RECOLLECTIONS OF EARLY DAY MINING IN ARIZONA

By Arthur L. Walker

During the winter of 1934 I spent a few weeks in Tucson, Arizona, at one of the luxurious hotels of which the citizens can be justly proud. The conveniences which the city now offers to visitors make it a delightful winter resort and it is not to be wondered that people flock to Tucson to enjoy comfort and health in that marvellous climate. Health was there fifty years ago—unless one happened to get into an argument with some one who could draw first and was quick "on the trigger"—so also was the climate, but comfort was lacking. I can vouch for that.

When I first saw Tucson in the real frontier days of 1883 it was not much to boast of. The main street was flanked with saloons and dance halls on both sides and a few adobe one-story houses were scattered around in the town and on the outskirts. There was a Catholic church, built years before, the Southern Pacific Railroad station, and a hotel. I well remember the hotel as I patronized it for a short, but all too long a time; a saloon under my room made sleeping difficult; often impossible.

All sections of this country of ours have changed greatly during the past half century; hamlets have become towns and towns great cities, with stores, hotels and office buildings of enormous size. In Arizona marked improvements have also taken place, but the interesting feature to note is the change in the residents. Fifty years ago the inhabitants were Indians, principally of the Navajo and Apache tribes, the latter being often on the war path; teamsters who carried freight, by ox, mule or horse team, hundreds of miles from the Southern Pacific Railroad in the south, and the Atlantic and Pacific Railway (now the Atchison Topeka and Santa Fe) in the north to points in the interior; cowboys who roamed the country with no wire fences to hinder them; prospectors who scoured the mountains and hillsides in search of ore containing valuable metals; miners who worked in the many small mines then being opened and operated; with of course a fair sprinkling of county and state officials, trades people and, it must be admitted, saloon keepers who could serve straight whisky that would corrode a cast iron pipe, and expert gamblers who made life more interesting for those who desired to lose money that way instead of speculating in stocks.

In addition to these picturesque members of the community there were the Mormons who came down from Utah, entering Arizona from the northeast. They settled in the fertile valleys where they devoted their energies to cultivating the land and raising stock. In time these settlements gradually extended to the south, so that by 1882 the Mormons constituted a considerable part of the inhabitants of the eastern section of Arizona Territory.

Then there were the many military posts, scattered all over the Territory, for the protection of the people from the raids of the Apaches. In those days it was generally considered the Indians were a curse and should be exterminated, that "the only good Indian was a dead one." Many of us now believe, however, that had the Indians been treated decently by the whites who came in contact with them and had the government at Washington been fairer in its dealings, there would have been much less trouble. The entire population of the Territory in the very early eighties was from 40,000 to 50,000 exclusive of the Indians; the latter numbered about 4,000.

Those were the days of real romance on the frontier. The people were rough and ready but were hospitable to a remarkable degree, always willing to help; and any one, even a tenderfoot, was safe, possibly safer than in one of our eastern cities, provided he behaved himself.

History informs us that the Spaniards, who came over from Mexico, discovered lead and silver ore in southern

Arizona in the Seventeenth Century, one of the earliest discoveries of any ore in this country. Attempts to extract the metals by crude methods were unsuccessful for obvious reasons. Then, after two centuries the Mowry mine, near Tucson, was discovered about 1850 and operated on a moderate basis for a short time before it was abandoned.

While the mineral wealth of Arizona was fully recognized from about the middle of the last century, it was not until the consummation of the Gadsden Treaty, in 1854, that prospecting and mining on an extended scale began to be carried on, and this was only made possible through the protection from Indian raids given the miners by the United States troops. In 1862 the exigencies of the Civil War compelled the government to withdraw the soldiers whereupon the Indians became such a menace that mining operations were suspended.

After the close of the war, when troops were sent west again, the miners drifted back and many promising mines were located, some of which were so successfully operated that they paid dividends for years. In those days gold and silver were the only metals considered worth while and all copper prospects were ignored.

The principal region of the occurence of the precious metals and of copper and lead is in a broad belt extending diagonally across the State from the southeastern to the northwestern corners. These metals are widely distributed throughout this region but the chief producers of gold have been located in the northwestern part of this belt, and the large copper properties mostly in the southeastern section.

From 1866 to 1875 the value of gold and silver produced in Arizona was comparatively small, $500,000 to $1,000,000 annually. Then the output of the precious metals began to increase rapidly. In 1878 it reached $3,500,000 and in 1881, $8,300,000 of which gold accounted for only about $1,000,000.[1] Discoveries of extraordinarily rich silver ore in Gila, Cochise, and Pinal (northern part) counties accounted for the marked increase in the production of that

[1] The values given are simply indicative, as statistics of early production are not reliable.

metal, but after 1882 the output decreased rapidly, due to exhaustion of the mines in depth. It was then apparent that Arizona would not be a large producer of silver.

When I arrived in the Territory I heard many fabulous tales about silver mines; what had been accomplished and what might be expected. Interesting as these stories might be, they were too romantic to record, but I feel quite safe in making the following statements, for I visted the mines mentioned shortly after my arrival.

In the McMillan district, about twelve miles northeast of Globe, a vein of silver ore was discovered on which many mines were located but only one of them, the Stonewall Jackson mine, ever produced profitable ore. In this mine a vein of solid silver, several inches thick, was discovered, while sinking a shaft on the footwall. It was stated to me on good authority that when this silver was hauled to the nearest point on the railroad it made up a full carload. The capacity of the car was not mentioned but in those days they were rather small. There is no doubt about finding the silver, however, for I saw samples of it on my arrival in Globe and when I visited the mine the location of the vein from which the silver came was shown to me, as were also more samples of the beautifully crystallized silver, different from any usually found. No further discoveries of real value were made in these mines after this rich pocket was excavated.

Another remarkable occurrence of silver was discovered about twelve miles north of Globe, at a place called Richmond Basin, a plateau at the foot of some low hills. A number of almost pure silver chloride (cerargyrite) nuggets were found here, some of them weighing as much as thirty pounds. Large silver nuggets were found even in later years.[2] One old lady, the wife of a prospector who had staked out a claim in the basin, told me she could go out and pick up a nugget any day before breakfast till the news got around and the rush came in. About 1881 the McMorris mine was located in this basin and some rich silver veins developed which seemed to warrant the construc-

[2] See cut in Report of Governor of Arizona, 1897, p. 30.

tion of a mill. There being no water at the mine, a site was selected at Wheatfields, on Pinal creek, and there a stamp mill was erected. Unfortunately the veins in the mine petered out and though the shaft was sunk to a depth of eight hundred feet and the mine thoroughly exploited, no more ore was discovered. The mill was really never called upon to show what it could do.

Mr. Flandin, the agent for the French company which had expended a large amount of money on the McMorris property, in development and construction, informed me that, in his opinion, no silver ore would be found in depth in any of the mines in Gila county. Time has proved the correctness of his forecast. All of the ore was at or near the surface, and for this reason these mines proved bonanzas for the prospectors in the early days. Other mines in this class were the Alice, Rescue, Miami, Old Mexican and Dime—forgotten long ago.

One of the most interesting silver mines was the old Silver King, in the northern part of Pinal county, near what is now Superior. In 1875 Benjamin W. Regan, Mason, and two or three other prospectors on returning from Globe, camped at the foot of the old Stoneman grade after having travelled twenty-five miles through a hostile Indian country. It is told that a mule while pawing the ground uncovered a ledge of black looking rock from which one of the men broke off a sample and, finding it very heavy, scratched it with a knife. Much to his surprise and joy the steel cut into soft metal which he recognized at once as native silver. The four men then located the property, naming it the Silver King mine. It was a paying proposition from the start, as the very rich ore extracted from the surface workings and shipped to San Francisco assayed $8,000 to $20,000 per ton.[3] Later a stamp mill was erected at Pinal, about five miles to the south, to treat the lower grade ore, there being no water for milling purposes at the mine. The ore was hauled to the mill in heavy wagons, four in a train, the motive power being twenty-two animals, horses and mules, in each team. In the mill it was crushed by stamps and

[3] McClintock's *History of Arizona.*

then concentrated on a new type of Frue vanners, six feet wide. The result was a high grade concentrate and a comparatively poor tailing. In 1883, when the mill had been operating successfully for some years under the supervision of Francis H. Blake, son of Professor William P. Blake, then professor of mining at the University, the average value of the ore was from forty to fifty dollars per ton and the recovery in the concentrate about eighty-eight per cent—good work for that period. The concentrate was shipped to the smelter near San Francisco.

In the lower levels in the mine a larger percentage of the silver in the ore occurred associated with friable minerals, principally barite, which made a satisfactory recovery by water concentration impossible. How to treat it was a problem. Arthur Macy, an experienced mining engineer, was superintendent in charge of all operations. He decided to build a second mill to treat this class of ore by a method of chloridizing, roasting and pan amalgamation, a process used at Virginia City, Nevada, on the Comstock Lode, in earlier days. Robert Peele, afterwards professor of mining at Columbia University, New York, was placed in charge of the new mill and in 1885 it was in full operation. The recovery in the mill was eighty per cent, a much more satisfactory result than could have been obtained if this ore had been treated in the concentrating mill due to the high specific gravity of the barite. The metal recovered was melted in a small furnace with flux, the products being silver bullion, which was shipped to the San Francisco mint, and a rich slag, which was sent to the smelter.

After several bars of silver had been made away with, in the course of transportation, by industrious highwaymen, the bars were cast of such a weight that they could not easily be carried away on the back of a mule. That put an end to these robberies, which had endangered the payment of dividends. Both mills were operated side by side 'till 1888 when the mine became exhausted and all work was practically suspended.

The ore in the Silver King mine occurred in an almost vertical pipe vein, the size of which varied greatly at different levels. There was a bonanza below the 250-ft. level but the great bonanza on the seventh level, about 800 feet below the surface, furnished enough ore to pay many dividends. Below this level the vein was absolutely cut off by a fault and while many efforts have been made to locate a continuation of the ore body none has been successful, though at times small veins or stringers of rich ore have been found from which silver has been recovered in comparatively small quantities.

During the last year of the life of the old Silver King, dividends were paid regularly, $25,000 a month, and it is officially reported that the stockholders received $1,950,000 in dividends during the life of the mine, a large amount in those days.

Silver ore was discovered near Tombstone, in the late seventies. In the early eighties John A. Church was smelting ore from the Contention mine, one of the principal properties in that district, and producing a lead-silver bullion. The unique feature of this smelting operation was the use of manganese oxide in lieu of iron oxide for a basic flux in the furnaces. Church succeeded in producing satisfactory results with a slag containing as much as forty per cent manganese oxide. This is one of few cases on record where iron was more expensive for fluxing ore than manganese. Tombstone was far more noted, however, as being the home of that celebrated paper, the *Tombstone Epitaph*, a publication in which the daily shooting scraps were recorded.

While in the early days silver occupied a more prominent position than gold in the Territory, in later years the gold mines have produced in a much more profitable degree.

One of the oldest gold mines in the Territory was the Vulture in Maricopa county, discovered in the early sixties. A succession of slips or faults made it difficult to follow the vein when the property was first developed and tended to discouraged operations. However, the owners preserved in a courageous manner and their efforts were fully rewarded, as a vein of ore was opened up from which millions of dollars in gold have been produced. Now, more than seventy years after its discovery the old Vulture mine is still active but lower grade ore is being extracted.

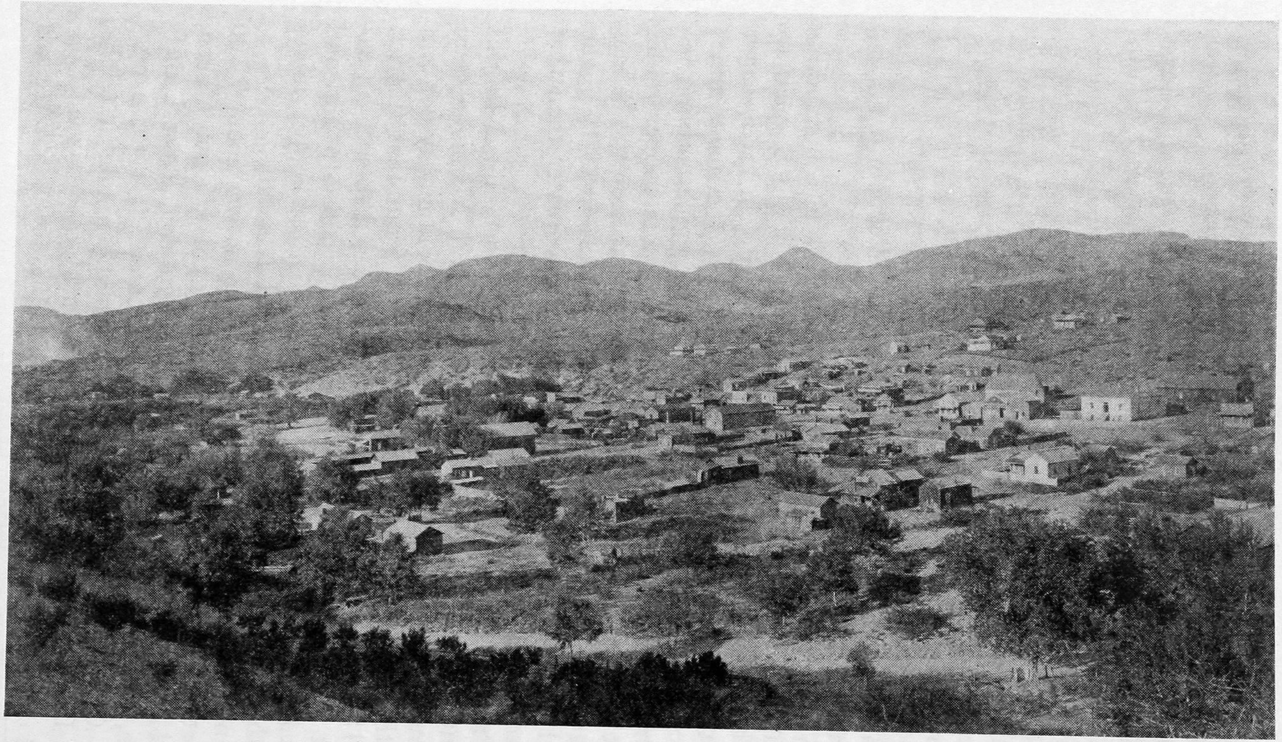
The Congress mine in Yavapai county produced a large amount of gold in the late nineties and early part of this century. In 1897 the production was about 3,600 ounces of gold per month. Later the Tom Reed and United Eastern mines, near Oatman in Mohave county contributed largely to the output of gold from Arizona. Many other mines might be mentionel if space permitted. In later years a large tonnage of gold and silver ore has been smelted with copper ore, thus increasing the output of the precious metals materially, until the production of copper was curtailed a few years ago.

While Arizona has never been noted as an outstanding producer of the precious metals, tribute should be paid to the hardy and adventurous prospectors who, in their search for gold and silver, discovered and located the many mines that were to become the backbone of the copper mining industry in that Territory. Later lower grade copper mines were developed and since 1910 Arizona has been the banner state in the production of copper. From 1850 to 1933 the total production from this State has been greater than that of any other in the Union.[4]

Prior to 1850 but little copper ore was mined in this country. Then the Lake Superior mines in Michigan were opened up and for the next thirty years about eighty per cent of the domestic copper produced came from that district. In 1880 the demand for the metal increased to such an extent that the price rose to twenty-three cents a pound and this high price promoted the development of copper mines in the west, especially in Arizona and Montana.

In 1882 the output of copper in Arizona was about 9,000 short tons, the producing mines being the Copper Queen, Old Dominion, Pima, Longfellow, Columbia, Russell, Buffalo, Neptune, Long Island, and Detroit. Of these only the Copper Queen at Bisbee, the Old Dominion at Globe, the Longfellow at Clifton (purchased by the Arizona Copper Company, together with the undeveloped Metcalf

[4] Minerals Yearbook, 1934, p. 9.



The town of Globe as it appeared in 1892. The smoke from the smelting plant of the Old Dominion Company can be seen on the left.

properties, in 1882) and the Detroit, at Morenci (acquired by Phelps, Dodge & Company who controlled the Copper Queen) survived the drop in the price of copper in 1884. The United Verde came into production in 1887, and Holbrook and Cave (acquired later by the Copper Queen) in 1888.

None of these mines produced copper in any quantity prior to 1880 except the Copper Queen and the Longfellow.

I arrived in Globe City—the euphonius name then given to the mining camp which is now Globe—on August 1, 1883. It is interesting to recall my trip from the east for it seemed to me when I started out, a tenderfoot from the Columbia School of Mines, I was headed for some unknown region at the ends of the earth. The railroads ran in a most leisurely manner, twenty miles an hour was the schedule on the crack Southern Pacific train. At the end of my railroad journey I was dumped off at Casa Grande about 10 P. M. where a boarding house was pointed out to me by the station master. It was a two-room adobe building; one room for the landlady's family and the other for the guests. I was the only guest that night but there were other small occupants, that kept me awake till it was time to get ready for the Globe stage the next morning. We left Casa Grande in a four-horse Concord coach, travelling through the deep dust and under a broiling sun to Florence where a lunch was served that was uneatable. Then in the afternoon we went on to Riverside (now Ray Junction), on the Gila river, where an even less tempting meal was offered to us in the evening. At Florence three other passengers had joined me. One of them was a mining man and it was a great pleasure, and most interesting, to listen to his stories about the country. At one place along the route an energetic individual had erected a canvas sunshade and bar—a board laid on top of two empty barrels—from which he dispensed beer to quench the thirst of the few travellers who passed that way. The mining man asked us to join him at the bar, which invitation was gladly accepted. He ordered four beers, and four very small glasses filled with rather warm liquid were placed on the bar before us.

The stuff was wet however and relieved our parched throats. Then our host threw down a silver dollar and I, remembering our five-cent overflowing steins in the east, waited to see him receive his change, but there was no change; the lowest charge for anything in those days was twenty-five cents, two bits. Later the low limit was reduced to one bit; a short bit was ten cents and a long bit was fifteen cents.

After looking over my supper I again boarded the stage and we started up the grade from the Gila river to cross the Pinal mountains during the night. I was then the only passenger so I climbed up on the box beside the driver to be able to talk to someone. He did most of the talking however and told me one story after another about how the stages had been held up by road agents, the leaders of the four-horse team shot down, the Wells-Fargo messenger killed and the strong box rifled. The passengers were lined up and relieved of any cash and valuables they possessed but the driver was not molested, if he behaved himself and obeyed orders. To make his stories more realistic he pointed out huge boulders from which the highwaymen emerged when practicing their art, and sharp turns in the road where they could easily remain concealed till they went into action. Of course I did not believe all he said but it was getting cold so I descended to the inside of the coach where I nearly froze. I had no overcoat, as I did not think one necessary for a midsummer drive in Arizona, and wore only very thin clothes. In spite of the cold I would doze off, as I had not slept the previous night, and then a sudden and violent contact of my head against an iron brace as we went round a curve or hit a rock, would bring me to. It was a joy when we ended the descent on the other side of the mountain and felt the warmth of the rising sun. I will never forget that ride, though afterwards I staged in the Territory many times, often for four days in succession.

We arrived in Globe at 6 A. M. having made the distance of about one hundred miles in twenty-three hours. I went to the Pascoe House, run by the family of the Sheriff, B. F. Pascoe, and my first act was to consume as much food for breakfast as would suffice for three good meals. The place was clean but not very elegant. I was shown to a small room, which I could have to myself. I soon discovered it was necessary to exercise care in modulating my voice as the walls were made of one inch boards, and all sounds could be heard from one end of the building to the other. The ceiling was made of cheesecloth, tacked to the walls at the desired height, and allowed to flap at will in the air currents. A paper hanger who came later, to put paper on the cheesecloth that covered the wooden partitions, told me that once he had been engaged to paper the cheesecloth ceiling in a bar room. He tried it but it was like trying to cover the underside of a big balloon waving around in the wind.

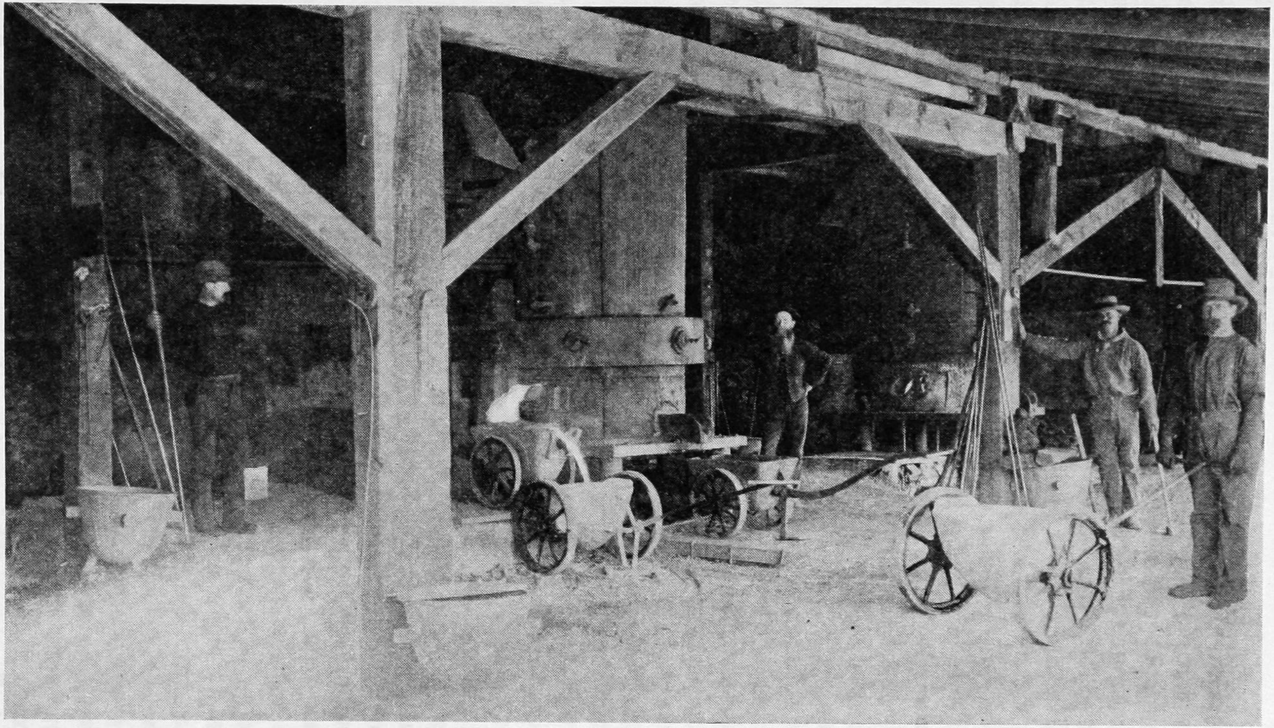
On reaching Globe I reported to Alex. Trippel, the metallurgist, who was to be my boss for four years. I was to fill the position of chemist and assayer.

The copper mines which were later to become the principal source of ore supply for the Old Dominion Copper Mining Co., were discovered and located for gold and silver about 1874 by Regan, Mason and others in their party, but little of these precious metals were ever found in them. In the original Old Dominion mine, located about four miles north of Globe, there was a narrow vein of rich copper ore containing particles of gold visible to the naked eye. This vein was opened up in the late seventies and in 1881 ore was mined and then smelted at a small plant near the Bloody Tanks, so named because it was here that General Crook had overtaken a band of Apache Indians he was pursuing, and exterminated them. Only a small amount of copper was produced and the cost of shipping it was so great that the results were unprofitable.

In January, 1882, Judge Hackney, the pioneer editor of the *Arizona Silver Belt,* wrote in his paper about this property and in the course of his article stated, "We hear that free gold in large quantities is found in the mine . . . a gold and copper mine is not a copper mine and the gold does not add a fraction to the commercial value of the copper." He then suggested the ore be sent to a "separating plant" in San Francisco. The only difficulty about this idea was that the information given the Judge was wrong; the actual value of the gold in the ore was very small and a "separation" would not have been successful. Hackney was a keen observer however and in 1878 was one of the first to call attention to the extensive and rich bodies of copper ore revealed by the superficial workings on the mines in the vicinity of Globe, and predicted that the value of these mines would come from copper and not from silver. He was a pioneer with great ability, with unbounded faith in Globe and Gila county. After Judge Hackney's death his nephew, Joseph Hammil, a worthy successor, became editor of the paper.

The Globe and Globe Ledge mines, about a mile north of Globe, were operated by the Globe Mining Company in 1881, but to a limited extent only. The silicious character of the ore made it difficult to smelt and high freight rates and costs precluded any chance for profit. In 1882 the Globe and Old Dominion mines, together with some claims in Lost Gulch and Webster Gulch, near the present location of the Inspiration mill, were sold to M. H. Simpson, of Boston, who transferred them to the Old Dominion Copper Mining Company, under which name they were operated. The small smelter from the Bloody Tanks was moved to the site of the Globe mines for it was recognized that these were the only properties in the entire group that stood any chance of producing copper profitably, under the existing conditions.

Production of copper commenced in 1882, but the costs were so enormous that in spite of the high grade ore treated the debt which had been incurred in the development of the property increased rapidly and in January 1885 amounted to almost a million dollars. In 1884 however the old and reliable firm of Pope, Cole and Company of Baltimore, Maryland, owners of one of the first copper smelting plants established in this country and one of the largest creditors, had taken over the financial management of the property, effected a satisfactory arrangement with the other creditors and the financial troubles of the company, which



The 36-inch copper furnaces in the old smeltery of the Old Dominion Company, showing slag being run from the furnace.

had been numerous and weird, were apparently put on a firmer basis. When I arrived in Globe and learned that I might or might not receive my salary on the next pay day I was much disturbed as walking was not good and the Indians along the route none too friendly. But as a matter of fact money was always forthcoming and never a pay day was missed.

George A. Pope, of Pope, Cole and Co., was elected president and Mr. Harnickell, of New York, secretary and treasurer. Then Pope, Cole and Co., themselves became embarrassed, and in 1886 the property passed into the control of William Keyser, of Baltimore, and his associates. Thus after a checkered and romantic financial career, the Old Dominion Copper Mining Company found itself in the hands of very strong interests and its financial troubles at an end. In 1887 the mines were shut down on account of the low price of copper, but operations were resumed January, 1888.

In the early days ore containing fifteen to twenty per cent copper was extracted from the surface and upper levels of the mine, and hauled by a four-horse ore team down grade to the smelter, a distance of about three quarters of a mile; that is, the team walked ahead of the load of ore going down but had a difficult job to pull the heavy empty wagon back to the mine. The ore was smelted in small round water-jacket furnaces, thirty-six inches in diameter without any flux, the products being pig copper, about ninety-six per cent pure, and a slag which was quite rich. Coke was expensive, costing sixty dollars a ton at the smelter, and it was deemed wiser to permit an excessive amount of copper to pass into the slag than to add enough flux to make a good smelting charge which would increase the weight to be smelted and require much more coke. The Copper Queen Company built a railroad from Fairbank to their plant at Bisbee, a distance of forty-seven miles, to secure cheaper coke and supplies, and the Arizona Copper Company also built one from Lordsburg, New Mexico to Clifton, sixty-nine miles. To finance a railroad from Bowie to Globe, 130 miles through the Apache Indian reservation, was another proposition however, especially when the Old Dominion was in financial distress. Even after 1888 when the large debt had been paid off and most satisfactory profits were coming in, William Keyser, the wise financier, would not agree to assist in building the road. He and Simpson were not interested in mining and the final results were entirely satisfactory to them, so when opportunity offered they sold the property to the Lewisohn Brothers of New York in 1895 for a most satisfactory figure, and then the purchaser built, or assisted in financing, a railroad from Bowie to Globe.

The geology of the Globe mines has been described at length and in an admirable manner by Dr. F. L. Ransome, and it is simply necessary to state here that, in the group of which the Globe mines were the principal ones, the footwall was an eruptive diabase having a dip to the southeast of from forty-five to fifty-five degrees and a strike to the southwest. On this footwall occurred a regular and ever-present talc slip. The hanging wall was limestone. The ore bodies in the thick vein between these two walls had a general dip to the southwest, were extremely irregular, and sometimes extended a hundred feet or more into the hanging limestone. To the southwest of the outcrop on the Globe mines the ground was covered with an irregular sheet of dacite (termed trachyte in the early days) and it is under this flow of dacite that the principal faults to the southwest occur.

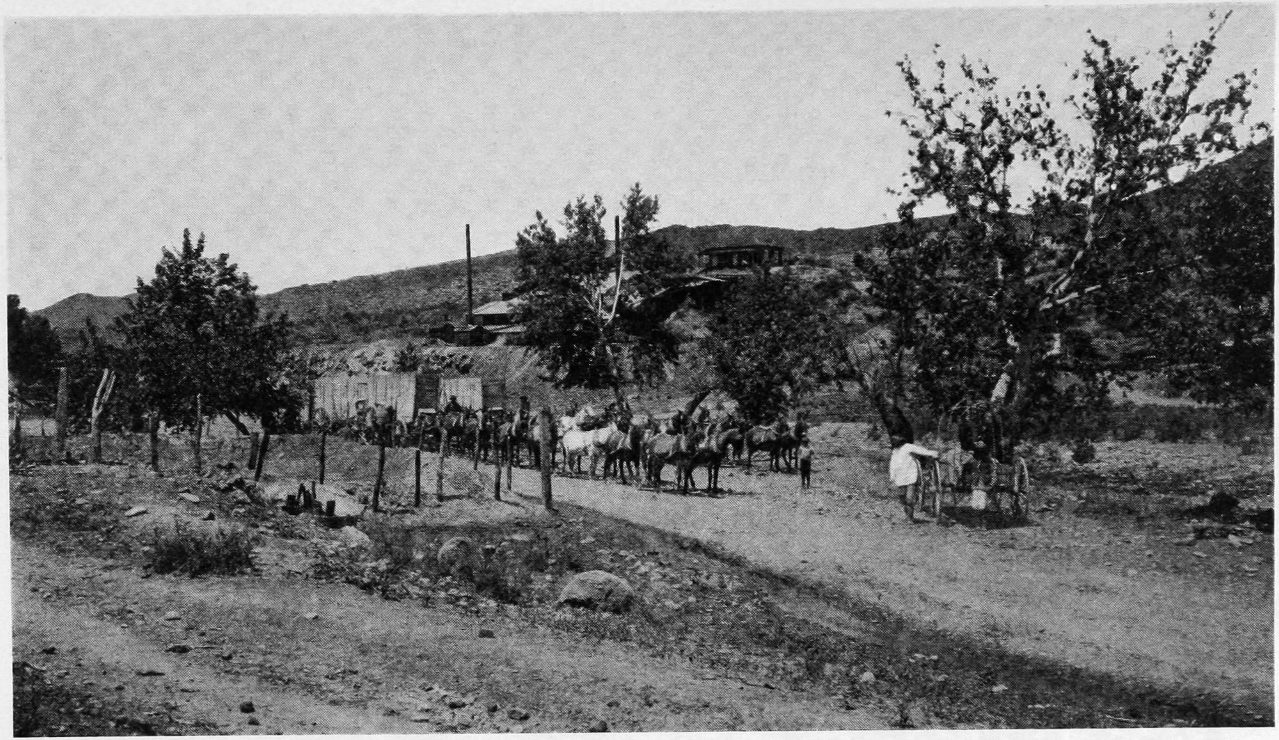
The ore was divided into three classes: (1) silicious oxidized ore; (2) basic oxidized ore, which occurred in extensive bodies throughout the vein; and (3) sulphide ore, of which there was very little, the first regular seam or vein having been encountered between the sixth and seventh levels.

Silicious ore, with a high copper content, occurred in more or less irregular veins along the footwall, sometimes in large bodies, from the outcrop to what was in 1893 the lowest level, the eighth. The surface outcrop of silicious ore, a magnificent body about thirty feet thick, contained from twenty to thirty per cent copper as carbonate, the remainder being principally, silica. On account of its high silica content it was for many years considered impossible to use it and not until 1888 and 1889 was it mined, mixed with suitable flux and smelted. The result was most profitable.

The cost of coke at the smelting plant was reduced to about forty-five dollars a ton (of two thousand pounds) in 1888, of which twenty-nine dollars was for wagon freight for the haul from the railroad. In good weather it took about a month for the teams to make the round trip but during the rainy season very much more time was required as the roads became almost impassable. We found the best quality to be the cheapest in the end, and frequently used coke brought all the way from Cardiff, Wales. It contained only three per cent ash while some of our domestic coke contained twenty per cent. To pay railroad and wagon freight on that ash was an expensive proposition. Besides the ash often required additional flux and extra fuel to smelt it. But it seemed strange to bring coke all the way from Wales to Arizona. Ocean freight charges to San Francisco were cheap in those days.

In 1883 Mr. Thomas from the Lake Superior country was superintendent. In 1884 he was succeeded by Alex Trippel, a graduate of the University of Zurich, Switzerland, and an able metallurgist, who remained in charge till near the end of 1887. I served under Dr. Trippel for four years, first as chemist and assayer and then as mine engineer, and the training I received during that period was of inestimable value to me in later years. Early in 1887 operations at the Old Dominion were suspended, due to the low price of copper. I had left and had gone to the Silver King mine for a few months to act as mechanical engineer for Mr. Macy. Trippel retired later in the year.

In the latter part of December, 1887, William Keyser, then President of the Old Dominion, wired me that they were going to resume work at Globe and offered me the position of superintendent in charge of all their operations in Arizona, except the freight contracts. That was a wonderful Christmas present. I accepted at once and felt much



Mule teams hauling coke from the railroad to Globe (130 miles). The old smeltery of the Old Dominion Company in the background.

complimented as I was not yet twenty-five years of age. I hoped they were not taking too much of a chance.

I went back to Globe January 1, 1888, and made a survey of conditions. Development work in the mine had not kept pace with ore extraction, due to the drive to keep costs down, and there was but little ore of smelting grade in sight. I decided that as the ore bodies in the mine were making to the southwest, a new shaft should be sunk, and selected a site on the Interloper mine, one of the claims we had acquired, about a thousand feet from the old Mooney shaft, through which ore had been raised to the surface from the old workings.

I wired Mr. Keyser for permission to sink the shaft, prophesying that we would find the continuation of the main ore body at this point, about 450 feet below the level of main outcrop and 1,300 feet from it, southwesterly. This was a rash forecast, and later, when I had time to remember it, caused me much uneasiness. He wired back permission to proceed with the work, which was sportsmanlike, in view of the depleted treasury and enormous company debt then hanging over his head.

We started work on the shaft, January 20, 1888, and reached the point that was to be the sixth level, September 6. Development work on this level was immediately commenced and in three weeks the large ore body we expected to encounter was found almost exactly where we had plotted it.

The sinking of the Interloper shaft was the turning point in the early history of the Old Dominion Company as from it we were able to develop the vein at a point far distant from the old workings and prove the continuation of the ore bodies to the southwest. Also the development of these bodies provided a sufficient supply of ore to enable the mine to keep well ahead of the smelting plant.

In sinking the shaft the water problem, which in after years was to become such a serious proposition, was first met and, after some delay, overcome. At a depth of 272 feet an unexpected flow of water flooded the pumps. A large bailing tank was put in commission and used alternately with the ore cage. This assistance, coupled with the heroic efforts of the crew, enabled us to sink the shaft to the sixth level, where the new pumping plant, previously ordered, was installed. Twenty years later a veritable flood of water was encountered in the deeper workings.

In 1891 the old smelting plant had become antiquated, even for Arizona. It had been in operation for nine years and some of it was scrap machinery at the beginning. It was considered a good time to suggest building a new one. The million dollar debt had been paid off and profits were coming in. I submitted plans and estimates to William Keyser, and, as usual, he gave his approval.

The site selected for the new smelter was a quarter of a mile southeast of the old one and here grading was commenced in the summer. The plant was completed by the end of the year and the furnaces blown in January 16, 1892. There were three furnaces having a total daily capacity of 185 tons of charge. Above each furnace was a chamber in which the speed of the gas was reduced, the dust collected and returned to the furnaces. The system was not perfect but the loss in fine ore and dust, containing ten per cent copper, was greatly reduced. Larger settlers were installed under the furnace slag spouts to collect the copper entrained in the slag as the latter flowed from the furnaces. A Bleichert rope tramway, the first of its kind to be installed in the Southwest, conveyed the ore from the mine ore bin to the smelter. By this means the cost of delivering the ore to the smelter which had been twenty-five cents per ton by wagon was reduced to seven cents. This smelting plant was a mere toy compared to modern installations but in 1892 it was considered by some to be the banner copper smelter in Arizona.

Up to 1894 the Old Dominion held its own very well with the six principal copper producers in the Territory. During the six years, 1888 to 1893, that I was in charge we produced over forty million pounds of copper, the production per year gradually increasing. This was sixteen per cent of the entire Arizona output. The yearly cost per pound of pig copper (ninety-six per cent copper) ranged from 5.26 cents to 7.19 cents at the smelter, to which should be added 1.75 cents for freight, fire refining, and marketing. The average yearly selling price of casting copper during this period ranged from 16 cents to 10 cents a pound. The yield of ore in copper dropped from 15 down to 11.4 per cent during the six years, very rich ore, but we were compelled to use twenty-five per cent barren limestone flux and the expense for coke amounted to nearly half of the entire cost of all operations. (For full details and cost sheets of the Old Dominion Copper Company, see "Early Day Copper Mining in the Globe District," by Arthur L. Walker, Engineering and Mining Journal, April 14, and 28, 1928.)

The slag problem was a nightmare to the metallurgists. When copper oxide is smelted the slag produced always contains more copper than when sulphide ore is used. In Arizona the presence of a large amount of silica and often excess alumina in the ore made the smelting proposition still more difficult. This resulted in scientific metallurgy being discarded in favor of financial metallurgy. Coke was dear, copper was cheap and the real problem was to produce as much copper as we could at the lowest cost. Consequently the old time producers sent slag over the dump containing a shameful amount of copper. But in the end this copper was not lost for in after years, when sulphide ore was found in depth, these immense old slag dumps were sent to the furnaces and the copper recovered. They were in fact a great asset. Afterwards my dear friend, James Douglas, said in his quaint way of the Copper Queen slag dump, "We never made a slag that ran over two per cent copper but, for some strange reason, when this slag was resmelted three per cent was recovered." Evidently the chemists were philanthropically inclined in those days, and desired to make the metallurgists less unhappy.

While the operations may have been lavish in regard to copper, we were most economical in other respects. The operating staffs of the old Arizona Copper companies were of the simplest character. Usually there was a superintendent in charge of all operations, an assistant superintendent (who was also the metallurgist), a mining engineer who did the mine surveying in the limited area of underground workings with the assistance of a rodman and a chemist who performed the assaying and determined the composition of the slag. "Type slags" were unknown factors in those days. Everyone worked hard and all with the fixed idea of producing the best results possible under the conditions then existing.

It is always a pleasure to record my appreciation of the loyal support afforded me by the employees of the Old Dominion Company during the period I was there, 1883 to 1893, and especially of the assistance rendered me during the last six years of my stay. I desire especially to emphasize the excellent work performed by Niles S. Berray, general mine foreman; Andrew Scott, night mine foreman; A. G. Pendleton, mine surveyor; and John Canovan and John Murphy, smelter foremen. Berray, who succeded me when I left, was an outstanding man, most capable, and similar in type to the Virginian in Owen Wister's novel of that name.

Of the sub-bosses, miners and smeltermen, I can truthfully state that I do not believe a finer body of men ever existed. The Anglo-Saxon race predominated, and included Cornish, Irish, and native Americans, about equally divided, with a sprinkling from other nationalities in Europe. They were hardworking and intelligent, took a real interest in affairs and it was a privilege to work with such a fine company of men. Everyone was as good as anyone else, but when it came to working and obeying orders, properly expressed, there was no questioning or dissatisfaction. The men themselves also realized with pride that each was one of an exceptionally fine group. Among those from this group who have made names for themselves might be mentioned the late Hon. George W. P. Hunt, former Governor of Arizona, who served seven terms in that office, a record not equaled in any other state; George Wilson, a banker of prominence, and others.

Globe was on the frontier in every sense of the word, being within six miles of the Apache Indian reservation, but in spite of the fact that it was in a wild and more or less lawless country, the town was even then a model of law and order. There were many saloons and gambling places; and pay day, which came only once a month, was a lively event. But though some of the inhabitants and practically all visitors wore six-shooters, real shooting affairs were few and far between, and I doubt if as many people were killed or hurt by gun play in those days as there are now by automobiles. Interesting incidents occurred, however, as is indicated by the following extracts from my diary:

AUGUST 6, 1883—A certain amount of excitement was caused in the town due to the fact that a man who pulled out a revolver in a bar-room quarrel let it fall and it went off, shooting him in the breast. The excitement was due not to the fact that a man was shot, but to the peculiar manner.

AUGUST 11, 1883—The mail stage due from Casa Grande was held up on the bank of the Gila River near Riverside; the messenger was killed, driver wounded and two thousand dollars consigned to the Pioneer Mill taken off. This robbery is exactly similar to the one that occurred a year ago. At that time two robbers were caught and lynched in Globe, being hung from a tree.

The sheriff led an easy life, and when dependent upon his fees had hard work to make a living. Of course, there were times when he was quite busy and when the sheriff's chair was not so comfortable as it might otherwise have been. One of these times occurred when a celebrated scout, Apache Kid, and nine other Indians were arrested for being implicated in the murder of Indians from another tribe. It was only a "shooting" quarrel, however, and the Indians were sentenced to imprisonment at Yuma. The sheriff decided that as they were to travel shackled and handcuffed he could easily convey them to prison with only one deputy. The stage carrying the Indians and their guards arrived at Riverside in the evening and after supper they commenced to climb the grade from the river. The prisoners were ordered to walk, the sheriff and his deputy, heavily armed, guarding them. Suddenly two of the Indians wheeled around and threw their handcuffed arms over the heads of the sheriff and his deputy, thus pinioning their arms to their sides, so that they could not move. Others jumped on them and forced gags into their mouths, so that they could not shout (the stage having disappeared around a bend in the road, the driver did not see what was taking place). While this was going on the remaining Indians broke their shackles and handcuffs by means of stones, took the weapons from the sheriff and his deputy and shot them both. When the driver stopped to see what was the matter, he was fired at by one of the Indians, who had run ahead, and dropped to the ground, slightly wounded, but bleeding profusely. This driver, Lee Middleton, was an old Indian fighter, and played 'possum so perfectly that when the Indians came up they thought he was dead and left him without further injury. He told me this story himself. Kid and his party took the stage horses and escaped. It was reported that some of the Indians were recaptured but the Kid was never discovered.

About the time the copper mines were discovered in Gila county, two adventurous men, Martin and Reilly, were engaged in developing a copper property in Cochise county at a small camp called Bisbee. They named the mine the Copper Queen. Some rich ore was shipped to the east, then a small furnace was built and blown in in 1880. Owing to the high rates for labor and transportation, the cost and danger of bringing in supplies (the Apache Indians were often on the war path) and the difficulties encountered in smelting the ore in the one small furnace, the operation of producing copper was not a financial success. Some carloads of this ore had previously been shipped to the Chemical Copper Company at Phoenixville, Pennsylvania, where James Douglas was engaged to employ the Hunt and Douglas Process. The ore attracted attention and in 1880 Douglas decided to make the long journey out to Arizona to look into a property that supplied ore sufficiently rich to stand shipment from the far west to a plant in Pennsylvania for treatment. James Douglas, with the experience he had gained, and with his broad vision, which was of much greater importance, saw the enormous possibilities of the property and his report to Phelps, Dodge and

Company of New York was so convincing that the Copper Queen mine was at once taken over by them and Douglas put in charge of all operations.[5]

In operating the Copper Queen mine in the early days many difficulties were encountered the most disturbing of which presented itself in 1884. The original orebody was almost exhausted, finances were at a low ebb and they were drifting energetically in pursuit of other orebodies. One of these drifts entered a large body of ore almost under the property line between the Copper Queen and the adjacent property belonging to the Atlanta Mining Company. By a strange coincidence the latter company uncovered the same orebody while sinking a shaft near their own property line, the discoveries being almost simultaneous. Then the inevitable legal questions hinging on the law of the apex loomed up and litigation seemed imminent. The judgment and perspicacity of Douglas, however, prevented a real clash and, instead, a consolidation was effected. Soon afterwards many other mines surrounding the Copper Queen were acquired, thereby assuring the future success of this property. Douglas finally obtained by purchase or otherwise, mining properties in the Globe and Morenci districts in Arizona and in Nacozari, Mexico, and built railroads so that these plants were provided with adequate transportation facilities. All of these properties were later consolidated in Phelps, Dodge & Co., Inc., of which he was president till 1915. The mines of this company have been the great copper producers in Arizona due to his untiring efforts and skill.

James Douglas was not only a distinguished mining engineer and metallurgist, a builder of great enterprises and a man of broad vision, but also was distinctly human. When I was in Globe he visited the town on several occasions while investigating, and subsequently planning the operations for the Buffalo mines. During these visits we had many talks, which were extremely pleasant and most profitable

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5 Arthur L. Walker, "Career and Achievements of James Douglas," Trans. Amer. Inst. Min. and Met. Eng., vol. 106, p. 9, 1933.

to the writer. The influence of his delightful personality and of his willingness to give unstintingly from his wonderful source of knowledge will never be forgotten.

It was in the Clifton-Morenci district that the first copper mines in Arizona were discovered and it was from these mines that the first copper was produced and shipped out of the Territory. The brothers Jim and Bob Metcalf, while scouting in that country in 1870, noticed the blue copper outcrop of the Longfellow and the green stained rocks of the Metcalf and located these mines. The country was infested with none too peaceful Indians at that time and these discoveries were considered of small value, especially as the nearest railroad was a thousand miles away.

About 1872 the Indians became more peaceful and a small amount of development work was done to open up the Longfellow mine. Then the Lesinsky brothers, adventurous frontier merchants, entered the picture and finally became absolute owners of that property. What followed is one of the most interesting episodes in the history of the Arizona copper mines.

The Lesinskys decided to smelt the rich carbonate ore on the spot and ship the copper produced east rather than attempt to transport the ore to a far distant smelting plant. They erected a small stone furnace near the mine in which two tons of ore were smelted per day. Charcoal, burned in the vicinity, was used for fuel and the blast supplied by a bellows worked by hand. Soon a new smelter was built on the San Francisco river, about five miles southeast of the mine, and some years later they constructed a narrow gauge railroad from the foot of the Longfellow incline down the gulch to the smelter. Thus the ore was conveyed by gravity all the way from the mine to the smelter; the problem was to get the empties back. At first mules were used but afterwards a tiny locomotive took the place of the mules; it was really the first locomotive to enter Arizona.

The copper produced during the early stages of the Lesinskys' metallurgical career was shipped to Kansas City by ox teams. Supplies were brought back on the return trip. As the railroad advanced westward the haul became shorter, but at all times the trip was a dangerous one and many men and animals fell by the wayside. By 1880 the stone furnaces had been improved by the introduction of a copper jacket which radiated heat and remained unmelted unless the furnaces became too hot. Some flux was also used. The whole operation was conducted in a free and easy manner, supplies and fuel were expensive but labor was cheap (largely Mexican) and the ore was rich. It is stated on excellent authority[6] that in 1880 the Lesinskys were producing one hundred tons of copper per month, a large amount for that time. The expense incurred in getting the copper to the market and refining it was so great that in spite of the high price prevailing, about twenty cents a pound, the Lesinsky brothers often found their mining and metallurgical business resulted in a financial loss. This loss was more than compensated for however by the profits made in stores they established at the mines and smelters from which they furnished the workmen and teamsters with all they required for their ordinary run of life and often what they did not require.

In 1881 the Lesinskys, having extracted the richest ore from the mine, and probably becoming weary of the great risks they must take, decided to sell the mines. Negotiations were entered into, which resulted in the sale of their properties, and also the mines belonging to the Metcalfs, to the Arizona Copper Company of Edinburgh, Scotland, in the year 1882.

It was an easy matter for the Scotch syndicate to float the new enterprise, when it was reported that the ore contained twenty per cent copper, and the capital of $4,000,000 was at once subscribed. The board decided to build a railroad from Lordsburg, New Mexico, to Clifton, to erect a new smelting plant, to construct gravity inclines from the mines, and to spend a large amount of money on equipment and buildings. It was a large order and the amount of money expended in carrying out the plan exceeded the estimates, but it turned out later that the policy of develop-

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[6] James Colquhoun, *The History of the Clifton-Morenci District*, p. 11.

ment and construction outlined by the original board was wise.

The Arizona Copper Company then became an important factor among the copper producers of the Territory. The Copper Queen was in the lead in those early days with the Old Dominion at Globe and the Arizona Copper Company fighting for second place. Later, in 1887, the United Verde came into production. By 1892 it had assumed second place, and in 1895 was making a strong bid for first place with the Copper Queen.

In the summer of 1883 James Colquhoun, a young Scotchman, arrived in Clifton. I met him in 1884 when I went over from Globe to visit Clifton and during the rest of my stay in Arizona we frequently compared notes about our doings. Colquhoun came to Arizona to fill the position of chemist for the Arizona Copper Company, but he did not confine his energies to that job. He studied conditions and proved to be so capable that he was made superintendent of the smelting department before the end of 1884, general manager in 1892, and later was elected president of the company, and also of the Arizona and New Mexico Railway. Under Mr. Colquhoun's able management many improvements were effected and the mines and smelting plant brought to a high state of efficiency, with a material increase in the output of copper. His outstanding achievement, however, was the development of a new method of leaching copper ore by means of sulphuric acid.

In the year 1892 the situation of the Arizona Copper Company was critical in the extreme. The price of copper had dropped to about eleven cents, and the cost of producing the metal at Clifton was greater than the amount realized. The grade of the ore had decreased and it became necessary to devise some scheme to treat this lower grade material and produce copper from it at a profit. Colquhoun decided to concentrate the ore in jigs for the recovery of the rich carbonates and oxides of copper and also for the recovery of the sulphides. It was only the tailings from the jigs that were to be treated by the leaching process, but it was essential that the leaching operation should be successful. It was a hazardous undertaking. No metallurgical operation of this nature in this country had ever succeeded but that did not dampen the ardor of Colquhoun and his associates. To make a long story short, the leaching and the sulphuric acid plants were built in quick time and in fine shape. The operation was a grand success from the day it was put in commission, but had it not been for Colquhoun's ability, energy and absolute faith in his own ideas and plans the future of the Arizona Copper Company might have been doubtful for some years. Strange as it may seem, it was many years before another copper leaching plant was put in successful operation.

James Colquhoun retired from active management in 1904 on account of failing health but retained the office of president till 1907, when the necessity for a complete rest compelled him to discontinue all his activities. Later Norman Carmichael took over the management of the Arizona Copper Company and continued to handle its affairs in a most satisfactory manner till it became absorbed by the Phelps Dodge Corporation. In 1933 and again in 1934 I visited Mr. Charmichael at his home at Rancho Santa Fe near San Diego, California, and it was a distinct pleasure to discuss old Arizona days and doings with him.

While the Arizona Copper Company was working its way to success, the Detroit Copper Company at Morenci, under the guidance of William Church as President and General Manager, was having its troubles and overcoming them. Church started to develop the properties about 1880 and after having proven to his satisfaction that there was sufficient promise of ore for the future, he built a small smelting plant on the San Francisco river. This plant was afterwards moved to the mines at Morenci together with all the buildings. Water was pumped from the river to the smelter through a main seven miles long and to an elevation of fifteen hundred feet. Production of copper commenced in 1882 and then the Detroit Copper Company became one of the four old time producers in Arizona. In 1895, after William Church had retired, the property was taken over by the Phelps Dodge Corporation and with an improved plant the production was considerably increased.

Church was not only energetic but progressive. In 1886 he built the first concentrating plant in Arizona to treat copper ore that was not then adaptable to smelting. He was the first to introduce quite large (for those days) rectangular water jacket furnaces for smelting copper ore in Arizona. I remember James Colquhoun and I had some correspondence on the subject, but what we said I cannot remember. Colquhoun and Church were great friends and always worked together in perfect harmony.

Harmony was the motto of the copper miners and metallurgists in Arizona in the early days; they were willing to help each other in every possible manner. A visitor was always welcome at any plant, especially those interested in the industry. All questions were readily answered and information freely given. It was a privilege to operate under those conditions and the only drawback was the inaccessibility of the different plants to each other and to the country at large. To attain success in those remote districts, foresight and resourcefulness were required. It was a wonderful training and I look back upon the ten years I spent in the mining regions of Arizona as having been of the greatest benefit to me. I doubt if as much could have been learned about human nature and the importance of prompt and determined action anywhere else.