

STORY OF HOW BIG ORE BODIES WERE
DISCOVERED READS LIKE CHAPTER FROM
MODERN FICTION

By Dr. James Douglas

"The Father of Copper Queen Operations"

(Note - The following article by the late Dr. James Douglas was written in 1909 but it is still the most complete and most interesting story of early day operations ever written).

I first saw the Copper Queen in January, 1881. It had been bonded in the spring of 1880 by Mr. Edward Riley. He was a lawyer by profession, a pupil of Jerry Black, and an able but erratic man. who had gone west many years previously--had operated first in Utah and was introduced to me at the Philadelphia Exposition by Prof. W. P. Blake. He came to own a small mine at Elko, Nevada, but, hearing of the fame of the Ajo mine in Southern Arizona, sold his Nevada mine and gravitated south. After more than one failure he bonded the Queen for \$20,000. In San Francisco he succeeded in selling it to Messrs. Martin and Ballard, through the mining firm of Bisbee, Williams & Co. for the \$20,000, taking his remuneration in a half interest. Bisbee, Williams & Co., were prepared to recommend the purchase, as Mr. Lewis Williams had already seen the property. Martin and Ballard were railroad engineers, who had heretofore resisted every mining temptation. A payment was made on the property, a thirty-inch jacket and some auxiliary machinery ordered and Lewis Williams took charge of the work, under Mr. Martin's personal supervision; for during all the preliminary oper-

ations Mr. Martin stayed at the mine. Mr. Ben Williams soon succeeded his brother in charge of the mine, as superintendent, Mr. Lewis Williams confining himself to the smelter.

Owing to my acquaintance with Mr. Riley, the first two carloads of copper bars were sent to me at the Chemical Copper Works, Phoenixville, Pa., for refining. The copper was found so excellent that it sold for a half-cent under Lake.

First Sees Copper Queen

In January, 1881, on returning from an examination of a claim which afterward passed into possession of the United Verde Copper Co., I visited the Copper Queen at the request of Prof. Sillman, who had a short bond on it at \$1,000,000. Mr. Martin's controlling idea was from the first to sell. At that time the mine consisted of an open cut on an almost circular body of ore of about sixty feet diameter, which dipped into the hill. It was enclosed in limestone, and consisted of copper carbonates with oxide of manganese and iron and a notable quantity of calcite, but so rich that the furnace yield was twenty-three per cent.

There was no hoist, as the ore was still extracted from the open cut. A small breaker was perched on the hillside, below the cut and the broken ore was shot down to the furnace shed below, where it was smelted in the small jacket. The ore was so basic that quartz boulders gathered in the canyon, had occasionally to be added to the charge as flux. The water to supply the engines and furnace was drawn from the spring on the Mulvina claim, but the flow was so scanty that the furnace had occasionally to be shut down for lack of it. Mr. Martin was planning a pump line from the San Pedro

before water was struck on the 300-foot level of the mine.

The posts and beams of the furnace shed were made of the undressed trunks of trees, and Mr. Martin and the Messrs. Williams lived and did their clerical duty and assay work in a one-roomed house, which stood to the north of the road leading down the canyon. The site is covered by the present store. The main street, with its few houses, constituted the whole town, but a few scattered houses lined the stage road which descended the canyon to Hereford on the San Pedro, whence it followed the valley of the San Pedro, via Charleston, then a populous town, into Benson. Coke and bullion took this direct route, but passengers were generally taken via Tombstone where stages were changed. One pretentious brick house was built in the Bisbee canyon. It was then, and is still, known as The Castle. It was built for Col. Herring, who was the superintendent of the Neptune Company, and he and his family occupied it. I called on the Colonel to secure, if possible, the Neptune copper for my refinery at Phoenixville. I was treated with the utmost courtesy and ceremony, but got no copper, for the company produced little or none.

Discouraging Times

The Colonel's brother was one of the pioneers of the Warren district. He located the Neptune group of claims before Bisbee was called Bisbee, and died and was buried on the hillside north of Main Street. The Colonel took a trip west to collect his property, and very wisely placed so high a value on the claims that he returned east and succeeded in organizing a company to work them. The stock

was largely subscribed in Hartford, Conn. He was made managing director, and one of the Raht brothers was made superintendent. There being no water in Bisbee, the smelting works were built fifteen miles off at Hereford, on the San Pedro, but the Neptune claim, on which Raht was working, yielded, of surface ore, only a few days run. Mr. Raht took a most hopeless view, both of the Copper Queen and of the whole district. No really effective exploration was done. He agreed with many other experts that in those limestones only isolated bodies of ore would be found, which it would be unprofitable to search for. At any rate the company's capital was spent on the smelter, roads, the Castle, and some very superficial exploration. A small debt was contracted, which was secured by mortgage bonds, and active work was abandoned by the company

Once and again it was leased. The smelter was removed to the mine by the lessors. Some good ore was found on the Spray, but it could not be made to pay. Failure after failure decided the bondholders to sell the property by sheriff's sale. It was bought by the Holbrook and Cave company, and, in 1892, with the other properties of the Holbrook and Cave company, was incorporated into the Copper Queen. For years the Neptune group of claims has been among the most productive of that company's property.

Early Day Troubles

In the beginning of 1881, though active mining operations were being conducted on only the Queen and the Neptune claims, the district for a long distance around had been located. Immediately above the Queen a parallel claim, the "Atlanta" had been relocated

over an older claim, the "Satisfaction." As the Queen ore body was dipping into the Atlanta, and not more than one hundred and fifty feet distant from the Atlanta side, I recommended Mr. Martin to buy it, as the price asked was only \$10,000. He was also recommended by Mr. Williams to buy the Prince which slightly overlapped the Queen claim to the northwest. Had he done so, much troublesome and expensive litigation would have been avoided; but Mr. Martin's one desire was to sell.

Prof. Sillman's bond having expired, Martin & Co. entered into negotiations with the firm of Zeckendorf to form a company and sell the stock of the Copper Queen company. Zeckendorf & Co., for a time, were financial agents for Martin & Ballard, and up to the time of the formation of the company, the Queen headquarters were in the office of Zeckendorf's firm in Thomas street, New York. During the early days the bullion was shipped east via San Francisco, and the only coke available was English or Welsh, imported through the same port.

I may be excused for introducing here a little bit of personal history. It was during the winter of 1881 that I was first introduced to the members of the firm of Phelps, Dodge & Company. Mr. Dodge asked my advice as to whether smelting works could be advantageously erected on an island in Long Island Sound, bought by his father long before for that purpose. I had no hesitation in assuring Mr. Dodge that building smelting works of the old type would be wasting money, as the Revere and Baltimore works were idle through

the falling off of mining in the Allegheny range, and as all western ores would ultimately be smelted at the mines.

First Electrolytic Copper

I pointed out that these western ores carried gold and silver, that the cost of separation in the west was prohibitory and that I believed that refining and separating works on the coast would be highly remunerative. I had made some tones of electrolytic copper in Phoenixville, under the guidance of Edward Weston. This was the first electrolytic copper marketed in this country, and I was convinced that this method would supplant all others, and that the first in the field would reap the harvest. During our conversation, Mr. Dodge said that a handsome, attractively frank man had that morning entered the office and, without any introduction, asked for \$50,000 with which to build copper works near Longfellow. The extraordinary effrontery of such a demand by a perfect stranger would have been resented but for the genuine sincerity and absence of all bluster or exaggeration on the part of the applicant. He was a Mr. William Church. He had secured undivided control of a number of claims near Clifton, adjacent to the Longfellow by getting options on all the stock of the Detroit Copper Co. He wanted the money to develop his mines and erect smelting works. As Ansonia was treating Queen copper, the subject interested Phelps, Dodge & Co., and Mr. Church had not been summarily dismissed. I told Mr. Dodge what I knew from personal observation of the Queen and what I knew from reliable information of the Longfellow. My story so impressed him that he employed me to make a report on Church's property, as the information would be of value to them, even though they did not accede to

Mr. Church's request. Thus Church and I were strangely mingled during our first introduction to Cliff street and the members of the firm of Phelps, Dodge & Co., took their first plunge into copper mining.

On my second visit to Arizona a young Englishman named Laing said he could secure me a bond on the Atlanta claim at Bisbee for \$25,000. This he did, but I was unable to sell it. Laing is now unknown in Bisbee, but not only in this, but in other ways, he influenced the early history of the district. He was an able and clever young fellow, but not without failings. He had been a merchant in Zanzibar, and once appeared very prominently in public, for he brought the body of David Livingstone to England.

Early Exploratory Work

While I was in Colorado in the summer of 1881 I received a telegram from Mr. James, asking me to examine the Atlanta, as it was under offer to them till, I think, July 15th. I accordingly hastened to fulfill the commission, and reported to Mr. James personally the progress of work on the Queen; that sinking had been prosecuted one hundred feet, that the ore at that level was netting twelve per cent; that the ore body was nearer the Atlanta line and would probably enter the Queen claim if it held out; that there was no ore of any value on the surface of the Atlanta. I advised him that there might be a legal question raised as to the right of the Atlanta to the extension beyond the Atlanta side line of any ore body originating on the Queen, and that the risks were too great to great to be taken by a purchaser who was not able and prepared to lose all that he had invested.

Mr. James decided to take the risk. The papers were drawn up by Mr. Coffin, the examination of title being made by Judge Haines of Tucson, and the day fixed for signature. But for some reason a postponement was requested, and in the interval Judge Haines wired a claim had been filed against the property. This was settled by the seller, and the title passed to Mr. James and Mr. Dodge. Other complications--legal and illegal--not very reassuring to eastern investors, occurred before a patent was secured to the Atlanta claim.

My first piece of exploratory work was a tunnel laid out by Manning exactly parallel to the Queen line, but which through error was actually driven on the Queen claim. This actually did not matter, as the tunnel proved to be too low to strike the Queen, or first ore body, and too high to intersect the second, or Atlanta, ore body.

I then sank on one of the small bunches of ore which cropped out on the east side of the claim. It twisted in and out in descending but apparently led to nothing of consequence and was abandoned. Had it been followed for two hundred feet, it would have let us into the big ore body two years in advance of its discovery.

Sinks New Shaft

On the west side of the Atlanta is an exposure of lead carbonates which extends across the end line into the Hendricks, then owned by the Corbins. The Corbins were, I believe, interested in the Toughnut. At the Corbin mill at Charleston Mr. John Church was smelting some of their ores, and, being short of lead, was

drawing it from the Hendricks claim. At the same time Mr. Simsbury, of the Sonora railroad, would supply him with abundance of custom ore. He was short of lead, and through Mr. Parsons, the New York agent of the Wells, Fargo Co., got permission to mine the lead carbonates on the Atlanta. He made a down payment of \$4,000. but never made a second and this was the only asset to the credit of the account of the Atlanta Mining Co.

But at this west end there was also an outcrop of copper, and on it I sunk. It was larger and continued larger in depth than the narrow streaks on the east end, but did not open up into a profitable ore body, though now we know that it can be followed into something more important.

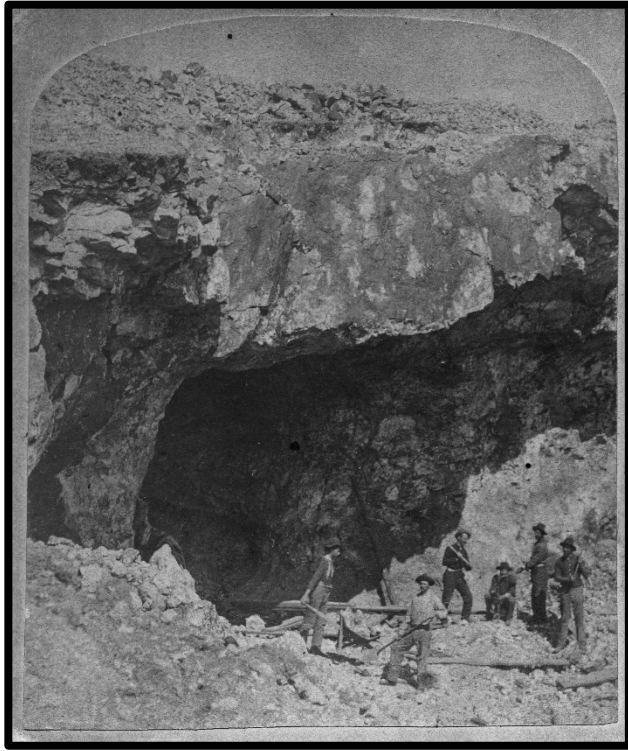
In the meantime the Queen also had its troubles. The Copper Prince had been located, as I have already said, to the north of the Queen, on an ore body which extended across the line, though the ore was richer on the Prince than on the Queen. Mr. Wendt, the advisor of the Prince, claimed that the ore to the south was too lean to be classed as ore, and that the apex being wholly on the Prince, the ore might be followed across the Queen side line. He gained his point and the Prince proceeded to extract ore from the Queen ground. But when the Copper Queen Consolidated company entered into possession, it was found that the Prince's excursion extended into the Queen claim far beyond their end lines. A suit to restrain them was successful, and so also would have been a suit for damages, had not the controversy been settled by the purchase of the Prince property by the Copper Queen.

Ore Body Exhausted

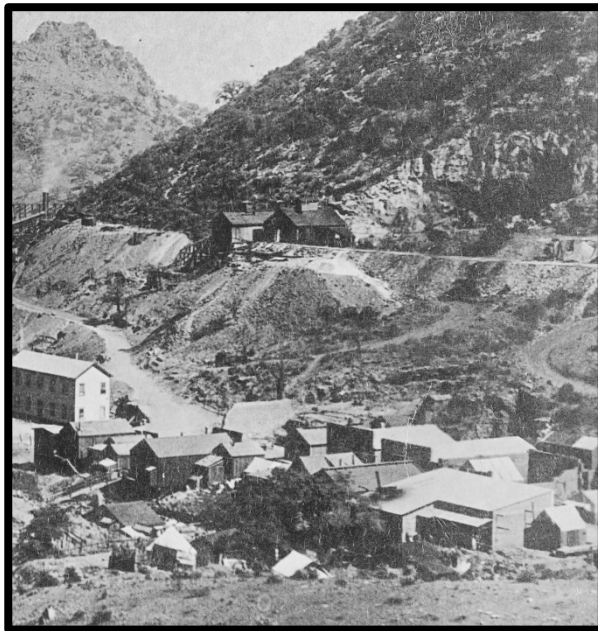
The spring of 1884 was a critical period in the history of

Bisbee. The big ore body on which the Copper Queen had been working since 1880, had pinched out, clean, before the incline, sunk to it, had reached the fourth level. The Queen had run a drift west into the King, and was drifting east along our side line in search of another ore body. Mr. Williams was opposed to the opinion of a San Francisco attorney, whom Mr. Martin had sent down to advise him as to whether the law of the apex applied, and who had advised that under the Richmond-Eureka decision, the limestones between the porphyry contact and the outcropping on the top of the Queen hill, might be considered a vein or lead under the law, being a mineralized zone. The Queen had also employed Mr. Price, of San Francisco, to advise them as an expert, and he pronounced only ninety days' ore in sight, and could not tell them where to look for more. Results have since proved that there were not more than ninety days' ore in sight.

Meanwhile, Mr. James and Mr. Dodge had become thoroughly disheartened, having spent some \$80,000. and over two years on exploration that had not yielded a carload of ore. There was a meeting with me in New York. The only underground trail I could recommend as worth following was a narrow vein of ore crossing our line from the big Queen ore body. Mr. Williams considered he had no right to follow it. We could only reach it by sinking from the surface and drifting, and to do so would cost, I estimated, \$15,000. So the last \$15,000 to be dropped into the mine was, with much misgiving, put at my disposal, and John Prout and I selected the site where the shaft was to be sunk. But long before it reached the 400 foot level the gloom which overhung both companies had been



The Copper Queen open cut "Gloryhole" c-1881 (p. 2 para 3)



The Copper Queen Mine Circa 1888



Girls playing with abandoned equipment at the site of the Neptune Smelter in Hereford, Arizona
(p.4 para 1)



A lady climbing a slag dump at the ruins of the Neptune Smelter (p.4 para 1)

dissipated, for at two hundred and ten feet from the surface the shaft penetrated a very rich ore body, which almost simultaneously was entered by the level being driven east from the foot of the Queen incline.

The Atlanta shaft was sunk for two hundred feet through ore, and a long drift was run into the hill from the 400-foot level; but though it was driven throughout in ledge matter, the ledge matter was almost barren of ore. Subsequent development showed that it penetrated the great Atlanta ore body, one of the largest and most productive bunches of ore ever discovered in the region, but by ill luck it happened to escape the ore which lay in close proximity on both sides. Had it been run throughout in ore, better terms could have been secured when the Queen and Atlanta companies were consolidated in 1885, and certain better terms would have been granted had it been foreseen how nearly the property which the Queen company put into the combination (Copper Queen Consolidated Mining Company) had been worked out.

Little Cash Available

The terms of amalgamation arrived at after some months of negotiation were that the capital of the consolidated company was to be reduced from two hundred and fifty thousand shares of \$10 each, to \$1,400,000, and that the Atlanta company was to receive \$200,000 in cash and two-sevenths of the capital stock. The treasury of the Copper Queen (original company) was, however, so depleted that only \$50,000 was available for payment in cash to the Atlanta company after leaving on hand a sufficient working capital. The property transferred by the Copper Queen company was the Queen, a full

claim, the Copper Jack, Czar and Iron Monster. The Atlanta company contributed the Atlanta and the Ellie. The Rucker had been bought by Mr. Martin personally and was purchased from him by the consolidated company. Nothing was bought in 1886 but in 1887 were purchased the Hendricks and Baxter, the Belle Isle, Dividend and Wedge. In the same year were added the Copper Globe, the Cuprite and other claims. They were bought from the estate of John Tappner, a splendid young fellow who was ruthlessly shot down in the main street by the raiders of 1883. The White Tail Deer, the Mammoth and the Wade Hampton and the New York were secured about the same date, and also the Silver Bear group, which gave great promise at surface, which have not been so far realized in depth.

Gardner Purchased

The Gardner group was bought with some misgiving in 1890 or 1891, as the extension of the ore in depth so far south was considered very doubtful. The most important acquisition was in 1892. In 1888, when the Queen was heavily in debt, the Holbrook and Cave claims, owned by Mr. Goddard of New York, and which has been partially explored, were offered for sale; were bought by Mr. James and Mr. Dodge, and organized as the Holbrook and Cave company. These claims were actively developed and became notable producers. The mining was done by the Holbrook and Cave company, but the Queen contracted to do the hoisting and smelting of the ore. The ore mixtures were desirable, and the arrangement was advantageous to both parties. Subsequently the Holbrook and Cave company bought the Neptune company's property at sheriff's sale, as already narrated, and individual ownership of these properties, while they were directors in the Queen

company, might expose them to criticism, or lead to complications, so these two groups on which the Queen has continued in great measure to subsist ever since, were offered to the Queen for \$600,000 in stock, raising the capital of the consolidated company to \$2,000,000. Even at that figure some of the Queen stockholders demurred to the purchase.

There were other purchases made from time to time, including the Cogswell and most of the claims covering the Sacramento mountain, which I cannot but believe will some day be a source of concentrating ore. The only large addition of recent years has been the Lowell group, lying nearly a mile south of the original Copper Queen outcrop and whose ores lie at over one thousand feet below the surface. The wildest enthusiast of the olden days did not dream that a chain of partially oxydized ore bodies would be traced for that distance and to that depth. Yet today, as we all know, some have faith enough to believe and risk their money on their convictions, that these ore bodies extend for at least another mile and must be sought for at over a half mile in depth. This enthusiasm, based on recent results, we must admit, must be credited to our neighbors rather than to ourselves.

Romantic Irish Mag

The story of the Irish Mag and its eccentric owner, Daly, is a romance of many chapters. That it should have ended in the possession of the claims by men from the Lakes and Pittsburg, who have entered the camp and explored its recesses with such vigor and courage, is a happy termination of a history with a gloomy beginning.

But to return to the story of the old mine. When the Queen

was opened in 1880, copper had jumped from twelve cents to twenty cents. It fell in 1881 to eighteen cents, and continued falling till, when the consolidation was effected, it stood at thirteen cents. Unfortunately, it did not stop there, but reached in 1886 the low level of ten cents for Lake and a trifle under eight cents for bar copper of ninety-six per cent. There was therefore but little profit in a production of about 500,000 pounds a month, which was all the two small thirty-six inch jackets made from a twelve per cent yield. And when copper touched its minimum there was an actual loss. One result was that during the period of depression Mr. Martin and Mr. Reilly's interest were sold, in great measure, to Mr. James and Mr. Dodge. They had not only the courage to buy, but to advance the company, already in debt, money with which to build new works of large capacity, better design, and in a more convenient locality. They were erected on the hillside just north of the Czar shaft, and contained four thirty-six inch furnaces, to which model Mr. Lewis Williams was still ardently attached. The capacity of the new works we estimated would double the output to 1,000,000 pounds per month, and the facilities and improvements would enable us to make some money, but not much. The old works were abandoned in August, 1886, and the new works with four furnaces were blown in in May, 1887. The unwatering of the mine during the shut-down and a reasonable amount of exploration were included in the estimate; but our calculations were disturbed by an unusually wet season, and therefore, when in the spring of 1887 the new works were started, the Queen owed on its mortgages to the Atlanta owners and for advances, about \$300,000.

Prices Stay Down

Prices still continued so low that at a meeting in New York, before I went west in October to inspect the Seven Devils district in Idaho, I recollect that the most flattering anticipations we could entertain was that at existing prices it would take three years to pay off our debts. Before I returned east the French syndicate had been organized, and we were negotiating sales to M. Secretan for three years at 14 1/4, 13 1/4 and 12 1/4 cents. The \$300,000 debt evaporated like dew. The ore, after the amalgamation, up to this date, had been drawn almost exclusively from the Atlanta ore body, which had been so happily discovered in 1884. It extended for a short distance into the Queen claim. But during the shut-down we had been through the John Smith stope into the famous Southwest ore body--both on the Atlanta claim--and the future of the company was assured, on a million to a million and a quarter pound production per month, for years to come.

Mr. Ben Williams' report for the broken year of 1887 carries us back to primitive conditions. We burnt in our furnaces 10,253 tons of coke, or just what we now use up in one month, and under our boilers 3,554 cords of wood. One result of stripping our hillsides of this lumber has been the oft-recurring floods, which sweep down our canyon after every heavy rain. Till 1882, when our mountains had been robbed of all timber within miles of the town, I do not recollect a single destructive flood. This condition, however, constantly elsewhere presents itself. It seems inevitable. Without a railroad and cheap transportation, mineral coal cannot be hauled from mines hundreds of miles distant, and no railroad is ever built until industrial development has attained

a certain growth. In attaining this growth the unfortunate forest destruction inevitably and invariably occurs.

Railroad Problems

During the eight months of 1887 there were produced 5,945,550 pounds of black copper from ore taken almost exclusively from the second and third levels of the Atlanta, which yielded 9.99 per cent of copper. The first experiment was made with a large furnace of 80 x 42 inches, which replaced one of the 36 inch jackets.

The increased production forced on the management the necessity of providing better transportation facilities than the eighteen mule teams. I called on President Nickerson of the Santa Fe, with Mr. Martin, to point out the prospective value of Bisbee and advocate the Deming railroad scheme via the Sonora river, but he treated us with supreme indifference, and built south from Benson, under a traffic arrangement between Deming and Benson with the Southern Pacific. The results we all know. Our own railroad projects would probably never have been thought of if we had been linked up with a strong road from our point of delivery. Had the Santa Fe built from Deming to Guaymas, via Bisbee, and the Sonora river, they would have absolutely controlled the freight of Bisbee, and the Cananeas. Cananea would probably have sprung into prominence long before it did, and this Sonora branch of the Santa Fe, instead of being a drain on the parent stock, would have been a profitable feeder.

When the Queen was first opened all freight was hauled by team up the San Pedro valley to Hereford, and thence along the eastern flank of the Mule Pass mountains into Bisbee, a distance of about sixty-five miles. To avoid this circuitous route we used

to take the stage to Tombstone, and ride into Bisbee over the trail. By 1883 the Sonora railroad was running out of Benson, and the Copper Queen company had built an excellent toll road, with ten per cent grades, over the mountain from Bisbee into Fairbank, a distance of about ninety miles. The teaming over this road was done at \$7.00 per ton by Carr, and subsequently by Durkee at \$6.00. But in 1886 steam transportation was felt to be a necessity. Yet before engaging in railroad building, one of Fowler's traction engines was imported from England. It did good service in supplementing the inadequate teaming facilities, when our production suddenly rose to one and a quarter million pounds per month, and in hauling ore from the White Tail Deer into Bisbee. But Geronimo, as the engine was named, would not work in either sand or mud, and it was dangerous to operate the engine a distance from the machine shop.

Railroad is Built

A railroad had to be built. A survey for a narrow gauge road across the mountains, with ten per cent grade was first made, but it was ultimately decided to build a standard gauge with light rails (forty pound) around the mountains, from Fairbank, if it could be completed for \$200,000. Mr. Wambaugh was recommended as locating engineer by the Santa Fe, and he was allowed fifteen days to make preliminary survey and estimate. His estimate fortunately fell within the limit and the road was built, though not for \$200,000. The road was opened as far as the mouth of the Bisbee canyon before the close of 1888, but it was the spring of 1889 before the terminal work at Bisbee was completed. Our freight did not exceed one hundred tons per day for many years and was carried at a transportation cost of

2.9 cents per ton mile, or about \$1.00 per ton, as against \$6.00 when teaming.

The extension of the Arizona & Southwestern into Benson arose out of disagreement with the Santa Fe over a lumber contract. The Copper Queen had bought its mine timbers for about ten years from a Mr. Ross, whose sawmills were in Rock Canyon, in the Chiricahuas, about 7,000 feet above the sea. The land department, however, decided that the land off which he cut was agricultural, not mineral, and instituted a criminal action against Ross, and a civil action against the Queen. The government lost its suit against Ross on the first trial, but the civil action against the Queen dragged on until 1903, when it was decided against the government by the supreme court of the United States. The Copper Queen, although put to great expense in its defense, greatly profited by the prohibition to use local lumber, as Oregon pine was delivered at either Benson or Fairbank at a much lower figure than Chiricahua lumber had cost at Bisbee. The competitors for the supply of Oregon pine were lumbermen who billed over the Southern Pacific through San Pedro, Cal., and the Santa Fe, which imported it through Guaymas. Out of this competition grew the trouble and the extension of the A. & S. E. into Benson.

Since 1888 the Queen has enjoyed prosperity--not without waves of depression--but they never sunk her below a dividend level. The dividends were, however, for many years small.

First Year Best

The Arizona & Southwestern railroad was therefore built and owned by the Copper Queen company until 1901. When it became

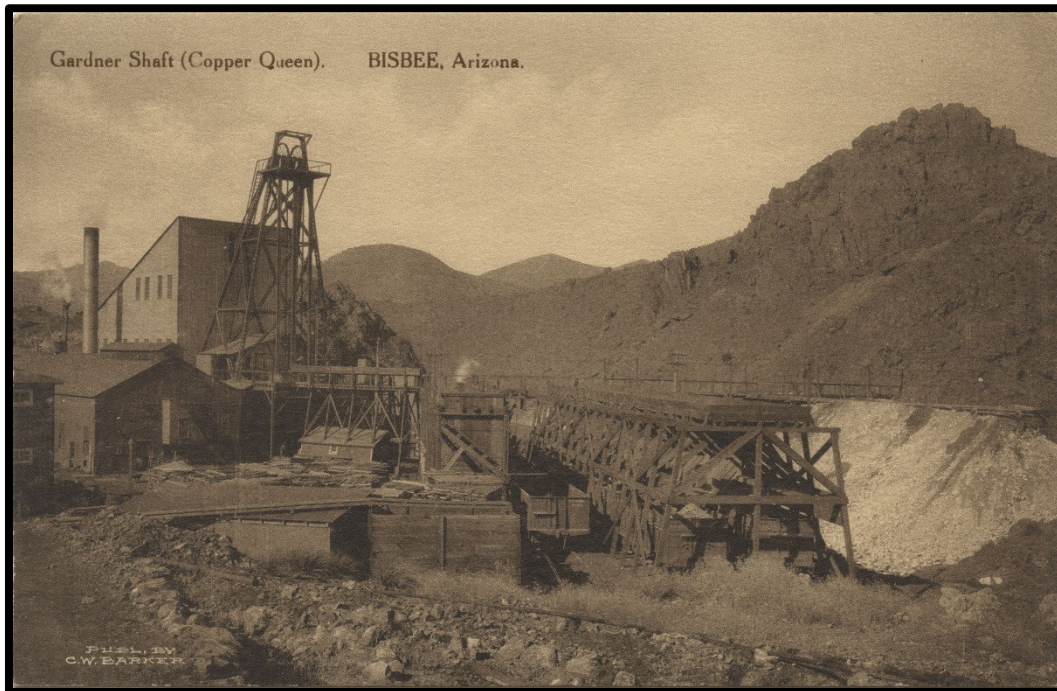
desirable to extend the railroad outside of the limits of the territory of Arizona, and for other reasons, which recent legislation has proved to have been good, the Arizona & Southwestern was sold to the El Paso & Southwestern Railroad company for \$750,000 in cash. This amount was distributed as a special dividend to the shareholders of the Copper Queen company. Since then mining and railroading have been completely disassociated.

The most prosperous period of the mine's history, considering the small output of copper and the insignificant investment in plant, was its first four years, when from some 36,000,000 pounds of copper produced, \$1,350,000 were distributed as dividends. Then followed three years of distress when debts not profits, were accumulated. In 1888 \$140,000 were distributed and \$105,000 in 1889, when the price of copper fell to almost as low an ebb as in 1886 and 1887. With the copper boom of 1890 and 1891, only to rise to \$420,000 in 1891, only to sink again to \$200,000 after the panic of 1893. Since then the dividends have responded to the greatly increased production.

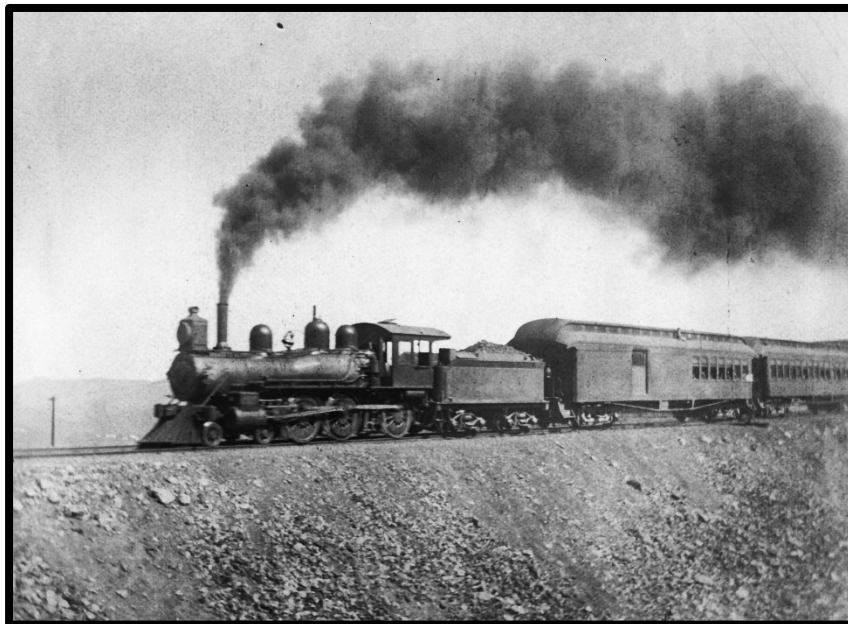
The records show the following as the product of the Copper Queen mines since consolidation. The Holbrook & Cave company between 1887 and 1892 added 14,708,000 pounds and Martin & Co., and the original Copper Queen company made 34,536,004 pounds before consolidation of the Queen properties. Thus the total production to the end of 1908 was 782,962,701 pounds of copper bars.

Output of Copper Queen Mines Since Consolidation

<u>Year</u>	<u>Number of Tons</u>
1885	6,721,535
1886	2,797,360
1887	5,945,550
1888	9,379,949
1889	2,408,000
1890	9,031,680
1891	10,203,683
1892	9,806,764
1893	13,795,618
1894	12,688,372
1895	15,741,731
1896	23,298,150
1897	23,999,873
1898	33,749,390
1899	36,901,684
1900	34,382,309
1901	39,781,333
1902	35,831,755
1903	36,939,800
1904	61,225,522
1905	76,791,981
1906	79,807,461
1907	62,502,961
1908	<u>81,886,236</u>
Total	733,718,697



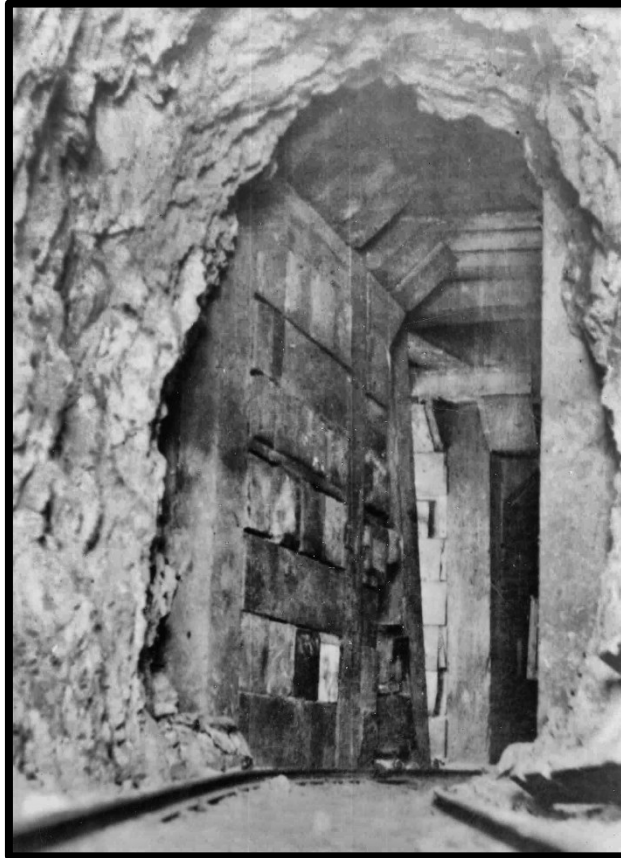
The Gardner Mine (p.14 para2)



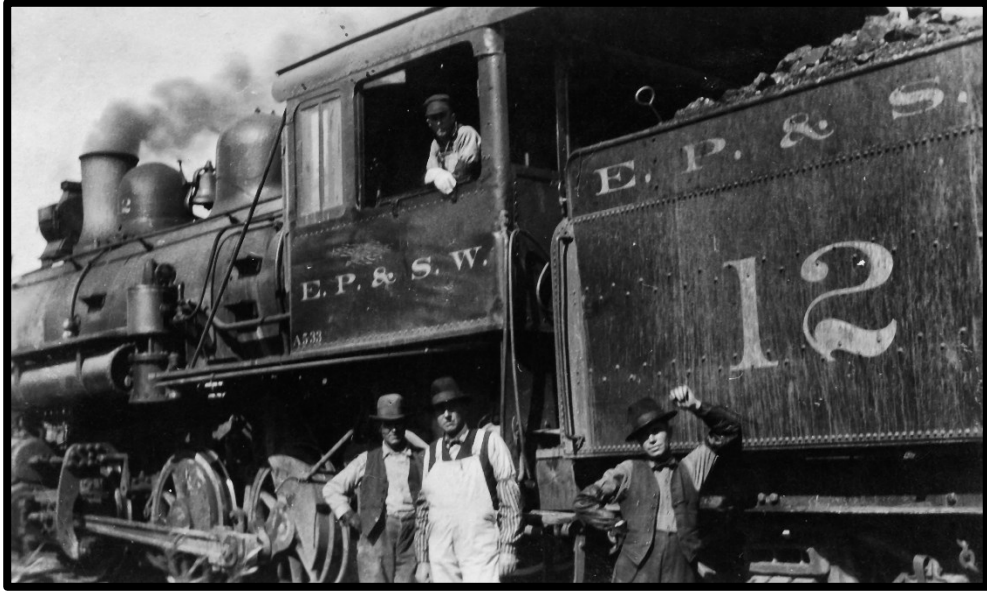
An Arizona and Southeastern Passenger train near Bisbee c-1900 (p.19 para2)



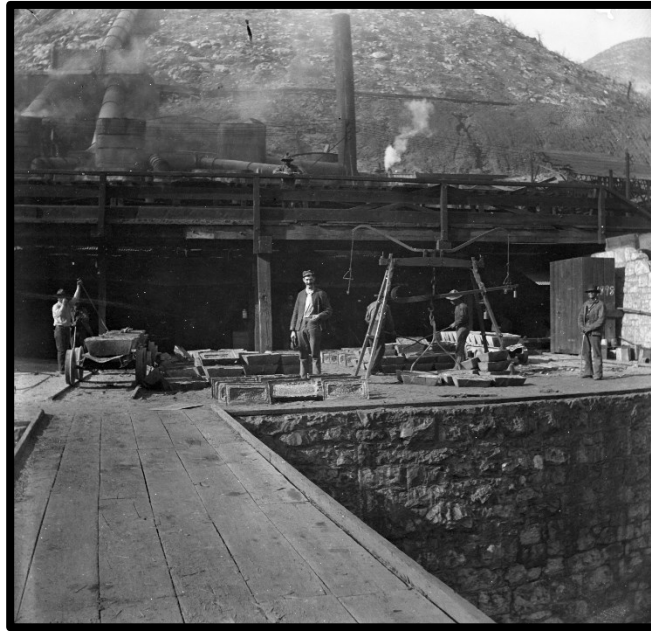
Arizona & Southeastern locomotive c-1900



The mines used huge quantities of timber as seen by the heavily timber crosscut above c-1905(p.20 para 2)



A El Paso & Southwestern Locomotive and Crew c-1908 (p21 para1)



Weighing copper ingots at the Copper Queen Smelter in Bisbee c-1890 (p.22 chart)

We have already remarked that the supply of ore during the first two years after the consolidation came mainly from the Atlanta ore body, and that in 1886 the John Smith and Southwest ore bodies also in the Atlanta were discovered and opened. The ore from these stopes on the second and third levels of the Atlanta yielded uniformly between 8 and 9 per cent of copper, and was practically free from sulphur, and supplied the smelter for three years with over 75 per cent of the ore, the Queen itself contributing substantially nothing. This wonderful ore body, the Southwest, was cut off sharply at 25 feet below the third level, as the original Queen ore body terminated below the old 400 (the present 200). Other sources had, however, meanwhile been developed, notably in the Dividend; but these new ores carried more or less sulphur, and as a result our bars not only fell off in percentage, but were depreciated in quality, and we made an increasing quantity of matte. This was removed partially, as it chilled on top of the copper bars, was roasted in stalls and returned to the cupolas. But it became imperative to abandon the conversion of our oxydized copper ores into metal directly by a single fusion, and to matte our mixed oxydes and sulphides.

Goes to Europe

The decision was reached in 1892, and I went to Europe to investigate the Mahnes-Bessemer process, and a peculiar form of barrel converter, which was preferred there to the upright converter heretofore used in Butte, and which had been introduced there by M. Mahnes' representative Mr. Franklin Farrell. At M. Mahnes' suggestion my son and I visited the works of the Metallurgical Society

in Leghorn, where a very small type of barrel converter was in operation, worked under very low blast and handled without electric cranes. On my return Fraser & Chalmers designed for us a converter of a larger size, but of the barrel type, and three of these were installed with a Riedler blowing engine, and started in the autumn of 1894. The blowing engine was built to give a pressure, if necessary, of thirty pounds should we be obliged to revert to the deep, upright converter, but in practice it was found that a pressure of eight to twelve pounds was sufficient.

The thirty-six inch furnaces had meanwhile been displaced by furnaces of 120 x 42 inches. In the first Bessemer plant each converter of an estimated capacity of one million pounds of copper per month was coupled up with the well of a cupola, which was expected to smelt approximately the quantity of ore into matte which the converter, harnessed to it, would reduce. But after some years of practice, the loss of time, occasioned by the converter waiting for the furnace, or the furnace for the converter induced us to introduce an electric crane, whereby the matte from the well of four furnaces could be converted to any one of the four converters. The silver in our ores is not uniformly distributed, and the cost of electrolytic refining was heavier than it is now, and therefore at first we assigned one coupled furnace and converter to selected copper-silver ores; but as the refining charges were lowered we found it profitable to refine all our copper electrolytically to receive the higher price which electrolytic copper commands over casting, and the \$10 to \$12 of precious metals which each ton of bullion from Queen ore carries.

Converter Tests

When the Queen was opened the application of the pneumatic method to the metallurgy of copper had not been practically affected, and to reduce sulphide ores by the old methods with the high cost of labor and fuel would have been unprofitable. But when in the Bessemer converter the liquid matte from the cupola could be blown up into copper of 100 per cent instead of an old black copper standard of 96 per cent, the increased cost of reduction was insignificant, and even this was compensated for many fold over by the saving of copper in the slags. In 1894 the furnace yield of our ore was 7.57 per cent, but in 1894, the first year of the Bessemer method, it rose to 8.39 per cent, the difference being entirely in the reduced slag loss. We now know from actual treatment of the old slags made before the introduction of the converter that they yield 2.5 per cent. Those of the Clifton and Globe districts yield even higher, which accounts for the ill-success of mining in those camps when the furnaces were fed with oxydized ores alone.

The Bessemer converter gave moreover a great impulse to production by enabling us to handle ore carrying sulphur, and in some cases a little lead, which were forbidden admission to the black copper furnace. The table of production shows the rapid growth of production after 1894. But when expansion reached 3,000,000 pounds per month it became evident that we had grown too big to be accommodated in our old quarters, and that we must move.

Douglas is Selected

Meanwhile development in other directions had occurred, which made it possible to select a site which permits of unlimited

expansion. The principal owners of the Copper Queen stock had acquired mines near Nacozari, some seventy miles south of the international boundary line. The location of the American and Mexican custom houses required that border be crossed by teams where Naco now stands, so the Arizona & Southwestern built a branch to that point, and the railroad surveyors spent nearly two years trying to find a practicable southeastern railroad route south of the line, through the network of mountains into the Fronteras valley, before it occurred to us that the sensible course was to keep as far east as possible in the United States Territory, and look for a due north and south location into Mexico. That was found, and Douglas was selected as the junction point between the extension of the Arizona & Southwestern line and the projected Nacozari railroad. That determination reached the Sulphur Springs valley, with unlimited space and unlimited water, was without hesitation decided on as the site for our future works by the Queen and the Calumet & Arizona company.

If so much copper was to be made in Douglas, why not carry it straight up to the Southern Pacific at Separ, or Lordsburg, instead of back west to Benson? Negotiations for a trackage contract were opened with the Southern Pacific during the interregnum between Mr. Huntington's reign and that of Mr. Harriman, but they did not result in an agreement, so the Arizona & Southeastern became the El Paso and Southwestern, and that company built independently into El Paso.

Since then it has reached forth in search of coal at Dawson. But in railroad building and railroad buying the control-

ling financial interests of the El Paso & Southwestern have had primarily in view the desire to foster the great copper enterprises of the southwest, and the people dependent upon them--not to engage in indiscriminate railroading. Every railroad built for business and not for speculative motives, intended to make money out of traffic, not out of stock gambling, must look to some commercial or industrial center for its subsistence. The El Paso & Southwestern looked to Southern Arizona and Northern Sonora and it has not been disappointed. And the copper interests depending upon them which means practically the whole population, have no reason to dread that a road, which has no higher aspirations than to serve them, and no connections but their alliance, will be indifferent to their legitimate and just requirements--and complaints.

Over Million Scrapped

The Copper Queen has benefited neither more nor less than her neighbors, but that she has benefitted, the growth of her production from 36,939,800 pounds in 1903 to 81,986,256 pounds in 1908 bears witness.

The old works at Bisbee stood on the Queen books at \$1,223,959.34. They were scrapped when the move was made. The new works at Douglas, with their maximum capacity of 130,000,000 pounds of copper a year, have cost \$2,500,000. But we believe that the life of the mines fully justified the sacrifice of the old smelter and the outlay on the new.

The Queen is now twenty-eight years old--an old age for a mine which has been actively worked; and she is still vigorous--never more so. But she retains her health because her growth has

been slow and never forced, and the policy of the governing board, which in the past consisted of two great merchants, Mr. James and Mr. Dodge, was to conduct the mining branch of their investments on the same principles of sound commercial finance as had made them so eminent in other business ventures. From the day they organized the Atlanta Mining company and co-operated in reorganizing the Copper Queen they never sold a single share of either stock.