Mining history of south-central Idaho

Clyde P. Ross
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Hydraulic mining was widely used in the early days. Jets of high-pressure water from hydraulic monitors undermined the gravel banks and washed the gold-bearing material into long sluices in which the gold was recovered. The scene above shows a placer mine near Idaho City about 1897.
FOREWORD

In production statistics and current activity, the great Coeur d'Alene district overshadows all other Idaho mining areas, with the possible exception of the southeast Idaho phosphate fields.

But Idaho mining started in the central part of the state. And it started with such momentum that it drew thousands of gold-seekers and adventurers, as well as artisans and tradesmen, to the remote hills of the Clearwater, the Boise Basin, and the Owyhee country, to form in a brief three years a new territory and, only 27 years later, a new state.

Mining in south-central Idaho was important in the growth of Idaho from territory to state. Although it has declined in later years, it is far from dead. When Clyde Ross, the dean of Idaho geologists, says—as he does herein—that there's geologic reason to believe rich mineral deposits still lie beneath the hills of Blaine and Boise and Custer and Idaho and Lemhi counties to be won by those with will and wit, we should listen—for nobody else can make that statement with such weight of experience and force of expert knowledge.

E. F. COOK, Director
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MINING HISTORY OF SOUTH-CENTRAL IDAHO

Clyde P. Ross

ABSTRACT

Trappers noted gold in south-central Idaho as early as 1844 and mining began in 1862. The placer boom that began then lasted less than 10 years, and yielded over $30 million largely from Boise Basin. Lode mining began during the boom but outlasted it. Poorly understood geologic features influenced development of placers and lodes.

Base metal mining began to prosper in the 1880's after branch railroads reached the mountain borders. Limitations in equipment and geologic knowledge tended to restrict exploration. The region yielded about $20 million in the early 20th century, mostly in gold, silver, lead, zinc and copper. The special needs of World War I increased yield to a peak in 1917.

Between the two World Wars mining was quiet but gold mining increased after 1933.

During World War II mining was distinguished by successful search for metals not previously mined extensively in the region, particularly tungsten, quicksilver, and antimony. Government aided mining during this war but also imposed controls that had hampering effects, especially on gold mining.

Since the war lead, antimony and tungsten have declined. Cobalt has risen and declined and search for special metals like uranium, beryllium, and columbium has been partially successful.

Exploration at depth, guided by attention to inconspicuous geologic features, should result in discovery of new ore shoots. These shoots, plus mineralogically complex bodies and some of grades below those hitherto regarded as economic should provide much new material for future mining in south-central Idaho.
INTRODUCTION

The first white men to enter south-central Idaho may have been the Lewis and Clark Expedition in 1805 (De Voto, 1953). American and Canadian fur trappers began operations at least as early as 1811 (Fisher, 1938, p. 79-84). From then through 1846 when the United States formally acquired title, the region was given over to fur trapping. Starting late in this period, many emigrants bound for Oregon passed over the Snake River Plain, but few lingered in Idaho.

Idaho owes much of its growth, after trapping declined, to the mining industry. At present, agriculture has so far outstripped mining both in the value of the product and in the number of people employed that many tend to overlook the importance of Idaho as a mining state. Even mining men remember chiefly the impressive record of the mines of the Coeur d'Alenes and forget that mining began in the central part of the state. The present account is concerned with the southern part of that central region: the part north of the Snake River Plain and south of the Salmon River near latitude 45° 30' (Fig. 1); including all of Lemhi County, although the northern part of that county is north of that latitude. Thus limited, the summary takes little account of some of the best known mining areas in Idaho. No discussion is presented of the mining areas in north-central Idaho, noted especially for precious metals; the Owyhee region in southwestern Idaho, where much silver ore was mined in the early days; southeastern Idaho with its great phosphate reserves; or the panhandle of the state, which includes the Coeur d'Alene region, whose yield of silver, lead, and zinc overshadows that of the rest of the state. Each of these regions deserves an historical account written by someone better acquainted with it than I am.

In the mountains of south-central Idaho, mining has long been and is likely to continue to be an outstanding industry. In the principal mining counties there, only about 7 percent of the area is farmland and crops are harvested from a mere fraction of that. Most of the farmland is pasture, and livestock grazes far and wide over the mountains during the short periods that the weather is suitable. Recreational pursuits are growing in importance but cannot be expected to supplant mining in value to the nation as a whole, especially in times of war.

Mining districts are scattered rather thickly over south-central Idaho, as Figure 1 shows. The region contains over a hundred districts. Some of these are the burying grounds of false hopes and some have yielded profits mainly to promoters and stock salesmen, but most have had boom periods of production and activity. Mines that have produced significantly tend to revive whenever the national climate for mining enterprises is favorable. These have aided our national economy greatly during the two World Wars and can be expected to add substantially to our resources in the future.

That the yield from mines of south-central Idaho is erratic can be deduced from the graphs in the present paper. The reasons for the variations are numerous. Some of the peaks in the graphs reflect special demands, such as that for tungsten during World War II; others result from fluctuations in general economic conditions. Many, however, result from discovery and rapid depletion of individual ore shoots. These peaks might have been
Fig. 1  Map of mining districts of south-central Idaho
smoothed out and production maintained for longer periods if better management and
greater comprehension of geologic conditions had obtained at the mines. The present
account touches on the various factors that have influenced mining in the region, but
it stresses geologic features.

Figures 2 to 9 are based primarily on data in the annual volumes of Mineral Re-
sources of the United States and the Minerals Yearbook. Some of the items of news
about production have been gleaned from the same sources. Some details are taken from
reports on particular districts. Figure 2 shows the fluctuations in production in the prin-
cipal mining counties: Blaine, Boise, Custer, Idaho, and Lemhi. Only the southern part
of Idaho County is in the region here discussed but its production could not be shown sepa-
rately in the graph. A number of other counties in the region, including Adams, Butte,
Canyon, Elmore, Gem, Valley, and Washington, contain mines, a few of which are large,
but for most years the yield from these counties has not been large. The county graphs
take into account only gold, silver, lead, zinc, and copper. Although various other met-
als are known, they have been mined so far only under special conditions and for short peri-
ods. Figures 4 and 9 show the production record since 1905 for the metals listed above.
In Figure 9, which covers recent years, the record for mercury (quicksilver) antimony,
tungsten, and cobalt has been included. Published data for the 19th century and the first
years of the 20th century are inadequate for the preparation of separate graphs for most
metals during these periods, but trends can be deduced from the county graphs if the pre-
dominant kinds of metals in each county are borne in mind. For example, Boise County
has yielded mostly gold, and Blaine County is noted for its base metals, especially lead.
INITIAL PROSPECTING

There are various reports of trappers or other mountain men noticing gold in gravel in and near south-central Idaho. For example, a trapper employed by the Hudson's Bay Company is said (Wells, 1961a, p. 9) to have recognized gold in Boise Basin in 1844, but none of these early observations were followed up. Perhaps the first definite attempt at prospecting in the region was that undertaken by men from a Mormon settlement along the Lemhi River. Bancroft (1890, p. 402-403) remarked that these men prospected copper deposits in the drainage basin of the Lemhi in 1854. When the settlement was abandoned March 28, 1858, because of trouble with Indians, the attempt at copper mining came to naught. It is interesting, however, that the first serious prospecting reported in south-central Idaho was directed at lodes rather than placers.

The difficulty with Indians was one of several that hindered early mining. When Lewis and Clark entered Idaho they were received with friendship; friendly relations were maintained as long as trappers entered in small, mobile parties. There were Indian settlements in the Snake River Plain, along the Lemhi River, and probably in some of the other intermontane valleys, but not, it seems, in the rugged mountains in south-central Idaho, where game was scarce and the climate somewhat rigorous. Even so, as soon as large groups of white men arrived, clashes occurred. A party of trappers belonging to the Hudson's Bay Company defeated 75 Piegan Indians in the valley of the Lemhi in 1823 (Fisher, 1938, p. 80), and there were various fights in the Snake River Plains about this time.

The first successful attempt at mining in Idaho was that of E. D. Pierce in 1860 (Wells, 1961b, p. 17-57; 1961a, p. 2-4) in an area somewhat north of south-central Idaho. He had had experience during the 1849 gold rush in California. In consequence, when he wintered along the Clearwater River in 1852, he recognized the potentialities of the region. Opposition from the Indians delayed the start of prospecting. The Orofino mining district was formally established January 5, 1861 (Wells, 1961a, p. 4), and gold dust was taken from there to white settlements farther west in March, 1861. The following year prospectors penetrated into what is here termed south-central Idaho. In May, 1862, a party journeyed up the Salmon River and met a group coming down the river from near the site of Salmon (Wells, 1961a, p. 13-16). These groups are said to have found gold along the river but the country was then too inaccessible for mining. The Warren mining district was organized July 22, 1862, and gold was discovered in the Boise Basin, August 2, 1862 (Wells, 1961a, p. 10), although an Indian fight delayed mining until the following year. The placers of the Secesh Basin in the southern part of the Warren district and other areas were found at about this time.

The abundant gravel and sand in some of the mountain basins here accumulated in part as a result of interference with drainage by faulting that may have begun during the middle of Tertiary time. Some of the gold in the Boise Basin is in sand and silt of probable Miocene age (Lindgren, 1898, p. 668). Most of the production, however, has come from gravel of Pleistocene and later age which was deposited in valleys and basins that differed little from those of the present time. Part of the placer gold that was mined was in
glacial moraines (Capps, 1940, p. 27-30), and in old, high-level terraces. Modern
flood plains seem to have yielded comparatively little gold, at least in some districts.
Features such as these distinguish the placer deposits of the region. They hindered
some of the early work and need to be borne in mind in future exploration, whether the
objective is gold or the various heavy minerals associated with it. Some of the heavy
minerals contain rare metals that are now beginning to be sought. In some districts aur-
iferous gravel high above modern streams was not touched in the early days because of
difficulty in getting water to it. Modern equipment might permit handling some of this.

Figure 2 shows that the mines of south-central Idaho had annual yields of some
$2 million to $5 million during the early years of operation. Most of the production came
from placers. Difficulties and costs were so great (Wells, 1961b, p. 17-48) that profits
were much less than one might suppose. The sharp decline in production within a few
years may have been caused as much by excessive costs as by exhaustion of known depos-
its. Only rich and easily mined material, whether lode or placer, was worth mining.

The production record of the early years of mining in Idaho is fragmentary and
rumor has tended to magnify the totals. Figure 2 summarizes the best available data for
the counties in the south-central region that contain the most productive of the early
mines. The graphs in Figure 2 are carried to 1902 when the U. S. Geological Survey be-
gan to publish more detailed compilations than had hitherto been possible. Note that the
graph for Idaho County in Figure 2 is for the whole county because data for the part of the
county south of the Salmon River could not be isolated.

In round numbers, the initial placer activity in south-central Idaho through 1870
yielded over $30 million. Lodes may have produced a little more than $3 million in addi-
tion. The products from both placers and lodes in Boise Basin much exceeded those from
any of the other districts then active. In the late 1860's, placer miners spread to Atlanta
and other areas in Elmore County (76, 84, 93, 94 in Fig. 1) and to the vicinity of Leesburg,
Lemhi County (26, Fig. 1). Base metals were not yet being sought anywhere to any signifi-
cant extent.

The first rush of placer mining had subsided by 1869. It might not have persisted
as long as that had it not been sustained by the influx of foot-loose men during and after
the Civil War. Costs were so high and hardships so marked as to discourage some.
Wells (1961b, p. 50) says costs in camps north of the Salmon River were 86 to 94 percent
of the yield. Those in camps south of the river were presumably similar. Food, at times,
was scarce and poor. Lodes at Warren began to be developed about 1866, apparently
with more excitement than profit. By 1873 the annual production of gold from all sources
in south-central Idaho had dropped below $2 million. From that time until the change in
price in 1934 caused a spurt in mining, the production rate remained below that figure.
When placer yields declined in each district and the original miners drifted away, the
diggings were left to the patient Chinese, content with smaller profits and more restricted
operations.
While placer mining, which required simple equipment and little technical knowledge had started the industry, lodes were soon discovered close to the placers. Workings in them were confined mainly to rich oxidized material. Nearly everywhere the oxidized zone was found to be shallow, for the geomorphic history was incompatible with the preservation of large or deep bodies of oxidized ore, in part because that kind of material is not resistant to weathering and erosion. The unoxidized parts of the lodes proved to be too complex mineralogically and too low in precious metals to be handled by methods and equipment then available. At some mines inefficiency, dishonesty, and wasteful operation were coupled with inherently high costs.

The unimpressive record of the first attempts at lode mining has tended to discourage exploration in the old gold camps, but skepticism on this basis is unwarranted. To a degree, that skepticism has rested on the fact that many of the lodes found during the early placer activity were in the deeply eroded Idaho batholith (Cretaceous). Some reasoned that lodes in such an environment would not persist in depth; the short periods of activity seemed to bear this out. Yet some of the lodes that have been followed downward, particularly in the Boise Basin, go quite deep enough to be encouraging. It is now realized (Ross, 1934, p. 276-277; Anderson, 1947, p. 189-190) that many of the lodes are genetically related, not to the batholith, but to a group of younger intrusions that, with interruptions, extends diagonally across south-central Idaho. Anderson (1951) goes so far as to contend that little of the mineralization in the state is genetically related to the batholith. His interpretation is open to argument but, at all events, there is good reason to regard many of the lodes within the area of the batholith, not as mere roots of old, eroded deposits, but as much younger features that may extend to depths great enough to justify exploration. Some of the ore shoots that have been explored are rather small and many are mineralogically complex enough to present difficulties in treatment but those interested should bear in mind that much of the metal originally deposited in them is still there awaiting future prospectors. The complex minerals of bismuth, selenium, etc., that baffled early miners and metallurgists may be added incentives in the future.
Fig. 2  Records of principal producing counties in 1860–1902

Data for Boise County from USGS Bull. 544 C p173
for Idaho and Lasci Counties from USGS Bull. 92 A p18
for Blaine County from USGS Bull. 314 p 82

500,000 1,000,000 1,500,000 2,000,000 2,500,000 3,000,000 3,500,000 4,000,000 4,500,000 5,000,000 5,500,000 6,000,000
1860 1862 1864 1866 1868 1870 1872 1874 1876 1878 1880 1882 1884 1886 1888 1890 1892 1894 1896 1898 1900 1902

Boise
THE START OF LODGE MINING

Lode mining began on a small scale in the 1860's at Warren (13 in Fig. 1) and other localities first opened for placers. That undertaken in the 1870's was only a little more extensive. Most of it was in precious metal deposits such as those at Quartzburg, Atlanta, and Yankee Fork (80, 78, 53, in Fig. 1). At this early date the Atlanta or Yuba and the Yankee Fork districts (78 and 57, Fig. 1) were among the most productive. The lodes at Warren, Quartzburg and Atlanta are among those in the Idaho batholith and that consequently have been suspected of being shallow. This suspicion is unfounded as the lodes are not genetically related to the batholith. At Quartzburg the first lode mining was confined to free-milling, oxidized gold ore, which in some mines extended only to depths of about 20 feet. The ore of the Yankee Fork district was high in silver. It included some complex minerals but evidently much of the value could be recovered by amalgamation.

The interval between 1880 and about 1902 was one of the prosperous periods of lode mining in south-central Idaho. Prospecting had progressed so far that most present mining districts and most of the varieties of lodes now recognized were known then, though not all were yet developed. Numerous factors in the development of Idaho as a whole contributed to aid mining in south-central Idaho. The wilderness period was passing. Farming and stock-raising expanded and towns grew in the major valleys of the state, providing relatively convenient supply points for the mines. The pack trains of the early days were gradually supplanted by freight wagons and stage coaches along main routes. Branch roads were extended even to some of the mines in the more rugged areas.

The Indians in and near Idaho were not especially warlike. Apparently they had never been numerous in the high mountains. They had interfered occasionally with the early miners but mostly in small bands. Some of the forays were by mixed groups, that included half breeds. The Nez Perce and Sheepeater Indian uprisings which were put down in 1877 and 1879 (Fisher, 1938, p. 88-90) essentially brought to a close the Indian troubles that so far as mining in south-central Idaho was concerned had started in 1862 with the killing of the first prospectors to enter Boise Basin. There had been clashes with trappers long before mining began.

In 1882, the Oregon Short Line, later incorporated in the Union Pacific system, started construction across the Snake River Plain; the following year a branch line reached Hailey, the metropolis of the Wood River mining region. Lodes in that region had been noted as early as 1864 (Bancroft, 1890, p. 551) but mining had not begun in earnest until 1880.

The first census of Idaho, taken in 1870, showed a population of 14,999; that of 1880 recorded 32,619 people; and by 1890 there were 88,548. The growth in population and the related increase in transportation facilities aided the mining industry. Now lode mines could be adequately equipped and ore dressing mills and smelters could be built locally to treat ore from base metal lodes.

In the early 1880's the Nicholia (49 on Fig. 1) district in the Beaverhead Mountains, the Mineral Hill (105 on Fig. 1) and Warm Springs (87 on Fig. 1) districts near
Hailey; the Little Wood River district (88 on Fig. 1) east of Hailey; the Vienna district in the Sawtooth Range (45 on Fig. 1); the Bayhorse district near Challis (52 on Fig. 1); the Gibbonsville and Mineral Hill (9, 11 on Fig. 1) districts in northern Lemhi County; and the Yellowjacket (36 on Fig. 1) district in western Lemhi County (Fig. 1) were developed. Most of these are principally noted for their lead-silver ore, although some were precious metal districts and several of the deposits yielded some copper. Copper deposits, such as those at Mackay, Custer County, as well as minor ones in the mountains bordering the Lemhi River, were first actively developed about 1884 although much of the production came later. A number of the lode mining districts that were opened earlier had revivals in the 1880's and numerous mining districts were tested during that decade. Some districts were opened in the 1890's. These include the Seven Devils (17 on Fig. 1) copper district on the western margin of south-central Idaho, and the Blackbird and Indian Creek (25, 10 on Fig. 1) districts in Lemhi County. The development of Yellowjacket district began earlier but its major production was in 1893 to 1897.

Most of the lodes explored in the larger mines of the 1880's were shear zones in which the distinctive gangue mineral was ankerite or siderite. Argentiferous galena, present in most such lodes, was the principal economic mineral in many. In numerous mines only the ore shoots originally discovered were explored before operations were halted because of difficulty in finding new ones. The failure was commonly ascribed to displacement of the ore by faulting. The effects of post-mineral faulting are certainly present in many of the mines. As an excuse for not finding ore, however, faulting has been overused (Upleby and others, 1930, p. 90-111). In many instances, the ore shoots feather out into sheared or brecciated rock, commonly somewhat altered, but with few ore minerals. Commonly underground exploration is complicated by an arrangement of the shoots en echelon, but the lack of continuity down dip is original, rather than the result of faulting. There have been revivals of interest in mines that were active late in the 19th century, and some ore missed then has been found. Even where such revivals have not been very successful, the possibility of finding ore by suitable modern methods remains.

The difficulty in finding new ore shoots is only one of the reasons that some of the miners of the 1880-1902 period met with limited success. In mines that had rich ore like the Ramshorn (Ross, 1937 (1938) p. 117-122), in the Bayhorse district, Custer County (52 in Fig. 1), the parts of the lodes that could be mined profitably were exceedingly narrow. Hence, mines of this sort were commonly operated on the leasing system under which lessees could afford to crawl into stopes only a foot or so wide to mine and sort selectively. As a result, mines were left in poor shape for future operations and the amount of exploratory development in advance of known ore bodies was reduced.

Much of the ore from such lodes could be concentrated in fairly simple mills; rich ore and concentrates could be treated in local smelters, saving freight costs. Because some ore, like that of the Triumph mine in Blaine County, was much too complex to be handled by such methods, some ore shoots could not be successfully mined at the time.
Lodes in the Idaho batholith, whether or not genetically related to that body, have distinctive features that affect mining. Of lodes of this kind active in the late 19th century, those in the general vicinity of Atlanta and Rocky Bar are important (Anderson, 1939; 1943). The mineralogic content, especially at Atlanta, is rather complex. Stephanite, pyrargyrite and other silver minerals are present and would interfere with simple amalgamation. Mining during the period under discussion must have been confined mainly to oxidized ore but much of this is reported to have netted between $700 and $900 in gold and silver per ton (Anderson, 1939, p. 20). Values in that range were decidedly exceptional in the mines of the region. The tonnages found were evidently small as the periods of active mining were short.

Lodes in the Challis Volcanics were another variety worked during the period. The Yankee Fork district, Custer County (53 in Fig. 1) contained the most productive of these. A number of such districts are known (Ross, 1927b) but most were not rich enough in precious metals for operation in the early days and several were, and for that matter are, remote from transportation. The rich shoots had relatively abundant silver. Milling losses were high because of mineralogic complexities and base-metal shoots had to be avoided in mining. Caving of old workings may have left some of the latter shoots difficult or impossible to extract when the old mines are reopened. The Yankee Fork district probably yielded over $12 million prior to 1905, mostly from the General Custer mine (Anderson, 1939, p. 14), but revivals of placer dredging since then have met with scant success.

Lodes in the volcanics have finely disseminated ore minerals that in places include agularite or some similar selenide. The tiny black specks of selenide may escape visual detection. The ore requires systematic sampling and assaying during mining and special metallurgical treatment afterward.

Available statistics do not permit determination of the amounts of the various metals mined in south-central Idaho in the 19th century as is done in Figures 4 and 7 for the present century. The graphs for Boise and Idaho counties in Figure 2 indicate the trend of gold mining in the region. That for Blaine County (Alturas County prior to 1895) indicates the fluctuations in lead mining, although several other counties yielded lead. Most of the production in Blaine County came from the Mineral Hill and Warm Springs districts near Hailey. The statistics on mines near Hailey are more satisfactory in all respects than those for most of south-central Idaho, because of the detailed records kept by E. Daft of the Hailey Sampling Works (Uimpleby and others, 1930, p. 82-85, 123-208). During the period discovery and accessibility of deposits were more important than prices in influencing production. Prices at that time are shown in a previous paper (Ross, 1930, Pl. 2). At times in the later development of the region fluctuations in prices were among the governing factors.
MINING IN THE EARLY 20TH CENTURY

A few years after the beginning of the 20th century the first boom periods were over and the major districts had settled down to development of known mines from which the choicest known ore had been already removed. Figure 3 reflects the diminished output during the part of the 20th century that preceded World War I. The peaks in the curves result mainly from the activities of a very few mines per county. That for Custer County in 1906-1907 was caused largely by production at the Empire mine, whose management had changed in 1906 (Umpleby, 1917, p. 14). The increased efficiency that resulted was probably the most potent influence in the increase in production, although higher prices for copper aided.

The Lost Packer mine in the Loon Creek district (45 in Fig. 1) began to produce when a smelter was built there in 1904 (Ross, 1934, p. 117-122). Some of the ore was rich, but the costs of mining at this remote camp were so high that profits must have been small. At first, transportation between the mine and Bonanza, a distance of about 25 miles, was by pack train; and throughout the operation of the mine supplies had to be hauled in and matte from the smelter taken out over the 110 miles of rough road to the railhead at Mackay. Known ore shoots at the Lost Packer are now exhausted but there has been no exploration below creek level. Much of the mining was in 1907, 1908, 1911, and 1914 during which period the mine may have yielded about half a million dollars. Most of the value in the ore mined then was in auriferous chalcopyrite of hypogene origin. Similar ore might be worth looking for at depth.

The marked increase in production in Lemhi County in 1911-1912 was a result of the coming of a railroad in 1910. At Gilmore, the Latest Out, Pittsburgh-Idaho, and Gilmore Mining Company mines expanded their operations and were a major factor in the increase in output of the county. The increase in the price of silver in 1912 may have helped; but no comparable increase in the price of lead took place. Copper prices rose in 1912 but this produced little response from the copper mines near Mackay.

Available records for most of the region are not detailed enough to pinpoint the production history of individual mines, but so far as they go they tend to support the idea that ore in sight and efficiency in management at a particular mine were more potent than general economic conditions in governing regional production rates. For the Mineral Hill district (105 in Fig. 1), near Hailey, data permit citing some examples. In general, the big producers of the boom days in that district had sharply curtailed yields by the beginning of the century, but there were exceptions. The Red Elephant mine, not one of the outstanding early producers (Umpleby and others, 1930, p. 147), had a good record around 1890 and again in 1905-1908, but did not respond markedly to the favorable market conditions of 1911-1912. Its tonnage did increase notably in 1913, after prices had begun to drop, possibly as a result of increased exploration underground when prices were encouraging. The Red Cloud mine (Umpleby and others, 1930, p. 156) produced well around 1890 but did not respond conspicuously to market incentives of 1911-1912. The Nay-Aug mine (Umpleby and others, 1930, p. 162) attained its principal production in 1907, 1908, 1909 and 1910 but then dropped off. The famous Minnie Moore mine (Hewett in Umpleby
Photo 2 -- The famous Minnie Moore Mine near Bellevue in the Wood River valley
and others, 1930, p. 219-223) closed down in 1906, when silver prices were high, but did have a good yield in 1913.

The Warm Springs district (No. 87 in Fig. 1), later active, did not have an impressive record in the early part of the 20th century. The district has been known since the early 1880's, but in many of its mines major development did not begin until 1914 or later.

The varied production record of the Mineral Hill and Warm Springs districts (Umpleby and others, 1930, p. 82-84) does not correspond to fluctuations in prices. On the contrary, it probably reflects the amount of ore in sight at each mine from time to time, which in turn, reflects the fact that individual ore shoots were rather small and new ones were hard to find. The difficulties in exploration were in part related to ignorance of the geologic conditions governing localization of ore. Even today the features governing ore shoots in the two districts are imperfectly understood but few engineers or mine operators would put faith in such notions as the "Wood River fault" which Campbell (1928, p. 289) correctly termed a myth. His paper deals primarily with the Minnie Moore mine but he implies that in past explorations throughout the Wood River region miners have placed excessive emphasis on faulting as a reason for termination of ore. The concept of the Wood River fault has never been stated in any precise way in print. This concept involves a great fault that is assumed to extend throughout the region at approximately the same depth everywhere. The depth at which the Wood River fault was to be expected was given at about 300 feet by some operators and ore shoots were supposed to be displaced wherever encountered by it. In view of the rugged topography such a fault would be difficult to visualize. It is true that many of the extensively developed mines have no known ore bodies more than some 200 feet below the surface (Umpleby and others, 1930, p. 101) but the Wood River fault is not the explanation of this. Modern engineers will see the fallacy in the concept just outlined but old ideas die hard and it may be worthwhile to call attention to the matter here.

Development underground, especially in the early days, was largely by means of adits, rather than by shafts which were both costly and difficult to sink with equipment then available. Most of the shoots that were mined in the early days had their pitch lengths flat or at low angles even where they were in veins that dipped over 60°. Sinking down the dip of the vein and exploratory crosscutting in barren ground were not undertaken as often as might have been wise. Extensions of lodes in the Wood River region, in any direction from ore shoots, are difficult to recognize. Commonly they consist merely of sheared or crushed rock with little or no vein minerals to distinguish them from the numerous uninteresting fracture zones. My observations on the Mayflower and neighboring lodes (Umpleby and others, 1930, p. 137-150) suggest that extensions of lodes were indeed cut in exploratory workings without being recognized. Further, some shoots are arranged en echelon with, or even in parallel with, others without visible connecting links. Geologic and engineering characteristics such as these had more influence in discouraging deep mining than features such as the hypothetical Wood River fault.

The character of the lodes in the two districts near Hailey and in similar districts in other parts of the region supports the idea that mineralization took place originally at con-
Fig. 3 Records of principal producing counties in 1902–1917

Data mainly from annual volumes of Mineral Resources of the United States.
siderable depth below the surface. There is no apparent reason why ore shoots should be confined to the range of a few hundred to about 1,000 feet below the present surface, the range through which most workings extend. If and when there is enough incentive to explore beneath the old mines, new and worthwhile ore shoots may reward the effort.

The production curve for Blaine County (Fig. 3) reflects the general failure of miners near Hailey to find virgin ore shoots. From 1906 until war in Europe began to influence production, the curve is nearly flat and the annual total was mostly below $250,000. The region was resting on past laurels.

Production prior to World War I in other parts of south-central Idaho was governed by factors as varied as the deposits. Dredge operations in the Boise Basin and near Salmon renewed interest in placers. The old mines in the Bayhorse district did not have an impressive record at that time, mostly because the rich but shallow oxidized ore had been largely exhausted. Hypogene ore was known and some of it was rich, but mining in ore of that character was not extensive.

The copper deposits of the Alder Creek district near Mackay (70 on Fig. 1) were mined actively during this period. The Empire mine, which is the only large one, may have yielded about $4 million worth of copper then. This mine is largely responsible for the sharp peak in 1913 shown in the graph for Custer County in Figure 3. According to Umpleby (1917, p. 13-14) a smelter was built in 1901 but for about 5 years thereafter the mine was flagrantly mismanaged by a succession of operating companies. After 1906 the management was better but much of the mining was done by lessees and little exploration in advance of stipping was attempted. The mine and its neighbors differ from most in the region in that the lodes are replacement bodies of contact metamorphic type in limestone on the borders of intrusive masses. At times early in the 20th century, the value of the copper produced exceeded that of the lead (Fig. 4) largely as a result of the yield from the Empire mine, although mines near Hailey also contributed substantially and small producers in other districts added to the total.

A number of small districts were in operation early in the 20th century. The old Warren (13 on Fig. 1) district, Idaho County, yielded $225,720, mostly from placers. Mines around Atlanta, Elmore County (84 on Fig. 1) had a mild revival but shut down about 1914. The Dome (59 on Fig. 1) district, Butte County, became active about 1905. The principal producer there is the Wilbert mine. This small lead-silver mine had an enviable record of almost constant production from 1906 into 1931 and some later work has been done (Ross, 1961, p. 246-251). The Lava Creek (89 on Fig. 1) district, also in Butte County, enjoyed some activity about 1913, although it has not yielded much since its oxidized silver ore was worked out in the early days. Both of these districts have distinctive geologic features; and in both, the lodes may have formed later than many of those in Idaho are commonly supposed to have formed. Boise County did fairly well during the period (Anderson, 1947 (1949), p. 179) largely because of dredging in previously placered areas but also because of revival of interest in Idaho.

It is impractical to plot on Figure 3 production from counties such as Ada, Adams, Butte, Camas, Canyon, Elmore, Gem, Payette, Valley, and Washington where activity
early in the 20th century was slight or sporadic. With a few exceptions, the annual production of each of these counties was commonly $10,000 or less. Even for Elmore County, where annual production exceeded $100,000 much of the time, a graph on the scale of Figure 3 would not show. Much of the production of this county was from the area near Atlanta. The highest recorded yield for the county in the period was $248,230 in 1911.

The Thunder Mountain boom in 1902 to 1907 constitutes to a degree, an exception to the fact that mining in south-central Idaho early in the 20th century was largely in previously developed districts. The gold deposits of the Thunder Mountain district in eastern Valley County (37 on Fig. 1) were discovered in 1895 (Ross, 1933, p. 588-589) and between 2,000 and 3,000 people rushed there in 1902. Stamp mills were built and for a time there was much activity here and in neighboring areas. Unfortunately the reports of the richness of the ore were exaggerated and mining soon began to decline. The total production has been only about $350,000. A landslide in May 1909, which flooded the principal settlement, brought the activity to most surviving mines to a close. The principal item of value that resulted from the boom was the intensive prospecting in the surrounding region. Some of the deposits outside of the Thunder Mountain district that were found during the boom later became major producers, notably the quicksilver and tungsten deposits east of Yellow Pine.

Although the results of the boom were scant, the gold deposits of the Thunder Mountain district should be kept in mind if gold mining becomes of interest in the future. The district contains large quantities of low-grade material formed by dissemination of hydrothermal solutions through permeable, mostly clastic, beds in the Challis Volcanics (Ross, 1933; Shenon and Ross, 1936). Where concentration occurred, either in fissures or under impermeable beds, the gold content became sufficient for profitable mining under favorable conditions. Some mining has continued in spite of handicaps imposed by the remoteness of the district and the lack of a favorable market for gold. The exaggerated early reports were based largely on rich stringers of supergene gold; the lack of success at the mines was in part because the mills made only about 80 percent recovery. Because part of the gold and silver was in pyrrhotite and probably also selenides, it was not recoverable in the amalgamation mills set up during the boom.

In the part of the 20th century that preceded World War I more diverse metals were being produced than in the 19th century, apart from the boom periods in and just after the 1880's (Fig. 4). Except for gold, the quantities of each metal produced at the beginning of the period was small. At times thereafter the yields of lead and copper rose sharply. Note that up to 1915 gold continued to dominate nearly all the time, even though most of the lead ore was low in gold. Except for metallurgical difficulties, zinc might have made a more impressive record than Figure 4 indicates. Contracts with smelters were unfavorable for ore that contained zinc, especially if the percentage was small. Consequently miners tended to avoid shipping such ore. Some lodes are rich in silver but production of such ore was not sufficient to be registered strongly on Figure 4. Except very early in the 20th century, lead made a more impressive record than silver. Some of the ore contained arsenic and antimony, which generally was not welcomed by the smelters and thus was a
Fig. 4 Records of principal metals produced in 1905–1935

Data: mostly from annual volumes of Mineral Resources of the United States and Minerals Yearbook.
disadvantage to the miners. As noted earlier, there was little correspondence between the amounts of the various metals that were mined and the prices (Fig. 5) obtained.
Fig. 5  Metal prices in 1902–1935

Price per ounce of silver and per pound of copper, lead and zinc

Data from annual Bulletins of U.S. Mint.
Source: United States Treasury Mineral Yearbook.
WORLD WAR I

The incentives provided by war in Europe affected mining in south-central Idaho as early as 1914; production reached its crest in 1917, especially in the copper mines near Mackay. On the whole the response to wartime demands was not impressive and the decline in production after hostilities ceased was prompt. The production increase in Blaine County was not great. The record set by that county in the first few years after World War I was somewhat better, and may have resulted largely from the opening up of ore bodies that were sought because of the war but found too late to aid in the war effort. Figure 6, like Figures 2 and 3, records only production of gold, silver, copper, lead and zinc. Until the 1930's no other metals were produced in significant quantities in the region, although several were known and some had been successfully mined. Indeed, for most years, the production of zinc and, to some extent, copper had not contributed greatly to regional totals. World War I did not change this picture greatly. The munitions required were not so markedly different from those of previous conflicts as to result in many special demands for metals. Mercury was still in demand for fulminate in detonating explosives, but the need for it in manufacturing felt campaign hats was on the decline. Such hats were useful in fighting Indians but were in the way in trench warfare. The deposits of quicksilver in Idaho had only begun to be recognized, in contrast to the major role they played in World War II. The uses of alloy steels in munitions grew enough to result in prospecting for cobalt and nickel in western Lemhi County (Hess, 1921) but these metals, like quicksilver, did not come into their own in the region until World War II. Figure 6 includes graphs for the part of Idaho County that is within south-central Idaho and for Valley County. In the early 20th century, prior to 1928, southern Idaho County yielded so little that it cannot be plotted on the graphs. Within a few years after that date interest in gold raised the production of this and other gold-producing areas notably.

The Clayton silver mine, north of Clayton in the Bayhorse district (52 in Fig. 1) was one of the properties whose development started in the interval between the two wars and whose subsequent record has been good. The existence of lodes here was known long before World War I but little was accomplished prior to 1927. Since the late 1930's the mine has been operated, with various interruptions mainly because of labor disputes, and its production record has been good. The workings are mainly in a dolomitic member of the Kinnikinic Quartzite (Ordovician); the ore lies in part along fracture and bedding planes but spreads out irregularly into the dolomitic country rock (Ross, 1937 (1938); p. 137-138). When I first saw the property in 1928 the visible ore was in such small and unsystematically distributed bodies that success in mining seemed doubtful, but evidently skillful underground exploration has been rewarded. Many of the deposits in the region, particularly in the Bayhorse district, are replacements in carbonate rocks. Some of these have even fewer fracture planes or similar structural features to guide exploration than the Clayton mine has. Some prospectors do not understand the difference between replacement deposits and veins, with the result that their exploration is erroneously planned. Wherever a mineral deposit has limestone or dolomite as its country rock, replacement rather than cavity filling is to be expected and exploration should be planned accordingly. The attitude of the bedding in the carbonate rock may have much to do with the shape of the ore bodies. Cross fractures may have influenced ore deposition and these are less readily seen and are less persistent and uniform than the walls of fissure veins.
Fig. 6 Records of principal producing counties in 1914–1939

Data mainly from annual volumes of Mineral Resources of the United States and the Minerals Yearbook.
THE INTERVAL BETWEEN THE WARS

Mining in south-central Idaho was rather quiet in the interval between the two world wars. Custer County was the only one to attain an annual production close to $1 million. The production there in 1929 resulted from activity at the copper mines near Mackay and at the Livingston mine in the Boulder Creek district (66 in Fig. 1). The production near Mackay probably came from leasing operations on the best and most accessible parts of the known ore bodies in the Empire mine. Similarly the work at the Livingston was the culmination of operations in the only known ore shoot of any consequence. Both the Empire and the Livingston shut down in 1930, although leasing continued at the Empire after that. In 1927 to 1931, activity at the Triumph mine near Ketchum sustained production in Blaine County. The complex, fine-grained ore at the Triumph, mineralogically somewhat similar to ore at the Livingston, was not profitable to work until a method of selective flotation was devised for it. The ore at the Triumph contains boulangerite among other complex minerals (Umpleby and others, 1930, p. 181-183) and that at the Livingston includes jamesonite (Ross, 1937 (1938), p. 151).

The large size of known ore bodies at the Triumph encouraged study of ore dressing methods, whereas the single, rather small shoot at the Livingston was worked out within a few years using make-shift machinery and leaving zinc-rich material on the borders of the shoot untouched (Ross, 1937 (1938) p. 149-151). The Triumph mine shut down in 1931 but was revived during World War II. There have been attempts to reopen the Livingston but with less success.

The depression of the early 1930’s was so profound that it dwarfed local influences such as have been commented upon. Figure 4 showing the records of particular metals and Figure 6 showing the county records both reflect the effects. Prices declined correspondingly, as shown by Figure 5, but, except for silver, the drops were not as precipitous as the declines in production. In one respect the depression increased mining activity in south-central Idaho. People who had been deprived of their normal means of livelihood journeyed to this and other mining regions to try their hands at gold mining by primitive methods. Most of these people had neither experience nor equipment for the job. They panned gravel in stream channels not controlled by established mining companies. Presumably some secured subsistence from their labor but the total gold output resulting was not large. Probably mining of this sort was more extensive in parts of California and other localities in the United States that were more accessible than suitable areas in south-central Idaho were. A few people did penetrate into areas in Valley and Idaho counties miles from roads.

One outgrowth of the depression was the increase in the price of gold that began in 1933. The price was stabilized at $35.00 per ounce in 1935, following a proclamation by the President in 1934. Figure 6 reflects increases in the production of gold in Boise, and southern Idaho counties, starting in 1932, and Figure 4 shows the same thing rather more impressively. Most of the gold came from such long-established districts as Boise Basin and Warren but the lode mines in the Marshall Lake district (14 in Fig. 1) contributed in 1929 into 1931. These latter had also been productive during World War I and were again in the late 1930’s. Activity at the principal mine at Atlanta gave Elmore County significant production in 1932 to 1935. For most of the period covered by Figure 6, the
Photo 3 -- Dredge-mining for gold in south-central Idaho
production of Elmore County was so low that it was not plotted on this figure.

The districts in Boise and Idaho counties just mentioned are geologically quite different from each other and from most others in the region. As already noted, lodes in Boise Basin are related to a dike zone of Tertiary age. Those at Warren are in quartz lenses in gouge-filled fissures, related to joints in the granitic rock of the Idaho batholith; presumably mineralization took place as a late result of the emplacement of the batholith. So far the record both of production and of continuity in depth at Warren is below that of the lodes of Boise Basin, although the records made by the placers at Warren are fairly good. Lodes of the Marshall Lake district are in partially silicified pendants or xenoliths in the Idaho batholith. They are quartz lenses associated with aplite and pegmatite. In places the vein quartz merges with pegmatite, either as an original feature or as a result of replacement of the dike rock by somewhat younger quartz. Metallic minerals are varied but generally so small in quantity that the base metal content of the lodes is negligible. The ore shoots at both Marshall Lake and Warren are far narrower than those in Boise Basin. Records are incomplete but from 1902 to 1928 the lodes at Warren yielded somewhat more than $265,000 and the Marshall Lake district (14 in Fig. 1) yielded $289,222, mainly from lodes, according to an unpublished table compiled by C. N. Gerry, U. S. Bureau of Mines. Data in annual volumes of Mineral Resources of the United States suggest that the lodes in Marshall Lake district yielded roughly $55,000 in 1929 through 1931 and little since then. In contrast, the geologically younger lodes in Boise Basin, largely in the Quartzburg district (80 in Fig. 1), are thought to have yielded over $4 million in 1901 to 1930 (Anderson, 1947, p. 178-179) on the basis of a table compiled by Gerry. He computed production of lodes in Boise County prior to 1901 to have been $10,014,676; most of it from Boise Basin. Destructive fires at the principal mine in 1929 and 1931 hampered operations but there has been some production since then.

Two areas in Valley County that had hitherto seen little development were active between the two wars. Numerous small properties were worked but the principal production was from the Lost Pilgrim lead-zinc mine in the Deadwood district (58 in Fig. 1), operated in 1924 to 1932; and the Meadow Creek mine in the Yellow Pine district (38 in Fig. 1), where the Yellow Pine Co. began operations in 1928. The principal ore bodies at this property contained gold and antimony but work was also done at a nearby quicksilver mine. Both were originally discovered during the Thunder Mountain boom about 1900. The Meadow Creek mine in 1932 through 1937 yielded 3,515 tons of antimony, 49,504.31 ounces of gold, and 168,093 ounces of silver (Cooper, 1951, p. 180). The antimony ore produced at this and other mines in the district constitutes the first significant yield of metal other than those common in the region.

Properties in both the Deadwood and Yellow Pine districts are mainly in the Idaho batholith but the Lost Pilgrim mine is in a schist xenolith and the quicksilver mine in the Yellow Pine district is in metamorphosed sedimentary rock, probably part of the roof of the batholith. The genetic relations between the Idaho batholith and the lodes of the Deadwood and Yellow Pine districts are not entirely clear. There are Tertiary dikes in the Deadwood district but relations to the mineralization have not been established. In the Yellow Pine area mineralization took place in several stages. The latest of these stages, at least,
is Tertiary and not directly related to the batholith. Those who have studied the deposits in detail (White, 1940, p. 264-265, Cooper, 1951, p. 171-172) regard the whole mineralization sequence as of Tertiary age. The matter is of interest in connection with the problem of the economic importance of lodes within the Idaho batholith and genetically related to it.

Tungsten was discovered in the Blue Wing district, Lemhi County, (47 in Fig. 1) in 1903 (Callaghan and Lemmon 1941, p. 4-5); an attempt to mine it was made in 1911 but little was accomplished until 1934; significant production did not begin until 1936.

The sharp increase in production in Blaine County just before World War II is one of the more conspicuous features of Figure 6. It results largely from renewal of activity at the Triumph and neighboring properties in the Warm Springs district (87 in Fig. 1). The group was the largest producer of gold in Idaho in 1939 and also ranked high in output of zinc, silver and lead.
The history of mining in south-central Idaho during World War II differs from that in prewar periods in that several metals not previously sought to any great extent were searched for and mined so extensively as to place the region among the leaders in the nation. Tungsten and quicksilver are the conspicuous examples, but antimony, cobalt, fluorite, and others were also sought with encouraging results. The urge to produce that was a part of the war effort and geologic, engineering, and other assistance by government agencies tended to accelerate mining. On the other hand, there were potent adverse factors. Because south-central Idaho is not densely settled, labor shortages have at times in the past hampered mining. During World War II this limitation was intensified. The armed forces took many of the young men. Other and perhaps more serious drains resulted from the needs in manufacturing centers in other regions for manpower. Wages and other tempting inducements resulted in emigration from south-central Idaho on a fairly large scale. The 8 counties that contain most of the mines had a population of 46,684 in 1940 and 44,372 in 1950, an aggregate decrease of 2,312 people. The decrease between 1950 and 1960 was 1,745 people. Some of the towns that are dependent mainly on mining may have had proportionately greater shrinkages.

Shortages in supplies and transportation difficulties added to the labor shortages in hampering mining. For many mines, especially those in the more remote areas, which had had difficulties in securing needed supplies and equipment in prewar years, the restrictions and shortages during the war increased costs and delays markedly. Transportation facilities had increased greatly since the latter part of the 19th century but were still much below those in most other parts of the United States. Rationing and other restrictions related to the war magnified the difficulties in transportation.

As Figure 7 shows, the trend in base metal prices was upward during the war period, but not sufficiently so to encourage much increase in mining. Copper prices did better than those of lead and zinc, with the result reflected in Figure 9. Comparison between Figure 6 and Figure 8 shows Blaine County as the only one that shows spectacular increase. And its record depended almost entirely on the Triumph mine in the Warm Springs district.

The production record for the first 10 years shown in Figure 8 is complicated by the influence of gold prices and controls. Early in that period gold was sold at $35.00 an ounce, higher than it had ever been. As a result, its production reached a total of $3,842,740 in 1941 (Fig. 9), which exceeds its annual production at any time since the early boom days. In 1942 governmental orders caused most gold mines to close. In 1945 restrictions were removed. Figure 9 shows the immediate response. As was to be expected, Boise County was the principal area affected. The mines in the part of Idaho County that is within south-central Idaho did not respond. The gold lode mines there that had been active in the 1930's did not reopen. They probably had little ore in sight and the operating companies may not have had enough capital for adequate exploration. In and after 1943 the production from the southern part of Idaho County was so low that it is not plotted on Figure 8.
Fig. 7 Metal Prices in 1935–1960

Data from annual volumes of Minerals Yearbook
Fig. 8  Records of principal producing counties in 1935-1960

NOTE—Production figures include only gold, silver, lead, zinc and copper.

Data mainly from the annual volumes of Minerals Yearbook.
Fig. 9 Records of principal metals produced in 1935-1960
Governmental restrictions on silver mining were less stringent than those on gold mining; besides, much of the silver obtained in south-central Idaho is in base-metal ore that was much desired for the war effort. Figure 9 shows that the rate of production of silver dropped in 1941 but that thereafter the production continued at a fairly high level throughout most of the war period.

The production of antimony in south-central Idaho reached significant proportions in 1932 when the Meadow Creek mine in the Yellow Pine district, Valley County (38 in Fig. 1) began to produce (Cooper, 1951, p. 180). Prior to that time, some antimony was doubtless obtained in the smelting of certain complex base metal ores from south-central Idaho but little material was mined as antimony ore. The development at the Meadow Creek mine would not have been undertaken except for the gold content of the deposit. Production was active throughout the war and continued for a time thereafter. The graph in Figure 9 takes into account only the antimony produced at the Meadow Creek mine and its neighbor the Yellow Pine mine, both on Meadow Creek and essentially in parts of the same lode. Other mines in south-central Idaho, including one in the Yellow Pine district, produced antimony, but available records are not adequate to include in Figure 9. They would not greatly change the shape of the graph, especially during the war years. The deposits along Meadow Creek were originally thought to be of interest mainly for their gold content. Indeed, to a degree, the antimonial minerals, mainly stibnite, were a detriment in treating the gold ore. During the war the deposits became the greatest source of antimony in the United States.

Tungsten had an even more spectacular history during World War II than antimony did. The presence of tungsten minerals in south-central Idaho had long been known but had attracted little attention. Scheelite in the deposits along Meadow Creek was recognized by D. E. White of the United States Geological Survey in the course of microscopic study of cores from drill holes put down by the U. S. Bureau of Mines (Cooper, 1951, p. 154). This discovery was one of the results of the strategic minerals program conducted by the two Federal bureaus. The investigation of the Meadow Creek area was, of course, undertaken because of the need for antimony, but when tungsten was looked for, large quantities were found in shoots close to those in which antimony was mined. Some of the tungsten ore contains much antimony and some has very little. Mining of tungsten ore started in August 1941; and in 1942, 1943, and 1944, the property was the largest tungsten producer in the United States. The main known tungsten ore body was exhausted in July 1945. To the end of 1945, 1,184,079 tons of ore were mined, yielding 95,358 tons of concentrate, containing 831,829 units of WO₃ (tungstic oxide), 14,981 tons of metallic antimony, 101,437 ounces of gold, and 592,211 ounces of silver.

Once attention had been directed to tungsten, numerous occurrences of it were recognized throughout south-central Idaho, but only a few of these have become producing mines. A group of deposits in the Blue Wing district, Lemhi County, have been known since 1881. They were prospected in the early days, mainly for silver, but the presence of tungsten was recognized in 1903 and some tungsten ore was shipped as early as 1911 (Umpleby, 1913, p. 109; Callaghan and Lemmon, 1941, p. 4-6). Active development accompanied by some production began in 1934. In consequence, the lodes
Photo 4 - The Yellow Pine Mine at Stibnite, a major producer of antimony and tungsten during World War II
yielded large quantities of tungsten, mostly in the form of hubnerite, during the war. The Ima mine in this group, the second largest tungsten mine in Idaho, contains the largest known hubnerite deposits in the western United States (Clabaugh, 1945). The deposits are in impure quartzite (Precambrian) surrounding a granite mass that does not outcrop. The lode matter fills a system of fractures in both rocks and includes quartz, microcline, mica, fluorite, rhodocrosite, siderite, calcite, hubnerite, tetrahedrite, pyrite, scheelite, sphalerite, galena, molybdenite, and other sulphides (Callaghan and Lemmon, 1941, p. 1-21); (Anderson, 1948, p. 181-200). Anderson tentatively regards the granite as of early Tertiary age but there is no direct means of dating it.

The third metal that came into prominence in south-central Idaho during World War II is called mercury as soon as it gets into commerce, but to most miners it is quicksilver. Although deposits in the Yellow Pine district had been known since the Thunder Mountain boom, the two main mines, opened in 1917 and 1918, produced little quicksilver until after 1940 when prices were high (Fig. 7). As Figure 9 indicates, production fell off before the end of the war, in part because of a labor shortage. In 1943, the Hermes mine in the Yellow Pine district was the second largest producer in the United States.

In 1936, quicksilver was discovered in agricultural country near Weiser, Washington County, (60 on Fig. 1) a somewhat surprising circumstance. Mining began in 1938. The principal mine, the Idaho-Almaden, productive from 1939 through 1943, shut down because favorable material had been exhausted. Much low-grade and some small bodies of high-grade ore remained but the management felt that continuation of mining was unwise at the time. Figure 7 shows that quicksilver prices declined sharply after 1943. The use of the metal was less vital in World War II than in previous contests, for it was no longer needed as a major constituent in detonators for high explosives.

Search for cobalt, fluor spar, and other mineral commodities was conducted in south-central Idaho during the war but, except for those mentioned above, little production had been attained before peace came. The stimulation to prospecting may prove to have been of great importance for the future of mining in the region, especially as much of it was in areas at a distance from old mines. Among those to which attention might be directed are the Thunder Mountain district, Valley County, (37 in Fig. 1) and the Parker Mountain district, Custer County (46 in Fig. 1). Mines in both districts present special problems in mining and treatment of the ore. Because most of the ore in both is low grade, early attempts at development have been directed to a large extent to the high grade pockets. Both districts are closer to good roads than they were when previously worked. The Thunder Mountain district has one mine that has been worked with some success for a long time.
Photo 5 -- The Idaho Almaden mercury mine near Weiser
THE POST-WAR PERIOD

The effects of post-war conditions in south-central Idaho have been varied. As in other parts of the United States, mining of lead and zinc ore has suffered. The rises in prices, with some fluctuations, shown in Figure 7 were not enough to offset increases in production costs and manpower shortages. Some ore shoots of such metals as antimony and tungsten, vigorously mined during the war, were exhausted soon thereafter. On the other hand, some metals, such as cobalt, sought during the war, did not reach production until peace came. Technologic advances of varied kinds have resulted in demands for special mineral products, which has inspired considerable prospecting for and some production of such products.

The output of gold, as reflected in Figure 9, was fairly good from 1945 to 1952, when it essentially ceased. Correspondingly, the production of Boise County and Elmore County, as shown in Figure 8, was moderately good in 1945 to 1952 but negligible thereafter. The precious metal mines in the part of Idaho County within the region did not yield enough to plot in Figure 8. Valley County also did fairly well in 1945 to 1950, largely because of its yield in precious metals. The county graphs include only data on gold, silver, copper, lead and zinc, the metals mainly produced in normal times. They do not show such things as tungsten and quicksilver, which are plotted separately on Figure 9. It seems fair to conclude from the various graphs that south-central Idaho has produced significant quantities of the precious metals whenever general economic conditions permit and is likely to do so again whenever conditions warrant. This inference applies mainly to Boise County, but precious metal mines in other counties should not be forgotten.

The production of lead and zinc held up fairly well from the end of the war until 1956, but from then to 1960, production was disheartening. A substantial part of the lead and zinc came from Blaine County (Fig. 8), much of it from the Triumph and associated mines. The Triumph shut down July 15, 1957, because (according to the company) of general economic conditions. Much of the postwar production of Custer County was in lead and zinc, in large part from the Clayton silver mine but supplemented by ore from several other mines.

The production of antimony rose sharply after the war (Fig. 9), but came to an end in 1953 with the exhaustion of readily accessible ore at the principal mine. There are a number of antimony deposits in the Yellow Pine district other than those at Meadow Creek, and many throughout south-central Idaho. None of these has a substantial production record to date but the possibility of mining antimonial material under favorable conditions exists. Of course, numerous mines have shipped ore containing tetrahedrite and other antimonial minerals for their content of silver and base metals. The amount of antimony obtained by the smelters from such material is not on record.

Tungsten production continued after the war but came to a halt in 1957, in part because of exhaustion of readily mined ore but also because of the drop in the price of tungsten concentrate recorded in Figure 7. In 1951-1955 the price was over $60.00 a
short-ton unit; in 1958 it was only about $18.50 per ton unit. Operations at Meadow Creek were stopped in June, 1952, because of unfavorable market conditions, but mining at the Ima mine, the other major producer, continued until June 1957. The search for tungsten that started during the war resulted in many discoveries, only a few of which became productive. Even so, in 1953, small mines in Adams, Custer, Lemhi and Valley counties were in production. In a general review published in 1955, Cook (1955, p. 20-24) lists 10 deposits in south-central Idaho that have produced and 14 others that had not then become producers. He shows that the metal has been found in a variety of types of lodes (Cook, 1956). When tungsten prices rose in 1959 and 1960, interest in the Ima mine was renewed.

One of the more interesting post-war discoveries of tungsten was on Wildhorse Creek, Alta district (72 on Fig. 1), Custer County, (Cook, 1956, p. 12-18). This deposit was found in August 1953. By September 1955, the mill at the principal mine had treated over 3,800 tons of ore with an average content of 0.87 percent WO3 and a gross value of $212,000. In 1956, 28 tons of concentrate with an average content of 71 percent WO3 were milled, but since then the property has produced little and is essentially shut down.

Quicksilver mining in the region had a revival in the late 1950's (Fig. 9) but not as great as the price increases, which exceeded those during the war (Fig. 7). The Hermes mine, Valley County, had various difficulties, including a fire that destroyed its mill in August 1958. Hence its production was not as large as it might otherwise have been. The Idaho-Almaden mine in Washington County, reactivated in 1955 under new management, has continued to produce since then, although in recent years the rate of production has declined and finally stopped. The deposits there are of the opalite type (Ross, 1956 (1957)), quite different from those in Valley County. Many of the quicksilver deposits in Nevada worked during the war are opalitic; my casual observations in southwestern Idaho, far south of those in Washington County, show that opalitic material is present there, although as yet untested or nearly so. It could be easily overlooked by prospectors not familiar with it.

Exploration for cobalt in the Blackbird district, Lemhi County, was revived during World War II but did not reach the production stage until peace had come. Production started in 1952 and continued until 1959 (Fig. 9) when the company's contract with the government was completed. The same deposits yielded copper and are largely responsible for the peak in the copper graph in 1955 through 1958 (Fig. 9) as well as for the high production rate for Lemhi County in 1955 to 1959. Copper was also produced at the Empire mine in Custer County.

Fluorspar deposits near Meyers Cove, Lemhi County, were found in 1941 but did not reach the production stage until 1951. After mill was burned down April 17, 1953, activity ceased in September 1953. During this brief period of production, the deposits yielded 10,978 tons of acid grade, 998 tons of ceramic grade and 100 tons of metallurgical grade fluorspar, but the operators decided not to rebuild the mill and left the area (Anderson, 1954a, p. 10). The presence of fluorspar is known in several places
in the region and some of the deposits have received a little development, notably those near Challis (Anderson, 1954b; Baber and others, vol. 3, p. 340). Only the best grades of fluorspar can be profitably mined in areas as inaccessible as most of those in Idaho; and so far, very little high-grade fluorspar has been found. Even if high-grade material was found the great distances to present markets would handicap its development.

Since the war, uranium, thorium, beryllium and various other metals and minerals have been prospected for with varying success but with little resulting production. The principal uranium mines are in Custer County east of Stanley (55 on Fig. 1). Several deposits are known but much of the mineralized material is not high grade. Claims were first staked for uranium in 1955 (Kern, 1959, p. 14) and 2,300 tons of uranium ore, averaging about 0.25 percent U₃O₈, were shipped in 1957 and 1958. In 1959, 3,374 tons, valued at $30,000, were shipped, but in 1960 activity declined.

The black sand in the placer deposits of south-central Idaho has long been known to contain monazite, ilmenite, garnet, and other potentially valuable substances but little has been done to recover any of these until recently (Savage, 1961). Dredging was conducted near Cascade, Valley County, (59 on Fig. 1) in 1952 to 1955, mainly for monazite, but was terminated in 1955 for lack of a market. Similarly dredging was started in 1955 in Bear Valley, Valley County (57 on Fig. 1) but closed down in 1959 when a contract with the government for 1,050,000 pounds of combined columbium-tantalum concentrate was completed. The principal valuable mineral in the placer sand here was euxenite, but uranium oxide was sold to the Atomic Energy Commission and monazite was also marketed. By-products were stock-piled. Dredges in Boise Basin and other areas recover monazite, garnet, and other minerals in connection with gold mining but apparently such material is saved and is being stockpiled pending a future demand.

Lodes containing thorium, especially in and near Lemhi Pass (33 on Fig. 1) are reported to show favorable indications but development has not yet resulted in any substantial production. Because the search for beryllium did not get started until 1960, there has not been time to test the deposits.
CONCLUSIONS

During 100 years of mining south-central Idaho has produced over $200 million in gold, silver, lead, copper and zinc; demands created during World War II placed the region temporarily in the forefront among producers of tungsten, quicksilver, and antimony. During the few years they were worked, mines of these three metals had an aggregate production of over $50 million estimated on the basis of average prices then current. Thus, while overshadowed by great camps like the Coeur d'Alenes, the region is to be reckoned with in any evaluation of the mineral resources of the United States.

Since lode mining began in south-central Idaho, the region has been known for its lead-silver lodes, which continue, in normal times, to be the backbone of its industry. Few of its mines are operated primarily for zinc but more of that metal might have been produced as a by-product of lead-silver mining if metallurgical contracts had been favorable. Only a very few mines have yielded much copper but the possibility of some expansion of copper mining exists. In my opinion, some of the copper mines that have so far yielded only limited amounts of ore have distinct possibilities under favorable conditions of market and of management. Gold deposits in the region tend to be thought of mainly in connection with the early placer mining but the record shows that placers and lodes have continued to respond to market incentives.

Tungsten, quicksilver, antimony, and cobalt are little produced at the moment but there is good reason to hope that exploration at depth and in low-grade parts of known lodes will be rewarded whenever demand justifies the expense of that sort of development. The extent to which rare metals such as thorium, columbium, beryllium, and others now being sought for may prove valuable remains for the future to determine. The presence of some of these metals has been known for a long time but there has been no incentive to mine them.

In certain respects the history of mining in south-central Idaho may have discouraged companies that might otherwise have entered the region. Production has tended to be erratic, largely because at any particular time only a few mines were in successful operation, which in turn, has resulted in part from the small size of the parts of lodes suitable for mining under the conditions of the moment. In some instances, the efficiency of the management may have been a factor. Difficulties of access, shortages of labor, and similar factors have tended to hamper operations. In attempts to judge future possibilities, one should bear in mind that exploration underground has so far been limited in most mines. Development has been mainly by means of adits, rather than deep shafts. Few mines extend downward below local creek level so the possibilities at depth can only be inferred from such geologic data as are available. Some mines in the past shut down when oxidized ore was mined out. In this mountainous and moderately humid region the oxidized zone was commonly very shallow. Other mines contain complex sulphide aggregates that can be treated successfully only if modern skills, equipment, and money are directed to the task. Thus, if and when the incentives of favorable market conditions become sufficient, the mines of south-central Idaho may well respond.
The future of mining in south-central Idaho depends, apart from the progress of the industry throughout the United States, on the application of modern methods to the known mines, and on success in the search for special metals demanded by the increasingly complex technology required by many industries. Some of these industries are themselves new.
Photo 6 -- Jet aircraft, satellites, and missiles like the Titan (above) require metals that can withstand high temperatures and high stresses. In recent years, changing demands for mineral resources have been reflected in South-Central Idaho by new methods of exploration and in production of metals like columbium, tungsten, tantalum, and uranium.


1948, Tungsten mineralization at the Ima Mine, Blue Wing district, Lemhi County, Idaho: Econ. Geology v. 43, no. 3, p. 181-206.


1951, Metallogenic epochs in Idaho: Econ. Geology, v. 46, no. 6, p. 592-607.


1933, The Thunder Mountain mining district, Valley County, Idaho: Econ. Geology v. 28, no. 6, p. 587-601.


