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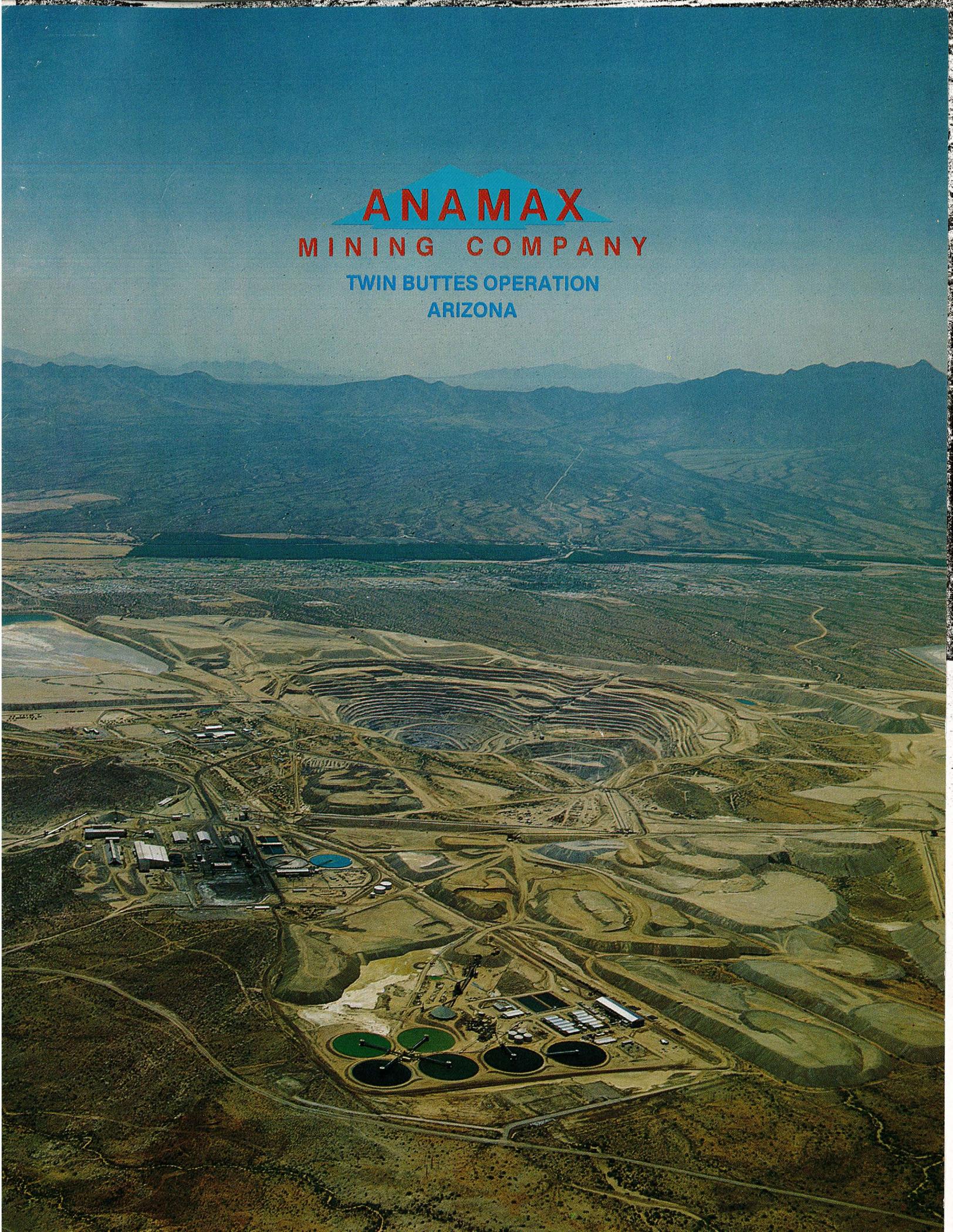
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ANAMAX
MINING COMPANY
TWIN BUTTES OPERATION
ARIZONA

60 megawatt
9 Diesel Generators

BEGINNINGS

The copper-rich Pima Mining District of southern Arizona is dotted with evidence of early mining activity—the remains of old workings, discarded equipment, exploratory shafts—some dating back to the 1870's. In the area known as Twin Buttes many small mining operations flourished and failed.

Over the years the Banner Mining Company gained extensive mineral holdings in the Twin Buttes area. In

1965, The Anaconda Company, under agreement with Banner, began an exploration and mining project far beyond the scope of those early day mines.

After four years of development, Anaconda produced the first copper concentrate from the Twin Buttes mine in 1969. In a later expansion, Anaconda entered into a partnership with AMAX Inc., forming the Anamax Mining Company, in 1973.



In 1912, the year Arizona became America's 48th state, the Twin Buttes Mining and Smelting Company operated Pioneer Smelting at a site called Camp Corwin, near today's Twin Buttes operation. This picture was made just after the Washington's Birthday snow.

HARD ROCK MINING

Anamax's Twin Buttes operation is an open pit copper mine. To reach the relatively low grade copper ore lying deep below the surface, 500-800 feet of waste material had to be removed. Since the project began in 1965, more than a billion tons of material have been moved here.

True to modern mining methods, Anamax's engineers make use of computers to assist them in pit design. Core samples from various holes are assayed, the results computerized, and from this data the engineers determine the configuration of the pit. Current design calls for the pit to be 1 3/4 miles long, 1 1/4 miles wide and 1700 feet deep, with the sides sloping downward in a series of 40 to 50 foot benches.

Daily blasting is the first of many steps in mining copper. For each blast a series of 80-100 holes, 47 feet

deep, twelve and one-half inches in diameter, are drilled at 30 foot intervals and loaded with explosives.

Once the ore and rock have been loosened and fractured by blasting, electric power shovels move in to load it onto 100 ton end-dump trucks (below left). These trucks carry the ore and rock to one of three crushers in the pit which reduce it to a size that can be carried on five foot wide conveyor belts, up and out of the pit to the various processing points on the property.



Many operations underway simultaneously in the pit. At right, a survey crew is dwarfed by two rigs drilling blast holes. In the background, left of center, another crew loads explosives and in the foreground, an electric shovel takes three or four bites to load a 100-ton dump truck with ore.



COPPER RECOVERY

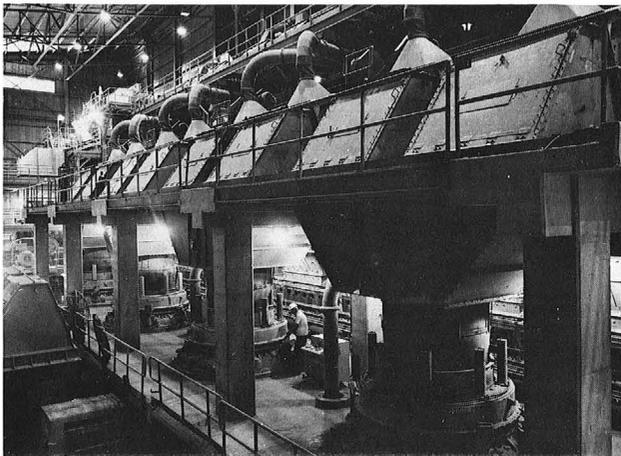
There are two distinct types of copper ore mined at Twin Buttes—oxide ore which is principally chrysocolla, and sulfide ore which is principally chalcopyrite.

The Sulfide Mill

The Sulfide Mill at Twin Buttes has the capacity to process 40,000 tons of ore per day, yielding 1,200 tons of copper concentrate.

Sulfide ore, traveling up from the pit by conveyor is sent through a secondary crushing stage. Upon reaching the Fine Ore Crusher, the ore is circulated through a series of giant cone crushers (shown below) which eventually reduce it to a pebble size. The fine ore is then moved by conveyor to the Sulfide Concentrator where it is fed into the series of rod and ball grinding mills.

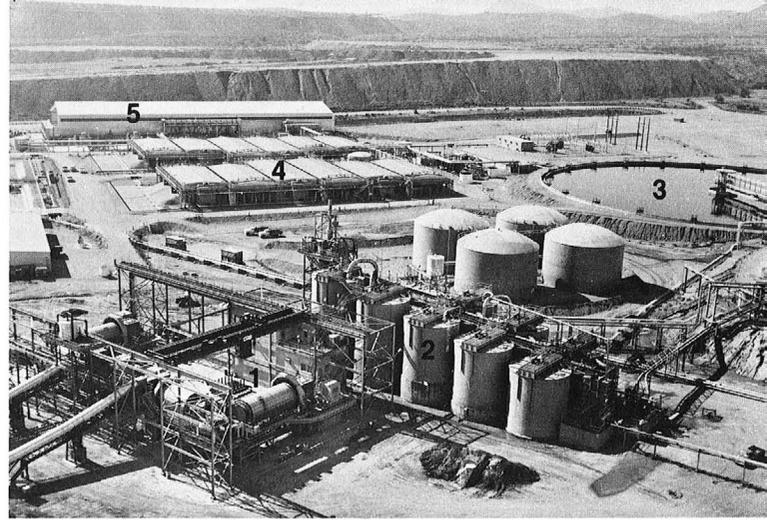
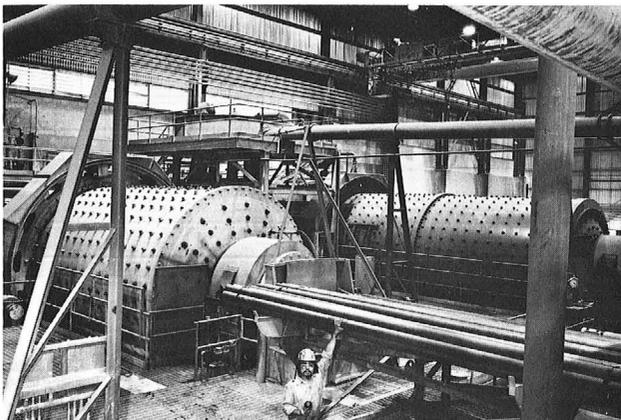
A rod mill is a large steel drum 18½ feet long and 14 feet in diameter which rotates at a speed of 15 RPM. The



inside of the mill is partially loaded with 4 inch diameter by 17 foot long steel rods. The ball mills are slightly larger and are filled with 2 inch diameter steel balls. (In the picture below, the mill worker stands in front of a rod and a ball mill, holding a steel ball and pointing to the rods.) Fine ore, fed into these mills, is mixed with water and ground into a mud-like substance called slurry.

The slurry is mixed with chemical reagents and pumped into large flotation tanks. Here the mixture is agitated with air and whipped into a froth. The reagents cause the copper to float to the top of the tanks, coating the large bubbles which are formed. The froth holding the copper concentrate is then floated off while the waste, called tailings, drops to the bottom and is pumped out.

The concentrate goes through one final milling step, again using the flotation method, which separates out the molybdenum, an important by-product metal. Dried to a black powder, the concentrate is shipped to copper smelters around the U.S. for further refining.



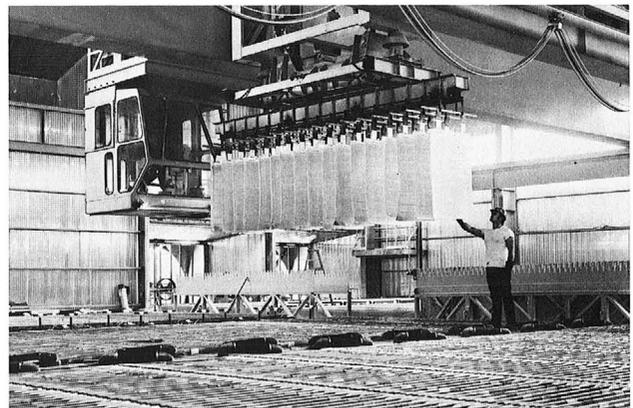
The Oxide Plant

Anamax's Oxide Leaching and Electrowinning plant is one of the first and largest of such facilities in the country incorporating a liquid ion exchange (solvent extraction) process. One hundred tons of pure copper can be produced here each day.

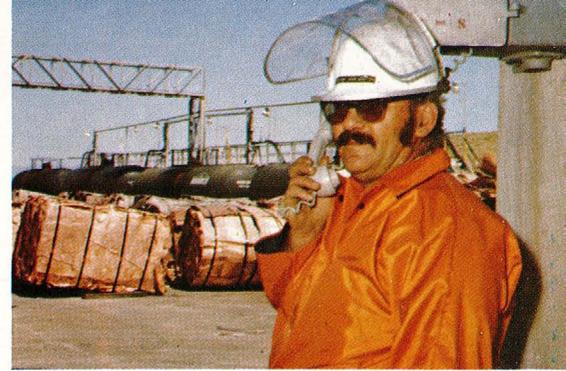
After crushing, oxide ore is fed into rod and ball mills¹ and reduced to a slurry which is then pumped through a series of eight leaching tanks². Sulfuric acid in the tanks leaches the copper minerals from the ore. After eight hours, virtually all the copper oxide has been removed from the ore and is in solution with the acid. It is then fed through a series of four thickener tanks³, 400 feet in diameter, where the waste or tailing is separated from the acid leach solution.

Solvent extraction and electrowinning are the two final steps in producing pure copper from oxide ore. In solvent extraction⁴ a chemical reagent called an organic extractant is mixed with kerosene and is used to transfer the copper out of the acid solution leaving other impurities behind. More acid is then added to separate the copper from the organic solution and prepare it for electrowinning.

In the tankhouse⁵, where electrowinning takes place, the acid/copper solution, called electrolyte, is pumped into



plastic lined concrete tanks. Each tank is filled with copper starting sheets. Each starting sheet is placed between two anodes. An electric current is passed through the tanks causing copper in the solution to be deposited on the starting sheets. After seven days in the tanks the finished sheets of copper, now called cathodes, are removed (above), washed, and loaded into railroad cars for shipping. The finished cathodes, each 36 inches by 44 inches and weighing about 140 pounds, are 99.9% pure copper—a finished product ready for fabrication.

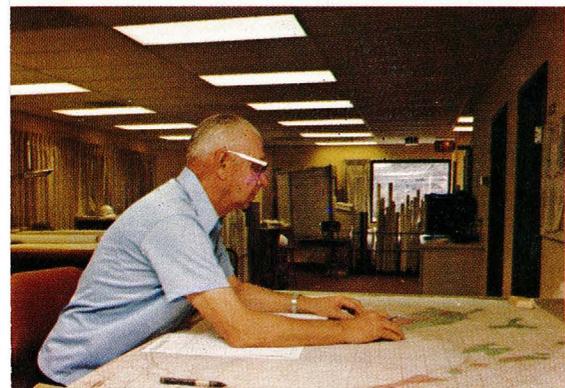


Anamax People

The effective operation of a modern copper mine such as Twin Buttes demands a wide variety of skills on the part of its employees. In addition to the mining engineers, metallurgical engineers, and equipment operators, there are carpenters, accountants, pipefitters, mechanics, buyers, computer programmers, safety experts, schedulers—even landscapers who restore a foliage covering to the moved earth.

In its traditionally masculine industry, Anamax was one of the first in the area to open fully equal job opportunities to women.

The Anamax economic impact extends to neighboring communities where a host of support facilities do an important part of their business with the mine.



The Future

Anamax Twin Buttes continues to grow. A new partnership has been formed with American Smelting and Refining Company to bring ore 6 1/2 miles overland on a new "cable belt" conveyor for processing through the Sulfide Mill.

New methods for recovering other metals as by-products of copper production are being tried at Anamax. A uranium extraction plant will recover this important by-product metal.

Innovative from its beginnings, Anamax will continue to be an important contributor to a nation in need of its products.

