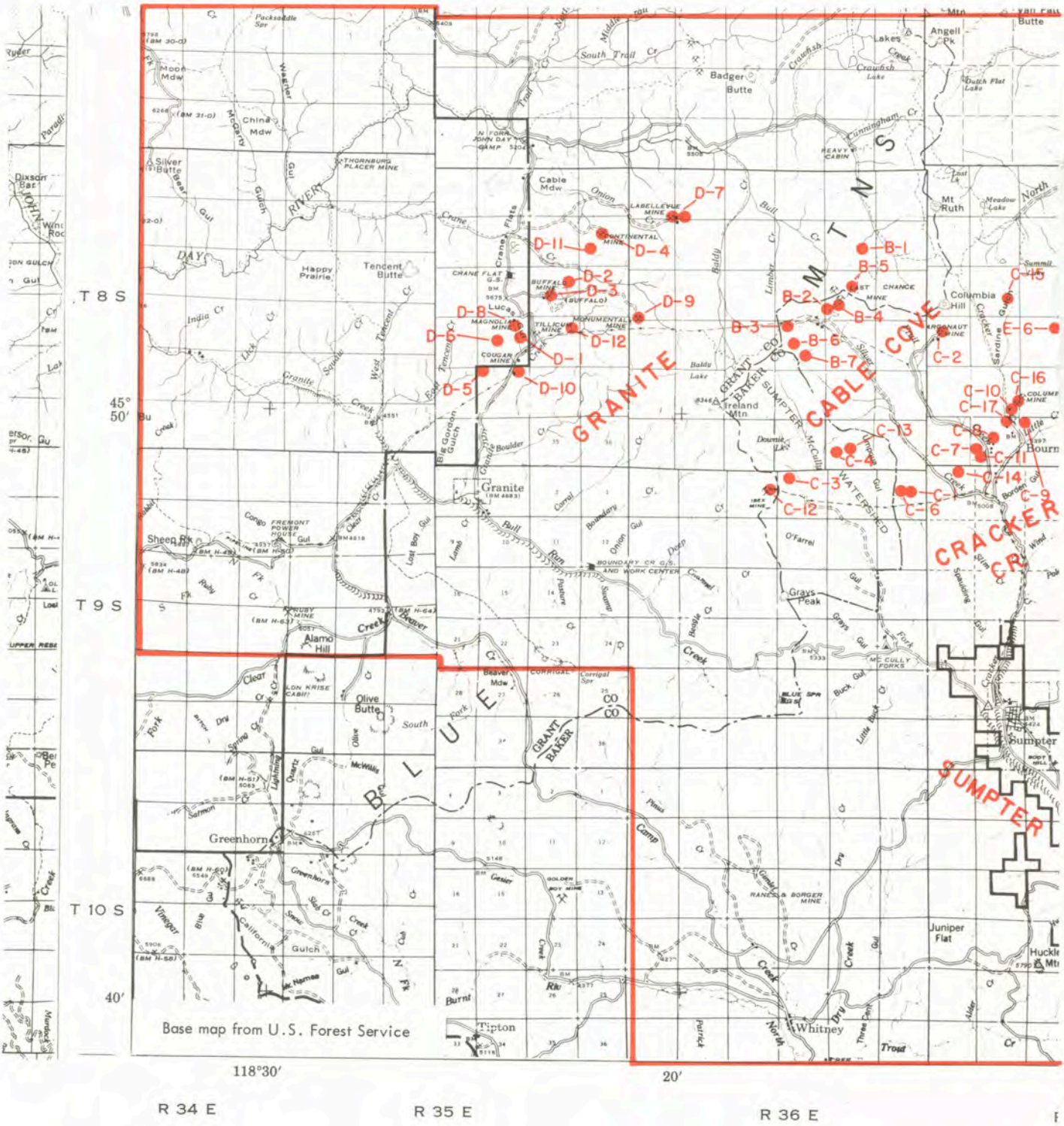
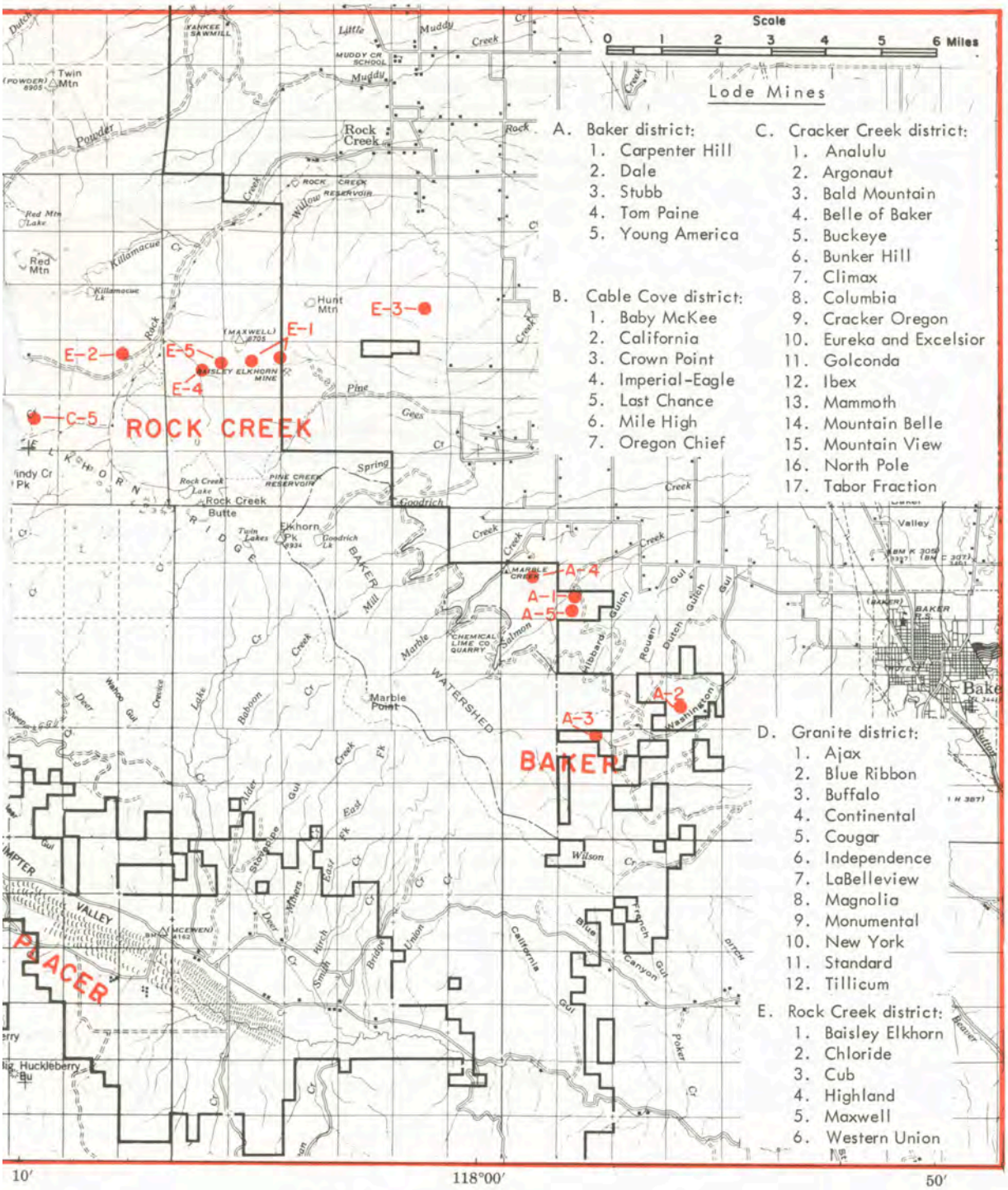


Figure 18. Index map of the Elkhorn Mountains area.


Scale
0 1 2 3 4 5 6 Miles
Lode Mines
A. Baker district:
1. Carpenter Hill
2. Dale
3. Stubb
4. Tom Paine
5. Young America
B. Cable Cove district:
1. Baby McKee
2. California
3. Crown Point
4. Imperial-Eagle
5. Last Chance
6. Mile High
7. Oregon Chief
C. Cracker Creek district:
1. Analulu
2. Argonaut
3. Bald Mountain
4. Belle of Baker
5. Buckeye
6. Bunker Hill
7. Climax
8. Columbia
9. Cracker Oregon
10. Eureka and Excelsior
11. Golconda
12. Ibex
13. Mammoth
14. Mountain Belle
15. Mountain View
16. North Pole
17. Tabor Fraction
D. Granite district:
1. Ajax
2. Blue Ribbon
3. Buffalo
4. Continental
5. Cougar
6. Independence
7. LaBelleview
8. Magnolia
9. Monumental
10. New York
11. Standard
12. Tillicum
E. Rock Creek district:
1. Baisley Elkhorn
2. Chloride
3. Cub
4. Highland
5. Maxwell
6. Western Union
E-1
E-2
E-3
E-4
E-5
C-5
A-1
A-2
A-3
A-4
A-5
ROCK CREEK
BAKER
PLACER
BAISLEY ELKHORN MINE
CHEMICAL LIME CO QUARRY
WATERSHED
10′
118°00′
50′
37 E
R 38 E
R 39 E
R 40 E

Geography

The Elkhorn Mountains are topographically rugged, heavily timbered except at high elevations, and contain many permanent streams. Elkhorn Ridge, a prominent southeast-trending prong of the range, forms the bold and rugged skyline west of Baker Valley and north of Sumpter Valley. For much of its length, this ridge stands above 8000 feet in elevation, one of the highest points being Rock Creek Butte (9105 feet). The streams and gulches draining the ridge are all tributary to Powder River. North and a little west of Sumpter, Elkhorn Ridge intersects the straggling, generally north-south trending, divide between the Powder River drainage to the east and the John Day River drainage to the west. North along the divide is the Anthony Lakes country. To the south is Mount Ireland, formerly known as Bald Mountain, a prominent peak 8346 feet in elevation. For several miles this divide marks the boundary between Baker and Grant Counties.

Geology and Mineralization

The Bald Mountain batholith is a composite intrusive of early Cretaceous age composed of at least eight distinct rock types, ranging from norite to quartz monzonite with tonolite and granodiorite comprising about 97 percent of the rocks exposed (Taubeneck, 1957, p. 181-238). The batholith intrudes Permian Elkhorn Ridge Argillite and a metagabbro-serpentine complex of post-Permian and pre-Late Triassic age. Both of these older units were tightly folded prior to emplacement of the granitic intrusives. Near the edges of the batholith widespread faulting has resulted in intricate, almost unsolvable disruption of strata (Pardee, 1909, p. 88; Pardee and Hewett, 1914, p. 34; and Taubeneck, 1957, p. 187). These writers considered the faulting as later than the folding but earlier than, or contemporaneous with, the emplacement of the intrusives.

Most of the gold deposits along the southern contact of the batholith occur in the argillite, although several are wholly in granodiorite and some cut both. The veins characteristically strike northeast to east and dip steeply. They are arranged in extensive groups or systems. The veins in the Cracker Creek and Rock Creek districts produce an en echelon or overlapping system that is nearly continuous for about 12 miles. Included in this system is the important North Pole-Columbia lode that is traceable for about 5 miles. To the west, the veins of the Cable Cove district form a similar but much shorter group. The vein system of the Granite district farther west is about 6 miles long.

Hewett (1931) has recognized a zonal arrangement of the ores along the southern edge of the batholith. He points out that the ores of the outer zone contain relatively fewer sulfides and more free gold than the ores of the inner zone. He also states (p. 315): "Almost all the veins, and especially those which have been the source of most of the production, are composite; they are the result of several epochs of mineralization....the general order of deposition of the minerals is as follows: (1) Quartz in several epochs of deposition, the first generally replacing the country rock; (2) sulfides, sulfarsenides, and sulfantimonides; (3) gold. In most of the veins examined that contain quartz, sulfides and gold, the relations of these minerals reveal at least three epochs of mineralization, each distinguished by an uncommonly high proportion of that mineral or minerals."

Each new epoch of mineralization was preceeded by brecciation of earlier material. Hewett (p.345) further states: "From both the extent of underground explorations in length and depth and the relations of the fractures to the geologic features of the region, it is clear that the veins of the Sumpter region have more than average persistence horizontally, and it seems that they should persist vertically much deeper than they have been explored thus far, especially those veins that are grouped around the Bald Mountain batholith."

Production

From the standpoint of total output and number of mines with significant past production, the Elkhorn Mountains area ranks first among the gold- and silver-mining areas of Oregon. Incomplete records and estimates of production presented by various authorities indicate that total output exceeds 1,200,000

ounces gold and $700,000 in silver. About 55 percent of the gold came from lode mines and the rest from placers. Dredge operations account for more than half of the placer production. Roughly 65 percent of the production from lode deposits came from mines along the North Pole-Columbia lode in the Cracker Creek district. Other mines with important past production are the Baisley-Elkhorn and Highland-Maxwell in the Rock Creek district and the Buffalo, Cougar-Independence, and La Belleview in the Granite district.

Placer Mines

The most productive placers in the Elkhorn Mountains were in the vicinity of Sumpter and Granite and on the east flank of Elkhorn Ridge south and west of Baker.

Sumpter placers

The many streams and gulches draining the Cracker Creek district join waters to form the Powder River at Sumpter. For approximately 8 miles along the Powder River below Sumpter almost the entire width of the mile-wide valley has been mined by bucketline dredges. Operations were nearly continuous during 1913-1924 and 1935-1954. All of the dredges combined covered 2603 acres and handled 60,625,514 yards of gravel. The first bucketline dredge was constructed and operated by Powder River Dredging Co. during 1913-1917 and 1920-1924. A second boat began work in 1915 and operated through 1922. In 1935 operation of a third bucketline dredge was begun by Sumpter Valley Dredging Co. and was continued by successor companies - Baker Dredging Co., 1948-1950, and a second Powder River Dredging Co., 1950-1954. The dredge was a Yuba-Electric equipped with 72 nine-cubic-foot buckets and dug to an average depth of 18 feet. Between 20 and 30 men were employed. Except for a three-year shutdown during World War II, this dredge operated almost continuously through September 1954. During 1946-1954 its annual production often exceeded the output of all other gold mines, both lode and placer, in the state. Throughout its 20-year history the dredge produced more gold than any other placer in the state. Its output exceeded that of all lode mines except during the years 1939-1941, when the Cornucopia mine was the largest producer. Recorded output from all of the bucketline dredges totals 296,906 ounces gold and 70,983 ounces silver, which at today's prices is equal to about $10,483,000.

For a mile or two above Sumpter the gravels of both Cracker Creek and McCully Fork have been worked in part by dragline dredge and in part by dry-land washing plant. Upper portions of these creeks were earlier exploited by hand and hydraulic methods, as were parts of some of the streams and gulches tributary to them, such as Buck Gulch and Mammoth Gulch. On the adjacent slopes are bench gravels and scattered remnants of an early Tertiary drainage system which has been the source of considerable placer gold (Pardee and Hewett, 1941).

Granite placers

Granite Creek and the streams and gulches draining into it, especially Bull Run and Clear Creeks, have yielded a large amount of placer gold. Pardee and Hewett (1914, p. 10) computed the minimum output to 1914 at $1,033,000. During 1938-1942 and 1946-1951 a bucketline dredge was operated almost continuously on Granite, Clear, and Bull Run Creeks. Output from the dredge was large, but statistics are not available for publication.

To the north, along the North Fork of the John Day River, are other placers of past importance. Pardee and Hewett (1914, p. 10) estimated production of placer gold from this area as being not less than $893,000. Placering, mainly on a small scale, has continued off and on up to the present time. Some of the more important deposits of early days were the Klopp placer mine and adjacent diggings in the vicinity of the junction of Trail Creek with the North Fork, the French Diggings about 6 miles up the South Fork of Trail Creek from the Klopp mine, and the Thornburg placers on the North Fork about 5 miles below the Klopp mine. These deposits were worked mainly with hydraulic equipment. Some of the operations were of large scale. The Davis and Calhoun and Howell placers several miles farther down the North Fork were worked by washing plant and dragline during 1940-1942 and 1947-1950. Several thousand ounces of gold was produced.

Elkhorn Ridge placers

Nearly every stream and gulch on the east flank of Elkhorn Ridge south and west of Baker show evidence of early-day placer operations. Some of the diggings are thought to have been very rich locally, but much of the best ground was worked before records began to be kept and so no reliable estimates of production are available.

Some of the more noted placers are those of French Gulch and Blue Canyon near the old townsite of Auburn. The Auburn Ditch, which was built in 1863, took water from the head of Pine Creek and intermediate water courses and carried it down to Auburn a distance of more than 30 miles. The ditch is now part of the Baker city water system. Little is left to mark the old townsite of Auburn.

North of Auburn are the placers of Elk Creek, Griffin Gulch, Washington Gulch, and Salmon Creek. Production from the Nelson placers, an alluvial fan at the mouth of Salmon Creek, is believed to have exceeded $400,000 by 1900 (Lindgren, 1901, p. 652). West of Auburn, old placer diggings are found in Poker Gulch, California Gulch, Union Creek, Miners Creek, and several tributaries that drain southwestward into Deer Creek, a tributary of Powder River.

Camp Carson placers

The Camp Carson district (not shown on index map) lies near the head of the Grande Ronde River toward the north end of the Elkhorn Range and near the north boundary of the Bald Mountain batholith. The district is about 20 miles air line north of Sumpter, but is usually reached from La Grande. The district is best known for the Camp Carson hydraulic placers at the head of Tanners Gulch, which were first worked in the early 1860's. Although the gravels are extensive and much work was done, no production records are available. Several quartz veins have been prospected, but production records are scarce.

Baker District

The Baker district embraces the southeastern end of Elkhorn Ridge southwest of Baker (figure 18). The area is bordered on the north by Baker Valley and on the south and east by Powder River. Elevations range from about 4000 to 7000 feet, although the main ridge is considerably higher a few miles to the northwest. The north and south flanks of Elkhorn Ridge are 4 to 5 miles wide, and are steep and deeply incised. The eastern slope below 5000 feet elevation is more gentle. The streams and gulches draining the area are tributary to the Powder River. Parts of the district have been referred to in the past as the Pocahontas, Auburn, and Minersville districts.

The oldest rocks in the district are siliceous argillites with subordinate greenstones and small limestone lenses of the Elkhorn Ridge Argillite. These rocks are cut by numerous irregularly shaped masses of gabbro and related rocks. Younger porphyry dikes probably related to the Bald Mountain batholith intrude both the argillite series and the gabbroic rocks.

The nature of the quartz deposits is best summarized by Lindgren (1901, p. 650-651): "Though... nearly every creek and gulch heading in this part of the range has carried more or less placer gold and a few have been enormously rich, there is throughout a very marked absence of important vein systems to which the origin of these placers could be attributed. In part this may be due to insufficient prospecting, but in most cases I believe that the placer gold was here rather derived from small seams and veinlets than from prominent fissure veins."

A few lode prospects are located in the drainage area of Salmon Creek and Marble Creek. This area was formerly known as the Pocahontas district and is credited by Lindgren (1901, p. 651) with a total output exceeding $100,000; one mine, the Tom Paine, produced $70,000 from "one small chimney" in about 1882. Small quartz prospects are also known in the Washington Gulch and Auburn areas and on the south slope of the range in the drainage of Deer Creek.

Cable Cove District

Cable Cove lies at the head of Silver Creek about 12 miles northwest of Sumpter (figure 18). This amphitheater-shaped feature is a glacial cirque cut into the southeast-facing side of the Powder River-John Day River divide. At its widest part Cable Cove is roughly a mile and a half from rim to rim and about 800 feet deep. The inner slopes are steep and rocky. The outer slopes descend more gently north and west to the North Fork of the John Day River. Elevations range from about 6500 to more than 7000 feet above sea level. The road up Silver Creek is ordinarily closed by snow from November through May.

The gold deposits of the Cable Cove district are in granodiorite of the Bald Mountain batholith. Basalt dikes are present but not abundant. Shearing in a northeasterly direction has developed a broad system of faults and shear zones in which the gold veins were formed.

Most of the mines worked veins made up of brecciated and intensely altered granodiorite interspersed with lenses and streaks of quartz and a little calcite. Pyrite and arsenopyrite are the chief metallic minerals. Lead and zinc sulfides are present locally. The gold values were confined mainly to portions of veins rich in pyrite and arsenopyrite. Much of the ore exceeded 10 percent sulfides. The Imperial-Eagle vein is traceable for more than 2 miles, and is as much as 25 feet wide. Ore shoots were rarely more than 2 feet wide, short, and unpredictably located.

The district was first worked in the early 1870's. The main period of development was between 1899 and 1910. Production has been small, probably less than $200,000, although several veins are extensively developed. The bulk of production is credited to the Imperial-Eagle, California, and Last Chance mines in the order of their productive rank. The workings of the Imperial Eagle mine are said to aggregate about 10,000 feet.

Cracker Creek District

General information

The Cracker Creek district encompasses the area drained by Cracker Creek and McCully Fork, headwaters of the Powder River north of Sumpter (figure 18). The district includes the highly productive North Pole-Columbia lode and numerous lesser veins of a system which extends southwesterly from the head of Rock Creek on the Elkhorn Ridge divide to the Ibex mine at the head of Deep Creek on the John Day River divide. In the past, parts of the area have been referred to as the Bourne district and McCully Fork district, but there is now little reason for such division.

The North Pole-Columbia lode crosses Cracker Creek near Bourne, a ghost town 6 miles by good forest road north of Sumpter. The Bald Mountain and Ibex mines are reached by road up McCully Fork from Sumpter. Branch roads, some of which are steep and poorly maintained, extend to most of the other mines in the district. Elevations at the mines range between 5500 and 8000 feet. The area is heavily timbered except at very high elevations.

The district is underlain mainly by dark-colored siliceous to tuffaceous argillites of the Elkhorn Ridge Argillite. Interbedded greenstones and small limestone pods are seen in places. Also present locally are large bodies of metagabbro. The southern contact of the Bald Mountain batholith extends along the northern and western edges of the district. Many dikes related to the latter intrusive are found in the argillite series. Most of the gold deposits occur along steep, northeast-trending faults in argillite. Some, such as the Mountain View, Argonaut, and Mammoth veins, are very near the granodiorite contact and may locally cut the granodiorite.

Production from lode mines in the district is estimated at more than $9,000,000, most of which was produced by the mines along the North Pole-Columbia Lode. The Belle of Baker and Mountain View mines are credited by Hewett (1931, p. 318 and 321) with an estimated output of $400,000 and $90,000 respectively. Other mines from which production has been reported include the Bald Mountain, Ibex, Mammoth, Argonaut, and Climax. Placer production from gravels along creeks and gulches draining the district is probably equal to or perhaps greater than output from the lode mines.

Principal lode mines

North Pole-Columbia lode: The North Pole-Columbia lode is traceable for nearly 5 miles from Elkhorn Ridge southwesterly across Cracker and Fruit Creeks to McCully Fork. The more productive part of the lode is more than 2 miles in length, extending southwest and northeast from the old town of Bourne on Cracker Creek. In this stretch the mines are, from southwest to northeast, the Golconda, Columbia, Taber Fraction, Eureka and Excelsior (better known as the E & E), and the North Pole.

Claims were located on the lode in the 1870's but the main periods of activity of each of the mines fell between 1894 and 1916. Since 1916 there have been numerous ill-fated attempts to reactivate some of the mines and comparatively small output has been made periodically by lessees.

An unpublished report by William W. Elmer dated June 30, 1930 contains the statement: "The gross production of the mines has been not less than $8,000,000 of which amount $7,782,005.01 is shown in available records." Production figures presented by Elmer and the principal periods of activity of each of the mines follows:

North Pole mine	$2,485,006.96	1895-1908
Eureka and Excelsior	1,064,833.57	1894-1898; 1903-1905; 1920-1922
Taber Fraction	445,255.34	1903-1905
Columbia mine	3,638,959.60	1897-1916
Golconda mine	147,949.50	1903-1904
Total gross output	$7,782,005.21	

The Golconga mine was operated during 1897-1904. Pardee and Hewett (1914, p. 92) state: "According to J. A. Howard of Baker the total production to 1904 was $550,000."

The following statement of production for the North Pole mine was taken from records of Emil Melzer, manager of the mine during 1895-1908.

	Dry tons treated	Gold contents per ton	Gold Value	Ounces recovered and sold	
				Gold	Silver
Milling ore	157,801.84	$ 12.21	$1,927,836.06	72,186.496	78,268.758
Shipping ore	1,115.55	499.45	557,170.96	27,858.545	25,347.437
Total production	158,917.40	15.63	$2,485,006.96	100,045.041	103,616.195

Records concerning the grade and quantity of ore mined and treated at the other mines are presented in the individual mine reports at the end of this chapter.

Old maps (figure 19) indicate that ore shoots were nearly continuous for about 9000 feet along strike through the North Pole, E & E, Taber Fraction, and Columbia mines. About 1500 feet south of the Columbia is the Golconda mine with nearly 1200 feet of continuous stoping. Therefore, the over-all productive length of the lode has been close to 12,000 feet.

South from the Golconda mine the lode splits into two branches, along which a considerable amount of development work has been done with little apparent success. To the northeast beyond the North Pole mine, extensive developments along the lode on the adjoining South Pole ground also failed to yield an appreciable amount of ore.

The country rock along the North Pole-Columbia lode is in most places dark-gray to black argillite with rare exposures of greenstone. Granodiorite dikes are abundant. A highly altered dike that was probably originally a granodiorite porphyry has been encountered at several places along the more productive parts of the lode.

The North Pole-Columbia lode is a composite vein, in that it consists of several bands of quartz and silicified argillite breccia separated by gouge or sheared country rock. Between the Golconda and

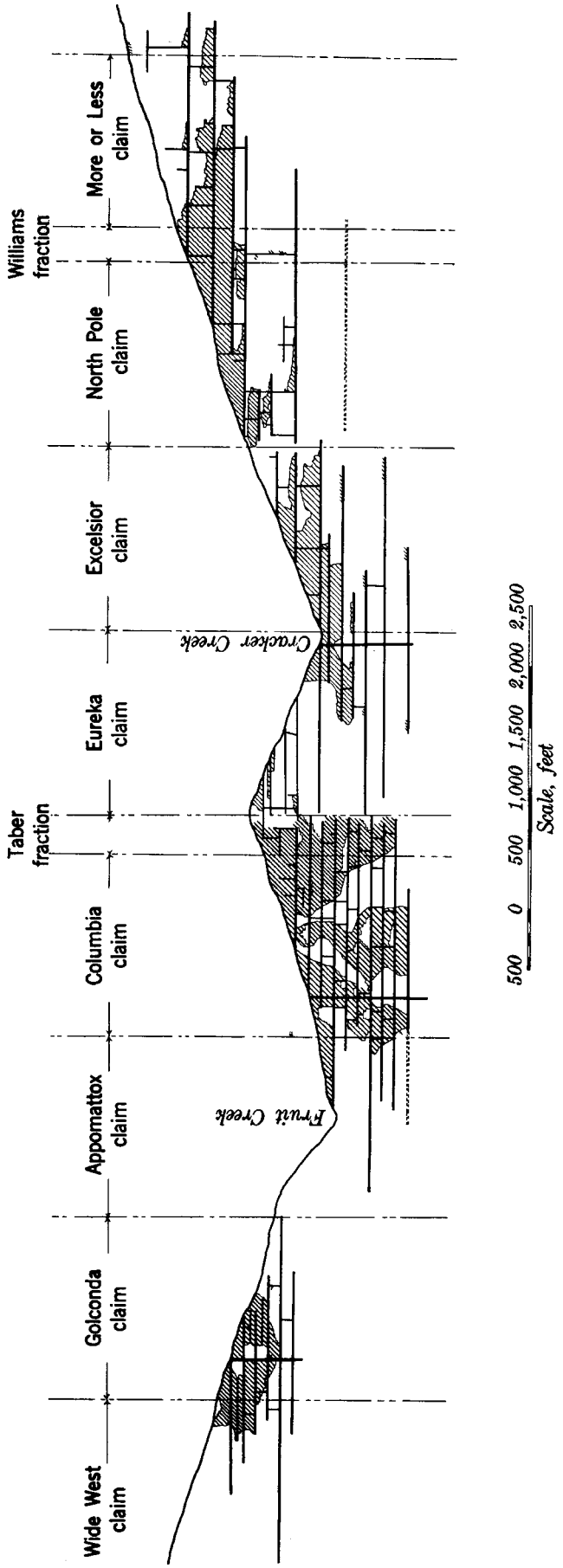


Figure 19. Longitudinal section through old workings on North Pole–Columbia vein (reprinted from Lorain, 1938).

the North Pole mines, the over-all trend of the lode is N. 30° E. It varies in dip from 86½° SE. at the Columbia to 78° SE. at the North Pole. In width the lode ranges from 7 feet to a maximum of about 300 feet, averaging perhaps about 25 feet. Its walls are fairly well defined in most places. According to Pardee (1909), this wide zone is a normal fault which has a vertical displacement of 400 feet and a horizontal displacement of approximately 1800 feet. As a result of this movement, which was probably accomplished by a series of small displacements over a long period of time, the rocks were shattered and in places thoroughly crushed. Thus a great amount of open space for the circulation of the ore-forming solutions was provided.

Much silica was introduced as replacement of the argillite and as quartz filling in open spaces. From place to place along and across the lode all gradations are found from fractured argillite impregnated with sulfides and cut by seams of quartz to almost completely silicified zones more than 100 feet wide. On the whole, vein quartz occupies a large part of the lode. The chief sulfides are pyrite, arsenopyrite, and chalcopyrite. Small amounts of tetrahedrite, stibnite, marcasite, and some tellurides have been found.

Swartley (1914, p. 151) states: "Most of the massive quartz does not contain to exceed $1 per ton in gold, while much of the less altered argillite is of low grade. The best values are more frequently contained in highly replaced argillite, and often bear a close relation to a gouge streak. The gold occurs chiefly in fine arsenopyrite....The ore is usually in a series of overlapping lenses, which make up the several shoots found in the developed part of the lode. These lenses vary from a mere seam to 25 feet in width." The over-all width of ore mined probably averages about 4 feet.

Ore shoots were usually found along or very near the footwall of the lode, although hanging wall shoots were not uncommon, and in at least one place ore was mined from a shoot near the middle of the lode.

Continuous stopes range up to as much as 2500 feet in length in the North Pole mine and ore was mined to a depth of 1000 feet in the Columbia mine. The horizontal length of most stoped areas, except at the Columbia mine, greatly exceeded the depth to which mining was carried on. Vertical distance from the highest point at which ore was mined in North Pole ground to the low point in Columbia ground is about 2100 feet. The horizontal interval between these points is about 6000 feet. A considerable block of ground within this zone has not been fully explored and there is incomplete development between the walls of the lode where drifting has been done.

During early productive days (figures 20 and 21) the Golconda, Columbia, and E and E mines were equipped with 20-stamp mills and the North Pole with a 30-stamp mill and cyanide plant. Sulfide concentration was accomplished mainly with tables and vanners. Bulk roasting and cyanidation was tried at the North Pole mine for a time, but later only the tailings were cyanided. Swartley (1914, p. 155) states that the combined average mill recovery from the several plants did not exceed 67 percent. The tailings were released into flowing streams and irretrievably scattered. A 50-ton-per-day flotation plant was erected in 1942 but has been little used.

Granite District

General information

The Granite district lies in the upper reaches of the North Fork of the John Day River, which drains the west flank of the Elkhorn Mountains (figure 18). The principal lode mines occury a northeast-trending belt about 2 miles wide and 5 miles long that extends from the Cougar mine on the southwest to the La Belleview mine on the northeast. The old ghost town of Granite, one of the earliest settlements in eastern Oregon, is about 3 miles south of the Cougar mine and 14 miles by gravelled road west of Sumpter. The southern part of this area is drained by Granite Creek and the northern part by Crane and Onion Creeks. Timber is abundant. Elevations range from about 5000 feet at the Cougar-Independence mill on Granite Creek to 7000 feet at the La Belleview mine.

The lode mines of the Granite district lie along the southwestern edge of the Bald Mountain batholith. The veins are mainly in older argillite of the Elkhorn Ridge Argillite, but a few also cut granodiorite of the batholith. Dikes related to the batholith have been observed in several of the mines. Most of

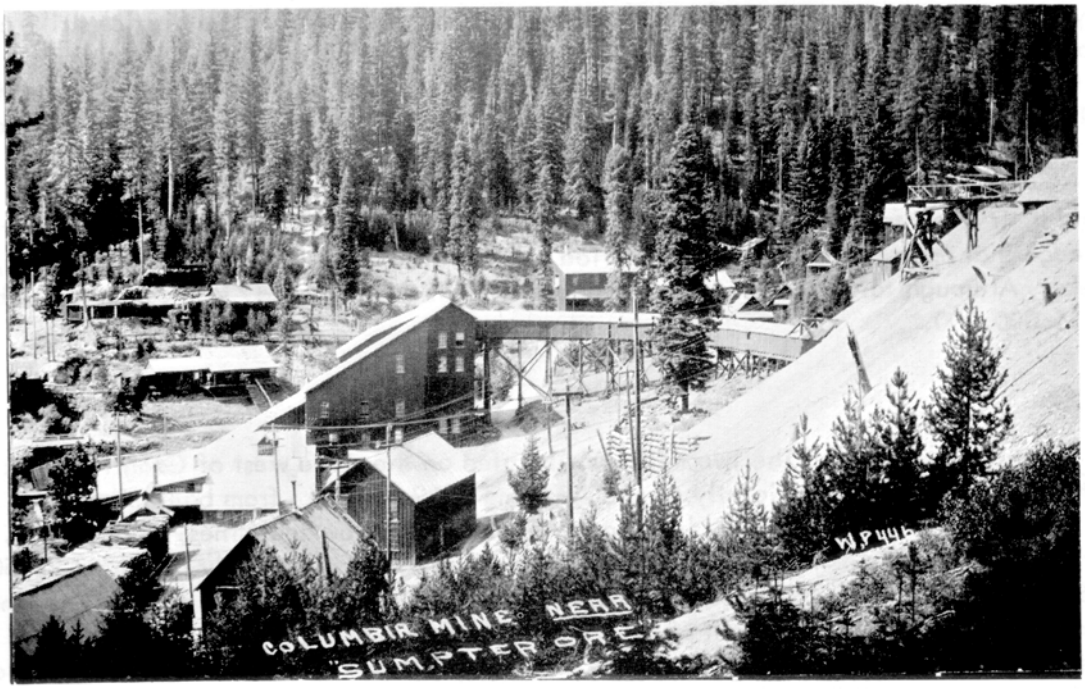


Figure 20. Columbia mine near Sumpter about 1914.

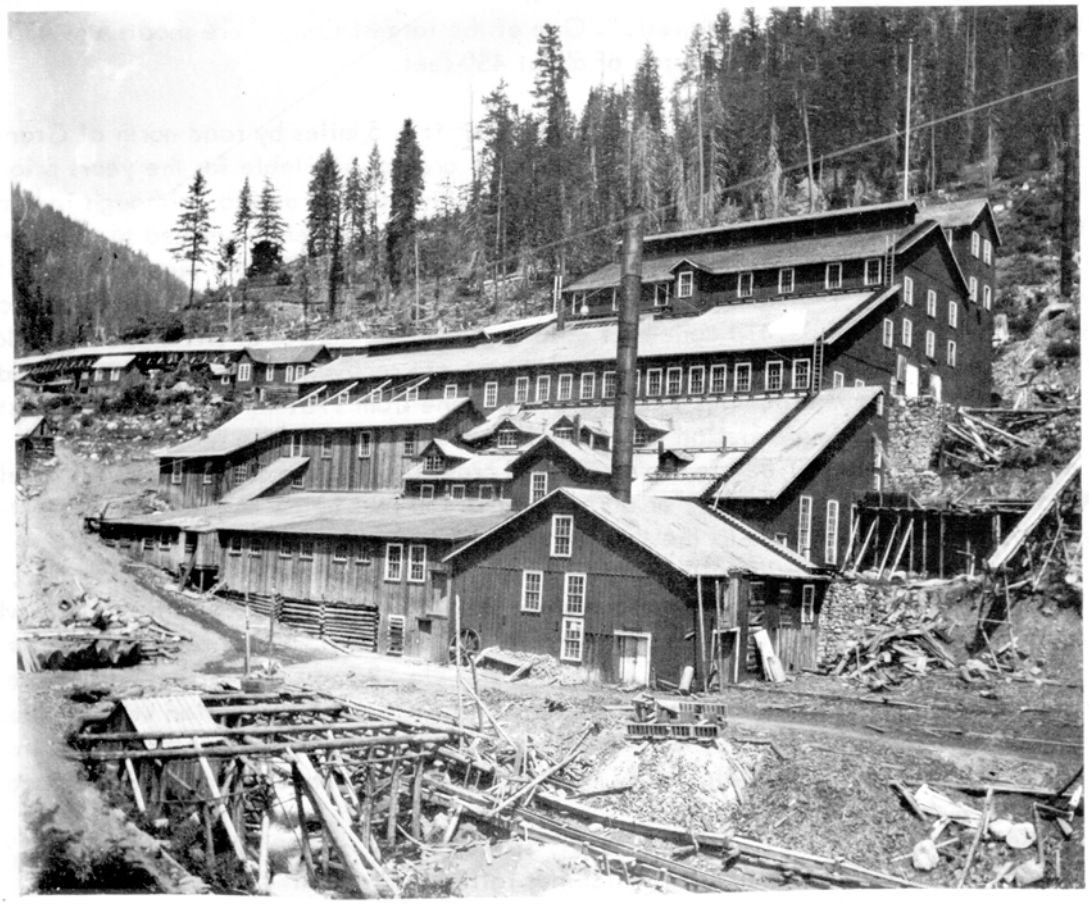


Figure 21. E & E mine mill about 1900. (Photograph courtesy of Baker County Historical Society.)

them are intensely altered near the veins. With very few exceptions, the veins of the district strike northeast and dip steeply either east or west.

Production from lode mines in the district exceeds $2.2 million, most of which has come from the Buffalo, Cougar-Independence, and La Belleview mines. Several other lode mines have had small production.

Pardee and Hewett (1914) estimate that the placers along Granite Creek and the North Fork of the John Day River and their tributaries produced nearly $2,000,000 to 1914. Production figures are not available for a dredge that operated for most of the period between 1938 and 1951 on Granite, Clear, and Bull Run Creeks. Although total placer output for the district is not recorded, it is estimated to be well in excess of $5,000,000.

Principal lode mines

Cougar and Independence mines: The two mines are located on the ridge west of Granite Creek about 3 miles north of Granite; they are jointly owned. During 1939-1942 ore from both mines was treated in a large mill which stood adjacent to the Granite Creek road below the mines. Since 1907, according to figures presented by Koch (1959, p. 30-31), the mines have collectively produced 22,509 ounces gold; 27,629 ounces silver; 8,032 pounds of copper; 866 pounds of lead; and 19 pounds of zinc from 61,125 tons of ore. More than 75 percent of this came from the Cougar mine during 1938-1942. Koch states: "There are two principal veins, the Cougar and Independence....These veins are more or less parallel, striking about N. 50° E. and dipping about 70° E. It is entirely possible that the Independence and Magnolia veins are the same and that the Cougar and Ajax veins are the same, but to determine this would require examining the intervening ground in detail and trenching the surface. In addition to the two principal veins there are numerous small veins and stringers....All of the veins are in argillite that strikes consistently northwest and dips southwest." One of the largest Cougar ore shoots was 475 feet long, 3 to 4.5 feet wide, and was worked to a depth of about 450 feet.

Buffalo mine: The Buffalo is the largest mine in the district; it is 5 miles by road north of Granite. Development began here in the mid-1880's but production records are not available for the years prior to 1903. Records since then indicate that the mine has been almost continuously active, although in some years there was little or no production. Since 1958 activity at the mine has been confined to exploration and development of the veins to greater depths. This work has been only periodically pursued and mill operations have been limited to the treatment of development ore from the lower levels. Recorded production from 1903 through 1964 totals 33,418 ounces of gold and 239,305 ounces of silver from 42,246 tons of ore. In addition, small amounts of copper, lead, and zinc are recovered from the ores but add little or nothing to their value. James Jackson, operator of the mine from 1951 through 1965, suggests that, considering the total stope area, production may actually be about double the recorded amount.

The mine is developed by about 10,000 feet of drifts and crosscuts divided among four adit levels, the 200, 400, 500, and 600 levels. The lowest, or 600, level is 450 feet below the highest, or 200-foot level. Present development is confined to the two lower levels.

The Buffalo mine works five roughly parallel veins. These are, from west to east, the Monitor, No. 1, No. 2, No. 3, and Constitution. The Monitor vein is a silicified breccia zone in argillite which has yielded little or no ore. The other four are roughly parallel composite quartz veins having similar structure and mineralogy. All have been productive, although the No. 2 and Constitution veins have been the most important. Since the early 1940's, mining has been confined to the Constitution vein. Probably no less than 4000 feet of drifting had been done previously on the No. 1, No. 2, and No. 3 veins on the 200 and 400 levels and, according to old maps, much of the ground above the drifts was stoped. These workings have long been abandoned.

The four quartz veins range from 80 to 220 feet apart, strike N. 15° to 30° E., and dip 60° to 80° W., except the north end of the Constitution vein, which has rolled in dip to steeply east.

The Constitution vein cuts back and forth across the contact between argillite and granodiorite. The other veins are said to lie largely in argillite. The argillite strikes N. 30° to 40° E. and dips 45° SW. The veins, formed partly by open-space filling and partly by replacement, contain pyrite with minor amounts of arsenopyrite, chalcopyrite, galena, sphalerite, and tetrahedrite in a gangue of quartz, calcite,

and incompletely replaced fragments and streaks of wall rock. The veins range in thickness from 1 to 6 feet, averaging probably about 20 inches. The sulfide minerals, which make up on the average about 10 percent of the ore and contain nearly all of the values, are concentrated by bulk flotation and the concentrates shipped to smelters. Free gold is rarely visible and no silver minerals other than tetrahedrite and a very little pyrargyrite have been identified.

During 1953-1958 treatment of 7938 tons of ore yielded 8760 ounces of gold and 62,004 silver. Mill recovery averaged 90 to 94 percent. Ratio of concentration was 8:1 to 10:1. Concentrates averaged 9 ounces gold and 68 ounces silver.

La Belleview mine: The La Belleview mine is at the head of Onion Creek about 3 miles air line northeast of the Buffalo. This mine produced close to $500,000 during the periods 1878-1892, 1927-1929, and 1939-1941. About 6000 feet of drifting and crosscutting has been done from four adits over a vertical range of about 600 feet.

The total production up to 1911, including ore shipped crude and ore treated in a mill on Onion Creek, amounted to 8000 tons having a gross value of $200,000. Concentrates averaged 1.20 ounces gold and 55 ounces silver to the ton and shipping ore was worth $60 to $300 to the ton. The 4800 tons of ore treated in 1940 yielded 1001 tons of concentrates containing 811 ounces gold; 40,444 ounces silver; 8243 pounds of copper; and 33,732 pounds of lead.

The country rock is quartz-biotite gneiss and granodiorite. The workings expose several veins, but most of the development follows one vein which trends N. 35° to 45° E., dips 65° to 70° NW., and varies from a narrow seam of chloritic gouge to 4 feet of crushed rock containing streaks of quartz with pyrite, arsenopyrite, and minor galena, chalcopyrite, and tetrahedrite. Silver minerals include argentiferous tetrahedrite, pyrargyrite, native silver, and possibly proustite. The massive pyrite rarely carried much gold. The ores were richest where galena, chalcopyrite, and antimony minerals were present. In the poorest zones the pyrite is dense and the other sulfides are only sparingly present.

Two shoots were mined, one pitching nearly vertically; the other had a rake of 30° SW. The intersection of the two shoots is said to have been very rich, with ore running $500 to $600 to the ton. One stope attained a length of 280 feet. The lower portion of this shoot yielded ore containing 0.40 ounce gold and 15 ounces silver.

Rock Creek District

General information

The Rock Creek district includes the upper reaches of Rock and Pine Creeks, which head close together in the high mountains northwest of Baker (figure 18). Here Elkhorn Ridge culminates in a straggling network of barren sawtooth ridges and peaks, some of which tower more than 5000 feet above Baker Valley. Elevations range from 5500 to 8500 feet. The principal mine workings lie between 6000 and 7000 feet, although some of the veins apex at much higher elevations.

The intrusive contact between rocks of the Elkhorn Ridge Argillite to the south and granodiorite of the Bald Mountain batholith to the north extends easterly through the district. The intruded rocks are mainly dark-colored argillites which, near the contact, have been altered to fine-grained crystalline hornfels. A number of veins occur along or close to the argillite-granodiorite contact. Some are in argillite, some are in granodiorite, and others cross the contact. This system of veins strikes northeast and connects with the Cracker Creek system on the southwest.

Past production of the Rock Creek district is credited largely to the Baisley-Elkhorn and Highland-Maxwell mines, whose combined output totals more than $1,560,000. Placer output from the district has been small.

Principal lode mines

Baisley-Elkhorn mine: The Baisley-Elkhorn mine is on the north fork of Pine Creek about 18 miles

from Baker by road. The last few miles are in poor condition.

The Baisley-Elkhorn vein was discovered in about 1882 and for several years was worked by two different mines, the Baisley-Elkhorn and the Robbins-Elkhorn. Around 1900 the two properties were consolidated. Since 1907 there has been very little production, although during the 1920's considerable development work was done. A small output was made in the late 1930's. Pardee and Hewett (1914, p. 74) presented the following production statistics but indicated that the statement may be incomplete, since there is no record of production from 1901 to 1905.

Prior to Jan. 1, 1898:	$ 342,861.07
1898 to Dec. 1, 1900:	
26,095 tons crude ore (bullion)	84,591.64
3759 tons concentrates	239,529.84
472 tons shipped at $45.03 per ton	21,254.04
1905: 20,000 tons crude ore, yielding 3000 tons concentrates	210,000.00
1907: 7680 tons crude ore, yielding 1280 tons concentrates	38,481.00
1912: Small production	?
Total	$ 936,717.59

The vein is developed by about 10,000 feet of workings. Most of the mining was done through a 626-foot adit crosscut to the vein and a 400-foot shaft sunk on the vein from the adit level. The adit level is about 6700 feet in elevation. The lowest of four levels turned from the shaft is about 665 feet below the outcrop.

The vein has an average strike of N. 40° E., a nearly vertical dip, and is partly in granodiorite and partly in argillite. The ore shoots varied from 2 to 10 feet in width and were chiefly in granodiorite. Lindgren (1901, p. 647) describes the ore as "...a soft mixture of coarse sulfides with much crushed diorite and occasional streaks of quartz which may show comb structure; in one place a 2-foot ore streak was adjoined by 10 inches of white, barren quartz.

"...The sulfides in order of their abundance are pyrite, black zinc blende, galena, and chalcopyrite....Ruby silver is occasionally found."

Pardee and Hewett (1914, p. 77) state: "The vein is reported to be traceable for 1800 feet on the surface and has been explored for 1400 feet on the second level from the shaft. Within this distance two shoots have been found, the Baisley-Elkhorn 850 feet long, and the Robbins-Elkhorn 150 feet long. Both appear to have pitched directly down the dip of the vein. Though the former was stoped continuously to the third level 515 feet below the outcrop, the fourth level, 150 feet lower, appears to have found only sporadic masses of ore."

A crosscut adit, driven during the 1920's, intersects the vein about 750 feet east of the old shaft and about 285 feet below the lower level. A drift extends westward for about 1000 feet on the vein which, according to Hewett (1931, p. 326), "...contains one or two strands of quartz 6 to 12 inches wide, containing coarse sulfides in the midst of quartz-diorite gouge." No assay data are available.

Highland and Maxwell mines: The Highland and Maxwell mines, which work portions of the same vein, lie in the Rock Creek drainage about 2 miles west of the Baisley-Elkhorn mine. The old camp and lower-level adits of the Highland are on the east fork of Rock Creek at an elevation of about 6100 feet. The Maxwell claims cover the higher eastern extension of the vein; the uppermost tunnel on Maxwell ground is about 200 feet below the crest of the high ridge west of the Baisley-Elkhorn mine.

Principal periods of production were 1900-1905, 1909-1914, and 1936-1938. Records of production prior to 1935 are incomplete, but estimates contained in old reports are $375,000 for the Highland and $100,000 for the Maxwell. The Highland produced more than $100,000 in 1913 but was idle in 1914. The properties were consolidated during the 1936-1938 operations. Ore produced during that period had a gross value of approximately $150,000 and was treated in a 100-ton flotation plant.

The Highland-Maxwell vein crosses the east fork of Rock Creek just above the old Highland camp and is developed on both sides of the gulch line. It has been prospected by numerous tunnels and cuts for

more than a mile along strike and over a vertical range of about 2000 feet. The vein is mostly in argillite, but in the upper eastern workings it is partly in granodiorite. The west extension of the vein strikes N. 75° E.; the east end strikes N.55° E. The dip is nearly vertical. The vein in most places is an incoherent mass of crushed and generally silicified argillite, clay, quartz, calcite, and ore minerals. The ore minerals in order of abundance are pyrite, sphalerite, galena, arsenopyrite, chalcopyrite, and tetrahedrite. The vein material is bounded by well-defined walls from which it breaks freely. Crosscuts locally show a width of as much as 28 feet between the walls, but the ore is seldom more than 3 feet thick. An old map of the property contained in Department files indicates that ore shoots were scattered. Stoped areas vary from less than 100 to more than 1000 feet in length. The larger shoots mined were in the lower levels.

During the period April 1936 to March 1938, about 7036 tons of ore having a gross value of $18.60 per ton were mined and treated. Ratio of sulfide concentration ranged from 4.5 to 1, to 7.5 to 1, with a recovery ratio of 75 to 98.7 percent. Net smelter returns averaged about $12.30 per ton of ore. From April 1936 to September 1, 1937 production amounted to 5400 tons of ore containing an average of 0.42 ounces gold and 3.65 ounces silver. Most of this ore came from the east end of the lowest level. The mine closed in the fall of 1938.

Lode Mines of the Elkhorn Mountains Area

A. BAKER DISTRICT

Carpenter Hill mine — Baker District, A-1

Location: Baker County, SW¼ sec. 8, T. 9 S., R. 39 E., on Salmon Creek above Nelson placers.

Development: 1200-foot adit.

Geology: Several quartz veins in greenstone, the largest seldom wider than 6 inches.

Production: Records not available. Small amount of ore treated in 5-stamp mill in early days.

References: Pardee and Hewett, 1914:146; Swartley, 1914:162; Parks and Swartley, 1916:51.

Dale mine — Baker District, A-2

Location: Baker County, W½ sec. 22, T. 9 S., R. 39 E.

Development: Several adits and pits; one adit is more than 400 feet long.

Geology: Country rock is mostly gabbro. Fractured zone strikes N. 23° E. and dips 70° W. Quartz seams locally show free gold.

References: Grant and Cady, 1914:150; Parks and Swartley, 1916:85; Gilluly, Reed, and Park, 1933:83; Gilluly, 1937:103.

Stub (Kent) mine — Baker District, A-3

Location: Baker County, secs. 20 and 29, T. 9 S., R. 39 E., in upper Washington Gulch.

Development: Tunnel several hundred feet long, with a short winze and some raises.

Geology: Country rock is argillite, greenstone, and chert. Quartz-impregnated shear zone up to 15 feet wide. Strike NE; dip nearly vertical.

Production: No record.

References: Grant and Cady, 1914:150; Swartley, 1914:162; Parks and Swartley, 1916:135; Gilluly, Reed, and Park, 1933:83; Gilluly, 1937:102; Department Bulletin 14-A, 1939:16.

Tom Paine - Old Soldier Group (Yellowstone) Baker District, A-4

Location: Baker County, NE¼ sec. 7, T. 9 S., R. 39 E. in McCord Gulch.

Development: Three adits, longest 700 feet.

Geology: Two veins 600 feet apart in argillite and limestone. Both pre-mineral and post-mineral dikes are present. Tom Paine vein strikes N. 25° W. and dips 30° to 50° SW. Old Soldier vein strikes N. 68° W. and dips 42° S. Both vary from a few inches to about 4 feet in width and consist largely of quartz and a little calcite with a scattering of fine pyrite.

Production: $36,000 in early days.

References: Lindgren, 1901:651; Grant and Cady, 1914:147-149; Swartley, 1914:162; Parks and Swartley, 1916:240; Gilluly, Reed, and Park, 1933:81; Gilluly, 1937:101; Department Bulletin 14-A, 1939:16.

Young America mine Baker District, A-5

Location: Baker County, SW¼ sec. 8, T. 9 S., R. 39 E. on Salmon Creek.

Development: 940 feet of tunnels.

Geology: Massive quartz vein, up to 5 feet wide, in greenstone. Strike NW.

Production: No record.

References: Grant and Cady, 1914:147; Swartley, 1914:162; Parks and Swartley, 1916:241; Department Bulletin 14-A, 1939:17.

B. CABLE COVE DISTRICT

Baby McKee mine Cable Cove District, B-1

Location: Baker County, E½ sec. 11, T. 8 S., R. 36 E.

Development: Poor record. Said to include 1800-foot crosscut which cuts vein at depth of 900 feet.

Geology: Mineralized shear zone similar to that developed at California mine.

Production: No record.

References: Newspaper accounts circa 1900-1904.

California mine Cable Cove District, B-2

Location: Baker County, secs. 14 and 15, T. 8 S., R. 36 E.

Development: Six adits over vertical range of 800 feet; longest 1750 feet.

Geology: Shear zone about 3 feet wide in granodiorite contains streaks and lenses of heavy sulfides, quartz, and calcite. Strikes NE. Sulfides mostly pyrite and arsenopyrite with galena, chalcopyrite, and sphalerite.

Production: About $40,000 mostly from sporadic output between 1873 and 1910. Mill erected in 1879, but little used. Estimated ratio of sulfides to gangue, 1:10.

References: Lindgren, 1901:675; Swartley, 1914:140; Parks and Swartley, 1916:49; Hewett, 1931:318; Lorain, 1938:19; Department Bulletin 14-A, 1939:18.

Crown Point mine — Cable Cove District, B-3

Location: Baker County, NW¼ sec. 22, T. 8 S., R. 36 E.

Development: 1800 feet of tunnels.

Geology: Shear zone as much as 4 feet in width in granodiorite contains quartz seams and scattering of pyrite and arsenopyrite.

Production: No record, property located in 1930.

References: Department Bulletin 14-A, 1939:18.

Imperial - Eagle mine — Cable Cove District, B-4

Location: Baker County, SW¼ sec. 14, T. 8 S., R. 36 E.

Development: Totals about 10,000 feet from six adits.

Geology: Three veins in granodiorite - Imperial, Eagle, and Winchester - made up of more or less completely crushed and altered granodiorite interrupted locally by streaks and lenses of heavy sulfides and quartz. Pyrite, arsenopyrite, chalcopyrite, galena, sphalerite. Vein zones said to vary up to 25 feet in width. Eagle vein traceable for two miles. Ore mined rarely exceeded 2 feet in width, with stope and pitch lengths of usually less than 50 feet.

Production: Estimated at $100,000 mostly during 1900-1915. Mill erected about 1900 and intermittently operated up to about 1910. Poor recovery. Estimated ratio of sulfides to gangue 1:10. Gold less than 10 percent free. Silver to gold ratio 10:1.

References: Lindgren, 1901:673; Pardee and Hewett, 1914:98; Swartley, 1914:140; Parks and Swartley, 1916:128; Hewett, 1931:314,317-8; Lorain, 1938:19; Department Bulletin 14-A, 1939:19-20.

Last Chance mine — Cable Cove District, B-5

Location: Baker County, sec. 14, T. 8 S., R. 36 E.

Development: Two adits and 150-foot shaft; 400-foot drift on vein.

Geology: Shear zone in granodiorite, strikes N. 50° E., dips 80° SE.; contains heavy sulfides locally. Ore shoots about 18 inches wide and less than 50 feet long.

Production: Estimated at $5,000. Inactive since about 1910.

References: Lindgren, 1901:675; Pardee and Hewett, 1914:102; Swartley, 1914:142; Parks and Swartley, 1916:139; Hewett, 1931:318; Lorain, 1938:19; Department Bulletin 14-A, 1939:20.

Mile High mine — Cable Cove District, B-6

Location: Baker County, sec. 22, T. 8 S., R. 36 E. on south wall of Cable Cove.

Development: Drift adit 640 feet long with two short raises and a small stope near face.

Geology: Shear zone in granodiorite. Strikes N. 45° E. and is nearly vertical. Vein splits 400 feet from portal. North branch thickens to 2 feet and contains streaks and bunches of pyrite with small amounts of chalcopyrite, galena, and sphalerite.

Production: It is said that several cars of crude ore were shipped during 1934-1939. Two shipments totaling 38 tons averaged about 0.84 ounces gold, 1.8 ounces silver, and 0.9 percent copper.

References: Department mine file report, 1963.

Oregon Chief mine — Cable Cove District, B-7

Location: Baker County, SE$\frac{1}{4}$ sec. 22, T. 8 S., R. 36 E.

Development: Several adits total 1400 feet.

Geology: Quartz vein as much as 4 feet wide in granodiorite.

Production: No record.

References: Parks and Swartley, 1916:171; Department Bulletin 14-A, 1939:21.

C. CRACKER CREEK DISTRICT

Analulu mine — Cracker Creek District, C-1

Location: Baker County, E$\frac{1}{2}$ sec. 1, T. 9 S., R. 36 E., about 9 miles from Sumpter on a branch of Silver Creek.

Development: About 600 feet of tunnels and shafts.

Geology: Vein as much as 10 feet in width in argillite is said to be the southwest extension of the North Pole-Columbia lode.

Production: No record.

References: Lindgren, 1901:667; Parks and Swartley, 1916:15; Hewett, 1931:321; Department Bulletin 14-A, 1939:34.

Argonaut mine — Cracker Creek District, C-2

Location: Baker County, NW¼ sec. 19, T. 8 S., R. 37 E., about 4.5 miles by road northwest of the Columbia mine.

Development: Includes about 2000 feet of drifts from two adit levels 160 feet apart vertically.

Geology: Country rocks are argillite and granodiorite, cut by premineral aplite and granodiorite porphyry dikes. Two veins mostly in argillite; one strikes N. 30° E. and dips 65° to 70° E., the other strikes N. 80° E. and dips about 60° S. Ore zones are abruptly discontinuous and range from a few inches to about 6 feet in width.

Production: Small shipments made during 1937-1941 period.

References: Lorain, 1938:23; Department Bulletin 14-A, 1939:34; Department mine files.

Bald Mountain mine — Cracker Creek District, C-3

[See Ibex mine.]

Belle of Baker — Cracker Creek District, C-4

Location: Baker County, S½ sec. 35, T. 8 S., R. 36 E., on the divide between McCully Fork and Silver Creek; a few hundred feet west of the Mammoth mine and on the same vein.

Development: Shaft 385 feet deep and about 2000 feet of drifts distributed between four levels.

Geology: Vein cuts granodiorite and locally argillite; strikes N. 45° E.; dips 70° SE.; attains maximum width of 35 feet. Splits on the southwest and pinches rapidly on the northeast and below the 100-foot level. Gangue is mainly granodiorite and argillite breccia and gouge that has been irregularly silicified. Wire gold is present in thin quartz seams and along fractures. Roscoelite is also present. Pyrite and arsenopyrite form a small percentage of the ore.

Production: Estimated at $400,000 prior to 1931. Gold largely free; average grade of ore is low.

References: Lindgren, 1901:669; Pardee and Hewett, 1914:97; Parks and Swartley, 1916:148; Hewett, 1931:321; Department Bulletin 14-A, 1939:34.

Buckeye mine — Cracker Creek District, C-5

Location: Baker County, sec. 27, T. 8 S., R. 37 E., about 2 miles northeast of Bourne on the Rock Creek-Cracker Creek divide.

Development: Seven adits with an aggregate length of about 4000 feet attain depth of 900 feet below outcrop.

Geology: Country rock is argillite. The main vein, consisting of argillite breccia cemented with quartz, strikes N. 60° to 70° E., dips 70° SE. and averages about 4 feet in width for considerable distances. Branch fissures locally contain quartz. Percentage of sulfides is low.

Production: Estimated at $6,000 to 1931.

References: Pardee and Hewett, 1914:94; Swartley, 1914:160; Parks and Swartley, 1916:204; Hewett, 1931:18 and 32; Department Bulletin 14-A, 1939:35.

Bunker Hill mine — Cracker Creek District, C-6

Location: Baker County, sec. 1, T. 9 S., R. 36 E. On southwest extension of the North Pole-Columbia lode.

Development: Poor record. Exceeds 1000 feet, including 300-foot crosscut to vein.

Geology: Vein in argillite is a quartz-replacement breccia said to be 25 feet wide locally. See description of North Pole-Columbia lode.

Production: No record.

References: Lindgren, 1901:667; Department Bulletin 14-A, 1939:36.

Climax mine — Cracker Creek District, C-7

Location: Baker County, SW$\frac{1}{4}$ sec. 32, T. 8 S., R. 37 E. On a vein that is 600 to 800 feet northwest of the Columbia and Golconda mines. The vein approximately parallels the North Pole-Columbia lode.

Development: Includes two adits, one a crosscut 550 feet long, with several hundred feet of drifts.

Geology: Similar to North Pole-Columbia lode, though the vein here is much narrower, ranging from a few feet to 10 or 12 feet in width.

Production: Small. An ore shoot 50 feet long and 100 feet deep was worked out in early days.

References: Swartley, 1914:159; Parks and Swartley, 1916:56; Hewett, 1931:17; Lorain, 1938:20; Department Bulletin 14-A, 1939: 36.

Columbia mine — Cracker Creek District, C-8

Location: Baker County, sec. 32, T. 8 S., R. 37 E. on the North Pole-Columbia lode.

Development: About 50,000 feet of drifts, crosscuts, and raises from a shaft 918 feet deep and three adits.

Geology: See general description of North Pole-Columbia lode under Cracker Creek district. On Columbia ground the lode has an average strike of N. 34° E. and dip of 86½°SE. The walls are generally well defined and are rarely less than 25 feet apart. Maximum width is about 100 feet. The ore shoots ranged from 3 to 8 feet in width.

Production: $3,638,959.60 total during 1897-1916 period, according to report by W.W. Elmer dated June 30, 1930. Bullion shipments by way of First National Bank of Baker from 1897 to 1916 totaled 112,066.51 ounces, which contained 58,062.66 fine ounces gold and $26,365.92 in silver. Total bullion value was $1,226,521.15.

When closed in 1916, the mine was equipped with a 20-stamp amalgamation and concentration mill and a 60-ton cyanidation plant. Bullion averaged 518 fine in gold. Gold 40 percent free. Ratio of concentration 10:1 to 15:1. Recovery averaged about 75 percent. Mill ore averaged $11.04 per ton. Shipping ore averaged $212.72 per ton.

References: Lindgren, 1901:659-663; Pardee and Hewett, 1914:81-94; Swartley, 1914:146-159; Parks and Swartley, 1916:59-65; Hewett, 1931: 312 to 336; Lorain, 1938:19.

Cracker-Oregon Mine — Cracker Creek District, C-9

Location: Baker County, NW¼ sec. 33, T. 8 S., R. 37 E. On a vein about 1800 feet southeast of and paralleling the North Pole-Columbia lode.

Development: About 3000 feet mostly from adit levels.

Geology: Vein in argillite similar to North Pole-Columbia lode, though narrower and less well mineralized.

Production: Small output from 10-stamp mill in early days.

References: Swartley, 1914:159; Department Bulletin 14-A, 1939:36.

E and E mine — Cracker Creek District, C-10

Location: Baker County, NE¼ sec. 32, T. 8 S., R. 37 E. on a segment of the North Pole-Columbia lode and a short distance up Cracker Creek from Bourne.

Development: A shaft 760 feet deep on the north bank of Cracker Creek and eight adits, three extending north and five south from Cracker Creek; total about 20,000 feet.

Geology: See general description of North Pole-Columbia lode under Cracker Creek district.

Production: Main periods of activity were 1891, 1894-1898, 1903-1905, and 1920-1922, according to Elmer report of 1930. Total output was $1,064,833.57. During 1894-1898, mill ore averaged $9.28 per ton. Ratio of gangue to sulfides, 25:1 to 20:1. Free gold less than 5 percent. Gold to silver ratio about 1 to 2. 100-ton flotation mill on property.

References: See Columbia mine.

Golconda mine — Cracker Creek District, C-11

Location: Baker County, SW¼ sec. 32, T. 8 S., R. 37 E. on the North Pole-Columbia lode immediately southwest of the Columbia mine. The property embraces about 3000 feet of the lode.

Development: Totals about 7000 feet, including a 510-foot underground shaft with several levels which is located near the portal of a 1300-foot adit.

Geology: The North Pole-Columbia lode is here as much as 200 feet wide. Ore has been mined from three veins which are nearly parallel in strike (N. 45° E.) but differ greatly in dip. The western and intermediate veins have not been found below the adit level. The eastern-most vein is more persistant, dipping steeply NW. in the upper levels and SE. in the lower levels.

Production: Estimated at $550,000. Main period of activity was 1897-1904. Ratio of concentration 7:1 to 15:1. Free gold 40 to 50 percent. Gold-silver ratio in bullion 720 to 220.

References: Lindgren, 1901:665; Pardee and Hewett, 1914:92; Swartley, 1914:146; Parks and Swartley, 1916:100; Hewett, 1931: 321, 339; Department Bulletin 14-A, 1939:36.

Ibex mine (including Bald Mountain mine) — Cracker Creek District, C-12

Location: Baker County, sec. 4, T. 9 S., R. 36 E., near the head of Deep Creek and McCully Fork on the John Day River divide. The Ibex and Bald Mountain are contiguous mines on the same vein.

Development: Four adits and a shaft total about 10,000 feet; lowest adit cuts vein about 1000 feet below outcrop.

Geology: Vein in argillite near contact with younger granodiorite; strikes N. 25° to 60° E., dips 60° to 80° SE.; varies from 5 to 25 feet in width. Gangue is crushed argillite cemented by quartz and a little calcite. Chief sulfides are pyrite and arsenopyrite with tetrahedrite, marcasite, and pyrargyrite present locally.

Production: Meager record. Ratio of sulfides to gangue is less than 5 percent. Ratio of gold to silver about 1:10 or less. Gold 30 percent free. Small production.

References: Lindgren, 1901:667; Pardee and Hewett, 1914:95; Swartley, 1914:144; Parks and Swartley, 1916:127; Hewett, 1931: 312 to 330; Lorain, 1938:22.

Mammoth mine — Cracker Creek District, C-13

Location: Baker County, SE¼ sec. 35, T. 8 S., R. 36 E., a few hundred feet east of the Belle of Baker mine and on the same vein.

Development: Shaft 300 feet deep with drifts.

Geology: See Belle of Baker mine.

Production: Estimated at $40,000 prior to 1931. Bullion 500 to 600 fine.

References: See Belle of Baker mine.

Mountain Belle mine — Cracker Creek District, C-14

Location: Baker County, NE¼ sec. 6, T. 9 S., R. 37 E.

Development: Shaft 300 feet deep and tunnel of unknown length.

Geology: Breccia zone in argillite, contains quartz and a little pyrite.

Production: No record.

References: Hewett, 1931: 321.

Mountain View mine — Cracker Creek District, C-15

Location: Baker County, SE¼ sec. 17, T. 8 S., R. 37 E., 4 miles north of Bourne.

Development: Two adits and a 100-foot shaft.

Geology: Vein in argillite near contact with younger granodiorite. Vein strikes N. 45° E.; dips steeply SE. and is a maximum of 4 feet wide. Filling is silicified argillite breccia and gouge cut by quartz seams.

Production: $100,000 between 1904 and 1906. Small shipments made in mid-1930's.

References: Pardee and Hewett, 1914:93; Swartley, 1914:159; Parks and Swartley, 1916:158; Lorain, 1938:23; Department Bulletin 14-A, 1939:37.

North Pole mine — Cracker Creek District, C-16

Location: Baker County, secs. 28 and 29, T. 8 S., R. 37 E. on North Pole-Columbia lode.

Development: About 13,000 feet distributed among five adits and an intermediate level.

Geology: See general description of North Pole-Columbia lode under Cracker Creek district.

Production: Total recovery 1895-1908 -- 100,045.04 fine ounces gold and 103,616.19 fine ounces silver from 158,917.40 tons of ore.

References: See Columbia mine.

Taber Fraction mine — Cracker Creek District, C-17

Location: Baker County, sec. 32, T. 8 S., R. 37 E. Property embraces 300-foot segment of North Pole-Columbia lode between the Columbia and E. & E. mines.

Development: Levels above 500 interconnect with Columbia and E. & E. workings. Lower levels worked through Columbia shaft.

Geology: See general description of North Pole-Columbia lode under Cracker Creek district.

Production: During 1903-1905, 24,910.9 tons of ore were treated at Columbia mill. Total assay value was $295,881.54 or $11.88 per ton. Total recorded output, according to the Elmer report, was $445,255.34 including shipments prior to 1903.

References: See Columbia mine.

D. GRANITE DISTRICT

Ajax mine — Granite District, D-1

Location: Grant County, E½ sec. 22, T. 8 S., R. 35½ E., in Lucas Gulch, 3 miles north of Granite.

Development: 5 short adits; longest contains 500 feet of drift on Ajax vein.

Geology: Intersecting shear zones up to 6 feet wide in argillite contain discontinuous quartz seams and lenses. A small amount of pyrite is present. Ajax vein strikes about N. 70° E. and dips 47° to 63° SE. Snowbird vein strikes about N. 10° E. and dips westerly.

Production: Five-stamp mill on property at one time. Mill record unavailable. Gold-silver ratio about 1:1. A shoot 90 feet long in Ajax vein produced $40,000 in 1905-1906.

References: Pardee and Hewett, 1914:106; Parks and Swartley, 1916:7; Hewett, 1931:320; Department Bulletin 14-B, 1941:41; Koch, 1959:13.

Blue Ribbon mine — Granite District, D-2

Location: Grant County, NE¼ sec. 14, T. 8 S., R. 35½ E., about half a mile northeast of the Buffalo mine.

Development: Two adits about 250 feet apart vertically, and 40-foot underground shaft from upper adit. There is a total of about 2000 feet of workings, attaining a depth of 190 feet below outcrop.

Geology: Two or more subparallel veins in argillite intruded by basic dikes. Veins strike about N. 60° and dip 85° SE. Width 2 feet or less. Gangue is quartz and calcite. Sulfides are chiefly pyrite with some tetrahedrite.

Production: Small.

References: Lindgren, 1901:685; Swartley, 1914:137; Parks and Swartley, 1916:36; Hewett, 1931:319,339; Department Bulletin 14-B, 1941:42-43; Koch, 1959:14.

Buffalo mine — Granite District, D-3

Location: Grant County, sec. 14, T. 8 S., R. 35½ E., about 5 miles north of Granite.

Development: About 10,000 feet of crosscuts and drifts divided among four adits; attain depth of about 650 feet below highest point on outcrop.

Geology: Five roughly parallel veins mostly in argillite but partly in granodiorite. Four have been productive. The veins are 80 to 220 feet apart. They are from 1 to 6 feet wide, averaging about 20 inches. Strike N. 15° to 30° E., dip 60° to 80° W. Gangue is mainly quartz, calcite, and altered country rock containing pyrite, arsenopyrite, chalcopyrite, galena, sphalerite, tetrahedrite, and rare ruby silver. Gold rarely visible.

Production: Bulk sulfide flotation. Concentration ratio 8:1 to 10:1. Silver to gold ratio averages about 7.5:1. Recorded output from 1903 to 1965 was 33,142 ounces gold and 252,893 ounces silver from 42,246 tons of ore. The 1880-1903 output unknown.

References: Lindgren, 1901:685; Swartley, 1914:137; Pardee and Hewett, 1914:106; Parks and Swartley, 1916:46; Hewett, 1931:312 to 346; Department Bulletin 14-B, 1941:43-45; Koch, 1959:15-25.

Continental mine — Granite District, D-4

Location: Grant County, sec. 12, T. 8 S., R. 35½ E., about 8 miles by road northeast of Granite.

Development: Four short adits and several cuts. Longest adit contains about 900 feet of crosscuts and drifts.

Geology: Several short veins and mineralized fracture zones in quartz-mica schist derived from thermal alteration of argillite. Pegmatites numerous. Strike of veins is within a few degrees of east. Dips average about 45° S. Gangue is quartz. Sulfides are chiefly pyrite with minor amounts of arsenopyrite, sphalerite, and galena.

Production: About $50,000 said to have been produced from high-grade ore about 1915.

References: Department Bulletin 14-B, 1941:46-47; Koch, 1959:27-29.

Cougar mine — Granite District, D-5

Location: Grant County, NW¼ sec. 27, T. 8 S., R. 35½ E., about 3 miles north of Granite.

Development: Four drift adits and 270-foot underground shaft with two connecting levels; total about 5000 feet of drifts and 2000 feet of raises. Vertical extent of workings about 440 feet.

Geology: Vein in argillite varies from a few inches to 9 feet in width; traced for about

2000 feet; strikes N. 43° to 50° E., dips 70° to 83° SE. Filling is largely argillite breccia, partly recemented by quartz and locally dolomite. Pre-mineral dikes are numerous, some being cut by the vein. Chief sulfides are pyrite and arsenopyrite. Ore shoots averaged 3 to 4 feet thick.

Production: 1938 to 1942 - 19,126.24 ounces gold and 10,976.30 ounces silver from roughly 51,500 tons of ore. Bulk flotation; sulfide concentration ratio 10:1. Little free gold. Ratio of gold to silver about 1.7:1.

References: Lindgren, 1901:683; Swartley, 1914:135; Pardee and Hewett, 1914:103-104; Parks and Swartley, 1916:81-82; Department Bulletin 14-B, 1941:47-51; Koch, 1959:30-35.

Independence mine — Granite District, D-6

Location: Grant County, sec. 22, T. 8 S., R. 35½ E., about 3½ miles north of Granite.

Development: 1100-foot crosscut adit and three drift levels totaling about 2500 feet explore vein to depth of 350 feet below outcrop.

Geology: Vein in argillite. Numerous light-colored dikes 2 to 4 feet wide. Vein strikes N. 50° E., dips 65° SE. Filling 3 to 6 feet wide is argillite breccia and gouge, cemented by dolomite and quartz. Sulfides mainly pyrite and arsenopyrite, with minor chalcopyrite and sphalerite; oxidized in the upper levels where manganese stains are abundant.

Production: Sporadic output from 1907 to 1940 totals 3,202.19 ounces gold, 14,582 ounces silver, and 4,724 pounds copper from about 9,500 tons of ore.

References: Swartley, 1914:135-136; Pardee and Hewett, 1914:104-105; Parks and Swartley, 1916:129; Department Bulletin 14-B, 1941:47-51; Koch, 1959:30-35.

La Belleview mine — Granite District, D-7

Location: Grant County, secs. 6 and 7, T. 8 S., R. 36 E. on Onion Creek about 10 miles by road northeast of Granite.

Development: 4 adits; total about 6000 feet of drifts and crosscuts reaching 500 feet below outcrop.

Geology: Vein in quartz-biotite gneiss, and granodiorite; varies from a few inches to 4 feet thick; strikes N. 35° to 45° E., dips 65° to 70° NW. Vein comprised mainly of crushed rock with seams and lenses of quartz and containing pyrite, arsenopyrite, galena, chalcopyrite, and silver-bearing tetrahedrite. Silver sulfides and native silver are rare.

Production: Estimated at about $500,000. Work began in 1878. 1939-1941 operations utilized 50-tons-per-day flotation plant. Ore runs 15 to 20 percent sulfides. Silver-to-gold ratio about 50:1.

References: Lindgren, 1901:685; Swartley, 1914:138; Pardee and Hewett, 1914:109; Parks and Swartley, 1916:137; Hewett, 1931:311 to 336; Lorain, 1938:18; Department Bulletin 14-B, 1941:53-55.

Magnolia mine — Granite District, D-8

Location: Grant County, NE¼ sec. 22, T. 8 S., R. 35½ E., in Lucas Gulch about 3½ miles north of Granite.

Development: Three adits, lowest and longest about 1000 feet; attains 280 feet below outcrop.

Geology: Quartz lenses and stringers in zone of crushed and locally silicified argillite. Vein zone said to average 4½ feet, strike N. 60° E., dip 70° SE. Sulfides are pyrite, marcasite, and arsenopyrite. Three stopes; longest 205 feet with average width of 4 feet.

Production: Ten-stamp mill erected in 1899; ore averaged less than $10 per ton. Gold 15 to 20 percent free. Small production.

References: Lindgren, 1901:684; Pardee and Hewett, 1914:105; Swartley, 1914:136; Parks and Swartley, 1916:148; Hewett, 1931: 312-320; Koch, 1959:35-36; Department Bulletin 14-B, 1941:55.

Monumental mine — Granite District, D-9

Location: Grant County, secs. 18 and 19, T. 8 S., R. 36 E., about 2 miles by road east of the Buffalo mine.

Development: Two tunnels, a shaft, and several raises total about 4000 feet, reach 700 feet below outcrop.

Geology: Twelve narrow veins in granodiorite. Strike N. to N. 20 E.; dip 65° NW. Most of the work done on four. Gangue is crushed granodiorite, with quartz stringers and lenses and later calcite. Sulfides are arsenopyrite, pyrite, galena, tetrahedrite, pyrargyrite. Ore lenses mined are a maximum of 18 inches wide and stope lengths are less than 100 feet.

Production: Mine located in 1870. Ore shipped to San Francisco in 1874. Total output estimated at $100,000 to 1928. Gold-to-silver ratio 1:20.

References: Lindgren, 1901:685; Swartley, 1914:139; Pardee and Hewett, 1914:108; Parks and Swartley, 1916:154; Hewett, 1931:314 to 340; Lorain, 1938:18; Department Bulletin 14-B, 1941:56-57.

New York mine — Granite District, D-10

Location: Grant County, NE¼ sec. 27, T. 8 S., R. 35½ E., opposite old Cougar-Independence Camp, 2½ miles north of Granite.

Development: Five adits; about 900 feet total.

Geology: Two veins, 3 to 7 feet wide, consisting of silicified argillite breccia and gouge.

One strikes about N. 30° E., and dips 70° E. to vertical; the other is nearly vertical and stikes N. 40° W. Ore oxidized. Pyrite encountered at face of lower adit 150 feet below outcrop.

Production: Most of the development work done between 1937 and 1941. Ore cyanided. More than 1000 tons treated. Millheads averaged $8.00 per ton.

References: Department Bulletin 14-B, 1941: 57-58; Koch, 1959:36-37.

Standard mine — Granite District, D-11

Location: Grant County, SW¼ sec. 12, T. 8 S., R. 35½ E., on the divide between Crane and Onion Creeks; about 8 miles by road northeast of Granite and a quarter of a mile south of Continental mine.

Development: 400-foot adit and shallow shaft.

Geology: Two quartz- and gouge-filled fissure zones in granodiorite and quartz-mica schist. One about 8 inches wide strikes NE.; the other, up to 6 feet wide, strikes E. Values best at intersection. Sulfides mostly pyrite and arsenopyrite with some galena.

Production: No record.

References: Department Bulletin 14-B, 1941: 64; Koch, 1959:37.

Tillicum mine — Granite District, D-12

Location: Grant County, NE¼ sec. 23, T. 8 S., R. 35½ E., on the north side of Granite Creek 3½ miles north of Granite.

Development: Two short adits 50 feet apart vertically.

Geology: Two parallel veins 40 to 50 feet apart in granodiorite. Strike N. 30° E., dip 50° SW. Ore consists of quartz-impregnated limonitic gouge. Gold is largely free.

Production: No records.

References: Department Bulletin 14-B, 1941:64-65; Koch, 1959:38.

E. ROCK CREEK DISTRICT

Baisley-Elkhorn mine — Rock Creek District, E-1

Location: Baker County, secs. 20 to 21, T. 8 S., R. 38 E., near the head of Pine Creek, about 15 miles from Baker.

Development: About 10,000 feet. Mining in early days was done chiefly through a 626-foot

crosscut adit and a 400-foot underground shaft. Later work includes a 2300-foot crosscut adit and long drift about 950 feet below the outcrop.

Geology: Nearly vertical vein in granodiorite and argillite. Strikes N. 40° E. and is traceable for 1800 feet. The ore shoots ranged from 2 to 10 feet wide, mostly in granodiorite. Ore consisted of crushed granodiorite containing coarse sulfides and occasional streaks of quartz. Sulfides in order of abundance: pyrite, sphalerite, galena, and chalcopyrite with a little ruby silver.

Production: Estimated at $950,000, mostly between 1890 and 1907. Ratio of concentration, 5:1 to 7:1. Gold 20 to 25 percent free. 1898-1900 recovery averaged $12.30 from 26,095 tons of mill ore and $45.03 per ton from 472 tons of shipping ore. The value for 1905 and 1907 was $7 and $5 respectively.

References: Lindgren, 1901:646; Pardee and Hewett, 1914:74; Swartley, 1914:161; Parks and Swartley, 1916:20; Hewett, 1931: 312-317; Lorain, 1938:25; Department Bulletin 14-A, 1939:85.

Chloride mine — Rock Creek District, E-2

Location: Baker County, NW¼ sec. 24, T. 8 S., R. 37 E.

Development: Poor record. Includes 3 adits with several hundred feet of drifts.

Geology: Vein in argillite near granodiorite contact. Strike N. 45° to 50° E.; dip 55° to 75° S. Ore contains galena, sphalerite, arsenopyrite, pyrite, chalcopyrite, and argentite.

Production: No record; some milling done in early days.

References: Lindgren, 1901:648; Department Bulletin 14-A, 1939:86.

Cub mine — Rock Creek District, E-3

Location: Baker County, sec. 14, T. 8 S., R. 38 E.

Development: No record.

Geology: Vein in granodiorite 6 inches to 2½ feet thick consists of crushed and sericitized granodiorite, with kidneys and streaks of quartz and sulfides. Strike N. 22° E.; dip 55° W. High-grade gold assays reported.

Production: No record.

References: Department Bulletin 14-A, 1939:86.

Highland and Maxwell mines — Rock Creek District, E-4,5

Location: Baker County, secs. 19 and 20, T. 8 S., R. 38 E., on the east fork of Rock Creek. The two mines are contiguous properties on the same vein.

Development: About 15,000 feet distributed among numerous adits and a shaft below the lowest level. Vertical range is about 2000 feet.

Geology: Vein mostly in argillite near contact with granodiorite. Strike N. 75° to 55° E.; dip nearly vertical. Vein described as incoherent mass of crushed and generally silicified argillite, clay, quartz, calcite, and ore minerals: pyrite, sphalerite, galena arsenopyrite, chalcopyrite, and tetrahedrite. Walls well defined and locally as much as 28 feet apart. Ore shoots were seldom more than 3 feet thick, and varied from less than 100 to more than 1000 feet long. Largest shoots found in lower levels.

Production: Estimated at $625,000; operated 1900-1905, 1909-1914, and 1936-1938. Ratio of sulfide concentration -- 4.5:1 to 7.5:1. Smelter returns averaged $12.30 per ton of ore. Gold-silver ratio about 1:10.

References: Lindgren, 1901:648; Swartley, 1914:161; Pardee and Hewett, 1914:77; Parks and Swartley, 1916:121, 150; Hewett, 1931: 314 to 319; Lorain, 1938:24; Department Bulletin 14-A, 1939:87.

Western Union mine

Rock Creek District, E-6

Location: Baker County, sec. 21, T. 8 S., R. 37 E., near the head of Rock Creek, 2 miles above Chloride mine.

Development: About 2000 feet of tunnels.

Geology: Country rocks are argillite and granodiorite. Vein strikes northeast.

Production: No record. Property located in 1887.

References: Department Bulletin 14-A, 1939:90.

WALLOWA MOUNTAINS AREA

Location and Geography

This area includes the high Wallowa Mountains and the adjoining foothills south and southeast of the range (figure 22). The region lies in the northeastern part of Baker County, the southwestern part of Wallowa County, and the southeastern part of Union County. Gold production from the region has come almost entirely from deposits on the south slope and adjoining foothills of the range, but a few prospects occur high in the mountains. Mining districts in the order described are: Cornucopia, Eagle Creek, Homestead, Medical Springs, and Sparta.

The Wallowa Mountains, which present some of the most scenically rugged terrain in eastern Oregon, are a northwest-trending, arched uplift about 50 miles long and about 20 miles wide. Many peaks and ridges in the central and northern parts of the range are more than 8000 feet in elevation. The Matterhorn, 9845 feet above sea level, is the highest peak in the eastern part of the state. Local relief exceeds 4000 feet. The foothills south and southeast of the range comprise a dissected plateau whose surface is characterized by rolling hills and bench lands cut by steep-sided gulches. The region is bordered on the south by Powder River, which flows easterly to Snake River following a winding course through an area of low relief. Eagle Creek, with several branches heading in the high reaches of the Wallowa range, flows generally southeastward entering Powder River at Richland. Pine Creek, whose upper tributaries drain the southeastern part of the range, enters Snake River at Oxbow.

Geology

General features

The Wallowa range is composed mainly of granitic rocks of the Wallowa batholith, a composite intrusive of Late Jurassic-Early Cretaceous age. Older rocks exposed in the range and along its flanks comprise volcanic, sedimentary, and plutonic rocks of Permian, Triassic, and Early Jurassic age. These older rocks have been regionally metamorphosed to the greenschist facies. Within one mile of the batholith they are generally altered to schists and hornfels.

The granitic rocks of the Wallowa batholith were deroofed and in places deeply dissected during Cretaceous and early Tertiary time, after which most, possibly all, of the area was buried under flow upon flow of Columbia River Basalt. The range was subsequently uplifted and most of the lava has since been stripped, but evidence of its former presence is seen in the remnants of nearly flat-lying flows perched on some of the highest peaks and ridges and the multitude of basalt dikes which intrude the granitic and older rocks. Removal of the lava was accelerated by vigorous Pleistocene glaciation, of which there is much evidence. Uplift of the Wallowa Mountains during the Pliocene was greatly accentuated by major faults on the north, south, and east (Taubeneck, 1963). The northern scarp in the vicinity of Enterprise is particularly impressive, being locally more than 4000 feet high.

The foothill belt south and southeast of the range is underlain chiefly by Tertiary basalt and by lake and stream deposits; rocks older than the Wallowa batholith are exposed in irregularly shaped areas where erosion has stripped the Tertiary cover. The Tertiary rocks dip generally southward and thus reflect the uplift of the Wallowa range. South of Powder River the Tertiary rocks dip to the north. Lower Powder River, therefore, roughly follows the axis of a syncline.

Pre-Tertiary sedimentary and volcanic rocks

Greenstones and associated sedimentary rocks: The oldest strata comprise a heterogeneous assemblage of altered lavas, pyroclastics, and coarse-to-fine-grained clastic sedimentary rocks consisting largely of volcanic detritus. Greenstones and tuffs predominate, but conglomerate, breccia, sandstone, shale, mudstone, and argillite layers locally attain considerable thicknesses and collectively make up a large part of the assemblage. Small limestone lenses are common. These rocks are partly Permian and partly Late Triassic in age but, because both sequences contain similar rocks and fossils are scarce, stratigraphic boundaries have been recognized only locally. Exposures of these rocks in the northeastern part of the Baker quadrangle were named the Clover Creek Greenstone by Gilluly (1937). In Idaho, equivalent rocks along Snake River and in the Seven Devils Mountains have been called the Seven Devils Volcanics.

Martin Bridge Formation: Comformable above the Upper Triassic part of the greenstone sequence is the Martin Bridge Formation, a lithologically distinctive series of thin-bedded to locally massive limestones and calcareous shales of widespread exposure in the Wallowa Mountains. Some of the best and most readily accessible exposures are along Eagle, East Eagle, and Paddy Creeks in the northern part of the Sparta quadrangle (Prostka, 1962). Because of strong folding over much of its extent, the thickness of the formation is not accurately known. Estimates range from 1000 to 2000 feet for different areas. Fossils of Karnian (Upper Triassic) age are locally abundant.

Hurwal Formation: The Hurwal Formation, which rests conformably on the Martin Bridge, is a sequence of gray, purplish, and black argillite, laminated siltstone, sandstone, and shale with minor limestone, conglomerate, and chert. The top of the formation has not been recognized, but a partial section in the Sparta quadrangle was estimated to be 4000 feet thick. Nolf (1967) found Lower Jurassic fossils in the upper part of the formation in the northern Wallowas.

Plutonic rocks

Exposures of Lower Triassic plutonic rocks are widespread in the southern foothills of the Wallowa Mountains, particularly in the Sparta quadrangle (Prostka, 1962). Albite granite and gabbro are the most prevalent representatives of the complex. Quartz diorite, peridotite, and serpentine are found locally. Contacts between the various rock types are transitional. In places Upper Triassic conglomerate and greenstones have been deposited directly upon eroded surfaces of these Lower Triassic plutonic rocks.

Granitic rocks of the Wallowa batholith of Late Jurassic-Early Cretaceous age are exposed over an area of about 225 square miles in the Wallowa Mountains. According to Taubeneck (1964, p. 1064), "The batholith...contains at least five small gabbroic units, four large zoned intrusions of tonalite-granodiorite and many small felsic bodies that include a sequence of unique cordierite trondhjemites and cordierite trondhjemite porphyries."

Satellitic bodies are numerous. Largest among them is the Cornucopia stock, which Taubeneck describes in the report cited above. The Cornucopia stock, 3 to 9 miles southeast of the parent batholith, is cut by the gold-quartz veins of the Cornucopia district.

Mineralization

According to their mode of occurrence, the gold deposits of the Wallowa Mountains area may be divided roughly into three classes--contact metamorphic deposits, replacement deposits, and fissure veins.

The contact metamorphic deposits contain copper, tungsten, and molybdenum minerals with small amounts of gold and silver. Known deposits of this type are found in the high central and northern parts of the range. Most are within the Eagle Cap Wilderness Area, where access is difficult and use of mechanized equipment is prohibited. The deposits occupy zones of thermal alteration along the contacts between granitic rocks and calcareous sediments into which the granitic rocks were intruded. Such zones are characteristically rich in epidote, garnet, calcite, and quartz. Metallic minerals present locally include magnetite, pyrite, chalcopyrite, galena, sphalerite, molybdenite, scheelite, hematite, and

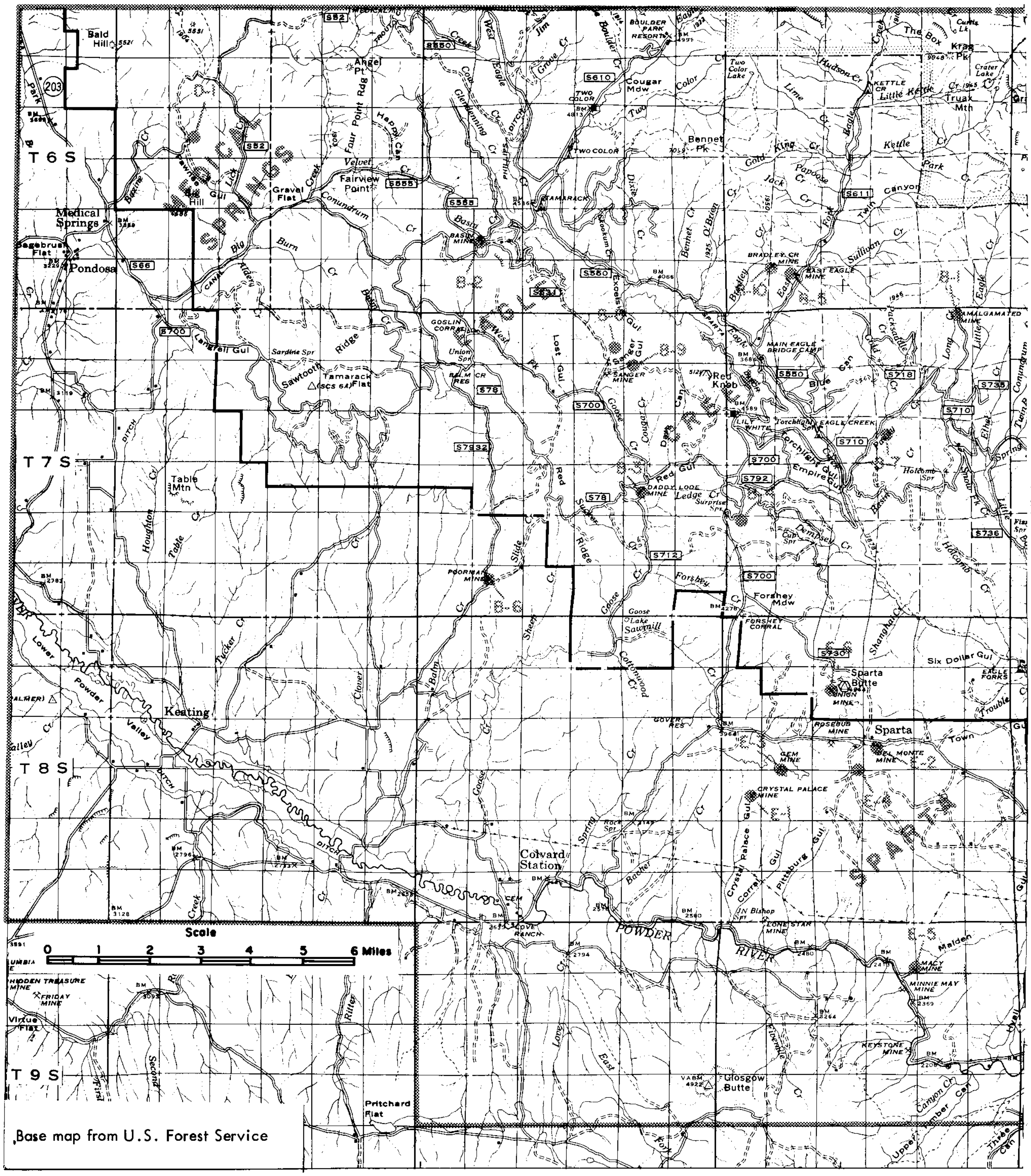
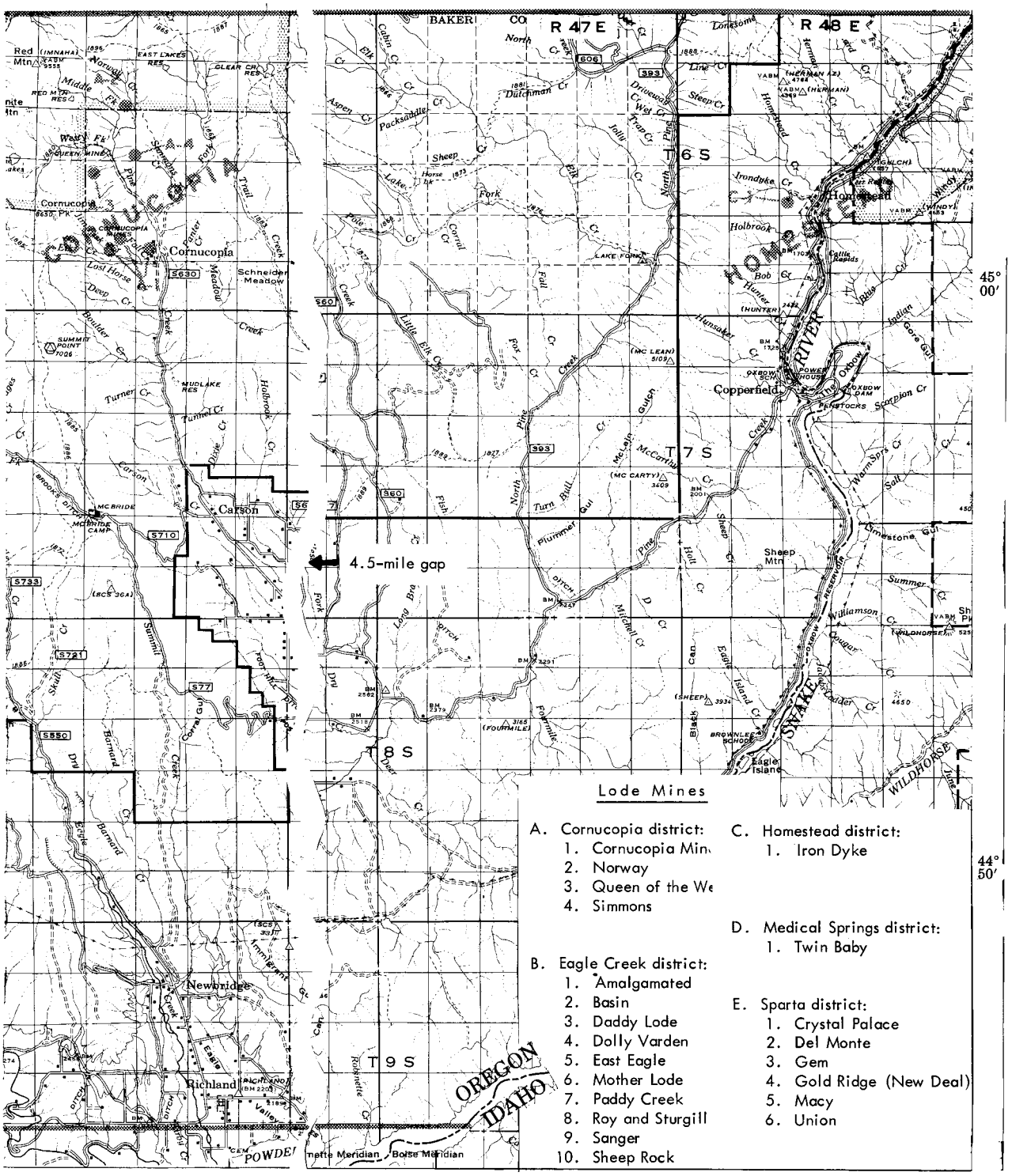


Figure 22. Index map of the Wallowa Mountains area.



Lode Mines

A. Cornucopia district:
1. Cornucopia Min
2. Norway
3. Queen of the We
4. Simmons

B. Eagle Creek district:
1. Amalgamated
2. Basin
3. Daddy Lode
4. Dolly Varden
5. East Eagle
6. Mother Lode
7. Paddy Creek
8. Roy and Sturgill
9. Sanger
10. Sheep Rock

C. Homestead district:
1. Iron Dyke

D. Medical Springs district:
1. Twin Baby

E. Sparta district:
1. Crystal Palace
2. Del Monte
3. Gem
4. Gold Ridge (New Deal)
5. Macy
6. Union

pyrrhotite. Gold and silver are rarely present in more than trace amounts. The several metalized contact zones range from a few inches to about 20 feet in width (Oregon Dept. Geology and Mineral Industries, 1939, p. 113-120). Proven metallic mineral concentrations are of limited extent. These deposits are little developed and are not further described here.

The replacement deposits which contain copper minerals and associated gold are widespread in the southern foothills of the Wallowa Mountains and along the Snake River to the east. The deposits occur as irregular replacement bodies in and along the edges of faults and shear zones in greenstones and related volcaniclastic sedimentary rocks. The gold and silver values appear to be independent of the copper content. The mineralized bodies are abruptly discontinuous and difficult to outline. None, so far as known, are amenable to open-pit mining. Many of the occurrences were known before 1900. Of the replacement-type deposits, only the Iron Dyke mine in the Homestead district and the Mother Lode mine in the Eagle Creek district have yielded significant production.

The fissure-vein deposits account for the bulk of gold output from the Wallowa Mountains region. The most productive deposits have been the narrow, steeply dipping quartz veins of the Cornucopia district. These cut granitic rocks of the Cornucopia stock, an offshoot of the Wallowa batholith. In the Eagle Creek district there are a number of gold-quartz veins in sandstones and shales of the Hurwal Formation. Most notable are those of the old Sanger mine. The East Eagle mine and a few other prospects develop copper- and gold-bearing fissure veins in old greenstones and volcaniclastic rocks. The deposits in the Sparta district occupy narrow, discontinuous quartz-filled fractures in Lower Triassic albite granite and diorite.

Production

Combined estimates of production from lode mines in the Wallowa Mountains area total more than $12,500,000, of which $10,000,000 was produced by the Cornucopia mines north of Halfway. The remainder was produced chiefly by the Sanger mine in the Eagle Creek district and the Iron Dyke mine in the Homestead district. Lesser producers include the Mother Lode and Basin mines in the Eagle Creek district and the Macy and Gem mines in the Sparta district.

Placer Mines

Few records exist upon which to base estimates of placer output from the Wallowa Mountains area. Considerable placer mining has been done in the vicinity of Sparta and the Sanger mine, along Eagle Creek and some of its tributaries, and along Pine Creek below Cornucopia.

Sparta

Near Sparta several gulches have been placered and in parts of the area the soil and decomposed granite on the dividing ridges contained placer gold. Among the better placers were those of Shanghai and Town Gulches, which drain north and east into Eagle Creek, and Pittsburg and Maiden Gulches, which drain southward into Powder River. During the few years immediately following completion of the 22-mile-long Sparta Ditch from West Eagle Creek in 1873, a good deal of placer mining was done in the Sparta area.

Sanger

The area in the vicinity of the Sanger mine constituted the old placer camp of Hog'em, and from the gulches leading up to the mine the sum of $500,000 is reported to have been extracted (Lindgren, 1901, p. 738-739). Fir Gulch below the Sanger mine is said to have been one of the richest placers in the district.

Eagle Creek

All along Eagle Creek there are benches of heavy gravels as high as 100 feet above present stream level. These benches have been placered to some degree from a point below the mouth of Paddy Creek to a few miles upstream above the mouth of East Eagle Creek. Parts of both Paddy and East Eagle Creeks have also been worked to some extent.

Pine Creek

Placer yield from Pine Creek below Cornucopia is unknown, but it probably was not large because of the excessive amount of large boulders in the gravels and their thickness, which is said to be 60 feet. Attempts to sink shafts through the gravels to bedrock have been hampered by water. The canyon is too narrow, the boulders too large, and the values too deep for dredging.

Cornucopia District

General information

The Cornucopia district is situated near the head of Pine Creek in northeastern Baker County (figure 22). The nearly deserted mining camp of Cornucopia on Pine Creek 12 miles north of Halfway is in the south-central part of the district. The workings of numerous mines and prospects are scattered along both slopes of the creek within 4 miles of the old camp site. The area is very rugged topographically. Elevations range from about 4700 feet at Cornucopia townsite to 8650 feet at the top of Cornucopia Peak about 2 miles to the west.

The gold deposits of this district lie within and along the irregular southeastern edge of the Cornucopia stock, a small offshoot of the Wallowa batholith. Country rocks are mainly hornblende-biotite schist and hornfels derived from thermal metamorphism of graywackes, shales, conglomerates, and greenstones. The greenstones are well exposed on Simmons Mountain northeast of Cornucopia. A description of the Cornucopia stock and country rocks in the thermal aureole is presented by Taubeneck (1964). Goodspeed (1939 and 1956) discusses the geology of the Cornucopia district and suggests that the stock was emplaced as a result of static granitization.

Estimates of the value of production range from $10,000,000 to about $18,000,000 in gold and byproduct silver, copper, and lead. The latter figure is probably excessive. Mining operations, which began about 1880, have been periodic. In 1930 Cornucopia Gold Mines Co. acquired the important mines and worked them collectively from 1933 through October 1941. Since that time little mining has been done in the district. Regarding production, Swartley (1914, p. 22) states: "According to Bernard MacDonald's report upon the property, the Union-Companion, Red Jacket, and Last Chance claims produced $1,008,000 previous to 1903." Recorded production since 1903 amounts to 272,776.64 ounces gold and 1,088,051 ounces silver recovered from 983,927 tons of ore. Gross content of copper in ores produced during 1933-1941 was 671,778 pounds and of lead 121,983 pounds.

Principal lode mines

Cornucopia mines group: The most important veins crop out 1 to 2 miles northwest and 1000 to 3000 feet above Cornucopia on the west side of Pine Creek. From east to west these are the Whitman, Union-Companion, Last Chance, Wallingford, and Valley View veins. The veins are from 1500 to 2500 feet apart, strike N. 20° to 40° E., and dip about 45° W. The bulk of production from the district is credited to the Union-Companion and Last Chance veins. The Union-Companion, the more extensively developed of the two, is a maximum of 2500 feet horizontally east of the Last Chance and it crops out roughly 1000 feet lower on the mountainside. The Union Companion vein is said to be traceable on the surface for 6800 feet.

About 36 miles of underground work has been done. The principal access during the last few years of operation was the Coulter tunnel (portal elevation 4805 feet) which was driven in 1936. This adit enters the mountain at the north edge of Cornucopia, trends N. 60° W., and crosscuts the Union-Companion vein about 6200 feet from its portal. Ore was treated in a 150-ton flotation plant erected in 1936 at the portal of the Coulter tunnel. About 4700 feet nearly due west and 985 feet in elevation above Coulter tunnel portal is the Clark tunnel, a long crosscut which taps both the Union-Companion and Last Chance veins. This tunnel continues in a northwesterly direction and taps the Wallingford and other small veins. During the early days, the upper part of the Last Chance vein was worked mainly through the Lawrence tunnel at 6910 feet elevation and 4100 feet north and a little west of the Clark tunnel portal. Several other adits cut either the Union-Companion or Last Chance veins, but development has progressed mainly from the three mentioned. Mine maps (plate 1, in pocket) are cross-sectional views of the workings and stopes on the Union-Companion and Last Chance veins. Figure 23 is a photograph of the Union-Companion mill built in 1913 at the portal of the Clark tunnel.

The veins are partly in granodiorite of the Cornucopia stock and partly in the older hornfels and schist. Dikes of granodiorite porphyry, aplite, and Tertiary basalt are numerous. Basalt dikes cut the veins, often causing offsets of several feet. In places the veins are split by aplite dikes.

The veins consist mainly of quartz with intermixed streaks of wall rock that, in general, has been thoroughly crushed and altered. Two stages of quarts are recognized. The first was probably introduced shortly after the fracturing and was contemporaneous with the alteration of the wall rocks; it contains no values. After the original quartz was deposited the vein was sheared and fractured, thus providing openings for the second stage of quartz deposition; this contains the ore values. The original quartz had deposited with it quite coarse pyrite, some of which was later fractured; second-stage quartz and ore minerals were then deposited in the fractures. Microbrecciation of the later quartz provides a key for mine development.

Scattered sulfides make up, on the average, less than 5 percent of the ore and contain the bulk of the gold values. They consist chiefly of pyrite, with smaller quantities of arsenopyrite, chalcopyrite, galena, and sphalerite. Ordinarily the richness of the ore was in direct proportion to the amount of copper minerals contained.

At the surface the ore contained free gold and small amounts of petzite and hessite. The ore was generally oxidized to a depth of about 300 feet, with local oxidation extending down as much as 2000 feet below the outcrop.

According to H. F. Anderson (written communication, 1965) who was staff geologist at Cornucopia during 1939-1940, "The ore shoots of both the Union-Companion and Last Chance veins were abruptly localized by structural controls, and comprised in the aggregate less than 25 percent of the total planar area of the vein systems. The tenor of the shoots commonly changed markedly in grade within a few feet from high-grade ore containing an ounce or more gold to the ton to barren vein material consisting of early-stage quartz and non-auriferous pyrite. Mining costs were above average, due to the excessive amount of development work required to explore and mine the localized shoots.

"The Union-Companion vein looked healthy and showed no diminution of structural strength where exposed by drifting on the Coulter tunnel level. Average stoping width ranged from 4 to 9 feet in the different ore shoots. Where last developed by drifts on the Clark tunnel level the Last Chance vein appeared less impressive than in upper levels. Stoping widths averaged 3 to 7 feet."

During 1938-1941, the last 4 years of operation, 156,388 tons of ore were concentrated by bulk flotation and 36 tons of crude ore were shipped directly to smelters. The 7170 tons of concentrates plus the 36 tons of crude ore contained 75,268 ounces of gold, 343,626 ounces of silver, 356,781 pounds of copper, and 82,563 pounds of lead. Thus the ore before treatment contained, in recoverable metals, approximately 0.48 ounces gold, 2.2 ounces silver, 0.1 percent copper, and 0.025 percent lead. The ratio of sulfide concentration was about 20 to 1.

Queen of the West mine: This mine is located high on the west side of Pine Creek about 3 miles northwest of Cornucopia and a little less than a mile north of, and on the opposite side of Bonanza Basin from, the Lawrence tunnel portal. Parks and Swartley (1916, p. 186) state: "The vein has the usual strike of N. 20° E. and a dip near the surface of about 45° but at depth this decreases to about 30°. The average width of the vein near the surface is between 3 and 4 feet, but generally speaking it decreases in

width with the decrease in dip.

"The gangue minerals are quartz and calcite containing pyrite, chalcopyrite, galena, and sphalerite in bunches. It is said that the zinc, lead, and copper minerals carry most of the gold values. In many places the vein shows included fragments of altered granodiorite, and the granodiorite on each side of the vein for about 2 feet is badly altered and impregnated with pyrite which is said to contain some values in gold and silver. This vein can be traced for a long distance, reported to be as much as 3000 feet."

Simmons mine: The Simmons mine vein, which has yielded a relatively small production, is exposed near the top of Simmons Mountain on the east side of Pine Creek and about $2\frac{1}{2}$ miles north of Cornucopia. The country rocks are mostly greenstones. The vein strikes N. 30° W., dips gently eastward, and is traceable for about 2000 feet. In 1941 a lessee shipped 1046 tons of ore from the Simmons for treatment at the Cornucopia mill; concentrates recovered contained 264 ounces gold and 1840 ounces silver.

Eagle Creek District

General information

This district includes the upper drainage of Eagle Creek and the adjoining area on the Powder River slope northeast of Keating that is drained by Clover, Balm, and Goose Creeks (figure 22). Roads enter the district from Sparta, Keating, and Medical Springs. Elevations at the mines range from 3500 to 7000 feet. Most of the area is timbered and there are several permanent streams.

Pre-Tertiary rocks exposed in the district include greenstones, tuffs, and related volcaniclastic sedimentary rocks of the Clover Creek Greenstone; limestone of the Martin Bridge Formation; and sandstones, mudstones, and shales of the Hurwal Formation. Granitic rocks of the Wallowa batholith underlie the northern part of the area. A large part of the district is blanketed by Tertiary basalt. The Sparta quadrangle geologic map (Prostka, 1963) covers most of the district.

Lode-gold production from the Eagle Creek district is dominated by the Sanger mine, whose output has been estimated at $1,500,000. The Mother Lode copper mine produced a limited amount of gold during 1935-1938. Production from other lode deposits in the Eagle Creek district has been small. Some of the better known prospects are the Basin, East Eagle, Amalgamated, Lilly White, and Dolly Varden.

Principal lode mines

Sanger mine: This old mine is located on a branch of Goose Creek near the top of the Powder River-Eagle Creek divide. The following description of the deposit is taken from Lindgren (1901, p. 738-739) and a Department mine-file report compiled in the early 1900's by Charles P. Berkey.

The principal vein, called the Summit lode, was discovered in 1870, and was actively worked during the following years. In 1874 the production was $60,000 from ore containing $16 to the ton. The total production to 1887 is unknown, though probably small, but a mill was then built, and in 1889 production began to increase rapidly. The Mint reports for the 4 years 1889-1892 give $813,000 as the production of the mine. Production ceased in 1897. Total output is estimated at about $1,500,000.

The rocks at the Sanger mine are dark-colored, medium-to-fine-grained mudstones and shales of the Upper Triassic Hurwal Formation. The rocks are pyritic near the veins. The Summit vein strikes nearly due east, dips 30° N. and has been worked to a depth of 400 feet on the dip from several adits and an inclined shaft. An old map dated January 1, 1901 seems to indicate that drifting was done on at least two other veins or fault zones, one paralleling the summit vein and the other crossing it at nearly right angles. The ore shoot in the upper stopes of the Summit vein was 600 feet long, about 15 inches wide and averaged $20 to $25 a ton in gold; below the zone of oxidation the vein widened to 2 to 4 feet and the value dropped to $12 a ton. The gangue is coarse quartz with a little calcite and about 3 percent sulfides, consisting mostly of pyrite with a little sphalerite and galena. Much of the gold was free. In its easterly extension on all levels the vein bends in a broad curve to the south and appears to blend with the strike of

Figure 23. Union-Companion mill, Cornucopia district. Built at the portal of Clark tunnel in 1913.

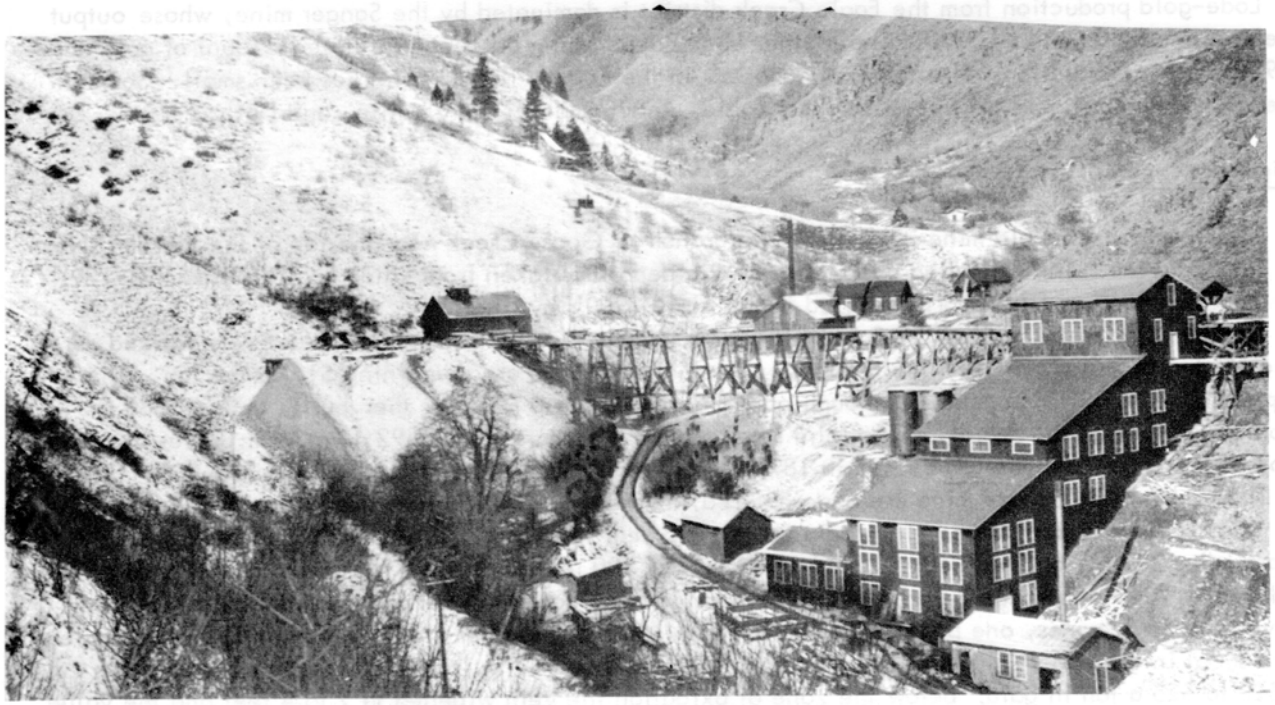


Figure 24. Iron Dyke copper mine at Homestead, Baker County, prior to 1914.

the host rocks, losing its characteristic size and value. Toward the west the vein has been offset by faulting, at which point mining ceased. Other veins on the property include the Packwood, Golden Eagle, and Knight. The Big Vein at the head of Fir Gulch may have been the source of the rich placers on Fir Gulch.

Mother Lode mine: The Mother Lode mine, which consolidates the old Balm Creek and Poorman workings, is located on Balm Creek about 8 miles by road northeast of Keating. Development, which began prior to 1900, led to the construction of a 100-ton flotation plant and the production of 8,108.8 ounces of gold and 1,047,015 pounds of copper between June 1935 and January 1, 1938. Yield in 1937 amounted to 3517 ounces of gold, 1665 ounces of silver, and 520,000 pounds of copper from 20,380 tons of ore. Mining ceased in December 1938 and there has been no further production. Sporadic promotion and exploration have continued to the present time.

Development comprises more than 15,000 feet of drifts, crosscuts, shafts, and raises. Principal access includes two shafts, one 700 and the other 420 feet deep; and three adits. Rocks cut by the workings are almost exclusively greenstones which have been sheared and hydrothermally altered. Gilluly (1931, plates 2 and 3) indicates that the rocks are cut by a great number of small faults and fractures, the majority of which strike west-northwest and dip southwest. He states (p. 26-28): "The mineralized masses appear, in general, to be elongated a little north of west, roughly parallel to the strike of the formation and the most prominent fractures, but in detail they are exceedingly irregular....the distribution of the metals is very irregular. Little copper is present on the upper levels, what was formerly there having been leached out. However, oxidation has not seriously affected the minerals at lower levels, and here too the distribution of gold and copper is erratic. Most of the material is highly silicified and carries sporadically distributed specks and veinlets of chalcopyrite and pyrite. The gold and chalcopyrite do not appear to be closely associated, as grab samples show wide variations in gold content although running about the same in copper...Pyrite and chalcopyrite are essentially the only primary metallic minerals. The gangue is dominantly quartz, with some sericite, ankerite, calcite, chalcedony, and barite."

The 1935-1937 mining operations proved uneconomic because of extreme irregularity of mineralization and structural disturbance of the ore bodies.

Homestead District

The Iron Dyke copper mine at Homestead on Snake River (figure 22) has produced a considerable amount of gold and silver in addition to copper. The deposit was discovered in 1897 and a 50-ton mill was erected before 1908 but little production was made prior to 1915. A 150-ton flotation plant was placed in operation in 1916 and for several years thereafter the Iron Dyke was one of the most productive mining enterprises in Oregon (figure 24). Concentrates and crude ore were shipped to the International Smelter at Salt Lake City, Utah. Production figures since 1910, as recorded by the U.S. Bureau of Mines, are shown in table 8. No mining has been done since 1928, and important workings are inaccessible. Reports by Swartley (1914, p. 107-109) and Parks and Swartley (1916, p. 130-132) were written when the mine was in early stages of development. Little data has since been published regarding the ore deposits and what was learned about them during mining.

Development includes a 650-foot vertical shaft, a 500-foot inclined shaft, and four adits. The lower adit is about 300 feet above Homestead and about 450 feet in elevation below the outcrop of the ore body on the south wall of Irondyke Creek.

Rocks exposed in the near vicinity of the deposit are mostly greenstones derived mainly from andesitic to rhyolitic lavas, breccias, and tuffs. Elsewhere in the adjacent area conglomerates and limestones form thin interbeds in the series. Permian fossils have been identified from nearby localities. A considerable amount of shearing and faulting has taken place and the rocks have been further disturbed by the intrusion of numerous dikes.

The main ore body of the mine is associated with a broad zone of shearing that strikes about N. 20° E. and dips steeply eastward. Swartley (1914, p. 109) states: "The best ore in the lower tunnel is massive chalcopyrite and pyrite with but little quartz as a gangue in a lens-shaped body dipping 60° E. with a maximum width of about 6 feet which is said to extend from the lower to the upper tunnel...On either side of this high grade ore, which is said to average 15 to 20 percent copper, is a much larger body of disseminated pyrite and chalcopyrite in the chloritic greenstone, in which are abundant quartz seams, veinlets, and nodules that contain pyrite. There is often a silicification of the rock itself. Statements are made that it contains about $2.00 in gold, and 6 to 30 ounces in silver, regardless of the percent of copper present. This deposit, both high and low grade, is in a zone of crushing in which copper-bearing solutions have deposited their contents largely by replacement." State of Oregon Department of Geology and Mineral Industries Bulletin 14A (1939, p. 62) states: "Since the above was written...the mine was developed by shaft to levels below the lower crosscut. On the lowest level the ore body was cut off by a nearly horizontal fault. The ore body here was egg shaped, about 140 feet wide, and 210 feet long, carrying good grades of copper and about $\frac{1}{4}$ ounce in gold."

Table 8. Production of gold, silver, and copper from the Iron Dyke mine, Homestead district, Baker County, Oregon 1910 to 1934.

Year	Ore smelted, tons	Ore milled, tons	Concentrates produced, tons	Gold, ounces	Silver, ounces	Copper, pounds
1910	68			1	535	13,861
1915	3,565			55	9,803	396,972
1916	1/ 23,225			377	80,856	2,230,729
1916			1,673	58	8,337	290,971
1917		36,676	7,522	1,279	31,256	1,372,110
1918		33,583	6,734	3,794	24,212	1,602,145
1919		27,618	7,044	10,753	17,624	2,087,276
1920		34,804	7,910	8,322	18,890	2,353,276
1921		2,398	573	434	1,339	174,300
1922	2,047			513	4,167	198,320
1922		15,070	3,570	2,259	10,238	813,869
1923	369			26	862	57,345
1923		17,980	5,117	3,141	21,244	1,176,144
1924		14,746	3,418	1,879	12,039	757,440
1925		2,740	548	375	1,938	105,600
1926	27			81	97	6,519
1926		5,155	1,031	510	3,512	227,691
1927	185			7	729	43,356
1927		16,018	1,236	805	7,513	439,696
1928		2,800	223	148	1,283	70,300
1934		2/ 1		150	15	-
	29,486	209,589	46,599	34,967	256,489	14,417,920

1/ Total ore milled and smelted. 2/ Bullion produced.

Medical Springs District

The Medical Springs district lies about 18 miles northeast of Baker (figure 22). Old prospect workings are found here and there among the hills surrounding the village of Medical Springs, but records of production from the district are meager. Much of the area is covered by Tertiary basalt. The prospects are in small exposures of Permian or Upper-Triassic greenstones and related sedimentary rocks.

The Twin Baby mine (including the Grull prospect) is 4 miles by road northeast of Medical Springs on the timbered divide between two tributaries of Big Creek. Development which began prior to 1900 includes numerous shallow adits, shafts, and open cuts scattered over several claims. One shaft is said to be 335 feet deep with drifts on the 100, 150, 230, and 335-foot levels. Near this shaft a 40-ton amalgamation and flotation mill was erected and operated for a short time during the mid-1930's.

The country rocks are mostly greenstones. Several narrow veins and mineralized fault zones of diverse trend have been exposed. The most persistent vein averages about 2 feet in width, strikes N. 5° W., dips steeply east, and has been traced along strike for more than 2000 feet. Where visible this vein consists mainly of brecciated and altered greenstone with thin lenses and stringers of brecciated quartz. In surface exposures, sulfide minerals are sparse, although their former presence is indicated by iron oxides; gold, where present, is largely free and occurs in very fine particles. Specimens found on the dump adjacent to the 335-foot shaft contain pyrite and chalcopyrite. Gold mineralization is spotty. Small pockets of high-grade ore have been won from near-surface workings.

Sparta District

General information

The Sparta district encompasses a small area between Eagle Creek and Powder River in the vicinity of Sparta, a ghost town about 40 miles by road east of Baker (figure 22). Elevations range from about 2300 feet on Powder River along the southern edge of the district to 4944 feet at the top of Sparta Butte in the northern part. Timber is absent on the Powder River slope of the divide but plentiful to the north.

The host rocks of the district are albite granite and quartz diorite of Early Triassic age (Prostka, 1963). The Triassic intrusive rocks are sheared and deeply decomposed. Patches of Cenozoic basalt, tuffs, and lake and stream sediments are present locally.

The Sparta district is noted mainly for its placers, although no production records exist. The several quartz veins that have been developed are small and nonpersistent, but locally contained pockets of rich ore. Total lode production is believed to be small. Lindgren's (1901, p. 736) figure of $677,000 for the four years 1889-1892 is said to be greatly exaggerated by local historians.

Principal lode mines

Macy mine: The Macy mine in Maiden Gulch, a quarter of a mile above Powder River, was discovered in 1920. Intermittent operations have produced in the neighborhood of $90,000. About 2000 feet of development work has been done, mainly from adit levels. Early work was mapped by Gilluly, Reed, and Park (1933, p. 61). The workings explore several small quartz veins of diverse trend, some of which intersect. The veins range in width from about an inch to 4 feet, and consist chiefly of quartz with a little calcite, sericite, and chlorite. Ore minerals are pyrite, sphalerite, and free gold. Ore shoots were small and irregular. Stope widths averaged 1 to 1½ feet.

Gem mine: Probably the most extensive underground development is at the Gem mine where, according to Lorain (1938, p. 33), there is an inclined shaft 550 feet deep from which short drifts have been turned on eight different levels. The vein strikes north, dips 30° to 40° E., and ranges from 1 to 4 feet in width between sharply defined walls. It consists of crushed and altered albite granite with streaks and lenses of quartz as much as 2 feet wide. The ore ordinarily consists of coarse quartz containing free gold with pyrite and sphalerite.

Crystal Palace mine: At the Crystal Palace mine, about 2000 feet of workings develop a curving vein which strikes from N. 30° W. to N. 60° E. and dips about 25° E. The vein consists of pyrite, arsenopyrite, and free gold in a gangue of quartz and minor sericite, chlorite, and ankerite.

Lode Mines of the Wallowa Mountains Area

A. CORNUCOPIA DISTRICT

Cornucopia Mines Group — Cornucopia District, A-1

Location: Baker County, secs. 27 and 28, T. 6 S., R. 45 E., on steep west wall of Pine Creek 12 miles north of Halfway.

Development: About 36 miles of workings over a vertical interval of more than 3000 feet, mostly from three adit levels. The lowest is near creek level.

Geology: Two principal veins, the Union-Companion and Last Chance, in granodiorite and along the contact between granodiorite and intruded greenstones and metasediments. Strike N. 20° to 40° E.; dip about 45° W. Veins range up to 20 feet in width, average 4 or 5 feet in the mined shoots which were abruptly discontinuous. Gangue is mostly quartz and altered wall rock. Ore minerals include pyrite, arsenopyrite, chalcopyrite, galena, and sphalerite with a little free gold and tellurides.

Production: About $10,000,000. Latest mill was a 150-ton bulk flotation plant. Ratio of concentration about 20:1. Mined ore produced during 1938-1941 averaged 0.48 oz. gold, 2.2 oz. silver, 0.1 percent copper, and 0.025 percent lead.

References: Lindgren, 1901:743; Swartley, 1914:36; Parks and Swartley, 1916: 21,74; Goodspeed, 1939:1-18; Lorain, 1938:38; Department Bulletin 14-A, 1939:26.

Norway mine — Cornucopia District, A-2

Location: Baker County, E½ sec. 9, T. 6 S., R. 45 E.

Development: 1000-foot drift adit with short cross cuts.

Geology: Quartz lenses along shear zone in greenstone. Trend nearly north. Dips steeply east. Lenses range from a few inches to a few feet in thickness.

Production: Small.

References: Swartley, 1914:61; Parks and Swartley, 1916:213; Ross, 1938:215; Department Bulletin 14-A, 1939:30.

Queen of the West mine — Cornucopia District, A-3

Location: Baker County, W½ sec. 21, T. 6 S., R. 45 E.

Development: Unknown.

Geology: Quartz vein in granodiorite traceable for 3000 feet. Strike N. 20° E., dip 30°

to 45° W. Vein minerals are quartz, calcite, pyrite, chalcopyrite, galena, and sphalerite.

Production: No record of production. Some milling done in early days.

References: Lindgren, 1901:745; Swartley, 1914:54; Parks and Swartley, 1916:186; Department Bulletin 14-A, 1939:30.

Simmons mine — Cornucopia District, A-4

Location: Baker County, secs. 15 and 16, T. 6 S., R. 45 E., on Simmons Mountain on the east side of Pine Creek opposite Cornucopia.

Development: Several short adits, shafts, and cuts. Total length unknown.

Geology: Vein in greenstone 18 inches to 4 feet wide; strikes N. 30° W., dips gently east, and is traceable for about 2000 feet. The vein consists chiefly of quartz with scattered sulfides.

Production: Small. Concentrates produced in 1941 from 1046 tons of ore contained 246 ounces gold and 1840 ounces silver. Previous output unknown.

References: Lindgren, 1901:745; Swartley, 1914:59; Parks and Swartley, 1916:203; Department Bulletin 14-A, 1939:31.

B. EAGLE CREEK DISTRICT

Amalgamated mine — Eagle Creek District, B-1

Location: Baker County, N½ sec. 2, T. 7 S., R. 44 E., at the head of Paddy Creek.

Development: Several tunnels, two of which aggregate 1500 feet.

Geology: Crushed zones along faults in greenstone; locally, 20 to 30 feet wide; strike NW.; dip steeply SW. and NE. Locally contain quartz seams and lenses.

Production: Small; 25-ton Chile mill operating in 1937.

References: Parks and Swartley, 1916:14; Gilluly, Reed, and Park, 1933:63.

Basin mine — Eagle Creek District, B-2

Location: Baker County, SW¼ sec. 29, T. 6 S., R. 43 E.

Development: Two or more adits, total about 2000 feet.

Geology: Country rock is quartz diorite. Numerous shear and joint openings of widely different attitude contain quartz lenses as much as 2 feet thick. One stoped vein strikes N. 60° W. and dips 35° S. Ore oxidized. Relict sulfides include pyrite, chalcopyrite, and sphalerite. Gold free.

Production: Small.

References: Lindgren, 1901:738; Gilluly, Reed, and Park, 1933:68; Department Bulletin 14-A, 1939:44-45.

Daddy Lode (Blue Bell mine) Eagle Creek District, B-3

Location: Baker County, sec. 23, T. 7 S., R. 43 E.

Development: Shaft 210 feet deep and several adits; total about 2000 feet.

Geology: Copper-gold mineralization along fractures in argillite, chert, and greenstone. Light-colored dikes are present.

Production: No record.

References: Department Bulletin 14-A, 1939:45.

Dolly Varden mine Eagle Creek District, B-4

Location: Baker County, secs. 19 and 30, T. 7 S., R. 44 E.

Development: Small.

Geology: Large outcrop of quartz-impregnated volcanic tuffs.

Production: $115,000 prior to 1900 from surface ore.

References: Lindgren, 1901:739; Parks and Swartley, 1916:87; Department Bulletin 14-A:47-48

East Eagle (McGee and Woodard Groups) Eagle Creek District, B-5

Location: Baker County, NW¼ sec. 32, T. 6 S., R. 44 E., just above level of East Eagle Creek.

Development: Two drift adits 600 and 350 feet in length respectively.

Geology: Quartz vein in argillite and minor greenstone. Pinches and swells rapidly from less than a foot to more than 4 feet in width; much gouge included locally. Strike averages N. 47° W.; dip 22° S. Chief ore minerals are pyrite and chalcopyrite with copper oxides and a little free gold.

Production: Small.

References: Department file report dated December 13, 1947.

Mother Lode (Balm Creek, Poorman) mine Eagle Creek District, B-6

Location: Baker County, NW¼ sec. 32, T. 7 S., R. 43 E.

Development: About 15,000 feet of drifts, crosscuts, and raises, including two shafts 700 and 420 feet deep respectively, and three adits.

Geology: Scattered copper-gold mineralization along small faults and fractures in sheared greenstone. Zone of shearing and mineralization trends a little north of west. Gangue is dominantly quartz with some sericite, ankerite, calcite, chalcedony, and barite. Sulfides are pyrite and chalcopyrite.

Production: Output during 1935-1938 amounted to 8108.8 ounces gold and 1,407,015 pounds of copper. No production since. Yield in 1937 was 3517 ounces gold, 1665 ounces silver, and 520,000 pounds of copper from 20,380 tons of ore treated in a 100-ton flotation plant.

References: Lindgren, 1901:732; Swartley, 1914:121; Parks and Swartley, 1916:181; Gilluly, 1931:24-28; Lorain, 1938:29; Department Bulletin 14-A, 1939:43.

Paddy Creek mine — Eagle Creek District, B-7

Location: Baker County, sec. 15, T. 7 S., R. 44 E.

Development: Several hundred feet of underground work.

Geology: Lens-like veins in sedimentary rocks.

Production: Small. Ten-stamp mill in early days; no mill records.

Reference: Parks and Swartley, 1916:77.

Roy and Sturgill mines — Eagle Creek District, B-8

Location: Baker County, SE$\frac{1}{4}$ sec. 3, T. 7 S., R. 43 E.

Development: Roy, 1000 feet of drift; Sturgill, 500 feet of drift on two levels.

Geology: Country rock is blocky argillite cut by diorite dikes. Vein strikes N. 10° to 35° E.; dips 35° to 45° E.; iron-stained quartz. No sulfides; gold free.

Production: No records.

References: Department Bulletin 14-A, 1939:49 and 50.

Sanger mine — Eagle Creek District, B-9

Location: Baker County, SW$\frac{1}{4}$ sec. 2, T. 7 S., R. 43 E.

Development: Inclined shaft and several adits work Summit vein through horizontal distance of 650 feet and inclined depth of 400 feet.

Geology: Country rock is shale and argillite. Several veins exposed; only one, the Summit, has been extensively worked. It strikes E., dips 30° N. Gangue is coarse quartz

and about 3 percent sulfides. Average thickness, 2 feet.

Production: $1,500,000. Little output since 1900. Ore averaged $20 to $25 per ton, mostly free gold, in upper levels and $12 in lower levels as sulfides increased.

References: Lindgren, 1901:738; Swartley, 1914:118; Parks and Swartley, 1916:198; Gilluly, Reed, and Park, 1933:67; Lorain, 1930:32; Department Bulletin 14-A, 1939:50.

Sheep Rock mine (including Summit property) — Eagle Creek District, B-10

Location: Baker County, NW$\frac{1}{4}$ sec. 32, T. 6 S., R. 44 E.

Development: Several short adits as much as 200 feet long, and many cuts and pits scattered about several claims.

Geology: Several narrow quartz veins in greenstone cut by basic dikes.

Production: $30,000 in early days.

References: Lindgren, 1901:738-739; Swartley, 1914:117; Parks and Swartley, 1916:200; Gilluly, Reed, and Park, 1933:64.

C. HOMESTEAD DISTRICT

Iron Dyke mine — Homestead District, C-1

Location: Baker County, sec. 21, T. 6 S., R. 48 E., on bank of Snake River.

Development: Includes 650-foot vertical shaft, 500-foot inclined shaft, and four adits.

Geology: Copper-gold mineralization associated with broad zone of shearing in greenstones. Zone trends N. 20° E. and dips steeply east. The rocks are partly silicified and contain abundant quartz seams, veinlets, and nodules that contain pyrite. Main copper mineral is chalcopyrite.

Production: Main period of operation was 1916-1928. Total recorded output since 1910 has been 34,967 ounces of gold, 256,489 ounces of silver, and 14,417,920 pounds of copper. (See table 8.)

References: Lindgren, 1901:749; Swartley, 1914:107; Parks and Swartley, 1916:124; Department Bulletin 14-A, 1939:60.

D. MEDICAL SPRINGS DISTRICT

Twin Baby mine — Medical Springs District, D-1

Location: Union County, sec. 20, T. 6 S., R. 42 E., about 4 miles by road northeast of Medical Springs.

Development: Shaft 335 feet deep; several short adits and cuts.

Geology: Country rock is mostly greenstone with some argillite. Principal vein strikes N. 5° W., dips steeply east and averages about 2 feet wide. On the surface the vein consists of brecciated country rock with stringers and nodules of quartz. Sparse pyrite. Gold largely free. Several other veins and mineralized fault zone have been meagerly explored.

Production: A few thousand dollars. Mill erected in 1930's but little used.

References: Gilluly, Reed, and Park, 1933:70; Lorain, 1938:31; Department Bulletin 14-A, 1939:112.

E. SPARTA DISTRICT

Crystal Palace mine — Sparta District, E-1

Location: Baker County, E½ sec. 19, T. 8 S., R. 44 E., 2½ miles west-southwest of Sparta.

Development: Two adits 80 feet apart vertically aggregate 2000 feet.

Geology: Quartz vein and silicification along shear planes in albite granite. Main vein ranges up to 7 feet thick, but averages about 1 foot. Strike varies from N. 35° W. to N. 60° E. Dip is shallow. Sulfides present are pyrite and arsenopyrite.

Production: Small.

References: Gilluly, Reed, and Park, 1933:59; Department Bulletin 14-A, 1939:47.

Del Monte mine — Sparta District, E-2

Location: Baker County, E½ sec. 15, T. 8 S., R. 44 E.

[No other data available.]

Gem mine — Sparta District, E-3

Location: Baker County, secs. 17 and 20, T. 8 S., R. 44 E.

Development: 550-foot inclined shaft with eight levels.

Geology: Vein 1 to 4 feet wide in albite granite; strike N.; dip 30° to 40° E. Vein matter is quartz and gouge with little pyrite and sphalerite and free gold.

Production: Probably small. Some milling done.

References: Lindgren, 1901:737; Swartley, 1914:127; Parks and Swartley, 1916:98; Gilluly, Reed, and Park, 1933:58; Lorain, 1938:33; Department Bulletin 14-A, 1939:92.

Gold Ridge (New Deal) mine — Sparta District, E-4

Location: Baker County, SE¼ sec. 16, T. 8, R. 44 E.

Development: Many cuts, and pits and 140-foot incline with short drifts on 100-foot level.

Geology: Quartz vein in albite granite; surface croppings on Gold Ridge yielded rich pockets in early days. Strike N. 30° W.; dip 40° E. Mostly free gold.

Production: $124,000 between 1889 and 1892.

References: Lorain, 1938:34; Department Bulletin 14-A, 1939:94.

Macy mine — Sparta District, E-5

Location: Baker County, SW¼ sec. 2, T. 9 S., R. 44 E. in Maiden Gulch, about half a mile from Powder River.

Development: About 1500 feet, mostly from adit levels. There are two short, inclined shafts.

Geology: Branching quartz veins, paper thin to about 4 feet thick, in albite granite. The main vein strikes N. 50° W. and dips 40° to 75° S. Gangue is chiefly quartz, locally brecciated and vuggy, containing pyrite, sphalerite, and free gold. Stope widths average 1 to 1½ feet.

Production: Approximately $90,000. Discovered about 1920.

References: Gilluly, Reed, and Park, 1933:59; Department Bulletin 14-A, 1939:93.

Union mine — Sparta District, E-6

Location: Baker County, sec. 9, T. 8 S., R. 44 E.

Development: Short adit.

Geology: Vein in albite granite.

Production: No record.

References: None.

GREENHORN MOUNTAINS AREA

Location and Geography

The area lies in the Greenhorn Mountains in Grant and Baker Counties (figure 25). A granitic intrusion named the Greenhorn Mountain batholith by Hewett (1931, p. 340) underlies the area. Numerous gold-silver lode deposits occur within the intrusive and also in older rocks along its edges. The deposits are grouped in two separate districts: the Greenhorn, which straddles the Baker-Grant County line, and the Susanville to the west in Grant County.

The Greenhorn Mountains trend generally northwestward from near Whitney to a few miles beyond Susanville, a total distance of about 30 miles. The range is bounded on the northeast and southwest by the North and Middle Forks of the John Day River, respectively. The east slope is drained by the North Fork of Burnt River. Elevations range from 8131 feet on Vinegar Hill, the highest point in the central part of the range, to 4200 feet at Whitney and 3400 feet on the Middle Fork of the John Day River at Galena. The elevation at Susanville on Elk Creek about 2 miles above Galena is 3796 feet. At the old townsite of Greenhorn, about 3 miles east along the crest of the range from Vinegar Hill, the elevation is about 6400 feet. Most of the area is heavily timbered with only portions of the highest ridges bare.

Geology

The Greenhorn batholith is compositionally similar to the larger Wallowa and Bald Mountain batholiths. It intrudes meta-argillites and greenstones which appear to represent the westward continuation of the Elkhorn Ridge Argillite. Near Susanville, however, these rocks are somewhat more schistose than is typical of that formation. Also found are numerous small masses of gabbro, peridotite, serpentinite, and related rocks which are younger than the argillite series but older than the Greenhorn batholith.

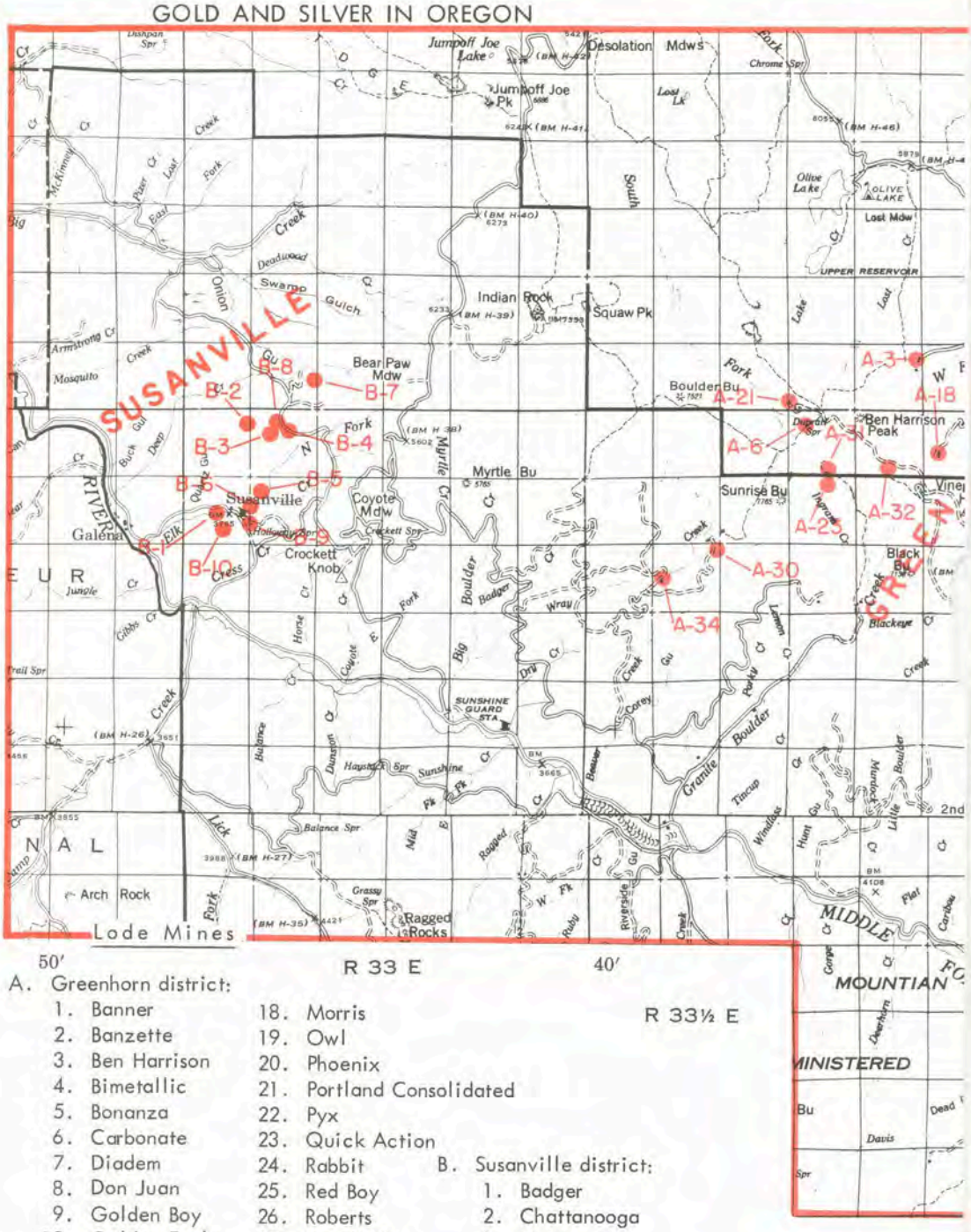
Production

The principal lode mines in the Greenhorn area are the Bonanza, Red Boy, and Ben Harrison mines in the Greenhorn district and the Badger mine in the Susanville district. Output from these mines has been about $3,500,000. There are also several small mines and prospects, particularly in the Greenhorn district, that have produced small amounts of gold and silver. It seems unlikely that total lode production exceeds $4,000,000. Total placer output cannot be as closely estimated, since only sketchy records are available.

Placer Mines

Greenhorn placers

Pardee and Hewett (1914, p. 10) estimated the yield from placers in the Greenhorn district, including the Bonanza and Whitney areas, as not less than $1,568,000. Subsequent production is unknown. A bucketline dredge operating on Burnt River above Whitney during 1941-1942 and 1945-1946 produced 4457 ounces gold and 902 ounces silver. During recent years there has been a small annual output from the Winterville hydraulic placers, which are situated about a mile south of the Bonanza.



A. Greenhorn district:

1. Banner
2. Banzette
3. Ben Harrison
4. Bimetallic
5. Bonanza
6. Carbonate
7. Diadem
8. Don Juan
9. Golden Boy
10. Golden Eagle
11. Golden Gate
12. Harrison Group
13. Intermountain
14. IXL
15. Listen Lake
16. Little Giant
17. Morning
18. Morris
19. Owl
20. Phoenix
21. Portland Consolidated
22. Pyx
23. Quick Action
24. Rabbit
25. Red Boy
26. Roberts
27. Royal White
28. Ruby Creek
29. Snow Creek
30. Stalter
31. Tempest
32. Tiger
33. West Side
34. Wray

B. Susanville district:

1. Badger
2. Chattanooga
3. Daisy
4. Gem
5. Golden Gate
6. Homestake
7. Princess
8. Rescue
9. Side Issue (Black Hawk)
10. Stockton

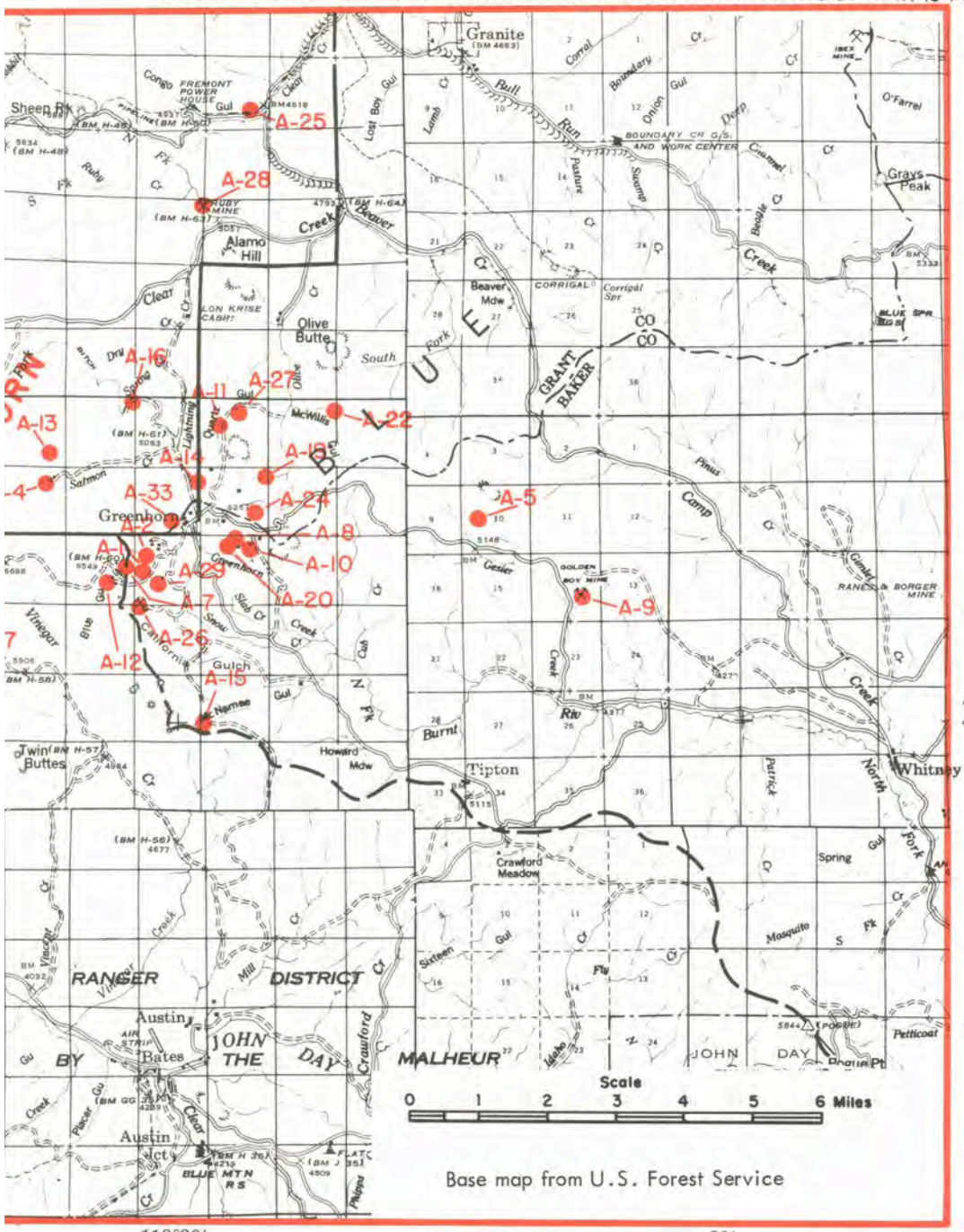


Figure 25. Index map of the Greenhorn Mountains area.

Susanville placers

The placer mines of the Susanville district were, according to Swartley (1914, p. 169-170), discovered in 1864 and by 1914 had produced about $600,000. Elk Creek was the most productive, but other creeks at a lower elevation along the north side of the Middle Fork were also important producers.

The Timms Gold Dredging Co. operated a bucketline dredge on the Middle Fork just below the mouth of Elk Creek from November 1933 until the spring of 1939. Placer yield from the district during this period was nearly $500,000, most of it from the Timms dredge. In 1939 the dredge was moved to the De Witt Ranch on the Middle Fork of the John Day River 10 miles below Bates, where it operated until 1942.

Greenhorn District

General information

The Greenhorn district embraces the eastern part of the Greenhorn Mountain range (figure 25) and incorporates all of the small subdistricts into which Swartley (1914, p. 173-194) divided this part of the range. The deposits are grouped around the old town of Greenhorn, which is about 50 miles by road from Baker by way of Whitney.

The mines and prospects in the Greenhorn district occur in a wide variety of host rocks. The Bonanza and Red Boy mines, several miles east and north of Greenhorn respectively, are in argillite. Closer to Greenhorn there are a great number of small veins in greenstone, argillite, and serpentinized intrusive rocks. Several of these small veins are associated with porphyritic dikes of intermediate to acid composition and they probably formed within the same zones of structural weakness (Allen, 1948, p. 21). Farther west the Ben Harrison, Tiger, Tempest, and several other small mines and prospects develop veins in granodiorite of the Greenhorn batholith. Still farther west in the drainage of Big Boulder Creek are several prospects in granodiorite and greenstone. Some of these, including the Wray and Reed prospects, contain copper minerals. The ores of several veins west of Greenhorn, including the Ben Harrison, Bi Metallic, Morris, and Intermountain, show a high silver-to-gold ratio.

Hewett found less definite evidence of mineral zoning in the veins around the Greenhorn batholith than around the Bald Mountain batholith, but suggested that the dissimilarities may be due to the fact that the deposits in the Greenhorn district occur in a wide variety of host rocks. Also only a few of the Greenhorn veins have been opened below the zone of oxidation.

The largest mines in the district and their estimated output are the Bonanza, $1,750,000; the Red Boy, $1,000,000; and the Ben Harrison, $425,000. In addition to these deposits the district embraces a large number of small mines and prospects. There is probably a greater concentration of small veins in the near vicinity of Greenhorn than is present in any other area of similar size in the Blue Mountains. Production records are available for very few of them, but while the combined production is probably small the presence of so great a concentration of small veins is indicative of widespread mineralization. Several of these veins have produced rich bunches of ore from near-surface workings and from residual placers.

Principal lode mines

Bonanza mine: The Bonanza mine is on the ridge north of Geiser Creek about 5 miles east of Greenhorn. It was discovered in 1877 and actively operated between 1892 and 1907 (figure 26). According to Pardee and Hewett (1914, p. 119), the lower levels were abandoned in 1904. From several adits and a shaft the mine is developed to a depth of 1250 feet. There are about 18,000 feet of workings. The vein, in argillite, strikes N. 55° W. and is nearly vertical. According to Lindgren (1901, p. 701): "The ore body as a whole forms a mass of clay slate traversed by quartz veins and seams of all sizes. The gold is low grade, being about 600 fine....Something like 70 percent is free, though it is said that as depth is increased more concentrates and less gold are obtained. The concentrates are said to vary from $20 to $60 per ton, chiefly in gold. The average ore is believed to run from $7 to $12 per ton, but lenses of ore 8 to 16 inches wide have been mined which ran as high as $1400 per ton, and several hundred tons are said

to have yielded at the rate of $100 in free gold per ton.

"Though the pay streak averages only 5 to 6 feet, it swelled in places to 40 feet by the appearance of a vast number of quartz stringers."

Pardee and Hewett (1914, p. 120) presented the following statement of production for the period from 1899 to 1904.

1899		$ 146,419.47 a
1900		175,953.45 a
1901	14,885 tons ore	279,556.42 b
1902	5,371 tons ore	84,003.08 b
1903	11,495 tons ore	202,375.85 b
1904	3,887 tons ore	52,315.81 b
		$ 940,624.08

a. probably net; b. gross.

The 1901-1904 output amounted to $636,251.16 from 35,638 tons of ore, indicating an average gross value of $17.85 per ton of ore treated.

Red Boy mine: The Red Boy mine is at the head of Congo Gulch 5 miles southwest of Granite. Development of this mine began about 1890. The period of greatest activity was from 1893 through 1903, although work was continued through 1914 (figure 27). The Red Boy mine is developed by about 5000 feet of drifts and crosscuts from three adits and a 300-foot shaft. Swartley (1914, p. 192) shows a plan of the workings.

The country rock is argillite that dips about 15° W. and is cut by numerous highly altered felsite dikes. The dikes are probably premineral but formed in zones of weakness where postmineral movement occurred.

At least five veins have been explored, the Red Boy, Monarch, Blaine, Concord, and Congo. The Red Boy and Monarch yielded nearly all of the ore produced by the mine. The other three, which were worked mainly during the later years of the mine's operation, are said to have been well defined, but few shoots that would pay to mill were found (Pardee and Hewett, 1914, p. 113).

The Red Boy and Monarch veins were explored for distances of 1000 feet and 900 feet respectively. Each has been stoped for a horizontal distance of about 800 feet. Good ore values are said to have held to a depth of only about 300 feet.

The Red Boy vein strikes nearly due north and dips about 80° W., whereas the Monarch strikes N. 30° E., and dips 50° to 55° W. The two join near the south end of the workings, and a short distance farther south are offset an unknown distance along a broad fault zone that contains one of the felsite dikes.

The veins consist of crushed argillite traversed by a great number of veins and stringers of quartz. Width of the crushed zones ranges from 3 to 15 feet. The values, which were generally best toward the footwall, were mainly in the quartz and consisted chiefly of free gold alloyed with much silver, the bullion being 515 to 525 fine. Sulfides, mainly fine pyrite, which made up about 5 percent of the mill ore, were largely contained in the argillite rather than in the quartz. According to data collected by the operators and presented by Pardee and Hewett (1914, p. 113), the combined areas of stopes on the Red Boy and Monarch veins up to January 1, 1902 was 437,000 square feet and the yield 83,000 tons, indicating an average stoping width of 28 inches. The return from this tonnage was $666,322.10 or $8.00 to the ton.

Ben Harrison mine: The Ben Harrison mine is near the head of the west fork of Clear Creek, about 28 miles by road from Sumpter by way of Granite, at an elevation of about 6500 feet. The mine was actively worked during several short periods including 1913-1914, 1916-1920, 1926-1928, and 1936-1937, producing roughly $425,000. The country rock is granodiorite cut by numerous aplite dikes. The vein strikes N. 3° E. and dips 80° E. in the upper levels, but flattens to 55° in the lower levels.

The vein and associated gouge is said to vary in width from 18 inches to a maximum of 21½ feet; the average stope width is probably 4 to 5 feet (Swartley, 1914, p. 176-180, and Lorain, 1938, p. 16-18). The ore shoot is a strong quartz vein which in most places contains numerous inclusions of incompletely

replaced fragments of the granodiorite.

The ore minerals are pyrite, arsenopyrite, stibnite, a little chalcopyrite, tetrahedrite, and sphalerite. The silver sulfides are pyrargyrite and stephanite.

An ore shoot 300 to 400 feet long has been mined to a depth of 450 feet below the outcrop, or about 300 feet below the main adit level. Development was carried down at least another 100 feet to the 600-foot level, but little ore was removed. Swartley (1914, p. 176-180) states that the average value of ore in the upper workings was a little more than $10 a ton but that ore developed on the 600-foot level was 19 to 20 percent higher in grade. There was a wide variation in the gold-silver ratio of the ore mined from different parts of the shoot. In 1917 the mine produced 977 ounces gold and 22,534 ounces silver from 4600 tons of ore treated in a 20-stamp mill. Flotation concentrates produced in 1937 contained 1294 ounces gold and 10,823 ounces silver.

Other mines: The Snow Creek mine is said to have produced $52,000 between 1902 and 1905. Some very small shipments were made in 1925-1927 and in 1939. Total production of the mine is probably not more than $60,000. The vein in argillite and serpentine averages about 2 feet in width and strikes east. It is developed from a 240-foot shaft and connecting crosscut adit 1400 feet long.

At the Morning mine, the most important vein lies along the footwall of a diorite-porphyry dike which strikes N. 45° E. and dips 35° to 75° NW. This vein pinches and swells from 1 to 4 feet in width. Other narrower veins lie within or transect the dike. A stope on the footwall vein is 200 feet long, 65 feet high, and 3 to 6 feet wide. Production records are not available.

Susanville District

General information

The Susanville district lies in Grant County about 18 miles by road down the Middle Fork of the John Day River from Bates (figure 25). The several lode mines and prospects of this district are confined mainly to an area 4 miles long and 2 miles wide that extends northeasterly through the old town of Susanville, which is about 1½ miles up Elk Creek from its junction with the Middle Fork. Relief is about 1200 feet; slopes are fairly steep; and timber and water are abundant.

The rocks in the district are mainly schists with subordinate amounts of quartzite, slate, greenstone, serpentinized peridotite, and gabbro, all of which are cut by numerous aplite dikes. Quartz diorite of the Greenhorn batholith occupies the northern and eastern edges of the district. The trend of the principal partings in the schists is east to northeast with steep dips to the south. Faulting parallel to the schistosity is common throughout the district. Most of the veins of the district occur in schists and fill fissures paralleling the schistosity. Several of the ore bodies show evidence of being related to the aplite dikes which, in turn, are related to the quartz diorite. Some of the veins are in serpentinized rocks or along their contacts with the schists.

The dominant gangue of the veins is quartz; the metallic minerals include pyrite, marcasite, arsenopyrite, pyrrhotite, sphalerite, galena, stibnite, tetrahedrite-tennantite, and chalcocite. The percentage of the gold values extractable by amalgamation was small except from oxidized surface ores which were soon exhausted.

Gold output of the Susanville district has come mainly from placers. Lode production has been small, probably not much more than $500,000 or $600,000.

Principal lode mine

Badger mine: The most prominent mine of the district is the Badger, which was first operated during the late 1870's. Records are scarce but the gross value of production from this mine probably lies between $250,000 and $500,000. Development includes a 900-foot shaft, a 1600-foot crosscut adit on the 500-foot level, and several hundred feet of drifts. Greatest activity was between 1899 and 1905, after which the mine was closed. Little mining has been done since. According to limited records for the 1899-1905

period of operation (Oregon Dept. of Geology and Mineral Industries, 1941, p. 133-137), the ores contained between 8 and 11 percent recoverable sulfide concentrate; total recovery from mill ore was between 58 and 60 percent of assay value. At least two veins have been stoped. They are 6 feet apart and vary in width from 1 to 20 feet (Gilluly, Reed, and Park, 1933, p. 111).

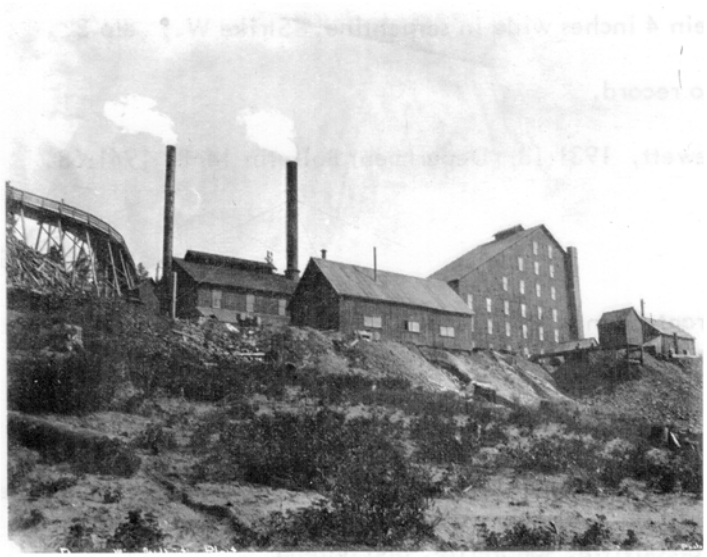


Figure 26. Surface plant at the Bonanza mine, Greenhorn district.

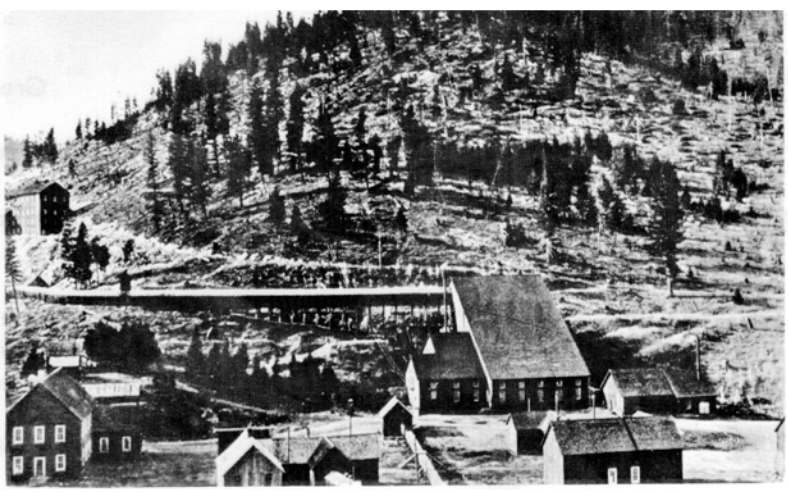


Figure 27. Red Boy mine, Greenhorn district, prior to 1915. (Photograph courtesy of Brooks Hawley.)

Lode Mines of the Greenhorn Mountains Area

A. GREENHORN DISTRICT

Banner mine — Greenhorn District, A-1

Location: Grant County, NW¼ sec. 16, T. 10 S., R. 35 E., about 1½ miles southwest of Greenhorn.

Development: 200-foot shaft; 600 feet of drift.

Geology: Vein 4 inches wide in serpentine. Strike W.; dip S.

Production: No record.

References: Hewett, 1931:18; Department Bulletin 14-B, 1941:68.

Banzette mine — Greenhorn District, A-2

Location: Grant County, NW¼ sec. 16, T. 10 S., R. 35 E., about 1½ miles southwest of Greenhorn.

Development: 1600-foot adit to shaft 100 feet deep.

Geology: Quartz veinlets and sulfide minerals associated with quartz monzonite porphyry dikes intruded into serpentine, argillite, and greenstone. Sulfides include pyrite, chalcopyrite, sphalerite, and galena.

Production: No record.

References: Hewett, 1931:19; Department Bulletin 14-B, 1941:68; Allen, 1948:41.

Ben Harrison mine — Greenhorn District, A-3

Location: Grant County, NE¼ sec. 35, T. 9 S., R. 34 E., near the head of Clear Creek.

Development: More than 4000 feet from two adits and a shaft; workings attain a depth of about 550 feet below outcrop.

Geology: Country rock granodiorite with small inclusions of greenstone. Aplite dikes abundant. Vein 18 inches to 21½ feet wide; strikes N. 3° E, dips 67° E. Average stope width 77 inches. Filling is sericitized granodiorite breccia and gouge cemented and partly replaced by quartz. Calcite also present. Sulfides are pyrite, stibnite, a little chalcopyrite, sphalerite, pyrargyrite, and stephanite.

Production: Records scarce, output estimated at $425,000. Last operated 1937. Concentrate ratio 20:1; silver to gold ratio 5:1 to 50:1. Ore mined prior to 1914 averaged $10 per ton.

References: Lindgren, 1901: 694; Swartley, 1914:176; Parks and Swartley, 1916:29; Hewett, 1931:10; Lorain, 1938:16; Department Bulletin 14-B, 1941:68-72.

Bi Metallic mine — Greenhorn District, A-4

Location: Grant County, NE¼ sec. 7, T. 10 S., R. 35 E., 2½ miles west of Greenhorn.

Development: Several adits; one includes 2150-foot crosscut and 410-foot drift.

Geology: Country rock is granodiorite intruded by quartz diorite and quartz monzonite porphyry dikes. Vein quartz and minor iron and copper sulfides fill narrow fissures in the dikes and in the granodiorite. Molybdenite present locally.

Production: No record.

References: Swartley, 1914:181-183; Parks and Swartley, 1916:37; Department Bulletin 14-B, 1941:73-74.

Bonanza mine — Greenhorn District, A-5

Location: Baker County, sec. 10, T. 10 S., R. 35½ E.

Development: Three adits and 1200-foot shaft; total about 18,000 feet.

Geology: Country rock mainly argillite with some greenstone; vein strikes N. 55° W. and is nearly vertical. Consists of sheared and brecciated country rock cemented by quartz veins and stringers. Ore shoots averaged 5 to 6 feet in width, but swelled in places to 40 feet.

Production: $1,750,000 estimated. Discovered 1877; little output since 1904. Gold average about 70 percent free and 600 fine. Sulfide concentrates varied from $20 to $60 per ton. Gross output during 1901-1904 totaled $636,251.16 from ore averaging $17.85 per ton.

References: Lindgren, 1901:700; Pardee and Hewett, 1914:119 (map); Swartley, 1914:188.

Carbonate mine — Greenhorn District, A-6

Location: Grant County, NW¼ sec. 3, T. 10 S., R. 34 E., adjoining the Tempest.

Development: Crosscuts and drifts, amount unknown.

Geology: Several narrow quartz veins in a broad northeast-trending fracture zone in granodiorite. Veins contain arsenopyrite, pyrite, sphalerite, and a little galena.

Production: Some ore shipped; date, quantity, or value not recorded.

References: Lindgren, 1901:964; Swartley, 1914:175; Parks and Swartley, 1916:43-44; Department Bulletin 14-B, 1941:75.

Diadem mine — Greenhorn District, A-7

Location: Grant County, NE¼ sec. 17, T. 10 S., R. 35 E., near Banzette, 1½ miles southwest of Greenhorn.

Development: Unknown.

Geology: Vein in greenstone, strike east to west; vertical. Ore minerals are pyrite and cinnabar.

Production: No record.

References: Lindgren, 1901:698; Swartley, 1914:185; Parks and Swartley, 1916:86; Hewett, 1903:19, 36; Department Bulletin 14-B, 1941:75.

Don Juan mine — Greenhorn District, A-8

Location: Baker County, secs. 10 and 15, T. 10 S., R. 35 E., one mile southeast of Greenhorn.

Development: Adit of unknown length.

Geology: Vein in serpentine and greenstone. Ore minerals are dolomite, chalcopyrite, and pyrite.

Production: Small.

References: Lindgren, 1901:696; Parks and Swartley, 1916:87; Hewett, 1931:20; Department Bulletin 14-A, 1939:54.

Golden Boy mine — Greenhorn District, A-9

Location: Baker County, sec. 14, T. 10 S., R. 35½ E.

[No further data available.]

Golden Eagle mine — Greenhorn District, A-10

Location: Baker County, E½ sec. 15, T. 10 S., R. 35 E.

Development: Three adits and an intermediate drift aggregating about 2600 feet; vertical range about 175 feet, plus a shaft 75 feet below lowest level.

Geology: Workings explore system of branching mineralized fractures in serpentine. Trend NW.; dip 40°-70° NE. Lenses of quartz and dolomite contain chalcopyrite, galena, and free gold. Average width 6 inches. Ore oxidized. High-grade pockets encountered. Gold 850 fine.

Production: Estimated at $75,000.

References: Pardee and Hewett, 1914:116; Parks and Swartley, 1916:105; Department

Bulletin 14-A, 1939:54.

Golden Gate mine — Greenhorn District, A-11

Location: Grant County, sec. 3, T. 10 S., R. 35 E., 2 miles north of Greenhorn.

Development: Three adits; the longest contains about 2400 feet of work, including raises.

Geology: Two veins, the Golden Gate and Belcher. The latter, being the most extensively developed, is in greenstone and argillite, strikes NNE. and dips steeply eastward. Vein filling is mostly quartz. Three small shoots have been stoped; maximum width 20 inches; low grade. The Golden Gate vein is said to be 40 feet wide, most of which is quartz.

Production: No record; output probably very small.

References: Lindgren, 1901:697; Pardee and Hewett, 1914:114; Swartley, 1914:187; Parks and Swartley, 1916:106; Hewett, 1931:20, 36; Department Bulletin 14-B, 1941:77-78.

Harrison Group (Windsor, Psyche, and Big Johnny) — Greenhorn District, A-12

Location: Grant County, sec. 17, T. 10 S., R. 35 E., 3 miles west of Greenhorn.

Development: Poor record; includes a 60-foot shaft and four adits 1200, 1100, 700, and 300 feet long.

Geology: North-northeast-trending shear zone in serpentine and altered gabbro contains several narrow quartz veins and porphyry dikes. High-grade ore occurs in scattered seams and lenses rarely more than 8 inches thick and containing calcite, dolomite, pyrite, and chalcopyrite.

Production: Small, no mill record. Psyche said to have produced $90,000 in 1905.

References: Department Bulletin 14-B, 1941:78.

Intermountain mine — Greenhorn District, A-13

Location: Grant County, SE$\frac{1}{4}$ sec. 6, T. 10 S., R. 35 E., half a mile north of Bi metallic.

Development: Unknown.

Geology: Vein in diorite and greenstone. Strike east-west and may be extension of Bi metallic vein. Ore consists of quartz and tetrahedrite rich in silver.

Production: Small. Property located in 1937. Latest shipments (crude ore) made in 1938 and 1940.

References: Lindgren, 1901:694; Swartley, 1914:183; Department Bulletin 14-B, 1941:79.

IXL mine — Greenhorn District, A-14

Location: Grant County, secs. 9 and 10, T. 10 S., R. 35 E., just east of Greenhorn.

Development: Two shafts, with drifts on the veins.

Geology: Three veins in argillite and greenstone.

Production: No record.

References: Hewett, 1931:20; Department Bulletin 14-B, 1941:79.

Listen Lake mine — Greenhorn District, A-15

Location: Baker County, SW¼ sec. 27, T. 10 S., R. 35 E.

Development: Includes shaft 120 feet deep.

Geology: Silicified shear zone in gabbro reportedly attains width of 50 feet; contains pyrite, chalcopyrite, and associated gold along fractures.

Production: Small; no mill record.

References: Pardee and Hewett, 1914:118; Parks and Swartley, 1916:141; Hewett, 1931: 19, 36; Department Bulletin 14-A, 1939:55.

Little Giant mine — Greenhorn District, A-16

Location: Grant County, secs. 4 and 5, T. 10 S., R. 35 E., near head of Spring Creek.

Development: Includes shaft 40 feet deep and two short adits 1000 feet apart.

Geology: Little data available. Country rocks are argillite, diorite, and serpentine. Ore minerals include quartz and massive pyrite. Some malachite in upper workings.

Production: No record. Property discovered in 1898; 20-stamp mill built in 1899; little activity since 1906.

References: Department Bulletin 14-B, 1941:81-82.

Morning mine — Greenhorn District, A-17

Location: Grant County, SE¼ sec. 13, T. 10 S., R. 34 E., about 5 miles southwest of Greenhorn.

Development: Two adits and an intermediate level. Lower level contains more than 1300 linear feet of workings and some small stopes.

Geology: The country rocks are argillite, greenstones, and serpentine intruded by quartz-diorite porphyry dikes. One dike ranges up to 100 feet in width, strikes N. 45° E. and dips 35° to 75° NW. Within this dike and along its walls are narrow, branching

quartz veins which have produced small amounts of ore. A footwall shoot was 200 feet long, 65 feet in maximum height, and averaged 3 feet in width; values were spotty, ranging from $15 to $50 per ton. Sulfides are mainly pyrite with small amounts of arsenopyrite, sphalerite, and chalcopyrite.

Production: Little data available. Output probably small. Mine active during 1937-1942 and for a short time after World War II. Gold-silver ratio about 1:3. Sulfides comprise about 5 percent of the ore. Mine located in 1893.

References: Swartley, 1914:183; Parks and Swartley, 1916:155; Department Bulletin 14-B, 1941:82; Allen, 1948:33.

Morris mine — Greenhorn District, A-18

Location: Grant County, SW¼ sec. 1, T. 10 S., R. 34 E., in Morris Basin.

Development: Two groups of workings about 800 feet apart comprise about 1000 feet of crosscuts and drift distributed among four adits.

Geology: Country rocks are argillite and quartz diorite cut by quartz-diorite porphyry dikes. Workings expose several quartz veins 6 inches to 15 inches wide, at least one of which has been stoped. Sulfides include pyrite, arsenopyrite, sphalerite, tetrahedrite, and galena and make up 5 to 10 percent of the ore.

Production: Little data available; 1891 output was $15,000 in silver and $3400 in gold. Shipments in 1913-1914 averaged $50 per ton.

References: Lindgren, 1901:694; Swartley, 1914:180; Parks and Swartley, 1916:156; Department Bulletin 14-B, 1941:84; Allen, 1948:38.

Owl (Red Bird and Virginia) mine — Greenhorn District, A-19

Location: Grant County, secs. 10 and 11, T. 10 S., R. 35 E. about 2 miles northeast of Greenhorn.

Development: Poor record. Probably about 1000 feet, including two shafts. Small stopes.

Geology: Indefinite. Country rocks include granodiorite and older gabbro. Several narrow quartz veins exposed; one is associated with a shear zone as much as 22 feet wide in granodiorite; strikes N. 35° W., dips 75° to 85°, steepening with depth. Another vein is in crushed gabbro. Ore mined from near-surface pockets.

Production: Probably about $50,000. A $20,000 pocket was taken from the Virginia claim in the 1890's. Red Bird and Owl claims, located in 1915 and 1921 respectively, operated intermittently until World War II. Thirty tons milled in 1940 ran $18 per ton in free gold, 700 fine.

References: Parks and Swartley, 1916:187, 229; Department Bulletin 14-B, 1941:86-87.

Phoenix mine — Greenhorn District, A-20

Location: Baker County, sec. 15, T. 10 S., R. 35 E.

Development: Three adits; total about 1500 feet.

Geology: Vein in serpentine. Ore minerals are quartz and chalcopyrite.

Production: Small, no mill record.

References: Hewett, 1931:20, 36; Department Bulletin 14-A, 1939:56.

Portland Consolidated mine — Greenhorn District, A-21

Location: Grant County, SE¼ sec. 33, T. 9 S., R. 34 E., at the head of the South Fork of Desolation Creek.

Development: Seventy-five-foot shaft and open cuts.

Geology: Quartz vein in argillite; strikes N. 28° E.; contains pyrite and galena.

Production: No record.

References: Department Bulletin 14-B, 1941:105.

Pyx mine — Greenhorn District, A-22

Location: Grant County, secs. 1 and 2, T. 10 S., R. 35 E., between forks of McWillis Gulch.

Development: Includes shaft 150 feet deep and several short adits; one is 600 feet long.

Geology: Vein in argillite; vein minerals are quartz and pyrite.

Production: Small output prior to 1900 and during 1907-1911. A 25-ton mill erected in 1954, but little used.

References: Hewett, 1931:20; Department Bulletin 14-B, 1941:88.

Quick Action (Ornament) mine — Greenhorn District, A-23

Location: Grant County, N½ sec. 10, T. 10 S., R. 34 E., on Granite Boulder Creek.

Development: Three drifts.

Geology: Two northeast-trending veins near granodiorite-argillite contact. Vein width averages about 24 inches.

Production: Small shipments of low-grade ore made prior to 1916.

References: Parks and Swartley, 1916:176; Department Bulletin 14-B, 1941:88.

Rabbit mine — Greenhorn District, A-24

Location: Grant County, SE¼ sec. 10, T. 10 S., R. 35 E., two miles northeast of Greenhorn.

Development: 1000 feet of tunnels and a 160-foot shaft with short drift levels.

Geology: Vein about 2 feet wide in granodiorite; strikes N. 10° E., dips 70° E.

Production: Discovered in 1925; said to have produced $40,000 prior to 1940 with five-stamp mill. Gold 90 percent free; 750 to 760 fine.

References: Department Bulletin 14-B, 1941:89.

Red Boy mine — Greenhorn District, A-25

Location: Grant County, SE ¼ sec. 10, T. 9 S., R. 35 E., near head of Congo Gulch, 5 miles west of Granite by way of Olive Lake road.

Development: Three adits and 300-foot shaft, total about 5000 feet; attains 500 feet below outcrop.

Geology: Country rock is argillite cut by premineral felsite dikes. Five veins explored; Red Boy and Monarch most important. Red Boy vein strikes N. and dips 80° W. Monarch vein strikes N. 30° E., dips 50° to 55° W. Vein filling is 3 to 15 feet wide and consists of crushed argillite cemented by veins and stringers of quartz. Stope widths average about 28 inches.

Production: Operated 1890 to 1914. Total output estimated at $1,000,000. Returns on 83,373 tons was $666,322.10, or $8.00 per ton. Over-all average grade of ore said to be $12.00 per ton. Gold 75 to 85 percent free; sulfides low grade. Bullion 520 gold:450 silver.

References: Lindgren, 1901:681; Pardee and Hewett, 1914:110; Swartley, 1914:189; Parks and Swartley, 1916:188; Lorain, 1938:15; Department Bulletin 14-B, 1941:60.

Roberts mine — Greenhorn District, A-26

Location: Grant County, secs. 16 and 21, T. 10 S., R. 35 E., about 2 miles southwest of Greenhorn.

Development: Four short adits and open cuts.

Geology: Crushed zone in serpentine and gabbro; strikes N. 70° W. and dips 40° NE.; said to be more than 40 feet wide; contains occasional small kidneys of quartz breccia, some of which have yielded high-grade oxidized ore.

Production: Total unknown; $10,000 produced from hydraulicking surface pocket. Discovered in 1899. Operated 1912 to 1917, with intermittent development from 1925 to 1942.

References: Parks and Swartley, 1916:194; Department Bulletin 14-B, 1941:90.

Royal White mine — Greenhorn District, A-27

Location: Grant County, sec. 3, T. 10 S., R. 35 E., about one mile north of Greenhorn.

Development: Adit containing 600 feet of drift and crosscuts attains depth of 95 feet.

Geology: Vein in argillite; strike N. 40 E., dip steeply west. Offset by cross fault. Vein filling is argillite breccia cemented by chalcedony and quartz. Ore oxidized. Two small stopes; ore 1 to 3 feet wide. Manganese oxides present.

Production: Several hundred tons of sorted ore yielded $25 to $28 per ton during 1904 to 1910 period. Small output in 1930's.

References: Pardee and Hewett, 1914:115; Swartley, 1914:187; Parks and Swartley, 1916:195; Hewett, 1931:20; Department Bulletin 14-B, 1941:91.

Ruby Creek mine — Greenhorn District, A-28

Location: Grant County, secs. 21 and 22, T. 9 S., R. 35 E., on Ruby Creek.

Development: Two adits, longest said to be 400 feet.

Geology: Country rock is cherty argillite. One adit crosscuts four veins within 160 feet of portal. Veins strike N. 10° E. and dip 80° E. Small stopes on each. No data on lower adit.

Production: Discovered in 1924. Output 1932 to 1936 was $7,430 from five-stamp mill. Previous production unknown.

References: Department Bulletin 14-B, 1941:63.

Snow Creek mine — Greenhorn District, A-29

Location: Baker County, sec. 16, T. 10 S., R. 35 E., near head of Snow Creek, 2 miles southwest of Greenhorn.

Development: Numerous adits; includes 1600-foot crosscut, a shaft more than 200 feet deep, and more than 1300 feet of drifts.

Geology: Country rocks argillite, serpentine, and greenstone; cut by quartz-monzonite dikes with which mineralized quartz seams 1 to 6 inches thick are associated. Main vein, mostly barren quartz, is 2 to 10 feet wide, strikes N. 60° W. to W., and dips 50° to 75° S. Ore shoots rich in galena, chalcopyrite, and pyrite. One stope 80 feet by 200 feet by 4 feet thick on crosscut level.

Production: $52,000 between 1902 and 1905. Ten-stamp mill on property in 1916; idle. Ore shipped during 1925-1927 and 1939.

References: Parks and Swartley, 1916:208; Hewett, 1931:19; Allen, 1948:41; Department Bulletin 14-A, 1939:56.

Stalter (Heppner) mine — Greenhorn District, A-30

Location: Grant County, secs. 8 and 17, T. 10 S., R. 34 E.

Development: 3,900 feet.

Geology: Granodiorite cut by porphyry dikes. A zone 1000 feet wide contains a dozen or more quartz veins which are 1 to 20 feet wide, strike N. 40 E., dip 50° to 75° E. Some are traceable for several hundred feet. Pyrite present locally. Gold free.

Production: Small. In 1937 to 1938, about 200 tons treated by flotation produced concentrates assaying $32.00 per ton. Concentrate ratio 30:1. Ore previously worked in two-stamp mill.

References: Swartley, 1914:174; Parks and Swartley, 1916:119; Department Bulletin 14-B, 1941:92.

Tempest mine — Greenhorn District, A-31

Location: Grant County, secs. 3 and 10, T. 10 S., R. 34 E., near the Chloride mine.

Development: Several short adits.

Geology: The country rock is granodiorite. There are said to be five veins consisting of crushed and sericitized granodiorite in which are small lenses and stringers of quartz with arsenopyrite, pyrite, and sphalerite. The chief values are in silver rather than gold. One vein is as much as 4 feet wide, strikes N. 35° E., and is nearly vertical.

Production: Probably small, although "quite a little ore was shipped" prior to 1916.

References: Lindgren, 1901:695; Swartley, 1914:175; Parks and Swartley, 1916:221; Department Bulletin 14-B, 1941:93; Allen, 1948:36.

Tiger mine — Greenhorn District, A-32

Location: Grant County, sec. 2, T. 10 S., R. 34 E., a mile and a half west of the Bi metallic.

Development: Two adits of unknown length.

Geology: North-trending vein in granodiorite cut by diorite-porphyry dikes. Sulfides make up about 5 percent of the vein material; include arsenopyrite, pyrite, sphalerite, tetrahedrite, and chalcopyrite.

Production: No record.

References: Department Bulletin 14-B, 1941:94; Allen, 1948:37.

West Side mine — Greenhorn District, A-33

Location: Grant County, SE$\frac{1}{4}$ sec. 9, T. 10 S., R. 35 E., immediately west of Greenhorn.

Development: 500-foot adit drift and a shallow shaft.

Geology: Vein in the form of broken lenses and blocks in greenstones, argillite, and serpentine all badly altered and structurally disturbed. Vein difficult to follow. Ore minerals are chiefly quartz, calcite, and dolomite with pyrite, galena, gold, and silver.

Production: Small. A few carloads of ore shipped in 1914; returns were $50 to $75 per ton.

References: Swartley, 1914:186; Parks and Swartley, 1916:235; Hewett, 1931:19; Department Bulletin 14-B, 1941:96.

Wray mine — Greenhorn District, A-34

Location: Grant County, W½ sec. 17, T. 10 S., R. 34 E.

Development: Small.

Geology: Copper minerals and associated gold along fractures in greenstone.

Production: None recorded.

References: Swartley, 1914:173.

B. SUSANVILLE DISTRICT

Badger mine — Susanville District, B-1

Location: Grant County, S½ sec. 7, T. 10 S., R. 33 E., on the south side of Elk Creek, about 2 miles above its junction with the Middle Fork of the John Day River.

Development: A 900-foot shaft with several drift levels, raises, and stopes. A 1600-foot crosscut adit connects with the 500-foot level of the shaft.

Geology: The country rock is mostly slate with some argillite, shale, and quartzite. The vein strikes a little north of east and dips 60° to 70° S. In parts of the mine; two veins about 6 feet apart. The principal ore shoot was 190 feet long and from 1 to 20 feet wide, consisting of quartz and partly replaced country rock containing pyrite, arsenopyrite, sphalerite, galena, chalcopyrite, and tetrahedrite containing high values in silver and gold. Sorted ore was kept above $150 per ton. The grade is said to decrease below the 500 level, and little ore has been removed.

Production: Probably between $250,000 and $500,000, mostly during 1899-1905. Mill recovery averaged about 60 percent of assay values. The vein discovered in 1878.

References: Lindgren, 1901:706; Swartley, 1914:170; Parks and Swartley, 1916:19; Gilluly, Reed, and Park, 1933:111; Department Bulletin 14-B, 1941:133.

Chattanooga mine — Susanville District, B-2

Location: Grant County, secs. 5 and 6, T. 10 S., R. 33 E., southwest of the Reserve Group.

Development: Poor record; includes shaft 210 feet deep.

Geology: Vein in talc schist; strikes N. 65° E., and dips 60° E. The predominant gangue is quartz but ankerite, mariposite, and sericite are present. Sulfides include pyrite, chalcopyrite, sphalerite, galena, and arsenopyrite. Vein said to range from 1 to 8 feet in width.

Production: A little ore was shipped in early days; amount unknown.

References: Swartley, 1914:171; Parks and Swartley, 1916:165; Gilluly, Reed, and Park, 1933:113; Department Bulletin 14-B, 1941:139.

Daisy mine — Susanville District, B-3

Location: Grant County, NW$\frac{1}{4}$ sec. 5, T. 10 S., R. 33 E.

Development: Open cuts.

Geology: Rusty quartz vein in talc schist; strikes N. 20° E., and dips 65° E. Quartz said to contain a little pyrrhotite, pyrite, chalcopyrite, and free gold.

Production: No record.

References: Gilluly, Reed, and Park, 1933:113; Department Bulletin 14-B, 1941:140.

Gem mine — Susanville District, B-4

Location: Grant County, N$\frac{1}{2}$ sec. 5, T. 10 S., R. 33 E., between the forks of Elk Creek.

Development: Shaft 350 feet deep, with four levels.

Geology: Country rock is talc schist and peridotite. Vein, mostly quartz with some ankerite, strikes N. 45° E., dips 60° SE., and is about 3 feet wide. Free gold is present along with chalcopyrite, pyrite, and pyrrhotite.

Production: Small.

References: Parks and Swartley, 1916:164; Gilluly, Reed, and Park, 1933:112; Department Bulletin 14-B, 1941:140.

Golden Gate (Poorman) mine — Susanville District, B-5

Location: Grant County, secs. 7 and 8, T. 10 S., R. 33 E., east of the Badger and north of Elk Creek.

Development: Poor record; includes several adits and cuts, one adit being 833 feet long.

Geology: The country rock is talc schist with some slate. The series is cut by an aplite dike about 50 feet thick which is locally mineralized. Numerous small veins and lenses of quartz are found in the aplite and enclosing schist. Some reportedly contain free gold. Sulfides present are sphalerite, pyrite, galena, chalcopyrite, and stibnite. A shoot on the Beaver vein said to be 70 feet long, $2\frac{1}{2}$ feet thick, and 100 feet deep was worked prior to 1870.

Production: Small (?).

References: Gilluly, Reed, and Park, 1933:114; Department Bulletin 14-B, 1941:141.

Homestake (Bull of the Woods, Mockingbird) mine — Susanville District, B-6

Location: Grant County, secs. 7 and 8, T. 10 S., R. 33 E., on the north side of Elk Creek opposite the Badger.

Development: Several adits, two of which are connected by a shaft.

Geology: The country rock is serpentine and talc schist. The workings explore several mineralized fracture zones which locally contain a little quartz, pyrite, chalcopyrite, pyrrhotite, and galena.

Production: Small output reported in 1905.

References: Parks and Swartley, 1916:124; Gilluly, Reed, and Park, 1933:113, 116.

Princess mine — Susanville District, B-7

Location: Grant County, $SW\frac{1}{4}$ sec. 32, T. 9 S., R. 33 E.

Development: Includes a 460-foot adit and 60-foot shaft.

Geology: Nearly vertical pipe-like quartz replacement body in schist near contact with quartz diorite. Stringers extend from the mass in several directions. Pyrite, chalcopyrite, pyrrhotite, sphalerite, and free gold have been reported.

Production: No record.

References: Swartley, 1914:172; Parks and Swartley, 1916:182; Gilluly, Reed, and Park, 1933:114; Department Bulletin 14-B, 1941:146.

Rescue mine — Susanville District, B-8

Location: Grant County, $NW\frac{1}{4}$ sec. 5, T. 10 S., R. 33 E., adjoining Gem group on the west.

Development: Shaft 140 feet deep and an adit of unknown length.

Geology: Vein in schist strikes N. 10° E., and dips 60° E. The vein is mainly quartz, with ankerite, pyrite, sphalerite, pyrrhotite, chalcopyrite, galena, and arsenopyrite.

Production: No record.

References: Gilluly, Reed, and Park, 1933:113; Department Bulletin 14-B, 1941:146.

Side Issue (Black Hawk) mine — Susanville District, B-9

Location: Grant County, secs. 7 and 8, T. 10 S., R. 33 E., on the south side of Elk Creek.

Development: 130-foot inclined shaft and short adit.

Geology: Vein consisting of quartz stringers and gouge 4 inches to 20 inches wide in talc schist; strikes N. 65° E., and dips 60° at the surface, flattening to 40° with depth. Pyrite, galena, and sphalerite present in small amounts.

Production: No record.

References: Gilluly, Reed, and Park, 1933:116; Department Bulletin 14-B, 1941:138.

Stockton mine — Susanville District, B-10

Location: Grant County, S½ sec. 7, T. 10 S., R. 33 E., southeast of the Badger.

Development: Poor record; includes a 200-foot shaft.

Geology: Vein in slate; details of mineralization unknown.

Production: No record.

References: Lindgren, 1901:707; Swartley, 1914:171; Parks and Swartley, 1916:214; Gilluly, Reed, and Park, 1933:117; Department Bulletin 14-B, 1941:147.

LOOKOUT MOUNTAIN-PEDRO MOUNTAIN AREA

Location and Geography

The Lookout Mountain-Pedro Mountain area encompasses the Connor Creek, Mormon Basin, and Weatherby lode mining districts and the old placer-mining areas of Rye Valley, Malheur, Clarks Creek, and Eldorado in southeastern Baker and northern Malheur Counties (figure 28).

The area is about 25 miles long, extending from Snake River southwesterly across Mormon Basin. U.S. Highway 30 cuts diagonally across the region, following Burnt River, and good gravel roads lead into the mining districts. The topography is in general rugged, with elevations ranging from 2077 feet at Brownlee Reservoir on Snake River to 7120 feet on Lookout Mountain and 6453 feet on Pedro Mountain. Parts of the upper flanks of Pedro and Lookout Mountains are sparsely timbered, whereas the remainder of the country supports little more than brush and desert grasses.

Geology

The gold deposits in the area appear to be genetically related to a northeasterly aligned group of exposures of Jurassic-Cretaceous intrusive rock, mainly granodiorite of medium grain size. The two largest exposures underlie Lookout Mountain and Pedro Mountain. Older bedded rocks in most of the area are part of a thick sequence of phyllite, slate, massive to schistose greenstones, and limestone of indefinite age which Gilluly (1937) named the Burnt River Schist for exposures in Burnt River Canyon. In the southern part of the area thick sections of metavolcanic rocks and graywacke sandstones and shales of Upper Triassic-Jurassic age are exposed. Small- to moderate-sized masses of altered gabbro are scattered throughout the area underlain by the Burnt River Schist. Gold deposits occur in the granitic rocks and in most of the older rocks.

Production

The Lookout Mountain-Pedro Mountain area contains both lode and placer mines of past importance. No estimates of total placer output can be given because few authentic records are available. Some of the placers, notably those in the Malheur, Eldorado, Rye Valley, and Mormon Basin areas, are generally believed to have produced considerable gold.

Total lode production is probably close to $4,500,000, more than half of which was produced by the Rainbow mine in the Mormon Basin district. Much of the remainder came from the Connor Creek mine in the Connor Creek district. Other mines of note are the Gold Ridge mine in the Weatherby district, the Humboldt and Sunday Hill in the Mormon Basin district, and the Bay Horse silver mine in the Connor Creek district.

Placer Mines

Mormon Basin and adjacent placers

Placer mines were in operation in the Mormon Basin district as early as 1863. Gravels cover a large part of the basin floor to varying depths. Despite a scarcity of water, most of these gravels have been worked; however, it seems likely that exploitation has not been as thorough here as in areas where water is more abundant. Little is known about total production. Lindgren (1901, p. 772) states: "In 1882 two

American and one Chinese company were operating, with a total yield of $40,000. In 1883 a yield of $35,200 was reported. Since that time the production has greatly diminished."

Several areas adjacent to Mormon Basin have produced large amounts of placer gold. To the north, on the lower reaches of Clarks Creek and on Burnt River below that stream, a small dredge was operated periodically during the years 1917 to 1936. To the east of Mormon Basin, on the south fork of Dixie Creek, are the Rye Valley placers where work began in 1862. These placers produced more than $1,000,000 (Swartley, 1914, p. 228), much of which was won from hydraulic mining of high gravels. Southwest of Mormon Basin on the Willow Creek slope are the famed early-day placer camps of Malheur, Eldorado, and Amelia. The 100-mile-long Eldorado Ditch, completed in 1873, carried water to these diggings all the way from the head of Burnt River.

Lower Burnt River and Weatherby placers

The gravel bars of Burnt River from Durkee to Huntington are said to have been placer mined in early days (Swartley, 1914, p. 217). Gravels along several tributary streams have also been worked, notably those on Sisley, Chicken, and Shirttail Creeks, which drain the Weatherby district. For a short time around 1900 the Pomeroy Dredging Co. operated a small dredge on Burnt River below the mouth of Sisley Creek. In Burnt River Canyon upstream from Durkee there is abundant evidence of small-scale placer activity.

Connor Creek placers

Connor Creek was one of the first to be mined for placer gold in the early days; it had been worked over twice when seen by Lindgren in 1901. Parts of the creek are still being mined intermittently in a small way. Probably most of the placer gold was eroded from the Connor Creek vein; little placering has been done in the creek above it. Total production of placer gold to 1914 was said by Swartley (1914, p. 213) to be about $125,000. According to local historians, this figure represents only a small part of the actual production. Several other gulches that drain into Snake River in this area have been worked for placer gold.

Connor Creek District

General information

The Connor Creek district includes all of the Snake River Canyon area between the mouths of Burnt River near Huntington and Powder River near Richland (figure 28). The relief is high and topography is rugged.

The district encompasses a wide variety of greenstones, slates, phyllites, low-grade schists, and old plutonic rocks of Permian (?) and Late Triassic age. These rocks have been intruded by Jurassic-Cretaceous granodiorite. Lookout Mountain is the largest exposure of the intrusive rock.

Most of the gold produced in the district has come from the Connor Creek mine, which has a total output of about $1,250,000. Nearly 150,000 ounces of silver have been produced by the Bay Horse mine. Little or no output has been reported for other deposits in the district. Placer production from Connor Creek has been discussed above.

Principal lode mines

Connor Creek mine: The Connor Creek mine, located 3 miles up Connor Creek from Snake River, is developed by six adits over a vertical interval of more than a thousand feet. This, together with the raises, amounts to well over 8000 feet of development work. The vein is enclosed in dark-colored slate and phyllite with a generally N. 40° W. strike and a 70° to 75° SW. dip. Above the outcrops to the northwest is a large exposure of limestone which, however, is not cut by the vein or by any of the drifts

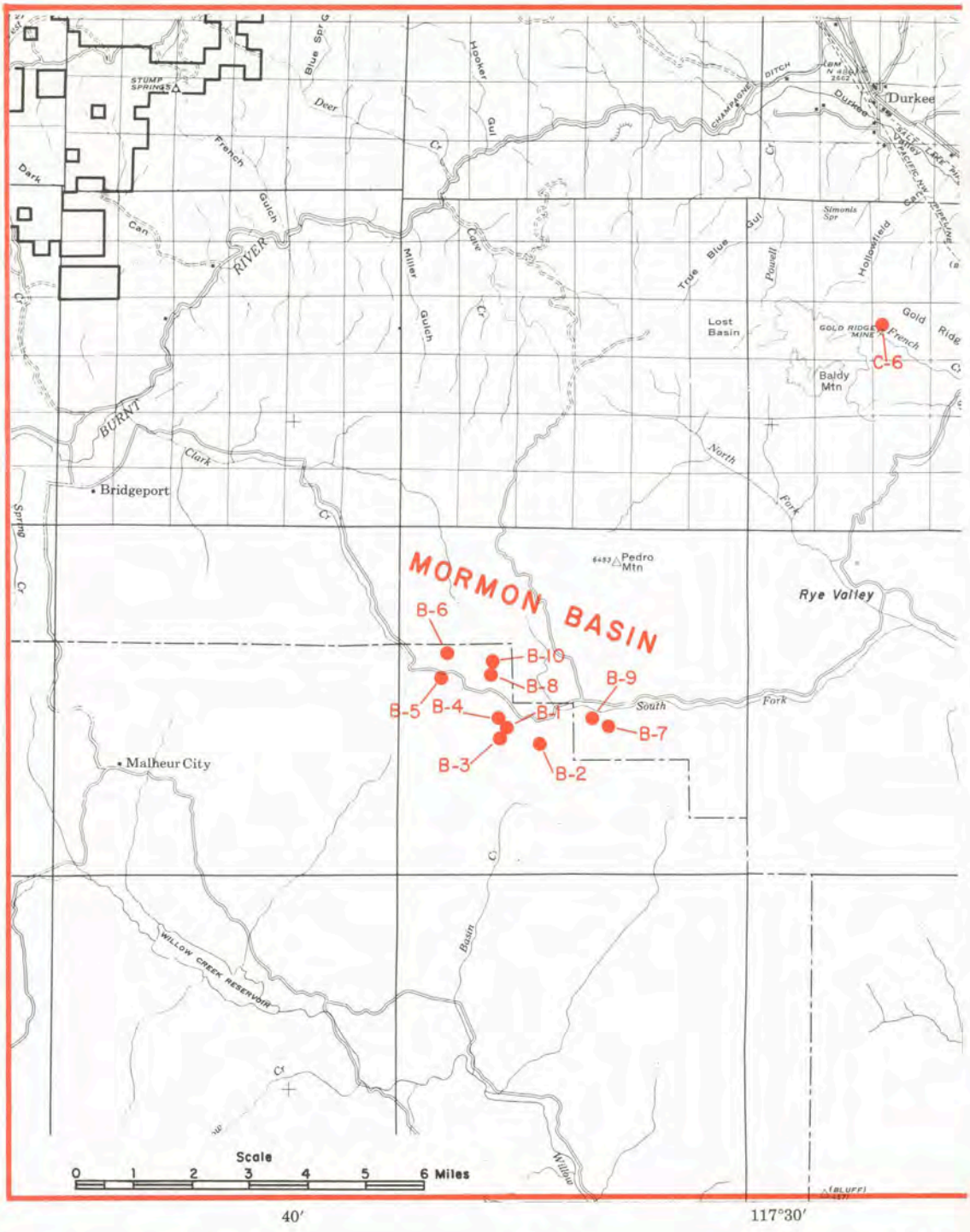
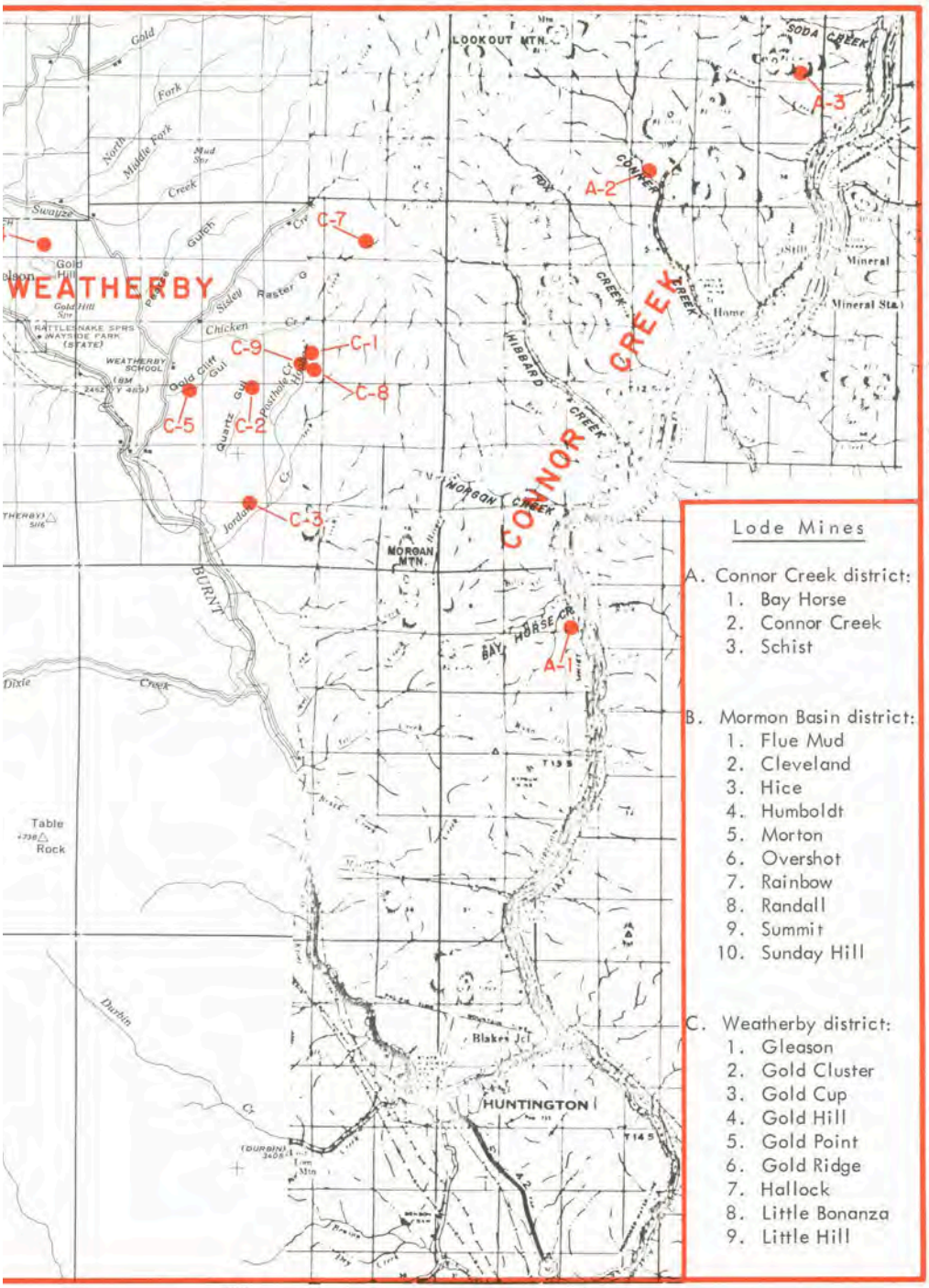


Figure 28. Index map of the Lookout Mountain - Pedro Mountain area.



Lode Mines

A. Connor Creek district:
1. Bay Horse
2. Connor Creek
3. Schist

B. Mormon Basin district:
1. Flue Mud
2. Cleveland
3. Hice
4. Humboldt
5. Morton
6. Overshot
7. Rainbow
8. Randall
9. Summit
10. Sunday Hill

C. Weatherby district:
1. Gleason
2. Gold Cluster
3. Gold Cup
4. Gold Hill
5. Gold Point
6. Gold Ridge
7. Hallock
8. Little Bonanza
9. Little Hill

Base map from U.S. Forest Service

or crosscuts. The vein has been followed and stoped on all levels in a westerly direction up to a zone of sheared and chloritized slate about 130 feet wide that strikes N. 31° E. and dips 45° to 60° SE. The vein has been found west of this "final cut-off" only on the lowest level of the mine.

The vein ranges in width from a narrow seam to 8 feet, but the average is between $1\frac{1}{2}$ and 4 feet. The filling is coarse white quartz that contains coarse gold, almost entirely native, with some argentite and pyrite. The gold is unusually fine. The main ore shoot had a maximum length of about 1400 feet on the lower levels and extended to the surface. The mill ore contained 0.15 to 0.5 ounce per ton of gold. Small rich pockets of coarse gold were scattered through the shoot.

Swartley (1914, p. 216) estimated the total production of the Connor Creek mine at about $1,250,000. Although work was started in 1871, the greatest period of activity was between 1880 and 1890 (Lindgren, 1901, p. 757). Except for a small production of probably not more than $20,000 in 1915-1918 (Gilluly, Reed, and Park, 1933, p. 50), little mining has been done since that period.

Bay Horse mine: The Bay Horse mine is located on a steep slope a few hundred feet above Snake River 7 miles below Huntington. According to Livingston (1925, p. 17-18), silver-bearing tennantite is the sole ore mineral, associated in only a few places with small amounts of other sulfides. The country rocks are andesite and rhyolite flows of Late Triassic(?) age. The ore body, made up of fractured and silicified rock containing seams and impregnations of tennantite, is irregular in outline but reportedly had an over-all strike of N. 70° W. to west with a dip of 10 feet in a hundred into the mountain (Livingston, 1925). The mine is developed by two adits 130 feet apart vertically.

The Bay Horse mine is credited with production as early as 1891 (Lindgren, 1901, p. 753-754), but the main period of activity was during the years 1920-1925 when 145,459.54 troy ounces of silver were recovered from 4,895.053 tons of ore shipped to smelters at Tacoma, Wash., and Kellogg, Ida.

Mormon Basin District

General information

The Mormon Basin district straddles the Baker-Malheur County line (figure 28). It encompasses an oval-shaped depression about 3 by 2 miles in extent at the heads of Basin Creek and the South Fork of Dixie Creek. Basin Creek flows south to Willow Creek, a tributary of the Malheur River, and the South Fork of Dixie Creek flows east and south to Burnt River. Elevations range from 4500 to 6000 feet.

Rocks of the district comprise quartz-rich schists, slates, and greenstones cut by numerous intensely sheared and altered igneous bodies of basic and ultrabasic composition. Intrusive into these rocks are several small offshoots of the Jurassic-Cretaceous granodiorite stock that underlies Pedro Mountain at the north edge of the district. Intrusion of the stock resulted in considerable deformation of the enclosing rocks. Minor offsetts and abrupt changes in the attitude of the bedded rocks are common, although on the whole the planes of schistocity are parallel to the edges of the intrusive. Wolff (1965, p. 56) states: "The direction of intrusion of the Pedro Mountain pluton has been upward and southwesterly and....the Burnt River Schist which trends easterly, has been deflected around the intrusion and has been broken by a series of faults." He suggests that the Burnt River Schist in the Mormon Basin area is a fault block thrust upward and southwestward ahead of the Pedro Mountain intrusive and that "The ultramafic rocks around the periphery of the Burnt River Schist provided the surface upon which the plate was thrust."

Mine and prospect workings are abundantly scattered throughout the district and numerous veins have been exposed. Few of these veins are persistent for any great length and in general they are irregular in both width and attitude. Quartz with lesser ankerite and fuchsite are the chief gangue minerals. Pyrite and arsenopyrite are the most abundant metallic minerals; galena, sphalerite, polybasite, hessite, and tetrahedrite are present locally.

The quartz mines of the district have produced more than $2,650,000 in gold, most of it from the Rainbow mine. Other properties in the district where development was fairly extensive include the Humboldt and Sunday Hill mines. Mills were erected on both properties. There is little record of production

from the Sunday Hill.

Principal lode mines

Rainbow mine: The Rainbow mine was first worked in 1901. The following figures, presented in a lengthy appraisal of the property by W. Elmer and G. Hogg dated January 26, 1923,were reportedly obtained from company records:

Operator	Period	Gross value	Tons milled	Gross value per ton	Recovery
Commercial Mining Co.	1901-1910	$ 242,000.00	?	?	?
United States Smelting, Mining & Refining Co.	1911-1915	1,111,796.76	103,547.5	$11.24	$10.737
Commercial Mining Co.	1916-1919	969,295.70	113,064	8.79	8.57
	Total	$ 2,323,092.46			

A 15-stamp mill and cyanide plant of 100-ton-per-day capacity was operated more or less continuously from 1912 to 1919. Since then production has been small and sporadic. In 1923 the surface plant was destroyed by fire. Condor Gold Mines produced 1222 ounces gold and 361 ounces silver in 1934 but closed in October of that year because of financial difficulties. At the Rainbow mine, a fault breccia zone as much as 50 feet wide occurs in slate and greenstone, the latter derived in part from old intrusives. Into portions of this zone a diorite dike was injected and later considerably altered. Quartz veins occur on both walls. The best and most persistent values of the mine are in the footwall vein, which strikes roughly N. 60° E. and dips 55° to 65° NW. In places the breccia and dike are cemented and veined with quartz, which is locally ore bearing. The ore shoots occur as lenses that are continuous for lengths of as much as 350 feet and are recurrent both on strike and dip. Ore has been mined at intervals through a maximum distance of 1500 feet along the strike and 500 feet down the dip. The gold was largely free milling; sulfide minerals are generally sparse even on the lowest levels.

Development includes about 7000 feet of drift on four levels turned from a 400-foot vertical shaft and upper-level adit. A winze was sunk to the 500-foot level and a little drifting was done but no mining.

Humboldt mine: The Humboldt mine (figure 29) operated rather steadily between 1909 and 1915 inclusive, producing roughly 35,000 tons of ore which yielded about $225,000 in gold and silver. The mine was equipped with a 20-stamp amalgamating and concentrating mill and in 1915 was developed by a 500-foot vertical shaft and 3500 feet of drifts.

Sunday Hill mine: A mill was built at the Sunday Hill mine in 1868 and the mine reputedly produced $80,000 in early days. Operations during the 1930's brought the total output of the mine up to around $100,000. The country rock is quartz-mica schist. One vein, the Phalen, strikes N. 40° to 50° W. and dips 50° N. Average mining width is about $2\frac{1}{2}$ feet. Several other narrower veins are known on the property. The vein matter is quartz and gouge with pyrite and lesser arsenopyrite, galena, and sphalerite. In 1934, 400 tons of ore treated by tabling and amalgamation yielded 120 ounces gold and 35 ounces silver. The ore was crushed in a 5-stamp mill.

Weatherby District

The Weatherby district (part of the old Lower Burnt River district) lies about 35 miles southeast of Baker (figure 28). It straddles U. S. Highway 30, which follows Burnt River. The district is in the Durkee quadrangle, which has recently been mapped by Prostka (1967). In this area a heterogeneous assemblage of phyllite, slate, chert, greenschist, graywacke, marble and metagabbro has been intruded by granodiorite. The largest exposure of the granodiorite underlies Lookout Mountain and an area of several square miles to the southeast, including the heads of Sisley and Chicken Creeks in the northeastern part of the district.

The Weatherby district is noted for the old placers along Chicken and Sisley Creeks north of the highway and for several small but high-grade auriferous quartz veins. The veins are not persistent; none can be traced for long distances, nor are directions of strike and dip constant. The veins occur mainly in the granodiorite, but some are in adjacent older schists and greenstones.

The more prominent quartz mines in the district are the Gold Hill, about 4 miles southeast of Durkee; the Gold Ridge 4 miles due south of Durkee; and the Little Bonanza, Little Hill, Gleason, and Hallock in the vicinity of Chicken Creek. The Gold Ridge mine, which worked several small, east-trending veins in granodiorite, is said to have produced about $210,000, practically all of it extracted between 1881 and 1886 (Lindgren, 1901, p. 765).

Figure 29. Humboldt mine, Mormon Basin district, Malheur County, prior to 1914.

Lode Mines of the Lookout Mountain - Pedro Mountain Area

CONNOR CREEK DISTRICT

Bay Horse mine — Connor Creek District, A-1

Location: Baker County, sec. 9, T. 13 S., R. 45 E., on the east bank of Snake River.

Development: About 1800 feet of drifts and crosscuts, mainly from two adit levels 130 feet apart and an intermediate shaft level.

Geology: The country rocks are altered andesite and rhyolite of probable Upper Triassic age. The ore occurs as small replacement masses of irregular shape scattered through a poorly defined zone of faulting. The ore zone is about 50 feet in maximum width and has a westerly trend.

Production: Output during 1920-1925 amounted to 145,459.54 troy ounces silver from 4,895 tons of ore shipped to smelters. Previous output unknown.

References: Lindgren, 1901:753; Livingston, 1925; Gilluly, Reed, and Park, 1933:52.

Connor Creek mine — Connor Creek District, A-2

Location: Baker County, sec. 34, T. 11 S., R. 45 E., about 3 miles up Connor Creek from Snake River.

Development: Six adits over vertical interval of 1000 feet. Total with raises more than 8000 feet.

Geology: Quartz vein in slate and greenstone; strikes N. 40° W., and dips 70°-75° SW. Width of vein $1\frac{1}{2}$ to 4 feet. The pay shoot was 1400 feet long on the Dry Creek level and extended to the surface. Ore minerals are coarse gold with a little argentite and pyrite.

Production: Estimated at $1,250,000. Main periods of operation were 1870-1910 and 1915-1918. Mill ore ran between $3 and $10 per ton. The gold averaged about 900 fine.

References: Lindgren, 1901:756; Swartley, 1914:216; Parks and Swartley, 1916:68; Gilluly, Reed, and Park, 1933:50; Department Bulletin 14-A, 1939:22, 23.

Schist (Snake River) mine — Connor Creek District, A-3

Location: Baker County, $SE\frac{1}{4}$ sec. 24, T. 11 S., R. 45 E.

Development: Several hundred feet of crosscut and drift from adit levels.

Geology: The country rocks are phyllite and marble. The phyllite is impregnated with reticulated veins and small, irregularly shaped masses of gold-bearing quartz. Channel

sampling is reported to have yielded about $3.50 per ton over a width of 90 feet.

Production: No record. There was a 75-tons-per-day mill on the property in 1916.

References: Swartley, 1914:215; Gilluly, Reed, and Park, 1933:52; Parks and Swartley, 1916: 207; Department Bulletin 14-A, 1939:23-24.

MORMON BASIN DISTRICT

Blue Mud prospect — Mormon Basin District, B-1

Location: Malheur County, E½ sec. 20, T. 13 S., R. 42 E., about 1500 feet south of the Humboldt mine.

Development: Several tunnels and 200-foot shaft.

Geology: Workings said to expose vein in greenstone, chlorite schist, and metagabbro. Width and altitude unknown. Rich float found in Tertiary gravels nearby.

Production: No record.

References: Gilluly, Reed, and Park, 1933:47; Department Bulletin 14-A, 1939:76.

Cleveland Development Co. mine — Mormon Basin District, B-2

Location: Malheur County, SW¼ sec. 21, T. 13 S., R. 42 E., on the south side of California Gulch just above confluence with Basin Creek.

Development: Two adits and several pits.

Geology: Quartz seams in porphyry dike cutting schist and greenstone. Dike is a few feet wide, strikes N. 75° E., dips steeply south.

Production: No record.

References: Parks and Swartley, 1916:56; Gilluly, Reed, and Park, 1933:47; Department Bulletin 14-A, 1939:76.

Hice mine — Mormon Basin District, B-3

Location: Malheur County, E½ sec. 20, T. 13 S., R. 42 E., about 2000 feet south of the Humboldt mine.

Development: 250-foot adit with branches; total 400 feet.

Geology: Many quartz seams less than 4 inches thick in quartz diorite. Diorite locally silicified and impregnated with sulfides.

Production: No record.

References: Gilluly, Reed, and Park, 1933:46; Department Bulletin 14-A, 1939: 78.

Humboldt mine — Mormon Basin District, B-4

Location: Malheur County, N½ sec. 20, T. 13 S., R. 42 E., in the southwestern part of Mormon Basin.

Development: 500-foot shaft with 3500 feet of drifts distributed among several levels.

Geology: Quartz vein in slate, diorite, and trachyte. Strike E-W., dip 75° N. in upper levels, steeper below. Vein zone, including altered country rock, is locally 40 feet wide, contains arsenopyrite, pyrite, galena, and sphalerite, some calcite. Free gold in upper levels.

Production: Output 1909-1915 was $225,000 from 35,000 tons of ore. No mill record.

References: Swartley, 1914:224; Gilluly, Reed, and Park, 1933:45; Department Bulletin 14-A, 1939: 78.

Morton mine — Mormon Basin District, B-5

Location: Malheur County, SE¼ sec. 18, T. 13 S., R. 42 E., on the divide between Glengarry and French Gulches.

Development: Shaft 96 feet deep.

Geology: Rich quartz float in decomposed diorite debris, which the shaft failed to penetrate.

Production: No record.

References: Gilluly, Reed, and Park, 1933:48; Department Bulletin 14-A, 1939:80.

Overshot mine — Mormon Basin District, B-6

Location: Malheur County, NE¼ sec. 18, T. 13 S., R. 42 E., near the head of the north fork of Glengarry Gulch.

Development: Adits; the longest is 300 feet.

Geology: Slate and quartz-mica schist cut by thin sheets and sills of altered quartz diorite. Gold said to have been found in the diorite and near its contact with the schist.

Production: No record.

References: Gilluly, Reed, and Park, 1933:43; Department Bulletin 14-A, 1939:80.

Rainbow mine — Mormon Basin District, B-7

Location: Baker County, sec. 22, T. 13 S., R. 42 E.

Development: 500-foot shaft with several levels and an upper-level adit; about 7000 feet of drift.

Geology: Fault zone as much as 50 feet wide in slate, chloritized ultrabasic intrusive rocks and minor limestone with some granitic dikes. Strike N. 60° E.; dip 55° to 65° N. Quartz veins on both walls contain free gold and very small amounts of pyrite and arsenopyrite.

Production: Output during 1901-1919 totaled $2,323,092.46 from ore averaging about $10 per ton treated in a 100-tons-per-day stamp mill and cyanide plant.

References: Swartley, 1914:220; Gilluly, Reed, and Park, 1933:37; Department Bulletin 14-A, 1939:81.

Randall mine — Mormon Basin District, B-8

Location: Malheur County, SE¼ sec. 17, T. 13 S., R. 42 E., on the south end of Sunday Hill.

Development: Two adits 24 feet apart vertically, total 1200 feet.

Geology: Three quartz veins in quartz-mica schist and diorite. Small amounts of pyrite, arsenopyrite, hessite, galena, and sphalerite are present. Gold largely free, since workings are in the oxidized zone. Two of the veins intersect in the lower level; one strikes N. 60° W., dips 32° SW., and is 2 to 5 feet wide; the other strikes N., dips 32° E., and is more than 8 feet thick.

Production: No record.

References: Gilluly, Reed, and Park, 1933:41; Department Bulletin 14-A, 1939:82.

Summit mine — Mormon Basin District, B-9

Location: Baker County, NW¼ sec. 22, T. 13 S., R. 42 E., on the hillside south of the South Fork of Dixie Creek west of Rainbow Gulch.

Development: Several adits; one is 1400 feet long, another 750 feet long.

Geology: The country rocks are slate, phyllite, and granodiorite. Vein strikes NE. and is 1 to 5 feet wide, cut off in the upper levels by an E.-W. fault. Sparse pyrite and galena. Gold mostly free.

Production: No record.

References: Gilluly, Reed, and Park, 1933:44; Department Bulletin 14-A, 1939:83.

Sunday Hill mine — Mormon Basin District, B-10

Location: Malheur County, E½ sec. 17, T. 13 S., R. 42 E.

Development: Many hundred feet of drifts and crosscuts from adit levels and a shaft.

Geology: One strong vein and several narrower ones in quartz-mica schist which is cut by quartz-diorite dikes. Main vein strikes N. 40° to 50° W. and dips 50° N. It is 2½ feet thick in mined area. Vein is faulted. Vein matter is chiefly quartz and gouge with pyrite, arsenopyrite, galena, and sphalerite. Some free gold.

Production: About $100,000. Located in 1867; mill erected in 1868. Some production also in 1920's and 1930's. Gold-to-silver ratio about 3.5 to 1.

References: Gilluly, Reed, and Park, 1933:39; Department Bulletin 14-A, 1939:83.

WEATHERBY DISTRICT

Gleason mine — Weatherby District, C-1

Location: Baker County, SE¼ sec. 15, T. 12 S., R. 44 E., on Hogback Creek north of the Little Bonanza mine.

Development: Two thousand feet of workings from two adits and a shaft.

Geology: Country rock is granodiorite cut by a porphyry dike. Quartz vein 2 to 4 feet wide along footwall of the dike strikes N. 7° E.; dips 65° W. Gold free milling.

Production: $150,000. The property was first located about 1867.

References: Parks and Swartley, 1916:99; Lorain, 1938:35; Department Bulletin 14-A, 1939:67.

Gold Cluster mine — Weatherby District, C-2

Location: Baker County, NE¼ sec. 21, T. 12 S., R. 44 E., east of Quartz Gulch.

Development: 600 hundred feet of tunnel and shallow shafts.

Geology: Discontinuous quartz stringers in a shear zone in granodiorite. Strike N. 7° E.; dip 35° W. Step-faulted easterly.

Production: $8000 in 1928-1938; early production not recorded. Gold mostly free; 770 to 825 fine.

References: Department Bulletin 14-A, 1939: 67.

Gold Cup mine — Weatherby District, C-3

Location: Baker County, secs. 28 and 33, T. 12 S., R. 44 E.

[Four patented mining claims -- no other data available.]

Gold Hill mine — Weatherby District, C-4

Location: Baker County, S½ sec. 1, T. 12 S., R. 43 E., on the north slope of Gold Hill.

Development: 4200 feet of drifts, three shafts, and several cuts.

Geology: Country rock is granodiorite. Phyllite and slate are exposed nearby. Eight small quartz veins are cut by the workings; strike N. 60° to 65° W.; dip S.; average thickness less than 6 inches. Ore minerals include pyrite, sphalerite, and galena. The wall rocks are intensely sericitized adjacent to the veins.

Production: Small.

References: Swartley, 1914:218; Gilluly, Reed & Park, 1933:54; Dept. Bulletin 14-A, 1939:68.

Gold Point mine — Weatherby District, C-5

Location: Baker County, NE¼ sec. 20, T. 12 S., R. 44 E., in Gold Cliff Gulch, about three-quarters of a mile from the Sisley Creek road.

Development: No record.

Geology: Quartz stringers in granodiorite. Average 2 to 4 inches thick. Strike N. 10° to 30° E.; dip 25° to 45° W.

Production: $40,000.

References: Department Bulletin 14-A, 1939: 69.

Gold Ridge mine — Weatherby District, C-6

Location: Baker County, W½ sec. 16, T. 12 S., R. 43 E., near the head of French Creek, about 4 miles due south of Durkee.

Developments: 250-foot shaft; 2000 feet of drifts and crosscuts, mostly from adit levels.

Geology: The country rock is quartz diorite. Three well-defined quartz veins, 2 to 3 feet wide, strike N. 50° to 70° W., dip 65° SW. Ore zone said to have been 780 feet long.

Production: About $210,000 between 1881 and 1886, with 10-stamp mill. Oxidized ore ran $12 to $15 per ton in gold about 870 fine.

References: Lindgren, 1901:765; Parks and Swartley, 1916:109; Gilluly, Reed, and Park, 1933:56; Department Bulletin 14-A, 1939:66.

Hallock mine — Weatherby District, C-7

Location: Baker County, SE¼ sec. 2, T. 12 S., R. 44 E., near the head of Chicken Creek.

Development: Six adits total 1650 feet, all shallow depth.

Geology: Quartz-calcite veins in granodiorite near irregular contact with sericite schist and limestone. Veins strike N. 68° W., dip 70° N., and vary from 4 to 16 inches thick. Gold free milling.

Production: Small.

References: Department Bulletin 14-A, 1939:69.

Little Bonanza mine — Weatherby District, C-8

Location: Baker County, SE¼ sec. 15, T. 12 S., R. 44 E., on Hogback Creek.

Development: Two thousand feet of tunnels and two winzes.

Geology: The country rocks are granodiorite cut by a basic lamprophyric dike 20 to 30 feet wide. A quartz vein as much as 4 feet wide associated with the dike contains pyrite galena, and free-milling gold.

Production: $200,000. Located about 1890.

Reference: Department Bulletin 14-A, 1939:70.

Little Hill mine — Weatherby District, C-9

Location: Baker County, SE¼ sec. 15, T. 12 S., R. 44 E., on Hogback Creek.

Development: Three or four tunnels 200 to 300 feet long and 60-foot shaft.

Geology: Narrow quartz veins in granodiorite strike N. 65° W., dip south; sulfides, including pyrrhotite, in lower levels.

Production: $200,000. Located in 1882. Gold free milling.

Reference: Parks and Swartley, 1916:142; Department Bulletin 14-A, 1939:70.

VIRTUE AREA

Location

The Virtue area includes the mines and prospects in the vicinity of Virtue Flat, about 10 miles east of Baker (figure 30). Lesser deposits occur in the Farley Hills (not shown on map) near Haines and North Powder, about 15 miles north of Baker.

The principal gold deposits of the area are scattered among the low hills bordering Virtue Flat, a gently rolling depression about 8 miles long and 3 miles wide drained by Ruckles Creek. Elevations range from 3400 to 5000 feet. The general region surrounding Virtue Flat has been known as the Virtue mining district.

Geology and Mineralization

Much of the area is covered by Cenozoic basalt flows and lacustrine and fluviatile sediments. Pre-Tertiary rocks are exposed in the hills bordering Virtue Flat and in the Farley Hills north of the map area. The pre-Tertiary units include Elkhorn Ridge Argillite, Clover Creek Greenstone, and gabbro and related rocks which intrude both formations. South of Virtue Flat the argillite series predominates, while to the north greenstones and gabbro are most abundant. All these rocks are structurally contorted and have undergone considerable shearing and dynamic metamorphism. A younger group of intrusive rocks consists largely of quartz diorite, probably of Jurassic-Cretaceous age. Exposures of the quartz diorite are small and scattered, but it is probable that the intrusive body occupies a considerably larger area beneath the younger basalts and alluvium.

The veins of the Virtue district lie along the edges of an intrusion of diorite and gabbro into argillite and greenstone. At different times during the intrusion, the intrusive as well as the intruded rocks were fractured. Into these fractures came many basic to acidic dikes and, later, quartz veins. The quartz veins strike in many directions and none are traceable for long distances. Several of the veins, notably those of the Virtue mine, strike northwest in marked contrast to most of the important veins elsewhere in eastern Oregon. Most of the ore deposits are simple quartz veins containing very small amounts of sulfides. The gold occurs largely in the free state, is coarse, and contains little silver.

The several gold prospects in the Farley Hills north of the map area are in greenstones and altered gabbro; some of the deposits contain copper minerals.

Production

Most of the production in the Virtue district has come from the Virtue mine, which was one of the largest gold producers in eastern Oregon. Its total output was more than $2,000,000. The White Swan mine has a reported production of about $700,000. Several other mines in the district have produced lesser amounts, notably the Flagstaff, Emma, Hidden Treasure, Friday, Rachel, and Mable mines. Production records for these mines are scarce, but none is believed to have produced more than $200,000.

The gulches leading up to the Virtue and White Swan are said to have contained rich placers in the early days.

Principal Lode Mines

Virtue mine: The Virtue was operated from 1862 to 1884 and from 1893 to 1898. A small output was made in 1906-1907. Since that time the mine has been closed. According to Lindgren, the production up

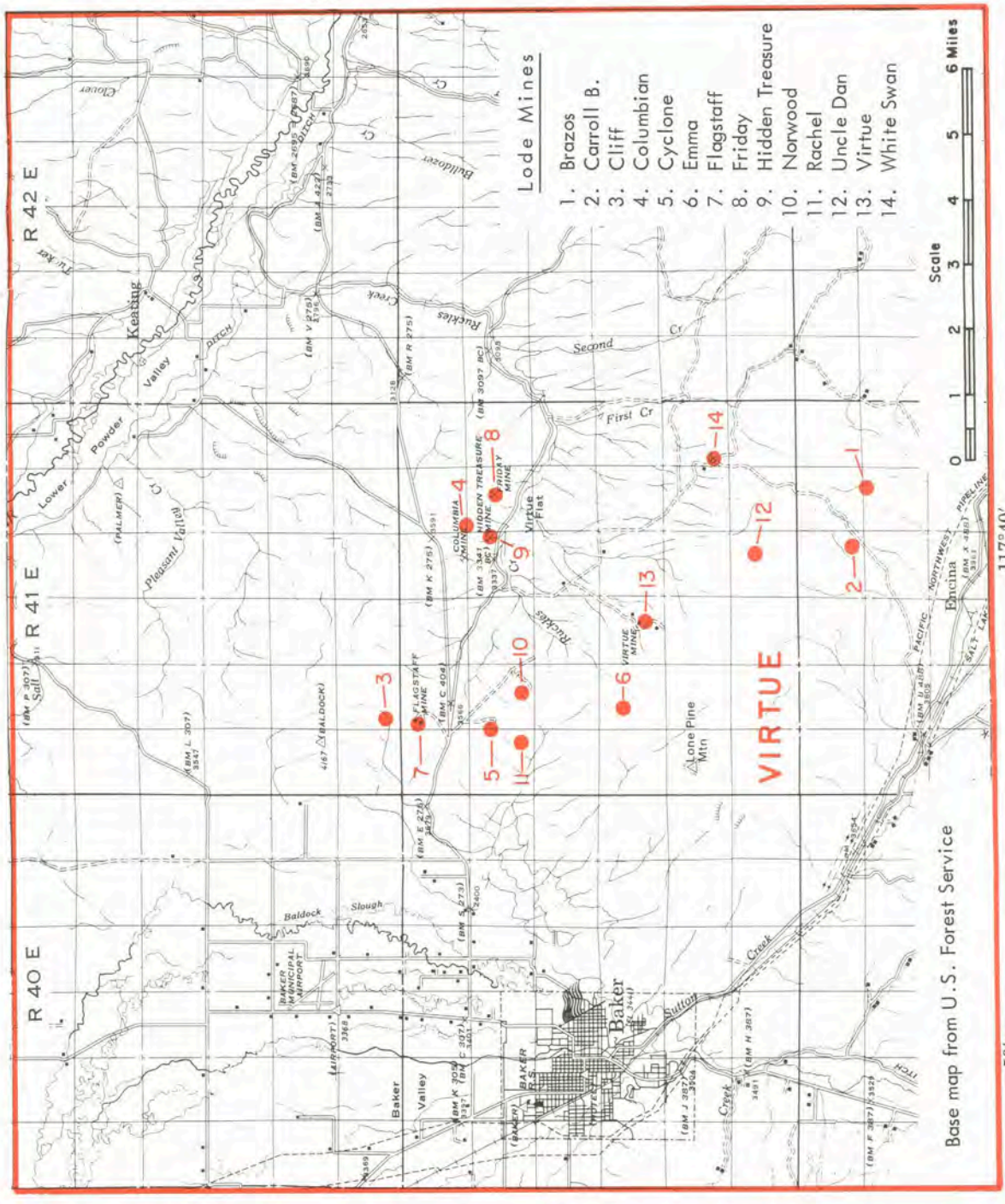


Figure 30. Index map of the Virtue area.

to 1878 was $1,250,000. From 1878 to 1884, the estimated amount is $200,000. From 1893 to 1898 the production was $739,000, the maximum being reached in 1896 with $256,000, and the minimum in 1898 with $13,100. The total production is thus $2,189,000.

The mine is developed by at least 10,000 feet of workings from three adits and an 800-foot shaft. Eight veins, of which the Virtue has been most productive, have been cut in the mine workings. They are subparallel and strike N. 20° to 45° W. They dip northeast above the mill level, but steepen downward and dip southwest in the lower workings of the old mine (Gilluly, Reed, and Park, 1933, p. 72-74).

According to Lindgren (1901, p. 722-723), an ore shoot with a maximum strike length of 1200 feet was mined to a depth of about 1000 feet below the outcrop. A lean broken zone was then encountered and operations ceased. The ore was a quartz vein 6 inches to 12 feet wide. The quartz averaged about 14 inches wide and contained from 0.5 to 1.0 ounces of gold per ton. During short periods values were often considerably higher. The quartz was sparsely mineralized with pyrite and chalcopyrite. The gold was largely free and very high grade, the bullion averaging more than 925 fine. Operations at depth were handicapped by a heavy flow of warm water.

White Swan mine: The White Swan mine is said to have produced at least $600,000 from 1890 to 1897, $84,000 in 1916, and about $40,000 during 1935-1937. The mine develops several subparallel quartz veins in a broad east-trending shear zone in argillite. Only one of the veins has been an important producer. This vein dips 70° S. and the workings include a shaft 350 feet deep. The only minerals observed in the veins were quartz, sericite, and calcite, with limonite indicating the former presence of sulfides which, however, must have been small in amount (Gilluly, Reed, and Park, 1933, p. 77).

Lode Mines of the Virtue Area.

VIRTUE DISTRICT.

Brazos mine — Virtue District, 1

Location: Baker County, secs. 2 and 11, T. 10 S., R. 41 E.

Development: 600-foot shaft and several drifts.

Geology: Quartz stringers and nodules along fault zone in argillite. Strike NW.; dip gently SW. Width 3 to 4 feet. Pay shoot 400 feet long; low grade.

Production: Small.

References: Lindgren, 1901:726; Parks and Swartley, 1916:43; Gilluly, Reed, and Park, 1933:79; Gilluly, 1937:100.

Carroll B mine — Virtue District, 2

Location: Baker County, SE¼ sec. 3, T. 10 S., R. 41 E.

Development: Shaft and two adits several hundred feet long.

Geology: Quartz vein 1 to 2 feet wide in argillite and greenstone.

Production: No record.

References: Gilluly, Reed, and Park, 1933:78; Gilluly, 1937:100; Department Bulletin 14-A, 1939:104.

Cliff mine

Virtue District, 3

Location: Baker County, SW¼ sec. 32, T. 8 S., R. 41 E.

Development: 225-foot shaft with short drifts on 4 levels.

Geology: Brecciated quartz vein in altered diorite; width 3 feet. Scheelite present in small quantity.

Production: 135 tons milled netted $13.55 per ton in early days. Gold free milling.

References: Lindgren, 1901:725; Parks and Swartley, 1916:56; Gilluly, Reed, and Park, 1933:77; Gilluly, 1937:98; Department Bulletin 14-A, 1939: 104.

Columbian mine

Virtue District, 4

Location: Baker County, secs. 2 and 11, T. 9 S., R. 41 E.

[Information on development and production not available.]

Cyclone mine

Virtue District, 5

Location: Baker County, secs. 7 and 8, T. 9 S., R. 41 E.

Geology: Vein in greenstone. Strike NW. Width 2 feet.

Production: No records.

Reference: Department Bulletin 14-A, 1939: 104.

Emma mine

Virtue District, 6

Location: Baker County, sec. 20, T. 9 S., R. 41 E.

Geology: Vein 2 to 5 feet wide in argillite strikes northeast.

Production: $250,000(?). Equipped with 20-stamp mill in 1905.

Reference: Department Bulletin 14-A, 1939:104-105.

Flagstaff mine

Virtue District, 7

Location: Baker County, NW¼ sec. 5, T. 9 S., R. 41 E.

Geology: Several brecciated zones arranged in a "horsetail" pattern in sheared gabbro and diorite. Strike N. 45° E. to north. Dip SE. Contain masses of gouge and quartz lenses as much as 1½ feet thick. Sulfides sparse.

Production: About $100,000.

References: Lindgren, 1901:724; Swartley, 1914:130; Parks and Swartley, 1916:93; Grant and Cady, 1914:152; Gilluly, Reed, and Park, 1933:74; Gilluly, 1937:96; and Department Bulletin 14-A, 1939:105-106.

Friday mine — Virtue District, 8

Location: Baker County, sec. 11, T. 9 S., R. 41 E.

Development: 200-foot inclined shaft with short drift levels.

Geology: East extension of Hidden Treasure vein.

Production: Small.

References: Lindgren, 1901:725; Gilluly, 1937:100.

Hidden Treasure mine — Virtue District, 9

Location: Baker County, NE¼ sec. 10, T. 9 S., R. 41 E.

Development: 138-foot inclined shaft with 3 short drift levels.

Geology: Vein in sheared, highly altered greenstone. Strike NW. Dip 60° S. Vein minerals include manganese oxides and stibnite. Gold mineralization spotty.

Production: $24,000 from crude ore shipped during 1933-1938; previous output unknown.

References: Gilluly, 1937:100; Department Bulletin 14-A, 1939:107.

Norwood mine — Virtue District, 10

Location: Baker County, S½ sec. 8, T. 9 S., R. 41 E.

Development: Unknown.

Geology: 2-foot quartz vein in greenstone. Strike E. to W.; dips steeply.

Production: No record. Mill installed in 1913.

References: Swartley, 1914:131; Grant and Cady 1914:152; Parks and Swartley, 1916:174; Gilluly, Reed, and Park, 1933:76; Gilluly, 1937:98; Department Bulletin 14-A, 1939:108.

Rachel mine

Virtue District, 11

Location: Baker County, SE¼ sec. 7, T. 9 S., R. 41 E.

Development: 800-foot incline with 3,000 feet of lateral workings.

Geology: One- to three-foot wide vein in argillite and greenstone.

Production: $150,000 (?).

References: Department Bulletin 14-A, 1939:108.

Uncle Dan mine

Virtue District, 12

Location: Baker County, NE¼ sec. 34, T. 9 S., R. 41 E.

[Information on development and production not available.]

Virtue mine

Virtue District, 13

Location: Baker County, sec. 21, T. 9 S., R. 41 E.

Development: Three adits and 800-foot shaft with several levels. Total 10,000 feet.

Geology: Country rock is strongly sheared greenstone derived mainly from gabbro. Eight sub-parallel veins cut by mine workings. Strike N. 20° to 45° W.; dip NE. near surface and SW. in lowest levels. Virtue vein most productive; average about 14 inches thick. Quartz, subordinate calcite, very minor pyrite, and chalcopyrite. Ore averaged 0.5 to 1.0 ounce gold per ton. Some high grade.

Production: $2,200,000 during 1862-1884; 1893-1899; 1906-1907. Gold free and coarse; average more than 920 fine.

References: Lindgren, 1901:722; Grant and Cady, 1914:150; Parks and Swartley, 1916:229; Gilluly, Reed, and Park, 1933:72; Gilluly, 1937:94; Department Bulletin 14-A, 1939:108-109.

White Swan mine

Virtue District, 14

Location: Baker County, SW¼ sec. 25, T. 9 S., R. 41 E.

Development: 300-foot shaft with 4 levels; total 2000 feet.

Geology: Several quartz veins, a few inches to 1½ feet thick, in broad shear zone in argillite. Most of production from one vein. Strike west; dip steeply south.

Production: $724,000 during 1890-1897, 1916, and 1935-1937. 1936 pilot mill flow-sheet given by Lorain. No other records available.

References: Lindgren, 1901:725; Swartley, 1914:131; Gilluly, Reed, and Park, 1933:77; Gilluly, 1937:98; Lorain, 1938:26; Department Bulletin 14-A, 1939:110.

CANYON AREA

Location

The gold deposits of the Canyon district in Grant County lie within a few miles of John Day, a small town situated at the junction of Canyon Creek and the John Day River (figure 31). Canyon City, one of the earliest mining camps in eastern Oregon, lies about one mile south up Canyon Creek from this point. Through this area the John Day River traverses a broad, fertile valley bordered on the south by the high and rugged Strawberry Range. Canyon Creek flows through a steep-walled canyon cutting across the range. Elevations range from about 3100 feet at John Day to 8007 feet at the top of Canyon Mountain.

Geology

The Canyon District is underlain chiefly by gabbro, peridotite, and serpentinite of the Canyon Mountain Complex of post-Permian-pre-Upper Triassic age (Thayer, 1956). Paleozoic and Upper Triassic sedimentary rocks are exposed on Miller Mountain and in the vicinity of Prairie Diggings.

Production

Records of early-day gold production for the Canyon district are sketchy but indicate that the total output was several millions of dollars. Most of the gold produced prior to 1916 came from the gravels of Canyon Creek and its tributary streams and gulches near Canyon City. In later years dredges were employed on Canyon Creek and the John Day River. Production from lode mines in the Canyon district has been small.

Placer Mines

Gold was discovered in the Canyon district in early 1862 and by mid-summer of that year more than a thousand miners were at work on the gravel bars of Canyon Creek and in the gulches of the surrounding hills. In his report on the district, Lindgren (1901, p. 712-720) states: "During the first few years production was very great, but exact figures will probably never be known. Estimates are made varying from $3,000,000 to $5,000,000 a year. In 1865 the product was estimated at $22,000 a week (Raymond's report, 1870), or about $1,000,000 a year. By 1870 it had already fallen to $300,000 a year. In the following year the production was still further reduced, but remained for a long time about $100,000. The Mint reports for 1883 and 1884 estimate $87,000 and $80,000; for 1890 $72,000, and for 1891, $100,000. While the figures are incomplete and untrustworthy, it is scarcely probable that the total production much exceeds $15,000,000."

From 1908 on, production gradually decreased to only a few thousand dollars each year until 1916. In that year a dredge was installed by the Empire Dredge Co. near the town of John Day. It operated almost continuously until it was dismantled and moved to Prairie City in 1929. The dredge reportedly produced about $1,750,000 in gold and silver, according to the Engineering and Mining Journal (1929, p. 736-737).

A large dragline dredge owned by Ferris and Marchbank began work in the John Day River near John Day in 1935, and in 1937 a connected bucket dredge was installed by Western Dredging Co. Both operations ceased in 1942. Recorded production from the Canyon district for the years 1935-1942 was $2,539,-214, most of it from the dredges. Combined recorded output from dredges operating in Canyon Creek and in the John Day Valley near the town of John Day during 1916-1942 was 123,911 ounces gold and 13,066 ounces silver.

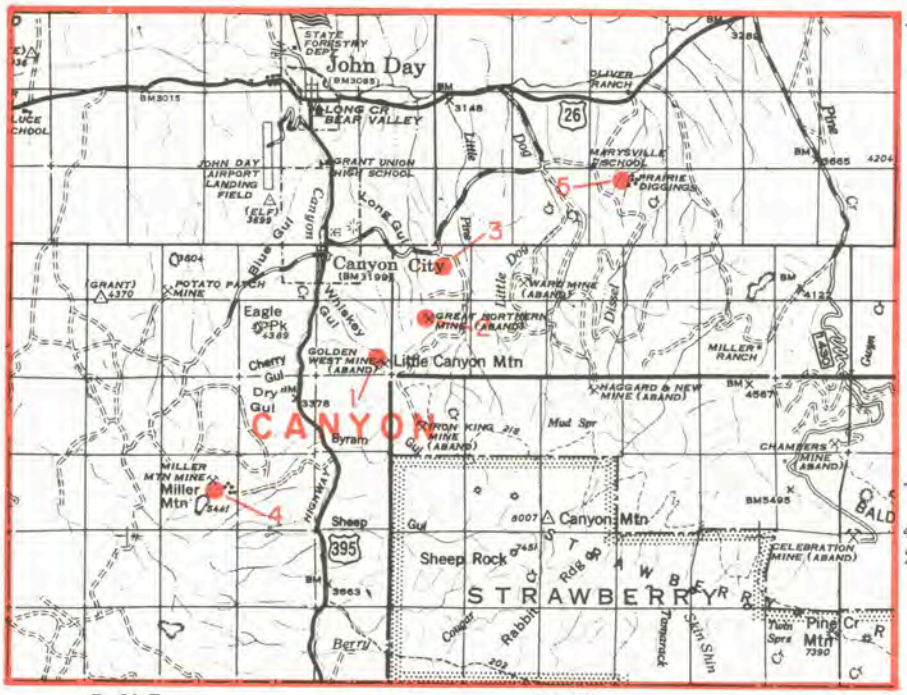


Figure 31. Index map of the Canyon area.

Principal Lode Mines

Numerous small veins and irregular masses of quartz have been found on Canyon Mountain east of Canyon Creek and on Miller Mountain to the west. From several of them small pockets of coarse gold have been extracted. In 1898, gold worth $30,000 was recovered from a quartz seam opened by a surface cut at the Great Northern mine.

At Prairie Diggings, 3 miles east of John Day, placers containing rough quartz gold were worked during early days. In the same vicinity is a broad quartz-impregnated shear zone in cherty metavolcanic and sedimentary rocks. In Raymond's report of 1870 it is stated that the zone is 400 feet wide, strikes northeast and dips 60° SE. In 1872 a mill had been erected and $10,000 extracted. Subsequently, little has been produced, since the values are reportedly scattered and low grade.

Lode Mines of the Canyon Area

CANYON DISTRICT

Golden West mine — Canyon District, 1

Location: Grant County, SE¼ sec. 12, T. 14 S., R. 31 E.

[No other data available.]

Great Northern mine — Canyon District, 2

Location: Grant County, N½ sec. 7, T. 14 S., R. 32 E. on Canyon Mountain 2 miles southeast of Canyon City and about 1500 feet above the town.

Development: Numerous prospect pits and short adits.

Geology: The country rock is mostly altered gabbro. From some of the numerous quartz-calcite seams cutting the gabbro small pockets of high-grade gold ore have been extracted. Quartz veins 1 to 2 feet thick are also present. These show a scattering of pyrite, but reportedly contain little or no gold.

Production: $30,000 from a pocket in 1898. Lesser pockets have since been extracted.

References: Lindgren, 1901:712-720; Parks and Swartley, 1916:111-112; Department Bulletin 14-B, 1941:24.

Haight mine — Canyon District, 3

Location: Grant County, NE¼ sec. 6, T. 14 S., R. 32 E. on Canyon Mountain about 1000 feet below Great Northern mine.

Development: Tunnel and several pits.

Geology: Numerous quartz seams 6 inches to 2 feet apart; strike N. 35° W. and dip 60° E. The quartz has been brecciated and recemented by hematite and calcite. Gold found in scattered pockets, usually where veins intersect or change in attitude. Elsewhere the veins are barren or nearly so.

Production: Said to have been "considerable" in early days.

References: Department Bulletin 14-B, 1941:26.

Miller Mountain mine — Canyon District, 4

Location: Grant County, NE¼ sec. 22, T. 14 S., R. 31 E. on the northeast slope of Miller Mountain.

Development: Totals about 4000 feet, including raises from several adits and shallow shafts.

Geology: Rocks exposed in the area include dark-colored meta-argillites and subordinate greenstones of Permian age overlain by upper Triassic graywackes and shales. Workings develop two quartz veins: one strikes N. 45° to 65° W. and dips 75° to 85° NE.; the other strikes N. 65° W. and dips 45° to 50° NE. Powell tunnel drifts 800 feet westerly on steep vein; about half this distance has been stoped to the surface. Stope width averages 3 to 4 feet. High-grade stringers penetrate hanging wall. The ore is mostly quartz, containing veinlets and patches of chalcopyrite, pyrite, and malachite in thin films, together with considerable manganese-oxide stains.

Production: Unknown, probably not less than $30,000 nor more than $100,000. Ten-stamp mill operated intermittently up to World War II.

References: Department Bulletin 14-B, 1941: 30-32.

Prairie Diggings — Canyon District, 5

Location: Grant County, N½ sec. 33, T. 13 S., R. 32 E.

Development: Surface cuts and shallow shafts.

Geology: Broad system of quartz veins and mineralized fractures in dark-colored slaty rocks. Mineralized zone said to be 400 feet wide and half a mile long in northeasterly direction.

Production: Little data available. The property was evidently placered extensively in early days. By 1872 a mill had been built and $10,000 in quartz gold extracted.

References: Lindgren, 1901:712-720; Swartley, 1914:205; Department Bulletin 14-B, 1941:34.

QUARTZBURG AREA

Location

The Quartzburg area, which includes the Quartzburg district, lies in Grant County mainly in the drainage of Dixie Creek, a southward-flowing tributary which enters the John Day River at Prairie City (figure 32). The area also extends northward over the Dixie Creek divide into the headwaters of Ruby Creek, a tributary of the Middle Fork of the John Day River. Elevations range from 3500 feet at Prairie City to 7592 feet at the top of Dixie Butte.

Geology and Mineralization

The rocks of the Quartzburg area are chiefly metamorphosed andesitic to basaltic lavas and tuffs, with subordinate argillite, gabbro, diabase, and serpentine into which numerous relatively fresh stocks and dikes of intermediate to silicic composition have been intruded.

The older rocks have been considerably sheared and altered. The volcanic rocks are in general quite chloritic. Uralite, biotite, and talc are common alteration products of the intrusive rocks.

The district contains quartz-carbonate-sulfide veins, sulfidized fault and shear zones, and quartz-tourmaline-sulfide replacement masses. The principal sulfide minerals are pyrite and chalcopyrite. The cobalt minerals glaucodot, cobaltite, and erythrite are sparingly present in several deposits. Other metallic minerals found locally include arsenopyrite, native bismuth, bismuthinite, tetrahedrite, pyrrhotite, sphalerite, and galena. Gilluly, Reed, and Park (1933, p. 85-105) describe 18 small mines and prospects.

Most of the work has been directed toward development of the veins which are valuable mainly for gold, although small amounts of copper and cobalt have been recovered from some of them. The values are contained in discontinuous lenses, which are rarely as much as 4 feet wide, and are composed chiefly of crushed and altered country rock with stringers of quartz, calcite, and sulfide minerals. In places considerable thicknesses of sheared and altered country rock have been impregnated with sulfide minerals. Little systematic prospecting and sampling of these zones has been done.

Production

No reliable estimate of total gold output can be made for the Quartzburg district. Although there is much evidence of early-day mining activity, authentic records of production are not available.

In his report of 1914 Swartley (p. 198) stated: "Locally the gross production from the Dixie placers is reported from $600,000 to $6,000,000. Probably the lesser amount approximates the truth." Statements by Lindgren (1901, p. 712) and Swartley (1914, p. 196) suggest that the combined production of all lode mines to 1914 was less than $200,000. On the other hand, production from the Equity mine alone was estimated by other authorities (Oregon Dept. of Geology and Mineral Industries, 1941, p. 124) at $400,000 to $600,000 prior to 1910. Dredges operating on the John Day River just below Prairie City during 1930-1936 and on Dixie Creek during 1938-1941 produced more than 22,500 ounces of gold.

Placer Mines

The most important placers of the district were on Dixie Creek, but many of the streams and gulches heading in the vicinity of Dixie Butte contained auriferous gravels. In 1901 (p. 712) Lindgren reported:

"The Dixie Creek placer mines were discovered about 1862, and were reported rich, though no data

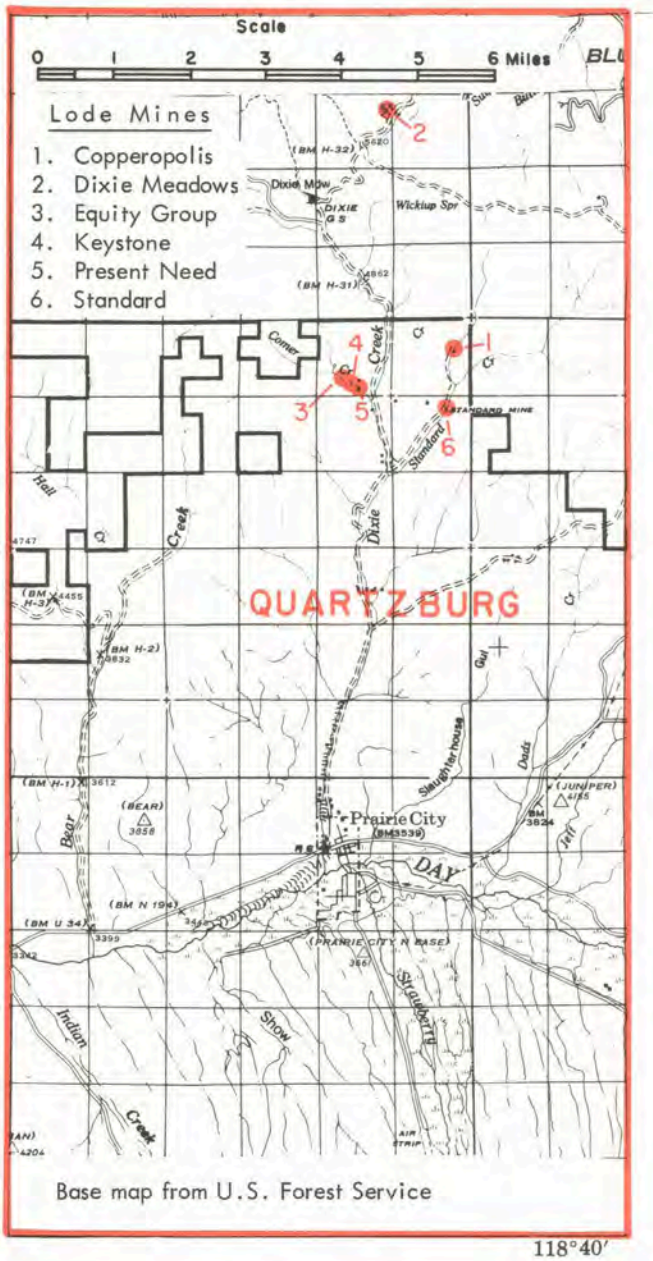


Figure 32. Index map of the Quartzburg area.

as to production are at hand. Raymond's report for 1870 contains the statement that at that time there were 100 white men and 200 Chinamen employed, and that the fine, scaly gold was 860 fine. In 1873 the creek is reported as turned over to Chinese labor. In 1882 two small hydraulic plants were in operation, producing $30,000 (Mint report). At the present very little placer mining is done.

"The placers consist of the gravels accumulated in the present creek to a depth of 10 or 15 feet. The workings extend upstream from Prairie City for 5 miles, or to the entrance of the diorite canyon, where the grade becomes very steep. The width of the gravel-covered river bottom is from 300 to 800 feet, the whole of which has been worked."

During 1930-1936 a bucket-line dredge owned by the Empire Dredging Co. was employed on the John Day River just below Prairie City. The H. D. England Co. dragline dredge worked in Dixie Creek above Prairie City almost continuously between October 1938 and April 1941.

Principal Lode Mines

Equity mine: The Equity group is on the West Fork of Dixie Creek 7 miles from Prairie City. According to the Oregon Department of Geology and Mineral Industries (1941, p. 124), "This property was discovered and located in 1878 and from that date up to 1910 was worked almost continuously.... The exact production is not known, but has been estimated from four to six hundred thousand dollars. Judging from the stoped areas these estimates would seem to be very nearly correct. From 1910 until 1933 very little work was done on the property, for it had been worked out down to the lowest point which could be attained by drifting or crosscutting." During 1933-1941 winzes were sunk and a small amount of drifting was done about 75 feet below the lowest level.

The country rock is nearly all sheared gabbro. The main vein strikes N. 35° and dips 80° SE. It has been opened by three adit levels, the top adit 95 feet above the lowest. Three distinct shoots have been found on this vein. Two of these have been mined out from the lowest level to the surface, a distance of 275 feet. The combined length of the three ore shoots is approximately 350 feet. The vein, which is about a foot wide in the stopes, is composed largely of quartz, dolomite, and massive sulfides--pyrite, chalcopyrite, galena, and sphalerite. The ore is said to contain as much as $500 a ton in gold.

Standard mine: The Standard mine is on the East Fork of Dixie Creek about one mile upstream from the forks. The Standard vein is said to have been discovered in the 1860's. According to Lindgren (1901, p. 701-712) a few tons of copper-gold ore had been shipped and about 600 feet of development work done prior to his visit in 1900. The principal period of development was during the years 1900-1907. A small smelter was erected on the property in 1901, but was shut down after only a few months' use. Crude ore and concentrates were railed to the Sumpter smelter. Ore containing cobalt and gold was reportedly shipped to Europe and to the Edison Laboratories in New York. In 1906 and 1907 shipments of 415 tons of concentrates netted about $18,200. Since 1907 attempts to work the mine have been periodic and short lived. In recent years several truckloads of hand-sorted copper ore mined from upper levels have been delivered to the Tacoma smelter. Three shipments totaling 57 tons made during 1964 averaged 0.5 ounces gold, 1.2 silver, and 20 percent copper.

On the Standard mine property several veins have been explored, including the Standard, Grover Cleveland, Juniper, and Smuggler. The Standard vein is the most extensively developed, with about 4000 feet of drift from four adits and a shaft. The levels are about 80 feet apart vertically and interconnected by numerous raises and stopes. The lowest and longest is just above the creek level. It contains 1700 feet of drift, above which are several large stopes. The average width of material mined from these stopes was probably about 18 inches.

The Standard vein is mainly in andesite, strikes N. 70° to 75° E., dips steeply south, and ranges in width from a few inches to 4 feet. It is not a persistent vein, but rather a group of mineralized stringers with considerable replaced wall rock. The main gangue mineral is quartz, but some ferriferous dolomite and calcite are also present. The ore minerals are pyrite, chalcopyrite, arsenopyrite, cobaltite, glaucodot, bismuthinite, native bismuth, galena, and sphalerite (Gilluly, Reed, and Park, 1933, p. 101). The cobalt minerals are said to be found mainly in the lower levels.

Dixie Meadows mine: The Dixie Meadows mine is at the head of Ruby Creek 12 miles north of Prairie City. During 1900-1910 between 8000 and 9000 tons of ore, averaging $8 to the ton in gold, were milled and about 350 tons of concentrates averaging $50 per ton shipped. Two adit levels 100 feet apart develop the deposit, the upper containing about 6000 feet of workings and the lower about 1200 feet. The workings explore a fault zone as much as 60 feet wide in a complex of sheared and altered andesite, tuff, diorite, and serpentine cut by dikes of granodiorite. The fault zone strikes N. 30° to 35° E. and dips 65° to 70° E. The rocks in the fault zone have been impregnated with quartz and sulfides, including pyrite, arsenopyrite, chalcopyrite, pyrrhotite, galena, marcasite, and sphalerite. The ore is but slightly oxidized; probably 75 percent of the gold is contained in the sulfides, mainly pyrite with lesser amounts of marcasite and pyrrhotite.

Lode Mines of the Quartzburg Area

QUARTZBURG DISTRICT

Copperopolis mine — Quartzburg District, 1

Location: Grant County, NE¼ sec. 1, T. 12 S., R. 33 E.

Development: Several adits, including one about 1500 feet long that cuts the deposit at a depth of 300 feet.

Geology: Steeply dipping quartz replacement body in meta-andesite, metadiorite, and diabase. Strikes N. 60° E. and is more than 1000 feet long and 40 to 75 feet wide, including unreplaced blocks of country rock and gouge layers. Walls well defined. Contains tourmaline, pyrite, chalcopyrite, and lesser amounts of magnetite, hematite, cobaltite, tetrahedrite, bornite, galena, and sphalerite. Content of copper and gold appears to be very low.

Production: About 250 tons milled in small concentrator prior to 1906.

References: Gilluly, Reed, and Park, 1933:100-101; Department Bulletin 14-B, 1941:113.

Dixie Meadows mine — Quartzburg District, 2

Location: Grant County, secs. 23 and 24, T. 11 S., R. 33 E., near the head of Ruby Creek just north of the Dixie Creek divide.

Development: Includes two adits from which about 7200 feet of drifts, crosscuts, and raises have been driven. A new development campaign has been under way in recent years.

Geology: Low-grade quartz-sulfides replacement body up to 60 feet wide localized along a fault in a complex of greenstone, meta-andesite, tuff, metadiorite, and serpentine. The zone strikes N. 30° to 35° E. and dips 65° to 75° SE. Contains much decomposed country rock. Sulfides present are pyrite, arsenopyrite, chalcopyrite, pyrrhotite, galena, marcasite, and sphalerite. Ore only slightly oxidized at the surface. Little free gold present.

Production: Total said to be less than $100,000. Development began about 1900. Between 1903 and 1910, about 8000 or 9000 tons of ore averaging $8 to the ton in goldwas milled and about 350 tons of concentrates averaging about $50 to the ton were shipped.

References: Swartley, 1914:196; Parks and Swartley, 1916:86; Gilluly, Reed, and Park, 1933:88; Department Bulletin 14-B, 1941:114.

Equity Group

Quartzburg District, 3

Location: Grant County, secs. 2 and 11, T. 12 S., R. 33 E., on the West Fork of Dixie Creek, a few hundred feet northwest of the Keystone.

Development: Three adit levels. The upper one is 95 feet above the lowest, which in 1930 was 750 feet long. Some work has been done from shafts sunk below the lowest level.

Geology: Narrow vein in sheared gabbro strikes N. 35° to 45° E. and dips 75° to 80° SE. It is about one foot wide in the stopes and is composed largely of quartz, dolomite, and massive sulfides including pyrite, chalcopyrite, galena, and sphalerite. Numerous small cross faults cut the vein. Three distinct shoots with total length of 350 feet have been mined, two of which extend from the lowest level to the surface, a distance of 275 feet. Some of the ore contained as much as $500.00 in gold per ton.

Production: Estimated at $400,000 to $600,000. The mine is said to have been almost continuously active from 1878 to 1910.

References: Lindgren, 1901:711; Swartley, 1914:196; Parks and Swartley, 1916:91; Gilluly, Reed, and Park, 1933:91-93; Department Bulletin 14-B, 1941:124-125.

Keystone mine

Quartzburg District, 4

Location: Grant County, secs. 2 and 11, T. 12 S., R. 33 E., in a gulch west of the West Fork of Dixie Creek, 7 miles from Prairie City.

Development: Poor record. The pay shoots are said to be worked out down to creek level.

Geology: Similar to the Present Need. The vein strikes NE., dips SW., and is 4 feet wide. The pay forms narrow streaks on the hanging wall, on the footwall, or on both. The gangue contains much calcite. In 1933 a shaft was sunk on the vein from the surface, exposing a 9-foot width with 4 feet of low-grade ore assaying $8.50 for the base ore.

Production: Small output in 1882 and 1889; no other record available.

References: Lindgren, 1901:710; Parks and Swartley, 1916:137; Gilluly, Reed, and Park, 1933:93; Department Bulletin 14-B, 1941:119.

Present Need

Quartzburg District, 5

Location: Grant County, secs. 2 and 11, T. 12 S., R. 33 E., on the West Fork of Dixie Creek about a mile above the forks and a few hundred feet below the Keystone.

Development: Poor record; the vein is said to have been exploited down to creek level.

Geology: Narrow and discontinuous quartz vein in diabase. Strikes N. 20 E., dips 70° SE. Contains pyrite, marcasite, and a little chalcopyrite, sphalerite, and galena. Two shoots 4 inches to 2 feet wide and about 70 feet long yielded ore averaging 6 to 25 ounces silver and 4 to 5 ounces gold per ton. The shoots are separated by 70 feet of barren ground.

Production: Small output during 1890's and later. Total unknown.

References: Lindgren, 1901:710; Gilluly, Reed, and Park, 1933:93; Department Bulletin 14-B, 1941:122.

Standard mine

Quartzburg District, 6

Location: Grant County, NE¼ sec. 12, T. 12 S., R. 33 E., on the east side of the East Fork of Dixie Creek.

Development: Totals about 4000 feet from three adits at 80-foot intervals and an inclined shaft about 70 feet deep. Considerable stoping has been done and the levels are interconnected by raises. The lowest and longest adit level is just above creek level.

Geology: The country rocks are chiefly porphyitic andesite cut by dikes of granodiorite porphyry and a few of diabase. The Standard vein strikes N. 70° E., dips steeply south, and ranges from a few inches to 4 feet in width. The ore minerals are pyrite, chalcopyrite, malachite, arsenopyrite, cobaltite, glaucodot, erythrite, bismuthinite, native bismuth, galena, and sphalerite. The cobaltiferous ores are found mainly in the lower levels and are said to contain much gold. Copper-gold ores occur in the intermediate and upper levels. In recent years, rich copper ores have been shipped periodically from surface cuts and short adits above the upper level. In addition to the Standard vein, at least three other veins have been explored.

Production: Unknown. Considerable stoping has been done on the Standard vein.

References: Lindgren, 1901:711; Swartley, 1914:197; Parks and Swartley, 1916:210; Gilluly, Reed, and Park, 1933:101; Department Bulletin 14-B, 1941: 125-127.

UNITY AREA

Location

The Unity area includes the Unity mining district (sometimes called the Bullrun district), which lies 5 to 9 miles southwest of Unity in Baker County (figure 33). The gold mines are situated on the northern flanks of Mine Ridge and Bullrun Mountain--two north-trending mountain spurs. Bullrun Creek, a tributary of the South Fork of the Burnt River, flows northward between the two mountain ridges and out onto an alluviated plain that slopes northward toward Unity.

Geology

Jurassic-Cretaceous diorite and quartz diorite intrude limy tuffs of the Rastus Formation of Late Triassic-Middle Jurassic age and older ultramafic rocks and schists. The geology of this region is described by Lowry (in press).

Production

Quartz mines in the district known to have been productive are the Record, Orion, and Bull Run. Production from the Record is said to be about $103,000, more than half between 1933 and 1937. Production from the others is unknown but, judging from the amount of stoping, it must have been quite small; the Orion was most active between 1903 and 1917.

The Ferris Mining Co. operated a dragline dredge with a 3-cubic-yard excavator on Bullrun Creek from October 1940 to July 1941. Output totaled 2161 ounces gold and 253 ounces silver from 61,000 yards of gravel.

Principal Lode Mines

The principal ore shoot of the Record mine is composed of a number of closely spaced parallel stringers of high-grade quartz in an irregular felsite-porphyry dike along the contact between granodiorite and serpentinite. Most of the ore was oxidized and contained a high percentage of free gold. The zone is 5 to 10 feet wide, is nearly vertical, and strikes about N. 60° E. The main ore shoot was 100 feet long and 260 feet high. Gold is also found in thin seams of hornblende associated with the felsite dike. A 150-ton amalgamation mill was erected on the property in 1929.

The ore of the Bull Run mine occurred as irregular veins, small lenses, and disseminations in argillite. Ore mineralization at the Orion mine consisted of veinlets of pyrite and arsenopyrite in a shear zone in argillite (Lorain, 1938, p. 43). The ore mined was highly oxidized.

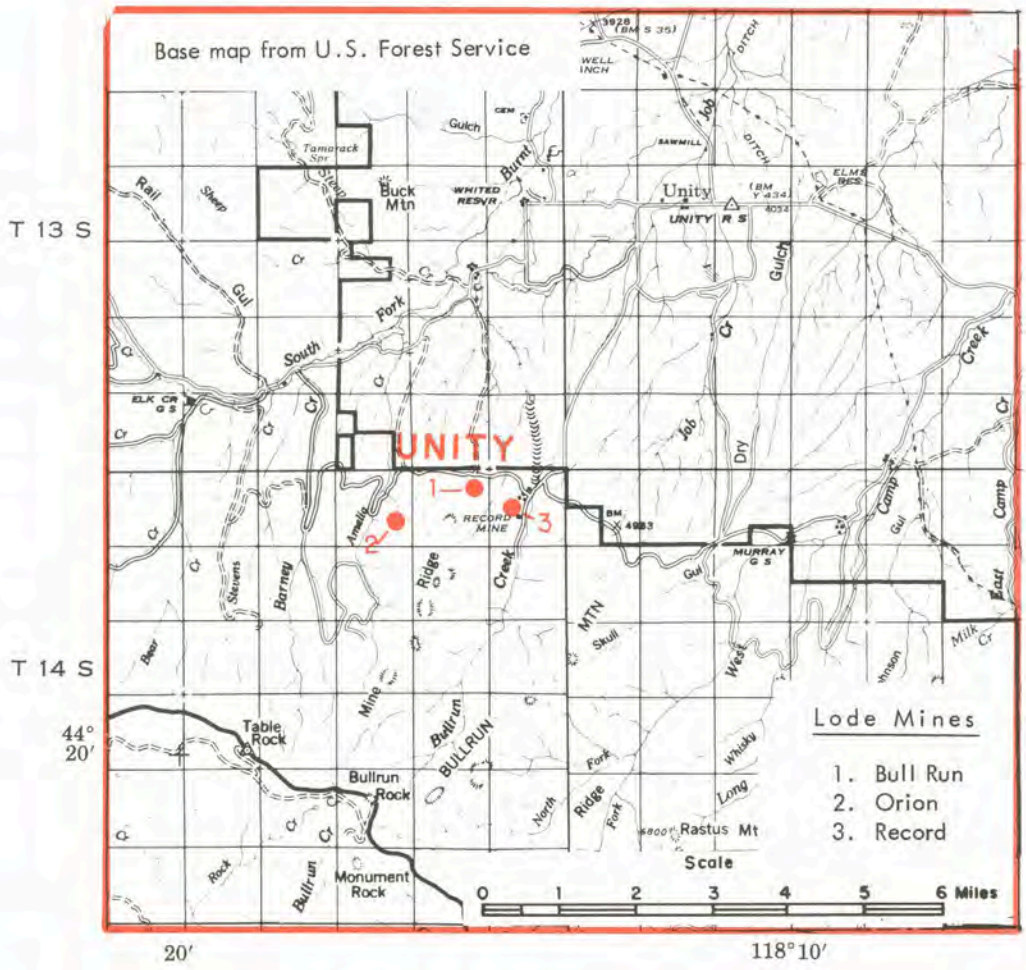


Figure 33. Index map of the Unity area.

Lode Mines of the Unity Area.

UNITY DISTRICT

Bull Run mine — Unity District, 1

Location: Baker County, sec. 2, T. 14 S., R. 36 E.

Development: 1200 feet of tunnel, a glory-hole raise, and 3 shallow shafts.

Geology: Small quartz veins in argillite.

Production: $10,000 (?)

References: Lorain, 1938:42-43; Department Bulletin 14-A, 1939: 98.

Orion mine — Unity District, 2

Location: Baker County, sec. 3, T. 14 S., R. 36 E.

Development: 280-foot adit drift and 425-foot crosscut adit.

Geology: Altered shear zone in argillite. Contains veinlets of pyrite and arsenopyrite.

Production: Small.

Reference: Lorain, 1938:43.

Record mine — Unity District, 3

Location: Baker County, sec. 1, T. 14 S., R. 36 E.

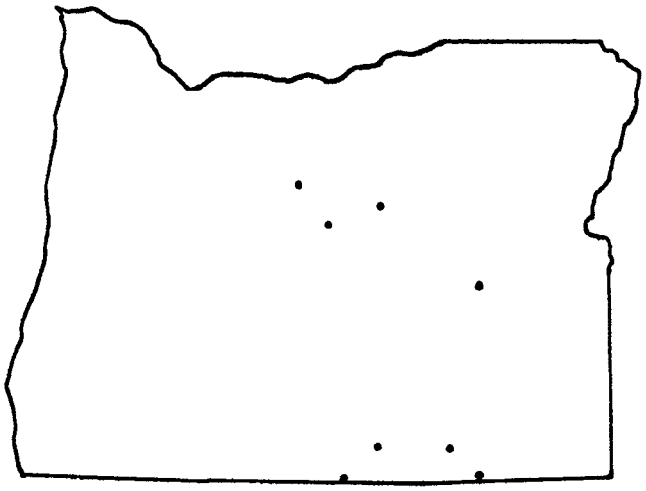
Development: Five adits total about 5000 feet.

Geology: Mineralization along irregular granodiorite-serpentine contact, which is locally intruded by felsite porphyry dike. Strike averages about N. 45° W. and dip is steep. Chalcopyrite, pyrite, and molybdenite. Free gold in amphibole veinlets and in quartz stringers. Ore zone locally attains width of 5 feet.

Production: $103,000 estimated. Gold 65 to 68 percent free, with 92 percent minus 100-mesh grind. Extraction 95 percent from 0.2 ounce heads in gravity mill. Gold 900 fine.

References: Lorain, 1938:41-43; Department Bulletin 14-A, 1939:101-102.

part two. deposits in eastern oregon isolated gold mining districts



ISOLATED GOLD MINING DISTRICTS

Table of Contents

ISOLATED GOLD MINING DISTRICTS

A number of small mining districts occur as isolated areas in eastern Oregon. Their location is shown in Figure 7, page 29. Of the seven districts described below, five are in Tertiary rocks and two in pre-Tertiary. Recorded production has been small.

ASHWOOD DISTRICT

The Ashwood district is situated in eastern Jefferson County, and it encompasses the village of Ashwood 26 miles east of Madras. It lies within the arbitrary bounds of the Horse Heaven quicksilver mining district. Rugged, rolling hills dotted with patches of sagebrush, desert grasses, and juniper characterize the landscape. The area is underlain by a complex assemblage of Tertiary volcanics and subordinate sedimentary rocks, mainly of the Eocene-Oligocene Clarno Formation. Topographically prominent volcanic plugs are common.

Gold-silver production in the region has been mainly, if not entirely, from the Oregon King mine 3 miles by road northeast of Ashwood. Other prospects occur in the vicinity of Axhandle Butte, a few miles farther to the east. Development of the Oregon King vein began in 1898, when some sheepherders dug into the outcrop and found rich silver ore. J. G. Edwards, then half owner of the nearby Hay Creek ranch, financed the first shaft in 1899.

Libbey and Corcoran (1962, p. 5-6) stated:

> "The ore zone at the Oregon King mine is associated with a fault zone trending N. 75° W. The dip on the fault averages about 75° SW., but it is steeper in the lower levels of the mine, according to mapping by the Alaska Juneau Co. The andesitic rocks along the fault have been brecciated, silicified, and impregnated with quartz and pyrite, together with smaller amounts of chalcopyrite, galena, and sphalerite. Cerargyrite, silver chloride, and native silver have been reported in upper levels. Bunches of massive sulfides, largely pyrite, are occasionally found.
>
> "Reportedly, the ore occurs in lenticular pipelike masses of variable size ranging in width from a few feet to as much as 20 feet. Generally, walls of the shoots must be determined by assay. It is said that some of the shipping-grade ore was difficult to distinguish visually from low grade.
>
> "Values are mainly in silver with a smaller amount of gold. Copper, lead, and zinc sulfides are found in relatively minor amounts except locally. A very little arsenic was reported in the concentrates, and stibnite was reported among the sulfides."

Development of the Oregon King now totals about 4000 lineal feet, including a 700-foot shaft. Production was recorded for the years 1899, 1901, 1904, 1935, 1940-1947, 1950, and 1963-1965. Smelter value of the 7334 dry tons of ore and concentrates shipped through 1950 was $233,693. The 1935-1950 shipments contained 2419 ounces gold, 232,402 ounces silver, 59,076 pounds copper, and 110,071 pounds lead. In September 1950 a fire in the shaft, which also destroyed much of the machinery and equipment on the surface, caused a stoppage of all mining activity.

The main shaft was reopened in 1962 by Oregon King Consolidated Mines, Inc., and new ore developed from the workings gave a significant boost to Oregon gold and silver production the following year. In 1963 the state produced 58,234 ounces of silver and 1281 ounces of lode gold, and nearly all of it came from this one mine. The bulk of the ore was taken from exploratory work on the east 400-foot level and west 600-foot level with lesser amounts obtained from between the 200-foot and 400-foot levels. Production dwindled in 1964 while the company conducted an exploration drilling program in some of the lower drifts. The mine is presently idle and renewal of operations presumably is contingent upon discovery and development of new ore bodies.

HARNEY DISTRICT

The Harney district, also known as the Idol City-Trout Creek district, lies 20 miles northeast of Burns, Harney County, in sec. 4, T. 21 S., R. 32 E., in the vicinity of Trout Creek, a branch of Silvies River.

The country rock is a porphyritic andesite of probable late Miocene age. The andesite underlies most of the larger hills in this region and presumably is a part of the Strawberry Volcanics (Brown and Thayer, 1966). Mineralization appears to be confined to a northwest-trending shear zone along which the andesite has been altered or bleached for a distance of at least a mile.

A small amount of underground development work has been done, but most of the gold production has come from placering the Recent valley fill in one of the tributaries of Trout Creek. The placers have yielded about $50,000 since discovery in 1891 (Parks and Swartley, 1916, p. 273).

HIGH GRADE DISTRICT

The High Grade district is largely in Modoc County, California, but it extends into the southern edge of Lake County in Oregon. Here it includes several prospects in the hills a few miles east of New Pine Creek, a small community on U.S. Highway 395 about 15 miles south of Lakeview.

The veins in the area are small and occur along fractures in early (?) Tertiary volcanic rocks. Much prospecting was done in the early days and a few properties were equipped with small plants. No records of production are available for deposits in the Oregon part of the district.

HOWARD DISTRICT

The Howard district lies in Crook County, 26 miles east of Prineville in the timbered hills bordering Ochoco Creek. The district includes some small placer and lode deposits.

The area is underlain by Tertiary andesites. Mineralization has taken place along rather broad fracture zones in which the andesite is intensely altered and cut by carbonate-quartz-sulfide veinlets. The veinlets are commonly less than an inch thick but locally enlarge into ore shoots, especially at junctions or intersections.

The principal placers, all of them small, worked deposits along the lower part of Scissors Creek, which crosses the mineralized area and enters Ochoco Creek from the southwest.

Lode mine production from the district has come mainly from the Ophir-Mayflower or Ochoco mine. Its lower adit, a crosscut 1435 feet long, enters the west bank of Ochoco Creek just above creek level. A second crosscut adit enters the slope about 200 feet higher. Many other short adits and opencuts dot the adjacent slopes.

According to Parks and Swartley (1916, p. 167-168), one ore shoot in the Ophir-Mayflower mine measured 70 feet long, 250 feet high, and 1 to 6 feet wide. Another measured 20 feet long, 40 feet high, and as much as 4 feet wide.

Available records (Gilluly, 1933, p. 125) show that the district produced $79,885 in gold up to 1923 from intermittent operations. Of this, $17,560 is based on estimates prior to 1902 and $62,325 is based on records since 1902. The earliest record of production in Mint reports shows an output of $10,000 for 1885. Recorded output from 1903 through 1923 amounted to 536.80 fine ounces of gold and 79 fine ounces of silver from placers, and 2225 tons of crude ore from which 2,478.35 fine ounces of gold, 442 fine ounces of silver, and 2662 pounds of lead were recovered. The greatest output was $26,623 in 1918, of which $24,092 was in gold. Subsequent production has been very small. A few ounces of gold were produced in 1923 and 1933.

LOST CABIN DISTRICT

The Lost Cabin district (also known as the Coyote Hill, or Camp Loftus district), is in T. 35 S., R. 23 E., about 10 miles north of Plush in Lake County. Gold was reportedly discovered here in 1906 by the Loftus Brothers. There was a small rush to the area and much shallow prospecting done but no records of production exist.

Rocks in the district include andesitic to rhyolitic flows, tuffs, breccias, and small intrusives of early (?) Tertiary age. In places these rocks are cut by small irregular fractures filled with seams of clay, limonite, and, locally, quartz. Small amounts of gold and copper-oxide minerals are said to have been found in some of these seams. A few flasks of quicksilver have been produced from the Gray prospect in sections 14 and 15, T. 35 S., R. 23 E.

SPANISH GULCH DISTRICT

The Spanish Gulch district is in southeastern Wheeler County just east of Antone. Rock and Birch Creeks, which cross the district and flow north to the John Day River, were worked for placer gold during the earliest days of placer mining in eastern Oregon. Development of quartz veins has been small, although some of the veins are reportedly wide and persistent (Parks and Swartley, 1916, p. 296). Records of output are scarce.

The district is located in a small exposure of pre-Tertiary rocks in an area otherwise covered by Tertiary lavas and sediments. The older rocks are greenstones, argillites, and serpentine which have been intruded by dikes and irregular masses of granodiorite. Many of the veins are almost entirely massive quartz, while in others the vein material is highly altered and silicified country rock. The other minerals are pyrite, chalcopyrite, and galena containing gold and silver.

One quartz vein described by Parks and Swartley (1916, p. 232) is a distinct quartz vein which strikes N. 60° E. and dips 45° S., and has an average width of 2 feet. Another strikes N. 60° E., dips 45° N., has a width of 12 feet, and can be traced on the surface for about 1000 feet.

STEENS-PUEBLO DISTRICT

A few gold prospects occur in extreme southern Harney County in the southern part of the Steens Mountain-Pueblo Mountains range. Tertiary and pre-Tertiary rocks exposed along the eastern front of the mountains are cut by a multitude of small faults related to the uplift of the range during late Tertiary time. Zones of silicification along these faults locally contain cinnabar and copper minerals. A very few contain gold. Small shipments of gold are reported to have been made from the Farnham and Pueblo prospects in secs. 8 and 17, T. 40 S., R. 35 E. (Williams and Compton, 1953, p. 47).