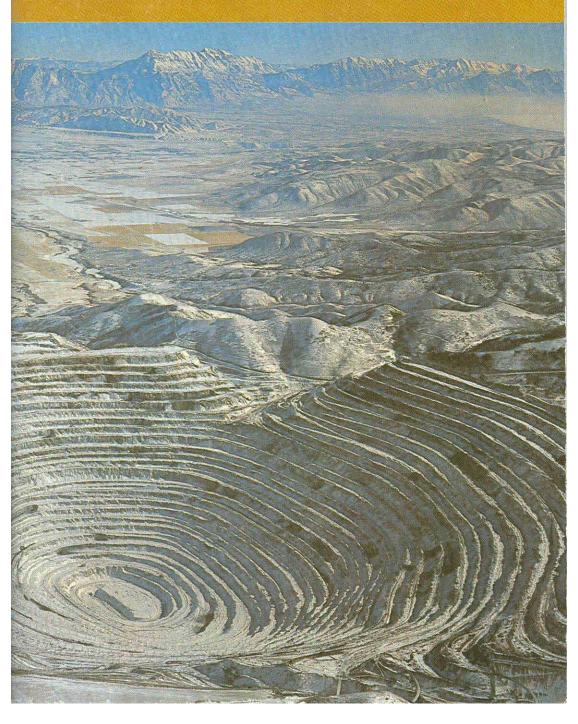
THE RICHEST HOLE ON EARTH

The History of the Bingham Copper Mine

Monograph Series
UTAH STATE UNIVERSITY
Logan, Utah



"The Richest Hole on Earth"

A HISTORY OF THE BINGHAM COPPER MINE

by
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PREFACE

The first systematic study of the Bingham Copper Mine was made by John M. Boutwell, of the United States Geological Survey, in 1904, and was published as Economic Geology of the Bingham Mining District, Utah (Washington, D.C., 1905). This early geological study makes only the briefest mention of the companies and persons involved in the development of the Bingham mines. This was followed, in 1918, by a series of articles by T. A. Rickard and others in the Mining and Scientific Press, of which Rickard was editor. These articles, strongly sympathetic toward Daniel C. Jackling and Utah Copper, were separately published by Rickard under the title The Utah Copper Enterprise (San Francisco, 1919). This quarto volume of 107 pages gives primary emphasis to the engineering and technological processes developed by Utah Copper. Much later, Rickard's A History of American Mining (New York, 1932) contained a short chapter on the history of mining in Utah, with a brief summary on Utah Copper and its technological contributions. In 1933, A. B. Parsons published a volume for the American Institute of Mining and Metallurgical Engineers under the title The Porphyry Coppers (New York, 1933), in which the background of porphyry copper mining at Bingham and at eleven other locations in the world was discussed. As with Rickard, much of the discussion was devoted to technology and engineering aspects. A later edition of this work, The Porphyry Coppers in 1956 (New York, 1957), reviewed developments at each porphyry mine from 1933 to 1956.

Relying upon such pioneering studies for much of the information in this monograph, the writers have endeavored to make a contribution by showing the continuity which existed between copper mining in Utah before and after the initiation of the Utah Copper enterprise. Whereas previous treatments began the story of the Bingham Mine with the porphyry innovation of 1903-1906, we have sought to show that it was a logical next-step from the copper sulphide mining and milling of the late 1890's, and that even copper sulphide mining was an outgrowth of the mining and milling of gold and lead-silver sulphides in the 1880's and early 1890's. Whereas other works have centered their narratives around the overpowering figure of Jackling, it is our contention that other

persons of equal (or nearly equal) stature — e.g., Samuel Newhouse — worked simultaneously to bring about the development of the Bingham Mine. Finally, while previous monographs have been written primarily for mining engineers, or as public relations handouts, we have attempted to give due importance to the business history of the enterprises concerned. In this respect, we acknowledge the omission of some important social and economic implications of the Bingham enterprise, particularly the history of labor relations. We also acknowledge the sketchy treatment of developments after 1910.

The present monograph was written under a grant from the Utah State University Research Council, and is one of a series of studies on Utah and the West.

The writers are grateful to the officials of the Utah Copper Division, Kennecott Copper Corporation, for the colored photograph on the cover, and for other assistance.

The writers also wish to express gratitude for the support of D. Wynne Thorne, Director of University Research; R. P. Collier, Dean of the College of Business and Social Sciences; and Evan B. Murray, Head of the Department of Economics. Particular thanks is extended to President Daryl Chase and Vice President M. R. Merrill, for their sympathetic interest in the publication of this study, and Helen Ure Hansen, who typed the manuscript more times than we care to admit.

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CHAPTER 1

INTRODUCTION

THE BINGHAM COPPER MINE

In a mountain canyon twenty-eight miles west and south of Salt Lake City, Utah, is a mammoth mine which can justifiably be called "the richest hole on earth." In the past sixty years more than 16 billion pounds of copper have been removed from this mine. At 1963 prices this would represent a value of almost \$5 billion. In addition, the mine has produced 500 million pounds of molybdenite, 70 million ounces of silver, and 9 million ounces of gold. The total yield of the mine thus far, at 1963 prices, exceeds \$6 billion. In addition to important yields of minor metals, the Bingham mine is now the world's second largest producer of copper, world's second largest producer of molybdenite, and Western Hemisphere's second largest producer of gold.

Despite the almost inconceivably vast yield of this mine — it holds undisputed first place in the aggregate quantity of metal produced by a single mine — the owner of the mine, the Kennecott Copper Corporation, has recently announced a \$100,000,000 program of local improvement and expansion, indicating that there is far more remaining in the mine than anyone had ever dreamed. In the process of obtaining these ores, more than 2.2 billion tons of overburden have been removed — a mountain has been converted into a vast amphitheater. As the largest man-made excavation on the face of the earth, involving the moving of four times the yardage of earth moved in the original digging of the Panama Canal, the Bingham Copper Mine is an outstanding example of the process by which economic waste is converted to economic gain.¹

¹ These and the following general statistics are found in or calculated from data found in the files of the Utah Copper Division, Kennecott Copper Corporation, Salt Lake City; and Works Progress Administration, National Research Project, *Technology, Employment, and Output Per Man in Copper Mining* (Washington, D.C., 1940), p. 27; and A. B. Parsons, *The Porphyry Coppers in* 1956 (New York, 1957), p. 6.

The facilities at Bingham today include the giant openpit mine, two ore concentrators, a smelter, an electrolytic refinery, and a 175,000-kilowatt steam electric generating plant. When John D. Rockefeller visited these facilities (then without the refinery and power plant) before World War I, and 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." 2 These sentiments have been repeated by literally millions of visitors from all over the world as they too viewed the mammoth undertaking. Operations at the mine are a marvel of organization on an immense and efficient scale; here many world records have been established. During World War II, when more than one-third of all the copper used by the nation and its allies came from this mine, more than 108,000 tons of ore were milled in a single day, and 320,000 tons of copper were produced in one year (1943). In addition, the concentrators and smelter are or have been the largest facilities of their type in the world.

The Bingham Mine has particular significance in the history of mining, not only because of its colossal size, but because it was here that the opencut mining of copper was first introduced and perfected. As the mountain of "worthless" low-grade ore was transformed into the world's largest opencut copper mine, the traditional hand-drilling and hand-picking of highly-selected first class ores gave way to mass production utilizing mechanical methods of handling large volumes of ores and overburden. A profusion of new techniques and equipment appeared on the scene – new techniques of gravity concentration and the development of the flotation process of dressing ore. For it was at Bingham that mining engineers perfected the technique of mass production of minerals - a technological breakthrough which bears resemblance in basic importance to the development of the factory system in industry. It was now commercially possible to exploit low-grade ores which previously had been considered uneconomic. Thus, the initiation of "nonselective mining" at Bingham prompted the emergence of a great new and spectacular national industry, and established a pat-

² Harvey O'Connor, The Guggenheims: The Making of an American Dynasty (New York, 1937), p. 290.

tern which came to dominate American mining. From less than 2 percent of world production of copper in 1907, opencut mining grew to more than 40 percent of the world total by 1940. This was more than 80 percent of the total in the Free World.³

It is no more than just that the individuals and companies which pioneered this technological breakthrough should be given more attention. "Colonel" Enos A. Wall, Samuel Newhouse, Daniel C. Jackling, and the Guggenheim family — the Boston Consolidated Mining Company, Utah Copper Company, and Kennecott Copper Corporation — these men and companies were also pioneers — industrial pioneers and Western pioneers.

Porphyry copper mining, as originated at Bingham, derived 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" (i.e., nonselectively) than by the selective methods used in the so-called "vein" or "bed" mines. In such mines the amount of copper will typically assay less than 2.0 percent and will usually range well below 1.0 percent. Early in the twentieth century it was profitable to work ore bodies so long as the yield of copper was at least 0.8 percent; i.e., 16 pounds of copper per ton. Through increased efficiency and the constant improvement of equipment and processes it has been reduced steadily. Today, ore containing as little as 8 pounds of copper per ton -i.e., 0.4 percent is shipped to the mills for processing.4 Moreover, the new methods "decreased the cost of producing copper, notwithstanding the low metal content of the porphyry ores," and reduced substantially the labor required per pound of copper produced.⁵ There resulted a

³ Compare Harold U. Faulkner, The Decline of Laissez Faire, 1897-1917, Vol. VII, The Economic History of the United States (New York, 1951), pp. 151-152; Harold Barger and Sam H. Schurr, The Mining Industries, 1899-1939 (New York, 1944), p. 109; Erich W. Zimmermann, World Resources and Industries (New York, 1933), p. 670.

⁴Parsons, The Porphyry Coppers in 1956, p. 12; Kennecott Copper Corporation, The Utah Copper Story (Salt Lake City, 1957), p. 15.

⁵ Technology, Employment, and Output Per Man in Copper Mining, p. 22.

rapid rise in the productivity of labor, permitting the payment of higher wages.

The story of the Bingham Copper Mine may be told in terms of four periods or stages of development: (1) The Pioneer Era, 1848-1886, during which the rich surface ores of Bingham were discovered, mined, milled, and shipped to distant centers for refining and marketing. (2) The Promotional Era, 1887-1902, involving particularly the activities of "Colonel" Enos A. Wall and Samuel Newhouse in acquiring, developing, and marketing the moderately rich and lowgrade sulphide and porphyry ores at Bingham. (3) The Formative Years, 1903-1910, during which new equipment and processes were developed and tested and a successful porphyry copper mining industry established. There was experimentation, trial and error, and companies competing for capital, engineers, and publicity. Above all, this key period featured the formation of the fabulous Utah Copper Company, which built the first concentrator for porphyry copper and shared with the Boston Consolidated Mining Company the honor of pioneering in the use of steam shovels. The period ended with the absorption of Boston Consolidated by Utah Copper. (4) The Period of Growth and Expansion, 1911-to-date, in which the Guggenheims provided the financial wherewithal for the world-wide operations of an expanding Utah Copper and subsequently its parent, the Kennecott Copper Corporation - largest producer of copper in the world. Utah Copper was transformed from a developmental local enterprise into a corporate enterprise of vast magnificence. As with the transition from Andrew Carnegie to U.S. Steel, and from John D. Rockefeller to Standard Oil, Utah Copper changed from a fief presided over by a local "captain of industry" to a giant business with far-flung connections and interests. The Guggenheims directed the over-all policies in a colossal concern that included smelting, refining, and selling on a world market, while the determined Jackling and his resourceful friends managed day-to-day production affairs in Utah.

This monograph is organized around these four phases or stages in the history of Bingham Copper. Although the events and personalities in each of these four periods will be discussed, the central focus is on the crucial third stage when Utah's great industry was successfully launched.

PIONEER UNDERTAKINGS

Two early Mormon pioneers, Thomas and Sanford Bingham, were the first to use Bingham Canyon, and it is to them that the Canyon owes its name. They were ranchers who grazed cattle upon the hillsides. The Binghams apparently found outcroppings of ore amidst the grass, but, lacking facilities for smelting and refining ore, Brigham Young told the Binghams to disregard their discovery. The brothers later moved to Weber County, where they were pioneer settlers of Ogden.

In 1860, a "find" of copper ore in or near Bingham Canyon was reported to the Mormon newspaper, the *Descret News*. The editors commented that "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." A similar "indication" was reported in 1862.8

Bingham ore deposits were again "discovered" a year later by some Mormon "boys" who were dragging logs for Army troops occupying the territory during the Civil War. The ore was taken to the troop commander, Colonel Patrick E. Connor, who had it assayed and directed the recording of the claim and the formation of the "West Mountain Mining District." The ostensible purpose of the location of troops in Utah was the protection of the Overland Mail and Overland Telegraph, but the belligerent Connor was angered at the independent spirit of Utah's pioneer residents and managed to convince himself that the Mormons were "disloyal and traitorous to the core." The solution to "the Mormon question," he stated, lay in attracting to Utah a rush of miners who would swarm over the territory and "overwhelm the Mormons by mere force of

⁶ George M. Addy, "The Economic and Social History of the Bingham Canyon, Utah" (Master's Thesis, Brigham Young University, 1949), pp. 10-13. Also, Salt Lake Tribune, March 19, 1948; Vernon H. Jensen, Heritage of Conflict: Labor Relations in the Nonferrous Metals Industry up to 1930 (Ithaca, 1950), pp. 256-257.

Desert News (Salt Lake City), May 9, 1860.

⁸ Kate B. Carter, ed., *Treasures of Pioneer History* (6 vols.; Salt Lake City, 1952), I, 164.

numbers . . . without the loss of a single soldier in conflict." 9

Upon the discovery of argentiferous galena in Bingham Canyon, therefore, Connor encouraged his Volunteers, many of them veterans of the gold fields in California and Nevada, to prospect. On Army time, with Army tools and equipment, tunnels were dug and ore removed. A newspaper, The Union Vedette, was founded to relay word to the nation of each new discovery and opportunity. In the spring of 1864 several companies of Volunteers were officially ordered to prospect in various promising locations in the territory. Numerous outcroppings of copper and other nonferrous metals were located in Bingham Canyon and elsewhere, but none of these was worked extensively or successfully because of the lack of transportation and difficulties in smelting. 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, Weber County, by the Walker Brothers (pioneer Utah bankers and miners) and shipped to Baltimore. A second shipment containing 10 tons of copper ore taken from a Bingham mine was shipped out of the territory in July 1869 by the Salt Lake City operators of a small smelter, the Woodhull brothers. These were from "small veins in quartzite, . . . containing azurite and malachite at the surface, and sulphides of copper and iron at the water line." 10

After the completion of the transcontinental railroad in 1869, and the construction of a branch line to Bingham Canyon (the Bingham and Camp Floyd Railroad) in 1873, there was a ten-year burst of silver and lead mining in the Canyon. Several million dollars worth of lead-silver ore was smelted at a Bingham smelter, at Salt Lake Valley smelters, or at smelters in San Francisco, Baltimore, or Wales. Some copper was produced as a by-product of these efforts, but the low-grade copper-bearing ores were not as

⁹ The phrases are from official Connor communications found in *The War* of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies, Series I, Vol. L, Part II (Washington, D.C., 1897), pp. 492-495, 527-531, 655-657.

¹⁰ D. B. Huntley "The Mining Industries of Utah," in S. F. Emmons and G. F. Becker, Statistics and Technology of the Precious Metals (Washington, D.C., 188), pp. 457-458. Also Hubert Howe Bancroft, History of Utah, 1840-1886 (San Francisco, 1889), p. 741; B. S. Butler, et al., The Ore Deposits of Utah (Washington, D.C., 1920), pp. 403-406, 489, 596; Edward L. Sloan, ed., Gazetteer of Utah and Salt Lake City Directory (Salt Lake City, 1874), p. 135.

easily smelted as Bingham's lead-silver ores. During the heydays of Utah's silver fever of the 1870's and early 1880's, the production of copper never exceeded a million pounds a year. The rich finds of copper that have dominated Utah's minerals industry in the past seventy-five years were not discovered and worked until the 1890's.

CHAPTER 2

THE BIRTH OF AN INDUSTRY (1887-1902)

THE WALL PROPERTIES

The first person to come to a realization of the possibilities opened up by the vast store of low-grade copper deposits at Bingham was "Colonel" Enos A. Wall. Of North Carolina parentage and reared in Indiana, "Colonel" Wall — his military title was conferred upon him by his friends — began his mining career in Colorado in 1860, and continued prospecting in Montana in 1863. Utah was a principal supplier of the Montana mines, and, in addition to prospecting, the Colonel began in 1868 fourteen years of freighting and trading between the two territories. During most of this period he lived in Salt Lake City. In the early 1880's Wall was a chief stockholder and superintendent of the Wood River Gold and Silver Mining Company, of Bullion, Idaho. Active in politics, he was elected to the Idaho territorial legislature and even served as president of the upper house. In 1885, he returned to Utah and engaged in mining at Mercur and elsewhere.

Colonel Wall first visited the Bingham Mining District in July, 1887, and his attention was drawn immediately to the 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. Wall examined the ridge of rock and sampled the ore in an abandoned tunnel, which assayed an average of 2.4 percent copper. Upon inquiring at the Recorder's Office, Wall found that a large part of the ground surrounding the exposure of mineral had been abandoned and was therefore subject to relocation. He staked two claims, naming them "Dick Mackintosh" and "Charles Read," after two of his local friends. Later, he located a third claim, the "Frank Cushing." Keeping his hopes to himself, he investigated the titles of all of the claims adjacent to these locations. He located

¹ T. A. Rickard, A History of American Mining (New York, 1932), p. 191.

some new claims and acquired others by purchase. By 1900, the spirited Colonel owned all or part of nineteen claims covering an area of 200 acres. He recognized the marginal nature of the property and even agreed to allow the local road supervisor to use the dumps on his property for road-making. Local residents disparag-

ingly referred to his claims as "Wall-rock." 2

Although he lacked sufficient money for systematic development of the property, Wall was able to keep up the assessment work and finance some 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." He also purchased a small 5-stamp mill (the "Rogers" mill) below the mine in order 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 engaged during the preceding decade. (Among other things he had sold the Brickyard Mine at Mercur, in 1894, to Captain Joseph R. De Lamar — about whom more later — for \$60,000).4

THE EXPLOITATION OF BINGHAM COPPER SULPHIDES

Meanwhile, the scene shifts from Wall's attempts to promote and develop his valuable but low-grade properties, to which we shall return in Chapter 3, to Samuel Newhouse and his more effective promotion and development of neighboring copper properties. It was Newhouse who gave publicity to Utah copper mining, enlisted the support of Eastern and British capital, and was among the first to have a vision of successful openpit mining.

Born in New York City, son of Russian-Jewish immigrants who came to the United States in 1829, Samuel Newhouse became a lawyer and practiced in Scranton and Philadelphia, Pennsylvania. Lured to the West by the prospect of adventure and opportunity, he was active in the freighting business around Leadville, Colorado, until 1886, when he sold his business and turned to mining. He was

² T. A. Rickard, The Utah Copper Enterprise (San Francisco, 1919),

p.17.,

³ A. B. Parsons, *The Porphyry Coppers* (New York, 1933), p. 50.

⁴ Salt Lake Tribune, December 13, 1901.

successful in mining and became the owner of the "Wheel of Fortune" and other mines. This made it possible for him to move to Denver, where he became a speculator and promoter. In that capacity he entered British financial circles and became widely known. Newhouse came to Utah in the 1890's because of the more tolerant attitude toward persons of Jewish ancestry, and because of the opportunity which Utah mining offered a man with his talents.⁵

Newhouse's first business experience in Utah involved the initiation and promotion of Bingham copper sulphide properties.⁶ This activity, because of its technical and economic success, had special relevance to the development of Bingham porphyries. Even more to the point, the extraction of copper sulphides was a surprise byproduct of the search for paying quantities of gold.

It was in 1896 that Newhouse and Thomas Weir, an earlier associate in Leadville, saw an opportunity in gold mining, and purchased Bingham's Highland Boy Mine — a mine which had been located in 1873 and only partially exploited after that date. The partners formed the Highland Boy Gold Mining Company, and started work on a cyanide mill to process the gold ore which they planned to mine. An attempt to interest English capital was successful, and there was formed the Utah Consolidated Gold Mines, Ltd., with a nominal capital stock of £300,000.

In the process of exploratory work at the Highland Boy, however, the miners "accidentally" discovered several ore channels carrying considerable quantities of copper. Further exploration confirmed the extent of the copper deposits, and Newhouse and Weir soon decided to erect a copper smelter to reduce the ore from their mine. Thus, on September 30, 1898, a contract was let for the construction of a "modern copper smeltery," to have a daily capacity of 250 tons of ore. Completed and placed in operation on May 23,

⁵ Noble Warrum, *History of Utah Since Statehood* (3 vols.; Chicago-Salt Lake City, 1920), III, 733-734; Harvey O'Connor, *The Guggenheims: The Making of an American Dynasty* (New York, 1937), p. 279.

⁶ Ores on the surface of the ground are referred to as oxide or carbonate ores. Because they are already partly decomposed by the atmosphere and weathering, the smelting of these ores is usually a relatively simple process. Farther underground, ore are under the water level, and are usually impregnated with solutions of sulphur — thus, the term sulphide ores or sulphurets. Smelting these ores is a more involved chemical and metallurgical process.

1899, this was the first smelter erected in Utah primarily for the reduction of copper ores. With massive quantities of moderately rich and low-grade ores, the Highland Boy Mine became the largest sulphide copper producer in Utah and one of the largest in the West.

The widely-publicized success achieved by Newhouse and Weir in developing the Highland Boy into a profitable copper mining and smelting venture soon brought their enterprise under the covetous eye of a "Standard Oil Company syndicate," headed by William Rockefeller (brother of John D.) and Henry H. Rogers (associate of John D. in Standard Oil). In May 1899, the "Standard Oil crowd," as it was called, purchased control of the Utah Consolidated Gold Mines, Ltd. from Newhouse and Weir, for a reported \$12,000,000. A new corporation, the Utah Consolidated Mining Company, resulted.⁸

The success of the Utah Consolidated venture stimulated the formation of numerous additional mining companies to exploit the sulphide coppers of Bingham. Among the more important were the Bingham Consolidated Mining and Smelting Company and the United States Mining Company (later, the United States Smelting, Refining, and Mining Company). In addition to Utah Consolidated, these two concerns built large smelters, as did the American Smelting and Refining Company, which entered the Utah smelting scene in April 1899 and soon became the dominant nonferrous smelting firm in the state.⁹

By the early summer of 1904, Salt Lake Valley was the home of three large copper smelters, all located between Murray and Midvale, south of Salt Lake City. There was also the lead smelter at Murray of the American Smelting and Refining Company. This was not to be a permanent condition, however, for the farmers living on lands adjacent to the smelters suffered extensive crop damage from the sulphur dioxide gas emitted from the smelter smokestacks. After

⁷ Engineering and Mining Journal (hereafter referred to as EMJ), 67 (July 9, 1898), 48; 67 (October 8, 1898), 528; The Mineral Industry, Its Statistics, Technology and Trade: Calendar Year 1900 (New York, 1901) (hereafter referred to as Mineral Industry, with the year), p. 165.

⁸ Salt Lake Tribune, March 4, May 7, 1899.

⁹ Isaac F. Marcosson, Metal Magic: The Story of the American Smelting and Refining Company (New York, 1949), pp. 57-69; Salt Lake Tribune, January 1, 1899.

a series of farmers' meetings in the fall and winter of 1904-1905, a suit was filed in the United States District Court of Utah. A lengthy trial resulted in a verdict against the four smelter companies which perpetually enjoined them "from the future roasting or smelting of sulphide ores carrying over 10 per centum of sulphur," at their locations "so as to discharge said sulphur into the atmosphere in the form of gas or acid, or from further discharging into the atmosphere of arsenic in any form." The smelter smoke suits resulted in the closure or removal of all of the copper smelting plants from the Salt Lake Valley, and heralded the end of Utah's sulphide copper mining and smelting boom.

THE BOSTON CONSOLIDATED MINING COMPANY

Successful in working and placing his sulphide properties, Newhouse began casting about in 1898 for additional mining property in Bingham Canyon. Again in association with the manager of the Highland Boy, Thomas Weir, Newhouse bought 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, which had previously been worked for gold. In all, they secured sixty-five claims, covering 350 acres, at a cost of \$300,000.¹¹

The newly-acquired property was potentially rich in copper, and possessed the mineral in two distinctly different ores, sulphide and porphyry. Newhouse employed thirty men and directed exploratory work in an attempt to find a copper lode which miners had seen many years before. After the driving of several tunnels, a rich sulphide ore shoot was exposed to vièw.¹²

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 previous success fresh on their minds, Newhouse was able to interest many of the same individuals who had participated in the organization of the Utah Consolidated Gold

¹⁰ Desert News (Salt Lake City), February 8, 1905, November 5, 14, 15, 1906

¹¹ J. M. Boutwell, Economic Geology of the Bingham Mining District, Utah (Washington, D.C., 1905), p. 281; Salt Lake Tribune, November 12, 1898.

¹² *Ibid.*, January 1, 1897, January 1, 1898, January 1, 1899.

Mines, Ltd., in joining him in the new venture. Together they organized, on May 14, 1898, the Boston Consolidated Copper and Gold Mining Co., Ltd. 13 The company was named for "the mother city of copper speculation," and bore a "synonym for the celebrated Amalgamated Copper." 14 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 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 the British company included John E. Dudley Ryder, chairman; Samuel Newhouse, managing director; and Charles S. Henry, M. I. Newhouse (no relation), Frank A. Schirmer, Eugene Meyer, Jr., and Captain Stephen H. Pollen, directors. Samuel Newhouse was president of the American corporation, and was ably assisted by several others who were to become famous in the copper industry — Frank Schirmer, vice president; Lafayette Hanchett, general manager; and Louis S. Cates, general superintendent. ¹⁵

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 in the Bingham properties. According to the report prepared by Thomas Weir and distributed in London by Newhouse, 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." Weir assumed the dimensions of the ore body to be 2,000 feet long, 3,500 feet wide, 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." 16

¹⁴ O'Connor, The Guggenheims, p. 279.

¹³ Horace J. Stevens, ed., The Copper Handbook (Houghton, Michigan: 1903-1931), 1909, p. 396.

The Copper Handbook, 1903, p. 212; 1906, p. 268; 1909, p. 396.
 EMJ, 68 (May 27, 1899), 615. History has borne out the conservatism of Weir's report. Over 1,000,000,000 tons of ore have been mined to date, and the mine still has many years of active life remaining.

Though in retrospect very conservative, these claims seemed fantastic, and Newhouse's enthusiastic assurances brought forth sharp criticism from the astute London Financial Times and the American Engineering and Mining Journal. The latter stated: "judging by the company's [Boston Consolidated] own showing, there appears to be no doubt as to the worthlessness of the proposition." Even should Weir's doubtful estimates be accepted, the editors said, "It would be impossible to mine and treat ores carrying 2 per cent. or less of copper at a profit " In the Montana mines, the editors added, ores of 4 per cent and up had been treated, but "the profits came chiefly from the gold and silver in the ores" The Boston Consolidated mineral, however, had no more than "very small values in gold and silver " The editorial concluded, "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."17

The issue of the worth of the Boston Consolidated porphyries continued to rage in the following weeks. Heated replies were made by Thomas Weir; and by Hartwig A. Cohen and Victor M. Clement, both of whom had been consulting engineers in the employ of Joseph R De Lamar (who held options on the neighboring Wall copper properties), and were seeking to demonstrate their worth. To these letters the editors replied:

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.¹⁸

While the discussion waxed and waned, Newhouse and Weir resolutely proceeded with the development of the Bingham properties. By 1900, the sulphide mine was almost on a paying basis, and the porphyry ore was being subjected to "elaborate tests." "A

¹⁷ Ibid.

¹⁸ Ibid., 69 (July 8, 1899), 36.

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." ¹⁹

Meanwhile, however, the price of copper dropped from 17 cents to 13 cents a pound, presumably as the result of the "bursting of the bubble" generated by the manipulation of copper in the United States by the Amalgamated Copper Company. While Newhouse and his associates found it necessary to slow down the development of their porphyry mine, they persisted in development work at the sulphide mine 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, and a little excess in iron. Some thought was given to the feasibility of erecting a smelter, but this project was abandoned when the company was able to make a "very favorable contract" with the neighboring Bingham Consolidated Copper Company. Of two-years' duration, the contract called for the shipment of 200 tons of ore per day, carrying not less than 3 percent copper.20

At a stockholders' meeting held at the close of 1903, Boston Consolidated officials reported that 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. Indeed, competent mining engineers had indicated the presence of 495,000,000 tons of porphyry ore, containing silver and gold as well as copper. Plans were announced for the construction of a copper concentrator, to be financed from the profits earned on the ore being shipped from the sulphide mine. The latter proved to be substantial; the company earned a net profit of \$127,245 in 1903-1904, and voted in September 1904 to increase the capital stock by 125,000 shares at \$1 par, and to issue £250,000 of 6-percent convertible bonds for the purpose of constructing a concentrating plant of 2,500 tons daily capacity.²¹

19 Deseret News, December 15, 1900.

²¹ Ibid., 1904, p. 238; Salt Lake Tribune, January 3, 1904.

²⁰ Mineral Resources of the United States (Washington, D.C., 1883-1934) (hereafter cited as Mineral Resources, with the year), 1901, pp. 161-173; 1903, p. 216; Parsons, The Porphyry Coppers, p. 78.

It was not until March 1905, however — almost a year after Utah Copper's experimental Copperton mill had proved successful — that Boston Consolidated began to develop the disseminated porphyry ore deposit on its Bingham property. Thirteen tunnels were driven during that year, with nearly two 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.²²

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 smelting contract during that year, the company entered into a new contract with American Smelting and Refining Company, which then had under construction at Garfield a huge new smelter, to deliver 75 tons of sulphide ore daily. Newhouse also announced that Boston Consolidated intended to construct its own 3,000-ton concentrator on 910 acres of ground near ASARCO's Garfield plant, to cost \$1,125,000. Even a 2,500-ton concentrating plant, said Newhouse, yielded a recovery of 70 percent, and with a copper content of 1.4 percent in the ores, would net the company \$2.72 per ton of crude ore. With copper at 12 cents a pound the company could make a profit of 94 cents per ton.²³

The actual construction of the Boston Consolidated mill got under way in 1906, and was completed the following year at a cost of \$1,468,902.²⁴ The work of stripping the overburden at the mine, by now recognized to be one of the largest copper properties in the world, was also initiated in 1906. The first steam shovel at Bingham was placed in operation by the company on June 24, 1906. (This was nearly two months before steam shovels were used by the rival Utah Copper Company, which is usually given the credit for pioneering the new method.) This shovel was augmented in October 1906 by a 90-ton Marion shovel, and two additional ones in Feb-

²² The Mineral Industry, 1905, p. 137.

²³ Mineral Resources, 1905, p. 354; EMJ, 81 (March 31, 1906), 630-631; The Copper Handbook, 1909, p. 396.

ruary and March 1907. Total cost of the four shovels amounted to \$72,981. By the end of 1906 these shovels had stripped more than 2,000,000 tons of capping from the mountainside. Credit for the inauguration of the extensive system of steam-shovel mining at Bingham is due Manager Lafayette Hanchett and Superintendent Louis S. Cates.²⁵

FINANCIAL DIFFICULTIES

At this stage of technological success, however, occurred the Panic of 1907, which brought on serious problems of finance. Copper was not selling, and obligations were coming due. Two of the American directors, Newhouse and Frank Shirmer, placed their personal endorsement on the company's (Boston Consolidated) paper, and by risking their personal fortunes managed to save the company

from bankruptcy.26

The status of the company's financial health was not helped by the news that the ore beneath the capping at the porphyry mine was not rich enough to warrant shipment to the company mill. While these difficulties were weathered successfully, and a fourth section of the mill was placed in operation increasing its capacity to 1,000 tons per day, shovels at the mine began running into ore with a high percentage of iron. This prevented the concentration necessary for economical operations, and forced discontinuance of shipments of this ore to the mill. The ore for the mills would have to come from tunnels lower down the mountain. This underground

²⁴ The Mineral Industry, 1907, p. 296. After the merger of Boston Consolidated and Utah Copper in 1910, this mill became the Arthur mill of the Utah Copper Company.

²⁵ Mineral Resources, 1906, p. 405; 1907, p. 458; The Mineral Industry, 1907, p. 296; Salt Lake 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. Salt Lake Tribune, August

²⁸ Ibid., February 29, 1908; The Copper Handbook, 1909, p. 396. Specifically, Newhouse and Schirmer personally endorsed 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.

mining raised the cost of extracting porphyry ore by 50 cents per ton.27

By the end of October 1908, the mine was shipping 1,600 tons of ore a day to the mill, practically all of the ore coming from underground mining. The efficiency of the mill had been raised to 72 percent, which at the time was well above that of the competing Utah Copper mill at Magna (which is discussed in Chapter 3). Nevertheless, many problems remained to be solved before the company could resume opencut operations. When General Superintendent Louis S. Cates was interviewed by a Boston newspaper late in 1908 he replied that "the rocky cliffs of Bingham are not adapted to profitable removal by steam shovel." The ever-present Colonel Wall added that it would probably require another million dollars to secure the removal of sufficient waste to allow mining by steam shovels, and this would have to be added to the \$540,000 which had already been spent for the removal of capping and the \$500,000 for equipment.28

To create a better public image of the company, Boston Consolidated's American board of directors decided, on December 7, 1908, to place the active management in the hands of an executive committee. Lafayette Hanchett, the general manager of both the Boston Consolidated and the Newhouse Mines and Smelters (a small Newhouse-controlled copper company operating in the San Francisco Mountains, Beaver County, Utah), was relieved of this latter position to enable him to spend more time at Bingham. The board also hired Sidney Jennings of Salt Lake City, formerly with the United States Smelting, Refining, and Mining Company, as a consulting engineer. His job was to plan and direct the development of extensive underground operations at the porphyry mine. Under this direction the company was able to sell 50,000 additional shares of stock at \$11 in order to raise money for additional removal of overburden.29

While Boston Consolidated continued to be a disappointment to many stockholders, ten of the thirteen sections at its Garfield mill were in operation by April 1909. Output for that month was esti-

²⁷ Salt Lake Tribune, March 29, October 25, 1908; Mineral Resources, 1908, Part I, p. 564.

²⁸ Salt Lake Tribune, November 26, 1908. ²⁹ *Ibid.*, December 2, 8, 1908, April 8, 1909.

mated at 1,750,000 pounds of copper. In May it was announced that the company was earning \$25,000 to \$35,000 per month, and the mill was now operating at a capacity of 2,750 tons of ore per day.³⁰

It was at this point that rumors began to circulate of an imminent merger of Boston Consolidated with the Utah Copper Company. The latter company, the story of which is reserved to Chapter 3, had been organized in 1903 under the laws of the State of Colorado. Principal owners were Charles M. MacNeill and Spencer Penrose, both Colorado mining capitalists, who had been induced by Daniel C. Jackling, an aggressive young metallurgical engineer, to purchase the Bingham copper claims of Colonel Wall. After successful experimentation with a small concentrating mill working on underground ores, the group was able to enlist the financial support of the Guggenheims, and constructed a 6,000-ton concentrating mill at Magna, Utah, and a large smelter at Garfield. Upon the completion of these facilities in 1906 — they represented the largest copperreducing facilities in the world — Utah Copper initiated opencut mining operations at its Bingham porphyry mines.

The Utah Copper porphyries were contiguous to those of Boston Consolidated, with Boston Consolidated owning the top of the mountain, and Utah Copper the lower part of the hill. Negotiations had been initiated as early as 1905 by the Guggenheims to bring about a merger of the two companies, but without success. While the detailed story of these negotiations is more appropriately told as a part of the history of Utah Copper, it would appear that Boston Consolidated was "ripe" for such a deal. For one thing, the financial (and some of the technical) problems of Boston Consolidated were still unresolved. For another, Newhouse was having difficulty with his other Utah copper property, the Newhouse Mines and Smelters, which was in need of a "reorganization" to keep it solvent. Finally, 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

³⁰ *Ibid.*, April 11, 1909.

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, he wrote, that Utah Copper was not seeking amalgamation, and therefore had no suggestion in the matter. The Boston Consolidated interests then reportedly asked if an exchange of shares could be arranged between the two companies, at a ratio of one share of Utah Copper for three shares of Boston Consolidated stock. At this point, the director stated, Utah Copper officials agreed to look over the Boston Consolidated propery if sufficient stockholders of the latter company would be willing to make the trade. There were to be no commissions of any kind; Utah Copper would "simply tender whatever number of shares were necessary to give one for three to each stockholder of the Boston Consolidated." 31

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.³²

By now it was apparent to veterans of the trade that Boston Consolidated was being softened for the takeover. Plagued by nu-

³¹ Salt Lake Tribune, August 26, 1909.

³² Ibid. A short time later, Colonel Wall published a strong accusation that Utah Copper was not really so different; its books had been juggled to pay dividends from "nonexistent profits." Mines and Methods, November 1909, p. 107.

merous difficulties and bad luck, the promising company became prey for the more astute and experienced syndicate which controlled Utah Copper. 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 absorb Boston Consolidated. Since Utah Copper backers were the better players in the game of "survival of the fittest," the end was near for Boston Consolidated. And yet, surprising as it may seem, Boston Consolidated was described in 1909 by The Copper Handbook in glowing terms: "the mine, by reason of almost incomprehensible tonnage of porphyry ores, is one

of the great possibilities " 33

Even though Boston Consolidated properties may have equalled those of Utah Copper in ultimate quantity and value of copper ore, the Newhouse enterprise was not in a position to bargain with strength. On January 26, 1901, Samuel Untermeyer, an adroit New York lawyer who was counsel for both companies, tied the knot which spelled the death knell of the Boston Consolidated Mining Company. Newhouse then turned his attention toward the development of urban real estate, and erected the Newhouse Hotel, Boston Building, and some 30 other important business structures in Salt Lake City. He also conceived and built the famous Flatiron Building in New York City. In the face of open ridicule by many who regarded the low-grade porphyries as submarginal, Newhouse had generated widespread public interest in one of the great discoveries of the mineral world fully three years before Daniel C. Jackling and his associates had taken over the "worthless rock" of Colonel Wall.³⁴

The Copper Handbook, 1909, p. 398.
 Horace Dunbar, "Glittering Sam," Salt Lake Tribune, March 11, 1951;
 Warrum, History of Utah Since Statehood, III, 733-734.

CHAPTER 3

THE FORMATION OF THE UTAH COPPER COMPANY (1903-1910)

INVESTIGATIONS OF BINGHAM PORPHYRIES

At the same time that Newhouse was acquiring the Stewart claims and other porphyries in Bingham Canyon, Colonel Wall was continuing to promote the development of his — at that time — mirth-provoking "Wall Rock." In his attempt to gain financial backing for the development of these low-grade properties, Wall approached several prominent mining men. Among these was Captain Joseph R. De Lamar, owner of extensive gold and other mining properties at Mercur and elsewhere in Utah. As with others connected with the early history of the Bingham Mine, Captain De Lamar was a remarkable man with an unusual career. Born in Amsterdam, he had been a diver, and later commanded cargoships between New York City and Bermuda. Often a "plunger" in mining ventures, he had invested in mines in southern Colorado, near Lake Nipissing, Ontario, and at Silver City, Idaho.

As early as 1895, De Lamar had 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 hand tests, by panning, and rendered a favorable opinion of the property. De Lamar therefore obtained from Wall a six-months' option on three-quarters of the property for \$375,000. A test was then made on 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

¹ T. A. Rickard, A History of American Mining (New York, 1932), p. 193; Merrill D. Beal and Merle W. Wells, History of Idaho (3 vols.; New York, 1959), I, 575.

2 percent ore.² 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% cents in the three-month period. De Lamar dropped his option on the property.

With the rise in the price of copper to 12½ cents in the summer of 1898, De Lamar was sufficiently encouraged to ask for a new option in order 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 (a gold recovery mill) at Mercur, Robert C. Gemmell, to make a preliminary sampling of the ore. Some tests were made at a small stamp mill (Rogers mill) by Daniel C. Jackling. Jackling, who will figure more importantly as our story develops, was a young metallurgical engineer working in De Lamar's Golden Gate mill in Mercur. The results of the tests were highly satisfactory, and De Lamar 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 undertake 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."8

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 taken by 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.

² Parsons says that the Cohen report was based on an estimate of probable ore amounting to 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." A. B. Parsons, *The Porphyry Coppers* (New York, 1932), p. 52.

³ T. A. Rickard, The Utah Copper Enterprise (San Francisco, 1919), p. 18.

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.⁴

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 [gold] mines on Douglas Island, Alaska, and those that might be expected at Wall's property." In reply to Clement's letter, dated February 28, 1899, De Lamar expressed his own doubts:

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.⁶

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 [southwest of Salt Lake City] for concentrating, and remarked, 'the character of the ore offers exceptional facilities for cheap mining, either by quarrying or

⁴ Ibid.

⁵ Ibid.

⁶ Parsons, The Porphyry Coppers, pp. 51-52.

by caving." 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 \$250,000.8 "His recommendation was to proceed promptly with mine development and concentrating tests as a basis for forming a more mature opinion." 9 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." 10

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 property) was equipped with a 5-stamp battery and other appropriate equipment.11

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.

8 Rickard says the second quarter was for \$250,000 and the third quarter

for \$1,250,000. Rickard, The Utah Copper Enterprise, p. 18.

⁷ Ibid., 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." John Hays Hammond, The Autobiography of John Hays Hammond (2 vols.; New York, 1935), II, 516.

⁹ Parsons, The Porphyry Coppers, p. 52. 10 Rickard, The Utah Copper Enterprise, p. 18. Parsons has pointed out that since Clement's contract with De Lamar called for the receipt of oneeighth 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. Parsons, The Porphyry Coppers, pp. 52-53.

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." ¹² 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." 13

Incorporating Clement's earlier suggestion, the report 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 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." ¹⁴ 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. Furthermore, "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," was attributed to the Captain. 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. 15

Clement went to Mexico in 1901, but maintained his interest

¹¹ 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 the latter was in DeLamar'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. Rickard, *The Utah Copper Enterprise*, pp. 18-26.

Parsons, The Porphyry Coppers, p. 53.
 Rickard, The Utah Copper Enterprise, p. 18.

Parsons, The Porphyry Coppers, pp. 53-54.
 Rickard, The Utah Copper Enterprise, p. 26.

in the Wall property. He wrote to Wall occasionally, suggesting on one occasion that he might persuade Volney Williamson of Spokane, Washington, 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." ¹⁶

In 1902, Clement suggested to John Hays Hammond that if Hammond could secure De Lamar's quarter holding and interest capitalists 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." ¹⁷

Clement returned 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 D. C. Jackling had been able to close a deal with Wall on behalf of the MacNeill-Penrose group (a group of Colorado capitalists).¹⁸

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, had attempted to interest others in the Wall property. One such person was Benjamin Guggenheim, to whose attention he had called his own report which had stated that the mine showed 18 million tons of 1.6 percent copper ore, which could be concentrated at the ratio of 15 to 1. In 1902, a similar attempt was made to interest Charles A. Coffin, of the General Electric Company.¹⁹

¹⁶ Ibid.

¹⁷ Hammond, Autobiography, II, 516-517.

¹⁸ Ibid

¹⁹ Rickard, The Utah Copper Enterprise, p. 26.

Several additional attempts were made to dispose of the property during the period from 1900 to 1903. In 1901 the property was examined 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 these attempts proved unsuccessful; those approached were not sufficiently convinced that a large mass of 1½ 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.²⁰

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 State, 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 (brother of Boies Penrose, U.S. Senator from Pennsylvania), owners of a controlling interest in the United States Reduction and Refining Company, which operated two mills near Colorado Springs. 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.

Born near Appleton City, Missouri, and orphaned at the age of two, Jackling had spent his boyhood years on Missouri farms going from one relative to another. Upon enrolling at the Missouri State Normal School, 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. After a year of teaching and industrial labor in Missouri, Jackling went to Cripple Creek, Colorado, where he first met MacNeill and Penrose. Working as a miner, assayer, mill hand, and metallurgist in several mining camps, Jackling finally went to Mercur, Utah, which was then undergoing a gold craze. There he served as construction and metallurgical superintendent of the Golden Gate mill of Captain De Lamar.²¹

²⁰ Ibid.

²¹ Kennescope (Salt Lake City), August 1954, pp. 22-23.

Having started life as a poor orphan, it was impossible for Jackling to forget the Wall properties which he had investigated for De Lamar in 1899. Visualizing the mountain of porphyry as a likely means of obtaining fame and fortune, 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.

It happened that while Jackling was in Salt Lake City he was able to meet Hartwig Cohen, who was also in town on business. Jackling told Cohen 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 replied that he was willing to sell half of his holdings for \$400,000, provided certain conditions were met covering the equipment and development of the mine. Wall also demanded that a mill to treat 500 tons daily be built by the supposed New York buyers, and that they must also purchase De Lamar's quarter. The negotiations broke down until Cohen obtained the help of William S. McCornick, a Salt Lake banker, who helped Cohen persuade Wall to come to terms. 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, 1903.²² Wall expressed his willingness to join in the organization of a stock company to develop the property, retaining the right to nominate one member of the governing board.

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 \$125,000.²³ His deal with De Lamar successfully completed, and 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. He had, Jackling told MacNeill, "without any exception, the greatest opportunity in

²² Rickard, The Utah Copper Enterprise, p. 27.

the world and that he just had to get in on it." At first skeptical, MacNeill finally agreed to select an engineer to inspect the property. Upon the recommendation of Spencer Penrose's brother, R. A. F. Penrose, a distinguished professor of economic geology at the University of Chicago, F. H. Minard was dispatched to Utah. In the meantime, Cohen obtained a short extension on the option.²⁴

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." ²⁵ The average of all Minard's samples was 1.6 percent, and he estimated that workings disclosed 9,000,000 tons of such copper-bearing rock. ²⁶ In addition, Minard pointed out "certain physical difficulties" and questioned Jackling's estimates of cost. His principal objection was the shortage of water at Bingham for concentrating purposes. ²⁷ (Jackling proposed to handle this by building the concentrator at Garfield.) Minard's 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. ²⁸

FORMATION OF THE UTAH COPPER COMPANY

On June 1, 1903, MacNeill and Spencer and R. A. F. Penrose accompanied Jackling to Salt Lake City to inspect personally the property. They drove out to the mine and walked over the property, at the conclusion of which "Dick" Penrose told MacNeill that he thought they should go ahead. That evening Jackling gave a dinner at the Knutsford Hotel to commemorate the occasion. The dinner is said to have cost Jackling his last \$100.²⁹

²³ Ibid.

²⁴ Parsons, The Poryphyry Coppers, p. 68.

²⁵ Ibid.

²⁶ Rickard, A History of American Mining, pp. 196-97.

²⁷ Parsons, The Porphyry Coppers, p. 68.

²⁸ Rickard, The Utah Copper Enterprise, p. 28.

²⁹ Parsons, The Porphyry Coppers, pp. 68-69.

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

MacNeill and Penrose as bankers and promoters took 250,000 shares and they and their friends paid \$250,000 in cash for the others. Doubtless some of the promtional 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 \$5000 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.30

THE EXPERIMENTAL 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. A lease was acquired for the surface rights on twenty acres in lower Bingham Canyon ("Copperton") for a mill site, and for the right to dump tailings. Utah Copper paid a monthly rental of \$250 for these rights, which were to cease upon the abandonment of the mill.31 Purposes of the mill were: (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." 32

Most of the equipment for the mill came from the Sunnyside works of the United States Reduction and Refining Company in

32 Parsons, The Porphyry Coppers, p. 70.

³¹ L. F. Pett, "History of Utah Copper," in "Chronological History of Important Events in Mining" (unpublished MSS., Kennecott Copper Corporation,

Colorado. This second-hand equipment was skillfully installed by George O. Bradley and Frank G. Janney, both former employees of Captain De Lamar at Mercur. Bradley, a mechanical engineer, remained as consulting mechanical engineer until 1915; Janney, a skillful mechanic with a flair for "making machinery do what it was intended to do," served as manager of Utah Copper's mills until his death in 1916.³³ After 1905 their chief function was to determine the best machines to install in the larger mill at Magna. Construction of the Copperton mill was started in August 1903, and it 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 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. The equipment was powered by steam until 1906 when the company completed an electric plant at Magna.³⁴

The ore was delivered to the mill by the Copper Belt Railroad (purchased by the Denver and Rio Grande Western Railroad in 1905). The nine-mile line was operated with Shay-geared engines 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.³⁵ (Rio Grande later constructed a branch line, the "High Line," which eliminated some of the hazards of the steep grade, slow speed, and time-consuming switchback, and permitted the use of standard engines in hauling ores from the mines directly to the concentrating mills and smelters.) The concentrates from Copperton were at first smelted at the Bingham Consolidated plant at Midvale. After the construction of the Garfield smelter by ASARCO in 1906, all concentrates were shipped to Garfield.³⁶

³³ Ibid.

³⁴ "History of Milling to 1939" (unpublished MSS., Kennecott Copper Corporation, Salt Lake City, 1939), p. 9, 12 (mimeographed); Rickard, *The Utah Copper Enterprise*, p. 47.

³⁵ Ibid., pp. 9-12; L. H. Beeson, "The Copper Belt Railroad of Bingham," Salt Lake Mining Review, February 15, 1905, pp. 17-18.

³⁶ Salt Lake Tribune, April 7, 1907.

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 a larger mill at Magna (near Garfield), 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 beyond 1906 was the need to "show results" — to enhance the company's potential in view of rival claims by Boston Consolidated, and to aid in soliciting capital for development and expansion. The Copperton mill also served as a training school for those who would later operate the larger mill at Magna.³⁷

THE UTAH COPPER MINE

While work at the Copperton mill was getting under way, John McDonald, another of Jackling's associates at Mercur, 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. Since it was vitally important to get the operation under way in a hurry in order to enhance its promotional potential, the mine was prepared for underground stoping.³⁸ (A stope is an underground excavation for extracting ore in successive steps or ledges.) This ore was tumbled into chutes or shoveled into cars for delivery to outside bins. Work was begun on a 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 underway until July 1, 1904.³⁹

American Mining, p. 196.

39 Rickard, The Utah Copper Enterprise, p. 47; Parsons, The Porphyry Coppers, pp. 70-71; Souvenir of Bingham, 1909 (Salt Lake City, 1909).

^{37 &}quot;History of Milling to 1939," p. 9.
38 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

FINANCING EXPANSION: THE GUGGENHEIMS

Shortly after the completion of the Copperton mill, the company was reorganized. The new company was incorporated in New Jersey on April 29, 1904, with a nominal capitalization of \$4,500,000 in \$10 shares. One of the first actions after the reorganization was the issuance of \$750,000 in 7 percent bonds on July 1, 1904, to run for three years; these were convertible into stock at par.⁴⁰

Although the enterprise had been launched, it was readily apparent that a great deal more capital would be required to carry out the ambitious expansion program and to make it financially successful. Plans called for the erection of a 6,000-ton concentrator at Garfield and opencut mining operations at Bingham. To raise funds for these purposes, the promoters renewed their efforts 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 its raw material needs for the production of electric wire. In spite of the favorable report submitted by engineers who made an examination of the property for General Electric, the recommendation was rejected by a skeptical board of directors who "didn't believe the damn figures." ⁴¹ Recourse was next had to the Guggenheims.

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 Colorado, a refinery in New Jersey, and silver-lead mines and smelters in Mexico. During that year the Guggenheims decided to form a new organization to enhance the power and resources of the family's growing empire. In June 1899 the Guggenheim Exploration Company was formed to "prospect, ex-

⁴⁰ Rickard, The Utah Copper Enterprise, p. 28.

⁴¹ Ibid.

plore, improve, and develop mining properties in any part of the world." ⁴² Thus, the turn of the century found the Guggenheims firmly entrenched in nonferrous smelting and refining, and with a good foothold in mining.

Coincident 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 the latter enterprise, Henry H. Rogers, was one of the organizers of Amalgamated Copper Company and 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.

While Rogers and Lewisohn were able to put together the big combine without too much difficulty, it was something else to make it operate profitably. In spite of all their efforts to eliminate the top-heavy condition of ASARCO by forcing a wholesale shutdown of plants and property, financial difficulties continued to plague the company. Overtures were soon made by major 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 to advance an additional \$6,000,000 in cash — all this in exchange for \$45,200,000 of ASARCO stock, to be part of a total issue of \$100,000,000 of stock issued by the giant firm.⁴³

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

 ⁴² Isaac F. Marcosson, Metal Magic: The Story of the American Smelting and Refining Company (New York, 1949), p. 63.
 ⁴³ Ibid., pp. 1-69.

of mining properties an important aspect of company policy. Not only were additional lead smelting plants acquired, but copper

smelters as well, and nonferrous mines of all types.

Such a program of expansion, planned to cover a period of fifteen to twenty years, required enormous capital resources. After a study of the project 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 guaranteed by ASARCO, rather 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 pursue aggressively the expansion into the field of copper smelting.⁴⁴

THE GUGGENHEIMS UNDERWRITE UTAH COPPER

The initial efforts of the Utah Copper Company had not gone unnoticed in the halls of finance in New York. Early in the project's history, Bernard Baruch, a young Wall Street financier at the time, had been invited by MacNeill and Jackling to participate, and had bought a good many shares when the promoters were unable to interest the public in the project. The Guggenheims — friends of Baruch — who had been unsuccessfully approached several years earlier, but who were now interested in expanding into copper, were also watching the operations of the fledgling company. 45

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 Guggenheim's consulting engineer, should interest them in financing the Utah Copper Company's expansion program.

44 *Ibid.*, pp. 1-83.

⁴⁵ Baruch, My Own Story, I, 222.

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, that he had previously expressed 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." ⁴⁶

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.47

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." ⁴⁸ 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 sixteen junior engineers as assistants to Krumb, and seven months were required to complete the report. The group took about 3,500 assays, half the number used by Jackling and Gemmell, and these averaged just under 2 percent copper. ⁴⁹ The extensive examination by Krumb and his assistants cost \$150,000.

The Mudd-Beatty report, as it was called, was submitted to the Guggenheims in October 1905, and was favorable to the project.⁵⁰ Krumb estimated that the mine contained 40,000,000 tons of ore and

⁴⁷ Ibid.; Parsons, The Porphyry Coppers, pp. 72-73.

48 Parsons, The Porphyry Coppers, p. 73,

⁵⁰ Hammond, Autobiography, II, 517; Parsons, The Porphyry Coppers, p. 74.

⁴⁶ Hammond, Autobiography, p. 517.

⁴⁹ *Ibid.*, p. 74. The discrepancy was less than 0.002 percent of the Jackling-Gemmell report.

a fair possibility of twice that amount. The Guggenheims, having decided to "come in," used the more pessimistic phases of the report to drive a good bargain. The arrangements, which left them with a commanding position over the affairs of the Utah Copper Company,⁵¹ were as follows: (1) The Guggenheim Exploration Company underwrote a \$3,000,000 issue of 6 percent convertible bonds, and purchased 232,000 shares of Utah Copper stock at \$20 per share (the stock had originally sold for \$10 a share). (2) The American Smelting and Refining Company was awarded a long-term contract to smelt the concentrates produced under lucrative terms - \$6 per ton. Under the aegis of the American Smelters Securities Company, a subsidiary, Garfield Smelting Company, was organized to build the huge copper smelter. (In 1923 the American Smelters Securities Company was disincorporated, and the Garfield Smelter became the property of ASARCO.)⁵²

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 ended 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." 53 A short time later, Hammond was officially appointed managing director, a post which he held until the end of 1907 when 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. 54

⁵¹ Parsons, The Porphyry Coppers, p. 70; Baruch, My Own Story, I, 223. 52 Both Parsons and Marcosson state that the American Smelters Securities Company purchased the 232,000 shares of Utah Copper stock, instead of Guggenheim Exploration. But when Kennecott Copper Corporation was organized in 1915, the Guggenheim Exploration Company turned in 404,504 shares of Utah Copper stock, which would account for the \$3,000,000 convertible bond issue and the 232,000 shares of stock at \$20. Parsons, The Porphyry Coppers, p. 74; Marcosson, Metal Magic, pp. 88, 113.

53 Utah Copper Company, First Annual Report, June 30, 1905, p. 8.

⁵⁴ Hammond, Autobiography, II, 518-524.

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." ⁵⁵

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 [Copper] was to be paid for 95 per cent of the copper extracted from its ore, 90 per cent 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, 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. ⁵⁶

Although the Guggenheims held only a minority interest in Utah Copper at the time, "by virtue of the smelting contract they became in fact the directors of its destinies." ⁵⁷ 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.⁵⁸

⁵⁵ Parsons, *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 smelter 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."

⁵⁶ O'Connor, The Guggenheims, p. 280.

⁵⁷ Ibid., pp. 280-281.

⁵⁸ Parsons, *The Porphyry Coppers*, pp. 75-76. It was not until 1923, when Utah Copper came under the control of the Guggenheim-dominated Kennecott Copper Corporation, that several large Utah stockholders agreed to trade their stock for Kennecott stock and join the Kennecott board.

THE GARFIELD SMELTER

The fulfillment of the twenty-year contract which Utah Copper granted to ASARCO to smelt the concentrates produced by the latter's ores required the construction of 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 was the massive mountain of Bingham porphyry, it was obvious that the plant would itself have to be of elephantine proportions.

The smelter site was located at the mouth of Kessler Canyon, overlooking the Great Salt Lake Valley, about fifteen miles southwest of Calt Lake City, and a short distance from the lake itself. The site was selected by E. L. Newhouse (no relation of Samuel), 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." ⁵⁹

Construction of the smelter began in 1905, just a little over two years after the organization of Utah Copper. The first parts of the mammoth structure 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, who lived in tents near the site. 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 — builder and operator of the company town of Garfield near the smelter.⁶⁰

Since this was the first smelter ever constructed to operate primarily on porphyry concentrates, it required the introduction of new

⁵⁹ Marcosson, Metal Magic, pp. 107-108.

⁶⁰ Ibid., pp. 147-148. The Garfield Improvement Company 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, Annual Report, 1906.

processes and techniques to handle these successfully. Karl Eilers, who was sent from New York to direct the construction, was fortunate in being able to obtain from Anaconda Copper (Butte, Montana) the blueprints of the Washoe Reduction Works to use in the designing and building of the Garfield plant. The original plant consisted of two reverberatory furnaces, two blast furnaces, six acid-lined convertors, and eight 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 1930, natural gas was installed.) The smelter was specifically designed as a copper smelting and converting plant, and was equipped to handle 500 tons of concentrates daily. The reported initial cost was \$3,000,000.61

When the furnace was first fired up, on Labor Day 1906, the No. 1 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. In 1908 the capacity of the furnace was increased to 2,700 tons. 62

As might be expected of a revolutionary plant of this type, with new and unsolved metallurgical problems to cope with, many difficulties were encountered during the first few years of operation. One news report suggested that "much of the concentrates were finding their way to the surrounding hills, via the stack." ⁶³ The elaborate flue system, intraplant transportation system, belt-convertor installations, and other mechanical devices for handling materials also contributed to the complexity. Nevertheless, there need not have been great concern; the smelter was on a sound operating basis by 1910.

⁶¹ Parsons, The Porphyry Coppers, pp. 502-504; Salt Lake Tribune, August 8, 1908.

⁶² Descret News (Salt Lake City), August 28, 1950; Salt Lake Tribune, June 11, 1908.

⁶³ Salt Lake Tribune, August 8, 1908.

THE GARFIELD CONCENTRATOR (MAGNA MILL)

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. This would replace the temporary experimental mill at Copperton. Jackling was given the go-ahead to begin planning for the new mill, and the Guggenheims made arrangements for the capital. Daniel Guggenheim approached Bernard Baruch to discuss the issuance of a \$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.⁶⁴

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 — the home of numerous flocks of water fowl. Nearer the mountain were several ranchhouses. 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, Mormon pioneers had come from the surrounding region to obtain these stones. Later, when the sagecoach road to California passed nearby, the point became known as "Point of West Mountain." 65

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" 66 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 development

⁶⁴ Baruch, My Own Story, I, 224-225.

^{65 &}quot;History of Milling to 1939," pp. 16-17.

⁶⁶ Utah Copper Company, Annual Report, 1907, p. 5.

oped, produced about 12,500 gallons of water per minute, with constant pumping. 67

Another very important reason for the construction of the mill at Carfield 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 farming area below.68

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 opposition from Colonel Wall, added to delays in construction, the first 500-ton section was not ready for operation until June 1907. In the interim the 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 six units with a 3,000 ton total capacity were enlarged to provide for twelve sections totaling 6,000 tons. The construction of the last six were to be carried out after the first six were in operation. 69

The first ore was milled in the new plant in June 1907, and the

⁶⁷ 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, Annual Report, 1906 p. 6.

⁶⁸ The original tailings pond covered an area of 1,315 acres, or more than two square miles. The pond, into which was discharged from 95 to 97 percent of all tonnage milled, was also used by the neighboring Boston Consolidated for the disposal of tailings from its 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. 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 the percentage of solids in the tailing pulp. 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. "History of Milling to 1939," p. 120.

⁶⁹ Ibid., p. 18.

entire twelve 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 \$4,005,000.70

Power for the Magna mill was provided by the construction of an 8,500 kilowatt steam electric generating plant at Magna in 1906. Because of continuously expanding needs, in 1912 Utah Copper entered into a 25-year contract with Utah Power and Light for 27,000 horsepower of electricity, to be delivered over 44,000 volt lines to the Utah Copper Magna and Arthur mills.⁷¹ (The Arthur mill was the name given to Boston Consolidated's Garfield concentrator after the 1910 merger of Utah Copper and Boston Consolidated. Shortly thereafter, the Magna steam generating plant was shut down and later dismantled.

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 Institute of Technology came to Salt Lake City 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.⁷²

⁷⁰ Ibid.; Parsons, The Porphyry Coppers, p. 76. 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.

⁷¹ Kennescope, August 1954, p. 12; "History of Milling to 1939," p. 126; Utah Copper Company, Annual Report, 1912, p. 15.

⁷² Salt Lake Tribune, August 8, 1908.

THE INAUGURATION OF OPENCUT MINING AT BINGHAM

As mentioned previously, Utah Copper at first followed the "caving system" of mining; until June 1907, all the ores extracted were derived from development work done under the application of that system. As development proceeded, it was discovered that the entire mineralized area was covered by a thickness of only about 70 feet of low-grade and oxidized ores that could not be profitably handled by concentration. Clearly, a system of mining, much cheaper than caving, could be applied. Steam shovels could be used to remove the low-grade, oxidized overburden, leaving the ore uncovered, so that it could also be handled on a mass basis by steam shovels. The Because of the large sum required to remove the capping or overburden, 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." The stockholders were conditions.

In January 1906, Jackling appointed Robert C. Gemmell, his former associate when working for Captain De Lamar, who was then in Mexico, as general superintendent of the company. Gemmell returned 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 college classmates, William J. Olcott, then a distinguished engineer in the Iron Country, they hired J. D. Shilling as superintendent of the Bingham Mine. Shilling came to Bingham in July 1906, and served in this capacity until his death in 1923.75

Under the direction of Shilling, the first steam shovels at the Utah Copper mine were placed in operation in August 1906. The work started on the "C" and "D" levels, and the equipment consisted of two Marion shovels, one Vulcan shovel, four small Davenport locomotives, and six-yard wooden dump cars. These 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

⁷³ Utah Copper Company, Annual Report, 1907, p. 5.

⁷⁴ Ibid.

⁷⁵ Rickard, The Utah Copper Enterprise, p. 47.

acre of ground every 30 days. By June 1907, the shovels had removed about 700,000 cubic yards of capping, uncovering nearly six acres of ore. At the end of 1909 the shovels had stripped 3,232,000

cubic yards.76

While the stripping of capping was going ahead full speed on the top of the ground, the mining of the ore body underneath continued. As of June 30, 1907 the mine had been developed to the extent of approximately 90,000 feet of underground workings. Underground development was suspended on January 1, 1907, however, when it was felt that there was sufficient ore blocked out to last for several years to come. Development expenditures were thought to be better utilized in the removal of surface overburden.⁷⁷

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." 78 There yet remained 88 acres not in any way developed. By now, announced the company, the operations of the steam shovels had proven so "satisfactory and economical" that the underground mining was being abandoned as rapidly as was possible. By June 1907, only 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." 79

As with many similar enterprises in the growing industry of the nation, the supply of labor for Utah Copper's expanded operations came largely from foreign-born workmen. Six hundred persons of

Parsons, The Porphyry Coppers, p. 76; Pett, "History of Utah Copper."
 Utah Copper Company, Annual Report, 1907, p. 10.

⁷⁸ Ihid.

⁷⁹ Utah Copper Company, Annual Report, 1907, p. 14.

Japanese ancestry were hired on the West Coast, and these were balanced with healthy young laborers from Croatia, Serbia, Greece, and Italy - many of them recruited by an unscrupulous labor agent, Leonidas G. Skirlis. (Attempts by the Western Federation of Miners to organize these industrious laborers were unsuccessful, partly because of their polyglot origin, and partly because of the uncompromisingly anti-union policies of Mr. Jackling. A determined effort to improve wages, hours and working conditions, and to secure union recognition occurred in September 1912, when a general strike was called. There was a near battle of several hundred entrenched miners and an "army" of company deputies. Largely through the employment of professional strikebreakers, the strike was broken within two months; the first contract to be successfully negotiated with Utah Copper by an independent union did not come until 1944.) The conditions under which these men worked reflect both the pitiable circumstances under which they had been reared, and the common arrangements of labor in the nation. Much of the success of copper mining, milling, and smelting in Utah, as elsewhere, is attributable to the skill, industry, and acquiescence of these new Americans.80

Laboring under far happier conditions than the majority of workmen, the operators of steam shovels had their own boarding house, which was opened with a grand ball in the dining room. By 1907, the equipment and facilities at the mine included fifteen steam locomotives, nine of which were 100,000 pounds in weight or larger; six steam shovels, four of which were 100-ton machines and two 70-ton machines; 125 stripping dump cars, of six yards capacity; five electric locomotives, two of which were 40,000 pound machines, the others being small ones for underground work.⁸¹

The company had also constructed five 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 stripping of 45 acres of ore. A machine shop, "thor-

⁸⁰ On the history of labor relations at Utah Copper, see Vernon H. Jensen, Heritage of Conflict: Labor Relations in the Nonferrous Metals Industry up to 1930 (Ithaca, 1950); James Solomon, "Preliminary Copy Master's Thesis" [Study of Utah Copper Operations of Kennecott Copper Corporation], unpublished MSS., in possession of James Solomon, Los Gatos, California.
81 Pett, "History of Utah Copper."

oughly 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." 82

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.⁸³

With the start of construction on the Garfield smelter and the adjacent Utah Copper and Boston Consolidated mills, it was evident that the Copper Belt-Rio Grande system would be unable to handle the rapid increase in ore tonnages from the mine to the mills at Garfield. The copper companies requested that the D&RGW (Denver and Rio Grande Western) 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 "High Line," to connect the Utah Copper mine with the company's

mill under construction at Magna.84

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." ⁸⁵ Unfortunately, this was not the case. The D&RGW, in spite of the newly-constructed line, was unable to carry adequately the enormous tonnage of Boston Consolidated and Utah Copper ore and concentrates. Through sheer neglect and indifference on the part of its management, the railroad company had allowed the branch line to deteriorate and the service to its main customers to drop alarmingly. When shipments became heavier and service con-

⁸² Utah Copper Company, Annual Report, 1907, p. 14.

⁸³ Ibid., Annual Report, 1909, pp. 9-11.

⁸⁴ Utah Copper Company, "Descriptive History of Utah Copper Company and Bingham & Garfield Railway Company" (unpublished MSS, in the possession of the Kennecott Copper Corporation, Salt Lake City), p. 15.
85 Utah Copper Company, Annual Report, 1906, pp. 4-5.

tinued to decline, Utah Copper demanded improvements, including

heavier rails, without result.86

Finally, 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, with a nominal capitalization of 10,000 shares of common stock with a par value of \$100 a share. Further negotiations having failed, the company issued 7,500 shares of capital stock (\$750,000) to the Utah Copper Company in payment for tracks and property owned by the latter company, and issued tenyear 6 percent gold bonds to the amount of \$2,500,000 to finance the construction of the line. When completed in September 1911, the main line of the railroad was approximately twenty miles long, and, complete with viaducts and tunnels, cost \$3,336,000.87

⁸⁶ Robert G. Athearn, Rebel of the Rockies: A History of the Denver and Rio Grande Western Railroad (New Haven, 1962), pp. 213, 222.

⁸⁷ Parsons, *The Porphyry Coppers*, pp. 82-83; Utah Copper Company, *Annual Report*, 1910, p. 8; Beatrice Spendlove, "History of Bingham Canyon, Utah" (Master's Thesis, University of Utah, 1937), pp. 35-37.

CHAPTER 4

THE ABSORPTION OF BOSTON CONSOLIDATED BY UTAH COPPER (1910)

RUMORS OF MERGER ATTEMPTS

From the very outset it had been 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 Bingham hill. 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. 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 Boston Consolidated officials to contain 1,000,000 tons of ore. As a result of the discovery, Samuel 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 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 & Smelters.³ In an interview Daniel Guggenheim was quoted as saying:

¹ A. B. Parsons, The Porphyry Coppers (New York, 1932), p. 78.

² Salt Lake Tribune, January 3, 23, 1906.

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.⁴

These preliminary 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.⁵

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 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 prestigious Engineering and Mining Journal.⁶

Because of these activities, Horace Stevens, 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,

³ Ibid., March 1, 1906.

⁴ Ibid., March 14, 1906.

⁵ Engineering and Mining Journal (hereafter referred to as EMJ), 81 (March 31, 1906), 360-361.

⁶ Harvey O'Connor, The Guggenheims: The Making of an American Dynasty (New York, 1937), pp. 283-284.

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.⁷

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." 8

Up to June 1907, when the first section of the Magna mill was placed in operation, Jackling had spent \$8,000,000. The situation was complicated further by the Panic of 1907 which caused a serious break 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.9

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 recurring rumors during 1907 and 1908 about a merger with Nevada Consolidated, little was said about Boston Consolidated. It was in the latter year that the Cole-Ryan group (which controlled the Amalgamated Copper Company of Butte, Montana) was threatening to invade Utah with a copper smelter that efforts were renewed to bring about a merger. Rumors were circulating that the Cole-Ryan group was going to build a custom smelter near Salt Lake, which would thus diminish

⁷ Parsons, The Porphyry Coppers, pp. 75-76.

⁸ O'Connor, The Guggenheims, p. 284.

⁹Bernard Baruch, My Own Story (2 vols.; New York, 1957), I, 224-227.

the monopoly which the American Smelting and Refining Company exercised over the smelting of Utah's lead and silver ores.¹⁰

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. Utah Copper's stripping operations and development work had, by 1909, demonstrated that most of the mountain was copper ore. But, as mentioned previously, Boston Consolidated owned the upper portions of the mountain. Utah Copper owned 190 acres, about half of which was underlain with ore, while the Boston Consolidated holdings "surrounded the most productive part of the Utah ground on three sides." 11 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." 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 [Mackintosh] tunnel by steam shovels, and it will resort to the caving system of mining at this end of the property." 12 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." 13 Notwithstanding the strong denial, it was quite evident that the situation was grave for Utah Copper.

The merger with 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, Thomas W. Lawson (a "spectacular and flamboyant" Boston promoter of the "frenzied finance" school) and William Boyce Thompson had held options on all of the Guggenheim's porphyry holdings in Utah and Nevada. They had attempted to form Copper Mines, Inc., which would include the Guggenheim prop-

13 Ibid.

¹⁰ Under the auspices of the newly-formed International Smelting Company, this large smelter was built at Tooele, Utah, in 1910.

¹¹ Parsons, The Porphyry Coppers, p. 77. ¹² Salt Lake Tribune, September 21, 1909.

erties 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." ¹⁴ 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." ¹⁵ The projected company fell to pieces in 1908, and Thompson resigned from Hayden, Stone and Company; Lawson turned his attention to the Chino property.

DETAILS OF THE MERGER

The failure of Lawson, Thompson, and Copper Mines, Inc. did not dim the desire of the Guggenheims to bring about a merger of their porphyry properties. Negotiations continued in November and December of 1909, and rapidly reached a climax. On November 25, 1909, Eastern dispatches stated 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 61½.16

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 & Company, and "perhaps" the Boston Consolidated. Also under consideration were the United Metals and the International Smelting.

¹⁴ O'Connor, The Guggenheims, p. 287.

¹⁵ Ibid.

¹⁶ Salt Lake Tribune, November 25, 1909.

[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.¹⁷

An event occurred during November which caused participants to abandon plans for the gigantic undertaking — 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." ¹⁸ This ruling was sufficiently strong and definite to deter the formation of the proposed copper combine. ¹⁹

By mid-December, the Guggenheims put forth a revised plan to merge Utah Copper, Nevada Consolidated, and Cumberland-Ely; absorb Boston Consolidated; buy the Garfield Smelter and Baltimore Refinery of American Smelters Securities Company; and ultimately put together 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.²⁰

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 Con-

¹⁷ EMJ, 88 (November 27, 1909), 1078.

¹⁸ U.S. v. Standard Oil Co., 173 Fed. (1909), 183.

¹⁹ George W. Stocking and Myron W. Watkins, Monopoly and Free Enterprise (New York, 1951), p. 272.

²⁰ EMJ, 88 (December 18, 1909), 1229.

solidated entering the picture would be to sell out at a handsome profit. The rumored basis of exchange listed 2½ shares or 2¾ shares of Boston and 2 or 2¾ shares of Nevada as equal to one share of Utah.

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.²¹

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."

An agreement having been reached, 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 the increase was to be used to acquire the Boston Consolidated at a ratio of 2½ to 1, and Nevada Consolidated at 2¼ to 1. The remainder was to be used to increase Utah Copper milling capacity to 12,000 tons per day and Boston Consolidated milling capacity to 5,000 tons per day.²² In essence, Boston Consolidated was to merge with Utah Copper, and the latter was to become a holding company to control Nevada Consolidated.

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 operation. (Other evidences also point to the probable juggling of accounts to indicate lower costs and higher volumes than those actually experienced, and to show profits where none exist-

²¹ Ibid.

²² Desert News (Salt Lake City), December 16, 1909.

ed.)²³ The editors felt that the proposed absorption of Boston Consolidated was necessary, "else a large part of the ore in the steamshovel section of its mine will be unavailable; also . . . is desirable to ameliorate dumping difficulties." ²⁴ But Nevada Consolidated, they asserted, was being put in as a "sweetener" and they could not understand "why the Guggenheims should want to perpetrate this deal." According to Parsons, Nevada Consolidated was brought into the orbit

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.²⁵

It was on the ground of the inclusion of Nevada Consolidated that Colonel Wall instituted injunction proceedings against the directors, charging that Utah Copper would suffer by taking in Nevada Consolidated. The most telling argument was given by Charles MacNeill, president of Utah Copper, who testified that unless the consolidation 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 underground mining." ²⁶

Later, 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 two and one-half shares of Boston Consolidated for one 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

²⁸ E.g., O'Connor, The Guggenheims, p. 288; EMJ, 88 (December 25, 1909), 1275; Mines and Methods (Salt Lake City), September 1909, pp. 32-36; Gary B. Hansen, "A Business History of the Copper Industry of Utah, 1860-1910" (Master's Thesis, Utah State University, 1963), pp. 207-217.

 ²⁴ EMJ, 88 (December 25, 1909), 1276.
 ²⁵ Parsons, *The Porphyry Coppers*, p. 80.
 ²⁶ EMJ, 89 (January 29, 1910), 260.

from the outrage than would his body if placed before the cannon's mouth." ²⁷ Lending some credence to the "conquest theory" is the candid appraisal of D. C. Jackling: "Sooner or later, I knew that we would have to take them, or they would have to take us." ²⁸

ROLE OF SAMUEL UNTERMEYER

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. Son of a Bavarian-born tobacco planter who fell dead at the news of Lee's surrender, the diminutive Untermeyer was a brilliant lawyer who was equally adept at serving "the money trust" and public commissions dedicated to fighting "the trusts." Thus, he represented William Randolph Hearst, John D. Rockefeller, and the Lewisohn brothers (Montana copper) — and incidentally made a fortune when he brought about the settlement which resulted in the formation of Bethlehem Steel Corporation. During the same years, he attacked "the monied power," including J. P. Morgan, and, as counsel for the Pujo Committee, was instrumental in preparing and defending the bill to create the Federal Reserve System.²⁹

The same ambivalence characterized Untermeyer's activity in the copper merger, for, in addition to serving as associate counsel for Utah Copper, the agile Untermeyer was also chief counsel for the rival Boston Consolidated. In this equivocal position, he engineered, in March 1910, the deal whereby all of the shares of the Boston Consolidated Mining Company, the American subsidiary of the parent British company, were exchanged for 310,000 newly-created treasury shares of Utah Copper Company. For these efforts, the orchid-wearing Untermeyer 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

²⁷ Ibid.; Mines and Methods (Salt Lake City), June 1910, p. 334.

²⁸ Parsons, The Porphyry Coppers, p. 79.

²⁹Current Biography: Who's News and Why (New York, 1940), pp. 819-820.

³⁰ Parsons, The Porphyry Coppers, p. 79.

share for legal expenses incident to the consolidation, which netted Untermeyer an additional \$193,750. The total fee is said to have been the largest ever paid a lawyer (to that time) for such a deal.³¹ Colonel Wall, the disaffected Utah Copper stockholder, called it "the price of treachery . . . merciless rape . . . bloated incompetence." But, as O'Connor writes, most of Boston's shareholders were Englishmen, and "it was a complicated business to make the English understand the beauties of amalgamation." ³²

The Boston property under the terms of the merger was appraised as being worth approximately 42 per cent of the value of Utah Copper. Whether better terms could have been obtained by Boston Consolidated by holding out longer is problematical, but in view of later events and ultimate values there can be no question that the Boston owners were shortchanged in the bargain.³³

Similarly, the strong opposition of President James Phillips, Jr., of Nevada Consolidated, prevented the outright merger of that concern with Utah Copper. For the time being, the Guggenheims 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 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 Untermeyer, made a poor deal or that in the Nevada transaction the Guggenheims made for themselves an excellent deal. A third alternative is that both these statements are true." ³⁴

³⁴ *Ibid.*, p. 80.

 ³¹ Ibid.; Mines and Methods, June 1910, p. 334; Bennett Cerf, "Trade Winds," Saturday Review, June 3, 1950, p. 5.
 32 O'Connor, The Guggenheims, p. 288.

³³ Parsons, The Porphyry Coppers, p. 79.

CHAPTER 5

THE GROWTH AND EXPANSION OF UTAH COPPER

(1911-1963)

The merger of the Utah Copper and Boston Consolidated Copper companies in 1910 set the stage for a prolonged period of growth and propserity 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 thirty-eight 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 Equally important, he had the drive and initiative to carry his ideas and plans to fruition, regardless of the doubts and opposition of others.

THE KENNECOTT COPPER CORPORATION

After the famous Kennecott Mine in Alaska was acquired by the Guggenheims from Stephen Birch in 1908, 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

¹ A. B. Parsons, The Porphyry Coppers in 1956 (New York, 1957), p. 50.

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 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

In this way, in December 1915, 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 eight 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.³

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 made it possible for Kennecott to merge the Utah properties into the parent company as a whollyowned subsidiary. In 1947 Kennecott dissolved the Utah Copper Company, and officially organized the Utah Copper Division as an operating division of Kennecott Copper Corporation. Since 1949, the Utah division has been operated, along with the other Western porphyry mines owned by Kennecott, under the direction of Kennecott's Western Mining Divisions, headquartered in Salt Lake City.

In a sense, the absorption of Utah Copper by Kennecott, rather than the other way around, reflects the triumph of high finance over technology. As the first and most important of many porphyry copper mining and smelting ventures in the nation, and responsible for many of the technological innovations and processes which were applied throughout the industry, Utah Copper would seem destined to have become the parent company of the porphyries. But when

² Harvey O'Connor, The Guggenheims: The Making of an American Dynasty (New York, 1937), pp. 352-353; Kennecott Copper Corporation, Annual Report, 1905, p. 6.

³ Ibid.; Federal Trade Commission Report on the Copper Industry, Part 1, The Copper Industry of the United States and International Copper Cartels (Washington, D.C., 1947), p. 404.

⁴ Kennecott Copper Corporation, Annual Report, 1936, p. 5.

the Guggenheims placed all their copper interests "in one bag," so to speak, it was their arbitrary decision that the brazen newcomer (Kennecott) should absorb the older, larger, and well-established Utah Copper. Jackling and his associates, who were large stockholders in the Utah company, may well have resented this decision, accounting for the fact that they held out for eight years before relinquishing their dream of Utah Copper as the mother concern in the industry. By 1923, they were induced to turn in their stock to the Guggenheim-dominated Kennecott in exchange for the latter's stock, thus giving Kennecott undisputed control. When the illustrious Utah Copper Company eventually was disincorporated and became but one of several operating divisions of Kennecott, there were many oldtimers who felt a tinge of nostalgia at the death of what they felt was the rightful "parent of the porphyries."

UTAH COPPER OPERATIONS, 1911-1963

Various contemporaries alleged that the early managements of Boston Consolidated and Utah Copper devoted attention, more than anything else, to promotion — that is, to measures which would give the infant enterprises the appearance of profitability in order to improve salability or obtain needed financial backing. Whether or not this was true, it is clear that, once the backing of the Guggenheims was assured and the merger effected, Jackling and his associates were able to put all their energies into increased production and improved engineering. The history of Utah Copper after 1910 is essentially a story of ingenious innovation, technological improvement, and new capital investment. Because of this constant upgrading of processes and equipment, the company has earned a deserved reputation as an industrial pioneer.

Mining and milling. An early task facing Utah Copper after the absorption of Boston Consolidated was the remodeling of the Boston mill (now renamed the Arthur mill after President Chester A. Arthur). The Arthur and Magna (Utah) plants utilized different processes and equipment, and one of Jackling's first moves after the consolidation was to employ Allen H. Rogers as an independent consulting engineer to make comparative tests on the two mills. (This would also silence the criticism of Colonel Wall and others

that Utah Copper was stubbornly persisting in a process which was inefficient.) Rogers' comprehensive report showed that the Magna mill had a better recovery of copper at lower costs than did the Arthur (Boston) mill. With this information, Jackling directed the extensive remodeling of the Boston mill along improved lines, and increased its capacity from 3,000 to 8,000 tons per day. At the same time, the neighboring Magna mill facilities and equipment were likewise improved and expanded, raising its capacity to 10,000 tons per day.⁵

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 alltime high of \$33,740,000 on a production of 93,800 tons of copper. 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 in April 1921. Both resumed operations in 1922 when the postwar demand for copper began to rise.

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 these 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 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,

⁵ A. B. Parsons, The Porphyry Coppers (New York, 1932), p. 80.

⁶ Ibid., pp. 85-87; Parsons, The Porphyry Coppers in 1956, p. 34.

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.⁸

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, forty-one locomotives were in service. The modernization of the mining equipment and the initiation of better handling techniques enabled the company to move its 232,000,000th 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.⁹

The depression of the 1930's and the accompanying decline in the market for copper resulted in the curtailment of the Bingham operations of Utah Copper Company. The Arthur plant was closed on January 25, 1930. The company operated the Magna mill and the mine at a reduced output, staggering the employment to allow the greatest numbers of workmen to be retained — giving them approximately one-half of full-time employment. Production continued to decline, however, due to the meagre demand for copper, reaching a low point in 1933 when operations were only one-fifth of normal capacity.¹⁰

⁷ Parsons, *The Porphyry Coppers*, pp. 92-93; L. W. Anderson, "History of the Concentrating Mills of the Utah Copper Company" (Utah Copper Company, Metallurgical Department, June 1930), pp. 15-24 (mimeographed); Utah Copper Company, *Annual Report*, 1928, p. 9; Kennecott Copper Corporation, *The Utah Copper Story* (Salt Lake City, 1961), unpaged.

⁸ "Chronological History of Important Events in Mining" (unpublished MSS., Kennecott Copper Corporation, Salt Lake City); Parsons, *The Porphyry Coppers*, pp. 88-89.

⁹ Ibid.; Utah Copper Company, Annual Report, 1924, p. 9; "World's Biggest Artificial Hole," Literary Digest, CXIX (April 6, 1935), 17.

¹⁰ Utah Copper Company, Annual Report, 1930, p. 11; 1933, p. 7.

From 1935 to 1938, both the Magna and Arthur mills were reconditioned to improve their recovery, the work being done while operations were at a minimum level. On September 1, 1936, the Arthur plant was reopened, after nearly six years of inactivity. Operations were continued at a modest rate until June 1938 when the economic downturn and an over-supply of copper resulted in the discontinuance of production from the Utah properties for two and one-half months. From then on, Utah Copper operations began a period of increasing production to meet the demands of World War II. Peak wartime production was reached in 1943, after which it dropped off slightly. The postwar strikes of 1946, and additional labor difficulties since then have contributed to several years of reduced copper output.¹¹

Since 1935, the gradually decreasing grade of the ore, coupled with the continually expanding scope of mining operations, have 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 increased as the mine deepened), 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.12

In mining operations today at Bingham, the ore and waste are broken up by using mobile drilling units to drive holes up to 30 feet deep at intervals of 20 to 50 feet into the toe of each level or bank. Each hole is charged with blasting powder or ammonium nitrate and then set off in a series of explosions, breaking up approximately 2,200 tons of material. The huge fully-revolving shovels scoop up from 10 to 16 tons of material at a "bite." The waste material is loaded into 80-ton dump cars, which are pulled by electric loco-

City, 1961), unpaged.

 [&]quot;History of Milling to 1939" (unpublished MSS., Kennecott Copper Corporation, Salt Lake City, 1939), p. 10; Desert News (Salt Lake City), December 31, 1936; Kennecott Copper Corporation, Annual Report, 1938.
 Kennecott Copper Corporation, The Utah Copper Story (Salt Lake

motives to the disposal areas in trains of seven cars each. The usable ore is loaded in a similar manner into railroad cars of 90-ton capacity and hauled in trains of 13 to 21 cars seven miles to the Copperton assembly yard at the mouth of Bingham Canyon. Here, trains are made up for movement to the Magna and Arthur concentration mills fourteen miles distant. Up to 92 cars are handled on the trip to Garfield by two 125-ton electric locomotives operating as a single unit.¹³

As the amphitheater has deepened and its boundaries widened, Utah Copper has pursued an aggressive policy of increasing its holdings in the Bingham District. More and more of the adjoining mines and surrounding property have been purchased. By 1961, the excavation area alone covered more than 1,000 acres (compared with the original 200 acres purchased from Colonel Wall in 1903). At that time, Kennecott 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.¹⁴

In 1962, Kennecott also acquired rights to 7,400 acres of land in the Lark-Bingham district, southeast of the pit, from the United States Smelting, Refining, and Mining Company. The arrangement with USSRM calls for the payment of \$7 million in cash by 1964 and approximately \$7 million in royalties over the next ten years. Negotiations are now pending with the Anaconda Company to acquire properties owned by that company southwest and west of the Bingham pit. When and if these negotiations are concluded, Kennecott would then have unrestricted opportunity to expand and exploit the huge Bingham porphyry deposit to its ultimate limits. ¹⁵

Plant and equipment. Since the beginning of opencut operations in 1906, a great deal of oxidized copper ore was uncovered as part of the capping of the main ore body. This was considered an uneconomic waste material until 1916 when a 2,000 ton leaching

¹³ Ibid.

¹⁴ Jack Goodman, "Utah Mine Engulfs Town and Lures Tourists," New York Times, XX (August 20, 1961), 13; Salt Lake Tribune, May 4, 1962.

¹⁵ Robert W. Bernick, Salt Lake Tribune, September 22, 1962, July 12, 1963; Don C. Woodward, Deseret News and Telegram, September 25, 1962.

plant was constructed south of the Magna mill to treat the ore with a sulphuric acid leach, and thereby precipitate the copper out using scrap iron. The plant operated until the decline in the price of copper in 1919. It was reopened for a short period in 1920, but was closed permanently in December of that year.

To provide the sulphuric acid to treat the ores at the leaching plant, the company joined with the Garfield Smelting Company to organize the Garfield Chemical and Manufacturing Corporation, which constructed and operated an acid plant near the Garfield smelter. A plant was erected in 1916 with a capacity of 75 tons of 50-degree acid per day, which was gradually increased to 150 tons per day. Over the years the plant has been periodically expanded and improved (1963 output 700 tons per day) and has continued as an important sulphuric acid producer to the present day. 16

In 1923, Utah Copper began experimenting once more in an attempt to recover the copper in the accumulating mine dumps. It had been noticed that rain and snow percolating down through these dumps emerged greenish-blue. Investigation indicated that some of the copper exposed in the waste rocks had been oxidized into a form soluble in water. Company engineers and scientists soon found a cheap and effective way of extracting this copper by placing metallic iron in the solution and allowing the copper to trade places with the iron. The copper would precipitate out in the form of copper mud, while the iron went into solution. By this process, the company hoped to recover approximately 1,000,000,000 pounds of copper from the otherwise worthless dumps. To make this possible, Utah Copper set up a test plant at the bottom of the pit in 1923. An improved precipitation plant was erected in 1924, followed by still another which operated successfully until the present plant was built in 1929. The plant now in use is 960 feet long and uses detinned scrap from tin can factories to precipitate the copper in huge concrete tanks ("launders") into which run the copper-bearing waters. The 1962 production of this leaching plant was approximately 20 million pounds of copper, which is almost 5 percent of total 1962 production.¹⁷

Over the years, the increasing depth of the mine has resulted

¹⁶ Utah Copper Company, Annual Report, 1916, p. 13.

¹⁷ Ibid.; 1928, p. 9; Kennescope, September-October, 1952, pp. 3-9.

in steadily increasing production costs. To reduce these costs, the Utah Copper Division was forced to abandon the Bingham & 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, was constructed in 1947 at a cost of \$5,500,000. In 1948 the Bingham and Garfield was scrapped.18

The impending threat of World War II resulted in an increasing demand for electricity to supply the growing number of defense industries coming to 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 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. 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 \$18,000,000.19

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.20

¹⁸ Kennecott Copper Corporation, The Utah Copper Story, 1961; Annual Report, 1947, p. 3; Parsons, The Porphyry Coppers in 1956, p. 38.

¹⁹ Kennecott Copper Corporation, Annual Report, 1941, p. 5; 1944, p. 3; 1947, p. 3; The Utah Copper Story, 1961; Parsons, The Porphyry Coppers in 1956, pp. 36-37.

²⁰ *Ibid.*, p. 39; The Utah Copper Story, 1961.

One of the most important acquisitions in the history of Kennecott's Utah Copper Division occurred on May 1, 1958 when arrangemens were completed 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 operations of the Garfield smelter through the 1930's. These were renewed periodically, with the last contract being signed in 1951 amid rumors of the purchase of the smelter by Kennecott.

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.

Kennecott was so desirous of completing its integration program that \$40 million were authorized for the construction of a new smelter above the Garfield townsite if the negotiations with AS-ARCO 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.²¹

Mineral recovery research. Over the years, attempts to recover additional minerals (other than copper, silver, and gold) from the Bingham porphyry ores have resulted in the production of several valuable and important metals. The recovery of molybdenite from Bingham ores (molybdenite is a compound (MoS₂) containing molybdenum and sulphur), which was initiated in 1936, has proven to

²¹ Salt Lake Tribune, May 1, 1958; Deseret News, December 30, 1960.

be the most profitable by-product operation ever initiated by Utah Copper. The annual production of this mineral has a value of nearly \$30 million.

The presence of molybdenite in the Bingham ores was known as early as 1898, when Jackling and Gemmell recorded its presence in the Wall ores which they analyzed. For many years after the start of milling operations, operators at Magna and Arthur had noticed the graphite-like mineral floating on the water in their concentrating apparatus, but they considered it to be present in such small amounts as not to justify its recovery. Through the research and development in alloy steels in the years that followed World War I, the demand for the steel-strengthening agent increased rapidly, and Utah Copper began an intensive investigation, looking to the separation of molybdenite from the copper concentrate. By the end of 1935, enough of a process had been worked out to justify an experimental plant test at the Magna mill. By the middle of 1936, the operation had proved so successful that the recovery of molybdenite concentrate began on a commercial scale. Production increased rapidly as the entire milling operation was converted to the recovery of the metal. By 1938, Utah Copper Company was the world's second largest producer of molybdenite, a position which it has retained to this day.22

In order to determine whether there might be other minerals in significant quantity and value in the ore body, Utah Copper made a complete spectrographic analysis of the copper ore, copper concentrate, and molybdenite concentrate. Taken in 1931, the examination indicated the presence of some 38 elements (in addition to several elements such as sulphur, oxygen, and chlorine which, although known to be present, were not indicated by this type of analysis). Of those metals occurring in quantities less than molybdenum, only gold, silver, platinum, and palladium were considered of sufficient value to warrant recovery — which could be done without any special treatment.²³

After World War II, however, the advent of the atomic age and the era of the "wonder metals" gave Kennecott a renewed interest

²³ "History of Milling to 1939," p. 106.

²² "History of Milling to 1939," p. 97; Kennecott Copper Corporation, Annual Report, 1936.

in the storehouse of minerals present in the Bingham ores. This culminated with the establishment of 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." ²⁴ In 1954, a new \$1,250,000 facility was dedicated to house the research center. This laboratory functions to coordinate and expand the research of Kennecott's four Western mining divisions — Utah Copper, Nevada Mines, Ray Mines, and Chino Mines. In addition to improvements in the recovery of molybdenite, research staff members have developed a method for recovering rhenium, and more efficient methods of recovering by-product metals from the electrolytic refining process. Today, the output of the Utah Division includes platinum, palladium, tellurium, selenium, rhenium, and nickel sulphate. ²⁵

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 ore body, greater and greater quantities of ore were indicated. Every year for nearly forty 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.²⁶ Nevertheless, the quantity of ore

²⁵ The Utah Copper Story, 1961; Parsons, The Porphyry Coppers in 1956, pp. 45-47; Kennecott Copper Corporation, Annual Report, 1956, p. 10; 1959, p. 7; 1962, p. 12.

²⁴Kennecott Copper Corporation, Annual Report, 1951, p. 16.

²⁶ Madsen suggests that the company does not publish reserves because "the ever changing economic conditions make the reserve figures inaccurate, 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 sixty years of operation under existing conditions, the company would be able to charge less to

reserves was increased considerably after 1930 by continuing development and exploration of the ore body and by continuous efforts to improve the efficiency of ore concentration (which reduced the cutoff point by one-half).²⁷

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 twenty years of active life remaining.²⁸

On the basis of more recent estimates, the Bingham copper deposit has about thirty-two years of active life remaining if Kennecott maintains production at about 300,000 tons of copper per year.²⁹ However, all estimates are 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 removed from the side hills. The stripping ratio is now about 2.5 tons of waste to one ton of ore. Sometime in the future, the problem will arise as

depreciation than if the reserves were sufficient for only twenty 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" (Master's Thesis, University of Utah, 1951), pp. 25-26.

²⁷Utah Copper Company, Annual Report, 1915, p. 9; 1930, p. 8.

²⁸ Works Progress Administration, National Research Project, Technology, Employment, and Output Per Man in Copper Mining (Washington, D.C., 1940), p. 260. Also, unpublished statistical data obtained from Kennecott Copper Corporation, 1963.

²⁹ See Gary B. Hansen, "A Business History of the Copper Industry of Utah, 1860-1910" (Master's Thesis, Utah State University, 1963), pp. 202-203.

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 affected by the general economics of the copper industry.³⁰

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 ten years "through a combination of natural conditions that affect mining." Principal projects included in the expansion program are the following:

- 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.
- 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.
- 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 nine-mile spur railroad from the present main line to the new crushing and grinding plant.
- Modifications in the Utah smelter to eliminate the present roasting of concentrates and provide for the direct charging of concentrates to reverberatory furnaces.
- Development of additional processing water for the concentrators and the mine leaching system.³¹

³⁰ Department of the Interior, Bureau of Mines, Materials Survey-Copper (Washington, D.C., September 1952), pp. III-20-21.

³¹ Kennescope, March-April, 1963, p. 4.

The first phases of the expansion project were completed during the summer of 1963, and the entire project is scheduled for completion early in 1967. It is expected 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 appropriate increases in the by-product output of molybdenite, gold, and silver. 32 The Bingham Mine will then hold unquestioned supremacy, as was also true before the Chuquicamata Mine in Chile began to exceed Bingham's production in 1956, as the world's largest copper mine.

A CONCLUDING APPRAISAL

The history of Utah Copper in the past sixty years epitomizes the transition from the days of the public-be-damned "captains of industry" (sometimes not inappropriately referred to as "Robber Barons") to the public-oriented corporate enterprise of today. Today, the Utah Copper Division deals with nineteen separate bargaining units for its 7,500 employees. This makes collective bargaining - difficult at any time - a Herculean task. Contract negotiations require several different bargaining teams participating in hundreds of negotiating meetings on an almost "round-the-clock" basis. One Kennecott official recently compared collective bargaining to General Walter Kreuger's classic judgment about Korea: "We've got a bull by the tail and we have to look him squarely in the eye . . . a very difficult operation!" 33

The transition from a policy of militant anti-unionism, as espoused by D. C. Jackling and his associates at the beginning of the century, to the present healthy policy of acceptance and mutual respect has not been an easy one. For many years, the "heritage of conflict" bore bitter fruit.34 After the end of World War II, the dynamics of collective bargaining resulted in several long and costly work stoppages and additional minor strikes at various Western

Kennecott Copper Corporation, Annual Report, 1962, p. 3.
 Address by C. D. Michaelson at the Town and Gown Forum, Utah State University, April 20, 1961.

³⁴ Vernon H. Jensen, Heritage of Conflict: Labor Relations in the Nonferrous Metals Industry up to 1930 (Ithaca, 1950).

properties. With the departure of many "oldtimers" in the ranks of management and labor during the past two decades, however, new and healthier attitudes took root. The key change occurred in 1942, after Jackling retired as president, when the company established a Department of Industrial Relations, and devoted an increased amount of effort to foster management-labor relations. The International Union of Mine, Mill, and Smelter Workers was recognized as bargaining agent in 1944, and in the past twenty years many enlightened programs have been applied. These include an employee training program, including on-the-job training, supervisory personnel development, and safety education; the publication of an excellent bi-monthly employee magazine, Kennescope; and a comprehensive range of fringe benefits, a Suggestion Plan, and a program of tuition-aids and scholarships to employees and their children. Kennecott has also built an image of public-spiritedness and civic-mindedness through excellent series on radio and television; through contributions to the support of such important projects as the University of Utah Medical Center, Westminster College Development Fund, and the University of Utah Pioneer Memorial Theater; and through the sponsorship of research at the University of Utah, Utah State University, and Brigham Young University.

Just as modern mining is a far cry from the days of the whiskered prospector and his heavily-laden burro, Kennecott's modern management-labor and public relations are far advanced from those prevailing in Utah and elsewhere at the turn of the century. The public interest is now a major factor in the formulation of policies and actions. All prospects point to the continuation of this policy of enlightened public relations and sound management-labor relations. To use the words of C. D. Michaelson, Kennecott's vice president in charge of mining, "Today's modern mining enterprise has become a 'permanent citizen,' as compared to mining at the start of this century when exhaustion of easily accessible high grade ore set the stage for the 'ghost town.'" 35 Kennecott's Utah Copper Division, as a "permanent citizen," is demonstrating that "the richest hole on earth" not only pays its way, but can contribute toward the advanced industrial economy of the West, the nation, and the Free World.

³⁵ Op. cit.

APPENDIX A*

GEOLOGY OF THE BINGHAM COPPER DEPOSITS

Geologists estimate that the Bingham Canyon 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 depth.

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. The ore today contains less than one per cent copper, plus small amounts of molybdenum and minute quantities of silver and gold.

^{*}From Kennecott Copper Corporation, The Utah Copper Story (Salt Lake City, 1961), with permission.

APPENDIX B

CHRONOLOGICAL OUTLINE OF UTAH'S LEADING COPPER COMPANIES

		ar organi or acquir	
A.	Predecessors of International Sm	elting	
	Highland Boy Gold Mining Co.	1896	Owned Highland Boy Mine and other properties, Bingham Can- yon
	Utah Consolidated Gold Mines, Ltd.	1896	Constructed Utah's first copper smelter at Murray, 1899, which operated until 1908
	Utah Consolidated Mining Co. — controlled by Standard Oil Co. investors Utah-Delaware Mining Co. — subsidiary of International Smelting & Refining Co., a holding company organized by Standard Oil interests in 1909	1903	Used new Tooele smelter built by International Smelting & Re- fining Co. in 1910 Consolidated with Utah Apex in 1937. Operated as a copper- lead-silver producer until 1940's
	National Tunnel & Mines Co. — subsidiary of International Smelting & Refining Co	1937	Copper section of Tooele smelter closed in 1945; lead smelter still in operation
В.	Predecessors of U. S. Smelting,	Refinin	g & Mining Co.
	Bingham Gold Mining Co.	1895	Owned the Commercial Mine and other properties, Bingham Canyon
	Bingham Copper & Gold Mining Co.	1898	Constructed copper smelters 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.
	Bingham Mines Company	1908	Reorganized from bankrupt Bingham Consolidated Mining & Smelting Co.
	United States Smelting, Refining & Mining Co.		Dalton & Lark mines still in operation in 1963

	Name of Company	ear organi: or acquire		Remarks
C.	Predecessors of U. S. Smelting,	Refining	& Mining	Co.
	United States Mining Co.	1899	Mines, Bing tennial-Euro District; of smelter at M	Old Jordan, Galena gham Canyon; Cen- ka Mines, Tintic constructed copper didvale, 1902; added furnaces 1905-06
	United States Smelting, Refining & Mining Co. — controlled by Boston copper investors	1906	in 1908; r zinc smelter Smelter clos Midvale flo operation.	vale copper smelter eopened lead-silver- r during same year. sed in 1958, though otation mill still in The Bingham prop- ired by Kennecott p. in 1962.
D.	Predecessors of U. S. Smelting,	Refining	& Mining	Co.
	Ohio Copper Company — controlled by F. A. Heinze, 1906-1909	1903	Owned the	Columbia Mine and orphyry property at
	Ohio Copper Mining Company	1912	Company re Went bankr	eorganized. upt in 1914.
	Ohio Copper Mining Company of Utah	1916	properties a ings retreati	t Bingham, and tail- ment plant. Opera- in 1947 when ores
	United States Smelting, Refining & Mining Co.	1950	Property in	active in 1963.
E.	Predecessors of Kennecott Copp	er Corp	oration	
	Boston Consolidated Copper & Gold Mining Co., Ltd., a British corporation	1898	Promoted by	V Samuel Newhouse. wart and adjacent Bingham.
	Boston Consolidated Mining Co- pany, an American Corpora- tion; stock held by British corporation	1898	Developed upper half	to Utah properties. sulphide mine and of Utah Copper tructed Arthur Con-

	ar organi or acquire	
Utah Copper Company	1910	310,000 shares of Utah Copper stock exchanged for all capital stock of Boston Consolidated
Kennecott Copper Corporation	1936	Utah Copper became a wholly owned subsidiary of Kennecott Copper Corp.
H. D. L (17 (1		
F. Predecessors of Kennecott Coppe	er Corp	oration
Utah Copper Company	1903	Purchased Enos A. Wall porphyry property at Bingham. Built Copperton Concentrating Mill
Utah Copper Company	1904	Company reorganized. Guggenheims purchase large block of stock and provide capital for expansion.
Kennecott Copper Corporation — organized by the Guggenheims as holding company for all their copper properties		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.

APPENDIX C*

THE OHIO COPPER COMPANY AND NEWHOUSE MINES AND SMELTERS, INC.

While this monograph is concerned chiefly with the attempts of Boston Consolidated and Utah Copper to develop the Bingham Mine, it should not be forgotten that there were also two contemporary small producers of porphyry copper in Utah, the Ohio Copper Company at Bingham, and Newhouse Mines and Smelters at Newhouse, Beaver County, Utah. Both were stimulated by the success of Utah Consolidated, Bingham Consolidated, and United States Mining in mining and milling copper sulphides at the turn of the century.

One mine which responded to the intensive exploration of smaller properties was the old Columbia Mine in Bingham Canyon. In the late 1890's the mine had yielded considerable quantities of high-grade copper from two small parallel veins known as the What Cheer and All's Well. The two small veins, about 500 feet apart, were separated by an intervening area of mineralized quartzite carrying copper and iron sulphides said to average from 1.5 to 1.8 percent copper.

The property was purchased by Frank B. Cook and associates near the turn of the century, and attempts were made to develop the porphyry ores on the Columbia property. Some concentrating tests were made of the ore in 1900 and 1901, after which it was concluded that the ores could be reduced successfully and sold on the market as a commercial product. Notwithstanding, Cook and his associates were unsuccessful in their attempts to raise funds to develop the property, and eventually sold it to N. J. Catrow and associates of Ohio, who organized the Ohio Copper Company in 1903.¹

The newly-organized Ohio Copper Company leased the old Winnemuck concentrating mill (it had been used on lead-silver ores in the 1870's and '80's) in Lower Bingham and attempted to mill the porphyry ore. Numerous problems were encountered, placing a drain on the company's financial resources. In 1906 the company sought outside financial assistance, which resulted in the entry of F. Augustus Heinze of Montana copper fame. The company suffered from the mishandling of Heinze until late 1908, when Heinze was forced by financial reverses to relinquish control of the company.

The new group erected a 2,000-ton concentrating mill in 1910. This was operated intermittently until 1919, during a period of recurring financial

^{*}This information is based upon a longer annotated discussion in Gary B. Hansen, "A Business History of the Copper Industry of Utah, 1860-1910" (Master's Thesis, Utah State University, 1963), pp. 104-128.

ter's Thesis, Utah State University, 1963), pp. 104-128.

¹The property was offered to Daniel Jackling's newly-created Utah Copper Company for \$160,000. Negotiations with Utah Copper broke down, however, and in October 1903 it was sold to the Catrow interests for \$225,000.

difficulty to the company. In the intervening years some 7 or 8 million tons of copper ore were milled—at a relatively poor rate of recovery.

At the close of World War I, the company made attempts to recover copper from a "vast body" of low-grade porphyry ore (average 0.3 percent, and hence, too low to be milled), which had been developed during the 1917-1919 period of operations. Due to the decline in the price of copper, however, this was deferred until 1923. At that time, the Ohio company utilized leaching methods to recover the copper. The success achieved by this method saved the company financially, and enabled it to break the world record for low-cost copper production, registering an unheard-of 5.3 cents per pound during June 1924. Leaching operations continued at a gradually reducing rate until 1937, when 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 decline in the profitability of the leaching operations led the company in 1937 to erect a 1,000-ton selective flotation mill to re-treat over 5,000,000 tons of tailings from the earlier milling operations. The mill and precipitation plant were operated until 1945 and 1947, respectively, at which time they were closed due to the exhaustion of the copper and old tailing dumps. The properties were worked intermittently by leases until 1950, when they were purchased at a public sale by the United States Smelting, Refining and Mining Company for \$115,000. Since that time the property has been idle.

The second early porphyry producer was the Cactus Mine at Newhouse, in the San Francisco Mountains in Beaver County, Utah. The property had long been known to contain a large quantity of disseminated monzonite-porphyry ore similar to that at Bingham Canyon. However, all attempts by the owners, a French-controlled company, proved unsuccessful. In 1901 Samuel Newhouse purchased the property. He set up an experimental plant in 1902, using the Callow process of concentration with some modifications by his own engineers. The results were successful enough to warrant the promotion of the venture in Europe by Newhouse to raise capital for development. The result was the organization, on May 17, 1903, of the Newhouse Mines and Smelters company. This company erected a 1,000-ton concentration mill which was completed early in 1905.

The isolated location of the mine and mill necessitated the founding of the town of Newhouse to house the employees. Newhouse was dubbed a "model camp," with everything being done for the convenience and comfort of the employees. Over \$2,000,000 was spent 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 the construction of the project.

Production at the property started in March 1905. Early in 1906 a steam shovel was installed at the surface of the 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 one-half of the tonnage of the mine was taken during the year. This unique method of mining was

heralded as "beyond question the cheapest mining work that is being done in Utah, the month of October [1906] having shown a product of 10,000 tons from the 'glory holes,' which cost only 19 cents per ton for the actual mining." At the time 350 men were employed at the mine and mill, and from 40 to 50 cars of concentrates were being shipped to the Salt Lake smelters every month.

Production continued until 1908, when the company became financially insolvent and unable to meet its obligations. A period of reorganization followed, during which time the mill was remodeled in order to improve the recovery of copper. Operations were resumed and continued until October 1912, when a wildcat strike for higher wages shut down the mine. The strike and an accompanying flooding of the lower levels in the mine by water was a telling blow to the company.

The strike lasted until April 1913, whereupon operations were resumed. However, the ore bodies were exhausted by 1914 and the mine was closed. The company continued to operate by the addition of a flotation unit to the mill in 1914, and the subsequent re-treatment of the mill tailings. The mill was shut down permanently in 1918. During its 15-year period of active life the property yielded about 30,000,000 pounds of copper and modest quantities of gold and silver.

APPENDIX D: STATISTICAL TABLES TABLE 1

ORE, WASTE, AND COPPER PRODUCTION UTAH COPPER MINE

1904 - 1962

Year	Ore Mined (Tons)	Waste Removed (Tons)	Copper Produced (Pounds)	Percent Copper in Ore Mined
7/1/1904	to			
6/30/190	5 216,769		5,311,702	1.98
7/1/1905	to			
6/30/190	6 231,125		5,121,029	1.96
7/1/1906				
6/30/190	7 183,569	1,450,532*	4,021,463	1.93
7/1/1907 t				
12/31/190		2,083,218*	54,051,211	1.91
1909	2,674,271	3,163,567*	51,749,233	1.66
1910	4,340,245	5,832,294*	84,502,475	1.54
1911	4,680,801	, , , , , , , , , , , , , , , , , , , ,	93,514,419	1.51
1912	5,315,321		91,366,337	1.36
1913	7,519,392		113,942,834	1.25
1914	6,470,166		115,690,445	1.42
	-,,	95,075,104*		
1915	8,494,300	, , , , , , , , , , , , , , , , , , , ,	148,397,006	1.43
1916	10,994,000		187,531,824	1.43
1917	12,542,000		195,837,111	1.34
1918	12,160,700		188,092,405	1.23
1919	5,538,700		105,088,740	1.26
1920	5,556,800		101,897,758	1.16
1921	1,220,700	737,815	24,511,593	1.16
1922	4,364,251	2,288,341	84,777,712	1.26
1923	11,167,800	5,227,861	195,142,919	1.12
1924	12,126,600	12,949,912	214,592,733	1.07
1925	12,538,300	16,488,080	214,162,139	1.02
1926	13,880,100	17,932,338	234,173,625	1.01
1927	13,811,500	15,149,189	233,002,661	0.98
1928	16,558,500	14,996,011	273,823,351	0.99
1929	17,724,100	19,821,357	296,625,554	0.99
1930	9,552,500	13,846,715	161,138,717	0.97
1931	8,147,764	10,180,881	142,694,917	0.96
1932	3,169,411	3,650,930	60,012,835	0.97
1933	3,521,425	3,362,061	69,462,784	1.03
1934	4,086,800	4,981,560	78,787,348	1.02

Year	Ore Mined (Tons)	Waste Removed (Tons)	Copper Produced (Pounds)	Percent Copper in Ore Mined
1935	6,529,800	7,483,981	118,466,057	1.00
1936	13,773,900	14,859,346	241,674,317	0.97
1937	23,119,800	28,292,292	402,461,055	0.97
1938	11,704,900	18,617,345	206,292,917	0.94
1939	19,310,200	23,111,402	330,310,250	0.94
1940	25,950,500	30,884,201	452,538,235	0.97
1941	30,090,400	38,380,432	525,064,848	0.98
1942	33,093,200	39,716,089	598,358,498	0.97
1943	35,375,800	41,308,996	639,484,093	0.97
1944	29,274,200	32,962,007	555,061,885	0.98
1945	23,361,000	29,002,916	444,800,637	0.99
1946	11,831,400	13,776,826	220,031,372	0.98
1947	28,539,300	34,359,084	526,847,062	0.97
1948	24,454,000	33,480,555	453,634,939	0.97
1949	20,922,300	26,581,965	394,667,367	0.98
1950	31,037,800	46,551,516	540,185,438	0.96
1951	30,444,800	46,551,516	540,185,438	0.96
1952	32,036,100	46,910,576	572,531,331	0.94
1953	29,922,200	49,291,904	541,549,262	0.93
1954	24,079,400	35,856,641	423,066,857	0.93
1955	27,740,600	46,000,000	461,675,423	0.89
1956	32,321,100	63,675,696	496,316,378	0.83
1957	30,919,900	67,088,795	370,270,000	0.82
1958	24,086,800	41,094,436	373,262,000	0.83
1959	19,673,217	50,928,800	284,704,000	0.81
1960	28,060,300	59,536,800	430,250,000	0.81
1961	27,839,700	71,108,000	433,008,000	0.81
1962	29,175,000	n.a.	420,750,000	0.77

^{*}Figured from cubic yardage figures for the year, using 2.072 tons per cubic yard.

n.a. Not available.

Source: Utah Copper Division, Kennecott Copper Corporation. Unpublished data supplied by the company; Kennecott Copper Corporation, The Utah Copper Story (Salt Lake City: Kennecott Copper Corporation, various years); Utah Copper Company, Annual Report, annually, 1904-1910; Utah Copper Company, "History of Milling to 1939," unpublished MSS., Utah Copper Company, January 1939.

TABLE 2

KENNECOTT COPPER UTAH REFINERY

PRODUCTION OF REFINED COPPER

1950 — 1962

Y	ear	Copper Produced (Pounds)	
19	50	64,470,670	
19	51	269,032,693	
19	52	294,515,443	
19	53	355,218,010	
19	54	323,904,000	
19	55	333,816,000	
19	56	374,346,000	
19	57	380,966,000	
19	58	322,254,000	
19	59	212,002,000	
19	60	338,628,000	
19	61	341,124,000	
19	62	348,877,000	

Source: Utah Copper Division, Kennecott Copper Corporation.
Unpublished data supplied by the company.

TABLE 3

PRODUCTION OF MOLYBDENITE

UTAH COPPER MINE

1937 – 1962

Year	Molybdenite (Pounds)
1937	9,093,981*
1938	5,392,585
1939	10,314,649
1940	14,321,806
1941	15,738,444
1942	18,757,391
1943	19,636,732
1944	19,316,420
1945	15,198,170
1946	11,100,305
1947	23,132,978
1948	18,687,152
1949	16,775,791
1950	24,502,346
1951	23,172,111
1952	26,834,367
1953	28,795,641
1954	22,297,572
1955	25,531,025
1956	26,030,400**
1957	23,004,800**
1958	18,900,800**
1959	16,773,600**
1960	21,940,800**
1961	20,651,200**
1962	20,343,200**

^{*}Includes production for 1936.

Source: Utah Copper Division, Kennecott Copper Corporation. Unpublished data supplied by the company.

^{**}Estimates based on 80% of the annual production of molybdenite by Kennecott Copper Corporation for the years 1956-1962.

TABLE 4

TOTAL EMPLOYMENT

UTAH COPPER DIVISION

KENNECOTT COPPER CORPORATION

Year	Employment	Year	Employment
1906	562	1936	4,000*
1907	1,202	1937	4,000*
1908	1,690	1939	3,900*
1909	2,168	1940	4,300*
1910	3,117	1945	3,843
1911	2,950	1946	3,737
1912	3,571	1947	4,425
1913	3,679	1948	4,501
1914	2,501	1949	4,411
1915	3,249	1950	5,247
1916	3,668	1951	5,332
1917	5,029	1952	5,540
1918	4,413	1953	5,680
1919	2,305	1954	5,518
1920	1,794	1955	6,636
1921	381	1956	6,696
1922	1,647	1957	4,858
1923	3,761	1958	7,169
1924	3,612	1960	7,586
1925	3,624	1961	7,321
1929	4,041	1962	6,683

^{*}Estimated

Source: 1906-1924, 1945-1954 Utah Copper Division, Kennecott Copper Corporation. Unpublished data furnished by the company.

1925-1940, 1955-1961 Utah Copper Company and Utah Copper Division, Kennecott Copper Corporation, The Utah Copper Story (Salt Lake City, various years).

TABLE 5

UTAH COPPER COMPANY PRODUCTION OF GOLD AND SILVER

1908 - 1938

Year	Gold (Ounces)	Silver (Ounces)	Value of Gold and Silver
1908	20,072	163,953	\$ 491,224
1909	20,862	198,943	519,758
1910	39,838	381,331	1,001,090
1911	40,202		999,623
1912	34,255	311,392	873,995
1913	28,121	285,589	732,583
1914	34,729	235,352	875,504
1915	36,760	371,712	920,612
1916	47,648	461,597	1,260,766
1917	51,112	498,820	1,433,002
1918	50,928	489,484	1,496,108
1919	28,907	263,721	873,572
1920	27,411	257,516	829,334
1921	7,041	65,929	206,510
1922	28,284	257,145	821,540
1923	72,549	630,941	1,929,920
1924	76,593	652,586	1,973,761
1925	78,158	692,782	2,041,321
1926	86,028	760,910	2,186,737
1927	89,303	795,888	2,234,967
1928	104,292	917,226	2,619,240
1929	116,087	1,050,075	2,881,269
1930	64,240	563,330	1,499,229
1931	54,124	481,251	1,219,982
1932	25,399	222,417	569,027
1933	34,856	312,333	1,089,802
1934	37,513	330,175	1,781,320
1935	66,111	536,846	2,703,403
1936	113,515	950,712	n.a.
1937	196,542	1,720,347	n.a.
1938	92,705	818,081	n.a.

n.a. Not available.

Source: Utah Copper Company, Annual Report, annually, 1908-1933; Kennecott Copper Corporation, Annual Report, annually, 1934-1935; Utah Copper Company, "History of Milling to 1939," unpublished MSS., Utah Copper Company, January 1939.

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