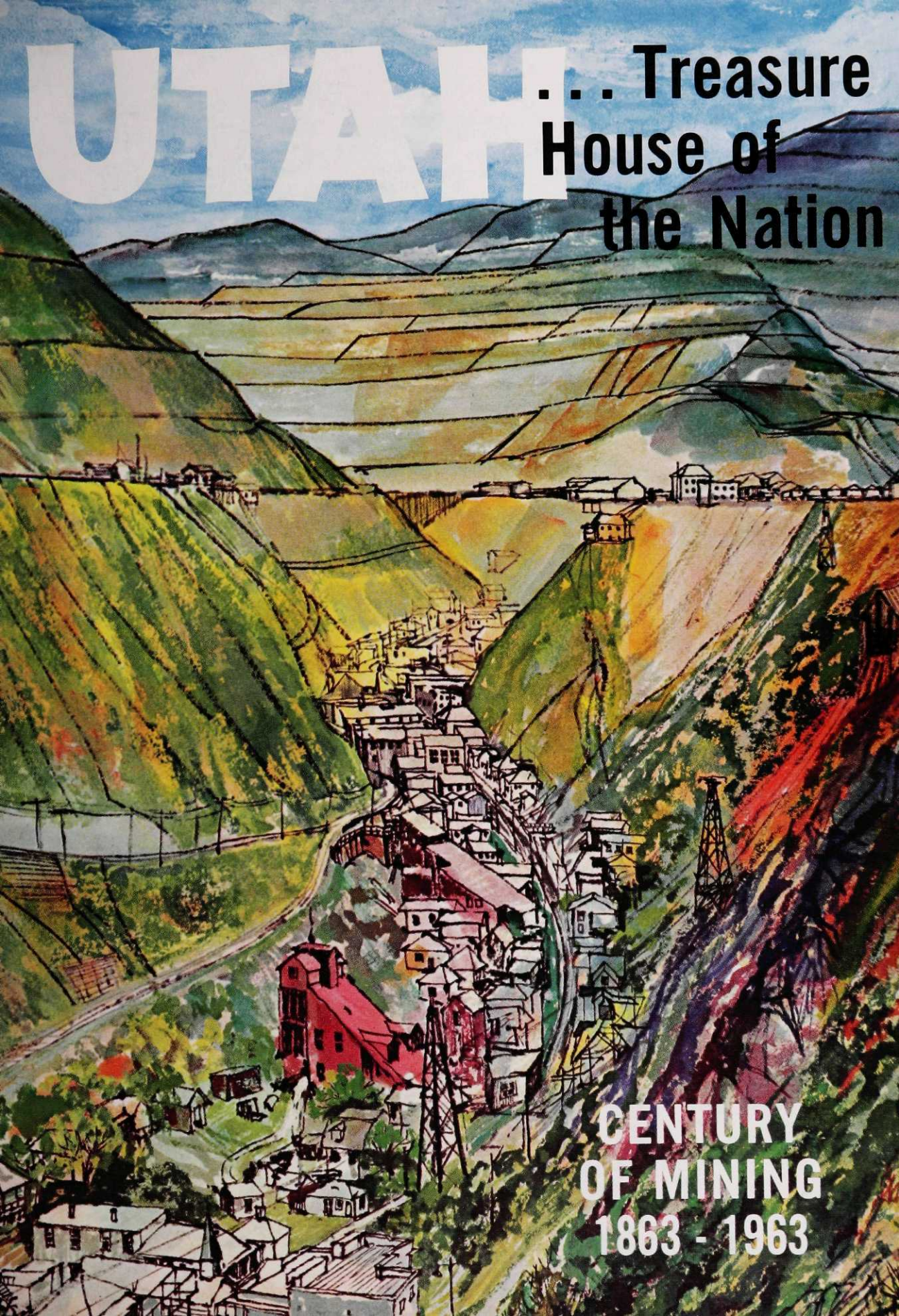
UTAH . . . Treasure House of the Nation



CENTURY OF MINING 1863 - 1963

UTAH
STATE HISTORICAL SOCIETY

BOARD OF TRUSTEES

J. GRANT IVERSON, Salt Lake City, 1967
President

DELLO G. DAYTON, Ogden, 1965
Vice-President

EVERETT L. COOLEY, Salt Lake City
Secretary

J. STERLING ANDERSON, Grantsville, 1967

LELAND H. CREER, Salt Lake City, 1965

RICHARD E. GILLIES, Cedar City, 1967

JACK GOODMAN, Salt Lake City, 1965

MRS. A. C. JENSEN, Sandy, 1967

JOEL E. RICKS, Logan, 1965

L. GLEN SNARR, Salt Lake City, 1967

LAMONT F. TORONTO, Secretary of State
Ex officio

S. LYMAN TYLER, Provo, 1965

LEVI EDGAR YOUNG, Salt Lake City
Honorary Life Member

ADMINISTRATION

EVERETT L. COOLEY, Director

T. HAROLD JACOBSEN, State Archivist, Archives

F. T. JOHNSON, Records Manager, Archives

K. W. INSCORE, Registrar, Military Records

JOHN JAMES, JR., Librarian

MARGERY W. WARD, Associate Editor

IRIS SCOTT, Business Manager

The Utah State Historical Society is an organization devoted to the collection, preservation, and publication of Utah and related history. It was organized by public-spirited Utahns in 1897 for this purpose. In fulfillment of its objectives, the Society publishes the *Utah Historical Quarterly,* which is distributed to its members with payment of a $4.00 annual membership fee. The Society also maintains a specialized research library of books, pamphlets, photographs, periodicals, microfilms, newspapers, maps, and manuscripts. Many of these items have come to the library as gifts. Donations are encouraged, for only through such means can the Utah State Historical Society live up to its responsibility of preserving the record of Utah's past.

The primary purpose of the *Quarterly* is the publication of manuscripts, photographs, and documents which relate or give a new interpretation to Utah's unique story. Contributions of writers are solicited for the consideration of the editor. However, the editor assumes no responsibility for the return of manuscripts unaccompanied by return postage. Manuscripts and material for publications should be sent to the editor.

The Utah State Historical Society does not assume responsibility for statements of fact or opinions expressed by contributors.

The *Utah Historical Quarterly* is entered as second-class postage, paid at Salt Lake City, Utah.

Copyright 1963, Utah State Historical Society, 603 East South Temple Street, Salt Lake City, Utah.

SUMMER, 1963 VOLUME 31 NUMBER 3

UTAH HISTORICAL QUARTERLY

CONTENTS

THE MINERAL INDUSTRY:
A FOUNDATION OF UTAH'S ECONOMY
BY ELROY NELSON 178

ABUNDANCE FROM THE EARTH: THE BEGINNINGS
OF COMMERCIAL MINING IN UTAH
BY LEONARD J. ARRINGTON 192

UTAH'S CINDERELLA MINERALS:
THE NONMETALLICS
BY MILES P. ROMNEY 220

FROM DEARTH TO DELUGE:
UTAH'S COAL INDUSTRY
BY THOMAS G. ALEXANDER 235

BULWARK OF THE KINGDOM:
UTAH'S IRON AND STEEL INDUSTRY
BY GUSTIVE O. LARSON 248

INDUSTRY OF DESTINY: COPPER IN UTAH
BY GARY B. HANSEN 262

WONDER MINERAL: UTAH'S URANIUM
BY DON SORENSEN 280

UTAH'S BLACK GOLD: THE PETROLEUM INDUSTRY
BY OSMOND L. HARLINE 291

The Cover

An artist's concept of famous Bingham Canyon about 1915. Prominent in the background is the decade-old Utah Copper Mine. Farther down the canyon are the Wall and Redwing mills and Winnamuck operations. Cogwheel railroads and tramways form part of the scene. DALE KILBOURNE, ARTIST

EDITOR ..... Everett L. Cooley
ASSOCIATE EDITOR ..... Margery W. Ward
ART EDITOR ..... Roy J. Olsen

THE MINERAL

SILVER GOLD COPPER
LOGAN
PHOSPHATE
RANDOLPH
BRIGHAM CITY
OGDEN
CEMENT CLAY
POTASH
LIMESTONE SALT
FARMINGTON
COALVILLE
MANILA
GAS
WENDOVER
SALT LAKE CITY
COPPER
CEMENT
KNOLLS
MURRAY
GOLD SILVER
SALT
SMELTING
LEAD ZINC
BINGHAM
PARK CITY
LEAD
MIDVALE
HEBER
TOOLE
ALTA
ZINC
PHOSPHATE
COPPER LEAD-ZINC GOLD
VERNAL
OPHIR
SILVER
STEEL MILLS
OIL SHALE
OIL GAS
GOLD
GOLD HILL
PROVO
PHOSPHATE
CLAY
OIL
SILVER TUNGSTEN ARSENIC
SPRINGVILLE
DUCHESNE
GAS
LEAD SILVER GOLD ZINC
EUREKA
GILSONITE
NEPHI
GAS
HELPER
COAL
PRICE
SUNNYSIDE
BERYLLIUM FLUORSPAR URANIUM
BUILDING STONE
COAL
DELTA
MANTI
CASTLE DALE
SALT
GUNNISON
SALINA
COAL
OIL GAS
FILLMORE
CISCO
GYPSUM CLAYS
URANIUM
POTASH
OIL-GAS POTASH
SULPHUR
RICHFIELD
MOAB
COPPER
GOLD SILVER
URANIUM
URANIUM
LEAD ZINC GOLD SILVER
ALUNITE
MARYSVALE
FLUORSPAR
MILFORD
BEAVER
URANIUM
URANIUM
OIL GAS
URANIUM
MONTICELLO
IRON
PANGUITCH
CEDAR CITY
COAL
COPPER LEAD GOLD
SILVER
ST. GEORGE
COAL
GOLD
BLUFF
SILVER
KANAB
URANIUM
OIL GAS

INDUSTRY: A Foundation of Utah's Economy

BY ELROY NELSON

The mining industry in Utah for the past one hundred years has been a major foundation on which the economy of Utah has been built. Throughout most of the territorial and state history since 1863, Utah has ranked among the top five states in percentage of the state's employment or income derived from mining and processing of minerals. In total value of all mineral production, Utah usually ranks from twelfth to fourteenth among the fifty states. In variety and balance as among the metals, the fuels and other nonmetallics, Utah usually ranks at or near the top.

The promise of the next century is for even closer relationship between the minerals and the general economy. Expansion of the older familiar metals, development of the newer ones, and increases in demand for industrial minerals and fuels are expected to provide even broader bases.

There has been no continuous long-time, year-to-year trend in mineral discovery or production. Instead, a series of new additions accompanying changes in demand, in discoveries, or in processing of specific minerals characterizes the industry. Each of the major minerals for which the state is noted has been a factor in establishing an additional base. Included are gold, silver, coal, lead, zinc, copper, iron ore, oil and gas, Gilsonite, uranium, vanadium, potash, and phosphate as well as salt, building minerals, and industrial minerals. Also, such newcomers as helium and beryllium should be noted. With few exceptions all minerals, regardless of the date in which discovery was made or production begun, are being produced today. Utah has a few ghost towns where recoverable metals have been exhausted, and a number of others where cost of production exceeded the final sales price in 1963 markets.

For want of a better classification, there are four major periods of mineral development. These include:

1847–1869 Materials such as clay, lime and stone, and salt were produced; and after 1863, gold and silver were mined. A little iron ore and lead mining followed. The major beginning was with discoveries in 1863.

Dr. Nelson is vice-president and economist for First Security Corporation. He is also the editor of *First Security News Letter* and former director of the Bureau of Economic and Business Research, University of Utah.

1869–1904 With the coming of the railroads and extension of the lines into productive mineral areas, major production began. The metals mined included gold, silver, lead, copper, and zinc, along with the other minerals, coal, clays, salt, and Gilsonite.

1905–1940 Copper, including production from porphyry ore; expansion of lead; successful processing of zinc ores; beginning of iron ore output; expansion of coking coal production and pig iron; and building materials characterized this period.

1940–1963 General expansion of metal output; birth of the steel industry; the growing age of industrial minerals; steel and steel production; expansion of copper, uranium, oil, phosphates, and industrial minerals including many new ones took place during this period.

The annual value of mineral production before 1860 was estimated at less than $10,000 — a small local industry. The total passed $100,000 (mostly gold and a little silver) by 1867, increased to $1.5 million in 1870, and to $25 million by 1905. The value exceeded $100 million in 1917 (World War I), again in 1925, 1937, and 1940; $200 million during World War II; $300 million by 1955; and $400 million by 1960. The value of production per capita in the territory or state was reported at $.82 in 1865, $16 by 1870, $100 by 1910, to more than $425 since 1960.

Before 1863, production included the building materials, salt, and some coal, principally at Coalville; after 1863, and until 1869, gold and a little silver were produced. From 1870 until 1904, silver was the leading metal; copper has been the leading mineral in most years since 1905. After 1940, steel was added along with mining of industrial minerals, part of which are related directly for use in metals industry processing. However, petroleum has become the number-two mineral in reported value since 1960.

Agriculture and food, of necessity, had to be the pioneers' first concern; development of a home industry economy was a requirement of survival. A sawmill and a flour or gristmill were constructed in 1848. These, added to salt and adobe production, constituted industry in the first two years. Prospecting for metals (particularly gold and silver) was generally discouraged during a time when the problem of securing food was paramount; exchange, except barter, was of less importance. In the meantime gold from California had become available to a limited extent in 1849–51 in exchange in the pioneer economy and for exchange with Eastern States.

Additional needs arose which could be supplied only from metals. Of first importance was iron for horseshoes, horseshoe nails, and wagon tires. These were home industry needs. Iron, wagon tires, and other such materials left in Salt Lake Valley by the California forty-niners or succeeding gold seekers were reworked, but the supply was short. However, in 1849, a forge was established

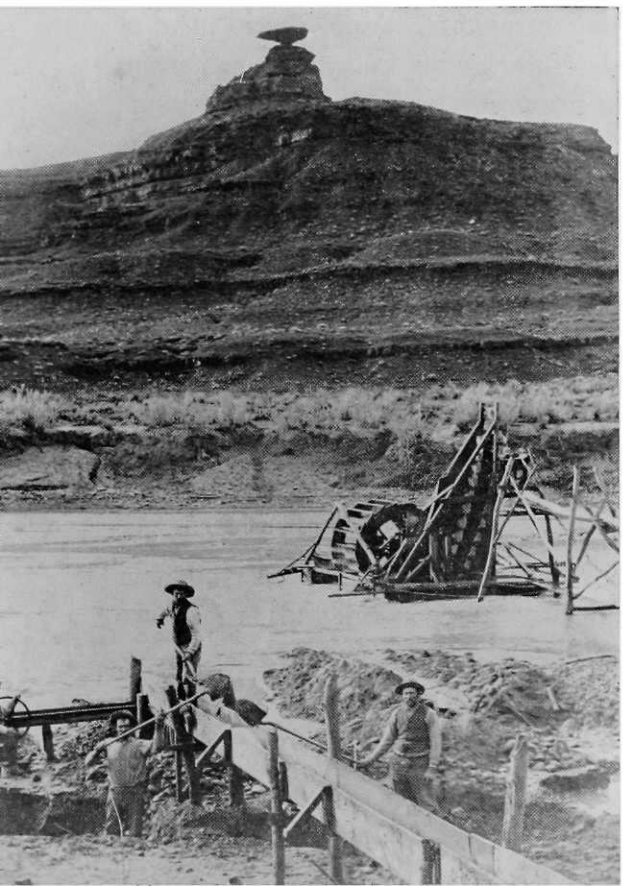
in Salt Lake City to recover usable iron from the scrap materials left along the wayside by California immigrants.

Four "missions" were organized to search for and develop minerals. The major one was for iron, smaller ones were for gold, lead, and coal. These were dramatic missions. All were economic failures except, to a limited extent, the one for coal at Coalville. The major problem was lack of processing knowledge for complex nonmetal ores, or in the case of iron, the problem of securing quality sources of carbon (coke or charcoal).

The census of 1860 listed 148 manufacturing firms in the territory with 389 wage earners. Manufacturing included production of lumber and flour, as well as textiles and apparels. Also included were adobe, pottery, and salt-processing works; forges; and one machinery manufacturer.

The real foundations for the metals industry began with the discoveries in Bingham Canyon in 1863. Placer mining began in 1865, and in a short period of time prospecting resulted in the discovery of lead and copper deposits in all of the present producing areas. By the time the railroad was constructed into the territory in 1869–70, the major metal deposits of the state had all been noted through outcroppings discovered by prospectors. These metals had no value simply as outcroppings until they could be mined, milled, smelted, transported, and sold at a price sufficient to repay costs and yield some profit.

UTAH STATE HISTORICAL SOCIETY



Placer mining in 1889 on the San Juan River, Mexican Hat. Dredge and sluice box used in the gold mining process.

Mining Growth (1870–1904)[1]

The real stimulous to the mining industry was completion of the transcontinental railroad into Ogden in 1869, with connections to

[1] Statistical data utilized are from annually published U.S., Department of the Interior, Geological Survey, *Minerals Yearbooks*; University of Utah, Bureau of Economic and Business Research, *Measures of Economic Changes in Utah 1847–1947* (Salt Lake City, 1947); University of Utah, Bureau of Economic and Business Research, *A Statistical Review of Utah's Economy* (Salt Lake City, 1960); various feature articles in *Utah Economic and Business Review;* Utah Mining Association, *Utah Mining Industry: An Historical, Operational, and Economic Review of Utah's Mining Industry* (2nd ed., Salt Lake City, 1959); and ElRoy Nelson, *Utah's Economic Patterns* (Salt Lake City, 1956).

Salt Lake City in 1870, and through Utah County in 1874. Rail lines had been completed to the major nonferrous metal-mining districts and within the next decade through the coal-mining areas. Completion of the transcontinental railroad had an instantaneous effect on the Utah economy. Major impacts were: (1) reduction in costs of "eastern" manufactured goods; (2) failure of many small local manufacturing establishments; (3) unemployment of teamsters; and (4) impetus to what was actually a dormant mining industry.

As shown by production data, the first real impact was on silver. A market had been found for silver-bearing ores from the Cottonwood Canyon districts, Park City, Tintic, and other areas. Gold from 1864 to 1869 represented 97 per cent of the reported value of metals, silver represented only 3 per cent. Maximum production of silver was 1,750 fine ounces, valued at $2,319 in 1869. In the following year gold production had increased over the preceding year by approximately 50 per cent, while that of silver had increased in reported value from $2,319 to $628,386.

The early discoveries near the surface, especially in the Park City and Cottonwood areas, were very rich in silver and might possibly be listed as silver mines, except that the ores were complex — lead-silver-zinc ores with some gold and traces of copper. Throughout the early period, through 1904, value of refined silver also exceeded that of copper in every year. As a per cent of national production, Utah's output of metals moved up from 3.19 per cent to more than 20 per cent during this 34-year period. Silver more than any other metal was the foundation on which family fortunes, employment, and development of mining areas and smelters were based. However, the value of all nonferrous metal output in the state, at least of the five major metals (gold, silver, copper, lead, and zinc), had increased from $190,000 in 1869 to $1.5 million by 1870, and to $22 million by 1904.

Crude furnaces, by later standards, were constructed in many areas of Salt Lake Valley (near Bingham and the Cottonwood canyons) and in the Tintic and other areas. These were small furnaces with a capacity of eight plus tons. Based on decennial census data, the peak in number of smelters (34) and in number of mills (18) was in 1880. To a great extent ores needed little crushing because they were handshovel loaded and were, of necessity, relatively fine. How many of these small furnaces were operated at one time is difficult to determine. However, combined at any one period they were small compared with smelters constructed after the turn of the century. Milling and selective flotation awaited a later period of time. However, as one example, an important breakthrough was the development of the famous Marcy ball mills in Salt Lake City by a branch of the Mine and Smelter Supply Company of Denver.

UTAH STATE HISTORICAL SOCIETY

Daniel C. Jackling (1869–1956), one of the founders of Utah Copper Company, and developer of Bingham open-pit copper mining. In 1954, Jackling's statue was unveiled in the rotunda of the Utah State Capitol.

Early smelters required refractories and gave impetus to the search for clays and other refractory materials. Also required were fluxing materials and fuel (coke). Demand for refractories had begun with iron processing in 1852, and continued in 1870 for nonferrous metals smelters. The building brick industries supplied some of these demands. But, with increased heat in furnaces, refractories as linings for furnaces that could be heated slowly to above 2700 degrees Fahrenheit without melting or fusing were required. Early refractories included sandstone, granite, and other types of stone. Clays were also required for plugging furnaces. Search for new raw materials and development of this type of industry were accelerated with each new discovery.

Expansion and Development (1905–1940)

The major development period in Utah's mining history came after the turn of the century. Actually, there were a number of developments. The first was the mining of copper, but equally important were the development of milling and flotation of ores and construction of larger smelters. The actual creation of new resources resulted from imagination, effective assembly and utilization of capital, and development of metallurgical processes. Low-grade copper became available. Zinc became a resource. It was in this period of time, soon after the turn of the century, that some radium or ores producing the radium were mined in southeastern Utah. These were to be developed some 40 years later.

Production of coking coal began in Carbon County, and iron ore was developed after 1920 for the first successful use in making pig iron. A new resource, molybdenum, was developed in the late 1930's. New building materials were developed through use of cinders, both volcanic and man-made.

In the rotunda of the State Capitol stands a monument to Daniel Cowan Jackling, a man who had an idea and a vision. It was Jackling who foresaw Kennecott's spectacular operation at Bingham, Arthur, Magna, and Garfield.

This operation is cited as one of the most significant metallurgical developments in the world. Jackling and those associated with him added a new resource — the low-grade porphyry copper ores to the lead-zinc-copper-silver ores — to the area, the region, and the world. This newly created wealth from porphyry ore is produced from material which was considered worthless until 1905. At that time rock that contained less than 40 pounds of copper per ton was regarded by competent mining engineers as worthless; it was not ore in the economic sense. Jackling's dream, preceded by the accumulation of claims beginning about 1900, was followed by an intensive investigation by the Guggenheim interests. It also represented major financing of the mine, the mill, and the smelter. It meant a mill and concentrator that would handle 300 tons of ore per day. The process which began at Bingham was the first such development and has since been extended world-wide. Most of today's copper production is from low-grade porphyry ores in 19 major operations throughout North and South America. Copper production, until after the turn of the century, was very small in Utah compared with that of gold, silver, and lead. In terms of value copper exceeded gold and lead in 1903 only, and silver in 1905; total tonnage of copper exceeded lead by 1910 only.

Production from porphyry ores required corresponding development in mills and smelters, and from crushing equipment to concentrating plants including flotation. It meant larger smelters to replace the small, few-tons-per-day plant. This was accomplished from 1905 through 1910. World War I also brought increased copper output, not only at the mine but also at the mills. These were rebuilt in large measure at Magna and Arthur in 1916–18. Low-grade ore production demanded expansion of the smelter at Garfield (the world's largest copper smelter with a daily capacity of 1,600 tons). It also meant research and development of gyratory and cone crushers, of rod and ball mills, and of flotation processes to replace gravity separation. It meant expansion of water uses in the mills, and use of filters to remove the water.

Such large-scale mining and milling required complex smelter operations. Blast furnaces were replaced with a series of furnaces (roasting, reverberatory, and converters) with blister copper the final product.

Mine production of copper had increased from 9.5 million pounds in 1899, to 46 million pounds in 1904, to 109 million pounds in 1909, and to 246 million pounds in 1917. Reported value was $1.6 million in 1899 and was increased to $66 million in 1917. This meant an increase from 1.7 per cent of the nation's total newly mined copper just before the turn of the century to 13 per cent by 1917. The next new record of copper production was in 1929, when 318 million pounds were reported. The value, however, was slightly less than that in 1917. New records were established in 1937 with 413 million pounds and in 1940 with

463 million pounds. This production far outdistanced all other nonferrous metals combined and equaled approximately 30 per cent of the nation's newly mined copper.

Although less spectacular than copper following 1905, development of milling, mining, and smelting of lead and zinc ores was on a large-scale basis. Included in this period were construction of the large concentrating mills and lead smelters at Murray and Midvale; expansion of the smelter at Tooele (both a lead smelter and a copper smelter); and development of concentrating mills in Park City, American Fork Canyon, Mercur, Tooele, and at Silver Horn operations west of Milford.

The lead-copper smelter development in Salt Lake and Tooele counties meant the end of the small smelters elsewhere and expanded output far beyond that of earlier periods. This signified that in the Salt Lake area was found the greatest concentration of nonferrous metal smelting in the world. So long as prices permitted, smelters meant expansion of the territory from which ores or concentrates could be assembled. Areas so developed were the Salmon River area of Idaho; southern Montana; and portions of Nevada, Arizona, and Colorado. Also included in the development were new machinery for drilling, equipment for haulage within the mine, milling equipment, and smelter furnaces. Actually, it meant that ores previously considered worthless, in addition to low-grade copper ores, could now be mined and processed.

In addition to major nonferrous metals recovered at the smelters (or refineries), bag houses at the smelters recovered such minerals as arsenic and sulfur. The latter was a foundation for sulfuric acid production, which began on a small scale in 1912. Coal, Gilsonite, clay, and other refractories were all part of the industrial growth of the period, 1905 to 1940.

Expansion and Additional New Bases (1940–1963)

The year 1940 marks the end of one period in mining and economic development in Utah and the beginning of what has been described as an economic explosion, certainly a dramatic evolution. Telescoped into a brief period of time has been industrial expansion in terms of employment, production, and variety and quantity of minerals to an extent almost equal to that of the preceding one hundred years of the territory and state.

The year 1940 also marks an interesting trend pattern — when both in Utah and the nation the number of employees in the service industries exceeded the number in basic physical production industries of agriculture, mining, manufacturing, and transportation. This does not mean a decreased importance of basic industries, but: (1) An expansion in demand for goods and services far beyond the food-shelter concept has taken place. The trend since 1940, especially

in the postwar period, means that by 1963 less than 40 per cent of the employment is in so-called physical production industries even when construction and utilities are included as basic. (2) A rapid increase in automation or use of machinery to replace manual labor on the farm, in mining, and in manufacturing has occurred. (3) A much higher pyramid of economic activity on a foundation of the physical-goods industries has resulted. World War II ushered in new economic bases in mineral development in Utah. It meant not only increased production of the nonferrous metals, but also of steel, many industrial minerals, uranium, oil, and gas.

Construction and operation of the steel plant at Geneva meant a new era corresponding in size and impact to that of copper development and metallurgical processing in the 1905–10 period. It meant tremendous expansion of iron-ore mining in the Cedar City area, coal mining in the Carbon-Emery counties area, mineral development such as fluorspar in the Delta area and dolomite in Payson, and refractories in the Lehi area. Perhaps of more importance, the steel plant ushered in a major beginning of steel fabrication. Production increased to satisfy considerable demand not only for steel in Utah, but expanded markets in Colorado and southern California.

In "defense" preparation for war, mineral production in Utah in 1940 increased significantly to total $103 million. In 1943, the total was reported at $163 million, which equaled 2.75 per cent of the nation's total mineral production, a new all-time high. But, in 1946, output of minerals totaled only $95 million. Strikes affected nonferrous metals, and there was no production of steel for some 10 months (1945–46) while the company awaited the sale of the steel plant. There was the business adjustment from war to peace, and the beginning of the postwar explosion of economic growth. Beginning in 1948, there were expansion of the old and the war-built industries and development of the new — oil, gas, and uranium. In 1947, output of minerals passed $200 million, in 1955 some $331 million, and in 1960 some $400 million. Even with adjustment in change in value of the dollar of more than 50 per cent since 1940, mineral output was more than doubled by 1960.

New peaks in certain nonferrous metals were established during the war. Copper production in Utah totaled 748 million pounds in 1943 to reach 30 per cent of the nation's total of newly mined copper. Actually, gold production also established new records in Utah, primarily as a by-product of copper. Consequently, national output of gold during the war came primarily from mines where gold was a by- or co-product of base metals. Gold mines, as such, were closed. Lead and zinc production was accelerated, but did not reach the total previously established in the late 1920's. The same generalization applies to silver production.

UTAH STATE HISTORICAL SOCIETY

United States Smelting, Refining and Mining Company smelter and refinery on the Jordan River at Midvale, south of Salt Lake City. The copper smelter was completed in November of 1902. The addition of a lead smelting unit to the plant was completed in January of 1904. Copper smelting was discontinued in 1908. Lead smelting continued until the smelter ceased operations in June of 1958, and the plant was dismantled in 1958 and 1959.

Following 1947, there were some major increases in demand and production. There were also increases in 1955–56. Price declines, especially of lead and zinc, beginning in 1952 with decreased tariffs continued to plague the industry. These were reflected in a number of changes in industrial patterns. Low prices for lead and zinc curtailed Utah operations. Mines were closed beyond the state borders where costs, including freight on ores to the Utah lead-zinc mills and smelters, were higher than the selling prices of the refined metals. This reduced drastically the geographical areas providing ores for Utah smelters. In the meantime foreign imports, accompanying the continual lowering of tariff, harassed the industry.[2]

The famous 50-year-old smelters at Murray and Midvale were closed and dismantled during the 1950's. By 1963, there was but one custom lead-zinc mill

[2] Comparison of mine production and mill-smelter output of lead and zinc in Utah, showing amounts of ores produced in neighboring states but processed in Utah during 1948–55, is shown in *ibid.*, 90.

at Midvale, and one lead-zinc smelter at Tooele. In 1963, a new company mill was constructed at Keetley to process ores from the Hecla Mine. The lead-zinc industry continues to have difficulties.

The new poling furnaces at the Garfield copper smelter and the new copper refinery at Garfield, constructed in 1951–52, produced for the first time in Utah's history a new product — refined copper, a product ready for fabrication. This meant one more step beyond production of blister copper. Utah had an integrated industry from the mine through milling, smelting, and refining.

Copper mining has been subject to rather significant year-to-year changes since the war. Although ore production was almost equal to wartime peaks, decreasing quality of ores meant lower copper production. In early 1963, Kennecott announced a $100-million, four-year expansion program at the Bingham mine, the Garfield-Arthur mills, and the Garfield smelter. This will mean a 20 per cent increase in ore production and grinding facilities, a new precipitation plant, and changes in smelting methods. The entire program will bring production capacity of the finished smelted or refined copper to World War II levels.

Vanadium production in the United States comes principally from the same territory as uranium and as a co-product in the milling of certain of these ores. Production at regional mills was significant in 1940 from San Juan ores, and the co-products were vanadium and uranium popularly referred to as "red cake" and

Kennecott Copper Corporation's open-pit copper mine in Bingham Canyon.

KENNECOTT COPPER CORPORATION

"yellow cake." From 1940 through 1953, production data on vanadium ores were not available for the simple reason that such data, with a little arithmetic, would have shown uranium production. Vanadium production was reported in Utah at approximately 1 million pounds per year in the middle 1950's and valued between $1 million and $1.7 million. Production decreased somewhat from the peak in 1955. The value has not been listed by the Bureau of Mines since that date. In 1963, new plant facilities at Vitro in Salt Lake City began processing slag from the elemental phosphate plant at Pocatello for recovery of vanadium.

A tungsten refinery was operated at the Industrial Center in Salt Lake City during World War II to process ores from areas in the Intermountain West, including ore from Utah, Tooele, and other western Utah counties. Tungsten ores in Utah and most neighboring states are of extremely low quality, and development of such areas as Cottonwood and American Fork canyons has never been feasible. Tungsten refineries or concentrating mills were constructed in Salt Lake City in 1953 and were operated for some four years utilizing ores from Western States. Imports of this metal from higher grade deposits in foreign countries and the buildup of reserves (nationally) were causal factors leading to the closing of these concentrating mills.

Cobalt, a fourth major steel-alloying metal, was produced in Utah from 1953 through 1957. Cobalt concentrates were utilized from the Salmon River

The berylometer is used in prospecting for beryllium, but only by licensed technicians as it emits harmful gamma rays.

BERYLLIUM RESOURCES, INCORPORATED

area in Idaho. The plant west of Garfield was built to produce 3.6 million pounds of the metal per year and was the only major producer of this metal from mining through milling and concentration in the United States. Termination of government purchases for stockpiling meant the end of the operation of this industry in the Intermountain region in 1957.

A number of other metals, as well as nonmetals, are produced as by-products of the nonferrous metal-mining, milling, smelting, and refining processes. These are recovered generally through the processing of copper, lead, and zinc. Some are recovered in the milling, smelting, refining, or flue dust. Some metals recovered are cadmium, bismuth, selenium, and nickel sulfate. Arsenic from time to time has also been recovered from ores produced in the Gold Hills area of Tooele County.

Beryllium is the new wonder metal and is entirely a postwar development. Most of the discoveries have been made in the Topaz Mountain area in Juab County and in adjacent Millard County. Pilot plants in Delta and in Salt Lake City have been constructed. A number of companies are pushing development of this new metal, which is so important to the space age.[3]

In addition to coal, petroleum, and natural gas, major future developments are anticipated in the oil shale of eastern Utah and neighboring states and in the bituminous sands in the Vernal area. Research on the utilization of these products is not continuous; further development awaits processing, chemical engineering, and economics.

One of the major developments in Utah's postwar period is that of fertilizer, including potash from the Bonneville Salt Flats and in 1963 from the Cane Creek area near Moab. Also there are phosphate developments in Rich County and in Uintah County. Added are the nitrogen fertilizers as by-products of coking coal operations at the Geneva steel plant. Utah is the only state in the nation producing all three primary plant foods: nitrogen, phosphate, and potash. Except for small potash operations during World War I, the remainder of the development began after 1940 with major developments after 1948.[4]

Associated closely with the fertilizer development, especially phosphate and nitrogen, is sulfuric acid output as a by-product of copper smelting. The major market for the 1,000-ton per day surfuric acid plant is the fertilizer industry, principally in Utah and Salt Lake counties.

War and postwar developments of building materials overshadow most other developments. Included are the new gypsum plants at Sigurd, the ex-

[3] For the relatively recent discussion of this metal and its possible use development, see Ann H. Moffat, "Beryllium Developments in Utah," *Utah Economic and Business Review*, XXI (September, 1961), 3–5.

[4] See Nelson, *Utah's Economic Patterns*, 138, 170–77.

panded cement plants at Salt Lake City and Devil's Slide, and new brick and block operations.

Today is known as the age of missiles and electronic development, or the age of the scientist, and Utah is a vital part of this development and trend. Missiles consist of the older and the newer metals of copper, some lead, zinc, silver, and gold. Components include cobalt, vanadium, and many other metals. The fuels encompass the hydrocarbons and many others not usually recognized as fuels. This means millions of dollars in research, development, and conversion of materials from the earth into these new products.

Demand for both new and old raw materials in this nation is tremendous and constantly growing. In 1963, the demand is in excess of 3.2 billion tons of minerals. This is in excess of 19 tons for every man, woman, and child in the United States. Utah is a major producer of many of these materials. Based on 1962 tonnage, output in this state of the minerals is in excess of 85 tons per capita, about five times the national average. All this is of vital importance to Utah. In the history of tomorrow, promises exceed those of yesterday and today.

ABUNDANCE FROM THE EARTH:
The Beginnings of Commercial Mining in Utah

BY LEONARD J. ARRINGTON

Next to human resources, available minerals are among our most essential and prized possessions. Mining provides essential raw materials for the tools and equipment used in agriculture, in industry, in transportation and communication, and in the ordinary household. Indeed, mineral products constitute the building blocks of both developing and advanced societies. As a state with a rich endowment of mineral resources, Utah has made, and is continuing to make, major contributions to the nation. When Abraham Lincoln said, "Utah will yet become the treasure-house of the nation,"[1] he could hardly have realized that one day the state would have the largest open-pit mine in the world; provide one-third of the immense demands for copper of a nation at war; and lead all the states, in various years, in production of lead, silver, zinc, copper, gold, and uranium, as well as in a number of minor minerals. The beginnings of the commercial exploitation of its mines justifies retelling in this centennial year.

Although we cannot exclude the possibility that skilled Navajo silversmiths may have used metals from Utah mines, the first known mining in Utah was done in the 1840's by Spanish-Americans. Silver and gold mines worked by Mexicans have been located near Cedar City and Kamas, Utah.[2] Far more extensive and systematic were the mining activities of the Mormon pioneers. There was mining of salt as early as 1847; a community was established devoted to working the coal and iron deposits of Cedar City; fifty young men were "called" to mine gold in California; other groups began to mine coal at Wales, Sanpete County, and Coalville, to mine lead at Las Vegas and Minersville, and to mine sulfur at Beaver; a company was dispatched from southern Utah in 1864 to develop lead and silver mines at Meadow Valley and another group in 1873 to work silver mines in the Uinta region; and exploring parties were organized to investigate reports of the existence of various kinds of minerals in

Dr. Arrington is professor of economics, Utah State University, Logan. The research for this study was done under a grant from the Utah State University Research Council. The writer wishes to express gratitude for the collaboration of Gary B. Hansen, university research fellow in economics at Utah State University in 1962–63. Two publications which appeared too late to be used in the preparation of this article give excellent perspective to Utah's early mining history. They are: William S. Greever, *The Bonanza West: The Story of the Western Mining Rushes, 1848–1900* (Norman, 1963); and Rodman W. Paul, *Mining Frontiers of the Far West, 1848–1880* (New York, 1963).

[1] Edward Tullidge, *History of Salt Lake City* (Salt Lake City, 1886), 697.

[2] Edgar M. Ledyard, "Early Mining and Smelting South of Salt Lake City," *Ax-I-Dent-Ax*, XVI (May, 1931), 1; J. Cecil Alter, ed., "Those Old Spanish Mines," *Utah Historical Quarterly*, IX (July, October, 1941), 129–31; William R. Palmer, "Other Spanish Mines," *ibid.*, 132.

UTAH STATE HISTORICAL SOCIETY

Placer mining in Utah was an uncommon practice. Exact location of this operation is not known, but the inscription on the log cabin would indicate that it was in the vicinity of Bingham Creek. This photograph was the work of C. W. Carter, early Utah photographer.

many locations of the territory.[3] At no time did this activity occupy a majority of the population, but it is not unlikely that there was as large a per cent of the people engaged in mining during some of those early years as in Utah today.

[3] Early mining activities of the Latter-day Saint pioneers are described in Leonard J. Arrington, *Great Basin Kingdom: An Economic History of the Latter-day Saints, 1830–1900* (Cambridge, 1958), esp. Chapters III, IV, and VII. See also "Journal History" (Church of Jesus Christ of Latter-day Saints Historian's Library, Salt Lake City), June 11, 1864, June 5, 1870, January 23, February 11, 12, 1873.

Above all, it is clear that a serious and methodical effort was made to ascertain the mineral resources of the region and to work the most promising finds. The "Journal History" of the Church of Jesus Christ of Latter-day Saints carries numerous references to mining explorations during the years after the initial Mormon settlement in 1847. It is not true, as some historians have asserted, that Utah's pioneers were uninterested in mining or that they "deliberately retarded" mining activity.[4] Mormon leaders seem to have known, as other statesmen have known, that an advanced and progressing economy could not be built without mining, and some of their strongest statements are those relating to the necessity of coal and iron mining. Their official interest is indicated by the fact that mining was not left to unaided private enterprise. The church called official exploring missions, and it dispatched official parties of miners to work the finds and prepare the mineral for use. Indeed, the extent of mining activity during the first decade and a half after settlement makes it possible for us to say that we are celebrating the centennial of mining in Utah a little late. There was a significant amount of mining more than a hundred years ago.

The Army Turns Prospector (1863–1868)[5]

If pioneer mining in Utah was promoted by the dominant church, the intimate inspection of the mountains, the discovery of ores, and the organization of mining districts were primarily the result of stimulus by the federal government — or, to be more specific, sponsorship by the United States Army. The story of how this occurred is a further aspect of the peculiar influence of the so-called "Mormon question" on Utah's economic development and definitely forms the basis for a centennial of Utah mining in 1963.

Utah was "invaded" by a substantial force of United States troops in 1857–58. These remained to occupy the territory until the outbreak of the Civil War in 1861. But the administration of Abraham Lincoln felt uneasy about Mormon intentions. Would the Mormons take advantage of the War Between the States to secede and declare themselves an independent commonwealth? Would they align themselves with neighboring Indians to stab the Union in the back? To "keep an eye on Brigham," and to protect the Overland Mail from Indian attacks, the Secretary of War ordered a force of approximately 750 California and Nevada Volunteers to Utah. Under the command of an ambitious Irishman, Patrick E. Connor, they established Camp Douglas overlooking Salt Lake City, in October, 1862. It is clear that the troops were disappointed that they

[4] S. F. Emmons, "Introduction," in J. Edward Spurr, *Economic Geology of the Mercur Mining District, Utah* (Washington, D.C., 1895), 351–52; T. A. Rickard, *History of American Mining* (New York, 1932), 182–83; Utah Works Projects Administration, *Utah: A Guide to the State* (New York, 1945), 120.

[5] The heading is borrowed from a chapter title in Muriel S. Wolle, *The Bonanza Trail: Ghost Towns and Mining Camps of the West* (Bloomington, 1953), 363.

STATE OF UTAH
OFFICE OF THE GOVERNOR
SALT LAKE CITY

GEORGE D. CLYDE
GOVERNOR

PROCLAMATION

WHEREAS, in recognition of the location of the first mining claim, the preparing of the first mining laws and the organization of the first mining district in Utah, all occurring in the year 1863, and

WHEREAS, in further recognition of the vital relationship which mining has had with the economic growth and welfare of our state and its citizens since that modest beginning - a growth impressively demonstrated by the officially reported value of Utah mineral products reaching a cumulative total of more than eight billion dollars in 1962;

NOW, THEREFORE, I, George D. Clyde, Governor of the State of Utah, do hereby proclaim 1963 as

THE CENTENNIAL YEAR OF MINING IN UTAH

and urge all citizens to participate in appropriate commemorative celebrations of the accomplishments of mining in Utah over the past century.

GEORGE D. CLYDE
GOVERNOR

Although there was mining in Utah prior to 1863, the first mining district in the territory was established that year and forms the basis for the 1963 centennial.

UTAH STATE HISTORICAL SOCIETY

General Patrick E. Connor (1820–1891), commander of the California Volunteers and the "father" of mining in Utah.

had not been ordered to the East to fight the Confederacy. It is also clear that Colonel Connor came with somewhat less than unquenchable admiration for the people of Utah. "It will be impossible for me to describe what I saw and heard in Salt Lake, so as to make you realize the enormity of Mormonism," he said after his first trip; "suffice it, that I found them a community of traitors, murderers, fanatics, and whores."[6]

Thus, in addition to conducting Indian campaigns, Colonel Connor directed a regular stream of reports to the Department of the Pacific in San Francisco, recommending incendiary policies to punish Mormon "treason." Either, he said, divide Utah Territory into four parts and give each of the four parts to adjoining territories, or declare martial law. Clearly preferring the latter, he requested the department to supply him with 3,000 men, a light battery, and three pieces of heavy ordnance. "I will [then] guarantee to take such measures as will give Brigham no alternative but to obey the law . . . ," he declared.[7] Army headquarters, however, facing the full force of the Confederacy, was in no mood to get involved in a war with the Mormons and instructed Connor to pursue a more peaceful policy.[8]

As early as 1848–49, Thomas and Sanford Bingham, who grazed livestock in Bingham Canyon, had found outcroppings of ore.[9] Word of these and other mineral findings drifted in to Camp Douglas, providing a made-to-order situation for the former California and Nevada miners and the energetic colonel. The "Indian problem" was largely resolved by the Bear River Massacre (which led to Connor's promotion to the rank of brigadier general) and other campaigns and treaties. Soldiers and officers stationed in Utah, therefore, occupied much of their time going into the mountains to prospect.

On the afternoon of September 17, 1863, to judge by later accounts, a group of Mormon "boys," including George Ogilvie, Alex Ogilvie, John Egbert, and Henry Beckstead (also Bexsted), while dragging logs, uncovered argentiferous

[6] *The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies* (Washington, D.C., 1897), Series I, Vol. L, Part II, p. 119.

[7] *Ibid.*, 320.

[8] *Ibid.*, 1100.

[9] George M. Addy, "The Economic and Social History of the Bingham Canyon, Utah" (Master's thesis, Brigham Young University, 1949), 10–13; *Salt Lake Tribune*, March 19, 1948; Vernon H. Jensen, *Heritage of Conflict* (Ithaca, 1950), 256–57.

Mine Production and Value of Major Nonferrous Metals in Utah 1865–1885

(Source: University of Utah, Bureau of Economic and Business Research, *A Statistical Review of Utah's Economy* [Salt Lake City, 1960]).

	Gold			Silver			Lead		
Year	*Production (fine ounces)*	*Value*	*Per cent of United States Production*	*Production (fine ounces)*	*Value*	*Per cent of United States Production*	*Production (short tons)*	*Value*	*Per cent of United States Production*
1865	2,700	$ 55,800	0.1	450	$ 600	---	---	$ ---	---
1866	4,100	84,800	0.2	800	1,100	---	---	---	---
1867	4,670	96,500	0.2	812	1,100	---	---	---	---
1868	8,000	165,400	0.3	1,600	2,100	---	---	---	---
1869	9,068	187,500	0.4	1,750	2,300	---	(a)	(a)	---
1870	14,512	300,000	0.6	473,182	628,400	3.9	4,166.5	500,000	23.4
1871	11,063	228,700	0.5	1,709,811	2,265,500	9.9	5,000.0	608,000	25.0
1872	8,500	175,700	0.5	2,981,521	3,941,600	13.7	11,785.0	1,484,900	45.5
1873	2,536	52,400	0.1	3,157,435	3,725,800	10.4	15,000.0	1,896,000	35.3
1874	13,608	281,300	0.8	2,904,246	3,630,300	9.7	20,000.0	2,440,000	38.4
1875	8,793	181,800	0.5	2,383,809	2,955,900	9.3	19,000.0	2,204,000	31.9
1876	8,820	182,300	0.5	4,436,982	5,146,900	13.3	25,000.0	3,050,000	39.0
1877	17,323	358,100	0.8	4,359,733	5,231,600	13.1	24,194.0	2,661,300	29.5
1878	13,394	276,900	0.5	4,132,313	4,752,100	10.5	21,627.0	1,557,100	23.8
1879	15,730	325,200	0.8	3,665,600	4,105,500	10.1	14,370.0	1,178,300	15.5
1880	3,020	165,800	0.5	3,663,183	4,212,700	12.1	15,214.0	1,521,400	15.6
1881	6,982	144,300	0.4	4,958,345	5,602,900	14.9	23,978.0	2,301,400	20.5
1882	9,039	186,900	0.6	5,435,444	6,196,400	15.0	29,937.0	2,933,800	22.5
1883	6,772	140,000	0.5	4,388,541	4,915,200	12.3	33,330.0	2,866,400	23.2
1884	5,805	120,000	0.4	5,263,157	5,842,100	13.9	30,432.0	2,252,000	21.8
1885	8,707	180,000	0.6	5,232,557	5,598,800	13.1	25,659.4	2,001,400	19.8

(a) Withheld to avoid disclosure.

At a meeting of the Quarts Miners of West Mountain Quarts Mining District held at Jordan Ward House Salt Lake Valley on the 17th Day of Sept. 1863. The following Bye Laws were passed.

Article No. 1 This District shall include that Portion of Territory situated in the Territory of Utah, and bound as follows Commencing at the Confluence of the River Jordan, with Great Salt Lake, and running thence in a Southernly Direction along the East Bank of said River Jordan to its point of Exit from Lake Utah, thence along the West margin of said Lake Utah, to the 40th Degree of North Latitude (Greenwich) to the 114th Degree of West Longitude (Greenwich) thence along said 114th Degree of West Longitude, to the 41st Degree of North Latitude (Greenwich) thence along said 41st Degree of North Latitude, to Great Salt Lake, thence along the Margin of said Lake, in a South Easterly direction to the place of Begin-ing.

Art. No 2 The extent of a Claim on any Quarts Lead, or Vein, Shall be Two hundred feet, to the Claim with all its Dips, Angles, and Varidtions.

Art. No. 3. No person will be permitted to hold more than one Claim by Location, on any one Vein. - By purchase can hold any Number of Shares.

Art. No. 4 All Claims located must have a Notice Posted upon them, Stateing the Number of Shares and the probable course claimed, and also Recorded in the Books of the District Recorder, within Ten Days after location.

Art. 5. Each Company must do one faithfull Days work on their Claims, each Month, after the first Day of April 1864, a failure to do so, the Claim will be Jumpable, provided however, that if the Company are prevented by local insurrection, or Rebbellion from Working: A failure to do so will not forfeit their Claim.

Art. 6. The Discoverer of a Vein of Quarts, Containing Gold Silver, Copper, or other valuable Metals, or Minerals, will be entitled to Locate Two Shares.

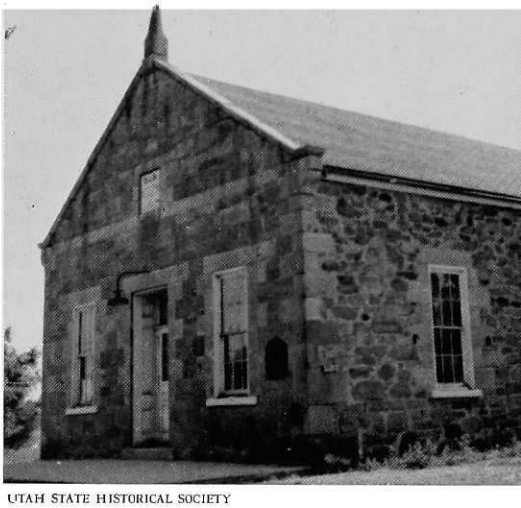
Art. 7. Their Shall be a District Recorder Elected from among the Miners of the District, whose duty it shall be to Record all Claims presented for the purpose: giving the name of each location or Owner. And receive as Compensation a sum not exceeding One Dollar per Location or Owner, His Term of Office Shall be One Year, or Untill his Successor is Chosen.

Art. 8. These Laws will Apply, to Locations of Claims or Veins, of Coal, Iron, or other Metals, or Minerals in this District.

Archibald Gardner. Was Elected District Recorder of West Mountain District, for One Year, from the Date above written.

Archibald Gardner } President
G. W. Carleton } Secretary

Organizational minutes of Utah's first mining district, the West Mountain Quartz Mining District (September 17, 1863), and the building where the meeting took place, the Jordan Ward meetinghouse adjacent to Bishop Archibald Gardner's mill which was near the Jordan River.



UTAH STATE HISTORICAL SOCIETY

galena in Bingham Canyon.[10] (The canyon was being used by George B. Ogilvie, by Bishop Archibald Gardner, and by units of the Volunteers as a grazing area.) George Ogilvie identified the ore and took it to General Connor, who had the ore assayed.[11]

Under Connor's direction Ogilvie located the West Jordan Mine and made out a notice in the name of the Jordan Silver Mining Company. The names of 25 persons were listed on the notice, including George Ogilvie for the "original discoverer's" share, Egbert's father Samuel, Henry Beckstead, Bishop Archibald Gardner (a West Jordan Mormon rancher and mill owner), General Connor, various Utahns, and officers and members of the Volunteers. On the same day there was a party of ladies and gentlemen under the leadership of Captain Arthur Heitz enjoying a picnic and grouse hunt in the canyon. These conducted a further search. One of that party, Mrs. Robert K. Reid, wife of the camp surgeon, located a second vein contiguous to the Jordan claim, and a second notice was made out crediting Mrs. Reid with the discoverer's share. Among the 20 other shareholders in that claim were Captain Heitz and General Connor's wife. A third claim, the Vedette, with 26 shareholders was also filed on September 17, 1863.

Following the discoveries and the staking of claims, the parties (some 52 persons in all) went to the Jordan Ward meetinghouse near Bishop Archibald Gardner's mill on the Jordan River and organized the West Mountain Quartz Mining District. Following the style developed earlier in California, laws for the government of the district were drawn up and approved. The boundaries of the district were defined to embrace the entire extent of the Oquirrh Range, from Black Rock on the southern end of Great Salt Lake to the southern end of the range beyond Mercur. Each claim might extend as far as 200 feet, and all claims were to be filed with the recorder 10 days after location.

[10] John R. Murphy, *The Mineral Resources of the Territory of Utah* (Salt Lake City, 1872), 1–2; T. B. H. Stenhouse, *The Rocky Mountain Saints* (Salt Lake City, 1904), 713–14; Tullidge, *History of Salt Lake City*, 697–98; Hubert Howe Bancroft, *History of Utah, 1540–1886* (San Francisco, 1889), 741; Edgar M. Ledyard, "Early Utah Mining and Smelting Addenda," *A-I-D-A*, XIV (June, 1929), 22–28; Addy, "The Economic and Social History of Bingham Canyon," 18–22; Fred B. Rogers, *Soldiers of the Overland* (San Francisco, 1938), 111; Robert G. Raymer, "Early Mining in Utah," *Pacific Historical Review*, VIII (1939), 81–88; Rickard, *History of American Mining*, 184–88.

[11] This is a synthesis of the story as it appears in the various sources. However, a letter in the *Deseret News* (Salt Lake City), December 29, 1904, states that A. P. Fordham and Peter Nelson made discoveries of ore in Bingham Canyon in June, 1863, while peeling bark for Salt Lake City tanneries. George B. Ogilvie, according to the letter, lived at the mouth of the canyon and subsequently purchased all the mining rights and claims of Mr. Fordham, obtaining a legally executed quit-claim deed.

Failure to do one day's work on the claim each month made the claim subject to jumping.[12] Thus, while the Mormon pioneers had previously located many veins and organized mining parties, the area encompassing Bingham Canyon was the first *recorded* mining claim in the Territory of Utah and also the first mining district to be formally organized and recorded.

Despite the urging of Acting Governor Amos Reed, however, the territorial legislature failed to pass laws permitting the general incorporation of mining and other companies,[13] and the following spring, on May 3, 1864, the group organized the West Jordan Mining Company and incorporated under the laws of the State of California. This may or may not have given the company a legal existence in Utah, but in any case, the procedure had the backing of the army of occupation. Work was then started on a tunnel. Within the next nine years, some 500 tons of ore were extracted from the original claim, although none was shipped or smelted. The silver in the ore assayed $34.00 a ton and the lead, $.56 a ton.[14]

A month after these discoveries were made, General Connor wrote to his superior in San Francisco concerning a new solution to the "Mormon problem."

> Already reliable reports reach me of the discovery of rich gold, silver, and copper mines in almost every direction. . . . If I be not mistaken in these anticipations, I have no reason to doubt that the Mormon question will at an early day be finally settled by peaceable means, without the increased expenditure of a dollar by Government, or, still more important, without the loss of a single soldier in conflict.[15]

In other words, the Mormons must be submerged by a flood of Gentiles who were to be attracted to the territory by discoveries of "gold, silver and other valuable minerals."

> Having reason to believe that the Territory is full of mineral wealth [he concluded], I have instructed commanders of posts and detachments to permit the men of their commands to prospect the country in the vicinity of their respective posts, whenever such course would not interfere with their military duties, and to furnish every proper facility for the discovery and opening of mines of gold, silver, and other minerals. The results so far have exceeded my most sanguine expectations.[16]

[12] Beatrice Spendlove, "A History of Bingham Canyon, Utah" (Master's thesis, University of Utah, 1937), 7–8.

[13] *Union Vedette* (Salt Lake City), December 4, 1863, and various issues in January and February, 1864. It was not until February 18, 1870, that the legislature passed laws for the general incorporation of mining, manufacturing, and other commercial enterprises. Territory of Utah, *Compiled Laws of the Territory of Utah, 1851–70* (Great Salt Lake City, 1871), 136.

[14] Ledyard, "Early Mining and Smelting South of Salt Lake City," *A-I-D-A*, XVI, 3.

[15] *War of the Rebellion*, 657.

[16] *Ibid.*, 656–57. I would not want to suggest that these accidental discoveries of minerals put the gleam of wealth in the general's eye such that he hit upon the "miners' rush" solution to the "Mormon problem" as a device for selling a reluctant government on the idea of underwriting the mining ventures of himself and his soldiers. There is every indication that Connor was sincere in his anti-Mormon policies, although he later came to admire the Mormons. See especially Robert J. Dwyer, *The Gentile Comes to Utah: A Study in Religious and Social Conflict (1862–1890)* (Washington, D.C., 1941).

To publicize the discoveries of mineral wealth, and to induce Gentiles to come to Utah, the pertinacious general, in November, 1863, founded a daily newspaper called *The Union Vedette*. In the first issue of that paper, Connor stated that various posts would be allowed to prospect for mines and warned the Mormons that the miners and prospectors would be provided with "the fullest protection from the military forces in this district." Any offender was to be tried as a public enemy "to the utmost extent of martial law."[17] The mountains and their hidden mineral wealth, wrote General Connor, did not belong to the Mormons but were "the sole property of the nation, whose beneficent policy has ever been to extend the broadest privileges to her citizens, and, with open hand, invite all to seek, prospect and possess the wonderful riches of her wide-spread domain."[18]

With the encouragement of the general, troops swarmed over the Bingham Canyon and adjoining areas hunting for bodies of ore. The Vedette claim was followed by the Galena, the Empire, the Kingston, the Julia Dean, and the Silver Hill claims. Other Volunteers organized and recorded the Wasatch Mountain Mining District, to include all of the Wasatch Mountains from Weber Canyon to Provo. This was accomplished within two months after the initial discovery in Bingham Canyon.[19]

Brigham Young's somewhat rankled reaction to all of this was given less than three weeks after the initial discovery, in a sermon in general conference:

> Who feeds and clothes and defrays the expenses of hundreds of men who are engaged in patroling the mountains and kanyons [*sic*] all around us in search of gold? Who finds supplies for those who are sent here to protect the two great interests — the mail and telegraph lines across the continent — while they are employed ranging over these mountains in search of gold? And who has paid for the multitude of picks, shovels, spades and other mining tools that they have brought with them? Were they really sent here to protect the mail and telegraph lines, or to discover, if possible, rich diggins in our immediate vicinity, with a view to flood the country with just such a population as they desire, to destroy, if possible, the identity of the "Mormon" community, and every truth and virtue that remains?[20]

The discovery of these promising claims led General Connor to broaden still further the scope of military exploration. Under official orders, troops were dispatched to more distant locations: some to Raft River in southern Idaho,

[17] *Union Vedette*, November 20, 1863.

[18] Letter published in Orson F. Whitney, *History of Utah* (4 vols., Salt Lake City, 1892–1904), II, 109.

[19] *Union Vedette*, December 4, 1863; John Mason Boutwell, *Economic Geology of the Bingham Mining District, Utah* (Washington, D.C., 1905), 83.

[20] Sermon of Brigham Young, October 6, 1863, *Journal of Discourses* (26 vols., Liverpool, 1854–1886), X, 254–55. Also the statement of Apostle George A. Smith: "The Government has men all through the mountains in every direction in search for gold, the hopes being that it can be found in such quantities as to cause a great influx of rowdies and destroy the order that remains in the mountains." George A. Smith to J. F. Kinney, "Journal History," November 4, 1863.

some to southeastern Nevada, and some to the Uinta Basin. The troops were given particular instructions to look for placer mines, which the general felt offered the surest prospect of attracting an inrush of miners.[21] The orders to one of the company commanders reveal evidence of the extent of army sponsorship of the mineral exploration of the territory:

HEADQUARTERS DISTRICT OF UTAH,
Camp Douglas, Utah Ter., May 11, 1864

Capt. N. BALDWIN,
First Nevada Territory Vol. Cavalry, Comdg. Expedition:

CAPTAIN: You will proceed with your company to-morrow by way of Parley's Park to Uintah Valley, in this Territory, and at some central point establish a temporary depot for your supplies, after which you will return to this post the four teams with your command, driven by citizens. You will afford ample protection to prospectors and miners, and the Indians in that valley being all friendly, they will be treated with kindness by your command. You will cause the valley and vicinity to be thoroughly prospected by your men, and will report from time to time the result to this office. The discovery of placer mines is of especial importance. You will therefore devote the most of your attention to their discovery. You will proceed to Fort Bridger, Utah Ter., by the way of Brown's Hole, on Green River, and report to the commanding officer of that post for duty on or about the 1st day of August next.

By command of Brigadier-General Connor:

M. G. LEWIS,
Assistant Adjutant-General.[22]

The result of this activity was the discovery of numerous bodies of ore throughout the territory. For one thing the attempts to find placer gold were successful, free gold having been discovered in Bingham in 1864. In the spring of 1865, gravel washing was initiated, and later on in the same year extensive lode mining was conducted with profit. The value of gold production in the territory rose from virtually nothing in 1860 to $55,000 in 1865, $165,000 in 1868, and $300,000 in 1870. By the end of 1871, about $1 million in gold had been recovered from Bingham Canyon gravels.[23]

The search for silver was conducted in a similar way, eventually leading to outcroppings and veins of silver-bearing ore which required some form of mining activity. Rather than being abundantly located in a free condition, however, silver was normally found mixed with several other metals, usually lead, copper, and zinc, in either oxide or sulphide ores. Oxide and carbonate ores were located close to the surface and the rock was already partially broken down due to the process of oxidation. Sulphide ores, on the other hand, were located below the water table, represented original unenriched metal ores, and were

[21] *War of the Rebellion*, 845–46.
[22] *Ibid.*, 846.
[23] Murphy, *Mineral Resources*, 3.

formed in sulphur-bearing solutions. Because of this the mining of silver became involved and soon required a complementary process of milling and smelting in order to recover the desired metal.

The first significant find of silver-lead ore was made by the Volunteers in East Canyon, Tooele County. There had been legends that Treasure Hill was a sacred spot to the Indians who gathered there each year to hold councils and obtain metals for bullets. Attracted by these legends, Volunteers located an outcropping of lead ore which came to be known as the Hidden Treasure Mine. Other locations included the Pocatello, Velocipede, and the Wild Delirium mines. Very little was done with these mines until 1870.[24]

Other rich finds of silver-bearing ore were discovered in Little Cottonwood Canyon in the summer of 1864 and afterward. Two small furnaces were erected in 1866 to smelt the ore, but little could be done until the improvement of transportation facilities.[25]

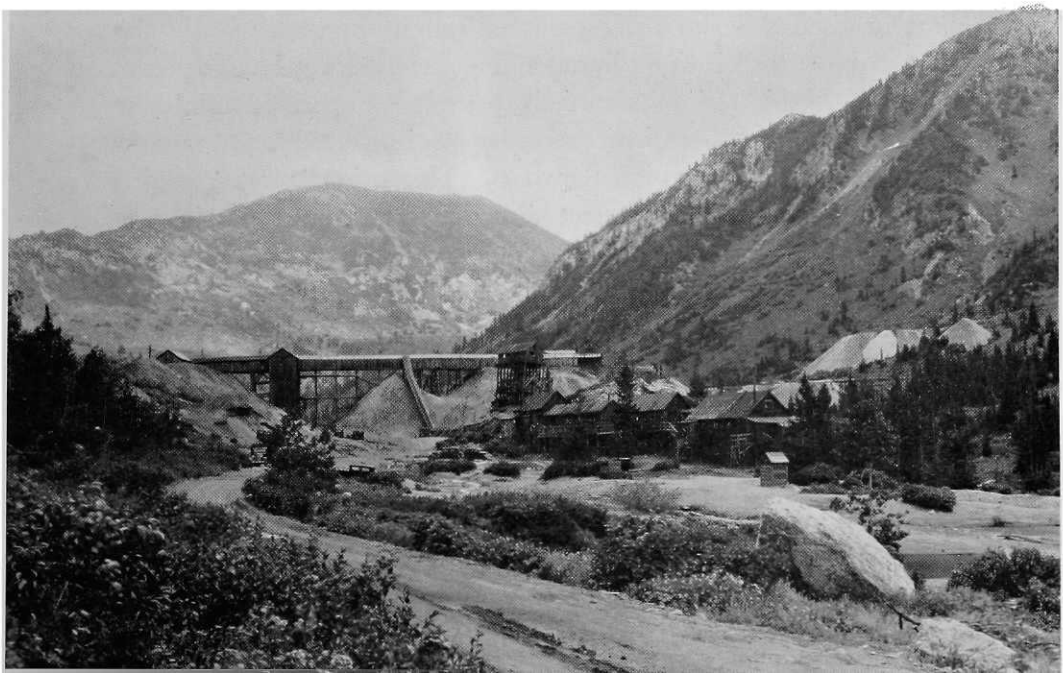
Another group of Volunteers, the Second Cavalry, established a camp on the western slope of the Oquirrh Range, called "Camp Relief," and surveyed the town of Stockton. The prospecting of the hills soon met with success, for in April of 1864, the "Rush Valley deposits" were discovered by the men of Company "L." Assays from early ledges proved to be rich in silver, and the Rush

[24] Stenhouse, *Rocky Mountain Saints*, 719; *Utah Mining Gazette* (Salt Lake City), January 7, 1874; B. S. Butler, G. F. Loughlin, V. C. Heikes and Others, *The Ore Deposits of Utah* (Washington, D.C., 1920), 366.

[25] John M. Boutwell, *Geology and Ore Deposits of the Park City District, Utah* (Washington, D.C., 1912), 18, 77; Robert Wallace, "Early History of Lead Smelting in the West," *A-I-D-A*, XIV (May, 1929), 2; Murphy, *Mineral Resources*, 29–30.

Standard Rex Silver Mine, Little Cottonwood Canyon. Alta was one of the large silver producing mining camps in Utah before the turn of the century. In hope of again experiencing a bonanza, some mines are in operation today.

UTAH STATE HISTORICAL SOCIETY



Valley Mining District was organized on June 11, 1864. The new district embraced all of the western slope of the Oquirrh Range, with the eastern slope forming the West Mountain District.

By the fall of 1865, over 500 mining claims were located in the Rush Valley District. Most of these were within a radius of two miles of the city of Stockton which, by 1866, had 40 families and 400 inhabitants. So promising were the finds that General Connor put up an estimated $80,000 of his own funds and persuaded friends to advance additional sums. One result of these efforts was the erection of the Pioneer Smelting Works at Stockton in 1864. A reverberatory furnace was completed a short time later. Several other trial furnaces were built, and $100,000 worth of machinery was purchased by the Knickerbocker and Argenta Mining and Smelting Company of New York City, which attempted to separate the gold and silver from the lead. But Connor and his Californians, whose experiences had been limited to mining and milling gold ores, found the art of smelting the Stockton ores to be beyond them. Moreover, charcoal was scarce and transportation rates high. While the year of "steady, hopeful toil" ended in suspension, the trials proved that the ores were capable of reduction and could be smelted profitably with improved technology.[26] All of these activities — prospecting, mining, and furnace-building — were, according to General Connor, "cheerfully executed."

> With great energy my officers and men . . . [have] prospected the country, and succeeded in discovering rich gold and silver bearing rock. It is now a settled fact that the mines of Utah are equal to any west of the Missouri River, and only await the advent of capital to develop them.[27]

There can be little doubt that the activity was indeed "cheerfully executed," since the findings of the men, all of whom were salaried and provisioned by the army, were all held in their private capacities.

Shortly after the capitulation of General Robert E. Lee at Appomattox, the Volunteers were disbanded and army-sponsored mining in Utah ceased. The troops sought to preserve their rights by amending the district by-laws to permit each locator to hold his claim indefinitely provided a specified minimum amount of work was done. The district recorder was instructed to preserve the claims perpetually valid to these original owners. "This action," wrote a mining historian, "which prevented all subsequent relocation of the same ground, greatly retarded and in fact prevented for some years the development of the Rush Valley district."[28]

[26] Butler *et al.*, *Ore Deposits of Utah*, 362–63; Murphy, *Mineral Resources*, 2–3; Rogers, *Soldiers of the Overland*, 116; Wallace, "Early History of Lead Smelting," *A-I-D-A*, XIV, 2; Ledyard, "Early Mining and Smelting South of Salt Lake City," *ibid.*, XVI, 4.

[27] *War of the Rebellion*, 1185.

[28] Butler *et al.*, *Ore Deposits of Utah*, 363. Also Murphy, *Mineral Resources*, 3; Stenhouse, *Rocky Mountain Saints*, 716.

General Connor was transferred to Denver, back to Utah, then to Washington, D.C. He was offered a commission as a Colonel of Cavalry in the regular army, "but declined on account of his mining interests."[29] He was mustered out of the service on April 30, 1866, and returned to Stockton to resume active direction of his mining and smelting ventures. "Connor [wrote Brigham Young upon Connor's return] is out of the service, and is here now as plain 'Pat,' engaged in mining business, which, as Government pap has been withdrawn, will very likely, if he pursue it diligently, break him up financially."[30] Connor died in Salt Lake City on December 17, 1891.

With the departure of the Volunteers, there was little mining or smelting in the territory until the completion of the railroad in 1869. The lack of adequate transportation facilities, superior opportunities in neighboring territories, the inexperience of the Volunteers in dealing with lead and silver ores — all of these conspired to render these early efforts as premature. There was a tendency on the part of General Connor and his associates to attribute their failures to Mormon opposition. And it is true that Brigham Young, as the embodiment of the collective purpose of the Latter-day Saints, did advise Mormon farmers and craftsmen to remain on their farms and in their shops and not leave them to go to the mines. But this advice seems to have been motivated by the awareness that Connor's efforts were irretrievably doomed and that there was no advantage in putting time and talent into a failing enterprise.[31]

The Acceleration of Lead and Silver Mining (1869–1885)

The beginning of commercial exploitation of Utah's mines actually began after the completion of the transcontinental railroad in 1869. While the railroad gave the primary impetus to this development, other factors included: (1) the improved technology which was now available as the result of the rapid pace at which mining and smelting had proceeded in neighboring territories and elsewhere in the world; (2) the financial assistance of eastern and English investors whose supply of capital had fattened on other postwar investments and who were induced to speculate on Utah enterprises by the missionary efforts of such Utah promoters as Eli B. Kelsey; and (3) the co-operation of the local Mormons, who were now able and willing to supply provisions, teams, and

[29] Rogers, *Soldiers of the Overland*, 248, 251–52.

[30] Brigham Young to Brigham Young, Jr., and John W. Young, "Journal History," August 11, 1866.

[31] Said Brigham Young: "On the bare report that gold was discovered over in these West Mountains, men left their thrashing [*sic*] machines, and their horses at large to eat up and trample down and destroy the precious bounties of the earth. They at once sacrificed all at the glittering shrine of this popular idol, declaring they were now going to be rich, and would raise wheat no more. Should this feeling become universal on the discovery of gold mines in our immediate vicinity, nakedness, starvation, utter destitution and annihilation would be the inevitable lot of this people." Sermon of Brigham Young, October 6, 1863, *Journal of Discourses*, X, 271.

labor in increased abundance for building railroads, establishing new communities and supply centers, and working the mines.

In anticipation of the completion of the railroad the next year, activity in several Utah mining camps was renewed in the summer of 1868. Utah's own Walker Brothers are credited with having shipped the first ore from the territory in June, 1868, when they hauled a carload of copper ore from Bingham Canyon to Uintah, Weber County, and shipped it on the Union Pacific Railroad to Baltimore. Shortly thereafter, operations were started on the mines at the head of Little Cottonwood Canyon, near the summit of the Wasatch Range. The Walkers rawhided one carload of ore from Little Cottonwood to the nearest railroad connection, while the firm of Woodhull, Woodman, Chisholm, Reich & Company initiated large shipments of ore to Swansea, Wales, which at the time was probably the greatest smelting center in the world.[32]

One week after the Central Pacific and Union Pacific were joined together at Promontory Summit on May 10, 1869, Brigham Young and his Latter-day Saint followers commenced the construction of the Utah Central Railroad, from Ogden to Salt Lake City. This line was completed on January 10, 1870, and was soon followed by the construction of the Utah Southern Railroad from Salt Lake City to Sandy on September 23, 1871. From Sandy, narrow-gauge roads were built east to the Little Cottonwood District (the Wasatch and Jordan), and the West Mountain District (the Bingham and Camp Floyd).

The completion of these spur and arterial railroads provided the mines in the Salt Lake area with suitable means of transportation for the shipment of their ores to the smelting centers of Swansea, Baltimore, and San Francisco.[33] When the first shipments to these centers proved beyond question that the mines were of sufficient quality to be self-sustaining and would prove highly remunerative to those so engaged, the export of ores catapulted from a few irregular weekly shipments in the fall of 1868 and throughout 1869, to "a regular and constant stream of from four to six hundred tons weekly" thereafter.[34] In one month the Walker Brothers alone shipped 4,000 tons. In the two months of August and September of 1872, 2,458 tons of ore were sent out of the territory. By the end of 1875, an estimated $21 million in products had been taken from Utah mines, and by 1880, the figure had grown to an estimated $45 million. More than half was in silver; lead ranked second, and copper third.[35]

[32] Murphy, *Mineral Resources*, 3–5; Wallace, "Early History of Lead Smelting," *A-I-D-A*, XIV, 7.

[33] An early Utah editor recorded that the first shipment of Utah ore on the Union Pacific Railroad was 10 tons from the Monitor and Magnet mines (Little Cottonwood, by Woodhull Brothers) to T. H. Shelby, San Francisco, on July 25, 1869. On January 12, 1870, Woodhull Brothers shipped the first carload of ore over the Utah Central Railroad. Edward L. Sloan, *Gazeteer of Utah and Salt Lake City Directory* (Salt Lake City, 1874), 80.

[34] Murphy, *Mineral Resources*, 4.

[35] Stenhouse, *Rocky Mountain Saints*, 716–20; U.S., Department of the Interior, *Mining in Utah 1880: Report of the Secretary of the Interior* (Washington, D.C., 1880), I, 73–74.

A similar effect of the elaboration of a railroad network and the acceleration of mining was a demand for suitable lead- and silver-smelting facilities and the concentration of those facilities in the Salt Lake Valley. Beginning in June, 1870, the Woodhull Brothers constructed a furnace seven miles south of Salt Lake City, at the junction of the state road with Big Cottonwood Creek, at what is now Murray. The Woodhull furnace was a cupola with a capacity of eight tons a day. This furnace did service in "testing practically" all the ores of the territory. "From these works was shipped the first bullion produced from the mines of Utah."[36] For the next two years (1870–72), there was a rush to construct all manner of smelting works in nearly every district of the territory, as well as in the Salt Lake Valley. By the middle of 1871, there were 18 "well appointed and most efficient smelting furnaces . . . erected and put in running order," with an average producing capacity of 16 tons each. This amounted to a total territorial capacity of approximately 288 tons of ore daily.[37]

Great success did not attend these efforts, however. Few of the newly erected plants continued in active operation, and fewer still operated with the regularity necessary for profitability. This was attributed by Stenhouse to the inexperience and lack of metallurgical skill of the operators, most of whom sought to repeat the type of smelting activity in which they had engaged in Nevada. Men accustomed to the amalgamation of gold attempted to treat silver ores which require very different processes.[38] The initial pattern of constructing smelters in each of the districts, therefore, soon gave way to the establishment and patronizing of smelters in the Salt Lake Valley. The area was centrally located with respect to materials and ores, was in a better position to attract and hold the skilled laborers necessary in this work, possessed an adequate water supply, and with the completion of the various railroad spurs provided ready accessibility to markets. Numerous sampling and smelting works came to dot the countryside around Salt Lake City, constituting what ultimately became the world's largest smelting center. The three most important smelters in the 1870's, all located in Murray, were:[39] (1) the Germania Smelter, constructed by the Germania Smelting and Refining Company in 1872; (2) the Mingo or Mountain Chief furnaces, built in 1872, and operated discontinuously for several years; and (3) the Morgan or Hanauer Smelting Works, erected in 1874 to smelt ores from the Morgan Smelting Company's Pittsburgh mine in the American Fork District and other ores purchased on the Salt Lake City market.

[36] Stenhouse, *Rocky Mountain Saints*, 720.

[37] Murphy, *Mineral Resources*, 6.

[38] Stenhouse, *Rocky Mountain Saints*, 723.

[39] Wallace, "Early History of Lead Smelting," *A-I-D-A*, XIV, 9–11; 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., 1885), 433–34.

Most of the mines were entangled in legal disputes, lacked adequate working capital, or quickly exhausted the rich surface-ore bodies and faced pyrite and water on the lower levels. But the growth of lead and silver mining in the territory during the decade of 1870 to 1880 is evidenced by the fact that in the Little Cottonwood District alone, over 3,500 claims were staked in an area 2.5 miles square.[40] Two of the mines rose on the horizon to reach national and international fame. The Emma Mine, located in Little Cottonwood Canyon in the fall of 1868, became a "bonanza," and paid over $2.5 million in dividends before its promotion by unscrupulous promoters caused an international scandal in 1872.[41] A companion mine, the Flagstaff, also achieved considerable national prominence, paid out handsomely in dividends for a short period, and finally ended in debt.[42]

The flurry of activity in Little Cottonwood caused excitement and activity in many other districts, notably the Ophir District in Tooele County where several important discoveries were made in 1870. Particularly important were the discoveries of "horn" or chloride silver ores of a very rich nature. It was in 1870 that William Tecumseh Barbee found horn silver on Silverado Hill, and the Silveropolis, Chloride Point, Shamrock, and other claims were located. A few days later, the Mountain Lion, Liver Chief, Mountain Tiger, Rockwell, and other locations were made on Lion Hill.[43]

Several of the mines near Ophir were opened to reveal numerous "boulders" highly impregnated with chloride of silver, several of which assayed as high as $20,000 per ton. The Walker Brothers, for example, shipped from the Silveropolis 40 tons of ore, which netted $24,000. The news of this $10,000 and $20,000 ore, found in boulders, together with the earnings of the Emma and Flagstaff, did much to spur the influx of prospectors into Utah and raise the territory to a position of importance in the mining world.

As with Little Cottonwood, however, most of the excitement at Ophir lasted only during the early 1870's. Whereas there had been 1,000 persons in the area in the early 1870's, fewer than 50 remained 10 years later. Of 2,500 locations which had been made in the early 1870's, less than 150 were still active in the early 1880's.

[40] *Ibid.*, 473.

[41] For a discussion of the Emma Mine see Clark C. Spence, *British Investments and the American Mining Frontier, 1860–1901* (Ithaca, 1958), 139–90; W. Turrentine Jackson, "The Infamous Emma Mine: A British Interest in the Little Cottonwood District, Utah Territory," *U.H.Q.*, XXIII (October, 1955), 339–62; Huntley, "Mining Industries," *Precious Metals*, 423; Tullidge, *History of Salt Lake City*, 707; Murphy, *Mineral Resources*, 22; Wallace, "Early History of Lead Smelting," *A-I-D-A*, XIV, 7; Bancroft, *History of Utah*, 742–43.

[42] The Flagstaff Mine is treated in Huntley, "Mining Industries," *Precious Metals*, 423; Bancroft, *History of Utah*, 742; Spence, *British Investments*, 59–60, 109–11; Butler *et al.*, *Ore Deposits of Utah*, 254–58.

[43] Boutwell, *Bingham District*, 84; Murphy, *Mineral Resources*, 29–30; Butler *et al.*, *Ore Deposits of Utah*, 366; Stenhouse, *Rocky Mountain Saints*, 719.

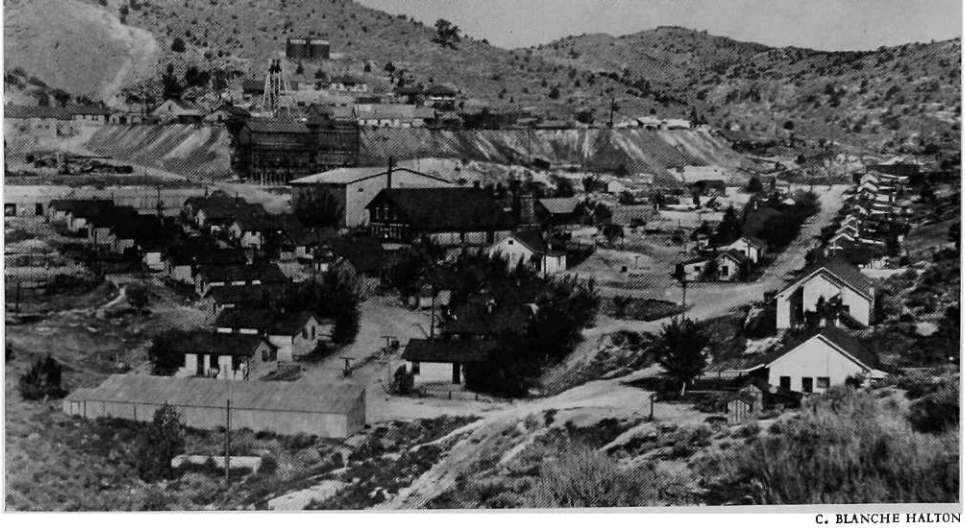
UNITED STATES SMELTING, REFINING AND MINING COMPANY

Surface plant of the Jordan and Galena mines, Bingham Canyon, in 1891.

It will be recalled that nearly all of the many claims in the West Mountain, the first organized district in the territory, had been located by California Volunteers in Bingham Canyon, and that steps had been taken to reserve these claims until the completion of a railroad should make them economically feasible to work. Several of the original locators returned in 1870 to develop the sizable ore bodies of lead carbonate and a large body of low-grade argentiferous galena in the old Jordan and Galena claims. The first really efficient and practical work toward the development of the mines of this district was undertaken by Messrs. Bristol and Daggett, on the Spanish and Winnamuck mines. As with the Emma and Flagstaff, the Winnamuck was owned by an English company. By 1874, this mine had produced 12,000 tons of ore, with a gross value of $876,000. The development of these mines prompted the construction of the Bingham and Camp Floyd Railway and of local smelting works to reduce the ore. By 1874, 3,305 claims had been located in this district.[44]

As the carbonate zones were exhausted in the 1870's, a sulphide zone was being encountered, necessitating new methods of treatment. In 1874, the territory's first concentrating plant for the treatment of sulphide lead ore was erected in Bingham. Thus, when other districts were sputtering and crumbling, the production of lead-silver ores in Bingham continued to increase with many new discoveries and locations and several highly profitable mines. Many of these properties passed from hand to hand like shares of stock in a modern giant corporation, with first one group, then another, holding and operating a given mine. By 1892, there were still 21 producing mines in the West Mountain District, the largest being the Jordan (or West Jordan), Brooklyn, Telegraph, Galena, Petro, and Yosemite.

[44] Sloan, *Gazeteer*, 163; Murphy, *Mineral Resources*, 14–15; Boutwell, *Bingham District*, 248; J. Fewson Smith, "Early History of the Bingham District," *A-I-D-A*, XIV (April, 1929), 3; Huntley, "Mining Industries," *Precious Metals*, 421.



C. BLANCHE HALTON

Tintic Standard Mine and town, approximately five miles from Eureka in Juab County, Utah.

Immediately north of and parallel to the Little Cottonwood District, the Big Cottonwood was organized in July, 1870. (The district had previously been organized in the 1860's as the Mountain Lake Mining District.) By the spring of 1872, there were over 700 locations in the district, with many producing large yields. Perhaps the most famous mines in the district were in the Prince of Wales group. By 1874, some $75,000 had been spent by the Walker Brothers on the development of this mine. The value of ore, primarily lead-zinc with some silver, shipped from these mines in the 1870's and 1880's approached $2 million. The nearby American Fork District was also important until 1876, when the ore bodies gave out. During a six-year period, an estimated 14,000 tons of lead-silver ore (40 to 54 per cent lead, 30 to 47 ounces of silver, and $2 to $10 in gold) were shipped from these mines.[45]

Located in the southern end of the Oquirrh Range, close to the intersection with the Sevier Mountains in Juab County, the Tintic District was organized in 1870. The difficulty of transporting ores to market caused the development of these mines to be rather slow, but the richest ores near the surface were mined and shipped to San Francisco, Reno, Baltimore, and to Swansea. Later, when smelters were established in the Arkansas Valley at Pueblo, Colorado, some ore was shipped there. Still later, with improved smelters being established in the Salt Lake Valley, considerable ore was shipped to them. Important mines were the Sunbeam, Black Dragon, Eureka Hill, and Mammoth, each of which contained deposits of lead carbonate rich in silver, copper, and gold. The district gave birth to three distinct mining camps: Eureka, Silver City, and Diamond City, all of which were in "full swing" in 1871.[46]

[45] Murphy, *Mineral Resources*, 27–28; Butler *et al.*, *Ore Deposits of Utah*, 254–58; Huntley, "Mining Industries," *Precious Metals*, 444; Sloan, *Gazeteer*, 130.

[46] Waldemar Lindgren and G. F. Loughlin, *Geology and Ore Deposits of the Tintic Mining District, Utah* (Washington, D.C., 1919), 105–7; Murphy, *Mineral Resources*, 34.

Lead-silver deposits in the Minersville area had been worked by a team of Mormons as early as the 1850's, but the first formally organized district was the Star District, organized in 1870, on the Star Range southwest of Milford. This was later separated into the North Star District and South Star District, which contained as many as 1,600 locations by the end of the 1870's. Thriving mining camps developed at Shauntie, Shenandoah City, Elephant City, South Camp, and Star City. The Shauntie camp contained 40 houses, but was destroyed by fire in the summer of 1876. In the summer of 1873, a smelter was erected with two small stacks. When it burned another was built which also burned. A succession of smelters worked about 12,000 tons of ore and produced about 3,000 tons of bullion containing $325,000 in silver and $10,000 in gold. Another smelter was located at Milford in 1876 and worked several hundred tons of ore from neighboring mines.[47]

The single most important event in the history of the Beaver County area was the discovery by James Ryan and Samuel Hawkes of the Horn Silver Mine in September, 1875. This was located on both flanks of a small range called the San Francisco Mountains. After some preliminary work the partners felt that the ore would fail, and sold the mine in 1876 to A. G. Campbell, Matthew Cullen, Dennis Ryan, and A. Byram for $25,000. These men sold ore, erected smelting works, and developed the ore body. In 1879, they sold most of their interest, at the rate of $5 million for the whole property, to Jay Cooke, who organized the Horn Silver Mining Company of Utah. With nominal capital stock of $10 million, the listed properties included the mine, smelter sites in Frisco (Utah), a three-stack smelter, refining works at Chicago, some iron-flux mines near Frisco, charcoal kilns, a 40-mile telegraph line to Beaver, two stores in Frisco, and some other minor property. By 1879, 25,000 tons of ore had been extracted from the mine, of which 5,500 tons had been sold to various parties and the remainder smelted in Frisco. The deposit was one of the richest in Utah with an average value of $42.68 per ton of ore. (During the early years of production the value exceeded $100 per ton of ore.)[48]

The bullion from the smelting works was freighted by wagon to Salt Lake City until 1880, when the Utah Southern Railroad, under the control of Jay Gould, extended its line to Frisco. The company then constructed an additional smelting plant south of Salt Lake City. Bullion was shipped from both smelting plants to its refinery in Chicago until the discontinuance of the Frisco smelter in 1882. In the 1890's, a 20-stamp mill was erected at Frisco to concentrate the low-grade ores; this operated until 1905.[49]

[47] Huntley, "Mining Industries," *Precious Metals*, 471–74; B. S. Butler, *Geology and Ore Deposits of the San Francisco and Adjacent Districts, Utah* (Washington, D.C., 1913), 116.

[48] Butler, *San Francisco*, 116; Huntley, "Mining Industries," *Precious Metals*, 464–71.

[49] Butler, *San Francisco*, 164–65.

The Park City District early won high standing as a bonanza camp — as one of the most profitable argentiferous lead mines of the world. The area was opened in 1869 when the prospecting in Little Cottonwood Canyon spread out into surrounding canyons, crossed over the divide at the head of Big Cottonwood and American Fork canyons, and entered the gulches leading into Parley's Park. The first discoveries in the area were made by Rufus Walker and Ephraim Hanks in 1869. It was not until 1871 that a large producer, the Piñon, was opened. The Piñon reportedly contained a large body of galena and carbonate ores assaying 30 to 250 ounces of silver to the ton and contracted to deliver 20 tons a day to a smelter in Ogden. Also in 1871, the Flagstaff, Walker & Webster, Wild Bill, Rocky Bar, and other prospects were located. All were lead mines, principally carbonate, in limestone.[50]

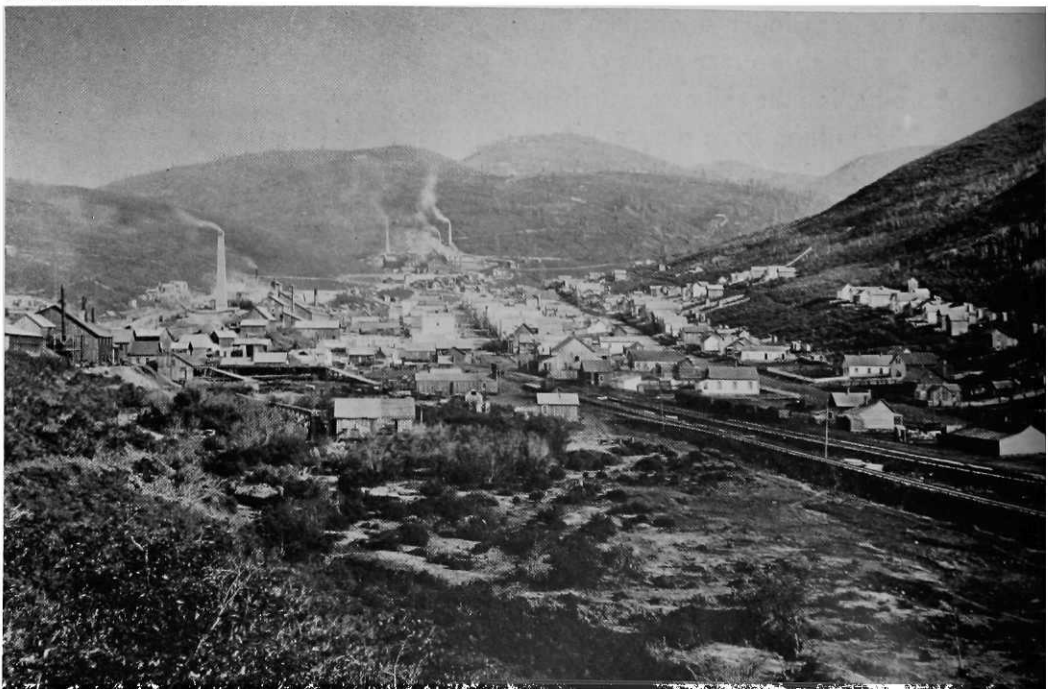
Rector Steen, a California miner, who as a civilian had prospected Bingham Canyon and Big and Little Cottonwood canyons with Connor's troops in 1863 and disappointedly went to Montana and Wyoming in 1864, returned in 1871 to the Parley's Park area where he located the Pioneer Mine and sold it for $6,000. After a winter in Arizona, he renewed his prospecting and located the famous Ontario ledge. Steen's accidental find is fraught with significance for it was the only ore outcropping in all of Ontario Canyon.

The sale of the Ontario to the Hearst interests was the culmination in the efforts of that group to enter the mining picture in Utah. George Hearst, father of the prominent publisher and capitalist William Randolph Hearst, and J. B.

[50] Boutwell, *Park City District*, 18–20.

Park City, at the turn of the century, was one of Utah's foremost mining towns and produced great fortunes for many prominent families of the state.

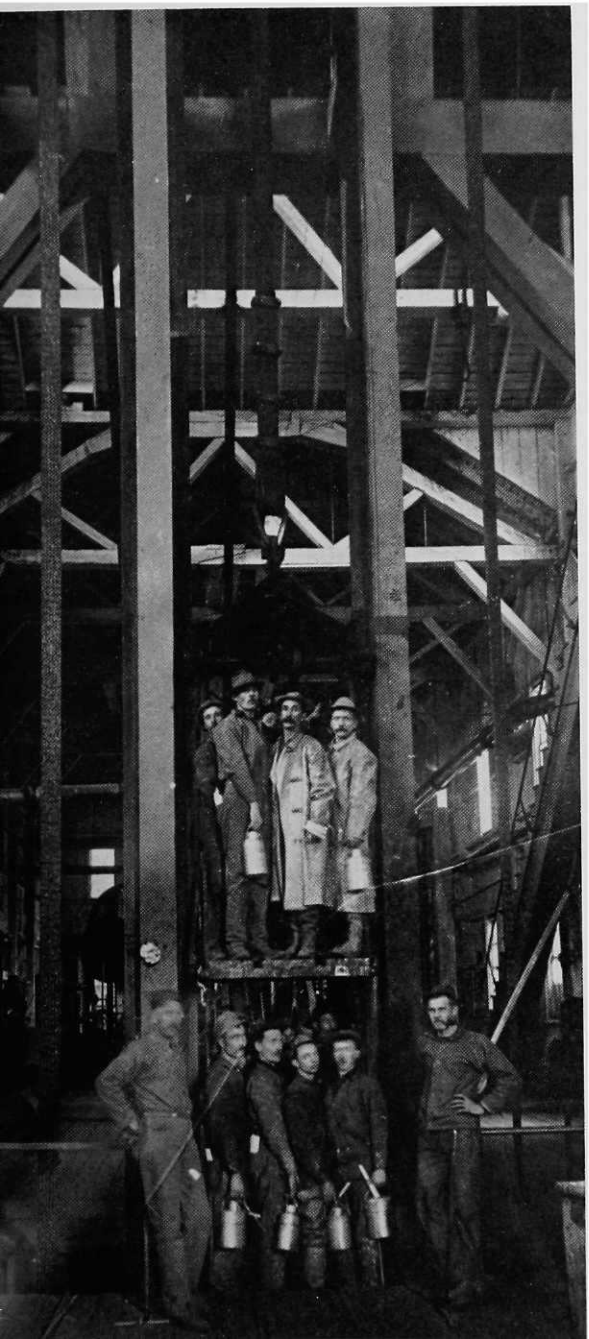
UTAH MINING ASSOCIATION



Haggin, a widely known financier and sportsman from San Francisco, had heard of the ore discoveries that were being made in Utah and sent a man to investigate. The scout was attracted to Park City by the reports of ore discovered on the Hawkeye claim in McHenry Canyon, a few miles south and east of the present town of Park City. The mine had developed a good showing of ore, but he turned it down on the ground that the water problem was too great. On his return to Park City, the agent took a shortcut over the mountains and crossed over the summit of Ontario Ridge where he saw four men trenching near a juniper tree. He inquired about the work and was informed that they were exploring an outcrop of ore. He dismounted from his horse, examined the trench, and took a sample of the ore. When he reached Salt Lake City he found the assay to carry 75 ounces of silver to the ton and immediately acquired a 30-day option. Before the 30 days were up, the Hearst-Haggin interest had purchased the claim for $27,000. Hearst-Haggin then financed the large-scale development of the property with R. C. Chambers, who had worked on the Comstock in Virginia City, in charge. This area laid the foundation for the Hearst fortune.[51]

After the Ontario discovery, there began efforts to mine lode ores. The first brush shanties were soon replaced with clusters of log houses around the shaft of each discovery. Hundreds of thousands of dollars were spent trying to develop the vari-

UTAH MINING ASSOCIATION



Double hoist transporting miners to various levels in Ontario Mine, Park City.

[51] Salt Lake City Chamber of Commerce, *The Mining Industry of Utah* (Salt Lake City, 1941), 12–31. A slightly different approach is given in Boutwell, *Park City District*, 136. See also *ibid.*, 20, 173, 203.

ous properties. But while small amounts of marketable ore were shipped by other mines, this was nothing to compare with the Ontario. By the second year of operttions, the Ontario vein had been opened up for 740 feet along its strike, and three shafts had been sunk. By the fall of 1874, the shafts indicated a body of high-grade ore valued at over a million dollars.

By 1876, the Ontario Mine was producing $14,000 a week, and the whole camp, a total of $20,000. About 150 men were employed at both mine and mill. The total yield of the property to that time was $1.1 million and the Ontario was the largest annual producer in the territory. The company was formally organized in 1876 and incorporated with a nominal capital of $10 million.[52]

By 1879, the influx of miners had reached a point that permanent homes were being built, business enterprises appeared, and there was a steady procession of wagons entering the burgeoning camp with salt, coal, and other merchandise from Salt Lake City and Coalville.

The company deepened its shafts in an attempt to work out the lodes cleanly from the higher to the lower levels, encountering a tremendous flow of water at a depth of 60 feet below the surface of the ground. Enormous amounts of capital were required to overcome this, amounting to two-thirds of the company earnings; but the production was such that the company continued to pay good dividends. By 1888, Ontario had paid $8,825,000, without the levy of a single assessment. Not until the late 1880's did the activities on the property gradually decrease. The Ontario was finally closed in 1897, although the tailings were worked over further until 1904. From 1877 to 1904, the Ontario yielded 37,619,047 ounces of silver, and paid dividends of $13,936,950.[53]

Other claims west of the Ontario helped to establish the Park City area as one of the richest in the world. The John J. Daly property for example, operated by the Daly Mining Company (in which the Hearst-Haggin interests acquired a considerable interest), produced $9,450,355 in minerals and paid dividends of $2,887,500.[54]

The Silver Reef District, in the eastern part of Washington County and covering an area of about five square miles, had a short but active career as a producer of silver-lead ores. Silver was discovered by John Kemple in 1866 (or in 1869, the stories differ), who found a piece of "float" which assayed $17,000 to the ton. He filled up his small shaft and left the country, but returned with others to organize the district in 1874. He worked his claims for a few months, became discouraged, and left for the Star District near Beaver. W. T. Barbee, who had discovered horn silver at Ophir, went to Silver Reef in the summer of

[52] *Ibid.*, 20, 28–29, 137; Huntley, "Mining Industries," *Precious Metals*, 441.
[53] Boutwell, *Park City District*, 139.
[54] *Ibid.*, 147.

MRS. C. N. RAY

Transporting ore from the mine to the railroad presented difficulties. Here the mine cars are being towed up to the mine from the depot after gravity had pulled the loaded cars down the hill.

1875, discovered very rich ore on the Tecumseh claim, and shipped 10 tons of $500 ore to Salt Lake City. Stating that "it is about time for something to turn up to take the place of sorghum and wine as a circulating medium . . . in this desolate god-forsaken looking country," Judge Barbee advertised his Bonanza City and continued shipments to Salt Lake City and Pioche during the following year.[55] News of this precipitated a rush, principally from Pioche, and by 1878–79 there were probably 1,500 persons in the sandstone mining camp. Recorders' books show 640 locations in the 1870's. Several arastras and stamp mills were erected in 1877 and 1878, and by 1880 the total production of the district had reached $3,243,739.[56] Considerable quantities of silver were produced annually until 1897, when production was suspended, to be resumed intermittently in this century. The output for the entire period from 1875 to 1909 is estimated at 7,211,463 ounces of silver, for a total value of $7,987,122.[57]

The result of all these discoveries, the opening of the widely scattered districts, and the working of the rich surface lodes, was the sky-rocketing of silver and lead production in this outpost of the national economy. From 450 ounces of silver in 1865, Utah's annual output surged to 470,000 ounces in 1870, 1.7 million ounces in 1871, and an average of approximately 4 million ounces per year throughout the 1870's and 1880's. During these years Utah's production of silver ranged from 10 to 15 per cent of the national total, and was valued at $3 to $6 million per year. Lead experienced a similarly inordinate rise, spurting from 4,200 tons in 1870 to 12,000 tons in 1872, and to 25,000 tons in 1876. Utah's production of lead represented from 20 to 50 per cent of the nation's total during the 1870's and 1880's. In addition to silver and lead, there was a substantial production of gold and copper, so that the total mineral production in the territory

[55] Mark A. Pendleton, "Memories of Silver Reef," *U.H.Q.*, III (October, 1930), 98–118.
[56] Huntley, "Mining Industries," *Precious Metals*, 477–82.
[57] Butler *et al.*, *Ore Deposits of Utah*, 586, 593–94.

ranged from $5 to $10 million per year during the two decades after the joining of the rails.[58]

The End of the First Stage of Commercial Exploitation

In 1885, upon the completion of studies connected with the 1880 census, government mining engineers undertook to make comments on the mining industry of the nation. In that valuable volume a large section is devoted to "The Mining Industries of Utah." Utah was singled out for this special comment because it was "fairly representative" of the progress which had been made elsewhere in the country because of the diversity of its mineral resources and because of its typicality with respect to metallurgical plant and processes, types of mining, and costs.[59]

In the early 1870's, it was pointed out, reduction of Utah ores presented few difficulties, for the quickly discovered surface bodies were of oxidized ore and easily worked.

> As these were exhausted and lower levels were reached mining became more difficult and the ores more rebellious. The old simple methods and machinery were found to be of little use. New methods and new machinery had to be in-

[58] University of Utah, Bureau of Economic and Business Research, *A Statistical Review of Utah's Economy* (Salt Lake City, 1960), 120.

[59] Huntley, "Mining Industries," *Precious Metals*, 405.

Boardinghouses were a common feature of mining towns, such as this one for the Ontario Mine in Park City.

UTAH MINING ASSOCIATION

vented and purchased. These expenses in many cases soon consumed the early profits, and left the mine owners without means to prospect extensively, or even to erect pumping machinery to follow known bodies. Then, again, the rich discoveries in Colorado, Arizona, and Idaho . . . turned the attention of investors in those directions, and, in consequence, capital was diverted from the old mining districts. In this way the industry in Utah suffered greatly.[60]

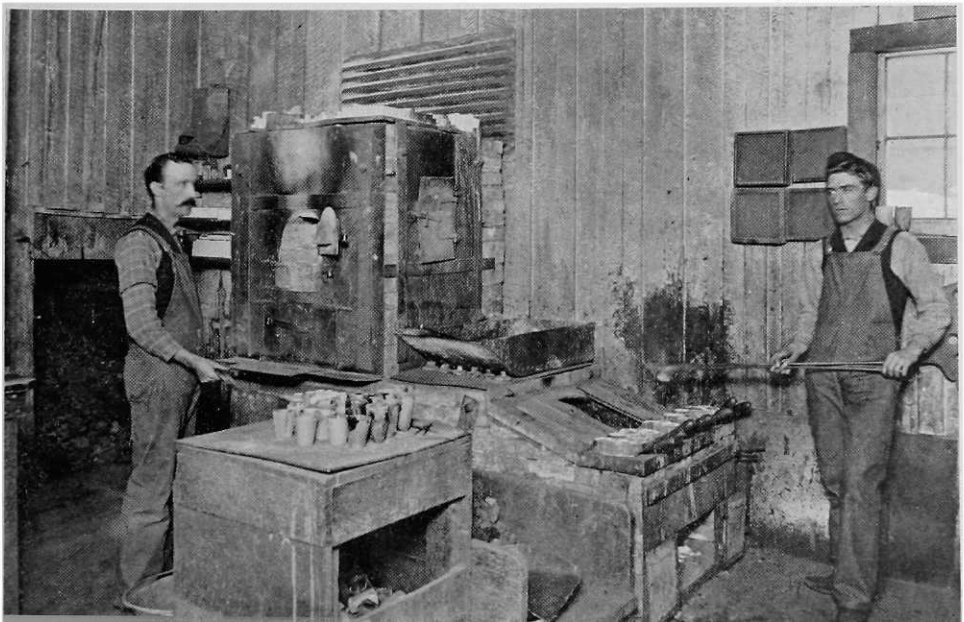
The rampaging development of the early 1870's was followed by a sluggishness due to the exhaustion of the surface bodies, the reaching of the water level, and the consequent change in the character of the deposits. "Ore which, at the surface, consisted of carbonates and sulphates of lead in a soft ocher, changed, below, to pyrite, galena, and sometimes to zincblende, in a hard siliceous or calcareous rock."[61] This increase in the quantity of pyrite not only lessened the value of the ore, but it made smelting more expensive. The hard ore could not be so cheaply extracted or concentrated.

Thus, Utah mining had gone through its initial period of commercial exploitation — the rich ores near the surface had been extracted and exported. To use the colorful expression of a contemporary journalist, "the eyes of the mines were picked out."[62] The next stage in Utah's mining history would require the investment of large sums of capital so as to probe deeper, achieve better separation of the ore, and work lower grade deposits. It would feature the improvement of concentration processes and metallurgical techniques. In most of the older districts, the day had passed when mines could be worked profitably by single individuals or partnerships having but little capital. After 1885, most of

[60] *Ibid.*, 405–6.
[61] *Ibid.*, 406.
[62] Spence, *British Investments*, 109.

An indispensable adjunct to every mine was the assay office. This is the furnace in the assay office of the Ontario Mine in Park City in the early 1900's.

UTAH MINING ASSOCIATION



R. R. MARRIOTT

Before the days of the automobile, the blacksmith shop was as much a part of the landscape as a modern service station. Horses and mules of the community and mines in Bingham Canyon were shod by R. R. Marriott in his shop in the 1900's.

the mines were worked by "wealthy companies with the means to construct extensive apparatus for the concentration of the low-grade material found between the bodies of rich ore."[63]

Significance of Utah's Early Mining History

Following in the wake of the newly completed transcontinental railroad, Utah's mining industry reminds us that economic development often depends upon prior development of what might be called social overhead capital — roads, bridges, ports, telephone systems, and schools. Utah's mining industry had a valuable assist from the early pioneers, who labored so diligently to build a diversified and self-sufficient economy in this mountain region. To employ a term now used by development economists, we could say that the Mormons had already developed the "infrastructure" or basic institutional framework of the territory's economy, so that when the railroad was completed the exploitation could proceed without bottlenecks and delays.

It should also be remembered that the mining industry itself precipitated much of the subsequent industrial development of the territory. There was not only the stimulus to the economy from the investment in the mines, but also the demand this created for various factors of production. The demand for labor initiated a new chapter in the history of immigration and colonization —

[63] Huntley, "Mining Industries," *Precious Metals*, 406.

it disciplined immigrant and local labor power to co-operative industrial effort. The workers were paid wages; wages were spent for the produce of farms and mills; and thus the demand for labor stimulated the spread of a market economy, the more extensive production of goods and services for local and distant markets, and contributed to the growth of economic specialization in the state.

Then there was the demand for real capital — for picks and shovels, mules and mine haulage cars, wagons and wheelbarrows, and dynamite and drills. This provided opportunities for hundreds of local entrepreneurs — in lumbering, blacksmithing, manufacturing, banking, and retailing. The initial impetus of investment in mining led in widening arcs to increments of economic activity over the entire local economy. There was a wavelike profusion of many kinds of enterprises, and the horizons of local commerce were broadened.

Finally, the initial advancements in mining triggered a chain reaction which led ultimately to the founding of other mining industries. In searching for gold the early prospectors found silver; in trying to obtain silver, they found complex ores containing the so-called base metals — lead, copper, and zinc. In separating the silver, metallurgists developed methods of reduction which produced at first a marketable lead, then a marketable copper, and then a marketable zinc (and in this century, marketable radium and uranium). Notwithstanding their accidental or incidental discovery, these industrial metals laid the foundation of the great nonferrous metals industry of Utah; their ultimate contribution to the economy of the state was incomparably greater than that of the so-called precious metals, gold and silver. It was almost as if the earth itself was one great bonanza from which man was able to obtain an abundance of the things he needed and desired.

UTAH'S CINDERELLA MINERALS:

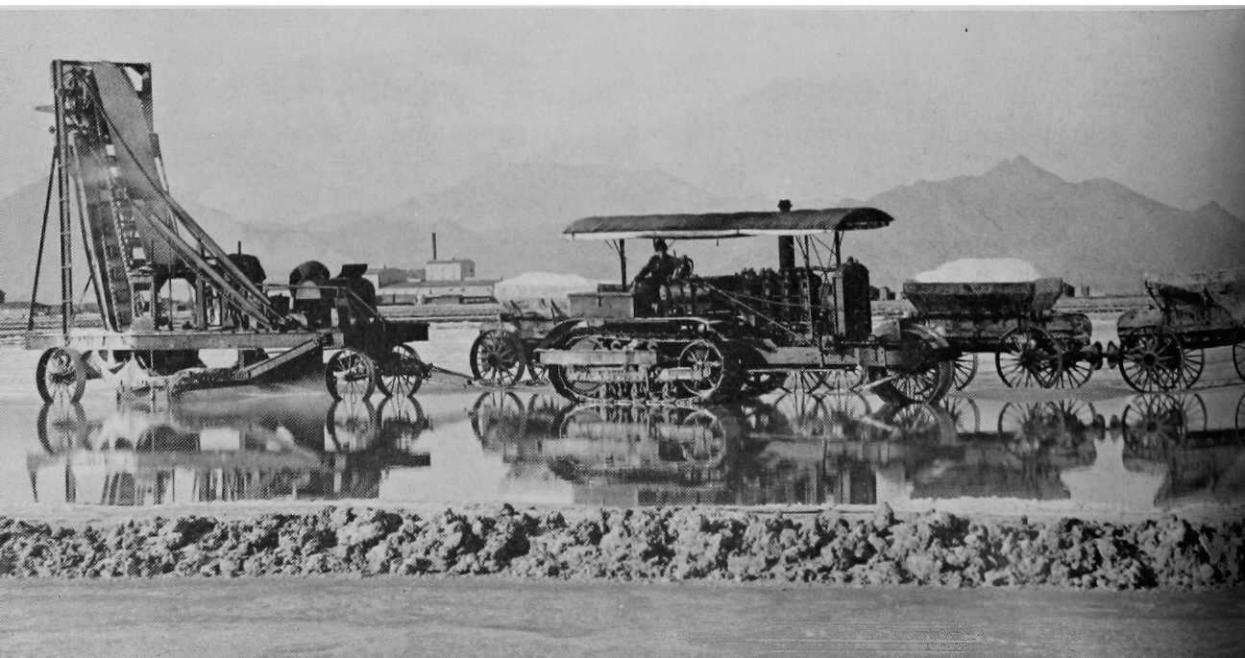
The Nonmetallics

BY MILES P. ROMNEY

Commonly referred to as "industrial nonmetallic minerals," the nonmetallic, nonfuel group might well be called the "Cinderella minerals." They have generally lacked the spectacular romantic appeal of the metals or of gas and oil. No mining "rushes" followed their discovery. Only meager records have been kept of their discovery, initial exploitation, and development. With few exceptions they are very low in unit value, so cannot be shipped and marketed over any great distance as raw materials. However, when markets develop for the great variety of products which are derived from them, they then furnish the basis for extensive processing in the communities where they are found.

Gypsum, cement rock, clay, limestone, sand, and gravel are typically illustrative; whereas Gilsonite, fluorspar, salt, and sulphur, because of relatively high unit value, might be classed as the exceptions. Utah and other Western States have substantial quantities and varieties of such minerals. The history of their development in Utah and the West has been much the same. Individual community needs supported small group or individually operated plants through the period of the founding and early growth of the communities. This phase continued, often on an intermittent operating basis, until population growth, improved processing techniques, up-graded quality, and widened variety of products justified the necessary investment for plants capable of producing for export markets as well as for expanded needs in the near-plant areas.

Mr. Romney is manager of the Utah Mining Association.



Settlers in the isolated wilderness area were primarily interested in the mineral substances which furnished food and shelter. Salt, the only major mineral food item, was obtained from the shores of Great Salt Lake almost from the day that the pioneers entered the Valley. Home and building needs were filled by stone, clay, and limestone, which were generally abundant throughout the state. Various types of building stone and kiln-burned brick, bonded with lime and sand mortar, soon replaced logs and adobe in the construction of homes and buildings. The numerous other nonmetallic industrial minerals, now included in Utah's production roster, were found and developed after completion of the railroad had stimulated population growth and opened outside markets.

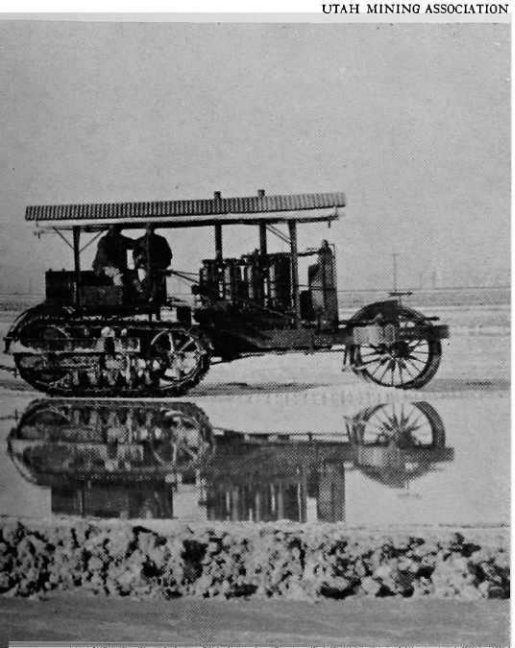
History and Development of the Minerals

Salt was in immediate demand on arrival of the pioneers in the Salt Lake Valley. This need was first met by boiling the water from Great Salt Lake in iron kettles. Later, more efficient solar evaporation methods were used and a commercial industry was started. The first reported production was 12,000 tons in 1880, valued at $60,000.

Culinary needs, after about 1870, were exceeded by demand from the newly developing mining industry. In 1885, Utah produced 15,000 tons of salt — more than half of which went to the mines of Utah, Nevada, Colorado, Idaho, and Montana for use in ore reduction (chlorination process for silver recovery).

In 1886, some 100,000 tons of salt were collected around the lake, but there was use for only 23,000 tons — 20,000 tons of which were used in the silver mills of Utah, Idaho, Montana, and Colorado.[1] Rock salt, by 1886, had been mined from two locations east of Nephi on Salt Creek (a source earlier used by the Indians of the area), from Ten Mile Creek near Manti, from Salina, and from near the southwest corner of Utah Territory. The last was the source for the Silver Reef mines at Leeds. At Salina, six or eight factories were dissolving rock salt in steam and hot water and then evaporating it to produce table salt for sale in southern Utah and part of Arizona. The People's Forwarding Company of Salina marketed the salt.[2]

UTAH MINING ASSOCIATION



Harvesting crude salts from solar vats at the edge of Great Salt Lake in the 1900's. Tractor and wagons are used for hauling the salt to the Utah-Salduro Company, in background.

[1] U.S., Department of the Interior, Geological Survey, *Mineral Resources of the United States* (Washington, D.C., 1886), 639. This publication is hereafter cited as *Mineral Resources*, with the year it covers.

[2] *Ibid.*, 640.

UTAH MINING ASSOCIATION

Remnants of small, crude kilns (such as this one near Mantua) are to be found near many of Utah's cities and towns.

Utah salt production increased from 28,000 tons in 1889, to 60,000 tons in 1890, to 136,000 tons in 1891, to 181,000 tons in 1892, and then for some undetermined reason dropped to 15,000 tons in 1893. Output did not reach 100,000 tons again until 1941, with 107,000 tons. In 1962, 280,000 tons from Utah operations reached an all-time peak.[3]

In 1961, companies producing solar evaporated salt were: the Morton Salt Company (major producer), Leslie Salt Company, Utah Salt Company, Solar Salt Company, and Lake Crystal Salt Company. Great Salt Lake and the salt flat deposits around the lake are the sources for these companies. Morton Salt Company, in Sanpete County, and Poulson Brothers Salt Company, in Sevier County, operate rock salt mines near Redmond, principally for stock feed. Salt in Great Salt Lake and rock salt deposits from a virtually inexhaustible resource in Utah, and future production will be governed by demand and competition.

[3] *Mineral Resources* for various years and U.S., Department of the Interior, Bureau of Mines, *Minerals Yearbooks* (Washington, D.C.) are the sources of these statistics. The latter publication is hereafter referred to as *Minerals Yearbook*, with the year.

Arrastra (rude, drag-stone mill) for pulverizing clay in the brick-making process at the old site of the Interstate Brick Company in Murray, Utah.

UTAH MINING ASSOCIATION

Clay was first used in Utah to fill the chinks in log cabins and for adobe brick. A few adobe buildings are still being used in Utah today. Communities and individuals started building kilns for burning brick after primary shelter needs were met. These kilns were operated intermittently as the need for brick arose in the area. Many homes built with the soft, light reddish brick from those early operations are still in evidence in Utah's cities and towns.

Mineral Resources of the United States, for the year 1900, reports that 201 operating firms reported production of clay products in 1899. Although the report does not differentiate between brick plants and other clay-product operations, a substantial majority was making brick. As early as 1870, government experts recognized extensive clay deposits in Utah. Rossiter W. Raymond in that year reported that "... higher up on the Weber, ten or twelve miles above the confluence of the Echo with the Weber, are found hematite ores, *fire-clay* and coal ...."[4] In 1885, another interesting report of clay occurrence relates that: "The Pleasant Grove clay banks were discovered in the early days. The price obtained was $3.00 per ton."[5]

The brick plant built by John P. Cahoon and Brothers in 1878 is reported to be the first important brick plant in the state.[6] John P. Cahoon and his brothers built the plant in Murray, Utah, to make brick for their own homes. They expanded into commercial brick production and in 1891 moved to Thirty-third South and Eleventh East streets, where a large quantity of good clay was available. In the ensuing years the plant was expanded and the products were diversified to meet growing demands. The clay beds near the plant supplied the full needs of the plant until 1921, when the first outside clay was purchased. The original company name was The Salt Lake Pressed Brick Company. It became the Interstate Brick Company in 1939. The Cahoons have directed operations since 1878, a span of 85 years. Chester P. and John B. Cahoon, sons of the founder John P. Cahoon, are the present executive officers.

One other Utah plant, operated by the International Pipe and Ceramics Company (successor of Gladding McBean and Company, which in turn succeeded Utah Fire Clay Company), approximates the Interstate Brick Company in size. It is located at Salt Lake City. Other clay-product companies operate in Salt Lake City, Ogden, Provo, and Lehi. Production from these Utah plants covers a wide range, from porcelainized, interior decorative tile to refractory brick for furnace lining. The Utah Department of Employment Security reports nine such structural clay-product plants operating in Utah in 1961, employing an average of 380 men and having an annual payroll of over $2 million.

[4] U.S., Department of the Interior, Bureau of Mines, *Statistics of Mines and Mining, in the States and Territories West of the Rocky Mountains* (Washington, D.C., 1870), 319.

[5] *Statistics and Technology of the Precious Metals* (Washington, D.C., 1885), 446.

[6] ElRoy Nelson, *Utah's Economic Patterns* (Salt Lake City, 1956), 167.

TREND OF NONMETALLIC MINERAL PRODUCTION IN UTAH
1905–1960

Year	Total Value All Minerals (1)	Total Value of All Metals, Coal and Liquid Fuels (2)	Total Value of Industrial Nonmetallic Minerals (3)	Total Value of Selected List of Industrial Nonmetallic Minerals (4)
1905	28,477,790	27,882,458	595,338	n.a.
1910	39,233,716	36,654,241	2,579,475	n.a.
1915	62,586,261	60,021,986	2,564,275	904,011
1920	76,536,657	69,349,541	7,187,116(a)	1,589,486
1925	100,275,442	95,363,585	4,911,857	1,757,186
1930	64,224,307	59,327,202	4,897,105	2,785,764
1935	41,933,136	38,328,597	3,604,539	2,389,781
1940	104,392,989	100,145,011	4,247,978	3,648,483
1945	127,961,000	121,779,169	6,181,831	3,821,217
1950	229,966,000	212,493,510	17,472,490	6,811,725
1955	332,002,000	308,676,991	23,325,009	11,490,830
1960	431,383,000	386,713,746	44,669,254	25,455,000

(n.a., not available)
(1) U.S., Department of the Interior, Bureau of Mines.
(2) U.S., Department of the Interior, Bureau of Mines plus some confidential data.
(3) Difference 2 minus 1.
(4) U.S., Department of the Interior, Bureau of Mines values for salt, asphalt products, clay, sand and gravel, stone and lime.
(a) No explanation found for this wide variation from trend.

Stone played an important role in early-day Utah. Red sandstone was extensively used for structural parts and for whole buildings. The Dooly Building at Second South and West Temple streets in Salt Lake City, the St. George Tabernacle, the foundation of the Salt Lake Temple, and the buttresses of the Salt Lake Tabernacle are constructed of red sandstone. A creamy white oölithic limestone found favor in the Sanpete County area for the Manti Temple and for many homes and buildings — including the new county courthouse at Manti. The Salt Lake Temple and the State Capitol were built with granite from Little Cottonwood Canyon. It was also used extensively as structural material in many homes and buildings.

Statistics of stone production from the early years of Utah's history are a poor measure of actual production and use, as only commercial transactions were reported. The early quarries were usually developed by individuals and communities, and the stone quarried as needed for their own use. However, in 1905, the value of stone production was:

Granite	$13,630[7]
Sandstone	43,429
Marble	1,150
Limestone	232,519
Total	$290,728

[7] *Mineral Resources*, 1906, p. 1009.

UTAH STATE HISTORICAL SOCIETY

Section of the Western Gypsum Company, Sigurd, Utah, formerly the American Plaster Company, is still in full operation.

The 1910 total production value was $439,975. It was $3.3 million in 1962. The types of stone produced, however, have changed materially. *Minerals Yearbook*, for 1961, reports:

> Crushed limestone constituted 90 per cent of the total stone output. More than one-third of the crushed limestone was used for manufacturing cement; other principal uses were as a flux in smelting and for manufacturing lime. Other types of stone produced, in order of value, were crushed sandstone, dimension sandstone, crushed miscellaneous stone, crushed marble, and dimension limestone.

Gypsum is abundant in Utah and was recognized very early in pioneer history. The mineral was discovered in Salt Creek Canyon before Nephi was settled (1851).[8] A claim located about 1870,

> was patented by John Hague and others in 1882 under the name of the Juab Plaster and Mining Claim. During the next few years rock gypsum was quarried and calcined in sorghum pans, and the plaster was used locally and shipped to Salt Lake City.[9]

A mill was built in 1888 by Hague and others.[10] This property was later acquired and operated up to the 1930's by the Nephi Plaster and Manufacturing Company. At least 10 other Utah counties possess gypsum; i.e., Juab, Sanpete, Sevier, Millard, Emery, Wayne, Kane, Grand, Iron, and Washington.[11]

Four gypsum mills were operating in Utah in 1910 — one at Nephi, one at Levan (Juab County), and two at Sigurd (Sevier County).[12] Total mine production was 46,279 tons valued at $149,089, of which, 31,333 tons were calcined

[8] U.S., Department of the Interior, Geological Survey, *Bulletin 697* (Washington, D.C., 1920), 261.
[9] U.S., Department of the Interior, Geological Survey, *Bulletin 225* (Washington, D.C., 1904), 487.
[10] USGS, *Bulletin 697*.
[11] *Ibid.*
[12] *Mineral Resources*, 1910, p. 730.

for plaster, 12,301 tons were sold to cement plants, and 4,185 tons were used for land plaster.[13] The Levan plant had closed by 1923, and during the early 1930 depression years, total gypsum production from the remaining plants dropped to 22,000 tons but rose to 58,000 tons in 1939.

Production of gypsum in Utah up to the 1940's was principally for Utah markets. Greatly increased postwar demands for prefabricated gypsum products in both local and outside markets encouraged the U.S. Gypsum Company and the Western Gypsum Company (now the Bestwall Gypsum Company) to build large, modern plants at Sigurd, Sevier County, for production of a full range of gypsum products. These plants were completed in 1947 and are now the only Utah gypsum operations. Detailed figures are not available, but present production is estimated at about 200,000 tons of wallboard, plaster, and keene cement annually.

Limestone, lime, and dolomite have a great variety of applications in industry and construction. Lime production goes far back in ancient history, as kilns for burning limestone are mentioned as early as 184 B.C.[14] Its early use in Utah was for plaster and mortar, but as industry developed lime's use was greatly expanded. Milling and smelting of ores, sugar refining, and cement production are examples of new commercial uses.

Because crude kilns could readily be built for burning limestone and producing lime, much of the early-day individual or co-operative community production was not reported. Remnants of small lime kilns, constructed with rough rock, are found around many of Utah's cities and towns. Several such lime kilns lie on the hillside just above the gravel operations in north Salt Lake.

Probably the oldest continuing lime operation in Utah today is the Utah Lime and Stone Company plant established about 1914 at Dolomite, in Tooele County. It was the first Utah plant to prepare sacked, hydrated lime, a product obtained by slaking and then dehydrating quicklime. Quicklime, the product of the kilns, absorbs water and carbon dioxide rather readily and is, therefore, perishable. Hydrated lime keeps well in storage.

Substantial tonnages of limestone are used in sugar refining. As both lime and carbon dioxide gas are needed in the refining process, the limestone is calcined at the sugar refinery in order to obtain both products.

Limestone is a calcium carbonate, whereas dolomite is a calcium-magnesium carbonate. For many uses they are interchangeable and the term "lime" is applicable to the calcined products of both. The principal end product of dolomite, which differs from that of limestone, is "dead burned dolomite." Dolomite with iron added is calcined at high temperature to yield a product which has a

[13] *Ibid.*, 718.

[14] U.S., Department of the Interior, Geological Survey, *Bulletin 556* (Washington, D.C., 1956), 457.

high melting point for use in refractory furnace lining. Utah's limestone and lime operations have grown apace with industrial needs, and the rock is available to satisfy all foreseeable future demands.

Portland cement, a finely ground rock which has the characteristic of hardening in contact with water, was discovered by Vicat, a French engineer, in 1818. The first portland cement plant was built in England in 1824 by Joseph Aspdin. The first plant in the United States was built at Coplay, Pennsylvania, in 1878.[15]

"Cement rock, which upon analysis showed very satisfactory composition, was discovered during the year (1888) at some point between Ogden and Provo City, Utah Territory."[16] This vague reference could apply to the deposits at either Devil's Slide in Morgan County or Parley's Canyon in Salt Lake County.

Utah's first cement production was reported at 5,000 barrels and was valued at $10,000 in 1891 (or 1892). It came from the Salt Lake City plant of the Portland Cement Company of Utah, built in 1891,[17] now operated under the name Utah Portland Cement Company. The second plant was constructed by the Union Portland Cement Company at the Devil's Slide deposit. The Devil's Slide plant was acquired by the Ideal Cement Company of Denver, Colorado, in 1922.

To fill the first large contract of the Union Cement Company, hand-filled burlap bags of cement were shipped for use on the Milliner Dam in Idaho around 1907. The successor, Ideal Cement Company, furnished about 670,000 barrels of "Red Devil" cement for building the Hoover Dam during the years 1929 to 1933.[18]

The two present Utah plants at Devil's Slide and Salt Lake City produce approximately 2.5 million barrels of cement annually. Most of this cement is consumed in Utah, for Utah is ringed with competitive plants in adjacent states.

UTAH PORTLAND CEMENT COMPANY

[15] *The Mineral Industry, Its Statistics, Technology and Trade for 1892* (New York, 1893), I, 49.

[16] *Mineral Resources*, 1888, p. 553.

[17] *Ibid.*, 1906, p. 918.

[18] Unpublished manuscript by Francis E. Bray in author's possession.

The Utah Portland Cement Company at Ninth South and Fifth West streets, in Salt Lake City.

Sand and gravel have been readily available throughout the state for the principal uses of construction and road building. There were side-hill, river-bottom, and creek-bed deposits to meet the needs of individuals, communities, and sand and gravel operators. Mother Nature, through erosion, had picked up the hard-broken rock from high places, moved it to the valley, rounded it by grinding rock against rock in its travel, and then roughly assorted it as to size when the streams or lake currents could no longer carry it.

History of sand and gravel use in Utah relates almost totally to needs within the state, and as they were widely available, the needs of any area could be met by deposits relatively close at hand. Sand and gravel production, therefore, is an excellent measure of the level of the state's construction and road-building developments. Such statistics were not reported, however, until after the turn of the century. The first U.S. Bureau of Mines report on Utah's sand and gravel production was in 1908, when 20,990 tons were reported, valued at $3,599. Production increased to 14.5 million tons by 1962, valued at $8,702,000.[19]

Sand and gravel, in addition to normal uses, have furnished the base in recent years for the manufacturing of concrete building blocks, ready-mixed concrete, and pre-stressed concrete structural members for bridges, buildings, etc. Pre-stressed concrete, first made commercially by the Utah Sand and Gravel Products Corporation, has developed out-of-state markets. Shipments have been made to Nevada, Wyoming, Idaho, and California.

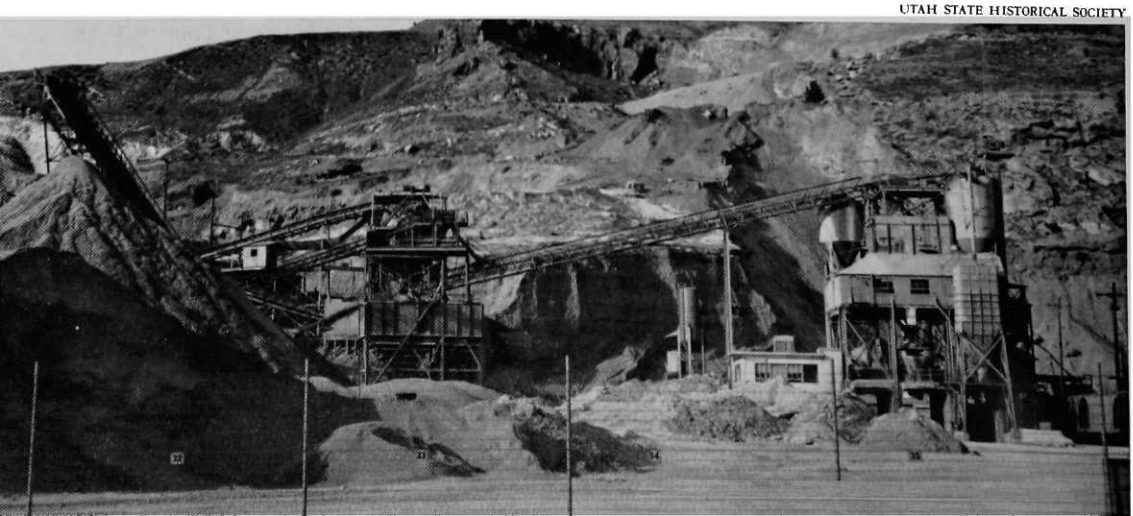
Sulphur in substantial quantity was discovered early in the state's history. The first sulphur production in Utah was from hot spring deposits near Salt Lake City, shortly before the Cove Creek discoveries were made.[20] In 1892, it was reported that "the most important deposits of brimestone in the United States are found in Utah, at Cove Creek, 22 miles from Beaver, near the line of Millard County . . . ." The first discoveries at Cove Creek were made in 1869.

[19] These statistics are from the publications *Mineral Resources* for the years 1908–23 and 1924–31, and the *Minerals Yearbook* from 1932 to the present.

[20] U.S., Department of the Interior, Bureau of Mines, F. J. Kelley, *Sulphur Production and Consumption in Eight Western States* (Washington, D.C., 1962), 60.

Utah Sand and Gravel Products Corporation plant and gravel pit are located in north Salt Lake.

UTAH STATE HISTORICAL SOCIETY



The first year of successful operation was in 1883, by the Dickert and Meyers (Myers, in other reports), Sulphur Company.[21] Peak output was 5,260 tons in 1896, and the yearly average for the 16 previous years was 1,372 tons. Sulphur mining has been sporadic since the turn of the century, with intermittent attempts to establish commercial operations. The most recent was by Sulphurdale Chemical Company, which built a 100-ton-per-day mill in 1961 to produce powdered and beaded sulphur.[22] The property is now idle.

The early-day sulphur production filled the needs of Utahns and other western settlers for sheep dip, gun powder, and medicinal purposes. The last mentioned revives childhood memories of "sulphur and molasses," the springtime home remedy to thin that heavy winter blood. Sulphur — or modern sulfur — is reported in undeveloped showings in four areas of the state, other than the "Cove Creek" deposit.[23]

Gilsonite was the name given to the light-weight, glossy black bituminous mineral found in the Uinta Basin south of Vernal and Roosevelt. In 1885, Professor W. P. Blake gave the name of Uintaite to the mineral, but it was later called Gilsonite in recognition of Mr. S. H. Gilson of Salt Lake City, who helped bring the mineral into prominence for commercial uses. From that early time

[21] *Mineral Industry*, I, 35, 37.

[22] *Salt Lake Tribune*, October 8, 1961.

[23] Utah Mining Association, *Utah Mining Industry: An Historical, Operational, and Economic Review of Utah's Mining Industry* (2nd ed., Salt Lake City, 1959).

Early Gilsonite mining in the Uinta Basin was primarily a hand operation even to the loading of the ore into burlap bags for transporting to the refinery.

UTAH MINING ASSOCIATION

to the present, Gilsonite has been mined commercially only in northeastern Utah. It occurs in parallel, almost vertical, veins that cut across the broad Uinta Basin and is believed to be a solid residue of petroleum.[24]

While there was some Gilsonite production in the period from 1888, the Barber Asphalt Company began developing the Black Dragon Gilsonite Mine in 1902. In 1904, its subsidiary, the Uintah Railroad Company, completed construction of a 63-mile narrow-gauge railroad to the mines. It ran across the rugged Book Cliffs from Mack, Colorado,[25] to connect with the Denver & Rio Grande, thus eliminating the long wagon haul over mountain roads. Freight costs in about 1900 were reported at $10 to $15 per ton loaded on railroad cars. Rail costs to Chicago or St. Louis were approximately $10 per ton.[26]

The production of Gilsonite increased enormously from 2,978 tons in 1904 to 10,916 tons in 1905.[27] Sales of Gilsonite from Uintah County had increased to 54,987 tons in 1929, valued at $1,235,920. In 1957, the next great increase in production of Gilsonite resulted from an extensive development program being completed by American Gilsonite Company, successor in operations to the Barber Asphalt Company. The developments were threefold: a completely hydraulic mining system was installed to increase tonnage and to reduce explosion hazards; a refinery was built at Fruita, Colorado, to produce high-octane gasoline and high-grade metallurgical coke from the Gilsonite; and a 72-mile pipeline was built from the mines at Bonanza, Utah, over the Book Cliffs to the refinery.

In 1961, "native asphalt" production in Utah totaled 470,000 tons, valued at $14.5 million. Gilsonite was not reported separately. However, it constituted very nearly all of the reported "native asphalt" production. Two companies were operating in Utah — The American Gilsonite Company and G. S. Ziegler & Company.

Bentonite, fuller's earth, and halloysite are types of clays which have been economically developed. The first recorded production of fuller's earth was in 1898.[28] No similar record of bentonite production was found, but it was undoubtedly put to various early-day uses. It is reported that "covered wagons that carried some of the pioneering white settlers into the West were greased with bentonite. The Indians used bentonite as soap . . . ."[29] The earliest reported production of bentonite in Utah found by the author was in 1934.[30]

[24] Joseph L. Gilson *et al.*, eds., *Industrial Minerals and Rocks* (3rd ed., New York, 1960), 633.

[25] Nelson, *Utah's Economic Patterns*, 157.

[26] U.S., Department of the Interior, Geological Survey, *Twenty-Second Annual Report of the United States Geological Survey to the Secretary of the Interior, 1900–1901* (Washington, D.C., 1902), Part 1, 355.

[27] *Mineral Resources*, 1905, p. 1164.

[28] *Minerals Yearbook, 1936*, p. 950.

[29] *Ibid., 1938*, p. 1113.

[30] *Ibid.*, 1115.

Bentonite and fuller's earth are processed by the Western Clay and Minerals Company at Aurora, Sevier County, Utah. In major portion these minerals with their wide range of industrial uses, primarily for fillers and cleansers, are shipped to out-of-state industrial centers. Deposits of fuller's earth are reported in three of Utah's 29 counties, bentonite in five, and halloysite in five.[31]

Potash deposits found in Germany in 1856 replaced wood ash as a source of potash. Loss of shipments from Germany during World War I initiated the search for potash in this country and instigated the beginning of a potash mining industry in Utah. Domestic prices in this period rocketed from $35 to $500 per ton. Agricultural needs for fertilizer were particularly acute.

In 1910, certain deposits of "pink spar" had been recognized as alunite near Marysvale, Utah. In 1911, feasibility of extracting potassium sulphate from the alunite was demonstrated.[32] The wartime shortage of potassium and the large tonnage of available alunite attracted a number of companies to build mills and start mining the alunite deposits in 1916–17. At the same time the Solvay Process Company built a plant at Salduro, Utah, some 20 miles east of Wendover, to extract potash from the brines of the Great Salt Lake.

Production was very small in 1917, and Utah's contribution was not reported separately. Thereafter, it was as follows:

1918 – 8 plants, 11,783 tons crude potash containing 3,878 tons K_2O

1919 – 13 plants, 22,426 tons crude potash containing 5,411 tons K_2O

1920 – 6 plants, 34,905 tons crude potash containing 10,069 tons K_2O (20 per cent of the nation's total)

1921 – No state-by-state production reported. German potash was again available and United States production of crude potash fell from 134,963 tons in 1920 to 10,330 tons in 1921.

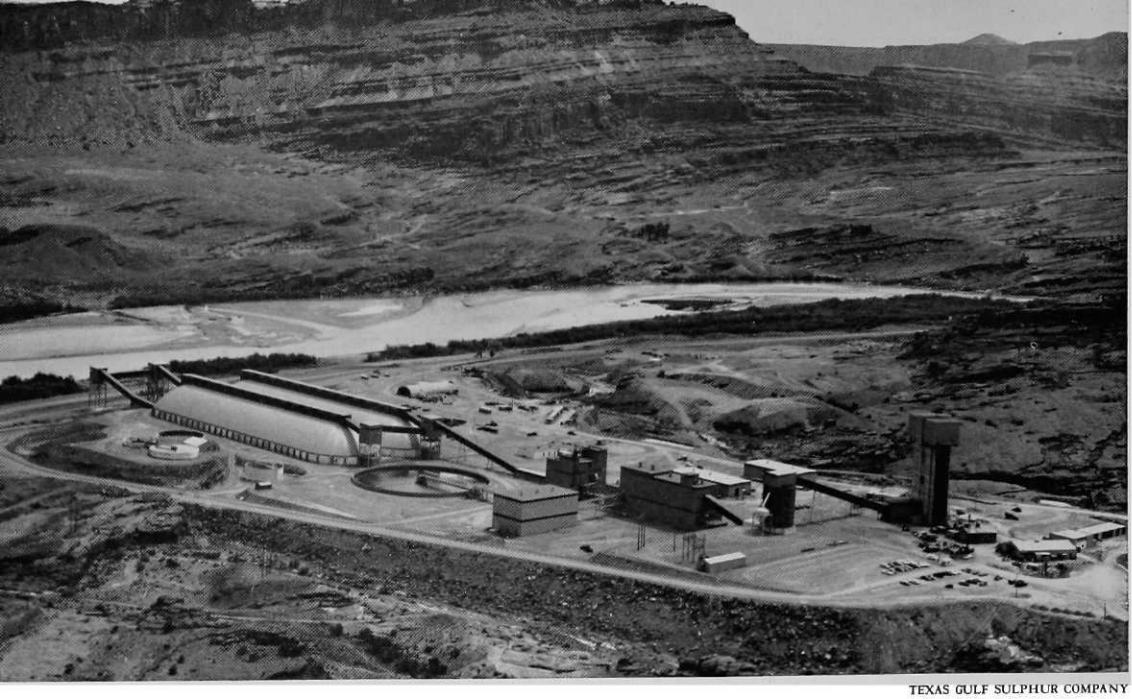
Utah's war-stimulated potash production terminated in 1921. However, interest in potash continued, and subsequent exploratory work led to future developments. The Bonneville Company acquired patent rights to considerable land south of Wendover, which contained potassium-bearing brines.[33] After extensive research a plant was built in 1936 to recover potash by flotation from solar-evaporated salts. Bonneville, Limited, successor to the Bonneville Company, has operated the plant continuously since that date. Bonneville, Limited, was recently merged with the Standard Magnesium Corporation.

Oil wells drilled in Grand County, just south of Thompson, Utah, discovered potash salts in the salt section of the Paradox formation. This and later drilling led the Defense Plant Corporation to drill a carefully controlled test

[31] See the Index references for these minerals in Utah Mining Association, *Utah's Mining Industry*.

[32] U.S., Department of the Interior, Geological Survey, *Bulletin 620* (Washington, D.C., 1915), 237.

[33] U.S., Department of the Interior, Geological Survey, *Bulletin 795-B* (Washington, D.C., 1927), 27.



TEXAS GULF SULPHUR COMPANY

Texas Gulf Sulphur Company plant on Cane Creek, near Moab, Utah, erected in 1962 to process potash ore.

well. The report on this drilling described a rich section of potash salts at a depth of 3,318 feet to 3,538 feet below the surface. Further drilling by various companies in this general area prompted an expert to state:

> The potassium and magnesium salts have been found in various places from the Denver and Rio Grande Western Railroad tracks about seven miles west of Thompson, in eastern Utah, to Cane Creek, a tributary of the Colorado River—a distance north and south of about 35 miles.[34]

The Delhi Taylor Oil Corporation leased substantial acreages of federal and state land in the Seven Mile and Cane Creek areas of Grand County for potash exploration and development. An intensive and successful drilling campaign was started in 1956 in the Seven Mile area just north of Moab and later extended to the Cane Creek area. Testing and economic evaluation of the extensive potash reserves continued until 1960, when the Delhi Taylor Company made a deal with the Texas Gulf Sulphur Company to take over development and operation. In 1960, this company announced plans for mine development and processing facilities to be continued at Cane Creek, and estimated to cost $25 million.[35]

Construction and mine development are at this date nearing completion. The *1962 Annual Report of the Texas Gulf Sulphur Company* states that through 1962, $24.84 million had been spent, and that an estimated $7.9 million would be spent to complete the facilities. Production at the rate of 4,000 tons of

[34] University of Utah, Bureau of Economic and Business Research, *Economic Factors Affecting the Development of the Intermountain Fertilizer Industry* (Salt Lake City, 1950), 91, 92, 93.

[35] *Tribune*, November 3, 1960.

ore per day is planned for sometime in 1963. Basic operation plans permit expansion to 12,000 tons per day. A large tonnage of salt, with which the potash occurs, will be stored as mill tailings.

The Superior Oil Company of California announced December 13, 1958, that a drill hole in Lisbon Valley had encountered favorable potash beds. As this discovery lies over 35 miles southeast of the Texas Gulf Sulphur's Cane Creek deposit, the potash potential area now extends 60 miles in length southeasterly from the original discoveries near Crescent Junction.

Phosphate rock became important as a source of plant food in 1842, when the English discovered that treating the rock with sulphuric acid produced good fertilizer. Using this principle, the first phosphate plant in the United States was built in Baltimore about 1850.

Although phosphate rock had been mined itermittently since 1941, Utah's output of that mineral attained national significance in 1954. That year the San Francisco Chemical Company began phosphate-rock mining operations in the Crawford Mountains area of Rich County. The ore was shipped to Leefe, Wyoming, for beneficiation, and a large portion was sold to the Western Phosphates Company plant at Garfield, Utah.[36] This plant was built at Garfield in 1953, principally because of availability of the sulphuric acid recovered by the Garfield Chemical Company by processing the gaseous effluents from the smelting of copper concentrates. Operations beginning in 1954 produced a wide variety of phosphate and phosphate-based fertilizers, as well as phosphoric acid, principally for out-of-state markets. The San Francisco Chemical Company acquired phosphate-rock reserves north of Vernal, Utah, in 1959, and began full scale production in 1961. A concentrating mill on the mining site produces concentrates which are hauled by truck about 200 miles to the Western Phosphates Company plant. Phosphate rock is another Utah resource available in sufficient quantity to meet any foreseeable market expansion.

Other industrial-type, nonmetallic resources are found in Utah in varying quantities and degrees of economic development. Among these are ozokerite, elaterite, pumice, and fluorspar. In addition, *Utah's Mining Industry* lists sixteen such minerals which are not specifically discussed in this paper. They include barite, diatomite, graphite, nitrates, perlite, pozzolana, guano, oölite, wurtzilite, aragonite, asbestos, obsidian, jasper and onyx, resins, emery, and silica. They have all been produced commercially at one time or another in the state's history, with the possible exception of nitrates, asbestos, and emery.

Barite, perlite, oölite, aragonite, and resins are currently being produced in Utah — the last recovered by flotation from Utah coal.

[36] *Minerals Yearbook, 1954*, III, 1060.

Summary

The industrial, nonmetallic minerals have experienced three phases in their development. In the first, extending up to and in many areas beyond the coming of the railroad to Utah in 1869, operations were conducted largely by individuals or communities with commercial operations playing a minor role.

In the second phase railroad transportation to other markets, population growth, and increased mining and industrial activity stimulated commercial developments in the industrial minerals field. The major markets during this period, which continued up to about 1940, were in-state with a few exceptions, such as Gilsonite and salt. The developments were relatively slow, as they were governed largely by the demand within Utah. From 1910 to 1940, the value of their production increased only from $2.6 million to $4.25 million — a growth factor of 1.63. Population in the same period increased from 373,351 to 550,310 — a growth factor of 1.47.

The third phase, production for a rapidly growing export market area and for accelerated demand in Utah, began after World War II and was characterized by substantial increases in established production, as well as by new commercial development of other minerals. The $4.25-million value of all industrial mineral production in 1940 was dwarfed by $44.7-million value in 1960. The unadjusted dollar value of the industrial, nonmetallic mineral production from 1940 to 1960 increased over 10 times, while the population increase rate was only 1.6 times. All values quoted are for the raw material only and, therefore, do not include the very substantial value which is added in the processing of the raw minerals to salable form.

Continued growth of the nonfuel nonmetallics portion of Utah's mining industry can be predicted with reasonable certainty from the trend shown by the foregoing developments. This optimistic prediction is based upon a combination of circumstances: (1) an expected substantial population growth in Utah's marketing areas; (2) abundant reserves of the developed, presently producible nonmetallic minerals; and (3) substantial reserves of other nonmetallics for which new or expanded markets hold promise. The second centenary seems fated to fit the nonmetallics as well as did Cinderella's slipper.

FROM DEARTH TO DELUGE:

Utah's Coal Industry

BY THOMAS G. ALEXANDER

From the date of their entrance into the Valley of the Great Salt Lake, the first settlers saw the need for coal in their regional economic development. As early as the summer of 1847, exploring parties sought coal and other resources. The territorial legislature and county courts gave further encouragement by offering bounties for the discovery of bodies of coal.[1] Today, the situation is quite the reverse. Utah now has the capacity to produce so much coal that its mines have had to limit their output. Like Prometheus, who first brought fire to mankind, the mines have been bound by a greater power after contributing a necessary gift.

The evolution of Utah's coal industry from acute shortage to damaging surplus is described in six stages: 1849–1868, 1869–1881, 1882–1919, 1920–1941, 1942–1950, and 1951–1963.

Pioneer Beginnings (1849–1868)

In early years transportation costs and limited technical knowledge diminished the usefulness of Utah's coal reserves. After discoveries in 1849 near Coalville, wagons delivered coal to Salt Lake City at $40 per ton by 1863. In 1854, two former Welsh coal miners discovered coal in Sanpete County, founded the town of Wales in 1857, and delivered coke by ox team to Salt Lake City the next year. In 1852, the Deseret Iron Company, a joint L.D.S. Church-Utah

Thomas G. Alexander, a Ph.D. candidate and teaching assistant in history at the University of California, Berkeley, was a research assistant in economic history at Utah State University when this article was prepared. The research was supported by a grant from the Utah State University Research Council. The author is grateful for the suggestions and assistance of Professor Leonard J. Arrington of Utah State University, Dr. Everett L. Cooley and the staff of the Utah State Historical Society and Utah State Archives, and Miles P. Romney and W. J. O'Connor of the mining industry.

[1] Leonard J. Arrington, *Great Basin Kingdom: An Economic History of the Latter-day Saints, 1830–1900* (Cambridge, 1958), 42, 435n; Territory of Utah, *Acts Resolutions and Memorials Passed at the Several Annual Sessions of the Legislative Assembly* (Great Salt Lake City, 1855), 393; Hubert Howe Bancroft, *History of Utah, 1540–1887* (San Francisco, 1891), 737n; *Ogden Standard Examiner,* August 18, 1937.

INDEPENDENT COAL AND COKE COMPANY

Utah Fuel Company's Number 2 Mine, Castlegate, Utah, ca. *1938. The Coal seam in this photograph is about 30 feet thick. Modern machinery has now replaced most hand labor.*

Territory project, tried to exploit iron and coal deposits near Cedar City, but a series of reverses forced the closing of operations in 1858. Again in 1881, another unsuccessful attempt was made to exploit these same reserves.[2]

Despite early failures and the high price of coal, Utahns remained hopeful. Deposits were known to underlie areas in present-day Carbon, Emery, Summit, Uintah, Grand, Iron, Garfield, and Kane counties. With existing equipment and industrial methods, Utahns could produce coke for lead, but not for iron smelting, from at least some of the coal.[3] The commercial usefulness of this coal had to await the development of transportation facilities more efficient than the ox team and wagon.

[2] ElRoy Nelson, *Utah's Economic Patterns* (Salt Lake City, 1956), 131; George M. Gadsby, *Utah's First Century: Sagebrush and Pioneer to a Treasure House in the Mountains* (New York, 1951), 18; Utah Mining Association, *Utah Mining Industry: An Historical, Operational, and Economic Review of Utah's Mining Industry* (2nd ed., Salt Lake City, 1959), 7; State of Utah, Investigating Committee of Utah Governmental Units, *Report of Sub-Committee on Utah's Coal Resources to the Governor and State Legislature, An Economic Study of the Development of Utah's Coal Resources* (Price, 1936), 3 (hereafter cited as *Coal Study*, 1936); Otto Herres, in *Salt Lake Tribune*, October 25, 1936; Arrington, *Great Basin Kingdom*, 123–24, 127, and 346.

[3] Bancroft, *History of Utah*, 736–37.

Development by the Union Pacific Railroad (1869–1881)

In the process of constructing and operating a transcontinental railroad, the Union Pacific Railroad Company developed mines in places such as Rock Springs, Wyoming; Gunnison, Colorado; and Coalville, Utah. The company began development of the Coalville field as early as 1874. With the opening of a railroad to the Park City mines in the 1880's, extended operations were undertaken; but owing to "water and the excessive cost of mining" the Coalville mines were "abandoned" in 1887. The reasonably priced coal from Union Pacific mines was virtually the only coal on the Salt Lake City market until the 1880's. During the 1870's, various Salt Lake interests, including the L.D.S. Church, sought to introduce competitive coal into the city from mines at Coalville and elsewhere; and rival roads were initiated to take the coal to market — the Coalville and Echo, Summit County, Sevier Valley, Sanpete Valley, and Utah Eastern railways.[4] But none of these was a financial success, and for more than 10 years Union Pacific reigned supreme in Utah's coal industry.

Denver & Rio Grande and its Competitors (1882–1919)

In 1882, the Denver & Rio Grande Western Railroad challenged UP by opening the vast coal deposits of Carbon County.[5] By August, 1882, as the road neared completion, Clear Creek became a coal-mining boom town. D&RGW's coal subsidiary, the Utah Fuel Company, began immediately to obtain coal property. The company acquired Winter Quarters Mine near Scofield (1882) and Castle Gate and Sunnyside coke properties in 1888 and 1900, respectively. By 1918, Utah Fuel Company's property was valued at $4 million. In 1900, the first year in which production topped 1 million tons, this company mined 90 per cent of Utah's coal. Utah Fuel had replaced Union Pacific as Utah's chief coal supplier.

After 1906, a number of independent producers led by men like Charles N. Strevell of Independent Coal and Coke Company, Fred and Arthur Sweet of

[4] Union Pacific Passenger Department, *The Resources and Attractions of Utah* (Chicago, 1889), 41; Union Pacific Coal Company, *History of the Union Pacific Coal Mines, 1868 to 1940* (Omaha, [1940]), 102–3; Union Pacific Railway, *Report to the Stockholders of the Union Pacific Railway, for the Year 1880* (New York, 1881), 11; Arrington, *Great Basin Kingdom*, 275–76 and 347.

[5] The principal sources for the period between 1880 and 1919 are: Robert G. Athearn, "Utah and the Coming of the Denver and Rio Grande Railroad," *Utah Historical Quarterly*, XXVII (April, 1959), 128–42; Robert G. Athearn, *Rebel of the Rockies: A History of the Denver and Rio Grande Western Railroad* (New Haven, 1962); Wain Sutton, ed., *Utah: A Centennial History* (New York, 1949), III, 362; State of Utah, Coal Mine Inspector, Reports (Salt Lake City, from 1896 to 1916); State of Utah, Joint Senate and House Committee, "Joint Senate and House Committee of the Legislature of the State of Utah, to investigate the question of coal shortage; said hearings beginning on the 29th day of January, A.D. 1917" (typescript, Utah State Archives) (hereafter cited as "Coal Investigation, 1917"). For lists of the companies active during this period see: State of Utah, Conservation Commission, *First Biennial Report of the Utah Conservation Commission, 1913* (Salt Lake City, 1913), 152–53; R. W. Crockett, "The Coal Industry of Carbon County [Denver & Rio Grande Western]," *The Railroad Redbook*, XXXIV (January, 1917), 249; U.S., Department of the Interior, Geological Survey, *Twenty-Second Annual Report of the United States Geological Survey, 1900–1901* (Washington, D.C., 1902), Part III, 454, 470 (hereafter cited as *Geological Survey, 1900–1901*).

Standard Coal Company, and J. William Knight of Spring Canyon Coal Company sought to compete in the production and marketing of coal. In response to the challenge to its supremacy, Utah Fuel resorted to practices which contemporary observers condemned.

Despite the fact that Utah Fuel produced only 40 per cent of Utah's coal in 1916, in January of 1917, when George Dern's joint legislative committee undertook an investigation into the shortage of railroad cars on the Denver & Rio Grande Western, the rancor of Strevell and Fred Sweet was evident in their testimonies. Fred Sweet testified that "armed guards" drove Arthur Sweet off the coal lands at gunpoint causing them to bring:

> injunction proceeding . . . to enjoin these armed guards — and . . . the Utah Fuel Company — from policing the public domain and preventing citizens of the United States from going on the mineral lands of the Government and developing the coal veins.[6]

Affidavits, filed with various executive departments and President Theodore Roosevelt, procured special agents to investigate, after which the Sweets pur-

[6] "Coal Investigation, 1917," 216–17.

UTAH STATE HISTORICAL SOCIETY

Sunnyside, Utah, in the early 1900's, was a coal mining community of the Utah Fuel Company, the coal subsidiary of the Denver & Rio Grande Western Railroad.

UTAH STATE HISTORICAL SOCIETY

Mass burial of Scofield Mine disaster victims. On May 1, 1900, an explosion in the mine claimed the lives of 200 men and left 107 widows and 268 fatherless children.

sued their rights "without further molestation."[7] Strevell read into the record a decision by the Interstate Commerce Commission showing that the Denver & Rio Grande Western had discriminated in favor of Utah Fuel Company's Sunnyside operations "by not less than 25 cents a ton . . . ."[8] Shortly over a month after the Dern committee investigation began, Utah created a public utilities commission in part to deal with the railroad rate problem.[9]

The efforts of these progressive entrepreneurs, together with the rapid growth of western industry after 1900 and particularly after the outbreak of World War I, stimulated the growth of Utah's coal-mining industry.[10] Unfortunately, this rapid growth contributed to the development of labor, safety, and social problems. Low wages, no organization, and the spectre of death haunted the miners. Strikers could hope for little more than loss of their jobs and homes. Taking cognizance of prevailing conditions, the state legislature in 1896 limited the hours of work in the mines to eight and prohibited the employment of children under 14.

Because the coal was found away from settled areas, many of the companies built towns for their employees. Clear Creek was described by the mine inspector in 1901:

> The town itself is located in a little park in the mountains and as the buildings are all new, of modern design and are arranged in order, the effect is indeed pleasing to the visitors. Near the entrance to this triangular park the Company has its cozy office, well appointed and equipped, the Wasatch Store Company, occupying a portion of the commodious structure, in addition the company has con-

[7] *Ibid.*

[8] Interstate Commerce Commission Report cited in the testimony of Charles N. Strevell, *ibid.*, 196–200.

[9] State of Utah, Public Utilities Commission, *Report of the Public Utilities Commission of Utah, April 3, 1917 to December 31, 1917 Inclusive* (Salt Lake City, [1918]), 5, 35, 61–62, 93–95.

[10] For the condition of Utah's mining industry in 1900 and its limited market see *Geological Survey, 1900–1901*, 454, 470. For the situation in 1917, see "Coal Investigation, 1917," 217.

> structed twenty double houses and an equal number of cottages which are leased to employees at a reasonable rental.[11]

Unfortunately, this idyllic setting, if accurate, was not typical. By 1909, immigrants made up over half of the labor force; and these Greeks, Germans, Finns, Austrians, French, Italians, Negroes, and Japanese often had to set up tents or shacks in the dirt without sewage or water facilities. Labor agents, gamblers, and labor agitators preyed upon the immigrant miners who were often clannish and distrustful of strangers. The local "Americans" heaped abuse and discrimination upon the hapless newcomers.[12]

Even in some of the best mines, accidents occurred because both employers and employees were unwilling to take the time or expend the money to provide for safety. Most coal was either mined by hand or shot-off-the-solid, and accidents were frequent. All too often, the report of the mine inspector had such entries as:

> They, [James] Cunningham and his partner, [Edward] Hughes, had fired a shot, taken down all loose rock, sounded [the] roof and pronounced it safe, about 20 or 30 minutes afterwards rock fell from the roof, instantly killing Cunningham and his partner Hughes.

Mine inspectors, though usually conscientious, were underpaid at $1,000 per year; and even mine companies which followed the safety rules could not stop disasters such as the Scofield explosion of May 1, 1900, when 200 men were killed. Some mines were completely unsafe, with insufficient air supplies and safety precautions. Though many of the mine operators "held aloof from the use of mining machines," in 1913, 60 electric machines were introduced into the mines.[13]

With the low pay, unhealthy living conditions, unsafe mines, and large unassimilated immigrant population, it is surprising that violence did not occur more frequently. There were some strikes and grievances, but the only disturbance of major proportions took place in the winter of 1903–4 when the United Mine Workers tried to organize the miners. Among other things, the union demanded a raise in wages from $2.50 to $3.50 per day and abolition of the company script system. On November 23, 1903, Governor Heber M. Wells called out the National Guard, and the D&RGW furnished a "special car" for Brigadier General John Q. Cannon. In spite of the good offices of William H.

[11] State of Utah, Coal Mine Inspector, *Report of the Coal Mine Inspector for the State of Utah for the years 1901 and 1902* (Salt Lake City, 1903), 21.

[12] Helen Zeese Papanikolas, "The Greeks of Carbon County," *U.H.Q.*, XXII (April, 1954), 145–47.

[13] *Report of the Coal Mine Inspector, 1901 and 1902*, 60; Thomas to Griffiths, December 15, 1896, "Letter Book of State Coal Mine Inspector, – July 4, 1896 (?)" (Utah State Archives), 37–38; Robert Forrester, "Report of the Territorial Mining Inspector on the Condition of the Chalk Creek Coal Company's Mine," February 16, 1893 (Utah State Archives); State of Utah, Mine Inspector, *Tenth Biennial Report of the State Mine Inspector of the State of Utah, 1913–1914* (Salt Lake City, 1915), 7.

King, a group of young "Mormons" broke the strike, the striking miners lost their jobs, and those who owned homes on company land either sold within six months or lost them to the company.[14]

Years of Depression (1920–1941)

Shipments of coal to the West Coast for industrial and transportational use during World War I and its aftermath helped push production over 6 million tons in 1920.[15] Then, with the depression of 1921, the bottom began to fall out of the market. As late as 1940, coal production was only 3.6 million tons.[16]

The basis for the decline during the 1920's and 1930's lies in the condition of Utah's coal industry and the changing economy of the Western States, as well as the usually cited competition from petroleum fuels and natural gas. Natural gas was not introduced into Utah until 1929, but in the late twenties oil displaced over 110,000 tons of coal annually, principally in the railroad (75 per cent of non-oil company use) market. Major gas use by 1936 (84 per cent of the total) had come in industrial consumption. In 1934, coal heated 85 per cent of Salt Lake City's homes; and the number of stoker installations per year between 1930 and 1935 was greater than the number of gas installations and conversions combined. Between 1919 and 1934 the number of Salt Lake City homes cooking with coal actually increased from 18,120 to 23,078.

Part of the coal industry's problem stemmed from seasonal production, conservative fiscal policy, and high fixed costs which prohibited the support of research, development, and advertising. Though coal was slow firing and dirty, it was, in 1935, considerably cheaper per Btu. than either gas or oil. Nevertheless, coal most rapidly lost its industrial and transportation markets where lower costs should have been a major consideration. In addition, technological developments in coal's consumer industries saved on fuel and freight rates put Utah mines at a disadvantage in competing in Idaho and the Pacific Northwest.

Though Utah's mine safety regulations appear to have been as good as any in the United States during the 1920's, owing to laxity in enforcement from 1918 to 1929, Utah's accident rate annually "exceeded, to a considerable extent,

[14] Cannon to Burton, December 31, 1904, Industrial Commission, Coal Mine Inspector, folder entitled, "Report—Militia At Scofield During Miners Strike 1904" (Utah State Archives). It is not known whether the L.D.S. Church itself was responsible for sending the strikebreakers or whether this action was undertaken by a group of church members without the sanction of church authorities. Joseph R. Sharp, mine superintendent for Utah Fuel Company, said, "The Mormon Church took a hand in this trouble and these young fellows now in our mines are mostly Mormons," State of Utah, Coal Mine Inspector, *Report of the Coal Mine Inspector for the State of Utah, for the years 1903 and 1904* (Salt Lake City, 1905), 67.

[15] Unless otherwise noted, the sources used for this period are *Coal Study*, 1936; *Tribune*, October 25, 1936; Otto Herres, "Utah's Endless Asset," *Tribune, ca.* 1935 (clip file, Utah State Historical Society); Nelson, *Utah's Economic Patterns*, 132.

[16] Leonard J. Arrington and George Jensen, "The Economic Structure of Utah" (MS, Department of Economics, Utah State University, 1962), 96.

the average for the United States as a whole."[17] Utah's underground mines had adverse natural physical conditions such as steep inclines, fragile coal, and dry atmospheric conditions; but according to O. F. McShane of the Industrial Commission $3 million and countless lives could have been saved between 1918 and 1936 with proper enforcement of the safety regulations. Fortunately, after 1936 conditions were improved, and in 1938 Utah had only one fatal accident.[18]

In addition to the difficult working conditions, labor relations in Utah as elsewhere deteriorated during the 1920's. Following World War I, the Ku Klux Klan and various so-called patriotic groups persecuted the immigrant miners. Hatreds which smouldered under cover for some time burst to the surface in the spring of 1922 when the miners struck. John Tenas, a young Greek, was killed by a deputy sheriff in mid-May, and in June strikers were prohibited from carrying guns and stopping strikebreakers on the way to the mines. After Deputy Sheriff Arthur Webb was killed by strikers trying to stop a train on the way to Spring Canyon, Governor Charles R. Mabey sent troops to Carbon County on June 14. Though both the union and the operators cooperated with the Utah National Guard, the prosecuting attorney accused the strikers of being un-American and the newspapers wrote from an anti-union bias. After the court sentenced one striker to life imprisonment, the trials were transferred to Castle Dale and later to Salt Lake City in an attempt to secure a more objective environment.[19]

It was not until the coming of the New Deal and the NIRA in 1933 that the union achieved recognition. By 1936, 94 per cent of all workers were employed under union contracts, and in 1941 the wages paid by the Utah coal companies were higher (at an average of $6.44 per day) than those of any other area of the United States.[20] Unfortunately, owing to depressed conditions, both productivity and wages had dropped below their 1928 level.

Despite the depression and transportation disadvantages, Utah's coal industry was able to compete successfully with other western mines for the diminishing market. The opening of Columbia Steel's Ironton plant near Provo in 1924 meant that coke could be produced by the more efficient by-product method (97 per cent in 1936) rather than in beehive coke ovens. In addition, automation meant decreasing costs, and, to an increasing degree, coal was cut by machines, loaded by steel tipples, cleaned and screened automatically, and hauled by electric locomotives or hoists and surface tramways. By 1935, 88 per cent of all mining and 30 per cent of all loading were done by machine.

[17] *Coal Study*, 1936, 34.

[18] *Ibid.*, 41; *Tribune*, January 28, 1940.

[19] Papanikolas, "Greeks of Carbon County," *U.H.Q.*, XXII, 155–59; State of Utah, Adjutant General, *Biennial Report of the Adjutant General Utah National Guard, 1921–1922* (Salt Lake City, 1923), 17.

[20] *Deseret News* (Salt Lake City), April 18, 1941.

The Climb to New Heights (1942–1950)

The impact of World War II rocketed coal production to over 6 million tons in 1942, and immediate postwar expansion pushed it to 7.4 million tons in 1948.[21] Part of the stimulus for this growth came from the West's burgeoning steel industry. At Sunnyside and Columbia in Carbon County, Kaiser Steel Company of Fontana, California, and Geneva Steel Company of Orem found a satisfactory coking coal. Kaiser spent over $2 million in 1942 developing its recently acquired properties; Geneva Steel built 252 coke ovens with a capacity of 1.3 million tons per year; and by 1944, the old Ironton plant alone produced almost 1.4 million tons of coke per year.

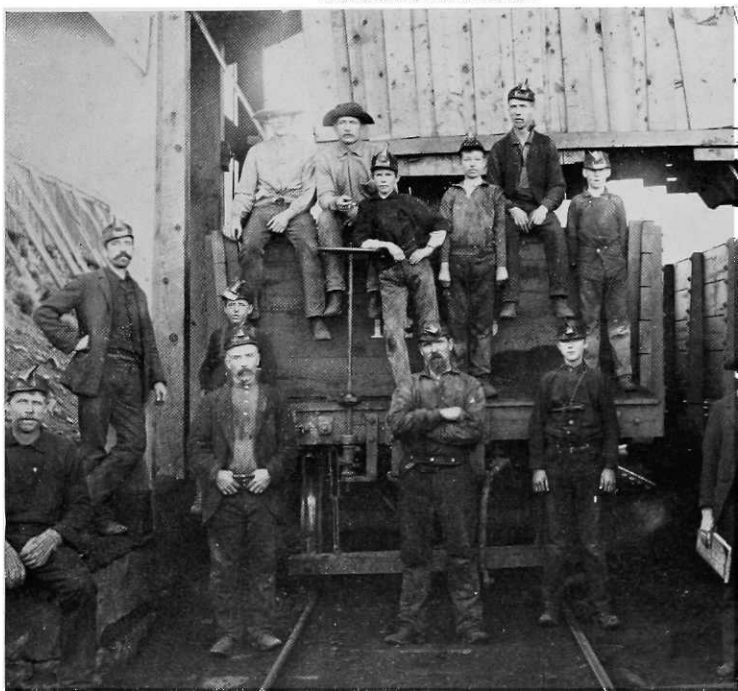
With the aid of state and federal governmental agencies, Utah's coal industry undertook the research and development which had been so desperately needed during the 1920's and 1930's.[22] As early as 1935, urban smog problems had suggested the need for a smokeless fuel; and just prior to the war, the state government and the Coal Logs Company of Salt Lake City undertook a jointly financed project to produce such a substance. Despite high expectations, by March of 1950, after the state had invested $57,000 and private capital invested $60,000, the company declared itself insolvent. Developments such as the production of ammonia for fertilizers and the increased generation of steam electric power produced more immediate results.

During the war, union members exercised restraint to prevent strikes, but beginning early in 1946, rapid inflation and inadequate health and welfare facilities cause a series of walkouts. Despite the contract which the miners and

[21] Unless otherwise noted, the sources used for this period are: Ora Bundy *et al.*, *After Victory: Plans for Utah and the Wasatch Front* (Salt Lake City, 1943); Nelson, *Utah's Economic Patterns*; and the *Tribune* and the *Deseret News* (clip files in the Utah State Historical Society and the Leonard J. Arrington collection at Utah State University); "Report of the Coal Logs Co., to Governor Herbert B. Maw," *ca.* 1942 (Governors' Papers, Utah State Archives); Hougaard to Board of Examiners, Salt Lake City, March 6, 1950 (Utah State Archives); L. Victor Riches, "Utah's Coal Industry," *Utah Economic and Business Review*, XII (August, 1952), 4-5; *Tribune*, February 20, 1948, and August 7, 1947; Osmond L. Harline, "Carbon-Emery Counties, A Critical Utah Unemployment Area with Long-Term Growth Prospects," *U.E.B.R.*, XXI (December, 1961), 2-5.

[22] *Tribune*, June 6, 1942.

UTAH STATE HISTORICAL SOCIETY



Utah coal miners. Notice the children whose employment in the mines was prohibited by the Utah State Legislature in 1896.

the federal government negotiated in July of 1946, which provided funds for health, welfare, housing, sanitation, and recreation, the mine workers struck in November and December. Exacerbated by a lack of railroad cars, the ensuing shortage of coal forced the reduction of heat in buildings in Salt Lake City, including the State Capitol. Because of its dependence upon manufactured gas from the by-product ovens at Ironton, Provo was hardest hit, and city officials began planning to convert to natural gas. Owing to the coal shortage, several buildings and schools in Salt Lake City converted their facilities to oil.[23]

Grievances, such as unsafe conditions in the mines, caused strikes as in April of 1947, when three of Utah's mines were temporarily closed by Secretary of the Interior Julius C. Krug. At the time of the strike during the winter of 1949–50, there was some pressure on Governor J. Bracken Lee to call out the troops. One of those protesting the strike found it difficult to understand why her husband, an independent coal miner, could not have "the right to work at any work he chooses so long as it is legal, . . . " Though there were some incidents of violence, Lee chose to leave the law enforcement to the local authorities. Newspaper reports of violence, which did not take place, caused some concern, but Lee was later able to report that although there were "several isolated incidents of violence, . . . for the most part, law and order prevailed."[24]

Despite the loss of markets and good will, the period between 1942 and 1950 was the best in Utah's coal-mining history. Productivity was 2.5 tons per man per day over the national average; the accident rate was .29 deaths below the national average per million tons mined; and machinery mined 98 per cent of Utah coal. Wages in 1950 reached an average of $352 per month; and workers received vacation pay, hospitalization, and other benefits.

An Age of Crisis (1951–1963)

From 1951 to 1957, Utah's coal industry continued production at above the 6-million-ton level.[25] Though production fluctuated somewhat during those years, it was not until 1958 that a sharp drop to 5.3 million tons revealed the industry's serious trouble. By 1963, the coal industry of Utah and other states had suffered a severe loss of markets for which no adequate substitutes are yet in view.

[23] *Deseret News*, April 30, 1943, July 3, 1946; *Tribune*, March 20, November 29, 30, December 9, 1946.

[24] *Tribune*, April 10, 1947. Pierson to Governor J. Bracken Lee, Wellington, February 28, 1950; Lee to Pierson, March 8, 1950; Lee to Andrus, March 8, 1950; clipping from the *Sun-Advocate* (Price) (Governors' Papers, Utah State Archives).

[25] In addition to the clip files; Nelson, *Utah's Economic Patterns*; Harline, "Carbon-Emery Counties," *U.E.B.R.*, XXI, 2–5; Utah Mining Association, *Utah Mining Industry*; Arrington and Jensen, "Economic Structure of Utah"; the U.S., Department of the Interior, Bureau of Mines, *Minerals Yearbooks* (Washington, D.C.) are the sources used for this period unless otherwise noted.

Both the radical change in markets and the wide divergence from national norms demonstrate some of the industry's problems. Australian mines captured many Asian markets upon which the industry depended; numerous domestic consumers and railroad companies converted to natural gas, fuel oil, and electricity; and only a small percentage of Utah's coal (10 per cent as compared with 42 per cent nationally) is used for the generation of electricity.[26]

One of the coal industry's main problems has been the absolute rise in both labor and fixed costs. Though W. J. O'Connor of Independent Coal and Coke Company reported that in 1958 labor costs averaged 69.3 per cent of total costs as compared with 75.5 per cent at the company's Kenilworth mine in 1934, other figures show that wages rose from about $6.60 per day in 1935 to about $25.00 per day in 1958. Despite the rise in the price of coal at the mine from $2.07 to $5.70 per ton and doubled productivity over the same period, the companies are now burdened with large fixed costs in the form of machinery during a time of slack production.[27]

Probably the most disastrous result of the recent decline in coal mining has been the recession in Carbon and Emery counties. The coal miners' loss of work has caused a deterioration in the economy of the two counties. Businesses have been forced to close, total unemployment reached 12 per cent of the labor force, and population in both counties dropped between 1950 and 1960. These counties were the first areas in Utah designated areas of "substantial persistent unemployment" by the federal government. The decline in coal mining has had serious repercussions on the economy of the state as a whole in lost jobs and diminishing tax revenues.

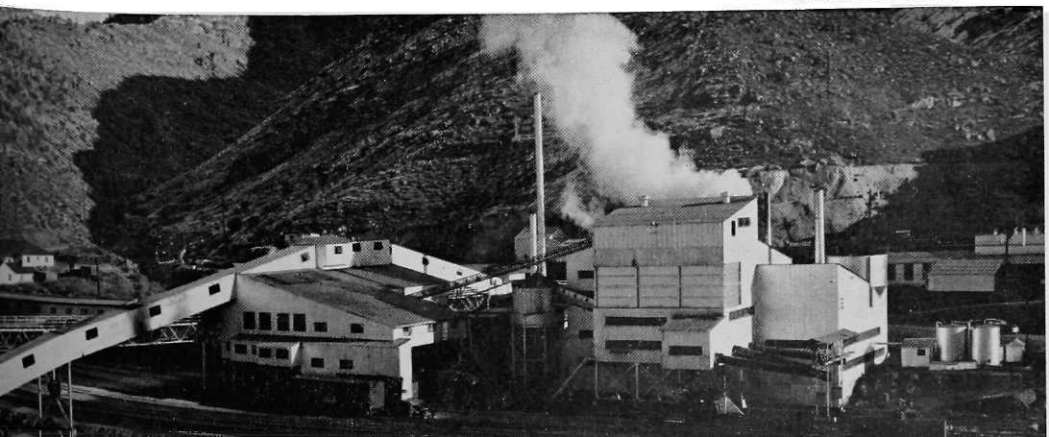
Despite these disheartening consequences, other developments in Utah's coal industry leave much room for hope. With increased productivity and less rapidly increasing costs, coal is expected by 1972 to become cheaper per Btu.

[26] *Deseret News*, January 26, 1959. For further statistics on Utah's coal problem see Harline, "Carbon-Emery Counties," *U.E.B.R.*, XXI, 4–5.

[27] *Tribune*, December 4, 1958; William O'Connor to the author, April 23, 1963; 1935 wage statistics are from Herres, "Utah's Endless Asset," *Tribune*.

Preparation and washing plant of the Independent Coal and Coke Company in Castlegate, Utah.

INDEPENDENT COAL AND COKE COMPANY



than natural gas. It is already cheaper than fuel oil, and residual fuel may not be available in the future in the increasing quantities needed by steam electric-generating plants. New industries have been built on coke by-products, such as oven gas. From the by-product process such diverse products as fertilizer, nylon, synthetic rubber, detergents, disinfectants, benzene, tolulene, dyes, solvents, perfumes, plastic, paints, and creosote are being made.

The coal industry of Utah has shown a viability unequalled by that of any other western state. Utah is the only state west of the Mississippi which is producing more coal today than it did in 1940, and it controls over one-half of the market in every state west of the Rockies. This resiliency is partly due to the fact that Utah's 45 mines produce twice as much per mine as the national average. Extensive advertising has resulted, and, despite the cutback in production, several companies have completed extensive renovations and introduced new techniques to help prevent costly accidents. Though there were complaints about some infractions of the rules, union officials reported in 1957 that enforcement of safety regulations was generally satisfactory.[28]

In 1960, estimates placed Utah's coal reserves at 27.8 billion tons, with about 13.9 billion recoverable. This is about 1.7 per cent of the total in the United States. If Utah could mine 6 million tons per year, its coal would last over 2,300 years.

Since 1950, new discoveries have been made which may help to save Utah's coal industry. Probably the most promising of these is the long-distance transmission of extra-high voltage electricity. Another possible innovation is a pipeline to carry a slurry of water and coal to the expanding California industries. At least one company has recently experimented with low temperature carbonization from which by-products might be used to produce synthetic materials. In 1954, a group of local capitalists bought large blocks of coal shares in the belief that the coal industry had a substantial future in the chemical industries. Other possible new markets include a coal-fueled gas turbine and co-operation between coal companies and mine unions to export coal for Japanese industry. Governmental units, such as the Western Governors Mining Advisory Council, have suggested such expedients as the fostering of research by state and federal governments, amendment of the coal lands leasing act to allow more land to be taken by each company, and review of limits on oil import quotas. George A. Lamb, director of the Office of Coal Research for the Department of the In-

[28] *Tribune*, October 14, 1951, January 15, 1958; *Deseret News*, January 26, 1959, September 22, October 13, 1960; Stevenson and Archibeque to Governor George D. Clyde, Sunnyside, June 13, 1957 (Governors' Papers, Utah State Archives). The two union leaders complained of a safety infraction by Kaiser Steel Company, but said that in general, safety orders had not been revised without consulting both labor and management.

terior, believes that by the early 1970's coal demand will be 75 per cent higher than it was in 1961.[29]

Thus, the coal industry, with a rich and diverse past and with substantial unemployment in the present, seems to have promise of a reasonably bright future. As with Prometheus of old, Utah's coal industry may find its Chiron and Hercules and be saved from the vulture of recession.

[29] *Herald-Journal* (Logan), May 11, 1961; *Tribune*, August 11, 1956, December 28, 1961, January 19, November 10, 1962; *Deseret News*, August 31, 1961; Robert W. Bernick, in *Tribune*, April 9, 1954, and January 31, 1962; see also report of the "Western Governors Mining Advisory Council" (Governors' Papers, Utah State Archives), 7.

BULWARK OF THE KINGDOM:

Utah's Iron and Steel Industry..

BY GUSTIVE O. LARSON

Scrap iron from abandoned equipment along the Oregon-California Trail, reworked in a simple forge, met emergency needs of the first Mormon colonists in Salt Lake Valley. But the meagerness of the supply mocked them as they dreamed of "The Kingdom" they were to build in their Great Basin retreat. As the mountains, canyons, and plains of their new environment suggested hidden resources, President Brigham Young announced "The Lord has done His share of the work. He has surrounded us with the elements . . . with which to build up, beautify and glorify the Zion of the last days and it is our business to mold these elements to our wants and necessities."[1] Among these elements were coal and iron ore in undisclosed abundance.

The Mormons knew that in the Great Basin, separated from civilization by a thousand miles, they must make their Kingdom self-supporting. Parley P. Pratt led a company of horsemen southward from Salt Lake Valley in the winter of 1849–50 to explore for colonizing sites and discover available resources. Beyond Little Salt Lake Valley in the region of the Little Muddy (later called Coal Creek) he discovered "thousands of acres of Cedar, constituting an almost inexhaustible supply of fuel which makes excellent charcoal. In the center of these forests rises a hill of richest iron ore."[2] Iron Mountain rose before them to challenge their ability to utilize its mineral stores.

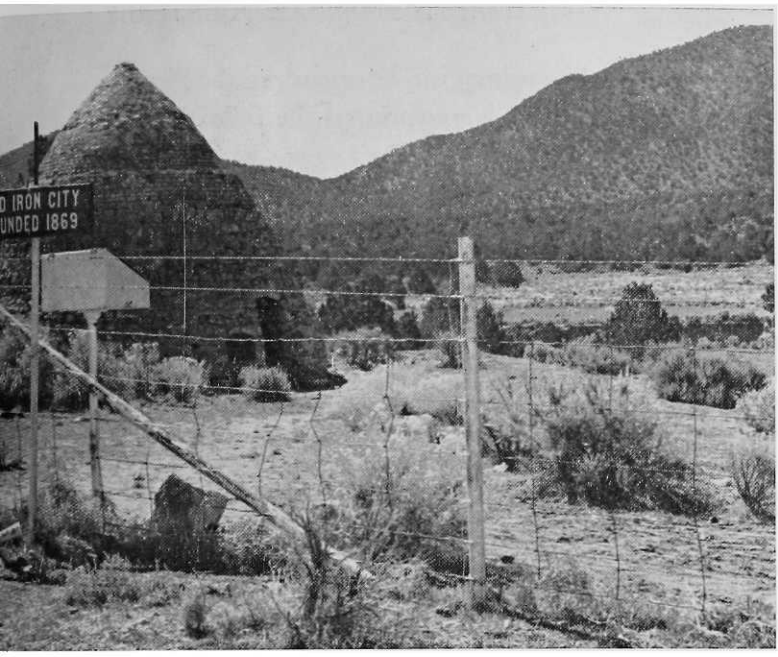
Back at Zion's capital reports of available iron ore set the leaders to planning for early development of iron manufacturing. While Pratt introduced a bill in the legislature for creation of Iron County, Brigham Young issued a call for volunteers for an "Iron Mission."

> Brethren of the Salt Lake City and vicinity who have faith and good works, who have been blessed with means, are informed by the Presidency of the Church that a colony is wanted at Little Salt Lake this fall; that fifty or more good effective men with teams and wagons, provisions and clothing are wanted for one year. Seed, grain, and abundance of tools in all their variety for a new colony are wanted to start from this place immediately after the fall conference to repair to the Valley of the Little Salt Lake without delay, there to sow, build, and fence, erect a saw

Mr. Larson is professor of church history at Brigham Young University, Provo.

[1] *Journal of Discourses* (26 vols., Liverpool, 1854–1886), IX, 283.

[2] "Journal History" (Church of Jesus Christ of Latter-day Saints Historian's Library, Salt Lake City), December 28–29, 1849.



Remnants of Iron City, on Pinto Creek, approximately 25 miles southwest of Cedar City.

UTAH STATE HISTORICAL SOCIETY

> and grist mill, establish an iron foundry as speedily as possible and do all other acts and things necessary for the preservation and safety of an infant settlement among the Indians . . . .[3]

A company consisting of 120 men, 30 women, and 18 children with 101 wagons was led southward by George A. Smith in December, 1850.[4] These "citizens of Iron County" were organized for military protection as they moved southward in midwinter. On January 13, 1851, they located on Center Creek to found Parowan as an agricultural base for the "Iron Mission." When the crops had been gathered in the fall, 35 men and 11 wagons with Henry Lunt in charge pushed on another 20 miles to locate Cedar City on Coal Creek not far from Iron Mountain. Its first citizens were Mormon converts from the iron-manufacturing centers of England, Scotland, and Wales.

This promising combination of iron ore, coal, and experienced labor sustained the men during the year ahead in which they built roads to the coal beds in the canyons, constructed a blast furnace on the banks of the creek, and assembled large quantities of fuel and iron ore. Lunt began his journal on January 1, 1852:

> The whole people were called together and in a mighty prayer we thanked the God of Israel for His past blessings upon our labors and presently called upon Him to bless us in the future to enable us to maintain ourselves in this desert land, to protect us from the Indians and to accomplish the mission we were sent to perform, namely to manufacture iron.

[3] *Deseret News* (Salt Lake City), July 27, 1850.

[4] Gustive O. Larson, ed., "Journal of the Iron County Mission, John D. Lee, Clerk," *Utah Historical Quarterly*, XX (April, July, October, 1952).

When President Young arrived on his spring visit, he organized the Pioneer Iron Company, and on July 24, the *Deseret News* printed the following enthusiastic report from the secretary written June 27, 1852.

> We have been busily engaged in preparing to make iron for the last month. Considerable work has been done. The fire bricks for the furnace are ready for laying up, and prove to be of the very best quality. The timber which we needed for the framing of the machinery we hauled from a canyon five miles south of Coal Creek where there is abundance of beautiful pine timber, and any quantity of poles for fencing. A few hands went with teams and worked the road one day, and hauled loads back to the iron works the following day. There is a good extensive blacksmith's shop erected, and the iron work for the machinery is progressing rapidly. It requires a deal of iron for the works, which we principally obtain off our wagons: take the tire off and lay the woodwork one side until we can replace the iron from the works. Our faith is, that in a very few weeks, we shall see iron of our own manufacture.

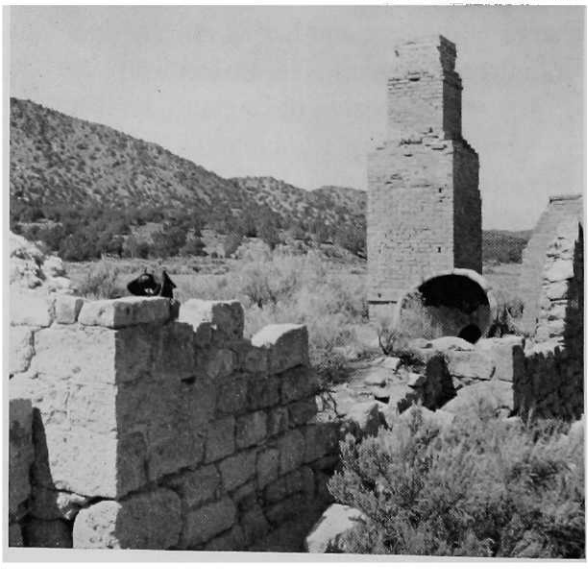
September found the colonists gathered around the blast furnace for the first trial run. And in the words of the company historian,

> On the 29th of September the blast was put on the furnace and charged with iron ore that had been calcined. The fuel used was stove coal coked, and dry pitch pine wood in the raw state. On the morning of the 30th the furnace was tapped and a small quantity of iron run out which caused the hearts of all to rejoice.[5]

It was a victory for the Kingdom which made the surrounding hills echo from shouts of "hosannah, hosannah, hosannah to God and the Lamb." A committee of five horsemen was dispatched at once with samples of the iron for exhibition in Salt Lake City.

Production of the first pig iron west of the Mississippi had been achieved, but the returns in iron were barely sufficient to keep hope alive for continued effort. Aside from valuable experience, the "nails enough to shoe a horse" and a pair of

UTAH STATE HISTORICAL SOCIETY



Ruins of Iron City, where the Union Iron Works built charcoal kilns and a furnace in 1869.

[5] William R. Palmer, "Graphic Story of Pioneer Iron Works," *Iron County Record* (Cedar City), September 7, 1933. An address by Palmer quoting from the Record Book of the Pioneer Iron Company. See also, Leonard J. Arrington, "Planning an Iron Industry for Utah, 1851–1858," *The Huntington Library Quarterly*, XXI (May, 1958), 237–60.

andirons were poor returns on a year's community effort. Primitive equipment and failure of the coal to coke satisfactorily made profitable production impossible. The isolated enterprise demanded capital and improved skills for survival.

In the meantime the church presidency in Great Salt Lake City sought support for the industry in iron-manufacturing centers of Europe.

> If a company of brethren could be formed in England, Wales, Sweden, or any other country to come and make iron from the ore . . . and machinery for rolling, slitting, and cutting nails, and drawing of wire, it would be one of the greatest auxiliaries for advancement in building up the valleys of the mountains; and the presiding elders in those countries are instructed to examine this subject and forward such a company with the least possible delay.[6]

Erastus Snow and Franklin D. Richards, who presided over the English Mission, introduced the subject to the British converts and found substantial investment support from several capitalists and iron workers. The Deseret Iron Company was organized to put British capital to work in western America.[7]

Snow and Richards arrived in Salt Lake City in time to witness the October, 1852, exhibition of the first iron products from the primitive Cedar City blast furnace. Following closely behind a company of iron workers from England, they hurried southward to effect a reorganization of the enterprise for improved operation. The Deseret Iron Company purchased the interests of the first settlers including a blast furnace and other equipment, extensive land claims, Coal Creek mining rights, and water power privileges for the sum of $2,865.64.[8] With $40,000 capital and improved organization, the company made surveys and platted locations for furnaces, foundries, iron-drawing works, and a nail factory. Some work progressed during the winter in spite of snow-filled canyons and water failure due to freezing.

The *Deseret News* informed its eager readers on February 26, 1853, that "an excellent air furnace was nearly finished built of adobes with a tunnel 300 feet long to convey the smoke to a chimney stack 40 feet high. And extensive frame building has been erected for a casting house." Failure of the coal to coke satisfactorily necessitated the gathering of large quantities of pine wood for charcoal, and on April 2, the *News* reported, "In the beginning of March, 1853 the blast furnace was run once a week during which 2500 pounds of clear good iron were made and 600 bushels of charcoal consumed." The heavy expense of

[6] Sixth General Epistle issued by First Presidency September 22, 1851, appearing in *Millennial Star* (Liverpool), XIV (1852), 20.

[7] *Ibid.*, XVII (1855), 1–7, gives a brief history of the Deseret Iron Company from its organization in London, April 28, 1852, to the close of 1854. Minutes of the meeting held in London in which the company was organized and a constitution adopted are quoted by John G. Crook, "The Development of Early Industry and Trade in Utah" (Master's thesis, University of Utah, 1926), 39–48.

[8] Palmer, "Iron Works," *Iron County Record*, September 7, 1933.

production in these early efforts emphasized that successful iron manufacturing in Utah would depend on solving the coking problem.

Behind these heroic efforts in Iron County, stood Brigham Young as champion of home industry. The iron pioneers must be encouraged and supported until their investments became profitable, for upon the success of the iron industry rested the welfare and progress of the Kingdom. The territorial legislature responded to his urging on January 5, 1853, by appropriating $5,000 "to finance the iron interests in Iron County." On the 17th the Deseret Iron Company was incorporated by legislative enactment.[9]

Success in iron manufacturing seemed assured during the summer of 1853, when suddenly news arrived of a general Indian uprising. The iron workers were forced to turn their efforts to conservation of food and strengthening of their fortifications. While engaged in this important task of self-preservation, a destructive flood tore away their canyon road to the coal beds and swept away bridges, dams, and stacks of fuel leaving in their stead a three-foot layer of debris and huge boulders around the iron works.[10]

The pioneers had suffered a crushing blow; but with experience as their teacher and under leadership of Isaac C. Haight, who was sent to take charge, the intrepid colonists redoubled their efforts. The damaged furnace was replaced with one built during the summer of 1854 at a cost of $3,782.45. Again, both church and territory came to their support with contributions of $4,840 each. With high hopes an appeal was made through the *Deseret News* for additional skilled manpower. Also extensive coal surveys were being made with most promising discoveries in San Pete Valley where, later President Young confessed, he had once considered locating the iron industry.[11]

In 1855, the colony came nearest to achieving the iron dream, when the enlarged furnace produced up to 1,000 pounds of pig iron in the first 24 hours. Ten tons of pig iron were produced in April; and as production continued intermittently through the summer and fall, there appeared a supply of household wares, agricultural implements, machinery parts, nails, and the only currently surviving article — a church bell.[12] But winter snows closed the canyons and shut off the coal supply, and the water failed with freezing weather. The latter was compensated for by introduction of two, 30-horsepower steam engines, but coking coal, such as it was, remained inaccessible through the winter.

[9] *Deseret News*, January 22, 1853.

[10] *Ibid.*, October 15, 1853.

[11] Hubert H. Bancroft, *History of Utah, 1540–1886* (San Francisco, 1889), 736–37.

[12] This bell was brought from Cedar City to announce the official dedication of the Columbia Steel Corporation plant at Ironton in July, 1924. The bell is now in custody of the Cedar City Daughters of Utah Pioneers.

Following the limited success of 1855, iron production at Cedar City became a losing battle of dedicated men against hostile nature. The year 1856 brought costly blowouts requiring time-consuming repairs. Before operations could resume a severe drought robbed the enterprise of water power; and to complete the shutdown, a grasshopper plague destroyed the colonists' crops to a point that it required their entire attention in securing food for survival.

Destructive floods again menaced the industry in the spring of 1857, requiring removal of the iron works to higher ground. Here, still optimistic, the colonists platted a townsite for industry and residence. This diversionary effort was hardly completed when a dispatch from Brigham Young informed them of impending military invasion by United States forces to install new territorial officials. The iron pioneers joined the rest of Mormondom which, having twice before suffered expulsion by military force, made preparations for resistance or evacuation as circumstances might require.

Economically this "ill wind" blew good as the army not only provided a market for Mormon products but made available sorely needed items including some iron. With the passing of the crisis a year later, the Cedar City colonists turned again to their project. A new furnace was built, but again fuel problems resulted in blowouts. After repeated failures operations ceased. One of the last runs converted seven wagon loads of U.S. Army cannon balls into molasses rollers and other castings.[13]

An estimated $150,000 had been spent in the over-all venture with returns of only about 25 tons of pig iron.[14] The problems involved in iron manufacturing were too big for the isolated, under-financed organization of the 1850's. Discouraged, many of the workers removed to more promising valleys. Cedar City's population, which was reduced by one-half, turned to agricultural pursuits for survival.

A further effort to manufacture iron in southern Utah came simultaneously with completion of the trancontinental railroad in 1869. This enterprise was succeeded by others in the eighties and nineties. They were co-operative ventures on the part of enterprising men ably supported by the Mormon Church. The Union Iron Works, organized in 1869, built charcoal kilns and a small furnace on Pinto Creek where "Iron City" developed about 25 miles southwest of Cedar City. Here up to two tons of grey cast iron per day were produced, which found a ready market in the stamp mills of Bullion, Nevada. The company was reorganized in 1873 as the Great Western Iron Mining and Manufacturing Company. Considerable equipment was imported, including engines and ma-

[13] Palmer, "Iron Works," *Iron County Record*, September 7, 1933.

[14] Leonard J. Arrington, *Great Basin Kingdom: An Economic History of the Latter-day Saints, 1830–1900* (Cambridge, 1958), 259. Also, ElRoy Nelson, *Utah's Economic Patterns* (Salt Lake City, 1956), 102.

chinery for molding and casting iron. New construction included an engine house, a foundry, two furnaces, a pattern shop, and a business office. Production increased to five tons of pig iron per day, which were manufactured into mining machinery, stoves, flat irons, and other items in demand in Nevada mining camps. Some products were shipped to Salt Lake City. Approximately $200,000 had been spent to produce 400 tons of pig iron when the property was sold in 1874.[15]

The iron ore resources were not overlooked in a program of Zion's Central Board of Trade in the early 1880's.[16] This organization with branches throughout the territory was instituted under President John Taylor's direction to give new co-operative life to all phases of industrial and commercial activities. Among the committees formed to promote industrial development was one which organized the Utah Iron Manufacturing Company in August, 1881, with a paid-up capital of $50,000. With liberal church backing the company acquired extensive coal and iron lands formerly worked by its several predecessors. Litigation of conflicting land claims delayed operations until 1884, when a new company was formed known as The Iron Manufacturing Company of Utah. The church underwrote one-fourth of the $250,000 capital stock, including considerable tithing credit for labor and patenting coal and iron land claims. Optimistically, the company not only constructed a furnace, factory, and storehouse, but also purchased the 20-mile Pioche-Bullionville Railroad together with rolling stock. The railroad was moved to Iron County to be used for transporting coal to the iron works. Plans also included rail connections between Iron City and the Southern Utah Railroad at Milford. But again the projects for manufacturing iron were doomed to failure. In view of previous experience, the plans to expend a half million dollars in iron manufacturing was seriously questioned by some church leaders; and while the proposed enterprise was being re-examined, the "polygamy crusade" drove the church leaders underground. The project was abandoned.

Once more during the depression of the 1890's, iron manufacturing was included in an extensive church-sponsored economic development plan which did not materialize. Heavy indebtedness precluded church financial support, and eastern capital was not available. However, outside capital would not long resist the challenge of Utah's iron and coal resources. Extensive surveys were now pointing to the major coal deposits in Emery and Carbon counties. Approximately 1,600 exploratory pits[17] in southern Utah at the turn of the century

[15] *Ibid.*

[16] Leonard J. Arrington, "Iron Manufacturing in Southern Utah in the early 1880's: The Iron Manufacturing Company of Utah," *Bulletin of the Business Historical Society*, XXV (September, 1951), 149–68.

[17] Nelson, *Utah's Economic Patterns*, 102.

told their own story of iron ore deposits. The Mormon Church sold its interest in coal and iron mines in Coalville and Iron County to Salt Lake City and eastern capitalists, the latter being largely associated with Colorado Fuel and Iron Company[18] of Pueblo, Colorado.

In the meantime manufacturing of iron products had been in progress by such pioneer foundries as Silver Brothers, in Salt Lake City, and the later Provo Foundry and Machine Company. In 1883, the product of such foundries and machine shops was estimated at $360,000.[19] Scrap iron was the chief source of metal, but most of the fuel was imported. Bancroft stated that between 1872 and 1882, 70,000 tons of coke were brought into Utah at the cost of $1.8 million. And during that same period 500,000 tons of coal were brought from Wyoming at a cost of nearly $4 million. He then added prophetically:

> The future of the iron interests of Utah appears to depend mainly on the question whether coking coal can be produced of sufficient consistency for smelting of pig iron. . . . It would seem almost a certainty that deposits will somewhere be found to answer the purpose. . . . It will be observed that there are large coal beds in close proximity to the principal iron deposits and with a ready market, cheap and reliable labor and supplies, access by railroad and other advantages it is probable that the coal and iron industries of the territory, far removed as it is from the manufacturing centers of Europe and America, will rank among the foremost.[20]

As a forerunner to larger fulfillment of the historian's prediction, the Utah Iron and Steel Company, in response to World War I demands for steel, constructed a plant in Midvale in 1915. Its first open-hearth furnace had a 150-ton capacity. Scrap was the principal source of metal, and fuel was supplied from gas made from Sunnyside, Carbon County, coal. However, as a war industry, dependent upon government contracts, the company closed its doors in Midvale with the end of hostilities.[21]

Capital, which had been lacking in Utah's pioneering ventures of the nineteenth century came to the support of her iron industry in the twentieth. The first financially successful production of pig iron came in 1924, when Columbia Steel Corporation erected modern iron works at Ironton, Utah County.[22]

Groundwork for this important development was laid by L. F. Rains and others who marshalled sufficient coal and iron resources to interest outside capi-

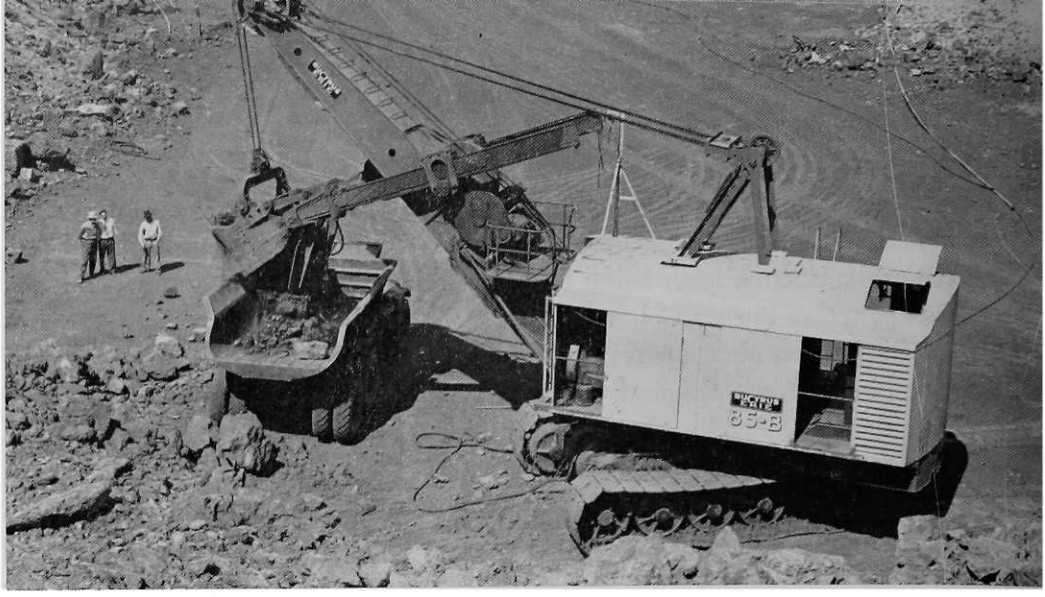
[18] Arrington, *Great Basin Kingdom*, 409. Robert F. Loer, "Iron Ore Mining in Southwestern Utah" (mimeograph copy, U.S. Steel Corporation, Salt Lake City), a paper presented at the American Institute of Mining, Metallurgical, and Petroleum Engineers Rocky Mountain Minerals Conference held in Salt Lake City, September 26, 1956.

[19] Bancroft, *History of Utah*, 735.

[20] *Ibid.*, 736–38.

[21] Nelson, *Utah's Economic Patterns*, 108.

[22] Leonard J. Arrington, "Economic History of a Mormon Valley," *Pacific Northwest Quarterly*, XLVI (October, 1955), 104–7.



UTAH STATE HISTORICAL SOCIETY

A huge electric shovel scoops up two and one-half cubic yards of ore in the open pit mine of Columbia Steel Company, Iron Mountain, Utah.

tal.[23] Thomas F. Pierpont, president of the Provo Foundry, also played a significant role as head of the Provo-Springville Holding Company organized in 1922 to secure land for the prospective enterprise. Two hundred and fifty acres of land were transferred initially by this organization to Columbia Steel Corporation when Ironton was selected as the site of operations. Here on the shores of Utah Lake was the rail intersection of the Denver & Rio Grande Western Railroad bringing coal from Carbon County, and the Union Pacific Railroad bringing iron ore from southern Utah.

Actual construction followed a year of investigation not only of quantity and quality of the basic resources, iron ore and coal, but of available water supply and fluxing materials. The coking qualities of Carbon County coal, the iron content of southern Utah ores, and the availability of limestone and dolemite, together with favorable rail connections to raw materials and markets justified the expenditure of $4.5 million in plant construction. Soon a blast furnace, power plant, coke ovens, and other facilities rose to announce that America's iron and steel industry had pushed west of the Rockies.

The challenge of Iron Mountain and nearby Iron Springs and Desert Mound was now met with modern equipment and electric power of Columbia Iron Mining Company, Colorado Fuel and Iron, and Utah Construction Company.[24] Geologists with magnatometers and geophysical instruments located ore bodies; exploratory drilling determined positions of attack; and giant shovels

[23] L. F. Rains was attracted to Utah by her coal resources, and by 1918 he had acquired a number of coal properties. The story of the untiring labors of Rains, Thomas F. Pierpont, and their associates in bringing the iron industry to Utah remains to be written. An unpublished brief, including Rains's activities, is to be found in the U.S. Steel Corporation offices in Salt Lake City and is referred to through the courtesy of the public relations officials.

[24] Loer, "Iron Ore Mining in Southwestern Utah," 5, 9–12.

UNITED STATES STEEL CORPORATION

Iron ore is loaded into cars at Columbia Steel Company's mines in southern Utah for shipment to steel mills in Utah, Colorado, California, and Japan.

removed the over-burden. Soon ever-widening open pits yielded their ores into 40-ton trucks to be delivered into jaw and gyratory crushers before being loaded into long lines of waiting railroad cars. In 1932, 136,000 gross tons of mixed, 52 per cent iron ore moved 250 miles over Union Pacific rails to Ironton. This gross tonnage had increased to 4 million in 1951.[25]

Meanwhile from 1903 to 1924, coal from Sunnyside and Castlegate had proved its coking qualities, and Kaiser Steel Company beehive coke ovens in Carbon County were serving the needs of Utah's nonferrous industries.[26] While producing only 60 per cent coke as compared to 74 per cent in the East, Utah coal was higher in volatile matter, which provided more chemical by-products. The new by-product coke ovens, built by Columbia Steel in 1924, produced about 600 tons of coke per day from 1,000 tons of coal. In addition they produced 13,000 gallons of tar, 13 million cubic feet of gas for Provo and Springville consumption (until replaced by natural gas), plus ammonium sulphate and other chemical products. Since World War II about one-half of Utah's 6-million-ton annual coal production is coked in the beehive ovens at Sunnyside (9 per cent) and in the 308 by-product ovens at Ironton and Geneva (91 per cent). Utah, which is the largest coking coal producer in the West, accounts for about 2.5 per cent of the nation's total coke.[27]

Supplied with iron ore from southern Utah and coking coal from Emery and Carbon counties, the Columbia Steel Company blast furnace had a capacity

[25] Nelson, *Utah's Economic Patterns*, 104.
[26] *Ibid.*, 106–7.
[27] *Ibid.*

of 500 tons of pig iron daily or 200,000 tons annually. About 350 men were employed at Ironton, with the number increasing to over 500 by 1941. Additional employment was provided by associated subsidiary units including a creosote plant with 30 employees and the Pacific States Cast Iron Plant with 480. These employment figures increased with the outbreak of World War II when an additional furnace at Ironton boosted pig iron production from 200,000 to 500,000 tons annually.[28]

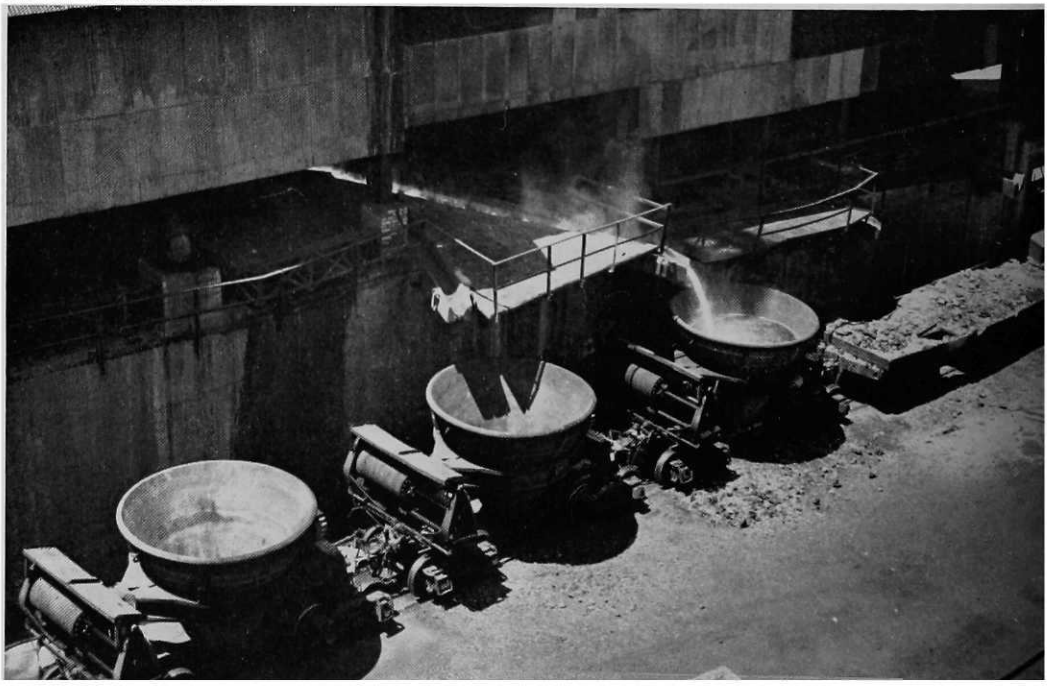
World War II found the United States steel industry concentrated in the East with large demands for its products in the West. To meet increased war demands for steel and to insure its continued availability to the vital shipbuilding operations on the Pacific Coast, the U.S. Defense Plant Corporation determined to establish a completely integrated steel plant in the West.[29] Its location would depend upon readily available raw materials and a suitable plant site with an ample water supply and access to markets. Columbia Steel Company had already found these available in Utah, one of the three states in the Union with rich deposits of iron ore and coking coal as well as most of the required minerals. Underground water was available with Deer Creek Reservoir as a reserve source. Not only was Utah Valley favored as the junction of railroads bringing iron ore from southern Utah and coking coal from Carbon and

[28] Arrington, "Mormon Valley," *P.N.Q.*, XLVI, 104–7.

[29] The significance of this action is reflected in nearly 300 magazine articles in the United States dealing with the subject between 1942 and 1953. This compilation is in an unpublished manuscript in the U.S. Steel Corporation offices in Salt Lake City.

After tapping the base of the blast furnace, molten iron streams through runners across the cast house floor to a machine which casts it into pigs, a crude casting in size and shape which is convenient for transporting or storage.

UTAH STATE HISTORICAL SOCIETY



Emery counties, but it was almost equidistant from three major western markets — Los Angeles, San Francisco, and Portland. Thus Columbia Steel Company, now a subsidiary of United States Steel Corporation, was given the wartime assignment to build the steel plant with required facilities at Geneva. E. M. Barber, vice-president and general manager of a U.S. Steel subsidiary, was appointed vice-president of Columbia Steel Company and executive officer of the company's defense plant division to supervise the construction.

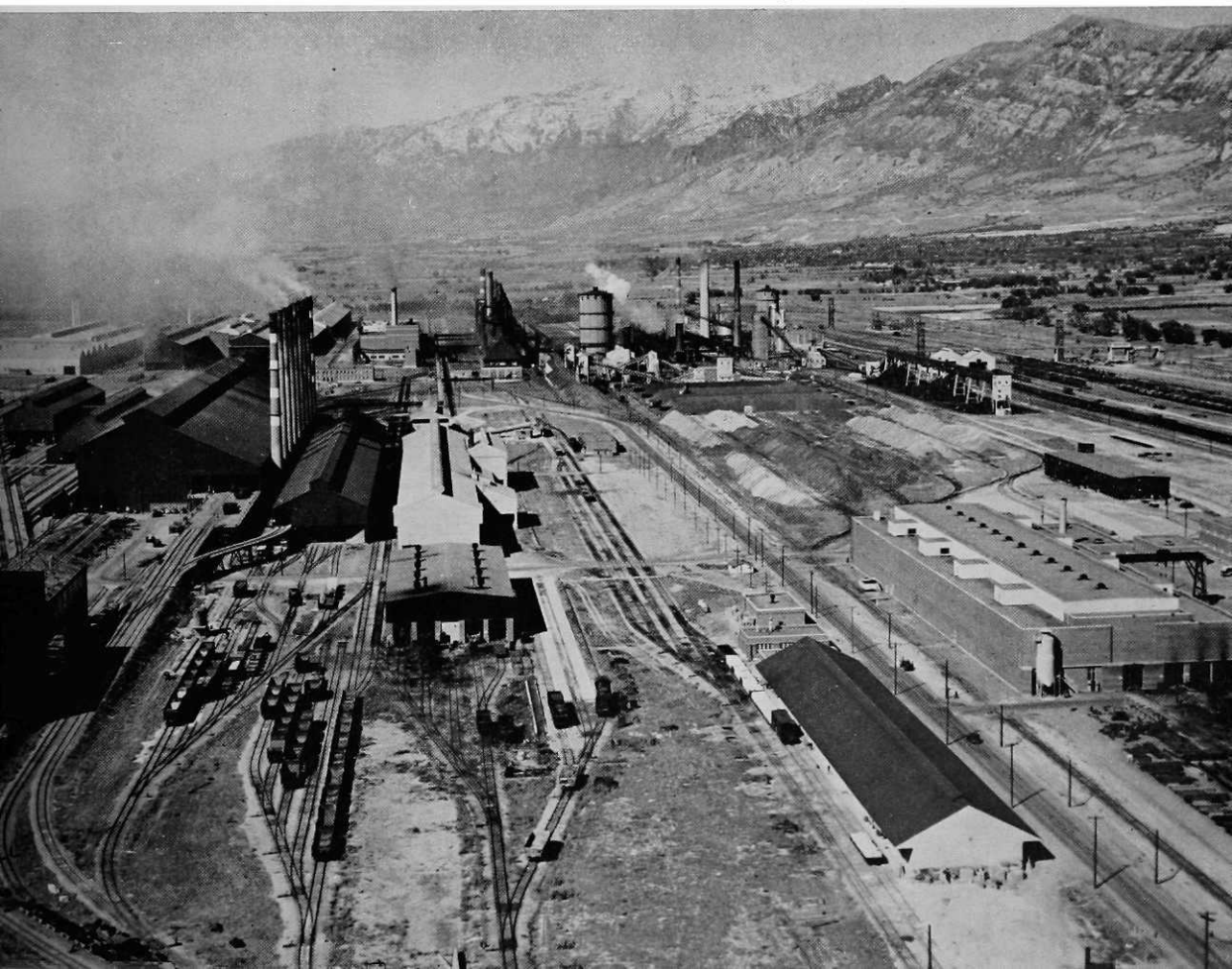
The Geneva steel plant, one of the largest producers of steel in the West, was built on a 1,600-acre tract in 1942–44 at a cost of $200 million. It was a forced wartime achievement which only decades could have brought to the state under normal conditions. Originally, the plant had a rated capacity of 1.15 million net tons of pig iron, 1,283,400 tons of steel ingots, 700,000 tons of plates, and 250,000 tons of structural shapes per year.[30] In addition to three blast furnaces,[31]

[30] United States Steel Corporation, *Report* (June 30, 1962), 3.

[31] A blast furnace known as "Old Joliet" was brought from Illinois to increase the output at Geneva. Having a rated capacity of 283,000 tons per year it operated until sold to Kaiser-Frazer Parts Corporation in 1947. It was later acquired by Columbia-Geneva Division of United States Steel Corporation.

Geneva steel plant near Provo, Utah, was built by the federal government in 1942–44, at a cost of $200 million. The plant was bought by United States Steel Corporation in 1946.

UNITED STATES STEEL CORPORATION



each with 1,120 tons daily capacity, there were 252 by-product coke ovens consisting of four batteries of 63 ovens each. Conveniently arranged, the plant also boasted a rolling mill of most modern design, a power house and maintenance shop, a 312-acre water reservoir supplied by deep wells, and 76 miles of railroad. In addition to the plant at Geneva, the over-all project included the expanded facilities of Columbia Iron Mining Company in Iron County, coal-mining facilities in Carbon and Emery counties (one major mine in Horse Canyon producing 5,600 tons daily), limestone and dolomite quarrying operations near Payson, and other mining activities elsewhere.

In the summer of 1943, a new subsidiary of U.S. Steel Corporation, known as Geneva Steel Company, was organized to operate the facilities now nearing completion. Walter Mathesius, vice-president in charge of the corporation's operations in Delaware, was elected president and director of the new company. Mathesius ranked high among U.S. Steel's operations men and was considered one of the world's foremost authorities on blast furnace practice. Others high in U.S. Steel officialdom were appointed as follows: J. R. Gregory, vice-president of sales; J. E. Butler, comptroller; J. Wohlwend, treasurer; and Merrill Russell, secretary and general attorney.

During the war the Geneva plant produced 634,000 tons of steel plate and 144,280 tons of structured shapes plus a considerable quantity of steel shell billets.[32] Having served its wartime purpose, the company slowed operations after Germany's defeat in May, 1945, and practically closed down upon Japan's surrender a few months later. The government offered the Geneva plant and subsidiaries for sale in 1946. U.S. Steel Corporation successfully bid against six major competitors and bought the properties for $47.5 million. This was less than one-fourth the construction cost, but the sale contract included a stipulation that the company would expend over $18 million for conversion of the plant to peacetime purposes. Geneva Steel Company was soon merged with the U.S. Steel Corporation and today operates as a unit of Columbia-Geneva Steel Division of the U.S. Steel Corporation.

Since 1947, over $75 million have been invested by U.S. Steel Corporation in new capital equipment at Geneva for conversion and development of new and larger processing facilities.[33] Rated annual steel-making capacity has increased to more than 2 million ingot tons by Geneva's 10 open-hearth furnaces. Two of the blast furnaces at the plant have been enlarged in recent years to increase Geneva's rated annual pig iron capacity to approximately 1.5 million tons, and the coke oven batteries are capable of producing more than 1 million tons of coke annually.

[32] Nelson, *Utah's Economic Patterns*, 109.
[33] *Ibid.*

Among major additions to Utah steel industry facilities in recent years is the Utah pipemill of Consolidated Western Steel Division, completed in 1955, adjacent to Geneva works; the American steel industry's first nitrogen plant, added in 1957 to existing coal chemicals processing operations; and a new Raw Materials Research Laboratory officially opened in 1961. Columbia-Geneva Steel's new research center was an appropriate addition in view of the rapid development of Utah's iron and steel industry which now accounts for about two per cent of the nation's total production.

Iron ore production in Utah amounted to 3,533,000 gross tons in 1961 valued at $25,493,000. Coal production for the same year, of which iron and steel production uses 50 per cent, was 5,159,000 tons valued at $31,126,000. In 1961, the steel plants employed 5,007 persons with a payroll of $42,661,041. Iron ore mining employed 494 persons that year with a payroll of $3,620,591. The joint operations employed 5,501 persons, which was 2.92 per cent of the total employment in the state.[34]

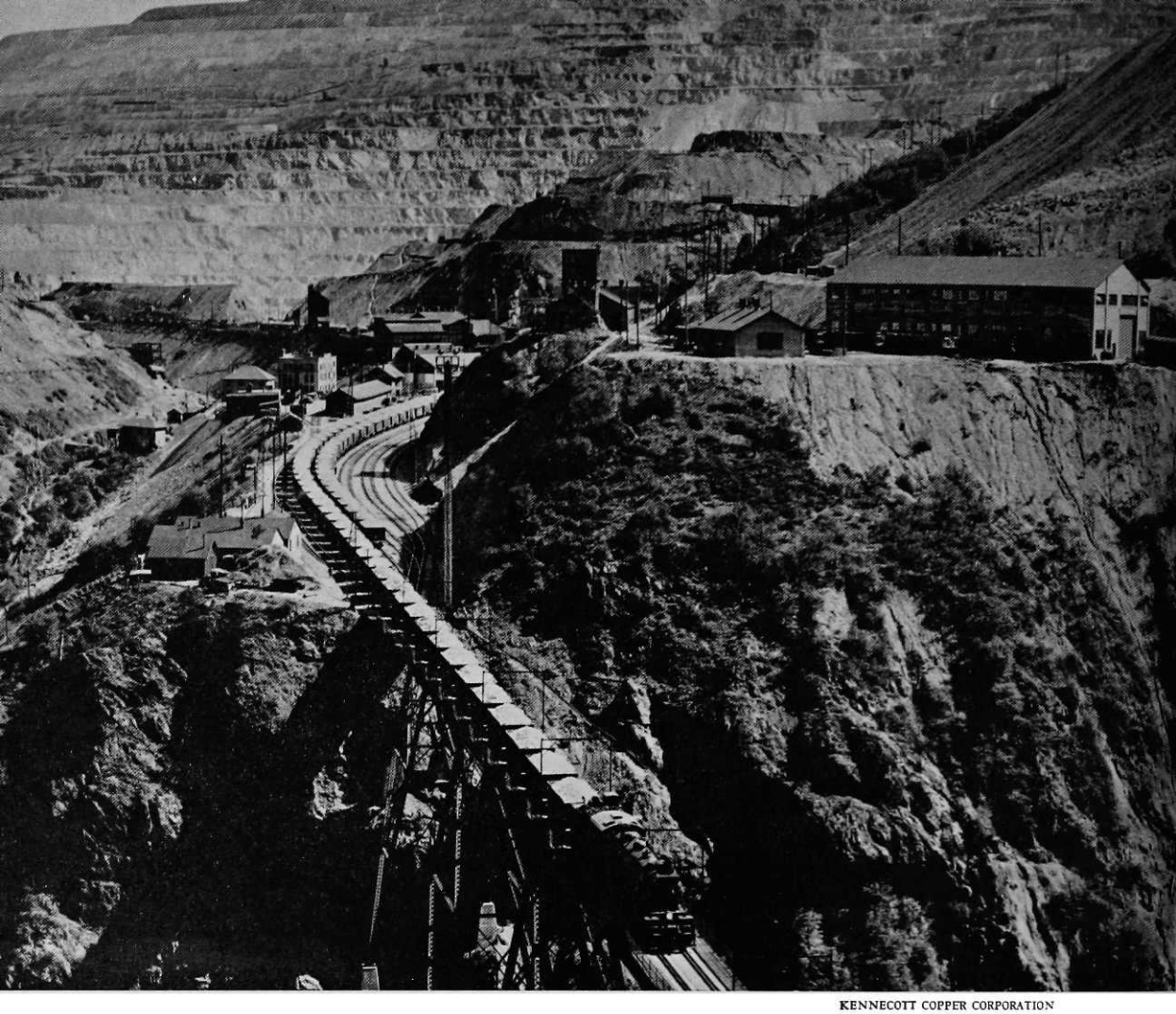
Columbia-Geneva Steel has become an important hub in the wheel of western industrial development. It is a major factor behind nearly 150 steel-fabricating firms in Utah, two-thirds of which have blossomed since 1940.[35] It is closely linked with other western steel plants, especially in California where much of Utah's steel output undergoes further processing. Also, Columbia-Geneva produces most of Utah's coking coal and iron ore for consumption in neighboring states. About one-half of Utah's iron ore is processed in the state, one-fifth is shipped to Colorado, large amounts go to the Pacific Coast, and some is transported by water to the Eastern States and to Japan.

The importance of iron and steel production in Utah's economy is edging upward in comparison with that of nonferrous metals and threatens to surpass it in the years ahead. With proven reserves of 100 million gross tons of around 45 per cent iron ore plus another 250 million gross tons[36] inferred, matched by similarly vast stores of coking coal, Utah's iron and steel industry seems solidly established in view of the rapidly increasing population shift to the West.

[34] The figures are from reports on Utah mineral production, employment, and payroll statistics compiled in Daybook, and were supplied to the author through the courtesy of the Utah Mining Association.

[35] Nelson, *Utah's Economic Patterns*, 127.

[36] From United States Bureau of Mines as quoted by Loer, "Iron Ore Mining in Southwestern Utah."



KENNECOTT COPPER CORPORATION

Transporting ore from the Utah Copper Mine in Bingham Canyon.

INDUSTRY OF DESTINY: Copper in Utah

BY GARY B. HANSEN

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

Mr. Hansen received the M.S. degree in economics from Utah State University in June, 1963. This article was prepared under a grant from the Utah State University Research Council and under the direction of Dr. Leonard J. Arrington, professor of economics, Utah State University. Complete documentation and a more detailed presentation of the facts and interpretations in this article are in Gary B. Hansen, "A Business History of the Copper Industry of Utah, 1860–1910" (Master's thesis, Utah State University, 1963).

> We have recently been presented with a specimen of virgin copper found in Cedar County, some ten or twelve miles from Camp Floyd, which those well versed in mineralogy, to whom it has been exhibited, pronounce equal to the best they have ever seen.
>
> If it exists in that vicinity, as alleged, in any considerable quantities, it would probably pay well for working, if any felt disposed to engage in such an enterprise, but in these days gold is the principal thing sought after, and a man who would engage in copper mining in an inland country like this, might, by some, be considered in a state of insanity.

Nearly 40 years passed before these prophetic words were invalidated completely.

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

> One day while he and his companions were returning to their camp, they saw what looked to them like copper in a creek bed. They got some out and the next morning decided to look for signs of copper ore which they found on the side of the mountain. When their job was finished they returned to Salt Lake City and turned the samples over to an assayer who was supposed to test it.

Unfortunately, Lowder was never able to capitalize on his discovery. A short time later, he was called by Brigham Young to be a Pony Express rider between Salt Lake City and San Bernardino, California. By the time he returned the ground had already been filed upon.[1]

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

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

Nevertheless, the departure of the Volunteers at the close of the Civil War left the Utah mineral prospects relatively untouched. It was in 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 and shipped to Baltimore.[3] A second shipment containing

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

[2] *The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies* (Washington, D.C., 1897), Series I, Vol. L, Part II, p. 657.

[3] Hubert Howe Bancroft, *History of Utah, 1540–1886* (San Francisco, 1889), 741.

10 tons of copper ore mined from the Kingston Mine at Bingham Canyon was shipped out of the territory on July 31, 1869, by the Woodhull Brothers.

In 1870, copper was discovered in the Lucin District, in western Box Elder County on the Utah-Nevada border. At Copper Hill native copper, in large lumps, was found on the surface of the ground.[4] When galena was found in considerable quantities a short time later, copper mining was neglected until 1886. The copper properties — the most important being the Copper Mountain Mine — were worked from 1886 to 1893, at which time they were sold to the Salt Lake Copper Company. This company built a copper smelter north of Salt Lake City in 1893 at a cost of $600,000. The smelter operated for a short time but was not profitable. The mining properties were later purchased by the Lewisohn Brothers of New York City (organizers of the United Metals Selling Company), and were operated by them for a number of years. It is estimated that 1,675,200 pounds of copper were produced in the Lucin District from 1870 to 1905, with a total value of $237,835. Peak production was reached between 1906–13 with output of 12,027,418 pounds of copper valued at $1,767,346.[5]

Contemporary with the discovery of ore at Lucin, copper was discovered in the Tintic District in Juab County. In 1870, the Mammoth and Crismon-Mammoth mines were discovered and worked intermittently for a number of years. They were both important early copper producers, with considerable quantities of ore being mined and shipped to smelters as far away as England.[6]

In the northwest corner of Beaver County, the Beaver Lake District was organized in August, 1871, after the discovery of a belt of copper veins said to have been from an inch to two feet in width. According to a government investigator, "some work was done in 1872 and 1873, and a few tons of ore were shipped assaying 30 percent copper, 17 ounces silver, and $12 gold."[7] In 1873, the Riverside Smelter was built seven miles north of Milford to work the copper ores from the district. After producing a few tons of copper matte and some lead bullion, it was shut down and abandoned.[8] In the nearby Rocky District, organized in 1872, some copper ore was mined and shipped prior to 1880. Taken together, the Beaver Lake and Rocky districts produced 931,000 pounds of copper between 1870 and 1902.[9]

[4] Edward L. Sloan, ed., *Gazeteer of Utah and Salt Lake City Directory* (Salt Lake City, 1874), 135.

[5] B. S. Butler, G. F. Loughlin, V. C. Heikes, and Others, *The Ore Deposits of Utah* (Washington, D.C., 1920), 489; *Deseret News* (Salt Lake City), December 17, 1904.

[6] 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., 1885), 456–57.

[7] *Ibid.*, 474.

[8] Copper matte is a crude mixture of sulphides formed in smelting sulphide copper ores that contain about 40 per cent copper.

[9] Huntley, "Mining Industries," *Precious Metals*, 474; Butler *et al.*, *Ore Deposits of Utah*, 505.

Copper was also discovered in the San Francisco and Pruiss districts of Beaver County during the 1870's. Several claims were worked during the decade, primarily those located in Copper Gulch, although their output was insignificant prior to 1880. The most important claims of the group were the Comet, Cactus, and Copper Chief. It was not until 1896 that serious and productive copper-mining activity commenced in these districts.[10]

Several early copper deposits were located in Washington County and northern Arizona in the 1870's.[11] As early as 1874, prospectors had known that the West Mountain Range, about 10 miles west of St. George, was rich in copper. No serious attempt was made until the mid-1880's, however, to develop the prospect. Several St. George residents worked the mine (known as the Apex or Dixie) between 1884 and 1888. During that time they were reported to have shipped 300 tons of copper ore out of the district.[12]

Between 1889 and 1891, the owners of the Dixie Mine are said to have received $300,000 for ore and bullion shipped to Swansea in Wales, and Denver, Colorado. In 1891, they erected a small smelter at St. George and produced bar copper. For over three years, considerable numbers of wagon teams with bullion from their smelter were consigned to the railroad at Milford, 154 miles distant. From 1894 to 1899, the smelter remained inactive, whereupon it was reactivated and produced 8 to 20 tons of blister copper per month. Copper production for the district prior to 1887 amounted to 300,000 pounds with a value of $41,400. From 1890 to 1894, production amounted to 1, 784,065 pounds, valued at $209,606.[13]

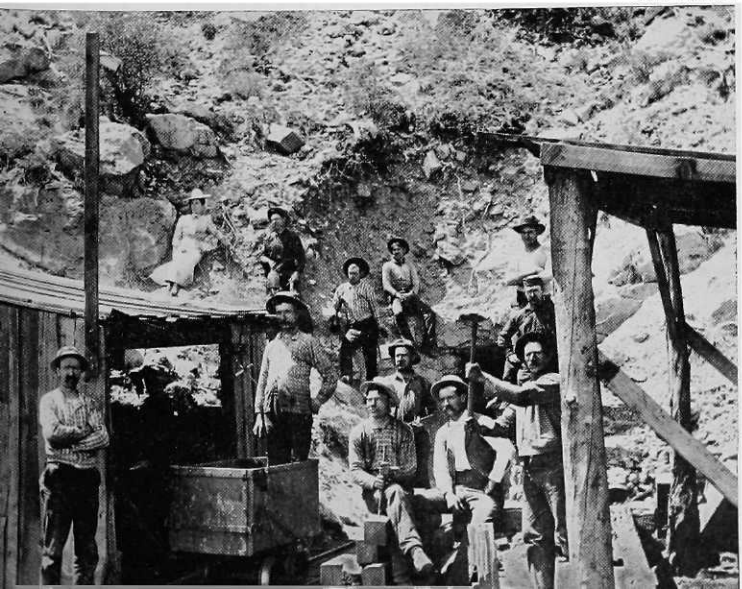
[10] Huntley, "Mining Industries," *Precious Metals*, 471.

[11] R. W. Raymond reported that in 1875 a mine known as the Grand Gulch copper mine, located 40 miles south of St. George and 15 miles north of the Colorado River in Arizona, was being worked by St. George residents. In 1875, they erected a copper furnace near St. George on the Virgin River for the treatment of copper ore from the mines. However, it was abandoned shortly after completion. The mine was later reported as having been leased to men from Salt Lake City in 1877. These individuals produced 10 tons of copper bullion in a shaft furnace. R. W. Raymond, *Statistics of Mines and Mining in the States and Territories West of the Rocky Mountains for 1875* (Washington, D.C., 1887), 281; Huntley, "Mining Industries," *Precious Metals*, 483.

[12] The original owners include John Pymm, James Andrus, Thomas Judd, William Lund, S. L. Adams, and other residents of St. George. *Engineering and Mining Journal*, LI (1891), 361 (hereafter referred to as *E.M.J.*); Butler *et al.*, *Ore Deposits of Utah*, 596.

[13] *Ibid.*

ORPHA MORRIS



The Apex or Dixie Mine, near St. George, Utah.

In Millard County the Drum Mining District was organized in the fall of 1872. It was abandoned shortly thereafter and was later reorganized as the Detroit District in 1879. Some copper was mined during the 1880's, and a small smelter constructed at Abraham in 1888 produced 130,000 pounds of copper bullion which was said to have been the largest quantity of copper bars produced in Utah up to that time. Subsequently, the smelter was destroyed by fire.[14]

In Bingham Canyon several copper mines were in operation prior to 1880; chief among the claims were the What Cheer, Hickman, Murphy, Kingston, and Washington. (One of the first shipments of copper ore, mentioned earlier, came from the Kingston.) According to Huntley, who visited the district in 1880, all of these mines were "small veins in quartzite, from 3 inches to 4 feet wide containing azurite and malachite at the surface, and sulphides of copper and iron at the water line. Traces of silver and gold are also found."[15]

Aside from the several mines previously noted, and perhaps a few others, most of the copper produced during the decades of the seventies and eighties came as a by-product of the lead-silver ores then being mined. From 1870 to 1880, production of copper never exceeded a million pounds annually.

After remaining low for several years, the price of copper advanced slightly in 1887 and enabled many of the producers to resume activity at their mines. At the Mammoth Mine in the Tintic District the output increased to about 300 tons of copper ore per month, valued at $60 per ton. This ore, as it had in the past, was shipped to the Argo Smelting Works in Denver, where it was used as a medium for the recovery of gold and silver. Other Utah producers resumed shipments to the Salt Lake smelters.[16]

The market for copper remained high until 1889, when the collapse of the French copper syndicate caused a decline in the price of copper from 16⅝ cents to 10½ cents per pound.[17] The industry struggled along until 1893, when the national financial crisis led to a reduction in the price of silver and lead as well. As a result, all of the nonferrous mines in the West were hard hit, including the Utah copper producers. From 1893 to 1896, there was only minimum activity in the Utah copper mines — an interlude before the beginning of a new era.

The Beginning of Sulphide Copper Production

In addition to the rising demand for copper due to its use in the burgeoning electrical industry, the abrupt rise in the production of copper in the late 1890's

[14] *Ibid.*, 463–64.

[15] Huntley, "Mineral Industries," *Precious Metals*, 419.

[16] U.S., Department of the Interior, Geological Survey, *Mineral Resources of the United States* (Washington, D.C., 1883–1934), 68–69. This publication is hereafter referred to as *Mineral Resources*, with the year.

[17] F. E. Richter, "The Copper Mining Industry in the United States, 1845–1925," *Quarterly Journal of Economics*, XLI (1926), 257–58.

was directly related to the decline in the production of lead and silver. Production of lead and silver in Utah in 1894 was only half what it had been in 1890. In the West Mountain District, the total value of minerals produced fell from $2,097,005 in 1890 to $1,133,242 in 1894.[18]

It was evident to mineowners that alternative methods for obtaining profits from the mines would have to be developed if the industry were to survive. One such alternative was gold. In the late 1870's and again in the 1880's, following the temporary exhaustion of known lead-carbonate bodies of ore, special attention had been directed periodically toward the recovery of gold from ores in the West Mountain District. By the close of 1882, four stamp mills had been erected for operation on ores from the Stewart and Old Jordan mines. Although a little gold was recovered, most of these efforts ended in failure.[19]

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

In January, 1896, Thomas Weir, a highly respected mine operator in Leadville, Colorado, and Butte, Montana, went to Salt Lake City to investigate the prospects of the gold-mining activity then under way at Bingham Canyon. Joining Samuel Newhouse (son of European Jewish immigrants) who had gone to Colorado and later to Utah to seek his fortune, Weir set about gathering mining properties. By October, 1896, he had secured bonds from the owners of a group of 10 claims in Bingham Canyon, embracing 75 acres of patented ground in Carr Fork, for the sum of $200,000. The most important claims in the group

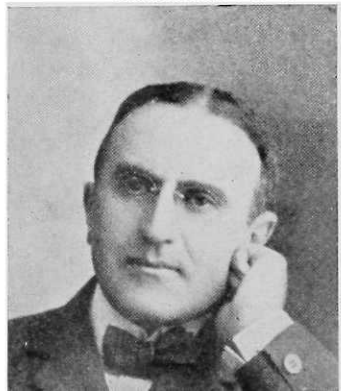
[18] Butler *et al.*, *Ore Deposits of Utah*, 345.

[19] John M. Boutwell, *Economic Geology of the Bingham Mining District, Utah* (Washington, D.C., 1905), 84.

UTAH STATE HISTORICAL SOCIETY

Thomas Weir
(1855-?)

UTAH STATE HISTORICAL SOCIETY



Samuel Newhouse
(1853-1930)

were the Highland Boy, Henry M., and Omaha.[20] These properties were held in the name of the Highland Boy Gold Mining Company. A subsequent promotional trip to London by Newhouse was successful in enlisting English capital in the venture. Thus, in October, 1896, the Utah Consolidated Gold Mines, Limited, a British company, was organized in London with a nominal capital stock of 300,000 pounds sterling. Samuel Newhouse was elected president and Thomas Weir general manager of the new company.[21]

The initial object of the company was to apply the newly developed methods to extract gold from the siliceous ores at the Highland Boy Mine, which was originally said to contain about 50,000 tons of "low-grade rock," with an average value of $10 in gold and $1.50 in silver. Development work on the property got under way in November, 1896, under the direction of Thomas Weir. In order to process the ore, a contract was signed in May, 1897, for the construction of a cyanide mill, of 100-tons per day capacity.[22]

Three days after letting the contract for the mill, an event occurred which eventually revolutionized the entire Bingham mining camp. Working in Highland Boy Tunnel No. 4, the miners discovered an ore channel carrying $3.00 in gold (per ton), 2.5 ounces in silver, and 6 per cent copper. As the work of exploration continued, on May 26, the face of No. 5 tunnel broke into an ore zone which showed 25 per cent copper, and $2.40 in gold per ton. This was said to be "over threefold higher in copper than anticipated."[23] Thus, three months before the cyanide mill to treat gold ores was completed, it became apparent that the "profit paying" copper ore in the sulphide zone below the zone of oxidation would be far more important than the gold ore above.[24] Shipments of copper ore were commenced in mid-1897, and during the remainder of the year the company shipped 2,100 tons of copper ore to the Salt Lake market.

The most important question confronting Newhouse and Weir after the discovery of the copper sulphide ore deposits was whether the costs of mining and smelting these low-grade ores could be lowered to such a point that they could be worked at a profit. After investigation of smelters in Montana, the partners placed in operation on May 23, 1899, the first smelter erected in Utah primarily for the reduction of copper ores.[25] The site selected for the new smelter consisted of 56 acres of land at Murray, eight miles south of Salt Lake City. It

[20] *Salt Lake Tribune*, October 6, 1896, May 7, 1899; *E.M.J.*, LXII (1896), 374.

[21] *Tribune*, August 6, 1908; Horace J. Stevens, ed., *The Copper Handbook*, 1910–1911 (Houghton, Michigan, 1912–1931), X, 1746–47.

[22] *Tribune*, January 1, 1898; *E.M.J.*, LXI (1896), 538; LXII (1896), 374, 665.

[23] *Ibid.*, LXI (1896), 582; LXIII (1897), 522.

[24] *Tribune*, January 1, 1898; *E.M.J.*, LXIV (1897), 258, 588, 665.

[25] *Ibid.*, LXVI (1898), 48, 439, 528; *The Mineral Industry, Its Statistics, Technology and Trade: Calendar Year 1900* (New York, 1901), 165. This publication is hereafter referred to as *Mineral Industry*, with the year.

was located a short distance from the Jordan River, about a mile southwest of the Germania Smelter.

Shortly after construction on the smelter commenced, the partners decided to build a lead-smelting addition of 300-tons per day capacity, which would also be completed at the same time the copper furnaces were ready. In order to save the oxide ores from the upper portion of the mine for later use by the new copper smelter, the cyanide mill at Bingham was closed down, after having crushed and treated 20,000 tons of ore.[26] In the meantime, the company continued to make shipments of ore from its mines to the Germania custom smelter. The ore averaged 12.09 per cent copper, 2.78 ounces silver, and $4.22 in gold values per ton. By the end of 1898, five tunnels were being worked on the Highland Boy property. Continuing its policy of acquisition, the company also purchased additional claims, giving it a total of 235 acres of mineral land located in Bingham Canyon.[27]

In the spring of 1899, about the time final preparations were getting underway to begin smelter operations, the enterprise came under the covetous eye of the Standard Oil Company syndicate, headed by William Rockefeller and Henry H. Rogers. Wanting to expand their empire into mining, Standard Oil investors began buying Utah Consolidated stock. They first obtained 100,000 shares in late February, 1899, for a total cost of $3.25 million, but continued buying on the open market, seeking to gain control. At first Samuel Newhouse remained silent over the attempted takeover, but he soon sweetened to the overtures. On May 7, 1899, just two weeks before the company's Highland Boy Smelter was completed, the control of the company passed into the hands of the Rockefeller syndicate, in a $12-million transaction. The largest block of stock was purchased by Rogers. Samuel Newhouse was said to have made $3 million on the sale. The new owners replaced Weir with R. H. Canning as general manager. Urban H. Broughton, a son-in-law of Rogers who had been acting as consulting engineer

JOSEPH C. CAHOON

Switching trains with two yoke of oxen about 1890, at Germania Smelter, built in 1872 in Murray.

[26] *E.M.J.*, LXVI (1898), 648.

[27] *Tribune*, January 1, March 5, 1899.

for the syndicate during the negotiations, was added to the board of directors and later elected president.[28]

The new smelter was an immediate success. The pig copper (a crude casting of copper run directly from the smelting furnace convenient for storage and transport) produced in the initial runs was claimed to contain $60 in gold and 40 ounces of silver per ton. A little later all three reverberatory furnaces and two copper converters, with a capacity of 250 tons per day, were operating at maximum output, producing close to 1 million pounds of copper a month. Operations were considered so successful that plans were immediately drawn up to enlarge the plant and double its volume. This was accomplished in the ensuing months at a cost of $178,000. The smelter capacity was boosted to 500 tons per day.[29]

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

During ensuing years the production of ores from the Highland Boy Mine continued to increase, giving Utah Consolidated Gold Mines, Limited, the distinction of being the only major copper producer in Utah (there were, of course, larger companies operating in Montana and Michigan). Its engineering and monetary success gave the company a national and international reputation and made its stock a much sought-after investment. Ore reserves were continually being increased by exploration and development work at the Highland Boy Mine, and plans were drawn up in 1903 to increase the capacity of the company's smelter by 40 per cent. At the same time, the board of directors authorized the transfer of the company headquarters from London to New York. (By moving company headquarters to the United States, the company could avoid the English tax of five per cent on corporation dividends, amounting to about $35,000 a year.) This action resulted in the disorganization of the British corporation and the formation of the Utah Consolidated Mining Company, a New Jersey corporation, with a nominal capitalization of $1.5 million. Utah Consolidated Mining Company was a holding company — a corporation organized to hold shares of stock in one or more other corporations — owning 2,490 shares of the Highland Boy Gold Mining Company of New Jersey, which in turn held direct title to the Utah properties.[31]

[28] *Ibid.*, March 4, May 7, 1899.

[29] *Mineral Industry, 1900*, p. 165; *Mineral Resources*, 1898–99, pp. 159–220; 1899–1900, pp. 163–223.

[30] *Ibid.*

[31] Stevens, *Copper Handbook*, 1910–11, pp. 1746–47. While the Newhouse-Weir concern was the most significant of the copper innovators in Utah in the 1890's, there were others. The Bingham Copper Mining Company, incorporated in 1895 with a nominal capitalization of $200,000, developed copper claims

The American Smelting and Refining Company

On April 4, 1899, a month before the transfer of ownership of the Utah Consolidated to "the Standard Oil crowd," the latter had formed a "mammoth smelter trust" under the name of the American Smelting and Refining Company, often referred to as ASARCO. Under the leadership of Henry H. Rogers and Leonard Lewisohn, the trust's purpose was to own and manage the properties of "all principal [lead] smelting works in the United States with the exception of the Guggenheims." The trust was seeking to restore order, stability, and profitability to an industry that had been plagued during the 1890's by an overcapacity resulting from numerous smelters throughout the country competing with each other for a limited supply of ores. It may also have been seeking profits from the promotion of the gigantic enterprise.

The combine had commenced the acquisition of various nonferrous smelters throughout the nation in 1897, and at the time of Rogers' purchase of a controlling interest in the Utah Consolidated properties in the spring of 1899, ASARCO had achieved its basic objective. Included among the "seventeen corporations and one partnership" were the Germania, Mingo, and Hanauer smelters in the Salt Lake Valley, and the Ibex Smelter located at Leamington, Utah. The three Salt Lake smelters had been the most important in the state, accounting for 60 per cent of the state's production of copper bullion and matte in 1898.[32]

Once ASARCO was organized its promoters and managers began a systematic program of shutting down plants to eliminate the "topheavy" condition of the company. By consolidating production in fewer plants, the company hoped to reduce smelter charges and cut costs. And while its officials did not say so, it was clear that consolidation would improve profitability by diminishing competition and strengthening monopolistic powers. In Utah the combine closed down the Hanauer and Mingo smelters in April, 1899, shortly after acquisition. The Ibex Smelter was idle at the time of purchase and was never reopened. Of the many lead smelters which had been built in Utah, only the Germania remained in operation at the beginning of 1900.[33] In 1902, even the Germania was closed when ASARCO completed a new $1 million lead-silver smelter at Murray.[34]

in the main Bingham gulch, just east of the town. The two claims owned by the company, the Starlus and Alameda, exposed copper veins averaging from 8.5 to 10.5 per cent copper, with some gold and silver. The property was worked modestly until 1897 when operations were suspended for lack of money. In 1898, with Chicago capital backing the enterprise, operations were resumed, and some 15 men were employed to tap some of the springs carrying copper in solution. (The experiment of precipitating copper had been tried for several years, by running water containing copper over scrap iron.) For a period of time the company used as much as 50 tons of iron per week and a carload of salt daily. Operations were continued for some time on a reduced scale, but eventually ended in failure.

[32] Isaac F. Marcosson, *Metal Magic: The Story of the American Smelting and Refining Company* (New York, 1949), 57–69; *Tribune*, January 1, 1899.

[33] *Ibid.*, April 16, 20, 1899.

[34] Boutwell, *Bingham District*, 383–84; Marcosson, *Metal Magic*, 74.

By constructing the new plant, ASARCO was now in a position to become the dominant, if not the only, custom smelter in the state. The stage was set for a merciless struggle which eventually led to the weeding out and consolidation of the entire nonferrous mining and smelting industry in Salt Lake and Tooele counties into three gigantic combines: American Smelting and Refining Company; United States Smelting, Refining and Mining Company; and International Smelting and Refining Company.

Although he was no longer attached to the Utah Consolidated Mining Company after its sale to Standard Oil interests in 1899, Samuel Newhouse had by then earned the title of "Father of Copper Mining in Utah."[35] He was responsible, more than anyone else, for the events which had occurred at the beginning of the copper era in Bingham. He had "set the pace" in demonstrating that the coppers of Bingham could be mined on an extensive scale and made to pay dividends. For once the extent of the Highland Boy discoveries became known, the search for copper at Bingham proceeded apace. Not all of these efforts, of course, met with success — at least immediately.[36]

The first of the related attempts to duplicate the success of Samuel Newhouse, Thomas Weir, and the Highland Boy resulted in the creation of the Bingham Copper and Gold Mining Company. In 1895, the Commercial Mine, which had previously been worked for its carbonate and oxidized ores, came under the ownership of the Bingham Gold Mining Company. This company sought to extract and treat the oxidized gold ore by a cyanide process, much as had been done by Utah Consolidated; but these efforts were unsuccessful, and the property remained idle for several years.

When a discovery of high-grade copper-silver-gold ore was made in one of the tunnels in November, 1898, the property took on a new look. To finance the extensive exploration and development of the mine, the principal owner of the company, William Bailey (sometimes Bayly), of Los Angeles, sold the property to an eastern group, which reorganized the company as the Bingham Copper and Gold Mining Company. Incorporated in New Jersey, with a nominal capital of $2 million in 200,000 shares of $10 par, the new company included the Commercial, Commercial No. 2, Venard Tunnel, and the Old Hickory mines. The principal new owners were Joseph A. Coram, Orington E. Weller, and Henry H. Boyce, all from Massachusetts and New York.[37]

During 1899, the company made extensive developments on its property. Discoveries gave encouragement to the company and in October they decided to construct a three-stack semipyritic smelter of 250-tons capacity to treat

[35] *Deseret News*, December 19, 1903.
[36] *Tribune*, January 1, 1897.
[37] *Ibid.*, November 18, 1898, January 11, 1899; Boutwell, *Bingham District*, 254.

UNITED STATES SMELTING, REFINING AND MINING COMPANY

Bingham Copper and Gold Mining Company in the early 1900's in Midvale, Utah.

the ore. This smelter, located at Midvale and completed in January, 1901, was essentially a duplication of the Utah Consolidated plant.[38] The ore was transmitted from mine to smelter by way of a steep, narrow-gauge railway called the Copper Belt Railroad, organized in 1900.[39]

With bright prospects for the future, Bingham Copper began to look about for likely properties which could be purchased to provide additional copper and siliceous fluxing ores for the smelter. In April, 1901, the company purchased the Dalton and Lark property at Bingham from Philo T. Farnsworth and Willard Snyder for the sum of $1.25 million.

To finance the purchase the Bingham Copper and Gold Mining Company was reorganized as the Bingham Consolidated Mining & Smelting Company. Incorporated under the laws of Maine on April 24, 1901, the new company had a nominal capitalization of $10 million, with shares at $50 par. Edward L. White was elected president, W. S. McCornick was elected vice-president, and Duncan McVichie was appointed managing director.[40]

The job of dewatering the Dalton and Lark properties got underway immediately. (By the late 1890's the mine was relatively inactive because of the presence of water in the lower levels.) Both the Brooklyn and Dalton and Lark shafts were deepened, and work commenced on an 8,000-foot drainage and ore-haulage tunnel (with a portal at Lark), called the Mascotte Tunnel. By the spring of 1902, the Dalton and Lark Railroad was completed to connect the tunnel outlet and the mines with the Rio Grande Western, over whose rails the ore could be hauled to the smelter at Midvale. With the completion of the convertor installation in May, 1902, the company was able to produce copper at the rate of 700,000 pounds per month, making it the third largest copper producer in the state (after the Utah Consolidated and United States Mining companies). The operations of Bingham Consolidated were further expanded in

[38] *E.M.J.*, LXVIII (1899), 79, 499, 529; *Tribune*, January 30, 1901.

[39] L. H. Beeson, "The Copper Belt Railroad of Bingham," *The Mining Review* (February 15, 1905), 17–18.

[40] Stevens, *Copper Handbook*, 1909, p. 370; *Tribune*, January 1, 1898, April 24, 1901; *Deseret News*, December 23, 1899, December 15, 1900.

1904 when a fifth blast furnace was added to the smelter, and a controlling interest purchased in the Eagle and Bluebell Mining Company, Tintic District.[41]

Early in 1899, while Henry H. Rogers and associates were putting together their "gigantic" smelter trust (ASARCO), another group, consisting of Albert E. Holden of Salt Lake City and a group of Boston bankers and businessmen appropriately called the "United States Oil crowd," were organizing the United States Mining Company. Holden and his father, Liberty E. Holden, had been prominent Utah mining men, with interests in the Bingham and Tintic districts dating back to the 1880's. By the late 1890's they had an extensive and profitable group of mining properties including the Old Jordan and Galena claims at Bingham, and the Centennial-Eureka Mine in the Tintic District.[42] The new company, with a capitalization of $10 million in 400,000 shares at $25 par, constituted the largest mining "deal" ever to be undertaken in Utah. Edward A. Clark, president of the United States Oil Company, was elected president of the new company and A. E. Holden appointed managing director. J. W. Neill, who had been manager of the Taylor & Brunton Sampling Works in Salt Lake City, was placed in charge of the company properties in Utah.[43]

The company immediately began a full program of exploration and development, as the result of which considerable quantities of copper-bearing ores were revealed in both the Bingham and Tintic properties. The company, therefore, selected a site for the new smelter on the Jordan River at Bingham Junction (Midvale) south of Salt Lake City. The $750,000 smelter was completed in November, 1902, and had a capacity of 1,000 tons of copper ore per day.[44]

As the company's development work at the mines continued deeper into the earth, it found that, as with the neighboring Bingham Consolidated, the characteristics of the ores changed sufficiently to warrant the addition of a lead section to its smelter. Construction of the new addition was completed in January, 1905, enabling the Midvale Smelter to handle all of the ores from the company's mines, plus some desired custom ore.[45]

There were a number of smaller mining companies (which recognized the potential afforded by the Bingham sulphide discoveries) organized between 1899 and 1905. These included the Tintic Mining & Development Company, which purchased the Yampa claims at the West Mountain District in April, 1901, and constructed the important Yampa Smelter that operated at Bingham

[41] *Mineral Resources*, 1901, pp. 161–73; *Deseret News*, December 19, 1903; Stevens, *Copper Handbook*, 1909, p. 370.

[42] J. Fewson Smith, "Early History of the Bingham Mines," *Ax-I-Dent-Ax*, XIV (August, 1929), 5.

[43] "Clarence Emir Allen: Father of the Public School System in Utah," *ibid.*, XVII (August, 1932), 4; *Tribune*, March 11, 25, April 22, 1899.

[44] *Ibid.*, March 12, 1899, February 6, 1901; *Deseret News*, December 20, 1902.

[45] *Ibid.*, November 12, 1902, January 24, 1905.

KENNECOTT COPPER CORPORATION

Utah Copper Mine, Bingham Canyon, 1904, before the present day levels were cut.

from 1903 to 1909; and the Utah-Apex Mining Company. Several smaller Bingham companies — the Bingham Central Mining Company, Bingham Standard Copper Company, and Bingham Metals Company — formed the Utah Metal Mining Company in 1909, with important properties in the Carr Fork area of Bingham. In 1914, this company acquired control of the Bingham-New Haven Copper & Gold Mining Company, a small but prosperous copper producer.

In addition to the Bingham area, considerable copper was mined in the Tintic District, Juab County; the San Francisco, Beaver Lake, and Star districts of Beaver County; the Tutsagubet District of Washington County; and the Little Cottonwood, Camp Floyd, and Park City districts of northern Utah. In most of these the copper output was an adjunct to lead-silver operations. The majority of the small campanies lacked the capital to develop economically their claims, owned relatively unimportant ore deposits, or suffered from excessive and capri-

Ore from the open pit mine in Bingham being loaded into the company owned rail cars to be transported to the mills at Magna and Arthur.

KENNECOTT COPPER CORPORATION

cious fluctuations in the market price of copper. One by one, they died or were absorbed by the larger, more aggressive firms. The ores of all of them were essentially exhausted by the 1940's.[46]

The production of copper in Utah during the sulphide period was as follows:

Copper Production in Utah, 1870–1905

(Source: Butler *et al.*, *Ore Deposits of Utah*. The last column is from University of Utah, Bureau of Economic and Business Research, *A Statistical Review of Utah's Economy* (Salt Lake City, 1960). Figures for 1904 and 1905 include some production from Utah Copper's porphyry mine at Bingham, but this production did not average more than 5 million pounds for either year.)

Year	*Copper Produced in Pounds*	*Value*	*Per cent of U.S. Copper Production*
1870–1885	7,479,284	$ 1,623,190	1.1
1886–1895	18,344,708	3,326,138	0.8
1896	3,502,012	378,217	0.8
1897	3,919,010	470,281	0.8
1898	3,740,000	465,000	0.7
1899	9,584,746	1,638,991	1.7
1900	18,354,726	3,946,885	3.0
1901	20,116,979	3,359,535	3.3
1902	23,939,901	2,920,668	3.6
1903	32,847,656	4,542,831	4.7
1904	46,417,324	5,802,154	5.7
1905	57,298,054	8,938,496	6.4
Total	245,554,310	$36,512,386	2.2

The Smelter Smoke Suit

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

The situation was not quite so peaceful as one might have supposed. In June, 1904, after a rainstorm accompanied by winds, the farmers living in the neighborhood of the smelters noticed that their crops were turning yellow,

[46] Fuller treatment of these and other companies may be found, with bibliographical notes, in Hansen, "A Business History of the Copper Industry of Utah."

as if diseased; some of their animals appeared sick as well. Investigation confirmed their suspicions that each time the wind shifted direction black smelter smoke was blown over their lands, and with it came an odor which smelled like sulphur which stung the eyes. Several weeks earlier a series of south winds and the accompanying rains had carried "the blight of the Murray smokestacks," as it was later called, north as far as the limits of Salt Lake City, devastating a wide swath of country. The area soon came to be known as the "smoke belt."

After a series of farmers' meetings in the fall and winter of 1904–5, a suit was filed in the United States District Court of Utah. A lengthy trial resulted in a verdict against the four smelter companies, and a decree was entered on November 13, 1906, perpetually enjoining the defendant companies

> from the future roasting or smelting of sulphide ores carrying over 10 per centum of sulphur, . . . at its present location, 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.[47]

While the farmers hailed the decision, the smelter companies had no alternative but to announce the closing of their plants. Utah Consolidated closed its Highland Boy Smelter in January, 1908, and, after a period of time in which it used the huge smelter constructed by Guggenheim interests at Garfield, transferred its ores to the plant of the International Smelting and Refining Company constructed at Tooele in 1910. The company was eventually absorbed by International. Bingham Consolidated closed its Bingham Smelter in 1907, had its ore processed for a time by the Yampa Smelter and the Garfield Smelter, and was eventually acquired by the United States Smelting, Refining and Mining Company. The United States Mining Company, which was reorganized in 1906 as the United States Smelting, Refining and Mining Company, closed its Midvale Smelter in 1908, but later secured a modification of the injunction to permit the smelting of lead-silver-zinc ores. That smelter was finally closed in 1958, although the Midvale flotation mill is still in operation.[48]

The one company which came out of the smoke suit with an improved position was the American Smelting and Refining Company. ASARCO representatives wisely met with officials of the farmers' group in 1907 and agreed to a stipulation whereby the farmers would be compensated to the extent of $60,000, in return for which they (the farmers) would approve a modification of the decree permitting continued operations of the Murray smelter. By this purchase of immunity ASARCO was left as the sole custom smelter in the Salt Lake Valley. Having also constructed a huge smelter at Garfield in 1906, the Guggen-

[47] *Deseret News*, February 8, 1905, November 5, 14, 15, 1906.

[48] *Ibid.*, May 23, December 15, 1907, January 3, 28, February 25, April 4, November 9, December 19, 1908, December 21, 1912; Stevens, *Copper Handbook*, 1910–11, pp. 422 1840–41; 1918, pp. 1356–57; 1925, pp. 1770–71; 1931, pp. 1817–18.

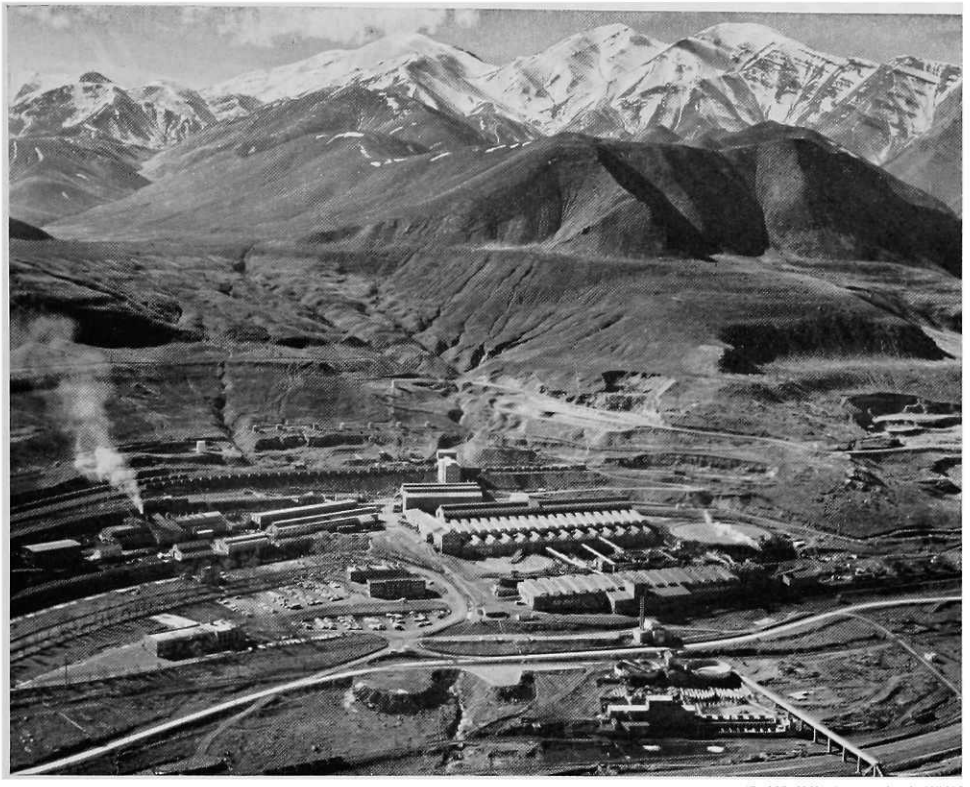
heim-controlled company was in an enviable position indeed. It was only with the construction of the large International Smelter at Tooele in 1910 that a competitive smelter became available. ASARCO and International then both competed for marketable ores, and the many small independent mineowners of the state were assured of receiving fairer treatment.

The Beginning of Porphyry Mining

While the mining of sulphide coppers was declining — with mines which were large copper producers becoming large producers of lead — there occurred the meteoric rise of the porphyry coppers. Not only was the introduction of open-cut copper mining at Bingham a major milestone in the history of mining in Utah, but it had world-wide significance as well. Of all copper mines in the history of the world, the Bingham porphyries came to hold undisputed first place in the aggregate quantity of metal produced by a single mine, with approximately 8 million *tons* of metal produced to 1963. This one mine produced one-third of all the copper used by the Allies during World War II.

Four personalities stand out above all others in launching this most successful of all Utah mining enterprises. The first was "Colonel" Enos A. Wall, of Indiana, who staked out a number of claims in Bingham Canyon in 1887, and for 16 years kept up the assessment work and sought to enlist the interest of persons of financial means to develop the property. The second was Samuel Newhouse, who (in association with Thomas Weir) purchased important claims at Bingham, organized the Boston Consolidated Mining Company in 1898, and (with the able assistance of Lafayette Hanchett and Louis S. Cates) successfully developed some of Bingham's best porphyries. Third was Daniel C. Jackling, the aggressive young metallurgical engineer who induced Colorado capitalists to purchase the Wall properties, organized the Utah Copper Company in 1903, and erected a successful concentrating mill at Copperton. Fourth was the Guggenheim family, owners of a controlling interest in American Smelting and Refining Company and other mining ventures, who agreed in 1905 to provide the enormous financial resources required for expansion and development of the Bingham porphyries. When the Guggenheims arranged for the merger of Boston Consolidated with Utah Copper in 1910, the stage was set for a prolonged period of growth and prosperity.

By 1910, when the sulphide era was well over its peak and on the decline, the combined and expanded Utah Copper Company was successfully applying mass-production methods and revolutionary technology in exploiting the formerly worthless porphyry rock at Bingham. While the combined Utah Copper was quickly rising to the position of premier copper producer in the nation, the sulphide companies one by one retired from the scene, through merger or ex-



KENNECOTT COPPER CORPORATION

The Arthur Mill was acquired by Kennecott Cooper Coporation in 1910 when Utah Copper Company and Boston Consolidated Mining Company merged. The plant was built during the years 1906 to 1908.

haustion, and their names were lost to all but those familiar with the industry's history. As Utah Copper was being absorbed by the Guggenheim-dominated Kennecott Copper Corporation, the name of Samuel Newhouse, "Father of Copper Mining in Utah," was heard no more. It was replaced by that of Daniel C. Jackling, the Missouri farm boy who ushered in the rich and profitable porphyry era in the history of Utah copper.

It is in the porphyry era that Utah Copper became synonymous with mining in Utah. In Bingham Canyon, copper mining expanded so greatly that all other mining operations nearly disappeared from the scene. The town itself gave way to the growth of the Utah Copper Mine. By 1963, Bingham Canyon as a residential and business community had disappeared, and Kennecott demonstrated its faith in the future of copper in Bingham Canyon by announcing a $100-million program of expansion.

WONDER MINERAL: Utah's Uranium

By Don Sorensen

To most persons, the word uranium became significant during the early 1950's when the badlands of the Colorado Plateau suddenly became alive with prospectors and miners feverishly hunting for the precious metal. Reminiscent of the California gold-rush days of a century before, both old pros and "city-fellers" set out on foot, in jeeps, in airplanes, and on burros in search of the modern-day version of the "Dutchman's gold"; and "investors" swarmed into the

Mr. Sorensen, a candidate for the Ph.D. in political science at the University of Illinois, was employed under a grant from the Utah State University Research Council when the research for this article was done. The author is grateful for the collaboration of Dr. Leonard J. Arrington of Utah State University Economics Department in preparing this article for publication.

Aerial view of the entrance of a uranium mine incline in the Red Canyon mining district in southeastern Utah. The photograph shows the typical desolate country where uranium is found and one of the many roads constructed as a result of isolated discoveries.

ATLAS MINERALS DIVISION, ATLAS CORPORATION

offices of the Salt Lake City brokers during the mad days and nights of the penny-stock boom.

But before the days of air reconnaissance, the geiger counter, government assistance, the guaranteed market, Charley Steen, and the penny-stock boom, there were 50 less spectacular years, extending back beyond the turn of the century. This history may be viewed as moving through three stages: (1) The radium era, which ended in 1923; (2) the vanadium era, which came to a close in the 1940's; and (3) the uranium era, which is the modern or current period of history.[1] Because of the importance attached to "beginnings" in this centennial mining year, this article deals only with the first of the three eras. The first era is particularly significant because many of the "discoveries" of recent years and many of the mines opened up since World War II are but the re-opening of old abandoned mines, the working of areas known for years to have contained ore, and the staking of new areas in the general vicinity of old uranium and vanadium mining districts. The present-day uranium industry rests upon a foundation of experience in the areas of prospecting, mining, and processing which was developed over a period of more than half a century.

Most of this history takes place on a 100,000-square-mile area of the Colorado Plateau, roughly centered around the common corner of Arizona, Colorado, New Mexico, and Utah. The landscape consists of cliff-bordered small plateaus, sage-covered plains, highly dissected canyonlands, and wide expanses of interspersed desert and mountain ranges, with elevations varying from 5,000 to 11,000 feet above sea level. The summers are hot in the low desert plains and pleasant in the higher altitudes. The lowlands are covered, in places, with piñon and juniper, and in large areas nothing but sage, bunch grass, and other kinds of desert vegetation can be seen. Water is scarce, perennial streams are relatively few, and in the summer flash floods may suddenly come rushing down the narrow canyons and washes after a thunderstorm. The area has always been sparsely settled, especially during the early part of the 1900's, and roads were, and in many places still are, poor or nonexistent.[2]

Early Days of Discovery and Mining

The first known people to use uranium ore in America were the Navajo and Ute Indians who roamed the Colorado Plateau area hundreds of years ago. These Indians decorated their bodies with bright red and yellow war paints made from the carnotite ores, as if foreboding its use in the future Atomic Age.[3] However, uranium mining in the West probably began, indirectly, in the gold

[1] These three eras are used in Kathleen Bruyn, *Uranium Country* (Boulder, 1955), 1–2.

[2] W. L. Dare, R. A. Lindblom, and J. H. Soule, *Uranium Mining on the Colorado Plateau*, United States Bureau of Mines *Information Circular 7726* (Washington, D.C., 1955), 1–5.

[3] *Facts You Should Know About Uranium* (Salt Lake City, 1954), 4.

and silver heydays of the last half of the nineteenth century. To those early miners, pitchblende was nothing more than a dull black substance, apparently worthless, which clung persistently to mining tools and was thrown unceremoniously on the waste pile. In 1871, Dr. Richard Pearce, a Welshman, visited mines in the Plateau area, recognized the presence of uranium, and arranged to have about 200 pounds handsorted and screened, and shipped to London, where it sold for 40 pounds sterling (about $200). A year later he leased property and mined successfully for small amounts of uranium until 1884.[4]

Twelve years later, mining for uranium was again underway in several mines. Production was very small, consisting of a few tons of $500 (per ton) ore per year. All of the product was shipped to France and Germany, where, in the forming of salts and oxides, it was used as a colorant for ceramics and ink dyes, in the manufacture of glass and pottery, and for experimentation in photography and the manufacture of steel plate.[5]

In 1898, the same year that radium was isolated from this uranium pitchblende by Pierre and Marie Curie, a French mining engineer, Charles Poulot, identified a bright yellow substance found in the Plateau region as a new mineral and named it for the prominent French physicist, Adolph Carnot. When it became known that carnotite contained uranium, Plateau prospectors began making dozens of claims, and the first American mill was erected for the extraction of uranium and vanadium oxides.[6]

It is interesting to note the rather widespread occurrences of uranium-bearing ore bodies that were known to exist by this early date in the history of the industry. Prospectors had found new ore bodies in South Dakota, Montana, California, New Mexico, and Utah, although there are no indications that mining was undertaken outside Colorado and Utah. Most of the discoveries occurred in the process of searching for what was considered more important minerals by sheep herders and ranchers familiar with various ores. The Utah deposits occurred in the eastern and southeastern portion of the state around basin margins of the Green, Grand, and Colorado rivers. The most valuable deposits in the state, predominantly high-grade vanadium ores and carnotite, were in the canyon of the Grand River, at Richardson, Grand County. These deposits had been discovered by a Mr. Welsh in March, 1898, prospected the same year by James Lofftus, and opened by the Welsh-Lofftus Uranium and Rare Metals Company. Small shipments were at first made for experimental purposes, and in 1902 Mr. Lofftus sent about 500 pounds to Buffalo, New York,

[4] Bruyn, *Uranium Country*, 19–25.

[5] *Engineering and Mining Journal*, LXV (1898), 637–38; LXVI (1898), 162; LXVIII (1899), 311; LXIX (1900), 593 (hereafter referred to as *E.M.J.*); U.S., Department of the Interior, Bureau of Mines, *Minerals Yearbook, 1944* (Washington, D.C., 1945), 816–18.

[6] Bruyn, *Uranium Country*, 26–33; *E.M.J.*, LXVIII (1899), 406.

for processing experiments and analysis. By September, 1903, the material was known to be radioactive, and some was sent to the Curies for tests. In May of the same year, the company was incorporated under the laws of New York to work the deposits on two claims, called the Jesse D. No. 1 and Jesse D. No. 2. Further experiments at the company's plant at Buffalo affirmed the presence of commercial-grade uranium minerals.[7]

The San Rafael deposits, located "about 15 miles southwest of Green River station (Rio Grande Western Railway)," were surface prospects said to have been discovered by sheep herders. These deposits were later prospected and claimed by Judge J. W. Warf of Price, Utah. These claims were thoroughly worked, and the material, totaling about 30,000 pounds, was sent to Germany. Southeast of the San Rafael Swell, in Wayne County, a number of deposits were also reported. These were also found by sheep herders and were actively prospected and developed in 1904. The finds were widespread, and deposits were reported west of the La Sal Mountains, south of the Richardson locality, at Mill Creek, around Grand River north of Moab, near Cold Creek, 20 miles north of Price, southward between Price and Henry Mountains, and on Temple Mountain. By 1906, an estimated 200 tons of ore were mined annually in Colorado and Utah.[8]

These examples indicate some of the known, but not necessarily commercially valuable, deposits. (At the time, no ore was accepted unless it assayed better than two per cent U_3O_8.) Roads were poor and far between, water was scarce for both processing and mining use, freight rates were high, and the demand was limited and uncertain.

Production Spurred by the Demand for Radium

Although, as indicated, radium had been isolated from pitchblende in 1898, for many years uranium ores were not sold or evaluated in America by the quantity of radium they contained. However, fabulous values were placed on the properties of radium by many publications, and experiments showed that the amount of radium present in radioactive materials was proportional to the content of uranium — estimated at the time to be 1 part of radium to 1.35 million parts of uranium.[9]

By 1911, the uranium industry began to show positive effects from the much-publicized and mysterious element. The value of a gram of radium (less than four-hundredths of an ounce) was quoted at $210,000, which made it more

[7] U.S., Department of the Interior, Geological Survey, *Mineral Resources of the United States* (Washington, D.C., 1901), 268–70 (hereafter referred to as *Mineral Resources*, with the year); J. M. Boutwell *Vanadium and Uranium in Southeastern Utah*, United States Geological Survey *Bulletin 260* (Washington, D.C., 1905), 202–10.

[8] *Ibid.*; Bruyn, *Uranium Country*, 102–12.

[9] *E.M.J.*, LXXXII (1906), 116.

precious than diamonds and rubies. Companies and individuals with properties in the uranium and vanadium areas of Colorado and Utah showed increasing interest in their development. Agents of ore-buying companies in the East, stirred by the increasing demand for radium, frequented uranium and vanadium fields; and foreign interests, both private and governmental, sent representatives to the region seeking radium-bearing ores for shipment abroad. Some American interests did not look with favor upon the shipment of all radium overseas to assist foreign medicine and science, and were sufficiently nationalistic to feel it their patriotic duty to develop an industry to retain the rare white metal in America.[10]

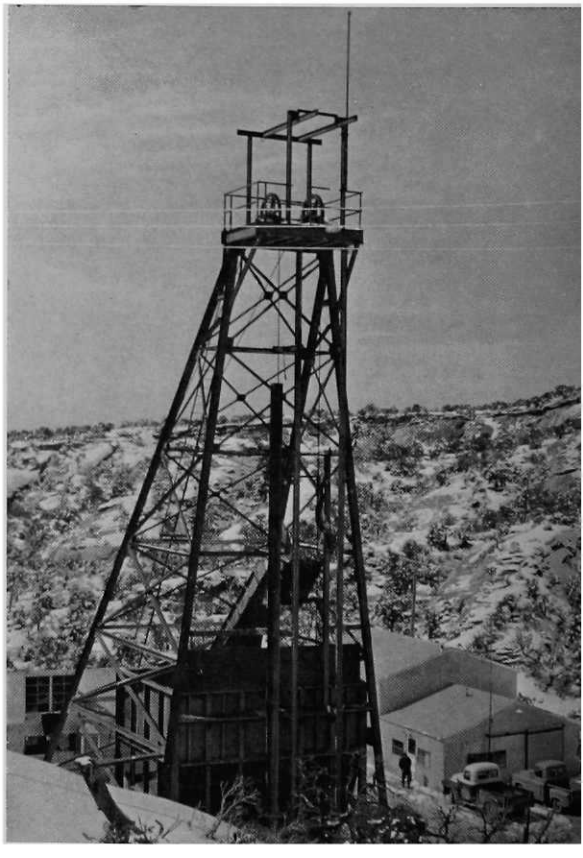
Uranium mining in Utah responded to the higher price with shipments of carnotite from deposits 15 miles west of Green River, on the east side of the San Rafael Swell; from Professor Valley, north of the La Sal Mountains; from deposits near Richardson; 17 miles southeast of Moab, Utah, in the neighborhood of Park Creek; from newly opened deposits northwest of Moab near a place called Court House; and experimental amounts from Kane County. Considerable development work was also done farther south along the San Rafael Swell in what was known as Wild Horse Canyon. In 1914, the Standard Chemical Company made the first commercial production of carnotite from the Henry Mountains. Production was also indicated at Temple Rock, 45 miles southwest of Green River, by other concerns. Several individuals and companies erected facilities to concentrate the ores.[11]

The most important new claims were staked at the summit of Big Canyon at the head of Lisbon Valley, just over the state line from the McIntyre District in Colorado, but deposits were found on and near La Sal Mountains, on the San Rafael Swell, about seven miles northeast of Monticello, along the Green

[10] *Ibid.*, XCII (1911), 507; Bruyn, *Uranium Country*, 49–56; Richard B. Moore and Karl L. Kithil, *A Preliminary Report on Uranium, Radium, and Vanadium*, United States Bureau of Mines *Bulletin 70* (Washington, D.C., 1913), 7–8, 42, *et passim*.

[11] *Ibid.*, 10, 13–18; *Mineral Resources*, 1911, pp. 951–53; 1914, p. 944.

ATLAS MINERALS DIVISION, ATLAS CORPORATION



Surface facilities of an underground uranium mine in the Big Indian District of Utah, showing headframe, shops, and hoist building. This mine is approximately 450 feet deep and is reached by the vertical shaft.

DAVID W. EVANS & ASSOCIATES

Typical small mining operation near Moab, Utah, in the 1950's. This sort of manual uranium production was soon surplanted by efficient, mechanized mining operations.

River, eight miles south of Green River, and on the east and southwest sides of the Henry Mountains; and in Uintah County and around Independence, reaching into Carbon County on the west.[12]

Many experiments were made in an attempt to separate radium from carnotite, but the cost of mining, of transportation, of extracting the minute quantities from the ore, and of the technical knowledge required rendered the process unprofitable, even though enormous prices were offered for radium. However, these obstacles were finally surmounted in 1913 by two companies, the Standard Chemical Company, of Pittsburg, and the Radium Company of America, of Sellersville, Pennsylvania. Standard used ores from the vicinity of Paradox Valley, Colorado, and the latter obtained its ores from San Rafael Swell, Utah. The cost was not small — Standard, for example, expended $480,000 extracting two grams of radium worth $240,000.[13]

Radium was now a "wonder drug," and great expectations and new hope filled the hearts of people throughout the world. Hopefully, men of medicine and science performed experiments on a variety of diseases, particularly various kinds of cancer. As in other fields where the opportunity for monetary remuneration approaches the outside fringes of social and individual integrity, so in radium the chicaning hucksters and others of questionable repute took ad-

[12] *Ibid.*; USBM *Bulletin 70*, p. 13–20.

[13] *Mineral Resources*, 1912, p. 1008; 1913, p. 324; *The Journal of Industrial and Engineering Chemistry*, VIII (May, 1916), 471.

vantage of the popular and often erroneous notions the public possessed about radium. The most common commercial exploitation took the form of "low-grade preparations" of radioactive bath salts, waters, salves, and muds. Indeed, these questionable preparations obtained a higher price than even the highest figures quoted for purified radium. Doses and treatments were given in a variety of ways, by means of baths in radioactive waters — whose radioactivity was not greater than ordinary well water — by drinking radioactive waters, by subcutaneous injections of water containing solutions of radium emanation, by exposure to radium preparations, and by inhalers.[14]

Despite the unique role of radium in medicine, and widespread public demand for government control to assure equitable distribution and reasonable prices, it was not until 1946 that the government came to regulate the production and sale of uranium ores and their products.

The War, the Depression, and the Congo

The outbreak of the war in Europe in 1914 interrupted the American overseas market for radium salts and radium-bearing ores, and mining activities nearly stopped. Production dropped from over 50,000 tons of crude ore, containing 74 tons of uranium and an estimated 22 grams of radium, in 1914, to 20,300 tons of crude ore containing 34 tons of metallic uranium and 10 grams of radium in 1916. The total value of uranium and vanadium ores mined in 1916 was only $500,000.[15]

This setback proved to be only temporary. Not only did the war increase the demand for vanadium as a steel-hardening agent, but there developed a demand for radium for illuminating watch faces, gunsights, compasses, and airplane dials of various kinds. Thousands of cheap watches, with faces shining in the dark, were produced, much to the consternation of those who felt strongly that radium ought to have been restricted to therapeutic uses. Moreover, with normal Continental sources cut off, the nation became a principal supplier of Britain and the Allies. By 1918, the value of uranium and vanadium ores mined in Montrose and Mesa counties, Colorado, and the La Sal Mountains and Green River District, Utah, had now reached $957,000, with an estimated 27 grams of radium contained in the ores. Nearly all of the radium was isolated in the United States.[16]

The names of swells, rivers, valleys, and mountains that were the sites of past production continued to be the sites of production during the war years and later, with some mines being closed or depleted and others being opened

[14] USGS *Bulletin 260*, pp. 200–10.

[15] USBM *Bulletin 70*, pp. 7–8, 56–57; *Mineral Resources*, 1916, pp. 805–7; 1918, pp. 811–15.

[16] John S. MacArthur, "The Radium Industry and Reconstruction," *E.M.J.*, CVII (1919), 605–6; *Mineral Resources*, 1917, pp. 955–57; 1918, pp. 811–15.

or mined anew. It was in 1918 that the United States Metals Reduction Company constructed a plant southwest of Gateway, Colorado, just inside the Utah line. The largest company engaged in isolating radium, the Standard Chemical Company, employed some 200 men and had 375 mining claims in Colorado and several dozen in Utah.[17]

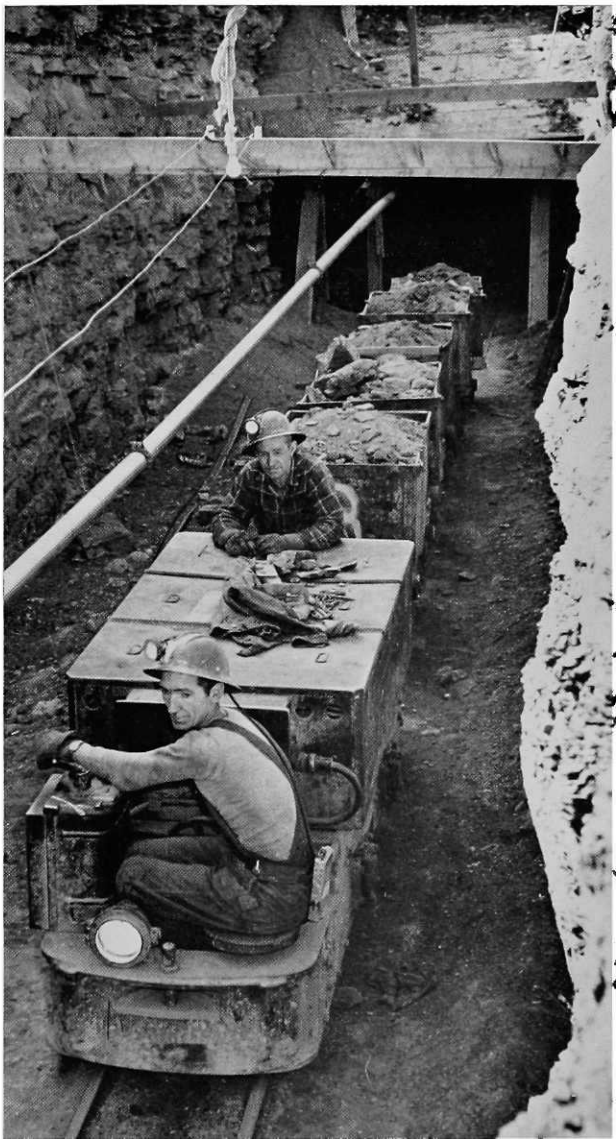
At the end of World War I, ore reserves were estimated to cover an area of 100,000 miles, and the discovery of exceptionally rich ore deposits on the Utah-Colorado border started a rush to stake out new locations. In 1920, more than 35,076 tons of uranium and vanadium ores were shipped, for a value of $2,401,000, and more than 32 grams of radium were produced. This radium had been used, for its refulgent effects, on more than 4 million watches, and there was some repugnance to the use of such a valuable element on "two-dollar watches" and "the manufacture of luminous fish bait and glowing eyes for toy dolls and animals."[18]

Modern methods of mining increasingly characterized the industry. More efficient mining procedures exposed high-grade ore bodies by short tunnels, and open cuts had given way to systematic drilling and careful mapping to show the contour of the rim and overburden. Jackhammer drilling with hollow steel as long as 32 feet was used, and the samples could be made from the cuttings that were blown from the hole during the process of drilling. Core drilling and later the gasoline-engine-driven pattern of diamond drilling were used to hunt for the rare metals at greater depths. Thus, experienced operators could determine the extent and quality of the ore bodies with reasonable accuracy and stabilize mining operations by

[17] *Ibid.*, 1917, pp. 955–57; 1918, pp. 811–19; *E.M.J.*, CXII (1921), 592.

[18] H. A. Mount, "The Story of Radium," *Scientific American*, CXXII (April 24, 1920), 454, 468; also W. H. Staver, "Radium Ore Supply Not Limited," *E.M.J.*, CXII (1921), 405; *Mineral Resources*, 1920, p. 100.

DAVID W. EVANS & ASSOCIATES



Big producing uranium mines utilized large scale mining methods, including heavy equipment and many employees.

approaching the ores from the most advantageous point, by blocking out the ores in advance, and by driving tunnels into productive areas in searching for ore. These new and more elaborate methods of prospecting and developing were expensive; core drilling, shaft sinking, tunneling, and transporting to the railroad elevated costs to as much as $200 per ton! But the increased volume of output tended to make up for this.[19]

The ore was hauled in bulk form, the loads varying from 1,000 to 4,000 pounds per horse, depending on whether the roads were rough or smooth and whether the pull was steep or of a more gradual grade. Where roads were good and hauls were long, trucks were used to increase the ton-mileage. At the concentrating mills the trucks were weighed and then driven onto an ore-dumping platform where the ore was mechanically unloaded into a sampling plant and storage bins built below the platform. After being processed in the mill, the ore was sent to the railroad and shipped to eastern reduction plants.[20]

This optimism and new life, however, proved to be short-lived; the depression of 1921 and the menacing shadow of foreign competition began to smother America's radium industry. As the depression deepened, ore production began to slow down, and by September, 1921, most of the mines were closed. The plants continued operating on the ore that had been stored, and fractional work continued in the mines until January of 1922. The quantity of ore mined in 1921 decreased to 8,540 tons, and the $2.4 million business of 1920 dropped to $876,000 in 1921. Only 929 tons of ore were mined in 1922, for a value of $166,016. This was the lowest production since 1910.[21]

But while the depression of 1921–22 caused the suspension of production, the industry was dealt the death blow by the opening of rich uranium ores in the Katanga Province of Belgian Congo in 1923. This new easily worked source drove the price of radium down from $120,000 to $70,000 a gram almost overnight. The mines of Utah and Colorado simply could not compete at this price.

Newly discovered vanadium deposits in Peru came to dominate the vanadium market almost as completely as Katanga dominated radium. And without a profitable market for either radium or vanadium, there was little cause to mine the ores of the West. The radium era thus came to an end in 1923, when 2,025 tons of ore valued at $150,000 were mined, and only 12 grams of radium were isolated. Whereas only $8,552 worth of uranium salts and oxides and radium salts were imported in 1921, and $28,685 in 1922, the death of the industry was epitomized when imports soared to $500,156 in 1923.[22]

[19] George Kunkle, "The Price of Radium in Relation to the Cost of Mining," *E.M.J.*, CXIV (1922), 503.

[20] H. S. Worcester, "Sorting, Hauling, and Sampling Carnotite Ore," *E.M.J.*, CXV (1923), 1068–71.

[21] Richard B. Moore, "Uranium and Radium Mining," *E.M.J.*, CXIII (1922), 92; *Mineral Resources*, 1922, pp. 575–79.

[22] *Ibid.*, 1923, pp. 245–50.

Since 1923

During the years between 1923 and the 1940's the production of uranium in Utah, the West, and the nation was negligible. However, the World War II demand for vanadium — for use in hardening steel — brought out a substantial price rise, and spurred activity on the Colorado Plateau. Roads were constructed to ore deposits, ore-purchasing depots were opened, and new plants were erected in Blanding, Monticello, and several locations in Colorado. Thanks to private operators, ably assisted by the U.S. Geological Survey, the Bureau of Mines, and the Reconstruction Finance Corporation, the nation led the world in the production of vanadium during the years 1943 to 1945.

The war also stimulated the demand for uranium — principally by the now-famous Manhattan Project. While most of the ore used in development work and in production of fissionable materials was obtained from the Shinkolobwe Mine in the Congo and the Eldorado Mine in Arctic Canada, there was also an intensive but secret attempt to reprocess the low-grade talings at the vanadium mills in Utah and Colorado. For this and other purposes the Defense Plant Corporation constructed an improved mill at Monticello.

All such activities were suspended at the conclusion of the war. Mines, ore mills, and chemical plants were closed. In contrast with the 1923 experience, however, this period of inactivity was short-lived. The necessities of military security prompted the passage of the Atomic Energy Act and the resumption of uranium production on a far larger scale than ever before. Exploration was stepped up; new processing plants were erected; and the output of ore soared to unprecedented heights. Uranium moved quickly from a minor industry to the most sought-after mineral in the world.

Its boom-like status and its crucial role in the Cold War gave uranium an exciting aura. Amateur and professional prospectors, mining engineers, and trained geologists flocked by the thousands to the Plateau region — and, indeed, trudged the hills and plains of every state from Florida to Alaska. Tens of thousands sought private fortune and public approbation by their participation. They included Pratt Seegmiller, humble Utah retailer, who discovered the famous Marysvale deposits in 1947. They also included Paddy Martinez, the Navajo, and Joy Sinyella, the Supai, who, without geiger counter or drilling rig separately discovered the rich deposits in Grants County, New Mexico. The most widely known embodiment of uranium success was the young geologist, Charles A. Steen, who, with a geiger counter under one arm and a bundle of Geological Survey bulletins under the other, found the fabulously rich Mi Vida deposit in the Big Indian District near Moab in the summer of 1952. The Utah Exploration Company was formed the same year, and it was only a matter of time until Steen was uranium-rich.

Such discoveries and the stimulus of lucrative government contracts induced the formation of thousands of new companies — some to explore, others to mine and mill, and still others simply "to promote." As the "uranium capital of the world," Salt Lake City became the locale for the wildest speculative mania in the nation since 1929 — the "investment" in penny uranium stocks during the years 1953, 1954, and 1955. For months on end, the demand for stock kept brokers at work around-the-clock.

Even this, as the seasoned observer might have anticipated, was to pass away. By 1956, the Atomic Energy Commission announced that the supply of uranium had reached the point of plenty, and producers were advised not to expand. No longer a "spectacular," the uranium industry, with its heritage of boom to bust, took its place as a substantial part of the permanent economy of the state.

UTAH'S BLACK GOLD: The Petroleum Industry

BY OSMOND L. HARLINE

This article (1) reviews briefly the development of Utah's crude-oil-producing industry, (2) summarizes the highlights of the establishment of Utah's petroleum-refining complex (which had its beginning even before commercial quantities of oil were found within the state) and (3) examines the significant events associated with the petroleum-related natural-gas-producing industry of Utah. The growth of these three aspects of the petroleum industry, all of which have contributed significantly to the economic advancement of the state, are an important chapter in Utah's mineral history.

Crude Oil Production

Petroleum in Utah first came to the attention of the white man in the form of an oil seep. On July 11, 1847, William Clayton chronicled the historic event in this manner:

> During the day some of the brethren [members of Brigham Young's first company of Mormon pioneers] discovered an oil spring. The substance which rises out of the ground resembles tar and is very oily. Some have oiled their shoes, others have gone to fill their tar baskets and are sanguine it will answer well to grease wagons . . . .[1]

The location of the discovery was about 82.5 miles east of Salt Lake City near the present Utah-Wyoming border on the old Pioneer Trail.

Dr. Harline is director of the Bureau of Economic and Business Research, University of Utah. Appreciation is expressed to the many individuals and companies in the industry whose significant contribution of information made this article possible. The research assistance of D. T. Verma, Charles J. Eidler, and Katherine L. Lueck, research analysts on the staff of the University Bureau, is also gratefully acknowledged.

[1] William Clayton, *William Clayton's Journal: A Daily Record of the Journey of the Original Company of "Mormon" Pioneers from Nauvoo, Illinois, to the Valley of the Great Salt Lake* (Salt Lake City, 1921), 289.

UTAH PETROLEUM COUNCIL

Oil drilling in Utah's vast plateau country of the Colorado and San Juan rivers region.

It was not until 1948, after a lapse of over a hundred years, that the frst well to produce petroleum in commercial quantities was brought in. Thus, Utah's crude-oil-producing industry was first born a century after the first Utah oil seep was discovered and almost a century after its big brother, the 1859 Titusville-Pennsylvania well, was completed.[2] Once established, however, the Utah industry lost little time, and in several years reached boom proportions as can be seen by examining the main features of its development.

The record of wells drilled in Utah, their exact location, date of completion, depth, information as to geologic formation, and results of the drilling are reasonably complete. Even so, much of the information is missing.[3] A close study of the available information shows that in the 72-year period, 1891 (when the first Utah well was drilled) to 1962, there were only about half a dozen years when no wells were drilled in the search for oil. Oil drilling during this span

[2] Sam H. Schurr and Bruce C. Netschert, *Energy in the American Economy 1850–1975, Its History and Prospects* (Baltimore, 1960), 84–85.

[3] George H. Hansen and H. C. Scoville, *Drilling Records for Oil and Gas in Utah*, Utah Geological and Mineralogical Survey *Bulletin 50* (Salt Lake City, 1955), for 1891–1954 period. See also, for period 1955 to date, reports of the Utah State Oil and Gas Conservation Commission, Salt Lake City, Utah.

appears to have been concentrated in three periods, 1907–1913, 1920–1932, and 1945 to date, more particularly 1956 to date. In addition to these periods, the annals show a considerable amount of oil prospecting and accompanying interest during the 1890's although the wells drilled were fewer in number. The "spudding-in" process[4] has occurred in all of Utah's 29 counties except four (Beaver, Morgan, Piute, and Rich).

The distinction of having drilled the first Utah oil well belongs to Bamberger and Millis.[5] Early in 1891, Simon Bamberger (later Utah governor from 1916 to 1920) financed the drilling of a hole near the track of the Denver & Rio Grande Western Railroad on the east side of the river south of the town of Elgin in Grand County. At 1,040 feet in depth the auger penetrated a stratum of gypsum; drilling was stopped, and the well was shut down with no reported oil production.

With these discouraging results, no additional efforts to drill for oil or gas in this locality were made for about 10 years. Three more wells were drilled in 1899 and 1900 with the same result. Ten years later, from 1910 to 1914, there was a revival of activity in the area of the "Green River Desert" during which time several more wells were drilled. None of the wells, which were probed to a depth of 1,400 to 1,800 feet, found more than a trace of oil; although some gas was found in one or two.[6]

For the second recorded drilling within the state the scene shifted to the Farmington area on the east shores of Great Salt Lake about one mile from the steep escarpment of the Wasatch Range. Drilling apparently started in the last part of 1891. No oil was found, but by March, 1892, there were four gas wells.[7] A dozen or more wells were drilled in the field, but as will be noted later, this beginning of the natural-gas industry in Utah soon played out. Meanwhile, the search for the first traces of black gold within the state moved elsewhere.

At the turn of the century there seems to have been little actual drilling, but excitement was apparently high. A 1901 editorial boldly announced:

> When it becomes generally known that the same conditions (as in California) exist in Utah . . . and that the area of oil bearing rocks are as great, we believe that the oil of this section will be brought as prominently before the public as are the oil bearing fields of either California or Texas, and we cannot but believe that in our time Utah will become famous the world over. . . .[8]

[4] "Spudding-in" is a term used in the petroleum industry to indicate the initial start in the drilling of a well.

[5] Charles T. Lupton, "Oil and Gas near Green River, Grand County, Utah," *Contributions to Economic Geology*, United States Geological Survey *Bulletin 541, 1912* (Washington, D.C., 1914), Part II, 117.

[6] Arthur A. Baker, "Geology and Oil Possibilities of the Moab District, Grand and San Juan Counties, Utah," United States Geological Survey *Bulletin 841* (Washington, D.C., 1933), 80.

[7] E. B. Heylmun, "Farmington Field, Davis County, Utah," *A Symposium of the Oil and Gas Fields of Utah* (Salt Lake City, 1961).

[8] *Salt Lake Tribune*, October 3, 1948, p. 85.

In May, 1902, the "oil interests" of Utah and "investors" called together an "oil convention" at Price, Utah, to discuss the development of Utah oil fields, protect original locations of claims, and formulate plans for the organization of a bureau of information.[9] But events revealed the optimism was premature. Little drilling was done; none of it successfully until 1907–8. These two years marked the beginning of seven years of the most intensive drilling the state had experienced to date in its history. Activity centered in three areas — the Virgin field, near the town of Virgin in Washington County, the Mexican Hat field near the town of the same name in San Juan County, and the Rozell field on the north shores of Great Salt Lake in Box Elder County (the last was a failure).[10] Events occurring in the other two fields are of historical significance because it was these fields which gave the state its first production of oil, 18 years and several dozen wells after the first unsuccessful oil well was completed.

In 1907, about two miles northeast of the little town of Virgin, Washington County, the existence of oil seeps prompted some drillings. About 15 wells were drilled, and although most were failures, one well is said to have produced gas to make a flame several feet long from a two-inch pipe; one well produced oil temporarily; three are stated to have produced initially as high as 36 barrels a day.[11] Lack of a ready market and the financial panic of 1907, which cut the source of ready capital for exploratory work, caused activity to cease.

Eleven years later, 1918, the three producing wells were cleaned out and shot, pumping was started, and a small local refinery was built.[12] About 140 wells have been drilled at the Virgin field and in the immediate vicinity, mostly to depths of less than 1,000 feet.[13] At the present time a small topping plant in the field operates intermittently refining crude oil into fuel oil and diesel fuel for local sale.[14]

[9] *Ibid.*

[10] As a matter of fact the Rozell field has still to produce its first barrel of oil although at this writing it is again one of Utah's hottest areas of activity in oil and gas leasing.

[11] Harvey Bassler and John B. Reeside, Jr., "Oil Prospects in Washington County, Utah," *Contributions to Economic Geology*, United States Geological Survey *Bulletin 726, 1921* (Washington, D.C., 1922), 94.

[12] *Ibid.*

[13] E. B. Heylmun, "Virgin Field, Washington County, Utah," *A Symposium*. The term field designates an area of oil or gas production; a field may contain many or only one well.

[14] Earl F. Cook, "Geology and Oil Possibilities of Washington County," *Oil and Gas Possibilities of Utah, Re-evaluated*, Utah Geological and Mineralogical Survey *Bulletin 54* (Salt Lake City, 1963), 313.

No area went unprospected in the search for oil. Even Great Salt Lake did not escape exploration as indicated in this photograph of drilling operations near Rozel, Utah.

UNITED STATES GEOLOGICAL SURVEY

Even though this original 1907 exploration gave Utah its first actual oil-producing field, the field (because of small production) was not termed commercial. This is self-evident when we realize that the Virgin oil field's 55-year cumulative production, estimated to total about 195,000 barrels of oil,[15] would keep Utah's four oil refineries supplied for only two days.

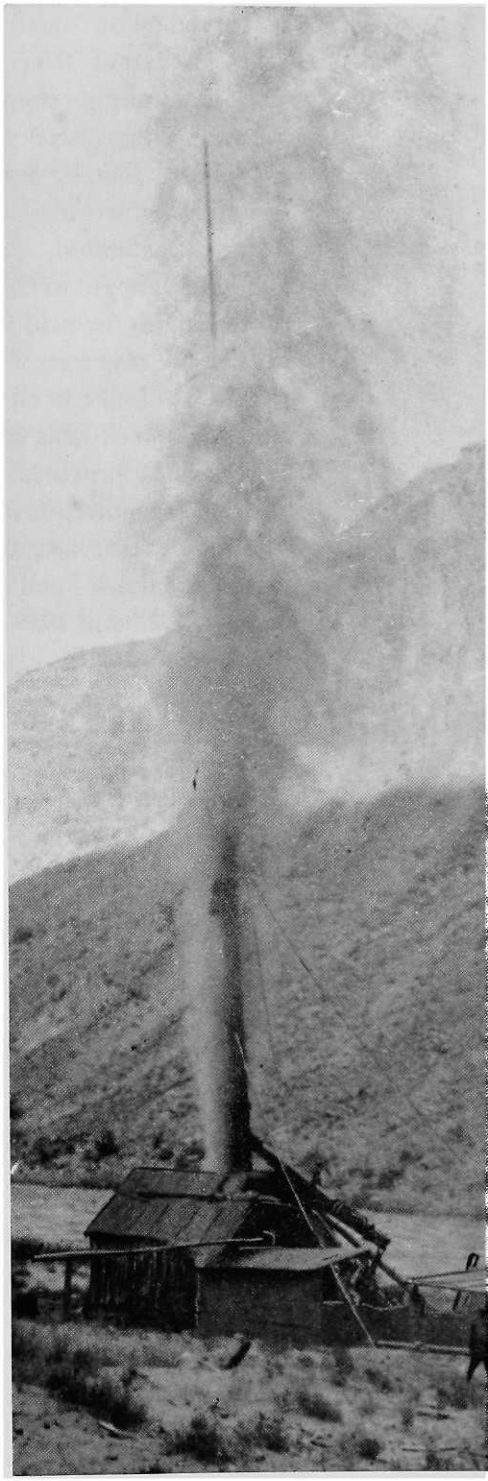
The discovery of Utah's second oil field brought about the state's first oil boom. The location was the Mexican Hat area on the San Juan River in San Juan County. About the time Silas Smith left Cedar City, Utah, in April, 1879, to investigate the colonization possibilities of the territory to the south and east of the Colorado River for Mormon settlers, another explorer, E. L. Goodridge, left Animas City (the present Durango, Colorado, the oldest city in the Four Corners area). Goodridge's mission was different from that of Silas Smith. His purpose was to prospect the length of the San Juan River and on down the Colorado River to Lee's Ferry. In the Mexican Hat area he took note of oil seeps[16] and, in the spring of 1882, located the first claim.[17] As far as can be determined, this was Utah's first recorded oil land entry.[18] No drilling was done in the area, however, until 1907, when the first well, Crossing No. 1, was begun. This well en-

[15] Heylmun, "Virgin Field, Washington County," *A Symposium*.

[16] John A. Frost, "Historical Background of the Four Corners Area," *Geology of the Parts of Paradox, Black Mesa and San Juan Basins* (Durango, 1955), 16–17.

[17] H. E. Gregory, "The San Juan Oil Field, San Juan County, Utah," *Contributions to Economic Geology*, United States Geological Survey *Bulletin 431, 1909* (Washington, D.C., 1911), 21.

[18] C. W. McCullough, "Thar She Blows," *Deseret News Magazine* (Salt Lake City), September 25, 1949, p. 5. The Hole-in-the-Rock expedition, it will be remembered, resulted in the establishment of Bluff 25 miles to the east of Mexican Hat on the San Juan River in 1880. The fact that the Mormon colonizers did not apparently participate in the filing and the oil-development activity leads one to conclude that the call of the Mormon Church officials to the Saints to "occupy the San Juan Valley" and choose the "choice places where there is grass and water" had been heeded.



One of the earliest oil wells in the San Juan region (1920's). Note the bailer (rod) blown out of the well in the oil gusher.

HYLAND OIL COMPANY

countered oil on March 4, 1908, at a depth of 225 feet. It was a gusher, throwing oil to a height of 70 feet.[19]

The resulting stampede was reported to be not unlike the clamor for leases around wildcat discoveries today.[20] A United States Geological Survey report of 1909 stated that by July, 1909, nearly 10,000 locations had been recorded at Monticello, the county seat of San Juan County.[21] Other well drillings followed in rapid succession. Promoters considered building a pipeline south to the Santa Fe Railroad to Gallup, New Mexico.[22] At least two prospective routes for railroads into the field were considered and pronounced practical, although expensive, by engineers.[23] A map published in 1910, based on field work during July, 1909, shows 39 oil wells to have been drilled between the San Juan River and the small towns of Goodridge and Mexican Hat on the south, and the escarpment approximately 12 miles to the north.[24]

By 1912, however, the boom was over. The relatively small production, restricted local market, and difficulty of transporting the oil to larger markets proved the death knell of the field. There was a revival of activity in this area between 1920 and 1930 and again in 1947 to 1960.[25] No well drilled after the early period has found significant quantities of oil or gas. Altogether, the approximately 50 wells which were drilled resulted in 13 producing oil wells in Utah's second oil field. An estimated 50,000 to 75,000 barrels of oil from the Mexican Hat oil field have been produced.[26]

During the early period 1891 to 1913, there was probably a total of over 150 wells drilled in 10 of Utah's counties (Box Elder, Davis, Emery, Grand, Juab, Millard, San Juan, Uintah, Washington, and Wayne).[27] Although there was some sporadic activity during the balance of the decade, it was not until 1920 that the pace of drilling was renewed. Between 1920 and 1932, another period of drilling occurred during which time more than 250 additional wells were drilled. Washington County was the most active (in terms of number of wells drilled), followed by Grand, San Juan, and Uintah counties. To the 10 counties

[19] E. G. Woodruff, "Geology of the San Juan Oil Field, Utah," *Contributions to Economic Geology*, United States Geological Survey *Bulletin 471, 1910* (Washington, D.C., 1912), 98.

[20] Frost, "Four Corners Area, *Geology of San Juan Basins*, 17. Wildcat wells (as distinguished from development wells drilled in an already-established field) are wells drilled in areas of no known actual oil production.

[21] Gregory, "San Juan Oil Field," USGS *Bulletin 431*.

[22] Frost, "Four Corners Area," *Geology of San Juan Basins*.

[23] Woodruff, "San Juan Oil Field," USGS *Bulletin 471*, 100.

[24] *Ibid.*, Plate IX.

[25] Sherman A. Wengerd, "Mexican Hat Oil Field, Relation to the Paradox Basin and an Estimate of Future Possibilities," UGMS *Bulletin 54*, 475.

[26] *Ibid.*, 479.

[27] As noted earlier, the records of early drillings are not complete. Hansen and Scoville, *Drilling Records*, UGMS *Bulletin 50*, identify the dates and county locations of 104 wells for the period, but indicate that approximately 60 wells had been drilled in these same counties for which exact dates are not known. The discussion in this paragraph is based on the Hansen-Scoville compilation.

in which wells had been drilled during the 1891–1913 period, 11 more were added during the 1914–32 period (Cache, Carbon, Daggett, Duchesne, Garfield, Kane, Salt Lake, Sanpete, Summit, Tooele, and Utah counties).

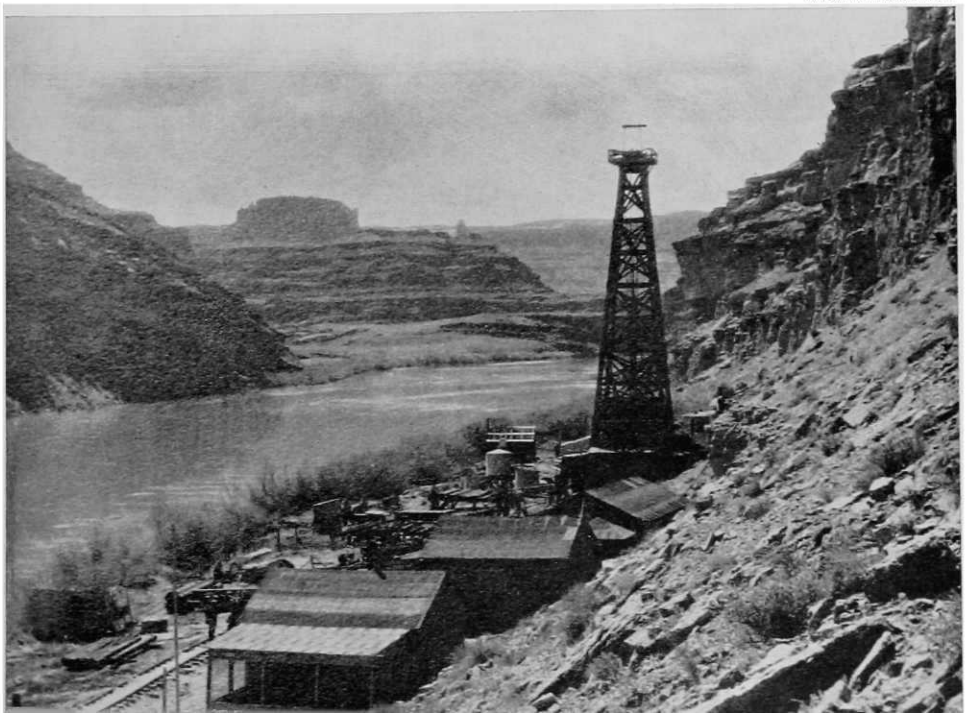
The most important oil developments, however, were occurring in the Moab district of Grand and San Juan counties.[28] Results were both encouraging and discouraging. Oil and gas showings were reported in some wells, none in others; none of the drillings resulted in producing oil wells. Perhaps the most heartbreaking of the exploratory attempts was the Frank Shafer No. 1 well located on the Cane Creek anticline. In December, 1925, oil was found at a depth of 2,028 feet. Oil and gas gushed from the well, caught fire, and burned the rig. The blaze was extinguished, but water from a higher elevation could not be controlled. After a full year of periodic drilling, during which oil and gas were encountered again at lower depths, drilling was suspended. Encouraged by this first attempt, additional wells were started in the area; oil showings were encountered, but no gusher. Whether oil is there still remains an inscrutable question, a challenge to the Utah petroleum industry.

The Great Depression, followed by World War II, had its effect on the development of the Utah petroleum industry. Although approximately 75 wells (an average of about six a year) were drilled during this 12-year period, no producers were found, and no county, which had not already been drilled, added its name to the list of Utah counties which had drillings. It was during this period that one prominent Utah geologist is said to have made the rather start-

[28] Baker, "Moab District," USGS *Bulletin 841*, 80–81.

The Frank Shafer No. 1 oil well on the Colorado River, shortly before the well caught fire and burned in 1925.

HYLAND OIL COMPANY



ling statement, "I will personally drink every barrel of oil that is ever produced in Utah."[29] He theorized that Utah's oil-bearing geologic formation had been exposed by the erosion of the deep canyons of the Colorado River and its tributaries, and over many past centuries any oil therein had washed out to sea. According to this theory the state's Gilsonite deposits in the Uinta Basin were a residue of what had once been a large oil field.

UTAH PETROLEUM COUNCIL

September 10, 1948, J. L. (Mike) Dougan, left, watches oil flow from Utah's first commercial well, the Ashley Valley No. 1, about 10 miles southeast of Vernal, Utah.

With the end of World War II, interest in Utah's oil and gas possibilities was renewed. The annual well-completion rate during 1945, 1946, and 1947 was double the pre-1945 rate, and the stage was set for the birth of the state's commercial petroleum-producing industry. In contrast to the earlier years, there were numerous geologists who disagreed with the "no-oil-in-Utah" theory. A 1947 writer analyzing the resurge of interest in Utah's oil exploration noted, " . . . we have not been able to find a geologist who denies that Utah has favorable structures for oil."[30] The past failure to obtain commercial production was attributed to drilling "off-formation," inadequate equipment, and the absence of adequate knowledge or information.

The development of the Rangely oil field in northwestern Colorado caused interest in the early postwar period to center (although not exclusively) in the Uinta Basin. But the postwar explorations were no longer a simple matter of promoting a company with limited funds and sometimes doubtful skill. The "Majors" were active. The list included such companies as Phillips, Standard of California, Stanolind, Texas, Continental, Tidewater Associated, Pure Oil, Sinclair, Union Oil, Carter, and others. The Carter Company was one of the biggest operators in the Uinta Basin.[31]

[29] John H. Klas, "Utah's Forty Million Barrel Drink" (manuscript, Utah Petroleum Council, Salt Lake City). Some credence is given to this theory by well-respected early publications. See Woodruff, "San Juan Oil Field," USGS *Bulletin 471*, figure 2, p. 97.

[30] *Tribune*, December 7, 1947, p. B14.

[31] James A. Hoagland, "Oil Boom," *Deseret News Magazine*, October 14, 1951, p. 11. See also, "Uinta Basin Oil Find is a Story of Courage," *Tribune*, July 22, 1951, p. C7.

But the honor of bringing in the state's first commercial oil well went not to the "Majors" but to an "Independent"— the Equity Oil Company. Ashley Valley No. 1, located about 10 miles southeast of Vernal, Utah, came in at 1:43 p.m., September 18, 1948, with an initial flow of about 300 barrels a day from a depth of 4,152 feet. It is interesting to note that J. L. (Mike) Dougan, president and general manager of Equity and a Salt Lake City resident, had been drilling for oil in Utah for over 25 years.[32]

By the end of 1948, eight more wells were drilled, and in a little over a year development drilling[33] of the field had been completed. Production from Utah's first commercial field, since discovery, has averaged slightly less than a million barrels a year from the approximately 30 wells within the field, and until 1957, Ashley Valley was the state's largest producing oil field.[34]

Discovery of this first Utah commercial well touched off a vigorous drilling campaign. Unlike the earlier attempts, these drillings were not shallow depth drilling of 1,000 to 2,000 feet (falling short of what was now considered normal objectives),[35] but rather 5,000 to 8,000 feet and in some instances even deeper. The result was the discovery of the Roosevelt field in 1949, by the Carter Oil Company; the short-lived Gusher field by the California company in 1950; the Red Wash field by Standard of California, and the Duchesne field by the Carter Oil Company, in 1951; and the Brennan Bottom field by the Gulf Oil Corporation and the Chapita Wells field by Continental Oil Company, in 1953.[36]

Of all these Uinta Basin discoveries, the Red Wash was the most important. By 1952, the year after discovery, it was producing half as much as the Ashley Valley field and, at this writing, the Red Wash and its neighboring field, Walker Hollow, are producing over five times as much as Utah's first commercial field, the Ashley Valley. Unique among the Uinta Basin discoveries was the Roosevelt field with its high pour-point, highly paraffinic crude that sets into solid wax at ordinary room temperatures.[37]

But the big find, which was to move the state from anonymous inclusion in the "all other" column in national crude-oil production reports to a separate Utah listing, was still to come. This find was to occur in the complex of fields known as Greater Aneth located on either side of the San Juan River in the Paradox Basin in the extreme southeast corner of the state. The Boundary Butte

[32] *Ibid.*, and *Deseret News*, September 19 and 20, 1948. This marked the first time Dougan had found oil within the state, although his company had found producing wells in other areas.

[33] V. E. Peterson, "Ashley Valley Oil Field," *A Symposium*.

[34] Records of the Utah State Oil and Gas Conservation Commission (Salt Lake City).

[35] See "Penetration Chart of Oil and Gas Fields in Utah," *Guidebook to the Geology of the Uinta Basin* (Salt Lake City, 1957), facing 164.

[36] See discussion for each of these fields in *A Symposium of the Oil and Gas Fields of Utah*.

[37] The Red Wash-Walker Hollow crudes have much the same characteristics. See George H. Hansen, "History of Drilling Operations in Utah's Uinta Basin," and John T. Brewster, "The Rangely-Salt Lake Crude Oil Pipeline," *Geology of Uinta Basin*, 165–71.

field, discovered in 1947 almost on the Utah-Arizona border, had not been termed commercial. Shell Oil Company had made previous field discoveries in the Bluff field in 1951, at Desert Creek in 1954, and at Akah in 1955, but extensive drilling in the region did not begin until after the Aneth discovery.[38] The well which set off the exploration boom was drilled at a depth of 5,896 feet in Section 23, Township 40 South, Range 24 East by the Texas Company. Initial flow was at the rate of 1,704 barrels per day — which helps explain the excitement it created. The confirmation well was completed by Superior Oil Company. By the end of the year, 20 producing wells had been completed in the field, with daily initial flows ranging from 300 to 1,900 barrels and averaging 800 barrels.[39] Operators responsible for the drilling were the Texas Company, Superior Oil Company, Three States Natural Gas Company, Shell Oil Company, and Gulf Oil Corporation, which reads like a roster of the nation's foremost oil companies.

Greater Aneth actually includes five fields, Cahone Mesa (the smallest producer), White Mesa, Ratherford, Aneth, and McElmo Creek (the largest producer). The approximately 500 producing wells in these five related fields accounts for 70 per cent of Utah's present crude-oil production.

With the discovery and development of the Greater Aneth fields, Utah moved into the nation's top dozen producing states. In 1959, there were only 10 states which produced more crude oil than Utah's 40.1 million barrels,[40] certainly a far cry from the half-million barrels produced in Utah in 1949 — the first full year after commercial oil production began. In fact, in 1959, the value of Utah crude-oil production surpassed the value of the state's copper production, the most important mineral produced in the state (partly because of the prolonged work stoppage in the Utah copper industry). Since 1960, crude-oil production has ranked second (only copper is higher) and ahead of each of Utah's other minerals in value of product produced.

Since 1959, total barrels of crude oil produced within the state have declined somewhat. The decrease is due to (1) the usual production pattern of new fields to decrease after the initial peak and (2) the inauguration of conservation measures by the industry and the Utah State Oil and Gas Conservation Commission.

Expansion of Utah production in the future will depend primarily on the discovery of new fields. If oil- and gas-leasing activity, rate of exploratory

[38] W. Don Quigley, "Aneth Field and Surrounding Area," *Guidebook to the Geology of the Paradox Basin* (Salt Lake City, 1958), 247.

[39] U.S., Department of the Interior, Bureau of Mines, *Minerals Yearbook, 1956* (Washington, D.C., 1957), III, Area Reports, 1159. This publication is hereafter cited as *Minerals Yearbook*, with the year.

[40] *Minerals Yearbook, 1959*, II, 352. Another measure of the importance of Utah's crude-oil production is the comparison with coal production. Utah is the leading coal-producing state west of the Mississippi, yet in 1959, the oil produced in Utah was the equivalent (in terms of Btu. content) of more than twice the state's coal production.

UTAH PETROLEUM COUNCIL

The life of a "roughneck" is not an easy one. In spite of all the technological advances, the work of many hands is needed in drilling for oil.

drilling, and the opinion of professional geologists are any indication, the possibility of such finds appears to be good. The discovery of the Lisbon field, south of Moab in 1960, is an example.

In August, 1959, the Pure Oil Company spudded in their Northwest Lisbon No.1 (later changed to No. 1 USA).[41] On January 5, 1960, the attention of the entire United States industry was focused on the Paradox Basin when the well became a producer. In fact, the Northwest Lisbon field was designated as the "discovery of the year"[42] by the national petroleum industry, because of the size of the field and because the area had heretofore been considered a poor prospect for oil and gas exploration. Pure Oil's exploration techniques are a good example of the approach now being used by the industry and bode well for the future of the Utah crude-oil-producing industry. To illustrate, the Four Corners Geological Society had this to say:

> Pure has shown how effective a team effort combining land, engineering geophysics, and geology can be . . . . When Major oil reserves become hard to find, this is not the time to reduce the professional staff, but rather a time to encourage imaginative thinking with full utilization of all exploration departments.[43]

Crude Oil Pipelines

The Utah crude-oil-producing industry could not have developed had it not been for the construction of pipelines to transport the crude to market. The Paradox Basin field is a good example. For those not familiar with the Paradox area a brief description is worthwhile: primitive, abrupt changes in relief, dry, largely uninhabited, in some cases deadly monotonous but in other areas wildly beautiful, characterized by slick rock, towering monuments, delicate

[41] Harrell Budd, "Notes on the Pure Oil Company Discovery at Northwest Lisbon," *Geology of the Paradox Basin Fold and Fault Belt* (Durango, 1960), 121–24.

[42] *Minerals Yearbook, 1960*, III, Area Reports, 1032.

[43] Budd, "Notes on the Pure Oil Company," *Geology of Paradox Basin*, 124.

arches and awe-inspiring natural bridges — but perhaps most significant, the area is inaccessible.

The area's inaccessibility can be illustrated by the experience of the Shell Oil Company in the Aneth Oil field in the exploratory period. Two of its wells on opposite sides of the San Juan River were three miles apart as the crow flies; yet in order to get from one well to another by automobile one had to travel the unbelievable distance of 170 miles. Today the areas are connected by a modern million-dollar bridge (built by the oil companies) and hard-surfaced roads (built by the Utah State Highway Department).

Many of the Utah fields discovered since 1948 have been large enough producers to warrant the construction of crude-oil-transporting pipelines. However, Utah's first crude-oil pipeline was not built to transport Utah-produced crude oil to market but rather to bring oil from areas outside the state to a Utah refinery for processing. In 1939, the Utah Oil Refining Company (now the American Oil Company) built a pipeline to transport petroleum from fields in Wyoming and Colorado to the company's Salt Lake refinery.[44]

The second Utah crude-oil pipeline was the 185-mile trunk line from Rangely, Colorado, which was constructed over the direct route west from the Rangely field through the Uinta Basin to Salt Lake. The line was completed from Rangely in 1948 by the Salt Lake Pipe Line Company, an affiliate of the Standard Oil Company of California. In 1951, a branch line from the Red Wash-Walker Hollow fields was built to transport Utah-produced petroleum from these Utah fields.[45] Several interesting sidelights are worth mentioning in connection with this pipeline.[46] The 9,569-feet elevation above sea-level, which the pipeline reaches at Wolf Creek Pass in traversing the Wasatch Range, is the highest altitude attained by any major oil pipeline in the world. The high paraffin-base crude from the Red Wash field must be heated to 180 degrees Fahrenheit in order to be moved along the seven-mile branch pipeline to the main pipeline, where it is diluted with lower pour-point Rangely crude so that it can be transported to Salt Lake City. The Rangely-Salt Lake City pipeline has been enlarged by "looping"[47] and the installing of additional pumps so that it now has a capability of moving 72,000 barrels of crude oil per day.

Utah's other crude-oil pipelines are located in San Juan County. It was not until they were built that oil production in quantity from the Paradox Basin oil fields could be achieved. As noted above, Aneth was discovered in 1956.

[44] Utah Oil Refining Company, *The Utoco Torch*, 50th Anniversary Issue, June, 1959, p. 5.

[45] Ashley Valley crude, Utah's first petroleum, was (and still is) trucked to Rangely and handled by the Service Pipeline Company.

[46] Brewster, "Rangely-Salt Lake Crude Oil Pipeline," *Geology of Uinta Basin*, 168–71.

[47] Looping a pipeline is a common practice which consists in the laying of a second (or more) additional pipeline alongside the first pipeline in the same right-of-way as the original.

That year a half-million barrels were produced from the Greater Aneth complex. During 1957, the Four Corners Pipeline Company, jointly owned by a number of companies, completed a 750-mile, 16-inch crude oil pipeline from Aneth to Los Angeles, California, with a capacity of 70,000 barrels a day. As a result, production from Aneth climbed from .5 million to 1.5 million barrels in 1957 and by 1958 to 20 million. In 1958, another 16-inch, 50,000-barrel crude-oil pipeline, the Texas-New Mexico Company's pipeline, was completed from Aneth to Jal, New Mexico, a distance of 512 miles where it connected with already-existing pipelines to the Gulf Coast.[48] This company is owned by Texaco, Incorporated; Sinclair Refining Company; Tidewater Oil Company; and Cities Service Oil Company. Because of these two pipelines, Utah is in the unique position of being able to transport Utah-produced crude from the Paradox Basin to both the Pacific Coast and the Gulf Coast for refining. In 1962, the Ute Pipeline in San Juan County was completed from Lisbon Valley to the Aneth area where it can deliver oil to the two foregoing pipelines.

Petroleum Refining

Utah's petroleum-refining industry is concentrated in a strip extending from Salt Lake City northward for about 10 miles to the town of Woods Cross in Davis County. Along this "refinery row" are located the state's four refineries with a combined processing capacity of over 101,000 barrels of crude oil per day. Of the Intermountain States, only Wyoming has a greater petroleum-refining capacity (110,000 barrels). But Wyoming's 10 refineries are scattered throughout the state. As a result, Utah's petroleum-refining complex, centered north of Salt Lake City, represents virtually the largest of its kind between the Mississippi River and the Pacific Coast.[49] This Utah development can best be understood by examining the establishment and growth of less than a half-dozen companies.

More than 40 years before petroleum was found in commercial quantities within the state, Utah's petroleum-refining industry was born.[50] On June 3, 1909, the Utah Oil Refining Company was incorporated in Salt Lake City with a capital of $30,000. John C. Howard, one of the original incorporators, was selected as the manager and first president. The primary purpose for organizing the company was to manufacture kerosene, greases, and lubricating oils. To do this, a "refinery"— consisting of a few secondhand tanks, a rather inadequate still, an old boiler, and a few other odds and ends of equipment — was gotten

[48] *Minerals Yearbook, 1957*, III, Area Reports, 1108.

[49] The exceptions are the large petroleum-refining centers of the Gulf Coast, the Kansas-Oklahoma area, and the Pacific Coast. See American Petroleum Institute, *Petroleum Facts and Figures* (New York, 1961), 62–63.

[50] Material for this section was obtained from various issues of *Utoco Torch*, especially the 50th Anniversary issue of June, 1959. See also Edward N. Bagley, "Utah Oil's Steady Growth Required Vision, Work," *Tribune*, May 8, 1949.

together on a quarter of an acre of ground not far north of downtown Salt Lake City. Plant capacity was seven barrels of crude oil per day which was received in railroad cars from fields in Wyoming, California, and Texas.

Problems of finding adequate working capital, obtaining necessary supplies of crude, keeping abreast of technical developments, marketing successfully a new product, rebuilding after fires, and many other challenging situations were encountered and successfully met. The foundation was laid for an expansion of capacity on a significant scale in 1917 when 50 per cent interest in the company was sold to the Midwest Refining Company. Midwest had crude oil in the Salt Creek field in Wyoming but inadequate outlets for it. The Utah Oil Refining Company had a refinery but no assured supply of vital crude oil. By means of a joint affiliation, the Utah Oil Company was able to procure crude without any cash payment. When refined and sold, this crude provided funds for growth. As a result, between 1918 and 1919 daily capacity was expanded to 4,000 barrels a day and Burton stills (the very latest technological development in the refining industry) were added in the 1919–21 period.

In July, 1921, the Standard Oil Company of Indiana acquired ownership of the Midwest Refining Company and, with it, Midwest's 50 per cent ownership in the Utah Oil Refining Company. Standard of Indiana later increased its stock ownership in the Utah Oil to 75 per cent and in the early 1950's to 100 per cent. The Utah company's products increased from three during this early period to almost 200. The brand names, Vico motor oils and greases and Pep 88 Gasoline, and later, Utoco, became familiar household words throughout Utah and Idaho, and later in eastern Nevada, parts of Wyoming, and eastern Oregon and Washington.

In 1961–62, an important event occurred when Standard of Indiana undertook a major change in its marketing operations. Several different brand names across the nation, including Utoco in the Western States, were dropped and the name "American" substituted. In the process on January 1, 1963, the Utah Oil Refining Company became a part of the American Oil Company (headquartered in Chicago) and the Utah staff was given additional responsibilities in expanding the western market of this nationwide company.

Today, the Salt Lake refinery of the American Oil Company has a capacity of 35,000 barrels a day. Utah's first refinery, which originally was little more than a skimming plant, has become a modern unit making use of the most up-to-date methods including catalytic cracking, ultraforming, polymerization, alkylation, and isomerization. The original seven employees have grown to over 400. In 1909, the company had no retail outlets; today, it has almost 100 wholesale bulk stations and approximately 1,000 independently operated retail outlets in the Intermountain marketing area.

Of the companies or refineries now making up Utah's oil refining industry, the Woods Cross Refinery of the Phillips Petroleum Company is the second oldest. The William Yeates Company, incorporated in 1932, started construction of a small refinery at Woods Cross early in 1932.[51] The capacity of the plant was projected at 1,000 barrels of crude oil per day. A cracking plant of this small capacity was something new in the industry, and when the plant was put in operation in late 1932, it did not function properly.

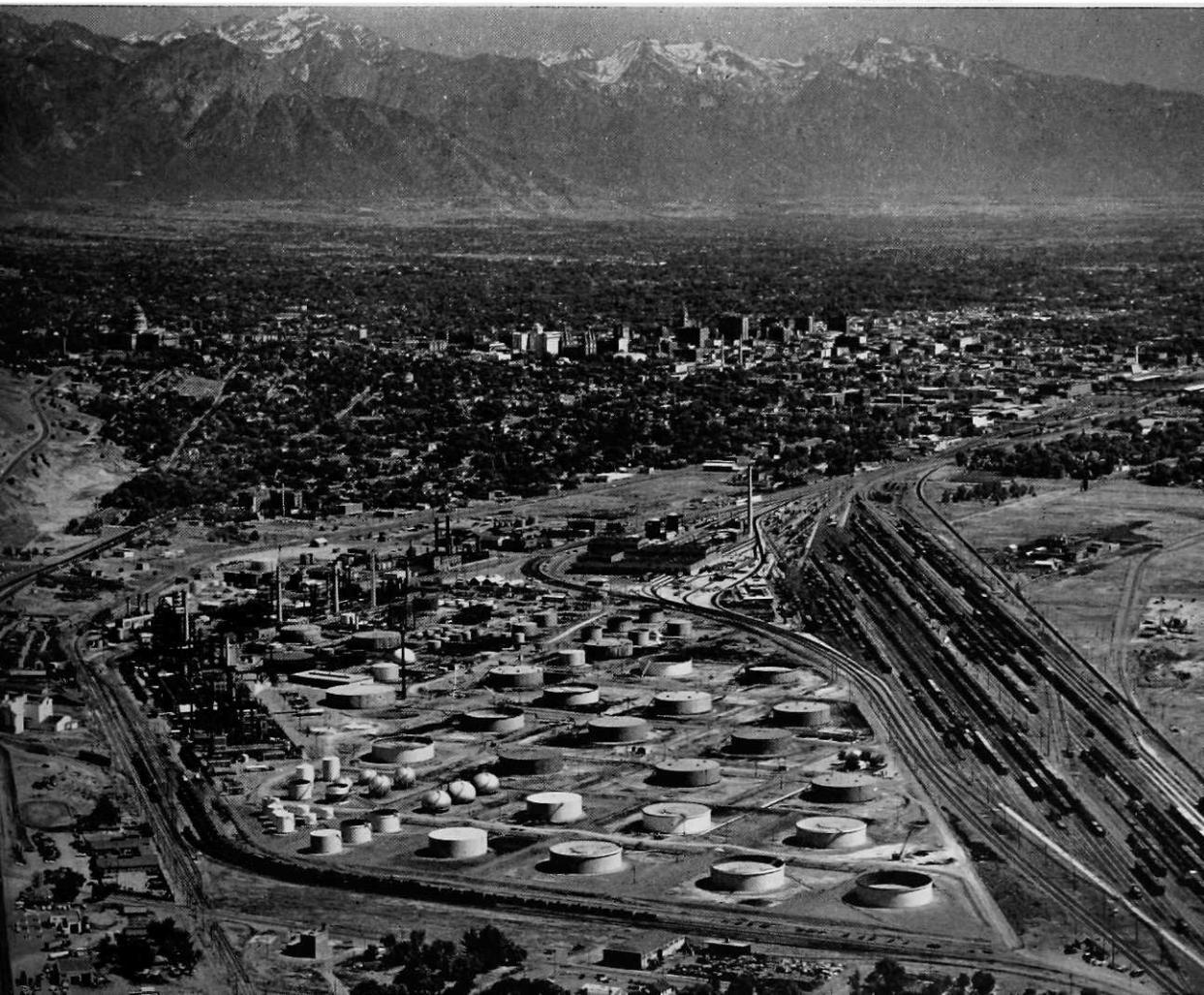
During this period the company had been negotiating with a number of producing oil companies for an assured supply of crude. Finally, a contract to purchase crude oil for a 10-year period was entered into with Skelly Oil Company of Tulsa, Oklahoma. Skelly, in return for the long-term crude contract in a new territory, sent refinery experts to Woods Cross to iron out technical difficulties.

Shortly after establishment the name of the company was changed to the Wasatch Oil Refining Company. Wasatch expanded, organizing the Idaho Re-

[51] Edward N. Bagley, "Vision, Tenacity Stimulated Wasatch Oil's Expansion," *Tribune*, July, 1949.

American Oil Company's refinery, northeast of Salt Lake City, is the oldest refinery in Utah.

AMERICAN OIL COMPANY



finery Company in 1937 and constructing a refinery at Pocatello. In 1938, the Inland Empire Refineries, Incorporated, was organized with a refinery at Spokane. During the 1940's, Wasatch also developed sources of crude oil by buying interest in properties in existing oil fields or in prospective oil fields.

In 1947–48, the Phillips Petroleum Company of Bartlesville, Oklahoma, purchased Wasatch Oil. The refinery at Woods Cross, which at the time of the purchase had a capacity of 4,200 barrels a day, has been expanded to 15,500 and includes catalytic cracking, catalytic reforming units, and H. F. Alkylation units. Most of the refinery's crude is transported over the Salt Lake Pipe Line Company's line (a common carrier owned by the California Oil Company) from the Rangely, Colorado, field.

The big expansion in Utah's petroleum-refining industry came in 1948, not because this was the year in which crude oil was first produced in quantity within the state, but because the Intermountain and Pacific Northwest market for refined petroleum products was growing. On March 4, 1948, Standard Oil Company of California broke ground on 150 acres of a 600-acre tract five miles north of downtown Salt Lake City, adjoining U.S. Highway 91 and the railroad trackage.[52] This was to become Utah's largest and most beautifully designed refinery. Whereas the others had started small and gradually grown, some in almost a topsy-turvy fashion, this refinery was producing full bloom within a few months.

Approximately $5 million were spent to construct a 27,000-barrel-per-day plant to produce regular grades of gasoline, stove oil, diesel fuel, and heavy fuel oil. An interesting feature of the installation was the construction later of a steam-heated line four miles long to deliver heavy residual fuel oil from the refinery to the new postwar-constructed Gadsby steam electric generation plant west of Salt Lake City. But the initial construction was only the beginning. A program undertaken during the 1950's expanded daily capacity to 45,000 barrels and added several catalytic crackers as well as a modern fresh-feed platformer to produce quality gasoline.

At the same time the refinery was built, the Salt Lake City-Rangely crude-oil pipeline was constructed. Thus, Standard of California in one year (1948) with the expenditure of more than $10 million, doubled the then-existing petroleum-refining industry of Utah. In 1950, a fully integrated installation was completed with the construction of a refined products pipeline to export petroleum products from the state.

[52] "Salt Lake Refinery and Salt Lake Pipe Line Company," *Know Your Company* (leaflet, Salt Lake Office, Standard Oil Company of California, n d.). See also *Deseret News*, October 24, 1948, p. B1; *Tribune*, June 27, 1948.

Utah's 1909 petroleum-refinery story was repeated in the case of the Western States Refinery. In 1946, several men sat down in a Salt Lake City restaurant to discuss the idea of establishing a small independent refinery. Three years later, in May of 1949, after numerous difficulties, the plant, Utah's then only independent refinery, went on stream with a rated capacity of 2,500 barrels a day. Crude oil was obtained via the Rangely-Salt Lake City pipeline from Rangely, Colorado. The crude was government oil made available to small independent refineries on a priority basis under Public Law 506 passed by Congress in 1946.[53]

The refinery now has a capacity of 7,500 barrels of crude oil per day. It has been acquired by the Frontier Refining Company and is known as the Beeline Refinery. In a recent expansion the most modern refining equipment was added to produce quality products for distribution throughout the Intermountain area.

For a number of years a Utah refinery operated in an area other than the Salt Lake City locality. This was a plant completed in 1941 at Jensen, Utah (in Uintah County), by the Equity Oil Company, to form a market for the company's crude-oil production from the Rangely oil field. The plant was later sold to the Uintah Oil Refining Company, which company operated the refinery until its subsequent sale to the Utah Cooperative Association in 1948.[54] The refinery had a capacity of 1,500 barrels of crude oil per day obtained from Equity Oil Company's wells in Rangely. The Jensen refinery has now closed down, and the Utah Co-op petroleum-refining operation moved to Colorado nearer the Rangely oil field. Products are distributed through outlets to members of the Utah Cooperative Association.

Refined Products Pipeline

Utah's petroleum-refining industry has been able to prosper and expand because of its ability to tap markets outside the boundaries of the state. It is estimated that 60 per cent of the petroleum products produced by the four Salt Lake refineries is sold in neighboring states. Just as the crude-oil pipelines have provided an outlet for Utah's once mountain-locked and desert-isolated petroleum, so have refined product pipelines provided a means of transporting to distant markets thousands of barrels of gasoline, diesel fuels, and other products of the Utah refining complex.

In the fall of 1950, a 569-mile pipeline from Salt Lake City to Pasco, Washington, capable of moving 15,000 barrels daily, was completed by Standard of California. During the following eight years the line was looped, additional pumping stations were added, and new delivery points were constructed. In 1953, an extension of the line from Pasco to Spokane lengthened the line to

[53] *Deseret News*, November 4, 1948, and December 14, 1949; *Tribune*, April 3, 1949.

[54] *Deseret News*, September 27, 1948, p. A6.

704 miles. Today this common carrier is capable of pumping and transporting a total of 56,000 barrels of finished products per day from all refineries northward to various distribution points in the states of Utah, Idaho, Oregon, and Washington. An interesting aspect of the line is worth mentioning.[55] Radioactive tracers called isotopes are inserted between various shipments of products, so that receiving points, by means of geiger counters, can determine the end of one shipment and the beginning of another. Constant pressure on the line which keeps the liquids moving forward at the rate of two to three miles per hour results in very little intermixing of the various products shipped — for example, gasoline and jet fuel.

Utah has a second refined products pipeline, the Pioneer Pipe Line Company owned by Continental Oil Company and Sinclair Refining Company.[56] This 10,000-barrel-per-day, 310-mile line, completed in 1952, brings refined products from the large refinery at Sinclair, Wyoming, to Salt Lake City for distribution in Utah and for trans-shipment northward by means of the Salt Lake-to-Spokane pipeline.

Natural Gas

Historically, most natural gas has been discovered while drilling for oil. This has been also true in the case of Utah. As noted earlier, oil drillings in the Farmington field, in Davis County in 1892, failed to find petroleum but discovered gas and thus marked the beginning of the state's natural-gas industry. In 1895, a nine-inch pipeline was built from the field to Salt Lake City, and customers were supplied with natural gas for 19 months.[57] But then the wells sanded-up, reserves dwindled, and the service had to be abandoned.

Utah's second natural-gas find, which was to supply a town with fuel, was from Ashley Valley, the field which gave Utah its first commercial oil production in 1948. In the spring of 1925, natural gas was discovered.[58] By 1928, a pipeline was built[59] to Vernal which supplied the town with natural gas until 1941, when the supply became exhausted and the service discontinued.

Also in the late 1920's the stage was being set for the eventual delivery and distribution of gas to Utah's populated Wasatch Front area. Between 1922 and 1927, natural gas in commercial quantities was discovered in three separate gas fields, all of them in the Baxter Basin of southwestern Wyoming, located south of Rock Springs near the Utah border. About this same time the steel industry

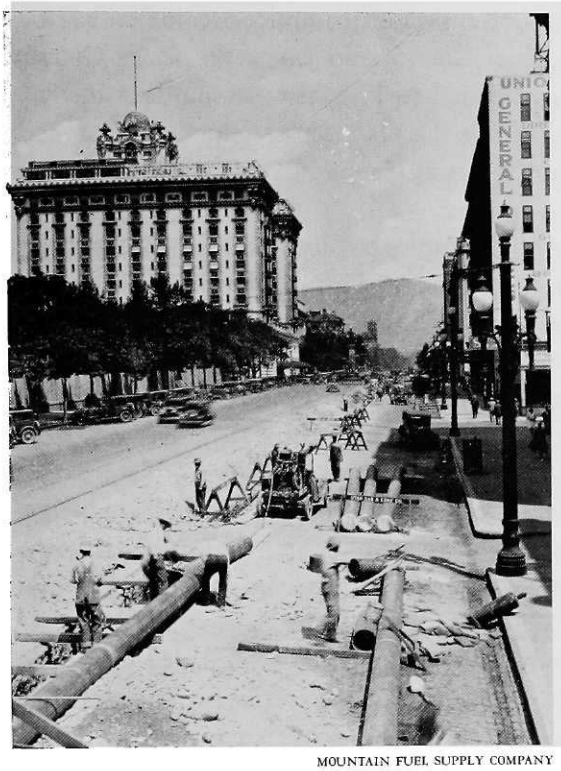
[55] Utah Petroleum Council, *Utah Petroleum Industry* (Salt Lake City, n.d.).

[56] *Tribune*, August 17, 1952, p. C11.

[57] Heylmun, "Virgin Field, Washington County," *A Symposium*.

[58] V. E. Peterson, "Ashley Valley Oil Field," *Ibid.*

[59] ElRoy Nelson, *Utah's Economic Patterns* (Salt Lake City, 1956), 150. This book is by far the best single source available on Utah's economy although it was written prior to many of the important developments occurring in Utah's petroleum industry.



MOUNTAIN FUEL SUPPLY COMPANY

Natural gas mains being installed on South Temple Street, Salt Lake City, about 1929.

developed thin-wall, large-diameter transmission pipe of higher tensile strength which made gas transmission to distant markets feasible.

The project to bring natural gas into Salt Lake Valley was initiated by the predecessor companies of the present Mountain Fuel Supply Company.[60] Control of the companies already distributing manufactured gas was first acquired — Salt Lake City and Ogden in 1928, and Provo in 1931. The next important step, that of linking the gas field and the market, was achieved between January and August, 1929, when a 200-mile pipeline between Baxter Basin and Salt Lake City was constructed. For this early period the achievement was significant, considering the distance and the terrain which had to be traversed. The arrival of gas in Salt Lake City was commemorated by lighting a huge flare of gas atop a 75-foot pipe on August 18, 1929. Public interest in the event was indicated by the huge crowd of about 15,000 people which turned out to see the torch despite a downpour of rain.

The most important of Utah's early gas fields, Clay Basin in the extreme northeast corner of Utah, was discovered in 1927 and connected to the transmission line in 1937. Additional gas fields have also been discovered in Wyoming and Colorado and later in Utah and connected to the line to satisfy the growing demand.

The magnitude of the demand for this preferred fuel was indicated by the expansion of distribution facilities beyond the Salt Lake City-Ogden area. In 1947–48, natural gas was brought to Provo, Springville, and Spanish Fork (all of which had been served with by-product gas from the Ironton plant of the Columbia Steel Company) as well as intervening towns. In 1957, Mountain

[60] Harold W. Simpson, "A History of Gas Distribution in the Salt Lake Area and a History of Mountain Fuel Supply Company" (manuscript, Mountain Fuel Supply Company, Salt Lake City), 13.

Fuel Supply began the second major extension of its service area when gas was brought to Brigham City in Box Elder County and Logan in Cache County. In the next few years service was extended to 15 other communities in these counties. The latest developments include the planned introduction of natural-gas service into Wasatch County and Summit County and possibly the Carbon County area.

During the 1930's gas supplies were ample, but by 1941 demand had outgrown supply; consumption restrictions had to be placed first on industrial users and in 1949 on new residential users.[61] To meet the increased need for gas, the company expanded its exploration programs and by negotiating for the purchase of gas from other suppliers, largely alleviated the shortage by 1952. In 1953, further Utah supplies of gas were utilized with the purchase of gas from the Utah Natural Gas Company (now a subsidiary of the El Paso Natural Gas Company). The gas from Utah Natural Gas Company was delivered by pipeline from gas fields in the Carbon-Emery-Sanpete counties area and came from the Clear Creek, Flat Canyon, and Joe's Valley fields discovered in 1951, 1953, and 1956, respectively.

In 1956, another major purchase arrangement for natural gas was completed by Mountain Fuel, this time with the Pacific Northwest Pipeline Corporation (now El Paso Natural Gas Company). The gas comes from Utah, Colorado, and Wyoming fields along the pipeline and is delivered to Mountain Fuel where lines of both companies cross in Wyoming.

Early in 1961, Mountain Fuel Supply Company discovered gas in the Uinta Basin in the Island field. Additional supplies of gas were obtained by negotiating with well owners in neighboring fields. As a result, Mountain Fuel together with El Paso Natural Gas constructed a pipeline in 1961 from the Uinta Basin westward to connect with the Clear Creek-to-Orem pipeline, in which 50 per cent interest had been purchased by Mountain Fuel. The latest gas placed in Mountain Fuel's system is from a pipeline owned by the Mesa Pipe Line Company, which transports gas from new fields on the Colorado-Utah border in northern Grand County to the Uinta Basin-to-Clear Creek pipeline.[62]

The growth of Utah's most important natural-gas supply system is shown by the increase in customers from about 18,000 in 1929 to over 200,000 in 1963. Since 1929, the Mountain Fuel Supply Company and its predecessors have sold more than 1,000 billion cubic feet of gas (almost five times their beginning reserves); they still have available more than 2,000 billion cubic feet of gas (including reserves and contracted-for purchases). Besides the new pipelines, the original pipeline from Wyoming has been triple-looped and additional compressor facilities installed to enlarge its carrying capacity.

[61] *Tribune*, April 3, 1949.

[62] Mountain Fuel Supply Company, *1962 Annual Report* (March, 1963), 9.

Utah's other natural-gas developments are associated with fields in the Paradox Basin. The Pacific Northwest Pipeline Corporation (now consolidated with the El Paso Natural Gas Company) was formed in 1949 and was organized to link the gas reserves of the San Juan Basin in New Mexico with markets of the Pacific Northwest.[63] In 1954, authorization to serve markets in Colorado, Wyoming, Utah, Idaho, Oregon, and Washington was obtained, and a 1,487-mile, 26-inch pipeline was completed in 1955–56. The line, sometimes referred to as the "scenic-inch" because of the picturesque territory it traverses, crosses Utah's borders six times. Monticello and Moab are the two Utah towns which receive their gas from this pipeline of El Paso Natural Gas Company.

Natural gas from the oil and gas fields in southeastern Utah are processed by El Paso Natural Gas Company's Aneth processing plant in order to remove water vapor and natural-gas liquids such as propane, butane, and natural gasoline.[64] The plant, built in 1958–59, sends the natural gas by means of a 75-mile pipeline to Farmington, New Mexico, where gas is fed into El Paso Natural's 24-inch main transmission line across northern Arizona to the California border. The natural-gas liquids are sent through a 98-mile pipeline to El Paso Natural's Chaco plant south of Farmington and then to Wingate near Gallup, New Mexico, where the various components are shipped to consumers all over the nation.

Importance of the Petroleum Industry

In the 116 years since Utah's first oil seep was discovered, the Utah oil and gas industry has grown to significant proportions. Not only have the state's petroleum resources furnished increasing amounts of low-cost, convenient fuel and energy to the Intermountain region, but they have furnished the foundation for important related industries including exploration, drilling, production, transportation, refining, and marketing. In the process of well-drilling, other resources have been discovered; carbon dioxide, helium, magnesium, and potash. Hitherto unexplored country has been opened up, roads and bridges built, and scenic wonders made accessible.

The economic indicators have also demonstrated the worth of the industry to the state: new payrolls, increased royalties, higher lease and rental payments for exploration on public lands, additional tax benefits, etc. The oil and gas finders and developers, goaded by eternal optimism, have brought a new era to Utah — an age of oil and gas. Even though the industry is young, its economic contribution to the state has been great; and there is reason to believe that the Utah industry's future can be viewed with optimism.

[63] Howard H. Walters, "Pacific Northwest Pipeline — The Scenic Inch," *Geology and Economic Deposits of East Central Utah* (Salt Lake City, 1956), 169–70.

[64] "Facts of Interest on El Paso Natural Gas Company's Aneth Facilities" (mimeograph copy, El Paso Natural Gas Company, Salt Lake City, n. d.).

UTAH STATE HISTORICAL SOCIETY

Membership in the Utah State Historical Society is open to all individuals and institutions who are interested in Utah history. We invite everyone to join this one official agency of state government charged by law with the collection, preservation, and publication of materials on Utah and related history.

Through the pages of the *Utah Historical Quarterly,* the Society is able to fulfill part of its legal responsibility. Your membership dues provide the means for publication of the *Quarterly*. So, we earnestly encourage present members to interest their friends in joining them in furthering the cause of Utah history. Membership brings with it the *Utah Historical Quarterly,* the bimonthly *Newsletter,* and special prices on publications of the Society.

The different classes of membership are:

Student	$ 2.00
Annual	$ 4.00
Life	$100.00

For those individuals and business firms who wish to support special projects of the Society, they may do so through making tax-exempt donations on the following membership basis:

Sustaining	$ 250.00
Patron	$ 500.00
Benefactor	$1,000.00

Your interest and support are most welcome.

Utah State Historical Society