History of Selected Mines in the Alder Creek Mining District, Custer County, Idaho

Victoria E. Mitchell

Staff reports present timely information for public distribution. This publication may not conform to the agency's standards.

Staff Report 97-2
April 1997

Idaho Geological Survey
Morrill Hall, Third Floor
University of Idaho
Moscow, Idaho 83844-3014
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INTRODUCTORY NOTE

This report was prepared under a cooperative agreement with the U.S. Forest Service, Region IV, as part of a project to identify and describe inactive and abandoned mines in the state of Idaho. Work on this project included preparing detailed histories of mines in Region IV that had significant recorded production. The information in this report is from a number of published and unpublished sources in the Idaho Geological Survey’s mineral property files. Where not otherwise noted, most of the mine production data is drawn from the U.S. Geological Survey’s (USGS) annual volumes on Mineral Resources of the United States (1882-1923) and the equivalent volumes produced by the U.S. Bureau of Mines (USBM) (Mineral Resources of the United States, 1924-1931, and Minerals Yearbook, 1932 to present). Information on underground workings and mine equipment is generally from the annual reports of the Idaho Inspector of Mines (IMIR), published from 1899 to 1979. After 1974, the Mine Inspector’s office was known as the Mine Safety Bureau, a section of the Idaho Department of Labor and Industrial Services. Detailed accounts of mine operations are, for the most part, drawn from the annual reports prepared by the companies for the State Inspector of Mines; these reports were required by law and the information contained in them formed the basis of the Mine Inspector’s annual reports. Reports of recent developments are taken from the Idaho Geological Survey’s (IGS) annual reports on the developments in mining and minerals in Idaho (from 1984 to present) or from similar reports produced by the Survey’s predecessor, the Idaho Bureau of Mines and Geology (IBMG) from 1975 to 1984. Other published sources are referenced in the text. A complete bibliography is included at the end of the report. Where direct quotations are taken from source materials, the original spelling and grammar are preserved even in cases where they do not conform to currently accepted usage.
History of Selected Mines
in the Alder Creek Mining District,
Custer County, Idaho

Victoria E. Mitchell

INTRODUCTION

The Alder Creek mining district is on the eastern slopes of the White Knob
Mountains near the southern border of Custer County (Figures 1 and 2). Most of the
mines are located near the contact between the White Knob Limestone and the
Mackay stock (Figure 3). Ore was first discovered in the area in 1879, but the
original prospectors were too poor to develop their claims. In 1884, additional
discoveries, including one in the area of what would become the Darlington Shaft of
the Empire Mine, finally set off a boom in the area. A 50-ton smelter was built at
Cliff City on Cliff Creek, not far from the southern end of the Empire property
(Figure 2; Umpleby, 1917). It began operations on November 23, and the initial test
run produced a pure-looking product. However, the smelter was closed in early
December after operating little more than a week (Wells, 1983). The smelter made
another short run in 1885 but was again idle by January 1886. After Wayne
Darlington gained control of the Empire, he persuaded some New York investors to
help finance the mine. They supported work in the district in 1890, and the Cliff City
smelter ran from late 1890 to February 1891 (Wells, 1983). British investors financed

1Idaho Geological Survey, Main Office at Moscow, University of Idaho, Moscow.
Figure 1. Location of the Alder Creek mining district and vicinity, Custer County, Idaho (U.S. Forest Service Challis National Forest map, scale 3/4 inch = 1 mile).
Figure 2. Topographic map of the area surrounding the Empire Mine, Alder Creek mining district, Custer County, Idaho (U.S. Geological Survey Mackay Reservoir and Shelley Mountain 7.5-minute topographic maps). Note the extensive mine workings and prospect locations throughout the area.
the construction of a good road to "a large Alder Creek mine" in 1892, but withdrew before doing any significant development at the mine. In 1894, W.A. Clark (whose holdings dominated the Butte district) began an extensive exploration and testing program (Wells, 1983).

Although Umpleby (1917, p. 100) claimed "The history of the district is essentially the history of the mine of the Empire Copper Co.", there are numerous other mines and prospects in the Alder Creek district (Figure 2). According to Nelson and Ross (1968), nearly 50 properties have been worked at one time or another, and the entire district has been heavily prospected. The Empire was by far the largest producer in the district, but other mines with significant production include the Homestake, Horseshoe, Doughboy, Blue Bird, and Champion mines.

Early production records for the district are not available, and how much metal was produced by the early smelter runs is not known. According to Wells (1983), $8,000 worth of copper was produced in 1899, presumably from the Empire Mine. Nelson and Ross (1968) stated that some ore was probably mined from the Empire Mine before 1902, but no records exist. Leland (1957) also believed the Empire produced high-grade oxidized ores from open cuts starting around 1884. Between 1902 and 1979, the six largest mines in the district produced a combined total of 994,269 tons of ore. From this was obtained 41,997 ounces of gold, 1,774,889 ounces of silver, 62,234,080 pounds of copper, 15,101,855 pounds of lead, and 5,496,067 pounds of zinc (Table 1).

Table 1. Total production from the largest mines in the Alder Creek mining district.

<table>
<thead>
<tr>
<th>Mine</th>
<th>Ore (tons)</th>
<th>Gold (ounces)</th>
<th>Silver (ounces)</th>
<th>Copper (pounds)</th>
<th>Lead (pounds)</th>
<th>Zinc (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue Bird Mine (1918-1939)</td>
<td>1,530</td>
<td>23.44</td>
<td>16,426</td>
<td>12,595</td>
<td>509,165</td>
<td>3,111</td>
</tr>
<tr>
<td>Champion Mine (1908-1964)</td>
<td>2,281</td>
<td>14.20</td>
<td>7,236</td>
<td>20,003</td>
<td>579,668</td>
<td>32,719</td>
</tr>
<tr>
<td>Doughboy Mine (1919-1968)</td>
<td>1,070</td>
<td>8.30</td>
<td>31,702</td>
<td>1,972</td>
<td>637,120</td>
<td>3,900</td>
</tr>
<tr>
<td>Empire Mine (1902-1975)</td>
<td>921,077</td>
<td>41,431.25</td>
<td>1,294,531</td>
<td>61,689,291</td>
<td>24,110</td>
<td>906,078</td>
</tr>
<tr>
<td>Horseshoe Mine (1916-1979)</td>
<td>16,810</td>
<td>110.89</td>
<td>129,686</td>
<td>257,945</td>
<td>3,896,442</td>
<td>1,113,821</td>
</tr>
<tr>
<td>TOTAL</td>
<td>994,269</td>
<td>41,996.61</td>
<td>1,774,889</td>
<td>62,234,080</td>
<td>15,101,855</td>
<td>5,496,067</td>
</tr>
</tbody>
</table>
EMPIRE MINE

The Empire Mine (Figures 2 and 3) was located around 1895. The mine was originally known as the White Knob, after the company operating it. (Table 2 lists the companies operating at the mine). A later White Knob Mining Company operated a different "White Knob Mine" about a mile north of the Empire in the 1920s and afterward.

The mine is in a contact metamorphic deposit, and mineralization was often related to blocks of White Knob Limestone engulfed by the Mackay stock (Figure 3). The orebodies were highly irregular, varying greatly in both size and shape, with branching arms that commonly diverged upwards and sometimes reconverged at higher levels. Most of the orebodies were circular or elliptical and most pitched to the southeast, but the exceptions were, in Umpleby's (1917, p. 46) words, "numerous and striking." The greatest vertical extent of an orebody described was from just above the No. 300 tunnel downward to the 850-foot level. In places this shoot was only a few feet wide, but in others, it widened to a floor area of up to 3,000 square feet (Umpleby, 1917).

In 1899, the main shaft at the White Knob Mine was 700 feet deep, with drifts connected by a ventilating shaft. Most of the ore was extracted from overhand stopes or by open quarry work. The cost of transporting supplies to the mine was 60 cents per hundredweight, and it cost $10 per ton to ship ore to the railroad. The average cost of smelting a ton of ore was also $10 per ton. With costs like these, large investments were needed to make any mine in the area successful.

Major financing for the Empire finally came from California millionaire John W. Mackay, who had made his money from the "Big Bonanza" (the Virginia Consolidated Mine in the Comstock Lode at Virginia City, Nevada). In 1901, Mackay arranged to have a branch of the Oregon Short Line constructed from Blackfoot to the Alder Creek district, providing his mine with ready access to rail transport. That same year, the town of Mackay, four miles northeast of the mine, was founded and soon had a population of 1,200. (Both the town and the Mackay School of Mines in Reno, Nevada, were named after Mackay.)

Development at the mine showed encouraging results. Exploration work had located a million tons of ore containing 4 percent copper, valued at $3 million in gold and copper (Wells, 1983). Wayne Darlington conducted a series of tests with the 50-ton smelter to verify that the ore could be processed without "insurmountable difficulties." The test lots produced 200,000 pounds of copper by direct smelting with no preliminary milling (Wells, 1983). Construction started on a 600 ton-per-day (tpd) smelter. The 1901 IMIR noted that the company employed "upwards of 500 men," was completing a 500-tpd smelter (the size of the smelter varied in different reports), and had constructed 12 miles of electric railroad to connect the mines to the smelter.
Figure 3. Geologic map and sections of a portion of the Alder Creek mining district. Map also shows claims and workings of the Empire Mine and the locations of other claim groups in the vicinity (Plate VII from Unempley, 1917).
<table>
<thead>
<tr>
<th>Company Name</th>
<th>Officer</th>
<th>Date Incorporated</th>
<th>Charter Forfeited</th>
<th>Year(s) at Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Knob Copper Co.</td>
<td>John W. Mackay, President</td>
<td></td>
<td></td>
<td>1904-1907</td>
</tr>
<tr>
<td>MacBeth Lease, Inc.</td>
<td>Ravenal Macbeth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White Knob Copper and Development Co.</td>
<td></td>
<td></td>
<td></td>
<td>1905-1905</td>
</tr>
<tr>
<td>Empire Copper Co.</td>
<td>Frank M. Leland, President</td>
<td>June 28, 1907</td>
<td>Dec 1, 1921</td>
<td>1907-1921</td>
</tr>
<tr>
<td></td>
<td>(company reorganized as Idaho Metals Co.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idaho Metals Co.</td>
<td>L.R. Eccles, President</td>
<td>Oct. 8, 1921</td>
<td></td>
<td>1921-1928</td>
</tr>
<tr>
<td>(in receivership)</td>
<td></td>
<td></td>
<td></td>
<td>1928</td>
</tr>
<tr>
<td>Mackay Metals, Inc.</td>
<td>W.E. Narkaus, Manager</td>
<td>June 4, 1928</td>
<td>December 1, 1930</td>
<td>1928-1931</td>
</tr>
<tr>
<td>(in receivership)</td>
<td></td>
<td></td>
<td></td>
<td>1931-1936</td>
</tr>
<tr>
<td>Mackay Exploration Co.</td>
<td>Ted Cherry, President; J. Ray Weber, Manager</td>
<td>August 21, 1939; reinstated March 25, 1974</td>
<td>1971; 1974</td>
<td>1939-1960</td>
</tr>
<tr>
<td>Custer Copper Corp. (lessee)</td>
<td>W.P. Barton, President</td>
<td>June 28, 1946</td>
<td>active through 1967</td>
<td>1946-19567</td>
</tr>
<tr>
<td>R.V. Lloyd &amp; Co.</td>
<td>R.V. Lloyd, President</td>
<td></td>
<td></td>
<td>company reorganized as Lost River Mines, Inc.</td>
</tr>
<tr>
<td>J.R. Simplot Co.</td>
<td>J.R. Simplot, President</td>
<td>February 2, 1946</td>
<td>active</td>
<td>1970</td>
</tr>
<tr>
<td>Ivie Mining Co.</td>
<td>W.W. Ivie, President</td>
<td>December 10, 1969</td>
<td>1971; 1975 (company taken over by Honolulu Copper Co.)</td>
<td>1971-1974</td>
</tr>
<tr>
<td>Honolulu Copper Co.</td>
<td></td>
<td></td>
<td></td>
<td>1972-1</td>
</tr>
<tr>
<td>Myko, Inc.</td>
<td>Ivan Taylor, Vice President</td>
<td>March 7, 1973</td>
<td>not reported as active in 1981</td>
<td>1973/1974</td>
</tr>
<tr>
<td>Exxon</td>
<td></td>
<td></td>
<td>still active</td>
<td>exploration: 1977</td>
</tr>
</tbody>
</table>

1Information not available in IGS’s files.
The following year, the company drove a long cross-cut tunnel from the head of the electric railway. Plans called for starting up the smelter after this tunnel reached the lowest workings of the mine.

Labor difficulties marked the mine’s operations during 1902. Darlington was unable to get along with his miners. On April 4, 1902, they organized as a union in the Western Federation of Miners. Two days later, the union went on strike to avoid being driven out of the district. In the settlement of this dispute, Darlington, his superintendent, and his foreman were dismissed (Wells, 1983). John W. Mackay died in London on July 20, 1902. When one of the two furnaces for the smelter was completed in October 1902, none of the people originally responsible for the big smelter was still connected with the mine.

The 1903 IMIR contained the following description of the mine and its operations (p. 53-54):

> The White Knob mine is situated on a spur from White Knob peak at an elevation of eight thousand feet above sea level and two thousand feet above the valley of Lost River and the company’s big smelter site. The surface manifestations of ore at this property amount to a mineral farm that cover the flat top of the ridge over an area of fully forty acres with low grade copper ore and copper stained formation in great patches and zones. Near a contact of a wide body of eruptive granite porphyry and overlying limestone beds, and including great masses of solid fifty to sixty per cent hematite and magnetite iron ore, which also carries important values in gold and silver.

> The development consists of a vertical shaft seven hundred feet deep sunk from the croppings¹. This, however, is only used as an air shaft at present, for it has been supplanted with a cross-cut tunnel eleven hundred feet long that taps the ore on a level with the bottom of the shaft.

> The ore bodies occur in the blue limestone, also in contact with a large dike of included coarsely crystalline feldspar porphyry. The ore seems to be a replacement of the lime and occurs in mammoth shoots thirty to fifty feet wide and seventy-five to one hundred feet long. The ground is dry and the ore still mostly altered reddish brown oxides and green carbonate of copper carrying from two to four per cent of the red metal together with about two dollars in gold and silver [Figure 4].

> The main ore shoots have been persistently continuous from the surface down to the first big cross-cut called the Albert tunnel², with stations and drifts at convenient horizon. The work is very substantially timbered and equipped with adjustable chutes arranged for handling ore, iron or lime flux, all of which can be mined right on the ground. One of the largest ore bodies is showing sulphide mineral strong in stockwork, threads, pebbles and masses of pure ore that varies from brassy chalcopyrite to spots of rich soft blue black bornite ore. This sulphide is very desirable for matting and has been eagerly anticipated by the management [Figure 5]. The strike of these great bodies is east

¹The Darlington Shaft.

²On the 700 level. Later authors referred to this as the Alberta tunnel.
Figure 4. Typical specimens of ore from the Empire Mine (Plate XV from Umpleby, 1917). 'A' is chrysocolla ore, which varied widely in color and in content of copper, iron, and manganese. 'B' is carbonate copper ore, composed of malachite, azurite, chrysocolla, brochantite (hydrous copper sulphate), and banded amorphous silica.
Figure 5. Specimens of ore from the Empire Mine (Plate XVI from Umpleby, 1917). ‘A’ is closely associated malachite (light) and brochantite with veinlets of gypsum (Copper Bullion tunnel). ‘B’ is garnet and chalcopyrite (light specks) cut by a veinlet of gypsum (Copper Bullion tunnel). ‘C’ is cuprite (light) surrounded by tenorite (dark layer) in chrysocolla ore (300-foot level). ‘D’ shows covellite pseudomorphs after chalcopyrite (black areas and lines) from the 300-foot level. ‘D’-b is magnified slightly less than 30X; all others are about 90 percent of natural size.
and west [of north]\(^3\) with a steep dip to the north [south]\(^4\) and towards the valley. A second tunnel has been started down the mountain side which will tap the ore bodies nine hundred feet below the Albert tunnel and sixteen hundred feet from the surface\(^4\).

This new tunnel is making rapid progress and should reach the big ore bodies in the early summer. It is started at the level of a deep gulch that furrows the mountain side where more water and much higher copper values may be safely expected when the ore bodies are reached.

The White Knob property is equipped with one of the finest smelting plants in the west [Figure 6]. It has two large blast furnaces of three hundred fifty tons capacity each, with all the necessary attendant equipment, including an electric railway seven miles long connecting the smelter with the mine. The ore is smelted direct as it comes from the mine without preliminary milling. One of these furnaces was gotten into commission in October and with the slight delays incident to tightening the harness of a plant of this kind, has been in successful operation since, producing a high grade matt, which carries fifty-eight per cent copper and important values in gold and silver, with a slight loss of less than half of one per cent copper. As soon as the development of the mine is a little further along so that the necessary large daily tonnage can be handled economically the other furnace will be started and will give the plant its maximum daily capacity of seven hundred tons a day. The ore bodies already developed in the mine are said to contain a net value of something like $2,000,000 over the cost of their extraction and reduction, and with the advantage of their precious values and the definite prospect of increased copper percentage at the new level now being opened the chances are that the White Knob will become one of the largest, most permanent and profitable producers of copper, gold and silver bullion in the west.

Umpleby's (1917, p. 93) description of the smelter's initial operation was less optimistic:

"The endeavor was to make black copper, but the furnace was so proportioned that draft was almost impossible, and after running 30 days on 2 per cent ore and failing to reduce slag content below 1.4 per cent copper, matting was adopted. For this purpose sulphide ore was shipped from Butte, Mont., but the financial losses were great and at the end of 10 months operations ceased."

The White Knob Copper Company worked the mine actively for the first eight months of 1904, employing between 300 and 400 men. However, the company failed in September and the property passed into the hands of a receiver. According to the Idaho Inspector of Mines, the company was being reorganized and was soon expected to resume developing the mine. He went on to say (1904 IMIR, p. 53-54):

---

\(^3\)Strike-outs and interpolated corrections are hand-written in IGS's copy of the 1903 IMIR. Changes agree with information given by Umpleby in U.S. Geological Survey Professional Paper 97 for ore bodies above the Alberta (Albert) tunnel level.

\(^4\)The 1600 level tunnel was variously known as the Van-Austin, the Van Ostrand, the Cassock, the Cossak, and the Cossack.
Figure 6. The White Knob (Empire) smelter at Mackay, Idaho (preceding page 55 in Bell, Robert N., 1905, Report of the Mining Districts of Idaho for the Year 1904).
The great trouble with the White Knob enterprise is the fact that its expensive smelting plant and surface equipment were undertaken before the metallurgical feature and method of treating the ore was sufficiently worked out. The great bodies of carbonate and oxide ores have continued down 700 feet in that altered condition to the Albert Tunnel level, and experience has shown that the ore lacked sufficient sulphur for a successful matting method of treatment with which it has been attempted to work it, and too much sulphur for making base bullion successfully.

Both the sulphur and copper tenor of the ore has shown a marked increase in two short winzes that have been sunk from the Albert Tunnel, and if the development is followed out in this direction and subsequently connected with the Van-Austin Tunnel that is designed to tap the ore bodies 900 feet below the Albert Tunnel, and is already in over 1,000 feet, the property is likely yet to blossom out in all the glory promised by its early advocates, for it has immense bodies of low-grade, oxidized and carbonate ores, and if they follow the normal rule of big copper ore bodies, a zone of secondary enrichment is yet due to make its appearance in the downward extension of the ore bodies that should bring the property into favorable prominence, and eventually justify the splendid plant with which it is equipped.

Umpleby (1917) was more direct when discussing the operations at the mine between 1901 and 1905 (p. 13-14):

The succession of White Knob companies which owned this property during the next five years is notorious in the annals of mining, each being a drain on the investing public and a failure more disastrous than the one preceding it. After an expenditure of about $3,000,000 without a cent of profit the enterprise passed into the hands of the Empire Copper Co., an entirely new organization, which has operated the mine on a leasing system at a noteworthy profit. The deceit and mismanagement that characterized its early history have been a serious detriment to the development of the mineral resources of the region, but its present management is conservative, and the company is encouraging the local industry in every legitimate way.

He expanded on this theme on p. 93:

During the period from about 1900 to 1907 the leading property of the district was owned and operated by a succession of White Knob corporations, which, though under the same general management, succeeded each other at short intervals, each a failure more disastrous than the one preceding it. Prior to 1905 more than $3,000,000 is said to have been spent on the property, and at one time the stock sold for $25 a share on a capitalization of 600,000 shares, yet not until 1905, when operated by a leasing company, was the mine ever worked on a business basis or at a profit.

The 1905 IMIR discussed the changes in management as follows (p. 52-53):

The White Knob Copper Mine, at Mackay, experienced one of the most interesting years of its checkered career during 1905.

5i.e., between 1901 and 1905.
This property was originally developed by Mr. Wayne Darlington, ex-State Engineer of Idaho, who did some extensive exploration work on the immense bodies of low-grade ore that the property carries and opened up a big resource of copper carbonate and oxide mineral near the surface. He built a 50-ton smelter and made several test runs of the ore from different parts of the property, producing a total of something like 200,000 pounds of base copper bullion by direct smelting.

This demonstration of handling the low-grade ore of this mine was so successful that its extensive equipment with a 600-ton smelter was undertaken and about half completed when one of the principal backers of the enterprise died and the control of the property passed into the hands of others who were antagonistic to Mr. Darlington’s plans. This resulted in the management being turned over to other people who changed his plan and design of the big smelter, transforming it into a matte plant, which in the hands of a number of high-priced operators, proved unsuccessful from lack of sufficient sulphur in the ore to make matte and save the values, with the result that last spring the property was turned over to a practical operator from California, Mr. Frank Leland, who was instructed to junk the plant and wind up the affairs of the company.

Mr. Leland found several thousand tons of low-grade ore on hand, and thought he could make a success of smelting it. He sold off all the superfluous supplies and equipments, put the company’s assayer in charge of one of the furnaces at the smelter and put the mine into the hands of some intelligent lesors, who went to mining on the best ore and sweetened up the values of the mineral he had on hand, with the result that one of the big furnaces was kept running for several months and successfully handled the material on hand, producing twenty-five carload shipments of high-grade gold and silver-bearing copper matte, and slag result containing considerably less than one-half of 1 per cent copper. The smelter was shut down late in the fall and the leasing system at the mine extended.

Under Mr. Leland’s leasing system the mine is now furnishing employment for about one hundred men, and recent reports show that they are putting out ore of a far better grade than was ever before produced from the mine, and the prospect seems bright at this date for the White Knob to become a profitable source of copper bullion after all its vicissitudes.

The White Knob ore deposits occur at a contact between limestone and porphyritic granite, or rather between an immense body of garnet rock, mixed with other contact metamorphic minerals and the overlying limestone.

The ore occurs in big, irregular shaped bodies 50 feet wide by 100 feet in length in some instances. It has continued in a largely oxidized and carbonated condition to a depth of 700 feet below the apex, where it has been tapped by a cross-cut tunnel.

The ore bodies seem to favor the limestone rather than the garnet rock. The deposit is distinctly of the Arizona variety, and the extensive leasing system now employed in the exploration of its ore bodies is not unlikely to lead to very valuable deposits of massive sulphide ore at further depth, as the ore is commencing to show some very handsome bodies of chalcopyrite mineral in the lowest opening.

The mineralization of this property is very extensive and justifies considerable further development. Mr. Leland has replaced the expensive electric haulage system [Figure 7] between the mine and smelter with a Shay engine [Figure 8], which it is expected will handle the material off the mountain at one-fourth of the former cost.

In 1904, Ravelen Macbeth (who had formerly worked the Lucky Boy at Custer and who would later be the Secretary of the Idaho Mining Association) obtained a 6

6 Multi-millionaire John W. Mackay.
Figure 7. Loading bin and electric tram at the White Knob (Empire) Mine, 1904 (opposite page 54 in Bell, Robert N., 1905, Report of the Mining Districts of Idaho for the Year 1904).
Figure 8. Shay locomotive and ore cars at the White Knob (Empire) Mine, 1906 (opposite page 52 in Bell, Robert N., 1907, Eighth Annual Report of the Mining Industry of Idaho for the Year 1906).
lease at the White Knob (Wells, 1983). In November 1905, MacBeth Lease, Inc., secured a 5-year lease on the mine and smelter and immediately let a number of subleases (Uempleby, 1917). Most of the 1905 production came from the Macbeth operation. The smelter ran for several months, but at the end of the year, it was undergoing repairs and being adapted to process the ore produced by the lessees.

The Macbeth lease was the most important mining operation in Custer County during 1906. One hundred men worked the mine between the time the smelter closed in the fall of 1905 and March of the following year, developing "some extensive bodies of good copper ore," mainly near the surface outcrops of the deposit (1906 IMIR, p. 52). The Mine Inspector (1906, p. 53) noted that the orebodies occurred "in very irregular manner in pockets, kidney, streaks and lenses over the area described and are mined in big open cuts and quarries." During the year, a fire destroyed the entire sampler, the machine shop, and the Shay locomotive, which caused a financial loss to the lessees of nearly $100,000. In spite of this, they produced 50,000 tons of ore during the year, which averaged over 4 percent copper, with significant amounts of gold and silver. One of the smelter's furnaces was blown in on March 5, 1906, and it operated continuously until August 29 of the following year. One factor in the smelter closure was complaints from ranchers against the smoke and from the fishermen against the slag dumped into the river (Uempleby, 1917). About 200 tons of ore per day was treated at the smelter.

Macbeth made substantial changes in the operation of the mine and plant (1906 IMIR, p. 53-54):

The surface deposits on the property were quite extensively developed under the original manager's administration, an electric railway was built right up to the quarries, and a steam shovel purchased for the economical handling of the ore in the surface work. The trackage and equipment of this electric railway above the Albert tunnel and the steam shovel were sold off for junk by the last administration on the White Knob prior to the present lease and an attempt was made to convey the surface ores down through a system of raises to the Albert tunnel level seven hundred feet below. This proved impractical, however, and the lessees installed a surface gravity tram during the early part of the summer for handling this most important source of their ore supply down to their big loading bins at the Albert tunnel level from where it was hauled by Shay geared locomotive to the smelter at Mackay, six miles below, over a six per cent grade.

The lessees had to ship in iron sulfides from Bingham, Utah, to mix with the ore to furnish enough sulphur for the smelter to operate properly. The resulting matte ran about 40 percent copper and from $30 to $50 per ton in gold and silver. Slag losses were said to be less than 0.25 percent when using a feed of ore containing 4 to 6 percent copper and using 13 percent coke fuel. Leland (1957) states that mismanagement under different companies between 1901 and 1907 resulted in an operating loss of $3 million for that period.

The Macbeth lease operated the mine until June 6, 1907. At that time, the property was taken over by the Empire Copper Company of New York City, with
Frank M. Leland as the president and general manager. The new company employed about 275 men at the mine and was the largest mining operation in the county. The smelter was operated for part of the year, producing a high-grade copper matte. However, the new company negotiated an arrangement with the railroad and the Bingham smelter to ship the ore directly to the smelter. This provided for a better profit margin because it did not require the company to pay for shipping fuel and sulfur to Mackay as well as shipping the matte to Bingham. The company smelter at Mackay was never reopened.

Even with the favorable transportation rates, a slump in copper prices in September 1907 made it unprofitable to ship the grades of ore that the mine was producing (about 60 to 80 pounds of copper and a few dollars in gold and silver per ton). The mine closed on October 1, although the Mine Inspector noted that large reserves of ore were in sight and that the mine would be able to operate at a reasonable profit with copper prices in the 17-18 cents per pound range. (The average price of copper the following year was 13.2 cents per pound. The price continued to drop for the next 3 years, reaching 12.5 cents per pound in 1911, before going back up.) Development on the property totaled 5,650 feet of workings. Wages paid to the workers by the Empire Copper Company were: miners, $3.50-$4.00 per day; laborers, $3.00 per day; blacksmiths, $4.00-$4.50 per day; and carpenters, $4.00-$5.00 per day.

Lessees carried out most of the work at the Empire during 1908 and 1909. In 1909, they produced 10 carloads of shipping ore during the year. The mine was kept in good repair and was ready to begin operations as soon as the price of copper went up. Lessees shipped a large tonnage of low-grade copper ore during 1910. Approximately 834,000 pounds of copper, 24,000 ounces of silver, and 250 ounces of gold were produced. Lessees also did 150 feet of sinking and discovered new orebodies, which had not been fully evaluated by the end of the year.

In 1911, the Empire was the largest producer in Custer County (Figure 9). From May to October, 155 cars of ore were shipped from the mine to Salt Lake. This ore ore assayed about 6 percent copper and had an average value of $19.22 per ton. Over 1 million pounds of copper was shipped during this period. Total shipments for the year from all leasing operations were 220 carloads, which provided a decent profit for both the company and the lessees. The Mine Inspector stated (1911, p. 40):

The leasing operations have been invariably profitable, as the ground is divided up into a number of smaller operations, and successful results depend on the care with which the ore is followed, handled and kept clean, and the leasing methods seem to attain this result much more successfully than has any of the several attempts at handling the property on a large scale by company management. The persistent success of these leasing operations is a strong argument in favor of the permanency of the deposit, which has been studied by some very eminent geological authorities, and it is believed that with more extensive development at depth a better segregation of its numerous branching ore channels would be encountered and a more profitable mine result.
Figure 9. Alberta tunnel, or 700 foot, level of the Empire Mine (c. 1910 or 1915) (Idaho Historical Society photograph).
The mine operated the entire year in 1912. Production more than doubled, reaching 25,000 tons of ore which averaged about 6 percent copper, $1.50 in gold, and 3 ounces of silver per ton. Most of the ore shipped ran over 5 percent copper. More than 100 men, mostly lessees, worked the mine. The strength of the ore showings in many of the leases led the company to proceed with its plans for deeper development through the Van Austin (Cossack) tunnel (which had been started in 1903). The tunnel was about 1,000 feet long, and it was hoped it would intersect the Alberta orebodies 900 feet below the Alberta tunnel (Figures 10 and 11).

In 1913, the Empire was the second largest copper mine in the state. (Table 3 lists mine output and economic data.) A force of 150 men worked throughout the year. The mine shipped 55 to 60 cars of ore a month to the smelters near Salt Lake City. The ore averaged about 6 percent copper with $5 per ton in gold and silver. The Cossack tunnel was over 2,000 feet long and was expected to undercut the working areas of the mine in another 1,000 feet. Mine equipment included two drill compressors, ten air drills, one 8-horsepower gasoline hoist, two 10-horsepower air hoists, 7 miles of narrow gauge railroad, two 31-ton Shay locomotives, 30 cars with a capacity of 7 tons each, and "One 500 ton Smelter (not running)". Total development was 36,960 feet of workings. (Table 4 lists development work at the mine.) The company paid out a 10-cent dividend during the year, which came to $100,000.

Umpleby (1917) visited the district in 1912 and 1913. At that time, aggregate mine workings were between 20,000 and 25,000 feet. The Cossack tunnel was 1,900 feet long and, Umpleby estimated, some 2,000 feet short of reaching a point below the north Alberta ore shoot. The other principal groups of workings were the Darlington shaft, the Alberta tunnel, and the Copper Bullion tunnel. The Darlington shaft was no longer accessible. The Copper Bullion tunnel was about 1,600 feet long, with connecting raises, winzes, and laterals totaling another 800 feet. The Alberta tunnel was the most important in the mine (Figures 12, 13, and 14). The main adit was 2,800 feet long and connected to the Darlington shaft; the lateral tunnels off the main adit added another 3,000 feet to the workings. There were also nine other tunnels, each between 100 and 1,000 feet long. Equipment at the mine included three hoists and an 8-drill compressor. The property was equipped with steam, gasoline, water, and air power. The company's railroad, which ran from the mine to Mackay, climbed 2,000 feet over the course of a circuitous 734-mile route. The railroad was equipped with two Shay mountain-climbing locomotives and 38 cars.

Production for 1914 was about half that of 1913 due to unfavorable market conditions related to the start of World War I. The Empire's market was completely shut off during the summer. However, by fall the company had a full complement of lease operations in place and over 60 men were working the mine. The Cossack tunnel was between 3,000 and 4,000 feet long, and, while still 1,400 feet short of the developed orebodies, was expected to reach the main ore zone within another year.
Figure 10. Principal workings at the Empire Mine. a = North Tunnel level; b = 300-foot level; c = Alberta or 700-foot level (Plate IX-A from Umpleby, 1917).
Figure 11. Principal workings at the Empire Mine; area is north of the area shown in Figure 10. The Alberta level is in the foreground; areas marked "Is" are blocks of limestone enclosed in granite porphyry (Plate IX-B from Umpleby, 1917).
Table 3. Mine output and economic data for Empire Mine for selected years, 1913-1931\(^1\).

<table>
<thead>
<tr>
<th>Year</th>
<th>Tons of ore</th>
<th>Average value per ton</th>
<th>Total mining cost per ton</th>
<th>Transportation and treatment costs per ton</th>
<th>Gold recovered (ounces)</th>
<th>Silver recovered (ounces)</th>
<th>Copper recovered (pounds)</th>
<th>Gross returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>1913</td>
<td>34,168</td>
<td>$18.33</td>
<td>$4.00</td>
<td>$4.79</td>
<td>2,243</td>
<td>77,148</td>
<td>3,507,281</td>
<td>$584,375.67</td>
</tr>
<tr>
<td>1915</td>
<td>23,450</td>
<td>14.01</td>
<td>3.50</td>
<td>4.63</td>
<td>1,236</td>
<td>76,728</td>
<td>2,767,100</td>
<td>328,534.50</td>
</tr>
<tr>
<td>1916</td>
<td>71,078.68</td>
<td>16.58</td>
<td>3.50</td>
<td>5.05</td>
<td>3,491.13</td>
<td>139,689.49</td>
<td>5,471,292.40</td>
<td>1,178,451.97</td>
</tr>
<tr>
<td>1918</td>
<td>64,437.78</td>
<td>19.84</td>
<td>2</td>
<td>5.60</td>
<td>2,740.77</td>
<td>104,280.86</td>
<td>4,481,645</td>
<td>1,278,377.69</td>
</tr>
<tr>
<td>1921</td>
<td>14,700</td>
<td>16.56</td>
<td>2</td>
<td>6.83</td>
<td>2,469.60</td>
<td>32,648.70</td>
<td>88,641</td>
<td>142,179.97</td>
</tr>
<tr>
<td>1922</td>
<td>10,404</td>
<td>2</td>
<td>3.30</td>
<td>957.17</td>
<td>23,259.18</td>
<td>1,072,028.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1923</td>
<td>15,184</td>
<td>2</td>
<td>3.03</td>
<td>1,731.29</td>
<td>28,151.14</td>
<td>1,614,467.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1924</td>
<td>15,000</td>
<td>2</td>
<td>2.00</td>
<td>1,500</td>
<td>25,500</td>
<td>1,350,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1931</td>
<td>27,507</td>
<td>2</td>
<td>2.77</td>
<td>1.50</td>
<td>731</td>
<td>22,102</td>
<td>1,097,780</td>
<td>154,720.67</td>
</tr>
</tbody>
</table>

\(^1\)All numbers taken from company reports to the Idaho Mine Inspector. Reporting periods and accounting methods are not necessarily consistent between companies or between reports made by different individual for the same company. Every effort has been made to accommodate varying reporting practices, where possible, but final results are only as good as the original data.

\(^2\)Mining costs not given.

\(^3\)Gross value per ton not given.

\(^4\)Gross returns not given.
Table 4. Employment, development work, and operating companies at the Empire Mine, by year.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Men employed</th>
<th>Tunnels (feet)</th>
<th>Sinking (feet)</th>
<th>Cross-cutting (feet)</th>
<th>Drifting (feet)</th>
<th>Raising (feet)</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1913</td>
<td>60/600</td>
<td>1,500</td>
<td>800</td>
<td>700</td>
<td>---</td>
<td>---</td>
<td>Empire Copper Co.</td>
</tr>
<tr>
<td>1914</td>
<td>7</td>
<td>3,000</td>
<td>400</td>
<td>2,600</td>
<td>---</td>
<td>---</td>
<td>Empire Copper Co.</td>
</tr>
<tr>
<td>1915</td>
<td>165</td>
<td>4,000</td>
<td>1,000</td>
<td>3,000</td>
<td>---</td>
<td>---</td>
<td>Empire Copper Co.</td>
</tr>
<tr>
<td>1916</td>
<td>293</td>
<td>9,000</td>
<td>1,000</td>
<td>8,000</td>
<td>---</td>
<td>---</td>
<td>Empire Copper Co.</td>
</tr>
<tr>
<td>1917</td>
<td>274</td>
<td>---</td>
<td>2,724</td>
<td>6,134</td>
<td>---</td>
<td>---</td>
<td>Empire Copper Co.</td>
</tr>
<tr>
<td>1921</td>
<td>30</td>
<td>3,100</td>
<td>1,240</td>
<td>1,860</td>
<td>---</td>
<td>---</td>
<td>Empire Copper Co.</td>
</tr>
<tr>
<td>1924</td>
<td>45</td>
<td>1,307</td>
<td>146</td>
<td>---</td>
<td>1,093</td>
<td>---</td>
<td>Idaho Metals Co.</td>
</tr>
<tr>
<td>1925</td>
<td>77</td>
<td>610</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Idaho Metals Co.</td>
</tr>
<tr>
<td>1927</td>
<td>3</td>
<td>200</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Mackay Metals, Inc.</td>
</tr>
<tr>
<td>1928</td>
<td>70</td>
<td>1,335</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Mackay Metals, Inc.</td>
</tr>
<tr>
<td>1930</td>
<td>90</td>
<td>2,200</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Mackay Metals, Inc.</td>
</tr>
<tr>
<td>1939</td>
<td>45</td>
<td>400</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Mackay Exploration Co.</td>
</tr>
<tr>
<td>1941</td>
<td>28</td>
<td>---</td>
<td>28</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Mackay Exploration Co.</td>
</tr>
<tr>
<td>1942</td>
<td>22</td>
<td>810</td>
<td>386</td>
<td>---</td>
<td>273</td>
<td>---</td>
<td>Mackay Exploration Co.</td>
</tr>
<tr>
<td>1943</td>
<td>11</td>
<td>166</td>
<td>15</td>
<td>---</td>
<td>---</td>
<td>98</td>
<td>Mackay Exploration Co.</td>
</tr>
<tr>
<td>1945</td>
<td>35</td>
<td>205</td>
<td>---</td>
<td>---</td>
<td>110</td>
<td>---</td>
<td>Mackay Exploration Co.</td>
</tr>
<tr>
<td>1947</td>
<td>15</td>
<td>200</td>
<td>50</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Custer Copper Corp.</td>
</tr>
<tr>
<td>1948</td>
<td>15</td>
<td>150</td>
<td>35</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Custer Copper Corp.</td>
</tr>
<tr>
<td>1950</td>
<td>4</td>
<td>7</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Custer Copper Corp.</td>
</tr>
</tbody>
</table>

1First number given is number employed by company. Number following "/" is the company's estimate of the number of lessees and men employed by the lessees. Where no slash is used, company did not report distinction between employees and lessees or did not report number of lessees.
2Total figure for development work for the year.
3Combined figure for sinking and raising.
4Combined figure for cross-cutting and drifting.
5Number of men employed not stated.
6Combined figure for company employees and lessees.
7Development work for year confined to surface stripping.
Figure 12. Generalized geologic plan of the Alberta level of the Empire Mine (upper half of Figure 2 from Umpleby, 1917).

Figure 13. Generalized plan of the stope on the 450-foot level of the North Alberta ore shoot at the Empire Mine (Figure 3 from Umpleby, 1917).
Figure 14. Longitudinal section through the Empire Mine, showing generalized geology (lower half of Figure 2 from Umpleby, 1917).
The Empire operated all year in 1915 and made particular efforts toward the end of the year to cash in on the increase in copper prices. This resulted in the company's most prosperous year ever. In each of several months, lessees shipped as much as 9,000 tons, but the average for the year was less than 5,000 tons a month. More ore could have been shipped if the smelters could have handled it. About 200 men were working the mine, most of them in small leasing units. In October, the company extended all the leases for another year. The lessees were actively developing the mine from the Alberta tunnel to the surface. The Cossack tunnel reached 4,500 in length and at last entered the ore zone. The Mine Inspector speculated that, should the ore occur as expected between the new tunnel and the Alberta tunnel 900 feet vertically above it, the new discoveries would add 20 years to the life of the mine.

The Empire was the largest copper producer in the state in 1916. Both oxidized and sulfide ore were shipped to Garfield, Utah, at an average rate of nearly 6,000 tons a month. (The IMIR put production at nearly 8,000 tons per month.) The high metal prices which prevailed during World War I allowed the company to pay out dividends in 1916 that were variously reported as $170,000 and $250,000 (the lower number is probably closer to correct). The Cossack tunnel was 6,000 feet long and the ore in this tunnel was "identical in character with the sulphide mineral shipped from the upper works" (IMIR, p. 29). The upper levels still contained large reserves of ore, even though 1916 had been the most productive year in the mine's history. Over 200 men were employed throughout the year.

In 1917, the Empire was again the largest copper producer in the state, producing more than half of the state's copper output. The mine shipped more than 5,000 tons of ore a month. According to the IMIR, the Empire shipped 70,000 tons of crude ore during 1917 and could have easily produced 100,000 tons, if smelter embargoes and railroad car shortages had not interfered. However, ore shipments were curtailed because the Salt Lake smelters were unable to handle the quantities of ore being shipped from various districts. Development work on the Alberta level discovered the richest and largest sulfide orebody found on the property up to that time. Extensive plans were made for continued development and for installing new equipment. Work was underway to connect the Cossack tunnel to the Alberta tunnel with a 900-foot, three-compartment raise. A vertical four-compartment raise was being driven 500 feet from the Alberta level to the oxidized zone near the surface. A 3-mile-long aerial tramway, planned for a maximum capacity of 125 tons per hour, was under construction. When completed, it was expected to reduce haulage costs 80 percent over the Shay railway. Dividends declared in 1917 amounted to $200,000.

Although the Empire was still the largest copper producer in Idaho in 1918, ore shipments were once again reduced at the request of the smelter. Labor and railroad car shortages caused by the war effort were blamed for the reduced production. Even so, the company shipped over 4,000 tons a month. The aerial
tramway, with capacity of 100 tons an hour, began successful operations and the vertical raise above the Alberta tunnel was completed. The raise to connect the Cossack tunnel with the Alberta workings was started, but the work was suspended because the company could not find enough "competent" miners to do the work. A dividend of $50,000 was paid in July.

Ore shipments were greatly curtailed in 1919. The mine shipped only about 1,000 tons of copper ore a month. Considerable time was spent during the year on exploration and development work, as the ore reserves were nearly exhausted. The company sank a 200-foot vertical shaft on the main ore zone from the Copper Bullion tunnel. By the end of the year, the company was drifting on two levels below the Copper Bullion tunnel to locate new reserves. Galena ore was discovered in the Cossack tunnel.

The Empire was again the largest producer in the district in 1920. As usual, most of the ore was mined by lessees, but the company did considerable development work, particularly on the ninth and tenth levels. These levels were reached through the Empire Shaft, an interior shaft that extended downward 340 feet from the Alberta tunnel.

The mine was "practically" idle for most of 1921. In October, the Empire Copper Company was reorganized as Idaho Metals Co. The new company granted many new leases and active operations were resumed. The mine started shipping ore in November and was running at full capacity by the end of the year. In spite of the low activity, the mine was the largest producer in the district. The ore, which was shipped to Garfield, was a mixture of oxide and sulfide minerals.

Worked primarily by lessees, the Empire maintained capacity production of about 1,300 tons (or 40 carloads) per month throughout 1922. The ore consisted of chalcopyrite, bornite, cuprite, and chrysocolla. The company did 3,859 feet of development work and substantially increased ore reserves. The mine had 45 tunnels and 3 shafts. Total development on the property was over 100,000 feet of tunnels, drifts, and crosscuts, and the longest tunnel (the Cossack, on the 1600 level) was 5,500 feet long. The principal tunnels were the Alberta (on the 700 level) and the Cossack. The Cossack tunnel was 900 feet below the Alberta tunnel. The mine was being worked principally through the Empire shaft. Workings also included a glory hole approximately 150 feet in diameter.

In 1923, Idaho Metals Co. continued to operate the Empire through lessees. Ore was shipped to the Garfield smelter at the rate of more than 1,000 tons a month. During the year, 2,400 feet of development work was done and the company had a large quantity of low-grade ore on hand.

Lessees continued active production through the first half of 1924. On July 1, a fire destroyed the mine's ore bins and the headhouse to the aerial tramway. The tramway was also badly damaged by buckets that were set loose and ran out of control during the fire. The tram was repaired, and a new headhouse and ore bins
were constructed. Mining operations were resumed on September 25. The company also installed a 150-ton flotation concentrator, which was housed in the old smelter building. The mill was designed to treat the huge volume of low-grade ore that had been located in the mine or that had accumulated in stope fillings over the previous 20 years. It was estimated that it would take 5 years to process the low-grade ore already at hand. Anaconda Copper Mining Co. furnished all the equipment for the mill and was in charge of its installation.

Despite the reduced output due to the fire, the Empire was still the largest producer of copper in Idaho in 1924. Both oxide and sulfide ore were shipped to Utah for smelting. Toward the end of the year, the company also shipped concentrate from the new mill. The company listed the major tunnels as follows: Davis, 1,000 feet; 300 level, 1,800 feet; Alberta, 4,200 feet; Copper Bullion, 2,800 feet; and Cossack, 6,000 feet. The mine had two vertical shafts. One was 560 feet deep, had four compartments, and reached five intermediate levels. The Empire shaft was 320 feet deep, had two compartments, and reached two intermediate levels. Equipment included a 10x10\(^3\) Vulcan air hoist, a 1,500-cubic-foot Laidlaw-Gordon-Dunn compressor, and a 16,300-foot aerial tramway that connected the mine to the railroad and had a capacity of 50 tons per hour. Haulage inside the mine was by mule.

Active production was maintained throughout 1925, and the Empire was again the largest copper producer in Idaho. Over 100 lessees were active at the mine. The mill capacity was increased to 250 tpd, and the company shipped both crude ore and copper concentrate to International, Utah. Much development work was done, but ore reserves were not large. As a result, the mill ran only part time.

The mine was active for only six months in 1926 but was operated all year in 1927. The IMIR noted that the leasing system did not permit sufficient development work, and the company tried to locate financing to explore the Cossack tunnel during 1927. The Empire was the largest copper producer in the state in 1927.

The mine was idle during the first part of 1928, and the property was in the hands of a receiver. In June, the property was purchased from the receivers by Mackay Metals. The new company reconditioned both the mine and mill, started an active development program, and resumed mining with a large number of lessees. By year's end, the company and the lessees were producing enough ore to operate the mill around the clock. The mill treated more than 9,000 tons of copper ore during the year, and the resulting concentrates were shipped to International, Utah, for smelting. The company also shipped more than 1,000 tons of first-class oxidized copper ore. The mine workings totaled over 20 miles of drifts and tunnels, and 1,500 feet of development work was done in 1928.

Besides being the largest copper producer in Idaho in 1929, the Empire ranked third in the state in gold production and was a large producer of silver. The mine and

\(^7\)The diameter and stroke, in inches, of the piston that powered the hoist.
mill were operated throughout the year. The company did 1,500 feet of development, mostly on the 1,000-foot level and in the Cossack tunnel. A Nordberg 1,250-cubic-foot steam-driven compressor was installed at the Cossack tunnel. Four miles of air line and "a large amount" of new equipment were added to the mine. The 1,000-foot level was opened for production, with the ore consisting chiefly of chalcopyrite, cuprite, and chrysocolla. (Figure 15 shows mine workings at this time.) Nearly 15,800 tons of first-class copper ore was shipped to Utah for smelting. The mill treated 51,000 tons of sulfide ore, producing 4,273 tons of copper concentrates. The copper output for 1929 was more than five times that of 1928.

The Empire Mine and mill were operated continuously during the first part of 1930, but the company suspended all its operations on August 1 because of low copper prices. (Copper reached an all-time low of 0.063 cents per pound in 1932.) Lessees continued to work the mine, but many of them were stockpiling the ore until prices improved. During the year, the mill treated 24,135 tons of copper ore, producing 2,379 tons of concentrates which contained 600 ounces of gold, 14,683 ounces of silver, and 933,529 pounds of copper. In addition, the mine produced 2,032 tons of first-class smelting ore which contained about 4 percent copper. The mine yielded 1,700,000 pounds less than in 1929, but was still the leading producer of copper in Idaho and was ranked sixth in gold production. The company did 1,300 feet of development work. This included advancing the face of the Cossack tunnel to a point 6,000 feet from the portal. Plans, which were never carried out, called for raising a 600-foot raise from the Cossack tunnel to connect with the Alberta tunnel through the Empire shaft.

The property once more passed into receivership on March 28, 1931, due to the Great Depression. Ownership of the property reverted to the county because of unpaid taxes. At the year's end, Mackay Metals had completed arrangements to repurchase the mine and to refinance its debts "as soon as conditions warrant." Five lessees worked the mine during the year, producing a "substantial tonnage" of high-grade ore, which was stored on the property (IMIR, p. 127).

Lessees operated the mine during 1932 and stored the ore while waiting for better metal prices. The 1933 IMIR, citing press reports, stated that the Empire had been sold to M.G. Thomle of Los Angeles, California, who was planning to reopen the mine as soon as metal prices permitted. The rumored sale did not materialize and Mackay Metals continued trying to refinance the mine.

Several small leasing operations worked the upper levels of the mine during 1935. Lessees shipped several carloads of ore from the Empire in 1937, but the activity stopped after word of the pending sale of the property was circulated. G.M. Tomle was rumored to hold an option on the property from the Custer County Commissioners. No changes occurred in the status of the property during 1938. Later reports indicated that Tomle lacked the funds to put the mine into production.

Mackay Exploration acquired the Empire Mine in May 1939. By December, 20 groups of lessees (totaling 45 men) were at work. The company rehabilitated the
Figure 15. Map of workings of the Empire Mine in 1929 (Figure 2 from The Alder Creek Mining District in Ross, Clyde P., 1930).
mine and resumed development. The 1,000-foot level was reopened and 480 feet of development was completed by the end of the year. The Cossack tunnel was also reopened and development work started on that level. During 1939, 996 tons of copper ore was shipped to the Salt Lake smelters. About 4,500 tons of ore was shipped in 1940.

The output from the Empire declined to 3,169 tons in 1941. All the production was being done by lessees, who sold the high-grade ores to the Utah smelters but left the mill-grade ore in the mine. The company stated it was working to develop enough low-grade ore to justify starting up milling operations.

The Empire shipped 1,274 tons in 1942. The company also did some development work on tungsten ore and produced 55 tons from a winze below the 1,000 level (Cook, 1956). The mine was closed in August, but in December the U.S. Bureau of Mines started diamond drilling in the mine.

Although the mine was idle for most of 1943, 49 tons of copper ore was shipped. The Bureau operated two diamond drills at the mine during the year with a "satisfactory increase in ore reserves." The U.S. Geological Survey also did some exploration.

In April 1944, Mackay Exploration Co. began reconditioning the mill and power plant, using funds from a $45,000 Reconstruction Finance Corporation (RFC) loan. The company rebuilt the flotation mill, installed machinery at the power plant, and constructed a 2½-mile transmission line from the power plant to the mill. Fifteen men were employed to do this work. Mining, with a work force of 50, began in July. During the second half of the year, 2,330 tons of ore was shipped to the smelter at Garfield and 500 tons was treated in the company mill.

Mackay Exploration operated the mine and 100-ton mill throughout 1945. The mine shipped 6,478 tons of ore (which contained 456 ounces of gold, 7,620 ounces of silver, and 367,893 pounds of copper) to a smelter in Utah. The company also treated 1,850 tons of similar ore by flotation. Some stoping on the orebodies was done during the year.

Custer Copper Corporation, whose president was the former mine manager for Mackay Exploration Co., leased the Empire in 1946. The company made plans to connect the 1,000-foot level to the Cossack tunnel (1,600 level) through a 700-foot inclined raise, eliminating hoisting and outside haulage. (Figure 16 shows the railroad loading station at the lower tramway terminal.) In conjunction with this, the Cossack tunnel was rehabilitated in 1947 and the tracks repaired. The raise was completed in 1948. The mine produced 877 tons of copper ore in 1946, 2,370 tons in 1947, and 431 tons in 1948. Also in 1948, Custer Copper moved 250,000 yards of earth in a surface stripping operation that exposed an ore zone 35 to 40 feet wide containing 6 percent copper.

The Empire shipped 69 tons of ore in 1949. In 1950, work at the mine was confined to surface stripping, opening and sampling an iron ore deposit, and researching sink/float separation of iron and fluorspar ores. The mine was idle except
Figure 16. Railroad loading station at the lower tramway terminal at the Empire Mine (c. 1947) (page 150 from McDowell, George A., 1948, 49th Annual Report of the Mining Industry of the State of Idaho for the Year 1947).
for sampling and maintenance from 1951 to 1953. Two operators shipped ore from the mine in 1954.

In 1955, block lessees worked the Empire Mine and shipped crude ore to a smelter. Late in the year, Idaho Alta Metals Corp., a New York concern, acquired a lease and option on the property. Idaho Alta began a development program with the goal of expanding production from the mine.

Idaho Alta started shipping ore late in October 1956 to the Combined Metals Reduction Co. mill in Bauer, Utah. Work at the mine was delayed by a fire, which destroyed the compressor house and machinery. The company completed 1,700 feet of drifting, 110 feet of raises, 200 feet of diamond drilling, and 18,921 cubic feet of stoping during the year. The main effort involved driving a tunnel 160 feet below the 1,000 level. The tunnel was 1,600 feet long in September 1956, and a raise off this tunnel broke into one of the old Empire stopes, which was nearly 30 feet in diameter (Leland, 1957). About 15 men were employed at the property.

Idaho Alta shipped a substantial quantity of copper ore from the Empire to the Combined Metals Reduction Co. mill in 1957. Output in 1958 was substantially less than in the previous year. The company's lease was terminated in September 1958.

Mackay Exploration Co. produced 593 tons of copper ore from the Empire in 1959, but reported doing only development work. The mine was sold to R.V. Lloyd & Co. on May 10, 1960. The Empire was the only producing mine in the district for the year.

According to the USBM, "sizeable" quantities of copper ore were produced each year from 1961 to 1964. The company built a new flotation mill at the portal of the 1,100 tunnel in 1961 and constructed a new compressor building during 1962. Twelve men were employed in the mining and milling operations during 1963.

U.S. Geological Survey records show that both Idaho Alta and R.V. Lloyd applied for government loans under the Defense Minerals Exploration Administration (Idaho Alta) and Office of Mineral Exploration (R.V. Lloyd) programs. Neither company's application was successful.

Lost River Mines, Inc., purchased the Empire Mine in February 1965. While the company started development work to locate new reserves, ore from the old stopes was mined and milled in the 175-tpd concentrator originally constructed in 1961. A diesel loader and 8-ton ore cars were placed in use on the main 1100 haulage level.

In 1971, the Empire, operated by Honolulu Copper Co., Inc., was active and the property was leased to Ivie Mining Co. Two men were employed on the property. The company employed 10 men in 1972 and 6 men in 1974-1973. Myko, Inc., acquired the Empire mill in 1973-1974, although mining efforts were concentrated on the Horseshoe and Phi Kappa mines. The Empire was active from 1974 through 1977, producing some ore during most of those years. Honolulu Copper employed a work force of 6 men at the mine. Some of the work during this period included operation
of an open-pit near the southern end of the property (Figure 17) and construction of a pilot leach plant to test recovery of the oxidized copper ores (Figures 18 and 19).

The mine was inactive during 1977 and 1978. Exxon Corporation drilled the property during that time but decided against further exploration.

In 1980 and 1981, Myko shipped ore from the Phi Kappa Mine to the Empire mill. USBM records show production from the Empire in 1982. However, the distribution of metals (dominantly silver and lead) suggests that this may actually have been Phi Kappa ore that was processed at the Empire mill. (See Figures 20, 21, and 22 for recent views of the mine.) In 1991, Honolulu Copper looked at the area as a potential site for a sulfuric acid copper-leaching operation.

Total recorded production for the Empire Mine between 1902 and 1975 is 921,077 tons of ore. From this were obtained 41,431 ounces of gold, 1,294,531 ounces of silver, 61,689,291 pounds of copper, 24,110 pounds of lead, and 908,078 pounds of zinc. In addition, a small quantity of tungsten ore was shipped in 1942.

BLUE BIRD (EASLIE) MINE

The Blue Bird Mine (Easlie Group) is located in Rio Grande Canyon just north of the Empire Mine (Figures 2, 3, and 22). When Umpleby (1917) visited the district in 1912, the Easlie group was developed by a shaft and several short tunnels, all of which were inaccessible. The claims covered a large limestone mass surrounded by granite porphyry. The tunnels followed the east contact between the limestone and the granite, while the shaft and several prospect pits were on the west contact. A small carload of ore, containing 30 percent lead and between 8 and 9 ounces of silver per ton, was produced in 1909 (Umpleby, 1917).

In 1924, activities on the Darlington and Fowler lease at the "Blue Jay" (the name by which the IMIR incorrectly referred to the property) added considerably to the activity in the district. The lessees did about 50 feet of development work, and some oxidized lead ore was shipped from the property during the year. The mine had a 100-foot vertical shaft and about 200 feet of drifts.

Lessees made important ore discoveries during 1925, and several lots of ore were shipped. In 1928, a lessee shipped a few hundred tons of smelting-grade sulfide lead ore and sent one carload of lead-zinc ore to a custom flotation mill at Midvale, Utah. (The reports of activity at the Blue Jay, "owned by the White Knob Mining Co.," in the 1927 IMIR probably refer to the Blue Bell, one of the claims that was owned by White Knob.)

The mine was inactive from 1929 to 1935. In 1936, production from the Blue Bird was credited with increasing the output of lead-silver ore from the district. The 1937 IMIR mentioned production from the "Blue Bell" (another incorrect reference by the Mine Inspector) by lessees Crocker and Judd. The Blue Bird produced ore in 1938
Figure 17. Honolulu Copper Co.'s open-pit mine (1994). The pit is near the location of the Darlington Shaft (Idaho Geological Survey photograph by Falma J. Moye).
Figure 18. Leach pad and staging area at the open-pit mine (1994) (Idaho Geological Survey photograph by Falma J. Moye).
Figure 19. Cement leach pad and copper plating system at the open-pit copper mine (1994) (Idaho Geological Survey photograph by Falma J. Moye).
Figure 20. Looking south at the main level portals of the Empire Mine (c. 1990) (Figure 13 from McHugh and others, 1991).
Figure 21. The Empire Mine (c. 1985). The Lost River Range forms the distant skyline (page 181 from Link, P.K., and W.R. Hackett, editors, Guidebook to the Geology of Central and Southern Idaho: Idaho Geological Survey Bulletin 27).
Figure 22. Overview of the Empire Mine area, with the White Knob Mountains in the background. An ore bin and tram station are in the center of the photograph, and the open-pit workings near the Blue Bird Mine are the reddish area to the upper right (Idaho Geological Survey photograph by Falma J. Moye).
and 1939. During 1938, Mackay Metals Consolidated was organized to consolidate the Blue Bird and several other properties adjoining the Empire Mine. According to the 1938 IMIR, the company was waiting for approval from the Securities and Exchange Commission before starting operations. Later IMIRs make no mention of this company.

According to McHugh and others (1991), the main shaft on the Blue Bird was at least 100 feet deep. Other development on the property consisted of several pits and short adits. Between 1918 and 1939, the property produced 1,530 tons of ore. From this was obtained 23 ounces of gold, 16,426 ounces of silver, 12,595 pounds of copper, 509,165 pounds of lead, and 3,111 pounds of zinc.

CHAMPION MINE

The Champion Mine was variously reported to have been located in 1895 (Nelson and Ross, 1968) and 1901 (Umpleby, 1917). In 1912, the Champion group consisted of nine claims located south-southeast of the Empire Mine at an elevation of about 8,000 feet (Figures 2 and 3). According to Umpleby, the workings consisted of three main tunnels in the central part of the property and several small tunnels located toward the north end. He noted that the Champion was the most important deposit in the district to be discovered outside the main body of granite porphyry. The workings on the property were almost entirely within limestone near the contact with the granite.

The first recorded production from the Champion was in 1908. Little mention was made of the property in the following years, but Champion Mining Co. (incorporated on November 9, 1905) consistently reported doing assessment work on the claim group. (See Table 5 for development work done on the mine.)

The company’s report for 1914 mentioned several tunnels, the longest of which was 470 feet long. Most of the work done during the year was clearing and retimbering caved workings. Total development at the mine was about 1,550 feet of workings. A lessee shipped 8 tons of sorted ore during the year; the company stated the average value of this ore was $15.49 per ton, and that 48 ounces of silver, 3,200 pounds of lead, and 800 pounds of zinc were recovered. Company reports from 1914 to 1917 stated most of the development work was being done on the O.S.L. claim, partly with contract workers, and that assessment work was being done to maintain the claim group (Figure 23).

In October 1917, the entire property was placed under lease. Total development at that time was approximately 1,800 feet of workings. It is not known when the lease was terminated; company reports do not mention lessees after 1920.

The 1922 company report described the mine workings as consisting of nine tunnels, five winzes, three cross-cuts, and five drifts. The No. 1 tunnel was 100 feet long; the No. 2, 470 feet; the No. 3, 275 feet; the No. 4, 85 ft; and the No. 5, 40
Table 5. Development work and number of employees at the Champion Mine.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Men employed</th>
<th>Tunnels (feet)</th>
<th>Sinking (feet)</th>
<th>Cross-cutting (feet)</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1914</td>
<td>2</td>
<td>10'</td>
<td>---</td>
<td>---</td>
<td>Champion Mining Co. and lessee</td>
</tr>
<tr>
<td>1915</td>
<td>2</td>
<td>40'</td>
<td>---</td>
<td>40'</td>
<td>Champion Mining Co.</td>
</tr>
<tr>
<td>1916</td>
<td>4</td>
<td>100'</td>
<td>8'</td>
<td>90'</td>
<td>Champion Mining Co. and contract workers</td>
</tr>
<tr>
<td>1917</td>
<td>2</td>
<td>75'</td>
<td>25'</td>
<td>50'</td>
<td>Champion Mining Co. and contract workers</td>
</tr>
<tr>
<td>1919</td>
<td>6</td>
<td>68'</td>
<td>---</td>
<td>68'</td>
<td>Lessees</td>
</tr>
<tr>
<td>1920</td>
<td>6</td>
<td>65'</td>
<td>---</td>
<td>65'</td>
<td>Lessees</td>
</tr>
<tr>
<td>1921</td>
<td>7</td>
<td>40'</td>
<td>---</td>
<td>40'</td>
<td>Champion Mining Co.</td>
</tr>
<tr>
<td>1922</td>
<td>1</td>
<td>50'</td>
<td>---</td>
<td>---</td>
<td>Champion Mining Co.</td>
</tr>
<tr>
<td>1923</td>
<td>1</td>
<td>25'</td>
<td>---</td>
<td>---</td>
<td>Champion Mining Co.</td>
</tr>
<tr>
<td>1924</td>
<td>1</td>
<td>35'</td>
<td>---</td>
<td>---</td>
<td>Champion Mining Co.</td>
</tr>
<tr>
<td>1925</td>
<td>1</td>
<td>35'</td>
<td>---</td>
<td>---</td>
<td>Champion Mining Co.</td>
</tr>
<tr>
<td>1926</td>
<td>1</td>
<td>50'</td>
<td>---</td>
<td>---</td>
<td>Champion Mining Co.</td>
</tr>
</tbody>
</table>

1Work for the year consisted mostly of clearing caved workings and retimbering these areas.
2Total development work for the year.
3Combined figure for cross-cutting and drifting.
4Company stated that work was done mainly on contract. Number of workers not reported.
5Combined figure for sinking and raising.
6Work done by lessees. Number of workers not reported.
7Number of workers not reported.
8Total development work for the year. Included drifting, cross-cutting, and raising.
9Total development work for the year. Included drifting and cross-cutting.
10Work for the year also included cleaning out old tunnels, retimbering, and some surface work.
11Work also included some surface and repair work.

feet. The "No. 5 tunnel" was located at the cabin and was used as a root cellar. Total mine workings were about 2,000 feet, consisting of 150 feet of winzes, 75 feet of raises, and 1,775 feet of tunnels, cross-cuts, and drifts.

Minor work was done on the property between 1922 and 1926. Total development in 1926 was 2,100 feet, which included 150 feet of winzes, 75 feet of inclined raises, and 1,900 feet of tunnels, cross-cuts, and drifts. The company noted that a new tunnel had been started at the south end of the property, headed toward the main mineralized areas of the mine. The Champion Mining Company forfeited its charter in 1927.
Figure 23. Claim map of the Champion Group (Figure 13 from Umpleby, 1917).
The next mention of the Champion mine was in 1943. The mine was active for most of the next decade. In 1943, 322 tons of lead ore was shipped to a smelter and 200 tons in 1944. The mine also shipped ore in 1947, 1948, and 1949. It was the principal producer in the district in 1951 and was active in 1952. In 1954, lessees produced 282 tons of ore, which yielded 53 tons of lead concentrate and 12 tons of zinc concentrate. A "substantial tonnage" of lead ore was produced in 1955.

U.S. Geological Survey records show that Joseph Ausich applied for government assistance under both the Defense Minerals Exploration Administration (DMEA) and the Office of Mineral Exploration (OME) programs. A DMEA contract for $31,650 was awarded on June 30, 1952; government participation in the project was 50 percent. The total amount of money was increased to $39,510 in 1954. The project was active from 1952 to 1954, but apparently no significant orebodies were discovered.

The mine produced ore in 1962. Assessment work was done on the property by Joe Ausich and/or Ausich Mines during the early 1970s. The mine workings total about 3,032 feet of drifts, crosscuts, raises, and winzes on three levels (McHugh and others, 1991; Figure 24). Production for the mine, between 1937 and 1970, was 2,708 tons of ore averaging 0.0069 ounce of gold per ton, 2.76 ounces of silver per ton, 0.3 percent copper, 12.8 percent lead, and 2.8 percent zinc. Between 1908 and 1964 the mine produced 2,281 tons of ore, which yielded 14 ounces of gold, 7,236 ounces of silver, 20,003 pounds of copper, 579,668 pounds of lead, and 32,719 pounds of zinc.

DOUGHBOY MINE

The Doughboy Mine is located in Cougar Gulch about two miles northwest of the Empire (Figure 2). By 1919, the mine was developed by a 100-foot-deep inclined shaft driven along the contact between the limestone and an intrusive porphyry. The mine shipped 3 carloads of ore averaging 30 to 40 percent lead and nearly an ounce of silver per unit of lead.

The Doughboy Mining and Leasing Co. (T.M. Douglass, Jr., Assistant Secretary) was incorporated on May 7, 1920. The company forfeited its charter in December 1921.

The 1920 company report to the Mine Inspector listed development on the property as a 243-foot shaft and 400 feet of drifting. A large shipment of ore was made in 1920, and smaller shipments were made in 1921 and in 1923 through 1925. Small amounts of ore were produced in 1943 and 1944. The mine was reopened in the 1960s, and the property produced 6 tons of lead in 1962.

According to McHugh and others (1991), the mine was developed by one 370-foot shaft (now caved), 1,500 feet of drifting, one short adit, and one pit. Between
Figure 24. Sketch map of the workings of the Champion Mine (Figure 7 from Leland, 1957).
1919 and 1968, the mine produced 1,070 tons of ore. This yielded 8 ounces of gold, 31,703 ounces of silver, 1,972 pounds of copper, 637,120 pounds of lead, and 3,900 pounds of zinc.

HORSESHOE MINE

The Horse Shoe Copper Company reports to the Idaho Mine Inspector indicate that the company acquired the Horseshoe Group in 1903. (Table 6 lists the companies operating at the mine). When Umpleby (1917) visited the Alder Creek district in 1912, the Horseshoe group consisted of about thirteen unpatented claims located north and east of the Empire (Figures 2 and 3). The property was developed by a few open cuts and short tunnels, but it had produced no ore.

The first recorded production from the Horseshoe was in 1916, when the mine made a few shipments of lead ore. The IMIR (p. 28) noted that lessees had discovered "a splendid shoot of desirable lead carbonate and galena ore," from which two carloads of ore yielded the miners a "good margin of profit."

In 1917, lessees at the Horseshoe shipped nearly 2,000 tons of ore from shallow, near-surface workings. The ore ran over 29 percent lead and about 10 ounces of silver per ton.

In 1918 and 1919, the property was worked by U.S. Smelting and Refining Co. of Salt Lake City. The mine shipped ore in both years. Output for 1919 totaled about 1,000 tons of ore which ran about 30 percent lead and 30 ounces of silver per ton. The 1919 IMIR described the ore (p. 82) as consisting of: "...a lensy contact deposit of crystallized lead and sand carbonate ore between limestone and granite porphyry. These lenses have varied up to 20 feet thick, but have proven decidedly irregular so far in both length and depth but of persistent recurrence to a point nearly 200 feet below the outcrop and have made a handsome total yield of desirable mineral from previous leasing operations."

A large quantity of lead ore was shipped from the Horseshoe during 1920. Lessees discovered a new ore zone during 1921, and a number of shipments of lead ore were made, although the output was small compared to previous years. "Considerable" oxidized lead ore was shipped to smelters in Utah during 1922 (USGS). Total workings for the mine were said to be "Many thousand feet". The principal workings consisted of three tunnels, two short shafts, and numerous crosscuts, drifts, and raises. A large amount of development work was done during the year.

In 1923, the company placed the mine under a 3-year lease to Wayne Darlington. Standard lease terms included a 10 percent royalty. Darlington also had the option to purchase the mine at 7 cents per share (about $70,000 total). In addition to shipping ore, Darlington opened a new orebody of chalcopyrite and pyrrhotite.
Table 6. Companies operating at the Horseshoe Mine.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Officer</th>
<th>Date Incorporated</th>
<th>Charter Forfeited</th>
<th>Year(s) at Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horse Shoe Copper Co., Ltd.</td>
<td>George L. Morgan, President/Manager</td>
<td>Dec. 10, 1903</td>
<td>Dec. 1, 1930</td>
<td>1903-1930</td>
</tr>
<tr>
<td>Kay Development Co., Inc.</td>
<td>Wayne Darlington, President/Manager</td>
<td>March 17, 1924</td>
<td>1</td>
<td>1924-1928</td>
</tr>
<tr>
<td>U.S. Silver Corp.</td>
<td></td>
<td>1</td>
<td>taken over by Myko, Inc.</td>
<td>1971-1972</td>
</tr>
<tr>
<td>Myko, Inc.</td>
<td>Ivan Taylor, Vice President</td>
<td>March 7, 1973</td>
<td>not reported as active in 1981</td>
<td>1974-1976</td>
</tr>
</tbody>
</table>

1Information not available in IGS’s files.

In 1924, Darlington's Kay Development Co., Inc., assumed control of the property. During the year, the company constructed a 4-mile electric transmission line from Mackay to the mine, installed new mine equipment, and conducted an active development program which included sinking the main shaft an additional 100 feet. (See Table 7 for development work done at the mine.) Several lots of ore were shipped. According to the company, most of the old workings in the mine were caved.

Kay Development conducted active operations throughout 1925. The main shaft was sunk to a deeper level and considerable lateral exploration was done on the mine's upper levels. The workings consisted of two tunnels and a two-compartment vertical shaft with four intermediate levels. The No. 1 tunnel was 450 feet long, and the No. 2 tunnel was 600 feet long. The mine was equipped with an electric hoist and an electrically driven two-drill air compressor.

Early in 1926, the company opened up considerable new ore. Production for the year was nearly 1,000 tons of silver-lead ore. In addition, some lead-zinc ore was shipped to a custom flotation plant for testing.

Active development work during the early part of 1927 located a large body of complex lead-zinc ore. The company's 1928 report to the Idaho Mine Inspector stated that the mine's surface plant and equipment had been destroyed by a snow slide. Kay Development shipped one carload of copper-lead-zinc ore to a custom flotation plant during 1928. The IMIR entry for the Horse Shoe Copper Co. said the property had been leased to Ray Strunk of Mackay.

Lessees did a small amount of work on the mine during 1930. Total workings on the property were over 2,000 feet (Figure 25). Horse Shoe Copper Co., Ltd., forfeited its charter on December 1, 1930.
Table 7. Development work, number of men employed, and operating companies at the Horseshoe Mine.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Men employed</th>
<th>Tunnels (feet)</th>
<th>Sinking (feet)</th>
<th>Cross-cutting (feet)</th>
<th>Drifting (feet)</th>
<th>Raising (feet)</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1924</td>
<td>12</td>
<td>---</td>
<td>100</td>
<td>400</td>
<td>---</td>
<td>---</td>
<td>Kay Development Co.</td>
</tr>
<tr>
<td>1925</td>
<td>7</td>
<td>---</td>
<td>90</td>
<td>100</td>
<td>200</td>
<td>---</td>
<td>Kay Development Co.</td>
</tr>
<tr>
<td>1926</td>
<td>6</td>
<td>---</td>
<td>---</td>
<td>150</td>
<td>350</td>
<td>---</td>
<td>Kay Development Co.</td>
</tr>
<tr>
<td>1928</td>
<td>1</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>100</td>
<td>Kay Development Co.</td>
</tr>
<tr>
<td>1931</td>
<td>2</td>
<td>150</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>Horseshoe Copper Co., Ltd.</td>
</tr>
</tbody>
</table>

*Number of men employed was not reported.

Lessees Whitney and Anderson shipped ore from the Horseshoe in 1937. The mine was operated from 1937 to 1951, and ore was shipped every year except 1942. The Horseshoe shipped 78 tons of zinc-lead ore in 1943, 252 tons of zinc-lead ore in 1944, 175 tons of silver-lead ore in 1945, and 244 tons of lead ore in 1946. In 1950, the mine shipped 75 tons of lead smelting ore. A small quantity of lead ore was produced from the mine by Ira C. Lambert and V.A. Anderson in 1954.


According to Nelson and Ross (1968), the mine was developed on six levels, of which the deepest was the 350 level. In 1929, the lower levels and most of the stopes were filled with water (Ross, 1930). The property was examined in 1955 for a DMEA loan, but no contract was awarded. The two adits on the property were about 875 and 1,225 feet long. Workings on the four lower levels, reached through a 350-foot shaft, totaled about 1,500 feet (McHugh and others, 1991).

Production from 1916 through 1978 was 13,916 tons of ore which yielded 108 ounces of gold, 149,461 ounces of silver, 37,350 pounds of copper, 4,186,963 pounds of lead, and 446,014 pounds of zinc. In 1979 the mine shipped 2,900 tons of ore, which averaged 3.8 percent copper and 12 percent zinc, to the Empire mill. Work in the late 1980s exposed a body of sulfide ore containing 12-14 percent zinc, 5-6 percent lead, and 0.7-1.0 ounce per ton of silver (McHugh and others, 1991).
Figure 25. Workings of the Horseshoe Mine (Figure 3 from The Alder Creek Mining District in Ross, 1930).
WHITE KNOB GROUP

The White Knob Group (not to be confused with the earlier White Knob Mine that became the Empire) was named after the company formed in 1919 to operate the mine. The main claims in the group were the Homestake, Copper Queen, and Blue Bell, which were located in Rio Grande Canyon about half a mile northwest of the main workings of the Empire Mine (Figure 2). The first record of the property was in 1909, when a small shipment of ore was made from the Homestake. The Homestake also produced ore in 1911. Both the Homestake and the Copper Queen were credited with producing "carbonate lead ore" in 1915. In 1916 the two claims shipped about 60 cars of lead ore, and in 1917 production averaged nearly 1,000 tons a month.

In the early part of 1918, the property was bonded by the United States Smelting, Refining & Mining Co., of Salt Lake City, Utah. Several thousand tons of oxidized lead ore was produced during the year.

The White Knob Mining Company (controlled by United States Smelting, Refining & Mining Co.) was organized in 1919. The mine was idle that year but shipped a "large" amount of ore in 1920. Production for 1921 was greatly reduced from that of the previous year. The mine had 5,000 feet of underground workings. The company did 800 feet of development work during the year. (See Table 8 for development work done at the mine.)

The mine, operated mostly by lessees, shipped ore every year from 1922 to 1929. The White Knob shipped nearly 2,000 tons of oxidized lead ore to the smelter at Midvale in 1923. The mine shipped several hundred tons of oxidized lead ore in 1924. Shipments were somewhat smaller in 1925, but lessees located important new ore reserves. Several cars of oxidized lead ore were produced in 1926, but shipments for 1927 to 1929 were one about one carload per year. In 1928, the mine had two tunnels, one shaft, twenty-two raises, six cross-cuts, and seven drifts. The No. 1 tunnel was 1,100 feet long, the No. 2 tunnel was 900 feet long, and the shaft was 250 feet deep. The mine had a 40-horsepower gasoline hoist.

Lessees worked the mine and shipped at least some ore every year from 1937 to 1943. In 1938, the company did 347 feet of development work on the new No. 3 tunnel. The mine had one 1-ton ore car and 300 feet of track, which were used by the lessees. The company described the hoist as a 16-horsepower Western gas engine, but went on to say that it was "Partly dismantled and not in use". Two lessees worked the mine in 1939.

Development work for 1940 included "Tunnels, 175 ft.; Sinking, 125 ft.; Drifting, 185 ft.; Raising, 55 ft." (IMIR, p. 132). The company's report to the Mine Inspector mentioned two new tunnels. The No. 4 tunnel was 100 feet long, and the No. 5 tunnel was 75 feet long. Twenty feet of work was done on the No. 6 tunnel in 1942, and 50 feet were driven on the new No. 7 tunnel in 1943.
Table 8. Development work and number of men working at the White Knob Mine.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Men employed</th>
<th>Tunnels (feet)</th>
<th>Sinking (feet)</th>
<th>Cross-cutting (feet)</th>
<th>Drifting (feet)</th>
<th>Raising (feet)</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1921</td>
<td>7</td>
<td>800</td>
<td>150</td>
<td>650</td>
<td>---</td>
<td>---</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1938</td>
<td>4</td>
<td>347</td>
<td>6</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1940</td>
<td>4</td>
<td>175</td>
<td>125</td>
<td>---</td>
<td>185</td>
<td>55</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1941</td>
<td>4</td>
<td>---</td>
<td>50</td>
<td>---</td>
<td>130</td>
<td>175</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1942</td>
<td>3</td>
<td>20</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1943</td>
<td>8</td>
<td>50</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1946</td>
<td>3</td>
<td>---</td>
<td>30</td>
<td>145</td>
<td>190</td>
<td>---</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1947</td>
<td>9</td>
<td>---</td>
<td>33</td>
<td>259</td>
<td>310</td>
<td>---</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1948</td>
<td>18</td>
<td>330</td>
<td>100</td>
<td>---</td>
<td>175</td>
<td>---</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1949</td>
<td>20</td>
<td>---</td>
<td>150</td>
<td>---</td>
<td>790</td>
<td>---</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1950</td>
<td>11</td>
<td>---</td>
<td>100</td>
<td>---</td>
<td>591</td>
<td>---</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1951</td>
<td>4</td>
<td>---</td>
<td>8</td>
<td>---</td>
<td>191</td>
<td>56</td>
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</tr>
<tr>
<td>1952</td>
<td>2</td>
<td>---</td>
<td>42</td>
<td>---</td>
<td>136</td>
<td>---</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1953</td>
<td>2</td>
<td>---</td>
<td>27</td>
<td>---</td>
<td>25</td>
<td>---</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1954</td>
<td>2</td>
<td>---</td>
<td>24</td>
<td>---</td>
<td>76</td>
<td>45</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1955</td>
<td>2</td>
<td>62</td>
<td>14</td>
<td>---</td>
<td>---</td>
<td>30</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1961</td>
<td>2</td>
<td>71</td>
<td>---</td>
<td>---</td>
<td>50</td>
<td>30</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1962</td>
<td>2</td>
<td>---</td>
<td>15</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>White Knob Mining Co.</td>
</tr>
<tr>
<td>1964</td>
<td>2</td>
<td>---</td>
<td>35</td>
<td>---</td>
<td>15</td>
<td>---</td>
<td>White Knob Mining Co.</td>
</tr>
</tbody>
</table>

1*Number of men employed* includes lessees. For most years, development work was done entirely by lessees.
2Total development work for the year.
3Combined figure for sinking and raising.
4Combined figure for cross-cutting and drifting.
5Mine was inactive from 1930 to 1937. Number of workers and amount of development not reported for years that mine was active between 1921 and 1938.
6Number of lessees working the mine was not reported.
7Development work for the year also included an open cut 225 feet long and 15 feet wide, ranging in depth from zero to 20 feet deep.
8Development work for the year also included work on the open cut. Dimensions were increased to 275 feet in length, and 50 to 70 feet wide at the top and 25 to 40 feet wide at the bottom.
9Development work for the year also included 50 feet of work on an open cut.
In 1942, lessees at the White Knob shipped 2,109 tons of crude zinc ore to the International slag-fuming plant at Tooele, Utah, between January and July. They also shipped 46 tons of silver-lead ore to a smelter.

The mine was idle in 1943 and 1944 but made a small shipment in 1945. The Homestake was the most important producer in the district in 1946. The mine shipped 5,605 tons of ore to a lead smelter where the gold, silver, and lead were recovered. The hot slag was then fumed to recover the zinc. In addition, 171 tons of silver-lead ore was shipped directly to a lead smelter. Development work for the year, done by lessees, consisted of 30 feet of sinking, 145 feet of cross-cutting, and 190 feet of drifting.

In 1947, the mine produced 4,979 tons of lead-silver ore and 1,680 tons of zinc ore. Production for 1948 was 5,082 tons of lead-silver ore and 711 tons of zinc ore. An average of 18 lessees worked the mine. Output for 1949 was 3,171 tons of lead-silver ore and 405 tons of zinc ore. Shipments of ore were also made in 1950, 1951, 1952, and 1954. In 1951 mine equipment included an 8x10" M&S steam hoist and a Gardner-Denver portable air compressor and air receiver. Lessees Myron and Curt Fullmer shipped lead ore to the Midvale, Utah, smelter in 1954.

According to the company, lessees worked the mine in 1955, but no ore was shipped. The mine was idle from 1956 to 1959. Lessees operated the mine from 1960 to 1969. Small shipments of ore were made in most years, although only assessment work was done for 1965 and 1966. Reports for the years after 1969 either list the mine as idle or mention that assessment work was done for the year. The 1974-1975 IMIR listed UV Industries as the controlling company for White Knob Mining Co. (replacing U.S. Smelting & Refining).

U.S. Geological Survey records show an application was made to the Defense Minerals Exploration Administration for assistance in exploring the Copper Queen. The application was not successful.

Total production for the mine between 1909 and 1968 was 51,501 tons of ore. From this 409 ounces of gold, 295,300 ounces of silver, 252,274 pounds of copper, 9,455,350 pounds of lead, and 3,436,438 pounds of zinc were obtained.

References


The diameter and stroke, in inches, of the piston which powered the hoist.
Idaho Geological Survey's mineral property files (includes copies of company reports to the Idaho Inspector of Mines).


