

## COPPER MINING IN ARIZONA

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Before going into the economics and the practical aspects of Copper Mining, perhaps we should try to describe what copper looks like before it is mined and converted into the red metal which you see every day in copper wire, copper pennies, copper utensils, etc., etc.

First of all, copper very rarely occurs in its native metallic state. By far most of the copper produced in Arizona is found combined with sulphur, or iron and sulphur, and is a grayish black mineral appearing in little specks or veinlets in the rock of the earth's crust. The copper ore mined in the large mines of Arizona looks for all the world like ordinary rock that you would pick up on a hike in the mountains. Sometimes you can hardly see the copper mineral with the naked eye. In addition to the black specks of copper sulphide which are the chief source of Arizona copper, there are brassy-yellow specks of copper-iron-sulphide, and also green and blue carbonates of copper, which account for the green and blue copper stains you see on the surface of good mining properties. They are the result of the oxidation of the sulphides by surface waters containing carbonic acid.

Of course there are really scores of varieties of copper minerals, but copper sulphide is the chief ore, and the basis of the copper mining industry of Arizona.

Last year, Arizona's copper production was 416,000 tons, or 45% of the total U. S. production. This was greater than the production of the next three copper producing states combined. And when you consider that almost ninety percent of this production was from the large low-grade copper mines of Morenci, Inspiration, Miami, Ajo and Ray, you will appreciate that here is an industry that is not depleting the natural resources of the state, but is actually creating wealth from the millions of tons of worthless rock in mountains of scenic value only.

The developed ore in none of these mines averages more than twenty pounds of copper to the ton; that is, in every two thousand pounds of rock there are less than twenty pounds of copper. Enormous plants had to be built to extract this metal from its containing rock.



Over two hundred millions of dollars had to be spent on these low-grade mines before they began to produce copper and return a profit to the investor. It took vision and courage, as well as capital to convert these large copper deposits into profitable enterprises. It was a fortunate thing for the state and nation that this copper was developed, for without it, one wonders whether this republic could have survived the last two World Wars. Even now the country is in urgent need of more and more copper.

The Magma Copper Company is now engaged in <sup>the</sup> development of a stupendous ore-body in Mammoth District of Pinal County, and this is a prime example of the conversion of worthless rock to copper metal. Over one hundred million dollars will have to be spent and six years of work and planning before they will get a dollar's worth of copper out of this mine. There are less than sixteen pounds of recoverable copper in each ton of ore, and it needs no more than ordinary sense to appreciate the utter worthlessness of this rock as it exists in the ground. Brains and capital have to be combined to create wealth out of this property.

Before the big, copper producing properties were developed, they were operated as small mines for many years, during which time, the higher grade portions of the ore bodies near the surface were mined out, leaving the low-grade for science and capital to develop. Large scale operations were necessary to make the ventures profitable. Churn drilling was essential to determine the extent and grade of the ore body, after which shafts, drifts, crosscuts and raises had to be driven to block out the ore and prepare it for extraction. This drilling and development usually delimited the ore-body by classifying as ore only that which could be mined, milled and smelted at a profit. Naturally, improvements in mining, milling and smelting as time went on, changed what had been originally classed as waste into profitable ore. In many cases the life of the mine was doubled by the discovery of new technical processes. Hence a mine which had originally a 20 year reserve of copper, remained in business long after the twenty years were past. In some cases additional drilling on the fringes of developed ore-bodies showed many years supply of what would have originally been classed as waste, but with new processes, became ore.



The block caving of large bodies of copper ore was developed in Arizona by Louis S. Cates when he was manager of the Ray Mine, and it proved to be a relatively cheap method of mining ore. However, in recent years, with the war and all, experienced miners have been rather scarce, due to the younger men not being attracted to this relatively hazardous occupation. It has therefore resulted in more and more open-pit mining, which requires less men and more machines. Here the use of forty and fifty-ton trucks has simplified the transportation problem, and many of the large open-pit mines of the state have made successful use of them. In many cases, they have spelled the difference *between* profit and loss, for the low copper content of the ore leaves a very small margin to work on.

After the ore is mined, a large plant is needed to crush and free the metal from its enclosing rock. It is then concentrated by the use of especially developed processes which discard the worthless portion of the rock and collect the copper into a high-grade concentrate. The concentrate is then smelted to further separate the heavy copper metal from the lighter minerals that are still attached to it. The product is known as blister copper, and although it is more than 99% pure, it still has to be refined to produce the practically pure metal needed for manufacturing wire and other copper products.

The result of all this alchemy, or the conversion of worthless rock to valuable copper metal, has been the creation of millions of dollars of taxable wealth in the State of Arizona. The big copper producers of Arizona have taken Federal lands on which no taxes were being paid, and have put them on the tax rolls, thus contributing to the state tax revenue.

The mining industry is the chief primary industry of Arizona and its ramifications extend to all parts of the State. There are many industries and professions in the large cities of Phoenix and Tucson which derive their income from trade with and services for the miner, millman and smelterman, and their families. The foundries of Phoenix are almost one hundred percent dependent on the mining districts for their business. The copper miner is the highest paid wage earner in the State, and he spends practically all of his earnings within the State. The railroads get the major portion of their revenue from the mines and smelters in the form of freight on ores, concentrate and blister copper. The power and telephone utilities derive much revenue from the mines.



Many state and federal employees in Arizona are paid out of the taxes which the mining companies pay. The wholesale and retail stores in Phoenix and Tucson get considerable business from both the mining companies and their employees in the mining districts. The farmer and stockman raise food for the miners.

Thus, it is demonstrated that the mining industry plays a vital and important part in Arizona's economy. It's ramifications extend in every direction. Contrary to the "popular" belief that the mining industry is exhausting the state's natural resources, history has shown that the industry actually has created resources where none previously existed.

Mines are made, not found. It has been almost forty years since a "bonanza" has been discovered. All the big mines in Arizona nowadays are the product of the application of venture capital in large amounts, the use of engineering skill in the invention and construction of labor-saving machinery and processes, and finally the business acumen of seeing into the future. A great industry has been developed, and with proper understanding and equitable treatment, still has tremendous potentialities of remaining vital to the state's economy indefinitely into the future.