

HISTORY OF OPEN PIT MINING,  
PHELPS DODGE CORPORATION, COPPER QUEEN BRANCH,  
BISBEE, ARIZONA

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The history of the early development of Open Pit Mining in the Warren District, Arizona, is contained in magazines, technical papers and Company reports. It began in April, 1917, when stripping was started on the West Orebody in Sacramento Hill.

The first known ores of the district were in limestone, and the occurrence of ore in porphyry, in important quantities, was not discovered until after 1904. The Sacramento Shaft, which was sunk in 1904, passed through a 300-foot thickness of the East Orebody but the value of such low grade material, which contained 1.5% copper was not recognized. It was not until several years later that the possibility of concentrating porphyry ore was seriously considered and exploration work was begun in the hopes of finding large deposits of low grade ore which might be milled rather than small bodies of high grade ore which might be smelted.

Active work to develop such possibilities was begun in 1909, and was directed toward the exploration of two areas having favorable surface indications; one in the east end and one in the west end of Sacramento Hill. Underground exploration developed ore in both areas but that in the west end was of much higher grade. Accordingly, attention was devoted particularly to the development of this discovery and underground work showed that the rich ore was surrounded by leaner ore which might be concentrated at a profit.

Exploration by churn drilling was begun in January, 1914, and underground work was abandoned soon afterwards. The exploration of the West Orebody was considered complete in 1916, and churn drilling was transferred to the East Orebody, which is now included in the Lavender Pit. The two orebodies were drilled out by a steam driven Star drill and four Armstrong drills driven by

electricity. They were equipped with crude steering gear and moved by attaching a wire line from the reel to a deadman.

Following the completion of drilling in the West Orebody, comparative estimates for mining by top slicing and by steam shovel were made. Block caving was not seriously considered. "Preliminary calculations showed that steam shoveling might compete with underground mining and the services of a consulting engineer experienced in steam shovel work were secured. ... His report indicated only a slight difference from the results to be expected from underground mining. There were other features that influenced the final decision. One of which was the lack of experienced miners in 1916 which, in fact, has prevailed with intervals until this date. (circa December, 1923.)" \*\*

Stripping was begun April 5, 1917, with one shovel. Equipment, which was furnished as it could be used, comprised the following machines:

- 7 Model 88C Bucyrus Steam Shovels
- 1 Model 40C Marion Steam Shovel
- 15 55-Ton H. K. Porter Saddle Locomotives
- 50 20-Yard Western Wheel Scraper Company Dump Cars
- 25 25-Yard Western Wheel Scraper Company Dump Cars
- 9 No. 14 Sanderson Cyclone Gasoline Driven Churn Drills
- 1 20-Ton Link-Belt Company Wrecker
- 1 50-Ton Brown-Hoist Wrecker
- 13 F.L.-3 Sullivan Piston Rock Drills
- 1 Powder Car
- 1 Oil Car

Published data on the Sacramento Pit includes:

Elevation

Top of Sacramento Hill Before Stripping	5665 feet above sea level
Top Shovel Bench	5540 feet above sea level
Bottom Shovel Bench	4925 feet above sea level

Horizontal Dimensions of Pit

On the 5360 Bench	1400' by 1200'
On the 4925 Bench	500' by 300'

4800  
500 Level

Bench Heights

Above the 5360 Bench	60 feet
Above the 5270 Bench	45 feet
Above the 4925 Bench	30 feet
Highest Bank	125 feet (above the 5540 Bench)

Output per Steam Shovel Shift

<u>Year</u>	<u>Solid Cubic Yards</u>
1917	200
1923	786
1924	841
1925-1929	1,000

Dry Tons Treated at the Copper Queen Concentrator

<u>Year</u>	<u>Source</u>	<u>Tons</u>	<u>Tons Copper</u>
1923-1929 Incl.	Sac. Pit	7,090,900	120,505.55
1929-1931 Incl.	Glory Hole	866,470	16,705.81
1925-1931 Incl.	S. E. Extension	2,253,450	48,077.41
1929-1931 Incl.	East Orebody	71,884	841.08
		<u>10,282,704</u>	<u>186,129.85</u>

8,000,000  
7,090,900

Stripping

Material to Leach Dumps	12,600,000 Tons
Material to Waste Dumps	<u>11,200,000 Tons</u>
Total Stripping	23,800,000 Tons

In January, 1921, stripping operations approached completion and operations were reduced to two shovels working on day shift. In November, 1921, work was stopped altogether since no more stripping could be done without putting an excessive quantity of ore into storage piles. Shovel mining was resumed in April, 1923, and was continuous until September, 1929. Following the completion of shovel operations, glory hole mining removed ore to a depth of 130 - 145 feet below the lowest shovel bench.

While the West Orebody was being mined, churn drilling was begun to outline the East Orebody. Block caving was selected as the best method, and active development was begun in 1929 and continued to November, 1931. Two blocks developed on the 400 level demonstrated that the East Orebody was not suitable for block caving by branch raise method. The ground was hard and very strong; in fact, a block, undercut and blasted in 1931, was standing open in 1950.

All work was stopped in the East Orebody in November, 1931, and this area was idle until 1950, when plans were made for shovel mining.

Included within the Lavender Pit limits were several small residential communities, the Sacramento Mine surface yard and plant, and the Southern Pacific tracks. Before stripping commenced, the surface was cleared and re-routing of U. S. Highway 80 was begun. Excellent cooperation was received from all parties and the work progressed without friction or interruption.

Pertinent data on the Lavender Pit are:

Elevation

Top of Hill Before Stripping	5500 feet above sea level
Bottom of Pit (Projected)	4500 feet above sea level

Horizontal Dimensions

Length	3,100 feet
Width	2,400 feet

Estimate of Material Within Pit Limits

	<u>Tons</u>	<u>Grade</u>	<u>Class</u>
✓	41,000,000	1.14% Copper	Ore
✓	31,000,000	0.42% Copper	Leach
✓	70,000,000	-	Waste

Bisbee, Arizona  
May 28, 1953  
W. P. Crawford  
fmc