A Business History of the Copper Industry of Utah, 1860-1910

Gary Barker Hansen
A BUSINESS HISTORY OF THE COPPER INDUSTRY

OF UTAH, 1860-1910

by

Gary Barker Hansen

A thesis submitted in partial fulfillment
of the requirements for the degree
of
MASTER OF SCIENCE
in
Economics

Approved:

UTAH STATE UNIVERSITY
Logan, Utah
1963
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Significance of Nonferrous Metal Stages of Development Source Material</td>
<td></td>
</tr>
<tr>
<td>II. PIONEER PERIOD, 1860-1895</td>
<td>8</td>
</tr>
<tr>
<td>Discovery of Copper Early Copper Mining Districts</td>
<td></td>
</tr>
<tr>
<td>III. EARLY SULPHIDE PERIOD, 1896-1910</td>
<td>19</td>
</tr>
<tr>
<td>The Birth of An Industry The Smelter Smoke Suit The Big Shake-up in Smelting</td>
<td></td>
</tr>
<tr>
<td>IV. THE PORPHYRY COPPERS, PART I</td>
<td>75</td>
</tr>
<tr>
<td>Boston Consolidated Mining Company Newhouse Mines and Smelters Ohio Copper Company</td>
<td></td>
</tr>
<tr>
<td>V. THE PORPHYRY COPPERS, PART II</td>
<td>129</td>
</tr>
<tr>
<td>Preliminary Investigations of Bingham Porphyries Formation of the Utah Copper Company Financing Expansion The Inauguration of Opencut Mining at Bingham The Absorption of Boston Consolidated</td>
<td></td>
</tr>
<tr>
<td>VI. THE UTAH COPPER COMPANY, 1910-1963: A SUMMARY</td>
<td>192</td>
</tr>
<tr>
<td>The Kennecott Copper Corporation Utah Copper Operations, 1910-1963 Utah Copper's Future</td>
<td></td>
</tr>
</tbody>
</table>
APPENDICES

A. The Dissonant Voice of Colonel Enos A. Wall ........................................ 207
B. Location of Important Copper Producing Districts ................................. 218
C. Chronological Outline of Utah's Leading Copper Companies ................. 219
D. Glossary of Technical Terms ................................................................. 222
E. Geological Origin of Bingham Porphyry Copper Deposit ......................... 224
F. Statistical Tables .................................................................................. 225

BIBLIOGRAPHY ....................................................................................... 240
PREFACE

Having a natural inclination and interest in history, and especially American history, this writer found it very enjoyable to seek out a history-oriented thesis problem. While doing research on the history of the lead-zinc mining industry in Utah, I became aware that very little had been written on the history of nonferrous mining and smelting in Utah. The few available descriptive accounts were either out of date or too general to be of great importance. Most of the published material about Utah’s mining industry was in the form of technical government publications or Chamber of Commerce pamphlets which extolled the virtues of the industry. Little had been written about Utah’s copper industry, though it has been the most important extractive mineral industry in the state, and one of the most important industries in Utah. Therefore, on the eve of the Utah Mining Centennial "A Business History of the Copper Industry of Utah" was thought to be a timely and significant subject. The wealth of material uncovered made it essential to conclude the thesis with the year 1910.

To those who have aided in bringing this project to fruition, I extend my gratitude and appreciation. Dr. Leonard J. Arrington, my thesis director, gave many hours of his time to guide the research and writing of this paper. His patience in answering many questions and the helpful suggestions which he offered throughout were invaluable in improving the quality of the product—and more important, in teaching me the rudiments of research and writing.
The University Research Council, especially Dr. D. Wynne Thorne, and the Graduate Council, particularly Dean J. Stewart Williams, granted a University Research Fellowship which provided the financial support which made this project possible.

Others who assisted materially were Mr. John H. Klas, public relations director for the Utah Copper Division of Kennecott Copper Corporation, and members of his staff. They graciously allowed me access to materials in the possession of the corporation and provided statistical information which would have been unobtainable otherwise. In addition, my thanks and appreciation to Dr. Everett L. Cooley, director of the Utah State Historical Society; library personnel at the three major Utah universities and the Historical Society; my graduate committee, Professor Evan B. Murray, Professor Reed R. Durtschi, Professor Brigham D. Madsen, and Professor Donald W. Dobler.

Finally, to Helen Ure Hansen, for her patience and encouragement in seeing this through to completion and for her secretarial assistance, I extend a husband's gratitude.
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Copper Production in Utah, 1870-1905</td>
<td>49</td>
</tr>
<tr>
<td>2. Metals Production at the Cactus Mine, 1905-1914</td>
<td>110</td>
</tr>
<tr>
<td>3. Copperton Plant, Utah Copper Company, Metallurgical Results, 1905-1910</td>
<td>150</td>
</tr>
<tr>
<td>4. Utah Copper's Potential Ore Reserves</td>
<td>204</td>
</tr>
<tr>
<td>5. Mine Production and Value of Copper in Utah, 1865-1961</td>
<td>225</td>
</tr>
<tr>
<td>6. Ore, Waste, and Copper Production, Utah Copper Mine, 1904-1962</td>
<td>228</td>
</tr>
<tr>
<td>8. Production of Molybdenite, Utah Copper Mine, 1937-1962</td>
<td>231</td>
</tr>
<tr>
<td>9. Utah Copper Company: Per-Ton Costs of Mining and Milling Ores, 1910-1933</td>
<td>232</td>
</tr>
<tr>
<td>10. Utah Copper Company: Per-Pound Cost of Producing Copper, and Per-Pound Sale Price, 1907-1933</td>
<td>233</td>
</tr>
<tr>
<td>11. Utah Copper Company, Production of Gold and Silver, 1908-1938</td>
<td>234</td>
</tr>
<tr>
<td>12. Utah Copper Company Expenditures for Fixed Assets by Years, 1904-1931</td>
<td>235</td>
</tr>
<tr>
<td>13. Kennecott Copper Corporation - Utah Copper Division, Expenditures for Fixed Assets by Years, 1932-1961</td>
<td>236</td>
</tr>
<tr>
<td>14. Total Employment, Utah Copper Division, Kennecott Copper Corporation</td>
<td>237</td>
</tr>
<tr>
<td>15. Kennecott Copper Corporation, Utah Copper Division, Average Rate Per Shift and Total Payroll, 1904-1962</td>
<td>238</td>
</tr>
</tbody>
</table>
# LIST OF ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Location of Important Copper Producing Districts in Utah</td>
<td>218</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

Significance of Nonferrous Metals

Historically, those communities or nations which are generously endowed with natural resources, and have the necessary skills to practice the liberal and useful arts, have become the most advanced civilizations. Furthermore, "of all the resources which are basic to civilization, the possession and utilization of minerals must be placed first."

It would be difficult to estimate the over-all importance of the nonferrous metals industry (gold, silver, copper, lead, zinc) in helping America to become a great civilization. However, if it were possible, it would be considerable indeed. As Utah has been an important non-ferrous mineral producing state for over 100 years, her contributions in helping America become a great civilization are unquestionable.

In Utah, as elsewhere, the early prospectors were primarily seekers after the so-called precious metals—gold and silver. They looked for free gold in the sand and gravel of many mountain streams, particularly in Bingham Canyon. When little was forthcoming, they proceeded to use more extensive hydraulic placer methods, spraying streams of water on gold-bearing soil. Later, when these efforts proved fruitless, they

---

1 Robert Strong Lewis, Mining, The Priceless Heritage (Salt Lake City: Extension Division, University of Utah, 1949), p. 9.
searched out quartz veins and more complex ores. What little success they may have encountered necessitated the adoption of some forms of surface and underground mining, and perhaps even milling and metallurgical techniques, in order to separate the gold from the ore in which it was contained.

Coeval with the search for gold, the early prospectors in Utah carried their search for silver to the hills and ravines throughout the territory. They eventually located outcroppings and veins of silver-bearing ore, the recovery of which required some form of mining activity. Rather than being abundantly located in a free condition, silver is normally found mixed with several other ores, usually lead, copper, and zinc, in either oxide or sulphide ores—the former close to the surface and the latter usually at greater depths. Because of this, the mining of silver became involved and soon required the complementary processes of milling and smelting in order to recover the metal content of the ores.

Thus, out of this search for gold and silver came the discovery of the industrial or base metals—lead, copper, and zinc. Notwithstanding their accidental or incidental discovery, these latter metals laid the foundation of the great nonferrous metals industry in Utah. Ultimately, they made a greater contribution to the economy of the state than either gold or silver. Today, copper is the most important nonferrous metal used in modern industry, with lead and zinc next in importance.

1 Oxide ores are located near the surface where the oxygen combines with the minerals. Sulphide ores are located deep in the ground, and are mixtures of sulphur and the metals.

Without these metals, many of America's most important industries would be without their primary source of raw materials.

In Utah, the production of copper had its start in the 1860's and grew steadily, though it remained in the shadow of gold and silver until the last decade of the nineteenth century. The accidental discovery of copper when searching for gold in 1896 led Samuel Newhouse to inaugurate copper mining and smelting in Utah. From the humble beginning of 1896 copper rose rapidly in importance until by 1905 its production exceeded the other nonferrous metals in value. Since 1905, the production of copper has been the most important mineral produced in Utah.

In tracing the development of Utah's copper industry from its earliest beginnings in 1860 to the present day, the present study seeks to portray in microcosm the evolution of the copper industry from the days of the individual prospector, through the era of mergers and consolidation, to today's large efficient industrial enterprise. Thus, the study attempts to give some insight into the evolution of industrial enterprise in Utah, and to graphically establish the relationship between the local mining economy and that of the nation as a whole. Such a relationship has existed throughout the entire period of the study because of the necessity of importing large amounts of capital from outside the region to develop and exploit the resources, and because of the national character of the markets to which the copper was exported.

Stages of Development

In the 100 years covered by this study, the history of copper mining and smelting in Utah may be said to have passed through three main periods or stages of development:
I. THE PIONEER PERIOD, 1860-1895, which began about 1860 with the first reported discovery of copper ore and continued until 1895. It was characterized by the initial discoveries of copper-bearing ores in many districts of the territory. These ore deposits were low grade—hardly rich enough to merit working—and their discoveries came at a time when economic and technological factors were unfavorable to extensive exploitation. Not as easily smelted as Utah's lead ores, and not in extensive demand because the electrical industry had not yet been born, copper remained essentially a "nuisance metal" until near the end of the period. This period is described in Chapter II of the thesis.

II. THE SULPHIDE PERIOD, which began in 1896 when the first of many discoveries of large quantities of moderately rich and low-grade sulphide copper ores were discovered at Bingham Canyon. The period lasted until about 1910, although vestiges remained for several years longer. During this period a profitable copper mining industry was established in Bingham Canyon and an extensive nonferrous smelting industry in the Salt Lake Valley. The period also featured the consolidation of many small mining ventures into larger companies by merger, absorption, and destruction. The new companies brought order to the industry and were large enough to attract or acquire the capital necessary to profitably exploit the copper deposits. The Sulphide Period is described in Chapter III of the thesis.

III. THE PORPHYRY PERIOD, which got under way in 1903 (thereby overlapping the Sulphide Period), was characterized by the exploitation of the porphyry copper deposits in Bingham Canyon and Beaver County by fewer than half a dozen companies. The history of the Utah Copper Company, the most important of the group, is a classic example of the
development of a capitalistic enterprise—from a small individual proprietorship, owner-managed and operated, to a huge industrial corporation with tremendous economic power and financial resources. For purposes of convenience the Porphyry Period has been divided into two chapters. Chapter IV discusses the corporate histories of the Boston Consolidated Copper and Gold Mining Company, Limited, Newhouse Mines and Smelters, and the Ohio Copper Company. All three companies were engaged in porphyry copper mining near the beginning of the period. Chapter V deals exclusively with the Utah Copper Company and its successor, the Kennecott Copper Corporation. In Chapter VI a brief summary is given outlining the important events in Utah's porphyry copper industry between 1910 and 1963.

Source Material

For source material the writer has depended heavily on publications by the federal government. Those found to be especially useful because of the wealth of information and statistics which they contain were the Mineral Resources of the United States, 1883-1934, and its successor, Minerals Yearbook, 1935 to date, which contains annual detailed reports and statistics on mines and mining in each state. In addition, there are several excellent technical publications by the United States Geological Survey which deal with the economic geology of several of the mining districts. These include Economic Geology of the Bingham Mining District, Utah, by John W. Boutwell; Geology and Ore Deposits of the San Francisco and Adjacent Districts, Utah, by B. S. Butler; and Ore Deposits of Utah, by B. S. Butler, G. F. Loughlin, V. C. Heikes et al. Another useful
government publication was the Annual Report of the Secretary of the Interior, especially for information on mining between 1880 and 1896.

Other important sources used were The Salt Lake Tribune, Deseret News, and the Engineering and Mining Journal, all of which contained good accounts of the events which transpired in the mining and smelting industry. The Copper Handbook, published by Horace Stevens, and its successor, Mines Register, is a good series of publications which dealt with copper mining from 1900 to 1930, and all nonferrous mining thereafter. It contains a wealth of information about the activities of mining companies during their formative years. Also useful was The Mineral Industry, Its Statistics, Technology and Trade—a yearly publication which chronicled many of the events in mining during the first years of this century.

Of the several published monographs, the most helpful in providing information about the Porphyry Period, and especially the Utah Copper Company were: The Porphyry Coppers, by A. B. Parsons, and its sequel by the same author, The Porphyry Coppers in 1956. Two books by T. A. Rickard, The History of American Mining and The Utah Copper Enterprise, were also useful in obtaining information about the Utah Copper Company. These four books, it should be said, were quite sympathetic to the company.

Two unpublished theses were also of value. "The Economic and Social History of Bingham Canyon, Utah, Considered with Special Reference to the Mormon-Gentile Synthesis," by George Addy, at the Brigham Young University Library, has a good treatment of the early pioneer period of mining at Bingham and contains much useful information, though general, about the
copper industry. Another thesis, at the University of Utah Library, by Gibb R. Madsen, "The Economic Factors Affecting the Development of the Copper Industry in Utah," contains a good deal of useful information about the technical processes employed by Kennecott Copper Corporation today and discusses in some detail the economic factors affecting the industry.
CHAPTER II

PIONEER PERIOD, 1860-1895

Discovery of Copper

The presence of copper, the lustrous red metal which would someday become the most important mineral produced in Utah, was evident from early pioneer times. On May 9, 1860, the Deseret News carried an article announcing the presence of copper in Utah Territory:

We have recently been presented with a specimen of virgin copper found in Cedar County, some ten or twelve miles from Camp Floyd, which those well versed in mineralogy, to whom it has been exhibited pronounce equal to the best they have ever seen.

If it exists in that vicinity, as alleged, in any considerable quantities, it would probably pay well for working, if any felt disposed to engage in such an enterprise, but in these days gold is the principal thing sought after, and a man who would engage in copper mining in an inland country like this, might by some, be considered in a state of insanity.

Nearly 40 years would pass before these prophetic words were invalidated completely.

In 1862, John Lowder, an early Utah pioneer, was reported to have gone into Bingham Canyon to get out "some special kinds of logs" to be used in the making of furniture for Governor Harding.

One day while he and his companions were returning to their camp, they saw what looked to them like copper in a creek bed. They got some out and the next morning decided

---

1 Cedar County was created from Utah County in 1856 and comprised essentially what is known today as Cedar Valley. The county was returned to Utah County in 1862. See James B. Allen, "The Evolution of County Boundaries in Utah," Utah Historical Quarterly, XXIII (October 1955), 268-70.
to look for signs of copper ore which they found on the side of the mountain. When their job was finished they returned to Salt Lake City and turned the samples over to an assayer who was supposed to test it.¹

Unfortunately, Lowder was never able to capitalize on his discovery. A short time later, he was called by Brigham Young to be a Pony Express rider between Salt Lake City and San Bernardino, California. By the time he returned the ground had already been filed upon.

The next mention of copper awaited the arrival of Colonel Patrick E. Connor and the California Volunteers in October 1862. Among the first discoveries made by Connor and his men, as they prospected the surrounding mountains, were several deposits of copper. In a communication to higher headquarters at San Francisco shortly after the initial discoveries, Connor announced:

Already reliable reports reach me of the discovery of rich gold, silver, and copper mines in almost every direction... Within a distance of from twenty-five to fifty miles of this city [Salt Lake City], in the East and West mountains, mines have been discovered yielding, with imperfect tests, rich indications of silver, and largely charged with lead and copper ores.²

Nevertheless, the departure of the Volunteers at the close of the Civil War left the Utah mineral prospects relatively untouched. It was not until June 1868, just prior to the completion of the transcontinental railroad, that the first carload of copper ore from Bingham Canyon was hauled to Uintah, Utah, by the Walker brothers and shipped to Baltimore.³

¹Kate B. Carter (ed.), Treasures of Pioneer History (6 vols.; Salt Lake City: Daughters of the Utah Pioneers, 1952), I, 164.
A second shipment containing 10 tons of copper ore mined from the Kingston Mine at Bingham Canyon was shipped out of the territory on July 31, 1869 by the Woodhull brothers.¹

Early Copper Mining Districts

**Lucin District.** In 1870, copper was discovered in the Lucin District, in western Box Elder County on the Utah-Nevada border. On Copper Hill, native copper, in large lumps, was found on the surface of the ground.² When galena was found in considerable quantities a short time later, copper mining was neglected until 1886. The copper properties—the most important being the Copper Mountain Mine—were worked from 1886 to 1893, at which time they were sold to the Salt Lake Copper Company.

This company proposed the construction of a copper refining and smelting plant on the northern outskirts of Salt Lake City; a plan which was heralded as "the largest industry in Utah and the finest and most complete plant of its kind in the world."³ The venture was so well publicized that the citizens of Salt Lake City contributed a bonus of $100,000 for the purchase of land and the construction of the smelter.

The plant was built at a cost of $600,000, and completed in the spring of 1894. Butler says that the plant operated for a short time, having shipped 2 carloads of fine copper out of the territory—the first

¹Edward L. Sloan (ed.), *Gazetteer of Utah and Salt Lake City Directory* (Salt Lake City: Salt Lake Herald Publishing Co., 1874), p. 185. Sloan says this was the first shipment of copper ore made from the Utah Territory.

²Ibid.

³Deseret News, December 17, 1904.
such shipment of refined copper made from Utah.\(^1\) A conflicting story is given by the *Deseret News*, on December 19, 1903, which said that the plant never operated and that it was a complete failure. Experts who investigated it "declared that it could never be a success with the equipment provided."

In either case, by the end of 1894 the company was heavily in debt and passed into the hands of receivers. The entire property was later sold to the Lewisohn brothers of New York City. They spent some money rearranging the equipment for better use, but never operated the smelter. They did, however, continue to work the mining properties in the Lucin District until the second decade of the twentieth century. It is estimated that 1,675,200 pounds of copper were produced in the Lucin District from 1870 to 1905, with a total value of $237,835. Peak production was reached between 1906 and 1913, when 12,027,418 pounds of copper were produced, having a value of $1,767,346.\(^2\)

**Tintic District.** Contemporary with the discovery of ore at Lucin, copper was discovered in the Tintic District in Juab County. In 1870, the Mammoth Mine was discovered, and in 1871 it passed into the hands of the British controlled Mammoth-Copperopolis Company. The mine was reported to have contained mainly copper ore, running from 10 to 80 percent, and which was "easily smelted."

\(^3\) A large amount of copper ore was shipped to England, then in 1873 a 15-stamp mill and two copper

---


\(^2\)Ibid.

smelting furnaces were erected 7 miles south of the mine. The smelter operated steadily for several months and made intermittent runs until late in 1873 when the company failed and the property was sold for debt. It was later redeemed by Lord Hamilton, who formed the British Tintic Mammoth Mining Company, Limited, in the fall of 1878. The new company operated the property intermittently until 1880 when it became idle. During the 10-year period over 5,000 tons of copper ore were reportedly shipped. ¹

A second mine in the Tintic District, the Crismon-Mammoth, was also an important early copper producer. The mine was located in 1870 and was worked as a copper mine until 1875 when silver was discovered. It continued as a copper-silver producer until 1880. When this mine was visited by D. B. Huntley (a government investigator) in September 1880, ten men were employed. They were hauling the ore from the mine to the company’s mill by four- and six-horse teams at a cost of $4.50 per ton. During that year, 3,448 tons of ore were mined. Prior to 1874 the mine was estimated to have produced copper valued at from $50,000 to $75,000; between 1874 and 1880 about $30,000 worth of copper was produced. ² At the time of Huntley’s visit to the Tintic mines, in September 1880, most of them were hauling their ore to Santaquin, 20 miles distant, a station on the Utah Southern Railroad. From here it was shipped by rail to the smelters at Sandy. ³


²Ibid. Huntley made a special report on the mining industry in Utah for inclusion in the Tenth U.S. Census (1880).

³Ibid.
After 1880, many additional mines in the Tintic District came into production as large copper producers. Among the more important were the Centennial-Eureka, Carissa, Victor, Ajax, and Grand Central. Most of the ores mined in the Tintic District were complex in makeup, and the copper produced by many of them came as an adjunct to the silver-lead and gold ores.¹

**Beaver County Districts.** In the northwest corner of Beaver County the Beaver Lake District was organized in August 1871, after the discovery of a belt of copper veins said to be from an inch to 2 feet in width. According to Huntley, "some work was done in 1872 and 1873, and a few tons of ore were shipped assaying 30 percent copper, 17 ounces silver, and $12 gold."² In 1873 the Riverside smelter was erected 7 miles north of Milford to work the copper ores from the district. After producing a few tons of copper matte and some lead bullion, it was shut down and abandoned. (Copper matte is a crude mixture of sulphides formed in smelting sulphide copper ores that contains about 40 percent copper.) In the nearby Rocky District, organized in 1872, some copper ore was mined and shipped prior to 1880. Taken together, the Beaver Lake and Rocky Districts produced 931,000 pounds of copper between 1870 and 1902.³

Copper was also discovered in the San Francisco and Pruess Districts of Beaver County during the 1870's. Several claims were worked during

¹Butler et al., *Ore Deposits of Utah*, pp. 405-10.
²Ibid., p. 474.
³Ibid., p. 505.
the decade, primarily those located in Copper Gulch, although their output was insignificant prior to 1880. The most important claims of the group were the Comet, Cactus, and Copper Chief. It was not until 1896 that serious and productive copper mining activity commenced in these districts.1

Washington County. Several early copper deposits were located in Washington County and northern Arizona in the 1870's.2 As early as 1874, the prospectors had known that the West Mountain Range, about 10 miles west of St. George, was rich in copper. No serious attempt was made until the mid '80's, however, to develop the prospect. Several St. George residents worked the mine, known as the Apex or Dixie, between 1884 and 1888. During that time it was reported to have shipped 300 tons of copper ore out of the district.3

Between 1889 and 1891 the owners of the Dixie mine are said to have received $300,000 for ore and bullion shipped to Swansea, Wales, and Denver, Colorado. In 1891 they erected a small smelter at St. George and produced bar copper. For more than 3 years they consigned

1Huntley, "Mining Industries," p. 471.

2R. W. Raymond reported in 1875 a mine known as the Grand Gulch copper mine, located 40 miles south of St. George and 15 miles north of the Colorado River in Arizona. He said that it was being worked by St. George residents, who had in 1875 erected a copper furnace near St. George on the Virgin River for the treatment of copper ore from the mine. However, it was abandoned shortly after completion. The mine was later reported as having been leased to men from Salt Lake City in 1877. These individuals produced 10 tons of copper bullion in a shaft furnace. R. W. Raymond, Statistics of Mines and Mining in the States and Territories West of the Rocky Mountains for 1875 (Washington: Government Printing Office, 1877), p. 281; Huntley, "Mining Industries," p. 483.

3The original owners included John Pynn, James Andrus, Thomas Judd, William Lund, S. L. Adams, and several other residents of St. George. Engineering and Mining Journal (hereafter referred to as EMJ), March 21, 1891; Butler et al., Ore Deposits of Utah, p. 596.
considerable numbers of wagon teams with bullion from their smelter to
the railroad at Milford, 154 miles distant. From 1894 to 1899 the
smelter remained inactive, whereupon it was reactivated and produced 8
to 20 tons of blister copper per month. Copper production for the
district prior to 1887 amounted to 300,000 pounds with a value of $41,400.
From 1890 to 1894 it amounted to 1,784,065 pounds, valued at $209,606.¹

Drum District. In central Utah the Drum Mining District was
organized in the fall of 1872. It was abandoned shortly thereafter and
was later reorganized as the Detroit District in 1879. Some copper was
mined during the 1880's, and a small smelter constructed at Abraham in
1888 produced 130,000 pounds of copper bullion, which was said to have
been the largest quantity of copper bars up to that time produced in
Utah. Subsequently, the smelter was destroyed by fire.²

Carbonate District. In the early 1880's copper was discovered in
Uintah County, near Vernal. By 1887 L. P. Dyer and others had located
the Ace, Antietam, and other claims, most of which were patented as the
Dyer group. Prior to 1890, some ore was hauled by ox teams to the
Carter Station on the Union Pacific in Wyoming. In 1890 the claims
were jumped by two men, Billie Haws and Heber Timothy, and sold by them
for $10,000. After a court case which went all the way to the Supreme
Court, the property was returned to the original owners. The Uintah
Copper Summit Company, which operated the property, produced about 400
tons of copper glance, prior to 1897. The ore assayed an average of

¹Ibid.
²Butler et al., Ore Deposits of Utah, pp. 463-64.
49.5 percent copper, 26 ounces of silver and $6 in gold per ton. Between
1897 and 1899 about 200 tons of ore was shipped. In October 1899 the
company erected a small blast furnace and operated the mine and smelter
for the next 2 years. The ore and bullion shipped was hauled to Price,
Utah, and Carter, Wyoming. The deposits were exhausted in 1901, and the
plant shut down in October 1901.¹

West Mountain District. In Bingham Canyon several copper mines were
in operation prior to 1880. Chief among the claims were the What Cheer,
Hickman, Murphy, Kingston, and Washington. (As mentioned earlier, one of
the first shipments of copper ore came from the Kingston.) According to
Huntley, who visited the district in 1880, all of these mines were "small
veins in quartzite, from 3 inches to 4 feet wide containing azurite and
malachite at the surface, and sulphides of copper and iron at the water
line. Traces of silver and gold are also found."²

The What Cheer had been located in 1873, and worked for 2 years with
a considerable quantity of ore and concentrates being shipped during that
time. The ore ran in places from 10 to 12 percent copper. At the
Hickman lode, $6,000 worth of copper ore was collected from the surface
deposits. In addition, Huntley mentioned the "very considerable quantity
of copper daily running down the canyon" in the streams of water and said
that no attempt had been made to save it as yet.³

¹Butler et al., Ore Deposits of Utah, pp. 601-02. Also Carter,
Treasures of Pioneer History, I, pp. 193-94. This source is at variance
with Butler concerning some of the details and gives the date of the
smelter operation as being from 1889 to 1891.
³Ibid.
Aside from the several mines mentioned above, and perhaps a few others, most of the copper produced during the decades of the '70's and '80's came as a by-product of the lead-silver ores then being mined. From 1870 to 1880 production of copper never exceeded a million pounds annually, and during some years was considerably less.

Most of the copper mined during the 1870's and early 1880's, especially the richer ore, was shipped out of the territory in the form of nonferrous ores, with the remainder (approximately one-third in the late 1880's) as bullion and matte. The majority of the bullion and matte was smelted at the three major custom Salt Lake Valley smelters: the Germania, Mingo, and Hanauer, which were constructed during the 1870's to smelt the lead-silver ores of the territory. The Hanauer and Mingo works sold their matte to the Germania, which was equipped with copper converters and could reduce the matte to blister copper assaying about 90 percent copper.¹ Some ore from the Tintic District was also smelted in the furnaces of the Crismon-Mammoth Company, located in that district.

After remaining low for several years, the price of copper advanced slightly in 1887 and enabled many of the producers to resume activity at their mines. At the Mammoth Mine in the Tintic District the output increased to about 300 tons of copper ore per month, valued at $60 per ton. This ore, as it had in the past, was shipped to the Argo Smelting

Works in Denver, where it was used as a medium for the recovery of gold and silver.¹ Other Utah producers resumed shipments to the Salt Lake smelters.

The market for copper remained high until 1889 when the collapse of the French Copper Syndicate caused a decline in the price of copper from 16-5/8 cents to 10-1/2 cents per pound.² The industry struggled along until 1893 when the national financial crisis led to a reduction in the price of silver and lead as well. As a result, all of the non-ferrous mines in the West were hard hit, including the Utah copper producers. From 1893 to 1896 there was only minimum activity in the Utah copper mines—an interlude before the beginning of a new era.


²F. E. Richter, "The Copper Mining Industry in the United States, 1845-1925," Quarterly Journal of Economics, XLI (1926), 257-58. The French (or Secretan) Copper Syndicate operated during some 17 or 18 months from the fall of 1887 to the spring of 1889. They used a large manufacturing corporation which was itself a large consumer of copper to make contracts with the leading producers of the world for the entire output of the latter for varying periods up to 3 years at specified prices. They were said to control from 175,000 to 200,000 tons of annual production, including most of the large American producers. They were thus able to force up the price to 16-5/8 cents per pound in 1888, compared with a price of 11-1/4 cents in 1887. However, because of a fall in consumption due to the high prices and the failure to restrict production, copper piled up in the hands of the syndicate and led to its collapse in March 1889.
CHAPTER III

EARLY SULPHIDE PERIOD, 1896-1910

The Birth of an Industry

In addition to the rising demand for copper due to its use in the burgeoning electrical industry, the abrupt rise in the production of copper in the 1890's was directly related to the decline in the production of lead and silver. That decline was occasioned by the conjuncture of two factors: (1) The world price of silver declined due to the abolition of free coinage of silver in India (1893), the repeal of the Sherman Silver Purchase Act (1893) (under which the Treasury purchased 4,500,000 ounces of silver per month), and the Gold Panic of 1893; and (2) the readily accessible and easily reducible oxide and carbonate ores were exhausted, and the cost of mining was rising.

Production of lead and silver in Utah in 1894 was only half what it had been in 1890. In the West Mountain District, for example, the total value of minerals produced fell from $2,097,005 in 1890 to $1,133,242 in 1894.¹

It was evident to mine owners that alternative methods for obtaining profits from the mines would have to be developed if the industry was to survive. One such alternative was gold. In the West Mountain District, in the late 1870's and again in the 1880's, following the temporary exhaustion of known lead-carbonate bodies of ore, special attention had

¹Butler et al., Ore Deposits of Utah, p. 345.
been directed periodically towards the recovery of gold from these ores. By the close of 1882, four stamp mills had been erected for operation on ores from the Stewart and Old Jordan mines. Although a little gold was recovered, most of these efforts ended in failure.¹

By the middle of the 1890's, with the development of the cyanide process, it was hoped that a renewal of the gold mining activity might have a better chance of success. One such attempt at gold mining, that made by Samuel Newhouse and Thomas Weir, propelled copper mining and smelting into a position of immediate importance in Utah and the nation, and attracted the attention of William Rockefeller and "the Standard Oil crowd," and the Guggenheims, and led ultimately to the establishment of four Salt Lake Valley smelters which came to be controlled by giant corporations or "trusts": The American Smelting and Refining Company, the United States Smelting, Refining, and Mining Company, and the International Smelting and Refining Company which together exerted a controlling influence on Utah's developing copper industry.

**Utah Consolidated Gold Mines, Limited.** In January 1896, Thomas Weir came to Salt Lake City from Butte, Montana, to investigate the prospects of the gold mining activity then underway at Bingham Canyon.² Joining up with Samuel Newhouse, a local mining promoter, Weir set about


²Thomas Weir had formerly managed the AY and Minnie Mines at Leadville, Colorado, and the Granite Mountain in Montana. He was, at the time, a highly-respected mining operator. *The Salt Lake Tribune* (cited hereafter as *Tribune*), October 6, 1896.
gathering together some mining properties for Newhouse. ¹ By October 1896, he had secured bonds from the owners of a group of 10 claims in Bingham Canyon, embracing 75 acres of patented ground in Carr Fork, for the sum of $200,000. The most important claims in the group were the Highland Boy, Henry M., and Omaha. ²

Once the purchase of their claims was completed, Newhouse and Weir organized the Highland Boy Gold Mining Company. In order to raise capital to develop the newly-acquired properties, Newhouse went to London. His efforts to interest English capital in the venture were successful, and so, in October 1896, the Utah Consolidated Gold Mines, Limited, a British company, was organized in London with a nominal

¹Samuel Newhouse was born in New York City on October 14, 1853, a son of European Jewish immigrants who came to America in 1829. Mr. Newhouse became a lawyer, practicing in Scranton and Philadelphia, and was later lured West by the prospect of adventure and opportunity. He was active in the freighting business around Leadville until 1886 when he sold out his business and turned to mining. He was very successful in mining, becoming the owner of the Wheel of Fortune and other mines. Eventually, he sold out and moved to Denver where he became a promoter of various enterprises. At that time he also entered British financial and business circles, where he was widely known. He came to Utah because of the discrimination against Jews in Denver and also because of the opportunity which the mining field offered a man with his talents. Noble Warrum, History of Utah Since Statehood (3 vols.; Chicago-Salt Lake City: S. J. Clarke Publishing Co., 1920), III, 733-34; Harvey O'Connor, The Guggenheims: The Making of an American Dynasty (New York: Covici Friede, Inc., 1937), p. 279.

²EMJ, October 17, 1896, p. 374; Tribune, May 7, 1899. The Highland Boy claim, the most important in the group, was located in 1873 by James W. Campbell. It contained a vein of rich gold ore ($30 to $47 per ton) and also a small shoot of lead ore. From 1873 until 1896, little work had been carried out—just enough to keep up assessments. John M. Boutwell, Economic Geology of the Bingham Mining District, Utah (Washington: Government Printing Office, 1905), pp. 264-65.
capital stock of $300,000.1 Samuel Newhouse was elected president and Thomas Weir, general manager of the new company.2

The initial object of the company was to apply the newly-developed methods to extract the gold from the siliceous ores at the Highland Boy mine, which was originally said to contain about 50,000 tons of "low-grade rock," with an average value of $10 in gold and $1.50 in silver. "Thus in one sense," wrote the Engineering and Mining Journal, "the silver depression has been beneficial, by forcing attention toward other resources, and particularly toward gold mining, just as has been the case throughout all the Western mining regions."3

Development work on the property got underway in November 1896, under the direction of Thomas Weir. In order to process the ore produced, a contract was signed in May 1897 for the construction of a cyanide mill, of 100 tons-per-day capacity, for the treatment of the gold ores. The mill was to be completed the following August at a cost of $50,000. In addition, an aerial tramway was contemplated as a means of transporting the ore from the Highland Boy Mine to the new mill.4

Early in May 1897, shortly after the contract for the mill had been let, an event occurred which eventually revolutionized the entire

---

1 An American living in London, R. A. Wood, was hired to make an investigation of the Highland Boy property. He made an extensive report which resulted in the investment of British capital in the venture. Tribune, August 6, 1908.


3 EMJ, June 6, 1896, p. 538; October 17, 1896, p. 374; December 4, 1896, p. 665.

4 Tribune, January 1, 1898.
Bingham mining camp. Working in Tunnel No. 4 the miners discovered an ore channel carrying (per ton) $3.00 in gold, 2-1/2 ounces in silver, and 6 percent copper. As the work of exploration continued, on May 26, the face of No. 5 tunnel broke into an ore zone which showed 25 percent copper, and $2.40 in gold per ton. This was said to be "over threefold higher in copper than anticipated." "Bingham's gold-copper outlook is indeed bright," reported the Engineering and Mining Journal.1

While exploratory work in the lower levels of the Highland Boy Mine continued, work on the new cyanide mill proceeded. By the end of August it was ready for operation. Experimental runs at the mill were started on September 10 and continued during the next 2 months. These were declared a success. While the new mill had been designed exclusively to handle gold ore, and while production was started with this in mind, the exploration for copper was continued.2

By early December 1897 it became apparent that the "profit paying" copper ore in the sulphide zone below the zone of oxidation would be far more important than the gold ore above. The values in the reserves thus far blocked out exceeded those in the upper portions of the mine.

Had it been known what was below, in all likelihood the present mill would not have been built, for the oxidized ore is what is needed in smelting the pyritic products. The copper-gold ledge exposed in No. 4 tunnel was not cut until three days after the mill contract was signed.3

1EMJ, June 5, 1896, p. 582; May 22, 1897, p. 522.

2Tribune, January 1, 1898; EMJ, August 28, 1897, p. 258; November 13, 1897, p. 588.

3EMJ, December 4, 1897, p. 665. It should be noted that there were also several other versions given about the events which transpired in the discovery of copper ore at the Highland Boy Mine. T. A. Rickard
Shipments of copper ore were commenced in mid-1897, and during the remainder of the year the company shipped 2,100 tons of copper ore to the Salt Lake market.¹

Utah Consolidated's Highland Boy Smelter. The most important question confronting Newhouse and Weir after the discovery of the copper sulphide

(The Utah Copper Enterprise, San Francisco: The Mining and Scientific Press, 1919, p. 91) says that the cyanide mill ran for several months, but it was not a success, largely because the copper, which they had failed to take into consideration in their experimental work, interfered with the gold recovery, and caused an unusually large consumption of cyanide. After the mill proved a failure and the company's affairs reached the critical stage, Newhouse went to Denver to raise money to meet the delinquent payrolls. While there, he received a telegram from Weir informing him that ore containing 15 percent copper had been struck in a side tunnel. This is supposed to have saved the day.

Another version asserts that in the course of exploratory work in the zone of oxidation, a winze penetrated sulphide ore. This so alarmed the management that the winze was covered. Later, failing to develop a successful gold mine and the price of copper making it attractive, the winze was reopened and the discovery of sulphide copper ore announced. (Boutwell, Bingham District, p. 85.)

Although there may still be some question as to the exact sequence of events leading up to the discovery and exploitation of the sulphide ore deposits, this writer is convinced that the most likely version is that which is given in the text, using the Engineering and Mining Journal as authority. It should be quite apparent that the cyanide mill could not have been in operation prior to the discovery of the sulphide ore, which was announced in May 1897. As will be shown below, the transition from the production of gold to that of copper is more orderly than suggested by either Rickard or Boutwell.

¹Most of the early authorities, including Rickard and Boutwell, and nearly everyone who has written since, state that the first shipment of copper ore from the Highland Boy Mine, in the amount of 5,000 tons, was made in December 1896. This writer can find no record of any such shipment (or shipments) made at that time; and questions the validity of this statement for two reasons: (1) the development work in the mine did not commence until November 1896, and the discovery of copper ore was not reported until May 1897. It is doubtful that a 5,000-ton shipment of copper ore would have been made before the announcement of the discovery was made, without some notice or comment; (2) the annual chronicle of ore shipments in The Salt Lake Tribune gives no record of any shipments for the Highland Boy in 1896. During 1897, on the other hand, the mine is reported as having shipped 2,100 tons of ore, "with large shipments of copper ore of late." Tribune, January 1, 1897; January 1, 1898.
ore deposits was whether the expenses of mining and smelting these low-grade ores could be lowered to such a point that they could be worked at a profit. To investigate the matter further the two partners went to Montana in June 1898 to look at several nonferrous smelters to see if they could adapt them to the special needs of the Highland Boy ore. Returning to Utah, they decided to build a modern copper smelter especially adapted to their needs. On September 30 a contract was let for the construction of a "modern copper smeltery," to have a daily capacity of 250 tons of ore. It was to consist of 3 reverberatories, each with an 80-foot smokestack and dust chambers.¹ This was the first smelter erected primarily for the reducing of copper ores in Utah.

The site selected for the new smelter consisted of 56 acres of land at Murray, 10 miles south of Salt Lake City. It was located close to the Jordan River, about a mile southwest of the Germania smelter. Shortly after construction on the smelter commenced it was decided to build a lead-smelting addition of 300 tons-per-day capacity, which would also be completed at the same time the copper furnaces would be ready. The cyanide mill continued to operate until July 1898 when it was closed down in order to save the oxide ores from the upper portion of the mine for later use by the new copper smelter. During the period of operation from September 1897 to July 1898 the cyanide mill crushed and treated 20,000 tons of ore, most of this being in 1898.²

While the smelter was under construction, the company continued to make shipments of copper ore from the mine to the Germania custom smelter.

¹EMJ, July 9, 1898, p. 48; October 8, 1898, p. 439; October 29, 1898, p. 528.
²EMJ, November 26, 1898, p. 648; Tribune, January 1, 1899.
From the beginning of development work in the sulphide copper mine, in May 1897 up to December 1, 1898, the company shipped 4,174 tons of copper ore to the Germania smelter. The ore averaged 12.09 percent copper, 2.78 ounces silver, and $4.22 in gold values per ton. The company also had on hand in iron ore bins located at the mine 1,000 tons of ore containing 9 percent copper, and 6,000 tons of 5-percent copper ore located on the dumps of No. 4, 5, and 6 tunnels.  

In December 1898, still another ore body was tapped which assayed over 12 percent copper, $4.50 in gold, and 4 ounces in silver per ton. By the end of the year, 5 tunnels were being worked on the property. The company, continuing its policy of acquisition, had also added 18 more claims to its property, making a total of 235 acres of mineral land in Bingham Canyon.  

In the spring of 1899, about the time the final preparations were getting underway to begin smelter operations, the enterprise came under the covetous eye of the Standard Oil syndicate, headed by William Rockefeller and Henry H. Rogers. Wanting to expand their empire into

---

1Tribune, March 5, 1899.  
2Ibid., January 1, 1899.  
3H. H. Rogers, William Rockefeller, and others erected beside the Standard Oil Company a "huge and ruthless" financial mechanism in Wall Street which was "naturally but improperly termed the 'Standard Oil crowd.'" During the decade 1897-1907, the heyday of industrial promotions and mergers, Rogers and Rockefeller were busy with financial flotations and manipulations, "often reckless in character." To finance these ventures they used the dividends from their Standard Oil holdings (which averaged about $40,000,000 a year, most of it going to half a dozen men, including Rogers and Rockefeller), and profits from other enterprises, and credit from the National City Bank of New York. According to Nevins, John D. Rockefeller had "nothing" to do "with their schemes and battles," which were often "brutal" and "sometimes clearly contrary to the public welfare." He "deeply resented" the "deliberate refusal" of H. H. Rogers to make it clear that he had no share in these "forays and adventures." Allan Nevins, Study in Power: John D. Rockefeller Industrialist and Philanthropist (2 vols.; New York: Charles Scribner's Sons, 1953), II, pp. 279-87.
mining, Standard Oil investors began buying Utah Consolidated stock. They first obtained 100,000 shares in late February 1899, at an average price of $32.50, for a total cost of $3,250,000. The syndicate continued buying on the open market, attempting to gain control. At first Samuel Newhouse remained silent over the attempted takeover, but soon sweetened to the overtures. On May 7, 1899 the control of the company passed into the hands of the syndicate in a $12,000,000 transaction. The largest block of stock was reportedly purchased by H. H. Rogers of the syndicate. Samuel Newhouse was said to have made $3,000,000 on the sale.

Replacing Thomas Weir as general manager of Highland Boy operations was R. H. Channing. Urban H. Broughton, a son-in-law of H. H. Rogers who had been acting as consulting engineer for the syndicate during the negotiations, was added to the board of directors, and later elected president.

In the meantime final preparations were being made at the smelter to start the operations. Originally, it was planned to transport the ore by building a railroad from the mine to the smelter. However, because of the steep grades up Carr Fork, the company built a Bleichert wire tram from the mine to a loading ore bin at the Rio Grande Western Depot in Lower Bingham. The tram, when completed, was 12,700 feet long and contained 123 buckets with an ore capacity of 500 pounds each.

The new smelter was placed in operation on May 23, 1899, and soon was pronounced a success. The pig copper (a crude casting of copper run directly from a smelting furnace, which was convenient for storage or

1Tribune, March 4, 1899; May 7, 1899.
2Ibid., January 1, 1899.
transporting of metal) produced in the initial runs was claimed to contain $60 in gold and 40 ounces of silver per ton.\(^1\) A short time later, all 3 reverberatory furnaces and 2 copper converters, with a capacity of 250 tons per day, were operating at full capacity, producing close to 1,000,000 pounds of copper a month.\(^2\) Operations were considered so successful that plans were immediately drawn up to enlarge the plant and double its capacity. This was accomplished in the ensuing months at a cost of $178,000.\(^3\) The smelter capacity was boosted to 500 tons per day.\(^4\)

Production from the new smelter during the first year of operation (May 1899 to June 1900) amounted to 6,497,205 pounds of fine copper, 93,221 ounces of silver, and 8,254 ounces of gold. The company was happy to announce a net profit of $661,627 for the 15-month period of operations from April 1, 1899 to June 30, 1900.\(^5\)

Utah Consolidated Mining Company. After 1900, the production of copper ores from the Highland Boy Mine at Bingham continued to increase, giving Utah Consolidated Gold Mines, Limited, the distinction of being the only major copper producer in Utah. (There were, of course, larger companies operating in Montana and Michigan.) The success of the venture and the increasing dividends gave the company a national and international reputation and made it a much sought-after investment.

In 1903, plans were drawn up to increase the capacity of the company's smelter by 40 percent. In other actions, the board of directors authorized

\(^1\)Mineral Industry, 1900, p. 165.
\(^2\)Mineral Resources, 1898-99, pp. 159-220.
\(^3\)Mineral Resources, 1899-1900, pp. 163-223.
\(^4\)Mineral Industry, 1900, p. 165.
\(^5\)Mineral Resources, 1899-1900, pp. 163-223.
the transfer of the company headquarters from London to New York. (English laws required a tax of 5 percent on corporation dividends, which amounted to about $35,000 a year. By moving company headquarters to the United States this could be avoided.) Therefore, the Utah Consolidated Mining Company, an American corporation, was organized under the laws of New Jersey with a nominal capitalization of $1,500,000, to replace the Utah Consolidated Gold Mines, Limited, the British corporation. The new American corporation was also a holding company (a holding company is a corporation organized to hold shares of stock on one or more other corporations) which owned 2,490 shares of the Highland Boy Gold Mining Company of New Jersey; the latter corporation holding direct title to the Utah properties.¹

At this point, the future looked bright for the Utah Consolidated Mining Company. Production of copper was increasing, profits were high, and ore reserves were continually being increased by exploration and development work at the Highland Boy Mine.

Samuel Newhouse, Father of Copper Mining in Utah. After the sale of the Utah Consolidated company to the Standard Oil investors in May 1899, Samuel Newhouse turned his attention to his other Utah mining ventures. In 1898 while work at the Highland Boy was getting under way, Newhouse became interested in the Stewart and adjacent claims known as the Copper Center group located in Bingham Canyon. A short time later, aided by Thomas Weir, he purchased the property and organized the Boston Consolidated Mining Company, Limited, to develop it. Initial development work on the property indicated that the Stewart contained a large quantity of sulphide

¹The Copper Handbook, 1910-11, pp. 1746-47.
copper ore similar to that in the Highland Boy, and also a large body of low-grade porphyry ore.

In 1901 while still promoting the Boston Consolidated, Newhouse became interested in the Cactus Mine and adjacent claims in Beaver County. These were purchased and a company organized in 1903 to develop them. The ore deposits were similar to those of the Boston Consolidated, containing both sulphide and porphyry ores. The development and exploitation of the Cactus Mine and that of the Boston Consolidated are covered in Chapter IV.

It should also be mentioned at this point that Thomas Weir became disassociated from Newhouse about the time the latter became interested in the Cactus property. Weir stayed at Bingham and became active in the management of the Ohio Copper Company, another Bingham porphyry property which was getting organized. The story of Ohio Copper is also told as part of the Porphyry Period.

Although he was no longer attached to the Utah Consolidated company, Samuel Newhouse had by now earned the title as the "Father of Copper Mining in Utah." He was responsible, more than anyone else, for the events which had occurred at the beginning of the copper era in Bingham 6 years before. He had "set the pace" in demonstrating that the coppers of Bingham could be mined on an extensive scale and made to pay dividends.

Once the extent of the Highland Boy discoveries became known, the search for copper at Bingham proceeded apace. "While the digging for the other metals (gold, silver, lead) has gone on there [Bingham] by day

---

1Deseret News, December 19, 1903.
and night, so has the persistent exploration for copper, that has also met with a measure of success.¹ Not all of these efforts, of course, met with success—at least immediately.

**American Smelting and Refining Company.** While the transfer of ownership of the Utah Consolidated to "the Standard Oil crowd" was taking place in the spring of 1899, another drama which would have a lasting impact on the Utah nonferrous smelting industry was unfolding in New York. The birth of the "gigantic" American Smelting and Refining Company (hereafter referred to as ASARCO) on April 4, 1899, helped set the stage for the merciless struggle which would eventually lead to the weeding out and consolidation of the entire nonferrous mining and smelting industry in Salt Lake and Tooele Counties within the next 10 years.

The formation of the "smelter trust" by Henry H. Rogers and Leonard Lewisohn was for the express purpose of owning and managing the properties of "all principal smelting works in the United States with the exception of the Guggenheims." They were seeking to restore order, stability, and profitability to an industry that had been plagued, during the 1890's,

¹*Tribune*, January 1, 1897. While the Newhouse-Weir concern was easily the most significant of the copper innovators in Utah in the 1890's, there were others. The Bingham Copper Mining Company, incorporated in 1895 with a nominal capitalization of $200,000, developed copper claims in the main Bingham gulch, just east of the town. The 2 claims owned by the company, the Starlus and Alameda, exposed copper veins averaging from 8-1/2 to 10-1/2 percent copper, with some gold and silver. The property was worked modestly until 1897 when operations were suspended for lack of money. In 1898, with Chicago capital backing the enterprise, operations were resumed with some 15 men attempting to tap some of the springs carrying copper in solution. (The experiment of precipitating the copper had been tried for several years, by running water containing copper over scrap iron.) For a period the company used as much as 50 tons of iron per week and a carload of salt daily. Operations were continued for some time on a reduced scale, but eventually ended in failure. *Tribune*, January 1, 1896; January 1, 1898; January 1, 1899.
by overcapacity resulting from numerous smelters over the county competing
with each other for a limited supply of ores.

The combine headed by Rogers began buying up the various nonferrous
smelters throughout the nation in 1897, and by 1899 had completed its
acquisitions. Included among the "seventeen corporations and one part-
miership," were the Germania, Mingo, and Hanauer smelters in the Salt Lake
Valley and the Ibex smelter located at Leamington, Utah.1 As indicated
previously, the three Salt Lake smelters were the most important in the
state, accounting for 60 percent of the state's production of bullion
and matte in 1898.2

Once ASARCO was organized, its promoters and managers began a system-
atic program of shutting down plants so as to eliminate the "top heavy"
condition of the company. By consolidating production in fewer plants,
they hoped to reduce smelter charges and cut costs. And while they did
not say so, it was clear that "consolidation" would improve profitability
by diminishing competition and strengthening monopolistic powers.

In Utah the combine closed down the Hanauer and Mingo smelters in
April 1899, shortly after acquisition. The Ibex smelter was idle at the
time of purchase and was never reopened. Only the Germania remained in
operation at the beginning of 1900.3 A little more than a year later, in
July 1902, ASARCO, now firmly under the control of the Guggenheims, com-
pleted the erection of a new $1,000,000 lead-silver smelter at Murray,

1Isaac F. Marcosson, Metal Magic: The Story of the American
Smelting and Refining Company (New York: Farrar, Straus and Company,
1949), pp. 57-59.

2Tribune, January 1, 1899.

3Ibid., April 16, 1899; April 20, 1899.
Utah, to replace and expand the facilities provided by the old Germania. This was in preparation for their attempt to become the dominant custom smelter, if not the only, in the state.¹

**Bingham Copper and Gold Mining Company.** A neighboring attempt which arose out of the success of Samuel Newhouse, Thomas Weir, and the Highland Boy, resulted in the creation of the Bingham Copper and Gold Mining Company. In 1895, the Commercial Mine, which had previously been worked for its carbonate and oxidized ores, came under the ownership of the Bingham Gold Mining Company. This company attempted to extract and treat the oxidized gold ore by a cyanide process, much as had been done by the Highland Boy company. All efforts had proved a failure, however, and the property remained idle for several years. In November 1898 a discovery of high-grade copper-silver-gold ore was made in one of the tunnels, and the property took on a new look. To finance the extensive exploration and development of the mine, the principal owner of the company, Mr. William Bailey (sometimes Bayly) of Los Angeles sold the property to an Eastern group who reorganized the company as the Bingham Copper and Gold Mining Company, in December 1898. Included in the new company were the Commercial, Commercial No. 2, Venard Tunnel, and the Old Hickory Mines. The new owners of the company included Joseph A. Coram, Orington E. Weller, and Henry H. Boyce, all from Massachusetts and New York. The new company was incorporated in New Jersey with a nominal capital of $2,000,000 in 200,000 shares of $10 par. Colonel H. B. Heffron was hired as the company's business agent in Salt Lake City.²

²Tribune, November 18, 1898; January 11, 1899; Boutwell, *Bingham District*, p. 254.
During 1899 the company made extensive developments on its property, running about 3,000 feet of tunnel from Copper Center Gulch. An ore shoot, said to have been 400 feet long and 40 feet wide—and similar to that in the neighboring Highland Boy—was uncovered, containing ore which ran 8 percent copper, 6 to 8 ounces of silver, and $5 of gold per ton. The discovery, after additional exploratory work, was considered to be large enough to warrant the erection of a semipyritic copper smelter. Manager Heffron estimated the presence of 200,000 tons of such ore already blocked out.¹

At a meeting of the company's board of directors, held in Boston on October 20, 1899, a decision was reached to construct a smelter of 250 tons capacity to treat the ore. This smelter was to be essentially a duplication of the Utah Consolidated plant. The contract for a smelter at Midvale was let in early 1900, calling for its completion in 5 months. Due to delays in obtaining structural materials, however, the smelter was not completed until January 1901. In the meantime additional discoveries were made at the Commercial Mine giving further encouragement to the company.²

In order to provide a suitable means of transporting their ore from the mine to the smelter, a cog railway, the Copper Belt Railroad, was organized in 1900. The construction of the Copper Belt was originally conceived by J. G. Jacobs, the general manager of the Salt Lake and Mercur Railroad, when the Bingham Camp had just begun to awaken after the period

¹Boutwell, Bingham District, p. 254; Deseret News, December 9, 1899; EMJ, July 15, 1899, p. 79.
²Ibid. Also EMJ, October 28, 1899, p. 529; July 16, 1899, p. 79; October 21, 1899, p. 499; Tribune, January 30, 1901.
of depression in the middle '90's.\(^1\) Foreseeing a bright future for the camp, Mr. Jacobs built a narrow-gauge mule and gravity tramway from Lower Bingham to Upper Bingham, a distance of about 3 miles. Later, Mr. Jacobs retired and sold the tramway to William Bailey and his associates when they became interested in the promotion of the Bingham Copper and Gold Mining Company.

After the Copper Belt Railroad was organized in 1900 considerable funds were expended to provide the line with new equipment and extend the track to the Commercial and other mines in the vicinity. Connections were also made with the Rio Grande Western at Bingham. A Shay engine was brought from Mercur to haul the initial traffic over the line, and a spur was built to the site of the new smelter at Lower Bingham. The extension was completed prior to the time scheduled for the initial operation of the new smelter on January 15, 1901.\(^2\)

By the first week of January the company had placed 7,000 tons of ore and fluxes in its spacious bins in preparation for the "blowing in" of the new smelter. Some 3,250 tons of ore had come from the company's own mines in Bingham and 2,000 tons from the Tesora Mine in the Tintic

---

\(^1\)"The Salt Lake & Mercur was a broad gauge mineral road built to run from a junction with the Salt Lake and Western to Fairfield, Utah County, to Mercur in the Tintic mining district. It was a very prosperous line during the great producing days of the Mercur mines. When the mines became depleted, the days of prosperity for the road were ended. Construction of the line was begun on September 1, 1894 and completed on February 20, 1895. It was dismantled in 1914, after the abandonment of mining operations at Mercur." David F. Johnson, "History and Economics of Utah's Railroads," Utah A Centennial History, ed. Wain Sutton (3 vols.; New York: Lewis Historical Publishing Company, Inc., 1949), II, 843.

District. After some delay caused by the late arrival of some of the
"fittings," and the last minute shortage of electric power from the Ogden
Canyon plant of the Utah Light and Power Company, the smelter was finally
ready to begin operations.1

The first of the 3 stacks with a capacity of about 100 tons per day
was started on January 13, 1901.2 The ores used for the initial run
came from the Commercial, the Tesora, and Grand Central Mines in the
Bingham and Tintic Districts, and a considerable amount of slag from an
old dump at Stockton.

The immediate success of the Bingham company's first furnace, was
heralded by the Boston Financial News as capable of providing net earnings
of $1,884 per day. It was suggested that with the 2 additional furnaces
in operation the company would be able to treat 450 tons of ore per day
and net $3,780 additionally. The paper concluded by stating that "the
success which has attended the starting up of the plant has a bearing of
broad significance upon the future of the Bingham camp, as it marks a new
era in the science of metallurgy."3

The new smelter was soon drawing ore from as far away as Arizona.
The Grand Gulch Mining Company, with holdings near the Grand Canyon,
shipped over 400 tons of copper to the new smelter. One shipment from the
Savannic Mine in the same location yielded 40 percent copper. The Carisa
Mine in the Tintic District shipped 35 carloads of ore to the smelter

---

1 Tribune, January 8, 1901; January 17, 1901; January 30, 1901;
February 1, 1901.

2 Ibid.

3 Ibid., February 6, 1901.
during January. Shipments from the company's own mines amounted to 200 tons per day during January and February. There were increased to 300 tons per day after the second furnace was started on February 20, 1901.¹

Since the new smelter did not have any converters for the reduction of the copper matte to bullion, arrangements were made with ASARCO to ship the matte to the Germania smelter at Murray for reduction. The later company then shipped the bullion to its refineries in the East.

At the time, ASARCO was in the process of building its new lead smelter at Murray to replace the Germania. ASARCO, now under Guggenheim direction, wanted to retain the Bingham Copper contract for the conversion of its copper matte and also enter the new sulphide copper smelting field. It was announced that the Germania would be converted into a pyritic copper smelter to handle the copper ores from the Bingham mines. Rather than accept the deal offered by ASARCO, President Coram made arrangements with the "Standard Oil crowd" through their United Selling company for the copper produced at the Bingham smelter. At the time, Coram was also president of Montana Coal and Coke Company which was being sought by the Standard Oil-Amalgamated group. Thus, when the ASARCO contract expired in March 1901, Bingham Copper entered into a two-year contract with the rival United Metal's Selling Company for the disposal of its metal products. This agreement also allowed Bingham Copper to erect copper converters at its smelter. Until these converters were completed, arrangements were made to send the matte to the nearby Highland Boy for reduction.²

¹Ibid., February 9, 1901; February 21, 1901.

²Ibid., March 12, 1901; April 15, 1901.
Bingham Consolidated Mining and Smelting Company. With bright prospects for the future, Bingham Copper began to look about for likely properties which could be purchased to provide additional copper and siliceous fluxing ores for the smelter. During the early spring of 1901 attempts were made to purchase the Grand Central and Mammoth Mines in the Tintic District. However, in April the company purchased, instead, the Dalton and Lark property at Bingham from Philo T. Farnsworth and Willard Snyder for the sum of $1,250,000. (The Dalton and Lark was an early lead-silver property which prior to 1900 had produced $15 million worth of metals. By the late '90's, however, the mine was relatively inactive because of the presence of water in the lower levels.)

To finance the purchase, the Bingham Copper and Gold Mining Company was reorganized as the Bingham Consolidated Mining and Smelting Company. Incorporated under the laws of Maine on April 24, 1901, the new company had a nominal capitalization of $10,000,000 with shares of $50 par. Edward L. White was elected president, W. S. Mc Cormick, vice-president, Duncan McVichie was appointed managing director.

The job of dewatering the Dalton and Lark properties got underway immediately. Both the Brooklyn and Dalton and Lark shafts were deepened and work commenced on an 8,000-foot drainage tunnel (with a portal at Lark) called the Mascotte Tunnel. (This was completed in 1904.) By the spring of 1902 the Dalton and Lark Railroad was completed to connect the

---

1Ibid., January 1, 1898; April 24, 1901; Deseret News, December 23, 1899; December 15, 1900.

2The Copper Handbook, 1909, p. 370; Tribune, January 1, 1898; April 24, 1901; Deseret News, December 23, 1899; December 15, 1900.
tunnel outlet and the mines with the Rio Grande Western, over whose lines the ore could be hauled to the smelter at Midvale.¹

With the completion of the converter installation in May 1902, the company was able to produce copper at the rate of 700,000 pounds per month, making them the third largest copper producer in the state.²

The dewatering of the Dalton and Lark had opened up several additional ore deposits enabling the company to increase production from this portion of the property to 150 tons per day. This work had also opened up considerable quantities of lead ore which prompted the company in late 1903 to consider the erection of lead blast furnaces to handle these ores. This would have been done had not the company been able to work out a satisfactory arrangement with ASARCO whereby the latter company agreed to smelt all Bingham Consolidated lead ores and, in return, send all ASARCO custom copper ores to the Bingham Consolidated smelter. This eliminated the need for ASARCO to convert the Germania into a copper smelter, and it was therefore dismantled a short time later.³

In 1904 the Bingham Consolidated expanded its operations. A fifth blast furnace was added to the smelter and a controlling interest purchased in the Eagle and Bluebell Mining Company in the Tintic District.⁴

¹Mineral Resources, 1901, pp. 161-73; Deseret News, December 19, 1903; December 17, 1904.
²Deseret News, December 19, 1903.
³Ibid.; Boutwell, Bingham District, p. 381; Deseret News, December 17, 1904.
The future looked good for the company, save for a few clouds of smoke on the horizon.

**United States Mining Company.** The successes attained by the Utah Consolidated and Bingham Consolidated companies did not go unnoticed in Utah mining circles. Early in 1899 while there was a great deal of rumor and speculation circulating about the organization of the giant "smelter trust" being put together by Henry H. Rogers and his associates (ASARCO), another movement of equal import to the future of the Utah mining and smelting industry was underway in Utah. The principal parties in the movement were Albert E. Holden of Salt Lake City and a group of Boston bankers and businessmen, appropriately called the "United States Oil crowd."

Holden and his father, Liberty E. Holden, were prominent Utah mining men, with interests in the Bingham and Tintic Districts dating back to the 1880's. By the late 1890's they had an extensive and profitable group of mining properties under their control. Among the most important of these were the Old Jordan and Galena claims at Bingham and the Centennial-Eureka Mine in the Tintic District.\(^1\)

In March 1899, after several months of negotiations, the United States Mining Company was born with a capitalization of $10,000,000 in 400,000 shares at $25 par. At the time this was the largest "mining deal ever to be undertaken in Utah." Edward A. Clark, president of the United States Oil Company was elected president of the new company and A. E. Holden was appointed managing director. J. W. Neill, who had

---

been manager of the Taylor and Brunton Sampling Works in Salt Lake City, was placed in charge of the company properties in Utah.¹

Shortly after its formation the company stopped ore shipments from its Bingham and Tintic Mines and began a full year of exploration and development work. This action on the part of the United States company to withdraw large shipments of ore to the custom smelters in the Salt Lake Valley helped hasten the closure of several of the smelting plants recently purchased by rival ASARCO, which were then in the process of consolidation.

Development work done by engineers hired to investigate the property prior to purchase by the United States company had revealed considerable quantities of copper-bearing ores in both the Bingham and Tintic properties. Additional exploration indicated that more was in sight so the new company announced, early in 1899, that plans were being drawn up to erect a large copper smelter in the Salt Lake Valley to handle the ores from its Utah mines. The new smelter was to be a "pyritic copper smelter" of a new design, and to be "the biggest smelter, perhaps, in the West." The site selected for the new smelter was on the ground formerly occupied by the Old Telegraph smelter some years before. It was located on the Jordan River at Bingham Junction (Midvale), south of Salt Lake City. The site embraced 171 acres of land and was supplied with water by a canal 8 miles in length. The water right on the Jordan River was said to be the oldest one on file.²

¹"Clarence Emir Allen: Father of the Public School System in Utah," Ax-I-Dent-Ax, XVII (August 1932, 4; Tribune, March 11, 1899; March 25, 1899; April 22, 1899.

²Tribune, March 12, 1899.
The actual construction of the new smelter, however, awaited further proof of the practicability of the treatment of the low-grade copper ores at Bingham. It was not until the success of the Bingham Copper and Gold Mining Company's new smelter was established in mid-1901 that the company was sufficiently convinced to proceed with plans for the smelter. Construction work on the new plant, therefore, was begun during the latter part of 1901 under the superintendancy of George K. Kischer. Over a year was required to complete the construction of the copper furnaces and office for the smelter. The total cost of this phase amounted to approximately $750,000. When completed, the smelter had 6 furnaces with a total capacity of 1,000 tons of copper ore a day and with provisions for additional furnaces if conditions warranted.¹

Operations at the smelter were started on November 11, 1902 utilizing ore from the Centennial-Eureka, Old Jordan, and Galena Mines. Within a short time the production of copper by the United States smelter elevated it to the position of second largest copper producer in Utah, behind the Utah Consolidated and a little ahead of the Bingham Consolidated. As the development work continued deeper into the earth the company found that, as with the neighboring Bingham Consolidated, the character of the ores changed sufficiently to warrant the addition of a lead section to the Midvale smelter. Construction of the new addition was started early in 1904 and was completed in January 1905. The United States Mining smelter was now fully equipped to handle all of the ores from the company's mines, plus some desired custom ore.²

¹Ibid., February 6, 1901; Deseret News, December 20, 1902; December 19, 1903.

²Deseret News, November 12, 1902; January 24, 1905.
Other Copper Producers. There were a number of smaller mining companies which recognized the potential afforded by the Bingham sulphide discoveries and were organized between 1899 and 1905. Among the most important was the Tintic Mining and Development Company which purchased the Yampa claims in the West Mountain District in April 1901 and constructed the important Yampa Smelter, which operated at Bingham from 1903 to 1909, and the Utah Apex Mining Company.

Tintic Mining and Development Company. The Tintic Mining and Development Company, organized in August 1896, had attempted for several years to drive a tunnel, known as the Sioux-Ajax Tunnel, through the Mammoth Range in the Tintic District. The undertaking, in the vicinity of the Mammoth, Grand Central, and Centennial-Eureka Mines, proved fruitless even after several years of work and a considerable amount of money had been expended. The company property remained idle from 1899 to 1901.1

The continuing successes in the mining of sulphide copper at Bingham led the Tintic company, in April 1901, to purchase the Yampa group of claims, embracing 180 acres in Carr Fork in the West Mountain District. The group of claims was located in the vicinity of the Columbia Mine (later known as the Ohio) and adjoined the Utah Consolidated on the north and the Boston Consolidated on the west. The most important claim in the group was the Yampa, a fractional claim surrounded by the Utah Consolidated.2

---

1_Tribune_, April 7, 1901.
2_Boutwell, Bingham District_, p. 382.
The Yampa group of claims was acquired from Colonel E. A. Wall for a reported $180,000 and 50,000 shares of stock in the Tintic company. Initially, the property was to have been developed under the direction of Colonel Wall with the ultimate aim of blending the Bingham ores with the siliceous ores from the Tintic District. It was hoped that results similar to those obtained by the Bingham Copper and Gold Mining Company could be achieved.  

Development work on the property, under the direction of George H. Robinson rather than Colonel Wall, soon led to what was described by The Salt Lake Tribune as a "sensational ore discovery" in the Yampa Tunnel, revealing a solid body of ore running as high as 10 percent copper, 60 ounces silver, and $6 in gold values per ton of ore. By April 1903 the ground had been opened by two tunnels, the Yampa and the Craig, and 5,910 feet of openings driven. An extension of the Copper Belt Railroad was made to the mine, and the ore shipments started to smelters in the Salt Lake Valley late in the summer of 1903.  

Initially, the company entered into a contract with the Bingham Consolidated to supply that company's smelter with 2,500 tons of ore per month for a two-year period. However, once the extent of the ore deposits had been ascertained the company decided to build a smelter of its own. Therefore, in the summer of 1903, a subsidiary called the Yampa Smelting Company was organized to build and operate the smelter.

1Ibid.; Tribune, April 7, 1901.

2Tribune, April 27, 1901; Deseret News, December 19, 1903; The Copper Handbook, 1910-11, pp. 1877-78.
To facilitate their control over the growing empire, the owners of the Tintic Mining and Development Company organized a $3,000,000 securities holding company. The new company, given the name of "Tintic Company," was officered by the same people who directed the subsidiaries.¹

Over $450,000 was expended for the construction of the 250-ton Yampa smelter. Located in the main canyon below the town of Bingham, the smelter was completed in December 1903. The smelter had one furnace, featuring the hearth-roasting process, and a large smokestack, said to be the highest in the state at the time. Initial operations at the smelter proved a failure, necessitating the reconstruction of the entire plant in 1904. The newly-rebuilt smelter consisted of two blast furnaces and a reverberatory with a daily capacity of 600 tons of ore.² As 1904 drew to a close, operations were resumed at the smelter.

Utah Apex Mining Company. The Utah Apex Mining Company was organized in May 1902 as a consolidation of the York and Copperfield Mining companies. While the initial search was for copper, subsequent development revealed considerable bodies of lead ore. In 1905 development work was still underway, and the mine was considered a promising "big little mine."³

¹Boutwell, Bingham District, p. 382; The Copper Handbook, 1910-11, p. 1840.

²Deseret News, December 19, 1903; Boutwell, Bingham District, p. 382; Mineral Resources, 1907, p. 458, states capacity as being increased to 750 tons.

³Tribune, July 31, 1906; Deseret News, December 19, 1903.
Other small companies at Bingham. Two small Bingham companies, organized between 1900 and 1905—the Bingham Central Mining Company and the Bingham Standard Copper Company, were merged in 1907 to form the Bingham Central Standard Copper Company. Two years later, in 1909, the Bingham Metals Company was added to the group and it was reorganized as the Utah Metal Mining Company. The property owned by the company consisted of 3,400 acres of mineral ground (including 139 acres of timber) in the Carr Fork area of Bingham and extended over the divide of the Oquirrh range into Middle Canyon, Tooele County.¹ The work of developing the property, however, did not get underway until 1910.

¹The Copper Handbook, 1910-11, p. 1759. In order to develop their property, the Utah Metal Mining Company drove a tunnel from Carr Fork through the mountain to a point above the International Smelter at Tooele, a distance of 11,500 feet. By this means the company hoped to develop any mineral deposits in their territory, provide a means of cheap transportation for the shipment of Bingham ores to the International Smelter, and develop a good source of water for the generation of electricity.

When completed in 1911, the waterflow generated in the tunnel amounted to 750,000 gallons per day. The water produced was sold to the Utah Copper Company for use in their Garfield concentrating mill. By 1924 the sale of this resource was bringing in an estimated $25,000 income annually. In 1930 the water rights were sold to the Utah Copper Company for $275,000.

In 1914 the Utah Metal Mining Company acquired stock control of the Bingham-New Haven Copper and Gold Mining Company, another small but relatively prosperous copper producer which had been organized in 1902 to develop the Zelora Mine near the head of Carr Fork, above the Highland Boy Mine. Between 1902 and 1906 the Bingham-New Haven Company had produced about $500,000 worth of ore and had paid a 20-percent dividend in 1906 and a 10-percent dividend in 1907. Up to 1915 dividends amounted to $900,000.

To operate the combined properties a new corporation was organized in May 1914. The new company continued as an active producer of lead, copper, silver, and gold, employing about 165 men by 1918. After World War I the company property was leased to others to work. The deposits were exhausted by the 1940's. Mineral Resources, 1913, p. 402; The Copper Handbook, 1924, pp. 1448-49; 1937, pp. 952-54; 1909, pp. 373-74; 1918, pp. 1448-49.
Other Bingham mining companies which had their start during the period included the Bingham-New Haven Copper and Gold Mining Company and the New England Copper and Gold Mining Company.

Elsewhere in the State. As mentioned above, between 1900 and 1905 the United States Mining Company shipped considerable quantities of copper ores from the Centennial-Eureka in the Tintic District. In addition, by 1904 there were about 25 other mines in the district shipping copper to the Salt Lake smelters. The more important were the Carisa, Mammoth, Victor, Grand Central, and Ajax. The production of copper in this district increased appreciably from 1894 to 1903, making it an important contributor to the state's output of copper. Production reached a high of over 10,000,000 pounds annually by 1903 and remained at peak levels for over a decade before the copper deposits were exhausted.¹

In addition to the Bingham and Tintic regions, considerable copper was mined in the San Francisco, Beaver Lake, and Star Districts of Beaver County. Much of the copper from the San Francisco District came from the concentrates of the Horn Silver ores. In the nearby Beaver Lake District the Majestic Copper Mining and Smelting Company operated a small copper-lead smelter for a short period of time on ores from the OK Mines, located in the Beaver Lake District, and from the Harrington-Hickory and Hoosier Boy properties in the Star District. In 1903 and 1904 there had been considerable publicity given to the copper prospects of the districts in Beaver County, but nothing important ever came of it.²

¹Butler et al., Ore Deposits of Utah, pp. 405-10.
In the Tutsagubet District in Washington County, the Dixie Mine, which had been operated by St. George residents during the last decade of the nineteenth century, was sold in January 1901 through the efforts of W. F. Snyder, a Salt Lake mining promoter, to an eastern syndicate headed locally by P. T. Farnsworth for $200,000.¹

Although a small run was made by the former owners at the Shem smelter, in December 1900, which turned out 35,000 pounds of copper in 13 days, there was little production until 1904. The new company, the Utah and Eastern Copper Company, constructed a small railroad operated by a traction engine to help transport the ores part of the way to the nearest railhead at Acoma, Nevada, 50 miles distant on the newly-constructed Salt Lake and San Pedro Railroad. The small smelter at Shem was operated intermittently under several managements until 1907 when it was closed. Production of copper amounted to 1,811,626 pounds in 1903, 1,448,597 pounds in 1904, 400,166 pounds in 1905, and 391,779 pounds in 1907. Butler lists the copper production for the entire period from 1898 to 1909 as being 8,318,266 pounds, with a value of $1,233,570. Only small lots were shipped after 1909.²

A little copper was also produced during these years in the Park City, Camp Floyd, Ophir, and Cottonwood Districts, but again primarily as an adjunct to the lead-silver ores which were the main staple.

Most of the small companies lacked the capital to economically develop their claims, owned relatively unimportant ore deposits or

¹Tribune, February 9, 1901.
suffered from excessive and capricious fluctuations in the market price of copper. One by one they died or were absorbed by the larger, more aggressive firms. The ores of all of them were essentially exhausted by the 1940's.

All told, the production of copper in Utah during the Sulphide Period is given in the following table:

TABLE 1

COPPER PRODUCTION IN UTAH, 1870-1905

<table>
<thead>
<tr>
<th>Year</th>
<th>Copper Produced in Pounds</th>
<th>Value</th>
<th>Percent of U.S. Copper Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1870-1885</td>
<td>7,479,284</td>
<td>$1,623,190</td>
<td>1.1%</td>
</tr>
<tr>
<td>1886-1895</td>
<td>18,344,708</td>
<td>3,326,138</td>
<td>0.8</td>
</tr>
<tr>
<td>1896</td>
<td>3,502,012</td>
<td>378,217</td>
<td>0.8</td>
</tr>
<tr>
<td>1897</td>
<td>3,919,010</td>
<td>470,281</td>
<td>0.8</td>
</tr>
<tr>
<td>1899</td>
<td>3,750,000</td>
<td>465,000</td>
<td>0.7</td>
</tr>
<tr>
<td>1899</td>
<td>9,584,746</td>
<td>1,638,991</td>
<td>1.7</td>
</tr>
<tr>
<td>1900</td>
<td>18,354,726</td>
<td>3,046,885</td>
<td>3.0</td>
</tr>
<tr>
<td>1901</td>
<td>20,116,979</td>
<td>3,359,535</td>
<td>3.3</td>
</tr>
<tr>
<td>1902</td>
<td>23,939,901</td>
<td>2,920,668</td>
<td>3.6</td>
</tr>
<tr>
<td>1903</td>
<td>32,847,656</td>
<td>4,542,831</td>
<td>4.7</td>
</tr>
<tr>
<td>1904</td>
<td>46,417,234</td>
<td>5,802,154</td>
<td>5.7</td>
</tr>
<tr>
<td>1905</td>
<td>57,298,054</td>
<td>8,938,496</td>
<td>6.4</td>
</tr>
</tbody>
</table>

1870-1905 | 245,554,310               | $36,512,386 | 2.2%                             |

Source: B. S. Butler, G. F. Loughlin, V. C. Heikes et al., *The Ore Deposits of Utah* (Washington: Government Printing Office, 1920), pp. 128-29. Figures for 1904 and 1905 include some copper production from Utah Copper's porphyry mine at Bingham. However, this production did not average more than 5,000,000 pounds for either year. The Cactus mine and mill in Beaver County were also in operation during part of the year, but mainly on an experimental basis and production was not significant.

The Smelter Smoke Suit

By the early summer of 1904 the Salt Lake Valley was the home of three large copper smelters and a lead smelter, all located between Murray and Bingham Junction (Midvale). These were the properties of Utah Consolidated Mining Company, Bingham Consolidated Mining and Smelting Company, United States Mining Company, and American Smelting and Refining Company. Surrounding the smelters were the prosperous farms and homes of the local inhabitants. Their crops were green and growing from the spring rains and supplemental irrigation, and the animals grazed contentedly in the pastures near the Jordan River. Occasionally smoke from the busy smelters was blown overhead, and some fly ash dropped on the trees and shrubs. A casual observer would have been pleased at the tranquil picture—a perfect balance between farm and factory.

The situation, however, was not quite so peaceful as one might have supposed. In June 1904, after a rainstorm, accompanied by winds, the farmers living in the neighborhood of the smelters noticed that their crops were turning yellow, as if diseased. Some of their animals appeared sick as well. Investigation confirmed their suspicions, and further observation indicated that every time the wind shifted direction the black smelter smoke was blown over their lands; and with it came an odor which smelled like sulphur and stung the eyes. They also remembered that several weeks earlier a series of south winds and the accompanying rains had carried "the blight of the Murray smokestacks," as it was later called, north as far as the limits of Salt Lake City, devastating a wide swath of country. The area soon came to be known as the "smoke belt."
By the fall of 1904 the farmers living in the area surrounding the smelters met together in organized meetings held at Granger, Murray, Taylorsville, and Sandy to discuss the problem. The meetings finally culminated in a central mass meeting of the landowners of the whole area held at Murray. At this meeting a central committee was appointed and a tax of 10 cents per acre levied on each landowner to meet expenses. In addition to the central committee, subcommittees were selected on finance, legislation, law, and publicity.

Members of the farmers' committee (later called the "Farmers Alliance") met with the smelter owners and attempted to solve the problem by the direct "peaceable measure" of effecting an understanding with the smelters. Their efforts proved fruitless even though they were received respectfully by three of the four smelter operators. The result was that the farmers were convinced that the management of the smelters felt that "it was none of their [the farmers'] affair what the smelters proposed to do."¹

The smelter men, on their part, were baffled by the problem and knew of no inexpensive solution. They therefore decided to employ a commission of three experts, one to be selected by the farmers, to investigate the evil and decide on some plan of overcoming it. The farmers, however, were not satisfied with this action, feeling it was merely an attempt to delay the situation and would not lead to any relief.²

After additional fruitless appeals to the Salt Lake County Board of Health, the County Commissioners, and the State Board of Health, the

¹Deseret News, November 5, 1906.
²Ibid., February 8, 1905.
farmers turned to the courts for help. A suit, filed in the name of one of the farmers, James Godfrey (and 409 others), was initiated in the federal District Court of Utah presided over by Judge John A. Marshall. The farmers selected Senator Joseph L. Rawlins and Judge William H. King (later a Senator) as their counsel and proceeded to prove the damage to their property by the valley's smelters.

The case was referred to a referee for the taking of testimony late in the summer of 1905. From then until June 1906 volumes of testimony, much of it technical, was taken. Starting in June, the case was argued before Judge Marshall. Upon the completion of testimony, he took it under advisement.¹

During the proceedings ASARCO, one of the four defendants, had attempted to establish the point that if its own smelter had been the only one operating, no damage would have been done. The court, however, held that the ASARCO lead smelter had unquestionably "materially contributed to the nuisance complained of."² Other challenges to the court's jurisdiction were likewise dismissed.

Eight days later, on November 13, 1906, the decree was entered against the four companies. It "perpetually enjoined" the four defendant companies owning smelters "from the future roasting or smelting of sulphide ores carrying over 10 per centum of sulphur, in any form or combination, at its present location, so as to discharge said sulphur into the atmosphere in the form of a gas or acid, or from further

¹Ibid., November 5, 1906.
²Ibid.
discharging into the atmosphere of arsenic in any form." The decision permitted the defendants to apply to the court

... for a modification or suspension of this injunction upon a showing which the court may deem sufficient, that conditions have so changed that the discharge of such sulphurous and arsenical fumes into the air by them or either of them may be resumed, or otherwise conducted so as not to create or continue to create or continue the nuisance complained of."

The farmers hailed the decision. Judge King said "it established their rights to their homes in the valley over the rights of the smelters, to come in and spread their poisonous smoke over the community, despite the financial gain to the smelters." The ultimate outcome, he predicted, would be to force the smelters to expend sufficient money to solve the smoke question, as was done in California under similar circumstances.

The smelter men were understandably upset over the decision. An application was immediately made to stay the proceedings, pending an appeal to the Circuit Court of Appeals, which convened in St. Paul the following May. The stay was granted by Judge Marshall upon the stipulation that the smelters each deposit a $100,000 bond. As it was wintertime it was assumed that no damage could occur from the continuation of their operation until May.

Before 1906 ended all of the smelting companies had made public pronouncements of their intention to move their plants out of the Salt Lake Valley, and each began looking for a suitable location to resume operations. Civic and business groups from Ogden, Tooele, Grantsville,

1Ibid., November 14, 1906.
2Ibid., November 5, 1906.
3Ibid., November 13, 1906; November 16, 1906.
and American Fork exhibited a strong interest in getting the companies to locate near their communities and offered favorable sites.\(^1\) The most promising of these was a location offered by the citizens of Tooele to Samuel Newhouse's old company, the Utah Consolidated. The company, now a "Standard Oil Company," was offered the site at the mouth of Pine Canyon, just east of the town of Tooele.\(^2\) The opportunity was offered of buying the large tract outright, and the property owners outside the immediate vicinity of the proposed smelter were to be given two propositions: One was to give the mining company smoke easements on their lands and to accept an annual cash consideration if it was found that any damage was inflicted thereupon through the operation of the smelter. The second proposition was that the company would buy the lands after 2 years from the time that the plant went into commission, if the owners so elected, with the consideration price to be that of an agreed evaluation made before the construction of the smelter.\(^3\)

Before these negotiations could be completed, however, ASARCO, with plenty of money in its coffers, pulled a coup in January 1907 by buying off the Salt Lake Valley farmers. ASARCO representatives met with officials of the farmers' group and worked out a plan which would allow the Murray lead smelter to continue operations. The company agreed to compensate the farmers who were parties to the suit against the smelting companies to the

\(^1\)Ibid., December 26, 1906; January 7, 1907; January 10, 1907.

\(^2\)Ibid., January 4, 1907; January 7, 1907. At first the company considered the purchase of the famous Iosepa farm in Skull Valley where a colony of Hawaiian Mormons were then colonized. The Utah Consolidated company had offered the Church of Jesus Christ of Latter-day Saints $150,000 for this tract of land, but had given up their option in favor of the site offered by the Tooele citizens at the mouth of Pine Canyon.

\(^3\)Ibid., January 7, 1907.
extent of $60,000. Of this amount, $20,000 was to be paid as soon as a stipulation could be filed with the District Court asking that the decree be modified to allow the resumption of operations at the Murray smelter. The balance of $40,000 was to be paid as soon as all of the plaintiffs to the suit signed a smoke easement on their property against any further damage which might be inflicted by ASARCO in the future. As part of the agreement, ASARCO agreed to install a system of bag houses and cooling chambers through which all smoke and fumes would be passed to remove any injurious fumes or solids. This was, at the time, considered to be merely a goodwill gesture on the part of the company—the main theme being the purchase of immunity.\footnote{Ibid., February 11, 1907.}

Meantime the other smelter companies bided their time pending the appeal to the Circuit Court. On May 23, 1907 the court met and heard the arguments on the case. In November the court handed down a decision upholding the lower court. When word of the appeal reached Salt Lake City, the reaction of the companies was glum. The United States Mining Company, which was reorganized on January 10, 1906 as the United States Smelting, Refining, and Mining Company with a capital of $75,000,000, announced that the company's plant at Bingham Junction would be closed indefinitely. "The position of the United States Smelting Company in the matter of smoke suits, is, of course, that it will follow absolutely the decree of the courts." Since the suits were filed, however, the company had installed "devices to avoid the escape of injurious matter" and did not believe that the smoke from their plant was now causing material damage to nearby vegetation. Nevertheless, they were planning to shut
down the smelter.¹ (Since the company was in the process of building a new copper smelter at Kennett, California, plans were being made to ship their ores to the California plant.)

The seriousness of the situation led the Utah mine owners and Governor John C. Cutler to try to arbitrate the matter between the farmers and the smelters. A last ditch attempt was made in December 1907 to get the farmers to allow Utah Consolidated to operate the Highland Boy smelter until a new smelter at Tooele could be built. After a heated discussion, the farmers agreed to accept $175,000 from Utah Consolidated in return for which the company might operate for the next 15 months until a new smelter could be constructed. (Of the total, $150,000 was to be for damages and $25,000 for legal fees.) The price was too high for the company to accept, however, and a counter offer of $125,000 was made by Utah Consolidated. Before an agreement could be reached, word was received that the Supreme Court of the United States had refused to review the decision made by the Circuit Court of Appeals. Upon hearing this, the farmers withdrew from any further negotiations and insisted on the enforcement of the Court decree which would become effective on January 6, 1908.²

With the last avenue of appeal closed to them, Utah Consolidated, Bingham Consolidated, and United States Smelting made plans to bank their copper furnaces in compliance with the Federal Court injunction.

The Big Shake-up in Smelting

The aftermath of the smelter smoke suits, in conjunction with several other factors, led to the demise of copper smelting in the southern portion

¹Ibid., May 23, 1907; December 15, 1907.
of the Salt Lake Valley. It also heralded the decline of the sulphide copper boom and its eventual extinction as a major Utah industry. The story of how each of the major companies came to be absorbed by large Eastern-financed combines and how these came to switch over the smelting of lead ores concludes our narrative of the Sulphide Era in Utah.

Utah Consolidated Mining Company. In compliance with the court injunction the Highland Boy smelter, in January 1908, was closed. However, instead of going ahead immediately with plans to construct a new smelter at Tooele, as expected, the company immediately negotiated a contract with ASARCO to have the ore from its mine smelted at ASARCO's huge Garfield smelter, which had been erected by the Guggenheims in 1905-1906. ASARCO agreed to smelt 800 tons of Utah Consolidated ore daily at the Garfield smelter for 1 year, with the privilege of renewal.¹ Utah Consolidated, however, regarded the charges as exorbitant and at the termination of the contract exercised its options on the Tooele property.

In 1909 the company entered into an agreement with W. D. Thornton, of Butte, Montana, for the smelting of its ores for a period of 10 years.

¹Deseret News, December 19, 1908. With the signing of the contract, it appeared that there would not be any need to build the Tooele smelter. This optimism was short-lived, for within 9 months speculation was resumed concerning the possibility of erecting a smelter at Tooele. By November 1908 the matter came to a head and all indications pointed to numerous difficulties between the two companies over the treatment of Utah Consolidated ore by ASARCO under the existing contract.

A short time later, in a letter to the stockholders of the Utah Consolidated, President Urban H. Broughton disclosed why the company was now planning to build a smelter. He said that under the terms of the contract with ASARCO the company had been given the right to renew the contract and take up the question of contract modifications. Utah Consolidated had exercised this option, but ASARCO had attempted to delay the negotiations beyond the time permitted by the Utah Consolidated option on the smelter site in Tooele County. A short time later ASARCO had indicated that they were not willing to make any modification in the existing contract, but would extend it for 5 years on the existing terms.
commencing in April 1910. The latter agreed to form a new company and erect a smelting plant near Tooele to be in operation by April 1910, which would treat the output of the Utah Consolidated up to 1,200 tons per day at a rate far more favorable to Utah Consolidated than those charged under the previous contract with ASARCO.¹ Utah Consolidated agreed to transfer at cost all of the land it had acquired for the smelter at Tooele and was given an option to buy $500,000 in capital stock in the new company to be formed.

The new smelter company, formed in January 1909, was the International Smelting and Refining Company,² and was an offshoot of the Amalgamated Copper Company of Butte and Anaconda, Montana. The leading investors included also capitalists associated with Standard Oil Company and United States Steel Corporation. Stock issues approximated $100,000,000 and the plant at Tooele, which would compete with ASARCO's Garfield smelter, proved to be but one of several which the company was to erect or acquire in the West.³

The Tooele smelter was completed and the first furnace started on July 24, 1910. About 500 men were employed at the plant.⁴

---

¹The president estimated that the new arrangement would save Utah Consolidated $300,000 per year over the ASARCO contract. Deseret News, December 19, 1908.

²John D. Ryan of Butte, Montana, president of the Anaconda Copper Company and managing director of the Amalgamated Copper Company, was in charge of the promotion of the new organization. Associated with him in this preliminary work was Thomas F. Cole, a prominent mining man of Duluth, Minnesota.

³Initially, the company acquired from the United Metal's Selling Company all of the capital stock of the Raritan Copper Works at Perth Amboy, New Jersey; the Raritan Terminal and Transportation Company; and the New Jersey Storage and Warehouse Company. The company made plans to construct a smelter at Miami, Arizona; the Tooele Valley Railroad; and the International Lead Refinery at East Chicago, Indiana. Isaac F. Marcossen, Anaconda (New York: Dodd, Mead & Company, 1957), pp. 143-44.

⁴Deseret News, December 21, 1912.
transportation of ore from Utah Consolidated's Highland Boy Mine in Carr Fork to the new smelter in Tooele was accomplished by means of an aerial tram, nearly 4-miles long, built while the smelter was under construction. The tram, which had a capacity of 100 tons per hour, saved 20 miles in the transportation of Utah Consolidated ores. The costs were reported to be approximately 2 cents per ton.¹

In order to supply the rising demand for custom smelting of the lead-silver and other crude and siliceous ores from the mining camps in Utah and the Mountain West in competition with ASARCO, International commenced construction of two blast furnaces for the treatment of lead-silver ores. With a capacity of 250 tons of ore each per day these furnaces were "blown in" early in 1912.²

The Utah Consolidated Mining Company continued for another decade as a nominal producer of copper. Gradually, however, its ores changed character to become more lead-bearing, and the quantity of its ore reserves continued to decline. Although the company continued to pay dividends until 1919, the slump in the metal market after World War I resulted in an operating loss of $196,140 in 1920.³ This was paralleled by a disastrous lawsuit as the result of which Utah Consolidated was required to pay the neighboring Utah Apex Mining Company damages totaling


²L. O. Howard, "International Lead Smelter," The Salt Lake Mining Review, November 15, 1912.

³The Copper Handbook, 1922, pp. 1597-98.
In order to pay this sum, Utah Consolidated was forced to borrow $1,200,000 from the International Smelting and Refining Company. This was payable on demand and secured by a mortgage upon all the mines, claims, and real properties of the company. In addition, the Utah Consolidated, by October 1923, was indebted to the United Metal's Selling Company in the sum of $1,635,140. This sum, added to the current operating liabilities on that date, left the company with a capital working deficit of $378,536. Attempts by other stockholders to reorganize the company failed. Therefore, International, who was desirous of obtaining the property, initiated foreclosure action in February 1924. The properties were sold at a Sheriff's sale on March 31, 1924, and were purchased by International Smelting and Refining Company for $1,000,000. The property was immediately reorganized as the Utah-Delaware Mining Company, a wholly-owned subsidiary of the International Smelting and Refining Company. It was operated under their ownership as a lead-silver-copper-zinc producer until the ore deposits were exhausted in the 1940's.

Bingham Consolidated Mining and Smelting Company. Early in 1906, while the smelter smoke suit was pending in the District Court, F. Augustus Heinze, who had been engaged in a struggle with the copper

1George M. Addy, "The Economic and Social History of Bingham Canyon, Utah, Considered with Special Reference to Mormon-Gentile Synthesis" (unpublished Master's thesis, Brigham Young University, 1949), pp. 70-71. In December 1918 Utah Consolidated filed suit against the Utah Apex Company for $500,000 for the alleged removal of ores from the former's property in the Dana fissure area. In return, the Utah Apex filed a countersuit for $1,750,000 alleging that the Utah Consolidated had been mining ores in the Leadville area belonging to the Utah Apex Company. The suit was decided in December 1921 in favor of Utah Apex.

2The Copper Handbook, 1925, pp. 1770-71.
barons of the Amalgamated Copper Company in Butte, Montana, obtained control of the Bingham Consolidated. Heinze, who had used every means at his disposal, both legal and illegal, to force Amalgamated to come to terms with him, had sold them his Montana copper holdings for $10,500,000 and now used these financial resources to buy Bingham Consolidated and other Utah mining companies.¹ (One of the latter was the neighboring Ohio Copper Company at Bingham, a budding porphyry copper property.) Once he gained control, Heinze reportedly began to "milk" the Utah properties to further his interests elsewhere.

In 1907, Heinze made plans to close the Bingham smelter and announced that he intended to form a "gigantic mining and smelting enterprise" to smelt ores from such Heinze-affiliated companies as Bingham Consolidated, Ohio Copper, Silver King Coalition at Park City, Western Utah Copper Company, and various other Idaho and Nevada mining companies.² The site selected for the new smelter was located about 2 miles west of the old Garfield Beach resort on the south end of the Great Salt Lake where a 2,000 acre tract was acquired at a cost of "over $30,000."³

Bingham Mines Company. Unfortunately the panic of 1907 prevented consummation of this plan and Heinze's New York bank and brokerage house failed. Heavily in debt as the result of Heinze's policies, Bingham Consolidated was also on the verge of bankruptcy.⁴ Not one to quibble

¹Tribune, February 10, 1906; March 17, 1906.
²Deseret News, July 18, 1907; EMJ, September 1908, p. 485.
³Deseret News, July 18, 1907.
⁴The Copper Handbook, 1909, pp. 370-77. Just how close, was disclosed a little later. The company had been reasonably prosperous in
over the death of an enterprise, Heinze was shrewd enough to maneuver himself into a position to purchase the Mascotte Tunnel from the Bingham Consolidated for $156,000 plus an annual income to the company of $15,000 and an agreement to have its ores transported at a cost "less than it could otherwise transport them".

The Mascotte Tunnel was then placed under the control of the Bingham Central Railroad Company, most of the stock being held personally by Heinze. He was later able to capitalize on this deal by extending the tunnel 3,000 feet to the Ohio Copper property, and exact a profitable toll of 15 cents per ton from this company—also a Heinze interest—to haul their ore from the Ohio Mine to the company's mill at Lark.

In addition to the Mascotte Tunnel, Heinze received from Bingham Consolidated a long-term contract for their ores to be smelted at his proposed Garfield plant. Until the smelter was constructed, the Bingham company was free to sell a small quantity of its ore on a custom basis. This agreement was apparently never fulfilled due to Heinze's inability to erect a smelter and the subsequent bankruptcy of the Bingham Consolidated company.

1905, its last full year of operations prior to Heinze's entry into the picture. In that year it had produced 14,396,269 pounds of copper. Company records indicated that production for 1906 had been 11,475,863 pounds of copper, of which only 6,124,333 pounds had been produced from the company mines. By 1907 the company sustained a loss from operations of $277,442.43, leaving it with "quick assets" of $244,697.70, and direct liabilities of $770,442.43. (Tribune for April 8, 1908 lists the operating loss as $339,739.) This situation indicated that the company had been operating at a loss for a considerable length of time—or more likely that Heinze had been very effective during his short period of control.

1Deseret News, November 13, 1907.

2Ibid.
In June 1908 an involuntary petition of bankruptcy was filed by the Bingham Consolidated Mining and Smelting Company; shortly thereafter, it was reorganized as the Bingham Mines Company. The new company operated on a lesser scale, shipping its ores to the Yampa smelter. When this smelter was closed in October 1909, new arrangements were made with ASARCO to send the lead-silver ores to the Murray smelter and the copper ores to the Garfield smelter of that company. (By this time the character of the ore was changing to lead-silver; in 1910 the company produced more lead than copper.) The company continued as a modest but profitable producer of lead-silver-copper-zinc ores until July 22, 1929 when the United States Smelting, Refining, and Mining Company acquired all of the property and assets of the Bingham Mines Company on a share-for-share exchange of stock. From then on the properties were operated by United States Smelting.

United States Smelting, Refining, and Mining Company. On January 28, 1908 the fires of the United States Smelting Company's Midvale smelter were blown out and 1,400 men placed out of work, both at the smelter and the company mines in Bingham and Tintic. The seriousness of the

---

1 The Copper Handbook, 1909, pp. 370-73. The Bingham Mines Company issued new stock for the old on a share-for-share basis, plus the payment of $3.50 in cash payable in five 50-cent installments. In addition, the company issued a $600,000 second-mortgage collateral 5-year 6 percent bond issue to pay off its debts.

2 Ibid., 1910-11, p. 422.

3 Ibid., 1918, pp. 1356-57; 1931, pp. 1817-18. The Bingham Mines Company, under its new management, was able to turn a profit of $55,775.92 during 1909, and $65,902.33 during 1910. Dividends totaling $1,461,125 were paid from 1917 to 1929.

4 Deseret News, January 3, 1908.
situation caused by the closure of this important smelter led many of the citizens of the affected communities to call a meeting in February 1908 in an attempt to work out a satisfactory solution whereby the United States smelter would be allowed to operate under terms similar to those afforded to ASARCO's Murray smelter. Said one man, "It is the height of injustice to allow the American Smelting and Refining Company privileges and deny the same privileges to its chief competitor, the United States Smelting, Refining, and Mining Company."  

Several weeks later the company was able to secure a modification of the injunction to permit the smelting of lead-silver-zinc ores. In testimony before Judge Marshall, U.S. Smelting maintained that it was now able, after considerable experimentation and the introduction of new scientific knowledge, to prevent the further damage of crops by smoke from their smelter. The company had constructed a new bag house at its plant, which, it said, removed from the fumes all of their lead dust, copper dust, arsenic and sulphuric acid—although some sulphur dioxide was allowed to escape in the form of a gas. The farmers were not convinced that the remaining sulphur dioxide was harmless and were dubious about allowing the company to continue lead smelting operations under the stipulated conditions. Judge Marshall, however, felt that since the farmers had entered into a more liberal agreement with ASARCO and that U.S. Smelting was the first company to make a "serious attempt" to solve the problem, the latter should be allowed to operate to prove whether it had succeeded. On this basis, the modification was granted.  

1Ibid., February 25, 1908.  
2Ibid., January 28, 1908; April 4, 1908. There were, however, certain restrictions placed on the United States company as a safeguard to
After the decision was rendered, Managing Director A. F. Holden of the United States Company shook hands with Mr. Mackay of the Farmers Alliance and said:

I'll bet the price of the entire plant that we never do the least bit of damage. We are investing almost the price of the plant in improvements. If we do any more damage we stand to lose this entire investment. All you will ever see coming from the U.S. plant flues from now on will be a little steam vapor from the water in the ores, in which will be mixed a little sulphur gas, which we cannot control.

It is not our desire to stay in the valley if we are to further antagonize the residents, or do harm to their land.1

Six months later the company proudly announced that the bag house and the other devices devised by its engineers had "effectively solved the 'smoke' problem" as far as U.S. Smelting was concerned. The company considered it a "triumph of metallurgical science in dealing with this vexed question."2

Due to the reduced amount of copper ores available from the company mines in Utah, the company made no effort to resume copper smelting operations. The copper furnaces were dismantled and the Midvale smelter became a lead-silver-zinc smelting operation only.3

the farmers. "These restrictions require that the smelter must absolutely stop all solids, including arsenic, sulphuric acid, copper, lead, and antimony dust, and may emit from the flue only three-quarters of 1 percent of sulphur dioxide gas to the total volume of smoke."

The smelter was allowed to operate on the basis of a report by Professor W. C. Ebaugh, head of the Chemistry Department at the University of Utah. His report said that the U.S. smelter contributed only slightly to the damage done, since it used less sulphide ores and collected most of its solid dusts in the flues.

1Ibid.

2Ibid., November 9, 1908.

3Ibid., January 28, 1908.
The Tintic Company. Although the Yampa smelter was located in Bingham Canyon and therefore not subject to the smelter smoke injunction, its days were also numbered.

In 1906 the ore transportation service provided by the Copper Belt Rio Grand Western proved inadequate to serve the needs of the company. To provide a more suitable means of transporting their ore, the parent Tintic Company organized, in 1906, the subsidiary West Mountain Tramway Company to build and operate a 12,270 foot aerial tram from the Yampa mine to the Yampa smelter. Completed in 1907 the tram had a capacity of 700 tons of ore per day and was claimed to save the company 25 cents per ton on the cost of ore transportation.¹

As mentioned above, the Yampa smelter did not have a converter section prior to 1906. All matte produced previously had been shipped to the United States smelter at Midvale for conversion. Notwithstanding, the unsettled conditions resulting from the smelter smoke litigation and the subsequent adverse decision by the court in November 1906 prompted the Yampa Smelting Company to increase the capacity of its smelter to 750 tons per day and install a converter department. The improvements were completed in 1907.²

Additional improvements were made at the smelter in 1908, during the period when the Yampa and the Garfield smelters were the only copper

¹Ibid., December 19, 1903; The Copper Handbook, 1910-11, p. 1678.
smelters in the state in operation. The capacity of the smelter was increased to 1,000 tons per day.\textsuperscript{1}

Notwithstanding, the era of prosperity was short-lived, as the Yampa smelter was not an efficient operation. The declining value of the company's ores from Bingham and the reduction of the market price of copper in 1909 necessitated the mortgage of all company property to secure additional loans. A short time later, in October 1909, the smelter was permanently closed. It was found that the ores were by now too low-grade to smelt in the quantity necessary to keep the Yampa smelter going and that "better results could be obtained by selecting and mining a smaller tonnage of higher-grade ore and shipping to another smelter."\textsuperscript{2}

For this reason, the company contracted with the Garfield smelter for the reduction of its ores.

In a short time the Yampa ore deposits were exhausted and the output of the mine diminished to the point where it was no longer profitable to operate and operations were ceased entirely.

**Independent smelters.** The shakeup of the copper and lead smelting business which occurred as a result of the smelter smoke suits ineradicably shaped the complexion of Utah's smelting industry. Hardest hit, to judge by their complaints, were the small independent nonferrous mine owners, who by 1908 found themselves at the mercy of what was called the "smelter trust"; i.e., the American Smelting and Refining Company.

\textsuperscript{1}Mineral Resources, 1908, p. 550.

\textsuperscript{2}Ibid., 1910, p. 593.
Between 1900 and 1905 the Salt Lake Valley had developed into a great custom copper-lead smelting center; the competition was so intense that ASARCO had had to fight for its very existence. Many of ASARCO's rivals had entered into ore contracts that were unprofitable, but advantageous to the ore producers. Then came the farmers and the smelter smoke suits. ASARCO was fortunate in having withdrawn from the fight early and having constructed in 1906 its huge Garfield smelter in a location immune to claims for damages and with long-term contracts to assure its future. For 3 years the Guggenheim-controlled ASARCO occupied a "monopsonistic" position—i.e., it was the only buyer of ores in the region.

Feeling the effects of this power, the miners banded together to form the Utah Mine Owners' Association in January 1908 to try to "obtain equitable adjustment of railroad freight and smelter rates . . . ."\(^1\) John Dern was elected president.

**Independent Smelting Company.** In addition to the organization of an association to protect their interests, there was considerable discussion about forming independent smelting concerns to provide a market for their ores. As early as 1906 there had been talk of forming a large nationwide independent smelting company to compete with ASARCO. Samuel Newhouse, the Lewisohn's, F. A. Heinze, Thomas F. Cole, and others had been mentioned as being interested in the venture. Nothing had come of it, and Heinze went on with other plans of his own. Newhouse had been initially interested in the erection of the large smelter to handle the

\(^1\) *Deseret News*, January 15, 1908.
ores from his Boston Consolidated and Cactus properties. He dropped out of the venture after an amicable arrangement was worked out with the Guggenheims for the Newhouse-controlled ores.¹

Although relations between Newhouse and the Guggenheims were good, he was nevertheless interested in the plight of the small independent mine owners. Having experienced a taste of discrimination when residing in Colorado, Newhouse became the champion of the underdog after coming to Utah. He became the unofficial spokesman for the small mine owners, and in this position subscribed to an independent smelter project initiated by a group of small producers in January 1908. He looked upon the venture as a cooperative effort and felt that the small shippers, lacking sufficient bargaining power, needed the plant to enable them to get all the values which their ores contained.

Said Newhouse:

Personally I have no grievance against any smelter or smelting corporation in this valley. On the contrary, I have done all in my power to aid them. Not alone by advising against any adverse legislation regarding them, but personally I have made long-term contracts with them for my own ores, and in many different ways has my attitude been friendly. Nor do I mean that this feeling will be changed because I am interested in a new smelter which is now in contemplation.²

In January 1908 Newhouse went to New York to take up the problem of fair dealing between ASARCO and the Utah mine owners. Meeting with Daniel Guggenheim, he reported the widespread dissatisfaction that had arisen in the ranks of the Utah mine owners, and of the alleged unfair treatment on the part of ASARCO towards them. Guggenheim replied to the

¹EMJ, March 31, 1906, pp. 630-31.
²Tribune, January 1, 1908.
allegations in a letter to Newhouse in which he stated that prior to their meeting he had had no knowledge of any grievance against ASARCO. The letter concluded with a statement of company policy in dealing with the producer's and his (Guggenheim's) willingness to investigate any complaints against the company. "... I shall approach the subject with an open mind and with an earnest desire to reach an arrangement that will be mutually satisfactory."¹

Newhouse's efforts to support the independent smelter project led to the formation of the Independent Smelting Company in 1908. The company purchased the plant of the Utah Smelting Company, erected north of Ogden by a group of Ogden businessmen in the fall of 1905. The plant had been an unsuccessful venture into copper smelting by the Ogden group and was not completed. It was operated by the new owners for a few months in 1908 and 1909, but was closed down early in 1909 because of "rates and other difficulties."²

**Fink Smelter.** Another smelting enterprise got its start in 1908 when Newhouse was approached by Edward Fink, an inventor with an idea for a new pyritic smelting process which he said would revolutionize copper smelting. Fink claimed that his new process, which was designed to utilize the fuel value of the sulphur and iron in the smelting of the ores, would provide a major breakthrough in copper smelting. Convinced of the merit of the new idea, Newhouse gave Fink the green light in designing and constructing a 100-ton experimental version of his furnace.

¹Deseret News, January 15, 1908; March 21, 1908.
²Ibid., December 19, 1908; December 18, 1909.
on land adjacent to the Boston Consolidated mill at Garfield. The entire venture was financed by Newhouse personally. He assured the other smelting companies that he was not interested in competing with them, but was interested in the project "... merely for the benefit of the smelting industry."1

The smelter was completed in January 1909, and an experimental run made early in the year. Some high-grade copper matte was produced, but the process did not prove to be a commercial success and was later abandoned.2

**Tintic Smelting Company.** In addition to the Newhouse-backed ventures, there was one other attempt made to meet the smelting needs of the small mine owners. This was under the auspices of Jesse Knight in the Tintic District.

In the fall of 1906 Knight was approached by the same Ogden capitalists mentioned above in connection with the Utah Smelting Company with a proposition to build a smelting plant near the Tintic mines. This group, composed of Bela Kadish, David Eccles, Henry H. Rolapp, and John Pingree, was casting about for a more desirable site for a smelting plant to recoup their losses from the unsuccessful Ogden venture.3

Knight liked their proposal since it would be a means of reducing the freight rates and the heavy smelting treatment expense he was then paying to send his ores to the Salt Lake smelters. Therefore, he agreed

---

1**Ibid., December 2, 1908; December 3, 1908; Tribune, October 22, 1908.**

2**Mineral Resources, 1908, p. 217.**

3**Deseret News, December 6, 1906.**
to become a minority stockholder in the venture. The Tintic Smelting Company (no kin to the Tintic Company previously mentioned) was organized in December 1906 with a nominal capital stock of $500,000 in 5,000 shares at $100 par. The board of directors of the new company consisted of Charles W. Nibley, Jesse Knight, C. E. Loose, David Eccles, and Bela Kadish.

As originally planned, the Tintic smelter was to be a 400-ton lead smelter with the provision of later erecting copper furnaces. Completion of the plant was scheduled for mid-1907. The site selected was near Silver City, Utah. Work got underway on the plant in early 1907, but due to financial difficulties on the part of the stockholders who were unable to pay up their subscriptions the plant was not completed until July 1908. In the meantime, Knight released the financially-pressed stockholders from their payments and assumed control of the company.

At the first, some difficulty was encountered at the smelter, but by the close of 1908 it was considered successful. On March 24, 1909 a copper furnace was placed in operation. The smelter continued to operate until October 1, 1909 when it was shut down. The reason given for its closure was that not enough of the ores necessary for a good smelting mix could be secured. The Tintic ores were not satisfactory as fluxing ores,

---

1Ibid.
2Ibid.; Jesse William Knight, The Jesse Knight Family: Jesse Knight, His Forebears and Family (Salt Lake City: Deseret News Press, 1941), pp. 45-47.
3Deseret News, December 18, 1908; December 18, 1909; Tribune, March 24, 1909.
and to overcome this deficiency, suitable ores had to be brought in from
the outside. As Knight put it, "the railroads charged a high rate for
hauling ore up the hill and a high rate for hauling the bullion down
hill."\(^1\) Once closed, the smelter was never operated again. It was kept
in working condition for a short time, but was then dismantled when
Knight was able to secure more favorable ore contracts from the Salt
Lake smelters.

During the 14 months of operation, the Tintic smelter sustained an
operating loss of $211,000. The total loss, including the cost of the
plant was nearly $1,000,000. The smelter, according to *The Copper
Handbook*, was offered for sale in 1911 for 50 cents on the dollar, but
there were no takers. "The unfortunate experience of this plant, which
was honestly built and managed, shows how extremely difficult it is to
compete, on a commercial basis, with the American Smelting & Refining
Co., in its own field."\(^2\)

Salvation came to the small Utah mine owners only through the inter­
vention of another group of Eastern capitalists with the construction of
the International smelter at Tooele. After 1910 Utah was equipped with
two large modern custom copper smelters. ASARCO and International both
competed for the marketable ores, and the mine owners were assured of
receiving fairer treatment.

By 1910 the sulphide copper era was well over its peak and on the
decline. Mines which formerly were large copper producers were rapidly

\(^1\) Knight, *The Jesse Knight Family*, p. 46.

becoming big lead producers. The meteoric rise of the Boston Consolidated and Utah Copper companies during the preceding 4 years and their successful attempts to apply mass production methods and revolutionary means of metallurgy to the "worthless" porphyry rock at Bingham, by now completely overshadowed the production of the sulphide mines which remained. One by one they retired from the scene, through merger of exhaustion, and their names were lost to all but those familiar with the industry.

The name of Samuel Newhouse, the "Father of Copper Mining in Utah," is heard no more. It has since been replaced by that of Daniel C. Jackling, the aggressive young metallurgist who ushered in the rich and profitable Porphyry Era in the history of Utah copper.
CHAPTER IV

THE PORPHYRY COPPERS: PART I

Significance of Porphyry Copper Mining

Up to 1897 the production of minerals in the United States came largely from the comparatively new underground mines. Technical progress had been small; hand drilling and hand picking were still the common methods of ore extraction. Mining was, to a large degree, a specialized hand process of individual miners who worked on highly-selected first-class ores. It was not until after 1897 that the extraction and preparation of minerals for use was mechanized. This technological breakthrough made possible the exploitation of low-grade ores previously regarded as uneconomic. Two events near the turn of the century were of particular importance in hastening this significant new development in American mining: (1) the use of the steam shovel on the Mesabi iron range, and (2) the introduction of opencut copper mining at the Bingham, Utah, porphyry copper deposits.¹

The rise of opencut copper mining, in turn, depended on two principal technological developments: mechanical methods of handling large volumes of materials and improvements in ore-dressing techniques. The former methods were borrowed from Mesabi's iron mining industry, and the latter methods were developed at Bingham in 1904. The improvements in gravity

concentration and the subsequent development of the flotation process of ore dressing made it commercially possible to recover the copper from the low-grade porphyry ores, which previously had been considered worthless by most engineers.¹

This new method of mining large quantities of low-grade copper ores, called nonselective mining, was "the mining industry's version of the process of specialization of functions which was occurring simultaneously in other industries." Since the introduction of opencut copper mining at Bingham in 1906, "nonselective mining methods have come to dominate the American mining industry."²

Porphyry copper mining thus originated at Bingham, deriving its name from the large quantity of igneous rock containing tiny specks of copper minerals throughout the mass of the rock. This rock underwent an intense shattering and fracturing at some geologic period or periods prior to the deposition of the copper minerals. Since the copper minerals were distributed so uniformly through the deposit it was more profitable to mine by "bulk" or nonselective methods than by the selective methods used in the so-called "vein" or "bed" mines. Today, the extent of the orebody usually is determined by the assay content of copper, which is relatively low—typically less than 2.0 percent and ranging well below 1.0 percent. (The copper content is usually highest at the "core" of the deposit, and gradually diminishes as the distance from the core increases.) "At some point—which necessarily varies with the existing physical and operational

¹Ibid.
conditions, the cost of production, with the price of copper, and with other economic conditions—a cutoff must be made between ore and waste.¹

The cutoff point may vary in different mines; and, of course, will vary with respect to the same mine at different times. Years ago the cutoff point at the Utah Copper mine was 0.8 percent, or 16 pounds of copper per ton of ore. Through increased efficiency and the constant improvement of equipment and processes it has been reduced steadily. At the present time it is 0.4 percent, that is, ore containing 8 pounds of copper per ton is shipped to the mills for processing, together with slightly higher-grade ore.²

The introduction of opencut copper mining operations at Bingham and elsewhere, with its labor-saving devices, has had two major effects on the copper-mining industry:

It has decreased the cost of producing copper, notwithstanding the low metal content of the porphyry ores, and it has reduced materially the labor requirements per pound of copper produced. Indeed, the open-cut method has been the most instrumental factor in the rapid increase in the productivity of labor in copper mining.³

This increase in labor productivity was brought about by two factors:

As the open-cut is the most productive method, the steady increase in the proportion of the total output mined by open-cut operations has tended to raise the over-all output per man. Being particularly well adapted to mass production, this method is especially susceptible to technologic improvements that are most


²Kennecott Copper Corporation, The Utah Copper Story (Salt Lake City: Kennecott Copper Corporation, 1957), p. 15.

Efficacious in labor saving. Moreover, increasing natural difficulties, which have had an adverse effect on the output per worker in underground mines, have been relatively insignificant at open-cut mines.1

Thus, the twentieth century has seen the rise of opencut copper mining, from a contribution of less than 2 percent of world production in 1907, to over 40 percent of the world total by 1940. (If Russia is excluded, the figure would approach 50 percent, and if only the Free World is considered, it would be about 80 percent since 1940.) The output of copper ore per man hour was, by 1940, four or five times as great in opencut operations than underground copper mining, and the copper output per man hour more than twice as great.2

Of all the copper mines throughout the world, the Bingham porphyry mine unquestionably holds first place as to the aggregate quantity of metal produced (15,963,042,100 pounds of copper to December 31, 1962). Bingham's mammoth mine is the biggest man-made excavation in the crust of the earth. At the end of 1961 the total quantity of material moved (ore and overburden) was 2,178,333,544 tons or approximately 1,000,000,000 cubic yards. This is more than four times the yardage of earth moved in the original digging of the Panama Canal. It exceeds by more than 50 percent the quantity of material moved at the famous Hull-Rust Mahoning openpit iron mine on the Mesabi Range in Minnesota.3

1Ibid.
3Ibid., p. 27; also statistical data obtained from the Utah Copper Division, Kennecott Copper Corporation, 1963, (in the files of the corporation).
Thus, it is possible to say that the story of the porphyry coppers at Bingham, Utah, is the story of the birth and development of opencut copper mining in the world.

Samuel Newhouse and the Porphyries

Boston Consolidated Copper and Gold Mining Company, Limited. In 1898, while development was underway at the Highland Boy Mine, Samuel Newhouse began casting about for additional mining property in which to invest. Looking about in the Bingham District, Newhouse became interested in the Stewart and other surrounding claims in Bingham Canyon. Newhouse's manager, Thomas Weir, therefore, began buying up the Stewart, Stewart No. 2, and adjacent claims, and a large number of claims in lower Copper Center Gulch, known as the Copper Center Group. In all, 65 claims, covering 350 acres were secured at a cost of $300,000.1

While the newly acquired property was primarily copper bearing, it possessed the mineral in two distinctly different ores, sulphide and porphyry. Several years before, in late 1896, A. Klopstine and Dan Harrington had taken over the Old Stewart Mine. It had been lying idle since the destruction of the company gold mill by fire in May 1895. Several of the old workmen had reported the discovery of a 3-foot vein of ore carrying 36 percent copper and some silver and gold. It reportedly "looked so much like pyrite that it was considered worthless."2 For over a year Klopstine and Harrington employed from 6 to 25 men in an effort to locate the lost veins.3

1Boutwell, Bingham District, p. 281; Tribune, November 12, 1898.
2Tribune, January 1, 1897.
3Ibid., January 1, 1898.
Initially, Newhouse directed the exploratory work on the Stewart group, in an attempt to find the copper lode seen many years before, with the view of opening up the shoots of sulphide ore. Thus, in 1898, 30 men were employed to drive several tunnels in the Stewart. After going a considerable distance, a rich sulphide ore shoot similar to that found in the Highland Boy was opened up.¹

As he had done previously after the discovery of copper in the Highland Boy Mine, Newhouse went to London to promote his latest acquisition. With the success of the Highland Boy fresh on their minds, Newhouse was able to interest many of the same individuals who had participated in the organization of the Utah Consolidated in joining him in the new venture. Together they organized the Boston Consolidated Copper and Gold Mining Company, Limited, on May 14, 1898, under the laws of Great Britain.²

For a suitable title for his newly-created enterprise Newhouse had coined the name Boston Consolidated, the former being the name of "the mother city of copper speculation," and the latter the "synonym for the celebrated Amalgamated Copper."³ Shares in the new company were listed on the London and Boston Stock Exchanges and the job of "floating the company" got underway.

To operate the Utah properties, an American corporation, the Boston Consolidated Mining Company was organized under the laws of New York, in

¹Ibid., January 1, 1899.
November 1898, with a nominal capitalization of $1,000,000 with shares at $100 par. The entire capital stock, except the founders' shares, was retained by the parent English company. Officers of this company included John E. Dudley Ryder, Chairman; Samuel Newhouse, General Manager; and Charles S. Henry, M. I. Newhouse, Frank A. Schirmer, Eugene Meyer, Jr., and Captain Stephen H. Pollen, directors. The American corporation was presided over by Samuel Newhouse, President; with Frank A. Schirmer, Vice-President, Secretary, and Treasurer; Lafayette Hanchett, General Manager; and Louis S. Cates, General Superintendent. 1

Promotion of the porphyry coppers. In their efforts to promote the new venture, Newhouse and Weir based their campaign on the enormous potential of low-grade porphyry copper ores contained on the property. Thomas Weir wrote a special report which outlined the deposits of copper on the company property at Bingham, which Newhouse used while in London to drum up support for the new company. The flamboyant efforts of Newhouse soon brought forth sharp criticism from the astute London Financial Times, which editorially criticized the Boston Consolidated as well as several other Utah companies. A short time later, the Engineering and Mining Journal took up the issue. Commenting on the article which had appeared in the Financial Times, the Journal editors did not think the attack on the other "Utah companies" was justified by the facts. However, when it came to the Boston Consolidated: 2

Judging by the company's own showing, there appears to be no doubt as to the worthlessness of the proposition. The company has

1The Copper Handbook, 1909, p. 396.

2EMJ, May 27, 1899, p. 615.
been floated, apparently, very largely on the reputation of the Utah Consolidated Gold Mines, Limited, a company which has so far made a very liberal showing, and advantage was also taken of the boom in everything connected with copper.\(^1\)

Weir's report claimed that the company property contained some 290,000,000 tons of ore "carrying 1 to 2 percent copper, with some small values of gold and silver." He assumed the dimensions of the ore body to be 2,000 feet long, 3,500 feet wide (or across the formation), and 500 feet deep—amounting to 3,500,000,000 cubic feet. "Allowing 12 cubic feet, in place, to the ton (this is exceedingly liberal), we have 291,666,666 tons. The above ore body assays from 0.75 per cent. to 2.5 per cent. copper."\(^2\)

After a discussion of Weir's assumptions, the accuracy of which were seriously questioned, the editor went on to say that he did not think they would be in any better position even assuming they were accepted.

It would be impossible to mine and treat ores carrying 2 per cent. or less of copper at a profit, under the existing conditions in Utah. In the Montana mines, where ores from 4 per cent. up are treated it is well known that the profits come chiefly from the gold and silver in the ores; and it is not claimed that the Boston Consolidated mineral has more than very small values in gold and silver; and many other parallel cases might be presented.\(^3\)

The editorial concluded with the oft-quoted gloomy prediction, "on the company's own showing, therefore, the more ore it has of the kind it claims to the poorer it is. Undoubtedly our London friends, who are now buying the stock at high prices, will realize this a little later."\(^4\)

\(^1\)Ibid.
\(^2\)Ibid. History has borne out the conservatism of Weir's report. Over 1,000,000,000 tons of ore have been mined to date (1963) and the mine is still a major producer with many years of active life remaining.
\(^3\)Ibid.
\(^4\)Ibid.
The criticism by the *Engineering and Mining Journal* soon brought forth heated replies. Thomas Weir wrote a reply, published on June 10, 1899, in which he defended his position as to the worth of the mining property. The same issue contained a letter from Hartwig A. Cohen, a consulting engineer in the employ of Captain Joseph R. De Lamar (a Utah mine operator who was interested in the nearby porphyry property of Colonel Enos A. Wall). In defense of the Boston Consolidated Mr. Cohen said, "I beg to state that you do this property a great injustice, and without a thorough and careful investigation have jumped at conclusions."\(^1\) Having inspected the neighboring Wall property a year previously, Cohen found that he could concentrate the 2.2 percent ore and sell the concentrates on the market for 7 cents per pound for the copper contents. He concluded: "I am in no manner interested in the Boston Consolidated property, but my investigation of the porphyry belt of Bingham, Utah, convinces me that it presents a basis for an important and valuable industry, to which I believe, you will agree upon investigation."\(^2\)

Commenting on the two letters, the editors said:

> We think both gentlemen take a somewhat too favorable basis for their estimates in several particulars . . . .

> In the first place, it is certainly misleading to ignore, as most of our correspondents do, the questions of water supply and dump room. The best authorities are pretty well agreed that the quantity of water required to treat the large amount of ore called for in the cited estimates of cost of treatment cannot be obtained in Bingham Canyon, and that the ore will have to be hauled to the Jordan River and milled there, where doubtless they could, artificially, get dump room . . . .

> We are ready to recognize that in cost of treatment the Utah copper bearing Porphyries have a considerable advantage over the

---


ores from Montana mines; but we are yet unconvinced that there is any fair profit in treating 1.38 per cent ore in Utah, and even very skillful bookkeeping cannot figure out any basis for the prices at which these mines, as represented by their stocks, are being sold.1

The issue of the worth of the Boston Consolidated and Wall porphyries continued to rage in the following weeks. Victor M. Clement, also hired as a consulting engineer by Captain De Lamar to inspect the neighboring Wall copper property, wrote that he had made a favorable report on the Wall Mine, and on his judgment De Lamar had made an investment in the property. Said Clement:

In explanation I will say that the development of this particular property [Wall property] consists of a number of old prospect workings, which in many places give evidence of rock assaying about 2-1/4 percent of copper in the nature of chalcopyrite impregnating the mass.

The precious metal contents I consider as unprofitable for parting.

The nature of the work on the property is such as to encourage further search for extensive bodies of similar material.

With favorable results attending such developments, that is, having once succeeded in exposing an unlimited quantity of this grade, I have no hesitancy in predicting a moderate profit under a normal copper market.2

Clement went on to state how he had come to these conclusions, and that it was on this basis (and favorable market conditions) that he "prevailed upon Captain De La Mar [sic] to venture as a gamble a nominal investment in this undertaking and to spend a few thousand dollars in exploring and testing this ground, with a view of obtaining the data necessary upon which to base a definite calculation prior to an attempt at actual operations."3

1Ibid.
2Ibid., July 8, 1899, p. 36.
3Ibid.
Clement also registered his surprise at the article which had appeared previously, and then, referring to Cohen's letter in the same issue, he said:

His present views seem at variance with the result of his examination to which he refers. In his report he distinctly condemned the property as nonproftitable, thus clearly establishing, from his own standpoint, at any rate, the correctness of your Journal's contention, since the only argument that he can plead in support of his present reversed opinion is the advance in the price of copper from about 13c.\(^1\)

Once again the editors of the *Engineering and Mining Journal* replied to the criticism of their position. They said they agreed that 2 percent copper would pay, provided that a good proportion "over 2 percent," be included. Concluding their argument, the editorial said:

The *Engineering and Mining Journal* will welcome every demonstration of the actual value of these great low grade properties and will rejoice when they have been treated at a profit. Utah has had too many lessons in the past of the harmful effects of getting capital invested in unprofitable mines, and we are confident its best citizens and its experts recognize the prevention of repetitions of such experiences as the service of a friend to its great and valuable legitimate mining industry.\(^2\)

Once the storm of protest over the porphyries had blown over, Newhouse and Weir set about the job of developing their property at Bingham. In 1900 development work at the Sulphide Mine was continued in hopes of blocking out sufficient ore to place the mine on a paying status. The company engineer, Mr. J. M. Callow, also began a number of "elaborate tests" on the porphyry ore during 1900. "A laboratory plant has been constructed and many months have been devoted to the working out of details preparatory to designing a big mill to handle these ores."\(^3\) The future

---

\(^1\)Ibid.

\(^2\)Ibid.

\(^3\)Deseret News, December 15, 1900.
Development of the Boston Consolidated porphyry ores depended on the results of these experiments.

Notwithstanding, the drop in the price of copper from 17 cents to 13 cents in 1901 as the result of the "bursting of the bubble" generated by the manipulation of copper in the United States by the Amalgamated Copper Company, caused Newhouse and his associates to go slow in their development of the porphyry mine.¹

**Development of the Boston Sulphide Mine.** Development work at the Sulphide Mine continued, however, and by the end of 1903 the mine was brought to the producing stage. The company had 8,000 feet of underground workings and claimed to have blocked out from 2,000,000 to 3,000,000 tons of ore, carrying values ranging from 3 to 6 percent copper, $3.50 in gold and silver, with a little excess in iron. At the porphyry mine, more than 3,000 feet of the workings had been run in a solid mass of ore, indicating a vast quantity of ore richer than that in the Sulphide Mine.²

Once production at the Sulphide Mine got under way, the Boston Consolidated directors considered the feasibility of erecting a smelter to handle the copper ores. This project was abandoned when the company was able to make a "very favorable contract" with the Bingham Consolidated Copper Company to smelt 200 tons of Boston Consolidated ore per day at the former company's plant. The contract, of 2-year's duration, called for the shipment of 200 tons of ore per day carrying not less than 3 percent copper.³

²Deseret News, December 19, 1903.
As 1903 drew to a close, the company, at its last stockholders' meeting of the year, announced plans for the construction of a concentrator, along the lines upon which the Utah Copper Company was then proceeding at Copperton, in Bingham Canyon. The Boston Consolidated was very optimistic, especially after reports of "competent mining engineers" indicated the presence of 495,000,000 tons of porphyry ore containing silver and gold—as well as copper. Assuming the efforts of the neighboring Utah Copper Company would be successful, there was nothing to prevent the Boston Consolidated from doing likewise.¹

It was planned to utilize the profits from the ore being shipped from the Sulphide Mine to provide the means to finance the new concentrating mill, once the Utah Copper Company had demonstrated the profitability of the reduction of the porphyries at its newly-constructed Copperton mill. It was felt that their (Utah Copper's) experimental operations would sustain the favorable report made by the Boston Consolidated's own engineer, Mr. Bettles.²

The initial operations at the Sulphide Mine were very favorable. The Annual Report of the Boston Consolidated Mining Company for the year ending September 30, 1904, showed a net profit of $127,245. During the preceding year the company had shipped 47,846 tons of ore to the Bingham Consolidated smelter, which had averaged 3.3 percent copper. In view of the success, the company, at a shareholders' meeting, voted to increase the capital stock by 125,000 shares at $1 par, and to issue

¹_Tribune_, January 3, 1904.
²_Ibid._
$250,000 of 6-percent convertible bonds for the purpose of constructing a concentrating plant of 2,500 tons daily capacity.¹

Development of the Boston porphyry mine and concentrating mill. In March 1905 the company began to develop the disseminated porphyry ore deposit on its Bingham property. Thirteen tunnels were driven during the remainder of the year, with nearly 2 miles of underground workings and considerable prospecting on the surface. From work done in the Ben Hur No. 1 and No. 2 and the Metropolitan, the company estimated that 30,000,000 tons of ore would be available. Plans were made to begin steam-shovel operations in 1906, and three were ordered.²

At the close of the 1905 fiscal year, the Annual Report indicated a net profit of $172,158 on the operations of the Sulphide Mine, with 43,717 tons of ore having been shipped during the year. With the termination of the Bingham Consolidated contract during the year, the company entered into a new one with American Smelting and Refining Company to deliver 75 tons of sulphide ore daily to the new Garfield smelter then under construction. At this same time Newhouse announced that on the basis of a 2,500-ton concentrating plant, yielding a recovery of 70 percent, and with a copper content of 1.4 percent in the ores, the company could yield $2.72 per ton of crude ore. With copper at 12 cents per pound the company could make a profit of 94 cents per ton. With these favorable prospects the company expected to go ahead with a 3,000 ton concentrator at Garfield, to cost $1,125,000.³

¹Mineral Resources, 1904, p. 238.
Originally the company had planned to construct its concentrating plant at Pelican Point on the west shores of Utah Lake in Utah County. For this purpose 1,085 acres of land had been purchased. However, since the plans were well underway for the construction of the Utah Copper Magna concentrator, and the deal between Utah Copper and the Guggenheims had been concluded, whereby the latter were to build a huge smelter nearby to smelt the concentrates of the former, Newhouse was persuaded to join the venture and build his plant at Garfield to take advantage of the proximity to the new smelter. In light of the new arrangements, Boston Consolidated purchased a tract of 910 acres of land near Garfield and construction started on the new mill.\(^1\)

The actual construction of the Boston mill got underway in 1906, at which time the work of stripping the overburden at the mine was also initiated. The first steam shovel at Bingham was placed in operation by the Boston Consolidated on June 24, 1906, nearly 2 months before rival Utah Copper Company. This shovel was augmented in October 1906 by a 90-ton Marion shovel and two additional ones in February and March 1907. Total cost of the four shovels amounted to $72,981. The credit for the inauguration of the extensive system of steam-shovel mining at Bingham Canyon is due Manager Lafayette Hanchett and Superintendent Louis S. Cates.\(^2\)

---


2. Mineral Resources, 1906, p. 405; 1907, p. 458; The Mineral Industry, 1907, p. 296; Tribune, July 19, 1908. In August, two cars of dynamite were loosed, in "one of the greatest blasts in Utah mining history," to jar the mountain into shape for steam shovelling. Tribune, August 11, 1906.
During 1906 the steam shovels stripped 2,011,733 tons of capping from the mountainside, at a cost of $379,576. In addition, $229,666 was expended for railway trackage for the shovels, and $52,505 for an incline tramway to carry the ore from the 60-foot steam shovel bench to the ore loading station at Carr Fork, a distance of 2,050 feet. Another $28,505 was expended to build an auxiliary yard to the Rio Grande tracks, which was 70 percent complete by September 30, 1907. The mill at Garfield was nearly complete by the close of September, and up to the end of the fiscal year $1,468,902 had been expended in its construction.\(^1\)

On the plus side of the ledger, the 1907 Annual Report indicated the production of 1,405 ounces of gold, 9,879 ounces of silver, and 508,862 pounds of copper from the Sulphide Mine, from the 11,919 tons of ore shipped to the Bingham Consolidated smelter. In addition, the company shipped 122,386 tons of ore to the Garfield smelter, which contained 11,237 ounces of gold, 68,249 ounces of silver, and 5,638,063 pounds of copper. Production costs for the copper amounted to 8.65 cents per pound, after deducting the value of gold and silver recovered.\(^2\)

The Annual Report stated that the cost of mining, removing, and disposing of the capping had been 18.25 cents per ton, compared to the estimates made by company engineers of 40 cents per ton. It was also estimated that the quantity of capping remaining to be removed amounted to approximately one-half the ore tonnage. During the year opencut operations were being carried out on seven bench levels.\(^3\)

---

\(^1\) The Mineral Industry, 1907, p. 296.

\(^2\) Ibid.

\(^3\) Ibid.
Adding his comments to the report, Samuel Newhouse indicated that the company had reached the point of "commencing the production of copper on a very large scale" from the porphyry mine, and was in a position "to maintain a heavy tonnage of ore from its Sulphide mine." "The Engineers," said Newhouse, "have conservatively figured 56,000,000 tons of workable and payable ores now contained in the company's mines. The mill will consume when operating at its fullest capacity but 1,080,000 tons per year of this vast quantity, which involves a period of 50 years of effective operation for the conversion of ore with our present plant." Concluding on a positive note Newhouse added, "In possession of one of the largest copper properties in the world, substantial results are limited only by the capacity provided for the treatment of the ores. The company is in a position to mine double the amount now required by the mill."\(^1\)

On January 28, 1908 the first section of the new mill, with a capacity of 250 tons of ore per day, was placed in operation. Four days later, on February 1, the second section followed suit.\(^2\)

Financial Difficulties Encountered at Boston Consolidated

Unfortunately, the optimistic tone of the 1907 Annual Report was not entirely justified by the events then transpiring. The Panic which had followed the decline of the stock market early in the year had caused the company considerable financial difficulty. Relating the events at a later date to the London stockholders, Lafayette Hanchett said:

\(^1\)Ibid., p. 298.

\(^2\)Tribune, January 28, 1908; February 1, 1908.
When the panic swept over our country, at the time when most of the contracts for our material were maturing, and knowing at the same time that our copper was not selling, I realized that we needed strong and daring men to take our enterprise through these trying times without embarrassment to the company. . . . When this company was pressed for funds, two of your American directors, Mr. Frank Shirmer and Mr. Samuel Newhouse, placed their personal endorsement on the company's paper; and by putting at risk, to the extent of a very large sum their personal fortunes for the benefit of the Boston Consolidated company [they] practically furnished the amount needed.¹

For the next few months, the company's financial health remained rather precarious. This was not helped by news that in the operations at the porphyry mine the ore beneath the capping was at first not rich enough to warrant shipment to the company mill. As a result, the new mill was unable to run at full capacity.²

Reports began to appear in the Boston papers that the company was in trouble. In April 1908, there were rumors that the Boston Consolidated, Ely, Nevada, and Cactus properties were considering a merger. Newhouse went to New York to talk with some of the other interested parties. Nothing came of it, and the talk disappeared. As in the past, there were also rumors of a Utah Copper–Boston Consolidated merger floating around. Newhouse denied the rumors, saying that even though the Guggenheims had offered $20 a share for the Boston Consolidated stock, which was then selling for about $11.50, no deal was in the offing.³

¹Tribune, February 29, 1908; The Copper Handbook, 1909, p. 396. What Hanchett was referring to was a first-mortgage loan of $1,500,000 which the American company had taken from the Federal Trust Company of New York, in February 1908, to cover the convertible bond issue of December 1907 by the English company.

²Tribune, March 29, 1908.

³Ibid., April 24, 1908.
In May 1908 the company placed the fourth section of the mill in operation, giving it a capacity of 1,000 tons per day. However, about the same time the shovels began mining ore which carried a high percentage of iron. This prevented the concentration necessary for economical operations (as being demonstrated by the neighboring Utah Copper Company), and necessitated the stopping of shipments of this ore to the mill. It then became necessary to get all the ore for the mills from tunnels lower down the mountain. The additional expense which the underground mining required increased mining costs of the porphyry ores by 50 cents per ton, and necessitated the making of a new contract with ASARCO whereby the company would not be penalized for the iron.¹

Efforts were soon made to determine the seriousness of the surface mining problem. A rise was driven up from the Ben Hur Tunnel toward the surface of the mine above. At 50 feet under the surface neutral ores were encountered, which was an encouraging sign. It was hoped that additional exploration would confirm these initial findings.

By the end of October the mine was shipping 1,600 tons of ore per day to the mill. The efficiency of the mill had been raised to 72 percent, which at the time was 8 percent above that of the Utah Copper Magna mill.

¹Tribune, October 25, 1908. "A grade of ore entirely unlocked for, containing a large percentage of iron pyrite, which served to lower the concentration ratio of the ore by 50 per cent, was encountered in the porphyry mine, and underground mining by the caving system was resumed and relied upon to supply the increased capacity of the mill at Garfield. The fact that the company's contract with the smelter contained no provision to take care of the excess of iron was given as a reason for discontinuing steam-shovel work." Mineral Resources, 1908, Part I, p. 564.
Nevertheless, the main problem remained to be solved to enable the company to resume opencut operations.¹

In addition to the problems encountered at the porphyry mine, the company, during October, experienced some difficulty in getting its ores from the mine to the smelter. The Denver and Rio Grande Western Railroad could not handle all the ore which the Utah Copper and Boston Consolidated companies were now shipping. No action was taken by the company to resolve the problem, however, after Utah Copper announced plans to construct a railroad of its own. It was now felt that the situation would improve.²

Louis Cates, the general superintendent of the Boston Consolidated, was interviewed by a Boston newspaper late in 1908 about the recent difficulties being encountered by the company in its opencut operations. Cates had been quoted as saying “that the rocky cliffs of Bingham are not adapted to profitable removal by steam shovel.”³ Upon hearing the report, Colonel Wall, the disaffected Utah Copper stockholder, commented that it would probably require another million dollars to secure the removal of sufficient waste to allow mining by steam shovels, and this added to the

¹During the fiscal year ending September 30, 1908 the company had shipped to the Garfield smelter 79,301 wet tons of sulphide ore, containing 4,447 ounces of gold, 55,705 ounces of silver, and 3,459,911 pounds of copper. The company mill, which commenced operations on January 27, 1908, treated 143,284 dry tons of ore and produced 9,935 tons of concentrate, containing 397 ounces of gold, 7,968 ounces of silver, and 2,937,599 pounds of copper. This concentrate was placed in storage at the mill until the Garfield smelter was put in successful operation to receive it. Shipments were commenced to the smelter on October 17, 1908. The percentage of recovery at the mill often reached 80 percent. Ibid.

²Ibid., November 17, 1908.

³Ibid., November 26, 1908.
Faced with a serious situation, the company's American board of directors met on December 7, 1908 to determine what steps could be taken to shore up the difficult position and create a better public image of the company. The outcome was that Samuel Newhouse was moved up to president, and the active management taken from him and placed in the hands of an executive committee. In addition, Lafayette Hanchett, the general manager of both the Boston Consolidated and the Newhouse Mines and Smelters (another Newhouse-controlled copper company), was relieved of his latter position to enable him to spend more time at Bingham. Finally, the board hired Sidney Jennings of Salt Lake City, formerly with the United States Smelting, Refining, and Mining Company, as a consulting engineer. His job would be to plan and direct the development of extensive underground operations at the porphyry mine. 2

Following the reorganization, the company proceeded with renewed optimism. Hanchett took a positive view of the previous difficulties:

While admitting that the rocky cliffs of Bingham are not so susceptible to steam shovel operation as possibly some other camps, yet it will be many years before the steam shovel will be abandoned in Bingham, for it is the best and cheapest method of mining, both by the Utah Copper Company and the Boston Consolidated Company, and our company plans to expand in the line of steam shovel work from now on.

1Ibid.
2Ibid., December 2, 1908; December 8, 1908.
The discovery of iron in our porphyry ores at the top of our mountain has proved somewhat a blessing in disguise, as it has forced us to do a lot of development work. In this development we have put 6,000,000 additional tons of ore which we never before counted on. This ore runs from 1.5 per cent to 1.8 per cent copper. This additional tonnage is equal to 1/5 of our total tonnage, and more than makes up for the tonnage of iron ore which we found. It is now only a matter of a week or so before the Boston Consolidated Co. will have its entire 8,000 [3,000] ton mill capacity in commission, and after the turn of the new year we should be upon a substantial earning basis.

Meanwhile, from New York Samuel Newhouse furthered the new note of optimism with appropriate publicity releases. He predicted a worldwide increasing demand for copper, and said that the copper industry "is on the eve of the greatest boom it has as yet experienced in its history."\(^2\)

From January to April 1909 there was very little in the way of news about the success or lack of it at the Boston Consolidated. In April a large eastern stockholder in the company wanted to know why there was an absence of information. "The placing of the affairs of the company in the hands of an executive committee may have been a good thing for the business management of the property, but the policy of this committee to keep information from the stockholders is a step in the wrong direction."\(^3\)

Commenting on the work of Mr. Jennings, and the potential of the company, he noted that Colonel Wall had invested a considerable sum of money in the company, which spoke well of its potential. Furthermore, the company had sold 50,000 shares of stock at $11 to raise money for the removal of capping, and much of this issue had been purchased by

---

1Ibid., December 20, 1908.
2Ibid., December 22, 1908.
3Ibid., April 8, 1909.
several of the new directors of the company. His own feeling of confidence was expressed thusly, "Boston Consolidated stock sold at $35 per share when it was of less value than today. I expect to see it sell there again under a legitimate appreciation of the value of the mine, not through rumors of any possible consolidation with neighboring properties." ¹

A short time later the situation was further clarified by the public admission of the problems faced by the company:

The Boston Consolidated proposition has been a huge disappointment to many stockholders, but the many difficulties experienced by the management which have led to these disappointments are apparently being overcome. Sidney Jennings, the mining engineer, is now in charge of the general operations of the property and since he has assumed control conditions have changed materially for the better. The eastern end is now in the hands of an executive committee so that the company should be assured of better management, both at the western and the eastern ends.²

By the first of April 10 of the 13 sections at the Garfield mill were in operation. In May it was announced that the company was now earning $25,000 to $35,000 per month, and that during March 1,253,000 pounds of copper had been produced. Output for April was expected to exceed this figure by 500,000 pounds. Furthermore, by early May the eleventh section at the mill was in operation, giving it a capacity of 2,750 tons of ore per day.³

Survival of the fittest. Notwithstanding, about this time the talk of merger with the Utah Copper Company was revived. A large shareholder of Boston Consolidated was quoted by the Boston News Bureau as favoring

¹Ibid.
²Ibid., May 12, 1909.
³Ibid., April 11, 1909.
such a move on the basis of two shares of Boston Consolidated for one share of Utah Copper stock. At that time, Boston Consolidated was selling for $15 a share and Utah Copper at $50 a share.¹

When the rumors of such a merger were mentioned to D. C. Jackling of Utah Copper, he said, "there is absolutely no truth in it." However, it could hardly be denied that there was some talk of merger then going on. Both the Guggenheims and the Cole-Ryan groups (the group which controlled the Amalgamated Copper Company of Butte, Montana, and which formed the International Smelting Company) were considering the possibility of further mergers within their ranks. For some time it had been rumored that the Guggenheims wanted to bring all their copper properties under one organization. In June 1909, it was even rumored that the Ray, Chino, and Gila copper properties were to be included with the Utah properties, to form a huge copper enterprise. A month later "reliable" eastern sources reported that the Cole-Ryan interests were desirous of getting a toehold in Bingham to insure a good source of ore for their new International smelter then under construction at Tooele. They were reportedly interested in the Boston Consolidated and Ohio Copper companies, the latter if they could also gain control of the Mascotte Tunnel controlled by F. A. Heinze.²

This apparent interest in Boston Consolidated by the Cole-Ryan interests encouraged the Guggenheims and Utah Copper to proceed with greater speed to bring about the merger between Utah Copper and Boston

¹Ibid., May 18, 1909.

Consolidated. The time was now ripe for a merger. Samuel Newhouse was having financial difficulty with his other Utah copper property, the Newhouse Mines and Smelters, which was in need of a "reorganization" to keep it solvent. His hands full of copper problems, and with the discouragement of the past few years at the Boston Consolidated still unresolved, Newhouse was ready to dick er. Then, too, the eastern and British stockholders of Boston Consolidated were demoralized by the continuing difficulties and the lack of concrete achievements from the mines at Bingham.

While preliminary discussions were getting underway between Newhouse and the Guggenheims, influential parties connected with Utah Copper attempted to paint a black picture of the Boston Consolidated situation in order to improve the bargaining position for Utah Copper. An article written by a director of Utah Copper appeared in an eastern newspaper, purporting to tell the story of Boston Consolidated's attempts to bring about the merger. He said that Boston Consolidated interests had approached officials prominent in the management of Utah Copper with a view towards amalgamation. They were told that Utah Copper was not seeking amalgamation, and, therefore, had no suggestion in the matter. The Boston Consolidated interests then asked if an exchange of shares could be arranged between the two companies. The offer had been made to take one share of Utah Copper for three shares of Boston Consolidated stock. At this point Utah Copper officials agreed to look over the Boston Consolidated property if sufficient stockholders of the latter company would be willing to make the trade.
It was furthermore distinctly stated to the Boston Consolidated people that there would be no commissions of any kind, shape or form payable to anybody in connection with such an amalgamation; that the Utah Copper Company would simply tender whatever number of shares were necessary to give one for three to each stockholder of the Boston Consolidated.¹

Continuing, the director went on to reinforce the Utah Copper position regarding the relative merits of the two companies:

The record of Boston Consolidated is no dividends, continual issuing of new securities, and no monthly successions of net profits.

The record of Utah Copper is a big cash working balance, regular dividends, with almost unanimous belief that the management is the best possible. Everyone knows what management means in a mine, and yet the Boston Consolidated people, with their shares at 16, would like to make the basis of consolidation such that the present selling values would not be at all indicative of the real merits of the properties, and the successful management of Utah [Copper] considered as a liability instead of an asset.

The Utah Copper company's leading stockholders are content to go on with their present property, their present dividends, and trust that the Boston Consolidated shareholders are equally satisfied to go on with their present income.²

By now it was quite apparent that the once mighty Boston Consolidated was being softened for the takeover. Plagued by numerous difficulties and bad luck, the company became likely prey for the far more astute and able syndicate, the Utah Copper Company. The latter, whose successes were well publicized and defeats well hidden, was backed by the immense financial resources and prestige of the Guggenheims. They knew that if Utah Copper was to survive, it would have to take over Boston Consolidated. Being the better players in the game of "survival of the fittest," the end was near for Boston Consolidated.

And yet, surprising as it may sound, the Boston Consolidated was described in 1909 by The Copper Handbook in glowing terms. "... the

¹Ibid., August 26, 1909.
²Ibid.
mine, by reason of almost incomprehensible tonnage of porphyry ores, is one of the great possibilities . . . .¹ Even though it may have equalled the Utah Copper Company in value of copper ore—ultimately—it was not in a position in 1909 to bargain from a position of strength. All that remained was for Samuel Untermeyer, the smart New York lawyer playing on both teams, to tie the knot which would spell the death knell of the Boston Consolidated Mining Company.² This was accomplished on January 25, 1910.

Porphyry Mining in Beaver County

The Cactus Mine. In 1870 an outcrop of copper, which came to be known as the Cactus Mine, was discovered in the San Francisco District of Beaver County. By the early 1880's, the property had been acquired


²" . . . according to the [last] annual statement of the . . . [Boston Consolidated Company], its mine produced during its fiscal year ending September 30, 1909, from the sulphide zone, 63,375 dry tons of ore, containing 5,823 ounces of gold, 68,525 ounces of silver, and 3,237,959 pounds of copper. After deducting smelting and refining losses, there remained 3,004,115 net pounds of copper, which cost, after crediting gold and silver values, 10.96 cents per pound delivered at New York City. The average cost of mining for this ore for the year was $1.66 per ton, making a total cost of $2.22 per ton. From the porphyry mine the ore averaged 5.39 per cent moisture. There were mined 645,679 dry tons of ore from the development of drifts and raises required to establish the caving system. On account of the extraordinary developments, the mining cost averaged 76.19 cents per ton, which is considered abnormal, since it was possible to mine the ore the last two months of the year for an average cost of 66.51 cents per ton. The mill product was 32,961 tons of concentrate, which, on shipment to the Garfield smelter, yielded 2,141 ounces of gold, 20,801 ounces of silver, and 13,446,315 pounds of copper. With smelting and refining deductions, there remained 12,539,067 net pounds of copper, which cost, with all charges added, 11.16 cents per pound delivered at New York. Thirteen sections, comprising the complete concentration mill, were in operation in July 1909." Mineral Resources, 1909, p. 477.
by French interests who organized the Cactus Company. They opened up the deposits to a depth of 100 feet. All efforts to work the mine and reduce the ore proved unsuccessful, however, and it remained idle for many years.\(^1\)

In 1897 the French-controlled company hired Professor James Luce to take charge of the development work at the property. Under his direction, a 100-ton concentrator was erected to handle the reduction of the ores. The mill was unsuited to the reduction of the monzonite-porphyry ore, however, and was shut down.\(^2\) The property remained idle until 1900 when A. B. Lewis acquired the interests of the French shareholders and organized the Royal Copper Company. Lewis was unable to attract sufficient capital to develop the property himself, and so, in 1901 sold it to Samuel Newhouse for a sum reported to have been from $200,000 to $250,000.\(^3\)

Under the direction of M. M. Johnson, one of Newhouse's assistants, a thorough exploration of the mine was undertaken during 1902 to determine the nature and extent of the ore body. It proved to be a large low-grade body of disseminated monzonite-porphyry similar to that owned by the Boston Consolidated in Bingham Canyon, and was estimated by Johnson to contain from 3,000,000 to 4,000,000 tons of ore. Another Newhouse assistant, A. J. Bettles, was placed in charge of the company

---


\(^2\) *The Mining Review*, September 15, 1902, p. 24; *Tribune*, January 1, 1897; *EMJ*, September 11, 1897, p. 318.

\(^3\) *The Mining Review*, September 15, 1902, p. 24; *Deseret News*, December 15, 1900; *Tribune*, October 19, 1901.
metallurgic department to determine how the Cactus ores could be treated economically and with the greatest savings of the metal content. Bettles set up an experimental plant in early 1902 using the Callow process of concentration with some of his own modifications. The mill ran a test using a batch of 50 tons of ore. The recovery was given as 92 percent and declared a success—the feeling being that the ores were actually easily concentrated—inspite of the fact that this seems to have been the reason for the failure of the former owners.¹

The results of the work by Johnson and Bettles being successful, Newhouse went to Europe in the summer of 1902 to promote the Cactus property. He proposed that the main shaft started by Johnson be sunk to a depth of 700 feet and that a 1,000-ton milling plant be erected at the mouth of Copper Gulch, 3-1/2 miles from the mine. Transportation for the ore would be achieved by driving a horizontal tunnel from the mill into the mountain which would intersect the main shaft at a depth of 700 feet.²

To provide water for the concentrating mill, the WahWah Springs located 10 miles away on the other side of the valley were purchased from a local Mormon farmer for $70,000. The water was to be collected into a reservoir and piped to a site above the mill where it would be stored in tanks for use. Newhouse also proposed that the area around the mill should be used to make a new town for the workers who would operate the mine and mill. It was to be given the name Newhouse.³

¹The Mining Review, September 15, 1902, p. 24; Deseret News, December 19, 1903.
³Ibid.
Newhouse Mines and Smelters. Samuel Newhouse returned to Utah in October 1902 with sufficient financial backing, and work was commenced on the development of the property. On May 16, 1903 the Newhouse Mines and Smelters Company was organized under the laws of New York with a nominal capital of $6,000,000 in 600,000 shares of stock at $10 par. To raise capital for the development of the mine and the erection of the 1,000-ton concentrating mill a $1,500,000 gold bond issue was subscribed, repayable in 10 years.¹

In Utah, the undertaking by the Newhouse interests was hailed as the "greatest industrial undertaking that the southern half of the state has ever seen--one of the greatest, indeed, that has ever been taken up in any western state." The importance of the project was magnified because of the critical period through which the area was then undergoing due to the temporary collapse of several other mining projects.²

Construction work at the mine got underway during 1903 and continued throughout 1904. The erection of the mill was under the supervision of Joseph Deidrich, and when finally constructed, had an operational capacity of 700 tons daily. Construction was started on May 29, 1904, but was delayed due to the slow delivery of material. It was completed early in 1905, about the same time as the Cactus Mine ore haulage tunnel.

The nearby town of Newhouse, when completed consisted of a large boarding house for 150 men, two stores, seventeen cottages of three, four, and six rooms each, with cement plaster outside and lime plaster and hard

²The Mining Review, April 30, 1904, p. 20.
finish interior. The four-room houses rented for $10 per month and those with five rooms at $15. In addition, a brick hotel named the "Cactus Inn" was built, and later, a theater. The town was dubbed as "a model camp," with everything being done for the convenience and comfort of the employees. No saloons were allowed in the town "so that temptation of employees to indulge in dissipation is now and will continue to be kept at a minimum." All in all, Samuel Newhouse spent nearly $2,000,000 to build the town, develop the mine, and build the mill before it could be placed in operation. Between 150 and 200 men were employed in carrying out the project.

Rail transportation facilities for the town and the mill were provided by the completion of a spur line from Frisco to Newhouse by the San Pedro, Los Angeles and Salt Lake. This was completed in September 1904. The mine was connected to the mill by the Newhouse, Copper Gulch and Sevier Lake Railroad, a 2.3 mill standard-gauge owned by the company. Equipment on the latter included a Shay engine and five 50-ton dump cars.

Production of ore at the Cactus property got underway in March 1905. Early in 1906 a team shovel was installed at the surface of the Cactus Mine and used to remove the overburden of earth which covered the ore body. After this was completed, two "glory holes" were started, from which about half of the tonnage of the mine was taken during the year.

---

2. Ibid.; December 30, 1904, p. 16.
The 1906 edition of the *Mineral Resources of the United States* reported that this was "beyond question, the cheapest mining work that is being done in Utah, the month of October having shown a product of 10,000 tons from the 'glory holes,' which cost only 19 cents per ton for the actual mining." The article continued by pointing out that 350 men were employed at the property, and that from 40 to 50 cars of concentrates were being sent to the Salt Lake smelters every month. Things were going so well that on December 1 the wages of all the employees of the Newhouse properties were voluntarily raised 25 cents per day.\(^1\)

The first quarterly dividend of 50 cents per share for a total of $300,000 was paid by the company on August 31, 1907. No further dividends were paid, however, and it soon became apparent that the company was having difficulty and had been unable to pay the dividend in the first place. It had merely done so for the market effect on the company's stock.\(^2\)

In view of this, attempts were made to improve the recovery of copper at the mill during 1908. The mill was shut down, completely overhauled, and additional machinery installed. The company claimed these improvements brought the mill up to its rated capacity of 1,000 tons daily, and that it was now achieving a reduction ratio of eight to one with about 80 percent copper savings. In addition to the trouble at the mill, during the year some difficulty was also encountered with caving in the lower

---

2. *The Copper Handbook, 1910-11*, pp. 1588-91. For the fiscal year ending June 30, 1908, the company indicated earnings of only $79,921 out of which bond interest of $81,000 was due, leaving a small net loss for the year.
levels of the mine. Whereupon attempts were made to utilize a caving system to recover the ore. Still, all was not well.¹

South Utah Mines and Smelters. Near the close of 1908 the company found itself financially insolvent, and near bankruptcy. To cope with the situation a "reorganization committee" was appointed by the board of directors early in 1909 to work out a method to keep the company from folding up. Under the direction of a committee composed of Charles A. Morse, Frank A. Schirmer, and Louis N. Kramer, a plan was drawn up to enable the company to continue operations. In an open letter to the stockholders and bondholders of the company, the situation was explained and a course of action suggested:

Owing to the recent depression in business generally and in the copper industries especially, and also owing to numerous unfortunate caves and mishaps at the mines of your company located at Newhouse, in the state of Utah, your company finds itself with an indebtedness of nearly $200,000, partly past due, on which suit is threatened, and with no funds with which to meet the semi-annual interest that will fall due on June 1, 1909, on its $1,300,000 par value of outstanding First Mortgage bonds, and the $100,000 required also on July 1, 1909, for sinking fund purposes.²

In addition, it was pointed out that the company needed "substantial further working capital for the development of its mines, the alterations of its mill, and to pay its creditors." It became evident that during the preceding 4 years the operations at the mill had not been entirely successful, and considerable quantities of copper had been lost in the tailings.

The committee proposed that new company be organized to acquire the property under foreclosure, and that this be done by floating $1,300,000

¹Ibid.
²Tribune, June 10, 1909.
in 6 percent 20-year income bonds, convertible at par, to cover the outstanding bond issue, and by issuing 600,000 shares of common stock in the new company at $5 par, on a share-for-share exchange for the stock in the old company. Under the new plan, necessary working capital would be raised by requiring stockholders who subscribed for shares of stock in the new company to pay a $1 assessment on each share of stock in the new company.¹

The plan was accepted by the shareholders, and the property was purchased for $500,000 by the new company. The assessment brought into the treasury $600,000, of which all but about $200,000 was required to liquidate the floating debt of the old company. This included a debt to the United Metal's Selling Company of $144,000.²

The new company, named the South Utah Mines and Smelters, was formally organized on February 28, 1910 under the laws of Maine. The company mill at Newhouse had been shut down since March 1909, and remodeled. Also the capacity of the mill was increased to 1,000 tons per day, and operations were resumed in September 1910.³

In 1908, prior to the reorganization, the company management had estimated that the mine contained 4,322,023 tons of ore averaging 2.5 percent copper. However, an estimate was made by E. P. Jennings, a Salt Lake Mining engineer in June 1909, and he estimated that the mine contained 1,127,083 tons of ore in sight at 1.8 percent copper, with 1,000,000

²Ibid.
tons of partly-developed and probable ore; and 1,000,000 tons of probable ore at 1 to 1-1/4 percent copper. These figures were considered more reliable than those issued by the company.¹

It would appear that the company had been prone to exaggerate its properties, accomplishments, and worth. This was evidenced, according to The Copper Handbook, after the completion of the $70,000 job of remodeling the Newhouse mill in 1910 when the company claimed that the mill's efficiency had been increased by 50 percent.

... and was claimed to have been so improved that it was extracting 75% of the assay values, as compared with the average extraction of about 50%, hence it is obvious that some very untruthful claims have been put out, from time to time, regarding this mill, and in consequence, present claims are to be accepted with due allowance for the exaggerated claims made in the past.²

By 1911 the town of Newhouse contained forty-seven dwellings and a clubhouse for the 250 men who were working for the company. However, with the price of copper as low as it was, the company was given a slim chance for profit on its ores.³

The concentrating mill was operated from September 1, 1910 to September 1912 when it was shut down. According to a telegram from W. Lee Heidenreich, general superintendent of the property, to the Deseret News, on October 7, 1912, the reason for the shut down was

... because of an unwarranted strike at the mine for higher wages. We were unable to grant this increase at this time for our production was temporarily cut down by a heavy flow of water on the 800 level, flooding our lower levels and the strike situation at Bingham has closed the smelter at Tooele, rendering it unable to handle our concentrates.⁴

⁴Deseret News, October 7, 1912.
The strike lasted to April 1913, whereupon operations were resumed. The ore bodies were exhausted by 1914, and the mine was closed in June of that year. The last Annual Report, issued in 1912, showed a loss of $31,113 by the company during that year.¹

In 1914 a flotation unit was added to the mill, and the company operated until 1918 by retreating mill tailings; whereupon, the property was closed down. In 1926 the property was liquidated and the townsite, mine, mill, and property were all sold. Shareholders got nothing, and the company was unable to retire the bonds due in 1930.²

Production for the Cactus Mine during its years of operation are given in the following table:

**TABLE 2**

METALS PRODUCTION AT THE CACTUS MINE, 1905-1914

<table>
<thead>
<tr>
<th>Year</th>
<th>Copper</th>
<th>Gold</th>
<th>Silver</th>
<th>Total Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1905</td>
<td>3,421,279</td>
<td>1,281</td>
<td>33,181</td>
<td>$ 593,917</td>
</tr>
<tr>
<td>1906</td>
<td>5,020,992</td>
<td>2,101</td>
<td>42,670</td>
<td>1,038,938</td>
</tr>
<tr>
<td>1907</td>
<td>4,537,418</td>
<td>2,031</td>
<td>59,054</td>
<td>988,438</td>
</tr>
<tr>
<td>1908</td>
<td>5,581,358</td>
<td>1,847</td>
<td>36,099</td>
<td>794,044</td>
</tr>
<tr>
<td>1909</td>
<td>858,272</td>
<td>250</td>
<td>5,361</td>
<td>119,539</td>
</tr>
<tr>
<td>Sept. 1, 1910–June 30, 1912</td>
<td>5,527,810</td>
<td>2,450</td>
<td>43,692</td>
<td>--</td>
</tr>
<tr>
<td>July 1, 1912–Sept. 30, 1912</td>
<td>674,987</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>April 1913–June 1914</td>
<td>3,294,113</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>


Samuel Newhouse—the Father of Copper Mining in Utah. The Newhouse Mines and Smelters and its successor South Utah Mines and Smelters, were the last of the Newhouse-controlled copper mining ventures in Utah. After withdrawing from the management of this company, Newhouse turned his attention to other activities, among the more noteworthy being real estate. In what was considered to be "the largest real estate deal since 1847," Newhouse agents gathered together a large area of real estate directly south of the business section of Salt Lake City. The area was occupied by cottages and small business structures, then in varying degrees of disintegration. On strategic corners of this property Newhouse created a sensation by erecting, in 1915, two modern office buildings, the Newhouse and the Boston, and the large 400-room Newhouse Hotel. He donated lots for the Salt Lake Commercial Club and the Salt Lake Mining Stock Exchange nearby and created a rival business section to the more staid structures to the north. All told, the Newhouse interests constructed some thirty business structures in Salt Lake City and elsewhere.¹

In New York, Newhouse also conceived and built the famous Flatiron Building. "In building this slice of architectural cake," wrote one admirer, Newhouse pointed the way to economical utilization of limited and expensive space, and "was responsible for the innumerable cloudscraped hives which punctuate the skyline today."²

The discoveries of Samuel Newhouse in the Bingham Mining District "revolutionized the methods and amazed the mining men of the country."³

¹Horace Dunbar, "Glittering Sam," Tribune, March 11, 1951; Warrum, History of Utah, pp. 733-34.
²Dunbar, "Glittering Sam," Tribune, March 11, 1951.
³Ibid.
Through his efforts in 1898 and 1899 in promoting the low-grade porphyry copper mines at Bingham, in the light of open ridicule by many who regarded them of doubtful value, he should be given the credit for demonstrating the worth of and bringing to the public the knowledge of one of the great discoveries of the mineral world fully 3 years before Daniel C. Jackling and his associates had taken over the property of the Bingham Copper Company. Samuel Newhouse was an antidote to the crude "public be damned" attitude espoused by many of his contemporaries in big business.

[He] did much to create the theory of modern advertising, . . . using himself and his enterprises as subjects for sustained public interest and administration. He sold Newhouse to the world because he was sincere in the possession of his own self-regard. The public became as enthusiastic over him as he was himself. He was the symbol of American opportunity, a walking proof that a poor boy can become rich, and powerful, and remain human in spite of it. His ventures were invariably glamorous. His magnetic personality explained his appeal to the imagination. He was the newspaperman's answer to prayer.

**The Ohio Copper Company**

**Columbia Mine.** The successes of the Utah Consolidated, Bingham Consolidated, and United States Mining Companies, at the turn of the century, led to further exploration of many of the smaller mines in the Bingham District in the hope of discovering additional valuable sulphide copper ore bodies. One of those which responded to the intensive search was the old Columbia Mine. In the late 1890's the Columbia had yielded considerable quantities of high-grade copper ore from two small parallel veins in the quartzite, shattered by a monzonite intrusion. The two veins were known as the What Cheer and All's Well. They were more than 500

---

1Ibid.
2Ibid.
feet apart and separated by mineralized quartzite, carrying copper and iron sulphides said to average from 1.5 to 1.8 percent copper. All told there were fourteen patented claims in the group, containing 120 acres of mineral ground.¹

The property was purchased by Frank B. Cook and his associates near the turn of the century. They continued the mining of high-grade ore from the mine and managed to pay for the property with the proceeds from the sale of ore before their working bond expired.²

In 1900, about the same time that Colonel E. A. Wall was attempting to develop the nearby Yampa group of claims at Bingham and was still trying to obtain financing for his Bingham porphyry mining venture, Mr. Cook and his associates recognized the potential for the development of the porphyry ores on the Columbia property. After several tests were conducted during 1900 and early 1901, it was concluded that such ores could be reduced successfully and sold on the market as a commercial product. Although the mine was not in the same class with the Boston Consolidated and Wall porphyries, it was, along with the Yampa, considered to be a good porphyry prospect.³

In March 1901, Cook and his associates made plans to build an independent concentrating mill for the reduction of their porphyry ore. Recognizing that the development of the property would require a

¹The Copper Handbook, 1910-11, p. 1328; Mines and Methods, December 1909, p. 141.

²Tribune, March 18, 1901.

³Ibid.
considerable sum of money, Cook and his group began to look about for some assistance to finance the work.¹

Finding no takers by early 1903, the property was offered to Daniel Jackling's newly-created Utah Copper Company for $150,000. Negotiations with Utah Copper broke down, however, and so on October the property was purchased by the Catrow interests of Ohio for $225,000.²

Ohio Copper Company. On November 1, 1903, the new owners of the property organized the Ohio Copper Company, under the laws of Nebraska, with a nominal capitalization of $1,000,000. The new company, under the direction of General Manager O. A. Tribbets, continued to exploit the high-grade copper veins in the Columbia Mine, and in addition devoted considerable attention to the low-grade porphyry deposit which lay between the two veins. Aware of the great potential in this class of ore, the manager drew up plans in 1904 for the construction of a "great concentrating plant" with a capacity of 1,000 tons of copper ore per day.

However, for the immediate future and for experimental purposes the company, in early December 1903, secured a 2-year lease on the old Winnemuck mill in Lower Bingham. This mill, which had been idle for a number of years, was remodeled and equipped with new machinery. A spur of the Copper Belt Railroad was completed to the mine, and 500-ton ore bins constructed at both the mine and the mill. Early in 1904 shipments of 125 tons of milling ores, averaging 1.5 percent copper, were made each day.³

¹Ibid.
²Mines and Methods, December 1909, p. 141; Deseret News, December 19, 1903; The Copper Handbook, 1910-11, p. 1328, lists the price as $245,000.
³Ibid.
One of the problems encountered by the company in the development of the low-grade porphyries was the fact that it had no dump room. The surface property was cut up by the county road and railroad right-of-ways to such an extent that there was very little suitable dump ground after the land for the ore bins and other surface buildings were provided for. As a result, much of the poorer grade waste material had to be mixed with or hauled to the old Winnemuck mill. Under such conditions, it was questionable whether the company would be able to make a profit. Therefore, to help defray the expenses of the experimental mill, considerable quantities of high-grade ore from the small veins was mined.\footnote{Ibid.}

Recognizing the value of the Winnemuck properties to future operations, the management of the Ohio company, aided by Thomas Weir, purchased the Winnemuck properties late in 1904. With the acquisition of these properties the company also received a valuable water right, which would be suitable for a mill several times the size of the Winnemuck.\footnote{Deseret News, December 17, 1904.}

In 1904-1905, the Ohio properties were examined by the Guggenheim engineers when they were making their investigations of the nearby Utah Copper property. The engineers were not impressed, however, and turned it down when they had not discovered the "real mine." The adverse decision rendered by the prestigious Guggenheim engineers considerably dampened the prospects of the Ohio company. N. J. Catrow and his associates next called in Thomas Weir for consultation regarding the future development of the mine. Weir suggested a course of development which he felt would result in the opening up of the real potential of the
mine. Satisfied with Weir's proposals, he was hired and placed in charge of the development work. The ore recovered from development work, which amounted to about 200 tons per day, was shipped to the Winnemuck mill for concentration.¹

Although the proceeds from the ore concentrated at the Winnemuck mill helped defray the work at the mine, it soon became evident that much more capital would be required to bring the mine to a paying status and build a large enough mill to handle the ore thus produced. In August 1906 the annual meeting of the stockholders of the Ohio Copper Company was held in Salt Lake City. At the meeting it was proposed that the directors float a $650,000 bond issue for the purpose of sinking the main shaft to a depth of 2,500 feet. Should the exploration and development work bring about the expected results, the directors agreed to plan for the erection of a new concentrating mill to handle the output. The bond issue was approved by the stockholders, and so work commenced immediately at the mine. In September, shortly after work got underway, the company announced that the caving system would be used for the extraction of ore. This was followed by the announcement of a rich strike of sulphide copper on the fifth level in newly-developed territory.²

F. A. Heinze comes to the Ohio. About this same time, Thomas Weir approached F. Augustus Heinze (who had recently become associated with the Bingham Consolidated Mining Company), and suggested that he might be interested in investing in the Ohio Copper Company. Heinze had his

¹Tribune, June 14, 1906; Mines and Methods, December 1909, p. 141; Deseret News, December 14, 1907.

²Tribune, August 30, 1906; September 8, 1906; September 9, 1906.
engineers look over the property, and, liking what he saw, purchased a controlling interest in the company.\(^1\) The addition of the Ohio property to his interest in Bingham Consolidated gave Heinze a strong toehold in the Bingham camp.

Now firmly under the management of Heinze, and with suitable financial backing assured, the company announced that a new 2,000-ton concentrating plant would be erected at Lark to replace the small and inadequate Winnemuck mill. In other actions, Heinze was able to purchase the Mascotte Tunnel from the Bingham Consolidated. (The ownership of the Mascotte Tunnel was placed under the control of the Bingham Central Railway, most of the stock being held personally by Heinze.) The Mascotte Tunnel, with its portal at Lark, was then being driven about 11,000 feet to the Dalton and Lark and Commercial Mines of the latter company in order to provide an outlet for its ores. Heinze now proposed to extend the tunnel an additional 3,000 feet from the Bingham Consolidated property to the Ohio shaft. This, he said, would provide the Ohio company with adequate and convenient transportation to move its ores from the mine to the proposed mill at Lark.\(^2\)

Heinze then made a deal with the Ohio company whereby the Bingham Central Railway was to receive 15 cents a ton for hauling the Ohio ores through the Mascotte Tunnel to the mill at Lark. At the same time, the Ohio Copper Company obtained from the Bingham Mines Company the right to all the water that would come from the tunnel, except for a small

---

\(^1\) *Deseret News*, December 14, 1907; *Tribune*, January 18, 1907.

\(^2\) *Deseret News*, November 13, 1907.
amount needed by the latter company to supply its boilers and for the
domestic purposes of its employees. The water was to be used in the
concentration of the Ohio ores by the new mill.¹

The financial panic in 1907 brought mixed blessings to the Heinze
enterprises in Utah. The Bingham Consolidated, already heavily in
debt, and apparently being "milked" by Heinze to support his other
activities, was on the verge of bankruptcy before the year ended. Mean-
while, his inexperience in wheeling and dealing on Wall Street resulted,
during the crisis, in the failure of his New York bank and brokerage
firm. In October 1907, he was forced to order work stopped on all of
his properties, including the Ohio mill and the Mascotte Tunnel.²

Rumors were soon floating in Utah to the effect that Heinze had gone
under in the crisis. These were vehemently denied, and Thomas Weir,
the managing director of the Ohio Copper Company, said that rather than
being stopped, work was being pushed on the Mascotte Tunnel and the new
mill, and that both would be completed by the beginning of 1908.³

Notwithstanding, things were not quite as rosy as Weir suggested.
In December 1907 the Rio Grande Western Railroad entered suit in Salt
Lake City to collect an outstanding bill of $26,000 from the company.
Somehow, money was secured to pay the debt and work continued at the
mine and mill—at a reduced rate. The completion dates for the mill
were continually pushed back, indicating serious difficulty in finan-
cing the venture. In April 1908 it was reported that the financial

¹Mines and Methods, December 1909, p. 141.
²Deseret News, October 24, 1907.
³Ibid., November 18, 1907; November 25, 1907.
difficulties of Mr. Heinze were over and that he was ready to resume operations. It was also suggested that the mill would soon be completed, and that Heinze planned to recoup his losses with "Utah copper money."¹

The syndicate takes over at Ohio. In spite of the pronouncements to the contrary, the mill at Lark remained unfinished through the summer of 1908. Heinze was still in financial difficulty and was unable to carry out the work at the mine and mill. In August 1908 newspapers announced that the Heinze interest in the Ohio company was being taken over by a syndicate. The announcement was confirmed in November when the details of the transaction became known. A syndicate composed of 26 men had secured an option on 530,000 shares of company stock, and had already paid for 250,000 of them. Although Heinze's name remained among the directors of the company, he was no longer in firm control.²

James McFarland, the president of Ohio Copper, attempted to quell the mounting rumors about the difficulties of the company. He said, had plenty of money to begin operations. Said McFarland, "The Ohio Copper mine is a big property," he continued, "and I believe it is just as good as any of the large copper propositions of Bingham."³ To back up his optimism the board of directors underwrote a $1,500,000 6-percent convertible bond issue to provide the funds necessary to complete the Ohio mill.⁴

¹Ibid., December 11, 1907; Tribune, April 23, 1908.
²EMJ, September 3, 1908, p. 485; Tribune, November 28, 1908. In October a Boston news release said that F. A. Heinze was in the process of selling some of his Ohio stock to the Mormon Church. Tribune, October 28, 1908.
³Tribune, November 17, 1908.
⁴Ibid., November 28, 1908.
After considerable delay, the tunnel and mill were finally completed and ready for operation in November 1909. In December the company started the first section at the mill and began shipping copper concentrates to the Garfield smelter. By February 1910, two sections were operating, treating 1,000 tons of ore per day, concentrating it at a ratio of twenty to one. The concentrates carried 23 percent copper and the cost of milling was reported to be 38 cents per ton, and that of mining at less than 50 cents per ton. Later in the year the output of the mill was increased to 1,850 tons of ore per day.¹

Because of the very low copper content in the ore (about 1.4 percent), the ratio of concentration was very high, increasing to twenty-five to one in 1910. This resulted in a heavy loss of copper in the mill tailing, which was reported to have been 35 percent or more. Nevertheless, the management reported a profit on operations for the first quarter of 1910 in the amount of $21,670. By April 1911, the floating debt of the company, according to management reports, had been reduced by $100,000 during the preceding year, and the property was then (1911) earning $20,000 a month. Of this amount, $6,000 a month was required to service the interest on the outstanding bonds.²

The potential of the Ohio property was somewhat limited by the low copper content of its ores. A 1910 estimate gave the ore reserves as being about 13,900,000 tons assaying 1.6 percent copper. Of this amount, about 3,500,000 tons were developed at that time. The production of

copper under the former management (prior to Heinze's entry) had been 840,000 pounds in 1904, and 3,000,000 pounds in 1905. With the new mill in operation, production in 1910 was estimated at about 8,000,000 pounds.\(^1\)

In 1911, a third unit was added at the mill, and equipped with special machinery consisting of rolls, tables, jigs, and other machinery designed by Colonel Wall. Presumably this was an attempt to improve the recovery of copper from the ore, and was also a chance for Colonel Wall to demonstrate that his own methods of concentration were better than those advocated by Daniel Jackling.\(^2\)

Ohio Copper Mining Company. Because of the difficulties encountered at the mill and the heavy bonded indebtedness of the company, an attempt was made in 1912 to reorganize the company to place it on better financial footing. Therefore, on July 8, 1912 the company was reorganized as the Ohio Copper Mining Company with a capitalization of $8,000,000.\(^3\)

Ohio Copper Mining Company of Utah. On September 1, 1914 the company defaulted payment of interest on the bonds. A bondholders' protective committee was formed by the creditors, and a bankruptcy suit initiated by them against the company shortly thereafter. In the meantime, the company filed a voluntary petition of bankruptcy on September 19, 1914, listing assets of $1,343,257, and liabilities of $1,668,838.

---

\(^1\)Ibid.

\(^2\)Ibid.

\(^3\)The Copper Handbook, 1918, p. 1366. The new company assumed $1,242,000 worth of the predecessor company's 6 percent gold bonds, dated September 1, 1907, and due on September 1, 1917.
On July 17, 1916, the Empire Trust Company of New York, as trustee for the bond holders, filed suit to foreclose the mortgage. The property was sold under foreclosure on August 30, 1916 to a representative of the bond holders' committee for $750,000.¹

Between 1914 and 1916 the mine and mill were operated by the General Exploration Company, under lease from the receivers. After the foreclosure sale, three plans for reorganization were devised, one by the bond holders' protective committee and one each by two stockholders' committees. The plan proposed by the "Rogers" stockholders committee (named after Chairman Hubert E. Rogers) was accepted by the court, and the former sale was set aside and the property sold to this group for $1,350,000.²

Under the plan submitted by the Rogers committee, a new company, the Ohio Copper Mining Company of Utah, paid into court the amount due on the bonds, less whatever sums had been realized on the property by (1) the trustees in bankruptcy, (2) the receivers appointed in the foreclosure proceedings, and (3) the purchaser since the foreclosure sale, after deducting in all cases whatever amount was determined by the court as expenses in connection with these various matters.³

Stock in the new company was issued by the committee and disposed of as follows: 1,500,000 shares were sold to an underwriting syndicate.

¹Ibid.
²Ibid.
³Ibid.
at par less 15-percent commission, 150,000 shares were retained by the committee for reorganization purposes, and 850,000 shares were placed in the company's treasury for future needs. Of the shares sold by the underwriting syndicate, the stockholders of the 1,350,000 shares of the predecessor Ohio Copper Mining Company were given the first opportunity to acquire new stock in exchange for their holdings on a share-for-share basis and the payment of $1 per share. The amount raised by this sale of stock was sufficient to retire the outstanding bonds, clear the property of all indebtedness, and provide approximately $200,000 in working capital.\(^1\) Operations at the company property at Bingham were resumed under the new management, shortly after the completion of the reorganization.

The copper recovery from the company mill at Lark had been extremely low for several years, being only about 47 percent in 1917. To improve the situation, an experimental 500-ton Minerals Separation plant and a 150-ton Janney machine were installed during that year. The results were considered excellent, raising the percentage of recovery to 80 percent. With this success, additional flotation units were installed throughout the mill in 1917.\(^2\) During the same year, the company estimated that it had 3,748,165 tons of ore developed, and 9,738,690 tons of probable ore, containing about 1.01 percent copper—similar to that being milled by the Lark mill.

\(^1\)Ibid.

\(^2\)Ibid.
The transportation problem was also improved for the company by the 1917 purchase of control of the Bingham Central Railway, which owned the Mascotte Tunnel. The railroad had remained under the control of F. A. Heinze until his death, and then under the control of his estate up to September 1917. During the entire 8 years of Heinze control the Ohio company had been paying the 15 cents toll per ton on all ore extracted through the tunnel.¹

From 1917 to 1919 the company operated the Lark concentration and flotation plant on the higher grades of ore mined. During these years approximately 7,000,000 tons of such ore, of about 1 percent grade, were mined and milled. However, the low grade of the ore and the poor recovery by flotation due to the oxidized copper, together with the high cost of supplies and the descending price of copper in 1918-1919 resulted in the closure of the mill and mine at that time.²

Leaching operations. During the 1917-1919 period of operations, large tonnages of low-grade ore were developed (too low grade to be milled) running from 0.3 to 1.3 percent copper. The area of this class of ore contained approximately 38,000,000 tons of rock which was said to contain 0.3 percent copper or 228,000,000 pounds. To recover this vast body of copper, the mine was caved in blocks 100 feet square and 60 feet vertical distance between, and in turn subdivided into 10-foot square blocks. It was proposed to extract the copper by leaching it

¹Ibid.
²Ibid. 1926, pp. 1514-16.
in place. However, because of the market conditions, development work in this part of the property ceased in March 1919. The plants remained closed until 1923, except for experimental work which continued through 1922.1

Leaching operations were commenced in January 1923, and continued for more than a decade. Early in 1926 additional ore bodies were prepared for leaching by removing the overburden from the surface of the ground.

The ore was leached by pumping about 400 gallons of water a minute from a creek in Bingham Canyon and 1,000 gallons collected from the Mascotte Tunnel by drainage from the various properties over the top of the caved area. The water was then distributed to selected spots through 10-inch copper-bound redwood pipes, where it was permitted to cascade over part of the caved surface, thus aerating and increasing the amount of dissolved oxygen in the water for leaching purposes. The solution then percolated down through 1,400 feet of caved area, enriching itself in copper until it arrived at the Mascotte Tunnel where it was run into solution launders and precipitated by using detinned scrap iron.2

By use of the new leaching process the company was able to register monthly production gains for nearly 18 months. Commencing in January 1923, with 88,097 pounds of copper, the production by this method reached a peak of 1,222,131 pounds for the month of June 1924, after which it

1Ibid.
2Ibid.
gradually declined. The cost of production also decreased correspondingly during the period. In 1923 it was 6.8 cents per pound, 5.8 cents for 1925, and 8.3 cents in 1926. During the peak month of June 1924, the company broke the world's record for low-cost copper production, registering an unheard of low of 5.3 cents per pound during that month. "The splendid results from leaching restored the credit of the company" and enabled it to pay its debts.\(^1\)

The success of the leaching operations enabled the company to pay a dividend of $144,656 in 1924, and a dividend of 5 percent in 1925, amounting to $144,976. In 1926 a 3-percent dividend was paid, amounting to $86,454. Profits gradually decreased during the late 1920's, however, as the recovery of copper by leaching steadily diminished.\(^2\)

The onset of the depression and the declining copper prices which accompanied it, resulted in the suspension of exploratory work at the mine in January 1931. Production by leaching operations, however, continued at minimum levels during the 1930's, averaging about 500,000 pounds annually during those years. In March 1937 the company sold the surface and mineral rights to its property to a depth of 1,050 feet to the Utah Copper Company for $600,000. The Ohio company retained the main haulage level (1,200 feet) and below, but the ground sold was said to contain 13,090,640 tons of low-grade copper ore reserves.\(^3\)

---

\(^1\)Ibid.; EMJ, August 2, 1924, p. 190.


\(^3\)Mines Register, 1937, p. 678.
By 1937 the leaching operations were not producing sufficient copper
to enable the company to make a profit. Therefore, in 1937 the company
decided to erect a 1,000-ton flotation mill to retreat over 5,000,000
tons of tailings from the earlier milling operations. The mill was com­
pleted in September 1937 and began production shortly thereafter. During
1938 the company produced 1,250,730 pounds of copper, 92 percent of
which came from the old tailings, and the rest from leaching operations.\footnote{Minerals Yearbook, 1938, p. 445; 1939, p. 474.}

The flotation mill was operated at full capacity until 1941 when the
capacity was increased to 1,500 tons of ore per day. During that year
410,075 tons of old tailings were treated, which produced 4,368 tons of
copper concentrates which carried an average of 25 percent copper.\footnote{Ibid.; 1942, p. 498.}

The mill continued to operate until the close of World War II in
1945. During the war years, the company employed about 75 men at the
mill. In July 1945 the precipitation plant was closed and operations
concentrated on the completion of the tailings retreatment program at
the Lark mill. On December 20, 1947 the tailings plant was closed.
During its 10 years of operation the plant had treated 4,037,000 tons
of tailings.\footnote{Ibid.; 1945, p. 473; 1947, p. 1522; Mines Register, 1946, p. 211.}

The Columbia group was operated by lessees for several more years
and finally, on May 1, 1950, the United States Smelting, Refining, and
Mining Company purchased the Salt Lake and San Juan properties of the
Ohio Copper company at a public sale, for the sum of $115,000. The Ohio company was $140,000 in debt to the United States company, the only bidder in the sale. From 1951 on, the property was operated as part of the United States Smelting, Refining, and Mining Company's Bingham operations—though by now, little was left to exploit.1

1Tribune, September 9, 1950.
CHAPTER V

THE PORPHYRY COPPERS: PART II

There is no story in the annals of American mining history which had more daring, intrigue, charm, and romance, than that presented by the story of the "Utah Copper Enterprise." Fortunes were made, reputations created, and bitter animosities engendered as the mountain of worthless "Wall rock" was transformed into the world's largest open-cut copper mine. The story of this enterprise, colorfully splashed over the last 75 years, is a graphic portrayal of the dynamic—and sometimes ruthless—growth of an American business enterprise. Those who played the major roles in this drama were representative of the time in which they lived. Robber Barons, promoters, manipulators, financiers, engineers—all were present on the Utah Copper stage.

Preliminary Investigations of Bingham Porphyries

Acquisition of Bingham properties by Enos A. Wall. The story of the Utah Copper company begins with the arrival in Utah of Colonel Enos A. Wall of Indiana. In July 1887 Colonel Wall first visited the

---

1 Term borrowed from the title of T. A. Rickard, The Utah Copper Enterprise (San Francisco: Mining and Scientific Press, 1919).

2 As he himself acknowledged smilingly, his military title was one that he owed to his friends. Such were the amenities of frontier days. His parents were North Carolinian; he started his mining career in Colorado in 1860, and went from there to Montana in 1863, varying the search for gold with general business as a freighter and trader in the material and supplies exchanged between that Territory and Utah, to which he came in 1868, remaining there for fourteen years. Then for five years
Bingham Mining District where his attention was drawn immediately to the usual signs of copper mineralization just above the junction of Carr Fork in the main canyon. A stream of water, issuing from a spring on the hillside, had left green stains on the bare rocks and in the gulch as it meandered down the hillside.¹

Upon examination, the ridge of rock proved to be an outcrop of monzonite impregnated with copper sufficiently to assay 3% for the entire length of 300 ft. An abandoned "tunnel," 90 ft. long, had been driven into the hill... This tunnel had followed a short-lived fracture that had yielded pieces of ore rich in chalocite, but the work evidently had proved unprofitable. Entering the tunnel, Wall broke a sample; upon the fresh face of the rock, under the green coloration, he saw that the monzonite was impregnated with black specks of chalcocite and bornite, suggesting a similarity to the ores of Butte, with which he was familiar. He sampled the tunnel, omitting the 20 ft. next the surface, where the copper-bearing rock was oxidized, and obtained an average of 2.4% copper by assay. Numerous tests by panning showed that a concentrate assaying 30 to 40% copper could be produced.

Upon enquiring at the Recorder's office, he ascertained that a large part of the ground adjoining and surrounding this exposure of mineral had been abandoned and therefore was subject to relocation; so he staked two claims, which he named "Dick Mackintosh" and "Charles Read," after two of his local friends. This gave him an area of 3000 by 600 ft., except a small fraction subject to conflict at one end. Subsequently he located another adjacent claim, which he named the "Frank Cushing." He found other old workings, one of them being a tunnel 250 ft. long on the opposite, or east, side of the gulch. This was nearly on the same level and about 700 ft. northeast of the one first inspected; it followed the so-called Quinn fissure, a gash marked by an irregular enrichment with chalocite, similar to many other short-lived fractures traversing the monzonite mass. The ore in this fissure assayed 5 to 40% copper, but it was not in quantity sufficient to justify the method of selective mining that the former owner of the

he was chief stockholder and superintendent of the Wood River Gold & Silver Mining Company, at Bullion, Idaho, where he won the regard of his fellowcitizens so as to be elected to the upper house of the territorial legislature and president of that chamber. In 1885 he returned to Utah, engaging in mining at Mercur and elsewhere." T. A. Rickard, A History of American Mining (New York: McGraw-Hill Book Company, 1932), p. 191.

¹This undoubtedly was the same stream observed by Huntley during his visit some 7 years earlier. Huntley, "Mining Industries," pp. 457-58.
claim had attempted to apply. A new tunnel 600 ft. northward and on the same side of the gulch had been driven 200 ft., and was in continuous ore averaging 1.8% copper. These facts indicated an extensive dispersion of the copper. He investigated the titles of the claims adjacent to his own locations, meanwhile keeping his hopes to himself. He even agreed with the road-supervisor that the dumps be used for road-making, being willing to have the value of the ore ignored. The local wits called it "Wall-rock."¹

For the next 10 years Colonel Wall continued to add to his holdings. Some new claims were located, and others acquired by purchase. By 1900 the group consisted of all or part of 19 claims covering an area of 200 acres. Although he lacked sufficient money for systematic development of the property, he was able to keep up the assessment work and finance some further development. Up to 1900 he had expended $20,000 and driven 3,250 feet of tunnels into the hillside, "following fractures and veinlets in the hope of finding larger masses of rich ore."² In December 1901 Wall purchased the Rogers mill at Bingham to demonstrate the effectiveness of reducing the porphyry ore. The money for these activities came from various and sundry mining deals in which Wall had also been engaging during the preceding decade. Among other things he had sold the Brick-yard mine at Mercur, in 1894, to Captain Joseph R. De Lamar for $60,000.³

¹T. A. Rickard, The Utah Copper Enterprise, p. 17.
²Parsons, The Porphyry Coppers, p. 50.
³Tribune, December 13, 1901; Wall was not just a typical prospector, but was also a miner and a dealer in or "promoter" of mines, which provided him with sufficient capital for his immediate needs. In 1901, for instance, he sold the Yampa Mine at Bingham to George H. Robinson of the Tintic Mining and Development Company for $150,000. When purchased by Wall earlier, it had cost $40,000. Rickard, The Utah Copper Enterprise, p. 17. The Salt Lake Tribune, April 7, 1901, reported the price as being $180,000 and 50,000 shares of stock in the Tintic company. Parsons, The Porphyry Coppers, p. 50, says the amount was $110,000.
Investigations of Joseph R. De Lamar and associates. Captain De Lamar, himself, was a rather remarkable man with an unusual career. "He was born in Amsterdam; he had been a diver; he had commanded cargo-ships between New York and Bermuda; his captaincy was of the sea. His mining adventures had extended all the way from the Sangre de Cristo mountains to Lake Nipissing."¹ In 1895 De Lamar sent his manager or chief of staff, Hartwig A. Cohen, to examine Wall's copper prospects at Bingham. Cohen took a few samples and made some handtests, by panning, and rendered a favorable opinion of the property. De Lamar therefore obtained from Wall a 6-months' option on three-quarters of the property for $375,000. A test was then made 76 tons of ore in the nearby Markham mill, a small stamp mill in the lower part of the town of Bingham. The ore for the test was taken from the Mackintosh Tunnel, then about 300 feet long, and from two other prospecting drifts. The tests yielded a recovery of 60 to 62 percent in a concentrate containing 28 to 33 percent of copper, from 2 percent ore. The results of the tests were not encouraging to De Lamar, who thought the ore too poor to be of commercial value. Furthermore, the price of copper near the close of 1895 had been suffering from disturbed financial conditions, and had fallen from 12 cents to 9-3/4 cents in the 3-month period. Therefore, De Lamar dropped his option on the property.

With the rise in the price of copper to 12-1/2 cents in the summer of 1896, De Lamar was sufficiently encouraged to ask for a new option to make additional tests and investigations. This time he obtained an

option on a quarter interest for $50,000 and on a second quarter for
$250,000. De Lamar then sent one of his engineers from the Golden Gate
mill at Mercur, Robert C. Gemmell, to make a preliminary sampling of
the ore. Some tests were then made at the Rogers mill, a small 5-
stamp mill below the mine, by one Daniel C. Jackling, a brash young
metallurgical engineer, who was also a member of De Lamar's staff.
(He was then working as a metallurgist at the Golden Gate mill.)¹ The
results of the tests were highly satisfactory, and the astute De Lamar
then told Wall

... that he would like an extension of time in order to do some
exploratory work in the mine, and that he was prepared to under-
take it if he could acquire a larger interest. Wall replied that
he would sell three-quarters of the property for $750,000 cash.
That ended negotiations.²

¹Jackling was born August 14, 1869, near Appleton City, Missouri,
a son of Daniel and Lydia Jan (Dunn) Jackling. He was orphaned at the
age of two, and spent his boyhood years on Missouri farms going from one
relative to another.

Later, he enrolled at the State Normal School at Warrensburg,
Missouri, to pursue a course in teacher training, with the hope of saving
sufficient money to purchase land. He was soon attracted to engineering,
and transferred to the Missouri School of Mines at Rolla, where he
received a Bachelor of Science degree in 1892. Jackling stayed on for
another year after graduation as an assistant professor of chemistry and
metallurgy.

He worked briefly at the Argentine Smelter at Kansas City where he
pushed slag pots, and then migrated to Cripple Creek, Colorado, in
search of fortune. While at Cripple Creek he met Charles M. MacNeill,
Spencer Penrose, and R. A. F. Penrose, with whom he later became associ-
ated in the formation of the Utah Copper Company.

Jackling drifted to various mining camps, working as a miner, assayer,
mill hand, and metallurgist, finally coming to Mercur, Utah, where he
became construction and metallurgical superintendent of the Golden Gate
mill (Mercur Gold Mines), controlled by Captain Joseph R. De Lamar. It
was while working for De Lamar that Jackling learned of Colonel E. A.
Wall, and the Bingham porphyry property which he was attempting to develop.
Kennescope, August 1954, pp. 22-23.

²Rickard, The Utah Copper Enterprise, p. 18. Parsons says that the
Cohen report was based on an estimate of probable ore amounting to
A short time later, at the end of 1898, De Lamar and his manager, Hartwig Cohen, had a disagreement which resulted in Cohen's resignation. Cohen's position was then given to Victor Clement, a mining engineer who had recently returned from the Transvaal. Clement was given a salary of $36,000 and an eighth interest in anything he found in the way of new mining ventures for De Lamar. Having heard about the Wall property from Gemmell and Jackling, Clement told Wall, early in 1899, that he had gone over the report by Cohen and thought the property had the makings of a successful venture. He also informed Wall that he (Clement) would personally participate in any business that might result with De Lamar, and that he could guarantee Wall a square deal.¹

Clement wrote to De Lamar (who was in Paris), in early 1899, in an attempt to sell him on the idea of the Wall property. To support his thesis that the property could be worked for a profit, Clement drew "a general analogy between the costs of operating on big masses of low-grade ore at the Treadwell mines on Douglas Island, Alaska, and those that might be expected at Wall's property."² In a reply to Clement's letter, dated February 28, 1899, De Lamar expressed his own doubts:

---

15,000,000 tons averaging 2.22 percent copper, and on a test run of 68 tons of ore made in the Little Chief mill at Bingham. He also quotes an excerpt from the Cohen report indicating that the report was unfavorable. "It is difficult to see how a product which will yield only $1.49 per ton under existing circumstances can be mined and concentrated at a profit. The low-grade capping containing four-fifths of one percent carbonate of copper, with an average of fifty feet thickness, precludes the idea of such a cheap method as quarrying for mining the ore." Parsons, The Porphyry Copper[s], p. 52.

¹Rickard, The Utah Copper Enterprise, p. 18.
²Ibid.
I have read all you said in regard to the property, and have again read over Cohen's report, but will frankly say I do not feel inclined to tackle it. With copper at its old normal price where it has been since the French copper corner (the Secretan Syndicate), this property is too near the danger line, and would be one of the first to shut down, and remain shut down for years; perhaps until production fell off and prices went up again. I dare not compare it with the Treadwell because the product of that mine is stationary—it is money, while this is merchandise and consequently dependent on supply and demand.¹

Back in Utah, Clement took Gemmell out to Bingham to look over the ground. Clement's report, on May 9, 1899, estimated the average value of copper to be 2.25 percent. At an average selling price of 15 cents per pound for copper, he reckoned that a profit of $2.70 per ton of ore could be made. "He proposed that the ore be shipped to a point in the Jordan Valley for concentrating, and remarked, 'the character of the ore offers exceptional facilities for cheap mining, either by quarrying or by caving.'"² Clement then made an offer to Wall, on behalf of De Lamar, to purchase a quarter interest for $50,000 outright, with a year's option on an additional one-half interest for $250,000.³ "His recommendation was to proceed promptly with mine development and concentrating tests

¹Parsons, The Porphyry Coppers, pp. 51-52.

²Ibid., p. 52. In his Autobiography, John Hays Hammond states that Clement advised the use of steam shovels to terrace down the mountain and mine it by opencut methods. Jackling, who later carried out the development independently, adopted this plan. At the time, the deterrent to this procedure was "the reluctance of capital to expend an estimated three million dollars in development before one ingot of copper could be produced." Because of this, the property remained idle. John Hays Hammond, The Autobiography of John Hays Hammond (2 vols.; New York: Farrar & Rinehart, Inc., 1935) II, p. 516.

³Ibid. Rickard says the second quarter was for $250,000 and the third quarter for $1,250,000. (Rickard, The Utah Copper Enterprise, p. 18.)
as a basis for forming a more mature opinion.\textsuperscript{1} Rickard suggests that it was Clement's intention "to prove the property and then sell the third quarter through his financial friends in London, thereby obtaining the money needed to build a mill and a railroad from the mine to the mill."\textsuperscript{2}

Wall accepted the offer, and De Lamar closed the deal in May 1899. Since De Lamar now had the right to test and explore during the year of the option, Clement put James Mason in charge of the mining work and expended $25,000 in extending the drifts and driving new crosscuts. Gemmell was assigned the job of sampling all of the work. Jackling, in turn, was given the job of running mill-tests on the ore. To accomplish this, the old Rogers mill, located in a gulch just below the Columbia Mine (and conveniently near the Wall property) was equipped with a 5-stamp battery and other appropriate equipment (e.g., two Wilfley tables, and a vanner).

\textsuperscript{1}Parsons, The Porphyry Coppers, p. 52.

\textsuperscript{2}Rickard, The Utah Copper Enterprise, p. 18. Parsons has pointed out that since Clement's contract with De Lamar called for the receipt of one-eighth interest in any property acquired as a result of his examination and recommendation, his report may have been more optimistic than it might otherwise have been--especially since De Lamar's immediate commitment was a small one; but the stake was large. He further suggests that this same agreement may have been a factor in De Lamar's later decision to abandon the option and then to part with his own interest in the property at a small profit.

Clement's widow (he died in Mexico in 1903) some years later started a suit against De Lamar in federal court in Salt Lake City "for monies she claimed were due her under the terms of the contract." The case went against her, as De Lamar was able to sustain the contention to the satisfaction of the court that the Wall copper business was initiated by Cohen, even though Cohen had advised De Lamar against it. Parsons concluded that many of those familiar with the facts felt that Clement deserved more credit than he got. See Parsons, The Porphyry Coppers, pp. 52-53.
While the work of testing and exploration was underway, Clement and De Lamar got into a dispute over Clement's one-eighth interest. De Lamar claimed that the Wall business had been introduced by Cohen, when in De Lamar's employ. Clement, on the other hand, contended that De Lamar's previous staff had turned it down and that he himself had initiated the later negotiations which had proved fruitful. The result was that Clement resigned and Cohen returned.1

Late in the summer of 1899 the work at the property was completed. On September 18, 1899, the Jackling-Gemmell report, addressed to Cohen, was submitted for De Lamar's consideration. This report was the "first conservative and reasonably comprehensive analysis of a mining enterprise based on the exploitation of ore containing as little as 2 percent copper, or 40 lb. to the ton."2 The report was a cooperative effort on the part of Jackling and Gemmell, with the latter "writing the portions that bore upon the development of the mine, the probabilities of further discovery, the character of the orebody, and the average value of the ore as determined by sampling."3

The report, incorporating Clement's earlier suggestion, called for stripping the overburden from the deposit, and the loading of both ore and waste on railroad cars by means of steam shovels. In the selection of a site for the concentrating plant, however, Jackling and Gemmell did not follow Clement's previous recommendation that it be near the Jordan

---

1Rickard, The Utah Copper Enterprise, pp. 18-26.
2Parsons, The Porphyry Copper, p. 53.
3Rickard, The Utah Copper Enterprise, p. 18.
River. They proposed instead that the site be "near the point of the
mountain, between Salt Lake City and Garfield Beach, where water is
plentiful." In order to transport the ore from the mine to the mill,
a 15-mile railroad was projected from Bingham to Garfield Beach.

In spite of the favorable report, and the expenditure of $46,000
to make the tests, Captain De Lamar again dropped his option. He did,
however, retain the quarter interest which he had purchased for $50,000.
His quarrel with Clement may well have been one of the reasons for
abandoning the option. It is also suggested by Rickard that "a not
unreasonable timidity at tackling a mining venture based on such low-
grade ore and requiring so much capital to place it on its feet," could
be attributed to De Lamar. For one thing, the loss of Clement, who
might have helped to place the property in London for disposal on
advantageous terms, spoiled this as a possibility.²

Clement went to Mexico in 1901 but maintained his interest in the
Wall property. He wrote to Wall occasionally, suggesting on one
occasion that he might persuade Volney Williamson of Spokane to join
him and Wall in developing the property. In the meantime, Wall became
concerned over the quarter-interest which De Lamar still held. Some
means would have to be taken to buy him out. Wall suggested to Clement
that if he (Clement) would buy De Lamar out for $100,000, Wall would
sell him (Clement) a quarter interest for $50,000, "provided the property
was incorporated and sufficient capital raised for development and
equipment."³

¹Parsons, The Porphyry Coppers, pp. 53-54.
³Ibid.
In 1902 Clement suggested to John Hays Hammond that if Hammond could secure De Lamar's quarter holding and interest capital in London or New York, they could take up the development of the property themselves. They agreed to put $100,000 each into the venture for additional prospecting work. De Lamar was approached and found willing to part with his quarter interest at about its cost. He told Hammond quite frankly "that he had no faith in the enterprise."¹

Clement went to Mexico in January 1903 after having agreed with Hammond to close the deal on Clement's return to the United States. Unfortunately, he died in a hospital at Saltillo, Mexico, on April 26, 1903. Hammond, who was also in Mexico at the time, returned to New York, where he learned that in his absence Jackling had been able to close a deal with Wall for the MacNeill-Penrose group.²

Thus, while Clement and Hammond had been attempting to work out independent arrangements to take over the Wall property, Cohen, as manager for De Lamar, attempted to interest Benjamin Guggenheim in the property. He called attention to his own report which stated that the mine showed 18 million tons of 1.6 percent copper ore, which could be concentrated at the ratio of fifteen to one. In 1902 a similar attempt was made to interest Charles A. Coffin, of the General Electric Company.³

Several additional attempts were made to dispose of the property during the period from 1900 to 1903. In 1901 the property was examined

¹Hammond, Autobiography, pp. 516-17.
²Ibid.
by an engineer for Marcus Daly, and in 1902 L. C. Trent acquired an option and offered it to the Tharsis Sulphur and Copper Company of Glasgow, Scotland. In 1903, it was offered to William A. Clark, of Montana copper fame. All attempts proved unsuccessful, however, as those approached were not sufficiently convinced that a large mass of 1-1/2 to 2 percent copper could be made to pay a profit—especially when such a large amount of capital would be required before any results could be obtained.¹

D. C. Jackling successfully places the Wall property. After the completion of the Jackling-Gemmell report in the fall of 1899, Gemmell went to Mexico and Jackling to Washington, the latter to build a cyanide plant for Clarence McCuaig and other Canadian capitalists. In 1901, however, Jackling returned to Colorado Springs where he became associated with Charles M. MacNeill and Spencer Penrose, owners of a controlling interest in the United States Reduction and Refining Company.² Jackling was hired as consulting engineer for the firm and given the job of rebuilding and managing the Bartlett zinc-pigment plant at Canon City.

¹Ibid.

²Charles M. MacNeill was born at Oak Park, Illinois, November 25, 1871. After receiving a public school education he came west in search of fame and fortune. He began his career as a cashier at a smelting company in Colorado at the age of 19. Later, he and Spencer Penrose became associated in mining interests, eventually forming the United States Reduction and Refining Company, which operated two mills at Colorado City, near Colorado Springs. MacNeill was a "capitalist," and was active in numerous commercial and banking ventures in addition to his interests in the Utah Copper Company and other copper mining enterprises. He made his home in New York after becoming president of the Utah Copper Company, and resided there until his death on March 17, 1923.

Spencer Penrose was born in Philadelphia, December 17, 1863, the son of R. A. F. Penrose and Sarah Hannah (Boies) Penrose. He was a
As with others before him, Jackling had not forgotten the Wall copper property since leaving Bingham in 1899. Having started life quite poor, he undoubtedly visualized this porphyry property as a likely means to obtaining the fame and fortune to which he aspired. When Jackling mentioned the Wall property to his employers in Colorado, they exhibited sufficient interest to encourage him; so, in December 1902, while in Salt Lake City on business, Jackling met with Colonel Wall to request an option on the property. This proposal was refused.

Brother of R. A. F. Penrose, Jr. (see below), and Boies Penrose, later a senator from Pennsylvania. Spencer received an A.B. degree from Harvard in 1886, after which he entered the mining business in the west. He was one of the pioneers of the Cripple Creek, Colorado, mining district. Later he became associated with Charles M. MacNeill in the organization of the United States Reduction and Refining Company at Colorado Springs. In 1903 he became associated with MacNeill, Jackling, and his brother R. A. F. Penrose, in the formation of the Utah Copper Company. Penrose became a prominent businessmen in Colorado Springs, and was a director of both Utah Copper and Kennecott Copper companies. He died on December 7, 1939. Who Was Who in America, 1897-1942, (Chicago: The A. N. Marquis Company, 1943), 1, pp. 766-956.

R. A. F. Penrose was born in Philadelphia December 17, 1863. He received his Ph.D. at Harvard in 1886, specializing in economic geology. From 1886 to 1888 he was the manager of the Anglo-Canadian Phosphate Company, for which he made surveys of mineral deposits in Texas and Arkansas. In 1892 he became an associate professor of Economic Geology at the newly founded University of Chicago. Promoted to full professor in 1895, he held that position until 1911, when the pressure of his mining interests (primarily Utah Copper) made it necessary for him to withdraw from teaching. A prolific writer, he was the author of several books and monographs, and served as associate editor of the Journal of Geology from 1893 to 1911.

In 1895 Penrose became one of the founders of the Commonwealth Mining and Milling Company at Pearce, Arizona, and held the position of president until 1903. In 1903 he became associated with Jackling, MacNeill, and his brother Spencer, in the formation of Utah Copper Company. He was a bachelor, and was modest to a point of diffidence. In his later years he resided in Philadelphia; through his many bequests, he became the foremost patron of his science. He died on July 31, 1931. Dictionary of American Biography, ed. Dumas Malone (New York: Charles Scribner & Sons, 1934) XIV, pp. 450-51.
However, while in Salt Lake City Jackling met Cohen, who was also in town on business. In discussing the Wall property with Cohen, Jackling mentioned that if he (Jackling) could get an option on the property, MacNeill and Penrose would provide the capital necessary to develop it. Cohen then went to Wall and informed him that he (Cohen) had New York friends who were willing to supply money to develop Wall's property if a reasonable option could be had.

Wall was willing to sell half of his holdings for $400,000, but he imposed conditions covering the equipment and development of the mine; and he demanded that a mill to treat 500 tons daily be built by the supposed New York buyers, who also were first to purchase De Lamar's quarter. The negotiations broke down until Cohen obtained the help of the Salt Lake banker, William S. McCormick, who aided Cohen in persuading Wall to come to terms. The result was that on January 23, 1903, Wall signed an option to Cohen on "two-fourths undivided interest" [that is, two-thirds of Wall's remaining three-fourths interest] at $350,000 in cash, of which $50,000 was payable on March 9 and $300,000 on June 7 of that year [1903]. In this agreement Wall recorded his willingness to join in the organization of a stock company, retaining the right to nominate one member of the governing board.¹

De Lamar was next approached, and found to be tired of holding what he felt to be a frozen asset. He was therefore willing to sell Jackling and his backers his own quarter interest for $125,000.² With his deal with De Lamar successfully completed, and with Cohen's option from Wall safely in hand, Jackling returned to Colorado Springs. Taking a copy of the Jackling-Gemmell report with him, he visited Charles MacNeill to sell him on the new venture. Jackling later related the circumstances of this visit as follows:

¹Rickard, The Utah Copper Enterprise, p. 27.
²Ibid.
I told him that I had, without any exception, the greatest opportunity in the world and that he just had to get in on it. At the time they were in the midst of a big fight with the Western Federation of Miners, and Charlie didn't even want to listen to the story. I told him just to read the report, and finally he did, but he didn't seem much interested. I asked him if it didn't look good; and if he thought I was trying to put one over on him. Finally, I said "Charlie, will you go into this if what that report says can be verified?" I proposed that they select an engineer to examine the property and check up; and then offered to pay out of my own pocket the expenses and fees of the engineer, if everything wasn't as represented. Charlie said, "You won't do anything of the kind;" but the upshot was that on Dick (more formally known as R. A. F.) Penrose's recommendation, they sent F. H. Minard to Utah. In the meantime Cohen got a short extension on the option.

Minard made his investigation and submitted his report on April 23, 1903. In the report he verified the estimates on the tonnage and grade of ore, but he "rather praised the property with faint damns." It made clear the fact that the porphyry had intruded into the limestone and quartzite, and that the copper was in the porphyry in the form of small particles of copper pyrite, which had undergone leaching and concentration within a zone of enrichment. The leached portion extended for 50 feet from the surface, and within this zone the monzonite averaged 0.75 per cent of copper. The zone of enrichment, underneath, was from 100 to 150 feet thick, with a copper content of 2 per cent, as chalcocite. Below this was the primary deposit, containing 1.1 per cent of copper. Minard's samples were taken with hammer and moil at intervals of 10 feet. Usually each sample weighted 50 pounds. The average of all his samples was 1.6 per cent, and he estimated that the workings disclosed 9,000,000 tons of such copper-bearing rock.

In addition, Minard pointed out "certain physical difficulties and questioned the estimates of cost." "The shortage of water at Bingham for concentrating purposes was the basis of his principal objection."

---

1Parsons, The Porphyry Coppers, p. 68.

2Ibid.


4Parsons, The Porphyry Coppers, p. 68.
His final recommendation was that a 200- or 300-ton plant be erected to make extended experiments covering a period of at least a year, and this only on the condition that they would be able to acquire an interest in the property for the construction of the plant without any payment whatever.1

Formation of the Utah Copper Company

On June 1, 1903, MacNeill, Spencer Penrose, and R. A. F. Penrose accompanied Jackling to Salt Lake City to personally inspect the property. They drove out to the mine and walked over the property, at the conclusion of which an informal conference was held before they returned to Salt Lake City.

MacNeill asked Dick Penrose what he thought about it. The reply, which seemed to settle the matter, according to unofficial records, was to this effect: "I rather think Jack is right—Minard seems to be worried over something that Jack doesn't even plan to do." This alluded to the question of water; and, as the report of 1899 indicated, Jackling proposed definitely to build the concentrator near Garfield, where there was no doubt as to the adequacy of the water supply.2

That evening Daniel C. Jackling gave a dinner to commemorate the occasion. The dinner, held at the Knutsford Hotel, is said to have cost him his last $100.3

The Utah Copper Company was duly incorporated under the laws of Colorado on June 4, 1903. The company was incorporated with a nominal capital of $500,000 in $1 shares.

---

1Rickard, The Utah Copper Enterprise, p. 28.
3Ibid. Whether or not this was true, Jackling later admitted that when the company was incorporated on June 4, 1903, he had not put up any
MacNeill and Penrose as bankers and promoters took 250,000 shares and they and their friends paid $250,000 in cash of the others. Doubtless some of the promotional shares went as bonus. A new option agreement was made with Wall to replace that held by Cohen. This provided that Wall would sell 55 per cent of the entire property for $385,000, of which $50,000 was the initial payment. The option ran for six months, after which it might be extended for an additional twelve months on the payment of $5,000 cash bonus for each month of extension. As thirteen months elapsed before the final exercise of the option, Colonel Wall received a bonus of $35,000, or $420,000 in all. De Lamar's quarter interest cost $125,000, so that the purchase price of the 80 per cent interest was $545,000. Colonel Wall retained 20 per cent.¹

The mill at Copperton. Colonel Wall was paid his first installment in June 1903 and Jackling was given the green light to start the erection of a 300-ton experimental concentrator, as proposed by Minard. On June 30, 1903, the Utah Copper Company acquired under a lease from the West Mountain Placer Company, the surface rights on 20 acres in Lower Bingham for a mill site, the right to dump tailings on the Ireland and Watson Placer Lot No. 37, and Curtis Placer Lot No. 38. Utah Copper paid a monthly rental of $250 for these rights, which were to cease on the abandonment of the company mill. A month later, Utah Copper officials located the Leigh Placer Mining claim on unlocated ground to the west of the Ireland and Watson Placer, and also a strip on both the north and south sides of the Leigh Placer claim. With these arrangements, the company was provided with a suitable site for the Copperton mill.²

money for the 25,000 shares which were allotted him. He was actually given an option on 50,000 shares at $1 per share. However, in accordance with an earlier agreement between Jackling and Cohen, that they would share 50-50 on any profit, provided that Jackling was able to finance the venture, Jackling transferred 25,000 shares to Cohen. (Ibid., p. 69.)

¹Ibid.

²L. F. Pett, "History of Utah Copper," in "Chronological History of Important Events in Mining" (unpublished MSS., Kennecott Copper Corporation).
The Copperton mill was originally intended as an experimental mill with three purposes in mind: (1) "To verify the accuracy of the mine sampling by actually treating substantial tonnages of ore;" (2) "To demonstrate on a reasonably large scale the percentage of the copper in the ore that could be recovered;" and (3) "To permit the testing of various kinds of machines and devices for crushing and concentrating the ores so as to guide the engineers in designing the proposed 6,000 ton milling plant at Garfield."¹

Most of the equipment for the mill came from the Sunnyside works of the United States Reduction and Refining Company in Colorado. The installation of this equipment, all of which was used, did not make the Copperton mill exactly a modern installation. What efficiency it did attain is largely attributable to the skillful work of George O. Bradley and Frank G. Janney, both former employees of Captain De Lamar at Mercur. Bradley, who was a mechanical engineer, was employed to design the plant. He later directed the design of the Garfield concentrator, and remained as consulting mechanical engineer until 1915. Janney was a skillful mechanic with a flair for "making machinery do what it was intended to do." He later became manager of mills for Utah Copper, a position he held until his death in 1916.²

The construction of the Copperton mill was started in August 1903 and was completed and placed in operation in April 1904. Water for the milling operations was supplied from a shaft 150 feet deep dug in the

¹Parsons, The Porphyry Coppers, p. 70.
²Ibid.
early days by the West Mountain Placer Mining Company to develop a water supply for hydraulic mining. In 1905 this supply proved inadequate, so a settling reservoir was built to impound water from Bingham Creek, which was then pumped to the mill.¹

The ore was delivered to the mill by the Copper Belt Railroad, which was purchased by the Rio Grande Western in January 1905. The line, by now about 9 miles long, was operated with Shay geared engines, necessary because of the steep grades (7.4 percent) and sharp curves in the canyon. The railroad entered the mill over a trestle, and the ore was dumped into a 1,000-ton bin beneath the track. The service provided by the Copper Belt was irregular, however, and the volume of ore transported proved to be inadequate to keep the mill running smoothly. The railroad equipment was the principal source of trouble, as it was much too limited to handle the tonnage needed for constant milling operations.²

The Rio Grande company soon recognized the disadvantages of the Copper Belt road; the hazard of the steep grade, the slow rate of speed of the Shay engine, and the time consuming switch backing necessary to reach the Utah Copper and other mines at Bingham. Therefore, it was decided to construct a branch line which would eliminate those bad features. The new branch line left the main Rio Grande line several miles below the canyon on a 2-percent grade, wound its way up the mountainside to the Utah Copper and United States mines, and crossing over the canyon.


continued up Carr Fork to the Utah Apex and Highland Boy mines. The new line was on a more gradual grade, allowing the use of standard swift moving engines to haul the ores from the mines directly to the concentrating mills and smelters.\textsuperscript{1}

Prior to 1906, power to operate the mill equipment was furnished by steam. In the fall of that year, electric power was furnished by the company-built power plant at Magna. Steam power at the mill was replaced by electric motors.\textsuperscript{2}

Having been built largely with second-hand equipment, and operated experimentally (the flow sheet was established in 1906), the mill never was very efficient. After 1906 the main research work centered on the selection of the most efficient concentrating machines. Among those tested were the Wall double-decked slime concentrator, Card Concentrating table, Mondell slime concentrator, Wilfley slime concentrator, Johnston standard corrugated belt vanner, and Johnston standard smooth belt vanner. This work was conducted primarily to determine the best machines for installation in the Magna mill.\textsuperscript{3}

During the first 2 years of operation the concentrates produced by the mill were smelted at the Bingham Consolidated plant at Midvale.

\textsuperscript{1}Beatrice Spendlove, "History of Bingham Canyon, Utah" (unpublished Master's thesis, University of Utah, 1937) pp. 35-36.

\textsuperscript{2}"History of Milling to 1939," p. 12.

\textsuperscript{3}Ibid. The modification of some equipment (Overstrom tables) by company engineers, resulted in a suit by the inventor of the Wilfley Concentrator, Arthur S. Wilfley, and the Mine and Smelter Supply Company against the Utah Copper Company, in 1907. The federal court decided in favor of the plaintiffs, who charged that Utah Copper had changed some of the equipment on the Overstrom so as to make them conflict with the Wilfley patents. The company settled for damages out of court.
After the construction of the Garfield smelter by ASARCO in 1905-1906, all concentrates were shipped to Garfield. (The first shipments were sent to the Garfield smelter on April 10, 1906.)

Although it was the original intention to use the Copperton mill solely as a pilot mill to gain information on which to base the design of the Magna mill, enlargements were made in the years following, "embodying every known type of gravimetric concentrating apparatus."

By August 1, 1910, when the mill was finally closed, the capacity had been increased to 1,000 tons per day. One of the main reasons for keeping the mill in operation was the need to "show results," and thus enhance the company's potential in view of rival claims by Boston Consolidated, and also in soliciting capital for development and expansion. In addition, the Copperton mill served as a training school for those who would later operate the new Magna mill.

Tonnages of ore treated and metallurgical results for the 7 years the Copperton mill was operated are shown in Table 3.

The Utah Copper Mine. While work at the Copperton mill was getting under way, John McDonald, another of Jackling's Mercur associates, was hired as mine superintendent. Since most of the available funds of the new company were needed for the construction of the Copperton mill, little was left for the development of steam shovel stripping operations preparatory to the initiation of opencut mining operations. Since it was vitally important to get the operation under way in a hurry, in order to

---

1"Tribune, April 7, 1907."

<table>
<thead>
<tr>
<th>Year</th>
<th>Dry Tons Milled</th>
<th>Heading Percent Copper</th>
<th>Tailing Percent Copper</th>
<th>Concentrate Percent Copper</th>
<th>Percent Extraction</th>
<th>Copper Recovered Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1905</td>
<td>216,769</td>
<td>1.98</td>
<td>.71</td>
<td>31.78</td>
<td>61.9</td>
<td>5,311,702</td>
</tr>
<tr>
<td>1906</td>
<td>231,125</td>
<td>1.96</td>
<td>.82</td>
<td>27.22</td>
<td>56.5</td>
<td>5,121,029</td>
</tr>
<tr>
<td>1907</td>
<td>183,569</td>
<td>1.93</td>
<td>.83</td>
<td>22.75</td>
<td>56.1</td>
<td>3,967,924</td>
</tr>
<tr>
<td>1908</td>
<td>404,425</td>
<td>1.91</td>
<td>.79</td>
<td>26.08</td>
<td>57.4</td>
<td>8,859,156</td>
</tr>
<tr>
<td>1909</td>
<td>260,488</td>
<td>1.66</td>
<td>.70</td>
<td>24.16</td>
<td>56.4</td>
<td>4,886,623</td>
</tr>
<tr>
<td>1910</td>
<td>193,361</td>
<td>1.50</td>
<td>.59</td>
<td>28.23</td>
<td>61.3</td>
<td>3,791,790</td>
</tr>
</tbody>
</table>

* Operations for 12 months ending June 30.
** Operations for 18 months ending December 31.

Source: "History of Milling to 1939" (unpublished MSS., Kennecott Copper Corporation, January 1939), p. 12. (Mimeographed.)
Enhance its promotional potential, the mine was prepared for underground stoping operations. (A stop is an underground excavation for extracting ore in successive steps or ledges.)

At first, no particular method or system was employed to obtain the ore:

The ore was simply stoped from the sub-levels in chambers extending up to the "cap," which was supported on stulls. When broken the ore was shoveled into cars and trammed to chutes, through which it was delivered to cars on the haulage levels and trammed to the bins outside.

Work was begun on the Utah Copper working tunnel in September 1903, and the extraction of the first ore began in November. In April 1904 the first ore was sent to the Copperton mill, although regular operations at the mine did not get under way until July 1, 1904.

Financing Expansion

Shortly after the completion of the Copperton mill, MacNeill and Penrose were able to purchase Captain De Lamar's remaining one-eighth interest. Whereupon, they reorganized the company, incorporating the new Utah Copper Company in New Jersey on April 29, 1904. The new company was capitalized at $4,500,000 in $10 shares.

---

1 Parsons, The Porphyry Coppers, pp. 70-71. Only $250,000 cash was put up at the start (all coming from the MacNeill-Penrose group), to launch the new company. Wall received $150,000 in bonds and 90,000 shares of stock. Jackling and Cohen each received a 5-percent stock commission (25,000 shares each). Hence there was little money for working capital. Rickard, History of American Mining, p. 196.

2 Rickard, The Utah Copper Enterprise, p. 47.

One of the first actions taken after the reorganization was the issuance of $750,000 in 7-percent bonds on July 1, 1904, to run for 3 years; these would be convertible into stock at par. This bond issue was subscribed largely by the Colorado promoters themselves, since they were financially in a position to provide some additional capital for the venture.¹

Although the initial steps in the inauguration were now well under way, it was readily apparent that a great deal more capital would be required to carry out the ambitious expansion program which called for the erection of a 6,000-ton concentrator at Garfield. Therefore, the promoters attempted to interest "outside" investors in the enterprise. One of those approached with a view of investing in the property was the General Electric Company, which was considering buying into copper mining in order to assure their raw material needs for the production of electrical wire.

General Electric's engineer, D. M. Riordan, recommended the project after an examination of the property was made by E. Gybson Spilsbury and W. Laurence Austin. Their report indicated that 5,000,000 tons of 1.98 percent ore had been developed, and that the Copperton mill had just been brought to the point of profitable operation. While the report confirmed the earlier reports of Minard and Jackling-Gemmell, it was received with considerable skepticism by the directors of General Electric. Following the lead of a member of the Board who said that he did not "believe the damn figures," the recommendation was rejected. The

¹Rickard, The Utah Copper Enterprise, p. 28.
comment registered by the General Electric Board member undoubtedly represented the opinion of others whom the promoters approached. After all, the report suggested the successful accomplishment of something that had never been done before.¹

The Guggenheims come to the rescue. Meyer Guggenheim was a Jewish immigrant to America in 1848. By 1881 he had established a prosperous lace and embroidery business in Philadelphia. Seeking to satisfy an urge to obtain something bigger for his seven sons to participate in, Meyer became interested in lead and silver mining in Colorado. Through careful management and shrewd business acumen, he was able to put together an important and prosperous mining and smelting business known as M. Guggenheim and Sons. By 1899 the business encompassed mines and smelters in Mexico. During that year the Guggenheims decided to form a new organization to enhance the power and resources of their growing empire. In June 1899 the Guggenheim Exploration Company was formed to "prospect, explore, improve, and develop mining properties in any part of the world."² Thus, the turn of the century found the Guggenheims firmly entrenched in nonferrous smelting and refining, and with a good foothold in mining.

Coeval with the organization of the Guggenheim Exploration Company had been the formation of the gigantic American Smelting and Refining Company in April 1899. The prime mover behind that enterprise, as previously indicated, was Henry H. Rogers, one of the organizers of

¹Ibid.
²Marcossen, Metal Magic, p. 63.
Amalgamated Copper Company. Rogers had been a trusted aid of John D. Rockefeller. With the help of Leonard Lewisohn, a New York metal merchant, Rogers was able to purchase all of the principal smelting works in the United States—with the exception of those controlled by the Guggenheims. Although Rogers needed the strength of the Guggenheims to give the venture a firm character and some semblance of stability which other firms could not give it, he was rebuffed in his attempts to bring them into the fold.

Rogers and Lewisohn were able to put together the big combine without too much difficulty, but it was something else to make it operate profitably. In spite of all their efforts to eliminate the top-heavy condition of the company by forcing a wholesale shutdown of plants and property, financial difficulties continued to plague the company. Efforts were soon made by major ASARCO stockholders to induce the Guggenheims to enter the combine. Negotiations were initiated in the spring of 1900, and after considerable discussion the Guggenheims agreed to turn over their property and business to ASARCO, to provide working capital equal to two-thirds of the working capital of the company, and an additional $6,000,000 in cash, in exchange for $45,200,000 of ASARCO stock, to be part of a total issue of $100,000,000 of stock issued by ASARCO. This offer was accepted.¹

With the assumption of the management of ASARCO by the Guggenheims in 1901, the established policy of the former management not to engage in the mining business to any degree was discarded. In order to insure adequate raw materials for their numerous smelters, the Guggenheims

¹Ibid., pp. 1-69.
decided to enter the mining business. Therefore, under the guidance of Daniel Guggenheim, the new president of ASARCO, the acquisition of mining properties became an important aspect of company policy.

Daniel Guggenheim's decision was not only to acquire additional lead smelting plants, but to enter the field of copper smelting as well, and to go into nonferrous metal mining in general. In order to finance such a program of expansion, which was planned to cover a period of from 15 to 20 years, some means of obtaining the necessary funds had to be established. After a study of the project was made by several banking firms, it was concluded that the most feasible way to finance the larger part of the project would be through the organization of a separate company. It was reasoned that the public would be more inclined to buy the securities offered by a new company— and guaranteed by ASARCO— than new issues by ASARCO alone. Then too, ASARCO would be free to issue its own securities should the need arise.

This concept resulted in the organization of the American Smelters Company. A few months later, in 1905, the name of the company was changed to American Smelters Securities Company. The sale of large amounts of securities by this new company provided the necessary capital to purchase or control numerous companies, and to aggressively pursue the expansion into the field of copper smelting.¹

The Guggenheims come to Utah. The initial efforts of the Utah Copper Company had not gone unnoticed in the halls of finance in New York. Bernard Baruch, the young Wall Street financier, had been invited to

¹Ibid., pp. 1-83.
participate early in the project by MacNeill and Jackling, and had bought "a good many shares" when the promoters were unable to interest the public in the project. Furthermore, the Guggenheims, who had been un unsuccessfully approached several years earlier but who were now interested in expanding into copper, were watching the operations of the fledgling company.

Hence, in 1905 it was at an opportune moment that Jackling and his associates prevailed upon John C. Montgomery, a Colorado mine promoter, to go to John Hays Hammond with a proposition that he, as the Guggenheims' consulting engineer, should interest them in financing the Utah Copper Company's expansion program. Hammond told Montgomery that he was familiar with the history of the property and would recommend it. He put the proposition before Daniel Guggenheim, with a view of securing approval at the next board meeting of the Guggenheim Exploration Company. Hammond pointed out his own interest in the project, which had been backed by his willingness to go into it personally with Victor Clement. He also pointed out that there was needed "someone with imagination enough to see beyond the great initial outlay and to grasp the eventual success of a large-scale operation." According to Hammond, "this demonstration of confidence, coupled with my arguments and figures, convinced Mr. Dan."

Hammond then sent his two assistants, Seeley W. Mudd and A. Chester Beatty to make a new examination and a thorough drill test of the property. The engineer who made the actual investigation was Henry Krumb, then under the immediate direction of Mudd, who was the chief Guggenheim engineer in the West with headquarters in Los Angeles.²

¹Hammond, Autobiography, p. 517.
The examination by Krumb, according to Parsons, was probably the most elaborate and thorough ever undertaken—"partly because of the large amount of money involved and partly because of the widespread doubt as to the success of treating ore of such low grade."¹ A large number of new holes were drilled and the workings thoroughly sampled. In addition, special mill tests were run to check the results reported by Jackling. The task necessitated the hiring of 16 junior engineers as assistants to Krumb, and 7 months were required to complete the work. The group took about 3,500 assays, half the number used by Jackling and Gemmell, and these averaged just under 2 percent copper. The discrepancy was less than 0.002 percent of the Jackling-Gemmell report. The extensive examination by Krumb and his assistants cost $150,000.²

The Mudd-Beatty report, as it was called, was submitted in October 1905 and was favorable to the project. Parsons states that both Hammond and Beatty were skeptical of the venture from the start, but that Krumb's report was distinctly favorable and Mudd concurred.³ Krumb estimated that the mine contained 40,000,000 tons of ore and a fair possibility of twice that amount. Beatty ventured that the mine contained about 9,000,000 tons; but, as suggested by Parsons, he was doubtlessly looking at the

¹Parsons, The Porphyry Coppers, p. 73.

²Ibid., p. 74.

³Hammond, Autobiography, p. 517; Parsons, The Porphyry Coppers, p. 74. It is doubtful that Hammond's position was as skeptical as Parsons suggests, since he was the man who had to sell the Guggenheims on the idea—and had previously been willing to invest in it personally. Furthermore, with his reputation, the Guggenheims would have hardly been willing to spend $150,000 for an investigation unless he supported it.
business angle for the Guggenheims, and was laying the ground work for
the driving of a good bargain. Nevertheless, the findings brought in the
Guggenheims with the badly needed capital—and in return gave them suffi-
cient leverage to obtain a commanding position over the affairs of the
Utah Copper Company.\(^1\)

The ultimate arrangements were as follows:

(1) the Guggenheim Exploration Company underwrote an issue of
6 per cent convertible bonds in the total sum of $3,000,000; (2)
the American Smelters Securities Co. bought 232,000 shares of Utah
stock at $20 per share; and (3) the American Smelting & Refining Co.
got a long-term contract to smelt the concentrates produced under
terms that would mean about $7 per ton.\(^2\)

To oversee their investment, the Guggenheims proposed that John Hays
Hammond be made managing director of the Utah Copper Company, and that
the glamour of the Hammond name be backed by the Guggenheim prestige.
The first Annual Report of the Utah Copper Company, for the period ending
June 30, 1905, made the following comment about the new marriage: "The
stockholders are to be congratulated upon the fact that the Guggenheim
Exploration Company has become largely interested in this Company and
that the services of John Hays Hammond have been secured as Consulting
Engineer."\(^3\)

\(^1\)Parsons, The Porphyry Coppers, p. 74. Because of the speculative
wave then gathering force after the 1903 panic, Baruch suggests that the
prospects of the Utah Copper Company appeared so good that "Utah's
backers were able to get $20 a share from the Guggenheims for the stock
which had sold originally for $10 a share." The new capital was used by
Jackling to proceed with his plans, but proved insufficient to meet his
growing needs. Therefore, a $3,000,000 bond issue was suggested. Bernard
p. 223.

\(^2\)Parsons, The Porphyry Coppers, p. 74.

\(^3\)Utah Copper Company, 1st Annual Report, June 30, 1905, p. 8.
A short time later, Hammond was officially appointed Managing Director, a post which he held until the end of 1907. In the latter year, he resigned from his positions with both Utah Copper and the Guggenheim Exploration Company due to ill health. Pope Yeatman, also a Guggenheim man, succeeded him as Managing Director and A. Chester Beatty as consulting engineer.¹

The receipt by the Guggenheim-controlled ASARCO of a long-term contract to smelt the concentrates from Utah Copper met with much criticism, and was regarded by many as "providing an excessive margin to the smelter."²

The contract . . . was in itself the crowning glory of the Guggenheim control of Bingham Canyon. For twenty years Utah Copper bound itself to ship its ores to the Garfield smelter, to pay a minimum base charge of $6 a ton for reduction (later boosted to $7) and $30 a ton for refining. Utah was to be paid for 95 per cent of the copper extracted from its ore, 90 percent of the silver and 68 per cent of the gold. It was the biggest contract ever signed by American Smelting and Refining and was valued by hostile critics at $5,000,000. Old Colonel Wall, wizened and embittered, [in later years] declared Utah Copper was being milked by the Guggenheims to the tune of $3 a ton on smelting charges, in comparison with other copper smelters. For twenty years, American Smelting and Refining, he said, would collect a toll of 8/10 of a cent on every pound of copper wrested from the great mine at the head of Bingham Canyon, plus a commission of 1/2 cent a pound on its sale.³

Although the Guggenheims held only a minority interest in Utah Copper at the time, "by virtue of the smelting contract they became in

²Parsons, The Porphyry Coppers, p. 74. In defense of the contract, Parsons points out that "a large investment was necessary to build a new smelting plant . . . and this smelting contract was one of the inducements to obtain the needed assistance in financing the development of the mine and the building of the new mill. At the same time it was arranged to retire the remainder of the $750,000 bond issue at a premium of 5 per cent." (This latter amounted to $37,500. Utah Copper Company, 1st Annual Report, June 30, 1905, p. 5.)
fact the directors of its destinies."¹ It should be mentioned, however, that even though the Guggenheims were now financially well entrenched in the Utah company, the active management remained in the hands of Jackling and MacNeill, the former serving first as general manager, then as vice president and general manager (after Wall resigned), and later as managing director, and finally as president.²

The Garfield smelter. To fulfill the 20-year contract which ASARCO was granted by Utah Copper to smelt the concentrates produced by the latter's ores, required the construction of what was the world's largest copper smelter. Of all the smelters which had been constructed previously (or since, for that matter) none could compare to the Garfield smelter in size or magnitude of operations. Since its source of supply would be the Bingham porphyry mines, a huge undertaking, it was obvious that the plant would also have to be mammoth in size.

The smelter site was located at the mouth of Kessler Canyon, overlooking the Great Salt Lake Valley, about 15 miles southwest of Salt Lake City, and a short distance from the lake itself. The site was selected by E. L. Newhouse (no relation to Samuel, so far as can be determined), vice-president in charge of operations for ASARCO, who, on his first visit to the area, gazed about and said, "this is where the smelter will rise."³

Construction of the Garfield smelter began in 1905, just a little over 2 years after the organization of the Utah Copper Company. The

¹Ibid., pp. 280-81.
²Parsons, The Porphyry Coppers, pp. 75-76.
³Marcossen, Metal Magic, pp. 107-08.
first part of the huge project to be constructed were the flues and the smokestack on the slope of the mountain. Later, during the winter months, sulphide and sampling units were installed, and gradually the smelting circuit took form. By August 1906 the plant was sufficiently completed to permit the starting of operations.

The workers hired for the construction were Greek, Slavic, Swedish, and Italian immigrants. They lived in tents near the site, until suitable quarters could be constructed. Later, through the joint efforts of ASARCO, Boston Consolidated, and Utah Copper, quarters for employees of all three companies were provided by the Garfield Improvement Company, which built and operated the town of Garfield near the smelter.1

The construction of the Garfield smelter was under the direction of Karl Eilers. Since this was the first smelter ever constructed to operate primarily on porphyry concentrates, it required the introduction of new processes and techniques to handle these successfully. Although Charles W. Whitley was the Utah manager for ASARCO, Daniel Guggenheim sent Eilers from New York to supervise its construction. Early in 1905 he went to Anaconda, Montana, to observe smelting operations at the Washoe Reduction Works, then under the direction of E. P. Mathewson.

After spending a few days at the plant, Eilers told Mathewson that he would like to have certain blueprints, including one giving the details of reverberatory construction and another showing the general layout of the plant. Mr. Mathewson replied that he did not have authority to furnish the drawings, but suggested that Mr.

1Tbid., pp. 147-48. The Garfield Improvement Company, the owner of the "Garfield Townsite," was organized in 1906 for the purpose of constructing a modern town for the use of the employees of the Garfield Smelting Company (three-fifths of the stock), Boston Consolidated Mining Company (one-fifth of the stock), and the Utah Copper Company (one-fifth of the stock). Utah Copper Company, 2nd Annual Report, June 30, 1906.
Eilers telegraphed his request to Benjamin B. Thayer, the Anaconda executive in New York. The prompt response was a wire to Mathewson to this general effect: "Let Eilers have whatever he wants." The result was that Mr. Eilers and his assistants, Carl Fogh and Carl F. Buck, had the advantage of familiarity with Anaconda practice in designing and building the smelter at Garfield.¹

The original plant consisted of 2 reverberatory furnaces, 2 blast furnaces, 6 acid-lined converters, and 8 roasters. The reverberatories were heated by means of hand-fired coal grates. (These were replaced in 1911 by oil, which in turn were replaced by powdered coal in 1915. In 1940, natural gas from Wyoming fields was installed.) The smelter was specifically designed as a copper smelting and converting plant, and was equipped to handle 500 tons of concentrates daily.

When the furnace was first fired up on Labor Day 1906, the number one reverberatory failed to operate satisfactorily. Operations were suspended until the necessary repairs could be made. In October the second furnace was started up. The combined tonnage handled by both units for the remainder of 1907 amounted to 56,918 tons, and copper production was 5,554 tons.²

Many difficulties were encountered during the first few years of operation at the new smelter. Delays in the installation of blast furnaces and many metallurgical problems contributed to the situation. In June 1908 the smelter was unable to handle the tonnages of concentrates being shipped from the newly-completed Utah Copper and Boston Consolidated mills, as well as that from the Cactus mill at Newhouse. Walter R. Ingalls, editor of the Engineering and Mining Journal, made a visit to

Utah in the summer of 1907. In a special article he commented on the problems faced by the new smelter:

It has been several times reported that the Garfield smelter is a failure . . . . Of course these reports are utterly incorrect and if they had any basis, the latter would be nothing more than the infantile troubles from which any new plant suffers . . . . Such defects as there may be are perhaps due to the fact that the American Smelting & Refining Co. has too many engineers and does not trust its work of this kind sufficiently to a single one upon whom the responsibility may be placed. In other words, it is a case of too many cooks.

The first cost of this plant was very high. It is said to have been $5,000,000 or will be that much when the additional furnaces that are now being installed have been completed, which will be about the end of this year. Its capacity may be placed as 900,000 tons of charge per year, which would make its cost upwards of $5 per ton of annual capacity. It is only a little while ago that $3 was considered a figure that would supply all that is needed for the most economical operation. Is the extra $2 worth while?¹

Ingalls pointed out that among the features of the Garfield plant several had contributed materially to increase the cost of construction: (1) a "very elaborate" flue system, (2) the "amazing magnitude" of the intraplant transportation system, with its trestles and electrically-operated trams, and (3) "the extensive belt-converter installations also designed for intra-plant movement of ores, fluxes, fuel, and other materials." Ingalls felt that the mechanical system of handling materials had probably been overdone.²

In 1908 there was more talk of trouble at the Garfield smelter. In June, the smelter was unable to handle the large tonnages of concentrates from the nearby mills, which were rapidly increasing their output. Therefore, a program of expansion was started to increase the capacity of the smelter from 1,800 tons to 2,700 tons.³

¹Parsons, The Porphyry Coppers, p. 502.
²Ibid.
³Tribune, June 11, 1908.
In August a news release from the Boston News Bureau suggested that "much of the concentrates were finding their way to the surrounding hills, via the stack," and what had started out as a $3,000,000 investment had required $8,000,000 up to then. The situation was so serious that by September, ASARCO dispatched W. S. Morse, one of the company's directors, to Salt Lake City to help get the smelter running properly. Said Morse on his arrival:

The Garfield smelter is not a failure. We have had to contend with the mistakes that invariably attend the erection of a new plant, especially when an entirely new and unsolved metallurgical problem has to be confronted, as we have had to do in the proper treatment of the concentrates from the Utah Copper and Boston Consolidated companies. I am certain that Mr. Eilers (Carl) successfully will complete the smelter and will make many more improvements on it, and this should be the hope of every one in or out of the company.2

By the last comment Morse was replying to those who hoped it would be a failure—which included many local mine operators who were suffering from the monopolistic policies then being practiced by ASARCO with regard to ore purchasing. Morse said that the success of the venture would mean more than just the recoup of losses on the millions that the Guggenheims had spent in building the smelter; it "was for the good of the Utah mining industry."3

There need not have been such concern, for the smelter was placed on a sound operating basis by 1910, and the formation of the rival International Smelting and Refining Company effectively eliminated ASARCO's monopolistic position in nonferrous smelting in Utah.

1Ibid., August 8, 1908.
2Ibid., September 25, 1908.
3Ibid.
Utah Copper Garfield concentrator. Once the Guggenheims assumed the financial burdens of Utah Copper, money was soon forthcoming to erect the 3,000-ton concentrating mill near the Garfield Beach. Jackling was given the go-ahead to begin planning for the mill, and the Guggenheims made arrangements for the financing of the venture. Daniel Guggenheim approached Bernard Baruch to discuss the issuance of the $3,000,000 bond issue. Baruch offered to underwrite it for a 5-percent commission, but was underbid by Charles Hayden, of Hayden, Stone and Company, who agreed to underwrite it for the "unheard of" low commission of less than 1 percent. The issue, underwritten by Hayden, was oversubscribed, and money provided for Jackling to proceed with the construction of the Garfield concentrator.¹

The site selected for the Magna mill, as it was later called, was situated at the northern extremity of the Oquirrh range, where the mountains rise steeply from the shore of Great Salt Lake. Because of the presence of numerous springs, the area was an irregular mass of marshes and sloughs, which were the home of numerous flocks of water fowl. Nearer the mountain were several ranch houses. The mill was located at what was originally known as Mill Stone Point, so named because the hill was covered with large stones suitable for making mill stones used in the grinding of grain. In the early days people from the surrounding territory came to obtain these stones. Later, when the stagecoach road to California passed nearby, the point became known as "Point of West Mountain."²

¹Baruch, My Own Story, pp. 224-25.
²"History of Milling to 1939," pp. 16-17.
The mill site consisted of 2,400 acres of ground, selected "on account of there being no suitable location in Bingham Canyon for a very large plant, and more particularly on account of sufficient water to operate it not being available in the vicinity of the mine ... ."\(^1\) The water for the mill was to come from several very large springs located at Pleasant Green, near Magna, which were purchased from Colonel Wall and others. The springs, when developed, produced about 12,500 gallons of water per minute, with constant pumping.\(^2\)

Another very important reason for the construction of the mill at Garfield was the availability of ample ground for tailings disposal, something which was not available at Bingham Canyon. The sloping hillside at Magna provided sufficient elevation not only for gravity flow through the mill, but for the disposal of the wastes on the large flat area below.\(^3\)

In late 1905, the foundations for a plant of 3,000 tons daily capacity were laid at the site near Garfield. Originally, the mill was expected to be completed and in operation during 1906. However, due to the delays caused by Colonel Wall, and in the actual construction, the first 500-ton section was not ready for operation until June 1907. In

---

\(^1\) Utah Copper Company, 3rd Annual Report, June 30, 1907, p. 5.

\(^2\) Rickard, The Utah Copper Enterprise, p. 51. In 1906, the Garfield Water Company was organized jointly by the Utah Copper Company, Boston Consolidated Mining Company, and the Garfield Smelting Company for the purpose of developing the water "for delivery to the milling and smelting plants of the companies, . . . and in addition, is to furnish the domestic supply of water for use in the town of Garfield." Utah Copper Company, 2nd Annual Report, June 30, 1906, p. 6.

\(^3\) "History of Milling to 1939," p. 120.
the interim the continued satisfactory results obtained at the Copperton plant and further developments at the mine indicated the desirability of conducting operations on a much larger scale than previously anticipated. Therefore, the original plans for 6 units with a 3,000 ton total capacity were enlarged to provide for 12 sections totaling 6,000 tons. The construction of the last six were to be carried out after the first six were in operation.¹

The first ore was milled in the new plant in June 1906, and the entire 12 sections were completed in November 1908. The mill building, located 115 feet above the valley floor, was 509 feet by 600 feet in dimensions. The framework was of steel set in concrete with corrugated iron sidings and roof. The cost of the original plant, together with accessory facilities, required the expenditure of $4,005,000. The added cost of the expanded mill necessitated the issuance, in February 1907, of 60,000 shares of treasury stock. This was sold at $25 per share by Hayden, Stone and Company through William Boyce Thompson.²

Because of the constant criticism by Colonel Wall of his milling techniques, Jackling expended considerable effort and money to insure the success of the Magna mill. The construction of the neighboring Boston Consolidated mill, in 1906 and 1907, was watched with polite skepticism by Jackling. When both mills were operating, each employing different concentrating equipment, frequent comparisons were made of the results obtained. In August 1908, an expert from the Massachusetts

¹Ibid., p. 18.
²Ibid.; Parsons, The Porphyry Copper, p. 76.
Institute of Technology came to Salt Lake to inspect the operations of both companies. He was reported as being very pleased with both mills, and thought both were operating successfully. When asked which he thought was the best, he declined to say, stating that both were experimental as yet, with the Utah Copper sticking to known methods and the Boston Consolidated trying new methods. He did, however, think the Utah Copper mill might prove the best in the long run.¹

**Tailings disposal.** As was mentioned above, the selection of the Magna mill site was based on the ample space and the ideal topography which it afforded for the disposal of the waste contemplated at the time. The land for the ponds was acquired from owners who had settled in the area, and prior to purchase had been utilized primarily for agricultural purposes.

The original tailings pond covered an area of 1,315 acres, or more than 2 square miles. The pond was also used by the neighboring Boston Consolidated for the disposal of tailings from their Garfield concentrating plant. To retain the water and protect the railroad tracks to the north, a dike was constructed on the north and east sides of the pond, out of mine waste.²

The tailings from the concentrators, which amounted to from 95 to 97 percent of all tonnage milled, was discharged into the tailings pond. The water for conveying the tailings varied in amount from 10,000 to 15,000 gallons per minute, depending upon the tonnage being milled and

¹_Tribune, August 8, 1908._

²_"History of Milling to 1939," p. 120._
the percentage of solids in the tailing pulp. Normally, the pulp was about 28 to 30 percent solids. Once the tailings were dispersed in the pond, the water was collected in concrete dewatering boxes on the north and east sides of the dike. They served to discharge the clear water from the tailing pond after the solids had been settled.¹

**Magna generating plant.** To provide power for the milling operations at the new Magna concentrating plant, the Utah Copper Company constructed a steam electric generating plant at Magna in 1906. When completed, the capacity of the plant was 8,500 kilowatts. The plant did not prove to be very efficient, however, and as the company's needs for electricity expanded, serious doubts were raised as to the wisdom of increasing the plant capacity. The management of the company decided that, rather than enlarge the Magna generating plant, better terms could be worked out by purchasing power from the Utah Power and Light Company. Therefore, in 1912, Utah Copper entered into a 25-year contract with Utah Power and Light for 27,000 horsepower worth of electricity, to be delivered over 44,000 volt lines to the Utah Copper Magna and Arthur mills.²

The 1912 Annual Report said that "the terms and conditions of the contract are such that we not only procure our power cheaper than we are able to produce it ourselves, but we are protected as to character of service in such a way as to insure fully as great reliability from this source as that afforded by our own steam plant."³ Shortly after

¹Ibid.
³Utah Copper Company, 8th Annual Report, 1912, p. 15.
the signing of the new contract with Utah Power and Light, the Magna steam generating plant was shut down and later dismantled.

The Inauguration of Opencut Mining at Bingham

As mentioned previously, the early mining followed the "Caving system" of mining. "Up until June 1907, all the ores extracted were derived from development work and by the application of that system."\(^1\)

The entire mineralized area was covered by a thickness of about 70 feet of low grade and oxidized ores that could not be profitably handled by concentration. It was originally thought that this low-grade zone would be much thicker, but as development progressed it was seen that "a system of mining, much cheaper than by caving, could be applied."

Thus, steam shovels were used to remove the low-grade, oxidized overburden entirely, "leaving the ore uncovered, so that it could also be handled by steam shovels, at a very low cost."\(^2\)

Obviously, a large sum of money was required to remove the capping or overburden from the mine, and the stockholders were warned that "the cost of mining for the first year or two will be somewhat excessive, as compared with the cost thereafter when the full complement of steam shovels shall be operating under advantageous conditions."\(^3\)

In January 1906, Jackling appointed Robert C. Gemmell, then in Mexico, as general superintendent of the company. Gemmell returned

---

\(^1\)Utah Copper Company, *3rd Annual Report*, 1907, p. 5.

\(^2\)Paraphrased from *ibid*.

\(^3\)Ibid.
immediately to accept the appointment, and in April 1906 went to Minnesota with Jackling to study the opencut mining methods employed at the Mesabi iron mines—particularly the use of steam shovels. Upon the advice of one of Gemmell's old college classmates, William J. Olcott, then a distinguished engineer in the iron country, they hired J. D. Shilling as mine superintendent for the Utah Copper Company. Shilling came to Bingham in July 1906 and served in this capacity until his death in 1923.¹

Under the direction of Shilling, the first steam shovels were placed in operation at the Utah Copper mine in August 1906. The work started on the "C" and "D" levels, and the equipment consisted of 2 Marion shovels, 1 Vulcan shovel, 4 small Davenport locomotives, and 6 yard wooden dump cars. They commenced the job of stripping the overburden from the hillside at the rate of about 100,000 tons per month, or the equivalent of nearly 1 acre of ground every 30 days. By June 1907, the shovels had removed about 700,000 cubic yards of capping, uncovering nearly 6 acres of ore. At the end of 1909 the shovels had stripped 3,232,000 cubic yards.²

While the stripping of capping was going ahead full speed on the top of the ground, the mining of the orebody underneath continued. As of June 30, 1907 the mine had been developed by approximately 90,000 feet of underground workings. Underground development work was suspended on January 1, 1907, however, when it was felt that there was sufficient ore

¹Rickard, The Utah Copper Enterprise, p. 47.
²Parsons, The Porphyry Copper, p. 76; Pett, "History of Utah Copper."
blocked out to last for several years to come. Development expenditures were thought to be better utilized for the removal of surface overburden.¹

By 1907 the development of the mine, both surface and underground, covered 72 acres, 60 of which were said to contain 2 percent copper, 0.15 ounces of silver, and 0.015 ounces of gold per ton. The other 12 acres were estimated to contain ore of about 1.5 percent copper. This work indicated the presence of ore to a depth of 310 feet, equivalent to about 60,000,000 tons of the better grade material (of which 20,000,000 tons were fully blocked out). "Taken as a whole, not to exceed one-half of the total area known to contain commercial values has been developed."²

The company announced in June 1907 that the operations of the steam shovels had, by now, proven so "satisfactory and economical" that the underground mining was being abandoned as rapidly as was possible. On that date about 25 percent of the total ore mined was coming from underground stopes, and this mainly from the north side of the canyon where it was felt that underground mining should be continued because this method was less expensive than stripping. "With the exception of this necessary piece of underground work, we expect that no further mining of this character will be done and the entire property, on both sides of the Canyon, will be worked by shovels."³

To provide for the increasing scope of operations, the equipment and facilities at the mine were rapidly expanded. In 1906, the company houses at Bingham consisted of a two-room shack for the engineer and a

¹Utah Copper Company, 3rd Annual Report, June 30, 1907, p. 10.
²Ibid.
small dwelling house for the office. In the early winter of that year
a boarding house for the shovel men was constructed. The building was
opened with a grand ball in the dining room. By June 1907, the equip-
ment at the mine consisted of 15 steam locomotives, nine of which were
100,000 pounds in weight or larger; 6 steam shovels, four of which were
100-ton machines and two 70-ton machines; 125 stripping dump cars, of
6-yards capacity; 5 electric locomotives, two of which were 40,000
pound machines, the others being small ones for underground work.¹

The company had also constructed 5 miles of standard gauge railroad
track, laid with 65-pound steel, and was in the process of constructing
4.5 miles of additional trackage to provide dumping room for the stripp-
ing of 45 acres of ore. A machine shop, "thoroughly modern in all its
appointments," had been erected, and a compressor plant. Furthermore,
"there are commodious offices and quarters for employees, and all the
minor equipment usual to a well-equipped mine."²

In 1908 an additional 8 acres of ground at the mine were stripped,
bringing the known ore area up to 80 acres, and adding about 8,000,000
tons of ore to the company's known reserves. During the year, about 3
percent of ore reserves were mined.³

One of the problems encountered in the stripping operations was to
obtain suitable dumping ground for the capping. To alleviate the problem,
the company, in 1908, secured by purchase and lease about 120 acres of

¹Fett, "History of Utah Copper."
²Utah Copper Company, 3rd Annual Report, 1907, p. 14
³Utah Copper Company, 4th Annual Report, 1908, p. 10.
ground outside its own property for dumping purposes. This provided sufficient ground for the dumping of 6,330,000 cubic yards of material, or the equivalent of the capping overlying 56 acres of ore with an average thickness of 70 feet.¹

The continuing addition of mining and transportation equipment, during 1908 and 1909, enabled the company to reduce the quantity of ore mined from underground methods to less than 3 percent by the end of 1909—the remaining 97 percent coming from opencut operations. During the same period, the ore reserves were increased to 90,000,000 tons as a result of development work and stripping operations. By 1909 the company had 11 steam shovels in operation, 21 locomotives, 145 dump cars, and 16 miles of railroad trackage.²

Ore transportation and the birth of the Bingham and Garfield Railroad. With the construction of the Garfield smelter and the adjacent Utah Copper and Boston Consolidated mills, the Copper Belt-Rio Grande system was unable to handle the rapid increase in ore tonnages from the mine to the mills at Garfield. The companies requested that the Rio Grande improve the line so that it could handle the increasing ore traffic. The Rio Grande company responded to the request, and in 1905 had begun the construction of the Bingham Low-grade Line, to connect the Utah Copper mine with the company's mill under construction at Magna.³

¹Ibid., p. 11.


³Utah Copper Company, "Descriptive History of Utah Copper Company and Bingham & Garfield Railway Company" (unpublished MSS., in the possession of the Kennecott Copper Corporation), p. 15.
The Utah Copper Company hoped that the new line, completed in April 1906, would "promptly handle, in accordance with contracts made, the tonnage necessary for both the Bingham and Garfield plants." Unfortunately, this was not the case. The Denver and Rio Grande Western, in spite of the newly-constructed line, was unable to adequately carry the enormous tonnage of Boston Consolidated and Utah Copper ore and concentrates. The railroad company, through sheer neglect and indifference on the part of its management, allowed the branch line to deteriorate and the service to its main customers to drop alarmingly. When shipments became heavier and service continued to decline, Utah Copper demanded improvements, including heavier rails, without result. Finally, in 1908 when the Utah Copper and Boston Consolidated concentrating mills were reaching their full-operating capacity, the situation could be borne no longer. On July 8, 1908, the Utah Copper Company organized a subsidiary company, the Bingham and Garfield Railway Company.

1Utah Copper Company, 2nd Annual Report, June 30, 1906, pp. 4-5.

2Under the management of George Gould, the son of Jay Gould, who over-extended himself and the Denver and Rio Grande in his attempt to build the Western Pacific from Salt Lake City to San Francisco in 1905, to provide a transcontinental link for his Missouri Pacific, the Denver and Rio Grande was soon sapped dry. The road became rundown, operations were slipshod, and accidents were frequent. The management of Edward T. Jeffrey answered the rising tide of protest against the condition of his railroad by cutting the working force and tightening the purse strings. In the spring of 1907 some 500 men were released to "reduce expenses and furnish money for dividends." "His action was taken in spite of the fact that some 2,000 'bad order' cars awaited repair and twenty-five locomotives were inoperable." Robert G. Athearn, Rebel of the Rockies, A History of the Denver and Rio Grande Western Railroad (New Haven and London: Yale University Press, 1952), p. 213.

3Ibid., p. 222.
Incorporated under the laws of the State of Utah, with the powers and obligations of a common carrier, Bingham and Garfield had an original authorized capitalization of 10,000 shares of common stock with a par value of $100 a share. Before construction of the line was initiated, however, one last attempt was made to work out an agreement with the Denver and Rio Grande to improve the service.¹

Our losses, and the disadvantages under which we have operated as a result of the failure on its [Denver and Rio Grande] part to give us the desired and necessary service, have been greater than would be indicated by the direct deficiency in tonnage that we desired to mine and mill, but which the Railway Company was not prepared to transport, for the reason that the tonnages that have been delivered to the mills have been handled at a disadvantage and at an extra cost. We have used every effort to induce the railway people to give us better service, but, so far, without very much encouraging result, and we have therefore, located and surveyed a line for a railroad of our own between the mines and mills. Negotiations are now pending, which if consummated, will relieve the situation and give us the transportation facilities we require. If these negotiations fail, I recommend that construction be commenced on our own railway at an early date. Daniel C. Jackling.²

The negotiations were carried out for several months, but ultimately failed. The Denver and Rio Grande contract provided for the transportation of 6,000 tons of ore per day between Bingham and Garfield (a distance of 27.5 miles over their tracks) at 25 cents per ton. In view of the large expansion program which Utah Copper was contemplating, and the relative assurance of its execution, the company felt that "the projected railroad would be profitable even after allocating the contract tonnage to the Denver & Rio Grande."³

¹Utah Copper Company, "Brief History, Bingham & Garfield Railway Company" (MSS., in the files of Kennecott Copper Corporation).
³Parsons, The Porphyry Coppers, p. 83; Spendlove, "History of Bingham," p. 37, says the Rio Grande charged $0.28 for hauling Utah Copper ore, as compared to Bingham and Garfield cost of 25 cents per ton.
Therefore, in 1910 the Bingham and Garfield Railway Company issued 7,500 shares of capital stock and a bond issue of $2,500,000 to finance the construction of the line. The entire $750,000 par value of the capital stock was issued to the Utah Copper Company in payment for tracks and property owned by the latter company. The bonds were 10-year 6-percent convertible gold bonds, which could be converted into Utah Copper Company stock at $50 per share at any time after July 1, 1911, and on or before July 1, 1914.¹

The main line of the railroad was approximately 20 miles (20.1) long, and saved about 7 miles in distance over the Denver and Rio Grande system. It was constructed with heavy duty 90-pound rails, and steel and concrete bridges and culverts. Construction of the line got underway in 1910 and was completed in September 1911. The line contained several long viaducts in Bingham Canyon, and four tunnels with a combined length of almost a mile. The total cost of the Bingham and Garfield was $3,336,000.²

The success achieved by the new venture was heralded in the 1911 Annual Report. The Bingham and Garfield,

... from both a physical and financial standpoint has proven entirely satisfactory and fully up to the predictions made at the time it was projected. The result of operations to date indicate that with the tonnage it will be called upon to transport after the middle of the present year, it will show earnings that will indirectly result in reducing the cost of copper 3/4 of one cent per pound.³

²Parsons, The Porphyry Copper, pp. 82-83.
The Absorption of Boston Consolidated

From the very outset it was apparent to most observers that the exploitation of the huge Bingham porphyry deposits could best be worked by joint efforts on the part of the Utah Copper and Boston Consolidated companies. Their lands adjoined each other, with the former owning the lower portion of the hillside, and the latter the top of the hill. Therefore, late in 1905 after the Guggenheims had entered the picture to finance the development of Utah Copper, attempts were made to bring about a merger of the two companies. Henry Krumb, an engineer for the Guggenheim Exploration Company, was sent to make an investigation of the Boston Consolidated properties while negotiations were under way.¹

Everything progressed satisfactorily until early in January 1906 when a rich strike of high-grade copper was discovered in the Boston Consolidated Sulphide mine. The deposit was claimed by the Boston Consolidated company to contain 1,000,000 tons of ore. As a result of the discovery, Newhouse called a temporary halt to the merger talks and said he wanted the Utah Copper property examined by Boston Consolidated experts.²

In March Daniel Guggenheim came to Utah to see what could be worked out regarding the merger. It was freely rumored that a large new company sponsored by the Guggenheims was to be formed, with Samuel Newhouse as president, to operate the porphyry properties in Utah and Nevada. Terms

¹Parsons, The Porphyry Coppers, p. 78.
of the deal were to be one share of Nevada Consolidated, two and one-half shares of Utah Copper, three shares of Boston Consolidated, and ten shares of Newhouse Mines and Smelters.\(^1\)

In an interview Daniel Guggenheim was quoted as saying:

I am planning a gigantic merger of mining properties, in which Nevada will figure prominently, perhaps. The details of this, however, are not sufficiently rounded out for me to give anything in particular for publication at this time. I cannot state just what properties are involved, but the plan contemplates a merger of mining properties and smelter interests, in which some of the largest and most powerful interests in the country will join me.\(^2\)

Notwithstanding, the talks came to a halt because agreement could not be reached on the amount of tonnage available in the Utah Copper and Boston Consolidated mines. Samuel Newhouse insisted that Boston Consolidated be given a better deal than had been offered.\(^3\)

Nevada Consolidated, the other major party to the merger, was a budding Nevada porphyry property which had been put together several years before by Mark Requa, a young Nevada mining engineer, and then sold to Guggenheim Exploration by William Boyce Thompson. Requa later became prominent in California Republican politics. Thompson had also managed to acquire some nearby copper properties which he put together to form the Cumberland-Ely Copper Company, which was purchased by the Guggenheims on the recommendation of John Hays Hammond and Chester Beatty. The two Nevada companies had been merged over the distressful cries of the

\(^1\text{Ibid.},\ March 1, 1906.\)

\(^2\text{Ibid.},\ March 14, 1906.\)

\(^3\text{EMJ, March 31, 1906, pp. 360-61.}\)
minority stockholders of each company who haggled for better terms. The merger was not looked upon with favor by outsiders, and was called "jugglery," by the Engineering and Mining Journal.¹

Because of these activities, Horace Stevens, the editor of The Copper Handbook, in discussing the Utah Copper Company's future, said that while the Utah company was managed by thoroughly experienced and capable mining men,

... the property has suffered somewhat in the eyes of conservative investors through the acquisition of a heavy share interest, said, in some quarters, to constitute a control by the Guggenheims. And suspicions of the possible future of the property if under Guggenheim control were aggravated by newspaper talk of merging this property with other Guggenheim interests at Ely, Nevada.²

The development of both the Utah Copper Company and the neighboring Nevada Consolidated required many millions of dollars. The Guggenheims permitted the eager public to subscribe for the funds needed, and permitted large issues of stocks and bonds to be showered on the market.

The risks of capital, it became apparent, were to be assumed by the bond-buying public, while the Guggenheims, holding stock control, reaped the harvest. The Engineering and Mining Journal, alarmed by the flood of securities based on the porphyries, cautioned the Guggenheims to go easy if they were "to preserve some of the esteem among investors that they once had so richly."³

Up to June 1907, when the first section of the Garfield mill was placed in operation, Jackling had spent $8,000,000. The situation was complicated further during 1907 by the panic which caused a serious break

---

² Parsons, The Porphyry Coppers, pp. 75-76.
in the Stock Market. During the crisis, Charles MacNeill, president of Utah Copper, was forced to turn to Bernard Baruch with an urgent request for $500,000 to meet the company payrolls. Baruch managed to provide the money, and Utah Copper came through without further difficulty.¹

Having dropped the "gigantic merger plans" previously drawn up when Samuel Newhouse balked at the deal, the Guggenheims bided their time until 1908. While there were continuing rumors during 1907 and 1908 about a merger with Nevada Consolidated, little was said about Boston Consolidated.²

However, during this same time, the Cole-Ryan (Amalgamated Copper) group were threatening to invade Utah with a copper smelter and to wean away the Utah Consolidated Mining Company. Rumors were floating about that the Cole-Ryan group was going to build a custom smelter near Salt Lake, thus carrying the war to ASARCO's own monopoly over Utah's lead and silver ores. Commenting on the situation Daniel Guggenheim said:

> The group of gentlemen known as the Ryan-Cole and their following have been for many years in the copper mining and copper smelting business. They are great believers undoubtedly in copper as a metal. So am I. They can see that a great deal of money can be made in this business—as it can be when intelligently prosecuted.³

Although Guggenheim had announced that ASARCO had no intention of going into the custom smelting of other company's ores, and would confine itself to ores that it controlled such as Utah Copper, still the war raged on.

¹Baruch, My Own Story, pp. 224-27.
²Tribune, April 9, 1908.
In addition to the pressure being exerted by the threatened entry of the Cole-Ryan group into Utah, the situation with the Boston Consolidated was taking on serious proportions. Stripping operations and development work had, by 1909, demonstrated that most of the mountain was copper ore. However, Utah Copper, as mentioned previously, did not own the upper portions of the mountain. The company owned 190 acres of which about half was underlain with ore, but the Boston Consolidated holdings "surrounded the most productive part of the Utah ground on three sides."¹

The situation had reached such serious proportions that in September 1909 statements began appearing from eastern mining and financial circles "to the effect that the steam shovel territory of the Utah Copper company at Bingham was becoming restricted, owing to threatened labor difficulties."² The difficulties, it seems, stemmed from the refusal of the shovel laborers "to work under the high banks which are already crowding against the Ben Hur Tunnel of the Boston Consolidated." Furthermore, "it has already been determined that the Utah Copper people cannot mine the upper end of the McIntosh tunnel by steam shovels, and it will resort to the caving system of mining at this end of the property."³

When asked about the reports, D. C. Jackling branded the statements as unwarranted. "We have never experienced any such difficulty as that mentioned, nor do we anticipate any trouble of such a nature."⁴ In spite

¹Parsons, The Porphyry Coppers, p. 77.
²Tribune, September 21, 1909.
³Ibid.
⁴Ibid.
of the strong denial on the part of Jackling, however, it was quite evident that the situation was serious.

In November 1909 the rumors of a renewal of merger talks were floating about Salt Lake City. Jackling denied knowledge of the talks, saying that he did not know anything about it except what he read in the papers. Samuel Newhouse took a more open-handed position and said, "from indications, however, I think that the merger will in all probability be effected."¹

The merger of the Boston Consolidated, as conceived at the time, was to be the forerunner of a consolidation of all the Guggenheim copper properties into a single "gigantic" combination. Earlier, in 1907, and 1908, Tom Lawson (a "spectacular and flamboyant" Boston promoter) and William Boyce Thompson had held options on all of the Guggenheims' porphyry holdings in Utah and Nevada. They had attempted to form Copper Mines, Inc., which would include the Guggenheim properties and Lawson's Chino porphyry mines at Santa Rita, New Mexico. These properties were to have been "bundled together and given to the 'great people' at a mere fraction of their worth."² This fraction amounted to $60,000,000.

The Engineering and Mining Journal looked with disfavor upon Copper Mines, Inc., indicating that its plans had resulted from what was "apparently an unholy alliance brought about by Samuel Untermeyer and the Guggenheims. The latter are beginning to see the effect of the Lawsonian connection and it is not a very pleasant situation for them."³

¹Ibid., November 24, 1909.
³Ibid.
The company fell to pieces in 1908, and Thompson resigned from Hayden, Stone and Company; Lawson turned his attention to the Chino property.

Notwithstanding the failure of Lawson and Thompson and Copper Mines, Inc., the Guggenheims were still interested in bringing about a merger of their porphyry properties. Negotiations continued in November and December of 1909, and rapidly reached a climax. Dispatches from the east appeared on November 25, 1909, stating that the control of the Boston Consolidated would soon pass into the hands of Utah Copper, and that if Utah Copper went into the "big copper merger," Boston Consolidated would also. There was heavy trading of Boston Consolidated stock during these days, pushing the price steadily upward. On November 25 it was selling at 21, and Utah Copper was selling at 61-1/2.¹

According to the Engineering and Mining Journal, the merger was to include the Amalgamated interests of Cole-Ryan, Nevada Consolidated, Utah Copper Company, and the copper mining interests of the J. P. Morgan and Company, and "perhaps" the Boston Consolidated. Also under consideration were the United Metals and the International Smelting.

[The] New company is expected to control a large percentage of the copper production of North America, which means a large percentage of the world's production, and by a curtailment of output on its own account elevate the price for copper sufficiently to pay dividends on the present water [stock] plus the water that may be added; and convert into marketable form a good many securities that a good many persons are tired of keeping. It is argued that the manufacturers of copper will not mind a higher price, indeed will rather like it (of course the consumers don't count), so the project is quite philanthropic, but discussion of its beauties is obviously best deferred until we are permitted to behold them.²

¹Tribune, November 25, 1909.
²EMJ, November 27, 1909, p. 1078.
Unfortunately, an event occurred during November which altered the plans for the gigantic undertaking. During the month the federal District Court handed down an adverse decision in the Standard Oil antitrust suit. The court ruled that, "the principal company . . . has prevented, and is preventing, any competition in interstate and international commerce in petroleum and its products between its subsidiary companies and between those companies and itself."¹ This ruling against Standard Oil altered the plans of the proposed copper combine, causing the principal parties to reconsider their course of action.²

By mid-December, the Guggenheims put forth a revised plan to the Utah Copper, Nevada Consolidated and Cumberland-Ely, absorb the Boston Consolidated, and later buy the Garfield Smelter and Baltimore Refinery of American Smelters Securities Company, and make a powerful copper producing combination with a capitalization of $150,000,000.

Evidently this is a result of the check to the larger plan. Its purposes may be surmised. The ratio of sufficient water at this time may make it easier to combine with the Cole-Ryan & Amalgamated interest later on, when a further dilution will not attract so much attention, distribution may be inaugurated, and in the meanwhile curtailment of production may be effected by tacit understanding.³

This, according to the Engineering and Mining Journal, could be the only possible basis for a consolidation. Although Utah Copper needed Boston Consolidated, the only reason for Nevada Consolidated entering the picture would be to sell out at a handsome profit. The rumored basis of exchange listed 2-1/2 shares or 2-3/4 shares of Boston and 2 or 2-1/4 shares of Nevada as equal to one share of Utah.

³EMJ, December 18, 1909.
Such a basis would appear to be a good exchange for Boston, which seems to be badly needed by Utah and is taking advantage of its opportunity, but it looks as if Nevada Consolidated, which has the best physical conditions and equipment of the three, and to many minds the best mines also, would come out of the small end of the horn.

Furthermore, the editors were not prone to criticize the valuation of the respective properties, because of the difficulties involved, "unless it be known that expert opinion has been put aside because of trading necessities." Most of all, they hoped that the outside stockholders of Nevada Consolidated would get a fair price, and felt it a pity to see "such a successful, substantial and self-contained company lose its identity in a consolidation."1

John Hays Hammond announced that Utah Copper would become a holding company to control the Nevada Consolidated and Boston Consolidated properties, and that the details were being worked out. About the same time, it was rumored that the owners of the Ohio Copper company were asking to join the merger, on the basis of one share of Utah for six shares of Ohio stock.2

On December 15, 1909 the Utah Copper Company announced that it would call a shareholders' meeting on January 7, 1910 to authorize an increase in the capital stock from 750,000 to 2,500,000 shares, part of which was to be used to acquire the Boston Consolidated at a ratio of 2-1/2 to 1, and Nevada Consolidated at 2-1/4 to 1 (providing that a majority of Nevada stock is thus exchanged). Additional funds from the

---

1Ibid.

stock increase were to be used to increase the Utah Copper milling capacity to 12,000 tons per day and the Boston Consolidated milling capacity to 5,000 tons per day.¹

Commenting on the announcement, the Engineering and Mining Journal was very critical of the management policies of the Utah Copper Company, especially with regard to honest reporting of company operations. The editors felt that the proposed absorption of Boston Consolidated was necessary, "else a large part of the ore in the steam-shovel section of its mine will be unavailable; also . . . is desirable to ameliorate dumping difficulties."² In reviewing a recent report on the Boston Consolidated made by Sidney Jennings, a Salt Lake Mining engineer, indicated an actual value of the company's stock of about $9 per share on 30 years of life, the editors said, "We are inclined to think that the relative value of Boston and Utah shares is probably somewhere between 4:1 and 2-1/4:1 and that in agreeing upon the latter ratio the Utah is conceding something out of its necessities."³

Finally, the editors reiterated their opposition to the inclusion of the Nevada Consolidated. They felt that it was being put in as a "sweetener," but could not understand "why the Guggenheims should want to perpetrate this deal."⁴

¹EMJ, December 25, 1909, p. 275.
²Ibid., p. 1276.
³Ibid.
⁴Ibid.
When interviewed on December 28, D. C. Jackling of Utah Copper said he was well pleased with the results of the negotiations, and the prospects for the future. He felt that the negotiations were carried out in such a manner "as to prevent any tie-up of plans by individual stockholders of the latter Co. [Utah Copper] . . . ."\(^1\)

The merger plans were temporarily held up in January 1910 by injunction proceedings against the directors of Utah Copper, initiated by Colonel Wall. Wall objected to the proposed plans on the ground that Utah Copper would suffer by taking in Nevada Consolidated. Out of the proceedings it was learned that the Guggenheim's through the Guggenheim Exploration Company, owned 232,805 shares shares of Utah Copper, (out of 1,624,490 shares issued) and, in addition, Solomon R. Guggenheim owned 900 shares personally. Guggenheim Exploration owned 379,416 shares of stock in Nevada Consolidated, and the Guggenheim brothers owned 199,125 additional shares between them. The directors of the Utah Copper Company were found to hold 127,000 shares of Utah Copper stock, and excluding S. W. Eccles (a New York associate of the Guggenheims, who was a member of both Utah Copper and ASARCO's Boards) and the Guggenheim interests, they owned or represented 240,000 shares of stock.\(^2\)

Charles MacNeill testified as to the mutual benefits which would accrue from the merger, and stated that unless the consolidated was made, "the present steam-shovel method of mining cannot be continued, and the Utah company will be compelled to resort to a more expensive scheme of

---

\(^1\)Tribune, December 28, 1909.

\(^2\)EMJ, January 29, 1910, p. 260.
Sidney Jennings, the above-mentioned consulting engineer, made an affidavit that without consolidation the Utah company could continue to produce 62,000,000 pounds of copper per year at a cost of 9 cents per pound, yielding $3.92 per share with copper at 13 cents. With an enlarged company he said it could produce copper at 8-1/2 cents.2

On January 25, 1910 the temporary injunction was dissolved by the court and the merger of the Utah Copper and Boston Consolidated companies was consummated before the close of the day, on the basis of 2-1/2 shares of Boston Consolidated for 1 share of Utah Copper. Colonel Wall, embittered by the court action, called it the "conquest of Boston Consolidated," which although not by the sword,

... was brought about by methods infinitely more brutal, and in violation of every known rule of common decency and moral ethics which should prevail in such transactions, so that the rights of the minority shareholder had less chance of escape from the outrage than would his body if placed before the cannon's mouth.3

And conquest it was, as attested by D. C. Jackling when he later summed up the situation: "Sooner or later, I knew that we would have to take them, or they would have to take us."

The credit for the merger went to Samuel Untermeyer, a New York lawyer, who, in the 1910 Annual Report of Utah Copper was listed as an associate counsel. The sage lawyer-promoter was also chief counsel for the rival Boston Consolidated. In this equivocal position he engineered, in March 1910, a deal whereby all the shares of the Boston Consolidated

---

1Ibid.

2Ibid.

3Ibid.; Mines and Methods, June 1910, p. 334.
Mining Company, the American subsidiary of the parent British company, were exchanged for 310,000 newly-created treasury shares of Utah Copper Company.¹

For his efforts Untermyer received $581,250 in cash from Utah Copper and 3,250 of the 310,000 shares of the Utah Copper stock which went to Boston Consolidated. In addition, the stockholders of Boston Consolidated were assessed 25 cents per share for legal expenses incident to the consolidation, which netted Untermyer an additional $193,750.²

"Colonel Wall charged that Untermyer's harvest was $777,250—"the price of treachery . . . merciless rape . . . bloated incompetence." He forgot that most of Boston's shareholders were Europeans and that it was a complicated business to make the English understand the beauties of amalgamation."³

The Boston property under the terms of the merger was appraised as being worth approximately 42 percent of the value of the Utah Copper property. Parsons suggests that whether better terms could have been obtained by Boston Consolidated by holding out long is problematical, but that dividends on the block of Utah shares would have totaled $40,000,000 by 1933, or about $55 on each of the 4d shares of the British company.⁴

Coeval with the efforts to bring about the consummation of the Utah Copper-Boston Consolidated merger, Daniel Guggenheim and William Boyce Thompson proceeded to bring Nevada Consolidated into the orbit. This

¹Parsons, The Porphyry Coppers, p. 79.
⁴Parsons, The Porphyry Coppers, p. 79.
... on the insistence of the Guggenheim interests who were strong enough on the Utah directorate to have vetoed the Boston acquisition. As a price for agreeing to the later trade, they demanded that they be permitted to 'turn in' their holdings of 950,476 shares of Nevada Consolidated for 422,288 shares of stock from the Utah treasury.1

At the time, they did not have too good an opinion of the Nevada Consolidated.

However, President James Phillips, Jr., of Nevada Consolidated saw no point in a merger between the two companies. He complained that mining costs of Utah were 3-1/2 cents per pound higher than those of Nevada Consolidated, that the proposed exchange on the basis of 2-1/2 shares of Nevada to 1 share of Utah was sheer robbery, that Utah had deliberately "fixed" its quarterly statements and refused to reveal the amount of tonnage run through the mill.2 Because of his opposition, the Guggenhems had to content themselves with stock control, rather than merger. A short time later additional shares of Nevada Consolidated were exchanged, giving Utah Copper 1,000,152 out of the 2,000,000 outstanding shares of Nevada Consolidated, and hence undisputed control. These were exchanged for a total of 444,512 shares of Utah Copper, which placed the total value of Nevada Consolidated at about three times that of the Boston Consolidated. From this standpoint,

... it is fairly evident either that the Boston people, guided by Untermyer, made a poor deal or that in the Nevada transaction the Guggenhems made for themselves an excellent deal. A third alternative is that both these statements are true.3

1Ibid., p. 80.
3Parsons, The Porphyry Coppers, p. 80.
CHAPTER VI

HISTORY OF UTAH COPPER, 1910-1963: A SUMMARY

As it is impossible in this thesis to tell the complete history of the Utah Copper Company from 1910 to the present, the present chapter is designed to chronicle the highlights of that history, and to give some suggestions as to the prospects for the future.

At the close of the first decade of the twentieth century, John D. Rockefeller, Jr., visited Bingham Canyon. As he viewed the beehive of activity created by the numerous steam shovels restlessly working to tear the green ore from the two-dozen terraces that lined the mountain from its base to the very top he exclaimed, "It's the greatest industrial sight in the world." These sentiments have been repeated by literally millions of visitors from all over the world as they too viewed the mammoth undertaking.

The merger of the Utah Copper and Boston Consolidated Copper companies in 1910 set the stage for a prolonged period of growth and prosperity at the Utah Copper mine. The era which followed was the result of the financial acumen of the Guggenheims and the aggressive indomitable leadership of Daniel C. Jackling and his able associates. Jackling guided the management of the Utah Copper Company for 38 years, retiring from his many duties in 1942. During those years he left the indelible

imprint of his personality on every facet of operations associated with Utah Copper and her sister porphyry enterprises.

Jackling's principal contribution—one which rightly earned him the title "Father of the Porphyries"—was his conception of mass production. He was, in effect, the Henry Ford of copper mining. "He visualized the economies of operating (both as to mining and beneficiating the ore) on a huge scale in a day when industry, in general, had not yet embraced the notion that later was to revolutionize the economy."¹

The Kennecott Copper Corporation

After the famous Kennecott Mine in Alaska was acquired by the Guggenheims in 1908 from Stephen Birch, they organized the Kennecott Mines Company to develop and operate the claims. The development of these mines necessitated the expenditure of $20,000,000 for the construction of the Copper River and Northwestern Railroad. Not knowing whether the mine would be able to repay this tremendous outlay, the Guggenheims attempted to sell the railroad to the United States Government. Failing in this, they decided to "throw all the Guggenheim coppers into one bag" and let the public appetite for shares in the new company spread the risk over a broader area. Thus on April 29, 1915 the Kennecott Copper Corporation was incorporated under the laws of New York, as a holding company to assume the ownership of all the Guggenheim-affiliated copper properties throughout the world.²

¹Parsons, *The Porphyry Coppers* in 1956, p. 50.
Thus, in December 1915, the Kennecott Copper Corporation acquired from the Guggenheim Exploration Company a total of 404,504 shares of Utah Copper Company stock, representing 25 percent interest in the latter, in exchange for 606,756 shares of Kennecott stock. During the next 8 years, by purchase and exchange, Kennecott obtained sufficient stock in Utah Copper to bring its holdings up to 77 percent of the outstanding stock, giving it undisputed control over Utah Copper Company.¹

Subsequently, on November 10, 1936, Kennecott acquired all of the property and assets which had formerly been owned by the Utah Copper Company. This action enabled the Utah properties to be merged with the Kennecott Copper Corporation as a wholly-owned subsidiary company. In 1947 Kennecott dissolved the Utah Copper Company, and officially organized the Utah Copper Division, an operating division of Kennecott Copper Corporation. Since 1949 it has been operated, along with the other Western porphyry mines owned by Kennecott, under the direction of Kennecott's Western Mining Division, headquartered in Salt Lake City.²

Utah Copper Operations, 1910-1963

After the merger with Boston Consolidated in 1910, the Boston Consolidated or Arthur mill, as it was now called (named according to one version in honor of President Chester A. Arthur), underwent an extensive remodeling to increase its capacity from 3,000 to 8,000 tons per day.

²Kennecott Copper Corporation, Annual Report, 1936, p. 5.
While the work at the Arthur mill was going on, the Magna mill and facilities were likewise improved and expanded, raising its capacity to 10,000 tons per day.¹

The outbreak of World War I, in 1914, resulted in a slump of the world copper market, forcing a 50 percent curtailment in the operations of Utah Copper. In 1915, however, the market bounced back due to the rapid increase in the wartime demand for copper. This resulted in an increase in production to 33 percent above normal. During World War I Utah Copper was second only to Montana's Anaconda as a source of newly-mined copper. In 1916 company profits rose to an all-time high of $33,740,000 on a production of 93,800 tons of copper.²

At the close of the war, however, the copper market slumped once again and operations at Bingham were curtailed drastically. The Magna mill was shut down on February 26, 1919 and the Arthur plant on April 1921. Both resumed operations in 1922 when the postwar demand for copper began to rise.³

During the period from 1918 until operations were resumed in 1922, both plants were extensively remodeled, froth flotation units were installed, and the recovery of copper from the porphyry ores was greatly improved. The fundamental effectiveness of the improvements in milling operations is indicated by the fact that, from 1905 to 1917 inclusive, the average recovery of the copper contained in the ore was almost 61 percent. With the installation of flotation units at the Arthur mill in

¹Parsons, The Porphyry Coppers, p. 80.

²Ibid., pp. 85-87; Parsons, The Porphyry Coppers in 1956, p. 34.

³Ibid.
1918, it was increased to 73 percent. By 1923, when both the Magna and Arthur mills were utilizing the flotation process, the savings of copper in the ores rose to 81 percent. For the remainder of the decade it remained above 85 percent. (At the present time, 1963, it is approximately 90 percent.)

By 1926 the capacity of the mills had been increased to 50,000 tons of ore per day. Since then, the plants have been continually expanded so that, by 1963, they have a combined capacity of 90,000 tons of ore per day.

At the mine, every attempt was made to improve the methods of mining and handling of the ore and waste. In November and December 1923, the first two electric shovels were placed in service; these were equipped with caterpillar tracks. Shortly thereafter, additional electric shovels were added and at the same time, all of the steam shovels with railroad-type tracks were equipped with caterpillar tracks. Subsequently, all of the steam shovels were either converted to "electric" or were replaced by new electric shovels.

In the late 1920's the entire mine haulage system was electrified, beginning with the purchase of eleven 85-ton electric locomotives in 1928. By the close of 1929, 41 locomotives were in service. The

---


2Utah Copper Company, Annual Report, 1928, p. 9; Kennecott Copper Corporation, The Utah Copper Story (Salt Lake City: Kennecott Copper Corporation, 1961). (No pagination.)

3Kennecott Copper Corporation, "Chronological History"; Parsons, The Porphyry Coppers, pp. 88-89.
modernization of the mining equipment and the initiation of better handling techniques enabled the company to move its 232,000,000 first cubic yard of material from the Bingham mine in April 1935. By this time the company had moved as much earth as had been moved in the construction of the Panama Canal.¹

Since 1935 the gradually decreasing grade of the ore, coupled with the continually expanding scope of mining operations had required a constantly increasing quantity of ore and waste to be removed in order to maintain production. In 1961, 270,000 tons of waste material had to be moved each day to enable the mining of the 90,000 tons of ore needed to keep the mills operating at capacity. To avoid the tremendous job of transportation, and to prevent the slow and expensive uphill haulage to the top of the mine (which continually increases as the mine deepens), three tunnels have been driven into the pit. The last one, 18,000 feet in length, was completed in February 1959 at a cost of $12,000,000. It was driven from the mouth of Bingham Canyon to a level (in 1960) of 150 feet below the bottom of the pit.²

From the time Utah Copper acquired Colonel Wall's 200 acres of Bingham mineral ground in 1903, the company pursued a policy aimed at increasing its holdings in the Bingham District. As the scope of mining operations continued to expand, it became necessary to purchase more and more of the adjoining mines and surrounding property. By 1961 the excavation area alone covered over 1,000 acres. At that time, Kennecott


²Kennecott Copper Corporation, The Utah Copper Story, 1960-61.
began purchasing the homes and businesses still remaining at the historic town of Bingham, the famous old mining camp which had its birth during the boom that followed the first ore discoveries in the 1860's. The buildings are being removed and the land cleared to make way for the future expansion of the Utah Copper mine.1

Over the years the increasing depth of the mine has resulted in steadily increasing production costs. To reduce costs, the Utah Copper Division was forced to abandon the Bingham and Garfield Railroad and to shorten the route of ore haulage over a lower elevation to eliminate the steeper grades and sharper curves. (The old line had grades as steep as 2.5 percent, as against 1.35 percent on the new one.) To accomplish this, a new electrified industrial railroad, the Copperton-Garfield Railroad, was constructed in 1947 at a cost of $5,500,000. In 1948 the Bingham and Garfield was scrapped.2

The impending threat of World War II resulted in an increasing demand for electricity to supply the growing number of defense industries coming into Utah. To help meet this urgent demand the government requested that Kennecott build a 100,000 kilowatt electric generating plant to supply the needs of the Utah Copper Division. Work on the plant was started in May 1941, but because of delays and other difficulties in obtaining materials the first unit was not placed in operation until February 1944. When finally completed, the cost of the plant amounted

---


2Kennecott Copper Corporation, The Utah Copper Story, 1960-61; Kennecott Copper Corporation, Annual Report, 1947, p. 3; Parsons, The Porphyry Coppers in 1956, p. 38.
to $8,000,000. A third generating unit was added in 1947 raising the plant capacity to 110,000 kilowatts; the added cost brought the total investment to $12,500,000.\(^1\)

The need for additional power at Utah Copper became evident in 1950 when the Utah refinery was built, and even more so with the purchase of the Garfield smelter in 1959. Therefore, the power plant was expanded to 175,000 kilowatts in 1960, at a cost of $18,000,000.\(^2\)

In 1948 Kennecott announced plans to construct an electrolytic copper refinery at Garfield, near the smelter of the American Smelting and Refining Company. Work started in 1948 and the plant was completed in 1950 at a cost of $17,000,000. Since then a $3,000,000 expansion program has been completed, giving the plant a capacity of 16,000 tons of refined copper per month (99.96 percent pure). The refined copper is shipped from Garfield to Kennecott customers throughout the world.\(^3\)

Kennecott established a central research laboratory on the campus of the University of Utah in 1951 "to improve the recovery of copper, gold and molybdenite, and to attempt to recover other metals not heretofore processed by Kennecott."\(^4\) In 1954 a new $1,250,000 facility was dedicated to house the research center. This laboratory functions to

---

\(^1\)Kennecott Copper Corporation, Annual Report, 1941, p. 5; 1944, p. 3; 1947, p. 3.

\(^2\)Parsons, The Porphyry Coppers in 1956, pp. 36-37; The Utah Copper Story, 1960-61.

\(^3\)Parsons, The Porphyry Coppers in 1956, p. 39; The Utah Copper Story, 1960-61.

\(^4\)Kennecott Copper Corporation, Annual Report, 1951, p. 16.
coordinate and expand the research of Kennecott’s four western mining
divisions—Utah Copper, Nevada Mines, Ray Mines, and Chino Mines.¹

One of the most important acquisitions in the history of Kennecott’s
Utah Copper Division occurred on May 1, 1958 when arrangements were com-
pleted for the purchase of the Garfield smelter from the American
Smelting and Refining Company. Originally, long-term contracts had been
signed by D. C. Jackling and ASARCO officials, which covered the opera-
tions of the Garfield smelter through the 1930’s. These were renewed
periodically, with the last contract being signed in 1951 amidst rumors
of the purchase of the smelter by Kennecott. The last contract had been
due to expire on December 31, 1962.

The purchase of the Garfield smelter by Kennecott was a major step
in the policy initiated by Kennecott in the late 1940’s to vertically
integrate all of its copper-producing facilities and operations. The
policy of vertical integration was actively pursued by President Charles
R. Cox in the early 1950’s, and for several years previous to 1958
Kennecott had entered into negotiations with ASARCO for the purchase of
the smelter, the latest being in 1954. At that time there had been some
disagreement over the future of the jointly-owned Garfield Chemical and
Manufacturing Corporation (a sulphuric acid plant adjacent to the
Garfield smelter, which uses by-products of the smelting operation for
the production of sulphuric acid). The talks were broken off when no
agreement was reached.

¹The Utah Copper Story, 1960–61; Parsons, The Porphyry Coppers in
1956, pp. 45–47.
Kennecott was so desirous of completing its integration program that $40 million was authorized for the construction of a new smelter above the Garfield townsite if the negotiations with ASARCO were not successfully concluded. This eventuality was obviated when the agreement was finally reached in 1958 enabling Kennecott to purchase the Garfield smelter for $20,000,000, and for the two companies to retain their joint ownership of Garfield Chemical. This agreement was consummated on January 2, 1959. Since the purchase of the smelter Kennecott has expended $5 million to modernize the materials-handling facilities at the plant.¹

Utah Copper's Future

The stripping and opencut operations at the Utah Copper mine were expanded such that by 1914 all of the ore for the company mills came from this source. As the development and drilling of the company property progressed in an attempt to determine the extent of the orebody, greater and greater quantities of ore were indicated. Every year for nearly 40 years the ore reserves were larger than the previous year, despite the quantity mined during the year.

In 1915 the ore reserves were listed as 390,000,000 tons. By 1930, the last year the company published known ore reserves, they were listed as being 640,000,000 tons of 1.07 percent copper ore. After 1930 the company adopted a policy of secrecy pertaining to information about ore reserves.² Nevertheless, the quantity of ore reserves was increased


²Hadsen suggests that the company does not publish reserves because "the ever changing economic conditions make the reserve figures inaccurate,
considerably after 1930 by continuing development and exploration of the orebody and by continuous efforts to improve the efficiency of ore concentration (which reduced the cutoff point by one-half).\(^1\)

The last available estimate of the copper reserves at the Utah Copper mine was made just prior to 1940. At that time the company's reserves were given as 1,000,000,000 tons of 1.10 percent copper ore, containing 11,000,000 tons of copper. This represented, at that time, 31 percent of the total United States copper reserves. Since 1940 Utah Copper has mined approximately 630,000,000 tons of ore which produced about 5,400,000 tons of copper. Assuming that additional development work has increased the ore reserves to a moderate degree, the mine still has a considerable quantity of comparable ore remaining, (containing roughly 5,600,000 tons of copper on the basis of these estimates). At the anticipated rate of production which the company hopes to maintain after the completion of its planned expansion program (300,000 tons per annum), the mine has at least 20 years of active life remaining.\(^2\)

---

and the company would want to give an estimate which would allow the greatest amount for depreciation of plant for income tax purposes." The reason for the latter being that if the ore reserves were sufficient for 60 years of operation under existing conditions, the company would be able to charge less to depreciation than if the reserves were sufficient for only 20 years of operation. A second reason is that Kennecott does not desire its competitors to know its potential strength. Gibb R. Madsen, "The Economic Factors Affecting the Development of the Copper Industry in Utah" (unpublished Master's thesis, University of Utah, 1951), pp. 25-26.

\(^1\)Utah Copper Company, Annual Report, 1915, p. 9; 1930, p. 8.

\(^2\)WPA, Technology, Employment and Output Per Man in Copper Mining, p. 260. Also, unpublished statistical data obtained from Kennecott Copper Corporation, 1963.
However, published ore-reserve figures mean very little, as the life of a porphyry mine is very closely related to the cutoff grade of the ore—the point below which it is not profitable to send material to the concentrators for treatment. Parsons, for example, used the Morenci deposit in Arizona as an example to estimate the life of a porphyry mine. Pointing out that the determination of the cutoff point is a very complex problem which depends on the favorable conditions (physical, operational, and economic) under which the ore is mined, he showed that the physical demarcation between the ore and waste is usually a question of copper content rather than a sharp change in the mineralogical character of the rock.\(^1\)

Using the Parsons method, and the assumption that in addition to the 1,000,000,000 tons of 1.0 percent ore at Bingham,\(^2\) there will be mined an equal quantity of material averaging 0.5 percent copper, this writer makes the following estimate (Table 4) of the porphyry ore reserves remaining at Bingham. (This, of course, is a conjecture and nothing more.)

On this basis, the Bingham copper deposit would have about 32 years of active life remaining if Kennecott maintains production at about 300,000 tons of copper per year. Once again, this estimate is conjectural, and even if reasonably accurate, mining conditions might prevent the extraction of all the copper which the deposit contains. The open pit has, over the years, transformed a mountainside into a hole in the ground. The deeper it goes, the more surrounding waste rock must be

---


2Ibid., pp. 53-54. Revised downward by 0.1 percent to improve the accuracy of the original estimate in the light of later figures.
<table>
<thead>
<tr>
<th></th>
<th>Ore Tons</th>
<th>Avg. Grade</th>
<th>Contained Copper Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>End of 1939</td>
<td>2,000,000,000</td>
<td>0.75</td>
<td>15,000,000</td>
</tr>
<tr>
<td>Production 1940-1962</td>
<td>630,229,000</td>
<td>0.857</td>
<td>5,404,000</td>
</tr>
<tr>
<td>Estimate of remainder at end of 1962</td>
<td>1,369,771,000</td>
<td>0.70</td>
<td>9,596,000</td>
</tr>
</tbody>
</table>

removed from the side hills. The stripping ratio is now 3 tons of waste to 1 ton of ore. In a number of years hence, the problem will arise as to whether to continue as an open pit, to start an underground mine, or to shut down entirely. 'The first two' will be settled, perhaps, by engineers' cost estimates, but the latter will undoubtedly be effected by the general economics of the copper industry. 1

The probability that the Utah Copper mine will maintain its "premier" position as the most important United States copper producer for some years to come is indicated by the recent announcement (February 15, 1963) of the Kennecott Copper Corporation that the company plans to embark immediately upon a $100,000,000 expansion program at the Utah Copper Division. The purpose of the project is to expand the productive capacity at the Utah division to regain the production capacity lost during the past 10 years "through a combination of natural conditions that affect mining." Principal projects included in the expansion program are the following:

1. Conversion of the waste haulage system at the mine from railroad to a truck system, thereby providing greater flexibility in operations at the upper levels.

2. Expansion of the mine dump leaching system through construction of necessary reservoirs, pipelines, pumping stations and precipitation plants to increase production of precipitate copper to 6,000 tons a month.

3. Construction of a crushing and grinding plant to process additional mine tonnage.

4. Expansion of the railroad ore haulage facilities from the mine to the concentrators by providing additional locomotives and ore cars.

5. Construction of a 9-mile spur railroad from the present main line to the new crushing and grinding plant.

6. Modifications to the Utah Smelter to eliminate the present roasting of concentrates and provide for the direct charging of concentrates to reverberatory furnaces.

7. Development of additional processing water for the concentrators and the mine leaching system.¹

The first phases of the expansion project are scheduled for completion by the summer of 1963, and the entire project will be completed early in 1967. It is hoped that with the completion of the expansion program the output of the Utah Copper Division will be increased by approximately 100,000 tons of copper per year. Utah Copper would then have a capacity of about 300,000 tons of copper a year, with the appropriate increases in the by-product output of molybdenite, gold, and silver.²

¹Kennescope, March-April, 1963, p. 4.
²Kennecott Copper Corporation, Annual Report, 1962, p. 3.
APPENDIX A

THE DISSONANT VOICE OF COLONEL ENOS A. WALL

From the inception of the Utah Copper Company in June 1903, Colonel Enos A. Wall was not pleased with the course of events surrounding its management. He was immediately offended by the blunt aggressive Jackling, who was placed in charge of the milling operations for the company. Throughout the construction of the Copperton Mill and its subsequent operations, Wall was opposed to the equipment and methods employed by Jackling to reduce the porphyry rock to useful copper concentrates suitable for the valley smelters.

Wall had definite ideas of his own on how the ore should be milled, and did not approve of those employed by Jackling. In 1905, before the ink was dry on the arrangement with the Guggenheims for the financing of the Utah Copper expansion program, which would include the 3,000-ton Magna concentrating mill to be located at Garfield Beach near Great Salt Lake, Wall let it be known that he wanted his own ideas used in the equipping of the new mill.

By now, Wall was disturbed by what he felt were high-handed methods employed by Jackling, and the rapid takeover by the Guggenheims of his dream of many years.¹

¹Rickard, The Utah Copper Enterprise, p. 51.
To stop the Jackling-Guggenheim steamroller, Wall brought suit in court on August 23, 1905 to enforce his right as a stockholder to subscribe to twenty percent of the $3,000,000 convertible bond issue which would be sold to finance the construction of the Magna Mill at Garfield and the purchase of equipment for the mine. This stand was sustained as the court ruled that "convertible bonds should be considered the same as a new issue of stock." Wall then purchased $600,000 par value of convertible bonds which he promptly converted into 30,000 shares of Utah Copper stock, giving him a total of 120,000 shares.\(^1\)

Wall now insisted that his ideas be utilized in the erection and equipping of the new Magna Mill. When Jackling indicated his disagreement, Wall carried the fight to MacNeill, president of Utah Copper, by means of a letter; a copy of which he sent to the Salt Lake Tribune. The letter contained several suggestions for increasing the percentage of metal saved from the ore through the milling processes, and advocated the inauguration of new methods of mining at Bingham.\(^3\)

Attacking Jackling personally, Wall said that the loss of copper in the milling operation was not the result of "economies of scale," or the size of operations, but rather on Jackling's mismanagement. Specifically, he was opposed to the use of Chili mills in the milling of ore.

---

\(^1\)L. F. Pett, "History of Utah Copper," (unpublished manuscript, Kennecott Copper Corporation, 1953).

\(^2\)Horace Dunbar, "Big Men and Big Fortunes," Salt Lake Tribune, February 18, 1951.

\(^3\)Tribune, January 30, 1906.
and also of the mining methods employed at the mine. The bitterness of Wall's attack is illustrated by his comments concerning the failure of the Copperton mill to measure up to expectations.

It is useless to say that our mill is only experimental, or that it is too small to insure economic results because a mill of 600 or 700 tons' daily capacity should be operated at practically as low rate of cost per ton of ore treated as if it were of five times that capacity. The difficulty lies deeper; it is fundamental. But the cure is most simple and has been urged upon yourself and your manager from the first. His insensate arrogance inflated to the point of spontaneous explosion by sudden, unexpected and unearned wealth would not permit him to change "his system" lest his total ignorance of even the rudiments of work in hand should thereby be betrayed.¹

Early in February 1906, MacNeill replied to Wall's letter decrying the personal references to Jackling, saying that it was an attack on the entire board of directors, since Jackling was carrying out their policies. MacNeill concluded that while he was sorry the company plans did not meet with Wall's approval, both he and the board would support Jackling in the execution of their plans.²

A little later, Wall wrote a second letter offering the use of his Wilfley tables and five-stamp mill to try out "his method" of concentration, to prove it was superior to that of Jackling. This was ignored.³

Throughout the construction period of the Magna mill, Wall carried on his feud with Jackling and the Utah Copper management. The difficulties encountered in the operation of the Magna Mill, and the costs and methods of extracting ore at Bingham, all came under his fire. Since the company published only sparse information in its annual reports, and no interim

¹Tribune, January 30, 1906.
²Ibid., February 8, 1906.
³Ibid., February 2, 1906.
reports whatsoever, Wall decried this blatant attempt to hide the truth about the company’s operations from the stockholders and the public.

Grudgingly the company met this criticism, much of which was sustained by others, and announced in May 1908 that as "a token of clean conscience on the part of the company," it would henceforth send each stockholder a quarterly report. However, no further effort was made to publish more detailed financial reports.¹

In early 1908, Colonel Wall began selling his Utah Copper stock. He reportedly held 62,000 shares in January 1908, and convertible bonds equivalent to 14,750 shares, plus 5,200 shares of convertible bonds purchased in March 1908. He sold his stock in April and May 1908, and resigned from the Board at the end of June, ending a brief but bitter association with the Utah Copper Company.

At the time of his departure Wall said the Magna mill "makes a cruel waste," and that the company-owned steam-electric generating plants were also a waste. He asserted that rival Boston Consolidated got its electric power from Telluride Power at $35 per horsepower, while Utah Copper had incurred a huge debt to construct its own facilities, and then paid $65 to $70 per horsepower for the electricity generated. His final suggestion was that the Magna mill be closed and the company make a new start. "It would be a blessing to the outside stockholder if a friendly cyclone would remove it from the earth."²

¹Ibid., May 21, 1908.
²Ibid., July 5, 1908.
While Wall became officially disassociated from the Utah Copper Company, his departure from the Board did not end his battle with Jackling and the company management. In September 1909 he began the publication of a monthly mining magazine, *Mines and Methods*, so named because "in it we intend to describe not only mines, but also methods—methods of mining, of milling, of smelting, of cyaniding, and also methods of handling men, of preventing certain methods used in deceiving shareholders and in preparing mines for leading them onto an unsuspecting public."¹

The first editor of the journal, Claude T. Rice, was later accused of being "not too scrupulous."² Throughout the fall and winter of 1909 and 1910, Wall and Rice attacked Jackling and Utah Copper on every front. In December 1909 Wall entered suit against the Utah Copper Company in the State courts in Utah to recover an alleged damage of $3,870,000 for ore taken from the Amanda lode claim of the Starless group owned by Wall, located adjacent to the Utah Copper property at Bingham.³ Wall lost the suit.

In the fall of 1909 when the negotiations for the merger of the Utah Copper, Boston Consolidated, and Nevada Consolidated companies were in the serious stages, Wall entered the fray. Previously, he had opposed the merger of Boston Consolidated and Utah Copper on grounds that the Boston properties were more valuable than the Utah properties—claiming that the latter were practically worthless by virtue of Jackling's mismanage-

¹*Mines and Methods* (Salt Lake City, 1909-1921), September 1909, p. 1.
²Ibid.
³Ibid., December 1909, p. 166.
ment. However, with the merger rapidly approaching consummation, Wall bought 1,000 shares of stock in the Utah Copper Company, 500 shares in his own name and 500 shares in the name of Charles W. Graham. Together they filed suit in the U.S. Circuit Court of and for the State of New Jersey in January 1910 to enjoin the consummation of the proposed merger of the properties. Their complaint sought to invoke either the Interstate Commerce Act or the Sherman Antitrust Act by alleging that the proposed merger was a "combination in restraint of trade." In addition, in an about face from his former position, Wall attempted to set up the

...equitable ground that, basing a valuation of the several properties upon the estimates of the officers and engineers of the several companies, the shares of the Utah Copper Company were shown to have a value, singly greatly in excess of that which they would obtain if combined as proposed; and also alleged that many of the directors of the Utah company were also directors of the Nevada Consolidated company and were likewise large shareholders of the Boston company, and therefore were not competent to respect the rights of the minority shareholders of the Boston Consolidated company.¹

This about face was explained by Wall to Samuel Newhouse. He said that he was not using his own figures in determining the relative values of the three companies, but those of their (the companies') engineers, which he believed were false; and that he still thought the merger was a bad thing for Boston Consolidated, the shares of which he still claimed were worth more than Utah Copper shares. Furthermore, "his [Wall's] sole object in filing the suit was to make it apparent and to give publicity

¹*Mines and Methods, June 1910, p. 335.*
to the true worthlessness and rottenness of the Utah properties."\(^1\)

After considerable testimony was taken from most of the parties attached to the merger plans, which revealed some of the little known facts about the transaction, the court adjourned to weigh the evidence. On January 25, 1910, the temporary restraining order issued by the court at the outset of the proceedings was lifted and the merger of Utah Copper and Boston Consolidated consummated.\(^2\) The grounds of the dissolution were that a private citizen could not invoke the Interstate Commerce or Antitrust law—that such action could only be instituted by the Attorney General of the United States. A short time after the verdict was rendered, a case was discovered in which the U.S. Supreme Court held a contrary view, and Wall hoped to obtain a reversal of the judgment, but such was not the case.

After the loss of his suit to enjoin the Utah Copper and Boston Consolidated merger, Wall continued to attack Jackling and Utah Copper, both in his magazine and in the courts. Rice's editorship of *Mines and Methods* was terminated in 1910, and Wall himself took the reins in directing the attack.\(^3\)

Other suits were initiated by Wall against Utah Copper in the ensuing months. In the fall of 1909 a court battle was fought over the right of

\(^1\)Ibid., p. 338.

\(^2\)EMJ, January 29, 1910, p. 260.

\(^3\)Mines and Methods, September 1911, p. 302.
the Bingham and Garfield Railroad to secure absolute and exclusive possession of eighty-nine acres of land for its track right-of-way. Wall lost the suit because mining was declared to be a "public use," and therefore the law of eminent domain could be invoked for the purpose of securing right-of-ways for railroads and tramways. 1

Aggin in 1912 he lost a similar encounter to Utah Copper when R. C. Gemmell obtained a court order from Third District Court granting a right-of-way over 3,500 feet of his property for the purpose of constructing a high-voltage transmission line. Wall declared that this was "ostensibly for the purposes of supplying the town of Upper Bingham" with electricity, but that if it were constructed in a straight line, it would have gone over Utah Copper Company property instead of his own. 2

After 1912, there was little left for Wall to oppose, as the mighty Utah Copper Company was well on its way to greatness under the able direction of Jackling and the Guggenheims.

The old fellow who had nursed his despised "Wall-rock" to glittering fame among the coppers, had the sympathy of Salt Lake mining men. To them it seemed that the riches of the State were being squeezed into the fists of the Guggenheims, Baruchs, Untermeiers and other members of the "haute Juiverie" who tossed stocks and bonds back and forth, gouging the public's pockets for their own aggrandizement, engineering bull and bear raids alternately for their added profit. The munificently paid engineers for these promoters—the Hammonds, Beattys, Yeatmans and Jacklings—it seemed to their humbler confreres in the West, were more promoters and tipsters than engineers. 3

1Ibid., December 1911, pp. 375-81.
2Ibid., March 1912, p. 432.
Not all of Wall's efforts were in vain, however, and there was considerable sympathy for some aspects of his fight with Utah Copper. While his mining and milling methods would never prove equal to those used by Jackling and his associates, his tenacious attempt to hound the company finally led it to be more truthful and openhanded. In doing this, Wall was performing a useful public service. As late as December 1909, the Engineering and Mining Journal commented on the nature of the financial and bookkeeping activities of the Utah Copper Company:

It has been evident for a long time that there is something wrong in the Utah Copper Company. Without doubt it possesses a great and valuable mine, but as we have previously remarked it has failed to come up to the expectations, particularly as to cost of production. The erratic manner in which the cost as reported quarterly by the company itself has been fluctuating is indicative of something askew that the explanations of the officers do not satisfactorily account for. It is to be noted, moreover, that while the company has been making elaborate quarterly reports, with apparent frankness, it has avoided stating an essential part of the fundamental data, viz, the tonnage of ore milled.

Recently our Salt Lake Contemporary, Mines and Methods, has specifically charged that the officers of the Utah Copper company conduct their bookkeeping in such a way as to conceal the real cost of mining, particularly as to the accounting of stripping overburden; that in order to maintain production of copper at the promised rate they have had to overcrowd the mills; and that it is doubtful if the estimated great ore reserves can be actually extracted by the present method of mining at anything like the profit heretofore reckoned. There is a strong suspicion that there is a great deal of truth in the main part of the charges of Mines and Methods. If there be not the company can easily disprove them by publishing the data that should have been given in its reports to enable a careful and impartial analysis. The stockholders of the company should demand of that data.

In the September issue of Mines and Methods Wall had attempted to prove that the net earnings reported by the company in its report for the

---

1EMJ, December 25, 1909, p. 1275.
period of eighteen months ending December 31, 1908 were not correctly stated. Instead of a net surplus balance of $1,655,010 remaining on that date, as shown by the company report, Wall charged that the two quarterly dividends for the year 1908 had exceeded the entire net earnings of the property previous to that date by $139,568, and that the latter sum "must have been supplied from funds derived from the sale of the company's bonds and shares, and was therefore, under no circumstances, available or applicable to the payment of dividends upon its capital stock."¹

Wall maintained that the financial statements were intentionally vague and shallow, and that no accurate picture of the company's financial operations could be derived therefrom. To prove his own contention that the report "as well as all previous and subsequent reports, are grossly inaccurate and deceptive in every essential particular," he published statements of the Utah Copper Company filed with the Utah State Board of Equalization, as called for by state law. The figures in these statements were compared with the statements given in the annual reports of 1907 and 1908. From this comparison he attempted to prove that instead of earning a profit of $588,261 which was carried forward from the operations of the Copperton plant, the company actually sustained a loss of $756,559. In spite of this factual discrepancy as it appeared between the two reports, the company had added the $588,261 to the net surplus for 1909.²

¹Mines and Methods, September 1909, p. 32.
²Ibid., pp. 32-36.
Wall's charges, in this instance, were strong, but they were never denied by Utah Copper, and apparently some credence can be placed in them. The financial report for the year ending December 31, 1909, showed no net surplus carried forward from the previous year, which leaves strong indication that Wall was probably right, and that he had caught Utah Copper playing the familiar game of reporting profits when none existed. Such activities, it seems, were part of business practice at the time; they were "necessary" to lead potential buyers of stock issues to believe that the company was immediately successful and well on the way to even greater earnings.¹

While Colonel Wall may have been a bitter old man attacking Jackling and the others for their usurpation of glory he felt was rightfully his, still he performed a useful public service through his vendetta against Jackling and the Utah Copper Company. Most important, he forced the company to publish accurate and honest financial reports. From 1912 to 1932 the Utah Copper Company published detailed financial and operating information giving a much more complete and accurate picture of its operations than before. Notwithstanding, in 1932 when the company was firmly under the control of Kennecott Copper Corporation its financial activities were submerged in the consolidated financial statements of the latter company. No longer can such figures be obtained. Thanks to Colonel Wall, however, we do have two decades of detailed financial history of the company.

¹Utah Copper Company 5th Annual Report, December 31, 1909.
APPENDIX B

LOCATION OF IMPORTANT COPPER PRODUCING DISTRICTS IN UTAH

FIGURE 1. IMPORTANT COPPER PRODUCING DISTRICTS IN UTAH

## APPENDIX C

### CHRONOLOGICAL OUTLINE OF UTAH'S LEADING COPPER COMPANIES

<table>
<thead>
<tr>
<th>Name of Company</th>
<th>Year organized or acquired</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Predecessors of International Smelting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highland Boy Gold Mining Co.</td>
<td>1896</td>
<td>Owned Highland Boy Mine and other properties, Bingham Canyon</td>
</tr>
<tr>
<td>Utah Consolidated Gold Mines, Ltd.</td>
<td>1896</td>
<td>Constructed Utah's first copper smelter at Murray, 1899, which operated until 1908</td>
</tr>
<tr>
<td>Utah Consolidated Mining Co.--controlled by Standard Oil Co. investors</td>
<td>1903</td>
<td>Used new Tooele smelter built by International Smelting &amp; Refining Co. in 1910</td>
</tr>
<tr>
<td>Utah-Delaware Mining Co.--subsidiary of International Smelting &amp; Refining Co., a holding company organized by Standard Oil interests in 1909</td>
<td>1924</td>
<td>Consolidated with Utah Apex in 1937. Operated as a copper-lead-silver producer until 1940's</td>
</tr>
<tr>
<td>National Tunnel &amp; Mines Co.--subsidiary of International Smelting &amp; Refining Co.</td>
<td>1937</td>
<td>Copper section of Tooele smelter closed in 1945; lead smelter still in operation</td>
</tr>
</tbody>
</table>

| **Predecessors of U.S. Smelting, Refining & Mining Co.** | | |
| Bingham Gold Mining Co. | 1895 | Owned the Commercial Mine and other properties, Bingham Canyon |
| Bingham Copper & Gold Mining Co. | 1898 | Constructed copper smelter at Bingham, 1901, which operated until 1907 |
Bingham Consolidated Mining & Smelting Co. 1901

Controlled by eastern investors; between 1906 and 1909 by F. Augustus Heinze, who "milked" property

Bingham Mines Company 1908

Reorganized from bankrupt Bingham Consolidated Mining & Smelting Co.

United States Smelting, Refining & Mining Co. 1929

Dalton & Lark mines still in operation in 1963

Predecessors of U.S. Smelting, Refining & Mining Co.

United States Mining Co. 1899

Predecessors of U.S. Smelting, Refining & Mining Co.

United States Smelting, Refining & Mining Co. 1906


Ohio Copper Company—controlled by F.A. Heinze, 1903-1909

Owned the Old Jordan, Galena Mines, Bingham Canyon; Centennial-Eureka Mines, Tintic District; constructed copper smelter at Midvale, 1902; added lead-silver furnaces 1905-1906

Ohio Copper Mining Company 1912

Ohio Copper Mining Company of Utah 1916

United States Smelting, Refining & Mining Co. 1950

Property inactive in 1963.
Predecessors of Kennecott Copper Corporation

<table>
<thead>
<tr>
<th>Company</th>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston Consolidated Copper &amp; Gold Mining Co., Ltd., a British corporation</td>
<td>1898</td>
<td>Promoted by Samuel Newhouse. Owned Stewart and adjacent property at Bingham.</td>
</tr>
<tr>
<td>Boston Consolidated Mining Company, an American Corporation; stock held by British corporation</td>
<td>1898</td>
<td>Held titles to Utah properties. Developed Sulphide Mine and upper half of Utah Copper Mine. Constructed Arthur Concentrator, 1906.</td>
</tr>
<tr>
<td>Utah Copper Company</td>
<td>1910</td>
<td>310,000 shares of Utah Copper stock exchanged for all capital stock of Boston Consolidated.</td>
</tr>
<tr>
<td>Kennecott Copper Corporation</td>
<td>1936</td>
<td>Utah Copper becomes a wholly owned subsidiary of Kennecott Copper Corporation.</td>
</tr>
</tbody>
</table>

Predecessors of Kennecott Copper Corporation

<table>
<thead>
<tr>
<th>Company</th>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utah Copper Company</td>
<td>1903</td>
<td>Purchased Enos A. Wall porphyry property at Bingham. Built Copperton Concentrating Mill</td>
</tr>
<tr>
<td>Utah Copper Company</td>
<td>1904</td>
<td>Company reorganized. Guggenheims purchase large block of stock and provide capital for expansion.</td>
</tr>
<tr>
<td>Kennecott Copper Corporation—organized by the Guggenheims as holding company for all their copper properties</td>
<td>1915</td>
<td>Acquires ownership of 25 per cent of Utah Copper stock. Undisputed control obtained in 1923. Utah Copper becomes a wholly-owned subsidiary in 1936 and a division of Kennecott in 1947.</td>
</tr>
</tbody>
</table>
APPENDIX D

GLOSSARY OF TECHNICAL TERMS

Adit--A horizontal opening in the earth's surface for mining purposes having connection with the surface.

Blister Copper--Metallic copper of a black blistered surface, being the product of converting copper matte. Is about 99.5% pure.

Bullion--Ingots of copper or lead containing precious metals.

Complex Ores--An ore containing more than one recoverable mineral, often lead, zinc, and copper, with silver or gold. Most often the ores are closely combined and difficult to process.

Concentrates--The product of copper milling and froth flotation processes, consisting of finely ground particles of ore containing 20 to 30 percent copper and minute quantities of gold, silver, and molybdenum.

Converting--Method whereby air is blown through heated copper matte to remove the impurities and refine it to blister copper.

Copper Matte--A curd mixture of sulphides formed in smelting sulfide ores of metals (copper-lead), etc.

Crushing--The process whereby ore is reduced to a small, uniform size, a necessary step in the preparation for concentration.

Cyanide Process--A metallurgical process in which cyanide is used in the extraction of gold from goldbearing ores.

Drift--A horizontal opening in the earth's surface having no direct connection with the surface. It is branch of a tunnel or shaft.

Froth Flotation--A process by which the waste is separated from the metal in a mass of finely pulverized copper ore, according to their relative capacity for floating (by virtue of the surface tension) on a given liquid instead of according to their specific gravities.

Jig--A concentrating device which operates by means of a vertical reciprocating motion which settles ore to the bottom of a tray where it is drawn off.
Milling—The process of grinding or crushing ores to reduce them to a fine powder, after which the metal can be removed from the ore by some means of concentration or flotation.

Raise—An opening driven up from an interior point in the mine, i.e., from a tunnel or drift.

Shaft—A vertical or sloping opening in the earth's surface for mining purposes having a direct outlet on the surface.

Shay engine—A locomotive engine designed for hauling on steep grades. Power is not applied directly to the wheels from the piston as is the case in an ordinary engine, but is applied through a system of secondary gears, thus giving great tractive force.

Smelting—A process of melting or fusing a metallic ore to separate the metal from the waste rock, by heating the ore (and suitable fluxes) to a high temperature in a furnace.

Stamp milling—A process for crushing ore by the vertical movement of a large iron shod, weighted timber or casting called a stamp, which is raised and then dropped on a platen bearing the crude ore.

Stopes—An underground place where ore is being or has been mined.

Tunnel—A horizontal opening in the earth's surface for mining purposes, having connection with the surface.

Vanner—A mechanical device or machine used in ore dressing, by means of a shaking motion and a stream of water.

Winze—An opening driven down from an interior point in the mine, i.e., from a tunnel or drift.
APPENDIX E

GEOLOGICAL ORIGIN OF BINGHAM PORPHYRY COPPER DEPOSIT

Geologists estimate that the Utah Copper porphyry mine had its origin some 60,000,000 years ago when mountains were formed by the folding and uplifting of sedimentary rocks, already old, which had been laid down as sands, silts and limestones in the shallow seas of the Pennsylvanian period.

Within these mountains an area of weakness developed in the earth's crust creating zones of fissures and fractures. Into one of these zones was forced a massive plug of molten porphyry rock from deep within the earth.

While still hot, much of the porphyry plug and some of the surrounding sedimentary rock were fractured and shattered. The shattered porphyry provided a ready path of escape for hot, mineral-charged waters and gases, which probably were driven off during the cooling of the molten rock at great depths.

As these hot-metal-bearing solutions passed upward through the fractured rock they were deposited in tiny cracks and cavities in the porphyry. Today, this mineralized plug constitutes the disseminated porphyry ore of the mine.

Copper is present chiefly in the minerals chalcocite and chalcopyrite, composed, respectively, of copper-sulfur and copper-iron sulfur.¹

¹Kennecott Copper Corporation, The Utah Copper Story, 1960-61, (Salt Lake City: Kennecott Copper Corporation, 1961.) No pagination.
### Table 5

**MINE PRODUCTION AND VALUE OF COPPER IN UTAH**  
**1865-1961**

<table>
<thead>
<tr>
<th>Year</th>
<th>Production (Short Tons)</th>
<th>Value (Dollars)</th>
<th>Percent of United States Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1870</td>
<td>50.0</td>
<td>$21,200</td>
<td>0.4%</td>
</tr>
<tr>
<td>1871</td>
<td>195.0</td>
<td>94,000</td>
<td>1.3</td>
</tr>
<tr>
<td>1872</td>
<td>300.0</td>
<td>213,400</td>
<td>2.1</td>
</tr>
<tr>
<td>1873</td>
<td>438.0</td>
<td>245,000</td>
<td>2.5</td>
</tr>
<tr>
<td>1874</td>
<td>167.0</td>
<td>82,300</td>
<td>1.0</td>
</tr>
<tr>
<td>1875</td>
<td>358.4</td>
<td>152,700</td>
<td>1.8</td>
</tr>
<tr>
<td>1876</td>
<td>473.5</td>
<td>182,900</td>
<td>2.2</td>
</tr>
<tr>
<td>1877</td>
<td>320.6</td>
<td>121,800</td>
<td>1.4</td>
</tr>
<tr>
<td>1878</td>
<td>382.2</td>
<td>126,900</td>
<td>1.6</td>
</tr>
<tr>
<td>1879</td>
<td>129.4</td>
<td>48,100</td>
<td>0.5</td>
</tr>
<tr>
<td>1880</td>
<td>43.0</td>
<td>18,400</td>
<td>0.1</td>
</tr>
<tr>
<td>1881</td>
<td>192.8</td>
<td>70,200</td>
<td>0.5</td>
</tr>
<tr>
<td>1882</td>
<td>302.9</td>
<td>115,700</td>
<td>0.7</td>
</tr>
<tr>
<td>1883</td>
<td>170.9</td>
<td>56,400</td>
<td>0.3</td>
</tr>
<tr>
<td>1884</td>
<td>132.8</td>
<td>34,500</td>
<td>0.2</td>
</tr>
<tr>
<td>1885</td>
<td>63.1</td>
<td>13,600</td>
<td>0.1</td>
</tr>
<tr>
<td>1886</td>
<td>1,204.0</td>
<td>267,200</td>
<td>1.5</td>
</tr>
<tr>
<td>1887</td>
<td>1,250.0</td>
<td>345,000</td>
<td>1.4</td>
</tr>
<tr>
<td>1888</td>
<td>1,106.6</td>
<td>358,000</td>
<td>0.9</td>
</tr>
<tr>
<td>1889</td>
<td>1,030.0</td>
<td>278,200</td>
<td>0.9</td>
</tr>
<tr>
<td>1890</td>
<td>503.3</td>
<td>157,000</td>
<td>0.4</td>
</tr>
<tr>
<td>1891</td>
<td>781.0</td>
<td>199,900</td>
<td>0.6</td>
</tr>
<tr>
<td>1892</td>
<td>1,104.7</td>
<td>256,300</td>
<td>0.6</td>
</tr>
<tr>
<td>1893</td>
<td>567.7</td>
<td>122,600</td>
<td>0.3</td>
</tr>
<tr>
<td>1894</td>
<td>573.8</td>
<td>109,000</td>
<td>0.3</td>
</tr>
<tr>
<td>1895</td>
<td>1,092.4</td>
<td>233,800</td>
<td>0.6</td>
</tr>
<tr>
<td>1896</td>
<td>1,751.0</td>
<td>378,200</td>
<td>0.8</td>
</tr>
<tr>
<td>1897</td>
<td>1,959.5</td>
<td>470,300</td>
<td>0.8</td>
</tr>
<tr>
<td>1898</td>
<td>1,875.0</td>
<td>465,000</td>
<td>0.7</td>
</tr>
<tr>
<td>1899</td>
<td>4,792.4</td>
<td>1,639,000</td>
<td>1.7</td>
</tr>
<tr>
<td>Year</td>
<td>Production (Short Tons)</td>
<td>Value (Dollars)</td>
<td>Percent of United States Production</td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
<td>-----------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>1900</td>
<td>9,177.4</td>
<td>3,046,900</td>
<td>3.0</td>
</tr>
<tr>
<td>1901</td>
<td>10,058.4</td>
<td>3,359,500</td>
<td>3.3</td>
</tr>
<tr>
<td>1902</td>
<td>11,970.0</td>
<td>2,920,700</td>
<td>3.6</td>
</tr>
<tr>
<td>1903</td>
<td>16,423.8</td>
<td>4,542,800</td>
<td>4.7</td>
</tr>
<tr>
<td>1904</td>
<td>23,208.6</td>
<td>5,802,200</td>
<td>5.7</td>
</tr>
<tr>
<td>1905</td>
<td>28,649.0</td>
<td>8,938,500</td>
<td>6.4</td>
</tr>
<tr>
<td>1906</td>
<td>28,296.8</td>
<td>10,922,600</td>
<td>6.2</td>
</tr>
<tr>
<td>1907</td>
<td>32,128.4</td>
<td>12,851,400</td>
<td>7.6</td>
</tr>
<tr>
<td>1908</td>
<td>43,424.4</td>
<td>11,463,400</td>
<td>9.1</td>
</tr>
<tr>
<td>1909</td>
<td>54,473.9</td>
<td>14,163,200</td>
<td>9.7</td>
</tr>
<tr>
<td>1910</td>
<td>63,798.5</td>
<td>16,204,800</td>
<td>11.7</td>
</tr>
<tr>
<td>1911</td>
<td>73,480.4</td>
<td>18,370,100</td>
<td>13.2</td>
</tr>
<tr>
<td>1912</td>
<td>68,653.7</td>
<td>22,655,700</td>
<td>11.0</td>
</tr>
<tr>
<td>1913</td>
<td>80,723.0</td>
<td>25,024,100</td>
<td>13.1</td>
</tr>
<tr>
<td>1914</td>
<td>76,017.0</td>
<td>20,220,500</td>
<td>13.2</td>
</tr>
<tr>
<td>1915</td>
<td>99,383.6</td>
<td>32,842,500</td>
<td>12.6</td>
</tr>
<tr>
<td>1916</td>
<td>120,137.6</td>
<td>59,107,700</td>
<td>12.0</td>
</tr>
<tr>
<td>1917</td>
<td>143,337.1</td>
<td>67,342,000</td>
<td>13.0</td>
</tr>
<tr>
<td>1918</td>
<td>113,584.8</td>
<td>56,110,900</td>
<td>11.9</td>
</tr>
<tr>
<td>1919</td>
<td>62,030.9</td>
<td>23,075,500</td>
<td>6.5</td>
</tr>
<tr>
<td>1920</td>
<td>58,465.6</td>
<td>21,515,300</td>
<td>9.6</td>
</tr>
<tr>
<td>1921</td>
<td>15,445.7</td>
<td>3,985,000</td>
<td>6.9</td>
</tr>
<tr>
<td>1922</td>
<td>48,596.9</td>
<td>13,121,200</td>
<td>10.1</td>
</tr>
<tr>
<td>1923</td>
<td>111,196.7</td>
<td>32,691,300</td>
<td>15.1</td>
</tr>
<tr>
<td>1924</td>
<td>121,069.1</td>
<td>31,720,100</td>
<td>15.1</td>
</tr>
<tr>
<td>1925</td>
<td>118,243.3</td>
<td>33,581,100</td>
<td>14.1</td>
</tr>
<tr>
<td>1926</td>
<td>128,732.2</td>
<td>36,045,000</td>
<td>14.8</td>
</tr>
<tr>
<td>1927</td>
<td>128,466.6</td>
<td>33,658,300</td>
<td>15.6</td>
</tr>
<tr>
<td>1928</td>
<td>147,617.5</td>
<td>42,225,800</td>
<td>16.2</td>
</tr>
<tr>
<td>1929</td>
<td>159,141.2</td>
<td>56,017,700</td>
<td>16.0</td>
</tr>
<tr>
<td>1930</td>
<td>90,263.2</td>
<td>23,468,400</td>
<td>12.8</td>
</tr>
<tr>
<td>1931</td>
<td>75,616.2</td>
<td>13,762,500</td>
<td>14.3</td>
</tr>
<tr>
<td>1932</td>
<td>32,482.0</td>
<td>4,082,700</td>
<td>13.6</td>
</tr>
<tr>
<td>1933</td>
<td>36,791.6</td>
<td>4,709,300</td>
<td>19.3</td>
</tr>
<tr>
<td>1934</td>
<td>43,012.5</td>
<td>6,882,000</td>
<td>18.1</td>
</tr>
<tr>
<td>Year</td>
<td>Production (Short Tons)</td>
<td>Value (Dollars)</td>
<td>Percent of United States Production</td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
<td>----------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>1935</td>
<td>64,757.6</td>
<td>10,749,800</td>
<td>17.0</td>
</tr>
<tr>
<td>1936</td>
<td>126,217.0</td>
<td>23,223,900</td>
<td>20.5</td>
</tr>
<tr>
<td>1937</td>
<td>205,999.0</td>
<td>49,850,500</td>
<td>24.5</td>
</tr>
<tr>
<td>1938</td>
<td>108,126.0</td>
<td>21,192,700</td>
<td>19.4</td>
</tr>
<tr>
<td>1939</td>
<td>171,890.0</td>
<td>35,753,100</td>
<td>23.6</td>
</tr>
<tr>
<td>1940</td>
<td>231,864.0</td>
<td>52,401,300</td>
<td>26.4</td>
</tr>
<tr>
<td>1941</td>
<td>266,838.0</td>
<td>62,973,900</td>
<td>27.9</td>
</tr>
<tr>
<td>1942</td>
<td>306,691.0</td>
<td>74,219,200</td>
<td>28.4</td>
</tr>
<tr>
<td>1943</td>
<td>323,989.0</td>
<td>94,234,100</td>
<td>29.7</td>
</tr>
<tr>
<td>1944</td>
<td>282,575.0</td>
<td>76,295,300</td>
<td>29.1</td>
</tr>
<tr>
<td>1945</td>
<td>226,376.0</td>
<td>61,121,500</td>
<td>29.3</td>
</tr>
<tr>
<td>1946</td>
<td>114,284.0</td>
<td>37,028,000</td>
<td>18.8</td>
</tr>
<tr>
<td>1947</td>
<td>266,533.0</td>
<td>111,943,900</td>
<td>31.4</td>
</tr>
<tr>
<td>1948</td>
<td>227,007.0</td>
<td>98,521,000</td>
<td>27.2</td>
</tr>
<tr>
<td>1949</td>
<td>197,245.0</td>
<td>77,715,500</td>
<td>26.2</td>
</tr>
<tr>
<td>1950</td>
<td>278,630.0</td>
<td>115,910,100</td>
<td>30.6</td>
</tr>
<tr>
<td>1951</td>
<td>271,086.0</td>
<td>131,205,600</td>
<td>29.2</td>
</tr>
<tr>
<td>1952</td>
<td>282,894.0</td>
<td>136,920,700</td>
<td>30.6</td>
</tr>
<tr>
<td>1953</td>
<td>269,496.0</td>
<td>154,690,700</td>
<td>29.9</td>
</tr>
<tr>
<td>1954</td>
<td>211,835.0</td>
<td>124,982,700</td>
<td>25.4</td>
</tr>
<tr>
<td>1955</td>
<td>232,949.0</td>
<td>173,780,000</td>
<td>23.3</td>
</tr>
<tr>
<td>1956</td>
<td>250,504.0</td>
<td>213,013,400</td>
<td>22.7</td>
</tr>
<tr>
<td>1957</td>
<td>237,857.0</td>
<td>143,189,900</td>
<td>21.9</td>
</tr>
<tr>
<td>1958</td>
<td>189,184.0</td>
<td>99,510,800</td>
<td>19.3</td>
</tr>
<tr>
<td>1959</td>
<td>144,715.0</td>
<td>88,855,000</td>
<td>17.5</td>
</tr>
<tr>
<td>1960</td>
<td>218,049.0</td>
<td>139,987,000</td>
<td>20.0</td>
</tr>
<tr>
<td>1961</td>
<td>213,534.0</td>
<td>128,120,000</td>
<td>18.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Ore Mined (Tons)</th>
<th>Waste Removed (Tons)</th>
<th>Copper Produced (Pounds)</th>
<th>Percent Copper in Ore Mined</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/1/1904 to 6/30/1905</td>
<td>216,769</td>
<td></td>
<td>5,311,702</td>
<td>1.98</td>
</tr>
<tr>
<td>7/1/1905 to 6/30/1906</td>
<td>231,125</td>
<td></td>
<td>5,121,029</td>
<td>1.96</td>
</tr>
<tr>
<td>7/1/1906 to 6/30/1907</td>
<td>188,569</td>
<td>1,450,532*</td>
<td>4,021,463</td>
<td>1.93</td>
</tr>
<tr>
<td>7/1/1907 to 12/31/1908</td>
<td>2,422,064</td>
<td>2,083,218*</td>
<td>54,051,211</td>
<td>1.91</td>
</tr>
<tr>
<td>1909</td>
<td>2,874,271</td>
<td>3,163,567*</td>
<td>51,749,233</td>
<td>1.66</td>
</tr>
<tr>
<td>1910</td>
<td>4,340,245</td>
<td>5,832,294*</td>
<td>84,502,475</td>
<td>1.54</td>
</tr>
<tr>
<td>1911</td>
<td>4,680,801</td>
<td></td>
<td>93,514,419</td>
<td>1.51</td>
</tr>
<tr>
<td>1912</td>
<td>5,315,321</td>
<td></td>
<td>91,366,337</td>
<td>1.36</td>
</tr>
<tr>
<td>1913</td>
<td>7,519,392</td>
<td></td>
<td>113,942,834</td>
<td>1.25</td>
</tr>
<tr>
<td>1914</td>
<td>6,470,186</td>
<td>95,075,104*</td>
<td>115,690,445</td>
<td>1.425</td>
</tr>
<tr>
<td>1915</td>
<td>8,494,300</td>
<td></td>
<td>148,397,006</td>
<td>1.434</td>
</tr>
<tr>
<td>1916</td>
<td>10,994,000</td>
<td></td>
<td>187,531,824</td>
<td>1.435</td>
</tr>
<tr>
<td>1917</td>
<td>12,542,000</td>
<td></td>
<td>195,837,111</td>
<td>1.337</td>
</tr>
<tr>
<td>1918</td>
<td>12,160,700</td>
<td></td>
<td>188,092,405</td>
<td>1.23</td>
</tr>
<tr>
<td>1919</td>
<td>5,538,700</td>
<td></td>
<td>105,088,740</td>
<td>1.26</td>
</tr>
<tr>
<td>1920</td>
<td>5,555,800</td>
<td></td>
<td>101,897,758</td>
<td>1.16</td>
</tr>
<tr>
<td>1921</td>
<td>1,220,700</td>
<td>737,815</td>
<td>24,511,593</td>
<td>1.16</td>
</tr>
<tr>
<td>1922</td>
<td>4,364,251</td>
<td>2,288,341</td>
<td>84,777,712</td>
<td>1.26</td>
</tr>
<tr>
<td>1923</td>
<td>11,167,800</td>
<td>5,227,861</td>
<td>195,142,919</td>
<td>1.12</td>
</tr>
<tr>
<td>1924</td>
<td>12,126,600</td>
<td>12,949,912</td>
<td>214,592,733</td>
<td>1.07</td>
</tr>
<tr>
<td>1925</td>
<td>12,538,300</td>
<td>16,488,080</td>
<td>214,162,139</td>
<td>1.02</td>
</tr>
<tr>
<td>1926</td>
<td>13,880,100</td>
<td>17,932,338</td>
<td>234,173,625</td>
<td>1.01</td>
</tr>
<tr>
<td>1927</td>
<td>13,811,500</td>
<td>15,149,189</td>
<td>293,002,661</td>
<td>0.979</td>
</tr>
<tr>
<td>1928</td>
<td>16,555,500</td>
<td>14,396,011</td>
<td>273,823,351</td>
<td>0.992</td>
</tr>
<tr>
<td>1929</td>
<td>17,724,100</td>
<td>19,821,357</td>
<td>296,625,554</td>
<td>0.994</td>
</tr>
<tr>
<td>1930</td>
<td>9,552,500</td>
<td>13,846,715</td>
<td>161,138,717</td>
<td>0.973</td>
</tr>
<tr>
<td>1931</td>
<td>8,147,764</td>
<td>10,180,861</td>
<td>142,694,917</td>
<td>0.961</td>
</tr>
<tr>
<td>1932</td>
<td>3,169,411</td>
<td>3,650,930</td>
<td>60,012,835</td>
<td>0.973</td>
</tr>
<tr>
<td>1933</td>
<td>3,521,425</td>
<td>3,362,061</td>
<td>69,462,784</td>
<td>1.03</td>
</tr>
<tr>
<td>1934</td>
<td>4,086,800</td>
<td>4,981,560</td>
<td>78,787,348</td>
<td>1.02</td>
</tr>
</tbody>
</table>
TABLE 6--Continued

<table>
<thead>
<tr>
<th>Year</th>
<th>Ore Mined (Tons)</th>
<th>Waste Removed (Tons)</th>
<th>Copper Produced (Pounds)</th>
<th>Percent Copper in Ore Mined</th>
</tr>
</thead>
<tbody>
<tr>
<td>1935</td>
<td>6,529,800</td>
<td>7,483,981</td>
<td>118,466,057</td>
<td>1.00</td>
</tr>
<tr>
<td>1936</td>
<td>13,773,900</td>
<td>14,859,346</td>
<td>241,674,317</td>
<td>0.97</td>
</tr>
<tr>
<td>1937</td>
<td>23,119,800</td>
<td>28,292,292</td>
<td>402,461,055</td>
<td>0.97</td>
</tr>
<tr>
<td>1938</td>
<td>11,704,900</td>
<td>18,617,345</td>
<td>206,292,917</td>
<td>0.94</td>
</tr>
<tr>
<td>1939</td>
<td>19,310,200</td>
<td>23,111,402</td>
<td>330,310,250</td>
<td>0.94</td>
</tr>
<tr>
<td>1940</td>
<td>25,950,500</td>
<td>30,884,201</td>
<td>452,538,235</td>
<td>0.97</td>
</tr>
<tr>
<td>1941</td>
<td>30,090,400</td>
<td>38,380,432</td>
<td>525,064,848</td>
<td>0.98</td>
</tr>
<tr>
<td>1942</td>
<td>33,093,200</td>
<td>39,716,089</td>
<td>598,358,498</td>
<td>0.98</td>
</tr>
<tr>
<td>1943</td>
<td>35,375,900</td>
<td>41,308,996</td>
<td>639,484,983</td>
<td>0.97</td>
</tr>
<tr>
<td>1944</td>
<td>29,274,200</td>
<td>32,962,007</td>
<td>555,061,685</td>
<td>0.97</td>
</tr>
<tr>
<td>1945</td>
<td>23,361,000</td>
<td>29,002,916</td>
<td>444,800,637</td>
<td>0.99</td>
</tr>
<tr>
<td>1946</td>
<td>11,831,400</td>
<td>13,776,826</td>
<td>220,031,372</td>
<td>0.98</td>
</tr>
<tr>
<td>1947</td>
<td>28,539,300</td>
<td>34,359,084</td>
<td>526,847,062</td>
<td>0.97</td>
</tr>
<tr>
<td>1948</td>
<td>24,454,000</td>
<td>33,480,555</td>
<td>453,634,939</td>
<td>0.97</td>
</tr>
<tr>
<td>1949</td>
<td>20,922,300</td>
<td>26,581,965</td>
<td>394,667,847</td>
<td>0.98</td>
</tr>
<tr>
<td>1950</td>
<td>31,037,800</td>
<td>41,344,160</td>
<td>550,506,103</td>
<td>0.96</td>
</tr>
<tr>
<td>1951</td>
<td>30,444,800</td>
<td>46,551,516</td>
<td>540,185,438</td>
<td>0.96</td>
</tr>
<tr>
<td>1952</td>
<td>32,036,100</td>
<td>46,910,576</td>
<td>572,531,331</td>
<td>0.94</td>
</tr>
<tr>
<td>1953</td>
<td>29,922,200</td>
<td>49,291,904</td>
<td>541,549,262</td>
<td>0.93</td>
</tr>
<tr>
<td>1954</td>
<td>24,079,100</td>
<td>35,856,641</td>
<td>423,066,857</td>
<td>0.93</td>
</tr>
<tr>
<td>1955</td>
<td>27,740,600</td>
<td>46,000,000</td>
<td>461,675,423</td>
<td>0.89</td>
</tr>
<tr>
<td>1956</td>
<td>32,321,100</td>
<td>63,675,696</td>
<td>496,316,378</td>
<td>0.83</td>
</tr>
<tr>
<td>1957</td>
<td>30,919,900</td>
<td>67,088,795</td>
<td>470,270,000</td>
<td>0.82</td>
</tr>
<tr>
<td>1958</td>
<td>24,086,800</td>
<td>41,094,436</td>
<td>373,262,000</td>
<td>0.83</td>
</tr>
<tr>
<td>1959</td>
<td>19,673,217</td>
<td>50,928,800</td>
<td>284,704,000</td>
<td>0.81</td>
</tr>
<tr>
<td>1960</td>
<td>28,060,300</td>
<td>59,536,800</td>
<td>430,250,000</td>
<td>0.81</td>
</tr>
<tr>
<td>1961</td>
<td>27,839,700</td>
<td>71,108,000</td>
<td>433,008,000</td>
<td>0.81</td>
</tr>
<tr>
<td>1962</td>
<td>29,175,000</td>
<td>n.a.</td>
<td>420,750,000</td>
<td>0.77</td>
</tr>
</tbody>
</table>

* Figured from cubic yardage figures for the year, using 2.072 tons per cubic yard.

n.a. Not available

<table>
<thead>
<tr>
<th>Year</th>
<th>Copper Produced (Pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>64,470,670</td>
</tr>
<tr>
<td>1951</td>
<td>269,032,693</td>
</tr>
<tr>
<td>1952</td>
<td>294,515,443</td>
</tr>
<tr>
<td>1953</td>
<td>355,218,010</td>
</tr>
<tr>
<td>1954</td>
<td>323,904,000</td>
</tr>
<tr>
<td>1955</td>
<td>333,816,000</td>
</tr>
<tr>
<td>1956</td>
<td>374,346,000</td>
</tr>
<tr>
<td>1957</td>
<td>380,966,000</td>
</tr>
<tr>
<td>1958</td>
<td>322,254,000</td>
</tr>
<tr>
<td>1959</td>
<td>212,002,000</td>
</tr>
<tr>
<td>1960</td>
<td>338,628,000</td>
</tr>
<tr>
<td>1961</td>
<td>341,124,000</td>
</tr>
</tbody>
</table>

Source: Utah Copper Division, Kennecott Copper Corporation. Unpublished data supplied by the company.
TABLE 8
PRODUCTION OF MOLYBDENITE
UTAH COPPER MINE
1937-1962

<table>
<thead>
<tr>
<th>Year</th>
<th>Molybdenite (Pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1937</td>
<td>9,093,981*</td>
</tr>
<tr>
<td>1938</td>
<td>5,392,585</td>
</tr>
<tr>
<td>1939</td>
<td>10,314,649</td>
</tr>
<tr>
<td>1940</td>
<td>14,321,806</td>
</tr>
<tr>
<td>1941</td>
<td>15,738,444</td>
</tr>
<tr>
<td>1942</td>
<td>18,757,391</td>
</tr>
<tr>
<td>1943</td>
<td>20,636,732</td>
</tr>
<tr>
<td>1944</td>
<td>19,316,420</td>
</tr>
<tr>
<td>1945</td>
<td>15,198,170</td>
</tr>
<tr>
<td>1946</td>
<td>11,100,305</td>
</tr>
<tr>
<td>1947</td>
<td>23,132,978</td>
</tr>
<tr>
<td>1948</td>
<td>18,687,152</td>
</tr>
<tr>
<td>1949</td>
<td>16,775,791</td>
</tr>
<tr>
<td>1950</td>
<td>24,502,346</td>
</tr>
<tr>
<td>1951</td>
<td>23,172,111</td>
</tr>
<tr>
<td>1952</td>
<td>26,834,367</td>
</tr>
<tr>
<td>1953</td>
<td>28,795,641</td>
</tr>
<tr>
<td>1954</td>
<td>22,297,572</td>
</tr>
<tr>
<td>1955</td>
<td>25,581,025</td>
</tr>
<tr>
<td>1956</td>
<td>26,930,400**</td>
</tr>
<tr>
<td>1957</td>
<td>23,004,800**</td>
</tr>
<tr>
<td>1958</td>
<td>18,900,800**</td>
</tr>
<tr>
<td>1959</td>
<td>16,773,600**</td>
</tr>
<tr>
<td>1960</td>
<td>21,940,800**</td>
</tr>
<tr>
<td>1961</td>
<td>20,651,200**</td>
</tr>
<tr>
<td>1962</td>
<td>20,343,200**</td>
</tr>
</tbody>
</table>

* Includes production for 1936
** Estimates based on 80% of the annual production of molybdenite by Kennecott Copper Corporation for the years 1956-1962.

Source: Utah Copper Division, Kennecott Copper Corporation. Unpublished data supplied by the company.
<table>
<thead>
<tr>
<th>Year</th>
<th>Mining Cost Per Ton</th>
<th>Transportation Cost Per Ton</th>
<th>Milling Cost Per Ton</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1910</td>
<td>$ .4097</td>
<td>$ .2978</td>
<td>$ .4663</td>
<td>$1.1738</td>
</tr>
<tr>
<td>1911</td>
<td>$.4479</td>
<td>$.3078</td>
<td>$.4168</td>
<td>1.1725</td>
</tr>
<tr>
<td>1912</td>
<td>$.4233</td>
<td>$.2848</td>
<td>$.4158</td>
<td>1.1239</td>
</tr>
<tr>
<td>1913</td>
<td>$.3288</td>
<td>$.2797</td>
<td>$.3676</td>
<td>.9761</td>
</tr>
<tr>
<td>1914</td>
<td>$.3232</td>
<td>$.2782</td>
<td>$.3536</td>
<td>.9550</td>
</tr>
<tr>
<td>1915</td>
<td>$.2441</td>
<td>$.2781</td>
<td>$.3402</td>
<td>.8624</td>
</tr>
<tr>
<td>1916</td>
<td>$.2781</td>
<td>$.2792</td>
<td>$.3982</td>
<td>.9355</td>
</tr>
<tr>
<td>1917</td>
<td>$.4446</td>
<td>$.2794</td>
<td>$.6930</td>
<td>1.4170</td>
</tr>
<tr>
<td>1918</td>
<td>$.5370</td>
<td>$.2983</td>
<td>$.9277</td>
<td>1.7630</td>
</tr>
<tr>
<td>1919</td>
<td>$.4900</td>
<td>$.3040</td>
<td>1.2062</td>
<td>2.002</td>
</tr>
<tr>
<td>1920</td>
<td>$.4823</td>
<td>$.2591</td>
<td>1.2472</td>
<td>1.9886</td>
</tr>
<tr>
<td>1921</td>
<td>$.4998</td>
<td>$.1921</td>
<td>1.1679</td>
<td>1.8598</td>
</tr>
<tr>
<td>1922</td>
<td>$.3833</td>
<td>$.1612</td>
<td>$.8417</td>
<td>1.3862</td>
</tr>
<tr>
<td>1923</td>
<td>$.3488</td>
<td>$.1088</td>
<td>$.6116</td>
<td>1.0692</td>
</tr>
<tr>
<td>1924</td>
<td>$.3605</td>
<td>$.1308</td>
<td>$.5990</td>
<td>1.0903</td>
</tr>
<tr>
<td>1925</td>
<td>$.3373</td>
<td>$.1151</td>
<td>$.5382</td>
<td>.9906</td>
</tr>
<tr>
<td>1926</td>
<td>$.3139</td>
<td>$.1019</td>
<td>$.4843</td>
<td>.9001</td>
</tr>
<tr>
<td>1927</td>
<td>$.3734</td>
<td>$.0926</td>
<td>$.4523</td>
<td>.9183</td>
</tr>
<tr>
<td>1928</td>
<td>$.3178</td>
<td>$.0874</td>
<td>$.3690</td>
<td>.7742</td>
</tr>
<tr>
<td>1929</td>
<td>$.4121</td>
<td>$.0896</td>
<td>$.3658</td>
<td>.8675</td>
</tr>
<tr>
<td>1930</td>
<td>$.5043</td>
<td>$.1042</td>
<td>$.4609</td>
<td>1.0694</td>
</tr>
<tr>
<td>1931</td>
<td>$.3957</td>
<td>$.1120</td>
<td>$.3927</td>
<td>.9004</td>
</tr>
<tr>
<td>1932</td>
<td>$.4578</td>
<td>n.a.</td>
<td>$.5901</td>
<td>n.a.</td>
</tr>
<tr>
<td>1933</td>
<td>$.4106</td>
<td>n.a.</td>
<td>$.5031</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

n.a. Not available

<table>
<thead>
<tr>
<th>Year</th>
<th>Copper Production Cost Per Pound</th>
<th>Sale Price of Copper Per Pound</th>
</tr>
</thead>
<tbody>
<tr>
<td>1907</td>
<td>$0.085</td>
<td>n.a.</td>
</tr>
<tr>
<td>1908</td>
<td>0.0885</td>
<td>$0.1320</td>
</tr>
<tr>
<td>1909</td>
<td>0.08787</td>
<td>0.12915</td>
</tr>
<tr>
<td>1910</td>
<td>0.08069</td>
<td>0.12672</td>
</tr>
<tr>
<td>1911</td>
<td>0.07866</td>
<td>0.12646</td>
</tr>
<tr>
<td>1912</td>
<td>0.08781</td>
<td>0.15839</td>
</tr>
<tr>
<td>1913</td>
<td>0.09256</td>
<td>0.14976</td>
</tr>
<tr>
<td>1914</td>
<td>0.08037</td>
<td>0.13264</td>
</tr>
<tr>
<td>1915</td>
<td>0.06612</td>
<td>0.17679</td>
</tr>
<tr>
<td>1916</td>
<td>0.0695</td>
<td>0.26139</td>
</tr>
<tr>
<td>1917</td>
<td>0.10995</td>
<td>0.24186</td>
</tr>
<tr>
<td>1918</td>
<td>0.1253</td>
<td>0.22876</td>
</tr>
<tr>
<td>1919</td>
<td>0.12366</td>
<td>0.17776</td>
</tr>
<tr>
<td>1920</td>
<td>0.1221</td>
<td>0.17737</td>
</tr>
<tr>
<td>1921</td>
<td>0.1157</td>
<td>0.12929</td>
</tr>
<tr>
<td>1922</td>
<td>0.0782</td>
<td>0.13584</td>
</tr>
<tr>
<td>1923</td>
<td>0.07422</td>
<td>0.14376</td>
</tr>
<tr>
<td>1924</td>
<td>0.07684</td>
<td>0.13121</td>
</tr>
<tr>
<td>1925</td>
<td>0.0707</td>
<td>0.14069</td>
</tr>
<tr>
<td>1926</td>
<td>0.0658</td>
<td>0.13894</td>
</tr>
<tr>
<td>1927</td>
<td>0.0638</td>
<td>0.13092</td>
</tr>
<tr>
<td>1928</td>
<td>0.0616</td>
<td>0.15119</td>
</tr>
<tr>
<td>1929</td>
<td>0.0520</td>
<td>0.16749</td>
</tr>
<tr>
<td>1930</td>
<td>0.0724</td>
<td>0.11915</td>
</tr>
<tr>
<td>1931</td>
<td>0.0597</td>
<td>0.07283</td>
</tr>
<tr>
<td>1932</td>
<td>0.0742</td>
<td>0.05216</td>
</tr>
<tr>
<td>1933</td>
<td>0.06455</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

n.a. Not available

Source: Utah Copper Company, Annual Report, annually, 1907-1933.
### TABLE 11

**UTAH COPPER COMPANY**

**PRODUCTION OF GOLD AND SILVER**

1908-1938

<table>
<thead>
<tr>
<th>Year</th>
<th>Gold (Ounces)</th>
<th>Silver (Ounces)</th>
<th>Value of Gold and Silver</th>
</tr>
</thead>
<tbody>
<tr>
<td>1908</td>
<td>20,072</td>
<td>163,953</td>
<td>$491,224</td>
</tr>
<tr>
<td>1909</td>
<td>20,862</td>
<td>198,943</td>
<td>519,758</td>
</tr>
<tr>
<td>1910</td>
<td>39,838</td>
<td>381,331</td>
<td>1,001,090</td>
</tr>
<tr>
<td>1911</td>
<td>40,202</td>
<td>311,392</td>
<td>999,623</td>
</tr>
<tr>
<td>1912</td>
<td>34,255</td>
<td>385,589</td>
<td>873,995</td>
</tr>
<tr>
<td>1913</td>
<td>28,121</td>
<td>295,352</td>
<td>732,583</td>
</tr>
<tr>
<td>1914</td>
<td>34,729</td>
<td>375,504</td>
<td>875,504</td>
</tr>
<tr>
<td>1915</td>
<td>36,760</td>
<td>371,712</td>
<td>920,612</td>
</tr>
<tr>
<td>1916</td>
<td>47,648</td>
<td>451,597</td>
<td>1,260,766</td>
</tr>
<tr>
<td>1917</td>
<td>51,112</td>
<td>498,820</td>
<td>1,433,002</td>
</tr>
<tr>
<td>1918</td>
<td>50,928</td>
<td>480,484</td>
<td>1,498,108</td>
</tr>
<tr>
<td>1919</td>
<td>28,907</td>
<td>263,721</td>
<td>873,572</td>
</tr>
<tr>
<td>1920</td>
<td>27,411</td>
<td>257,518</td>
<td>829,334</td>
</tr>
<tr>
<td>1921</td>
<td>7,041</td>
<td>65,929</td>
<td>206,510</td>
</tr>
<tr>
<td>1922</td>
<td>28,284</td>
<td>257,145</td>
<td>821,540</td>
</tr>
<tr>
<td>1923</td>
<td>72,549</td>
<td>630,941</td>
<td>1,929,920</td>
</tr>
<tr>
<td>1924</td>
<td>76,593</td>
<td>652,586</td>
<td>1,973,761</td>
</tr>
<tr>
<td>1925</td>
<td>78,158</td>
<td>692,782</td>
<td>2,041,321</td>
</tr>
<tr>
<td>1926</td>
<td>86,028</td>
<td>760,910</td>
<td>2,186,737</td>
</tr>
<tr>
<td>1927</td>
<td>89,303</td>
<td>795,888</td>
<td>2,283,967</td>
</tr>
<tr>
<td>1928</td>
<td>104,292</td>
<td>917,226</td>
<td>2,619,240</td>
</tr>
<tr>
<td>1929</td>
<td>116,087</td>
<td>1,050,075</td>
<td>2,881,269</td>
</tr>
<tr>
<td>1930</td>
<td>64,240</td>
<td>563,330</td>
<td>1,499,229</td>
</tr>
<tr>
<td>1931</td>
<td>54,124</td>
<td>481,251</td>
<td>1,219,982</td>
</tr>
<tr>
<td>1932</td>
<td>25,399</td>
<td>222,417</td>
<td>569,027</td>
</tr>
<tr>
<td>1933</td>
<td>34,856</td>
<td>312,333</td>
<td>1,089,802</td>
</tr>
<tr>
<td>1934</td>
<td>37,513</td>
<td>330,175</td>
<td>1,781,320</td>
</tr>
<tr>
<td>1935</td>
<td>66,111</td>
<td>536,846</td>
<td>2,703,503</td>
</tr>
<tr>
<td>1936</td>
<td>113,515</td>
<td>950,712</td>
<td>n.a.</td>
</tr>
<tr>
<td>1937</td>
<td>196,542</td>
<td>1,720,347</td>
<td>n.a.</td>
</tr>
<tr>
<td>1938</td>
<td>92,705</td>
<td>818,018</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

n.a. Not available

<table>
<thead>
<tr>
<th>Year</th>
<th>Mine</th>
<th>Magna</th>
<th>Arthur</th>
<th>Ore Haulage</th>
<th>All Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1907</td>
<td>$57,298</td>
<td>$3,184,787</td>
<td>--</td>
<td>--</td>
<td>$108,594</td>
<td>$5,762,572</td>
</tr>
<tr>
<td>1908</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>3,330,680</td>
</tr>
<tr>
<td>1909</td>
<td>434,480</td>
<td>932,806*</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1,577,616</td>
</tr>
<tr>
<td>1910</td>
<td>374,771</td>
<td>305,176</td>
<td>$1,342,238***</td>
<td>--</td>
<td>2,284,324##</td>
<td>4,140,705</td>
</tr>
<tr>
<td>1911</td>
<td>93,233</td>
<td>140,956</td>
<td>856,554#</td>
<td>--</td>
<td>77,750</td>
<td>1,215,121</td>
</tr>
<tr>
<td>1912</td>
<td>75,062</td>
<td>243,968</td>
<td>785,589</td>
<td>--</td>
<td>15,500</td>
<td>1,120,120</td>
</tr>
<tr>
<td>1913</td>
<td>93,362</td>
<td>284,213</td>
<td>451,699</td>
<td>--</td>
<td>(12,000)##</td>
<td>817,427</td>
</tr>
<tr>
<td>1914</td>
<td>75,680</td>
<td>113,960</td>
<td>26,792</td>
<td>--</td>
<td>59,511</td>
<td>275,933</td>
</tr>
<tr>
<td>1915</td>
<td>82,899</td>
<td>45,243</td>
<td>302,338</td>
<td>--</td>
<td>168,625</td>
<td>587,163</td>
</tr>
<tr>
<td>1916</td>
<td>210,855</td>
<td>102,841</td>
<td>535,900</td>
<td>--</td>
<td>494,710</td>
<td>1,343,806</td>
</tr>
<tr>
<td>1917</td>
<td>284,499</td>
<td>522,910</td>
<td>2,070,000</td>
<td>--</td>
<td>1,596,645</td>
<td>4,873,854</td>
</tr>
<tr>
<td>1918</td>
<td>238,956</td>
<td>1,642,415</td>
<td>2,030,658</td>
<td>--</td>
<td>207,694</td>
<td>4,119,723</td>
</tr>
<tr>
<td>1919</td>
<td>76,050</td>
<td>438,563</td>
<td>435,852</td>
<td>--</td>
<td>42,748</td>
<td>993,214</td>
</tr>
<tr>
<td>1920</td>
<td>60,687</td>
<td>83,142</td>
<td>63,697</td>
<td>1,308,195</td>
<td>145,770</td>
<td>1,651,491</td>
</tr>
<tr>
<td>1921</td>
<td>13,157</td>
<td>1,246</td>
<td>22,055</td>
<td>1,401</td>
<td>7,468</td>
<td>45,327</td>
</tr>
<tr>
<td>1922</td>
<td>58,726</td>
<td>662,319</td>
<td>77,824</td>
<td>65,855</td>
<td>7,029</td>
<td>871,754</td>
</tr>
<tr>
<td>1923</td>
<td>868,987</td>
<td>2,434,055</td>
<td>130,658</td>
<td>52,695</td>
<td>53,128</td>
<td>3,539,523</td>
</tr>
<tr>
<td>1924</td>
<td>855,351</td>
<td>377,537</td>
<td>85,016</td>
<td>113,695</td>
<td>23,098</td>
<td>1,654,696</td>
</tr>
<tr>
<td>1925</td>
<td>715,619</td>
<td>184,595</td>
<td>227,122</td>
<td>10,615</td>
<td>103,978</td>
<td>1,241,928</td>
</tr>
<tr>
<td>1926</td>
<td>738,739</td>
<td>182,837</td>
<td>125,871</td>
<td>7,194</td>
<td>297,325</td>
<td>1,351,966</td>
</tr>
<tr>
<td>1927</td>
<td>404,161</td>
<td>21,269</td>
<td>55,397</td>
<td>43,483</td>
<td>8,622</td>
<td>532,913</td>
</tr>
<tr>
<td>1928</td>
<td>1,334,157</td>
<td>188,308</td>
<td>48,929</td>
<td>18,827</td>
<td>8,701</td>
<td>1,578,921</td>
</tr>
<tr>
<td>1929</td>
<td>2,201,817</td>
<td>1,238,275</td>
<td>639,625</td>
<td>515,135</td>
<td>34,855</td>
<td>4,829,708</td>
</tr>
<tr>
<td>1930</td>
<td>334,848</td>
<td>136,483</td>
<td>31,063</td>
<td>14,017</td>
<td>9,744</td>
<td>526,155</td>
</tr>
<tr>
<td>1931</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>80,869</td>
</tr>
</tbody>
</table>

---

* Figures are rounded to nearest dollar
* Includes expenditures on Power Plant
** Includes $2,253,239.72 which is net cost of properties acquired from Boston Consolidated Mining Co., exclusive of valuation placed upon Arthur mill
*** Includes $1,200,000.00 which is valuation placed on Boston Consolidated (Arthur) mill
# Improvements minus $28,613.84 adjustment of credits for overvaluation on Arthur mill
## Right-of-way sold to Bingham & Garfield Railway Company
n.a. Not available

<table>
<thead>
<tr>
<th>Year</th>
<th>Mine</th>
<th>Magna</th>
<th>Arthur</th>
<th>Ore Haulage</th>
<th>Power Plant</th>
<th>Refinery</th>
<th>Smelter</th>
<th>All Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1932</td>
<td>$10,890.86</td>
<td>$4,221.75</td>
<td>$1,567.32</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$159.30</td>
<td>$15,261.91</td>
</tr>
<tr>
<td>1933</td>
<td>$561.83</td>
<td></td>
<td>$1,567.32</td>
<td>$6,642.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1934</td>
<td>$55,574.13</td>
<td>$660.71</td>
<td>$636.33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1935</td>
<td>$81,256.49</td>
<td>$107,700.49</td>
<td>$24,933.55</td>
<td>$984,210.49</td>
<td>$11,491.88</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1936</td>
<td>$113,120.93</td>
<td>$197,422.90</td>
<td>$129,194.81</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1937</td>
<td>$1,817,565.68</td>
<td>$375,483.52</td>
<td>$623,876.93</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1938</td>
<td>$126,833.68</td>
<td>$210,399.30</td>
<td>$122,798.53</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1939</td>
<td>$110,077.70</td>
<td>$188,112.83</td>
<td>$171,671.63</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1940</td>
<td>$5,142,701.35</td>
<td>$102,313.76</td>
<td>$248,781.27</td>
<td>$896,313.56</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1941</td>
<td>$3,338,882.09</td>
<td>$550,190.17</td>
<td>$177,313.68</td>
<td>$780,258.39</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1942</td>
<td>$1,517,214.11</td>
<td>$8,942.34</td>
<td>$12,850.18</td>
<td>$96,624.92</td>
<td>$3,429,819.37</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1943</td>
<td>$1,093,167.26</td>
<td>$2,092,611.50</td>
<td>$15,142.26</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1944</td>
<td>$1,322,008.09</td>
<td>$910,457.01</td>
<td>$20,112.30</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1945</td>
<td>$709,834.82</td>
<td>$2,392,043.17</td>
<td>$3,197.89</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1946</td>
<td>$2,092,611.80</td>
<td>$17,890.10</td>
<td>$52,220.88</td>
<td>$</td>
<td></td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1947</td>
<td>$1,279,045.17</td>
<td>$283,978.82</td>
<td>$19,503.27</td>
<td>$2,844,545.20</td>
<td>$1,752,872.71</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1948</td>
<td>$2,871,337.62</td>
<td>$1,144,323.40</td>
<td>$836,373.33</td>
<td>$565,441.37</td>
<td>$316,944.97</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1949</td>
<td>$1,437,699.20</td>
<td>$129,648.25</td>
<td>$103,046.93</td>
<td>$1,178,816.35</td>
<td>$9,230,964.85</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1950</td>
<td>$1,442,259.37</td>
<td>$144,057.01</td>
<td>$71,651.65</td>
<td>$5,874,663.95</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1951</td>
<td>$3,834,510.85</td>
<td>$43,835.94</td>
<td>$56,945.98</td>
<td>$2,806.88</td>
<td>$565,317.90</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1952</td>
<td>$2,170,200.89</td>
<td>$175,089.35</td>
<td>$1,404,473.53</td>
<td>$19,388.97</td>
<td>$408,289.59</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1953</td>
<td>$2,852,229.13</td>
<td>$797,971.81</td>
<td>$1,036,800.70</td>
<td>$6,532.81</td>
<td>$179,570.02</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1954</td>
<td>$1,322,666.27</td>
<td>$101,121.05</td>
<td>$101,121.05</td>
<td>$138,614.77</td>
<td>$1,339,147.11</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1955</td>
<td>$2,008,674.93</td>
<td>$110,076.09</td>
<td>$135,726.42</td>
<td>$687.84</td>
<td>$13,004.29</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1956</td>
<td>$1,396,507.15</td>
<td>$297,357.29</td>
<td>$660,031.94</td>
<td>$908.27</td>
<td>$684,808.80</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1957</td>
<td>$690,455.88</td>
<td>$232,328.47</td>
<td>$383,441.77</td>
<td>$438,775.96</td>
<td>$285,288.52</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1958</td>
<td>$549,949.30</td>
<td>$233,924.46</td>
<td>$66,882.46</td>
<td>$2,162.63</td>
<td>$1,380,461.68</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1959</td>
<td>$1,404,267.92</td>
<td>$783,474.69</td>
<td>$56,512.61</td>
<td>$28,003.24</td>
<td>$6,140,652.50</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1960</td>
<td>$1,594,047.11</td>
<td>$451,957.78</td>
<td>$292,553.98</td>
<td>$30,600.68</td>
<td>$1,014,898.75</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1961</td>
<td>$1,655,566.05</td>
<td>$404,236.07</td>
<td>$510,109.43</td>
<td>$201,397.23</td>
<td>$292,522.78</td>
<td>$</td>
<td>$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$43,215,349.26 $6,173,392.51 $7,244,786.88 $8,440,342.12 $25,025,012.35 $23,227,603.44 $20,091,424.63 $6,607,393.21 $140,025,304.40

Source: Utah Copper Division, Kennecott Copper Corporation. Unpublished data supplied by the company.

Recapitulation

<table>
<thead>
<tr>
<th>Mine</th>
<th>$43,215,349.26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magna</td>
<td>6,173,392.51</td>
</tr>
<tr>
<td>Arthur</td>
<td>7,244,786.88</td>
</tr>
<tr>
<td>Ore Haulage</td>
<td>8,440,342.12</td>
</tr>
<tr>
<td>Power Plant</td>
<td>25,025,012.35</td>
</tr>
<tr>
<td>Refinery</td>
<td>23,227,603.44</td>
</tr>
<tr>
<td>Smelter</td>
<td>20,091,424.63</td>
</tr>
<tr>
<td>All Other</td>
<td>6,607,393.21</td>
</tr>
<tr>
<td>Total</td>
<td>$140,025,304.40</td>
</tr>
<tr>
<td>Year</td>
<td>Employment</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
</tr>
<tr>
<td>1925</td>
<td>3,624</td>
</tr>
<tr>
<td>1929</td>
<td>4,041</td>
</tr>
<tr>
<td>1936</td>
<td>4,000*</td>
</tr>
<tr>
<td>1937</td>
<td>4,000*</td>
</tr>
<tr>
<td>1939</td>
<td>3,900*</td>
</tr>
<tr>
<td>1940</td>
<td>4,300*</td>
</tr>
<tr>
<td>1945</td>
<td>3,843</td>
</tr>
<tr>
<td>1946</td>
<td>3,737</td>
</tr>
<tr>
<td>1947</td>
<td>4,425</td>
</tr>
<tr>
<td>1948</td>
<td>4,501</td>
</tr>
<tr>
<td>1949</td>
<td>4,411</td>
</tr>
<tr>
<td>1950</td>
<td>5,247</td>
</tr>
<tr>
<td>1951</td>
<td>5,332</td>
</tr>
<tr>
<td>1952</td>
<td>5,540</td>
</tr>
<tr>
<td>1953</td>
<td>5,680</td>
</tr>
<tr>
<td>1954</td>
<td>5,518</td>
</tr>
<tr>
<td>1955</td>
<td>6,636</td>
</tr>
<tr>
<td>1956</td>
<td>6,696</td>
</tr>
<tr>
<td>1957</td>
<td>4,858</td>
</tr>
<tr>
<td>1958</td>
<td>7,169</td>
</tr>
<tr>
<td>1960</td>
<td>7,586</td>
</tr>
<tr>
<td>1961</td>
<td>7,321</td>
</tr>
</tbody>
</table>

* Estimated

Source:
- 1925-1940: Utah Copper Company, *The Utah Copper Story* (Salt Lake City: Utah Copper Company).
- 1945-1954: Utah Copper Division, Kennecott Copper Corporation. Unpublished data furnished by the company.
<table>
<thead>
<tr>
<th>Year</th>
<th>Average Pay Rate Per Shift</th>
<th>Total Payroll</th>
</tr>
</thead>
<tbody>
<tr>
<td>1904</td>
<td>$2.86</td>
<td>$141,593</td>
</tr>
<tr>
<td>1905</td>
<td>2.85</td>
<td>325,564</td>
</tr>
<tr>
<td>1906</td>
<td>2.89</td>
<td>517,527</td>
</tr>
<tr>
<td>1907</td>
<td>2.93</td>
<td>1,213,330</td>
</tr>
<tr>
<td>1908</td>
<td>2.63</td>
<td>1,581,414</td>
</tr>
<tr>
<td>1909</td>
<td>2.63</td>
<td>1,800,025</td>
</tr>
<tr>
<td>1910</td>
<td>2.75</td>
<td>3,038,324</td>
</tr>
<tr>
<td>1911</td>
<td>2.79</td>
<td>3,636,773</td>
</tr>
<tr>
<td>1912</td>
<td>2.83</td>
<td>3,645,484</td>
</tr>
<tr>
<td>1913</td>
<td>2.97</td>
<td>4,097,673</td>
</tr>
<tr>
<td>1914</td>
<td>2.91</td>
<td>3,364,411</td>
</tr>
<tr>
<td>1915</td>
<td>3.06</td>
<td>3,447,405</td>
</tr>
<tr>
<td>1916</td>
<td>3.53</td>
<td>4,597,394</td>
</tr>
<tr>
<td>1917</td>
<td>4.00</td>
<td>7,277,952</td>
</tr>
<tr>
<td>1918</td>
<td>4.58</td>
<td>7,608,722</td>
</tr>
<tr>
<td>1919</td>
<td>4.59</td>
<td>3,611,664</td>
</tr>
<tr>
<td>1920</td>
<td>4.97</td>
<td>3,562,029</td>
</tr>
<tr>
<td>1921</td>
<td>4.40</td>
<td>864,094</td>
</tr>
<tr>
<td>1922</td>
<td>4.03</td>
<td>2,014,827</td>
</tr>
<tr>
<td>1923</td>
<td>4.49</td>
<td>5,546,713</td>
</tr>
<tr>
<td>1924</td>
<td>4.38</td>
<td>5,675,332</td>
</tr>
<tr>
<td>1925</td>
<td>4.46</td>
<td>5,826,649</td>
</tr>
<tr>
<td>1926</td>
<td>4.47</td>
<td>5,322,054</td>
</tr>
<tr>
<td>1927</td>
<td>4.53</td>
<td>4,441,579</td>
</tr>
<tr>
<td>1928</td>
<td>4.66</td>
<td>4,832,709</td>
</tr>
<tr>
<td>1929</td>
<td>5.27</td>
<td>6,503,069</td>
</tr>
<tr>
<td>1930</td>
<td>4.88</td>
<td>3,453,400</td>
</tr>
<tr>
<td>1931</td>
<td>4.57</td>
<td>2,515,109</td>
</tr>
<tr>
<td>1932</td>
<td>4.31</td>
<td>1,196,465</td>
</tr>
<tr>
<td>1933</td>
<td>4.43</td>
<td>1,110,118</td>
</tr>
<tr>
<td>1934</td>
<td>4.68</td>
<td>1,419,252</td>
</tr>
</tbody>
</table>
TABLE 15—Continued

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Pay Rate Per Shift</th>
<th>Total Payroll</th>
</tr>
</thead>
<tbody>
<tr>
<td>1935</td>
<td>4.81</td>
<td>2,059,916</td>
</tr>
<tr>
<td>1936</td>
<td>5.03</td>
<td>3,930,734</td>
</tr>
<tr>
<td>1937</td>
<td>5.70</td>
<td>7,065,218</td>
</tr>
<tr>
<td>1938</td>
<td>5.50</td>
<td>4,503,505</td>
</tr>
<tr>
<td>1939</td>
<td>5.69</td>
<td>5,880,393</td>
</tr>
<tr>
<td>1940</td>
<td>6.17</td>
<td>7,178,881</td>
</tr>
<tr>
<td>1941</td>
<td>6.92</td>
<td>9,034,717</td>
</tr>
<tr>
<td>1942</td>
<td>7.85</td>
<td>10,773,442</td>
</tr>
<tr>
<td>1943</td>
<td>8.44</td>
<td>11,695,443</td>
</tr>
<tr>
<td>1944</td>
<td>8.49</td>
<td>10,747,797</td>
</tr>
<tr>
<td>1945</td>
<td>8.61</td>
<td>9,648,022</td>
</tr>
<tr>
<td>1946</td>
<td>9.65</td>
<td>6,361,396</td>
</tr>
<tr>
<td>1947</td>
<td>10.82</td>
<td>13,572,853</td>
</tr>
<tr>
<td>1948</td>
<td>11.94</td>
<td>13,960,296</td>
</tr>
<tr>
<td>1949</td>
<td>12.35</td>
<td>13,575,866</td>
</tr>
<tr>
<td>1950</td>
<td>13.75</td>
<td>19,391,075</td>
</tr>
<tr>
<td>1951</td>
<td>15.30</td>
<td>23,944,485</td>
</tr>
<tr>
<td>1952</td>
<td>16.57</td>
<td>27,603,135</td>
</tr>
<tr>
<td>1953</td>
<td>18.18</td>
<td>30,854,532</td>
</tr>
<tr>
<td>1954</td>
<td>18.31</td>
<td>24,944,702</td>
</tr>
<tr>
<td>1955</td>
<td>18.80</td>
<td>28,167,269</td>
</tr>
<tr>
<td>1956</td>
<td>19.17</td>
<td>33,674,655</td>
</tr>
<tr>
<td>1957</td>
<td>21.92</td>
<td>34,884,360</td>
</tr>
<tr>
<td>1958</td>
<td>23.47</td>
<td>28,936,627</td>
</tr>
<tr>
<td>1959</td>
<td>23.97</td>
<td>30,273,151</td>
</tr>
<tr>
<td>1960</td>
<td>24.92</td>
<td>42,755,942</td>
</tr>
<tr>
<td>1961</td>
<td>26.23</td>
<td>43,891,971</td>
</tr>
<tr>
<td>1962</td>
<td>27.19</td>
<td>47,298,500</td>
</tr>
</tbody>
</table>

Source: Utah Copper Division, Kennecott Copper Corporation. Unpublished data supplied by the company.
A SELECTED BIBLIOGRAPHY

Public Documents


Books


Knight, Jesse William. The Jesse Knight Family: Jesse Knight, His Forebears and Family. Salt Lake City: Deseret News Press, 1941.


Murphy, John R. The Mineral Resources of the Territory of Utah With Mining Statistics and Maps. Salt Lake City: James Dwyer, 1872.


Articles and Periodicals


Engineering and Mining Journal. Weekly and monthly, 1866—current.


The Mining Review, Salt Lake City. Weekly, 1900-1904.

The Salt Lake Tribune, Salt Lake City, Daily, April 15, 1871—current.


Reports


Unpublished Material


Anderson, L. W. "History of the Concentrating Mills of the Utah Copper Company." Utah Copper Company, Metallurgical Department, June 1930. (Mimeographed.)


Other Sources

The following unpublished materials are in the possession of the Utah Copper Division, Kennecott Copper Corporation, Kearns Building, Salt Lake City, Utah:

"Brief History, Bingham & Garfield Railway Company." Unpublished MSS., Utah Copper Company. No date.

"Chronological History of Important Events in Mining." Unpublished MSS., Kennecott Copper Corporation, 1954.

"Descriptive History of Utah Copper Company and Bingham & Garfield Railway Company." Unpublished MSS., Utah Copper Company. No date.

"History of Milling to 1939." Unpublished MSS., Utah Copper Company, January 1939. (Mimeographed.)


Utah Copper Division, Kennecott Copper Corporation, Salt Lake City, Utah. Statistical data furnished by the company to the author, December 1962, January, February, March, 1963.